Indicators of Sustainable Development: Guidelines and Methodologies – Third edition

Methodology sheets

Table of content

PROPORTION OF POPULATION LIVING BELOW NATIONAL POVERTY LINE		
Poverty	**Income poverty**	**Core indicator**

1. INDICATOR

(a) **Name:** Proportion of population living below national poverty line, also known as national poverty rate.

(b) **Brief Definition:** The national poverty rate is the proportion of the population living below the national poverty line.

(c) **Unit of Measurement:** Percentage

(d) **Placement in the CSD Indicator Set:** Poverty/Income poverty

2. POLICY RELEVANCE

(a) **Purpose:** Poverty is the most important defining characteristic of underdevelopment. National poverty rate is one of the core measures of living standards and it draws attention exclusively towards the poor. National estimates are based on population-weighted subgroup estimates derived from household surveys.

(b) **Relevance to Sustainable/Unsustainable Development (theme/sub-theme):** Poverty reduction is one of the key goals of the international community's sustainable development strategy. Many countries give priority to poverty reduction in their national strategies of economic development. Measuring and monitoring the current level as well as the trend in poverty rates provides useful information for the policy makers to plan and implement pro-poor growth strategies and ultimately contributes to the betterment of human lives. Moreover, poverty statistics are important for analyzing the relationship of income or consumption poverty to other dimensions of human development such as education, health, labor skills and other measures of living standards. National poverty rates use a country specific poverty line, designed to better reflect the country's economic and social circumstances.

(c) **International Conventions and Agreements:** None.

(d) **International Targets/Recommended Standards:** None

(e) **Linkages to Other Indicators:** This indicator is closely linked with other measures of human development (education attainment, literacy, health status, mortality etc) and domestic economic development.

3. METHODOLOGICAL DESCRIPTION

a) **Underlying Definitions and Concepts:** Poverty has many dimensions. The proportion of the population below national poverty line measures poverty by the level of income/consumption available to an individual. A person is considered poor if his or her consumption or income level falls below some minimum level necessary to meet basic needs. This minimum level is usually called the "poverty line". What is necessary to satisfy basic needs varies across time and societies. Therefore, poverty lines vary in time and place, and each country uses lines which are appropriate to its level of development, societal norms and values.[1]

b) **Measurement Methods:** Information on consumption and income is obtained through sample surveys in which households are asked to answer detailed questions on their spending habits and sources of income. Information on consumption and income is obtained through sample surveys in which households are asked to answer detailed questions on their spending habits and sources of income. Individual income or consumption levels are calculated as total household income or consumption divided by household size or "effective" household size in some cases. An "effective" household size is calculated based on household composition to reflect assumed efficiencies in consumption; adjustments may also be made to reflect the number of children in a household. However, the World Bank's preferred methodology is to make no such adjustments.

c) National poverty rates use a country specific poverty line, which reflects the country's economic and social circumstances. In some case, the national poverty line is adjusted for different areas (such as urban and rural) within the country, especially when prices or the availability of goods and services differs. National poverty lines tend to have higher purchasing power in rich countries, where more generous standards are used, than in poor countries. In some countries the urban poverty line in common use has a higher real value—meaning that it allows the purchase of more commodities for consumption—than does the rural poverty line.

d) **Limitations of the Indicator:** National poverty lines are set to reflect the country's specific economic and social circumstances, and national poverty rates are not intended for comparisons across countries. Local poverty lines tend to have higher purchasing power in rich countries, where more generous standards are used, than in poor countries. Issues also arise when comparing poverty measures within countries when urban and rural poverty lines represent different purchasing powers.[2]

The national poverty rate is a "headcount" measure, which is by far the most commonly calculated measure of poverty. But it fails to reflect the fact that among poor people there may be wide differences in income levels, with some people located just below the poverty line and others experiencing far greater shortfalls. Policymakers seeking to make the largest possible impact on the headcount measure might be tempted to direct

[1] For further discussion on poverty lines, refer to *World Development Report 2000/2001: Attacking Poverty*, The World Bank (2000).

[2] For further details, refer to the *About the data* section of the Table 2.6 in *World Development Indicators 2007*, The World Bank (2007).

their poverty alleviation resources to those closest to the poverty line (and therefore least poor).[3]

Lastly, this income/consumption based poverty indicator does not fully reflect the other dimensions of poverty such as inequality, vulnerability, and lack of voice and power of the poor.[4]

e) **Status of Methodology:** The methodology is generally well developed.

f) **Alternative Definitions/Indicators:** There are other useful indicators of measuring poverty: the poverty rate at the international poverty line, which is more suitable for assessing poverty level worldwide; the poverty gap, which takes into account the distance of poor people from the poverty line; and the squared-poverty gap, which take into account the degree of income inequality among poor people.[5] Moreover, quantitative methods of measuring income/consumption poverty are increasingly being complemented by participatory methods, where people are asked what their basic needs are and whether such needs are met. Interestingly, new research shows a high degree of concordance between poverty lines based on objective and subjective assessments of needs.[6]

4. <u>ASSESSMENT OF DATA</u>

(a) **Data Needed to Compile the Indicator:** Poverty estimates are calculated from nationally representative household surveys.

(b) **National and International Data Availability and Sources:** The World Bank produced its first global poverty estimates for developing countries for *World Development Report 1990* using household survey data for 22 countries (Ravallion, Datt, and van de Walle1991). Incorporating survey data collected during the last 17 years, the database has expanded considerably and now includes more than 550 surveys representing about 100 developing countries. Some 1.1 million randomly sampled households were interviewed in these surveys, representing 93 percent of the population of developing countries. The surveys asked detailed questions on sources of income and how it was spent and on other household characteristics such as the number of people sharing that income. Most interviews were conducted by staff of government statistics offices. Along with improvements in data coverage and quality, the underlying methodology has also improved, resulting in better and more comprehensive estimates. In the last 25 years there has been enormous progress in designing, implementing and processing such surveys for developing countries — thanks in large part to the efforts of

[3] More information is available at the World Bank's website: www.worldbank.org/poverty
[4] For further discussions on different dimensions of poverty, refer to *World Development Report 2000/2001: Attacking Poverty*, The World Bank (2000).
[5] Source: *World Development Report 2000/2001: Attacking Poverty*, The World Bank (2000).
[6] Source: *About the data* section of the Table 2.6 in *World Development Indicators 2007*, The World Bank (2007).

national statistics agencies throughout the world, and the support of the donor community and international development agencies. [7]

(c) **Data References:** Data on national poverty rate are included in the World Development Indicators (WDI) publications and WDI Online database of the World Bank, see http://go.worldbank.org/3JU2HA60D0 and http://go.worldbank.org/6HAYAHG8H0.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) **Lead Agency:** The lead agency is the World Bank. The contact point is Data Help Desk: data@worldbank.org

(b) **Other Contributing Organizations:**

6. REFERENCES

(a) **Readings:**
The World Bank, *World Development Report* 1990, 2000-2001, and 2006 editions
The World Bank, *Word Development Indicators*, various years

(b) **Internet site:**
The World Bank: www.worldbank.org/poverty
World Development Report: www.worldbank.org/wdr
World Development Indicators: www.worldbank.org/data

[7] Source: *About the data* section of the Table 2.6 in *World Development Indicators 2007*, The World Bank (2007).

PROPORTION OF POPULATION BELOW 1 $ A DAY		
Poverty	**Income poverty**	

1. INDICATOR

(a) **Name:** Proportion of population below 1 $ day, also known as poverty rate at $1 a day.

(b) **Brief Definition:** The poverty rate at $1 a day is the proportion of the population having per capita consumption of less than $1.08 a day, measured at 1993 international prices.

(c) **Unit of Measurement:** Percentage

(d) **Placement in the CSD Indicator Set:** Poverty/Income poverty

2. POLICY RELEVANCE

(a) Purpose: Progress against absolute poverty is now a widely accepted yardstick for assessing the overall performance of developing economies. The population below $1 a day provides a uniform measure of absolute poverty for the developing world, using data from nationally representative household surveys. This indicator is used for monitoring progress towards the achievement of Goal 1 of the Millennium Development Goals - to eradicate extreme poverty and hunger.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): Poverty reduction is one of the key goals of the international community's sustainable development strategy. Many countries give priority to poverty reduction in their national strategies of economic development. Measuring and monitoring the current level as well as the trend in poverty rates provides useful information for the policy makers, the international development agencies and the donor community to plan and implement pro-poor growth strategies and ultimately contributes to the betterment of human lives across the globe. Moreover, poverty statistics are important for analyzing the relationship of income or consumption poverty to other dimensions of human development such as education, health, labor skills and other measures of living standards.

(c) International Conventions and Agreements: None.

(d) International Targets/Recommended Standards: Goal 1 Target 1 of the Millennium Development Goals sets a goal of reducing by half the rate of extreme poverty between 1990 and 2015.

(e) Linkages to Other Indicators: This indicator is closely linked with other measures of human development (education attainment, literacy, health status, mortality etc) and economic development.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: The population below $1 a day measures poverty by the level of consumption (or, in some case, income) available to an individual. A person is considered poor if his or her consumption or income level falls below some minimum level necessary to meet basic needs. This minimum level is usually called the "poverty line." What is necessary to satisfy basic needs varies across time and societies. Therefore, poverty lines vary in time and place, and each country uses lines that are appropriate to its level of development, societal norms, and values.[8] When estimating poverty worldwide, a uniform poverty line has to be used and expressed in a common unit across countries. Therefore, for the purposes of global aggregation and comparison, the World Bank uses poverty lines set at $1 and $2 per day (more precisely $1.08 and $2.15 in 1993 Purchasing Power Parity terms). [9]

(b) Measurement Methods: Information on consumption and income is obtained through sample surveys in which households are asked to answer detailed questions on their spending habits and sources of income. Individual income or consumption levels are calculated as averages of total household income or consumption. In some cases, an "effective" household size is calculated from the actual household size to reflect assumed efficiencies in consumption; adjustments may also be made to reflect the number of children in a household. However, the World Bank's preferred methodology is to make no such adjustments.

Poverty measures based on an international poverty line attempt to hold the real value of the poverty line constant across countries, as is done when making comparisons over time. The $1-a-day standard, measured in 1985 prices and adjusted to local currency using purchasing power parities (PPPs), was chosen for the World Bank's *World Development Report 1990: Poverty*, because it is typical of the poverty lines in low-income countries. Early editions of *World Development Indicators* used PPPs from the Penn World Tables. Recent editions use 1993 consumption PPP estimates produced by the World Bank. Recalculated in 1993 PPP terms, the original international poverty line of $1 a day in 1985 PPP terms is now about $1.08 a day. The 2005 round of the International Comparison Program will provide new consumption PPPs in the coming year.

(c) Limitations of the Indicator: International comparisons of poverty estimates entail both conceptual and practical problems. A key building block in developing income and consumption measures of poverty is the poverty line—the critical cutoff in income or consumption below which an individual or household is determined to be poor. Countries have different definitions of poverty, and consistent comparisons across countries can be difficult. Local poverty lines tend to have higher purchasing power in rich countries, where more generous standards are used, than in poor countries. The internationally comparable lines are useful for producing global aggregates of poverty. In principle, they test for the ability to purchase a basket of commodities that is roughly similar across the world. But such a universal line is generally not suitable for the

[8] For further discussion on poverty lines, refer to *World Development Report 2000/2001: Attacking Poverty*, The World Bank (2000).
[9] Source: The World Bank website: www.worldbank.org/poverty.

analysis of poverty within a country. For that purpose, a country-specific poverty line needs to be constructed, reflecting the country's economic and social circumstances. Similarly, the poverty line may need to be adjusted for different locations (such as urban and rural areas) within the country, if prices or access to goods and services differs.

The international poverty line uses 1993 consumption PPP estimates produced by the World Bank. Any revisions in the PPP of a country to incorporate better price indexes can produce dramatically different poverty lines in local currency. PPP exchange rates, such as those from the Penn World Tables or the World Bank, are used because they take into account the local prices of goods and services not traded internationally. But PPP rates were designed for comparing aggregates from national accounts, not for making international poverty comparisons. As a result, there is no certainty that an international poverty line measures the same degree of need or deprivation across countries. [10]

The national poverty rate is a "headcount" measure, which is by far the most commonly calculated measure of poverty. But it has decided disadvantages. It fails to reflect the fact that among poor people there may be wide differences in income levels, with some people located just below the poverty line and others experiencing far greater shortfalls. Policymakers seeking to make the largest possible impact on the headcount measure might be tempted to direct their poverty alleviation resources to those closest to the poverty line (and therefore least poor).[11]

Lastly, this indicator measures income/consumption based poverty and does not take into account other dimensions of poverty such as inequality, vulnerability, and lack of voice and power of the poor.[12]

(d) **Status of Methodology:** The methodology is generally well developed.

(e) **Alternative Definitions/Indicators:** There are other useful indicators of measuring poverty: the poverty gap at international poverty line, which takes into account the distance of poor people from the 1$ a day poverty line; and the squared-poverty gap, which take into account the degree of income inequality among poor people.[13]Moreover, quantitative methods of measuring income/consumption poverty are increasingly being complemented by participatory methods, in which people are asked what their basic needs are and what poverty means for them. Moreover, quantitative methods of measuring income/consumption poverty are increasingly being complemented by participatory methods, where people are asked what their basic needs are and whether such needs are met. Interestingly, new research shows a high degree of concordance between poverty lines based on objective and subjective assessments of needs. [14]

---

[10] For further details, refer to the *About the data* section of the Table 2.6 in *World Development Indicators 2007*, The World Bank (2007).

[11] More information is available at the World Bank's website: www.worldbank.org/poverty.

[12] For further discussions on different dimensions of poverty, refer to *World Development Report 2000/2001: Attacking Poverty*, The World Bank (2000).

[13] Source: *World Development Report 2000/2001: Attacking Poverty*, The World Bank (2000).

[14] Source: *About the data* section of the Table 2.6 in *World Development Indicators 2007*, The World Bank (2007).

4. ASSESSMENT OF DATA

(a) **Data Needed to Compile the Indicator:** Poverty estimates are calculated from nationally representative household surveys. Another important indicator need for estimating absolute poverty is the consumption Purchasing Power Parity (PPP) rate.

(b) **National and International Data Availability and Sources:** The World Bank produced its first global poverty estimates for developing countries for World Development Report 1990 using household survey data for 22 countries (Ravallion, Datt, and van de Walle 1991). Incorporating survey data collected during the last 17 years, the database has expanded considerably and now includes more than 550 surveys representing about 100 developing countries. Some 1.1 million randomly sampled households were interviewed in these surveys, representing 93 percent of the population of developing countries. The surveys asked detailed questions on sources of income and how it was spent and on other household characteristics such as the number of people sharing that income. Most interviews were conducted by staff of government statistics offices. Along with improvements in data coverage and quality, the underlying methodology has also improved, resulting in better and more comprehensive estimates. In the last 25 years there has been enormous progress in designing, implementing and processing such surveys for developing countries — thanks in large part to the efforts of national statistics agencies throughout the world, and the support of the donor community and international development agencies. Purchasing power parity (PPP) rates are calculated by the World Bank using price data from International Comparison Program.

The problems of estimating poverty and comparing poverty rates do not end with data availability. Several other issues, some related to data quality, also arise in measuring household living standards from survey data. One relates to the choice of income or consumption as a welfare indicator. Income is generally more difficult to measure accurately, and consumption comes closer to the notion of standard of living. And income can vary over time even if the standard of living does not. But consumption data are not always available. Another issue is that household surveys can differ widely, for example, in the number of consumer goods they identify. And even similar surveys may not be strictly comparable because of differences in timing or the quality and training of survey enumerators. Comparisons of countries at different levels of development also pose a potential problem because of differences in the relative importance of consumption of nonmarket goods. The local market value of all consumption in kind (including own production, particularly important in underdeveloped rural economies) should be included in total consumption expenditure. Similarly, imputed profit from the production of nonmarket goods should be included in income. This is not always done, though such omissions were a far bigger problem in surveys before the 1980s. Most survey data now include valuations for consumption or income from own production. Nonetheless, valuation methods vary. For example, some surveys use the price in the nearest market, while others use the average farmgate selling price. Whenever possible, The World Bank uses consumption data in deciding who is poor and income surveys only when consumption data are unavailable. [15]

(c) **Data References:** Data on global poverty is included in the World Development Indicators (WDI) publications and WDI Online database of the World Bank, see http://go.worldbank.org/3JU2HA60D0 and http://go.worldbank.org/6HAYAHG8H0
The World Bank Research Group compiles and maintains a Global Poverty Monitoring Database: http://iresearch.worldbank.org/PovcalNet/jsp/index.jsp.
Global Monitoring Reports (GMR) also publishes data on global poverty, see http://go.worldbank.org/UVQMEYED00.
The UN Millennium Development Goals website also contain data on global poverty: http://www.un.org/millenniumgoals/

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(c) **Lead Agency:** The lead agency is the World Bank. The contact point is Data Help Desk: data@worldbank.org

(d) **Other Contributing Organizations:**

6. REFERENCES

(a) **Readings:**

The World Bank, *World Development Report* 1990, 2000-2001, and 2006 editions
The World Bank, *Word Development Indicators*, various years
The World Bank, *Global Monitoring Report*, various editions
Shaohua Chen and Martin Ravallion, "How Have the World's Poorest Fare since the early 1980s?", *The World Bank Research Observer, Vol. 19. No. 2,* 2004
Shaohua Chen and Martin Ravallion, "Absolute Poverty Measures for the Developing World, 1981-2004", 2007

(b) **Internet site:**
The World Bank: www.worldbank.org/poverty
PovcalNet: http://iresearch.worldbank.org/PovcalNet/jsp/index.jsp
World Development Reports: www.worldbank.org/wdr
World Development Indicators: www.worldbank.org/data
Global Monitoring Reports: http://go.worldbank.org/UVQMEYED00
The UN Millennium Development Goals website: http://www.un.org/millenniumgoals

[15] For further details, refer to the *About the data* section of the Table 2.6 in *World Development Indicators 2007*, The World Bank (2007

RATIO OF SHARE IN NATIONAL INCOME OF HIGHEST TO LOWEST QUINTILE		
Poverty	**Inequality**	**Core indicator**

1. INDICATOR

(a) **Name:** Ratio of share in national income or consumption of highest to lowest quintile

(b) **Brief Definition:** Ratio of the share in national income (or consumption) accruing to the highest 20 percent of the population to the share accruing to the lowest 20 percent.

(c) **Unit of Measurement:** Dimensionless ratio, with higher values indicating a more unequal distribution of income or consumption.

(d) **Placement in the CSD Indicator Set:** Poverty/Inequality

2. POLICY RELEVANCE

a) **Purpose:** The indicator shows the extent of inequality in income distribution within a country.

b) **Relevance to Sustainable/Unsustainable Development (theme/sub-theme):** Inequality in outcomes such as income or consumption and inequality in opportunities hinder human development and are detrimental to long-term economic growth. Poor people generally have less voice, less income, and less access to services than wealthier people. When societies become more equitable in ways that lead to greater opportunities for all, the poor stand to benefit from a "double dividend." Empirical studies suggest that the impact of growth on poverty reduction is greater when initial income inequality is lower. [16]

c) **International Conventions and Agreements:** None.

d) **International Targets/Recommended Standards:** None

e) **Linkages to Other Indicators:** This indicator is closely linked with other measures of poverty, inequality, human development and domestic economic development.

3. METHODOLOGICAL DESCRIPTION

[16] For further discussions on correlation between growth, inequality and poverty, refer to the World Bank website: www.worldbank.org/poverty and the *World Development Report 2006: Equity and Development*, The World Bank 2005.

(a) **Underlying Definitions and Concepts:** The ratio of the share in national income (or consumption) of the highest to lowest quintile measures the extent of inequality between the tails of the distribution of income or consumption. The higher this ratio, the larger the share of the country's total income or consumption belonging to the richest quintile, compared to the poorest quintile.

(b) **Measurement Methods:** This indicator is constructed by dividing the income (or consumption) accruing to the richest quintile of population by the income (or consumption) accruing to the poorest quintile of population. Data on the distribution of income or consumption come from nationally representative household surveys. Where the original data from the household survey are available, they can be used to directly calculate the income or consumption shares by quintile. Otherwise, shares can be estimated from grouped data. The distribution data may be adjusted for household size, providing a more consistent measure of per capita income or consumption. Adjustments for spatial differences in the cost of living within countries are not made, because the data needed for such calculations are generally unavailable.

(c) **Limitations of the Indicator:** This ratio merely shows how much more the wealthiest quintile of the population earn or consume compared to the poorest quintile and does not provide a full picture of the income distribution. It does not convey information about the inequality among the poor. Also, this indicator does not assess non-income dimensions of inequality such as inequality in access to health, education, power and voice.[17]

(d) **Status of Methodology:** The methodology is generally well developed.

(e) **Alternative Definitions/Indicators:** Alternative indicators include: the Gini index which measures the extent to which the a distribution deviates from a uniform distribution; Generalized Entropy (or GE) indexes, which measures inequality by applying different weights to distances between observations at different parts of the distribution; Atkinson Coefficients, which explicitly consider society's preference for equality; Percentile Ratios (such as p80/p20, p90/p10 and p90/p50); and Relative Poverty Rates.

4. ASSESSMENT OF DATA

(a) **Data Needed to Compile the Indicator:** To calculate this ratio, data on the distribution of income or consumption from nationally representative household surveys is needed.

(b) **National and International Data Availability and Sources**: Data on the distribution of income or consumption come from nationally representative household

[17] For further discussions about non-income dimensions of inequality, refer to *World Development Report 2006: Equity and Development*, The World Bank 2005.

surveys. Data coverage has been improving in most countries as more and better quality household income/expenditure surveys were fielded in the past two decades.[18]

Because the underlying household surveys differ in method and type of data collected, the distribution data are not strictly comparable across countries. These problems are diminishing as survey methods improve and become more standardized, but achieving strict comparability is still impossible. Two sources of noncomparability should be noted. First, surveys can differ in many respects, including whether they use income or consumption expenditure as the living standard indicator. The distribution of income is typically more unequal than the distribution of consumption. In addition, definitions of income differ more often among surveys. Consumption is usually a better welfare indicator, particularly in developing countries. Second, households differ in size (number of members) and in the extent of income sharing among members. And individuals differ in age and consumption needs. Differences among countries in these respects may bias comparisons of distribution. [19]

(c) **Data References:** Data on income distribution is included in the World Development Indicators (WDI) publications and WDI Online database of the World Bank, see http://go.worldbank.org/3JU2HA60D0 and http://go.worldbank.org/6HAYAHG8H0.
Data collection and analysis of income distribution for high income countries are conducted by the Luxembourg Income Study (http://www.lisproject.org/) and maintained in Luxembourg Income Study database.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the World Bank. The contact point is Data Help Desk: data@worldbank.org

(b) Other Contributing Organizations: Luxembourg Income Study (http://www.lisproject.org/)

6. REFERENCES

(a) Readings:

The World Bank, *World Development Report* 1990, 2000-2001, 2004 and 2006 editions

The World Bank, *Word Development Indicators*, various years

Atkinson, A. B., L. Rainwater, and T. M. Smeeding. 1995. Income *Distribution in OECD Countries: Evidence from the Luxembourg Income Study (LIS)*. Paris: OECD.

Barro, R. (2000). "Inequality and Growth in a Panel of Countries", *Journal of Economic Growth*, 5.

Chen, S. and M. Ravallion (1997), "What Can New Survey Data Tell Us about Recent Changes in Distribution and Poverty?" *The World Bank Economic Review*, 11(2).

[18] More information on data availability and quality can be found in the *About the data* sections of Table 2.6 and Table 2.7 of *World Development Indicators 2007*, The World Bank, 2007.

[19] For further discussions refer to the *About the data* section of Table 2.7 *in World Development Indicators 2007*, World Bank, 2007.

Deninger, K. and L. Squire (1996). "A New Data Set Measuring Income Inequality." *The World Bank Economic Review*, 10(3).

(b) Internet site:

The World Bank: www.worldbank.org/poverty
PovcalNet: http://iresearch.worldbank.org/PovcalNet/jsp/index.jsp
World Development Reports: www.worldbank.org/wdr
World Development Indicators: www.worldbank.org/data
Luxembourg Income Study http://www.lisproject.org/

PROPORTION OF POPULATION USING IMPROVED SANITATION FACILITIES		
Poverty/Health	**Sanitation**	**Core indicator**

1. **INDICATOR**

(a) **Name:** Proportion of population using improved sanitation facilities, urban and rural.

(b) **Brief Definition:** Proportion of population that is regularly using a private sanitary facility for human excreta disposal in the dwelling or immediate vicinity.

(c) **Unit of Measurement:** %.

(d) **Placement in the CSD Indicator Set:** Health/Sanitation.

2. **POLICY RELEVANCE**

(a) **Purpose:** To monitor progress in the accessibility of the population to sanitation facilities.

(b) **Relevance to Sustainable/Unsustainable Development (theme/sub-theme):** This represents a basic indicator useful for assessing sustainable development, especially human health. Accessibility to adequate excreta disposal facilities is fundamental to decrease the faecal risk and the frequency of associated diseases. Its association with other socioeconomic characteristics (education, income) and its contribution to general hygiene and quality of life also make it a good universal indicator of human development. When broken down by geographic (such as rural/urban zones) or social or economic criteria, it also provides tangible evidence of inequities.

(c) **International Conventions and Agreements:** Agenda 21 UNCED (1992) indicates the need for universal coverage and the Second World Water Forum and Ministerial Conference, The Hague, March 2000 established the target of universal coverage by the year 2025, the Millennium Summit, 2000, established the target of halving the proportion of unserved by 2015.

(d) **International Targets/Recommended Standards:** International targets for this indicator have been established according to different international events (see above).

(e) **Linkages to Other Indicators:** The indicator is closely associated with other socioeconomic indicators (see section 2(b) above), particularly the proportion of population with access to improved water sources. The indicator represents two of the eight elements of primary health care and is one of the targets of the Millennium Development Goals.

3. **METHODOLOGICAL DESCRIPTION**

(a) **Underlying Definitions and Concepts:** Definitions for sanitary facility:

i) *Sanitary facility:* "A sanitary facility is a unit for disposal of human excreta which isolates faeces from contact with people, animals, crops and water sources. Suitable

facilities range from simple but protected pit latrines to flush toilets with sewerage. All facilities, to be effective, must be private, correctly constructed and properly maintained".
ii) *Population covered:* This includes the urban and rural population served by improved sanitation facilities including connections to public sewers, pit privies, pour-flush latrines, septic tank, ventilated improved latrines, latrines with slabs, etc.)

(b) Measurement Methods: This indicator may be calculated as follows: The numerator is the number of people with improved excreta-disposal facilities available multiplied by 100. The denominator is the total population.

(c) Limitations of the Indicator: The indicator uses a proxy to adequate sanitation facilities as it is not possible at the current stage to define precisely the proportion of population with sanitary facilities strictly according to the conceptual definitions above.

(d) Status of the Methodology: The estimates of access to improved sanitation facilities are obtained from the use of existing sample household surveys such as DHS, MICS and national censuses. Trend lines of urban and rural coverage are build up, which provide estimates for relevant years as required (the last estimates were carried out in 2004 referring to coverage figures for 1990 and 2002).

(e) Alternative Definitions/Indicators: An additional indicator dealing with access to toilet facilities flushing to sewerage systems might be relevant. The population that must be used in the numerator is the number of people with access to these facilities.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: The number of people with access to improved excreta disposal facilities, and the total population.

(b) National and International Data Availability and Sources: Routinely collected at the national and sub-national levels in most countries using censuses and surveys. Household surveys used by the JMP include: USAID supported Demographic and Health Surveys (DHS); UNICEF supported Multiple Indicator Cluster Surveys (MICS); national census reports; WHO supported World Health Surveys; and other reliable country surveys that allow data to be compared.

(c) Data References: International data is included in the MDG database maintained by the United Nations Statistics Division as well as in the World Health Statistics published by WHO.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agencies are the World Health Organization (WHO) and UNICEF through the WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation (JMP). The contact point is the Coordinator, Water, Sanitation and Health, WHO or the Unit Chief WES at UNICEF.

(b) Other Contributing Organizations: Members of the JMP Technical Advisory Group including individual experts from academic institutions and civil society, plus representatives of organizations involved in both water and sanitation and data collection, including UN-Habitat, ORC Macro International, United Nations Environment Programme, the Environmental Health Project of the United States Agency for International Development, the World Bank, the Water Supply and Sanitation Collaborative Council and the Millennium Project.

6. REFERENCES

(a) Readings:

World Health Organization, *Development of Indicators for Monitoring Progress Towards Health for All by the Year 2000.* Geneva, WHO, 1981, p. 29.
World Health Organization, *Global Strategy for Health for All by the Year 2000.* Geneva, WHO, 1981.
World Health Organization. *National and Global Monitoring of Water Supply and Sanitation.* CWS Series of Cooperative Action for the Decade, No. 2, 1982.
World Health Organization. *Water Supply and Sanitation Sector Monitoring Report (WSSSMR)*, 1990.
World Health Organization, *Ninth General Programme of Work Covering the Period 1996-2001.* Geneva, WHO, 1994.
World Health Organization and UNICEF, *Meeting the MDG drinking water and sanitation target: the urban and rural challenge of the decade.* Geneva, WHO, 2006

(b) Internet site:

World Health Statistics: http://www.who.int/whosis/en/index.html
Water, Sanitation and Health: http://www.who.int/water_sanitation_health/en/
MDG Indicators: http://mdgs.un.org/unsd/mdg/Default.aspx

PROPORTION OF POPULATION USING AN IMPROVED WATER SOURCE		
Poverty/Health	**Drinking Water**	**Core indicator**

1. INDICATOR

(a) Name: Proportion of population using an improved water source, urban and rural.

(b) Brief Definition: Proportion of population with access to an improved drinking water source in a dwelling or located within a convenient distance from the user's dwelling.

(c) Unit of Measurement: %.

(d) Placement in the CSD Indicator Set: Poverty/Drinking Water.

2. POLICY RELEVANCE

(a) Purpose: To monitor progress in the accessibility of the population to improved water sources.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): Accessibility to improved water sources is of fundamental significance to lowering the faecal risk and frequency of associated diseases. Its association with other socioeconomic characteristics, including education and income, makes it a good universal indicator of human development. When broken down by geographic (such as rural/urban zones), or social or economic criteria, it provides useful information on equity issues.

(c) International Conventions and Agreements: Agenda 21 of UNCED (1992) indicates the need for universal coverage and the Second World Water Forum and Ministerial Conference, The Hague, March 2000 established the target of universal coverage by the year 2025, the Millennium Summit, 2000, established the target of halving the proportion of unserved by 2015.

(d) International Targets/Recommended Standards: International targets for this indicator have been established according to different international events (see above).

(e) Linkages to Other Indicators: This indicator is closely associated with other socioeconomic indicators on the proportion of people covered by adequate sanitation. These indicators are among the eight elements of primary health care and are one of the targets of the Millennium Development Goals. It also has close links to other water indicators such as withdrawals, reserves, consumption, or quality. (See section 2(b) above.)

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: This indicator requires definitions for several elements.

i) *Population covered:* This includes urban and rural population served by house connections, or without house connections but with reasonable access to other sources.
ii) *Reasonable access to water:* not more than 1000 metres from a house to a public stand post or any other improved drinking water source providing at least 20 litres per capita per day may be considered reasonable access.
iii) *Minimum amount of water:* The amount of water needed to satisfy metabolic, hygienic, and domestic requirements. This is usually defined as twenty litres of safe water per person per day.
iv) *Safe water:* The water does not contain biological or chemical agents at concentration levels directly detrimental to health according to WHO's guidelines for drinking water quality or national standards of water quality. It is likely that treated surface waters, and water such as that from protected boreholes, springs, and sanitary wells are safe. Untreated surface waters, such as streams and lakes, should be considered safe only if the water quality is regularly monitored and considered acceptable by public health officials. Water from unimproved sources is likely to be unsafe.

(b) Measurement Methods: This indicator may be calculated as follows: The numerator is the number of persons with sustainable access to an improved drinking water source located within a convenient distance from the user's dwelling multiplied by 100. The denominator is the total population.

(c) Limitations of the Indicator: The existence of a water outlet within reasonable distance is often used as a proxy for availability of safe water. The existence of a water outlet, however, is no guarantee in itself that water will always be available or safe, or that people always use such sources.

(d) Status of the Methodology: The estimates of access to improved drinking water facilities are obtained from the use of existing sample household surveys such as DHS, MICS and national censuses. Trend lines of urban and rural coverage are build up, which provide estimates for relevant years as required (the last estimates were carried out in 2004 referring to coverage figures for 1990 and 2002).

(e) Alternative Definitions/Indicators: An additional indicator expressed as the percent of population with access to household connections from a public piped distribution system would be very relevant.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: The number of people with access to improved water sources, and the total population. Data on the source of water, for example, house tap or yard pipe, would provide additional meaning to this indicator.

(b) National and International Data Availability and Sources: Routinely collected at the national and sub-national levels in most countries using censuses and surveys. Household surveys used by the JMP include: USAID supported Demographic and Health Surveys (DHS); UNICEF supported Multiple Indicator Cluster Surveys (MICS); national census reports; WHO supported World Health Surveys; and other reliable country surveys that allow data to be compared.

(c) Data References: International data is included in the MDG database maintained by the United Nations Statistics Division as well as in the World Health Statistics published by WHO.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agencies are the World Health Organization (WHO) and UNICEF through the WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation (JMP). The contact point is the Coordinator, Water, Sanitation and Health, WHO or the Unit Chief WES at UNICEF

(b) Other Contributing Organizations: Members of the JMP Technical Advisory Group including individual experts from academic institutions and civil society, plus representatives of organizations involved in both water and sanitation and data collection, including UN-Habitat, ORC Macro International, United Nations Environment Programme, the Environmental Health Project of the United States Agency for International Development, the World Bank, the Water Supply and Sanitation Collaborative Council and the Millennium Project.

6. REFERENCES

(a) Readings:

World Health Organization, *Global Strategy for Health for All by the Year 2000.* Geneva, WHO, 1981.

World Health Organization, *Development of Indicators for Monitoring Progress Towards Health for All by the Year 2000.* Geneva, WHO, 1981, p. 40.

World Health Organization. *National and Global Monitoring of Water Supply and Sanitation.* CWS Series of Cooperative Action for the Decade, No. 2, 1982.

World Health Organization. *Water Supply and Sanitation Sector Monitoring Report (WSSSMR),* 1990.

World Health Organization, *Ninth General Programme of Work Covering the Period 1996-2001.* Geneva, WHO, 1994.

World Health Organization, Guidelines for Drinking-Water Quality, third edition. Geneva, WHO, 2004

World Health Organization and UNICEF, *Meeting the MDG drinking water and sanitation target: the urban and rural challenge of the decade.* Geneva, WHO, 2006

(b) Internet site:

World Health Statistics: http://www.who.int/whosis/en/index.html
Water, Sanitation and Health: http://www.who.int/water_sanitation_health/en/
MDG Indicators: http://mdgs.un.org/unsd/mdg/Default.aspx

SHARE OF HOUSEHOLDS WITHOUT ELECTRICITY OR OTHER MODERN ENERGY SERVICES		
Poverty	**Access to energy**	**Core indicator**

1. INDICATOR

(a) Name: Share of households without electricity or other modern energy services

(b) Brief Definition: Share of households with no access to commercial energy services including electricity, or heavily dependent on 'traditional' non-commercial energy options, such as fuelwood, charcoal, agricultural wastes and animal dung

(c) Units of Measurement: Percentage

(d) Placement in the CSD Indicator Set: Poverty/Access to energy

2. POLICY RELEVANCE

(a) Purpose: To monitor progress in accessibility and affordability of modern energy services including electricity.

(b) Relevance to Sustainable Development: Modern energy services are an essential component of providing adequate food, shelter, water, sanitation, medical care, education and access to communication. Lack of access to modern energy services contributes to poverty and deprivation and limits economic development. Furthermore, adequate, affordable and reliable energy services are necessary to guarantee sustainable economic and human development.

It is estimated that 2.5 billion people, or about one-third of the world's population, depend mainly on traditional biomass sources of energy; 1.6 billion are without electricity. About 300 million people have been connected to electricity grids or have been provided with modern biomass or other forms of commercial energy options since 1993. However, in the absence of adequate measures, the number of people with no access to modern energy services will remain stable or continue to grow as demographic growth outpaces electrification in some parts of the world.

(c) International Conventions and Agreements: None.

(d) International Targets/Recommended Standards: The Johannesburg Plan of Implementation (JPOI) of the World Summit on Sustainable Development held in 2002 includes the aim of improving access to reliable and affordable energy services. The JPOI also includes the commitment to support Africa's efforts to implement the New Partnership for Africa's Development (NEPAD) objectives on energy, which seek to secure access for at least 35 per cent of the African population within 20 years, especially in rural areas.

(e) Linkages to Other Indicators: This indicator is linked to the use of traditional fuels, to energy prices and to several indicators of the social dimension, such as income inequality, share of household income spent on fuel and electricity, energy use relative to income level, urbanization, etc. The indicator might indirectly reflect a related use of forest resources as fuelwood, which in turn could cause deforestation.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: Consumption of traditional fuels refers to the consumption of fuelwood, charcoal, agricultural wastes and animal dung. Total household energy use might comprise modern (commercial) energy as well as traditional (non-commercial) fuels.

Households choose among energy options on the basis of fuel accessibility and affordability, the household's socioeconomic characteristics and attitudes, and the attributes of the different fuels. Lack of access to modern energy services implies unsatisfied energy requirements or the use of traditional fuels. If electricity and other commercial fuels and are available, income is the main characteristic that appears to influence a household's choice of fuel. Different income groups use different fuels, and the poor in many developing countries to a great extent meet their energy demand using traditional biomass fuels, either because of a lack of access to commercial energy services or because of limited disposable income. National shares of traditional fuel in total energy use do not accurately reflect this indicator, as the average figures may strongly differ from corresponding figures for each income group of the population. Therefore, the preferred indicator is the percentage of households or population with no access to modern commercial energy options, or heavily dependent on 'traditional' non-commercial energy options, such as fuelwood, agricultural wastes and animal dung.

(b) Measuring Methods: This indicator is defined by the share of households without access to modern energy or electricity and by the share of households that are heavily dependent on 'traditional' non-commercial energy options. Where possible, the share of households without access to electricity should be calculated separately from the share of households that rely on traditional fuels as their primary energy option for cooking and heating. The indicators should be calculated for both urban and rural households where this is relevant.

(c) Limitations of the Indicators: Availability of current and historic data may be a limitation. Heavy dependence on non-commercial energy is defined as relying on traditional fuels as the primary energy option for cooking and heating and is subject to interpretation. The 'access to electricity' could reflect different concepts, like the exact physical access to electricity (connectivity to the grid) or the financial access to electricity (ability to pay the electricity bill).

(d) Alternative Definitions/Indicators: An alternative indicator that may be useful is 'Per capita consumption of non-commercial or traditional energy'. However, this does not really capture the essence of the issue. Population rather than households could be used as reference in calculating this indicator.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: The number of urban and rural households without access to electricity, those urban and rural households that are heavily dependent on traditional fuels, and the total number of urban and rural households in a specific country or a region.

(b) National and International Data Availability and Sources: The most important source of data on commercial and traditional fuel and electricity consumption is household surveys. The results of these surveys can be obtained from reports published by government statistical agencies. About two-thirds of the developing countries have conducted sample household surveys that are representative nationally, and some of these provide high-quality data on living standards. International agencies such as the United Nations Children's Fund (UNICEF) also carry out their own surveys of households.

Data on household fuel and electricity consumption by average population are available from the International Energy Agency (IEA) *Energy Balances of OECD Countries* and *Energy Balances of Non-OECD Countries*.

The United Nations Regional Commissions for Asia and the Pacific (ESCAP) and for Latin America and the Caribbean (ECLAC) publish data on access to electricity in their member countries in their electricity surveys (ESCAP) and statistical yearbooks (ECLAC).

(c) Data references

IEA: http://www.iea.org/Textbase/stats/prodresult.asp?PRODUCT=Balances

ESCAP: http://www.unescap.org/esd/energy/information/electricpower/

ECLAC: http://websie.eclac.cl/sisgen/ConsultaIntegrada.asp

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agencies: The International Energy Agency (IEA) is the lead agency.

(b) Other contributing organizations: International Atomic Energy Agency.

6. REFERENCES

Chen, S., Datt, G., Ravallion, M., 1992. *POVCAL: A Program for Calculating* Poverty Measures from Grouped Data. Washington DC, USA: World Bank, Poverty and Human Resources Division, Policy Research Department.

IAEA, UN DESA, IEA, EUROSTAT and EEA, 2005. Energy indicators for sustainable development: guidelines and methodologies. Vienna, Austria: International Atomic Energy Agency.

IAEA and UN DESA, 2007. Energy Indicators for sustainable development: country studies on Brazil, Cuba, Lithuania, Mexico, Russian Federation and Thailand. New York, USA: United Nations.

IEA, various editions. *Energy Balances of Non-OECD Countries*. Paris, France: International Energy Agency.

IEA, various editions. *Energy Balances of OECD Countries*. Paris, France: International Energy Agency.

IEA, various editions. *Energy Statistics of Non-OECD Countries*. Paris, France: International Energy Agency.

IEA, various editions. *Energy Statistics of OECD Countries*. Paris, France: International Energy Agency.

UNICEF. *MICS Household Surveys.* New York, USA: United Nations Children's Fund. Available at http://www.childinfo.org.

UNSD, 1991. *Energy Statistics: A Manual for Developing Countries*. New York, USA: United Nations Statistics Division.

WEC, 2000. *Energy for Tomorrow's World – Acting Now.* London, UK: World Energy Council.

World Bank, various editions. *World Development Indicators.* Published annually. Washington DC, USA: World Bank.

PERCENTAGE OF POPULATION USING SOLID FUELS FOR COOKING		
Poverty	**Access to energy**	

1. INDICATOR

(a) Name: Percentage of population using solid fuels for cooking.

(b) Brief Definition: Percentage of population using solid fuels for cooking.

(c) Unit of Measurement: %.

(d) Placement in the CSD Indicator Set: Poverty/ Access to energy

2. POLICY RELEVANCE

(a) Purpose: To monitor changes in cooking fuel use as a measure of access to modern household energy services.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): This indicator is relevant to many sustainable development themes. Most importantly, the use of solid fuels in households is a proxy for indoor air pollution, which is associated with increased mortality from pneumonia and other acute lower respiratory diseases among children as well as increased mortality from chronic obstructive pulmonary disease and lung cancer (where coal is used) among adults. Its association with other socioeconomic characteristics (education, income) and quality of life make it a good universal indicator of social and economic development. When broken down by geographical (rural/ urban) or socioeconomic (income quintiles/ education) criteria, it also provides tangible evidence of inequities. Finally, the percentage of population using solid fuels is a Millennium Development Goal indicator towards environmental sustainability, as high demand for biomass fuels to meet household energy needs can contribute to deforestation and subsequent land degradation.

(c) International Conventions and Agreements: The Johannesburg Plan of Implementation (2002) recommends improving access to modern biomass technologies and more efficient use of firewood.

(d) International Targets/Recommended Standards: The Forum of Energy Ministers of Africa (2005) is committed to providing access to modern cooking energy to 50% of the rural poor. In a White Paper (2005), the Economic Community of West African States (ECOWAS) commits to providing modern cooking energy to 100% of the rural population corresponding to more than 300 million people.

(e) Linkages to Other Indicators: The indicator is closely associated with socioeconomic indicators.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: Definitions of solid fuels: Solid fuels include biomass fuels, such as wood, charcoal, crops or other agricultural waste, dung, shrubs and straw, and coal.

(b) Measurement Methods: This indicator is calculated as follows: The numerator is the number of people using solid fuels multiplied by 100. The denominator is the total population.

(c) Limitations of the Indicator:

- The indicator uses solid fuel use as a proxy for indoor air pollution, as it is not currently possible to obtain nationally representative samples of concentrations of criteria pollutants, such as small particles and carbon monoxide, in the indoor environment.

- The indicator is based on the main type of fuel used for cooking as cooking occupies the largest share of overall household energy needs. However, many households use more than one type of fuel for cooking and, depending on climatic and geographical conditions, heating with solid fuels can also be a contributor to indoor air pollution levels.

- Nationally representative data are available for a majority of countries; where no data are available through surveys and censuses, a model is applied to estimate national solid fuel use (see 3.d).

(d) Status of the Methodology: The estimates of solid fuel use are obtained through the following three approaches:

- The data from surveys and censuses are used as reported in the surveys and censuses.

- All countries with a Gross National Income (GNI) per capita above US$ 10,500.- are assumed to have made a complete transition to cooking with non-solid fuels.

- For low- and middle-income countries with a GNI per capita below US$ 10,500.- and for which no household solid fuel use data are available, a regression model based on GNI, percentage of rural population and location or non-location within the Eastern Mediterranean Region is used to estimate the indicator.

(e) Alternative Definitions/Indicators: Not available.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator:

- Data: The number of people using solid fuels, total population.

- Model: Gross national income per capita, total population, percentage of rural population.

(b) National and International Data Availability and Sources: Solid fuel use data are routinely collected at the national and sub-national levels in most countries using censuses and surveys. Household surveys used include: USAID-supported Demographic and Health Surveys (DHS); UNICEF-supported Multiple Indicator Cluster Surveys (MICS); national census reports; WHO-supported World Health Surveys (WHS); and other reliable and nationally representative country surveys.

(c) Data References: The indicator is included in the WHO Core Health Indicators, see http://www3.who.int/whosis/core/core_select.cfm.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the World Health Organization (WHO). The contact point is the Director, Public Health and Environment, WHO.

(b) Other Contributing Organizations: The initial assessment of solid fuel use was undertaken in the context of WHO's *Comparative quantification of health risks: global and regional burden of disease attributable to selected major risk factors* by Kirk Smith, University of California at Berkeley and colleagues. Kirk Smith and other experts from academic institutions and civil society as well as representatives of organizations involved in data collection related to household energy, such as ORC Macro International, the United States Agency for International Development and the World Bank, continue to provide data and expertise towards the assessment of solid fuel use.

6. REFERENCES

(a) Readings:

Smith KR, Mehta S, Feuz M. Indoor air pollution from household use of solid fuels. In: Ezzati M et al., eds. *Comparative quantification of health risks: global and regional burden of disease attributable to selected major risk factors*. Geneva, World Health Organization, 2004.
World Health Organization. *World Health Report 2002: Reducing risks, promoting healthy life*. Geneva, World Health Organization, 2002.

Rehfuess E, Mehta S, Prüss-Üstün A. Assessing household solid fuel use – multiple implications for the Millennium Development Goals. *Environmental Health Perspectives*, 2006, 114(3):373–378.

United Nations. *The Millennium Development Goals Report*. New York, United Nations, 2005.

United Nations Statistics Division. *Millennium Development Goal Indicators Database*. Available at: http://millenniumindicators.un.org/unsd/mi/mi_goals.asp

United Nations Millennium Project. *Investing in development. A practical plan to achieve the Millennium Development Goals*. London, Sterling, VA, Earthscan and United Nations Millennium Project, 2005.

World Health Organization. *Fuel for life: household energy and health*. Geneva, World Health Organization, 2006.

Mehta S, Gore F, Prüss-Üstün A, Rehfuess EA, Smith KR. Modelling household solid fuel use towards reporting of the Millennium Development Goal indicator. *Energy for Sustainable Development*, 2006, 10(3):36-45.
IAEA, UN DESA, IEA, Eurostat and EEA, 2005. *Energy Indicators for Sustainable Development*. Vienna, IAEA.

(b) Internet sites: World Health Organization. http://www.who.int/indoorair or http://www.who.int/indoorair/mdg/en/

PROPORTION OF URBAN POPULATION LIVING IN SLUMS		
Poverty	**Living conditions**	**Core indicator**

1. INDICATOR

(a) Name: Proportion of urban population living in slums

(b) Brief Definition: The proportion of urban population lacking at least one of the following five housing conditions: Access to improved water; Access to improved sanitation facilities; Sufficient-living area, not overcrowded; Structural quality/durability of dwellings; Security of tenure.

(c) Unit of Measurement: Percentage.

(d) Placement in the CSD Indicator Set: Poverty/Living conditions

2. POLICY RELEVANCE

(a) Purpose: This indicator measures the proportion of urban dwellers living in deprived housing conditions. It is a key indicator measuring the adequacy of the basic human need for shelter. An increase of this indicator is sign for deteriorating living conditions in urban areas.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): Overcrowding, inadequate housing, lack of water and sanitation are manifestations of poverty. They deprive residents from their human rights, are associated with certain categories of health risks and are often detriments to future development

(c) International Conventions and Agreements: to be added

(d) International Targets/Recommended Standards: MDG target 11: "By 2020, to have achieved a significant improvement in the lives of at least 100 million slum-dwellers"

(e) Linkages to Other Indicators: This indicator is closely linked to the indicators on access to improved sanitation, access to safe drinking water, rate of growth of urban population, as well as to other socio-economic indicators.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: The five housing conditions used for this indicator are defined as follows:
Access to improved water: A household is considered to have access to improved drinking water if it has sufficient amount of water for family use, at an affordable price, available to household members without being subject to extreme effort, especially to women and children. A sufficient amount is the availability of at least 20

liters/person/day. The following criteria are used to determine the access to improved water:

- Piped connection to house or plot
- Public stand pipe serving no more than 5 households
- Bore hole
- Protected dug well
- Protected spring
- Rain water collection
- Bottle water (new)

Access to improved sanitation: A household is considered to have access to improved sanitation, if an excreta disposal system, either in the form of a private toilet or a public toilet shared with a reasonable number of people, is available to household members. The following criteria are used to determine the access to improved sanitation:

- Direct connection to public sewer
- Direct connection to septic tank
- Poor flush latrine
- Ventilated improved pit latrine
- Pit latrine with slab (new)

Sufficient-living area, not overcrowded: A dwelling unit is considered to provide a sufficient living area for the household members if there are fewer than four people per habitable room. Additional indicators of overcrowding have been proposed: area-level indicators such as average in-house living area per person or the number of households per area; housing-unit level indicators such as the number of persons per bed or the number of children under five per room may also be viable. However, the number of persons per room has been shown to correlate with adverse health risks and is more commonly collected through household surveys. See UN-HABITAT (1998), "Crowding and Health in Low Income Settlements of Guinea Bissau", SIEP Occasional Series No.

Structural quality/durability of dwellings: A house is considered as 'durable' if it is built on a non-hazardous location and has a structure permanent and adequate enough to protect its inhabitants from the extremes of climatic conditions such as rain, heat, cold, humidity. Durability of housing will manifest itself in various ways in different cities. For example, in Nairobi a non-durable house may be made of a patchwork of tin, cardboard, plastic sheets; while in Moscow it could be a dilapidated condominium. Considerable variability in local definition is allowed. For the estimation procedure the durability of housing is measured by the building materials for the roof, walls and/or the floor. An earthen floor is an indicator of a slum dwelling.
The following criteria are used to determine the structural quality/durability of dwellings:

- Permanency of Structure
- Permanent building material for the walls, roof and floor
- Compliance of building codes
- The dwelling is not in a dilapidated state

- The dwelling is not in need of major repair
- Location of house (hazardous)
- The dwelling is not located on or near toxic waste
- The dwelling is not located in a flood plain
- The dwelling is not located on a steep slope
- The dwelling is not located in a dangerous right of way (rail, highway, airport, power lines).

Security of tenure: Secure Tenure is the right of all individuals and groups to effective protection by the State against arbitrary unlawful evictions. Secure tenure can be made evident through formal or informal mechanisms in codified law and in customary law. In its most formal presentation secure tenure is based on a cadastral system where title deeds or lease agreements are registered with the authorities. Less formal security of tenure is more commonly found. It is recognized that informal customary secure tenure practice may also offer effective protection against arbitrary eviction.
The following criteria are used to determine security of tenure:

- Evidence of documentation that can be used as proof of secure tenure status
- Either *de facto* or perceived / protection from forced evictions

(b) Measurement Methods: In principle, the indicator can easily be computed if data on all five conditions are contained in household surveys. UN Habitat has developed estimation methods for multiple data sources and missing data on certain attributes.
In the context of monitoring progress towards the MDG target "By 2020, to have achieved a significant improvement in the lives of at least 100 million slum-dwellers", the criterion of tenure security is excluded due to non-availability of internationally comparable data. The following hypothetical example shows the general estimation method used by UN Habitat for computing this indicator in the MDG context:

Order of Estimation	Indicator	Cumulative Percent of Households
Step 1	Lack of improved water	20 %
Step 2 'OR'	Lack of improved sanitation	50 %
Step 3 'OR'	Lack of sufficient living area	60 %
Step 4 'OR'	Lack of durable housing	65 %

The operation is a logical 'OR' condition. If any one, any combination of, or all of the indicator conditions are 'TRUE' then a household is counted only once as a slum dwelling. The TRUE condition means that the household lacks the attribute indentified by the indicator. In practice, 'lack of improved sanitation' was the dominant feature identifying slum households.

(c) Limitations of the Indicator: The indicator does not cover the spatial dimension of slums. As the indicator cannot take into account how many and to which extent the five conditions of deprived housing are fulfilled, it cannot provide information on the severity of slum conditions.

(d) Status of the Methodology: Methodology is applied for monitoring the MDG indicator. Further work on the methodology is ongoing.

(e) Alternative Definitions: According to the situation in a specific city the basic definition of a household living in a slum may be locally adapted. For example, in Rio de Janeiro living area is insufficient for both the middle classes and the slum population and is not a good discriminator. It could either be omitted, or it could be formulated as *two or more* of the conditions such as overcrowding and durability of housing.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Data on number of households with access to improved water, access to improved sanitation, sufficient living area, structural quality/durability of dwellings and secure tenure as well as number of persons per household.

(b) National and International Data Availability and Sources: Data availability is general good for access to improved water and access to improved sanitation. For sufficient living area, structural quality/durability of dwellings the data availability is fair, whereas data on tenure security is not available in many countries. Primary data sources include household surveys such as DHS, MICS.

(c) Data References: International data is available on the MDG website http://mdgs.un.org/unsd/mdg/ .

5. AGENCIES INVOLVED WITH THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the United Nations Human Settlements Programme (UN-HABITAT).

(b) Other Contributing Organizations:

6. REFERENCES

(a) Readings:

World Bank. *Housing: Enabling Markets to Work.* The World Bank, Washington D.C., 1993 (A World Bank Policy Paper).

UN-HABITAT. State of the World's Cities 2006/2007, UN-HABITAT, Nairobi, 2006.

UN-HABITAT. The Global Report on Human Settlements 2003: The Challenge of Slums, UN-HABITAT, Nairobi, 2003.

UN-HABITAT. Improving the lives of 100 Million Slum Dwellers: Guide to Monitoring Target 11, UN-HABITAT, Nairobi, 2003.

UN-HABITAT Global Urban Indicators Database, UN-HABITAT, Nairobi, 2002

(b) Internet site:

UN Habitat website : http://www.unhabitat.org/

MDG website of the United Nations Statistics Division:
http://mdgs.un.org/unsd/mdg/Default.aspx.

PERCENTAGE OF POPULATION HAVING PAID BRIBES		
Governance	**Corruption**	**Core indicator**

1. Indicator

(a) Name: Percentage of population having paid bribes

(b) Brief definition: Individuals/households having been asked or having complied to expectation by government officials to pay a bribe for his or her services.

(c) Unit of measurement: Proportion of individuals/households having been asked or having complied to expectation by government officials to pay a bribe for his/her services of the population at a given point in time.

(d) Placement in the CSD indicator set: Governance/Corruption

2. POLICY RELEVANCE

(a) Purpose: The states parties to the United Nations Convention against Corruption have agreed to:

- Promote and strengthen measures to prevent and combat corruption more efficiently and effectively
- To promote, facilitate and support international cooperation and technical assistance in the prevention of and fight against corruption, including asset recovery
- To promote integrity, accountability and proper management of public affairs and public property.
- To adopt such legislative and other measures as may be necessary to establish as criminal offences, when committed intentionally:

(a) The promise, offering or giving, to a public official, directly or indirectly, of an undue advantage, for the official himself or herself or another person or entity, in order that the official act or refrain from acting in the exercise of his or her official duties;

(b) The solicitation or acceptance by a public official, directly or indirectly, of an undue advantage, for the official himself or herself or another person or entity, in order that the official act or refrain from acting in the exercise of his or her official duties.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme).
The completion and signing of the UN Convention against Corruption in 2003[20] represented a major step forward in building effective responses against corruption. An analysis of the relationship between crime and development suggests that poorer countries, in particular those affected by ethnic strife, armed conflict, violence or instability, may be more vulnerable than others to corruption. The vicious circle is

[20] Assembly resolution 58/4 of 31 October 2003.

completed by the fact that such countries not only are vulnerable, but also have limited capacity to respond to corruption effectively.[21]

(c) International conventions and agreements:
By its resolution 58/4 of 31 October 2003, the General Assembly adopted the United Nations Convention against Corruption. It was opened to all States for signature from 9 to 11 December 2003 in Merida, Mexico. In accordance with article 68 (1) of the afore-mentioned resolution, the United Nations Convention against Corruption entered into force on 14 December 2005.
Pursuant to article 63 of the Convention, a Conference of the States Parties to the Convention is established to improve the capacity of and cooperation between States Parties to achieve the objectives set forth in this Convention and to promote and review its implementation.
(d) International Targets/Recommended Standards: None

(e) Linkages to Other Indicators: This indicator is linked to other governance indicators (e.g. rule of law, e-governance), indicators of poverty and income disparities (e.g., percent of population living below poverty line, unemployment rate, Gini index of income inequality), population change as well as those on economic performance.

3. <u>Methodological description</u>

(a) Underlying Definition and Concepts. Individuals/households having been asked or having complied to expectation by government officials to pay a bribe for his/her services. As defined by the UNCAC, public official shall mean (i) any person holding a legislative, executive, administrative or judicial office of a State Party, whether appointed or elected, whether permanent or temporary, whether paid or unpaid, irrespective of that person's seniority; (ii) any other person who performs a public function, including for a public agency or public enterprise, or provides a public service, as defined in the domestic law of the State Party and as applied in the pertinent area of law of that State Party; (iii) any other person defined as a "public official" in the domestic law of a State Party or who performs a public function or provides a public service as defined in the domestic law of the State Party and as applied in the pertinent area of law of that State Party.

(b) Measurement methods:
Over the past few decades, the advent of victim surveys has facilitated a broader understanding of the crime problem as well as a better assessment of its burden on citizens at the international level. While in the past only police and criminal justice data were used to measure crime, it is now widely acknowledged that such information alone is not sufficient and should be integrated with victim surveys results. Surveys of victims of crime are a more comparable tool to assess risks across countries and world regions. More than 150 surveys have been done with comparable methodology in over 80 different countries since 1989.

[21] United Nations, The State of Crime and Criminal Justice Worldwide, Report of the Secretary-General, Eleventh United Nations Congress on Crime Prevention and Criminal Justice, Bangkok, 18-25 April 2005.

(c) Limitations of the indicator: Status of the methodology. Response rate. Availability of data trends. Cultural barriers. Level of tolerance of corruption in the society.

(c) Alternative definitions. Perception of corruption by businesses. Sources: Crime and Corruption Business Survey, UNODC. Corruption Perception Index, Transparency International. BEEPS, World Bank.

4. <u>Assessment of Data</u>

(a) Data needed to compile the indicator: Survey results; Population figures per countries/ cities/ urban-rural / age/ socio-economic group/ gender.

(b) National and International Data Availability and Sources: Victim surveys; Corruption/Governance surveys; International Crime Victim Surveys; Regional barometers.

(c) Data References: National Statistical Institutes; UNODC; UNICRI.

5. <u>Agencies Involved in the development of the indicator</u>

(a) Lead Agency: The lead agency responsible for crime and corruption indicators is the United Nations Office on Drugs and Crime.

6. <u>References</u>

(a) Readings:

Manual for the conduct of victim surveys. UNODC-UNECE (forthcoming).

Nieuwbeerta, P. (Ed.) (2002). *Crime victimization in comparative perspective*. *Results from the International Crime Victims Survey*, 1989-2000. Den Haag: Boom Juridische uitgevers
Kury, H. (Ed.) (2003)

International Comparison of Crime and Victimization: The ICVS
Special issue of the International Journal of Comparative Criminology (IJCC), Vol. 2, No. 1

(b) Internet sites:

UNODC website on corruption: http://www.unodc.org/unodc/en/corruption.html
UNODC webpage on crime victim surveys:
http://www.unodc.org/unodc/en/research_icvs.html

NUMBER OF INTENTIONAL HOMICIDES PER 100,000 POPULATION		
Governance	**Crime**	**Core indicator**

1. INDICATOR

(a) Name: Number of intentional homicides per 100,000 populations.

(b) Brief definition: Total number of intentional homicides completed per 100,000 population

(c) Unit of measurement: Police recorded cases/100,000 population, per country and per year

(d) Placement in the CSD indicator set: Governance/Crime

2. POLICY RELEVANCE

(a) Purpose: The Economic and Social Council, in its resolution 1984/48 of 25 May 1984, requested the Secretary-General to maintain and develop a United Nations crime-related database by continuing to conduct surveys of crime trends and operations of criminal justice systems. The major goal of the United Nations Surveys on Crime and Trends and the Operations of Criminal Justice Systems is to collect data on the incidence of recorded crime and the operations of criminal justice systems with a view to improving the analysis and dissemination of that information globally.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme). Crime prevention and criminal justice are an integral part of the development process. Upholding the rule of law and good governance and proper management of public affairs and public property at the local, national and international levels are prerequisites for creating and sustaining an environment for successfully preventing and combating crime. .[22] Such a stable and secure climate is necessary to support the goals of poverty eradication, economic investment, environmental stewardship, gender equality, participation, and sustainable livelihoods.
Crime represents a dimension of growing concern in the framework for CSD indicators. The Secretary-General report "In larger freedom: towards development, security and human rights for all" highlighted that although poverty and denial of human rights may not be the direct cause of civil war, terrorism or organized crime, they all greatly increase the risk of instability and violence.[23] However, measurement of organized crime poses serious methodological limitations. Measurement is more feasible when dealing with "conventional" categories of crime, or "volume" crime, the most serious of which is intentional homicide.

[22]. A/CONF.203/18 Bangkok Declaration on Synergies and Responses: Strategic Alliances in Crime Prevention and Criminal Justice, adopted at the high-level segment of the Eleventh United Nations Congress on crime Prevention and Criminal Justice, held in Bangkok from 18 to 25 April 2005.
[23] A/59/2005.

The *number of intentional homicides per 100,000 population* represents the most widely available and uncontroversial indicator and is included as a measure in the Common Country Assessment Guidelines. Taking into account the seriousness of the crime, thus the almost inevitable statistical recording, this indicator provides reliable information from a large number of countries. Intentional homicide rates were highest in Africa, followed by the Americas, while other regions showed much lower rates. The analysis of homicide trends in the period 1995-2004 suggests that there is an overall decreasing trend.

(c) International conventions and agreements: The United Nations Congresses on the Prevention of Crime and Treatment of Offenders, held every five years, formulated non-binding recommendations (The Caracas Declaration of 1980), plans of action (e.g., Milan Plan of Action of 1985) and declarations (e.g. the Bangkok Declaration on Synergies and Responses: Strategic Alliances in Crime Prevention and Criminal Justice of 2005) on the subject.

(d) International Targets/Recommended Standards: None

(e) Linkages to Other Indicators: As other crime indicators, this indicator is linked to indicators of poverty and income disparity (e.g., percent of population living below poverty line, unemployment rate, Gini index of income inequality), population change, including urbanisation and rapid population growth, as well as those on economic performance. Violent crime and homicide are considered to be especially linked to alcohol consumption, drugs (abuse and trafficking), and proportion of youth in the population.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definition and Concepts. Intentional Homicide may be understood to mean death deliberately inflicted on a person by another person, including infanticide. This indicator refers only to police-recorded homicides.

(b) Measurement methods: Questionnaire sent to responsible government agency / official statistical body in each country. The indicator is computed as the number of total homicides recorded by the police in a given year multiplied by 100,000 and divided by the total population of the country in the same year (based on UN Population Division data).

(c) Limitations of the indicator: Efficiency of the police systems. Response rate to the questionnaire. Scope of the definition (inclusion or not of death caused by injuries, euthanasia, help with suicide…)

(d) Status of the methodology. Widely used in developed and developing countries. The Tenth UN Survey on Crime Trends and the Operations of Criminal Justice Systems (2007) will collect metadata associated to this indicator from all member States.

(e) Alternative definitions. Number of recorded violent crimes per 100,000 population (including homicides).

a. **Brief definition**. Homicides, Assault, Rape and Robbery crimes recorded in criminal police statistics.
   i. **Intentional Homicide**: Death deliberately inflicted on a person by another person, including infanticide.
   ii. **Assault**. Physical attack against the body of another person, including battery but excluding indecent assault. It includes aggravated assault and simple assault as maybe classified in some criminal codes.
   iii. **Rape**. Sexual intercourse without valid consent.
   iv. **Robbery**. Theft of property from a person, overcoming resistance by force or threat of force.

b. **Unit of measurement**. Homicide, Assault, Rape and Robbery police recorded cases per 100,000 population per country per year.

c. **Limitations**. The disadvantage of such a composite indicator is that the capacity of member States to record statistics on all four categories of crime is uneven, therefore there may be cases of countries with high levels of violent crime that are unable to reflect such incidents into statistics. The potential problem would be that countries with good statistical systems would appear as more affected by violence than others.

4. ASSESSMENT OF DATA

(a) Data needed to compile the indicator: Midyear population figures per country; Police statistics on total intentional homicides.

(b) National and International Data Availability and Sources: Data are normally available from local and regional police agencies and are collated by a national agency, often a statistical division within the Ministry or Department of Justice or Interior.

(c) Data References: National Statistical Institutes; UN Survey of Crime Trends and Operations of Criminal Justice Systems.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF INDICATOR

(a) Lead Agency: The lead agency is the United Nations Office on Drugs and Crime.

6. REFERENCES

United Nations Rules, Norms and Standards
UN Survey of Crime Trends and Operations of Criminal Justice Systems
http://www.unodc.org/unodc/crime_cicp_surveys.html

UNDER-FIVE MORTALITY RATE		
Health	**Mortality**	**Core indicator**

1. INDICATOR

(a) Name: Under-five Mortality Rate (U5MR).

(b) Brief Definition: The under-five mortality rate refers to the probability of dying before age 5 years per 1,000 newborns.

(c) Unit of Measurement: Per thousand live births.

(d) Placement in the CSD Indicator Set: Health/Mortality.

2. POLICY RELEVANCE

(a) Purpose: This indicator measures the risk of dying in infancy and early childhood.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): The reduction of child mortality is one of the most strongly and universally supported development goals. In high-mortality settings, a large proportion of all deaths occur before age 5. Despite considerable progress in reducing child mortality, there remains a large gap between developed and developing countries in the risks of dying before age 5: for instance, during 2000-2005, under-five mortality stood at 9 per 1000 in the more developed regions but at 153 per thousand in the least developed countries (United Nations, 2007). The gap between more developed and the less developed regions is larger in proportional terms for death rates in early childhood than for those in adult ages. Under-five mortality levels are influenced by poverty, education, particularly of mothers; by the availability, accessibility and quality of health services; by environmental risks including access to safe water and sanitation; and by nutrition.

(c) International Conventions and Agreements: Quantitative goals for the reduction of under-five mortality rates have been adopted by several international conferences and summits including the World Summit for Children (1990), the International Conference on Population and Development (1994) the Fourth World Conference on Women (1995), the World Summit for Social Development (1995), and the United Nations Millennium Summit. The Programme of Action of the International Conference on Population and Development (ICPD) encouraged countries with intermediate mortality levels to achieve an under-five mortality rate below 60 deaths per 1000 births by 2005, and all countries to achieve an under-five mortality rate below 45 per 1000 live births by 2015. The United Nations Millennium Declaration, adopted in 2000, established the goal of reducing under-five mortality by two-thirds between 2000 and 2015 (A/RES/55/2, para. 19). The under-five mortality rate is one of the indicators included in the Human Assets Index and is therefore one of the quantitative criteria for the identification of least developed countries within the United Nations. Many other international agreements, including Agenda 21, also refer to the general goal of reducing mortality in childhood.

(d) International Targets/Recommended Standards: See section 2(c) above.

(e) Linkages to Other Indicators: This indicator is closely related to life expectancy at birth. It is more generally connected to many other social and economic indicators, including those listed in section 2b above.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: Standard statistical definitions of the terms "live birth" and "death" are set forth in the United Nations *Principles and Recommendations for a Vital Statistics System* (para. 46):
LIVE BIRTH is the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of pregnancy, which after such separation breathes or shows any other evidence of life such as beating of the heart, pulsation of the umbilical cord, definite movement of voluntary muscles, whether or not the umbilical cord has been cut or the placenta is attached; each product of such a birth is considered live-born regardless of gestational age.
DEATH is the permanent disappearance of all evidence of life at any time after live birth has taken place (post-natal cessation of vital functions without capability of resuscitation).

(b) Measurement Methods: The under-five mortality rate is derived from estimates of births and deaths gathered by vital registration systems, censuses and surveys. Where vital registration data on births and deaths are complete, or adjustments for age misstatement and incompleteness can be made, the under-five mortality rate can be calculated directly from those data. Details on the procedures used can be found in demographic or actuarial references that describe the construction of life tables, for example, Pressat (1972) or Shryock and Siegel (1980). When civil registration systems do not exist, such data may be obtained from maternity history data gathered by demographic surveys or the under-five mortality rate can be calculated using indirect information on mortality in childhood obtained via special questions included in censuses or demographic surveys. For information on the methods used to estimate mortality in childhood from indirect data see United Nations (1983 and 2003).

(c) Limitations of the Indicator: There are often problems in the information required for calculating the under-five mortality rate in less developed countries where routine data collection in the health services may omit many infant and child deaths and where vital registration may be deficient. Some countries do not follow the standard definition given above of "live birth". However, adjustments can sometimes be made for incomplete registration and age misstatement, and in many developing countries maternity-history data collected by nationally representative sample surveys provide a sound basis for estimating levels and trends of under-five mortality. Sample surveys have been more successful at obtaining estimates of under-five mortality than of adult

mortality and, for that reason, information about child mortality is currently more commonly available and is more timely than information about the mortality of adults.
If the necessary data are available, the under-five mortality rate can be calculated separately for boys and girls, and for geographic and social subgroups (based on the characteristics of parents). It is also useful to disaggregate the under-five mortality rate into separate rates referring, respectively, to the probability of dying before age 1 and the probability of dying between ages 1 and 4.

(d) Status of the Methodology: Well developed and widely employed.

(e) Alternative Definitions/Indicators: The infant mortality rate is another indicator of early child mortality for which quantitative goals have been set at recent international conferences. The infant mortality rate is the number of deaths under 1 year of age during a period per 1000 live-births during the same period.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: The under-five mortality rate is derived from data on births and deaths occurring under the age of 5 years, as described in section 3(b) above.

(b) National and International Data Availability and Sources: Data allowing the estimation of under-five mortality are currently available for most countries thanks to demographic surveys using representative samples in countries where vital registration systems are deficient or unavailable. Surveys that rely on maternity histories, in which women are asked to provide the date of birth and age at death (if applicable) of each child they have borne alive, are common but demand well trained interviewers to ensure that the data collected are of good quality. In addition, retrospective questions about the number of children ever born and the number surviving by women enumerated in censuses or surveys provide indirect information from which estimates of under-five mortality can be derived.

(c) Data References: Data sources include vital registration, sample registration systems, surveillance systems, censuses, and demographic and health surveys. Information needed to calculate this indicator from vital registration data is compiled by the Statistics Division of the Department of Economic and Social Affairs of the United Nations Secretariat on a regular basis. Data generated by vital registration systems, censuses and surveys are evaluated and, if necessary, adjusted for incompleteness by the Population Division of the Department of Economic and Social Affairs (DESA) as part of the preparation of the United Nations population estimates and projections. Past, current and projected estimates of under-five mortality are prepared for all countries by the Population Division of DESA and appear in the biennial *World Population Prospects* reports. Estimates by the United Nations Children's Fund (UNICEF) are published in the annual *State of the World's Children* reports. Monitoring by national statistical offices often entails the preparation of child mortality estimates for small geographical units within countries. Surveys, if appropriately designed, may provide estimates for major regions within countries as well as at the national level.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the United Nations Department of Economic and Social Affairs. The contact point is the Director, Population Division, fax no. (1 212) 963 2147.

(b) Other Contributing Organizations: United Nations/DESA/Statistics Division; United Nations Children's Fund (UNICEF); and World Health Organization (WHO).

6. REFERENCES

(a) Readings:

Hill K. (1991). Approaches to the measurement of childhood mortality: A comparative review. *Population Index* 57(3):368-382, Fall.

Pressat, R. (1972). *Demographic Analysis: Methods, Results, Applications*. London, Edward Arnold; Chicago, Aldine Atherton.

Shryock, H. S, and J. S. Siegel (1980). *The Methods and Materials of Demography*. U.S. Government Printing Office, Washington, D.C.

United Nations (1973). *Principles and Recommendations for a Vital Statistics System*. United Nations publication, Sales No. E.73.XVII.9.

________ (1983). *Manual X: Indirect Techniques for Demographic Estimation.* United Nations publication, Sales No. E. 83.XIII.2, New York.

________(1990). *A Step by Step Guide to the Estimation of Child Mortality.* United Nations publication, Sales No. E.89.XIII.9, New York.

________ (2003). *MORTPAK for Windows - The United Nations Software Package for Demographic Measurement,* CD-ROM. United Nations, New York.

________ (2004). *Demographic Yearbook 2001*. United Nations publication, Sales No. 03.XIII.1.

________ (2007). *World Population Prospects: The 2006 Revision*, CD-ROM Edition.

United Nations Children's Fund (2005). *The State of the World's Children*. UNICEF, New York.

(b) Internet sites:

Statistics are available at:

http://www.un.org/esa/population/unpop.htm

http://milleniumindicators.un.org/unsd/mi/mi_goals.asp

LIFE EXPECTANCY AT BIRTH		
Health	**Mortality**	**Core indicator**

1. INDICATOR

(a) Name: Life Expectancy at Birth.

(b) Brief Definition: The average number of years that a newborn could expect to live, if he or she were subject to the age-specific mortality rates of a given period.

(c) Unit of Measurement: Years of life.

(d) Placement in the CSD Indicator Set: Health/Mortality.

2. POLICY RELEVANCE

(a) Purpose: The indicator measures how many years a new-born baby is expected to live on average given current age-specific mortality rates. Life expectancy at birth is an indicator of mortality conditions and, by proxy, of health conditions.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): Mortality, with fertility and migration, determines the size of human populations, their composition by age and sex, and the population's potential for future growth. Life expectancy, a basic indicator, is closely connected with health conditions, which are in turn an integral part of development. The Programme of Action of the International Conference on Population and Development (ICPD) notes that the unprecedented increase in human longevity reflects gains in public health and in access to primary health-care services (paragraphs 8.1 and 8.2), which Agenda 21 recognizes as an integral part of sustainable development and primary environmental care (paragraph 6.1). The ICPD Programme of Action highlights the need to reduce disparities in mortality and morbidity among countries and between socio-economic and ethnic groups. It identifies the health effects of environmental degradation and exposure to hazardous substances in the work-place as issues of increasing concern. Life expectancy is included as a basic indicator of health and social development in, among others, the Minimum National Social Data Set endorsed by the United Nations Statistical Commission at its 29th session in 1997, the Human Development Index, the UNDG-CCA indicator set and the OECD/DAC core indicators.

(c) International Conventions and Agreements: The Declaration of Alma Ata (1978) set a target of life expectancy greater than 60 years by the year 2000; the World Summit for Social Development (WSSD) also included this goal. The ICPD Programme of Action specified that: life expectancy should be greater than 65 years by 2005 and 70 years by 2015 for countries that currently have the highest levels of mortality; and 70 years and 75 years, respectively, for the other countries (ICPD Programme of Action, paragraph 8.5).

(d) International Targets/Recommended Standards: See above.

(e) Linkages to Other Indicators: This indicator reflects many social, economic, and environmental influences. It is closely related to other demographic variables and is related to human health and the environment as well as to economic indicators.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: Calculation of life expectancy at birth is based on age-specific mortality rates for a particular calendar period. Mortality rates are commonly tabulated for age groups 0 to1, 1 to 5 years and for five-year age groups thereafter until an open-ended interval starting at age 80 or above.

(b) Measurement Methods: Several steps are needed to derive life expectancy from age-specific mortality rates; details on the methodology to follow can be found in demographic or actuarial references that describe the construction of life tables including Pressat (1972) or Shryock and Siegel (1980). For a description of the methodology implemented in computer programs, see United Nations (2003).

(c) Limitations of the Indicator: Where data on deaths by age are of good quality, or adjustments for age misstatement and incompleteness can be made, the life expectancy at birth can be calculated directly from registered deaths and population counts, which are usually based on census enumerations. When data on deaths by age are not available because vital registration is deficient, the life expectancy at birth can be estimated using methods that derive indicators of mortality from indirect information on the risks of death obtained from special questions included in censuses or demographic surveys. For information on these indirect methods, see United Nations (1983 and 2003).

(d) Status of the Methodology: Well developed and widely employed.

(e) Alternative Definitions/ Indicators: Another indicator of general mortality in common use is the Crude Death Rate (CDR), which is the number of deaths in a period (commonly a one-year period) divided by the mid-period population; it is usually expressed in deaths per 1,000 population. The CDR can be calculated from data that have less detail than those needed to calculate the life expectancy at birth, but it has the drawback of being influenced to a substantial degree by age structure of the population. That is, two populations with the same CDR could be subject to markedly different mortality risks at each age.
Life expectancy may be calculated separately for males and females, or for both sexes combined. If the underlying data permit, life expectancy may also be calculated for sub-national populations. Life expectancy can also be presented for particular ages after birth. For instance, life expectancy at age 60 represents the number of additional years a person aged 60 would expect to live, on average, given current age-specific mortality rates for ages 60 and over.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Age-specific death rates are the basic information for the calculation of the indicator. Some data sources yield estimates of age-specific mortality for only some age groups, so that it may be necessary to employ data from different sources, each adjusted independently, to arrive at a complete and consistent set of rates for a given period. Countries may tabulate data derived from death registration systems at the sub-national level. The under-five mortality rate is more readily available for sub-national populations than life expectancy at birth.

(b) National and International Data Availability and Sources: Data on deaths classified by age are compiled by the Statistics Division of the Department of Economic and Social Affairs (DESA) of the United Nations Secretariat on a regular basis but they are reported only by countries with functioning civil registration systems. For all countries, data allowing the estimation of mortality, including those derived from vital registration systems, censuses or demographic surveys are evaluated and, if necessary, adjusted by the Population Division of the Department of Economic and Social Affairs (DESA) as part of the preparation of the United Nations population estimates and projections.

(c) Data References: Past, current and projected estimates of life expectancy at birth are prepared for all countries by the Population Division, DESA, and appear in the biennial *World Population Prospects* reports.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the United Nations Department of Economic and Social Affairs (UN/DESA). The contact point is the Director, Population Division, fax no. (1 212) 963 2147.

(b) Other Contributing Organizations: United Nations/DESA/Statistics Division; United Nations Children's Fund (UNICEF); and World Health Organization (WHO).

6. REFERENCES

(a) Readings:

Pressat, R. (1972). *Demographic Analysis: Methods, Results, Applications*. London, Edward Arnold; Chicago, Aldine Atherton.
Shryock, H. S, and J. S. Siegel (1980). *The Methods and Materials of Demography*. U.S. Government Printing Office, Washington, D.C.
United Nations (1983). *Manual X: Indirect Techniques for Demographic Estimation*. United Nations Sales No. E.83.XIII.2, New York.
________ (1994). *Report of the International Conference on Population and Development.* Programme of Action of the International Conference on Population and Development. United Nations Document A/CONF. 171/13. Cairo, Egypt, September 5-13.
________ (2003). *MORTPAK for Windows - The United Nations Software Package for Demographic Measurement,* CD-ROM (United Nations, New York).

________ (2004). *Demographic Yearbook 2001.* United Nations publication, Sales No. 03.XIII.1.
________ (2007). *World Population Prospects: The 2006 Revision*, CD-ROM Edition.

(b) Internet site:

Statistics and substantive reports are available at:
http://www.un.org/esa/population/unpop.htm

HEALTHY LIFE EXPECTANCY AT BIRTH		
Health	**Mortality and morbidity**	

1. INDICATOR

(a) Name: Healthy Life Expectancy at Birth.

(b) Brief Definition: The average equivalent number of years of full health that a newborn could expect to live, if he or she were to pass through life subject to the age-specific death rates and ill-health rates of a given period.

(c) Unit of Measurement: Years of life.

(d) Placement in the CSD Indicator Set: Health/Mortality.

2. POLICY RELEVANCE

(a) Purpose: Measures how many equivalent years of full health on average a new-born baby is expected to have, given current age-specific mortality, morbidity and disability risks. Healthy life expectancy at birth is an indicator of health conditions, including the impacts of mortality and morbidity.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): Healthy life expectancy (HALE) provides a summary of overall health conditions for a population, which are in turn an integral part of development. The ICPD Programme of Action highlights the need to reduce disparities in mortality and morbidity among countries and between socio-economic and ethnic groups. It identifies the health effects of environmental degradation and exposure to hazardous substances in the work-place as issues of increasing concern. While communicable diseases such as HIV/AIDS, tuberculosis and malaria continue to cause substantial loss of health and mortality in developing countries, particularly African countries, non-communicable diseases and injuries are responsible for more than half of all lost years of healthy life in developing as well as developed countries. HALE thus provides a more complete picture of the impact of morbidity and mortality on populations, than simple life expectancy alone.

(c) International Conventions and Agreements: The World Health Organization has published HALE estimates for Member States as part of WHO's regular annual reporting on the health for Member States (World Health Reports from 2000 to 2004). Apart from general aspirational statements, HALE has not been specifically used in international conventions or agreements to date.

(d) International Targets/Recommended Standards: See above.

(e) Linkages to Other Indicators: This indicator reflects many social, economic, and environmental influences. It is closely related to other demographic variables, particularly life expectancy at birth, and it is related to human health and the environment as well as economic indicators.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: Calculation of healthy life expectancy at birth is based on age-specific death rates for a particular calendar period together with severity-adjusted health state prevalences by age.

(b) Measurement Methods: The World Health Organization has developed methods for calculation of HALE that combine standard life table information on mortality together with age-sex-specific prevalence data for health states using Sullivan's method . Since comparable health state prevalence data are not available for all countries, a four-stage strategy has been used by WHO:

1. Data from the WHO Global Burden of Disease (GBD) study are used to estimate severity-adjusted prevalence by age and sex for all countries.
2. Data from the WHO Multi-Country Survey Study (MCSS) are used to make independent estimates of severity-adjusted prevalence by age and sex for survey countries.
3. Prevalence for all countries is calculated based on GBD and MCSS estimates.
4. Life tables constructed by WHO are used with Sullivan's method to compute HALE for countries

More detailed information on the methods are provided by Mathers et al (Mathers et al. 2004; Mathers, Murray, and Salomon 2002). A number of countries have also carried out HALE calculations based on either population survey data or national burden of disease analyses.

(c) Limitations of the Indicator: Health expectancy estimates based on self-reported health status information are generally not comparable across countries due to differences in survey instruments and cultural differences in reporting of health(Romieu and Robine 1994). Comparability problems with self-report health status data relate not only to differences in survey design and methods, but more fundamentally to unmeasured differences in expectations and norms for health ref. Even when reliability and within population validity have reached acceptable levels, the meaning that different populations attach to the labels used for each of the response categories, such as mild, moderate or severe, in self-reported questions can vary greatly. In order to improve the methodological and empirical basis for the measurement of population health, WHO has initiated a data collection strategy with Member States consisting of household and/or postal or telephone surveys in representative samples of the general populations using a standardised instrument together with new statistical methods for adjusting self-reported health measures to comparable scales (Ustun et al. 2003b). Healthy life expectancy estimates for all countries are based on a mix of survey data for some countries (with its own uncertainty due to sampling and systematic biases) and analyses of disability prevalence in the Global Burden of Disease project, which draws on a wide range of epidemiological and demographic data of varying degrees of uncertainty. These methods are not easily replicated for single national estimates.

(d) Status of the Methodology: Developmental. Methods have been developed drawing on self-report survey data on functioning in core health domains (such as mobility, usual activities, affect, pain, cognition), and on estimated health state prevalences from burden of disease analysis using the Disability Adjusted Life Year (or DALY). Both of these approaches require relatively complex analyses and are data-demanding. A number of issues remain to be resolved around cross-population comparability, and methods for dealing with comorbidity in the DALY-based approach (King et al. 2003).

(e) Alternative Definitions/ Indicators: Other summary measures in common use include the Disability Free Life Expectancy (DFLE) and measures of health expectancy based on self-reported global health questions (with response categories such as excellent, very good, fair, poor). Both these forms of indicator suffer from intractable problems of cross-population comparability, and a level of arbitrariness in the choice of threshold for definition of poor health or disability. Additionally, such indicators are insensitive to differences in severity distribution of health or disability beyond the threshold. Both these indicators require less detailed data and analysis for their calculation than does HALE, and are reported by a number of organizations including OECD.
As with life expectancy, HALE may be calculated separately for males and females, or for both sexes combined. If the underlying data permit, HALE may also be calculated for subnational regions, or for other population subgroups. HALE can also be presented for particular ages after birth, and age 60 is a common choice for a second age to be reported.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Mortality data as required for calculation of period life expectancy together with comprehensive prevalence estimates for health states in the population and a health state valuation function to enable computation of equivalent years of full health lived at each age. Alternately, HALE may be calculated from DALY estimates for burden of disease by cause, age and sex. A prevalence-based analysis is normally required for the calculation of prevalence YLD (Years Lived with Disability) and a method for dealing with comorbidity.

(b) National and International Data Availability and Sources: Data on health states in populations have been collected by the World Health Organization in its Multicountry Study (Ustun et al 2003b) and in the World Health Survey in 2003-2004 (Ustun et al. 2003a).

(c) Data References: Estimates of healthy life expectancy at birth have been prepared for all WHO Member States and appear in the World Health Reports for years 2000 to 2004.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the World Health Organization. The contact point is the Coordinator, Country Health Information, Evidence and Information for Policy, fax no. (41 22) 7914328. (Mathers et al. 2003; Robine et al. 2003)

6. REFERENCES

(a) Readings:

1. King, G., C. J. L. Murray, J. A. Salomon, and A. Tandon. 2003. Enhancing the validity and cross-cultural comparability of measurement in survey research. American Political Science Review 93, no. 4:567-583.
2. Mathers, C. D., K. Iburg, J. Salomon, A. Tandon, S. Chatterji, B. Ustun, and C. J. L. Murray. 2004. Global patterns of healthy life expectancy in the year 2002. BMC Public Health 4, no. 1:66.
3. Mathers, C. D., C. J. L Murray, and J Salomon. 2002. Methods for measuring healthy life expectancy. In Health systems performance assessment: debate, new methods, new empiricism, and future directions, edited by Murray, C. J. L and D. Evans (Geneva: World Health Organisation).
4. Mathers, C. D., J Saloman, C. J. L Murray, and A. Lopez. 2003. Alternative Summary Measures of Average Population Health. In Health systems performance assessment: debates, methods and empiricism, edited by Murray, C. J. L and D. Evans (Geneva: World Health Organisation).
5. Robine, J. M., C. Jagger, C. D. Mathers, E. M. Crimmins, and R. M. Suzman. 2003. Determining health expectancies. Chichester: John Wiley & Sons.
6. Romieu, I. and J. M. Robine. 1994. World atlas of health expectancy calculations. In Advances in health expectancies, edited by Mathers, C. D., J. McCallum, and J. M. Robine (Canberra: Australian Institute of Health and Welfare).
7. Ustun, T. B., S. Chatterji, A. Mechbal, Murray C.J.L, and WHS Collaborating Groups. 2003a. The World Health Surveys. In Health systems performance assessment: debates, methods and empiricism, edited by Murray, C. J. L and D. Evans (Geneva: World Health Organisation).
8. Ustun, T. B., S. Chatterji, M. Villanueva, L. Bendib, C. Celik, R. Sadana, N. Valentine, J. Ortiz, A Tandon, J Saloman, Y. Cao, J. Xie Wan, E. Ozaltin, C. D. Mathers, and Murray C.J.L. 2003b. The WHO Multicountry Household Survey Study on Health and Responsiveness 2000-2001. In Health systems performance assessment: debates, methods and empiricism, edited by Murray, C. J. L and D. Evans (Geneva: World Health Organisation).

(b) Internet sites:

Statistics are available at:
http://www.who.int/healthinfo/statistics/indhale/en/

PERCENT OF POPULATION WITH ACCESS TO PRIMARY HEALTH CARE FACILITIES		
Health	**Healthcare Delivery**	**Core indicator**

1. INDICATOR

(a) Name: Percentage of Population with Access to Primary Health Care Facilities.

(b) Brief Definition: Proportion of population with access to primary health care facilities.

(c) Unit of Measurement: %.

(d) Placement in the CSD Indicator Set: Health/Healthcare Delivery.

2. POLICY RELEVANCE

(a) Purpose: To monitor progress in the access of the population to primary health care.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): Accessibility of health services, going beyond just physical access, and including economic, social and cultural accessibility and acceptability, is of fundamental significance to reflect on health system progress, equity and sustainable development. It should, however, be supplemented by indicators of utilization of services, or actual coverage, and quality of care. In addition, accessibility is an instrumental goal, a means to an end, to achieving the final intrinsic goals of the system. The more accessible a system is, the more people should utilize it to improve their health.

(c) International Conventions and Agreements: World Health Assembly Resolution WHA34.36, Global Strategy for Health for All by the Year 2000.

(d) International Targets/Recommended Standards: International targets have been outlined in the Global Strategy for Health for All and more recently in the Ninth General Programme of Work. In addition, many countries have established national targets.

(e) Linkage to Other Indicators: This indicator is associated with other socioeconomic indicators on the proportion of people covered by other essential elements of primary health care. It should also, as indicated above, be linked with indicators of utilization of services and quality of care.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts:

(i) Primary health care: is essential health care made accessible at a cost the country and community can afford, with methods that are practical, scientifically sound and socially acceptable.
(ii) Population covered: All the population living in the service area of the health facility.
(iii) Access: Definition of accessibility may vary between countries, for different parts of the country and for different types of services.

(b) Measurement Methods: The numerator - the number of persons living within a convenient distance to primary care facilities; the denominator - the total population.

(c) Limitations of the Indicator: The existence of a facility within reasonable distance is often used as a proxy for availability of health care. If the existing primary care facility, however, is not properly functioning, provides care of inadequate quality, is economically not affordable, and socially or culturally not acceptable, physical access has very little value as this facility is bypassed and not utilized. Therefore, other factors, as mentioned in 3(e) have to be taken into account.

(d) Status of the Methodology: Not Available.

(e) Alternative Definitions/Indicators: In the light of 3(c) the indicator must be supplemented by indicators of availability of services, quality of services, acceptability of services, affordability of services, or utilization of services.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: The number of people with access to primary health care facilities, total population in service areas of health facilities.

(b) National and International Data Availability and Sources: No routinely available data. Information has to be acquired through surveys. Data Sources include Ministries of Health and National Statistical Offices.
(c) Data References: Not Available.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the World Health Organization (WHO). The contact point is the Director, Health System Policies and Operations, fax: 41 22 791 4747.

(b) Other Contributing Organizations: None.

6. REFERENCES

(a) Readings:
HIS Development Strategy and Catalogue of Health Indicators, Geneva 2000 (EIP/OSD/00.12)
WHO, *The World Health Report 2000; Health Systems: Improving Performance*, Geneva, 2000.

El-Bindari-Hammad, Smith, DL, *Primary Health Care Reviews, Guidelines and Methods*, WHO, Geneva, 1992.
WHO, *Development of Indicators for Monitoring Progress towards Health for All by the Year 2000*, Geneva, 1981.
WHO, *Evaluating the Implementation of the Strategy for Health for All by the Year 2000, Common Framework: Third Evaluation*, Geneva, 1996.
WHO, *Health Centres: the 80/20 Imbalance; Burden of Work Vs Resources*, Geneva, 1999.

(b) **Internet site:** World Health Organization: http://www.who.int

CONTRACEPTIVE PREVALENCE RATE		
Health	**Healthcare Delivery**	

1. INDICATOR

(a) Name: Contraceptive Prevalence Rate (CPR).

(b) Brief Definition: This indicator is generally defined as the percent of women of reproductive age (15-49 yrs) using any method of contraception at a given point in time. It is usually calculated for married women of reproductive age, but sometimes for other base population, such as all women of reproductive age at risk of pregnancy.

(c) Unit of Measurement: %.

(d) Placement in the CSD Indicator Set: Health/Healthcare Delivery.

2. POLICY RELEVANCE

(a) Purpose: The measure indicates the extent of people's conscious efforts and capabilities to control their fertility. It does not capture all actions taken to control fertility, since induced abortion is common in many countries.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): Increased contraceptive prevalence, is, in general, the single most important proximate determinant of inter-country differences in fertility, and of ongoing fertility declines in developing countries. Contraceptive prevalence is also an indicator of access to reproductive health services one of the eight elements of primary health care (Ref: WHO/RHR/04.011). Agenda 21 discusses reproductive health programmes, which include family planning, as among the programmes that promote changes in demographic trends, factors towards sustainability and development..
Health benefits include the ability to prevent pregnancies that are too early, too closely spaced, too late, or too many. By preventing unintended pregnancies, contraception reduces resort to induced abortion - as well as avoiding potential complications of pregnancy including maternal morbidities and mortality. Current contraceptive practice depends not only on people's fertility desires, but also on availability, functioning, and quality of family planning services; social influences that affect contraceptive use; and other factors, such as marriage patterns and traditional birth-spacing practices, that independently influence the (supply of children?).

(c) International Conventions and Agreements: Family planning is included and discussed in the broader context of reproductive, sexual health, and reproductive rights by Chapter VII of the Programme of Action, International Conference on Population and Development (ICPD); and Strategic Objective C of the Platform for Action adopted at the Fourth World Conference on Women.

(d) International Targets/Recommended Standards: International agreements do not establish specific national or global targets for contraceptive prevalence. Recent international conferences have strongly affirmed the right of couples and individuals to choose the number, spacing and timing of their children, and to have access to the information and means to do so. The ICPD Programme of Action states that "Governmental goals for family planning should be defined in terms of unmet needs for information and services. Demographic goals, while legitimately the subject of government development strategies, should not be imposed on family-planning providers in the form of targets or quotas for the recruitment of clients" (paragraph 7.12).

(e) Linkages to Other Indicators: The level of contraceptive use has a strong, direct effect on the total fertility rate (TFR) and, through the TFR, on the rate of population growth. Use of contraception to prevent pregnancies that are too early, too closely spaced, too late, or too many has benefits for maternal and child health. This indicator is also closely linked to access to primary health care services particularly those pertaining to reproductive health care. Furthermore, it has broader and predictive implications for many other sustainable development indicators and issues, such as rate of change of school-age population, woman's participation in the labour force, and natural resource use.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: The standard indicator is the percentage currently using or whose partner is using any method of contraception among married (or in a stable union) women aged 15-49 or 15-44. In this context, the married group usually includes those in consensual or common-law unions in societies where such unions are common. Contraceptive prevalence is also frequently reported for all women of reproductive age at risk of pregnancy, and statistics are sometimes presented for men instead of, or in addition to, women (see attached document).

Users of contraception are defined as women who are practising, or whose male partners are practising, any form of contraception. These include female and male sterilization, hormonal methods (injectable and oral contraceptives, implants), intrauterine devices, diaphragms, spermicide, condoms, rhythm, withdrawal and abstinence, lactation amenorrhoea, among others.

For this indicator, *too early* is defined as under age 15. Such adolescents are 5 to 7 times more likely to die in pregnancy and childbirth than women in the lowest risk group of 20-24 years. *Too closely spaced* means women who become pregnant less than two years after a previous birth. Greater adverse consequences to women and their children are experienced under such circumstances. Women who have had five or more pregnancies (*too many*) or who are over 35 *(too late*), also face a substantially higher risk than the 20-24 year old group.

When presenting information about contraceptive use, it is useful to show the data according to specific type of contraception; by social characteristics such as rural/urban or region of residence, education, marital status; by 5-year age group, including specific attention to adolescents aged under 18 years; and by family size.

(b) Measurement Methods: Measurements of contraceptive prevalence come almost entirely from representative sample surveys of women or men of reproductive age.

Current use of contraception is usually assessed through a series of questions about knowledge and use of particular methods.

(c) Limitations of the Indicator: For surveys, under-reporting can occur when specific methods are not mentioned by the interviewer. This can be the case with the use of traditional methods such as rhythm and withdrawal, and use of contraceptive surgical sterilization. The list of specific methods is not completely uniform in practice, but in most cases is sufficiently consistent to permit meaningful comparison. "Current" use is often specified in surveys to mean "within the last month", but sometimes the time reference is left vague, and occasionally longer reference periods are specified. With statistics from family planning programmes, the accuracy of the assumptions is often difficult to assess. The derived estimates obviously omit contraceptive users who do not use the programme's services, and thus tend to underestimate the overall level of use.
Service statistics maintained by family planning programmes are also sometimes used to derive estimates of contraceptive prevalence. In such cases it is necessary to apply assumptions in order to derive estimates of numbers of current users from the records of numbers of family planning clients. Base population statistics (numbers of women or of married women) are in this case usually derived from census counts, adjusted to the reference date by the Population Division of the Department of Economic and Social Affairs (DESA), as part of its preparations of the official United Nations population estimates and projections.

(d) Status of the Methodology: The methodology is widely used in both developed and developing countries.

(e) Alternative Definitions/Indicators: None.

4. <u>ASSESSMENT OF DATA</u>

(a) Data Needed to Compile the Indicator: Number of women of reproductive age at risk of pregnancy using family planning methods. Number of women of reproductive age at risk of pregnancy. Both data sets are frequently limited to married women, and those in stable union.

(b) National and International Data Availability and Sources: The most recent United Nations review of contraceptive prevalence includes statistics for 119 countries and areas with information dating from 1975 or later. These countries include 90 per cent of world population. This review includes contraceptive prevalence measures for all women of reproductive age in 64 countries and areas and for samples of men in 27 countries and areas.
Contraceptive prevalence is one of the few topics for which data coverage is more complete and more current for developing than for developed countries. Most surveys provide estimates for major regions within countries as well as at the national level. Less frequently the sample design permits examining prevalence at the state, provincial, or lower administrative levels. In addition to those with national or near-national coverage, surveys covering this topic are sometimes available for particular geographic areas. Data are much

less widely available for population groups other than married women, although such information has increased in recent years.

(c) Data References: Executing agencies for surveys covering this topic vary. National statistical offices and ministries of health are the most common source, but other governmental offices, non-governmental voluntary or commercial organizations are frequently involved. Many surveys are conducted in collaboration with international survey programmes. The Population Division, DESA regularly compiles information about contraceptive prevalence and publishes it in the annual *World Population Monitoring* report.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the World Health Organization (WHO). The contact point is the Director, Reproductive Health and Research, fax no. (41 22) 791 3111.

(b) Other Contributing Organizations: The United Nations Department of Economic and Social Affairs (DESA), with the contact point as the Director, Population Division, fax no. (1 212) 963 2147.

6. REFERENCES

(a) Readings:

Levels and Trends of Contraceptive Use as Assessed in 1988 (United Nations, Sales No. E.89.XIII.4).
Levels and Trends of Contraceptive Use as Assessed in 1994 (United Nations, ST/ESA/SER.A/146, forthcoming).
Programme of Action of the International Conference on Population and Development, *Report of the International Conference on Population and Development,* Cairo, Egypt, September 5-13, 1994. (United Nations Document - A/CONF. 171/13).
World Population Monitoring, 1993 (Sales No. E.95.XIII.8, New York).
World Population Monitoring, 1996 (ESA/P/WP.131).

(b) Internet site: World Health Organization. http://www.who.int

IMMUNIZATION AGAINST INFECTIOUS CHILDHOOD DISEASES		
Health	**Healthcare Delivery**	**Core indicator**

1. INDICATOR

(a) Name: Immunization Against Infectious Childhood Diseases.

(b) Brief Definition: The percent of the eligible population that have been immunized according to national immunization policies. The definition includes three components: (i) the proportion of children immunized against diphtheria, tetanus, pertussis, measles, poliomyelitis, tuberculosis and hepatitis B before their first birthday; (ii) the proportion of children immunized against yellow fever in affected countries of Africa; and (iii) the proportion of women of child-bearing age immunized against tetanus.

(c) Unit of Measurement: %.

(d) Placement in the CSD Indicator Set: Health/Healthcare Delivery.

2. POLICY RELEVANCE

(a) Purpose: This indicator monitors the implementation of immunization programs.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): Health and sustainable development are intimately interconnected. Both insufficient and inappropriate development can lead to severe health problems in both developing and developed countries. Addressing primary health needs is integral to the achievement of sustainable development. Particularly relevant is the provision of preventative programmes aimed at controlling communicable diseases and protecting vulnerable groups. Good management of immunization programmes, essential to the reduction of morbidity and mortality from major childhood infectious diseases, is a basic measure of government commitment to preventative health services.

(c) International Conventions and Agreements: See sections 2(d) and 6.

(d) International Targets/Recommended Standards: In 2005, the *WHO Assembly adopted the Global Immunization Vision and Strategy*. In the *Global Strategy for Health* and the *Ninth General Programme at Work,* all children and 90% of children respectively, should be immunized against diphtheria, tetanus, pertussis, measles, poliomyelitis, tuberculosis and hepatitis B (see section 6 below). The 1992 *World Health Assembly* agreed that all children should be immunized against hepatitis B as part of expanded national programmes of immunization. In addition, all children in affected countries of Africa should be immunized against yellow fever. At the *World Summit for Children* it was resolved that all pregnant women should be immunized against tetanus.
The indicator is one of three indicator used to measure progress towards the Millennium Development Goal Nr. 4 (Reduction of childhood mortality) and the associated target "Reduce by two-thirds, between 1990 and 2015, the under-five mortality rate.

(e) Linkages to Other Indicators: This indicator is linked to other health indicators, particularly those associated with the young, such as infant mortality and life expectancy. It is influenced by such indicators as health expenditure and the proportion of population in urban areas.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: A child is considered adequately immunized against a disease when he or she has received the following number of doses: tuberculosis (1 dose); diphtheria, tetanus and pertussis (DTP) (2 or 3 doses according to the immunization scheme adopted in the country); poliomyelitis (3 doses of live or killed vaccine); measles (1 dose); hepatitis B (3 doses); and yellow fever (1 dose). A pregnant woman is considered adequately immunized against tetanus if she has received at least 2 doses of tetanus toxoid during pregnancy or was already previously immunized.

(b) Measurement Methods:
i) *Infant population*: The numerator is the number of infants fully immunized with the specified vaccines x 100, while the denominator is the number of infants surviving to age one. For immunizations against tuberculosis the denominator is the number of live births. If the national schedule provides for immunization in a different age group, such as measles in the second year of age, the value should be the percentage of children immunized in the target age group. For the proper management of immunization programmes, it is however essential to be able to break down the data in such a way as to show the percentage covered in the first year of life (or second year for measles immunization).
ii) *Women of child-bearing age:* The numerator is the number of women immunized with two or more doses of tetanus toxoid during pregnancy x 100, while the denominator is the number of live births.

(c) Limitations of the Indicator: It is useful to have a composite indicator of adequate coverage by immunization. However, it is easier to collect data on the global coverage of a population against one disease than on the immunization of each child against all target diseases at the same time. This is why in most countries only the former data are easily available and collected.
The percent of pregnant women immunized with two or more doses of tetanus toxoid during pregnancy is rather easy to monitor through routine data collection in the health services. However, it underestimates the percent of pregnant women actually immunized against tetanus. It does not take into account women who are already adequately immunized when becoming pregnant and therefore do not require new doses of tetanus toxoid during pregnancy. Women in this category are not numerous in countries where neonatal tetanus is still an issue and where, accordingly, this indicator is mainly used. But in some countries in transition, with long-standing child immunization programmes, the percent of pregnant women receiving tetanus toxoid is misleading as a significant number of them may be already immunized at the moment of pregnancy.
The indicator does not reflect other health preventative measures, such as education, diet, and pollution prevention. The international targets are not very meaningful for many countries.

(d) Status of the Methodology: Not Available.

(e) Alternative Definitions/Indicators: Not available.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: The number of infants fully immunized against: DTP; poliomyelitis; measles; the number of infants surviving to age one year; against tuberculosis; the number of births; the number of infants living in African countries exposed to yellow fever; the number of pregnant women immunized against tetanus; and the number of live births.

(b) National and International Data Availability and Sources: Data is readily available from national immunization programmes of most countries, at least at the national level. Reporting of vaccinations performed annually or nation-wide surveys are the most common data sources.

(c) Data References: Data on immunization against DTP, measles and Hepatitis B is included in the WHO Core Health Indicators, see http://www3.who.int/whosis/core/core_select.cfm
Data on immunization against measles is available at the MDG website, see http://mdgs.un.org/unsd/mdg/

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the World Health Organization (WHO). The contact point is the Director, Office of Global and Integrated Environmental Health, WHO; fax no. (41 22) 791 4123.

(b) Other Contributing Organizations: The United Nations Children's Fund is a cooperating agency.

6. REFERENCES

(a) Readings:

WHO. *Global Strategy for Health for All by the Year 2000.* Geneva, WHO, 1981.
WHO. Ninth General Programme of Work Covering the Period 1996-2001. Geneva, WHO, 1994.
WHO. *World Health Assembly Resolution.* WHO45.19, 1992.
WHO. *WHO Vaccine Preventable Diseases Monitoring System*; 1999 Global Summary. WHO/V&B/99.17,1999.
WHO. *WHO-Recommended Standards for Surveillance of Selected Vaccine-Preventable Diseases.* WHO/EPI/GEN/99.012,1999.
UNICEF. *World Summit for Children.* Paris, UNICEF, 1990.

(b) Internet sites:

World Health Organization. http://www.who.int
WHO website on immunization: http://www.who.int/topics/immunization/en/

NUTRITIONAL STATUS OF CHILDREN		
Health	**Nutritional Status**	**Core indicator**

1. **INDICATOR**

(a) Name: Nutritional Status of Children.

(b) Brief Definition: Percentage of underweight (weight-for-age below -2 standard deviation (SD) of the WHO Child Growth Standards median) among children under five years of age; percentage of stunting (height-for-age below -2 SD of the WHO Child Growth Standards median) among children under five years of age; and percentage of overweight (weight-for-height above +2SD of the WHO Child Growth Standards median) among children under five years of age.

(c) Unit of Measurement: %.

(d) Placement in the CSD Indicator Set: Health/Nutritional Status.

2. **POLICY RELEVANCE**

(a) Purpose: The purpose of this indicator is to measure long term nutritional imbalance and malnutrition resulting in undernutrition (assessed by underweight and stunting) and overweight.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): Health and development are intimately interconnected. Meeting primary health care needs and the nutritional requirement of children are fundamental to the achievement of sustainable development. Anthropometric measurements to assess growth and development, particularly in young children, are the most widely used indicators of nutritional status in a community. The percentage of low height-for-age reflects the cumulative effects of under-nutrition and infections since birth, and even before birth. This measure, therefore, should be interpreted as an indication of poor environmental conditions and/or long term chronic restriction of a child's growth potential. The percentage of low weight-for-age may reflect the less common wasting (i.e. low weight-for-height) indicating acute weight loss, and/or the much more common stunting. Thus, it is a composite indicator which is more difficult to interpret.

(c) International Conventions and Agreements: The United Nations World Summit for Children and the Millennium Development Goals represent international agreements relevant to this indicator.

(d) International Targets/Recommended Standards: To half the prevalence of underweight among children younger than 5 years between 1990 and 2015. This target of the Millennium Development Goal No. 1 to "eradicate extreme poverty and hunger" has been established at the Millennium Summit in 2000, where representatives from 189 countries committed themselves to give highest priority to sustaining development and eliminating poverty.

(e) Linkages to Other Indicators: This indicator is closely linked with adequate birth weight. It is also associated with such socioeconomic and environmental indicators as squared poverty gap index, access to safe drinking water, infant mortality rate, life expectancy at birth, national health expenditure devoted to local health care, Gross Domestic Product (GDP) per capita, environmental protection expenditures as a percent of GDP, and waste water treatment coverage.

3. <u>METHODOLOGICAL DESCRIPTION</u>

(a) Underlying Definitions and Concepts: An international standard (i.e. the WHO Child Growth Standards) is used to calculate the indicator prevalences for low weight-for-age, low height-for-age, and high weight-for-height (1,2). The International Pediatric Association (IPA), the Standing Committee on Nutrition of the United Nations System (SCN), and the International Union of Nutritional Sciences (IUNS), have officially endorsed the use of the WHO standards describing them as an effective tool for detecting and monitoring both undernutrition and overweight, thus addressing the double burden of malnutrition affecting populations on a global basis (3-5). The WHO standards may be used for all children up to five years of age, since the influence of ethnic or genetic factors on young children is considered insignificant (6).
Low weight-for-age and low height-for-age are defined as less than two standard deviations below the median of the WHO Child Growth Standards (1,2). High weight-for-height is defined as more than two standard deviations above the median of the WHO Child Growth Standards (1,2).

(b) Measurement Methods: The proportion of children under five with low weight-for-age and low height-for-age can be calculated by using the following formula:

% underweight children = (Numerator/ denominator) x 100

Numerator: number of children under five with weight-for-age below -2 SD

Denominator: total number of children under five weighed.

% stunted children = (Numerator/ denominator) x 100

Numerator: number of children under five with height-for-age below -2 SD

Denominator: total number of children under five measured.

The proportion of children under five with high weight-for-height can be calculated by using the following formula:

% overweight children = (Numerator/ denominator) x 100
Numerator: number of children under five with weight-for-height above +2 SD
Denominator: total number of children under five measured.

For height, supine length is measured in children under two years of age, and standing height in older children (7).

(c) Limitations of the Indicator: Lack of specificity when using anthropometry to assess nutritional status, as changes in body measurements are sensitive to many factors including intake of essential nutrients, infections, altitude, stress and genetic background. In some countries, the age of children is difficult to determine. It is also difficult to measure the length of young children, particularly infants, with accuracy and precision.

(d) Status of the Methodology: A well-established methodology for the compilation and standardized analysis of nutritional surveys, as well as robust methods for deriving global & regional trends and forecasting future trends, have been published (8-10).

(e) Alternative Definitions/Indicators: Not Available.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: The data needed to compile this indicator are the weight, length/height, age and sex of the children in the index populations.

(b) National and International Data Availability and Sources: The data are routinely collected by ministries of health at the national and subnational levels for most countries. Other sources are: Demographic and Health Surveys (DHS, www.measuredhs.com); Multiple Indicators Cluster Surveys (MICS, www.childinfo.org); Living Standards Measurement Surveys (LSMS, www.worldbank.org/lsms/). All data from these four sources are being collected and standardized by the WHO Department of Nutrition and disseminated via the WHO Global Database on Child Growth and Malnutrition web site www.who.int/nutgrowthdb.

(c) Data References: Available via the WHO Global Database on Child Growth and Malnutrition web site www.who.int/nutgrowthdb

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the World Health Organization (WHO). At WHO, the contact point is the Director, Department of Nutrition for Health and Development; fax no. (41 22) 791 3111.

(b) Other Contributing Organizations: UNICEF.

6. REFERENCES

(a) Readings:

1. de Onis M, Garza C, Onyango AW, Martorell R, editors. WHO Child Growth Standards. *Acta Paediatrica Suppl* 2006;450:1-101.

2. WHO Multicentre Growth Reference Study Group. *WHO Child Growth Standards: Length/height-for-age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age: Methods and development.* Geneva: World Health Organization, 2006.

3. International Pediatric Association Endorsement. The New WHO Growth Standards for Infants and Young Children. *http://www.who.int/childgrowth/Endorsement_IPA.pdf*

4. Standing Committee on Nutrition of the United Nations System. SCN Endorses the New WHO Growth Standards for Infants and Young Children. *http://www.who.int/childgrowth/endorsement_scn.pdf*

5. International Union of Nutritional Sciences. Statement of Endorsement of the WHO Child Growth Standards. *http://www.who.int/childgrowth/endorsement_IUNS.pdf*

6. WHO Multicentre Growth Reference Study Group. Assessment of differences in linear growth among populations in the WHO Multicentre Growth Reference Study. *Acta Paediatrica Suppl* 2006;450:56-65.

7. WHO. *Physical Status: The Use and Interpretation of Anthropometry. Report of a WHO Expert Committee.* Geneva, World Health Organization, 1995 (WHO Technical Report Series, No. 854).

8. de Onis M and Blössner M. The WHO Global Database on Child Growth and Malnutrition: methodology and applications. *International Journal of Epidemiology* 2003;32:518-26.

9. de Onis M, Blössner M, Borghi E, Morris R, Frongillo EA. Methodology for estimating regional and global trends of child malnutrition. *International Journal of Epidemiology* 2004;33:1260-70.

10. de Onis M, Blössner M, Borghi E, Frongillo EA, Morris R. Estimates of global prevalence of childhood underweight in 1990 and 2015. *JAMA* 2004;291:2600-6.

(b) Internet sites:

1. WHO Global Database on Child Growth and Malnutrition. http://www.who.int/nutgrowthdb
2. WHO Child Growth Standards. http://www.who.int/childgrowth/en

MORBIDITY OF MAJOR DISEASES SUCH AS HIV/AIDS, MALARIA, TUBERCULOSIS		
Health	**Health status and risks**	**Core indicator**

1. **INDICATOR**

(a) Name: Morbidity of major diseases such as HIV/AIDS, malaria, tuberculosis

(b) Brief Definition: Prevalence and/or incidence related to major diseases.

(c) Unit of Measurement: Cases of prevalence or incidence per 100 000 people.

(d) Placement in the CSD Indicator Set: Health/Health status and risks.

2. **POLICY RELEVANCE**

(a) Purpose: The indicator measures the morbidity caused by major diseases. It also provides important information on the success of measures to fight major diseases.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): The goals of sustainable development can only be achieved in the absence of a high prevalence of debilitating diseases. HIV/AIDS, malaria, tuberculosis and other diseases are major impediments to sustainable development, especially in many developing countries.

(c) International Conventions and Agreements:

(d) International Targets/Recommended Standards: Under Millennium Development Goal 6 "Combat HIV/AIDS, malaria and other diseases", both target 7 "have halted by 2015 and begun to reverse the spread of HIV/AIDS" and target 8 "have halted by 2015 and begun to reverse the incidence of malaria and other major diseases" are relevant for this indicator.

(e) Linkages to Other Indicators: This indicator is closely related to other health indicators as well as to indicators on poverty and economic development.

3. **METHODOLOGICAL DESCRIPTION**

(a) Underlying Definitions and Concepts: Diseases are classified according to the International Statistical Classification of Diseases and Related Health Problems (ICD).
Incidence of diseases refers to the number of cases arising in a given time period. Prevalence refers to the number of people suffering from the disease at a given point of time.
The indicator is computed separately for each relevant disease by dividing the number of cases arising in a given time period (incidence), the number of people suffering from the disease at a given point of time (prevalence), and then multiplying the result by 100

000. The indicator can be calculated separately for men, women and both sexes. It can also be broken down by age group.

(b) Measurement Methods:

Exact measurement methods depend on the diseases chosen. Prevalence data of HIV/AIDS is obtained through national HIV surveillance systems, which may include national population surveys with HIV testing. In concentrated and low level epidemics, surveillance focuses on high-risk populations. Standardized tools and methods of estimation developed by UNAIDS and WHO are used to estimate overall, gender and age-specific prevalence rates. Prevalence of tuberculosis can be estimated based on population-based surveys. In the absence of such surveys, prevalence can be estimated based on incidence estimates. Incidence of tuberculosis is estimated based on notified cases, prevalence surveys and/or information from death (viral) registration systems. Details of all these estimation methods are available through WHO. Similar methods exist for other diseases.

(c) Limitations of the Indicator: Limitations in reporting mechanisms and estimation methods may lead to underreporting of certain diseases or imprecise indicator values. This also limits the comparability of data across countries. Changes in reporting mechanism and estimation methods may affect changes in the data of morbidity of diseases over time.

(d) Status of the Methodology: Methodologies for most diseases are under constant review by the WHO.

(e) Alternative Definitions/ Indicators: The indicator could be calculated separately for children. On a global level, diarrhoeal diseases, pneumonia, malaria, neonatal causes, measles and HIV/AIDS are among the most deadly diseases for children.

In addition to morbidity, disease specific mortality rates provide important information on the impact of major diseases in form of death toll. Death rates associated with malaria and tuberculosis are included in the MDG Indicators. Death rates associated with HIV/AIDS, tuberculosis, non-communicable diseases, cardio-vascular diseases and cancer are included in the WHO Core Health Indicators, as well as death rates for children associated with diarrhoeal diseases, pneumonia, malaria, neonatal causes, measles and HIV/AIDS.

Complementary indicators on responses by health systems to major diseases provide important information. Indicators used in the context of MDG monitoring include "Percentage of population with advanced HIV infection with access to antiretroviral drugs" (Recommended as alternative to "Population with access to essential drugs"), "Proportion of children under 5 sleeping under insecticide-treated bednets and proportion of children under 5 with fever who are treated with appropriate anti-malarial drugs" and "Proportion of tuberculosis cases detected and cured under directly observed treatment short course". These indicators are also included in the WHO Core Health Indicators, together with indicators on treatment of children with acute aspiratory syndromes (ARI) and with diarrhoea.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Administrative data, household surveys, data from death (vital) registration systems and/or national estimates for the nominator and population data from censuses or other sources for the denominator. International data may include estimation techniques ensuring the comparability of data across countries and is typically based on internationally agreed population estimated provided by the United Nations Population Division.

(b) National and International Data Availability and Sources: Coverage of diseases varies across countries due to variations in relevance of diseases and in quality of health information systems. WHO regularly publishes data on all major diseases.

(c) Data References: Data on all MDG indicators on HIV/AIDS, Malaria and Tuberculosis is available from the MDG database, available at http://mdgs.un.org/unsd/mdg/
Death rates, prevalence and incidence rates for a number of diseases are included in the WHO Core Health Indicators, see http://www3.who.int/whosis/core/core_select.cfm
Estimates on death rates by cause for all WHO member states are included in WHO's Global Burden of Disease Estimates, available at http://www.who.int/healthinfo/bodestimates/en/index.html

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the World Health Organization. The contact point is the Director, Measurement & Health Information and/or Co-ordinator, Health Statistics and Evidence.

6. REFERENCES

(a) Readings:

World Health Organization (WHO), The World Health Report, Geneva, various years.
WHO, World Health Statistics, Geneva, various years.
WHO, International Statistical Classification of Diseases and Related Health Problems - 10th Revision, Second edition, Geneva, 2005.

(b) Internet sites:

http://www.who.int/whosis/en/index.html
http://mdgs.un.org/unsd/mdg/Default.aspx

PREVALENCE OF TOBACCO USE		
Health	**Health status and risks**	

1. INDICATOR

(a) Name: Prevalence of tobacco use (smoking)

(b) Brief Definition: Prevalence of current daily tobacco smoking among adults aged 15 years and older.

(c) Unit of Measurement: %.

(d) Placement in the CSD Indicator Set: Health/ Health status and risks

2. POLICY RELEVANCE

(a) Purpose: Prevalence of current daily tobacco smoking among adults is a measure useful to determine of the economic and future health burden of tobacco use, and provides a primary basis for evaluating the effectiveness of tobacco control programmes over time.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): Tobacco is an undisputable health threat causing 5.4 million deaths in 2005, and representing the second risk factor for mortality worldwide. The death toll is expected to reach 8.3 million by 2030, with the majority of deaths occurring in developing countries[24]. Tobacco consumption is costly and contributes to poverty and associated health inequalities at the individual and national levels. Studies have shown that prevalence is higher among the poor illustrating a negative association between prevalence and household income and/or wealth. The cost of treatment of tobacco-caused diseases is high and falls heavily on the finances of poor households and countries. Premature deaths from tobacco-related diseases also lead to productivity losses.

In relation to the different UN Millennium Development goals, tobacco use and production undermine efforts to improve primary education, gender equality promotion and maternal and children's health. Money spent by the poor on tobacco use is money diverted from nutrition and education, with especially detrimental consequences for mothers and children. In addition, children are employed in the developing world for the growing and manufacturing of tobacco. Moreover, passive smoke disproportionately affects infants and children and increases respiratory and other ailments in them. Women are currently targeted by tobacco industry marketing in developing countries encouraging them to smoke as a sign of increased gender equality, independence and

---

[24] Mathers, C. and D. Loncar (2004). "Projections of Global Mortality and Burden of Disease from 2002 to 2030", PLoS Medicine. Available at http://medicine.plosjournals.org.

success. Women who use tobacco have smaller babies who are weaker and more likely to die in infancy.

Tobacco use can also be linked with some communicable diseases. Smoking and exposure to passive smoke most affect those who are ill and whose immune systems are weak, due to HIV infection for example. Smoking is also implicated in large numbers of tuberculosis deaths.

Additionally, tobacco growing has negative environmental implications. The firewood used to cure and process tobacco increases deforestation. Tobacco growing also requires heavy use of pesticides which can poison people, water and land. The heavy fertilizing of the land in order to grow tobacco leads to soil degradation.

Finally, the large scale illicit trade in tobacco products, which has been linked with organized crime, threatens the security of countries but also increases internal instability and affects human security by increased crime and violence.

(c) International Conventions and Agreements: The WHO Framework Convention on Tobacco Control (WHO FCTC) is the first global health treaty negotiated under the auspices of the WHO. "Reflecting the concern of the international community about the devastating worldwide health, social, economic and environmental consequences of tobacco consumption and exposure to tobacco smoke" and "Seriously concerned about the increase of the worldwide consumption and production of cigarettes and other products, particularly in developing countries, as well as about the burden this places on families, on the poor, and on national health systems", the WHO FCTC redefines the role of international law in preventing disease and promoting health. Among its many measures, the treaty requires countries to impose restrictions on tobacco advertising, sponsorship and promotion; establish new packaging and labelling of tobacco products; establish clean indoor air controls; and strengthen legislation to clamp down on tobacco smuggling. The WHO FCTC was adopted unanimously by the 56th World Health Assembly on 21 May 2003 and entered into force on 27 February 2005. The final text of the treaty is available at: http://www.who.int/tobacco/framework/text/final/en/index.html.

(d) International Targets/Recommended Standards: The core demand reduction provisions in the WHO FCTC are contained in Articles 6-14, which detail the price, tax, and non-price measures necessary to reduce the demand for tobacco. The core supply reduction provisions are contained in Articles 15-17. Mechanisms for scientific and technical cooperation and exchange of information are set out in Articles 20-22. Guidelines are being developed on Articles 8 *Protection from exposure to tobacco smoke*, 9 *Regulation of the contents of tobacco products* and 10 *Regulation of tobacco product disclosures.* Draft template protocols are being elaborated on Articles 13 *Tobacco advertising, promotion and sponsorship* and 15 *Illicit trade in tobacco products.* For further details, please refer to http://www.who.int/tobacco/framework/text/final/en/index.html.

(e) Linkages to Other Indicators: The indicator is closely associated with other poverty, health, education, environment (atmosphere and land), governance and economic development indicators (see 2.b).

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: Tobacco products are defined in the WHO FCTC as "products entirely or partly made of the leaf of tobacco as raw material which are manufactured to be used for smoking, sucking, chewing or snuffing." However, for the purposes of the present indicator, and based on the availability of data, the definition will be confined to smoking tobacco products only. The definition of tobacco smoking may include the following tobacco products: manufactured and hand-rolled cigarettes, *kreteks*, *bidis*, cigars, cheroots, cigarillos, pipes including water pipes, and any other smoked tobacco products.

(b) Measurement Methods: The prevalence of tobacco use is calculated from the responses to individual or household surveys that are nationally representative. The numerator is the number of adults aged 15 years or older that reported to be currently daily smokers of any tobacco product in surveys, multiplied by 100. The denominator is the adult population aged 15 years or older that was surveyed, adjusted for non-responses. See 6.d for further guidance on conducting surveys. Prevalence rates can be age-standardized according to the WHO world standard population to enhance comparability over time and across populations.

(c) Limitations of the Indicator:

- Information is available through self-reported questionnaires difficult to verify.
- There is a 30 to 40 year time lag between the exposure to tobacco and incidence of tobacco-related disease, i.e. the prevalence of current tobacco use is not a good proxy to assess cumulative effects of tobacco use.
- Adult prevalence rates do not reflect the gender influence on tobacco smoking, particularly in developing countries, a difference between the rates of males and females which can be substantive (see 3.e).
- Smokeless tobacco products constitute a significant burden in several countries and regions. While a more general measure of tobacco use, including both smoked and smokeless tobacco products, would be ideal, many countries do not yet collect data on smokeless tobacco (see 3.e).
- Occasional or non-daily tobacco smoking constitutes a significant risk factor for tobacco-related disease, however it is typically not consistently defined across surveys and countries (see 3.e).
- Nationally representative data are available for a majority of countries, although the definitions are somewhat different, which make the comparison across countries difficult. Where data is for a subpopulation or is non-comparable across countries and over time, models may need to be applied to arrive at comparable estimates (see 4.a).

(d) Status of the Methodology: There are many different survey instruments available for collecting data on health behaviours, including tobacco use. While each has advantages and limitations, differences can lead to results that are not comparable. Surveys that have collected tobacco prevalence in the past include the WHO STEPwise approach to chronic disease risk factor Surveillance (STEPS) and the World Health Survey (WHS) (for further details, see the reference in part 6.b). There is an urgent need for a standardized module to assess prevalence of tobacco use and WHO is taking a leadership role to coordinate and harmonize survey modules.

(e) Alternative Definitions/Indicators: In countries where smokeless tobacco products are used extensively and data is available for the prevalence of current daily adult smokeless tobacco use, this may be provided in a footnote. When possible, tobacco use prevalence, whether smoked or smokeless tobacco, may also be provided in disaggregated form by sex, age and socio-economic characteristics, in a footnote. In particular, it can be argued that the prevalence of smoking among youth (typically defined as those aged 13-15 years), as an indicator of longer-term adult prevalence (prevention of youth uptake and reduction of youth prevalence are an important tool to reduce future burden of disease and exacerbation of poverty), is a stronger measure of sustainable development. Household surveys of tobacco use prevalence often include questions related to the quantity of tobacco consumed; reporting countries may consider tracking consumption alongside the prevalence figures, to capture the depth as well as the scope of tobacco use. Countries may also consider reporting the prevalence of current non-daily tobacco use, if it comprises a significant proportion of tobacco use and/or if the patterns of non-daily use are thought to differ significantly from daily use.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator:

- Data: The number of adults aged 15 years or older that currently smoke any tobacco product daily; the total adult population aged 15 years or older, preferable disaggregated by gender.
- Model: When the available empirical data does not conform to the definition of the prevalence of tobacco use indicator, models may need to be applied to standardize definitions and create comparable estimates across countries or over time. The WHO Global Infobase (see 4.b) employs regression models to adjust country-reported prevalence to a standard set of definitions, age groups and reporting years (see the reference in 6.b for further information).

(b) National and International Data Availability and Sources: The WHO Global InfoBase collects on an on-going basis all country-level survey information for eight risk factors for non-communicable diseases, including tobacco use.

(c) Data References: Detailed metadata is contained in the WHO Global Infobase Online, see
http://www.who.int/ncd_surveillance/infobase/web/InfoBaseCommon/index.aspx.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the World Health Organization (WHO). The contact point is the Director, Tobacco Free Initiative (TFI), WHO. Email: tfi@who.int

(b) **Other Contributing Organizations:** WHO has collaborated/continues to collaborate with the Centers for Disease Control and Prevention (CDC), the United Nations Children's Fund (UNICEF), the World Bank and the Canadian Public Health Association (CPHA), amongst others.

6. REFERENCES

(a) Readings:

World Health Organization. *WHO Framework Convention on Tobacco Control*. Geneva, World Health Organization, 2003. Available at: http://www.who.int/tobacco/framework/download/en/index.html .

World Health Organization. *The Millenium Development Goals and Tobacco Control: An opportunity for global partnership*. Geneva, World Health Organization, 2004. Available at: http://www.who.int/tobacco/research/economics/publications/ .

(b) Internet sites:

Global InfoBase Online:
http://www.who.int/ncd_surveillance/infobase/web/InfoBaseCommon/index.aspx

STEPwise approach to surveillance (STEPS): http://www.who.int/chp/steps/en/

The World Health Survey: http://www.who.int/healthinfo/survey/en/index.html

Tobacco Free Initiative: http://www.who.int/tobacco/en/

Tobacco Free Initiative, Economics:
http://www.who.int/tobacco/research/economics/

SUICIDE RATE		
Health	**Health status and risks**	

1. INDICATOR

(a) Name: Suicide rate

(b) Brief Definition: The number of deaths from suicide and intentional self-harm per 100 000 people.

(c) Unit of Measurement: Deaths per 100 000 people.

(d) Placement in the CSD Indicator Set: Health/Health status and risks.

2. POLICY RELEVANCE

(a) Purpose: The indicator measures the suicide rate, which is an important proxy for the prevalence of mental health disorders in a country. Moreover, in many countries suicide is a major cause of death, especially among adolescents and young adults, and, therefore, a major public health concern in its own.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): The goals of sustainable development can only be achieved in the absence of a high prevalence of debilitating diseases. Mental health disorders are a major impediment to the well-being of populations in developed and developing countries. Mental health disorders, especially depression and substance abuse, are associated with 90% of all suicides. People with these disorders are often subjected to social isolation, poor quality of life and increased mortality. These disorders are the cause of staggering economic and social costs. Consequently, there is a need for preventing and curing mental disorders as part of the efforts to strengthen the capacity of health-care systems.

(c) International Conventions and Agreements: None

(d) International Targets/Recommended Standards: None.

(e) Linkages to Other Indicators: This indicator is closely related to other health indicators as well as to indicators on poverty and social exclusion.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: Suicide mortality statistics are collected under the international classification of diseases under the international classification of diseases and related health problems, "Suicide and intentional self-harm' (ICD-10 codes X60-X84).
Statistics on mental and behavioural disorders are also collected under the international classification of diseases and related health problems (ICD -10 codes F00-F99). However,

in many cases the data does not allow for meaningful aggregation across disorders and does not allow for meaningful comparisons across time and across countries. Therefore, suicide rate as proxy may provide a more reliable and robust indicator.

(b) Measurement Methods: The indicator is derived by dividing the number of deaths caused by suicide and intentional self-harm by the number of people, and then multiplying the result by 100 000. The indicator can be calculated separately for men, women and both sexes. In order to allow for international comparisons as well as for comparisons across sexes, standardized death rates are often used. These rates are adjusted by using a 'standard' population as defined by WHO.

(c) Limitations of the Indicator: The indicator provides only limited information about the prevalence of mental disorders. It cannot provide information on the causes of these disorders. Procedures for recording a death as a suicide are not uniform across countries. Cultural and social norms also play a role in determining suicide as cause of death. These factors limit the comparability of suicide rates across countries. Changes in procedures and in cultural and social norms may also affect changes in suicide rates over time.

(d) Status of the Methodology: Well established.

(e) Alternative Definitions/ Indicators: Indicators on the prevalence of mental disorders would provide an alternative or complementary measure.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Death registration data for the nominator and population data from censuses (or 'standardized' population data from the WHO) for the denominator.

(b) National and International Data Availability and Sources: Most countries maintain centralized or decentralized death registers and report them to the WHO, even though coverage greatly varies across countries.

(c) Data References: Time series data on suicide rates in 99 countries is available on the WHO website at :
http://www.who.int/mental_health/prevention/suicide/country_reports/en/index.html
Estimates on self-intentional death rates for all WHO member states are included in WHO's Global Burden of Disease Estimates, available at
http://www.who.int/healthinfo/bodestimates/en/index.html

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the World Health Organization.

6. REFERENCES

(a) Readings:

World Health Organization (WHO), The World Health Report 2002 – Reducing Risks, Promoting Health Life, Geneva, 2002.
WHO, Mental Health Atlas 2005, Geneva, 2005.
WHO, International Classification of Diseases and Health Related Problems - 10th Revision, Second edition, Geneva, 2005.

(b) Internet sites:

http://www.who.int/mental_health/en/
http://www.who.int/healthinfo/bod/en/index.html

GROSS INTAKE RATIO TO LAST GRADE OF PRIMARY EDUCATION		
Education	**Education Level**	**Core indicator**

1. **INDICATOR**

(a) **Name:** Gross Intake Ratio to Last Grade of Primary Education (GIRLG). Also called Primary Completion Rate (PCR).

(b) **Brief Definition:** The total number of new entrants in the last grade of primary education (according to ISCED97[25]), regardless of age, expressed as percentage of the total population of the theoretical entrance age to the last grade of primary.

(c) **Unit of Measurement:** expressed as a percentage (%).

(d) **Placement in the CSD Indicator Set:** Education/Education Level.

2. **POLICY RELEVANCE**

(a) **Purpose:** Gross Intake Rate to Last Grade of Primary Education is considered to be a measure of primary completion in a country's education system.

(b) **Relevance to Sustainable/Unsustainable Development (theme/sub-theme):** Education is a process by which human beings and societies reach their fullest potential. Education is critical for promoting sustainable development and improving the capacity of people to address environment and development issues. It is also critical for achieving environmental and ethical awareness, values, and skills consistent with sustainable development and effective public participation in decision-making.
Policy-makers concerned with children's access and participation in education would find this indicator particularly useful. It reports the current final grade intake at primary level stemming from previous years of schooling and past education policies on entrance to primary education.

(c) **International Conventions and Agreements:** Indirect link to Millennium Development Goals (MDGs), the Dakar Framework for Action for Education for All (EFA) – see next two sections d) and e) for further elaboration.

(d) **International Targets/Recommended Standards:** The MDG goal 2 is "to ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling". The goal for EFA is similar. Progress towards this goal is monitored by the indicator School Survival Rate to Grade 5 with a view that the general target should be 100% for every country of the world. Current discussions emerging

[25] *International Standard Classification of Education.* Primary education is defined by ISCED97 as programmes normally designed on a unit or project basis to give pupils a sound basic education in reading, writing and mathematics along with an elementary understanding of other subjects such as history, geography, natural science, social science, art and music.

from the MDG Interagency Expert Working Group suggest that this indicator should be complemented by the indicator GIRLG - see rationale in next section on Linkages.

(e) Linkages to Other Indicators: Currently, one of the indicators used to monitor MDG goal 2 on universal primary education is School Survival Rate to Grade 5. This is defined as the number of pupils belonging to a school-cohort who reached grade 5 divided by the number of pupils in the school-cohort, i.e., those originally enrolled in the first grade of primary education, and multiply the result by 100. It has been suggested that a better indicator to monitor MDG goal 2 would be the indicator GIRLG. The rational is: while School Survival Rate to Grade 5 is important in assessing the internal efficiency of a school system for children who have effective access to school through inclusion of repetitions and drop outs, it gives no idea on the magnitude of coverage of the eligible school population. For instance, one might have a 100% School Survival Rate to Grade 5 but have only 25% of children in school. This is because the denominator of the School Survival Rate to Grade 5 is based on the number of children who have entered school and not the number who are eligible to enter school. The suggested supplement indicator, GIRLG combines two dimensions to assess UPE: it addresses whether or not the entire eligible school age population has access to school and whether or not they complete the full primary cycle.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: Gross Intake Ratio to Last Grade of primary education is the total number of new entrants in the last grade of primary education (according to ISCED97), regardless of age, expressed as percentage of the total population of the theoretical entrance age to the last grade of primary.

(b) Measurement Methods: Determine the population of the theoretical entrance age to the last grade of primary by reference to the theoretical starting age and duration of ISCED97 Level 1 (primary education) as reported by the country.

Divide the number of new entrants in last grade of primary education, irrespective of age, by the population of the theoretical entrance age to the last grade of primary, and multiply the result by 100.

This method requires information on the structure of education (i.e. theoretical entrance age and duration of ISCED97 Level 1), enrolment and repeaters in the last grade of primary education and population of the theoretical entrance age to the last grade of primary.

$$\mathbf{GIRLG}^t = \frac{\mathbf{N}^t}{\mathbf{P}_a^t} * \mathbf{100}$$

Where,

$\mathbf{GIRLG}^t$ = Gross Intake Ratio to Last Grade in school-year t

$\mathbf{N}^{t}$ = Total number of new entrants in the last grade of primary education (enrolments minus repeaters), in school-year t

$\mathbf{P}_{a}^{t}$ = Population of the theoretical entrance-age a to last grade of primary, in school-year t

(c) Limitations of the Indicator: The Gross Intake Ratio to Last Grade of primary reports on the current primary access to last grade stemming from previous years' of schooling and past education policies on entrance to primary education. It is a measure of first-time completion of primary education as it excludes pupils repeating the last grade. A high Gross Intake Ratio to Last Grade denotes a high degree of completion of primary education.

As this calculation includes all new entrants to last grade (regardless of age), the Gross Intake Ratio may exceed 100%, due to over-aged or under-aged pupils entering the last grade of primary school for the first time. It is measuring the capacity of the education systems regarding primary completion rather than a proportion of a specific group.

Country figures may differ from the international ones because of differences between the national education system and ISCED97; or differences in coverage (i.e. the extent to which different types of education – e.g. private or special education – or different types of programmes e.g. adult education or early childhood care and education - are included in one rather than the other) and/or between national and UNPD population data.

(d) Status of the methodology:

(e) Alternative Definitions: Three other indicators of primary completion have been proposed by the UNESCO Institute for Statistics (UIS) alongside GIRLG:

Enrolment-based completion indicators

Expected Gross Intake Ratio to the Last Grade of Primary (E-GIRLG). It predicts the effect on last grade intake of current education policies on entrance to primary education and future years of schooling

$$Apparent\,(gross)\,Intake\,rate \times Survial\,rate\,to\,the\,last\,grade$$

Graduation-based completion indicators

Gross Primary Graduation Ratio (GPGR). It reports the current primary outputs stemming from previous years of schooling and past education policies on entrance to primary education.

$$\frac{Number\ of\ graduates}{Population\ of\ the\ theoritical\ primary\ graduation\ age}$$

Expected Gross Primary Graduation Ratio (E-GPGR). It predicts the effect on primary outputs of current education policies on entrance to primary education and future years of schooling.

$$Apparent\,Intake\,rate \times Survial\,rate\,to\,last\,grade \times \Pr obabilty\ for\ graduation$$

$$\Pr obabilty\ for\ graduation = \frac{Graduates}{New\ entrants\ to\ last\ grade}$$

All these indicators are GROSS measure of completion. This means that they are measuring the **volume** of completion with regard to the eligible school age population. Therefore the figures may exceed 100% for some countries. This is the case for several countries where children complete primary education after multiple repetition and even re-enrolment after drop-out. Their interpretation should be completed along with other indicators of intake and progress (i.e. Intake and enrolment rates).

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Basic data required to derive this indicator include number of enrolled and number of repeaters for the last grade of primary education (as determined by the country and in accordance with the ISCED97 definition). Corresponding demographic age related data is required for students in the last grade of primary, again as determined by the country and in accordance with the ISCED97 definition.

(b) National and International Data Availability and Sources: At the national level, data on enrolment and repetition by grade in primary school are generally available in most countries. For sound measurement, this indicator should be supported by consistent data for gender and area (such as rural/urban zones). At the international level the UNESCO Institute for Statistics (UIS) undertakes an annual data collection of the latest available enrolment and repetition data from each country of the world. It then combines these with demographic age data from UN Population Division to form the indicator. Gross Intake Ratio to Last Grade of primary is available for around 140 countries.

(c) Data References:
The UNESCO Institute for Statistics web site: http://www.uis.unesco.org
UNESCO Institute for Statistics (UIS) Global Education Digest (GED), 2003, 2004, 2005, 2006.
The Education for All (EFA) Global Monitoring Reports (GMR), UNESCO.
The Millennium Development Goals Report 2006, United Nations.
The Human Development Reports, UNDP.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the United Nations Educational, Scientific and Cultural Organization (UNESCO). The contact point is the Director, UNESCO Institute for Statistics (UIS); email: uis.unesco.org; fax: (1-514) 343-5740.

(b) Other Contributing Organizations: The UN Population Division in New York provides the population counts that comprise the denominator of this indicator.

6. REFERENCES

(a) Readings:

UNESCO Institute for Statistics (UIS) Global Education Digest (GED), 2003, 2004, 2005.
The Education for All (EFA) Global Monitoring Reports (GMR), UNESCO.
The Millennium Development Goals Report 2006, United Nations.
The Human Development Reports, UNDP.
The World Development Indicators Reports, the World Bank.
World Education Report (UNESCO), 1995, 1998.
International Standard Classification of Education 1997, UNESCO

(b) Internet site: http://www.uis.unesco.org (UNESCO Institute for Statistics)

NET ENROLMENT RATE IN PRIMARY EDUCATION		
Education	**Education Level**	**Core indicator**

1. INDICATOR

(a) Name: Net Enrolment Rate in Primary Education.

(b) Brief Definition: The number of children of official primary school age (according to ISCED97[26]) who are enrolled in primary education as a percentage of the total children of the official school age population.

(c) Unit of Measurement: expressed as a percentage (%).

(d) Placement in the CSD Indicator Set: Education/Education Level.

2. POLICY RELEVANCE

(a) Purpose: Net Enrolment Rate is considered to be a measure of the education coverage in a specific level of a country's education system.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): Education is a process by which human beings and societies reach their fullest potential. Education is critical for promoting sustainable development and improving the capacity of people to address environment and development issues. It is also critical for achieving environmental and ethical awareness, values, and skills consistent with sustainable development and effective public participation in decision-making.
Policy-makers concerned with children's access and participation in education would find this indicator, alongside the Gross Enrolment Ratio or GER (defined later in "Linkages to Other Indicators"), particularly useful. A sharp discrepancy between the GER and the NER indicates that enrolled children enter late to the first grade or do not progress regularly through the grades and that the system's internal efficiency could be improved. Appropriate policies and measures could then be adopted to address problems of grade repetition and drop-out as well as bottlenecks with regard to retention in school.

(c) International Conventions and Agreements: Millennium Development Goals (MDGs), the Dakar Framework for Action for Education for All (EFA),

(d) International Targets/Recommended Standards: The MDG goal 2 is "to ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling". The goal for EFA is similar. Progress towards this goal is

[26] *International Standard Classification of Education.* Primary education is defined by ISCED97 as programmes normally designed on a unit or project basis to give pupils a sound basic education in reading, writing and mathematics along with an elementary understanding of other subjects such as history, geography, natural science, social science, art and music.

monitored, amongst other indicators but principally, by the NER with a view that the general target should be 100% for every country of the world.

(e) Linkages to Other Indicators: This indicator is often analysed along side the Gross Enrolment Ratio for Primary Education (GER). This is defined as the number of pupils (of any age) who are enrolled in primary education as a percentage of the total children of official school age population (according to ISCED97).
Gross Enrolment Ratio is widely used to show the general level of participation in a given level of education. It indicates the capacity of the education system to enroll students of a particular age-group at a specific level of education. It can be a complementary indicator to NER by indicating the extent of over-aged and under-aged enrolment. GER can be over 100% due to the inclusion of over-aged and under-aged pupils/students because of early or late entrants, and grade repetition. In this case, a rigorous interpretation of GER needs additional information to assess the extent of repetition, late entrants, etc.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: Net primary enrolment rate in primary education is the number of pupils of official primary school age (according to ISCED97) who are enrolled in primary education as a percentage of the total children of the official school age population. Where more than one system of primary education exists within the country the most widespread or common structure is used for determining the official school age group.

(b) Measurement Methods: Determine the population of official school age by reference to the theoretical starting age and duration of ISCED97 Level 1 (primary education) as reported by the country.

Divide the number of pupils enrolled in primary education who are of the official school age by the population for the same age-group and multiply the result by 100. This method requires information on the structure of education (i.e. theoretical entrance age and duration of ISCED97 Level 1), enrolment by single years of age and population of the age-group corresponding to the given level of education.

$$NER_h^t = \frac{E_{h,a}^t}{P_{h,a}^t} * 100$$

Where:

NER_h^t = Net Enrolment Ratio at level of education **h** in school-year **t**

$E_{h,a}^t$ = Enrolment of the population of age-group **a** at level of education h in school-year **t**

$P_{h,a}^t$ = Population in age-group **a** which officially corresponds to level of education **h** in school-year **t**

Example: If the entrance age for primary education is 7 years with a duration of 6 years then a is (7-12) years.

(c) Limitations of the Indicator: A high NER denotes a high degree of enrolment in education by the official school-age population. The theoretical maximum value is 100%. NERs below 100 percent provide a measure of the proportion of primary school age children who are not enrolled at the primary level. This difference does not necessarily indicate the percentage of students who are not enrolled at all in education, since some children may be enrolled at other levels of education. When the NER is compared with the Gross Enrolment Ratio (GER) the difference between the two ratios highlights the incidence of under-aged and over-aged enrolment.

Net Enrolment Rates may exceed 100% due to inconsistencies between population and enrolment data. In this case the indicator is adjusted by the UNESCO Institute for Statistics (UIS) using a capping factor so that the Gender Parity Index[27] of the new set of values remains the same as for the original values but setting the higher of the male and female NERs to 100% and adjusting the other values proportionately.

Nationally-published figures may differ from the international ones because of differences between national education systems and ISCED97; or differences in coverage (i.e. the extent to which different types of education – e.g. private or special education – or different types of programmes e.g. adult education or early childhood care and education - are included in one rather than the other) and/or between national and UNPD population data.

(d) Status of the methodology:

(e) Alternative Definitions: The UNESCO Institute for Statistics (UIS) estimates the number of out-of-school children using an adaptation of NER. (Note that there is no internationally agreed upon title for this adaptation of NER as of yet.) The adaptation uses an alternative numerator calculation which includes the number of children enrolled in either primary *or secondary* school. This is felt to be a more "honest" measure since children who are enrolled in secondary school but are of primary school age should not be considered a failure of the system and so should be included in the count.

4. <u>ASSESSMENT OF DATA</u>

(a) Data Needed to Compile the Indicator: Basic data required to derive this indicator include enrolment by single year of age for at all ages that are encompassed in the official definition of primary school level (in accordance with ISCED97) in a country. Corresponding demographic age related data is required for all ages encompassed by the definition of primary school level.

(b) National and International Data Availability and Sources: At the national level, data on enrolment by age in primary school are available in about 140 countries. For sound measurement, this indicator should be supported by consistent data for gender and area (such as rural/urban zones). At the international level the UNESCO Institute for Statistics (UIS) undertakes an annual data collection of the latest available enrolment data from each country of the world. It then combines these with demographic age data from UN Population Division to form the indicator.

[27] *Gender parity index is the ratio of female to male values of a given indicator. A GPI of 1 indicates parity between sexes.*

(c) Data References:
The UNESCO Institute for Statistics web site: http://www.uis.unesco.org
UNESCO Institute for Statistics (UIS) Global Education Digest (GED), 2003, 2004, 2005, 2006.
The Education for All (EFA) Global Monitoring Reports (GMR), UNESCO.
The Millennium Development Goals Report 2006, United Nations.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the United Nations Educational, Scientific and Cultural Organization (UNESCO). The contact point is the Director, UNESCO Institute for Statistics (UIS); email: uis.unesco.org; fax: (1-514) 343-5740.

(b) Other Contributing Organizations: The UN Population Division in New York provides the population counts that comprise the denominator of this indicator.

6. REFERENCES

(a) Readings:
UNESCO Institute for Statistics (UIS) Global Education Digest (GED), 2003, 2004, 2005, 2006.
The Education for All (EFA) Global Monitoring Reports (GMR), UNESCO.
The Millennium Development Goals Report 2006, United Nations.
The Human Development Reports, UNDP.
The World Development Indicators Reports, the World Bank.
World Education Report (UNESCO), 1995, 1998.
International Standard Classification of Education 1997, UNESCO

(b) Internet site: http://www.uis.unesco.org (UNESCO Institute for Statistics)

ADULT SECONDARY (TERTIARY) SCHOOLING ATTAINMENT LEVEL		
Education	**Education level**	**Core indicator**

1. INDICATOR

(a) Name: Adult Secondary (Tertiary) Schooling Attainment Level.

(b) Brief Definition: Adult Secondary Schooling Attainment Level is defined as the proportion of the population of working age (25-64 years) which has completed at least (upper) secondary education. Adult Tertiary Schooling Attainment Level is defined as the proportion of the population of working age (25-64 years) which has completed at least the first stage (as defined by the International Standard Classification of Education or ISCED) tertiary education.

(c) Unit of Measurement: expressed as a percentage (%).

(d) Placement in the CSD Indicator Set: Education/Education Level.

2. POLICY RELEVANCE

(a) Purpose: These indicators provide measures of the quality of the human capital stock within the adult population of approximately working age. For instance, those who have completed upper secondary education can be expected either to have an adequate set of skills relevant to the labour market or to have demonstrated the ability to acquire such skills. The indicator corresponding to secondary attainment can be made more dynamic by presenting the results in 10-year age bands (25-34, 35-44, 45-54, 55–64) in order to give an indication of changes over time in actual secondary education completion rates. Nevertheless, one should not assume that differences between age groups correspond to progress over time, because individuals are not always necessarily schooled at the "appropriate" age, especially in developing countries. This may even underestimate progress if older cohorts have returned to school in recent years, which seems plausible.

(b) Relevance to Sustainable/Unsustainable Development: Education is a process by which human beings reach their fullest potential. It is critical for promoting and communicating sustainable development and improving the capacity of people to address environment and development issues. It facilitates the achievement of environmental and ethical awareness, values, and skills consistent with sustainable development and effective public participation in decision-making.

(c) International Conventions and Agreements: None.

(d) International Targets/Recommended Standards: International agreements do not establish specific national or global targets for this indicator.

(e) Linkages to Other Indicators: Education is closely linked to indicators reflecting basic needs such as literacy, capacity-building, information and communications and the role of major groups. These indicators also give a broad measure of the quality of the human capital stock within countries (and hence, an indication of the potential for future sustained development).

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: The *International Standard Classification of Education (1997)* defines levels of education (pre-primary, primary, lower secondary, upper secondary etc.) in an internationally comparable manner.

(b) Measurement Methods: To calculate the adult secondary education attainment level, divide the number of adults aged 25-64 years who have completed at least upper secondary education by the corresponding total population aged 25-64 years and multiply by 100. To calculate the adult tertiary education attainment level, divide the number of adults aged 25-64 years who have completed at least first stage (as defined by the International Standard Classification of Education or ISCED) tertiary education by the corresponding total population aged 25-64 years and multiply by 100.

(c) Limitations of the Indicator:
Schooling attainment levels are mostly based on self-declaration or declaration of the head of household, which may give rise to concerns about data reliability and consequently comparability, especially for females in many developing countries. Some countries determine completion of upper secondary (or tertiary) education by making inference using data on the number of years of schooling received rather than qualifications obtained. In some cases, the available data only indicate whether an individual has studied at the upper secondary (or tertiary) level as opposed to having completed upper secondary (or tertiary) education.

(d) Status of the methodology:
These indicators have the status of an international recommendation since the basic data elements to derive them are included in the *Revised Recommendation concerning the International Standardization of Education Statistics* adopted by the UNESCO General Conference at its twentieth session, Paris, 1978. In the latest revised Principles and Recommendations for Population and Housing Censuses in 1999, the concerned UN agencies co-operated with international experts in upgrading the methodology used in collecting statistics on literacy and educational characteristics.

(e) Alternative Definitions:
Where relatively small numbers of the population have completed upper secondary education, alternative indicators are either the Adult Primary Education Attainment Level (although this may be closely correlated with the Adult Literacy Rate) or the Adult Lower Secondary Education Attainment Level.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Data on the number of people of the relevant age (recommended to be 25-64) who have completed at least upper secondary (or tertiary) education and the corresponding population of the same age.

(b) National and International Data Availability and Sources: Data are usually collected during national population censuses, or during household surveys such as Labour Force Surveys. Official statistics exist for many countries in the world but are often out-of-date due to censuses taking place every ten years and late census data release. For sound measurement, the ratio must be supported by consistent data by gender and age-group.

(c) Data References: The UNESCO Institute for Statistics (UIS) web site: http://www.uis.unesco.org

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the United Nations Educational, Scientific and Cultural Organization (UNESCO). The contact point is the Director, UNESCO Institute for Statistics (UIS); e-mail: uis@unesco.org and fax (1-514) 343-5740.

(b) Other Organizations: The International Labour Organization (ILO) also collects statistics on educational attainment from national Labour Force Surveys and the Organisation for Economic Co-operation and Development (OECD) publishes such data.

6. REFERENCES

(a) Readings:

UNESCO, World Education Report, 1995, 1998.
UNESCO, Statistics of Education in Developing Countries: an Introduction to their Collection and Analysis, 1983.

(b) Internet site: http://www.uis.unesco.org

LIFE-LONG LEARNING		
Education	**Education Level**	

1. **INDICATOR**

(a) **Name:** Life-long learning

(b) **Brief definition:** Percentage of the population aged 25 to 64 in education or training.

(c) **Unit of Measurement:** %

(d) **Placement in the CSD Indicator Set:** Social/Education/Education Level

2. **POLICY RELEVANCE**

a) **Purpose:** The scale and quality of human resources are major determinants of both the creation of new knowledge and its dissemination. Key factors are the constant updating of the knowledge of the workforce, as well as the overall educational level of the working age population and the intensity of lifelong learning activities.
b) **Relevance to Sustainable/Unsustainable Development (theme/subtheme) :** Life-long learning is essential to sustainable development. As society shifts towards sustainable production and consumption patterns, workers and citizens will be needed who are willing to develop and adopt new technologies and organisation techniques as workers, as well as new attitudes and behaviour as citizens and consumers. Life-long learning can contribute to making persons more flexible, open-minded and interested in new developments.

c) **International Conventions and Agreements:** None.

d) **International Targets/Recommended Standards**: None.

e) **Linkages to other indicators**: The indicator 'lifelong learning' is closely linked to indicators reflecting educational needs such as literacy ("adult literacy rate"), numeracy, capacity-building, information and communications. Higher skilled workers have better access to the labour market and are therefore less prone to unemployment ("unemployment rate") and subsequent poverty ("percent of population living below poverty line") and social exclusion. In addition, more highly skilled workers should achieve higher labour and resource productivity and therefore contribute to growth in the economic dimension ("GDP per capita").

3. **METHODOLOGICAL DESCRIPTION**

(a) Underlying definitions and concepts: The indicator refers to the percentage of persons aged 25 to 64 who are in education or training, as part of the total population of the same age group.

Education or training, whether or not relevant to the respondent's current or possible future job, includes all taught activities related to formal and non formal education (regular education, continuing training, training within the company, apprenticeship, on-the-job training, seminars, distance learning, evening classes, etc.). It also includes courses followed for general interest and may cover all forms of education and training as language, data processing, management, art and culture, and health or medicine courses.

(b) Measurement method: The indicator is calculated by using the number of persons aged 25 to 64 who answered they received education or training in the four weeks preceding the survey as the nominator,, and as the denominator, the total population of the same age group, excluding no answers to the question 'participation to education and training'.
A reference period comprising the last four weeks preceding the survey has been chosen for the questions on participation in the education in order to avoid distortion of information due to recall problems.

(c) Limitations of the Indicator: As the data for this indicator are based on a sample of the population, the results are subject to the usual types of errors associated with random sampling. Based on the sample size and design in the various countries, basic guidelines should be implemented to avoid publication of figures that are too small to be reliable or to give warning of the unreliability of the figures.

(d) Status of the Methodology:

(e) Alternative definitions/Indicators: Different age groups will be appropriate for different countries and regions and should take account of the normal patterns of working life, education and retirement in each country. For most of Europe and North America the 25-64 age group is the most appropriate. But the 15-24 age group (in combination with other age groups) will also be applicable for countries where the majority of the young people do not continue to participate in formal education beyond the age of 15.

4. ASSESSMENT OF DATA

(a) Data needed to Compile the Indicator: Data on the number of people aged 25 to 64 who are in education or training and the corresponding population of the same age.

(b) National and International Data Availability and Sources: Labour force surveys are carried out in most parts of the World, and results are often available online (see http://www.ilo.org/dyn/lfsurvey/lfsurvey.home).

(c) Data References: Data for member states of the European Union is included in the Sustainable Development Indicators Database, see http://epp.eurostat.ec.europa.eu/portal/page?_pageid=1998,47433161,1998_47437052&_dad=portal&_schema=PORTAL

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is Eurostat (the Statistical Office of the European Communities).

(b) Other Contributing Organizations:

6. REFERENCES

(a) Readings:

(b) Internet site: http://europa.eu.int/comm/eurostat

ADULT LITERACY RATE		
Education	**Literacy**	**Core indicator**

1. <u>INDICATOR</u>

(a) **Name:** Adult literacy rate.

(b) **Brief Definition:** The proportion of the adult population aged 15 years and over that is literate.

(c) **Unit of Measurement:** expressed as a rate (%).

(d) **Placement in the CSD Indicator Set:** Education/Literacy.

2. <u>POLICY RELEVANCE</u>

(a) **Purpose:** This indicator provides a measure of the stock of literate persons within the adult population who are capable of using written words in daily life and to continue to learn. It reflects the accumulated accomplishment of education in spreading literacy. Any shortfall in literacy would provide indications of efforts required in the future to extend literacy to the remaining adult illiterate population.

(b) **Relevance to Sustainable/Unsustainable Development (theme/sub-theme):** Literacy is critical for promoting and communicating sustainable development and improving the capacity of people to address environment and development issues. It facilitates the achievement of environmental and ethical awareness, values, and skills consistent with sustainable development and effective public participation in decision-making.

(c) **International Conventions and Agreements:** the Dakar Framework for Action on Education for All (EFA), the Millennium Development Goals (MDG), the Literacy Initiative for Empowerment (LIFE) and the United Nations Literacy Decade (UNLD).

(d) **International Targets/Recommended Standards:** The general target is full literacy, i.e., 100% adult literacy rate. This is the goal of most national efforts and international campaigns to eradicate illiteracy. The EFA and MDG goals are to improve the literacy rate by 50% from 2000 levels by 2015.

(e) **Linkages to Other Indicators:** Literacy is closely linked to indicators reflecting basic needs such as education, capacity building, information and communication, and the role of major groups. The literacy rate indicates the status or stock of literates at a given point in time. It is often linked to the number of out-of-school children representing those that would gain literacy skills unless they are enrolled or attending primary school. School enrolment ratios and the number of pupils reaching grade 5 of primary education, both having an impact on the future stock of literates.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: The *Revised Recommendation concerning the International Standardization of Educational Statistics* suggests the following definitions for statistical purposes:

(i) A person is literate who can with understanding both read and write a short simple statement related to his/her everyday life.

(ii) A person is functionally literate who can engage in all those activities in which literacy is required for effective functioning of his/her group and community and also for enabling him/her to continue to use reading, writing and calculation for his/her own and the community's development.

Persons who do not fulfill (i) or (ii) are termed illiterates or functional illiterates. Adult literacy measurement applies to the population aged 15 years and over, and data are generally available by sex, age-group, and urban/rural areas.

(b) Measurement Methods: To calculate the adult literacy rate, divide the number of literates aged 15 years and over by the corresponding total population aged 15 years and over and multiplied by 100.

(c) Limitations of the Indicator: As literacy is a relative concept, no single measure can separate the literate from the illiterate. A cut-off point is not totally appropriate because there are many different forms and degrees of literacy. A person might be literate in numeric terms, but have difficulty with text comprehension. Literacy can be defined in terms of work, school, home, and social spheres. Each area of life requires different types of literacy skills.

Literacy status is mostly based on self-declaration or declaration of the head of household, which gives rise to concerns about data reliability and consequently comparability, especially for females in many developing countries. Some countries estimate literacy rates by making inference using data on educational attainment, such as by equating persons with no schooling or incomplete primary education as illiterates in the absence of theoretical and empirical basis. Increasingly, it is deemed critical that literacy should be determined by actual assessment of reading, writing and numeracy abilities of each person within a social context. Although direct assessment of literacy is time-consuming, costly and operationally complex, the UIS is currently developing the Literacy Assessment Monitoring Programme (LAMP) as an international instrument in order to provide cross-nationally comparable measurements on literacy skills for those countries of the world that participate.

(d) Status of the methodology: This indicator has the status of an international recommendation since the basic data elements to derive it are included in the *Revised Recommendation concerning the International Standardization of Education Statistics* adopted by the UNESCO General Conference at its twentieth session, Paris, 1978. In the latest revised Principles and Recommendations for Population and Housing Censuses in 1999, the concerned UN agencies co-operated with international experts in upgrading the methodology used in collecting statistics on literacy and educational characteristics. Further development of literacy test instruments (such as UIS' LAMP), and their use in spreading the practice of literacy test measurement shall help to improve the quality of international statistics on literacy which in turn will permit targeted policy interventions in those countries where it is needed.

(e) Alternative Definitions: To meet the limitations discussed in 4c above, the definition and measurement of functional literacy represents an improved indicator. This is usually measured for three to five components of literacy such as "prose", "document", and "numeracy" domains. The aim is to measure the degree of functionality, rather than the dichotomy literate vs. illiterate. In order to undertake a direct assessment of literacy skills, measurement instruments such as LAMP are required.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Data on the number of literates or illiterates and the corresponding population aged 15 years and over.

(b) National and International Data Availability and Sources: Data are usually collected during national population censuses, or during household surveys or literacy surveys. Official statistics exist for most countries in the world but are often out-of-date due to census taking every ten years and late census data release. The United Nations Educational, Scientific and Cultural Organization (UNESCO), through its Institute for Statistics (UIS), undertakes an annual data collection of the latest available international literacy data. The UIS also makes available forecasted literacy rates that are based on a newly developed demographic projection model. In principle, literacy data are available at both the national and sub-national levels. For sound measurement, the ratio must be supported by consistent data by gender, age-group and area (such as rural/urban zones). The primary data sources are national population censuses and household surveys. International data sources include the UNESCO Institute for Statistics (UIS) and the Statistics Division of the United Nations Department of Economic and Social Affairs (DESA). .

(c) Data References: The UNESCO Institute for Statistics (UIS) WEB site: http://www.uis.unesco.org; the UIS Global Education Digests (GED), the UNESCO EFA Global Monitoring Reports (see “Literacy for Life” (2006)); the UNDP Human Development Reports; the World Bank World Development Indicators Reports.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the United Nations Educational, Scientific and Cultural Organization (UNESCO). The contact point is the Director, UNESCO Institute for Statistics; e-mail: uis@unesco.org and fax (1-514) 343-5740

(b) Other Contributing Organizations: The Statistics Division of the United Nations DESA also collects and publishes statistics on literacy from national population censuses, apart from providing the data to UNESCO for processing and dissemination.

6. REFERENCES

(a) **Readings**: The UIS Global Education Digests (GED), the UNESCO EFA Global Monitoring Reports (see "Literacy for Life" (2006)); the UNDP Human Development Reports; the World Bank World Development Indicators Reports., Compendium of Statistics on Illiteracy: 1995 Edition, UNESCO, Paris. 1995.

(b) **Internet site: http://**www.uis.unesco.org

POPULATION GROWTH RATE		
Demographics	**Population Change**	**Core indicator**

1. **INDICATOR**

(a) **Name:** Population growth rate

(b) **Brief Definition**: The average annual rate of change of population size during a specified period.

(c) **Unit of Measurement**: Usually expressed as a percentage.

(d) **Placement in the CSD Indicator Set**: Demographics/Population.

2. **POLICY RELEVANCE**

(a) **Purpose**: The population growth rate measures how fast the size of population is changing.

(b) **Relevance to Sustainable/ Unsustainable development (theme/sub-theme):** Agenda 21 identifies population growth as one of the crucial elements affecting long-term sustainability (see especially paragraphs 5.3 and 5.16). Population growth, at both national and sub-national levels, represents a fundamental indicator for national decision-makers. Its significance must be analyzed in relation to other factors affecting sustainability. However, rapid population growth can place strain on a country's capacity for handling a wide range of issues of economic, social and environmental significance, particularly when rapid population growth occurs in conjunction with poverty and lack of access to resources, or with unsustainable patterns of production and consumption, or in ecologically vulnerable zones (paragraphs 3.14, 3.25 and 3.26 of the Programme of Action of the International Conference on Population and Development (ICPD)).

The dramatic growth of urban populations is of concern in many countries. Between 2005 and 2030, almost all of the population growth expected for the world will be concentrated in the urban areas of the less developed regions (United Nations, 2003). The causes of rapid urban growth include high rates of natural increase (excess of births over deaths) in urban areas as well as migration from rural to urban areas and the transformation of rural settlements into urban places. The speed and scale of this growth continue to pose serious challenges to both countries and the world community. Monitoring these developments and creating sustainable urban environments remain crucial issues on the international development agenda.

Although rural populations have in general grown more slowly than urban populations, rural growth has been robust in many developing countries, particularly in Africa and Asia, and in most of the least developed countries. As was recognized by the Commission on Sustainable Development during its 14th session (E/CN.17/2006/2), protecting and managing the natural resource base is an essential requirement for sustainable development. In settings where the conditions for sustainable agricultural and rural development are not in place, high rates of rural population growth could negatively affect the use of land, water, air, energy and other resources.

(c) International Conventions and Agreements: None

(d) International Targets/Recommended Standards: International agreements do not establish national or global targets. However, a number of Governments have adopted numerical targets for the rate of population growth. In 2005, 19 per cent of Governments considered their rates of population growth to be too low, 42 per cent were satisfied with their rate of growth and 39 per cent considered it to be too high (United Nations, 2006b). Over half of Governments of developing countries regarded their rates of population growth as too high, and 80 per cent of Governments of the least developed countries did so. In addition, over 80 per cent of all Governments reported some degree of dissatisfaction with the spatial distribution of their populations. Developing countries are more likely than developed countries to report dissatisfaction in this regard (86 per cent vs. 63 per cent).

(e) Linkages to Others Indicators: There are close linkages between this indicator and other demographic and social indicators, as well as all indicators expressed in per capita terms (for example, GDP per capita). Population growth usually has implications for indicators related to education, infrastructure and employment. It is also related to human settlements and the use of natural resources.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Measurements Methods: The rate of population growth, *r*, between two time points, t_1 and t_2, is calculated as an exponential rate of growth, conventionally expressed in percentage units per year:

$$r = 100 \ln (P_2/P_1)/(t_2 - t_1)$$

Where P_1 and P_2 are the number of persons at times t_1 and t_2, respectively, and the time interval $(t_2 - t_1)$ is expressed in years. Besides referring to the total population, this indicator can also be calculated separately for the urban and rural populations. In the case of the urban population growth rate, P_1 and P_2 in the above formula would refer to the number of persons in urban areas. Similarly, P_1 and P_2 would refer to the number of persons in rural areas in the case of the rural population growth rate.

For a country, the indicator is generally based on either: (i) the population enumerated at two consecutive censuses, each of them adjusted for incompleteness; or (ii) the components of population growth (births, deaths and migrants) during a specific period, adjusted for incompleteness when necessary. Population growth rates can also be calculated for sub-national areas.

(b) Limitations of the Indicators: In calculating the urban and rural population growth rates, the United Nations relies on data from national sources reflecting the definitions of urban and rural places established by each country. These definitions vary widely across countries and sometimes over time for a given country. Furthermore, as the process of urbanization proceeds, the number and extension of the areal units qualifying as urban generally expand, so that keeping an urban versus rural division of the territory constant over time would be inappropriate and would likely result in a major underestimation of the actual proportion of the population living in areas with urban characteristics.

4. ASSESSMENT OF DATA

(a) Data needed to compile the Indicator: As indicated above, the population growth rate can be calculated either from census data or from civil registration data (births and deaths) together with information on migration. The United Nations recommends that countries take censuses every 10 years and these data are most commonly the source used to calculate intercensal population growth rates.

(b) National and International Data Availability and Sources: In recent decades, most countries have carried out population censuses that distinguish the populations of urban and rural areas. Data on births and deaths may be derived from civil registration systems or from special questions in demographic surveys and censuses. Data on migration comes from very varied sources. In most countries, national and sub-national census data and data on births and deaths are available from national sources and publications. These data are compiled by the Statistics Division of the Department of Economic and Social Affairs (DESA) of the United Nations Secretariat from reports submitted by national statistical offices. For all countries, census and vital registration data are evaluated and, if necessary, adjusted for incompleteness by the Population Division of DESA as part of the preparation of the United Nations population estimates and projections.

(c) Data references: Past, current and projected total, urban and rural population growth rates are estimated for all countries by the Population Division, DESA, and appear in the biennial reports *World Population Prospects* and *World Urbanization Prospects*.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the United Nations Department of Economic and Social Affairs (DESA). The contact point is the Director, Population Division, DESA; fax no. (1 212) 963 2147.

(b) Other Contributing Organizations: None

6. REFERENCES

(a) Reading:

United Nations (1983). *Manual X: Indirect Techniques for Demographic Estimation*. United Nations Sales No. E.83.XIII.2, New York.

________ (2003). *MORTPAK for Windows - The United Nations Software Package for Demographic Measurement,* CD-ROM (United Nations, New York).
________ (2004). *Demographic Yearbook 2001.* United Nations publication, Sales No. 03.XIII.1.
________ (2007). *World Population Prospects: The 2006 Revision*, CD-ROM Edition.

________ (2006a). *World Urbanization Prospects: The 2005 Revision,* CD-ROM Edition – Data in digital form (POP/DB/WUP/Rev.2005).

________ (2006b). *World Population Policies 2005* (United Nations publication, Sales No. E.06.XIII.5, New York).

(b) **Internet site:** http://www.un.org/esa/population/unpop.htm

TOTAL FERTILITY RATE		
Demographics	**Population Change**	

1. **INDICATOR**

(a) **Name:** Total fertility

(b) **Brief Definition**: The average number of live births a woman would have by age 50 if she were subject, throughout her life, to the age-specific fertility rates observed in a given year. Its calculation assumes that there is no mortality.

(c) **Unit of Measurement**: Children per woman.

(d) **Placement in the CSD Indicator Set**: /Demographics/Population

2. **POLICY RELEVANCE**

(a) **Purpose**: Total fertility refers to the average number of children per woman.

(b) **Relevance to Sustainable/ Unsustainable development (theme/sub-theme):** Family size and the number of children per woman fell substantially in many countries over the twentieth century, especially after 1960, a trend that is broadly favourable for sustainable development. High fertility is associated with increased risk of maternal morbidity and mortality. In most settings, women who have several children find it more difficult to work outside the home, thus having fewer opportunities to improve their economic and social status and that of their families. Low income households with many children often find it more difficult to get out of poverty than those with less children, and high fertility societies face greater demands for services from their youthful populations.

The changes in the population age distribution resulting from declining fertility are, for a period, beneficial for economic growth. As fertility declines, the proportion of children in the population falls and the proportion of the population of working age increases, resulting in a lower dependency ratio (defined as the number of children and older persons per 100 persons of working age). Provided jobs are available for the increasing population of working age, a country can reap the benefits of increased production and lower the costs associated with the decreasing proportion of dependants. This "demographic bonus" can thus contribute significantly to economic growth and poverty reduction.

Over the long run, however, especially if fertility continues decline, the share of the population of working age also declines and that of older persons increases, leading to rising dependency ratios. In countries experiencing below-replacement fertility (lower than 2.1 children per women), population ageing accelerates and the fact that a generation does not produce enough children to replace itself eventually leads to outright reductions in population. It is not yet clear to what extent declining and ageing populations may have beneficial effects on sustainable development.

(c) International Conventions and Agreements: None

(d) International Targets/Recommended Standards: International agreements do not establish national or global targets. However, the Programme of Action adopted by the International Conference on Population and Development (ICPD) recognizes the usefulness of reducing population growth by lowering fertility levels as early as possible. It notes that, in many countries, slower population growth has bought more time to adjust to future population increases, improving the ability of those countries to combat poverty, protect and repair the environment, and set the conditions for sustainable development (para. 3.14). In 2005, only 36 per cent of national Governments considered their total fertility to be satisfactory. In 2005, 54 per cent of developing countries considered that their fertility was too high and over four-fifths of the least developed countries did so. Conversely, about two-thirds of the countries in Europe considered that their fertility levels were too low and more than three-quarters of these countries had policies to boost fertility.

(e) Linkages to Others Indicators: There are close linkages between total fertility and other demographic and social indicators. Fertility change directly affects population growth and dependency ratios. In fact, during the past century fertility has been the most important determinant of population growth, far exceeding the contributions of migration and mortality. Increased infant and child survival, greater access to education and health services, especially for women, together with the advances made in empowering women and improving their participation in the labour force have contributed to postpone childbearing and to reduce number of children women have over their lifetimes. Decreasing fertility has also contributed to improve maternal health, reduce child mortality, combat poverty and enhance economic growth.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Measurements Methods: Total fertility refers to the average number of children that a hypothetical cohort of women would bear over the course of their reproductive life if they were subject to the age-specific fertility rates estimated over a given period and were not subject to mortality. Total fertility is therefore a period measure constructed by summing the age-specific fertility rates (ASFR) and multiplying by the length of the age groups used.

Age-specific fertility rate: Annual number of births per woman in a particular age group expressed per 1000 women in that age group.

High fertility: Total fertility levels above 5 children per woman.

Replacement-level fertility: Total fertility levels of about 2.1 children per woman. This value represents the average number of children a woman would need to have to reproduce herself by bearing a daughter who survives to childbearing age. If replacement level fertility is sustained over a sufficiently long period, each generation will exactly replace itself in the absence of migration.

Below-replacement fertility: Total fertility levels below 2.1 children per woman.

Very low fertility: Total fertility levels below 1.3 children per woman.

(b) Limitations of the Indicators: Data allowing the estimation of total fertility has become widely available thanks to demographic surveys that gather retrospective information on the fertility histories of women. The number of countries lacking current information on total fertility has been decreasing over time.

(c) Status of the Methodology: Well developed and widely employed.

(d) Alternative Definitions/Indicators: The underlying age-specific fertility rates used to calculate total fertility provide useful information about the level and timing of childbearing among women in particular age groups. In particular, it is possible to assess the level of adolescent fertility (births to women age 15 to 19 years), which is of special concern for Governments because women who start having children at very young ages are the more likely curtail their education and less likely to join the labour force. Early childbearing (before age 18) entails greater risks of maternal death and children born to very young mothers have higher levels of morbidity and mortality.

4. ASSESSMENT OF DATA

(a) Data needed to compile the Indicator: The basic information to calculate age-specific fertility rates is the number of births by age of mother and the number of women of childbearing age classified by five-year age groups. In all developed countries and in several developing countries, the information on births is obtained from a civil registration system and that on women from censuses. In developing countries, the necessary data are generally collected by representative sample surveys or censuses.

(b) National and International Data Availability and Sources: Particularly important sources of information are the annual editions of the Demographic Yearbook as produced by the Statistics Division of the Department of Economic and Social Affairs of the United Nations Secretariat, which collects demographic data on a regular basis from the national statistics offices. Estimates derived from census data and from surveys are commonly used. Important sources are the surveys conducted in the 1970s and early 1980s under the World Fertility Survey (WFS) programme, the surveys conducted since the late 1980s under the Demographic and Health Surveys (DHS) programme, the Center for Disease Control (CDC) Reproductive Health Surveys and other regional programmes such as the Arab-Gulf PAPFAM and PAPCHILD surveys. In addition, information as produced by other United Nations entities, such as ECLAC, UNICEF or WHO, as well as by regional organizations such as EUROSTAT and the Council of Europe are consulted. For all countries, the available data are evaluated and, if necessary, adjusted by the Population Division of DESA in preparing the official United Nations population estimates and projections.

(c) Data references: Past, current and projected total fertility estimates are calculated for all countries by the Population Division of the Department of Economic and Social Affairs and appear in the biennial United Nations publication *World Population Prospects*. A compilation of estimates derived directly from the sources available is presented in the publication *World Fertility Report*, prepared by the Population Division.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the United Nations Department of Economic and Social Affairs (DESA). The contact point is the Director, Population Division, DESA; fax no. (1 212) 963 2147.

(b) Other Contributing Organizations: None

6. REFERENCES

(a) Reading:

United Nations, *World Population Prospects: The 2006 Revision.* http://www.un.org/esa/population/publications/wpp2006/wpp2006.htm

United Nations, *Manual X: Indirect Techniques for Demographic Estimation*. (United Nations publication, Sales No.E.83.XIII.2, New York, 1983).

United Nations, *World Fertility Report 2003*. (United Nations publication, Sales No. E.04.XIII.6, New York, 2004).

United Nations, Statistics Division, *Demographic Yearbook*. (United Nations publication, various years).

United Nations, *Programme of Action adopted at the International Conference on Population and Development, Cairo, 5-13 September 1994*. (United Nations publication, Sales No. E.95.XIII.7, New York, 1995).

For information about government policies regarding this indicator, see:

United Nations, Population Division, *World Population Policies 2005* (United Nations publication, Sales No. E.06.XIII.5, New York, 2006).

(b) Internet site: http://www.un.org/esa/population/unpop.htm

DEPENDENCY RATIO		
Demographics	**Population**	**Core indicator**

1. INDICATOR

(a) Name: Dependency Ratio

(b) Brief Definition: The dependency ratio relates the number of children (0-14 years old) and older persons (65 years or over) to the working-age population (15-64 years old).

(c) Unit of Measurement: Per hundred persons aged 15-64.

(d) Placement in the CSD Indicator Set: Demographics/Population

2. POLICY RELEVANCE

(a) Purpose: Dependency ratios indicate the potential effects of changes in population age structures for social and economic development, pointing out broad trends in social support needs.

(b) Relevance to Sustainable/ Unsustainable development (theme/sub-theme): By relating the group of the population most likely to be economically dependent (net consumers) to the group most likely to be economically active (net producers), changes in the dependency ratio provide an indication of the potential social support requirements resulting from changes in population age structures. In addition, the ratio highlights the potential dependency burden on workers and indicates the shifts in dependency from a situation in which children are dominant to one in which older persons outnumber children as the demographic transition advances (that is, the transition from high mortality and high fertility, to low mortality and low fertility). A high dependency ratio indicates that the economically active population and the overall economy face a greater burden to support and provide the social services needed by children and by older persons who are often economically dependent. A high youth dependency ratio, for instance, implies that higher investments need to be made in schooling and child-care.

As fertility levels decline, the dependency ratio falls initially because the proportion of children decreases while the proportion of the population of working age increases. The period when the dependency ratio declines is known as the "window of opportunity" when a "demographic dividend" may be reaped because society has a growing number of potential producers relative to the number of consumers. However, as fertility levels continue to decline, dependency ratios eventually increase because of the proportion of working age starts declining and the proportion of older persons continues to increase. As populations grow older, increases in old-age dependency ratios are indicators of the added pressures that social security and public health systems have to withstand.

The need to ensure access to basic services, such as education and health, as well as to ensure the economic security of children and older persons has been emphasized in many international conferences and summits, including the World Summit for Children (1990), the International Conference on Population and Development (1994), the World Summit for Social Development (1995), The United Nations Millennium Declaration and the World Assembly on Ageing (2002).

(c) International Conventions and Agreements: None

(d) International Targets/Recommended Standards: International agreements do not specify targets in terms of values of the dependency ratio. However, in 2005, 66 per cent of Governments were concerned about the size of their working-age population and for 52 per cent reported that population ageing represented an issue of major concern (DESA, *World Population Policies 2005*).

(e) Linkages to Others Indicators: This indicator reflects the cumulative effect of past demographic dynamics in terms of fertility and mortality and is also related to past trends in the population growth by age.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Measurements Methods: The dependency ratio refers to the number of children aged 0 to 14 years plus the number of persons aged 65 years or over per 100 persons aged 15 to 64 years:

Dependency Ratio =100 x (Population (0-14) + Population (65+)) / Population (15-64)

The dependency ratio can be disaggregated into: (1) the youth dependency ratio, which is the number of children aged 0-14 per 100 persons aged 15-64, and (2) the old-age dependency ratio, which is the number of persons aged 65 or over per 100 persons aged 15-64. The dependency ratio, also referred to as total dependency ratio, is the sum of the youth and old-age dependency ratios. Some studies employ other age groups in calculating dependency ratios, for instance 0-19 years to represent the population of children or the population aged 60 or over to represent the population of older persons.

(b) Limitations of the Indicators: The dependency ratio is an approximation to the ratio of net consumers to net producers. As a proxy for that ratio, the dependency ratio suggests that children under age 15 as well as persons aged 65 or over are economically dependent. In many populations, however, people do not stop being economically active at age 65, nor is it true that all persons aged 15-64 are economically active. Although older persons often require economic support from others, in many societies they have economic resources of their own and provide support to their adult children. Furthermore, as the period of training for a productive life increases, most adolescents and young adults remain in school and out of the labour force, effectively extending the period of young-age dependency well beyond age 15. Whenever available, direct estimates of net producers and net consumers can be used for a more precise assessment and analysis of economic dependency.

4. ASSESSMENT OF DATA

(a) Data needed to compile the indicator: The information on population classified by age that is necessary to calculate the dependency ratio is usually derived from censuses or demographic surveys. The United Nations recommends that countries undertake population censuses every 10 years.

(b) National and international data availability and sources: In recent decades, most countries have carried out population censuses. National and sub-national census and survey data are available for the large majority of countries from national sources and publications, and are reported to the Statistics Division of the Department of Economic and Social Affairs (DESA) of the United Nations Secretariat by national statistical offices. For all countries, census and survey data are evaluated and, if necessary, adjusted by the Population Division of the Department of Economic and Social Affairs (DESA) as part of the analysis carried out in preparation of the official United Nations population estimates and projections.

(c) Data references: Past, current and projected dependency ratios are calculated for all countries by the Population Division of DESA and appear in the biennial United Nations publication, *World Population Prospects*.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the United Nations Department of Economic and Social Affairs (DESA). The contact point is the Director, Population Division, DESA; fax no. (1 212) 963 2147.

(b) Other Contributing Organizations: None

6. REFERENCES

(a) Readings:

United Nations, *World Population Prospects: The 2006 Revision*, vol. I: *Comprehensive Tables*. http://www.un.org/esa/population/publications/wpp2006/wpp2006.htm

United Nations, *World Population Policies 2005* (United Nations publication, Sales No. E.06.XIII.5, 2006).

(b) Internet site: http://www.un.org/esa/population/unpop.htm

RATIO OF LOCAL RESIDENTS TO TOURISTS IN MAJOR TOURIST REGIONS AND DESTINATIONS		
Demographics	**Tourism**	

1. INDICATOR

(a) Name: Ratio of local residents to tourists in major tourist regions and destinations

(b) Brief Definition: Number of visitors (tourists and same day visitors) divided by the number of local residents in tourist destinations (average and in peak seasons or days)

(c) Unit of Measurement: % of tourists of total local population

(d) Placement in the CSD Indicator Set: Demographics /Tourism.

2. POLICY RELEVANCE

(a) Purpose: The ratio can indicate seasonal pressure on the environmental and social resources of host regions and populations.

(b) Relevance to Sustainable/ Unsustainable development (theme/sub-theme): Tourism has been one of the most remarkable socio-economic phenomena of the past half century, generating the temporal movement of a large number of people around the world. Between 1950 and 2005 international tourist arrivals grew from 25 million to 808 million, and domestic tourism has been also growing dynamically in both developed and developing countries. While tourism represents a key source of income and employment in most tourist receiving regions and destinations, it also exerts considerable pressure on the environmental and socio-cultural resources of host populations. Tourism is an activity highly concentrated in space and time, and many destinations experience huge seasonal influx of tourists and visitors. In many destinations the tourist population outnumbers local residents in peak periods, and the ratio of the number of tourists can be a multiple of the number of locals. During their stay tourists share the public spaces, public services (e.g. transport, communication), and natural resources (e.g. consumption of water and energy, waste generation) with local residents. If tourism activities are not adequately managed, they can result in the reduced availability and quality of scarce natural resources, cause extra burden for local authorities and facilities, disruption of social structures and customs, causing frustrations and discontent of locals. In many coastal destinations, geared for conventional beach tourism, the peak seasons coincide with dry periods when water resources might be scarce. The increased demand for water in tourism facilities can place considerable stresses on the supply for both tourists and locals.

It has to be underlined that the negative environmental and social impacts of tourism can be prevented and mitigated with appropriate planning, management and monitoring of tourism activities, following integrated approaches and sustainability principles. Therefore, the seasonal increase of population by tourism not necessarily leads to the degradation of the environment. The cooperation between public authorities and the tourism private sector is a must to reduce negative impacts of tourism and increase its contribution to the wellbeing of local communities. A key challenge for regional and local authorities is to develop capacities for handling the seasonal increase of demand for public services, in order to satisfy the needs of both residents and tourists.

The ratio of tourists to local residents can be used as an indication of potential pressure on natural and social resources and conditions of major tourist receiving regions. It can be applied especially in peak periods, and at sub-national levels in tourist regions and local destinations, where tourists concentrate and the impacts occur.

(c) International Conventions and Agreements: None

(d) International Targets/Recommended Standards: None

(e) Linkages to Others Indicators: This ratio can indicate potential stresses on local environment and social systems, but it has to be interpreted in the local context, through analyzing policies, governance and management capacities, environmental and socio-economic issues of tourism. Therefore, this indicator is suggested to be used with other indicators measuring environmental and socio-economic impacts of tourism (both negative and positive), in order to detect specific implications in the local context and allow adaptive management.

There are a number of SD indicators related to the use of natural resources in this set, with sectoral applications suggested (for example related to energy and water use, air pollution, waste management). In these indicators it would be useful to specify the share of tourism in order to identify the impacts derived from tourism activities. For example, water and energy consumption, waste generated in tourism facilities (total volume, annual distribution and in peak periods, % of total consumption in a region, consumption per tourist) can be measured.

For the evaluation of the economic impacts of tourism in destinations, tourism's contribution to the local economy and employment can be evaluated (see SD indicator on *Tourism contribution to GDP* – Economic Development Theme, Tourism Sub-theme).

In order to have complete information on the local impacts of tourism, it is key to regularly evaluate the opinion of local residents. The most commonly used tools are resident surveys, which can provide information on local attitudes towards tourism and the perception of tourism's environmental and socio-economic impacts. Other means are analyzing complaints received and information gathered at resident forums and through consultation processes.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Measurements Methods:

(b) Limitations of the Indicators:
National statistical sources may not always provide satisfactory estimates at subnational levels. Filling information gaps at subnational levels would require initiatives (that sometimes may be complementary) such as:

- in regions or tourism destinations where there is evidence of the importance of a specific accommodation segment (second homes for tourism use and holiday homes, as well as the lending or renting out of homes by residents are examples in many countries of direct competition with existing collective accommodation supply), it would be necessary to supplement the survey with other procedures for making a quantitative assessment of the segment. It would also be advisable in such cases to carry out specific surveys to estimate the expenditure on maintenance and the rent paid.

- administrative records may provide data that are extremely valuable both for completing the measurement of basic statistical units (such as overnight stays and trips) and for identifying information that is especially relevant to the regions, for instance, on itineraries (by interviewing travel agents). Furthermore, is more, tourist activity itself increasingly leaves "electronic fingerprints" of various kinds, thereby boosting the number of potentially usable records: the use of toll roads, credit cards, mobile telephones and access to specific tourism websites are some examples of this

- it may also be relevant to develop specific indicators for modelling exercises that will serve to estimate the number of visitors and to apportion the number of overnight stays among all the trips they take in the region.

(c) Alternative Definitions: The following alternative indicators can be suggested to detect seasonality trends, thus indicate pressure on the resources of tourist receiving regions and destinations:

- Occupancy rates in licensed (official) accommodation facilities by month (distribution throughout the year)
- Number of tourist overnight stays in accommodation facilities (annual distribution) [28]
- % of water, electricity, sewage and garbage system capacity used for tourism and for locals (annual distribution)
- Funding allocated for the operation and maintenance of infrastructure, especially in high seasons.

4. ASSESSMENT OF DATA

Data needed to compile the Indicator: flows of visitors and resident local population

UNWTO proposes an approach limited to two territorial levels: [29]

---

[28] EUROSTAT suggests the indicator "Number of tourist overnight stays in various accommodation facilities" as an indication of "pressure" on destinations (Methodological work on measuring the Sustainable Development of Tourism – Technical Report, 2005).

[29] It should be noted that there are other territorial divisions that are important for tourism analysis (e.g. tourism area and tourism community) but that do not precisely correspond to a region or tourism destination).

- the **region**, identified as the administrative unit corresponding to the first level of territorial disaggregation of a country in terms of its political and administrative organization (for instance, level 2 of the Nomenclature of Territorial Units for Statistics - NUTS in the European Union, the provinces of Canada, and the states of USA and Brazil);

- the **tourism destination**, treated as a subregional territory (which may correspond to a single municipality or group of municipalities) with substantial tourism activity.

Measuring flows of visitors at subnational levels, there is a need to check the relevance of same day visitors as the measurement of this subset of visitors requires specific measurement instruments. Additionally, the coverage of accommodation information should be analyzed as not always all type of accommodation are included

Tourist flows can be measured identifying number of guests at all types of accommodation establishments as well as visitors staying in private houses. Correction of tourist figures should include same day visitors estimate (where relevant).

Resident local population should be measured according to the ILO standards.

(b) National and International Data Availability and Sources: Accommodation occupation statistics are regularly available in most countries. Annual average data as well as tourism peak season estimates would be the most relevant indicators in the absence of monthly or quarterly data

(c) Data references: UNWTO does not compile this data in its general statistical publications

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the World Tourism Organization, the United Nations' Specialized Agency in Tourism. Contact:
Department of Sustainable Development of Tourism (env@unwto.org)
World Tourism Organization
Capitán Haya, 42
28020 Madrid – Spain
Tel: (+34) 91 5678100
Fax: (+34) 91 5713733

(b) Other Contributing Organizations: None

6. REFERENCES

(a) Readings:
Indicators of Sustainable Development for Tourism Destinations (UNWTO 2004)

Making Tourism More Sustainable: a Guide for Policy Makers (UNWTO-UNEP 2004)
Guide for Local Authorities on Developing Sustainable Tourism (UNWTO 1999)
Tourism Congestion Management at Natural and Cultural Sites (UNWTO 2004)

(b) Internet site:

UNWTO: http://www.unwto.org
Sustainable Development of Tourism: http://www.unwto.org/sustainable
Statistics and Economic Measurement of Tourism:
http://www.unwto.org/statistics/index.htm

PERCENTAGE OF POPULATION LIVING IN HAZARD PRONE AREAS		
Natural hazards	**Vulnerability to natural hazards**	**Core indicator**

1. INDICATOR

(a) Name: Percentage of population living in hazard prone areas.

(b) Brief Definition: The percentage of national population living in areas subject to significant risk of death or damage caused by prominent hazards: cyclones, drought, floods, earthquake, volcanoes and landslides. The indicator maybe calculated separately for each relevant prominent hazard. The risk of death in a disaster caused by natural hazards is a function of physical exposure to a hazardous event and vulnerability to the hazard. The indicator measures the risk at sub-national scale by using historical and other data on hazards and on vulnerability. The sub-national risk levels are then aggregated to arrive at national values.

(c) Unit of Measurement: Percentage.

(d) Placement in the CSD Indicators Set: Natural hazards/ Vulnerability to natural hazards

2. POLICY RELEVANCE

(a) Purpose: To calculate the percentage of population living in disaster prone areas, thus providing a useful estimate of national vulnerability to cyclones, drought, floods, earthquake, volcanoes and landslides, which combines almost the totality of human and economic loss due to disasters caused by vulnerability to natural hazards. This indicator will contribute to a better understanding of the level of vulnerability in a given country, thus encouraging long-term, sustainable risk reduction programs to prevent disasters, which are a major threat to national development.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): There is a recognized high degree of interdependency between sustainable development and vulnerability to natural hazards. High vulnerability means higher exposure to natural catastrophes in the absence of disaster reduction measures. Disasters caused by vulnerability to natural hazards have a strong negative impact on the development process in both industrialized and developing countries. Therefore, the degree of vulnerability to a given natural hazard provides a key measure of social welfare and development in a given country, as well as an indication of the risk (probability) of natural disasters.

The general increase in vulnerability of societies worldwide has caused the social, economic and environmental impact of to natural disasters to become far greater now than ever before. In fact, the overall number of people affected by disasters has been growing by 6 % each year since 1960. This trend is expected to continue primarily because of increased concentration of people and values in the areas exposed to natural hazards.

(c) **International Conventions and Agreements:** Under the Hyogo Framework for Actions, countries and other actors work towards a substantial reduction of disaster losses, in lives and in the social, economic and environmental assets of communities and countries.

(d) **International Targets/Recommended Standards:** None.

(e) **Linkages to Other Indicators:** This indicator is linked with many demographic indicators, including population growth rate (total, urban and rural) and percentage of population in coastal areas. It is also linked to most poverty indicators, as poverty is a major determinant of vulnerability. It is directly linked to the indicator on human economic losses due to natural disasters.

3. <u>METHODOLOGICAL DESCRIPTION</u>

(a) **Underlying Definitions and Concepts:**

The individual vulnerability to hazard is the probability being killed in the event of a hazard. Alternatively, the indicator can be calculated on the basis of the expected economic damage in the event of a hazard.

The mortality risk due to hazards in a geographic area is the product of the probability of a hazard taking place in that area and the average vulnerability to hazards.

An area is defined as hazard prone area if the mortality risk is higher than a certain threshold.

A cyclone is defined as a wind storm with maximum speed of more than 64 knots per hour. The definition includes typhoons and hurricanes.

A drought is a period of deficiency of moisture in the soil such that there is inadequate water required for plants, animals and human beings. It can be further defined as weighted anomaly of standardized precipitation over an extended period (e.g., 3 months).

A flood is a significant rise of water level in a stream, lake, reservoir or coastal region. Only extreme floods are typically counted.

Earthquake is sudden break within the upper layers of the earth, sometimes breaking the surface, resulting in the vibration of the ground, which where strong enough will cause the collapse of buildings and destruction of life and property. Typically, earthquakes >4.5 on the Richter Scale are considered.

Volcano, or volcanic eruption, is the discharge (aerially explosive) of fragmentary ejecta, lava and gases from a volcanic vent.

Landslides are, in general, all varieties of slope movement, under the influence of gravity. More strictly refers to down-slope movement of rock and/or earth masses along one or several slide surfaces. Snow avalanches may also be included under landslides.

(b) **Measurement Methods:**

For earthquakes, the percentage of population living in seismic risk zones will be obtained by combing population density maps with seismic hazard maps. The most suitable way to express the level of seismic risk is through zoning (very high, high, medium, and low). Richter Scale and Modified Mercalli scale (easily compatible) are

recommended as basis for the zoning. Population living in "very high" and "high" zones are considered to be at risk.
The percentage of population living in flood prone areas will be obtained by combining the area affected by the 100 year return period flood with population density data.
For other hazards, the risk at a sub-national scale can be measured by using historical and other data on hazards and on vulnerability.

(c) Limitations of the Indicator: The validity of this indicator is limited by the quality and the format of the data used for its calculation. Comparability over time may represent a particular problem for this indicator.

(d) Status of the Methodology: This methodology is being used by a the Disaster Risk indexing project of the UNDP in partnership with UNEP-GRID; the Hotspots indexing project implemented by Columbia University and the World Bank, under the umbrella of the ProVention Consortium and the Americas programme of IDEA in partnership with the InternAmerica Developing Bank. These projects are based on a conceptual framework that includes particular understanding of the factors contributing to human vulnerability and disaster risk. The methodology for seismic risk assessment is widely used through the scientific community, in particular in RADIUS (Risk Assessment Tools for Diagnosis of Urban Areas Against Seismic Disasters), a tool developed to assess earthquake risk in urban areas worldwide.

(e) Alternative Definitions: Not available

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Cyclone prone areas; drought risk map, floods risk map, earthquake risk maps, volcanoes and landslides risk maps (see above); population distribution maps; flood hazard (floodplain) maps; population distribution maps.

(b) National and International Data Availability and Sources: Data availability at the country varies according to countries. At the international level, data on global hazard frequency and risk and their distribution is available through the Hotspot project implemented by the Center for Hazards & Risk Research at Columbia University. Data on global disasters is available in the EM-DAT database, maintained by the Centre for Research on the Epidemiology of Disasters (CRED) in Brussels.

(c) Data References: For the Hotspot core data set, see
http://www.ldeo.columbia.edu/chrr/research/hotspots/
For the EM-DAT database, see http://www.em-dat.net/

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the Secretariat for the International Strategy for Disaster Reduction (ISDR), United Nations, Geneva.

(b) Other Contributing Organizations: UNDP, UNEP-GRIP, World Bank (ProVention Consortium), Inter American Development Bank, **:** ICSU – International Council of Scientific Unions, WMO, Munich Reinsurance.

6. REFERENCES

(a) Readings:

CRED. Statistical Update from CRED Disaster Events Database in: CRED Disasters in the World. November 1991.

UNDP. *Reducing Disaster Risk, A challenge for development*. UNDP, 2004.

ISDR/UNDP, *Vision of Risk, A Review of International Indicators of Disaster Risk and its Management, A report for the ISDR inter-Agency Task force on Disaster Reduction, Working Group 3: Risk, vulnerability and Disaster Impact Assessment,* Geneva, December 2004. (http://www.undp.org/bcpr/disred/documents/publications/visionsofrisk.pdf#search='Hotspots%20indexing%20project');

ISDR, *Living with Risk, a global review of disaster reduction initiatives,* UN Geneva 2004.

International Bank for Reconstruction and Development/The World Bank and Columbia University, *Natural Disaster, Hotspots: A Global Risk Analysis Dilley, M., Chen, R.S., Deichmann, U., Lerner-Lam, A.L. and Arnold, M. with Agwe, J. Buys, P., Kjekstad, O., Lyon, B. and Yetman, G.,* Washington, D.C 2005.

IBD, *Indicators of Disaster Risk and Risk Management, Inter-American Development Bank,* Washington, D.C.

See also the internet sites below for further references

(b) Internet sites:

http://www.unisdr.org
http ://www.munichre.com
http://www.geohaz.org/
http://www.ldeo.columbia.edu/chrr/research/hotspots/
http://www.cred.be
http://www.undp.org/bcpr

HUMAN AND ECONOMIC LOSS DUE TO DISASTERS		
Natural hazards	**Disaster Preparedness and Response**	

1. INDICATOR

(a) Name: Human and economic loss due to disasters caused by vulnerability to natural hazards.

(b) Brief Definition: The number of persons deceased, missing, and/or injured as a direct result of a disaster involving natural hazards; and the amount of economic and infrastructure losses incurred as a direct result of the natural disaster.

(c) Unit of Measurement: Number of fatalities; $US.

(d) Placement in the CSD Indicators Set: Natural disaster/Disaster Preparedness and Response.

2. POLICY RELEVANCE

(a) Purpose: To provide estimates of the human and economic impact of disasters in order to measure the trends in population vulnerability and to determine whether a country or province is becoming more or less prone to the effects of disasters.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): Disaster involving natural hazards can have devastating short and long-term impacts on the society and the economy of any country, adversely affecting progress towards sustainable development. They cause loss of life, social disruption and affect economic activities. This is particularly true for highly vulnerable, low-income groups. They also cause environmental damage, such as loss of fertile agricultural land, and water contamination. They affect urban settlements and may result in major population displacements.

The general increase in vulnerability of societies worldwide has caused the social, economic and environmental impact of disaster involving natural hazards to become far greater now than ever before. In fact, the overall number of people affected by disasters has been growing by 6% each year since 1960. This trend is expected to continue primarily because of increased concentration of people and values in the areas exposed to natural hazards, such as floods and earthquakes.

(c) International Conventions and Agreements: Based on the experience of the International Decade for Natural Disaster Reduction, the UN General Assembly adopted resolution A/54/219 which established a permanent mandate for the UN system in the field of disaster reduction, in the framework of the global programme named International Strategy for Disaster Reduction (ISDR).

(d) International Targets/Recommended Standards: None.

(e) Linkages to Other Indicators: This indicator is linked with indicators that are related to issues of vulnerability: % Population Living Below Poverty Line, Floor Area Per Person, Population Growth Rate, Population of Urban Formal and Informal Settlements, Area of Urban Formal and Informal Settlements, and other institutional indicators like National Sustainable Development Strategy.

This indicator would have greater significance if correlated to indicators of vulnerability to specific hazards such as earthquakes and floods, which account for the majority of loss due to natural disasters, especially in developing countries and if related to the number of people leaving in high-risk areas.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: There is a recognized high degree of interdependency between sustainable development and vulnerability to natural hazards. High vulnerability means higher exposure to natural catastrophes in the absence of disaster risk reduction measures. Disasters caused by vulnerability to natural hazards have a strong negative impact on the development process in both industrialized and developing countries. Therefore, the degree of vulnerability to a given natural hazard provides a key measure of social welfare and development in a given country, as well as an indication of the risk (probability) of a disasters.

For the purpose of this indicator, the following definitions have been used:

Disaster involving natural hazards is the consequence of the impact of a natural hazard on a socio-economic system with a given degree of vulnerability, which overwhelms local capacity to respond to the emergency and has disruptive consequences on human, social and economic parameters.

Natural hazards comprise phenomena such as earthquakes; volcanic activity; landslides; tsunamis; tropical cyclones and other severe storms; tornadoes and high winds; river floods and coastal flooding; wildfires and associated haze; drought; infestations.

Vulnerability to hazards is a function of human activities. It describes the degree to which a socio-economic system is susceptible to the impact of natural and other related hazards. Vulnerability also depends on aspects such as hazard awareness, the characteristics of human settlements and infrastructure, public policy and administration, and organized abilities in all fields of disaster management. At present, poverty is one major cause of vulnerability in many parts of the world.

(b) Measurement Methods: The measurement methods proposed are based on the criteria used by the Centre for Research on the Epidemiology of Disaster (CRED). The data elements included here have been selected and modified according to the requirements of the sustainable development indicator methodology sheets. Overall, these data should be collected and validated at the country level by a public authority using these standard criteria and methods. Each element is presented first in a concise description, followed by comments and the proposed recording procedure.

i) *Onset Date:* This establishes the date when the disaster situation occurred. This date is well defined for all sudden-impact disasters. For disaster situations which develop gradually overtime (for example, drought) scientific (meteorology and seismology institutes) and governmental (civil defence authorities) sources are used to determine the onset date.

ii) *Declaration Date:* The date when the first call for external assistance concerning the disaster is issued. This call for external assistance mentioned here is defined according to the definition of a disaster situation stated above. This date is available for all disaster situations to be included for the indicator. Only the date of the first appeal for external assistance is recorded.

iii) *Disaster Type:* This describes the disaster according to a pre-defined classification scheme. Disaster types should include all types of natural disasters, for example, earthquakes, cyclones, floods, volcanic eruptions, drought, and storms. Disasters may be further described as sudden onset, such as earthquakes and floods, and long-term, such as drought. Two or more disasters may be related, or other disaster types may occur as a consequence of a primary event. For example, a cyclone may generate a flood or landslide; or an earthquake may cause a gas line to rupture.

iv) *Country:* This defines the country in which the disaster occurred. Every disaster record will be by country. Autonomous regions, not yet recognised as countries, will not be used. The same disaster may affect more than one country, and here separate records are maintained.

v) *Fatalities:* This includes persons confirmed dead and persons missing and presumed dead. Official figures are used whenever available. The figure is updated as missing persons are confirmed to be dead.

vi) *Estimated Amount of Damage:* This represents the value of all damages and economic losses directly related to the occurrence of the given disaster. The economic impact of a disaster usually consists of direct (for example, damage to infrastructure, crops, housing) and indirect (for example, loss of revenues, unemployment, market destabilisation) consequences on the local economy. Although several institutions have developed methodologies to quantify these losses in their specific domain, no standard procedure to determine a global figure for the economic impact exists. Three different figures are recorded from sources which have a well-defined methodology for the assessment of economic impacts, including the World Bank and other international lending agencies; the host government; and, especially in the case of complex emergency situations, the total budget requirements listed in the consolidated appeals launched by UN agencies and other major non-government organizations.

(c) Limitations of the Indicator: The validity of this indicator is limited by the quality and the format of the data used for its calculation. Comparability over time may represent a particular problem for this indicator.

(d) Status of the Methodology: The methodology is in widespread use on both developed and developing countries although it is not standardized.

(e) Alternative Definitions: If the indicator has to reflect changing risk, the measurement should be losses per unit of time per capita. This is not possible without further development of the indicator methodology.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: As described in 4.b.

(b) National and International Data Availability and Sources: Data above is normally available within each country or easily obtainable; other sources are international scientific associations; insurance companies (Munich Re, Swiss Re), national geological survey agencies; space agencies and satellite service providers; the UN system and the ISDR framework. Internationally, some data is maintained by the Centre for Research on the Epidemiology of Disasters (CRED) in Brussels, which compiles and validates data from diverse sources

(c) Data References: EM-DAT database, maintained by CRED, see http://www.em-dat.net/ .

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the Secretariat for the International Strategy for Disaster Reduction (ISDR), United Nations, Geneva.

(b) Other Contributing Organizations: The Centre for Research on the Epidemiology of Disasters, Faculty of Medicine, University of Louvain, Belgium. The following organizations were consulted over the development and subsequent review of this indicator methodology sheet: World Food Programme, United Nations Environment Programme, Pan American Health Organization, International Federation of the Red Cross and Red Crescent Societies, and US Agency for International Development, ICSU – International Council of Scientific Unions, Munich Reinsurance Company.

6. REFERENCES

(a) Readings:

CRED. *Profiles in the World: Summary of Disaster Statistics by Continent*. CRED Statistical Bulletin, May 1994.

International Federation of Red Cross and Red Crescent Societies, Centre for Research on the Epidemiology of Disasters. *World Disasters Reports for 1993, 1994, and 1995.* Martinus Neijhoof Publishers, Dordrecht, Netherlands. 1993, 1994, and 1995.

Sapir, D.G. *Natural and Man-made Disasters: the Vulnerability of Women-headed Households and Children without Families.* World Health Statistical Quarterly; 46: 227-233, 1993.

CRED. *Proposed Principles and Guidelines for the Collection and Dissemination of Disaster Related Data.* Report on the IERRIS Workshop, 7-9 September 1992.

Sapir, D.G. & Sato, T. *The Human Impact of Floods: Common Issues for Preparedness and Prevention in Selected Asia-Pacific Countries.* Paper presented at the Second Asian Pacific Conference on Disaster Medicine, Chiba, Japan. 1992.

Sapir, D.G. and Misson, C. *The Development of a Database on Disasters.* Disasters; 16(1): 80-86. 1992.

CRED. *Statistical Update from CRED Disaster Events Database in: CRED Disasters in the World.* November 1991.

UNDP. *Reducing Disaster Risk, A challenge for development.* UNDP, 2004.
ISDR/UNDP, *Vision of Risk, A Review of International Indicators of Disaster Risk and its Management, A report for the ISDR inter-Agency Task force on Disaster Reduction, Working Group 3: Risk, vulnerability and Disaster Impact Assessment,* Geneva, December 2004. (http://www.undp.org/bcpr/disred/documents/publications/visionsofrisk.pdf#search='Hotspots%20indexing%20project');
ISDR, *Living with Risk, a global review of disaster reduction initiatives,* UN Geneva 2004.
International Bank for Reconstruction and Development/The World Bank and Columbia University, *Natural Disaster, Hotspots: A Global Risk Analysis Dilley, M., Chen, R.S., Deichmann, U., Lerner-Lam, A.L. and Arnold, M. with Agwe, J. Buys, P., Kjekstad, O., Lyon, B. and Yetman, G.,* Washington, D.C 2005.

(b) Internet sites:
http://www.unisdr.org
http ://www.munichre.com
http://www.geohaz.org/
http://www.ldeo.columbia.edu/chrr/research/hotspots/
http://www.cred.be
http://www.undp.org/bcpr

CARBON DIOXIDE EMISSIONS		
Atmosphere	**Climate Change**	**Core indicator**

1. INDICATOR

(a) Name: Carbon dioxide (CO_2) emissions.

(b) Brief Definition: Anthropogenic emissions, less removal by sinks, of carbon dioxide (CO_2). In addition to total emissions, sectoral CO_2 emissions can be considered. The typical sectors for which CO_2 emissions/removals are estimated are energy, industrial processes, agriculture, waste, and the sector of land use, land-use change and forestry (LULUCF).

(c) Unit of Measurement: Annual CO_2 emissions in gigagrams (Gg).

(d) Placement in the CSD Indicator Set: Atmosphere/Climate Change.

2. POLICY RELEVANCE

(a) Purpose: This indicator measures the emissions of carbon dioxide which is known to be the most important, in terms of impact on global warming, anthropogenic greenhouse gas (GHG).

(b) Relevance to Sustainable/ Unsustainable Development (theme/sub-theme): For about a thousand years before the industrial revolution, the amount of greenhouse gases in the atmosphere remained relatively constant. Since then, the concentration of various greenhouse gases has increased. The amount of carbon dioxide has increased by more than 30% since pre-industrial times and is currently increasing at an unprecedented rate of about 0.4% per year, mainly due to the combustion of fossil fuels and deforestation.

Since the late nineteenth century, the mean global temperature has increased by 0.4-0.8°C and the sea level has risen by 10 to 15cm. A doubling of the CO_2 concentration in the atmosphere is believed to cause an increase in the global mean temperature of 1.5 to 4.5°C. To appreciate the magnitude of this temperature increase, it should be compared with the global mean temperature difference of perhaps 5 to 6°C from the middle of the last ice age to the present interglacial period.

(c) International Conventions and Agreements: The United Nations Framework Convention on Climate Change entered into force in March 1994 and as of 11 April 2007 has received 191 instruments of ratification or accession. The Kyoto Protocol to the Convention was adopted in December 1997 and entered into force on 16 February 2005. As of 6 June 2007, the Kyoto Protocol has received 174 instruments of ratifications, accessions, approvals or acceptances.

(d) International Targets/Recommended Standards: The Climate Change Convention includes a commitment by developed country Parties (Annex I Parties),

including economies in transition, to aim to return emissions of CO_2 and other GHGs not controlled by the Montreal Protocol to their 1990 levels by 2000. This was achieved: in 2000, GHG emissions from Annex I Parties were about 6 per cent below the 1990 level. The Kyoto Protocol sets individual emission reduction targets for Annex I Parties (developed countries, including countries with economies in transition), which should lead to an overall reduction in GHG emissions from developed countries by at least 5 per cent below the 1990 level in the first commitment period 2008 to 2012. Carbon dioxide amounts to about 80 per cent of total GHG emissions and therefore changes in CO_2 emissions determine, to a sizable extent, the trend for total GHG emissions.
The indicator is also used to measure progress towards the Millennium Development Goal Nr. 7 (Ensure environmental sustainability) and the associated target "Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources"

(e) Linkages to Other Indicators: This indicator is linked to many other socio-economic and environmental indicators, including GDP growth rate, energy consumption, environmental protection expenditures, and expenditures on air pollution abatement. Of particular relevance is the link to the CSD GHG indicator and to the CO_2 per capita indicator within the framework of the Millennium Development Goals (MDG).

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: Greenhouse gases contribute in varying degrees to global warming depending on their heat absorptive capacity and their lifetime in the atmosphere. The global warming potential (GWP) describes the cumulative effect of a gas over a time horizon (usually 100 years) compared to that of CO_2. For example, according to the IPCC Second Assessment Report, 1995, the global warming potential of CH_4 (methane) is 21, meaning that the global warming impact of one kg of CH_4 is 21 times higher than that of one kg of CO_2. However, although the GWP values for methane is higher than for carbon dioxide, the volume of emissions is much greater for CO_2.

(b) Measurement Methods: CO_2 emissions are estimated from data on emission sources, which are mostly facilities where fuel is combusted to produce energy. Data on the amount of fuel used and emission factors for each source are applied in the estimates.

(c) Limitations of the Indicator: Carbon dioxide is only one of greenhouse gases and therefore CO_2 emissions are smaller than the overall GHG emissions. Data for developed countries, including economies in transition, are more complete and easier available than data for developing countries.

(d) Status of the Methodology: Developed country Parties to the Convention have been reporting CO_2 data as part of their GHG data submissions since 1994. The IPCC has published two sets of guidelines on methodologies for the estimation of GHG inventories and further elaborated this with guidance on good practice in 2000 and another guidance for land use, land-use change and forestry in 2003.

(e) Alternative Definitions/Indicators: CO_2 emissions can alternatively be measured on a gross instead of net basis in which case no account is taken of removal by sinks. CO_2 emissions can be also assessed on the per capita basis or per GDP basis, as in indicator 28 (a) of the MDG indicators "CO2 emissions, total, per capita and per 1$ GDP (PPP)"

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Greenhouse gas emissions data.

(b) National and International Data Availability and Sources: National communications from Parties to the Climate Change Convention, including both developed and developing countries, are available. In addition, developed countries submit their detailed GHG inventories, including CO_2 data, to the UNFCCC secretariat annually. At the international level, the UNFCCC Secretariat supports a database with GHG data based on annual data inventory submissions from developed countries and periodic submissions of national communications from developing countries.

(c) Data References:
GHG data section at the UNFCCC website (http://unfccc.int/ghg_emissions_data/items/3800.php)
CO_2 data at the IEA website (www.iea.org)
The UN site on the Millenium Development Goals indicators (http://mdgs.un.org)
National greenhouse gas inventory data for the period 1990-2004 and status of reporting. UNFCCC document FCCC/SBI/2006/26 (available at http://unfccc.int/resource/docs/2006/sbi/eng/26.pdf)
National submissions of GHG inventories of Annex I Parties under the Climate Change Convention (available at http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/3734.php)

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the Secretariat of the United Nations Framework Convention on Climate Change (UNFCCC). The contact point is the Executive Secretary, Secretariat, UNFCCC, fax no. (49-228) 815-1999.

(b) Other Contributing Organizations: The Intergovernmental Panel on Climate Change (IPCC develops methodological guidance for GHG emissions estimates). The International Energy Agency (IEA) supports a comprehensive database on CO_2 emissions from fuel combustion, including the data on CO_2–related indicator.

6. REFERENCES

(a) Readings:

National greenhouse gas inventory data for the period 1990-2004 and status of reporting. UNFCCC document FCCC/SBI/2006/26 (available at http://unfccc.int/resource/docs/2006/sbi/eng/26.pdf)
UNFCCC reports on technical reviews of GHG inventories of developed countries (http://unfccc.int/national_reports/annex_i_ghg_inventories/inventory_review_reports/items/3723.php).
UNFCCC reports on in-depth reviews of national communications of individual countries (available at http://unfccc.int/national_reports/annex_i_natcom/idr_reports/items/2711.php).

(b) Internet sites:

unfccc.int (UNFCCC)
http://www.un.org/climatechange/ (Gateway to the UN System's Work on Climate Change)
www.iea.org (IEA)
www.ipcc.ch (IPCC)
www.ipcc.nggip.iges.or.jp (IPCC technical support)

EMISSIONS OF GREENHOUSE GASES		
Atmosphere	**Climate Change**	

1. INDICATOR

(a) Name: Emissions of Greenhouse Gases (GHG).

(b) Brief Definition: Anthropogenic emissions, less removal by sinks, of the greenhouse gases carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6). .

(c) Unit of Measurement: Annual GHG emissions in gigagrams (Gg). Emissions of CH_4, N_2O, HFCs, PFCs and SF_6 can be converted to CO_2 equivalents using the so-called global warming potentials (GWPs) provided in assessments of the Intergovernmental Panel on Climate Change.

(d) Placement in the CSD Indicator Set: Atmosphere/Climate Change.

2. POLICY RELEVANCE

(a) Purpose: This indicator measures the emissions of the six main GHGs which have a direct impact on climate change, less the removal of the main GHG CO_2 through sequestration as a result of land-use change and forestry activities.

(b) Relevance to Sustainable/ Unsustainable Development (theme/sub-theme): For about a thousand years before the industrial revolution, the amount of greenhouse gases in the atmosphere remained relatively constant. Since then, the concentration of various greenhouse gases has increased. The amount of carbon dioxide, for example, has increased by more than 30% since pre-industrial times and is currently increasing at an unprecedented rate of about 0.4% per year, mainly due to the combustion of fossil fuels and deforestation. The concentrations of methane and nitrous oxide are increasing as well due to agricultural, industrial and other activities. Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) do not occur naturally in the atmosphere but have been introduced by human activities. They are strong greenhouse gases and have long atmospheric lifetimes.

Since the late nineteenth century, the mean global temperature has increased by 0.4-0.8°C and the sea level has risen by 10 to 15cm. A doubling of the CO_2 concentration in the atmosphere is believed to cause an increase in the global mean temperature of 1.5 to 4.5°C. To appreciate the magnitude of this temperature increase, it should be compared with the global mean temperature difference of perhaps 5 to 6°C from the middle of the last ice age to the present interglacial period.

(c) International Conventions and Agreements: The United Nations Framework Convention on Climate Change entered into force in March 1994 and as of 11 April 2007 has received 191 instruments of ratification or accession. The Kyoto Protocol to the Convention was adopted in December 1997 and entered into force on 16 February 2005.

As of 6 June 2007, the Kyoto Protocol has received 174 instruments of ratifications, accessions, approvals or acceptances.

(d) International Targets/Recommended Standards: The Climate Change Convention includes a commitment by developed country Parties (Annex I Parties), including economies in transition, to aim to return emissions of CO_2 and other GHGs not controlled by the Montreal Protocol to their 1990 levels by 2000. This was achieved: in 2000, GHG emissions from Annex I Parties were about 6 per cent below the 1990 level. The Kyoto Protocol sets individual emission reduction targets for Annex I Parties (developed countries, including countries with economies in transition), which should lead to an overall reduction in GHG emissions from developed countries by at least 5 per cent below the 1990 level in the first commitment period 2008 to 2012.

(e) Linkages to Other Indicators: This indicator is linked to many other socio-economic and environmental indicators, including GDP growth rate, energy consumption, environmental protection expenditures, and expenditures on air pollution abatement.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: Greenhouse gases contribute in varying degrees to global warming depending on their heat absorptive capacity and their lifetime in the atmosphere. The global warming potential (GWP) describes the cumulative effect of a gas over a time horizon (usually 100 years) compared to that of CO_2. For example, according to the IPCC Second Assessment Report, 1995, the global warming potential of CH_4 (methane) is 21, meaning that the global warming impact of one kg of CH_4 is 21 times higher than that of one kg of CO_2.

(b) Measurement Methods: In some cases, GHG emissions can be measured directly at the source. More commonly, emissions are estimated from data on emission sources, for example oil sales data or cattle numbers, using an emission factor for each source.

(c) Limitations of the Indicator: This indicator shows the net amount of GHGs entering the atmosphere for each reporting country each year. It does not show how much the climate will be affected by the increased accumulation of GHGs or the consequent effect of climate change on countries. Data for developed countries, including economies in transition, are more complete and easier available than data for developing countries.

(d) Status of the Methodology: Developed country Parties to the Convention have been reporting GHG data, beginning with 1990 data, since 1994. The IPCC has published two sets of guidelines on methodologies for the estimation of GHG inventories and further elaborated this with guidance on good practice in 2000 and another guidance for land use, land-use change and forestry in 2003.

(e) Alternative Definitions/Indicators: GHG emissions can alternatively be measured on a gross instead of net basis in which case no account is taken of removal by sinks. There are a number of other gases that indirectly produce GHGs and these could also be included in the scope of the definition. The GWP potential can be calculated over different time horizons, such as 20 years or 500 years.
In addition to the six main greenhouse gases included in this indicator, chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs) and other ozone-depleting gases also contribute to the global warming and could be monitored. However, the global warming potentials of ozone-depleting greenhouse gases are highly uncertain, since they depend on the depletion of ozone, itself a greenhouse gas. CFCs and HCFCs are included in the indicator "Consumption of ozone-depleting substances". One could also monitor indirect greenhouse gases such as nitrogen oxides (NOx), carbon monoxide (CO) and non-methane volatile organic compounds (NMVOCs). Although these gases themselves are not greenhouse gases, they affect atmospheric chemistry, leading to an increase in tropospheric ozone, which is a greenhouse gas. However, no global warming potentials are provided for indirect greenhouse gases.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Greenhouse gas emissions data.

(b) National and International Data Availability and Sources: National communications from Parties to the Climate Change Convention, including both developed and developing countries, are available. In addition, developed countries submit their detailed GHG inventories to the UNFCCC secretariat annually. At the international level, the UNFCCC Secretariat supports a database with GHG data based on annual data inventory submissions from developed countries and periodic submissions of national communications from developing countries.

(c) Data References:
GHG data section at the UNFCCC website (http://unfccc.int/ghg_emissions_data/items/3800.php)
National greenhouse gas inventory data for the period 1990-2004 and status of reporting. UNFCCC document FCCC/SBI/2006/26 (available at http://unfccc.int/resource/docs/2006/sbi/eng/26.pdf)
National submissions of GHG inventories of Annex I Parties under the Climate Change Convention (available at http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/3734.php)

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the Secretariat of the United Nations Framework Convention on Climate Change (UNFCCC). The contact point is the Executive Secretary, Secretariat, UNFCCC, fax no. (49-228) 815-1999.

(b) Other Contributing Organizations: The Intergovernmental Panel on Climate Change (IPCC) develops methodological guidance for GHG emissions estimates. The International Energy Agency (IEA) supports a comprehensive database on CO_2 emissions from fuel combustion, including the data on CO_2–related indicator.

6. REFERENCES

(a) Readings:

National greenhouse gas inventory data for the period 1990-2004 and status of reporting. UNFCCC document FCCC/SBI/2006/26 (available at http://unfccc.int/resource/docs/2006/sbi/eng/26.pdf)

UNFCCC reports on technical reviews of GHG inventories of developed countries (http://unfccc.int/national_reports/annex_i_ghg_inventories/inventory_review_reports/items/3723.php).

UNFCCC reports on in-depth reviews of national communications of individual countries (available at http://unfccc.int/national_reports/annex_i_natcom/idr_reports/items/2711.php).

(b) Internet sites:

unfccc.int (UNFCCC)

http://www.un.org/climatechange/ (Gateway to the UN System's Work on Climate Change)

www.iea.org (IEA)

www.ipcc.ch (IPCC)

www.ipcc.nggip.iges.or.jp (IPCC technical support)

CONSUMPTION OF OZONE DEPLETING SUBSTANCES		
Atmosphere	**Ozone Layer Depletion**	

1. **INDICATOR**

(a) **Name:** Consumption of Ozone Depleting Substances (ODSs).

(b) **Brief Definition:** This indicator will show the consumption trends for ODSs controlled under the Montreal Protocol on Substance that Deplete the Ozone Layer, thereby allowing inference of the amounts of Ozone Depleting Substances being eliminated as a result of the protocol.

(c) **Unit of Measurement:** ODP Tonnes, which is defined as the Metric Tonnes of ODSs weighted by their Ozone Depletion Potential (ODP).

(d) **Placement in the CSD Indicator Set:** Atmosphere/Ozone layer depletion.

2. **POLICY RELEVANCE**

(a) **Purpose: This indicator depicts the progress towards the phase out the ODSs by** the countries which have ratified the Montreal Protocol on Substances that Deplete the Ozone Layer and its Amendments of London (1990), Copenhagen (1992), Montreal (1997) and Beijing (1999).

(b) **Relevance to Sustainable/Unsustainable Development (theme/sub-theme):** The phase-out of ODSs, and their substitution by less harmful substances or new processes, will lead to the recovery of the ozone layer. Stratospheric ozone absorbs most of the biologically damaging ultraviolet radiation (UV-B). Without the filtering action of the ozone layer, more UV-B radiation can penetrate the atmosphere to have adverse effects on human health, animals, plants, micro-organisms, marine life, materials, biogeochemical cycles, and air quality.

(c) **International Conventions and Agreements:** The Vienna Convention for the Protection of the Ozone Layer and its Montreal Protocol on Substances that Deplete the Ozone Layer and the London, Copenhagen, Montreal and Beijing Amendments to the Protocol.

(d) **International Targets/Recommended Standards:** The international target under the agreements listed in 2 (c) is the gradual (but ultimately complete) phase-out of use/consumption of ODSs.
The indicator is also used to measure progress towards the Millennium Development Goal Nr. 7 (Ensure environmental sustainability) and the associated target “Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources”.

(e) Linkages to Other Indicators: This indicator has links to other environmental and institutional indicators, such as number of chemicals banned or restricted and ratification of international agreements. It has significant implications to human health and natural resources.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: **Ozone Depleting Substance** (ODS) means any organic substance containing chlorine or bromine, which destroys the stratospheric ozone layer. **Controlled substance** means a substance in Annex A, Annex B, Annex C or Annex E of the Montreal Protocol, whether existing alone or in a mixture. It includes the isomers of any such substance, except as specified in the relevant Annex, but excludes any controlled substance or mixture which is in a manufactured product other than a container used for the transportation or storage of that substance. **Production** means the amount of listed, controlled substances produced, minus the amount destroyed by technologies to be approved by the Parties to the Montreal Protocol and minus the amount entirely used as feedstock in the manufacture of other chemicals. The amount recycled and reused is not to be considered as "production". **Consumption** is the sum of production plus imports minus exports of controlled substances. We are addressing apparent consumption. **Weighted tonnes of ODSs** means the amount of ODSs in tonnes multiplied by their ozone depleting potential. **Ozone depleting potential** (ODP) is a relative index of the ability of a substance to cause ozone depletion. The reference level of 1 is assigned as an index to CFC-11 and CFC-12. If a product has an ODP of 0.5, a given weight of the product in the atmosphere would, in time, deplete half the ozone that the same weight of CFC-11 or CFC-12 would deplete. ODPs are calculated from mathematical models which take into account factors such as the stability of the product, the rate of diffusion, the quantity of depleting atoms per molecule, and the effect of ultraviolet light and other radiation on the molecules.

(b) Measurement Methods: Weighted Tonnes of ODSs for production are the sum of national annual production (in tonnes) of each controlled substance (as reported to the Ozone Secretariat in accordance with Article 7 of the Montreal Protocol) multiplied by the ozone depleting potential of that substance (as listed in Annexes A, B, C and E of the Montreal Protocol, whose text can be found in the Handbook for the International Treaties for the Protection of the Ozone Layer, 2003 [NB: A new edition is coming out in 2006]). It can be found at: http://ozone.unep.org/, http://www.unep.ch/ozone or http://www.unep.org/ozone. Weighted Tonnes of Ozone Depleting Substances for consumption are obtained through a similar calculation using national annual consumption values (in tonnes).

(c) Limitations of the Indicator: Availability and accuracy of data and timely reporting will determine the country's ability to use the indicator. The indicator by itself does not reveal much about current trends in the deterioration of the ozone layer because of delays in ecosystem response.

(d) Status of the Methodology: For more information, please consult the Reports of the Secretariat on information provided by the Parties in accordance with Article 7 of the

Montreal Protocol or the Home Page at: http://ozone.unep.org/, http://www.unep.ch/ozone or http://www.unep.org/ozone.

(e) Alternative Definitions/Indicators: An alternative indicator could focus on emissions of ODSs. However, such information is not available, hence the use of the consumption data as a proxy for indicating possible levels of emissions since most of the usage of ODSs is ultimately emitted to the atmosphere. Another possible indicator is the concentration levels of ODSs in the atmosphere.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Data on production, imports and exports of controlled substances by the Parties to the Montreal Protocol.

(b) National and International Data Availability and Sources: The data are available for most countries, on a national level, on a regular annual basis, as part of their reporting obligations under the Montreal Protocol. The data are more centrally available at the international level from the Ozone Secretariat in Nairobi and from the Multilateral Fund Secretariat in Montreal (as Parties to the Protocol report to these Secretariats). The data sources are the Ozone Secretariat and the national government ministry responsible for reporting under the Montreal Protocol.

(c) Data References: UNEP, Production and Consumption of Ozone Depleting Substances, 1986-2004, United Nations Environment Programme, pp. 41, 2005. Web site: http://ozone.unep.org/, http://www.unep.ch/ozone or http://www.unep.org/ozone. Data on this indicator is also included in the MDG database, see http://mdgs.un.org/

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the United Nations Environment Programme (UNEP)/Ozone Secretariat. The contact point is the Executive Secretary of the Ozone Secretariat, fax no. (254-2) 762-4691/2/3.

(b) **Other Contributing Organizations:** Other organizations interested in the further development of this indicator would include: The Multilateral Fund Secretariat, the Global Environment Facility (GEF) Secretariat, United Nations Development Programme (UNDP), UNEP Division of Technology, Industry & Economics (UNEP DTIE), United Nations Industrial and Development Organization (UNIDO), the World Bank, the Technology and Economic Assessment Panel to the Montreal Protocol, the Parties to the Montreal Protocol, the Organisation for Economic Co-operation and Development (OECD), and members associated with the Alternative Fluorocarbon Environmental Acceptability Study (AFEAS).

6. REFERENCES

(a) Readings:

Ozone Secretariat, UNEP, Handbook for the International Treaties for the Protection of the Ozone Layer (Sixth Edition), pp.398, 2003. (ISBN: 92- 807-2316-2).

UNEP, Synthesis of the Reports of the Scientific, Environmental Effects and Technology and Economic Assessment Panels of the Montreal Protocol. A Decade of Assessments for Decision Makers Regarding the Protection of the Ozone Layer: 1989-1998, United Nations Environment Programme, pp. 161, 1999. (ISBN: 92-807- 1733-2).
UNEP, Reports of the Technology and Economic Assessment Panel of the Montreal Protocol.
Reporting of Data by the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer.

(b) Internet sites:

http://ozone.unep.org/
http://www.unep.ch/ozone
http://www.unep.org/ozone
http://www.unmfs.org
http://www.uneptie.org/ozonaction.html
http://www.undp.org/seed/eap/montreal/index.htm
http://www.unido.org
http://www-esd.worldbank.org/mp

AMBIENT CONCENTRATION OF AIR POLLUTANTS IN URBAN AREAS		
Atmosphere	**Air Quality**	**Core indicator**

1. INDICATOR

(a) Name: Ambient concentration of air pollutants in urban areas.

(b) Brief Definition: Ambient air pollution concentrations of ozone, particulate matter ($PM_{10,}$ and $PM_{2,5}$, if those are not available: SPM, black smoke), sulphur dioxide, nitrogen dioxide, lead. Additional: carbon monoxide, , volatile organic compounds including benzene (VOCs). The priority is collection of the indicator in large cities (over 1 million population).

(c) Unit of Measurement: $\mu g/m^3$, ppm or ppb, as appropriate;

(d) Placement in the CSD Indicator Set: Atmosphere/Air Quality.

2. POLICY RELEVANCE

(a) Purpose: The indicator provides a measure of the state of the environment in terms of air quality and is an indirect measure of population exposure to air pollution of health concern in urban areas.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): An increasing percentage of the world's population lives in urban areas. High population density and the concentration of industry exert great pressures on local environments. Air pollution, from households, industry power stations and transportation (motor vehicles), is often a major problem. As a result, the greatest potential for human exposure to ambient air pollution and subsequent health problems occurs in urban areas. Improving air quality is a significant aspect of promoting sustainable human settlements.

The indicator may be used to monitor trends in air pollution as a basis for prioritising policy actions; to map levels of air pollution in order to identify hotspots or areas in need of special attention; to help assess the number of people exposed to excess levels of air pollution; to monitor levels of compliance with air quality standards; to assess the effects of air quality policies; and to help investigate associations between air pollution and health effects.

(c) International Conventions and Agreements: None.

(d) International Targets/Recommended Standards: World Health Organization (WHO) air quality guidelines exist for all the pollutants of this indicator. Many countries have established their own air quality standards for many of these pollutants.

(e) Linkages to Other Indicators: This indicator is closely linked to others which relate to causes, effects, and societal responses. These include, for example, the indicators on population growth rate, rate of growth of urban population, percent of population in urban areas, annual energy consumption per capita, emissions of sulphur oxides and nitrogen oxides, life expectancy at birth, total national health care as a percent of Gross National Product, share of consumption of renewable energy resources, environmental protection expenditures as a percent of Gross Domestic Product, expenditure on air pollution abatement, childhood morbidity due to acute respiratory illness, childhood mortality due to acute respiratory illness, capability for air quality management, and availability of lead-free gasoline.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: The indicator may be designed and constructed in a number of ways. Where monitored data are available, it is usefully expressed in terms of mean annual or percentile concentrations of air pollutants with known health effects – e.g., ozone, carbon monoxide, particulate matter ($PM_{10,}$ $PM_{2,5}$, SPM), black smoke, sulphur dioxide, nitrogen dioxide, volatile organic compounds including benzene (VOCs) and lead – in the outdoor air in urban areas.
Where monitoring data are unavailable, estimates of pollution levels may be made using air pollution models. Dispersion models, however, depend on the availability of emission data; where these are not available, surveys may be conducted using rapid source inventory techniques. Because of the potential errors in the models or in the input data, results from dispersion models should ideally be validated against monitored data.

(b) Measurement Methods: Suitable air monitors must fulfil several requirements, such as detection limits, interferences, time resolution, easy operation and of course, cost. There are several good references in the literature or available at agencies on air monitoring and analysis from where information can be obtained. It is important, however, to refer to the published scientific literature for the most appropriate and recent air monitoring methods.
A number of models are available for estimation of ambient concentration of air pollutants. Most of them are founded on the Gaussian air dispersion model.

(c) Limitations of the Indicator: Measurement limitations relate to detection limits, interferences, time resolution, easy operation, and cost. Evaluation of the accuracy of model results is critical before relying on model output for decision-making.

(d) Status of the Methodology: The methodology is widely used in many developed and developing countries.

(e) Alternative Definitions: None.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Data must be time and spatially representative concentrations such as, for example, mean annual concentrations (mean concentrations of the pollutant of concern, averaged over all hours, or days, of the year) or percentile concentration (concentration of the pollutant of concern exceeded in 100-X% of hours/days, where X is the percentile as defined by the relevant standards). In addition, information must be available on site location and type (e.g., industrial, transport oriented or residential area).

(b) National and International Data Availability and Sources: Data on ambient air pollution concentrations is often routinely collected by national or local monitoring networks. Data is often also collected for research purposes by universities and research institutes. In addition, industry collects many data.

(c) Data References: Data on ambient air pollution can be obtained from national and local monitoring networks. Sometimes, data is available from universities, research institutes and industry. In addition, a growing volume of data can be obtained from international sources such as the European Environmental Agency.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the World Health Organization (WHO). The contact point is the Director, Department for the Protection of the Human Environment; fax no. (41 22) 791 4159.

(b) Other Contributing Organizations: The United Nations Environment Programme.

6. REFERENCES

(a) Readings:

WHO (2000) *Air Quality Guidelines for Europe, Second Edition. WHO Regional Publications, European Series, No. 91*

WHO (2000) *Human Exposure Assessment*, Environmental Health Criteria Document 214, Programme of Chemical Safety.

WHO (2000) *Decision-Making in Environmental Health: From Evidence to Action*, edited by C. Corvalan, D. Briggs and G. Zielhuis, E & FN Spon, London, New York.

WHO (1999) *Monitoring Ambient Air Quality for Health Impact Assessment*, WHO Regional Publications, European Series, No. 85.

WHO (1999) *Environmental Health Indicators: Framework and Methodologies*. Prepared by D. Briggs, Occupational and Environmental Health.

WHO (2006) WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulphur dioxide. Global update 2005. Summary of risk assessment. http://www.who.int/phe/air/aqg2006execsum.pdf

Schwela & Zali (eds. 1999) *Urban Traffic Pollution*. Edited by D. Schwela and O. Zali, E & FN Spon, London, New York.

UNEP/WHO (1992) *Urban Air Pollution in Megacities of the World*, Blackwell Publishers, Oxford, UK.

UNEP/WHO (1994) *Global Environmental Monitoring System (GEMS/Air)*, Methodology Review Handbook Series. Volumes 2, 3, and 4.

(b) Internet sites:

http://www.who.int/phe/en/
http://www.euro.who.int/air
http://www.unep.org

LAND USE CHANGE		
Land	**Land use and status**	

1. INDICATOR

(a) Name: Land use change.

(b) Brief definition: Change with time of the distribution of land uses within a country.

(c) Unit of Measurement: Proportion of change of each category of land use to another land use per unit of time.

(d) Placement in the CSD Indicator Set: Land/Land use and status.

2. POLICY RELEVANCE

(a) Purpose: The purpose of this indicator is to highlight changes in the productive or protective uses of the land resource to facilitate sustainable land use planning and policy development.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub theme): Information on land use change is critical for integrated and sustainable land use planning. Such information is useful in identifying opportunities to protect land uses or promote future allocation aimed at providing the greatest sustainable benefits for people.

Changes in arable and permanent crop land and wooded areas give important information about a country's endowment in agricultural and forest resources, both from an economic and an environmental perspective. Economically, changes in land use will, for example, result in changes in the volume of produce available and influence employment opportunities. From an environmental point of view, unsustainable land use is an important factor in land degradation, may pose a threat to ecosystems, and lead to natural habitat loss and landscape changes. Changes which lead, for example, to inappropriate farming and grazing practices, or to environmentally insensitive construction or mining activities are significant from a sustainability viewpoint. This indicator acts as a synoptic measure for the myriad of more specific environmental and natural resource changes significant to sustainable development.

(c) International Conventions and Agreements: Not available.

(d) International Targets/Recommended Standards: Generally, international targets for this indicator do not exist. However, certain minimal contiguous limits or proportions of total land area have been established for certain need or desirable land uses, for example protected areas.

(e) Linkages to other indicators: The interpretation of this indicator is significantly improved if it is considered with land quality. It is also closely linked to many other social, economic, environmental, and institutional indicators, such as those related to population (for example, population growth rate, rate of growth of urban population, population density, population dynamics in mountain areas), energy and mineral reserves, land affected by desertification, sustainable use of natural resources in mountain areas, arable land per capita, wood harvesting intensity, protected areas as a percent of total land area, and sustainable development strategies.

3. <u>METHODOLOGICAL DESCRIPTION</u>

(a) Underlying definitions and concepts: The underlying concepts and definitions for land use classifications are widespread. Work coordinated by the United Nations Food and Agriculture Organization (FAO) is currently underway to harmonize classification systems and databases to improve national and international land use information. This includes the development of definitions and protocols, computerized land use database structure, and broadly accepted structure of land use classifications.

(b) Measurement method: Land use change data can be derived from periodic mapping and monitoring, partly on the basis of land cover information; from remote sensing, supported by ground truthing; and the use of land use aspects from agricultural census. It is essential to use a uniform classification of land use and cover. The Land Degradation Assessment in Drylands (LADA) approach is recommended (see http://lada.virtualcentre.org/pagedisplay/display.asp?section=method). The Global Land Cover Network (GLCN) is actually developing a software which would be able to indicate changes in broad land use classes over the last twenty years in addition to complement the existing Land Cover Classification System (LCCS). Use of these tools will lead to the production of uniform results and statistics.

(c) Limitations of the Indicator: The indicator by itself does not identify the causes or pressures leading to the change in land use. At the international level, sufficient harmonization of land use classification has yet to be achieved. Georeferenced land use change data are generally not available.

Generally, inferences regarding sustainability of land management would depend on the degree of characterisation of land uses (obviously the more detail the better). If land-use characterisation is limited (e.g. restricted only to socio-economic purpose, as is the case for many countries), areas of “no change” may give rise to misleading inferences regarding sustainability.

(d) Status of the Methodology: A methodology has not been agreed to by any intergovernmental fora.

(e) Alternative definitions/Indicators: Not available.

4. <u>ASSESSMENT OF DATA</u>

(a) Data needed to Compile the Indicator: The data required includes updated statistics and remote sensing coverage, dependable agricultural census data on land uses, and dependable land use maps, all updated at regular intervals. Broad land use statistics are available for most countries. However, variable definitions, and the lack of consistent land use change data which is spatially referenced are serious impediments to, for example, temporal analysis and international comparisons.

(b) National and International Data Availability and Sources: Times series of land use data (related to agriculture and forestry) aggregated at the national level are available in FAOSTAT for all countries since 1961. Some time-series data related to livestock as well as modelled livestock distribution maps are also available in GLIPHA.

(c) Data References: Not available.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The Food and Agriculture Organization of the United Nations (FAO).

(b) Other Contributing Organizations: The United Nations Environment Programme is a partner in the development of this indicator. National experts from governments and institutes, for example the International Institute for Aerospace Survey and Earth Sciences and the Institute for Terrestrial Ecology, have also contributed.

6. REFERENCES

(a) Readings:

United Nations Environment Programme and Food and Agriculture Organization. Report of the UNEP/FAO Expert Meeting on Harmonizing Land Cover and Land Use Classifications. Geneva November 23-25, 1993. GEMS Report Series No. 25. Nairobi. March 1994.

(b) Internet Sites:

http://lada.virtualcentre.org/

LAND DEGRADATION		
Land	Land use and status	

1. INDICATOR

(a) Name: Land degradation.

(b) Brief Definition: The indicator intends to measure the amount of land affected by degradation and its proportion of national territory.

(c) Unit of Measurement: Area (Km^2) and % of land area affected.

(d) Placement in the CSD Indicator Set: Land/Land use and status.

2. POLICY RELEVANCE

(a) Purpose: The indicator will measure the extent and severity of land degradation at the national level. It also measures the implementation of agreements and programmes to address causes of land degradation and to reclaim degraded lands.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): Land degradation is an impediment to sustainable development in general, and to sustainable agriculture in particular. Land degradation and soil loss threaten the livelihood of millions of people and future food security, with implications for water resources and the conservation of biodiversity.

(c) International Conventions and Agreements: The two most significant agreements are: Agenda 21 of the 1992 UN Conference on Environment and Development; and the UN Convention to Combat Desertification, 1994.

(d) International Targets/Recommended Standards: None

(e) Linkages to Other Indicators: This indicator is linked to indicators on land use change, agricultural land, forest area, agricultural productivity, water use, water quality, abundance of species, poverty, population growth.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: The methodology for this indicator is currently under development, in relation to the Land degradation assessment in drylands (LADA) project executed by the Food and Agricultural Organization (FAO). *Land degradation* means reduction or loss of the biological or economic productivity and complexity of rainfed cropland, irrigated cropland, or range, pasture, forest and woodlands resulting from land uses or from a process or combination of processes, including processes arising from human activities and habitation patterns, such as: (i) soil erosion caused by wind and/or water; (ii) deterioration of the physical, chemical and biological or economic properties of soil; and, (iii) long-term loss of natural vegetation. Land degradation, therefore, includes processes which lead to surface salt accumulation and waterlogging associated with salt-affected areas.

(b) Measurement Methods: A variety of assessment tools for measuring land degradation is investigated for the LADA project, including expert opinions, remote sensing, field monitoring, land productivity, participatory surveys (such as farmers' opinion). The Global Assessment of the Status of Human-Induced Soil Degradation (GLASOD) project (1987-1990) was based on expert opinions.

(c) Limitations of the Indicator: Not applicable

(d) Status of the Methodology: Under development

(e) Alternative Definitions/Indicators: Not available.

4. ASSESSMENT OF DATA

(a) Data Needed to Complete the Indicator: The data needed to compile the indicator are the extent and severity of land degradation in the country concerned. The degree of accuracy and reliability of both spatial and statistical data varies considerably and are often poorly documented and/or out of date. For some countries, the data do not yet exist. Benchmark data on desertification is critical to measuring progress.

(b) National and International Data Availability and Sources:
The webpage of the LADA project contains a number of country case studies and a wealth of related information, including references. Information on extent and severity of land degradation based on the Global Assessment of the Status of Human-Induced Soil Degradation (GLASOD) project (1987-1990) is available at the webpage of the World Soil Information (ISRIC).

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency will be the Food and Agricultural Organization (FAO).

(b) Other Contributing Organizations:

6. REFERENCES

(a) Readings: See under 6 b) below

(b) Internet sites:
Food and Agricultural Organization: Land Degradation Assessment in Drylands
http://lada.virtualcentre.org/
World Soil Information (ISRIC): http://www.isric.org/

GLASOD project
http://www.isric.org/UK/About+ISRIC/Projects/Track+Record/GLASOD.htm

LAND AFFECTED BY DESERTIFICATION		
Land	**Desertification**	

The methodology for this indicator is currently under revision in the context of the Land Degradation Assessment in Drylands (LADA) project implemented by the Food and Agricultural Organization (FAO) and partners. Consequently, the information contained in the present version mainly reflects the status of the methodology in the previous two editions of the CSD indicators.

1. INDICATOR

(a) Name: Land Affected by Desertification.

(b) Brief Definition: This is a measure of the amount of land affected by desertification and its proportion of national territory.

(c) Unit of Measurement: Area (Km^2) and % of land area affected.

(d) Placement in the CSD Indicator Set: Land/Desertification.

2. POLICY RELEVANCE

(a) Purpose: The indicator describes the extent and severity of desertification at the national level. It should be: (i) a measure of the state of the problem at any one time; (ii) an indication of the trend in the severity of the problem over time and success of response mechanisms; and (iii) a means of comparing the severity of the problem from one country to another.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): The indicator should be a mechanism for determining the importance of this issue at the national level. Trend data over time can indicate success of response mechanisms. For dryland areas, desertification is a central problem in sustainable development. While many dryland ecosystems have generally low levels of absolute productivity, maintenance of that productivity is critical to the present and future livelihood of many hundreds of millions of people. Combating desertification is the core of sustainable development for large areas of the world. Severe degradation is a major impedent to sustainable development; moderate or slight degradation is also a significant barrier.

(c) International Conventions and Agreements: The two most significant agreements are: Agenda 21 of the 1992 UN Conference on Environment and Development; and the UN Convention to Combat Desertification, 1994. In addition, the Desertification Convention texts (INCD-10/ New York) spell out a sound methodology for developing indicators. No definitive set of indicators has been agreed upon within the context of the desertification Convention.

(d) International Targets/Recommended Standards: No specific targets have been defined, however, the goal should be to reduce the area and percentage of land affected by desertification, and/or reduce the severity of desertification.

(e) Linkages to Other Indicators: This state and trends indicator needs to be considered in conjunction with related driving force and response indicators, integrating physical and socio-economic processes, for meaningful interpretation and policy relevance at the national level. It is closely linked with indicators concerning land use, such as deforestation, use of marginal land, protected area as a percent of total land area, and population living below the poverty line.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: For the purposes of this indicator, desertification is defined as land degradation in arid, semi-arid, and dry sub-humid areas resulting from various factors, including climatic variations and human activities (UN Convention to Combat Desertification, 1994). *Land degradation* means reduction or loss, in arid, semi-arid and dry sub-humid areas of the biological or economic productivity and complexity of rainfed cropland, irrigated cropland, or range, pasture, forest and woodlands resulting from land uses or from a process or combination of processes, including processes arising from human activities and habitation patterns, such as: (i) soil erosion caused by wind and/or water; (ii) deterioration of the physical, chemical and biological or economic properties of soil; and, (iii) long-term loss of natural vegetation. Land degradation, therefore, includes processes which lead to surface salt accumulation and waterlogging associated with salt-affected areas.
Arid, semi-arid, and dry sub-humid areas means areas, other than polar and sub-polar regions, in which the ratio of annual precipitation to potential evapotranspiration falls within the range from 0.05 to 0.65 (UN Convention to Combat Desertification, 1994).

(b) Measurement Methods: Measurement for this indicator initially requires an assessment of the extent of land degradation throughout the arid, semi-arid, and dry sub-humid zones of the nation. This is best done by a combination of previous assessments represented in map form, carried out by the United Nations Environment Programme (UNEP) with the United Nations Office to Combat Desertification and Drought (UNSO), and the Food and Agricultural Organization (FAO); and updates from a combination of remote sensing and local knowledge.
The creation of an index that combines degrees of severity will require the following measures:

(i) Area subjected to severe land degradation xKm^2 (severe here includes both the severe and very severe categories of UNEP.
(ii) Area subjected to moderate land degradation yKm^2.
(iii) Area subjected to slight land degradation = zKm^2.
(iv) National area (excluding surface water bodies) nKm^2.
(v) National area of drylands (vulnerable to desertification, assuming that all drylands are potentially vulnerable to desertification. Hyper-arid lands are excluded), consisting of arid, semi-arid, and dry subhumid land = dKm^2.

From the above measurements, the following sets of numbers can be derived:

Indicator computations:

a. National area affected by desertification

$$= x + y + z \text{Km}^2$$

b. Percent of national area affected by desertification

$$= \frac{x + y + z}{n} \text{ X } 100$$

c. Percentages of national area affected by severe, moderate and slight desertification respectively can be calculated in the same way.

d. Percent of national drylands affected by desertification

$$= \frac{x + y + z}{d} \text{ X } 100$$

e. National area not affected by desertification

$$= n - (x + y + z)\text{Km}^2$$

f. National dryland area not affected by desertification

$$= d - (x + y + z)\text{Km}^2$$

Trends can be determined by comparing results computed for a sequence of years (for example, every five years).

A useful extension of the indicator would be for countries to report dryland areas (d) as a percentage of all agriculturally productive areas (e=n-hyper arid land) to give an indication of the overall vulnerability of the country to desertification.

While it is based on a combination of analytical and subjective assessment, if these are done systematically on an annual basis, a sound database can be developed. Given the importance of determining the extent and severity of desertification to the index, it may be that a periodic special survey using remote sensing and ground assessment may be important, though this may only be technically feasible for some countries.

An important issue in the basis measurement of degradation is the factors that are measured to assess the degree of local degradation. As Bie (1990) clearly points out, the two factors of *productivity* and *resilience* are the most important elements in assessing the existence and the extent of dryland degradation. Accurate measurement of land affected by desertification is a problem about which there is not yet complete consensus and further work needs to be done to agree on a comparable methodology for the various countries affected by desertification (UNEP, Atlas of Desertification; UNEP/ISRIC/ISS/FAO, Global Assessment of the Status of Human-induced Soil Degradation (GLASOD)).

(c) Limitations of the Indicator: There are a number of issues to be resolved before this indicator can be entirely satisfactory. The ecosystems addressed in this definition undergo cyclic episodes of more or less rainfall, as well as long-term degradation in many cases. Separating short-term fluctuations from longer-term trends is important, though scientists often find this difficult to determine, except for longer time periods. Also, the United Nations Environment Programme (UNEP) has generally defined desertification (degradation) in categories (severe, moderate, slight), and a national indicator needs to include an assessment of this kind. It has been a practice to include problems of waterlogging and salinization as part of desertification, if they occur within the ecosystems as defined above. In this case, the area affected by these problems should also be included in the desertified area.

Because of these issues, the indicator may well benefit from further refinement and definition. The concepts of land degradation in arid, semi-arid, and dry sub-humid areas are well defined and described in a number of UNSO, UNEP, and other UN publications, as well as in the academic literature. The translation of these concepts into agreed national level indicators has not been so well articulated. (Mabbutt, J.A. 1986; Maimuet 1991).

(d) Status of the Methodology: The methodology is currently under revision.

(e) Alternative Definitions/Indicators: Not available.

4. ASSESSMENT OF DATA

(a) Data Needed to Complete the Indicator: The data needed to compile the indicator are the extent and severity of dryland degradation in the country concerned, the dryland area, and national area (excluding surface water bodies). The degree of accuracy and reliability of both spatial and statistical data varies considerably and are often poorly documented and/or out of date. For some countries, the data do not yet exist. Benchmark data on desertification is critical to measuring progress.

(b) National and International Data Availability and Sources:
The webpage of the LADA project contains a number of country case studies and a wealth of related information. Information on drylands and national areas can also be obtained from national statistical institutions and publications, and can also be found in standard World Resources Institute (WRI), UN and World Bank publications. Some data on extent and degree of land degradation are available at the country level in national institutions or from non-government organizations, in donor countries, and in publications of the United Nations Development Programme (UNDP)/UNSO, UNEP, FAO and other international institutions.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency will be the Food and Agricultural Organization (FAO).

(b) Other Contributing Organizations: Other contributing organizations include: UNDP Dryland Development Centre, UNEP, Consultative Group on International Agricultural Research (CGIAR), International Fund for Agricultural Development (IFAD), World Soil Information (ISRIC).

6. REFERENCES

(a) Readings:
Bie, Stein W. 1990. *Dryland Degradation Measurement Techniques*, World Bank, Environment Work Paper No. 26, 42 p.
Dregre, H., Kassas M. and Rozanov, B. 1991 A new assessment of the world status of desertification. *Desertification Control Bulletin* 20. p. 6-18.
Dumanski, J. And Pieri, C. 1994. Comparison of available frameworks for development of land quality indicators. *Agr. Tech. Div.*, World Bank. p. 14.
Mabbutt, J.A. 1986. Desertification Indicators. *Climatic Change* 9. P. 113-122.

Mainguet, M. 1991 *Desertification: Natural Background and Human Mismanagement*. Springer-Verlag, Berlin. 306 p.
Organisation for Economic Co-operation and Development. 1998. *"Towards Sustainable Development:Environmental Indicators"*. OECD. Paris.
O Connor, J. et al. 1995. *Monitoring Environmental Progress*(Draft). World Bank. 72 p.
UNDP/UNSO and NRI. 1995. *Development of Desertification Indicators for Field Level Implementation*. 53 p.
UNEP. 1992. *World Atlas of Desertification*. Edward Arnold. London.
UNEP. 1994. United Nations Convention to Combat Desertification in those countries experiencing drought and/or desertification, particularly in Africa. Text with Annexes. 71 p.
UNEP/ISRIC. 1988. Guidelines for General Assessment of the Status of Human-induced Soil Degradation (GLASOD).
UNEP/ISRIC. 1990. World Map of the Status of Human-induced Soil Degradation: *An Explanatory Note (*GLASOD*).*
UNEP/ISRIC. 1991. *World Map of the Status of Human-induced Soil Degradation*. *(*GLASOD*).*
UNEP/ISRIC/ISSS/FAO. 1995. Global and National Soils and Terrain Digital Databases (SOTER), Procedures Manual (revised edition). ISBN 90-6672-059-X.
UNEP/Netherlands National Institute of Public Health and Environment (RIVM). 1994. An Overview of Environmental Indicators: State of the art and perspective. UNEP/EATR.94-01:RIVM/402001001. Environmental Assessment Sub-Programme, UNEP, Nairobi. ISBN 92-807-1427-9.
WB/FAO/UNDP/UNEP. In print. *Land Quality Indicators*. World Bank Discussion Papers.

(b) Internet sites:

Food and Agricultural Organization: Land Degradation Assessment in Drylands
http://lada.virtualcentre.org/pagedisplay/display.asp
FAO Webpage on Desertification:
http://www.fao.org/desertification/default.asp?lang=en
United Nations Convention to Combat Desertification. http://www.unccd.ch
United Nations Development Programme's Dryland Development Centre:
http://www.undp.org/drylands/
World Soil Information (ISRIC): http://www.isric.org/

ARABLE AND PERMANENT CROPLAND AREA		
Land	**Agriculture**	**Core indicator**

1. INDICATOR

(a) Name: Arable and Permanent Crop Land Area.

(b) Brief Definition: Arable and permanent crop land is the total of "arable land" and "land under permanent crops". Arable land is the land under temporary crops, temporary meadows for mowing or pasture, land under market and kitchen gardens and land temporarily fallow (for less than five years); and land under permanent crops is the land cultivated with crops that occupy the land for long periods and need not be replanted after each harvest.

(c) Unit of Measurement: 1000 ha.

(d) Placement in the CSD Indicator Set: Land/Agriculture.

2. POLICY RELEVANCE

(a) Purpose: This indicator shows the amount of land available for agricultural production and, *inter alia*, the cropland area available for food production. The data when related to other variables such as population, total land area, gross cropped area, fertilizer use, pesticides use, etc., can also be used to study agricultural practices of the country. In order to be useful, it must be available as a time series.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): Population growth in developing countries is driving a rapid increase in the demand for food and fibre. At the same time, rising population density in rural areas diminishes the farm size. Small farmers are forced to extend cultivation to new areas, which are fragile and not suitable for cultivation. Crop intensification, which has contributed significantly to agricultural growth in recent years, can ease the pressure on cultivating new lands but farm practices adopted for raising yields can also, in some situations, result in damaging the environment (such as when expanding into new areas). Changes in the indicator value over time or between various components may show increased or decreased pressure on agricultural land. This indicator is of value to land planning decision making.

(c) International Conventions and Agreements: Not available.

(d) International Targets/Recommended Standards: Not applicable.

(e) Linkage to Other Indicators: The indicator is primarily linked to other measures related to land resources covered in the Chapter 10: "Integrated Approach to the Planning and Management of Land Resources" and Chapter 14: "Promoting Sustainable Agriculture and Rural Development" of the Agenda 21. This includes indicators such as land use changes, share of irrigated area in the arable and permanent crop land area, *per capita* arable and permanent crop land area, etc.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: The concept of arable land and land under permanent crop is clearly defined but "arable"is often misunderstood. Arable land is the land under temporary crops (double-cropped areas are counted only once), temporary meadows for mowing or pasture, land under market and kitchen gardens and land temporarily fallow (less than five years). The abandoned land resulting from shifting cultivation is not included in this category. Data for arable land are not meant to indicate the amount of land that is potentially cultivable. Similarly land under permanent crops is the land cultivated with crops that occupy the land for long periods and need not be replanted after each harvest, such as cocoa, coffee and rubber; this category includes land under flowering shrubs, fruit trees, nut trees and vines, but excludes land under trees grown for wood or timber.

(b) Measurement Methods: The indicator is connected to the use of land for agricultural activity and is historically based on point estimates derived from data collected in periodic agricultural censuses and surveys.

(c) Limitations of the Indicator: This indicator does not reveal anything about increased productivity of agricultural land, or of the spatial variation in land quality.

(d) Status of the Methodology: Concepts and methods of measurements for the indicator are well defined and documented. However, some of the countries follow somewhat different concepts. For example, some countries take arable land as the land that is potentially cultivable, whereas the actual definition excludes permanent fallow land and land under permanent meadows and pastures. Similarly, "permanent" status for pastures, etc., is taken as ten years by some countries instead of the period of five years recommended by the Food and Agriculture Organization of the United Nations (FAO).

(e) Alternative Definitions/Indicators: Agricultural land that includes permanent pastures and meadows is a more appropriate indicator which could universally be related to data on use of fertilizers, pesticides and statistics on irrigated area (as some countries have permanently cultivated pastures).

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Data on arable land and land under permanent crops. Data on permanent pastures and fallow land also would be useful for undertaking quality check.

(b) National and International Data Availability and Sources: National data for the indicator has been estimated generally through agricultural census/surveys. However, in the case of many countries such statistical exercises are undertaken only at selected points of time. At the international level data are being produced by FAO. This data set is produced as a continuous time series where missing data for intercensal/survey periods have been derived by using data from various official and non-official sources. Thus the data for many countries are of unknown reliability.

(c) Data References: The primary data source at the international level is the FAO Statistical Yearbook released annually by the FAO and available on FAOSTAT http://faostat.fao.org

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the Food and Agriculture Organization of the United Nations (FAO). The contact point is the The Director Statistics Division, FAO; fax no. (39 06) 5705 5615.

(b) Other Contributing Organizations: None.

6. REFERENCES

(a) Readings:

FAO. 2005. World *Programme for the Census of Agriculture 2010. In*: FAO Statistical Development Series (FAO), no. 11 / FAO, Rome (Italy). Statistics Div., 160 pp.

(b) Internet site:

FAO Statistical Databases. http://faostat.fao.org/

FERTILIZER USE EFFICIENCY		
Land	**Agriculture**	

1. INDICATOR

(a) Name: Fertilizer use efficiency.

(b) Brief Definition: Extent of fertilizer use recovery in agriculture per crop unit.

(c) Unit of Measurement: kg/kg

(d) Placement in the CSD Indicator Set: Land/Agriculture.

2. POLICY RELEVANCE

(a) Purpose: The purpose of this indicator is to measure the recovery of plant nutrients from mineral fertilizer application in crop husbandry (agriculture) for resource use efficiency.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): Production increases in the next three decades are to be no smaller in absolute terms than in the past three decades, although the growth rates will be significantly lower. These future increases must be achieved starting from a resource base that is today much more stretched than in the past. The task of obtaining these production increases while minimizing adverse effects is thus more arduous than in the past. The prospect that growing shares of the increments in world production will originate in the developing countries further enhances such risks. This means that pressures will be increasingly gathering in the agro-ecological environments of the tropics, which are more fragile than the temperate ones and contain much of the world's biodiversity. In addition, in the developing countries, conventional objectives of agricultural development (food security, employment, export earnings) usually take precedence over those of sustainability and environment conservation. The preservation of the productive potential of their agriculture, however, is much more critical than it is for the industrial countries where agriculture is a small part of the economy.

Given scarcities of suitable agricultural land in several developing countries, there is no escape from the necessity for a good part of the required production increases to come by extracting more output from each ha cultivated. That is, agriculture will be becoming ever more intensive. Obviously, what is required is intensification that can keep threats to the resource base and the wider environment within bounds not threatening the sustainability of the system. This indicator shows the potential environmental pressure from inappropriate fertilizer application. Intensive fertilizer application is linked to nutrient losses that may lead to eutrophication of water bodies, soil acidification, and potential of contamination of water supply with nitrates. The actual environmental effects will depend on the adoption of nutrient losses reducing commensurate with soil conditions and crop yields under prevailing meteorological conditions.

(c) **International Conventions and Agreements:** Not available.

(d) **International Targets/Recommended Standards:** Market forces drive the adoption of efficient fertilizer nutrient practices. Targets should be based on national situations.

(e) **Linkages to Other Indicators:** This indicator is closely linked to others in the agricultural, water (nutrient loads in ground water, surface water bodies and coastal aquatic ecologies), and atmospheric groups, such as, algae index, and emissions of greenhouse gases.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: The concepts are available. Data on the quantities of fertilizers used are converted into the three basic nutrient components and aggregated. The three components are nitrogen (N), phosphorous (P_20_5), and potassium (K_20). Chemical composition of crops and their by-products are standardized. However, due to the limitations discussed in section 4(d) below, this indicator should be regarded as interim for sustainable development purposes.

(b) Measurement Methods: Data on fertilizers and yields are compiled from FAO statistics. Data for developing countries generally refer to domestic disappearance based on imported products. The derived figures in terms of nutrient application are then divided by the nutrient contents removed by harvested crops and their by-products.

(c) Limitations of the Indicator: Environmental impacts caused by leaching and volatilization of fertilizer nutrients depend not only on the quantity applied, but also on the condition of the agro-ecosystem, cropping patterns, and on farm management practices. In addition, this indicator does not include organic fertilizer from manure and crop residues. The indicator assumes even distribution of crop-fertilizer application in a country.

(d) Status of the Methodology: Described and applied in FAO: Agriculture, Towards 2015-2030.

(e) Alternative Definitions/Indicators: A more relevant and sophisticated indicator focuses on *nutrient balance* to reflect both inputs and outputs associated with all agricultural practices. This addresses the critical issue of surplus or deficiency of nutrients in the soil and captions system losses, ceteris paribus, over a period of time.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Data on fertilizer use for N, P_20_5, and K_20; and crop yields.

(b) National and International Data Availability and Sources: Data for all countries exist at the national level only. The data are updated on a regular basis. At the international level, the Food and Agriculture Organization of the United Nations (FAO) is the primary source.

(c) Data References: see 6(a).

5. <u>AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR</u>

(a) Lead Agency: The lead agency is the Food and Agriculture Organization of the United Nations (FAO). The contact point is the Assistant Director-General, Sustainable Development Department, FAO; fax no. (39 06) 5705 3152.

(b) Other Contributing Organizations: The USDA-ERS and the Fertilizer Institute – Washington are associated with the development of this indicator.

6. <u>REFERENCES</u>

(a) Readings:

FAO. 1996. *Fertilizer use by crop, 3*. International Fertilizer Industry Association, Paris (France); International Fertilizer Development Center, Muscle Shoals, AL (USA); FAO, Rome (Italy). Statistics Division, 49 pp.

FAO. 2000. *Fertilizer requirements in 2015 and 2030*. FAO Land and Water Development Division, 29 pp

FAO. 2001. *Global estimates of gaseous emissions of NH3, NO and N2O from agricultural land*. FAO Land and Water Development Division, 66 pp

FAO. 2004. *Scaling soil nutrient balances*. FAO Fertilizer and Plant Nutrition Bulletin no.15, 132 pp.

(b) Internet sites:

FAO Statistical Databases. http://faostat.fao.org/

International Fertilizer Association. http://www.fertilizer.org/

FAO Land and Water Development Division. FAO/AGL - Land and Water On-line documents

USE OF AGRICULTURAL PESTICIDES		
Land	**Agriculture**	

1. INDICATOR

(a) Name: Use of Agricultural Pesticides.

(b) Brief Definition: Use of pesticides per unit of agricultural land area.

(c) Unit of Measurement: Pesticide use in kilograms of active ingredients per hectare of agricultural land.

(d) Placement in the CSD Indicator Set: Land/Agriculture.

2. POLICY RELEVANCE

(a) Purpose: This indicator measures the use of pesticides in agriculture.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): The challenge for agriculture is to increase food production in a sustainable way. One important aspect of this challenge is the use of agricultural pesticides which add persistent organic chemicals to ecosystems. Pesticides can be persistent, mobile, and toxic in soil, water, and air; and can have impact on humans and wildlife through the food chain. They tend to accumulate in the soil and in biota, and residues may reach surface and groundwater through leaching. Humans can be exposed to pesticides through food. Exaggerated use may result from government subsidies and/or failure of pesticide users to internalize health-related costs. The indicator is related to other agricultural intensification practices.

(c) International Conventions and Agreements: Some agricultural pesticides are banned by international trade agreements.

(d) International Targets/Recommended Standards: Not available.

(e) Linkages to Other Indicators: This indicator is closely linked to others in the agricultural area, such as fertilizer use. Use of pesticides can have wide implications for the environment, and is linked to the indicators listed under toxic chemicals and biodiversity.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: The concepts are available, however, because of the limitations discussed below in section 4(d), it should only be regarded as an interim indicator. More work is required to develop a more suitable pesticide indicator pertinent to sustainable development.

(b) Measurement Methods: Data on pesticide use are usually derived from sales or "domestic disappearance" and expressed as active ingredients. Agricultural area data are widely available. Interpretation will benefit from information on types of active ingredients in use, seasonal doses, rate of application, and variability on use for different crops and regions.

(c) Limitations of the Indicator: This indicator provides an aggregation, which ignores toxicity, mobility, and level of persistence; and spatial and application variances. It does not consider the use of pesticides outside of agriculture, which can be significant in developed countries. Data omissions and errors often occur during the transfer of the primary data to statistical authorities.

(d) Status of the Methodology: Not available.

(e) Alternative Definitions/Indicators: To meet some of the limitations expressed above in section 4(d), an indicator could be developed which would recognize the classification of pesticide into classes, ranging from less harmful to highly toxic. Such a pesticide index would show if pesticide use is becoming more sustainable or not. The interpretation value of this indicator would benefit from its application to crop types or agro-ecological zones. However, data availability does not support this in many areas.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Pesticide sales data; agricultural land area.

(b) National and International Data Availability and Sources: The land area data are readily available for most countries. However, pesticide supply-use data in metric tons are only available from international sources for selected countries and limited to the major types of pesticide. Some pesticide data are available for about 50-60 countries. The data are not regularly collected and reported, and not usually available on a sub-national basis. Some data are available on total national pesticide use from the Food and Agriculture Organization of the United Nations (FAO) and the Organisation for Economic Co-operation and Development (OECD). Eurostat maintains a database of their members' data. Landell Mills Market Research Ltd. (Bath, UK) also has data.

(c) Data References: see 6(b).

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the Food and Agriculture Organization of the United Nations (FAO). The contact point is the Assistant Director-General, Sustainable Development Department, FAO; fax no. (39 06) 5705 3152.

(b) Other Contributing Organizations: OECD, the European Union, and Landell Mills Market Research Ltd. have been involved in the development of this indicator.

6. REFERENCES

(a) Readings: Not available.

(b) Internet sites:

Food and Agriculture Organization of the United Nations (FAO). http://www.fao.org/
Organisation for Economic Co-operation and Development (OECD). http://www.oecd.org/
European Union Eurostat. http://europa.eu.int/comm/eurostat/

Landell-Mills. http://www.landell-mills.com/

AREA UNDER ORGANIC FARMING		
Land	**Agriculture**	

1. **INDICATOR**

(a) **Name:** Area under organic farming

(b) **Brief definition:** Ratio of total utilised agricultural area occupied by organic farming to total utilised agricultural area.

(c) **Unit of Measurement:** %

(d) **Placement in the CSD Indicator Set:** Land/Agriculture

2. **POLICY RELEVANCE**

(a) **Purpose:** This indicator shows the importance of organic farming at global, regional and national levels.

(b) **Relevance to Sustainable/Unsustainable Development (theme/subtheme):** A move towards organic farming has a positive impact on sustainable development, as it contributes to reducing environmental loading on soil and water resources and pressure on biodiversity. The reduction of use of pesticides, herbicides and other chemicals, combined with enhanced management of natural resources not only improve the health of ecosystems but also foster the health of animals and people and increase income generation and communities self-reliance.

(c) **International Conventions and Agreements: Codex Alimentarius Commission** Guidelines on Organically Produced Foods (GL 32 – 1999, Rev.1 – 2001); Also used as indicator in the Convention on Biological Diversity' Global Strategy for Plant Conservation, Target 12 for 2010.

(d) **International Targets/Recommended Standards**: There are no specific targets in relation to area or number of farmers.

(e) **Linkages to other indicators**: This indicator is related to the indicators "Arable and Permanent Crop Land Area", "Use of Fertilizers", "Use of Agricultural Pesticides".

3. **METHODOLOGICAL DESCRIPTION**

(a) **Underlying definitions and concepts:** The indicator is defined as the share of total utilised agricultural area occupied by organic farming. Utilised agricultural area (UAA) is the area utilised for farming, which includes all the area of arable land, permanent meadow and pasture, and land developed to permanent crops and kitchen gardens. Organic farming involves holistic production management systems, for crops and livestock, emphasising the use of management practices in preference to the use of off-farm inputs. This is accomplished by using, where possible, cultural, biological and mechanical methods in preference to fertilisers and pesticides. At EU level there is a European Action Plan for Organic Food and Farming (SEC(2004)739) and a Council Regulation EEC No. 2092/91 related to organic farming policies and methods that include also agreements with third countries concerning imports of "organic products" that comply with the EU. In USA, the National Prganic Program of USDA implements legislation on organic farming enacted by the US Congress in 1990. The Japanese Organic Standards regulate the sector and globally, there are 71 countries with organic regulations at some stage of development.

(b) **Measurement method**: The indicator refers to the evolution in the share of the organic farming area (where possible divided into fully converted and in-conversion area) in the total utilised agricultural area.

(c) **Limitations of the Indicator**: Data comparability across countries is limited as definitions on organic farming and their application differs.

(d) **Status of the Methodology:** At global level, principles, minimum standards and list of permitted substances are established by the Codex Alimentarius Commission Guidelines on Organically Produced Foods as well as by the International Basic Standards of the International Federation of Organic Agriculture Movements (IFOAM).

(e) **Alternative definitions/Indicators:** It may be possible to extend the indicator to include aquaculture and forest areas.

4. ASSESSMENT OF DATA

(a) **Data needed to Compile the Indicator:** Data on organic certified and in conversion areas, as well as data on total utilized agricultural area.

(b) **National and International Data Availability and Sources:** Certification bodies and Ministries of Agriculture and Statistical Offices are main sources at the national level. At the international level, the Foundation Ecology & Agriculture SOEL and the research Institute of Organic Agriculture FiBL, in cooperation with the International Federation of Organic Agriculture Movements (IFOAM), collect data through an annual survey. Data is available for 123 countries. FAO will include data in the future, (see www.fao.org/organicag - under Country Data

(c) **Data References:** Survey data is included in the annual IFOAM publication "World of Organic Agriculture: Statistics and Emerging Trends", see www.soel.de/oekolandbau/weltweit.html or http://www.organic-world.net/

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) **Lead Agency:** The lead agency is Eurostat (the Statistical Office of the European Communities).

(b) **Other Contributing Organizations:** The Food and Agriculture Organization of the United Nations (FAO)

6. REFERENCES

(a) **Readings:**

(b)Internet Sites:

Eurostat: http://europa.eu.int/comm/eurostat
Food and Agricultural Organization (FAO): www.fao.org/organicag
International Federation of Organic Agriculture Movements (IFOAM): www.ifoam.org
International Trade Centre (ITC): http://www.intracen.org/dbms/organics/index.asp

PROPORTION OF LAND AREA COVERED BY FORESTS		
Land	**Forests**	**Core indicator**

1. **INDICATOR**

(a) **Name:** Proportion of land area covered by forests.

(b) **Brief Definition:** The amount of forest area tracked over time. When possible, the area of primary forest should also be reported on.

(c) **Unit of Measurement:** %.

(d) **Placement in the CSD Indicator Set:** Land/Forests.

2. **POLICY RELEVANCE**

(a) **Purpose:** The purpose of the indicator is to show the area covered by the forest formations of a region/country over time.

(b) **Relevance to Sustainable/Unsustainable Development (theme/sub-theme):** Forests serve multiple environmental, socio-economic, and cultural roles in many countries. They are among the most diverse and widespread ecosystems of the world. Forests provide many significant resources and functions including wood products and non-wood products, recreational opportunities, habitat for wildlife, conservation of biological diversity, water and soil, and play a crucial role in the global carbon cycle. They support employment and traditional uses, and biodiversity. There is general concern over human impact on forest health, and the natural processes of forest growth and regeneration. Combating deforestation to maintain the production of wood and non-wood products and to preserve soils, water, air and biological diversity is explicitly considered in Agenda 21. Primary forests are usually associated with high levels of biological diversity, particularly in tropical regions. The area of primary forest is an important indicator of the status of the forest ecosystem as a whole.
A continuing and fast decreasing forest area in a country might be an alarm signal of unsustainable practices in the forestry and agricultural sector. The availability of accurate data on a country's forest area, which is a basic characteristic of its forest resources, is an essential requirement for forest policy and planning within the context of sustainable development.

(c) **International Conventions and Agreements:** Specific forest agreements include the *Non-Legally Binding Authoritative Statement of Principles for a Global Consensus on the Management, Conservation and Sustainable Development of All Types of Forests* (the Forest Principles of the United Nations Conference on Environment and Development (UNCED)); and the *International Tropical Timber Agreement.* Many other international agreements deal with forests within the context of natural resources and environment conservation, for example, the Convention on International Trade in Endangered Species (CITES), the Convention on the Conservation of Wetlands of International

Importance (Ramsar Convention), the Convention on Biological Diversity, the Convention on Climate Change and the Convention to Combat Desertification. In addition, several regional conventions cover forests.

(d) International Targets/Recommended Standards: There are no international targets or standard sets for size of forest, rate of deforestation or area of primary forest. It is, however, understood that the higher the deforestation rate is, the more critical the forestry situation is in a country/region. Several countries have set targets for the extent of their forest area, either in absolute values or as a percentage of total land area of the country. The United Nations Forum of Forests recently developed four global objectives on forests, including an objective to "reverse the loss of forest cover worldwide through sustainable forest management, including protection, restoration, afforestation and reforestation, and increase efforts to prevent forest degradation". Members agreed to work globally and nationally and to make progress toward the achievement of these objectives by 2015.

The indicator is also used to measure progress towards the Millennium Development Goal Nr. 7 (Ensure environmental sustainability) and the associated targets "Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources" and "Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss"

(e) Linkages to Other Indicators: The indicator is closely linked with several other environmental indicators, such as land use and land condition change, wood and non-wood products harvesting intensity, protected forest area, arable land, threatened species, sustainable use of natural resources in mountain areas, etc. In some countries, it will also be generally linked to some of the socio-economic indicators, such as population growth and share of natural resource industries in manufacturing.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: Definitions are available from the Food and Agriculture Organization of the United Nations (FAO) Forest Resources Assessments. The *forest area* is defined as "land spanning more than 0.5 hectares with trees higher than 5 metres and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use. In addition, the definition of *forest* exists in most countries. The comparisons of forest area over time using reference years allows the calculation of change in absolute values, and as a percentage.

The *primary forest area* is defined by the Food and Agriculture Organization of the United Nations (FAO) Forest Resources Assessments as "Naturally regenerating forest of native species, where there are no clearly visible indications of human activities and the ecological processes are not significantly disturbed".

Different land uses practices and ranges of ecological condition result in different forest types and characteristics. These differences should be recognized, especially in country comparisons.

(b) Measurement Methods: The measurement methods for forest area can be contained in national forest inventories or assessments, and the estimate is obtained by sampling ground surveys, cadastral surveys, remote sensing, or a combination of these. Since forest resources assessments are expensive and thus rarely undertaken annually, the forest area for a given reference years is estimated through inter- or extrapolation. The areas of forest and primary forest are then presented as the percentages of the land area.

(c) Limitations of the Indicator: The forest area figure alone does not give any indication of the quality of the forest, its ecosystem context, nor forest values or practices. The indicator does, for instance, not provide information on the degradation of the forest resources in a country. In addition, the total forest area in a country might remain unchanged, but this may conceal sub-national changes such as deforestation in one area compensated by plantation establishment in another area. Due to the definition used, the indicator covers a very diversified range of forests ranging from open tree savanna to very dense tropical forests.

The primary forest areas are often equated with high levels of biodiversity, but this is not always the case. In the temperate and boreal zones, for example, they can be poor in terms of number of plant and animal species, while other forest types and forests bordering agricultural areas may provide additional habitats and thus harbour more species. Nevertheless, the size of the area of primary forest is one of several important indicators of the state of forest ecosystems.

(d) Status of the Methodology: Not available.

(e) Alternative Definitions/Indicators: A further breakdown of the forest area according to forest types or characteristics may give a more detailed picture of the situation.

4. <u>ASSESSMENT OF DATA</u>

(a) Data Needed to Compile the Indicator: The total forest area of a country and area of primary forest, at different yearly intervals.

(b) National and International Data Availability and Sources: Data on the extent of forest areas are available for most countries, both at national and sub-national scales. The data are often estimates, which are not always comparable because of changes in definitions and assessment methodologies. International data are available from FAO's Global Forest Resources Assessments (FRA). These are based on national data submitted by ministries responsible for forestry and statistics.

(c) Data References: Not available.

5. <u>AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR</u>

(a) Lead Agency: The lead agency is the Food and Agriculture Organization of the United Nations (FAO). The contact point is the Assistant Director-General, Sustainable Development Department, FAO; fax no. (39 06) 5705 3152.

(b) Other Contributing Organizations: The United Nations Environment Programme (UNEP), the United Nations Forum on Forests (UNFF), the Intergovernmental Panel on Climate Change (IPCC), the Centre for International Forestry Research (CIFOR), the International Tropical Timber Organization (ITTO) and the International Union of Forest Research Organizations (IUFRO) as well as other members of the Collaborative Partnership on Forests (CPF); national agencies responsible for forestry, remote sensing and geographic survey; universities and research institutes have all be involved in a series of Expert Meetings on harmonizing forest-related definitions of relevance to the development of this indicator.

6. REFERENCES

(a) Readings:

FAO. 2007. *State of the World's Forests* (FAO). / FAO, Rome (Italy). Forestry Dept., 144 pp.

FAO. 2006. *Global Forest Resources Assessment 2005. Progress towards sustainable forest management.* FAO Forestry paper 147. / FAO, Rome (Italy). Forestry Dept., 320 pp.

(b) Internet sites:

FAO's Global Forest Resources Assessment Programme.
http://www.fao.org/forestry/fra
FAO's Statistical Databases. http://faostat.fao.org
International data provided by other institutions, for example World Resources Institute, are mostly based on the FAO Forest Resources Assessment information and data.
http://www.wri.org/
The International Tropical Timber Organization (ITTO). http://www.itto.or.jp/
The United Nations Environment Programme (UNEP). http://www.unep.org/
United Nations Forum on Forests (UNFF). http://www.un.org/esa/forests/

AREA OF FOREST UNDER SUSTAINABLE FOREST MANAGEMENT		
Land	**Forests**	

1. INDICATOR

(a) Name: Area of forest under sustainable forest management as a percent of forest area.

(b) Brief Definition: The amount of area under sustainable forest management tracked over time.

(c) Unit of Measurement: %.

(d) Placement in the CSD Indicator Set: Land/Forests.

2. POLICY RELEVANCE

(a) Purpose: The purpose of the indicator is to show the area under sustainable forest management of a region/country over time.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): Forests serve multiple environmental, socio-economic, and cultural roles in many countries. They are among the most diverse and widespread ecosystems of the world. Forests provide many significant resources and functions including wood products and non-wood products, recreational opportunities, habitat for wildlife, conservation of biological diversity, water and soil, and play a crucial role in the global carbon cycle. They support employment and traditional uses, and biodiversity. There is general concern over human impact on forest health, and the natural processes of forest growth and regeneration. Combating deforestation to maintain the production of wood and non-wood products and to preserve soils, water, air and biological diversity is explicitly considered in Agenda 21.
The areas under sustainable forest management are likely to contribute directly to sustainable development.

(c) International Conventions and Agreements: Specific forest agreements include the *Non-Legally Binding Authoritative Statement of Principles for a Global Consensus on the Management, Conservation and Sustainable Development of All Types of Forests* (the Forest Principles of the United Nations Conference on Environment and Development (UNCED)); and the *International Tropical Timber Agreement*. Many other international agreements deal with forests within the context of natural resources and environment conservation, for example, the Convention on International Trade in Endangered Species (CITES), the Convention on the Conservation of Wetlands of International Importance (Ramsar Convention), the Convention on Biological Diversity, the Convention on Climate Change and the Convention to Combat Desertification. In addition, several regional conventions cover forests.

(d) International Targets/Recommended Standards: There are no international targets/recommended standards available for area of forest under sustainable management. The United Nations Forum of Forests (UNFF) recently developed four global objectives on forests, including an objective to "reverse the loss of forest cover worldwide through sustainable forest management, including protection, restoration, afforestation and reforestation, and increase efforts to prevent forest degradation". Members agreed to work globally and nationally and to make progress toward the achievement of these objectives by 2015.

In absence of international targets/recommended standards countries are encouraged to develop a set of measurable criteria/benchmarks and process to determine the forest area under sustainable management, if possible, involving different stakeholders. The criteria are likely to differ between countries, but it is more important to have consistent time national trends than comparable data.

(e) Linkages to Other Indicators: The indicator is closely linked with several other environmental indicators, such as forest area, land use and land condition change, wood and non-wood products harvesting intensity, protected forest area, threatened species, sustainable use of natural resources in mountain areas, etc. In some countries, it will also be generally linked to some of the socio-economic indicators, such as population growth and share of natural resource industries in manufacturing.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: The underlying definitions and concepts of sustainable forest management are under development. The Food and Agriculture Organization of the United Nations (FAO) Forest Resources Assessment (FRA) will include this indicator in the next Global Forest Assessment (FRA 2010).

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: The total forest area of a country and forest area under sustainable management, at different yearly intervals.

(b) National and International Data Availability and Sources: Not available.

(c) Data References: Not available.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the Food and Agriculture Organization of the United Nations (FAO). The contact point is the Assistant Director-General, Sustainable Development Department, FAO; fax no. (39 06) 5705 3152.

(b) Other Contributing Organizations: The United Nations Environment Programme (UNEP), the United Nations Forum on Forests (UNFF), the Centre for International Forestry Research (CIFOR), the International Tropical Timber Organization

(ITTO) and the International Union of Forest Research Organizations (IUFRO) as well as other members of the Collaborative Partnership on Forests (CPF).

6. REFERENCES

(a) Readings:

ITTO. 2006. Status of Tropical Forest Management. ITTO Techincal Series No 24. ITTO (Japan), 302 pp.

(b) Internet sites:

The International Tropical Timber Organization (ITTO). http://www.itto.or.jp/
The United Nations Environment Programme (UNEP). http://www.unep.org/
The United Nations Forum on Forests. http://www.un.org/esa/forests/
The Convention on Biological Diversity. http://www.cbd.int/
The Food and Agriculture Organization of the United Nations http://www.fao.org

PERCENT OF FOREST TREES DAMAGED BY DEFOLIATION		
Land	**Forests**	

1. **INDICATOR**

(a) Name: Percent of forest trees damaged by defoliation

(b) Brief definition: Percentage of trees on forest and other wooded land in the defoliation classes 'moderate', 'severe' and 'dead'.

(c) Unit of Measurement: %

(d) Placement in the CSD Indicator Set: Land/Forests.

2. **POLICY RELEVANCE**

(a) Purpose: To provide information on the state of forest defoliation at the global, regional and national levels.

(b) Relevance to Sustainable/Unsustainable Development (theme/subtheme) : The Johannesburg plan of implementation states that "sustainable forest management of both natural and planted forests and for timber and non-timber products is essential to achieving sustainable development as well as a critical means to eradicate poverty, significantly reduce deforestation, halt the loss of forest biodiversity and land and resource degradation and improve food security and access to safe drinking water and affordable energy; in addition, it highlights the multiple benefits of both natural and planted forests and trees and contributes to the well-being of the planet and humanity".

The extent of defoliation provides an indication of the state of health of forests, and forest health is a precondition for sustainable forest management. Defoliation is influenced by a combination of climatic factors (especially drought), soil conditions, atmospheric pollution and forest pathogens and thus policies are needed which reduce the occurrence of such influencing factors, in particular air pollution.

(c) International Conventions and Agreements: Many international agreements cover the health of forests and forest ecosystems, including the *Non-Legally Binding Authoritative Statement of Principles for a Global Consensus on the Management, Conservation and Sustainable Development of All Types of Forests* (the Forest Principles of the United Nations Conference on Environment and Development (UNCED)); the *International Tropical Timber Agreement,*and a number of Resolutions of the Ministerial Conference on the Protection of Forest in Europe (MCPFE). Other international agreements deal with forests within the context of natural resources and environmental conservation, for example, the Convention on International Trade in Endangered Species (CITES), the Convention on the Conservation of Wetlands of International Importance (Ramsar Convention), the Convention on Biological Diversity, the Convention on Climate Change and the Convention to Combat Desertification.

In addition, due to the growing concerns of possible adverse effects of air pollution on forests, several regional conventions cover forest health, in particular the Convention on Long-Range Transboundary Air Pollution of the United Nations Economic Commission for Europe. Under this convention, ICP-Forests (International Cooperative Programme on Assessment and Monitoring of Air Pollution Effects on Forests) monitors the health of European forest trees, forest growth and associated variables such as soil chemistry, air quality, atmospheric deposition and meteorological conditions.

The indicator on forest defoliation was adopted by the pan-European Ministerial Conference on the Protection of Forests in Europe (MCPFE) in 2003 and reporting obligations exist for UNECE/FAO and MCPFE

(d) **International Targets/Recommended Standards**: As defined in the Convention on Long-Range Transboundary Air Pollution of the United Nations Economic Commission for Europe and its Protocols.

(e) **Linkages to other indicators**: This indicator is related to "Wood Harvesting Intensity". To the extent that air quality in urban and forest areas are related a link to "Ambient Concentration of Air Pollutants in Urban Areas" would also be expected.

3. METHODOLOGICAL DESCRIPTION

(a) **Underlying definitions and concepts:** This indicator is defined as the percentage of trees on forest and other wooded land in the defoliation classes moderate, severe and dead. Defoliation is needle or leaf loss in the assessable crown as compared with a reference tree.

(b) **Measurement method**: Forest condition is measured by an annual assessment of the crown condition of a sample of trees. To measure the spatial and temporal changes on a large scale and over a necessary period of time, a network of monitoring plots needs to be systematically arranged in nominal grid at regional or national level. The denser the network, the more reliable the estimates of course will be.

ICP-Forests classify the state of defoliation as follows:

Defoliation class	Needle/leaf loss (%)	Degree of defoliation
Class 0	Up to and including 10	none
Class 1	>10-25	slight (warning stage)
Class 2	>25-60	moderate
Class 3	>60-<100	severe
Class 4	100	dead

(c) **Limitations of the Indicator**: Monitoring requires a large amount of human resources.

(d) Status of the Methodology: The methodology has been applied and calibrated in Europe over many years and is in regular use by ICP-Forests

(e) Alternative definitions/Indicators: None.

4. ASSESSMENT OF DATA

(a) Data needed to Compile the Indicator: Annual monitoring of number of trees per defoliation class.

(b) National and International Data Availability and Sources: ICP-Forests collect data through the so-called Level I network surveys, which covers the main forests in Europe with approximately 6 000 monitoring plots arranged in a 16 x 16 km grid.

(c) Data References: Available from ICP-Forests

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is Eurostat (the Statistical Office of the European Communities).

(b) Other Contributing Organizations:

6. REFERENCES

(a) Readings: *Manual on methods and criteria for harmonized sampling, assessment, monitoring and analysis of the effects of air pollution on forests,* United Nations Economic Commission for Europe Convention on long-range transboundary air pollution International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests (available at http://www.icp-forests.org)

(b) Internet Sites:
http://europa.eu.int/comm/eurostat;
http://www.icp-forests.org

PERCENTAGE OF TOTAL POPULATION LIVING IN COASTAL AREAS		
Oceans, Seas and Coasts	**Coastal Zone**	**Core indicator**

1. INDICATOR

(a) Name: Percentage of Total Population Living in Coastal Areas.

(b) Brief Definition: Percentage of total population living within 100 kilometers of the coastline. A country might also consider percentage of population in the low elevation coastal zone (<10 meters elevation) or percentage of population in river deltas. See methodology for more information on defining the coastal zone.

(c) Unit of Measurement: %.

(d) Placement in the CSD Indicator Set: Ocean, Seas and Coasts/Coastal Zone.

2. POLICY RELEVANCE

(a) Purpose: This indicator serves two purposes. It quantifies an important driver of coastal ecosystem pressure, and it also quantifies an important component of vulnerability to sea-level rise and other coastal hazards.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): Because of the economic benefits that accrue from access to ocean navigation, coastal fisheries, tourism and recreation, human settlements are often more concentrated in the coastal zone than elsewhere. Presently about 40% of the world's population lives within 100 kilometers of the coast. As population density and economic activity in the coastal zone increases, pressures on coastal ecosystems increase. Among the most important pressures are habitat conversion, land cover change, pollutant loads, and introduction of invasive species. These pressures can lead to loss of biodiversity, coral reef bleaching, new diseases among organisms, hypoxia, harmful algal blooms, siltation, reduced water quality, and a threat to human health through toxins in fish and shellfish and pathogens such as cholera and hepatitis A residing in polluted water.
Finally, it is important to recognize that a high population concentration in the low-elevation coastal zone (defined as less than 10 meters elevation) increases a country's vulnerability to sea-level rise and other coastal hazards such as storm surges.

(c) International Conventions and Agreements: The Millennium Ecosystem Assessment identified a number of international agreements relevant to coastal zone management, including the following:

- United Nations Convention on the Law of the Sea
- UN Regional Seas and Action Plans
- Global Programme of Action for the Protection of the Marine Environment from Land-based Activities

- Jakarta Mandate on the Conservation and Sustainable Use of Marine and Coast Biological Diversity
- Ramsar Convention on Wetlands of International Importance
- Chapter 17 of Agenda 21
- Paragraph 29 of the World Summit on Sustainable Development Plan of Implementation

In addition, there are 76 international coastal management plans in place which are relevant.

The conservation of biological diversity and the sustainable use of its components are among the primary objectives of the Convention on Biological Diversity (CBD). This indicator is of particular relevance to several articles of the CBD, e.g.: Article 6 - General measures for conservation and sustainable use; Article 7 - Identification and monitoring.

(d) International Targets/Recommended Standards: None.

(e) Linkages to Other Indicators: Many of the CSD core environmental indicators can be linked to this one, particularly those relating to urbanization, biodiversity, agriculture, fisheries, algae concentration, and fresh water quality. A directly linked social indicator is the population growth rate. It also may have implications for economic performance and GDP per capita.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: The coastal zone can be defined in different ways depending on the focus of interest and the availability of data. Typically a combination of distance-to-coast and elevation data is used. The Millennium Ecosystem Assessment used 100 kilometers from the coast as the distance threshold and 50 meters as the elevation threshold, choosing whichever was closer to the sea. McGranahan, Balk and Anderson (2006 and 2007) use 10 meters elevation contiguous with the coast and no distance threshold; in most places this delineated an area closer than 100km from the sea, though in some areas it extended farther. In general distance-based measures are best suited for indicators used to denote coastal pressures, while elevation-based measures are best suited for indicators used to denote hazard vulnerability.

Another approach would be to assess the population size or percentage of population residing in delta areas, which are important areas at the land-ocean interface.

(b) Measurement Methods: To measure the percent of total population living in the coastal zone two underlying pieces of information are required: spatially disaggregated data on a country's population distribution and information on the spatial extent of the coastal zone.

A Geographic Information System (GIS) should be used to measure this indicator. Many different types of free and proprietary GIS packages exist. Using a GIS, the percent population in the coastal zone can be calculated in three steps.

i. To measure the population in the coastal zone, the population data of a country needs to be disaggregated such that the population within the zone can be distinguished from the population in the rest of the country. Censuses usually offer population data disaggregated sub-nationally by administrative units, such as regions and districts. The smaller the geographic area covered by each unit, the better the precision can be in measuring where people live within the country.

If a country's census administrative units line up with the coastal zone, the population from these units can be summed to estimate the population of the zone. It is far more likely, however, that the geographic administrative units will not match the area of the coastal zone exactly. In these cases, creating a gridded surface of population can provide an estimate of the population in the zone. The vector layer of administrative units with associated population can be converted into a raster layer made up of grid cells of an assigned size (e.g., 30 arc-seconds which equates to an approximately 1 km grid at the equator). The population of an administrative unit is distributed evenly among the grid cells within that unit. On the edges, where a grid cell is split by two or more units, a proportional allocation method can be used to assign population to the grid cell based on the area of each unit that falls within the cell. Country's wishing to skip this step may use one of three ready made gridded population datasets – Gridded Population of the World (GPW), Global Rural-Urban Mapping Project (GRUMP), or Landscan – which are described in greater detail, along with other useful data sets, in Section 4.

ii. Once the population data are gridded, a suitable map of the coastline needs to be selected and the spatial extent of the coastal zone needs to be delineated. Ideally the population and coastline data sets will have matching coastlines. If not, the next paragraph describes a possible remedy. Here we illustrate the separate methods required for the three different measures of the coastal zone.

100 kilometer buffer: To calculate the 100 kilometer coastal buffer of the land area, the data must be projected into an equidistant map projection appropriate for the country. Due to the curvature of the Earth, this will be different for each country. The map projection used to create the 100 kilometer buffer for Iceland won't create an accurate 100 kilometer buffer for India. An equidistant map projection will minimize distortion so that distance calculations can be measured with relative accuracy (examples include Polar Azimuthal Equidistant Projection and Equidistant Cylindrical Projection). Using such an equidistant map projection, the next step is to calculate an inland buffer of 100 kilometers. Subsequently, convert the buffered layer into the same map projection as the population data. If the coastlines of your population and land area layers do not exactly match, one can also include in the 100 kilometer buffer a thin band extending from the coastline into the ocean.

Low Elevation Coastal Zone (LECZ): To calculate the land area contiguous with the coast that is 10 meters or less in elevation, the following data are required: a gridded elevation data set, a gridded representation of the country's land area, and coastal boundary file (i.e., coastline). The gridded elevation data can be used in conjunction with the gridded country land area (in the same projection and resolution) to create a mask of land area where the elevation is 10 meters or less. This mask can be converted to a vector layer. Using the low-elevation mask along with an vector coverage of the coastline, all of the polygons in the mask that are contiguous with the coast can be selected (thereby removing from consideration inland areas less than 10 meters in elevation). These selected polygons represent the LECZ and can be converted back into a grid to be used with the population grid.

iii. Once the population data are gridded and a coastal zone mask is created, both in the same projection and resolution, the coastal zone can be overlaid on the population grid and the GIS can be utilized to sum the population within that mask. This population can then be divided by the total country population (using the same data source as the gridded population data) and multiplied by 100 to obtain the percentage of the country's population in the coastal zone.

(c) Limitations of the Indicator: This indicator can be used in monitoring processes that affect coastal ecosystem pressures and coastal hazard vulnerabilities, but it does directly quantify such pressures and vulnerabilities. Quantification of pressures requires knowledge of the total population, not just percentages, and is further enhanced by information on environmentally significant human activities (e.g., industry, tourism, agriculture). In a similar vein, quantification of vulnerability requires information on the exposure to coastal hazards, the nature of the built environment, and measures of phenomena that affect coping capacity and resilience.

(d) Status of the Methodology: The methodology is described in section (b) above. Additionally, there are pre-prepared national-level data for two versions of this indicator available at: http://sedac.ciesin.columbia.edu/es/csdcoastal.html.

(e) Alternative Definitions/Indicators: Population density, rather than percentage of a country's population, provides more direct measurement of the pressures and impacts of human development in the coastal zone. Percentage of the coastal population that is urban can provide a proxy for how densely populated the area is. An alternate way to measure the relative human impact along the coastal zone is the length (or percentage) of the coastline that is built up. Two examples of data sources to provide this information are the Global Rural Urban Mapping Project (GRUMP) urban mask, or a land cover data set that includes urban areas as one of the land cover types (e.g., IGBP's Land Cover Characterization). The length of the coastline that is urban or 'built up' can then be divided by the total length of the coastline. Built up areas often result in the reduction and potential elimination of coastal ecosystems many of which provide services, such as buffering from coastal storms, and serve as important habitat for flora and fauna at the land-sea interface. In addition, the impermeable surfaces characterized by many built up areas reduce ground infiltration of rainfall, resulting in storm water discharge directly into coastal waters. The most appropriate coastal zone delineation to capture the direct consequences of built up areas might be an "immediate" coastal zone of 10 kilometers inland from the coast.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: The two pieces of spatial data needed to measure this indicator are gridded population and a coastal zone delineation (or mask). Countries may have the most detailed and accurate population and coastal zone data available for their own country. Where these data are not available, or where data incompatibilities make integration difficult, there are freely-available global datasets that can be used. For example, the Socioeconomic Data and Applications Center (SEDAC) of the Center for International Earth Science Information Network at Columbia University

(CIESIN) has developed a digital database of global population distribution in 1990, 1995, and 2000. Known as Gridded Population of the World v.3 (GPW), this data set is available at a 2.5 arc-minute grid (equivalent to 21 km^2 at the equator), and its coastline closely matches the widely available coastline from the Digital Chart of the World (DCW). The Global Rural-Urban Mapping Project (GRUMP) is a related product that delineates urban areas using a variety of information sources (night-time lights, Digital Chart of the World, tactical pilotage charts, and classified satellite data), reallocating the population distribution of GPW to reflect higher densities in urban areas. GRUMP includes three data products: (1) a gridded population product at 30 arc-second resolution (1 km^2 at the equator), (2) an urban extents grid (or urban mask), and (3) a global points data set of all urban areas with populations greater than 1,000 inhabitants. The Oak Ridge National Laboratory's Landscan population distribution map represents a modelled distribution of the world's population on a 30 arc-second grid, starting with census data then using a number of parameters such as road networks, night-time lights, elevation, and slope to allocate population to grid cells. Users should be cautioned that because land cover and elevation are among the parameters that drive the population allocation model, Landscan may be less appropriate as a monitoring tool than population data sets that do not assume a particular relationship between population and these factors.
Several data sets useful for compiling the coastal zone delineation are listed in section (c) below.

(b) National and International Data Availability and Sources: The primary sources for gridded population distributions at global, continental and country levels are the Socioeconomic Data and Applications Center (SEDAC) and the Oak Ridge National Laboratory (ORNL). Data sources for coastal zone delineation are listed in section (c) below.

(c) Data References: The Web site for the Gridded Population of the World and the Global Rural-Urban Mapping Project is: http://sedac.ciesin.columbia.edu/gpw/. This Web site also has a grid identifying country areas (i.e., national identifier grid) on a 2.5 minute and a one kilometre resolution. Landsan can be downloaded from http://www.ornl.gov/sci/landscan/. The Digital Chart of the World coastline can either be acquired on an individual country basis from the Pennsylvania State University Map Library web site, http://www.maproom.psu.edu/dcw/, or by purchasing a CD-ROM from ESRI (http://www.esri.com). The Millennium Ecosystem Assessment has also produced a coastal boundary data set. For elevation data, Shuttle Radar Topography Mission (SRTM) 30 arc-second data can be obtained from http://www2.jpl.nasa.gov/srtm/, and GTOPO 30 arc-second digital elevation model data can be obtained from
http://edc.usgs.gov/products/elevation/gtopo30/gtopo30.html.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: Center for International Earth Science Information Network at Columbia University (CIESIN), Palisades, NY, USA. The focal point is Mr. Marc Levy. tel. No. (+1-845) 365-8988, email ciesin.info@ciesin.columbia.edu.

(b) Other Contributing Organisations: the United Nations Environment Programme (UNEP) Global Programme of Action for the Protection of the Marine Environment From Land-based Activities (GPA) Coordination Office. The contact point is the GPA Coordination Office, tel. no. (+31 70) 311.4467 , fax no. (+31 70) 345.6648 and e-mail gpa@unep.nl.

6. REFERENCES

Agardy, Tundi and Jacqueline Alder (Coordinating Lead Authors), 2005, "Coastal Systems," chapter 19 in Rashin Hassan, Robert Scholes, and Neville Ash, eds, *Ecosystems and Human Well-Being: Current State and Trends, Volume 1*, Washington, DC: Island Press.

Agenda 21. http://www.un.org/esa/sustdev/agenda21.htm

Center for International Earth Science Information Network (CIESIN) of Columbia University. 2006. *CSD Coastal Population Indicator: Data and Methodology Page*. http://sedac.ciesin.columbia.edu/es/csdcoastal.html

IPCC Projected Changes in Global Sea-Level.
http://www.grida.no/climate/vital/24.htm

OSPAR Commission for international cooperation on the protection of the marine environment of the North-East Atlantic. http://www.ospar.org/

McGranahan, Gordon, Deborah Balk and Bridget Anderson. 2007. The rising tide: assessing the risks of climate change and human settlements in low elevation coastal zones. *Environment & Urbanization* 19(1): 17-37 (2007).

McGranahan, Gordon, Deborah Balk and Bridget Anderson. 2006. "Low Coastal Zone Settlement," *Tiempo* 59, 23-26.

The International Oceanographic Commission (IOC) Harmful Algal Bloom Programme.
http://ioc.unesco.org/hab/intro.htm

UNDP, UNEP, World Bank, World Resources Institute, 2000. *World Resources 2000-2001: People and Ecosystems: The Fraying Web of Life.* World Resources Institute, Washington, DC. http://www.wri.org/wr2000/

UNEP. 2006. *Marine and coastal ecosystems and human wellbeing: A synthesis report based on the findings of the Millennium Ecosystem Assessment*. UNEP. 76pp.
http://www.maweb.org//en/Products.Synthesis.aspx

UNEP Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities. http://www.gpa.unep.org/

UNEP's Caribbean Environment Programme. http://www.cep.unep.org/

UNEP's Mediterranean Programme Action Plan. http://www.unepmap.org/

USGS Sea Level and Climate Change. http://pubs.usgs.gov/fs/fs2-00/

BATHING WATER QUALITY		
Ocean, Seas and Coasts	**Coastal Zone**	

1. INDICATOR

(a) Name: Bathing Water Quality.

(b) Brief Definition: The indicator describes the changes over time in the quality of designated bathing waters (inland and marine) in terms of compliance with standards for microbiological parameters (total coliforms and faecal coliforms) and physicochemical parameters (mineral oils, surface-active substances and phenols).

(c) Unit of Measurement: The data are expressed in terms of percentage of inland and marine water bathing waters complying with the mandatory standards and guide levels for microbiological and physicochemical parameters.

(d) Placement in the CSD Indicator Set: Ocean, Seas and Coasts/Coastal Zone.

2. POLICY RELEVANCE

(a) Purpose: Particulate organic pollutants discharged into coastal waters around outlets of insufficiently treated wastewater lead to an excess of dissolved oxygen consumption, resulting in high environmental degradation of coastal waters.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): Microbiological pollution of coastal waters and substances produced by pathogenic micro-organisms in the sea can cause diseases in humans and marine animals. The main impact on human health concerns gastric-intestinal infections from seafood, including salmonella, gastro-enteritis and hepatitis. Some marine animal diseases have been reported, related to infection by a mobilivirus (fish and sponge diseases, the deaths of dolphins in the 1990s). Human enteric viruses are the most likely pathogens responsible for waterborne diseases from recreational water use but detection methods are complex and costly for routine monitoring, and so the main parameters analysed for compliance with the Directive are indicator organisms; total and faecal coliforms. Compliance with the mandatory standards and guide levels for these indicator organisms does not therefore guarantee that there is no risk to human health.

(c) International Conventions and Agreements:

The EU directive on the quality of bathing waters (76/160/EEC) aims to ensure that coastal and inland waters commonly used for bathing do not contain bacteriological or chemical contamination at levels that could pose a health risk. Adopted in 1976, the directive is one of the EU's oldest environmental laws and has been the driving force behind a steady improvement in bathing water quality around Europe, as shown by the Commission's annual bathing water reports published every spring.

Following agreement between the Council and European Parliament in October 2006, a revised bathing water directive has been adopted which updates and simplifies the current standards. This new EU Directive on bathing water (2006/7/EC), concerning the management of bathing water quality and repealing Directive 76/160/EEC, will be implemented progressively.

Each of the Regional Seas has its own convention or action plan; details of these can be found at http://www.gpa.unep.org/.

(d) International Targets/Recommended Standards:

Standards from EU Directive on bathing water (2006/7/EC), EEC Directive on quality of bathing waters 76/160/EEC and criteria of the World Health Organization (WHO).

(e) Linkages to Other Indicators: This indicator can be linked to many of the CSD core indicators, especially those relating to coastal population and coastal development, fisheries, biodiversity, fresh water quality and fertiliser use. It also has significant implications for human and animal health.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: The bathing water are classified as following:

- C(I): percentage of bathing areas sufficiently sampled which comply with mandatory values
- C(G): percentage of bathing areas sufficiently sampled which comply with both guide values and mandatory values
- NF: percentage or number of bathing areas not sufficiently sampled
- NB: percentage or number of bathing areas where bathing was prohibited throughout the bathing season
- NC: percentage or number of bathing areas that do not comply with mandatory values
- NS: percentage or number of bathing areas not sampled or for which no data are available
- DY percentage or number of bathing areas de-listed during this bathing season (year) with respect to the previous one
- DA percentage or number of bathing areas de-listed during previous bathing seasons (accumulated)

(b) Measurement Methods: Guidelines have been produced by WHO : "Monitoring bathing waters: A practical guide to the design and implementation of assessments and monitoring programmes"

(c) Limitations of the Indicator: The major constraints to the use of this indicator will be the availability of appropriate data and the consistency of sampling and measurement methods over time as well as adequate data synthesis methods. The measurement

(d) Status of the Methodology:

(e) Alternative Definitions/Indicators:

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Standardised quantitative data on bathing water quality from an appropriately distributed network of monitoring stations.

(b) National and International Data Availability and Sources: Limited data are available at the national level under the. Except in Europe, these data are not collected in standardised format.

(c) Data References: Data for the European countries are available at EEA

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the United Nations Environment Programme (UNEP)/GPA Coordination Office. The contact point is the GPA Coordination Office, tel. no. (+31 70) 311.4467 , fax no. (+31 70) 345.6648 and email gpa@unep.nl.

(b) Other Contributing Organisations: Other organisations interested in the further development of this indicator would include:

World Health Organization

UNEP/MAP : United Nations Environment Programme/ Mediterranean Action Plan
MED POL: The Programme for the Assessment and Control of Marine Pollution in the Mediterranean Region,
Blue Plan: Blue Plan Regional Activity Centre.

European Commission, Directorate-General Environment
EEA : European Environment Agency.

6. REFERENCES

(a) Readings: Monitoring bathing waters: A practical guide to the design and implementation of assessments and monitoring programmes Edited by Jamie Bartram and Gareth Rees, WHO 2000

(b) Internet sites:

http://www.who.int/water_sanitation_health/bathing/en/index.html

http://www.gpa.unep.org/
http://www.unepmap.org/
http://www.planbleu.org/

http://ec.europa.eu/water/water-bathing/index_en.html
http://www.eea.europa.eu/

http://www.un.org/esa/sustdev/agenda21.htm

PROPORTION OF FISH STOCKS WITHIN THEIR SAFE BIOLOGICAL LIMITS		
Oceans, Seas and Coasts	**Fisheries**	**Core indicator**

1. INDICATOR

(a) Name: Proportion of fish stocks within their safe biological limits

(b) Brief definition: Percentage of fish stocks exploited within their level of maximum biological productivity

(c) Unit of Measurement: %

(d) Placement in the CSD Indicator Set: Ocean, Seas and Coasts/Fisheries.

2. POLICY RELEVANCE

(a) Purpose: To provide information on the state of exploitation of fishery resources at the global, regional and national levels.

(b) Relevance to Sustainable/Unsustainable Development (theme/subtheme) : This indicator will provide an important reference for policy making related to sustainable management of fish stocks at the national level, regionally (e.g. regional fisheries bodies and LMEs) and at the global level (COFI and other relevant international bodies such as the CBD).

(c) International Conventions and Agreements: The Food and Agriculture Organization of the United Nations (FAO) Code of Conduct for Responsible Fisheries and the UN Fish Stock Agreement.

(d) International Targets/Recommended Standards: With the aim of maximizing sustainable production from capture fisheries, and therefore contributing to increased food security, the target for this indicator should be a value close to 100% fish stocks exploited within their safe biological limits.

The indicator is included in the revised MDG monitoring framework, presented in 2007 to the General Assembly, to monitor the Millennium Development Goal Nr. 7 (Ensure environmental sustainability) and the associated targets “Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources” and “Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss”.

(e) Linkages to other indicators: This indicator is related to “Annual catch by major species”.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying definitions and concepts: The indicator will be based on formal national stock assessments that relate catches to the fishing effort deployed. The usefulness of this indicator should be seen in the context of monitoring trends at the national, regional and global levels, by international institutions. The indicator will be less useful for fisheries management at the national level, where a set of more specific indicators will be needed.

(b) Measurement method: The indicator will be based on formal stock assessments to assess the exploitation state of the world's main resources. Classification will follow FAO/FIRM's procedure to classify the state of the stocks (based on descriptors such as Underexploited, Moderately exploited, Fully exploited, Overexploited, Depleted and Recovering). This classification will allow calculation of the " % stocks within safe biological limits" indicator.

(c) Limitations of the Indicator: While fishing effort is a major variable influencing population abundance, it is widely recognized that other factors, such as environmental fluctuations and climatic change, predator-prey interactions and habitat modification may also play an important role.

(d) Status of the Methodology: This methodology is already used by FAO for describing status and trends in capture fisheries in the biannual publication SOFIA and for regular reviews of the state of the world marine fisheries .

(e) Alternative definitions/Indicators:

4. ASSESSMENT OF DATA

(a) Data needed to Compile the Indicator: Time series of catch and effort data for each exploited stock, including at least 10 years of data points

(b) National and International Data Availability and Sources: Countries usually collect catch and effort statistics as part of their monitoring responsibility. As regards shared stocks, usually regional fisheries bodies, through their scientific committees, collate data on shared resources to synoptically cover each stock.

(c) Data References: International and regional data is included in the bi-annual FAO publication "State of World Fisheries and Agriculture (SOFIA)"

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The Food and Agriculture Organization of the United Nations (FAO)

(b) Other Contributing Organizations: Not available

6. REFERENCES

(a) Readings:

Garcia, S., DeLeiva, I. and Grainger, R. (2005). Global trends in the State of Marine Fisheries Resources 1974-2004. In: FAO. Review of the State of World Marine Fishery Resources. FAO Fisheries Technical Paper. No. 457. pp 10-14.

(b) Internet Sites:

http://www.fao.org/fi/default.asp

PROPORTION OF MARINE AREAS PROTECTED		
Ocean, seas and coasts	**Marine environment**	**Core indicator**

1. INDICATOR

(a) Name: Proportion of marine areas protected.

(b) Brief Definition: This indicator is expressed as percentage protected of total surface area of national waters.
The marine area indicator can be expressed by different zones under national jurisdiction (e.g. territorial waters, exclusive economic zones etc.). It may also be possible and desirable to disaggregate the indicator further, for example by protected area category (i.e. using the IUCN protected area management categorisation system).
This indicator can also be separately expressed as the percentage protected of marine ecological region

(c) Unit of Measurement: % of total marine area. / % of marine ecological region

(d) Placement in the CSD Indicator Set: Ocean, seas and coasts/Marine environment and Biodiversity / Ecosystems.

2. POLICY RELEVANCE

(a) Purpose: The indicator represents the extent to which marine areas important for conserving biodiversity, cultural heritage, scientific research (including baseline monitoring), recreation, natural resource maintenance, and other values, are protected from incompatible uses. It shows how much of each major ecosystem and habitat is dedicated to maintaining its diversity and integrity.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): Sustainable development depends on a sound environment, which in turn depends on ecosystem diversity. Protected areas are essential for maintaining ecosystem diversity, in conjunction with management of human impacts on the environment.

(c) International Conventions and Agreements: Marine protected areas are increasingly presented as important spatial management tools to reduce or prevent ongoing declines in marine biodiversity and subsequently are key among the suite of biodiversity indicators that are being elaborated for several international targets and processes, including those under the following global processes and agreements:

- the Millennium Development Goals, and
- the World Summit on Sustainable Development (WSSD).

Marine protected areas indicators also demonstrate progress on Article 8 (a) of the Convention on Biological Diversity (CBD).
The CBD's *Programme of Work on Protected Areas* has set goals for creation of protected area networks, for example: "By … 2012 in the marine area, a global network of

comprehensive, representative and effectively managed national and regional protected area system is established as a contribution to (i) the goal of the Strategic Plan of the Convention and the World Summit on Sustainable Development of achieving a significant reduction in the rate of biodiversity loss by 2010; (ii) the Millennium Development Goals – particularly Goal 7 on ensuring environmental sustainability; and (iii) the Global Strategy for Plant Conservation."[i]

(d) International Targets/Recommended Standards:
The international community has committed "to achieve a significant reduction of the current rate of biodiversity loss at the global, regional, and national level as a contribution to poverty alleviation and to the benefit of all life on earth by 2010". This "2010 Target" was formally adopted by governments at the 6th Conference of the Parties of the **CBD** in 2002, and endorsed later that year at the **WSSD**. The 2010 target, and the targets relating to the general objectives of the CBD, relate specifically to Parties to the Convention on Biological Diversity but could also be used as a guide for non-Party states. The CBD established a target that 'at least 10% of each of the world's ecological regions [including marine and coastal] be effectively conserved [by 2010]'.
The revised MDG monitoring framework, presented in 2007 to the General Assembly, includes the new target "Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss" under MDG 7 (Ensure environmental sustainability), in addition to the original target "Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources".
The **Vth World Parks Congress** in 2003 was made to "[g]reatly increase the marine and coastal area managed in marine protected areas by 2012 …. includ[ing] strictly protected areas that amount to at least 20-30% of each habitat"[9]

(e) Linkages to Other Indicators: This indicator is linked to other indicators which are related to, *inter alia,* marine habitats and marine resource use. These would include; Area of Selected Key Ecosystems, Ratification of Global Agreements, etc.
This indicator is also linked to indicators of species diversity and environmental quality. It would be complemented by an indicator measuring trends in the management effectiveness of protected areas.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts:
A **marine protected area** is defined as: *'Any area of intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment'* (IUCN, 1988).
Only '**designated'** protected areas are used in this calculation. In other words no 'Proposed' sites are included in the analysis. The status 'Designated' is attributed to a protected area when the management authority that according to national legislation or common practice (e.g. by means of an executive decree or similar) officially endorses a document of designation.
The marine area indicator can be disaggregated by country. It may also be desirable to disaggregate the indicator further, for example by different **zones under national**

jurisdiction e.g. territorial waters and exclusive economic zones[30] (where declared), and by protected area category (i.e. using the IUCN protected area management category system).

The World Conservation Union (IUCN) defines six **management categories** of protected areas.

I. Protected area managed mainly for science of wilderness protection (e.g. Strict Nature Reserve/Wilderness Area)

II. Protected area managed mainly for ecosystem protection and recreation (e.g. National Park)

III. Protected area managed mainly for conservation of specific natural features (e.g. Natural Monument)

IV. Protected area managed mainly for conservation through management intervention (e.g. Habitat/Species Management Area)

V. Protected area managed mainly for landscape/seascape protection and recreation (e.g. Protected Landscape/Seascape)

VI. Protected area managed mainly for the sustainable use of natural ecosystems (e.g. Managed Resource Protected Area)

The indicator may also be expressed as the coverage of protected areas as a percentage of marine ecological regions. Suggested ecoregional approaches, to be utilised for global and regional scale reporting, may include Large Marine Ecosystems (NOAA 2001) and the ecological regions described in the recent Marine Ecoregionalisation of the World (Spalding, M. *et al,* 2006).

At the country scale, national agencies will be encouraged to develop their own marine biogeographic classification system. It may be desirable to utilise the ecoregional boundaries[31] provide by the Marine Ecoregionalisation of the World (MEOW) approach. These units may be further resolved by the national agencies. However these ecoregions would only provide a basis for global or regional reporting if the national systems employ coherent and consistent approaches in defining national ecoregions.

The minimum size of the units varies depending on the classification system used and the size of the country (or other territory) being assessed.

(b) Measurement Methods: The indicator will be expressed as a proportion of marine ecological regions protected reported by country. Spatial analysis will be conducted through the use of GIS software for areas where spatial data exists. For protected areas with no spatial data, but where size is known and location is approximate (e.g. a centre point for the protected area is reported.), the available information will be interpreted on a case by case basis by utilizing automated routines and informed by expert opinion.

---

[30] The United Nations Convention on the Law of the Sea (UNCLOS) defines these zones in the following manner:

- Territorial Sea - The territorial sea extends from the baseline up to 12 nautical miles.
- Exclusive economic zone - From 12 to 200 nautical miles, the coastal State can declare an exclusive economic zone.

[31] The MEOW approach uses a three tiered system of progressively smaller units (from 'realms' to 'provinces', to 'ecoregions').

(c) Limitations of the Indicator: The indicator represents *de jure* not *de facto* protection. It does not indicate the quality of management or whether the areas are in fact protected from incompatible uses. It also gives a rather coarse picture of ecosystem protection. Additional detail would be needed to show the extent of disturbance of the ecosystem within each protected area, and coverage of rare or key ecological communities. Limitations to this indicator also include the lack of spatial data for many of the sites.

(d) Status of the Methodology: The methodology for combining area protected with other layers is commonly used for a variety of international reporting mechanisms.

(e) Alternative Definitions/Indicators: If a suitable ecosystem classification is not available, alternative indicators that are disaggregated by habitat may be utilized.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: A map of the ecosystems and habitats of the territory, preferably using a classification that is internationally compatible and valid for other countries and territories in the region. A map of the protected areas of the country or territory. A geo-referenced list of the protected areas, giving their sizes (area in hectares) and locations, and classifying them by the IUCN protected area management categories - see 3(a).

(b) National and International Data Availability and Sources: Major ecosystem and habitat classifications have been mapped for most regions and many countries. National classifications may not be compatible with other countries in their region, and few regional classifications are sufficiently detailed or accepted for national use. Global classifications are generally too coarse. Most countries keep statistics on protected areas, but their protected area systems may not be accurately mapped.
However, the World Database on Protected Areas (WDPA) provides the most comprehensive dataset on protected areas worldwide and is managed by UNEP-WCMC in partnership with the IUCN World Commission on Protected Areas (WCPA) and the World Database on Protected Areas Consortium. The WDPA is a fully relational database containing information on the status, environment and management of individual protected areas. This database includes information from countries, NGOs and academic institutions, international environmental conventions, etc. The WDPA enables searching of protected areas data by site name, country, and international programme or convention. It is possible to disaggregate the data in the WDPA by country and by IUCN Management Category, therefore it is suitable for this indicator. Data is currently available for over 110,000 protected areas worldwide. UNEP-WCMC provides online access to the WDPA Consortium 2006 World Database on Protected Areas web-download as part of a broad strategy to share conservation information. Statistical information produced for the WDPA 2006 CD-ROM which relate to WDPA datasets is also available in addition to information on the definitions and categorisation of protected areas worldwide.
UNEP-WCMC and IUCN also cooperate on the compilation of the periodic *United Nations List of Protected Areas*, which provides the name, IUCN protected area

management category, location, size, and year of establishment of all protected areas. This database includes information only from officially recognized national authorities.

(c) Data references: The United Nations List of Protected Areas (1993, 1997, 2003) is available as a web-based data resource. Ten editions of the List were previously printed between 1962 and 1990.
The World Database on Protected Areas is available as a web-based data resource and on CD-ROM.
In addition to supporting the production of the periodic UN List, the data in the WDPA has been used, and continues to be used, to support a number of global and regional assessments, including:

- The Convention on Biological Diversity Programme of Work on Protected Areas.
- Global Environment Outlook (ongoing)
- Global Biodiversity Outlook (ongoing)
- World Resources Report (ongoing)
- Protected area and thematic studies for the World Heritage Convention (ongoing)
- Millennium Ecosystem Assessment
- Protected areas information support for the Vth World Parks Congress (2003)
- Circumpolar Protected Areas Network (CPAN) – Strategy and Action Plan (1996)

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agencies are the UNEP World Conservation Monitoring Centre (UNEP-WCMC) and the IUCN World Commission on Protected Areas (WCPA).

(b) Other Contributing Organizations: The World Database on Protected Areas Consortium was established in 2002 to expand participation and leadership on the development of the protected areas database. The Consortium brings together a growing number of international conservation organizations that have agreed to ensure that information on protected areas is maintained on a cooperative basis and used to monitor the effectiveness of global conservation agendas. In addition to UNEP-WCMC and IUCN, consortium members include the American Museum of Natural History, BirdLife International, Conservation International, Flora and Fauna International, The Nature Conservancy, Wildlife Conservation Society, World Resources Institute, World Wildlife Fund – US, World Wide Fund for Nature (WWF International).
In addition to the Consortium's support the University of British Columbia Fisheries Centre, and specifically the Seas Around Us Project[32], in 2005 and 2006 supported a process to improve the WDPA's data holdings on marine protected areas.

6. REFERENCES

(a) Readings:
Guidelines for Protected Area Management Categories, McNeely, Jeffrey (ed.). (1993).

[32] http://www.seaaroundus.org/

Parks for Life: report of the IVth World Congress on National Parks and Protected Areas. IUCN - The World Conservation Union, Gland, Switzerland. Dinerstein, Eric, David M. Olson, et al. (1995).

United Nations. Report of the World Summit on Sustainable Development, Johannesburg, South Africa, 26 August-4th September 2002. A/CONF.199/20 (2002).

IUCN. Recommendations of the Vth IUCN World Parks Congress (2003).

CBD. Decisions adopted by the Conference of the Parties to the Convention on Biological Diversity at its seventh meeting (Decision VII/30). UNEP/CBD/COP/7/21 (2004).

National Oceanic and Atmospheric Administration, 2001. Large Marine Ecosystems. National Oceanic and Atmoshpheric Administration, Kingston, RI. For further information see http://woodsmoke.edc.uri.edu/Portal/ptk

Global coastal and marine biogeographic regionalization as a support tool for implementation of CBD programmes of work. UNEP/CBD/COP/8/INF/34. Spalding, M. et al. (2006)

CONABIO. Capital natural y bienestar social. Comisión Nacional para el Conocimiento y Uso de la Biodiversidad, México (2006)
http://www.conabio.gob.mx/2ep/images/c/c5/capital_natural_1.pdf

(b) Internet sites:

World Database on Protected Areas. http://www.unep-wcmc.org/wdpa

World Commission on Protected Areas
http://www.iucn.org/themes/wcpa/index.html

UN List of Protected Areas, 2003.
http://www.unep-wcmc.org/protected_areas/UN_list/index.htm

UN List of Protected Areas, 1997.
http://www.unep-wcmc.org/protected_areas/data/un_97_list.html

UN List of Protected Areas, 1993.
http://www.unep-wcmc.org/protected_areas/data/un_93_list.html

Convention on Biological Diversity http://www.biodiv.org/

The Millennium Development Goals http://unstats.un.org/unsd/mdg/default.aspx

The World Summit on Sustainable Development Plan of Implementation http://www.johannesburgsummit.org/

MARINE TROPHIC INDEX		
Oceans, Seas and Coasts	**Marine Environment**	

1. **INDICATOR**

(a) **Name:** Marine Trophic Index.

(b) **Brief Definition:** The marine trophic index measures the change in mean trophic level of fisheries landings by region and globally. Trophic level is defined as the position of an organism in the food chain, and ranges from a value of 1 for primary producers up to a level of 5 for marine mammals and humans.

(c) **Unit of Measurement:** None, the mean trophic level of landings is a numerical value that ranges from 1 to 5.

(d) **Placement in the CSD Indicator Set:** Oceans, Seas and Coasts/Marine Environment.

2. **POLICY RELEVANCE**

(a) **Purpose:** In addition to being an indicator of the sustainability of fisheries, the marine trophic index provides a measure of ecosystem integrity. Declining trophic levels result in shortened food chains, leaving ecosystems less able to cope with natural or human-induced change. The long term sustainability of fisheries is, in turn, directly linked to human livelihoods and well-being.

(b) **Relevance to Sustainable/Unsustainable Development (theme/sub-theme):** The majority (70.8%) of the Earth is covered by marine systems. The oceans, besides representing repositories of biodiversity, play a significant role in climate regulation, the freshwater cycle, food provisioning, and energy and cultural services, including recreation and tourism. They are also an important source of economic growth, with capture fisheries alone worth approximately 81 billion USD in 2000.
Excessive fishing is the most widespread and dominant human impact on ocean ecosystems and is a major impact on marine biodiversity. The lowered biomasses and fragmented habitats resulting from the impacts of fishing are predicted to lead to local extinctions especially among large, long-lived, slow growing species and any endemics. In addition, the capacity of component ecosystems and their embedded species to withstand stresses resulting from climate change and other human impacts is likely reduced. Through elimination of destructive fishing practices, and maintenance and restoration of fisheries stocks to sustainable levels, the loss of marine biodiversity in the oceans can be reduced.

(c) **International Conventions and Agreements:** The United Nations Convention on Law of the Sea (UNCLOS), FAO Code of Conduct for Responsible Fisheries, a variety of fisheries agreements, Regional Seas Conventions and Action Plans.

(d) International Targets/Recommended Standards: No international targets have been established for this indicator.

(e) Linkage to Other Indicators: This indicator could be linked with all the indicators related to biodiversity.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: The marine trophic index is a state indicator. The mean trophic level of landings is a numerical value. Trophic levels range from a definitional value of 1 for primary producers up to a level of 5 for marine mammals and humans.

Trophic level is defined as the position of an organism in the food chain, determined by the number of energy-transfer steps to that level. The role of fishes within ecosystems is largely a function of their size: small fish are more likely to have a vast array of predators than very large ones. On the other hand, various anatomical and physiological adaptations may lead to dietary specialization, enabling different fish species to function as herbivores, with a trophic level of 2.0, or as carnivores, with trophic levels typically ranging from 3.0 to about 4.5.

Moreover, trophic levels change during the life history of fishes. Larvae, which usually feed on herbivorous zooplankton (TL= 2.0) consequently have a trophic level of about 3.0. Subsequent growth enables the juveniles 1 to consume larger, predatory zooplankton and small fishes or benthic invertebrates; this leads to an increase in trophic level, often culminating in values around 4.5 in purely piscivorous, large fishes.

Because of the close relationship between trophic level and size, mean trophic levels reflect changes in both size composition and position in the food chain, and therefore ecological roles. Overfishing tends to lead to decline in large, high trophic level fish relative to low trophic level small fish and invertebrates. This leads to "fishing down marine food webs", where fisheries, first having removed the larger fishes at the top of various food chains, must target fishes lower and lower down, and end up targeting very small fishes and plankton.

Trophic decline, combined with decreasing biomass, leads to changes in the structure of ecosystems. Long food chains are being replaced by shorter ones, which expose top predators to strong environmentally-driven fluctuations exhibited by plankton organisms at the base of food webs. Such fluctuations were previously dampened by food webs with a variety of strong and weak links. Thus the biomass of fish species targeted by fisheries will fluctuate more widely than before, making fisheries increasingly difficult to manage and increasingly vulnerable to environmental changes, such as climate change.

It should be noted that environmental factors, such as eutrophication of coastal areas, may cause an increase in plankton-eating lower trophic level fish, particularly in semi-enclosed seas. Upwelling of nutrient-rich water may result in a similar increase in lower trophic species, as can periods of warmer water temperatures. However, environmental effects alone cannot explain the steady decline in global mean trophic levels seen in figure 1, as such effects are restricted to certain coastal areas and will therefore likely have only a relatively minor impact on the overall trend. This observation is supported by a recent study undertaken in the Celtic Sea, where a significant decline in mean trophic level of both survey catches and landings was observed, implying a substantial change in underlying structure of the Celtic Sea fish community as a result of intensive fishing, though long-term climate variability may have been a contributing factor. It is also possible to filter out these environmental effects when calculating mean trophic level trends by excluding fish and invertebrates below a certain trophic level from the calculations.

(b) Measurement Methods: Two data sets are needed to calculate the indicator: (i) catch data by taxonomic groups, and (ii) one estimate of trophic level for each of these groups.

One of the sources for (i) (catch data by taxonomic group) are the FAO, which created and maintains a global data set, available online (at www.fao.org). This data set can be used for calculating the indicator, from 1950 to the present minus 2 years, for the landings of individual countries, the landings of 18 statistical areas largely representing ocean basins, and globally. Another source of data for (i) is the online database of the Sea Around Us Project (www.seaaroundus.org), whose geo-referenced data pertain to the Exclusive Economic Zones (EEZ) of all maritime countries, to Large Marine Ecosystems (LME) and to the High Seas, outside of EEZ.

Trophic level estimates for fish, based on their diet composition, may be found in FishBase, the global online database on fish, and for invertebrates, in the Sea Around Us database. Another source are the ecosystem food web models constructed using the widely used Ecopath software (see www.ecopath.org). Stable nitrogen isotopes of stomach contents have also been used in one study.

By combining these two data sets, mean trophic levels of landings can be estimated for any of the world's country or area.

The FAO has collected data on capture fisheries from all maritime countries and analysed global trends in fisheries stocks since 1950. These data are reported in aggregated format, by 18 broad FAO regions, and present a solid basis for undertaking a global analysis of mean trophic level change.

In an effort to provide fisheries data on a finer scale, the Sea Around Us Project (SAUP) (www.seaaroundus.org) has disaggregated the FAO data into spatial cells measuring ½ a degree latitude by ½ a degree longitude. This procedure makes it possible to report landings taken with a range of statistical boundaries, including by country EEZs, large marine ecosystems, and high seas areas. In this process, the SAUP has also substituted data from regional organizations such as the International Council for the Exploration of the Sea (ICES) (www.ices.int/fish/statlant.htm), the Northwest Atlantic Fisheries Organization (NAFO) (www.nafo.ca/) and others. This provides a finer spatial catch breakdown for most of the Atlantic and the Mediterranean. Where possible, they have also added national datasets such as that from Canada's Department of Fisheries and Oceans (DFO) for Atlantic Canada. Plans are underway to include more national and smaller scale datasets in other areas as well, thus mitigating the problem of taxonomic resolution and incomplete coverage mentioned above.

(c) Limitations of the Indicator: The marine trophic index is a powerful indicator of marine ecosystem integrity and sustainability of fisheries. Its main limitations are (i) the use of catch composition data as index of relative abundance in the ecosystems, and (ii) the quality of the underlying fisheries landings or catch data. The current data quality is sufficient for global and regional level analyses. For some maritime countries, the quality of the data is low (little taxonomic resolution, failure to cover inshore fisheries), and hence the computed index is not as indicative as it could be. Note, however, that no one indicator alone can provide a comprehensive picture of the "health" of the oceans, and that such an assessment would require a number of additional data sources/indicators.

(d) Status of the Methodology:

(e) Alternative Definitions/Indicators:

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Two data sets are needed to calculate the indicator: (i) catch data by taxonomic groups, and (ii) one estimate of trophic level for each of these groups.

(b) National and International Data Availability and Sources: The marine trophic index provides a robust indicator of ecosystem integrity and the sustainability of fishing at the global and regional levels. Depending on data quality, this indicator can also be used nationally. However, in many cases, data quality may not, as of yet, be sufficient to support the undertaking of such calculations for each country. Additional improvement in fisheries catch data would be required before the indicator can be used on the national level by all countries.

(c) Data References:

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the Food and Agriculture Organization of the United Nations (FAO). The contact point is the The Director Fishery Resources Division, FAO; fax no. (39 06) 5705 XXXX.

(b) Other Contributing Organizations: None.

6. REFERENCES

(a) Readings:

FAO 2004. The State of World Fisheries and Aquaculture. FAO. Rome.

(b) Internet sites:

FAO Fisheries Department: http://www.fao.org/fi/
The State of World Fisheries and Aquaculture: http://www.fao.org/sof/sofia/
Fishery Resources Monitoring System (FIRMS): http://firms.fao.org/
Sea Around Us Project: http://www.seaaroundus.org

AREA OF CORAL REEF ECOSYSTEMS AND PERCENTAGE LIVE COVER		
Oceans, seas and coasts	**Marine environment**	

1. INDICATOR

(a) Name: Area of Coral Reef Ecosystems and Percentage Live Cover.

(b) Brief Description: This factsheet suggests an indicator that will use trends in the extant area of coral reefs (a 'key ecosystem' for many countries), and the percentage live cover of those reefs, to assess the relative effectiveness of measures for conserving coral reef biodiversity at the ecosystem level and as a tool to estimate the need for specific conservation measures to maintain the coral reef biodiversity in a country or region.

(c) Unit of Measurement: Area (km^2 or ha) of coral reefs, and the percentage live cover of those reefs.

(d) Placement in the CSD Indicator Set: Oceans, seas and coasts/Marine environment and Biodiversity / Ecosystems.

2. POLICY RELEVANCE

(a) Purpose: The indicator has the potential to illustrate the effectiveness of national measures designed to conserve biological diversity and ensure its use is sustainable, including the measures implemented in fulfilment of obligations accepted under the Convention on Biological Diversity (CBD).

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): The CBD recognises that biodiversity has its own intrinsic value and that biodiversity maintenance is essential for human life and sustainable development. Many biological resources, at gene, species and ecosystem level, are currently at risk of modification, damage or loss.

(c) International Conventions and Agreements: The conservation of biological diversity and the sustainable use of its components are among the primary objectives of the Convention on Biological Diversity. This indicator is of particular relevance to several articles of the CBD, e.g., Article 6 - General measures for conservation and sustainable use; Article 7 - Identification and monitoring; Article 8 - In-situ Conservation; and Article 10 - Sustainable use of components of biological diversity. The Convention has, in several COP decisions explicitly recognised the need for an ecosystem approach, and further formalised this position in Decision V/6 made at the fifth COP held in Nairobi in May 2000.
This indicator is relevant to many other global agreements for which the maintenance of biological diversity is important, including: Convention on the Conservation of Migratory Species of Wild Animals (Bonn); Convention on International Trade in Endangered Species (CITES); United Nations Convention on the Law of the Sea

(UNCLOSS); Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar); Convention for the Protection of the World Cultural and Natural Heritage (World Heritage Convention).
Related regional conventions and agreements include: Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention)

(d) International Targets/Recommended Standards: The international community has committed "to achieve a significant reduction of the current rate of biodiversity loss at the global, regional, and national level as a contribution to poverty alleviation and to the benefit of all life on earth by 2010". This "2010 Target" was formally adopted by governments at the 6th Conference of the Parties of the Convention on Biological Diversity in 2002, and endorsed later that year at the World Summit on Sustainable Development. Avoiding further loss of biodiversity could variously involve measures designed to maintain current levels of biodiversity, or to reverse current declining trends. Article 8 (In-situ Conservation) of the CBD, states that contracting parties shall, as far as possible and as appropriate, promote the protection of ecosystems, natural habitats and the maintenance of viable populations of species in natural surroundings.

The 2010 target and general objectives of the CBD provide targets for Parties to the Convention, but could also be used as a guide for non-Party states.

(e) Linkages to Other Indicators: This indicator has links to other environmental indicators relating to agriculture (in particular aquaculture), desertification, urbanisation, the coastal zone, fisheries water quality and species. Its trends are also linked to those in population and economic indicators.

It is closely related to the suite of indicators being implemented by the members of the 2010 Biodiversity Indicators Partnership (2010BIP; www.twentyten.net) to measure progress towards the CBD's 2010 target, and in particular to the indicator on *Trends in extent of selected biomes, ecosystems, and habitats*.

This indicator also relates to a number of the indicators that come under the "Environmental" category of the CSD Core Indicator Framework, including *Coverage of protected areas as a percentage of total area and with a breakdown by biome and habitat* and, in particular, *Area of Key Ecosystems*. The 'area of coral reefs' aspect of this indicator follows the same methodology as the latter.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: Few of the concepts and definitions are as yet clearly and consistently applied. Some important points are noted below.
'Ecosystem' refers to the plants, animals, micro-organisms and physical environment of any given place, and the complex relationships linking them into a functional system. Individual ecosystem types may be defined either according to composition in terms of life forms and species, or with respect to ecological processes such as nutrient cycling or carbon sequestration. The former is generally more straightforward for the purposes of area assessment. At present there is no standard classification of ecosystems.

'Key ecosystems' will vary on a country-by-country basis. They can in theory be defined as either those ecosystems for which it is most important to measure changes in extent, or those ecosystems for which it is possible for measure changes in extent. It will be the responsibility of countries to undertake the selection of 'key ecosystems', based on consultation to ensure regional and global interests are evaluated in addition to national priorities, and constrained by the level of detail in the data available.
Coral reefs can be classified as a 'key ecosystem' for many countries, due to one or more of the following factors (among others):

- They contain rare or locally endemic or threatened species (see the indicator on *Abundance of key species*), and in some cases will have concentrations of these species;
- Are of particularly high species richness;
- Represent rare or unusual habitat types;
- Are severely reduced in area relative to their potential original extent;
- Are under a high degree of threat;
- Are of high actual or potential economic importance.

'**Area'** refers to the spatial extent of coral reef ecosystems. This requires the definition of limits or boundaries to the ecosystem, which is difficult where similar or related ecosystems are adjacent. This is especially true if the condition or status of the ecosystem is also of concern. For example, coral reef area may remain relatively constant despite a decline in its health and function and attendant change in ecological processes. Therefore, measurement of changes in 'percentage of live cover' is suggested here as the second component of the indicator.

(b) Measurement Methods: Coral reef area and the percentage of live cover will normally be derived from mapped data. This is most efficiently done using data in electronic form and Geographic Information System (GIS) software. Increasingly, cover maps are derived from remotely sensed data, and these will be combined with biological and other ancillary information to produce ecosystem maps. Data on the percentage of live coral cover will in most cases be obtained from a combination of remote sensing data and survey data. In some cases, retrospective information may be obtained from historical data sets to provide context and longer-term trends. It is also fundamental to ensure consistency of the classification and the method of measurement, including considerations of spatial scale and resolution, over time.

(c) Limitations of the Indicator: Application of this indicator is constrained by several factors, but these can mostly be overcome if resources and personnel are available. The main factor preventing the immediate and widespread application of this indicator is the scarcity of suitable time-series of coral reef cover data. Availability of this data will vary on a country-by-country basis. The reliability of evaluating the extent and uniqueness of coral reef ecosystems depends on the detail, quality and compatibility of ecosystem classifications applied across continuous terrestrial and marine areas.
Coral reef distribution has not been mapped at an appropriate scale for many areas of high biological diversity. A structured monitoring framework using standardised classification procedures would provide one solution to this problem, but might well not meet the full range of needs for this type of data.

Data on percentage of live coral cover may in a number of cases be scarcer and less reliable than data on the area of coral reefs, since it is often difficult to distinguish live coral from dead coral using remote sensing imagery. This data will therefore require considerable amounts of field survey data.
The indicator fails to account for variation in coral reef status other than extent and percentage of live coral. For example, it does not account for other declines in reef ecosystem health and function that have not led to coral death. It will not be possible to anticipate likely future trends in coral reef ecosystem status through this indicator alone, however this may be possible if this indicator is taken in combination with othermeasures of ecosystem condition, and an indicator of trends in the protection status of coral reef ecosystems.

(d) Status of the Methodology: To be determined. No single universally accepted methodology currently exists. Assessments of ecosystem area, including coral reefs, have been carried out in a number of contexts, both globally and nationally, however the quality and coverage of these vary considerably.

(e) Alternative Definitions/Indicators: Area may not be the best indicator of ecosystem status for biodiversity preservation. Many alternatives are area-related and include measures of fragmentation and of naturalness or exposure to the impacts of human activities (UNEP-WCMC 2000), and analysis of the protection status of ecosystems (Lysenko & Henry 2000; Lysenko *et. al* 1995), particularly in areas of high conservation priority.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: This indicator requires data on the total area of coral reef, and the percentage of that which is live cover. An agreed ecosystem classification must be applied, depending upon consensus on key ecosystem types and on the type and quality of raw remotely sensed or other primary data. Supplementary data on distribution of key species, priority areas for biodiversity conservation, distribution of human population and infrastructure as well as protected areas could also be useful.

(b) National and International Data Availability and Sources: To be determined. The Global Coral Reef Monitoring Network (GCRMN) compiles data on coral reefs for a number of countries. An important limitation for this indicator is the frequency with which most data sets are updated. Data on protected areas worldwide are held by UNEP-WCMC in the World Database on Protected Areas (WDPA) and updated frequently. Useful regional and national data sets are held by WWF-US, UNEP-GRID centres, national conservation and academic institutions.

Some mechanisms exist for the international coordination of ecosystem monitoring. The International Global Observing Strategy – Partnership (IGOS-P) includes IGOL (International Global Observation of Land), and GTOS (Global Terrestrial Observing System) which includes GOFC-GOLD (Global Observation of Forest Cover and Land Dynamics), as well as those agencies and academic organizations that are leading implementation of global monitoring including the ESA (European Space Agency), the UN FAO (Food and Agriculture Organization), and several laboratories supported by NASA (US National Air and Space). All of these fall under the GEOSS framework (Global Earth Observation System and Systems).

(c) Data References: To be determined. GCRMN publishes the *Status of Coral Reefs of the World* with regular updates. UNEP-WCMC holds data on priority areas for biodiversity conservation and on coverage of some types of ecosystems (see http://www.unep-wcmc.org). Land cover data are available from Eros Data Centre (see http://edcdaac.usgs.gov/glcc/glcc.html) and from the CORINE programme (see http://www.satellus.se).

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) **Lead Agency:** There are a number of agencies leading the development of global scale indicators of trends in extent of various ecosystem or habitat types. For coral reefs the lead agency is the UNEP World Conservation Monitoring Centre (UNEP-WCMC), and the primary sources of data include the Global Coral Reef Monitoring Network. The NASA/NGO Working Group on Biodiversity also carries out relevant remote-sensing activities. This members of this Working Group include the American Museum of Natural History, NatureServe, Conservation International, Conservation Biology Institute, Smithsonian Institution, NASA, The Nature Conservancy, UNEP, Wildlife Conservation Society, and the World Wildlife Fund – US.

(b) Other Contributing Organizations: The number of other organisations and individuals with the potential to contribute data or advice, or otherwise interested in further development of this indicator is very large. At global level, they would include *inter alia*: the Secretariat of the Convention on Biological Diversity (CBD), the World Wide Fund for Nature (WWF), and IUCN – The World Conservation Union. Other concerned organisations include the Organisation for Economic Cooperation and Development (OECD), the National Institute of Public Health and the Environment (RIVM) in The Netherlands, and a very large number of governmental and non-governmental organisations, mainly in developed countries. The GCRMN is managed by the Intergovernmental Oceanographic Commission (IOC / UNESCO), UNEP, the World Conservation Union (IUCN), the World Bank, Convention on Biological Diversity, International Coral Reef Initiative (ICRI), Australian Institute of Marine Science (AIMS), and the World Fish Center.

6. REFERENCES

(a) Readings:

Groombridge, B. and Jenkins, M. D. 1994. *Assessing Biodiversity Status and Sustainability*. WCMC Biodiversity Series No. 5. World Conservation Press, Cambridge, UK.

Mittermeier, R.A., N. Myers, J.B. Thomsen, G.A.B. da Fonseca, and S. Olivieri. 1998. *Biodiversity hotspots and major tropical wilderness areas: Approaches to setting conservation priorities*. Conservation Biology 12(3):516-520.

Wilkinson, C. (Editor) 2004. *Status of Coral Reefs of the World 2004 – Volume 1.* Australian Institute of Marine Science, Townsville, Australia.

(b) Internet sites:

http://www.biodiv.org/
http://www.ramsar.org
http://www.ecnc.nl/doc/europe/legislat/bernconv.html
http://edcdaac.usgs.gov/glcc/glcc.html
http://www.satellus.se
http://www.gcrmn.org
http://www.conservation.org/Hotspots/default.htm

PROPORTION OF TOTAL WATER RESOURCES USED		
Freshwater	**Water Quantity**	**Core indicator**

1. **INDICATOR**

(a) Name: Proportion of total water resources used; also known as Total water withdrawal as percent of total renewable water resources.

(b) Brief Definition: Total annual volume of groundwater and surface water withdrawn from their sources for human use (in the agricultural, domestic and industrial sectors), expressed as a percentage of the total volume of water available annually through the hydrological cycle (total renewable water resources). The terms water resources and water use are understood as freshwater resources and freshwater use.

(c) Unit of Measurement: %.

(d) Placement in the CSD Indicator Set: Freshwater/Water Quantity.

2. **POLICY RELEVANCE**

(a) Purpose: The purpose of this indicator is to show the degree to which total renewable water resources are being exploited to meet the country's water demands. It is an important measure of a country's vulnerability to water shortages.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): The indicator can show to what extent freshwater resources are already used, and the need for adjusted supply and demand management policy. When the indicator is calculated by sector, it can reflect the extent of water resource scarcity with increasing competition and conflict between different water uses and users. Scarce water could have negative effects on sustainability constraining economic and regional development, and leading to loss of biodiversity. Sustainability assessment of changes in the indicator is linked to total renewable water resources. The indicator's variation between countries as well as in time is a function of climate, population, and economic development, as well as the economic and institutional capacity to manage water resources and demand.

(c) International Conventions and Agreements: For international water law, see reference in section 6(a) below. International water sharing agreements also exist between many countries.

(d) International Targets/Recommended Standards: No specific international target exists other than those set by international treaties between countries.
The indicator is included in the revised MDG monitoring framework, presented in 2007 to the General Assembly, to monitor the Millennium Development Goal Nr. 7 (Ensure environmental sustainability) and the associated target "Integrate the principles of

sustainable development into country policies and programmes and reverse the loss of environmental resources”.

(e) Linkages to Other Indicators: The indicator's interpretation would benefit from linkage with established water vulnerability indicators, such as freshwater resources *per capita*, measures of the country's economy, such as Gross Domestic Product (GDP) (by industry), and poverty incidence as an indicator of equity of access. The indicator also needs to be matched with population, social and economic indicators, irrigation as a percentage of arable land, and drought frequency. Interpretation will benefit from linking this indicator with groundwater reserves and unused buffer water resources.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: The *total renewable water resources* are defined as the sum of internal renewable water resources and incoming flow originating outside the country, taking into consideration the quantity of flows reserved to upstream and downstream countries through formal or informal agreements or treaties and reduction of flow due to upstream withdrawal. This gives the maximum theoretical amount of water actually available for the country. The in this definition mentioned *internal renewable water resources* is defined as the average annual flow of rivers and recharge of groundwater generated from endogenous precipitation. For total renewable water resources, no differentiation has been made between surface water and groundwater. This approach brings a number of limitations which are described below.

(b) Measurement Methods: The indicator measures total water abstractions divided by total renewable water resources.

(c) Limitations of the Indicator: This indicator has several important limitations, most of them related to the computation of *total renewable water resources*:

- Accurate and complete data are scarce.
- Local sub-national variation of water resources and water use abstractions could be considerable, and this indicator does not reflect the local or individual river basin situation.
- Seasonal variation in water resources is not reflected. There is no consideration of distribution among uses and policy options for mitigating scarcity, for example, re-allocation from agricultural to other uses
- Total renewable water resources do not consider water quality and its suitability for use.
- Since abstraction can occur from fossil groundwater (considered being non-renewable) the indicator can, in principle, be greater than 1.

http://www.iucn.org/themes/wcpa/index.html

(d) Status of the Methodology: Not available.

(e) Alternative Definitions/Indicators: The indicator could consider withdrawals and water resources at the basis of a river basin. It could also take into account the efficiency of use and economic and environmental water costs and values. The data for such calculations, however, are not readily available. For some countries, calculation of the indicator at sub-national levels would be more appropriate. The indicator could be disaggregated to show total renewable water resources, withdrawals for different users, and efficiencies for these different users.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Annual water withdrawals divided by total renewable water resources. Current water uses need to be known.

(b) National and International Data Availability and Sources: Data is available for most countries, at the national level. Data consistency is a problem in AQUASTAT (see 4(c) below) as the data are estimated by country level at various periods, they are sometimes interpolated and national data on withdrawals are sometimes biased and could be intentionally over- or underestimated.

(c) Data References: Recent data are available at the country level and recorded by the Food and Agriculture Organization (FAO) of the United Nations in AQUASTAT (http://www.fao.org/ag/aquastat/).

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the Food and Agriculture Organization of the United Nations (FAO). The contact point is the Assistant Director-General, Sustainable Development Department, FAO; fax no. (39 06) 570 53064.

(b) Other Organizations: Not available.

6. REFERENCES

(a) Readings:

Barberis, J.A. 1986. International groundwater resources law. *In*: *FAO Legislative Study* (FAO), no. 40 / Rome (Italy), FAO, 1986, 74 pp.

Caponera, D.A. 1992. *Principles of water law and administration: national and international.* Rotterdam (Netherlands), Balkema, 260 pp.

FAO. 1998. Sources of international water law. *In*: *FAO Legislative Study* (FAO), no. 65 /

FAO, Rome (Italy). Legal Office, 346 pp.

FAO. 2003. Review of world water resources by country. *Water Report 23*. FAO, Rome (Italy). Land and Water Development Division, 110 pp.

Mar del Plata 1977, Dublin ICDE 1992. International Water Law. Helsinki Rules on Use of Waters of International Rivers 1966 and Seoul Rules, International Groundwaters 1986.

Shiklomanov, I.A. 1990. Global water resources. *In*: *Nature and Resources* (UNESCO), v. 26(3) p. 34-43.

Shiklomanov, I.A. and Rodda, J.C. 2004. World water resources at the beginning of the Twenty-First Century. *International Hydrology Series*. UNESCO and Cambridge University Press.

UN. 1977. Water development and management; proceedings of the United Nations Water Conference, Mar del Plata, Argentina, 1977 - pt. 1-4 *In: Water Development, Supply and Management*, v. 1(pt.1-4); United Nations Water Conf., Mar del Plata (Argentina), 14-25 Mar 1977 / United Nations, New York, N.Y. (USA), 1978, 1 v. in 4.

WMO. 1990. *International Conference on Water and the Environment: Development Issues for the 21st Century*, Dublin (Ireland), 26-31 Jan 1992 / WMO, Geneva (Switzerland), 55 pp.

World Water Assessment Programme (WWAP). 2003. Water for people, water for life. *The United Nations World Water Development Report 1*. 576 pp.

World Water Assessment Programme (WWAP). 2006. Water, a shared responsibility. *The United Nations World Water Development Report 2*. 584 pp.

(b) Internet site:

FAO AQUASTAT. http://www.fao.org/nr/water/aquastat/main/index.stm

WATER USE INTENSITY BY ECONOMIC ACTIVITY		
Freshwater	**Water Quantity**	**Core indicator**

1. INDICATOR

(a) Name: Water use intensity by economic activity

(b) Brief Definition: Cubic metres of water used per unit of value added (in US $) by economic activity.

(c) Unit of Measurement: m^3/ US $

(d) Placement in the CSD Indicator Set: Freshwater/Water Quantity

2. POLICY RELEVANCE

(a) Purpose: This indicator measures the intensity of water use in terms of volumes of water per unit of value added. It is an indicator of pressure of the economy on the water resources and therefore an indicator of sustainable development. It is an important indicator for policies of water allocation among different sectors of the economy since in water-scarce regions, where there is competition for water among various users, water is likely to be allocated to the less intensive use.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): When this indicator is monitored over time, it shows whether the country manages its water resources to improve economic performance while simultaneously reducing the impact on the environment, that is, to decouple pattern of water use from economic growth. Water conservation policies aiming at improving water intensity (through, for example, recycling and better water-saving technologies) ultimately reduce pressure on the environment.
If the indicator is compiled for the whole economy without the breakdown by economic activity, it should be redefined as water abstraction divided by Gross Domestic Product (GDP). A decrease in the value of this indicator may indicate: (a) improvements in technological efficiency; (b) structural changes in the economy with water allocated to less intense activities; (c) increase reuse of water in the economy; and (d) use of alternative sources (e.g. desalinated water).
Water use intensity is defined in a similar way as the indicators on material and energy intensity. It could also be expressed as 'water use productivity' (the inverse of water intensity) (see points 3(c)).

(c) International Conventions and Agreements: None

(d) International Targets/Recommended Standards: None

(e) Linkages to Other Indicators: This indicator is linked to Annual Abstraction of Ground and Surface Water as Percent of Renewable Water. While the indicator of annual abstraction measures pressure on the water resources, the water intensity indicator measures the 'water requirements' of an economic activity (cubic metres of water per unit of value added generated) thus the pressure of the economy on the water resources. Together these two indicators form the basis for water allocation policies: in water-scarce countries, water is likely to be allocated to the less water intensive activity. This indicator can also be linked to social indicators, such as employment by economic activity, to evaluate the social impact of different allocation policies.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: Water used by an economic activity consists of the sum of (i) water directly abstracted from the environment either permanently or temporarily for own use and (ii) water received from other industries including reused water. Value added (gross) by economic activity is defined as in the National Accounts as the value of output less the value of intermediate consumption; it is a measure of the contribution to GDP made by an economic activity. The industrial classification follows the International Standard Industrial Classification of all Economic Activities Rev.4 (ISIC) (UN, 2006a) used in the National Accounts. The following breakdown of the economic activities is recommended as minimum: Agriculture, Forestry and Fishing (ISIC 01-03), Mining, Manufacturing and Electricity (ISIC 5-35) and Service industries (ISIC 37-99). Note that the activity that abstracts water for distribution – Water collection, treatment and supply, ISIC 36 – is excluded from the indicator as (i) the water abstracted and distributed to other activities is included in the use of the other activities and (ii) only a small part of the water abstracted by ISIC 36 is for its own uses. The indicator is computed at national level and its temporal scale is the calendar year.

(b) Measurement Methods: Value added is generally obtained from standard national accounts. Water abstracted for own use by an economic activity may be difficult to estimate especially for Agriculture. Water received from other economic units is often metered.

(c) Limitations of the Indicator: Since the indicator is computed at national level and for a year-long, it may hide spatial and temporal variability in water use. The industry breakdown distinguishes only three groups of industries to broadly distinguish Agriculture from Manufacturing and Service industries. A more detailed breakdown may be useful to compare productivity within these groups. For example, for countries which rely heavily to seasonal tourism, which often coincides with periods of high water scarcity, it may be particularly useful to identify explicitly the most relevant economic activities for tourism (such as, Accommodation and Food service activities).

(d) Status of the Methodology: This indicator can be derived from the standard hybrid tables of the System of Environmental-Economic Accounting for Water (UN, 2006b).

(e) Alternative Definitions/Indicators: In countries in which economic activities receive negligible amount of water from other units, the indicator could be calculated dividing the volumes of water directly abstracted by an economic activity for own use by value added. As mentioned in point 2(b), the inverse of water use intensity is 'water use productivity' which measures the value added generated by one unit of water used. Water productivity gives an indication of the intrinsic value being placed on water. It has low values when water is used for low value purposes, which is generally the case when water is abundant and/or undervalued. High values of the indicators are associated with water recycling and improved technology which reduce the amount of water used and therefore abstracted.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Direct water abstraction, water received from other economic units and value added (gross) by economic activity.

(b) National and International Data Availability and Sources: Economic data on value added by economic activity are generally available in countries. At the international level information on value added is part of the official national accounts statistics collected by UNSD and can be found in the UNSD publications *National Accounts Statistics: Main Aggregates and Detailed Tables* and *National Accounts Statistics: Analysis of Main Aggregates.* Data on water use by economic activities are collected at international level by two Questionnaires on water: the UNSD/UNEP Questionnaire which covers non-OECD countries and the Joint OECD/Eurostat Questionnaire which covers OECD countries.

(c) Data References:
Economic information is available at
http://unstats.un.org/unsd/snaama/Introduction.asp
Water use information is available at http://unstats.un.org/unsd/ENVIRONMENT

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: United Nations Statistics Division. The contact point is the Chief of Environment Statistics Section, UNSD; fax no. 1 (212) 963 1374.

(b) Other Organizations: Not available.

6. REFERENCES

(a) Readings:

United Nations (2006a). International Standard Industrial Classification of all Economic Activities, ST/ESA/STAT/SER.M/4/Rev.4.

United Nations (2006b). System of Environmental-Economic Accounting for Water, (Published draft http://unstats.un.org/unsd/envaccounting/ceea/PImeetings/Handbook_Voorburg.pdf).

United Nations (2005). *National Accounts Statistics: Analysis of Main Aggregates, 2004.* ST/ESA/STAT/Ser.X/35. Sales No. E.06.XVII.8.

United Nations (2006). *National Accounts Statistics: Analysis of Main Aggregates, 2003-2004.* ST/ESA/STAT/Ser.X/34. Sales No. E.06.XVII.5.

United Nations (2008). International Recommendations for Water Statistics (forthcoming)

(b) Internet site:

http://unstats.un.org/unsd/environment
http://unstats.un.org/unsd/nationalaccount/nadefault.htm

PRESENCE OF FAECAL COLIFORMS IN FRESHWATER		
Fresh Water	**Water Quality**	**Core indicator**

1. INDICATOR

(a) Name: Presence of Faecal Coliforms in Freshwater.

(b) Brief Definition: The proportion of freshwater resources destined for potable supply containing concentrations of faecal coliforms which exceed the levels recommended in the World Health Organization (WHO) Guidelines for Drinking-water Quality.

(c) Unit of Measurement: %

(d) Placement in the CSD Indicator Set: Fresh Water/Water Quality.

2. POLICY RELEVANCE

(a) Purpose: The indicator assesses the microbial quality of water available to communities for basic needs. It identifies communities where contamination of water with human and animal excreta at source or in the supply poses a threat to health.

(b) Relevance to Sustainable/Unsuitable Development (theme/sub-theme): The concentration of faecal coliforms in freshwater bodies is an indirect indicator of contamination with human and animal excreta. Water contaminated with human and animal excreta poses a serious health risk and is therefore unsuitable for potable supply unless it has been suitably treated. Faecal indicator bacteria remain the preferred way of assessing the hygienic quality of water. *Escherichia coli (E. coli*), the thermotolerant and other coliform bacteria, the faecal streptococci and spores of sulphite-reducing clostridia, are common indicators of this type used. This measure indicates situations where treatment is required or has to be improved to guarantee safety of supply. As population density increases and/or more people are provided from a supply, the more critical the supply of safe, potable water becomes.
Diarrhoeal diseases, largely the consequence of faecal contamination of drinking-water supply, are variously estimated to be responsible for 80% of morbidity/mortality, or more, in developing countries. A prerequisite for development is a healthy community. Ill health not only reduces the work capability of community members but frequent diarrhoeal episodes disrupt children's development and education, which, in the longer term, can have serious consequences for sustainable development.

(c) International Conventions and Agreements: The United Nations Water Conference recommended that governments reaffirm the commitment made at 'Habitat' to adopt programmes with realistic standards for water-quality to provide sanitation for urban and rural areas. The goal of universal coverage was reiterated at the World Summit for Children, in 1990.

(d) International Targets/Recommended Standards: The standards are available in the WHO Guidelines for Drinking-water Quality. These have been adopted by most countries.

(e) Linkages to Other Indicators: The indicator is closely linked with several others in the environmental and socio-economic (health) categories, including annual water withdrawals, domestic consumption of water *per capita*, biochemical oxygen demand in water bodies, wastewater treatment coverage, and percent of population with adequate excreta disposal facilities.

3. <u>METHODOLOGICAL DESCRIPTION</u>

(a) Underlying Definitions and Concepts: Ideal faecal indicator characteristics are difficult to find in any one organism. However, many useful characteristics are found in *E. coli* and, to a lesser extent, in the thermotolerant coliform bacteria. For this reason, *E. coli* is the preferred/recommended faecal contamination indicator. Faecal streptococci satisfy some of the criteria and tend to be used as supplementary indicators of faecal pollution indicating both human and animal faeces.

(b) Measurement Methods: For the purposes of this indicator, the term "faecal coliforms" encompasses *Escherichia coli* and thermotolerant coliforms.
Microbiological examination provides the most sensitive, although not the most rapid, indication of pollution by faecal matter. Because the growth medium and the conditions of incubation, as well as the nature and age of the water sample, can influence microbiological analysis, accuracy of results may be variable. This means that the standardization of methods and laboratory procedures are extremely important. Established standard methods are available through the International Organization of Standardization (ISO), American Public Health Association (APHA), the UK Department of Health (DHSS), and the Guidelines for Drinking-water Quality (WHO).
Determination of sample size is the first important step in the examination. The source of the sample will determine, in the first instance, the concentration of organisms. Under normal conditions, the volume of sample for a lake or reservoir sample would be 100 ml, while in the case of raw municipal sewage, only 0.001 ml would be required. Larger samples would result in too large a number of organisms to make counting possible. Time-of-travel may often be of relevance, and changes in the bacterial characteristics of samples can be reduced to a minimum by ensuring the samples are not exposed to light and are kept between 4 and 10°C for the shortest feasible time – preferably analysed within six hours. Such precautions are particularly important in tropical climates where ambient temperatures are high and sunlight (ultra-violet radiation) is brightest.

(c) Limitations of the Indicator: Concentration of *E. coli* or thermotolerant or faecal coliforms in a water sample provides only one part of the picture with regard to water-quality. To assess the overall status of water at source and supplied for potable and other uses, it is necessary to combine the information of this indicator with complementary data on physical and chemical water quality. *E. coli* is predominantly an indicator but, under certain circumstances, can itself be a pathogen.

(d) Status of the Methodology: Not Available.

(e) Alternative Definitions/Indicators: The indicator could be shown as the proportion of the population using water source for domestic water supply that does not meet the standards. The microbiological quality of water in relation to faecal contamination can be currently defined in terms of *E. coli*, thermotolerant coliform bacteria, total coliform organisms, faecal streptococci, sulphite-reducing clostridia, bifidobacteria and coliphages. The magnitude of deviation from the WHO guideline value for microbial water quality, expressed as the average concentration in a water resource, could also indicate the degree or magnitude of contamination of a water supply.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Records of water authorities laboratories, hydro-geological institutes, universities, municipal public health laboratories, research institutes, and special studies, which show the level of *E. coli,* or thermotolerant coliform bacteria.

(b) National and International Data Availability and Sources: Data are normally available from municipal water supply authorities on a routine basis. Ministries of Health in many countries often check on the bacterial quality of new sources when they are being considered for supply purposes. The data are available from national water authorities and water supply utilities, Ministries of Health, and research institutes.

(c) Data References: Not Available.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the World Health Organization (WHO). The contact point is the Coordinator, Water, Sanitation and Health, Department of Protection of Human Health, WHO; fax no. (41 22) 791 4159.

(b) Other Contributing Organizations: Other organizations contributing to the development of this indicator include: the Water and Environmental Sanitation Section, United Nations Children's Fund (UNICEF); United Nations Centre for Human Settlements (HABITAT); Land and Water Division, Food and Agriculture Organization of the United Nations (FAO); and the United Nations Environment Programme Global Environment Monitoring System for Freshwater (UNEP GEMS/Water).

6. REFERENCES

(a) Readings:

WHO. *Guidelines for Drinking-Water Quality*. Second Edition, Volume 1 Recommendations, WHO, Geneva, 1993, and Volume 3: Surveillance and Control of Comments Supplies, WHO, Geneva, 1996.

American Public Health Association, American Water Works Association, and Water Pollution Control Federation. *Standard Methods for the Examination of Water and Wastewater*. 17th Edition, 1989.

International Organization for Standardization. *Water Quality: Detection and Enumeration of the Spores of Sulphite-reducing Anaerobes (clostridia*). Part 1: Method by Enrichment in a Liquid Medium. ISO 646171.

International Organization for Standardization. *Water Quality: Enumeration of Viable Microorganisms – Colony Count by Inoculation in or on a Nutrient Agar Culture Medium.* ISO 6222.

International Organization for Standardization. Water Quality: Detection and Enumeration of Coliform Organisms, Thermotolerant Coliform Organisms and Presumptive Escherichia coli, ISO 9308-2; Part 1 Membrane Filtration Method, Part 2 Multiple Tube. ISO 9308-1.

International Organization for Standardization. *Water Quality: Detection and Enumeration of Faecal Streptococci*; Part 1 Method by Enrichment in a Liquid Medium, Part 2 Method by Membrane Filtration. ISO 7899/2.

(b) Internet site:

World Health Organization (WHO). http://www.who.int
WHO website on water, sanitation and health:
http://www.who.int/water_sanitation_health/en/

BIOCHEMICAL OXYGEN DEMAND IN WATER BODIES		
Fresh Water	**Water Quality**	

1. INDICATOR

(a) Name: Biochemical oxygen demand (BOD) in water bodies.

(b) Brief Definition: BOD measures the amount of oxygen required or consumed for the microbiological decomposition (oxidation) of organic material in water.

(c) Unit of Measurement: mg/l of oxygen consumed in 5 days at a constant temperature of 20°C in the dark.

(d) Placement in the CSD Indicator Set: Fresh water/Water quality.

2. POLICY RELEVANCE

(a) Purpose: The purpose of this indicator is to assess the quality of water available to consumers in localities or communities for basic and commercial needs. It is also one of a group of indicators of ecosystem health.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): Sustainable development is heavily dependant on suitable water availability for a variety of uses ranging from domestic to industrial supplies. Strict water quality standards have been established to protect users from health and other adverse consequences of poor water quality. The presence of high BOD may indicate faecal contamination or increases in particulate and dissolved organic carbon from non-human and animal sources that can restrict water use and development, necessitate expensive treatment and impair ecosystem health. Human ill health due to water quality problems can reduce work capability and affect children's growth and education. Increased concentrations of dissolved organic carbon can create problems in the production of safe drinking water if chlorination is used, as disinfection by-products, such as trihalomethanes and other compounds toxic to humans, may be produced. Increased oxygen consumption poses a potential threat to a variety of aquatic organisms, including fish. It is, therefore, important to monitor organic pollution to identify areas posing a threat to health, to identify sources of contamination, to ensure adequate treatment, and provide information for decision making to enhance water sustainability. BOD is also a useful measure to assess the effectiveness of current water treatment processes.

(c) International Conventions and Agreements: The Resolution II and Plan of the United Nations Water Conference recommended governments reaffirm the commitment made at Habitat to "adopt programmes with realistic standards for quality and quantity to provide water for rural and urban areas". The goal of universal safe water coverage was reiterated at the World Summit for Children in 1990.

(d) International Targets/Recommended Standards: Not available.

(e) Linkages to Other Indicators: Several indicators are directly linked to the concentration of organic material in freshwater. These measures include annual withdrawals of ground and surface water, domestic consumption of water per capita, concentration of faecal coliforms in freshwater, percent of population with adequate excreta disposal facilities, access to safe water, infant mortality rate, nutritional status of children, environmental protection expenditures as a percent of Gross Domestic Product, and expenditure on waste collection and treatment, and ecosystem health.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: Biochemical oxygen demand (BOD) is an empirical test to provide a measure of the level of degradable organic material in a body of water. There are two main methods for measuring BOD:

Method 1: This is the most common method used. It simply involves the incubation of a water sample over a specified period (usually five days) at a constant temperature of 20°C in the dark.

Method 2: This method involves the incubation of a water sample that is diluted with de-ionised water saturated with oxygen. The incubation of the diluted sample is identical to the first method, i.e., it is conducted over 5 days at a constant temperature of 20°C in the dark.

These tests represent standard laboratory procedures usually referred to as the BOD5 test.

These procedures are used to estimate the relative oxygen consumption of wastewaters, effluents, and other waters affected by organic pollution. Microorganisms (mainly bacteria although other microorganisms, algae, plants and animals can also make significant contributions in some aquatic systems) use the oxygen in the water for oxidation of polluting organic matter and organic carbon produced by algae, plants and animals.

(b) Measurement Methods:

Method 1: This method consists of filling to overflowing an airtight bottle of specified size with the water sample to be tested. It is then incubated at a constant temperature for five days in the dark. Dissolved oxygen is measured initially and after incubation. The BOD5 is then computed from the difference between the initial and final readings of dissolved oxygen.

Method 2: This method consists of filling a bottle with incremental levels of a water sample that is then diluted with de-ionised water. The dilution water contains a known amount of dissolved oxygen. The bottles are completely filled, freed of air bubbles, sealed and allowed to stand for five days at a controlled temperature of 20 °C (68 °F) in the dark. During this period, bacteria oxidize the organic matter using the dissolved oxygen present in the water. At the end of the five-day period, the remaining dissolved oxygen is measured. The relationship of oxygen that was consumed during the five days and the volume of the sample increment are then used to calculate the BOD.

(c) Limitations of the Indicator: The main limitation of the indicator is that it provides empirical and not absolute results. It gives a good comparison among samples, but does not give an exact measure of the concentration of any particular contaminant. Further, it was designed to assess the impact of point-source organic effluents on source waters and is not generally suitable for environmental monitoring. Further, the BOD can increase due to an increase in nutrient (e.g., nitrogen and phosphorus) loads to a water body (eutrophication) without a concomitant increase in external organic carbon loading. The increase in nutrients stimulates the growth of algae and aquatic plants (primary production), which causes an indirect increase in biological (usually mainly bacterial) oxygen consumption. However, bacterial activity can be directly increased in some waters with low nutrient concentrations. It is important to follow laboratory procedures precisely to obtain consistent results. The five-day time frame to obtain results represents the main operational drawback of the indicator. In addition, the methodologies outlined are not indicative of in situ oxygen consumption rates because of the artificial incubation conditions, i.e., bottling water with its associated microbial communities with no air flow, currents, light etc.

(d) Status of the Methodology: Operational.

(e) Alternative Definitions/Indicators: Chemical Oxygen Demand (COD) is an alternative measure of the oxygen equivalent of the organic matter content of a sample that is susceptible to oxidation by a strong chemical exigent. COD can be empirically related to BOD5. After this correlation is determined for a specific source, it is a useful measure obtained from an instantaneous chemical test. Dissolved oxygen concentration (DO) is a better general environmental monitoring indicator that is also applicable to assessing organic pollution. DO also has known concentration limits for a variety of aquatic species.

4. <u>ASSESSMENT OF DATA</u>

(a) Data Needed to Compile the Indicator: BOD5 results from laboratories.

(b) National and International Data Availability and Sources: Data are normally available on a routine basis from municipal wastewater treatment and discharge facilities, the laboratories of water or public health authorities, water research institutes, and universities. At the national level, the data sources include national water authorities, water supply utilities, ministries of health or environment, and research institutions.

(c) Data References: None.

5. <u>AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR</u>

(a) Lead Agency: The lead agency is the United Nations Environment Programme (UNEP). The contact point at UNEP is the Director, Division of Environmental Information, Assessment and Early Warning, fax no. (254-2) 62- 4274.

(b) Other Contributing Organizations: Other agencies assisting in the development of this indicator include the World Health Organization (WHO), the UNEP Global Environment Monitoring System (GEMS/Water) Programme, the United Nations Children's Fund (UNICEF); United Nations Centre for Human Settlements (Habitat); and the United Nations Food and Agriculture Organization (FAO).

6. REFERENCES

(a) Readings:

American Public Health Association, American Water Works Association, and Water Pollution Control Federation. *Standard Methods for the Examination of Water and Wastewater*. 20th Edition. 1999.

International Standards Organization. *Water Quality--Determination of Biochemical Oxygen Demand after Five Days (BOD5)*. ISO 5815. 1989.

International Standards Organization. *Water Quality--Determination of the Chemical Oxygen Demand*. ISO 6060. 1989.

(b) Internet site:

UNEP/GEMS Programme for Freshwater Quality Monitoring and Assessment at the National Water Research Institute of Environment Canada: http://www.gemswater.org.

WASTEWATER TREATMENT		
Freshwater	**Water Quality**	

1. INDICATOR

(a) Name: Wastewater treatment.

(b) Brief Definition: Proportion of wastewater that is treated, in order to reduce pollutants before being discharged to the environment, by level of treatment.

(c) Unit of Measurement: Percentage of volume of generated wastewater treated by primary treatment, secondary treatment, tertiary treatment or not treated.

(d) Placement in the CSD Indicator Set: Freshwater/Water Quality.

2. POLICY RELEVANCE

(a) Purpose: This indicator assesses the potential level of pollution from domestic and industrial/commercial point sources entering the aquatic environment, and monitors progress towards reducing this potential within the framework of integrated water resources management. It helps to identify communities where wastewater treatment action is required to protect the ecosystem.

Wastewater from households and different industries represent a significant pressure on the environment and treatment is normally required before discharge. The indicator assesses the proportion of wastewater that undergoes different (primary, secondary and tertiary) levels of treatment. It includes the volume of wastewater treated at public wastewater treatment plants, industrial wastewater treatment plants and by independent wastewater treatment systems. For treated wastewater from households (sometimes mixed with industrial wastewater in a public collecting system) to be considered acceptable it should undergo at least secondary treatment either at a public wastewater treatment plant, an independent wastewater treatment plant or in an industrial wastewater treatment plant (where usually the industrially generated wastewater is dominating). Industrial wastewater needs to undergo a treatment process which is to remove the specific pollutants generated by the production process to a limit which does not negatively affect the aquatic environment or human uses (in the case of direct discharges), or allows a proper treatment together with wastewater originating from household activities in a public wastewater treatment plant (indirect discharges).

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): Wastewater effluents can result in increased nutrient levels, often leading to algal blooms; depleted dissolved oxygen, sometimes resulting in fish kills; destruction of aquatic habitats with sedimentation, debris, and increased water flow; and acute and chronic toxicity to aquatic life from chemical contaminants, as well as bioaccumulation of chemicals in the food chain. Treatment plants remove varying amounts of contaminants from wastewater, depending on the level of treatment they provide. In many countries a large proportion of wastewater is discharged to the environment with little or no treatment. This is economically, socially, and environmentally unsustainable, especially recognizing the increasing demands on finite water resources, rapidly expanding populations particularly in urban areas, industrial expansion, and the need to expand irrigated agriculture. Low water quality reduces the availability of water resources for specific uses, in particular domestic needs, and has adverse implications for public health. As well as containing organic matter and nutrients, wastewater can also contain hazardous substances. The level of treatment of these hazardous substances before discharge and the sensitivity of the receiving waters will affect their impact on the aquatic ecosystem.

(c) International Conventions and Agreements: None

(d) International Targets/Recommended Standards: None

(e) Linkages to Other Indicators: This indicator has important linkages to Annual Withdrawal of Ground and Surface Water as Percent of Renewable Water, Water Use Intensity by Economic Activity, Biochemical oxygen demand (BOD) in Water Bodies, Concentration of Faecal Coliform in Freshwater, Population Growth Rate, Generation of Waste and Population with Access to Safe Sanitation.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts:
Wastewater treated by primary treatment + wastewater treated by secondary treatment + wastewater treated by tertiary treatment + wastewater discharged without treatment have to add up to 100% of wastewater generated. Volumes should only be accounted for under the highest treatment category to which they were subjected.
Wastewater is defined as water which is of no further immediate value to the purpose for which it was used or in the pursuit of which it was produced because of its quality, quantity or time of occurrence. However, wastewater from one user can be a potential supply to a user elsewhere.

For the purpose of this indicator on wastewater treatment it is important to refer only to the volume of wastewater generated by households and economic activities which would negatively affect the aquatic environment or human beings if pollutants are not reduced to an acceptable and widely accepted limit before discharge. Therefore, it excludes unpolluted cooling water (in this context heat is not considered as pollutant; however, discharges of heated cooling water may have negative effects on aquatic life of a particular lake or a certain downstream river stretch). It furthermore excludes wastewater which will be reused (reclaimed wastewater), because it will contribute to discharges into the environment only after the reuse by another economic unit.

Industrial (process) wastewater is water discharged after being used in, or produced by, industrial production processes and which is of no further immediate value to these processes. Where process water recycling systems have been installed, process wastewater is the final discharge from these circuits. To meet quality standards for eventual discharge into public collecting systems, this process wastewater is understood to be subjected to ex-process in-plant treatment. For the purpose of this indicator cooling water is not considered to be industrial wastewater.

Wastewater treatment: Process to render wastewater fit to meet applicable environmental standards before being discharged to the environment. Three broad types of treatment are distinguished: primary, secondary and tertiary. For purposes of calculating the total amount of treated wastewater, volumes and loads reported should be shown only under the "highest" type of treatment to which they were subjected:

Primary treatment: Treatment of wastewater by a physical and/or chemical process involving settlement of suspended solids, or other process in which the Biological Oxygen Demand (BOD_5) of the incoming wastewater is reduced by at least 20% before discharge and the total suspended solids of the incoming wastewater are reduced by at least 50%.

Secondary treatment: Post-primary treatment of wastewater by a process generally involving biological or other treatment with a secondary settlement or other process, resulting in a Biological Oxygen Demand (BOD_5[33]) removal of at least 70% and a Chemical Oxygen Demand (COD[34]) removal of at least 75%.

Tertiary treatment of public wastewater: Treatment (additional to secondary treatment) of nitrogen and/or phosphorous and/or any other pollutant affecting the quality or a specific use of water: microbiological pollution, colour etc. For organic pollution the treatment efficiencies that define a tertiary treatment are the following: organic pollution removal of at least 95% for BOD and 85% for COD, and at least one of the following:

- nitrogen removal of at least 70%
- phosphorus removal of at least 80%
- microbiological removal achieving a faecal coliform density less then 1000 in 100 ml

In the case of industrial wastewater treatment tertiary treatment means the reduction of pollutants to a concentration not adversely affecting the aquatic environment and human water uses before direct discharge. In the case of indirect discharges into a public wastewater collecting system this means that the treatment processes (pre-treatment plus treatment in the public wastewater treatment plant) achieve standards as defined above. For both, direct and indirect discharge, in addition to removal of organic pollution and nutrients this means in particular the removal of toxic substances, acids and alkalis, hard organics or oils and greases (depending on the composition of the wastewater). Typical methods are chemical immobilisation, neutralisation or precipitation. Dilution of polluted wastewater is not considered as wastewater treatment.

[33] BOD_5 is the Biochemical Oxygen Demand for a period of five days. It is equal to the amount of dissolved oxygen required by organisms for the aerobic decomposition of organic matter present in water. This is measured at 20 degrees Celsius for a period of five days. The parameter yields information on the degree of water pollution with organic matter.

[34] COD is the mass concentration of oxygen equivalent to the amount of a specified oxidant consumed by dissolved or suspended matter when a water sample is treated with that oxidant under defined conditions.

Public wastewater treatment (synonym "urban wastewater treatment") is defined as treatment of wastewater in public wastewater treatment plants (PWWTPs). PWWTPs can be operated by public authorities or by private companies. Wastewater can arrive to the PWWTPs through the public wastewater collecting system or can be delivered there on trucks.

Industrial wastewater treatment can be either in form of pre-treatment before discharge into a public wastewater collecting system or as final treatment in an industrial wastewater treatment plant (as part of the production establishment or operated externally) before direct discharge to the environment. To avoid double counting, only final treatment before direct discharge should be included here. Volumes pre-treated and discharged into a public collecting system will be counted under public wastewater treatment.

Independent wastewater treatment: Systems of collection, preliminary treatment, treatment, infiltration or discharge of domestic wastewater from dwellings generally between 1 and 50 population equivalents, not connected to a public wastewater collection system. Examples of such systems are septic tanks. Excluded are systems with storage tanks from which the wastewater is transported periodically by trucks to a public wastewater treatment plant. These systems are considered to be connected to the public wastewater system. Independent wastewater treatment systems usually achieve primary or secondary treatment level.

(b) Measurement Methods: The volume of wastewater generated by households can be calculated with population statistics and the application of per capita water use coefficients (e.g. from research centers, water associations or water suppliers). One has to take into account that water use volumes (and consequently the generated wastewater volumes) may be different for households connected to the public water supply network and those households which have to self-abstract their water.

The volume of wastewater generated by industries can be taken from industry surveys and, in the case of missing data, be calculated with the help of wastewater generation factors. In the case of industrial discharges into a public collecting system usually the operators of these systems have data on volumes wastewater collected from industries.

The volume of wastewater treated at different levels of treatment can be obtained from public wastewater treatment plants, from industrial wastewater treatment plants and from independent wastewater treatment systems. The volume of household wastewater treated in public wastewater treatment plants or independent wastewater treatment systems can also be calculated with water use coefficients on the basis of areas of a community connected to the sewerage system linked to the treatment plant and the population inhabiting these localities. The classification of the type of treatment (primary, secondary or tertiary) should preferably be based on actually achieved removal rates.

(c) Limitations of the Indicator: This indicator provides information about wastewater volumes generated by point sources but not about wastewater volumes generated and discharged by diffuse sources.

The indicator does not give information about the quality of the wastewater discharged. Wastewater treatment plants are often overused beyond their design capacity so the quality of the treated wastewater that is discharged into the environment can also be questionable. The indicator also does not address the level of treatment required to meet the requirements of specific ecosystems.
Ideally, it would be more informative to measure an indicator such as the overall removal rates for selected parameters (e.g. BOD_5, COD, nitrogen or phosphorus) from all types of wastewater treatment plants (including industrial and independent wastewater treatment plants), including untreated wastewater from point sources and diffuse sources.

Another important information for political decision processes would be the total loads of discharges from different types of point sources (after treatment and without treatment) and diffuse sources, classified according to households and economic activities. However, in practice these data are more difficult to obtain.

(d) Status of the Methodology: Methodologies on data generation are recommended in the Data Collection Manual for the OECD/Eurostat Joint Questionnaire on Inland Waters Tables 1 – 7 (version 2.0) of Eurostat (2006) and the UNSD International Recommendations for Water Statistics (2008, in preparation).

(e) Alternative Definitions/Indicators: The percentage of population connected to the different levels of wastewater treatment (primary, secondary or tertiary) which is the sum of percentage of the population connected to different levels of public wastewater treatment, independent wastewater treatment and industrial wastewater treatment. This may be easier to measure but it does not consider wastewater generated by industrial or other economic activities.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: The data required would be the volume of wastewater generated by households and all economic activities (excluding cooling water and reused wastewater) and the volume of wastewater treated at different levels (primary, secondary, tertiary) by public wastewater treatment plants, independent wastewater systems and directly discharging industrial wastewater treatment plants.

(b) National and International Data Availability and Sources: At the national level, data sources would include national water or environmental authorities, municipal authorities and national statistical offices. At the international level, data are collected through two Questionnaires on environment statistics: the UNSD/UNEP Questionnaire which covers non-OECD countries and the Joint OECD/Eurostat Questionnaire which covers OECD/Eurostat countries. Data are often not available, or are incomplete.

(c) Data References:
UNSD Web site: http://unstats.un.org/unsd/environment

OECD website: http://www.oecd.org/statisticsdata

Eurostat website:
http://epp.eurostat.cec.eu.int/portal/page?_pageid=0,1136239,0_45571444&_dad=portal&_schema=PORTAL)

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: United Nations Statistics Division. The contact point is the Chief, Environment and Energy Statistics Branch, UNSD. The fax no. (1 212) 963 0623.

(b) Other Organizations: OECD and Eurostat

6. REFERENCES

(a) Readings:
Eurostat (2006): Data Collection Manual for the OECD/Eurostat Joint Questionnaire on Inland Waters Tables 1 – 7
OECD/Eurostat Joint Questionnaire 2006 on Environment Statistics – Inland Waters Section.
United Nations (2006). System of Environmental-Economic Accounting for Water (SEEAW). Final Draft.
United Nations (2008). International Recommendations for Water Statistics (forthcoming).
UNSD/UNEP Questionnaire 2006 on Environment Statistics – Water Section.

(b) Internet site:
UNSD home page: http://unstats.un.org/unsd/environment/

PROPORTION OF TERRESTRIAL AREA PROTECTED, TOTAL AND BY ECOLOGICAL REGION		
Biodiversity	**Ecosystems**	**Core indicator**

1. INDICATOR

(a) Name: Proportion of terrestrial area protected, total and by ecological region

(b) Brief Definition: This indicator can be expressed as the percentage protected of terrestrial surface area.
The terrestrial area indicator can be disaggregated by country. It may also be possible and desirable to disaggregate both indicators further, for example by protected area category (i.e. using the IUCN protected area management category system).
This indicator can also be separately expressed as the percentage protected of terrestrial ecological region.

(c) Unit of Measurement: % of total terrestrial area / % of terrestrial ecological region

(d) Placement in the CSD Indicator Set: Biodiversity / Ecosystems.

2. POLICY RELEVANCE

(a) Purpose: The indicator represents the extent to which terrestrial areas important for conserving biodiversity, cultural heritage, scientific research (including baseline monitoring), recreation, natural resource maintenance, and other values, are protected from incompatible uses. It shows how much of each major ecosystem and habitat is dedicated to maintaining its diversity and integrity.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): Sustainable development depends on a sound environment, which in turn depends on ecosystem diversity. Protected areas are essential for maintaining ecosystem diversity, in conjunction with management of human impacts on the environment.

(c) International Conventions and Agreements: This indicator shows implementation of Article 8(a) of the Convention on Biological Diversity.

(d) International Targets/Recommended Standards: The international community has committed "to achieve a significant reduction of the current rate of biodiversity loss at the global, regional, and national level as a contribution to poverty alleviation and to the benefit of all life on earth by 2010". This "2010 Target" was formally adopted by governments at the 6th Conference of the Parties of the Convention on Biological Diversity in 2002, and endorsed later that year at the World Summit on Sustainable Development. The 2010 target, and the targets relating to the general objectives of the CBD, relate specifically to Parties to the Convention on Biological Diversity but could

also be used as a guide for non-Party states. The CBD established a target that 'at least 10% of each of the world's ecological regions be effectively conserved [by 2010]'.
The revised MDG monitoring framework, presented in 2007 to the General Assembly, includes the new target "Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss" under MDG 7 (Ensure environmental sustainability), in addition to the original target "Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources".

(e) Linkages to Other Indicators: This indicator is linked to other indicators that have implications for land and resource use. These would include; Forest Area as a % of Land Area, Wood Harvesting Intensity, Area of Selected Key Ecosystems, Ratification of Global Agreements, etc.
This indicator is also linked to indicators of species diversity and environmental quality. It would be complemented by an indicator measuring trends in the management effectiveness of protected areas.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts:
A **protected area** is defined by the IUCN as: '*An area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means.*'
Only '**designated'** protected areas are used in this calculation. In other words no 'Proposed' sites are included in the analysis. The status 'Designated' is attributed to a protected area when the management authority that according to national legislation or common practice (e.g. by means of an executive decree or similar) officially endorses a document of designation.
The terrestrial area indicator can be disaggregated by country. It may also be desirable to disaggregate both indicators indicator further by protected area category (i.e. using the IUCN protected areas management category system).
The World Conservation Union (IUCN) defines six **management categories** of protected areas.

I. Protected area managed mainly for science of wilderness protection (e.g. Strict Nature Reserve/Wilderness Area)

II. Protected area managed mainly for ecosystem protection and recreation (e.g. National Park)

III. Protected area managed mainly for conservation of specific natural features (e.g. Natural Monument)

IV. Protected area managed mainly for conservation through management intervention (e.g. Habitat/Species Management Area)

V. Protected area managed mainly for landscape/seascape protection and recreation (e.g. Protected Landscape/Seascape)

VI. Protected area managed mainly for the sustainable use of natural ecosystems (e.g. Managed Resource Protected Area)

The indicator may also be expressed as the coverage of protected areas as a percentage of terrestrial ecological regions. Suggested ecoregional approaches, to be utilised at global and regional scales, may include WWF Terrestrial Ecoregions of the World.
At the country scale, national agencies will be encouraged to develop their own terrestrial biogeographic classification system. It may be desirable to utilise the ecoregional boundaries[35] provide by the WWF Terrestrial Ecoregions approach. These units may be further resolved by the national agencies. However these ecoregions would only provide a basis for global or regional reporting if the national systems employ coherent and consistent approaches in defining national ecoregions.
The minimum size of the units varies depending on the classification system and the size of the country (or other territory) being assessed.

(b) Measurement Methods: The indicator will be expressed as a proportion of terrestrial ecological regions protected reported by country. Spatial analysis will be conducted through the use of GIS software for areas where spatial data exists. For protected areas with no spatial data, but where size is known and location is approximate (e.g. a centre point for the protected area is reported.), the available information will be interpreted on a case by case basis by utilizing automated routines and informed by expert opinion.

(c) Limitations of the Indicator: The indicator represents *de jure* not *de facto* protection. It does not indicate the quality of management or whether the areas are in fact protected from incompatible uses. It also gives a rather coarse picture of ecosystem protection. Additional detail would be needed to show the extent of disturbance of the ecosystem within each protected area, and coverage of rare or key ecological communities. Limitations to this indicator also include the lack of spatial data for many of the countries.

(d) Status of the Methodology: The methodology for combining area protected with other layers is commonly used for a variety of international reporting mechanisms.

(e) Alternative Definitions/Indicators: If a suitable ecosystem classification is not available, alternative indicators that are disaggregated by habitat may be utilised.

4. <u>ASSESSMENT OF DATA</u>

(a) Data Needed to Compile the Indicator: A map of the ecosystems and habitats of the country or territory, preferably using a classification that is internationally compatible and valid for other countries and territories in the region. A map of the

[35] The WWF Terrestrial Ecoregion approach uses a three tiered system of progressively smaller units (from ‘realms’ to ‘biomes’, to ‘ecoregions’). The database currently delineates 825 terrestrial ecoregions, with the average size roughly being 150,000 km^2, with a median of 56,300 km^2.

protected areas of the country or territory. A geo-referenced list of the protected areas, giving their sizes (area in hectares) and locations, and classifying them by the IUCN protected area management categories - see 3(a).

(b) National and International Data Availability and Sources: Major ecosystem and habitat classifications have been mapped for most regions and many countries. National classifications may not be compatible with other countries in their region, and few regional classifications are sufficiently detailed or accepted for national use. Global classifications are generally too coarse. Most countries keep statistics on protected areas, but their protected area systems may not be accurately mapped.

However, the World Database on Protected Areas (WDPA) provides the most comprehensive dataset on protected areas worldwide and is managed by UNEP-WCMC in partnership with the IUCN World Commission on Protected Areas (WCPA) and the World Database on Protected Areas Consortium. The WDPA is a fully relational database containing information on the status, environment and management of individual protected areas. This database includes information from countries, NGOs and academic institutions, international environmental conventions, etc. The WDPA enables searching of protected areas data by site name, country, and international programme or convention. It is possible to disaggregate the data in the WDPA by country and IUCN Management Category; therefore it is suitable for this indicator. Data is currently available for over 110,000 protected areas worldwide. UNEP-WCMC provides online access to the WDPA Consortium 2006 World Database on Protected Areas web-download as part of a broad strategy to share conservation information. Statistical information produced for the WDPA 2006 CD-ROM which relate to WDPA datasets is also available in addition to information on the definitions and categorisation of protected areas worldwide.

UNEP-WCMC and IUCN also cooperate on the compilation of the periodic *United Nations List of Protected Areas*, which provides the name, IUCN protected area management category, location, size, and year of establishment of all protected areas. This database includes information only from officially recognized national authorities.

(c) Data references: The United Nations List of Protected Areas (1993, 1997, 2003) is available as a web-based data resource. Ten editions of the List were previously printed between 1962 and 1990.

The World Database on Protected Areas is available as a web-based data resource and on CD-ROM.
In addition to supporting the production of the periodic UN List, the data in the WDPA has been used, and continues to be used, to support a number of global and regional assessments, including:

- The Convention on Biological Diversity Programme of Work on Protected Areas.
- Global Environment Outlook (ongoing)
- Global Biodiversity Outlook (ongoing)
- World Resources Report (ongoing)

- Protected area and thematic studies for the World Heritage Convention (ongoing)
- Millennium Ecosystem Assessment
- Millennium Development Goals
- Protected areas information support for the Vth World Parks Congress (2003)
- Mountain Watch Study (2002)
- Prioritisation of Target Areas For Forest Restoration (Report to WWF, 2000)
- European Forests and Protected Areas: Gap Analysis (2000)
- FAO Global Forest Resource Assessment (2000)
- WWF Forest for Life Campaign and Living Waters Campaign (1996/1998)
- Biodiversity Conservation in the Tropics: Gaps in Habitat Protection and Funding Priorities (1997)
- Circumpolar Protected Areas Network (CPAN) – Strategy and Action Plan (1996)

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agencies are the UNEP World Conservation Monitoring Centre (UNEP-WCMC) and the IUCN World Commission on Protected Areas (WCPA).

(b) Other Contributing Organizations: The World Database on Protected Areas Consortium was established in 2002 to expand participation and leadership on the development of the protected areas database. The Consortium brings together a growing number of international conservation organizations that have agreed to ensure that information on protected areas is maintained on a cooperative basis and used to monitor the effectiveness of global conservation agendas. In addition to UNEP-WCMC and IUCN, consortium members include the American Museum of Natural History, BirdLife International, Conservation International, Flora and Fauna International, The Nature Conservancy, Wildlife Conservation Society, World Resources Institute, World Wildlife Fund – US, World Wide Fund for Nature (WWF International).

6. REFERENCES

(a) Readings:

Guidelines for Protected Area Management Categories, McNeely, Jeffrey (ed.). (1993).
Parks for Life: report of the IVth World Congress on National Parks and Protected Areas. IUCN - The World Conservation Union, Gland, Switzerland. Dinerstein, Eric, David M. Olson, et al. (1995).

A conservation assessment of the terrestrial ecoregions of Latin America and the Caribbean. The World Bank, Washington, DC. Ricketts, Taylor, Eric Dinerstein, et al. (1999).

Terrestrial Ecoregions of the World: A New Map of Life on Earth. Bioscience, Vol. 51 No. 11 pp 933 - 938, David M. Olson, Eric Dinerstein et al, (November 2001)

United Nations. Report of the World Summit on Sustainable Development, Johannesburg, South Africa, 26 August-4th September 2002. A/CONF.199/20 (2002).

CBD. Decisions adopted by the Conference of the Parties to the Convention on Biological Diversity at its seventh meeting (Decision VII/30). UNEP/CBD/COP/7/21 (2004).

CONABIO. Capital natural y bienestar social. Comisión Nacional para el Conocimiento y Uso de la Biodiversidad, México (2006) http://www.conabio.gob.mx/2ep/images/c/c5/capital_natural_1.pdf

(b) Internet sites:

World Database on Protected Areas.
http://www.unep-wcmc.org/wdpa

World Commission on Protected Areas
www.iucn.org/themes/wcpa/index.html

UN List of Protected Areas, 2003.
http://www.unep-wcmc.org/protected_areas/UN_list/index.htm

UN List of Protected Areas, 1997.
http://www.unep-wcmc.org/protected_areas/data/un_97_list.html

UN List of Protected Areas, 1993.
http://www.unep-wcmc.org/protected_areas/data/un_93_list.html

MANAGEMENT EFFECTIVENESS OF PROTECTED AREAS		
Biodiversity	**Ecosystems**	

1. **INDICATOR**

(a) **Name:** Management effectiveness of protected areas

(b) **Brief Definition:** This indicator will use information about the context, planning and design, resource inputs, management processes, delivery of goods and services, and conservation outcomes of protected areas to determine the effectiveness with which they are being managed, and thus the effectiveness of protected areas as a tool for biodiversity conservation.

(c) **Unit of Measurement:** To be determined.

(d) **Placement in the CSD Indicator Set:** Biodiversity / Ecosystems.

2. **POLICY RELEVANCE**

(a) **Purpose:** The indicator represents the effectiveness of attempts to protect areas important for conserving biodiversity, cultural heritage, scientific research (including baseline monitoring), recreation, natural resource maintenance, and other values, from incompatible uses.

The principal users of the framework on which the indicator is based have been: protected area management agencies, NGOs involved in conservation projects, the World Heritage Commission, and the World Bank / Global Environment Facility.

(b) **Relevance to Sustainable/Unsustainable Development (theme/sub-theme):** Sustainable development depends on a sound environment, which in turn depends on ecosystem diversity. Protected areas are essential for maintaining ecosystem diversity, in conjunction with management of human impacts on the environment.

(c) **International Conventions and Agreements:** This indicator shows implementation of Article 8(a) of the Convention on Biological Diversity.

(d) **International Targets/Recommended Standards:** Recommendation 16 of the Fourth World Congress on National Parks and Protected Areas (Caracas, 1992) establishes a target of 10% protected area of each biome (major ecosystem type) by the year 2000 (McNeely 1993).

The international community has committed "to achieve a significant reduction of the current rate of biodiversity loss at the global, regional, and national level as a contribution to poverty alleviation and to the benefit of all life on earth by 2010". This "2010 Target" was formally adopted by governments at the 6th Conference of the Parties of the Convention on Biological Diversity (CBD) in 2002, and endorsed later that year at the World Summit on Sustainable Development. The 2010 target, and the targets relating to the general objectives of the CBD, relate specifically to Parties to the CBD but could also be used as a guide for non-Party states.

(e) Linkages to Other Indicators: This indicator is linked to other indicators which have implications for land and resource use. These would include; Forest Area as a % of Land Area, Wood Harvesting Intensity, Area of Selected Key Ecosystems, Ratification of Global Agreements, etc. It is complemented by the CSD indicator on *Coverage of Protected Areas*.

An indicator of management effectiveness of protected areas is being developed by members of the 2010 Biodiversity Indicators Partnership (2010BIP; www.twentyten.net) as part of the suite of indicators monitoring progress towards the 2010 target.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: Management effectiveness of protected areas is an important indicator of how well protected areas are conserving biodiversity. This is critical as most nations use protected areas as a cornerstone of biodiversity conservation, but to know whether this is a successful strategy it is necessary to know not only about the area and systems they cover, but also whether they are effectively managed.

(b) Measurement Methods: A framework for evaluating management effectiveness of protected areas on a global scale has been developed and promulgated by the World Commission on Protected Areas (WCPA) (Hockings et al 2000). This framework has been used to develop methodologies and assess effectiveness in several thousand protected areas throughout the world, and some comparative studies have been conducted on this data.

It is proposed that the indicator have six sub-indicators which contribute to understanding of how well each protected area is managed and how significant it is to biodiversity conservation at a range of scales. The sub-indicators are:

- Context (including values, significance, threats);
- Planning (including design (shape/size/boundary issues), and the level of management planning available);
- Inputs (level of resourcing);
- Processes (standards and procedures for management);
- Outputs (whether stated goods and services are being delivered);
- Outcomes (extent to which the protected area is achieving its stated objectives, which relate primarily to conservation of its values and abatement of threats, and to community relationships).

Data for the indicator will be obtained from site-level assessments, collected by a number of methodologies developed from a common Framework. These methodologies have a range of custodians and vary in scope, purpose and focus areas, but it is anticipated that a common reporting framework can be developed resulting in a valid indicator.

(c) Limitations of the Indicator: The development of a global indicator or indicator set is only just beginning. No trends are yet available and there are significant data gaps. At the national level this indicator depends on the availability of sufficient, relevant data. The potentially sensitive nature of some of the data will preclude the publication of some disaggregated information.

(d) Status of the Methodology: The methodology for this indicator is in its infancy, at both national and global levels.

(e) Alternative Definitions/Indicators: To be determined.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Data is required for all six sub-indicators mentioned in 3(b) above. Specific details of necessary data to be determined.

(b) National and International Data Availability and Sources: Data availability and sources for the six sub-indicators to be determined. Most countries keep statistics on protected areas, but their protected area systems may not be accurately mapped.
The World Database on Protected Areas (WDPA) provides the most comprehensive dataset on protected areas worldwide and is managed by UNEP-WCMC in partnership with the IUCN World Commission on Protected Areas (WCPA) and the World Database on Protected Areas Consortium. The WDPA is a fully relational database containing information on the status, environment and management of individual protected areas. The WDPA enables searching of protected areas data by site name, country, and international programme or convention. It is possible to disaggregate the data in the WDPA by country, biome and habitat, and therefore it is suitable for this indicator. Data is currently available for over 110,000 protected areas worldwide. UNEP-WCMC provides online access to the WDPA Consortium 2006 World Database on Protected Areas web-download as part of a broad strategy to share conservation information. Statistical information produced for the WDPA 2006 CD-ROM which relate to WDPA datasets is also available in addition to information on the definitions and categorisation of protected areas worldwide.

UNEP-WCMC and IUCN also cooperate on the compilation of the periodic *United Nations List of Protected Areas*, which provides the name, IUCN category, location, size, and year of establishment of all protected areas of 1,000 hectares or more (plus smaller areas occupying entire islands) for all countries. UNEP-WCMC maintains a copy of the UN list, compiles data on smaller protected areas, and has mapped most large areas and many smaller ones.

(c) Data references: Full list of data references to be compiled.
The United Nations List of Protected Areas (1993, 1997, 2003) is available as a web-based data resource. Ten editions of the List were previously printed between 1962 and 1990. The World Database on Protected Areas is available as a web-based data resource and on CD-ROM.

5. <u>AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR</u>

(a) Lead Agency: The lead agency is the IUCN World Commission on Protected Areas, in collaboration with the UNEP World Conservation Monitoring Centre (UNEP-WCMC).

(b) Other Contributing Organizations: Stakeholders and collaborators include: WWF, The Nature Conservancy, World Bank, University of Queensland, and a number of protected areas management agencies including the Conservation Measures Partnership.

6. <u>REFERENCES</u>

Ervin, J. (2003). *WWF Rapid assessment and prioritisation of protected area management (RAPPAM) methodology.* WWF. Gland Switzerland.

Cifuentes, M A, A Izurieta and H H De Faria (1999); *Medición de la Efectividad del Manejo de Areas Protegidas*, Forest Innovations Project, WWF, IUCN and GTZ, Turrialba, Costa Rica

Ferreira, L V, R M Lemos de Sá, R Buschbacher, G Batmanian, N R Bensusan and K L Costa, edited by A C Barbosa and U Lacava (1999); *Protected Areas or Endangered Spaces? WWF Report on the Degree of Implementation and the Vulnerability of Brazilian Federal Conservation Areas*, WWF Brazil, Brasilia (available in Portuguese and English)

Hockings, M., Stolton, S. & Dudley, N. (2000). *Evaluating effectiveness. A framework for assessing the management of protected areas.* IUCN World Commission on Protected Areas Best Practice Protected Area Guidelines No 6. (Adrian Phillips Series Editor) Rue Mauverney 28, CH-1196 Gland, Switzerland.

Hockings, M. (2002). *Evaluating the effectiveness of protected area management*. PhD Thesis. Australian School of Environmental Studies, Faculty of Environmental Science. Griffith University, Nathan Campus, Queensland.

Hockings, M., Stolton, S., Courrau, J., Dudley, N. and Parrish, J. (2004). *The World Heritage Management Effectiveness Workbook: Revised Edition.* United Nations Foundation. A UNESCO-IUCN project. Gland, Switzerland.

Hockings, M., Leverington, F., James, R. (2005). Chapter 21. Evaluating Management Effectiveness in Worboys, G.L., Lockwood, M., and De Lacy, T. (2005). *Protected area management principles and practice.* Oxford University Press, Melbourne.

Leverington, F. and Hockings, M. (2004). Chapter 5. Evaluating the effectiveness of protected area management: The challenge of change. In (eds) Barber, C.V., Miller, K.R. and Boness, M. (eds) (2004). *Securing protected areas in the face of global change. Issues and strategies. A report by the Ecosystems, Protected Areas and People project.* IUCN Gland, Switzerland.

MacKinnon, J and K MacKinnon (1986); *Review of the Protected Areas System of the Indo-Malayan Realm*, IUCN, Gland

Staub, F and M E. Hatziolos (2004); *Score Card to Assess Progress in Achieving Management Effectiveness Goals for Marine Protected Areas*, World Bank, Washington DC

Stolton, S., Hockings, M., Dudley, N., Mackinnon, K. and Witten, A. (2003). *Reporting progress in protected areas. A site-level management effectiveness tracking tool.* World Bank/WWF Alliance for Forest Conservation and Sustainable Use. WWF International, Gland, Switzerland. The World Bank, Washington D.C. USA.

World Conservation Union (IUCN), United Nations Environment Program (UNEP) and World Wide Fund for Nature (WWF) (1991). *Caring for the earth: a strategy for sustainable living*. Gland, IUCN.

AREA OF SELECTED KEY ECOSYSTEMS		
Biodiversity	**Ecosystems**	

1. INDICATOR

(a) Name: Area of Selected Key Ecosystems.

(b) Brief Description: This indicator will use trends in the extant area of identified key ecosystems to assess the relative effectiveness of measures for conserving biodiversity at ecosystem level and as a tool to estimate the need for specific conservation measures to maintain the biological diversity in a country or region.

(c) Unit of Measurement: Area (km^2 or ha) of selected ecosystem types.

(d) Placement in the CSD Indicator Set: Biodiversity / Ecosystems.

2. POLICY RELEVANCE

(a) Purpose: The indicator has the potential to illustrate the effectiveness of national measures designed to conserve biological diversity and ensure its use is sustainable, including the measures implemented in fulfilment of obligations accepted under the Convention on Biological Diversity (CBD).

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): The CBD recognises that biodiversity has its own intrinsic value and that biodiversity maintenance is essential for human life and sustainable development. Many biological resources, at gene, species and ecosystem level, are currently at risk of modification, damage or loss.

(c) International Conventions and Agreements: The conservation of biological diversity and the sustainable use of its components are among the primary objectives of the Convention on Biological Diversity. This indicator is of particular relevance to several articles of the CBD, e.g., Article 6 - General measures for conservation and sustainable use; Article 7 - Identification and monitoring; Article 8 - In-situ Conservation; and Article 10 - Sustainable use of components of biological diversity. The Convention has, in several COP decisions explicitly recognised the need for an ecosystem approach, and further formalised this position in Decision V/6 made at the fifth COP held in Nairobi in May 2000.
This indicator is relevant to many other global agreements for which the maintenance of biological diversity is important, including: Convention on the Conservation of Migratory Species of Wild Animals (Bonn); Convention on International Trade in Endangered Species (CITES); United Nations Convention on the Law of the Sea (UNCLOSS); Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar); Convention for the Protection of the World Cultural and Natural Heritage (World Heritage Convention).

Related regional conventions and agreements include: Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention); Program for the Conservation of Arctic Flora and Fauna (CAFF); Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR).

(d) International Targets/Recommended Standards: The international community has committed "to achieve a significant reduction of the current rate of biodiversity loss at the global, regional, and national level as a contribution to poverty alleviation and to the benefit of all life on earth by 2010". This "2010 Target" was formally adopted by governments at the 6th Conference of the Parties of the Convention on Biological Diversity in 2002, and endorsed later that year at the World Summit on Sustainable Development. Avoiding further loss of biodiversity could variously involve measures designed to maintain current levels of biodiversity, or to reverse current declining trends (e.g., in natural forest cover). Article 8 (In-situ Conservation) of the CBD, states that contracting parties shall, as far as possible and as appropriate, promote the protection of ecosystems, natural habitats and the maintenance of viable populations of species in natural surroundings.

The 2010 target and general objectives of the CBD provide targets for Parties to the Convention; these objectives could be used as a guide for non-Party states.

(e) Linkages to Other Indicators: This indicator has links to other environmental indicators relating to agriculture, forests, desertification, urbanisation, the coastal zone, fisheries water quality and species. Its trends are also linked to those in population and in economic indicators.

It is closely related to the suite of indicators being implemented by the members of the 2010 Biodiversity Indicators Partnership (2010BIP; www.twentyten.net) to measure progress towards the CBD's 2010 target, and in particular to the indicator on *Trends in extent of selected biomes, ecosystems, and habitats*.

This indicator also relates to a number of the indicators that come under the "Environmental" category of the CSD Core Indicator Framework. These include: *Arable and Permanent Crop Land Areas*, *Forest Area as a Percent of Land Area*, and *Coverage of protected areas as a percentage of total area and with a breakdown by biome and habitat*.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: Few of the concepts and definitions are as yet clearly and consistently applied. Some important points are noted below.
'Ecosystem' refers to the plants, animals, micro-organisms and physical environment of any given place, and the complex relationships linking them into a functional system. Individual ecosystem types may be defined either according to composition in terms of life forms and species, or with respect to ecological processes such as nutrient cycling or carbon sequestration. The former is generally more straightforward for the purposes of area assessment. At present there is no standard classification of ecosystems.

'Key ecosystems' will vary on a country-by-country basis. They can in theory be defined as either those ecosystems for which it is most important to measure changes in extent, or those ecosystems for which it is possible for measure changes in extent. It will be the responsibility of countries to undertake the selection of 'key ecosystems', based on consultation to ensure regional and global interests are evaluated in addition to national priorities, and constrained by the level of detail in the data available.
'Key ecosystems' for a particular country can be selected according to a number of criteria:

- Ecosystems containing rare or locally endemic or threatened species (see the indicator on *Abundance of key species*), and especially those with concentrations of these species;
- Ecosystems of particularly high species richness;
- Ecosystems that represent rare or unusual habitat types;
- Ecosystems severely reduced in area relative to their potential original extent;
- Ecosystems under a high degree of threat;
- Ecosystems with high actual or potential economic importance.

However, the most important factor is likely to be the availability of good quality remotely-sensed spatial data for the ecosystems in question, to ensure that they can be mapped and so that the indicator can be calculated.
'Area' refers to the spatial extent of the ecosystem. This requires the definition of limits or boundaries to the ecosystem, which is difficult where similar or related ecosystems are adjacent. This is especially true if the condition or status of the ecosystem is also of concern. For example, forest area may remain relatively constant despite removal of a substantial proportion of the trees and attendant change in ecological processes.

(b) Measurement Methods: Ecosystem area will normally be derived from mapped data on land cover. This is most efficiently done using data in electronic form and Geographic Information System (GIS) software. Increasingly, land cover maps are derived from remotely sensed data, and these will be combined with biological and other ancillary information to produce ecosystem maps. In some cases, retrospective information may be obtained from historical data sets to provide context and longer-term trends. The greatest difficulty is in arriving at an agreed ecosystem classification that is compatible with the available data. It is also fundamental to ensure consistency of the classification and the method of measurement, including considerations of spatial scale and resolution, over time.

How and whether data on different ecosystems should be combined into a single indicator has yet to be determined. It is possible that trends in ecosystem area may be combined in ways that are analogous to the approaches used for species population trends.

(c) Limitations of the Indicator: Application of this indicator is constrained by several factors, but these can mostly be overcome if resources and personnel are available. The main factor preventing the immediate and widespread application of this indicator is the scarcity of suitable time-series of land cover data. Availability of this data will vary on a country-by-country basis. The reliability of evaluating the extent and

uniqueness of ecosystems depends on the detail, quality and compatibility of ecosystem classifications applied across continuous terrestrial and marine areas.
Ecosystem diversity distribution has not been mapped at an appropriate scale for many areas of high biological diversity. A structured monitoring framework using standardised classification procedures would provide one solution to this problem, but might well not meet the full range of needs for this type of data.
The indicator fails to account for variation in ecosystem status other than extent. Perturbations that do not affect total area will not be recognised through monitoring this indicator, nor will it be possible to anticipate likely future trends in ecosystem status through this indicator alone. Measures of ecosystem condition and protection status are needed to answer this deficiency.

(d) Status of the Methodology: No single universally accepted methodology currently exists. Assessments of land cover and of forest area have been carried out in a number of contexts, including the Forest Resources Assessment 2000 conducted by FAO, but the evaluation of specific forest types is more problematic. There has been little area assessment of other ecosystem types, although global and other land cover data sets do provide some relevant data. It is possible that trends in the areas of many ecosystems can be standardised and combined into a single index using an approach similar to that developed for use with species population data by UNEP-WCMC and WWF: the Living Planet Index (Loh *et al*., 1998, 1999, 2000) (see indicator *Abundance of selected key species*). In this method, an index value for each period is derived by normalising the geometric mean change over the period in the sample of species populations. Using ecosystem area in place of population size, a line graph of these index values would provide an indicator of change in the area of key ecosystems. The numbers and types of ecosystems included would be decided according to the types of criteria outlined above.

(e) Alternative Definitions/Indicators: Area may not be the best indicator of ecosystem status for biodiversity preservation. Many alternatives are area-related and include measures of fragmentation and of naturalness or exposure to the impacts of human activities (UNEP-WCMC 2000), and analysis of the protection status of ecosystems (Lysenko & Henry 2000; Lysenko *et. al* 1995), particularly in areas of high conservation priority.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: The principal data needed for this indicator are land cover data to which an agreed ecosystem classification has been applied. Agreement on the classification will depend upon consensus on key ecosystem types and on the type and quality of raw remotely sensed or other primary data. Supplementary data on distribution of key species, priority areas for biodiversity conservation, distribution of human population and infrastructure as well as protected areas could also be useful.

(b) National and International Data Availability and Sources: Land cover data are available at the global scale from the EROS Data Centre and also at regional (e.g., CORINE) and national scales for many countries. The challenge is in agreeing an appropriate classification that can be applied to the existing data. A further limitation is the frequency with which most such data sets are updated. Mapped data on global priority areas for biodiversity conservation, such as Centres of Plant Diversity, Endemic Bird Areas (EBAs), Important Bird Areas (IBAs), and Ramsar sites are held at UNEP-WCMC. Data on protected areas worldwide are held by UNEP-WCMC in the World Database on Protected Areas (WDPA) and updated frequently. Useful regional and national data sets are held by WWF-US, UNEP-GRID centres, national conservation and academic institutions.

Some mechanisms exist for the international coordination of ecosystem monitoring. The International Global Observing Strategy – Partnership (IGOS-P) includes IGOL (International Global Observation of Land), and GTOS (Global Terrestrial Observing System) which includes GOFC-GOLD (Global Observation of Forest Cover and Land Dynamics), as well as those agencies and academic organizations that are leading implementation of global monitoring including the ESA (European Space Agency), the UN FAO (Food and Agriculture Organization), and several laboratories supported by NASA (US National Air and Space). All of these fall under the GEOSS framework (Global Earth Observation System and Systems).

(c) Data References: Selected references only are mentioned as a general guide to the kinds of data that are available for this type of work. UNEP-WCMC holds data on priority areas for biodiversity conservation and on coverage of some types of ecosystems (see http://www.unep-wcmc.org). Land cover data are available from Eros Data Centre (see http://edcdaac.usgs.gov/glcc/glcc.html) and from the CORINE programme (see http://www.satellus.se).

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: There are a number of agencies leading the development of global scale indicators of trends in extent of various ecosystem or habitat types. These include UNEP-WCMC (coral reefs) and FAO (forests etc.). The NASA/NGO Working Group on Biodiversity also carries out relevant remote-sensing activities. This members of this Working Group include the American Museum of Natural History, NatureServe, Conservation International, Conservation Biology Institute, Smithsonian Institution, NASA, The Nature Conservancy, UNEP, Wildlife Conservation Society, and the World Wildlife Fund – US.

(b) Other Contributing Organizations: The number of other organisations and individuals with the potential to contribute data or advice, or otherwise interested in further development of this indicator is very large. At global level, they would include *inter alia*: the Secretariat of the Convention on Biological Diversity (CBD), the World Wide Fund for Nature (WWF), and IUCN – The World Conservation Union. Other concerned organisations include the Organisation for Economic Cooperation and Development (OECD), the National Institute of Public Health and the Environment (RIVM) in The Netherlands, and a very large number of governmental and non-governmental organisations, mainly in developed countries.

6. REFERENCES

(a) Readings:

Groombridge, B. and Jenkins, M. D. 1994. *Assessing Biodiversity Status and Sustainability*. WCMC Biodiversity Series No. 5. World Conservation Press, Cambridge, UK.

Loh, J., Randers, J., MacGillivray, A., Kapos, V., Jenkins, M., Groombridge, B., Cox, N. and Warren, B. 1999. *Living Planet Report 1999.* WWF-World Wide Fund for Nature, Gland, Switzerland.

Loh, J., Randers, J., MacGillivray, A., Kapos, V., Jenkins, M., Groombridge, B. and Cox, N. 1998. *Living Planet Report 1998.* WWF-World Wide Fund for Nature, Gland, Switzerland.

Loh, J. (Ed). 2000. *Living Planet Report 2000.* WWF-World Wide Fund for Nature, Gland, Switzerland.

Lysenko I., Henry D. 2000. *GAP Analysis in Support of CPAN: The Russian Arctic.* CAFF Habitat Conservation Report No 9; CAFF International Secretariat, 2000.

Lysenko I.,Barinova S., Belikoff S., Bronnikova V., Dezhkin. 1995. *GAP-Analysis. - Biodiversity Conservation Program for the Russian Federation.* Global Environment Facility.

Mittermeier, R.A., N. Myers, J.B. Thomsen, G.A.B. da Fonseca, and S. Olivieri. 1998. *Biodiversity hotspots and major tropical wilderness areas: Approaches to setting conservation priorities*. Conservation Biology 12(3):516-520.

Stattersfield, A.J., Crosby, M.J., Long, A.J. and D.L.Wege. 1998. *Endemic Bird Areas of the World: Priorities for their conservation.* BirdLife Conservation Series No. 7. BirdLife International, Cambridge, UK. 846pp.

UNEP-World Conservation Monitoring Centre. 2000. *European Forests and Protected Areas Gap Analysis: Technical Report.* Cambridge, UK. 27pp.

UNEP-World Conservation Monitoring Centre. 2000. *Assessing forest integrity and naturalness in relation to biodiversity.* Cambridge, UK. 75 pp.

(b) Internet sites:

http://www.biodiv.org/
http://www.ramsar.org
http://www.wetlands.agro.nl
http://www.ecn.nl/doc/europe/legislat/bernconv.html
http://edcdaac.usgs.gov/glcc/glcc.html
http://www.satellus.se
http://www.fao.org/forestry

FRAGMENTATION OF HABITATS		
Biodiversity	**Ecosystems**	

1. INDICATOR

(a) Name: Fragmentation of habitats.

(b) Brief Description: This indicator will use trends in the fragmentation of identified key habitats to assess the relative effectiveness of measures for conserving biodiversity and as a tool to estimate the need for specific conservation measures to maintain the biological diversity in a country or region.

(c) Unit of Measurement: To be determined.

(d) Placement in the CSD Indicator Set: Biodiversity / Ecosystems.

2. POLICY RELEVANCE

(a) Purpose: The indicator has the potential to illustrate the effectiveness of national measures designed to conserve biological diversity and ensure its use is sustainable, including the measures implemented in fulfilment of obligations accepted under the Convention on Biological Diversity (CBD).

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): The CBD recognises that biodiversity has its own intrinsic value and that biodiversity maintenance is essential for human life and sustainable development. Many biological resources, at gene, species and ecosystem level, are currently at risk of modification, damage or loss.

(c) International Conventions and Agreements: The conservation of biological diversity and the sustainable use of its components are among the primary objectives of the Convention on Biological Diversity. This indicator is of particular relevance to several articles of the CBD, e.g., Article 6 - General measures for conservation and sustainable use; Article 7 - Identification and monitoring; Article 8 - In-situ Conservation; and Article 10 - Sustainable use of components of biological diversity. The Convention has, in several COP decisions explicitly recognised the need for an ecosystem approach, and further formalised this position in Decision V/6 made at the fifth COP held in Nairobi in May 2000.
This indicator is relevant to many other global agreements for which the maintenance of biological diversity is important, including: Convention on the Conservation of Migratory Species of Wild Animals (Bonn); Convention on International Trade in Endangered Species (CITES); United Nations Convention on the Law of the Sea (UNCLOSS); Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar); Convention for the Protection of the World Cultural and Natural Heritage (World Heritage Convention).

Related regional conventions and agreements include: Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention); Program for the Conservation of Arctic Flora and Fauna (CAFF); Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR).

(d) International Targets/Recommended Standards: The international community has committed "to achieve a significant reduction of the current rate of biodiversity loss at the global, regional, and national level as a contribution to poverty alleviation and to the benefit of all life on earth by 2010". This "2010 Target" was formally adopted by governments at the 6th Conference of the Parties of the Convention on Biological Diversity in 2002, and endorsed later that year at the World Summit on Sustainable Development. Avoiding further loss of biodiversity could variously involve measures designed to maintain current levels of biodiversity, or to reverse current declining trends (e.g., in natural forest cover). Article 8 (In-situ Conservation) of the CBD, states that contracting parties shall, as far as possible and as appropriate, promote the protection of ecosystems, natural habitats and the maintenance of viable populations of species in natural surroundings.

The 2010 target and general objectives of the CBD provide targets for Parties to the Convention; these objectives could be used as a guide for non-Party states.

(e) Linkages to Other Indicators: This indicator has links to other environmental indicators relating to agriculture, forests, desertification, urbanisation, the coastal zone, fisheries water quality and species. Its trends are also linked to those in population and in economic indicators.

It is closely related to the suite of indicators being implemented by the members of the 2010 Biodiversity Indicators Partnership (2010BIP; www.twentyten.net) to measure progress towards the CBD's 2010 target, and in particular to the indicator on *Connectivity / fragmentation of ecosystems*, which comes under the focal area "Ecosystem Integrity and Ecosystem Goods and Services".

This indicator also relates to a number of the indicators that come under the "Environmental" category of the CSD Core Indicator Framework. These include: *Arable and Permanent Crop Land Areas*, *Forest Area as a Percent of Land Area*, and *Coverage of protected areas as a percentage of total area and with a breakdown by biome and habitat*.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: To be completed.

(b) Measurement Methods: To be determined. A number of methods for measuring trends in habitat fragmentation are in the process of being developed, with varying methods being developed for different habitat types. Considerable further discussion is required to ensure a consistent and robust approach, and to finalise an indicator that is applicable to a range of habitat types.

(c) Limitations of the Indicator: To be determined.

(d) Status of the Methodology: No single universally accepted methodology currently exists.

(e) Alternative Definitions/Indicators: To be determined.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: To be determined.

(b) National and International Data Availability and Sources: To be determined.

Some mechanisms exist for the international coordination of ecosystem monitoring. The International Global Observing Strategy – Partnership (IGOS-P) includes IGOL (International Global Observation of Land), and GTOS (Global Terrestrial Observing System) which includes GOFC-GOLD (Global Observation of Forest Cover and Land Dynamics), as well as those agencies and academic organizations that are leading implementation of global monitoring including the ESA (European Space Agency), the UN FAO (Food and Agriculture Organization), and several laboratories supported by NASA (US National Air and Space). All of these fall under the GEOSS framework (Global Earth Observation System and Systems).

(c) Data References: To be determined.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: A number of agencies are involved in the development of habitat fragmentation indicators, including the UNEP World Conservation Monitoring Centre (UNEP-WCMC) and the UN Food and Agriculture Organization (FAO). The NASA/NGO Working Group on Biodiversity also carries out relevant remote-sensing activities. This members of this Working Group include the American Museum of Natural History, NatureServe, Conservation International, Conservation Biology Institute, Smithsonian Institution, NASA, The Nature Conservancy, UNEP, Wildlife Conservation Society, and the World Wildlife Fund – US.

(b) Other Contributing Organizations: The number of other organisations and individuals with the potential to contribute data or advice, or otherwise interested in further development of this indicator is very large. At global level, they would include *inter alia*: the Secretariat of the Convention on Biological Diversity (CBD), the World Wide Fund for Nature (WWF), and IUCN – The World Conservation Union. Other concerned organisations include the Organisation for Economic Cooperation and Development (OECD), the National Institute of Public Health and the Environment (RIVM) in The Netherlands, and a very large number of governmental and non-governmental organisations, mainly in developed countries.

6. REFERENCES

(a) Readings:

Costanza, R., and T. Maxwell. 1994. Resolution and predictability: an approach to the scaling problem. Landscape Ecology **9**:47-57.

Ewers, R. M., and R. K. Didham. 2006. Confounding factors in the detection of species responses to habitat fragmentation. Biological Reviews **81**:117-142.

Kapos, V., I. Lysenko, and R. Lesslie. 2000. Assessing Forest Integrity and Naturalness in Relation to Biodiversity. FRA2000 working paper, UNEP World Conservation Monitoring Centre and FAO, Cambridge.

Riitters, K., J. Wickham, R. V. O'Neill, B. Jones, and E. Smith. 2000. Global-scale patterns of forest fragmentation. Conservation Ecology **4**:3. (online) URL: http://www.consecol.org/vol4/iss2/art3.

Riitters, K. H., R. V. O'Neill, C. T. Hunsaker, J. D. Wickham, D. H. Yankee, S. P.

Timmins, K. B. Jones, and B. L. Jackson. 1995. A factor analysis of landscape pattern and structure metrics. Landscape Ecology 10:23-39.

CHANGE IN THREAT STATUS OF SPECIES		
Biodiversity	**Species**	**Core indicator**

1. INDICATOR

(a) Name: Change in threat status of species.

(b) Brief Definition: This indicator uses an adaptation of the global World Conservation Union (IUCN) Red List Index /and Sampled Red List Index methodology to show overall changes in threat status (i.e. relative projected extinction risk) of representative sets of species at the global level. It is also applicable at the national level for any country which has a national Red List, and which has fully assessed its species more than once over time.

(c) Unit of Measurement: The number of species in each category of the IUCN Red List (Least Concern, Near Threatened, Vulnerable, Endangered, Critically Endangered, Extinct in the Wild, Extinct), and the number of species changing categories between assessments as a result of genuine improvement or deterioration in their conservation status.

(d) Placement in the CSD Indicator Set: Biodiversity/Species.

2. POLICY RELEVANCE

(a) Purpose: The indicator has the potential to illustrate the effectiveness of national, regional and global measures designed to conserve biological diversity and ensure its use is sustainable, including the measures implemented in fulfilment of obligations accepted under the Convention on Biological Diversity (CBD) and under the Millennium Development Goals). The Red List Index (RLI) is currently "ïn process" for adoption by the UN Statistics Division for the new BD indicator under MDG7, Target 9bis.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): The CBD recognises that biodiversity has its own intrinsic value and that biodiversity maintenance is essential for human life and sustainable development through the provisioning of ecosystem goods and services. Many biological resources, at gene, species and ecosystem level, are currently at risk of modification, damage or loss.

(c) International Conventions and Agreements: The conservation of biological diversity and the sustainable use of its components are two of the three primary objectives of the Convention on Biological Diversity. This indicator is of particular relevance to several articles of the CBD, e.g., Article 6 - General measures for conservation and sustainable use; Article 7 - Identification and monitoring; and Article 10 - Sustainable use of components of biological diversity.

This indicator is relevant to many other global agreements for which the maintenance of biological diversity is important, including: Convention on the Conservation of

Migratory Species of Wild Animals (Bonn); Convention on International Trade in Endangered Species (CITES); United Nations Convention on the Law of the Sea (UNCLOSS); Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar); International Convention for the Regulation of Whaling. Related regional conventions and agreements include: Convention on the conservation of European wildlife and natural habitats (Berne); EU Habitats and Species Directive and the EU Birds Directive; Program for the Conservation of Arctic Flora and Fauna (CAFF); Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR); Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA).

(d) International Targets/Recommended Standards: The international community has committed "to achieve a significant reduction of the current rate of biodiversity loss at the global, regional, and national level as a contribution to poverty alleviation and to the benefit of all life on earth by 2010". This "2010 Target" was formally adopted by governments at the 6th Conference of the Parties of the Convention on Biological Diversity in 2002, and endorsed later that year at the World Summit on Sustainable Development. The 2010 target, and the targets relating to the general objectives of the CBD, relate specifically to Parties to the Convention on Biological Diversity but could also be used as a guide for non-Party states.

The revised MDG monitoring framework, presented in 2007 to the General Assembly, includes the new target "Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss" under MDG 7 (Ensure environmental sustainability), in addition to the original target "Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources".

(e) Linkages to Other Indicators: The global IUCN Red List Index and Sampled Red List Index are part of the suite of indicators measuring progress towards the CBD's target to reduce the rate of biodiversity loss by 2010, which are being implemented by the members of the 2010 Biodiversity Indicators Partnership (2010BIP; www.twentyten.net). It refers to the CBD 2010 indicator on "Change in status of threatened species", and comes under the headline indicator "Status and trends of the components of biodiversity".

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts:

Threatened species: A threatened species is one that is listed under the IUCN Red List Categories as Vulnerable, Endangered or Critically Endangered (i.e., species that are facing a high, very high or extremely high risk of extinction in the wild). Increasing numbers of threatened species represent actual or potential declines in biodiversity. Decreasing numbers of threatened species following management interventions is strongly indicative of successful conservation measures.

'The IUCN Red List': The IUCN Red List of Threatened Species ™ is widely recognised as the most authoritative and objective system for classifying species by their risk of extinction. Species are included in the following categories according to a range of data regarding their abundance, populations, ecology, and the threats they face, among others: Least Concern, Near Threatened, Vulnerable, Endangered, Critically Endangered, Extinct in the Wild, Extinct, or Data Deficient.

The 2006 release of the global IUCN Red List of Threatened Species ™ included assessments for 40,168 species, of which more than 16,118 are threatened with extinction. The assessment includes species from a broad range of taxonomic groups including vertebrates, invertebrates, plants, and fungi. The small number of groups that have been comprehensively assessed once include birds, mammals, amphibians, and gymnosperms (primarily conifers and cycads). So far only birds have been comprehensively assessed more than once. Mammals will be have also been comprehensively assessed for the second time by 2008 and 'back-casting' is being carried out on the amphibians so they can be added as well. The IUCN SRLI is also going to allow for appropriate samples of under-assessed taxonomic groups to be included – inverts, plants, reptiles, fish, corals, etc.

The data in the IUCN Red List, and used in the calculation of the RLI, and the SRLI is collected by members of the IUCN SSC Specialist Group network, Red List partners BirdLife International, NatureServe, and the Zoological Society of London as well as several botanical institutions and a number of global assessment projects (for mammals, amphibians, reptiles, freshwater and marine taxa). They are then reviewed by the appropriate Red List Authority and entered into the IUCN Red List database, which is uploaded annually to www.iucnredlist.org. There are strict data standards and guidelines for using the IUCN Red List Categories and Criteria, as described by the Red List Standards and Petitions Working Group (2006; see references).

(b) Measurement Methods: The best known and most accepted methodology for assessing trends in the status of threatened species at a global level is the IUCN Red List Index RLI. The method for calculating the IUCN RLI has been published in detail by Butchart et al (2004, 2005), with revisions to the methodology published in 2007. The RLI is based on the number of species in each Red List Category, and the number moving between categories in different assessments owing to genuine improvements and deterioration in status only (i.e. category changes owing to revised taxonomy or improved knowledge are excluded).

In the revised version of the methodology, the RLI value can range from 1 (when all species are categorised as Least Concern) to 0 (when all species are categorised as Extinct). An intermediate value indicates how far the set of species has moved overall towards extinction. Thus the RLI allows comparisons between sets of species in both their overall level of extinction risk (i.e. how threatened they are on average), and in the rate at which this changes over time. An upward trend means that the situation is improving and that expected rate of species extinctions is abating (i.e. the rate of biodiversity loss is decreasing), and a horizontal line means that the expected rate of species extinctions is remaining the same, although in each of these cases it does not mean that biodiversity loss has stopped. Hence, to show that the target of significantly reducing the rate of biodiversity loss may have been met, an upward RLI trend is needed at the very least. A RLI value of 1.0 would show that biodiversity loss had been halted. Further details of the calculation methodology and formula are given in Butchart et al (2004, 2005, 2007).

The indicator can be calculated for any taxonomic group for which Red List assessments have been carried out on all species at least twice. To date a IUCN Red List Index (RLI) has been developed for all bird species for 1988-2004 (Butchart et al 2004), and a preliminary RLI has been developed for all amphibian species for 1980-2004 (Butchart et al 2005), with a national example calculated for birds, mammals and amphibians for Madagascar (Randriarnasolo et al submitted). In any particular group trends can be shown for all species, or can be disaggregated to show trends in particular families, ecosystems, biomes, or for suites of species impacted by particular threats (e.g. overexploitation, alien invasive species or climate change) or relevant to particular international treaties(e.g. the Convention on Migratory Species or CITES).). RLIs show a fairly coarse level of resolution, but for fully assessed taxonomic groups they are highly representative of the change in conservation status over time.

The 2007 revision of the Red List Index focused on overcoming shortcomings of the original methodology. As a result, the indicator now performs appropriately when a value of zero is reached, RLI values are no longer affected by the frequency of assessments, and newly evaluated species no longer introduce bias. It also developed two additional strengths: (i) assessment errors are not propagated, and (ii) overall extinction risk and rates of change can be distinguished.

Global RLIs can be disaggregated to the national level for countries that have a high proportion of endemic species. In addition, RLI methodology can be applied at the national level for countries that have national Red Lists derived using the guidelines on the use of the IUCN Red List Categories and Criteria, and that have assessed their species more than once. Ideally species should be re-assessed at regular intervals of approximately four years to help ensure that changes in status are identified. Information about the reasons for any change in conservation status is required, to ensure that any documented change is genuine and not an artifact of survey techniques, for example. It is also necessary to know the time when that change happened, so that changes in status can be assigned to the appropriate time period.

(c) Limitations of the Indicator: The main limitation of the RLI is that it shows relatively low temporal resolution, because the Red List Categories are relatively broad measures of status, and the RLI can practically be updated only every four years at most. The RLI captures trends in one particular aspect of biodiversity: the rate that species are moving towards extinction and becoming extinct. It does not encompass the wider spectrum of biodiversity, including genes and ecosystems, although the Sampled Red List Index will be representative of a wide diversity of taxa. However, losing species through extinction is a particularly tangible and readily understandable component of biodiversity loss and has clear relevance to ecosystem function. The RLI does not capture particularly well the deteriorating status of common species that are declining slowly as a result of general environmental degradation.

National Red List Indices based on national-scale extinction risk can only be calculated where Red List Categories have been assigned according to the 'regional' IUCN Red List guidelines. One issue relating to this is that not all national Red List processes follow these guidelines. IUCN is investigating the possibility of developing a means to determine which countries are compiling their Red Lists in accordance with the guidelines. Furthermore, the country's species must have been assessed at least twice if the index is to be calculable. At present few countries have completed a second full Red List assessment. IUCN does not at present hold a complete list of national Red Lists, however a proposal is in the pipeline for both compilation of this list and the provision of training to countries in the compilation of Red Lists.

RLIs can be disaggregated to the national level for countries that have a high proportion of endemic species. For smaller countires that share many species with their neighbours, it may not be meaningful to disaggregate global trends to the national level, since it is difficult to determine whether the trends are driven by processes operating in the particular country.

(d) Status of the Methodology: The technical and methodological aspects of the IUCN RLI are well-developed and have been published in peer-reviewed scientific journals. The results of the RLI have also been published in the *Millennium Ecosystem Assessment* (2005), *Global Biodiversity Outlook 2* (2006), and the *2004 IUCN Red List of Threatened Species: A Global Species Assessment*, and will be included in the 4th Edition of the *Global Environment Outlook* (due for publication in 2007).

To date a RLI has been developed for all bird species for 1988-2004 (Butchart et al 2004) and a preliminary RLI has been developed for all amphibian species for 1988-2004 (Butchart et al 2005), with a national example calculated for birds, mammals and amphibians for Madagascar (Randriarnasolo et al submitted). RLIs are in development for other groups. By 2010 trends will be available for birds (1988-2008), mammals (1996-2007), amphibians (2004-2008), cycads (2003-2008), and possibly conifers (1998-2008). First assessments for a number of other groups will also be available e.g. freshwater molluscs, dragonflies, and selected marine groups) as the first stage in the development of the SRLI.

At present, Madagascar is the country with a national RLI available. Other national disaggregations of the global index are in preparation (e.g. Philippines).. In addition, the formula and methodology for the global RLI is applicable at the national level, provided sufficient data are available and that the national Red List has been developed in accordance with the IUCN guidelines.

(e) Alternative Definitions/Indicators: An alternative, or complementary, indicator could be one that uses estimates of population trends in selected species to represent changes in biodiversity, and the relative effectiveness of measures to maintain biodiversity. Please refer to the indicator *Abundance of selected key species*.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: This indicator requires data on species' conservation status, including information about population sizes and trends, species range, ecology, threats, and relevant conservation measures. These data must then be used to assign species to Red List Categories according to the guidelines on use of IUCN Red List Categories and Criteria. For it to be possible for a Red List Index to be calculated for a particular country or taxonomic group, all species within that country or group must be assessed at least twice over time.

(b) National and International Data Availability and Sources: The data used to determine species' global Red List categories is provided principally by the Specialist Groups of the IUCN Species Survival Commission (SSC) and from BirdLife International's global network, with additional information coming from other partner organizations (the same data standards and procedures are applied to all assessments used by IUCN). The SSC Specialist Group network comprises nearly 7,000 species experts with representatives in almost every country of the world.

National Red List data availability and sources vary considerably. In some cases data are collected by governments or other in-country organisations, while in others the data collection is provided by the SSC and coordinated by the IUCN Species Programme. For national Red List data to be applicable to the Red List Index methodology it must conform to the IUCN Red List data collection system and the guidelines for assigning Red List Categories. At least 122 countries have published one or more national Red Data Books or Red Lists. Of these, at least 77 countries are known to be using the IUCN Red List Categories and Criteria, either fully or in part, and many others intend to do so in future.

(c) Data References: Global Red List data are available on the IUCN Red List website (www.iucnredlist.org) and this database is updated annually. At present IUCN does not hold a complete list of national Red Lists; however this is in development.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the World Conservation Union (IUCN).

(b) Other Contributing Organisations: Contributors to the global IUCN Red List come from numerous organisations around the world, individuals from which are members of the IUCN Species Survival Commission extensive voluntary network of experts. The data contributions are co-coordinated and managed by the IUCN Species Programme. At the national level data are largely collected by government agencies or other in-country organisations.

6. REFERENCES

(a) Readings:

The global RLI has been used in the following publications:

Baillie, J.E.M., Hilton-Taylor, C. and Stuart, S.N. Eds., 2004. *2004 Red List of Threatened Species: A Global Species Assessment*. IUCN, Gland, Switzerland and Cambridge, UK.

BirdLife International, 2004. *State of the World's Birds 2004 – Indicators for Our Changing World.* BirdLife International, Cambridge, UK.
Mace, G.M. et al, 2005. Biodiversity. Chapter 4 in: *Millennium Ecosystem Assessment, Current State and Trends: Findings of the Condition and Trends Working Group. Ecosystems and Human Well-Being, volume 1.* Island Press, Washington D.C., USA.
The following publications on the methods for the IUCN Categories and Criteria or the methods of the RLI/SRLI have been published in reviewed scientific journals.
Akçakaya, H. R., Ferson, S., Burgman, M. A., Mkeith, D. A., Mace, G. M. and Todd, C. A. 2000. Making consistent classifications under uncertainty. *Conservation Biology* 14: 1001–1013.

Butchart, S.H.M., Akçakaya, H.R., Chanson, J., Baillie, J.E.M., Collen, B., Quader, S., Turner, W.R., Amin, R., Stuart, S.N., Hilton-Taylor, C. 2007. Improvements to the Red List Index. *PLOS One.* 1: 1-8.

Butchart, S.H.M., Stattersfield, A.J., Baillie, J.E.M., Bennun, L.A., Stuart, S.N., Akcakaya, H.R., Hilton-Taylor, C., and Mace, G.M. 2005. Using Red List Indices to measure progress towards the 2010 target and beyond. *Philosophical Transactions of the Royal Society of London*. 360 (1454): 359–372

Butchart, S.H.M., Stattersfield, A.J., Bennun, L.A., Shutes, S.M., Akcakaya, H.R., Baillie, J.E.M., Stuart, S.N., Hilton-Taylor, C., and Mace, G.M. 2004. Measuring global trends in the status of biodiversity: Red List Indices for birds. *PLOS Biology* 2 (12): 2294-2304.

Gärdenfors, U., Hilton-Taylor, C., Mace, G.M. and Rodríguez, J.P. 2001. The application of IUCN Red List Criteria at regional levels. *Conservation Biology* 15: 1206–1212.

Mace, G.M. and Lande, R. 1991. Assessing extinction threats: toward a re-evaluation of IUCN threatened species categories. *Conservation Biology* 5: 148–157.

Milner-Gulland, E.J., Kreuzberg-Mukhina, E., Grebot, B., Ling, S., Bykova, E., Abdusalamov, A., Bekenov, A., Gärdenfors, U., Hilton-Taylor, C., Salnikov, V. and Stykova, L. 2006. Application of IUCN red listing criteria at the regional and national levels: a case study from central Asia. *Biodiversity and Conservation* 15(6): 1873–1886.

The Millennium Ecosystem Assessment is not a scientific journal, but all chapters underwent an extensive peer- review process involving many of the worlds leading scientists.

Mace, G.M. et al, 2005. Biodiversity. Chapter 4 in: *Millennium Ecosystem Assessment, 2005*. Current State and Trends: Findings of the Condition and Trends Working Group. Ecosystems and Human Well-being, vol.1., Island Press, Washington DC.

The data in the following publications underwent an extensive review process:

Baillie, J. and Groombridge, B. 1996. *1996 IUCN Red List of Threatened Animals*.

International Union for Conservation of Nature and Natural Resources, Gland, Switzerland and Cambridge, UK.

Baillie, J.E.M., Hilton-Taylor, C. & Stuart, S.N. (eds.) 2004. *2004 IUCN Red List of Threatened Species. A Global Species Assessment.* IUCN, Gland, Switzerland and Cambridge, UK.

BirdLife International 2000. *Threatened birds of the world*. BirdLife International and Lynx Edicions, Cambridge, UK and Barcelona, Spain.

BirdLife International 2001. *Threatened birds of Asia: the BirdLife International Red Data Book*. BirdLife International, Cambridge, UK.

BirdLife International 2004a. *Threatened birds of the world 2004*. CD-ROM. BirdLife International, Cambridge, UK.

BirdLife International 2004b. *State of the worlds birds 2004: indicators for our changing planet.* BirdLife International, Cambridge, UK.

Collar, N.J. and Andrew, P. 1988. *Birds to watch: the ICBP world checklist of threatened birds*. International Council for Bird Preservation and
International Union for Conservation of Nature and Natural Resources, Cambridge, UK:.

Collar, N.J., Crosby, M.J. and Stattersfield, A.J. 1994. *Birds to watch 2: the world list of threatened birds*. BirdLife International, Cambridge, UK:. (BirdLife Conservation Series 4).

Hilton-Taylor, C. (compiler). 2000. *2000 IUCN Red List of Threatened Species*.
IUCN, Gland, Switzerland and Cambridge, UK.

The following documents represent two periods of extensive review of the IUCN Red List Categories and Criteria involving a large number of scientists.

IUCN. 1994. *IUCN Red List Categories*. IUCN Species Survival Commission, IUCN, Gland, Switzerland and Cambridge, UK.

IUCN. 2001. *IUCN Red List Categories and Criteria: version 3.1*. IUCN Species Survival Commission, IUCN, Gland, Switzerland and Cambridge, UK.

(b) **Internet sites:**

IUCN Red List of Threatened Species: www.iucnredlist.org and http://www.iucn.org/themes/ssc/redlist.htm

IUCN Sampled Red List Index: measuring progress towards the 2010 biodiversity targets, 2005: http://www.iucn.org/themes/ssc/images/miscellaneous/SRLIsmall.jpg

ABUNDANCE OF SELECTED KEY SPECIES		
Biodiversity	**Species**	

1. INDICATOR

(a) Name: Abundance of Selected Key Species.

(b) Brief Definition: This indicator uses estimates of population trends in selected species to represent changes in biodiversity, and the relative effectiveness of measures to maintain biodiversity. The indicator can be applied to individual species groups (e.g. birds, butterflies), or can be aggregated to incorporate a number of taxa (e.g. in a fashion similar to the Living Planet Index), according to data availability and indicator applicability.

(c) Unit of Measurement: Number of mature individuals or other relevant indicator of abundance within a given area or population.

(d) Placement in the CSD Indicator Set: Biodiversity/Species.

2. POLICY RELEVANCE

(a) Purpose: The indicator has the potential to illustrate the effectiveness of national measures designed to conserve biological diversity and ensure its use is sustainable, including the measures implemented in fulfilment of obligations accepted under the Convention on Biological Diversity (CBD).

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): The CBD recognises that biodiversity has its own intrinsic value and that biodiversity maintenance is essential for human life and sustainable development. Many biological resources, at gene, species and ecosystem level, are currently at risk of modification, damage or loss.

(c) International Conventions and Agreements: The conservation of biological diversity and the sustainable use of its components are among the primary objectives of the Convention on Biological Diversity. This indicator is of particular relevance to several articles of the CBD, e.g., Article 6 - General measures for conservation and sustainable use; Article 7 - Identification and monitoring; and Article 10 - Sustainable use of components of biological diversity.

This indicator is relevant to many other global agreements for which the maintenance of biological diversity is important, including: Convention on the Conservation of Migratory Species of Wild Animals (Bonn); Convention on International Trade in Endangered Species (CITES); United Nations Convention on the Law of the Sea (UNCLOSS); Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar); International Convention for the Regulation of Whaling.

Related regional conventions and agreements include: Convention on the conservation of European wildlife and natural habitats (Berne); Program for the Conservation of Arctic Flora and Fauna (CAFF); Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR); Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA).

(d) International Targets/Recommended Standards: The international community has committed "to achieve a significant reduction of the current rate of biodiversity loss at the global, regional, and national level as a contribution to poverty alleviation and to the benefit of all life on earth by 2010". This "2010 Target" was formally adopted by governments at the 6th Conference of the Parties of the Convention on Biological Diversity in 2002, and endorsed later that year at the World Summit on Sustainable Development. The 2010 target, and the targets relating to the general objectives of the CBD, relate specifically to Parties to the Convention on Biological Diversity, but could also be used as a guide for non-Party states.

(e) Linkages to Other Indicators: This indicator can be linked to the majority of the CSD Environmental Core Indicators, eg. annual fisheries catch by major species. There may also be indirect links to social indicators, such as changes in human population. This indicator is also directly related to the suite of indicators measuring progress towards the CBD's target to reduce the rate of biodiversity loss by 2010, which are being implemented by the members of the 2010 Biodiversity Indicators Partnership (2010BIP; www.twentyten.net). It particularly relates to the indicator on "Trends in abundance and distribution of selected species", which includes the Living Planet Index (LPI) and associated population indices, and the Global Wild Bird Index.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: Few of the concepts and definitions are as yet clearly and consistently applied. Some important points are noted below.
'Abundance' - This may be defined as the number of mature individuals within the population or area under study. Where it is difficult or inappropriate to survey individuals, comparable surrogate units of measurement, such as number of nests (marine turtles) or spawning stock biomass (fishes), may be acceptable.

'Key species' - It is possible to suggest general criteria for selecting key species, but it will be the responsibility of nations to undertake this selection. This should be done in a consultative way that ensures that regional and global interests are evaluated in addition to national priorities. No single organism or related group of organisms can be expected to reflect comprehensively the patterns of distribution and abundance of all other taxa, and effective biodiversity indicators are likely in most cases to be based on an indicator group composed of several appropriate species. The following categories of species might be considered as 'key species' when developing a biodiversity monitoring programme:

- **Keystone species**: A taxon whose impact on the ecosystem or community studied is disproportionately large relative to its abundance (Caro and O'Doherty, 1998). The loss of these species will significantly impact upon the population sizes of other species in the ecosystem, potentially leading to further species loss ('cascade effect').

 Rare or locally endemic species: Any area contributes to global biodiversity by the overall number of different species within it (and the different higher taxa that are represented), and by the proportion of those that do not occur anywhere else (species endemic to the area). Conservation of endemic species, particularly those sharing a discrete geographic area, can be a cost-effective way to maintain global biodiversity levels.

 Threatened species: By definition, a threatened species represents actual or potential decline in biodiversity, and recovery of threatened species following management intervention is strongly indicative of successful conservation measures.
Any candidate 'key species' selected from the above categories, or whatever other categories may be deemed appropriate, can be further selected on the basis of other more general biological and logistic criteria. The following are among the characteristics that effective indicator species are likely to possess (e.g., Noss, 1990; Pearson, 1994):

- taxonomically well known, so that populations can be reliably identified, usually in the field,
- biologically well understood,
- easy to survey (e.g., abundant, non-cryptic) ,
- widely distributed at higher taxonomic levels (e.g., order, family, tribe, genus) across a large geographic and habitat range,
- diverse and include many specialist taxa at lower taxonomic levels (e.g., species or species populations) which would be sensitive to habitat change,
- representative to some extent of distribution and abundance patterns in other related and unrelated taxa,
- actually or potentially of economic importance.

(b) Measurement Methods: Information on species abundance should be collected through the consistent, long-term, application of an appropriate survey technique that is widely accepted by the scientific community. Examples of publications with details of field study methodologies for certain groups are given below. Retrospective population information may be obtained through review of published literature, including previous field study reports, seeking material that is appropriate for comparison with the ongoing methodologies adopted.

While it is in most cases impossible to count every individual within a population or area, a knowledge of habitat requirements and species population density in sample areas, coupled with data on climate, altitude, soil type or vegetation cover may be used to estimate population size in the area of interest. A geographic information system (GIS) is commonly used to analyse the spatial data. It is important that population size predictions are verified by fieldwork.

This indicator will be better capable of international integration if, after recording, abundance values are processed in a way that minimises or avoids the effects of different scales of change in species that are biologically very different. For example, raw abundance values derived from a large terrestrial predator and from Antarctic krill would need to be measured on scales possibly several orders of magnitude apart, making any comparison between them meaningless. This also bears on national selection of key species, whenever the goal is to derive a single integrated national indicator value for biodiversity change over time.

By definition, monitoring of indicator species will be a continuing process, but for studies within a set timeframe, species should have a life history that complements this period, i.e., there may be little benefit from attempting to monitor very long-lived species over a five-year period only. For studies within a set area it is preferable to avoid selecting taxa that are directly influenced by external events, for example species that annually migrate outside of the study area. For many purposes, it will be preferable to avoid species that show high amplitude annual or irregular variation in population number.

(c) Limitations of the Indicator: Application of this indicator is constrained by several factors, but these can mostly be overcome if resources and personnel are available. The main factor preventing the immediate and widespread application of this indicator is the scarcity of suitable time-series of population data. In practice, change in biodiversity at species and habitat level has to date very often been identified retrospectively, on an ad hoc basis, by means of largely anecdotal evidence, and using terms and units of measurement that are highly case-specific. A structured monitoring framework is preferred, with a secure project lifetime of many years. For comparative purposes, perhaps seeking to build a comprehensive continental or global picture from national data, it is important that similar parameters are measured in similar terms. Care should be taken in interpreting the results of studies based on indicator groups, since the empirical relationship between biodiversity in different groups of organisms has been little investigated.

It is important to note that more species population data are available from temperate than tropical regions of the world, whereas species richness is higher in the tropics. Aside from the issue of data availability this does not have the same implications for national-scale indicators as it does for regional or global aggregate indices. The LPI overcomes this problem by dividing data by biome (terrestrial/freshwater/marine) depending on the principle habitat of the species, and then according to the biogeographic realm or ocean they inhabit.

(d) Status of the Methodology: No single practicable and universally accepted methodology for national-level indicators of abundance of selected key species currently exists. However, through the Living Planet Index, UNEP-WCMC and WWF (Loh *et al*. (1998, 1999, 2000, 2005) have designed and implemented a system to generate indicators of biodiversity change over time, principally at global or continental level. Output from this system was first used in the WWF Living Planet Report 1998 and has been regularly updated since then (in 2000, 2002 and 2004). This method is designed to make use of the very imperfect data that are available. The index value for each period is derived by normalising the geometric mean change over the period in the sample of populations. A line graph of these index values provides an indicator of biodiversity change. In principle, range area could be used where population counts are not available. This system is limited ultimately by the number of populations for which quantitative size (or area) estimates are available.

BirdLife International's Wild Bird Index (WBI) (Gregory et al, 2003, 2004, 2005; Roberts et al 2005; van Strien 2001) measures average population trends of a suite of representative wild birds, as an indicator of the general health of the wider environment. The WBI can be disaggregated geographically and by habitat for analysis, interpretation and communication. The methodology is already well developed and has been peer-reviewed. The WBI is currently used in Europe to measure aspects of sustainable human development, and is in the process of being expanded to the global scale.

A similar method has been used in the UK Government's indicators programme (see http://www.environment.detr.gov.uk/sustainable/) to show population change in bird groups. Other related approaches have been used, and several other proposed biodiversity indicators remain at the design stage.

(e) Alternative Definitions/Indicators: The percentage of a country's flora or fauna that is categorised as threatened with extinction provides a static view of the status of national biodiversity, and change over time in this proportion, or the changing membership of particular status categories (e.g., 'Extinct in the Wild' or 'Critically Endangered'), could illustrate the effectiveness of measures for maintaining particular elements of biological diversity. This approach requires a stable species-level taxonomy, and a standard system for assessing conservation status. The IUCN Red List Categories and Criteria offer such a system (see indicator *Assessment of Threatened Species*). This indicator is only of value if changes in Red List Categories can be attributed to actual change in the conservation status of species, rather than changes in taxonomy or in the availability of information, for example.

Permanent reduction in habitat area or quality will tend to lead to loss of some species originally present. Therefore, indicators of change in habitat area and quality (assessment of the latter is problematic) also have the potential to indicate change in overall biodiversity.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: The preferred input would be sets of quantitative data on the population size (or proxy of population size) of selected species within a given area, assessed at suitable time intervals using a standardised method. Data can include total population estimates (e.g. counts of an entire species), direct measures (e.g. the number of birds per km of transect), biomass or stock estimates (e.g. for commercial fish species), and proxies of population size (e.g. number of nests of marine turtle species on various nesting beaches).

(b) National and International Data Availability and Sources: In the absence of any comprehensive global programme for species monitoring, and of universal standards for national monitoring, suitable data are in relatively short supply. Several developed countries hold data that would be suitable as a basis for this indicator. These data have variously been collected by amateur field biologists or as part of official monitoring programmes. It is in some cases probable that much more information exists with individuals, groups and organisations than is generally known, and the problem is thus one of gaining access to suitable data. However, although the number of field surveys and biodiversity assessments has increased greatly in recent years, very little true monitoring has taken place in developing countries or biodiversity-rich countries in the tropics. These are the nations most likely to face difficulties in developing monitoring programmes, but also to be much in need of them. By far the greatest volume of readily available time-series data relate to stock estimates and catch levels (the latter not usually suitable for abundance estimation) in the marine fish populations targeted by industrialised fisheries of developed countries. The various management bodies are often sources of these data. The bird species that are surveyed regularly by networks of mainly amateur ornithologists in developed countries are by far the best-known large terrestrial group. Suggestions for taxa that can be focused upon therefore include farmland and woodland birds, as well as butterflies which are also well-surveyed in a number of countries.

(c) Data References: Selected references only are mentioned as a general guide to the kinds of work that exist in this field. Population data and analytic tools for birds and other groups can be accessed at the website of the United States Geological Survey Patuxent Wildlife Research Centre (http://www.pwrc.usgs.gov), and see, for example, Sauer *et al*., 2000. Bird populations are the focus of one headline indicator in the UK Government's strategy for sustainable development: DETR Government Statistical Service, 1999, *Indicators for a Strategy of Sustainable Development for the UK: a baseline assessment*. Extensive documentation on fish populations in the North Atlantic region is available at the website of the International Council for the Exploration of the Sea (ICES) (http://www.ices.dk). Results of the Living Planet Index methodology are presented in Loh *et al.* (1998, 1999, 2000). The methodology and results have been published and peer-reviewed (Loh et al 2005).

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agencies are the UNEP World Conservation Monitoring Centre (UNEP-WCMC), and the World Wide Fund for Nature (WWF International) and Zoological Society of London (ZSL) who are jointly responsible for the Living Planet Index.

(b) Other Contributing Organisations:. The number of other organisations and individuals with the potential to contribute data or advice, or otherwise interested in further development of this indicator is very large. At global level, they would include *inter alia*: the Secretariat of the Convention on Biological Diversity (CBD), BirdLife International, and IUCN – The World Conservation Union. Other concerned organisations include the Organisation for Economic Cooperation and Development (OECD), the National Institute of Public Health and the Environment (RIVM) in The Netherlands.

6. REFERENCES

(a) Readings:

Caro, T.M. and O'Doherty, G. 1998. On the use of surrogate species in conservation biology. *Conservation Biology*, 13(4): 805-814.

DETR Government Statistical Service. 1999. Quality of Life Counts 'Indicators for a Strategy of Sustainable Development for the UK: a baseline assessment'.

Gregory, R. D., Noble, D., Field, R., Marchant, J.H, Raven, M. & Gibbons D.W. 2003. Using birds as indicators of biodiversity. *Ornis Hungaria* 12-13, 11-24.

Gregory, R. D., Noble, D. A. & Custance, J. 2004. The state of play of farmland birds: population trends and conservation status of farmland birds in the United Kingdom. *Ibis* 146 (Suppl.), 1-13.

Gregory, R.D., van Strien, A., Vorisek, P., Meyling, A.W.G., Noble, D.G., Foppen, R.P.B. & Gibbons, D.W. 2005. Developing indicators for European birds. *Phil. Trans. R. Soc. B.* 360, 296-288.

Groombridge, B. and Jenkins, M. D. 1994. *Assessing Biodiversity Status and Sustainability*. WCMC Biodiversity Series No 5. World Conservation Press, Cambridge, UK.

Loh, J., Randers, J., MacGillivray, A., Kapos, V., Jenkins, M., Groombridge, B., Cox, N. and Warren, B. 1999. *Living Planet Report 1999.* WWF-World Wide Fund for Nature, Gland, Switzerland.

Loh, J., Randers, J., MacGillivray, A., Kapos, V., Jenkins, M., Groombridge, B. and Cox, N. 1998. *Living Planet Report 1998.* WWF-World Wide Fund for Nature, Gland, Switzerland.
Loh, J. (Ed). 2000. *Living Planet Report 2000.* WWF-World Wide Fund for Nature, Gland, Switzerland.

Loh, J., R.E. Green, T. Ricketts, J. Lamoreux, M. Jenkins, V. Kapos, J. Randers. 2005. The Living Planet Index: using species population time series to track trends in biodiversity. *Philosophical Transactions of the Royal Society B* 360, 289-295.

Noss, R.F. 1990. Indicators for monitoring biodiversity: a hierarchical approach. *Conservation Biology*, 4: 355-364.

Pearson, D.L. 1994. Selecting indicator taxa for the quantitative assessment of biodiversity. *Philosophical Transactions of the Royal Society of London: Biological Sciences*, 345: 75-79.

Roberts, R.L., Donald, P.F. & Fisher, I.J. 2005. Worldbirds: developing a web-based data collection system for the global monitoring of bird distribution and abundance. *Biodiversity and Conservation* 14: 2807–2820.

Sauer, J. R., J. E. Hines, I. Thomas, J. Fallon, and G. Gough. 2000. *The North American Breeding Bird Survey, Results and Analysis 1966 - 1999. Version 98.1, USGS Patuxent Wildlife Research Center, Laurel, MD.*

van Strien, A. J., Pannekoek, J., & Gibbons, D. W. 2001 Indexing European bird population trends using results of national monitoring schemes: a trial of a new method. *Bird Study* 48, 200-213.
Field study guidelines:

Bibby, C. J., N. D. Burgess, & D. A. Hill (1993) Bird census techniques. Academic Press, London.

Bibby, C. J., M. J. Jones, & S. J. Marsden (1998) Expedition field techniques: bird surveys. Expedition Advisory Centre, Royal Geographic Society/ BirdLife International, London.

Heyer, R. W., M. A. Donnelly, R. W. McDiarmid, L. C. Hayek, & M. S. Foster (eds.) Measuring and monitoring biological diversity: standard methods for amphibians. Smithsonian Institution, Washington.

Wilson, D.E., F.R. Cole, J.D. Nichols, R.Rudran, and M.S. Foster. (eds.). 1996. Measuring and Monitoring Biological Diversity, Standard Methods for Mammals. Smithsonian Institution Press, Washington, D.C.

(b) Internet sites:

http://www.biodiv.org/
http://www.ices.dk
http://www.iucn.org/themes/ssc/guidelines.htm
http://www.panda.org/news_facts/publications/living_planet_report/index.cfm
http://www.redlist.org/
http://www.unep-wcmc.org/species/reports/
http://www.wri.org/wri/biodiv/cascade.html

ABUNDANCE OF INVASIVE ALIEN SPECIES		
Biodiversity	**Species**	

1. INDICATOR

(a) Name: Abundance of Invasive Alien Species.

(b) Brief Definition: This aim of this indicator is to monitor trends in invasive alien species (IAS) at the national scale. An additional component could be to measure the cost of invasions of such species.

(c) Unit of Measurement: Number of invasive alien species in a given country or region.

(d) Placement in the CSD Indicator Set: Biodiversity/Species.

2. POLICY RELEVANCE

(a) Purpose: The indicator has the potential to illustrate the effectiveness of national measures designed to conserve biological diversity and ensure its use is sustainable, including the measures implemented in fulfilment of obligations accepted under the Convention on Biological Diversity (CBD).

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): The CBD recognises that biodiversity has its own intrinsic value and that biodiversity maintenance is essential for human life and sustainable development. Many biological resources, at gene, species and ecosystem level, are currently at risk of modification, damage or loss.

(c) International Conventions and Agreements: The conservation of biological diversity and the sustainable use of its components are among the primary objectives of the Convention on Biological Diversity. This indicator is of particular relevance to several articles of the CBD, e.g., Article 6 - General measures for conservation and sustainable use; Article 7 - Identification and monitoring; Article 8 – In-situ conservation (Article 8 h) calls upon countries to prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species) and Article 10 - Sustainable use of components of biological diversity.

This indicator is relevant to many other global agreements for which the maintenance of biological diversity is important, including: Convention on the Conservation of Migratory Species of Wild Animals (Bonn); Convention on International Trade in Endangered Species (CITES); United Nations Convention on the Law of the Sea (UNCLOSS); Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar); International Convention for the Regulation of Whaling.
Related regional conventions and agreements include: Convention on the conservation of European wildlife and natural habitats (Berne); Program for the Conservation of

Arctic Flora and Fauna (CAFF); Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR); Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA); African Convention on the Conservation of Nature and Natural Resources.

(d) International Targets/Recommended Standards: The international community has committed "to achieve a significant reduction of the current rate of biodiversity loss at the global, regional, and national level as a contribution to poverty alleviation and to the benefit of all life on earth by 2010". This "2010 Target" was formally adopted by governments at the 6th Conference of the Parties of the Convention on Biological Diversity in 2002, and endorsed later that year at the World Summit on Sustainable Development. The 2010 target, and the targets relating to the general objectives of the CBD, relate specifically to Parties to the Convention on Biological Diversity, but could also be used as a guide for non-Party states.

(e) Linkages to Other Indicators: This indicator can be linked the indicator on abundance of selected key species. It is also directly related to the suite of indicators measuring progress towards the CBD's target to reduce the rate of biodiversity loss by 2010, which are being implemented by the members of the 2010 Biodiversity Indicators Partnership (2010BIP; www.twentyten.net). It particularly relates to the focal area on threats to biodiversity, and the 'Composite Global Indicator: Invasive Alien Species' being developed by the Global Invasive Species Programme

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: Some important points are noted below.
'Invasive alien species': A species introduced outside its normal distribution whose establishment and spread modifies ecosystems, habitats, or species. Although humans have been responsible for species introductions to new areas for thousands of years, the number of such introductions has greatly increased with improvements in transportation and the globalisation of trade. Most introductions fail, but those that do establish themselves as invasive alien species can have a major impact on native biodiversity. IAS may threaten native species as direct predators or competitors, as vectors of disease, by modifying the habitat, or altering native species dynamics. IAS have been a major cause of extinction, especially on islands and in freshwater habitat.
Species introductions may be intentional (e.g. species released for hunting or biological control), but more commonly are unintentional (e.g. introduced with traded goods such as lumber, or in the ballast water of ships).

(b) Measurement Methods: To be completed.
At present there is no clearly defined, single methodology for national-level indicators of trends in invasive alien species. However a number of IAS indicators have been developed and implemented at a range of scales, albeit with varying methodologies. Examples include the Swiss Agency for the Environment, Forests and Landscapes indicator on 'size of forest area dominated by non-indigenous trees', and the UK Government indicator on 'numbers of IAS present in different taxonomic groups'. The

Heinz Center is in the process of developing IAS indicators relating to forest, farmland, grassland and shrubland, coastal and oceanic, and freshwater habitats.

Since these indicators are developed at the national level, there is some room for variation in the methodologies used. However, it may be additional useful for the national indicators to be developed in a way that enables them to contribute towards a regional or global process. For this the methods used to acquire data on each indicator should facilitate up-scaling of the information, and should be gathered at scales that are comparable across nations and ecosystems.

It may be advisable to direct sampling or data acquisition based on a process that prioritises threat, risk, rate of change, and maximum benefit per unit effort. Pilot studies are recommended, and should form part of the indicator testing.

(c) Limitations of the Indicator: While it is clear that invasive alien species are having a major impact on biodiversity and are costing society billions of dollars, and that there is information available in a variety of databases and other sources, the information from the various sources is often incompatible, and does not generally include time series information (UNEP/CBD/SBSTTA10/INF/17). However this is generally more of a problem at global or regional levels, rather than the national level. If statistics for a country (or region) are derived using a consistent methodology then it is possible to calculate trends.

Measuring the costs of invasions of alien species would be a useful additional component to this indicator, however in many cases information on financial costs is extremely limited.

(d) Status of the Methodology: Thus far, the indicator originally proposed by the CBD on 'numbers and cost of alien invasions / trends in invasive species' has not been widely used. Very few programmes monitoring trends in invasive alien species are in place, the availability of data is very limited, and to date there has been no concerted effort to develop a global indicator. However, although there has been limited progress at the global level, various single indicators have been developed and applied in a number of countries and regions, and using a range of taxa and ecosystems.

While 'number of invasive alien species' categorised by taxon and threat appears to be the most widely used indicator, several others have been proposed and developed to varying extents at the national level. For example the Heinz Center has used the percentage of plant cover made up of non-native species, as well as percentage of invasive birds, to monitor the ecological condition of grasslands and shrublands. The Australian Natural Heritage Trust used 'area and density of weeds under active management', as well as 'new incursions of significant weeds' for monitoring invasive alien species and management responses.

(e) Alternative Definitions/Indicators: To be completed.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Key data required for this indicator include: identification of all relevant IAS in a particular country, and time series data for monitoring trends in those IAS. Data on the ecology and distribution of those IAS, and the species which they predominantly affect, would be useful for interpretation of the indicator. It would also be relevant to collate information on the costs incurred as a result of invasions (i.e. costs of mitigating impacts and removing invasives).

(b) National and International Data Availability and Sources: Despite the general lack of data on invasive alien species, there are a number of databases that contain relevant information, as well as a number of national-level monitoring programmes, both of which could be used as a basis to provide the information needed for an IAS indicator. In addition, there are a number of other databases and/or monitoring programmes which – although not focussed on IAS – may incorporate information on IAS in some way, and might be able to be used as a basis for at least some measures which would comprise an IAS indicator. For example, information on species listed on the IUCN Red List now makes reference to what are the main threats to those species, including the impacts of IAS. A possible measure could therefore be, what percentage of Red Listed species for a given country are threatened as a consequence of IAS. Appropriate data on birds might also be available from BirdLife International. Similarly, monitoring programmes on protected areas may include, or could be expanded to include, information on the level of threat posed to the protected area in terms of numbers of individual invasive species, as well as the percentage of area they impact.

Many databases are available that include a subset of data on IAS, and these may provide sufficient data for single, national-level indicators. These include at least four metadatabases that list and/or have links to other databases of IAS – including the Global Invasive Species Database of the ISSG, and the North European and Baltic Network on IAS. Each single database contains some or all of the following information for particular taxa, ecosystems, countries or states, and geographic regions:

- Species list
- Classification
- Natural history
- Ecology
- Distribution
- Impacts
- Risk assessments
- Control measures
- Literature citations.

The Global Invasive Species Database (GISD) contains comprehensive profiles of invasive species ranging from plants, mammals, invertebrates, birds, reptiles, fish, and amphibians, to macro-fungi and micro-organisms. GISD profiles cover the biology, ecology, native and alien range of invasive species, impacts, pathways of introduction, and management information. Information in the GISD is created and/or reviewed by acknowledge international invasive species experts, and is updated on an ongoing basis.

An important development in the field is the establishment of the Global Invasive Species Information Network (GISIN: www.gisinetwork.org). GISIN will provide a platform through which IAS information and data from participating databases can be accessed.

In addition, several countries have ongoing, systematic monitoring programmes for IAS. Sixteen countries have thus far indicated monitoring programmes of one form or another for one or more selected IAS: Belgium, China, Denmark, Estonia, Germany, Hungary, Israel, Latvia, Lesotho, Lithuania, Mauritania, Morocco, Namibia, Niue, Norway, and the UK.

(c) **Data References:** Not available.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) **Lead Agency:** The Global Invasive Species Programme (GISP) is leading on efforts to develop a global-scale composite indicator on IAS as part of the 2010 Biodiversity Indicators Partnership initiative.

(b) **Other Contributing Organisations:** IUCN (and the Zoological Society of London) are involved in collating data on threats from IAS in the Red List database. The SEBI2010 initiative is undertaking relevant indicator work at the European regional scale.

6. REFERENCES

(a) Readings

Balmford A, Crane P, Dobson A, Green RE, Mace GM (2005) The 2010 challenge: data availability, information, needs and extraterrestrial insights. Phil. Trans. R. Soc. B 360:221-228

Born, W. et al. Economic evaluation of biological invasions – a survey. Ecological Economics 55: 321-336

Buckland ST, Magurran AE, Green RE, Fewster RM (2005) Monitoring change in biodiversity through composite indices. Phil. Trans. R. Soc. B 360:243-254

Butchart SHM, Stattersfield AJ, Baillie J, Bennun LA, Stuart SN, Akcakaya HR, Hilton-Taylor C, Mace GM (2005) Using Red List Indices to measure progress towards the 2010 target and beyond. Phil. Trans. R. Soc. B 360:255-268

Collins JP, Halliday T (2005) Forecasting changes in amphibian biodiversity: aiming at a moving target. Phil. Trans. R. Soc. B 360:309-314

Cote IM, Gill JA, Gardner TA, Watkinson AR (2005) Measuring coral reef decline through meta-analyses. Phil. Trans. R. Soc. B 360:385-395

De Heer M, Kapos M, Ten Brink BJE (2005) Biodiversity trends in Europe: development and testing of a species trend indicator for evaluating progress towards the 2010 target. Phil. Trans. R. Soc. B 360:297-308

Didham, RK et al. (2005) Are invasive species the drivers of ecological change? Trends in Ecology & Evolution 20: 470-474

Dobson A (2005) Monitoring global rates of biodiversity change: challenges that arise in meeting the Convention on Biological Diversity (CBD) 2010 goals. Phil. Trans. R. Soc. B 360:229-241

Gaston KJ, Spicer JI (2004) Biodiversity an introduction. 2nd ed. Blackwell Publishing, Oxford

Gregory RD, Van Strien A, Vorisek P, Gmelig Meyling AW, Noble DG, Foppen RPB, Gibbons DW (2005) Developing indicators for European birds. Phil. Trans. R. Soc. B 360:269-288

Hutchings JA, Baum JK (2005) Measuring marine fish biodiversity: temporal changes in abundance, life history and demography. Phil. Trans. R. Soc. B 360:315-338

Krajick, K (2005) Winning the war against island invaders. Science 310: 1410-1413

Lawton JH, May RM (1995) Extinction Rates. Oxford University Press, Oxford

Loh J, Green RE, Ricketts T, Lamoreux J, Jenkins M, Kapos V, Randers J (2005) The Living Planet Index: using species population time series to track trends in biodiversity. Phil. Trans. R. Soc. B 360:289-295

Lughadha EN, Baillie J, Barthlott W, Brummitt NA, Cheek MR, Farjon A, Govaerts R, Hardwick KA, Hilton-Taylor C, Meagher TR, Moat J, Mutke J, Paton AJ, Pleasants LJ, Savolainen V, Schatz GE, Smith P, Turner I, Wyse-Jackson P, Crane PR (2005) Measuring the fate of plant diversity: towards a foundation for future monitoring and opportunities for urgent action. Phil. Trans. R. Soc. B 360:359-372

Mayaux P, Holmgren P, Achard F, Eva H, Stibig H-J, Branthomme A (2005) Tropical forest cover change in the 1990s and options for future monitoring. Phil. Trans. R. Soc. B 360:373-384

McGeoch, M.A., Chown, S.L. and Kalwij, J.M. (2006) A Global Indicator for Biological Invasion. Conservation Biology 20 (6), 1635–1646

Pauly D, Watson R (2005) Background and interpretation of the 'Marine Trophic Index' as a measure of biodiversity. Phil. Trans. R. Soc. B 360:415-423

Revenga C, Campbell I, Abell R, De Villiers P, Bryer M (2005) Prospects for monitoring freshwater ecosystems towards the 2010 targets. Phil. Trans. R. Soc. B 360:397-413

Richardson DM, Pysek P, Rejmanek M, Barbour MG, Dane Panetta F, West CJ (2000) Naturalization and invasion of alien plants: concepts and definitions. Diversity and Distributions 6:93-107

Simberloff, D & Von Holle, B (1999) Positive interactions of non-indigenous species: Invasion meltdown? Biological Invasions 1: 21-32

Thomas JA (2005) Monitoring change in the abundance and distribution of insects using butterflies and other indicator groups. Phil.Trans.R.Soc. B 360:339-357

Watson RT (2005) Turning science into policy: challenges and experiences from the science-policy interface. Phil. Trans. R. Soc. B 360:471-477

Wilcove, D.S. et al. (1998) Quantifying threats to imperiled species in the United States. BioScience 48: 607-615

Williamson, M (1996) Biological Invasions. Chapman & Hall, London

(b) Internet sites:

2010 Biodiversity Indicators Partnership: http://www.twentyten.net

Countdown 2010: European Initiative to ensure that all European Governments have taken the necessary actions to halt the loss of biodiversity by 2010. http://www.countdown2010.net

Convention on Biological Diversity: www.biodiv.org

The Global Partnership for Plant Conservation: http://www.plants2010.org

The Ramsar Convention On Wetlands: http://www.ramsar.org

UN Millenium Development Goals: http://www.un.org/milleniumgoals/

GROSS DOMESTIC PRODUCT PER CAPITA		
Economic development	**Macroeconomic Performance**	**Core indicator**

1. INDICATOR

(a) Name: Gross domestic product (GDP) per capita.

(b) Brief Definition: Levels of GDP per capita are obtained by dividing GDP at current market prices by the population. A variation of the indicator could be the growth in real GDP per capita, which is derived as the percentage change in real GDP divided by the population.

(c) Unit of Measurement: $US.

(d) Placement in the CSD Indicator Set: Economic development/ Macroeconomic performance.

2. POLICY RELEVANCE

(a) Purpose: The indicator is a basic economic indicator and measures the level of total economic output relative the population of a country. It reflects changes in total well being of the population.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): Growth in the production of goods and services is a basic determinant of how the economy fares. By allocating total production to each head of population, shows the extent to which the total production of a county can be shared by its population. The growth in real GDP per capita ndicates the pace of income growth per head of the population. As a single composite indicator it is a powerful summary indicator of economic development. It does not directly measure sustainable development but it is a very important measure for the economic and developmental aspects of sustainable development.

(c) International Conventions and Agreements: None.

(d) International Targets/Recommended Standards: National targets are generally oriented towards priorities, availability of resources and, in large measure, to historical economic performance. International targets are most often established by financial institutions and international organizations only for the purposes of inter-country comparison of economic performance in determining the direction of aid distribution or resource allocation projects. Country groupings to form economic entities, for example, the European Union, Organization of Petroleum Exporting Countries (OPEC), also set international targets among constituent members to serve as guidelines in setting priorities for national policy. . Moreover, the United Nations uses per capita income to determine the level of relief allowance for countries and in its formulation of the scale of assessments of member states.

(e) Linkages to Other Indicators: As a highly aggregated composite measure, this indicator has close links with many, more disaggregated indicators. Examples would include population growth, net migration, other GDP indicators, land use change, arable land per capita, and forest area.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: GDP as described in the 1993 SNA can be derived in three ways: Firstly, it is the sum total value added of all production units including all taxes and subsidies on products which are not included in the valuation of output. It is also equal to the sum of final uses of goods and services measured in purchasers' prices, less the value of imports of goods and services. Finally, it can be measured as the sum of primary incomes distributed by resident producer units.

(b) Measurement Methods: The current price estimates of GDP are adjusted to GDP at constant prices using appropriate price deflators. Real GDP can also be derived by extrapolating total value added in the base year with production indicators in physical terms. GDP divided by population estimates enable the conversion of GDP to per capita levels. ,.

(c) Limitations of the Indicator: As a necessary condition to being a key economic performance indicator of sustainable development, one of the often-cited limitations of GDP is that it does not account for the social and environmental costs of production; it therefore is not a good measure of the level of over-all well being. For example, GDP per capita reveals nothing concerning energy and material interactions with the environment.

(d) Status of Methodology: The 1993 System of National Accounts (SNA) provides international standards for national accounts. There may be some differences in national accounting and demographic reporting procedures and practices between countries. One other possible drawback could be the comparability of price information used in deflating current price data and technical differences in the choice of base year for the original data. Additionally, a considered basic limitation is related to the conversion of GDP into a common denomination as a result of current misalignments in exchange rates for some countries vis-a-vis the comparator currency (US dollar) particularly for those countries in transition whose market exchange rates produce unrealistic levels of GDP, making any meaningful inter-country interpretation difficult.

(e) Alternative Definitions/Indicators: Economic indicators that measure the achievement of higher levels of goods and services more efficiently are better indicators of sustainable development. Consumption trends are better reflected by such indicators as final consumption expenditure by households as used in the USA. Such indicator can be derived from the SNA. The GDP indicator and its GDP growth variant may be broken down by economic activity. Such indicator, expressed as value added per (main) economic activity, can also be derived from the SNA and provides information on shifts in economic structure in general and the degree of industrialization in particular.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: The conversion rates used by the UN Statistics Division (UNSD) are normally the market or blended rates of exchange obtained from the International Monetary Fund (IMF). In some cases, use is made of UN operational rates that are established primarily for the settlement of administrative transactions between host countries and the UN. In very unique circumstances the use of purchasing power parities (PPP) or price-adjusted rates of exchange (PARE) is necessary. The World Bank also uses a special exchange rate where the official exchange rate produces distortion in the dollar levels of GDP.

(b) National and International Data Availability and Sources: The indicator has no serious limitations in terms of data availability. The principal data elements for a majority of countries are mostly and regularly available from national and international sources on a historical basis. Internationally accepted conceptual guidelines, are also available to assist with the compilation of the indicator. Annual GDP data in current and constant prices are generally reported by national statistical offices or central banks through the United Nations National Accounts Questionnaire (UN NAQ) and supplemented by estimates prepared by the UN as well as other international organizations such as the World Bank and the IMF. The Organisation for Economic Co-operation and Development (OECD) compiles quarterly GDP estimates for its Members. Population data are mainly obtained either through censuses or surveys. These are supplemented by growth estimates prepared by the UN Population Division.

(c) Data References: Comprehensive national accounts statistics are published by the UN in the series *National Accounts Statistics: Main Aggregates and Detailed Tables.* A historical series of GDP is available from the national accounts database of the UN Statistics Division. Population data and projections are available in the World Population Prospects published by the Population Division of the UN Department of Economic and Social Affairs. Exchange rates are published by the IMF in *International Financial Statistics*.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the United Nations Department of Economic and Social Affairs (DESA). The contact point is the Director, Statistics Division, DESA; fax no. (1 212) 963 9851.

(b) Other Contributing Organizations: None.

6. REFERENCES

(a) Readings: The 1993 SNA provides international standards on national accounts and is the product of collaborative efforts between EUROSTAT, IMF, OECD, UN and the World Bank.

(b) Internet site:

United Nations Statistics Division: http://www.un.org/Depts/unsd

INVESTMENT SHARE IN GROSS DOMESTIC PRODUCT		
Economic development	**Macroeconomic Performance**	**Core indicator**

1. INDICATOR

(a) Name: Investment Share in Gross Domestic Product (GDP).

(b) Brief Definition: This indicator refers to the share of investment in total production. It is obtained by calculating gross capital formation as percentage of gross domestic product.

(c) Unit of Measurement: Per cent.

(d) Placement in the CSD Indicator Set: Economic development/ Macroeconomic performance.

2. POLICY RELEVANCE

(a) Purpose: Investment provides a stimulus to economic development, and the rate of investment reflects the infusion of requisite capital to support the development process.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): This indicator deals with the processes and patterns of economic activities. It is an important element of the sustainable development process in developing countries, aimed at increasing their partnership in the global economy. It reflects an objective aimed at accelerating the pace of development.

(c) International Conventions and Agreements: None.

(d) International Targets/Recommended Standards: None. National targets for investment share in GDP are usually included in government policy as a basis for budget funding programmes and for priority-setting exercises.

(e) Linkages to Other Indicators: This indicator is closely linked with other measures of economic development, such as GDP per capita and capital labor ratio.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: Gross capital formation (investment) is defined in the System of National Accounts (SNA) as the total value of gross fixed capital formation plus changes in inventories and acquisitions less disposal of valuables. Gross fixed capital formation is the total value of produced assets used in the production process for more than one year.

(b) Measurement Methods: Gross capital formation at purchasers' prices as percentage of gross domestic product at purchasers' prices.

(c) Limitations of the Indicator: Investment in SNA terms, as in this indicator, constitutes only investment on produced assets. Any expenditure on non-produced assets, for example, land or payments for education and health that enhance the quality of human capital are not included.

(d) Status of the Methodology: The concepts of gross capital formation and GDP are standardized in the SNA and, therefore, comparable between countries.

(e) Alternative Definitions/Indicators: An alternative indicator would be one which would identify selected investment expenditures by sector, such as environmental protection, health and education, housing, nutrition, etc., that are individually considered relevant to sustainable development. A second alternative would report the indicator using only gross fixed capital formation.

4. <u>DATA ASSESSMENT</u>

(a) Data Needed to Compile the Indicator:

(i) Gross capital formation at purchasers' prices;

(ii) Gross domestic product at purchasers' prices.

(b) National and International Data Availability and Sources: Data is of reasonable quality and commonly available from national sources on a historical basis. Data on gross capital formation and GDP are generally reported by national statistical offices or central banks to the United Nations Statistics Division (UNSD) through the United Nations National Accounts Questionnaire (UN NAQ). These are supplemented by estimates prepared by the UNSD as well as other international organizations, such as the World Bank and the International Monetary Fund (IMF).

(c) Data References: National accounts statistics are published in the series *National Accounts Statistics: Main Aggregates and Detailed Tables.*

5. <u>AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR</u>

(a) Lead Agency: The lead agency is the United Nations Department of Economics and Social Affairs (DESA). The contact point in terms of SNA references as well as data compilation on an international level is the Director, Statistics Division, DESA; fax no. (1 212) 963 9851.

(b) Other Contributing Organizations: None.

6. <u>REFERENCES</u>

(a) Readings: Further details on the conceptual definitions of gross capital formation and GDP are contained in the *System of National Accounts,* 1993.

(b) Internet site:

United Nations Statistics Division: http://www.un.org/Depts/unsd

GROSS SAVING		
Economic development	**Macroeconomic Performance**	

1. **INDICATOR**

(a) **Name:** Gross saving

(b) **Brief Definition:** Gross saving is disposable income less consumption. It can be calculated for each institutional sector and the total economy.

(c) **Unit of Measurement:** $US or local currency.

(d) **Placement in the CSD Indicator Set:** Economic development/ Macroeconomic performance.

2. **POLICY RELEVANCE**

(a) **Purpose:** The indicator is a basic economic indicator and measures the level and extent of resources available for investment in capital assets.

(b) **Relevance to Sustainable/Unsustainable Development (theme/sub-theme):** Saving is closely related to investment. By not using income to buy consumer goods and services, it is possible for resources to instead be invested in productive capital, such as factories and machinery. Saving can therefore be vital to increase the amount of capital available, contributing to sustainable future economic growth.

(c) **International Conventions and Agreements:** None.

(d) **International Targets/Recommended Standards:** National targets are generally included in government policy.

(e) **Linkages to Other Indicators:** This indicator is closely linked with other measures of economic development, in particular gross capital formation and saving as percentage of GDP.

3. **METHODOLOGICAL DESCRIPTION**

(a) **Underlying Definitions and Concepts:** Gross saving as described in the 1993 SNA can be derived in three ways: Firstly, it is the gross disposable income less consumption. It is also equal to the sum of gross capital formation, net capital inflows from the rest of the world and changes in foreign reserves. Finally, it can be derived from net lending/borrowing to/from the rest of the world by adding gross capital formation and net capital transfers to the rest of the world. Net lending/borrowing to/from the rest of the world, in turn, can be obtain from the rest of the world account as, the current external balance plus net capital transfers from the rest of the world or, the financial account as, the net acquisition of financial assets less net disposal of financial liabilities.

(b) Measurement Methods: Gross saving is available only in current prices

(c) Limitations of the Indicator: Gross saving does not account for social and environmental conditions.

(d) Status of Methodology: The 1993 System of National Accounts (SNA) provides international standards for national accounts. A considered basic limitation is related to the conversion of saving into a common denomination as a result of current misalignments in exchange rates for some countries vis-a-vis the comparator currency (US dollar) particularly for those countries in transition whose market exchange rates produce unrealistic levels of saving, making any meaningful inter-country interpretation difficult.

(e) Alternative Definitions/Indicators: An alternative indicator would be net saving (gross saving less consumption of fixed capital) or gross or net saving as per cent of GDP.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: The conversion rates used by the UN Statistics Division (UNSD) are normally the market or blended rates of exchange obtained from the International Monetary Fund (IMF). In some cases, use is made of UN operational rates that are established primarily for the settlement of administrative transactions between host countries and the UN. In very unique circumstances the use of purchasing power parities (PPP) or price-adjusted rates of exchange (PARE) is necessary.

(b) National and International Data Availability and Sources: The indicator is not generally available for all countries. However, annual saving data in current prices are generally reported by national statistical offices or central banks through the United Nations National Accounts Questionnaire (UN NAQ) and supplemented by estimates prepared by the UN as well as other international organizations such as the World Bank and the IMF.

(c) Data References: Comprehensive national accounts statistics are published by the UN in the series *National Accounts Statistics: Main Aggregates and Detailed Tables.* A historical series of saving is available from the national accounts database of the UN Statistics Division.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the United Nations Department of Economic and Social Affairs (DESA). The contact point is the Director, Statistics Division, DESA; fax no. (1 212) 963 9851.

(b) Other Contributing Organizations: None.

6. REFERENCES

(a) **Readings:** The 1993 SNA provides international standards on national accounts and is the product of collaborative efforts between EUROSTAT, IMF, OECD, UN and the World Bank.

(b) **Internet site:** United Nations Statistics Division: http://www.un.org/Depts/unsd

ADJUSTED NET SAVING AS A PERCENTAGE OF GROSS NATIONAL INCOM		
Economic development	**Macroeconomic performance**	

1. INDICATOR

(a) Name: Adjusted Net Saving (ANS) as a percentage of Gross National Income (GNI).

(b) Brief Definition: Adjusted net saving is derived from the standard national accounting measure of gross saving by making four adjustments: (i) consumption of fixed capital is deducted to obtain net national saving; (ii) current public expenditure on education is added to account for investment in human capital; (iii) estimates of the depletion of a variety of natural resources are deducted to reflect the decline in asset values associated with extraction and depletion; (iv) deductions are made for damages from carbon dioxide and particulate emissions. The indicator is then computed by dividing ANS by GNI.

(c) Unit of Measurement: %.

(d) Placement in the CSD Indicator Set: Economic development/ macroeconomic performance.

2. POLICY RELEVANCE

(a) Purpose: Adjusted net saving provides a measure of a country's sustainability by measuring the change in comprehensive wealth during a specified accounting period. In particular it provides a test to check the extent to which today's rents from a number of natural resources (i.e. change in natural capital) and changes in human capital are balanced by net saving (i.e. change in man-made capital), that is, this generation's bequest to future generations.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): Adjusted net saving measure the change in value of a specified set of assets, excluding capital gains. If a country's net saving is positive and the accounting includes a sufficiently broad range of assets, economic theory suggests that the present value of social welfare is increasing. Conversely, persistently negative adjusted net saving indicates that an economy is on an unsustainable path.

(c) International Conventions and Agreements: None.

(d) International Targets/Recommended Standards: For developed and developing countries, adjusted net saving should not be negative. This constitutes a necessary condition for sustainability.

(e) Linkages to Other Indicators: This indicator is particularly linked with the other national accounting measures such as gross national income, gross saving and net saving. It builds upon the SNA by accounting for natural resource depletion and human capital net changes.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: **Gross savings** are the difference between gross national income and public and private consumption, plus net current transfers. **Consumption of fixed capital** represents the replacement value of capital used up in the process of production. **Net savings** are gross savings minus the value of consumption of fixed capital. **Education expenditure** refers to public current operating expenditures in education, including wages and salaries and excluding capital investments in buildings and equipment. **Energy depletion** is the product of unit resource rents and the physical quantities of energy extracted. It covers coal, crude oil, and natural gas. **Mineral depletion** is the product of unit resource rents and the physical quantities of minerals extracted. It refers to tin, gold, lead, zinc, iron, copper, nickel, silver, bauxite, and phosphate. **Net forest depletion** is the product of unit resource rents and the excess of roundwood harvest over natural growth. **Carbon dioxide damage** is estimated to be $20 per ton of carbon (the unit damage in 1995 U.S. dollars) times the number of tons of carbon emitted. **Particulate emission damage** is the willingness to pay to avoid mortality and morbidity attributable to particulate emissions. **Adjusted net savings** are net savings plus education expenditure and minus energy depletion, mineral depletion, net forest depletion, and carbon dioxide and particulate emissions damage.

Gross national income (GNI) is the sum of value added by all resident producers plus any taxes (less subsidies) not included in the valuation of output, plus net receipts of primary income (compensation of employees and property income) from abroad.

(b) Measurement Methods: Measurement of adjusted net saving (ANS) is based on standard national accounting concepts. Adjusted net saving is obtained using the following identity:

Gross national saving
- Consumption of fixed capital
= **Net national saving**
+ Education expenditure
- Energy depletion
- Mineral depletion
- Net forest depletion
- Damage from carbon dioxide emissions
- Damage from particulate emissions
= **Adjusted net saving**

Note: all the terms are expressed as percent of Gross National Income (GNI)

(c) Limitations of the Indicator: The exercise treats **public education expenditures** as an addition to savings effort. The adjustment made to savings goes in the right direction. However, the reader should bear in mind that current expenditure of $1 on education does not necessarily yield $1 of human capital. The calculation should also consider private education expenditure, but data are not available for a large number of countries. The accounting of natural resource depletion and pollution costs still has some gaps. Key **estimates missing on the resource side** include the value of fossil water extracted from aquifers, net depletion of fish stocks, and depletion and degradation of soils. The **energy and mineral depletion** figures are part of a range of depletion estimates that are possible depending on the assumptions made about future quantities, prices, and costs, and there is reason to believe that it is at the high end of the range. Because the **net forest depletion** estimates reflect only timber values, they ignore all the external and nontimber benefits associated with standing forests.

(d) Status of Methodology: The methodology is kept under review by the World Bank**.**

(e) Alternative Definitions/Indicators: Adjusted net saving has been referred to as 'genuine saving'.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: GNI, consumption of fixed capital, current education expenditure. For energy and minerals: extraction volumes, price, cost of extraction. For forest: roundwood production, price, cost of production. For carbon dioxide damage: emission levels. For particulate emissions damage: concentration levels, dose-response relationship, baseline mortality and morbidity data, value of a statistical life.

(b) National and International Data Availability and Sources: The data is published by World Bank in World Development Indicators (Table 3.15).

(c) Data References: World Bank, *World Development Indicators*; World Bank, *Little Green Data Book.*

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the World Bank. The contact point is the Environment Department, World Bank; e-mail eadvisor@worldbank.org.

(b) Other Contributing Organizations: None

6. REFERENCES

(a) Readings:

World Bank, *World Development Indicators 2007*. World Bank: Washington DC.
Katharine Bolt, Mampite Matete, and Michael Clemens, 2002, *Manual for Calculating Adjusted Net Savings*, Environment Department, World Bank: Washington DC.

(b) Internet sites:

www.worldbank.org/environmentaleconomics
http://go.worldbank.org/3AWKN2ZOY0

INFLATION RATE		
Economic Development	**Macroeconomic performance**	

1. INDICATOR

(a) Name: Inflation rate

(b) Brief Definition: The annual percentage increase of the cost of living as measured by the consumer price index. Consumer price indices are based on a representative basket of goods and services purchased by consumers in an economy. Composition and relative weights of the basket are reviewed periodically.

(c) Unit of Measurement: Percentage point

(d) Placement in the CSD Indicator Set: Economic Development/ Macroeconomic performance

2. POLICY RELEVANCE

(a) Purpose: The indicator measures the change in prices of consumer goods and services acquired, used or paid for by households. The rate of inflation is one of the indicators monitored by the authorities to set monetary policy.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): High inflation is a sign of macroeconomic imbalances. It often reduces economic growth and future growth prospects, thereby reducing the means of implementation available for achieving sustainable development goals. However, no agreement exists on costs (or benefits) resulting from low or moderate inflation. Also low inflation by itself in the absence of other factors that contribute to a favorable investment climate does not guarantee high growth. High and unanticipated inflation increases uncertainty and leads to inter-and intra-temporal misallocation of resources as long as prices are not full flexible. Inflation, especially if unanticipated, has often unwanted distributional effects, as it reduces real income of fixed income earners and shifts wealth away from creditors to debtors. Moreover, high and accelerating inflation rates may be the consequence of financing of public deficits through seignorage (that is, through a transfer of real resources from the public to the central bank or government caused by the creation of notes, coins, and reserve money) due to an inability of the government to issue debt instruments or to collect taxes. In such cases, inflation is an indicator of unsustainable public finances.

(c) International Conventions and Agreements: None.

(d) International Targets/Recommended Standards: None

(e) Linkages to Other Indicators: The consumer price index is closely linked to whole sale price index, producers price index, food price index and gross domestic product (GDP) deflator. All these indicators measures inflation rate, the broadest being the GDP deflator.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: The indicators measures changes over time in the general level of prices of goods and services that a reference population acquires, uses or pays for consumption. A consumer price index is estimated as a series of summary measures of the period-to-period proportional change in the prices of a fixed set of consumer goods and services of constant quantity and characteristics, acquired, used or paid for by the reference population. Each summary measure is constructed as a weighted average of a large number of elementary aggregate indices. Each of the elementary aggregate indices is estimated using a sample of prices for a defined set of goods and services obtained in, or by residents of, a specific region from a given set of outlets or other sources of consumption goods and services.

(b) Measurement Methods: The indicator is typically expressed as annual change in percentage points of the CPI. Alternatively, the indicator can be expressed by the value of the CPI.

(c) Limitations of the Indicator: Because there is no fixed method, each country has adopted their own method of compiling the consumer price index, depending on data availability, and their budget. For example, in some countries, the consumer price index refers only to cities and not to the whole country. In some cases it may refer to only a particular group such as the low- or high-income group. Further the number of items chosen to be included in the index and the regularity with which data are collected vary from country to country. Therefore, it is often very difficult to compare data across countries. One has to be extremely careful in using this indicator across countries, and exceptions should be footnoted clearly.

(d) Status of Methodology: The methodology is generally well developed.

(e) Alternative Definitions/Indicators: The deflator of the gross domestic product is an alternative, more broad-based indicator of inflation in the general economy. For the purpose of setting and monitoring monetary policy, some countries use a narrower measure, excluding certain items such as energy prices or unprocessed food process from the consumer price index.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Retail price data and national accounts data for GDP.

(b) National and International Data Availability and Sources: In most countries national statistical offices or central banks regularly collect data on consumer price indices.

Internationally, the International Monetary Fund (IMF) and the International Labor Organization (ILO) regularly publish time series data on consume price indices. The World Bank publishes inflation data from the IMF as well as inflation data based on the GDP deflator in its World Development Indicator series.

(c) Data References:
The World Development Indicators of the World Bank are available at
http://go.worldbank.org/3JU2HA60D0
IMF data on CPI is included in the International Financial Statistics as well as in the World Economic Outlook series, see http://www.imf.org/external/data.htm
ILO data is included in the LABORSTA series, see http://laborsta.ilo.org/
IMF and ILO data is also include din the United Nations Common Database, available at http://unstats.un.org/unsd/cdb/cdb_help/cdb_quick_start.asp

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the World Bank. International data on this indicator is compiled by the statistical department of IMF.

(b) Other Contributing Organizations: UN Statistics Division, and ILO.

6. REFERENCES

(a) Readings:
International Monetary Fund**,** International Financial Statistics, various years.

World Bank, Word Development Indicators, various years.

(b) Internet sites:
World Bank: www.worldbank.org/data.
IMF: http://www.imf.org/external/data.htm
ILO: http://laborsta.ilo.org/
UNSD: http://unstats.un.org/unsd/cdb/cdb_help/cdb_quick_start.asp

DEBT-TO-GNI RATIO		
Economic development	**Sustainable public finance**	**Core indicator**

1. INDICATOR

(a) Name: Debt to GNI ratio

(b) Brief Definition: The indicator can be defined as the total amount of outstanding debt (internal and external) issued by the general government divided by gross national income. For countries where external debt is a major concern, the indicator can alternatively or additionally be defined as total external debt divided by gross national income.

(c) Unit of Measurement: Percentage

(d) Placement in the CSD Indicator Set: Economic development/ Sustainable public finance and/or Global Economic Partnership/ External financing

2. POLICY RELEVANCE

(a) Purpose: With regard to public debt, this is a standard measure for public finances. With regard to external debt, this indicator measures the liabilities of the public sector for external debt of a country in relation to it's total income (GNI).

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): External debt sustainability for poor countries is one of the MDG goals. While external borrowing is a method of supplementing savings and financing the investment gap in a country, an unsustainable debt burden will choke development. For poor countries borrowing to finance previous borrowing can become a vicious circle, which may require drastic measures and outside aid to close.

Public debt constitutes a burden for future generations as it reduces the amount of resources available for their consumption and investments. High and increasing debt ratios can be seen as an indication of unsustainable public finances.

(c) International Conventions and Agreements: On external debt, there exist agreements on Highly-Indebted Poor Countries (HIPC) and the Multilateral Debt Relief Initiative (MDRI), initiated by the G8, to aid poor countries. There exist also the Paris and London "clubs" for renegotiation of debt and debt service payments to public and private creditors.
No global conventions or agreements exist for public debt.

(d) International Targets/Recommended Standards: Millennium Development Goal (MDG) 8, target 15, "Deal comprehensively with the debt problems of developing countries through national and international measures in order to make debt sustainable in the long term" addresses external debt.

(e) Linkages to Other Indicators: This indicator is closely linked with measures such as total debt as a share of GNI and debt service as a ratio to exports of goods and services, which is measures debt burden in relation to a country's foreign exchange earning capacity.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts:
Gross general government debt comprises the stock (at year-end) of all government gross liabilities (both to residents and nonresidents). To avoid double counting, the data are based on a consolidated account (eliminating liabilities and assets between components of the government, such as budgetary units and social security funds). General government should reflect a consolidated account of central government plus state, provincial, or local governments, social security funds and special funds, but exclude public corporation. General government debt can also be expressed in net terms, defined as gross general government debt minus all government assets (domestic as well as foreign).

Total external debt is debt owed to nonresidents repayable in foreign currency, goods or services. It is the sum of public, publicly guaranteed, and private nonguaranteed long-term debt, use of IMF credit and short-term debt.

Short term debt includes all debt having an original maturity of one year or less and interest in arrears on long-term debt.

Long-term debt is debt that has an original or extended maturity of more than one year. It has three components: public, publicly guaranteed, and private non-guaranteed debt.
Public and publicly guaranteed debt comprises the long-term external obligations of public debtors, including the national government and political subdivisions (or an agency of either) and autonomous public bodies, and the external obligations of private debtors that are guaranteed for repayment by a public entity.

Gross national product (GNI) is the sum of value added by all resident producers plus any taxes (less subsidies) not included in the valuation of output, plus net receipts of primary income (compensation of employees and property income) from abroad.

(b) Measurement Methods: The indicator is derived by dividing total public debt and/or external debt outstanding and disbursed as contained in the World Bank's Global Development Finance (GDF) database by total GNI.

(c) Limitations of the Indicator: While a high debt to GNI ratio is not desirable, a high ratio by itself is not a definite sign of trouble. There are no absolute rules to determine when the ratio of debt to GNI is too high. The sustainable level debt varies from country to country. The same value of ratio could be sustainable for one country whereas a heavy burden for another country. For example, countries with fast growing economies and, in case of external debt, exports can sustain a higher debt ratio than countries with low growth and limited resources.

(d) Status of Methodology: The methodology is generally well developed.

(e) Alternative Definitions/Indicators: Gross domestic product (GDP) can be used as a denominator instead of GNI. Also present value of debt can be used instead of total external debt as the numerator.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Debt data for public debt and/or for external debt and national accounts data for GNI.

(b) National and International Data Availability and Sources: In most developing countries central bank or ministry of finance collects and reports external borrowings to the World Bank Debt Reporting System. Data reported by the IMF and OECD, based in part on credit reports may differ due to varying methodology and timing of data collection. Availability of international data on general government debt is scarce and the data is often not comparable.

(c) Data References: Information on external debt, including a breakdown in public and publicly-guaranteed external debt and private non-guaranteed external debt, and GNI are available in World Banks GDF and WDI publications and databases.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the World Bank. The contact point is I. Levent (phone: +1 202. 473-3843; email: ilevent@worldbank.org)

(b) Other Contributing Organizations: IMF and OECD

6. REFERENCES

(a) Readings:
World Bank, *Global Development Finance*, various years
World Bank, *Word Development Indicators*, various years

(b) Internet sites:
World Bank www.worldbank.org/debt
IMF: www.imf.org

EMPLOYMENT-TO-POPULATION RATIO		
Economic Development	**Employment**	**Core indicator**

1. INDICATOR

(a) Name: Employment-to-Population Ratio.

(b) Brief Definition: The employment-to-population ratio is defined as the proportion of a country's working-age population that is employed.

(c) Unit of Measurement: %.

(d) Placement in the CSD Indicator Set: Economic development/ Employment

2. POLICY RELEVANCE

(a) Purpose: The employment-to-population ratio provides information on the ability of an economy to create employment; for many countries the indicator is often more insightful than the unemployment rate. If unemployment can been seen as, for the most part, the undesirable portion (although some short-term unemployment may be unavoidable), employment is viewed as the desired portion of the economically active population (labour force). Employment-to-population ratios are of particular interest when broken down by sex, as the ratios for men and women can provide information on gender differences in labour market activity in a given country.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): Employment is useful and relevant to measuring sustainable development, especially if uniformly measured over time, and considered with other socio-economic indicators. It should be noted, however, that it is common to find people working full-time but remaining poor due to the particular social conditions, low earnings, and type of industrial relations prevalent in their country, industry, or occupation. Remunerative and productive employment is one of the main means to tackle poverty.

(c) International Conventions and Agreements: The measures of employment and the working age population are defined for statistical purposes in the International Labour Office (ILO): Resolution concerning statistics of the economically active population, employment, unemployment and underemployment, adopted by the Thirteenth International Conference of Labour Statisticians, Geneva, 1982.

(d) International Targets/Recommended Standards: The ILO Convention concerning Employment Policy, 1964 (No. 122) states that "With a view to stimulating economic growth and development, raising levels of living, meeting manpower requirements and overcoming unemployment and underemployment, each Member shall declare and pursue, as a major goal, an active policy designed to promote full, productive and freely chosen employment".

The revised MDG monitoring framework, presented in 2007 to the General Assembly, includes the new target "Achieve full and productive employment and decent work for all, including women and young people" under MDG 7 (Eradicate extreme poverty and hunger).

(e) Linkages to Other Indicators: Although a high overall ratio is typically considered as positive, the indicator alone is not sufficient to describe employment characteristics and quality of work and for assessing the level of decent work. Additional indicators are required to assess such issues as earnings, hours of work, informal sector employment, underemployment and working conditions. In fact, the ratio could be high for reasons that are not necessarily positive – for example, where education options are limited so that young people take up any work available rather than staying in school to build their human capital. For these reasons, it is strongly advised that indicators should be reviewed collectively in any evaluation of country-specific labour market policies. The employment characteristics include important job classifications: status in employment and employment by sector and by occupation. These indicators reflect most of the important aspects of possessing a job and should be viewed together to give a more in-depth picture of the working lives of a population and to assess the progress made toward the goal of decent work.

2. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts:

Employment is defined in the resolution adopted by the 13th International Conference of Labour Statisticians (ICLS) as persons above a specified age who performed any work at all (paid or self employment), in the reference period, for pay or profit (or pay in kind), or were temporarily absent from a job for such reasons as illness, maternity or parental leave, holiday, training or industrial dispute. The resolution also states that unpaid family workers who work for at least one hour should be included in the count of employment, although many countries use a higher hour limit in their definition. Members of the armed forces are typically included among persons employed; however, some countries restrict measurement to civilian employment.

The population base for employment ratios can vary across countries. In most cases, the resident non-institutional population of working age living in private households is used, excluding members of the armed forces and individuals residing in mental, penal or other types of institution. Many countries, however, include the armed forces in the population base for their employment ratios even when they do not include them in the employment figures (for example, the United States).

An age limit: For most countries, the working-age population is defined as persons aged 15 years and older, although this may vary slightly from country to country. The ILO standard for the lower age limit is, in fact, 15 years. In countries, where compulsory schooling and legislation on the minimum age for admission to employment have broad coverage and are widely respected, the age specified in these regulations may be used as a basis for determining an appropriate minimum age limit for measuring the economically active population. In other countries, the minimum age limit should be determined empirically on the basis of (i) the extent and intensity of participation in economic activities by young people, and (ii) the feasibility and cost of measuring such participation with acceptable accuracy. Some countries also determine a maximum age for inclusion in the labour force, although the international standards do not recommend the use of a maximum age limit.

-- *The involvement in economic activities (or availability for such involvement) during the survey reference period:* The concept of economic activity, or employment, adopted by the Thirteenth International Conference of Labour Statisticians (1982) is defined in terms of production of goods and services as set forth by the United Nations System of National Accounts (revised in 1993).

-- A *short reference period:* For example, one week or a day.

(b) Measurement Methods: In general, information for this indicator is derived from household surveys of the labour force, that is, sample surveys of the population. Some countries, however, use "official estimates" or population censuses as the source of their employment figures.

Virtually every country in the world that collects information on labour market status should, theoretically, have the requisite information to calculate employment-to-population ratios; data on the working-age population – ideally, individuals aged 15 years and older – and total employment are required.

(c) Limitations of the Indicator:

A high ratio means that a large proportion of a country's population is employed, while a low ratio means that a large share of the population is not involved directly in market-related activities, because they are either unemployed or (more likely) out of the labour force altogether.

Comparability of employment ratios across countries is affected most significantly by variations in the definitions used for the employment and population figures. Perhaps the biggest differences result from age coverage, such as the lower and upper bounds for labour force activity. Employment can also vary according to whether the armed forces are included or excluded. Estimates of both employment and population are likely to vary according to whether members of the armed forces are included. There is also the issue of exclusion of the institutionalized population, as noted above.

Another area with scope for measurement differences has to do with the national treatment of particular groups of workers. The international definition, as stated above, calls for inclusion of all persons who worked for at least one hour during the reference period. The worker could be in paid employment or in self-employment or engaged in less obvious forms of work, each of which is dealt with in detail in the resolution, such as unpaid family work, apprenticeship or non-market production. The majority of exceptions to coverage of all persons employed in a labour force survey have to do with slight national variations to the international recommendation applicable to the alternate employment statuses.

(d) Status of the Methodology:

The methodology is well established. The indicator is widely used in developed and developing countries.

(e) Alternative Definitions/Indicators:

The importance of employment indicators should come as no surprise to analysts of labour markets, since employment and the lack of it (where employment is the goal) are largely what labour market policies are all about. It is not sufficient, however, to discuss the quantity of employment alone, especially given the ILO's framework of the decent work agenda, which brings quality aspects of employment into the picture. To better assess working conditions, one needs to understand that the underlying concept of work is broad and encompasses all forms of economic activity, including self-employment, economic unpaid family work and wage employment in both the informal and formal sectors.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Working age population (total number of persons) and total number of employed persons, preferably derived from the same survey.

(b) National and International Data Availability and Sources: 125 countries in the KILM database.

(c) Data References: Most of the information for this indicator was gathered from two international repositories of labour market data: the ILO Bureau of Statistics, Yearbook of Labour Statistics (LABORSTA) database and the Organisation for Economic Co-operation and Development (OECD).

5. AGENCIES INVOLVED WITH THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the International Labour Office (ILO), located in Geneva, Switzerland. Contact: kilm@ilo.org

(b) Other Contributing Organizations: None.

6. REFERENCES

(a) Readings:

Key Indicators of the Labour Markets, 4th edition (ILO, Geneva).

Yearbook of Labour Statistics (ILO, Geneva).

Bulletin of Labour Statistics (biannual) (ILO, Geneva).

Statistical yearbooks and other publications issued by the national statistical offices.

Surveys of Economically Active Population, Employment, Unemployment and Underemployment -An ILO Manual on Concepts and Methods (ILO, Geneva, 1992).

Sources and Methods: Labour Statistics, Volume 3 - Economically active population, employment, unemployment and hours of work (household surveys), third edition (ILO, Geneva, 2004).

Sources and Methods: Labour Statistics, Volume 4- Employment, unemployment, wages and hours of work (administrative records and related sources), second edition (ILO, Geneva, 2004).

Sources and Methods: Labour Statistics, Volume 5- Total and economically active population, employment and unemployment (population censuses), second edition (ILO, Geneva, 1996) (third edition under preparation).

ILO-comparable annual employment and unemployment estimates, in *Bulletin of Labour Statistics*, 2004-4 (ILO, Geneva, 2004)

System of National Accounts 1993 (Commission of the European Communities, International Monetary Fund, Organisation for Economic Co-operation and Development, United Nations, World Bank, Brussels/Luxembourg, New York, Paris, Washington, D.C., 1993)

Current international recommendations on labour statistics (ILO, Geneva, 2000). See in particular: *Resolution concerning Statistics of the Economically Active Population, Employment, Unemployment and Underemployment,* adopted by the Thirteenth International Conference of Labour Statisticians (October 1982).

(b) Internet sites:

International Labour Office, Bureau of Statistics: the ILO's statistical database on labour statistics, including unemployment data and ILO-comparable estimates:
http://laborsta.ilo.org

International recommendations on labour statistics, including the resolution concerning statistics of the economically active population, employment, unemployment and underemployment:
http://www.ilo.org/public/english/bureau/stat/res/index.htm

Key Indicators of the Labour Market, Geneva, 2005 (available on CD-ROM; sample tables on web site):
http://www.ilo.org/public/english/employment/strat/kilm/

VULNERABLE EMPLOYMENT		
Economic development	**Employment**	

1. INDICATOR

(a) Name: Vulnerable employment, by sex

(b) Brief Definition: Vulnerable is measures as the proportion of own-account workers and contributing family members in total employment. The indicator is based on the status in employment indicator contained in ILO's Key Labour that generally distinguishes between three categories of the total employed. These are:

- wage and salaried workers (also known as employees);
- self-employed workers that include self-employed workers with employees (employers), self-employed workers without employees (own-account workers) and members of producers' cooperatives;
- contributing family workers (also known as unpaid family workers).

(c) Unit of Measurement: %.

(d) Placement in the CSD Indicator Set: Economic development/ Employment

2. POLICY RELEVANCE

(a) Purpose: This indicator provides information how many persons are vulnerable to economic risk because of weak institutional employment arrangements. The categories of own-account workers and contributing family workers are thought to be particularly vulnerable when it comes to both economic risk and strength of the institutional arrangement, two qualities which are closely intertwined. Given that the institutional arrangements for the work of own-account workers and contributing family workers are likely to be weak, such workers are more likely to (a) lack contractual arrangements which can lead to a lack of job security and (b) lack the degree of social protection and social safety nets that govern wage and salaried workers and are therefore not likely to benefit from social security, health or unemployment coverage.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): The indicator of vulnerable employment may be used to confirm or refute claims of an increasing informalization of labour markets, because contributing family workers and own account workers are by definition not likely to have formal work arrangements. If the proportion of vulnerable workers is sizeable, it may be an indication of a large agriculture sector, lack of growth in the formal economy or widespread poverty. The poverty connection arises because workers in the vulnerable statuses lack the social protection and safety nets to guard against times of low economic demand and often are not capable of generating sufficient savings for themselves and their families to offset times of low demand.

(c) International Conventions and Agreements: None.

(d) International Targets/Recommended Standards: The overall goal of the International Labour Organisation is decent work for all women and men in all countries. Decent work is about opportunities for women and men to obtain decent and productive employment in conditions of freedom, equity, security and human dignity.
The revised MDG monitoring framework, presented in 2007 to the General Assembly, includes the new target "Achieve full and productive employment and decent work for all, including women and young people" under MDG 7 (Eradicate extreme poverty and hunger).

(e) Linkages to Other Indicators: The indicator is strongly linked to the employment-by-sector indicator. With economic growth, one would expect to see a shift in employment from the agricultural to the industry and services sectors, which, in turn, would be reflected in an increase in the number of wage and salaried workers. Also, a shrinking share of employment in agriculture would result in a lower proportion of contributing family workers, who are often widespread in the rural sector in developing economies. Countries that show falling proportions of either the share of own-account workers or contributing family workers, and a complementary rise in the share of employees, accompany the move from a low-income situation with a large informal or rural sector to a higher-income situation with high job growth.

Shifts in proportions of status in employment are generally not as sharp or as clear as shifts in sectoral employment. A country with a large informal economy, in both the industrial and services sectors, may tend to have larger proportions of both self-employed and contributing family workers than a country with a smaller sector. It may be more relevant to view status in employment within the various sectors in order to determine whether there has been a change in their relative shares, and such degree of detail is likely to be available for countries in the results of recently conducted labour force surveys or population censuses.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: According to the International Classification of Status in Employment (ICSE), the basic criteria used to define the status groups are the types of economic risk that they face in their work, an element of which is the strength of institutional attachment between the person and the job, and the type of authority over establishments and other workers that the job-holder has or will have as an explicit or implicit result of the employment contract. At the 15th International Conference of Labour Statisticians (ICLS) in 1993, the definitions of categories were revised. The 1993 revisions retained the existing major categories, but attempted to improve the conceptual basis for the distinctions made and the basic difference between wage employment and self-employment.

The 1993 ICSE categories and extracts from their definitions follow:

i. **Employees** are all those workers who hold the type of jobs defined as "paid employment jobs", where the incumbents hold explicit (written or oral) or implicit employment contracts that give them a basic remuneration that is not directly dependent upon the revenue of the unit for which they work.

ii. **Employers** are those workers who, working on their own account or with one or a few partners, hold the type of jobs defined as a "self-employment jobs" (i.e. jobs where the remuneration is directly dependent upon the profits derived from the goods and services produced), and, in this capacity, have engaged, on a continuous basis, one or more persons to work for them as employee(s).

iii. **Own-account workers** are those workers who, working on their own account or with one or more partners, hold the type of jobs defined as a "self-employment jobs" [see ii above], and have not engaged on a continuous basis any employees to work for them.

iv. **Members of producers' cooperatives** are workers who hold "self-employment jobs" [see ii or iii above] in a cooperative producing goods and services.

v. **Contributing family workers** are those workers who hold "self-employment jobs" as own-account workers [see iii above] in a market-oriented establishment operated by a related person living in the same household.

vi. **Workers not classifiable by status** include those for whom insufficient relevant information is available, and/or who cannot be included in any of the preceding categories.

Please note that contributing family workers are also technically self-employed according to the classification and could therefore be combined with the other self-employed categories to derive the total self-employed. The choice to remove contributing family workers from among the self-employed group was made for the purpose of this publication in order to emphasize the difference between the two statuses, since the socio-economic implications associated with each status can be significantly varied.

(b) Measurement Methods: Household or labour force surveys are generally the most comprehensive and comparable sources for employment statistics. Other sources include population censuses, employment office records and official estimates.

(c) Limitations of the Indicator: The indicators on vulnerable employment, and on status in employment in general, can be used to study how the distribution of the workforce by status in employment has changed over time for a particular country; how this distribution differs across countries; and how it has developed over the years for different countries. However, there are often differences in definitions, as well as in coverage, across countries and for different years, resulting from variations in information sources and methodologies that make comparisons difficult.

Some definitional changes or differences in coverage can be overlooked. For example, it is not likely to be significant that status-in-employment comparisons are made between countries using information from labour force surveys with differing age coverage. (The generally used age coverage is 15 years and over, but some countries use a different lower limit or impose an upper age limit.) In addition, in a limited number of cases one category of self-employed – the members of producers' – are included with wage and salaried workers. The effects of this non-standard grouping are likely to be small.

What is more important to note is that information from labour force surveys is not necessarily consistent in terms of what is included in employment. For example, the information supplied by the OECD relates to civilian employment, which can result in an underestimation of "employees" and "workers not classifiable by status", especially in countries that have large armed forces. The other two categories, self-employed and contributing family workers, would not be affected, although their relative shares would be.

With respect to geographic coverage, information from a source that covers only urban areas or only particular cities cannot be compared fairly with information from sources that cover both rural and urban areas, that is, the entire country. It is, therefore, not meaningful to compare results from many of the Latin American countries with results from the rest of the world because employment-by-status information for most Latin American countries relates to urban areas only. Similarly, for some sub-Saharan African countries – where very limited information is available anyway – the self-employed group often does not include members of producers' cooperatives, while for other countries it may.
For "wage and salaried workers" one needs to be careful about the coverage, noting whether, as mentioned above, it refers only to the civilian population or to the total population. Moreover, the status-in-employment distinctions do not allow for finer distinctions in working status – in other words, whether workers have casual or regular contracts and the kind of protection the contracts provide against dismissals, as all wage and salaried workers are grouped together.

(d) Status of the Methodology: The methodology for status in employment, on which the vulnerable employment indicator is based, is well established. The indicator is widely used in developed and developing countries.

(e) Alternative Definitions/Indicators: The indicator is only broken down by sex. It would be useful to break down this indicator by age group or by economic sector as these two variables certainly have a major effect on the results of this indicator. .

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Employment by status and total number of employed persons preferably derived from the same survey.

(b) National and International Data Availability and Sources: 131 countries in the KILM database.

(c) Data References: Most of the information for this indicator was gathered from three international repositories of labour market data: (a) the ILO Bureau of Statistics, Yearbook of Labour Statistics (LABORSTA) database; (b) the Organisation for Economic Co-operation and Development (OECD); and the Labour Market Indicators Library (LMIL).

5. AGENCIES INVOLVED WITH THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the International Labour Office (ILO), located in Geneva, Switzerland. Contact: kilm@ilo.org

(b) Other Contributing Organizations: None.

6. REFERENCES

(a) Readings:

Yearbook of Labour Statistics (ILO, Geneva).

Bulletin of Labour Statistics (biannual) (ILO, Geneva).

Statistical yearbooks and other publications issued by the national statistical offices.

Surveys of Economically Active Population, Employment, Unemployment and Underemployment -An ILO Manual on Concepts and Methods (ILO, Geneva, 1992).
Sources and Methods: Labour Statistics, Volume 3 - Economically active population, employment, unemployment and hours of work (household surveys), third edition (ILO, Geneva, 2004).

Sources and Methods: Labour Statistics, Volume 4- Employment, unemployment, wages and hours of work (administrative records and related sources), second edition (ILO, Geneva, 2004).

Sources and Methods: Labour Statistics, Volume 5- Total and economically active population, employment and unemployment (population censuses), second edition (ILO, Geneva, 1996) (third edition under preparation).

ILO-comparable annual employment and unemployment estimates, in *Bulletin of Labour Statistics*, 2004-4 (ILO, Geneva, 2004)

System of National Accounts 1993 (Commission of the European Communities, International Monetary Fund, Organisation for Economic Co-operation and Development, United Nations, World Bank, Brussels/Luxembourg, New York, Paris, Washington, D.C., 1993)

Current international recommendations on labour statistics (ILO, Geneva, 2000). See in particular: *Resolution concerning Statistics of the Economically Active Population, Employment, Unemployment and Underemployment,* adopted by the Thirteenth International Conference of Labour Statisticians (October 1982).

(b) Internet sites:
International Labour Office, Bureau of Statistics: the ILO's statistical database on labour statistics, including unemployment data and ILO-comparable estimates:

http://laborsta.ilo.org

International recommendations on labour statistics, including the resolution concerning statistics of the economically active population, employment, unemployment and underemployment:
http://www.ilo.org/public/english/bureau/stat/res/index.htm

Key Indicators of the Labour Market, Geneva, 2003 (available on CD-ROM; sample tables on web site):
http://www.ilo.org/public/english/employment/strat/kilm/

LABOUR PRODUCTIVITY AND UNIT LABOUR COST		
Economic development	**Employment**	**Core indicator**

1. **INDICATOR**

(a) **Name:** Labour productivity and unit labour costs.

(b) **Brief Definition:** Labour productivity is defined as output per unit of labour. The Key Indicators of Labour Markets (KILM) distinguish five different categories. These are:

i. the total economy.
ii. manufacturing.
iii. transport and communication.
iv. trade, including sales and repairs of motor vehicles, wholesale, retail, hotels and restaurants.
v. agriculture, forestry and fisheries.

The unit labour cost is defined as labour cost per unit of output.

(c) **Unit of Measurement:** 1990 US$.

(d) **Placement in the CSD Indicator Set:** Economic development/ Employment.

2. **POLICY RELEVANCE**

(a) **Purpose:** This indicator provides estimates of growth rates of labour productivity. All estimates are made according to the national accounts conventions to ensure that labour productivity for individual sectors can be compared. Labour productivity therefore is a key measure of economic performance. Unit labour cost represents a direct link between productivity and the cost of labour used in generating output.

(b) **Relevance to Sustainable/Unsustainable Development (theme/sub-theme):** Economic growth in a country or a sector could be ascribed either to increased employment or to more effective work by those who are employed. The latter effect can be demonstrated through statistics on labour productivity. The understanding of the driving forces behind labour productivity, in particular the accumulation of machinery and equipment, improvements in organization as well as physical and institutional infrastructures, improved health and skills of workers ("human capital") and the generation of new technology, is important for formulating policies to support economic growth.

Labour productivity estimates can serve to develop and monitor the effects of labour market policies. For example, high labour productivity is often associated with high levels or particular types of human capital, indicating priorities for specific education and training policies. Likewise, trends in productivity estimates can be used to understand the effects of wage settlements on rates of inflation or to ensure that such settlements will compensate workers for (part of) realized productivity improvements.

Finally, productivity measures can contribute to the understanding of how labour market performance affects living standards. When the intensity of labour utilization – the average number of annual working hours per head of the population – is low, the creation of employment opportunities is also an important means of raising per capita income in addition to productivity growth. In contrast, when labour utilization is already high, productivity will be the key to improving living standards.

A rise in a country's unit labour cost represents an increased reward for labour's contribution to output. However, a rise in labour cost that is higher than the rise in labour productivity may be a threat to a country's competitiveness, if other costs are not adjusted in compensation. As a competitiveness indicator, unit labour costs are particularly relevant for the manufacturing industry where many internationally tradable products are produced.

(c) International Conventions and Agreements: None

(d) International Targets/Recommended Standards: The overall goal of the International Labour Organisation is decent work for all women and men in all countries. Decent work is about opportunities for women and men to obtain decent and productive employment in conditions of freedom, equity, security and human dignity.

The revised MDG monitoring framework, presented in 2007 to the General Assembly, includes the new target "Achieve full and productive employment and decent work for all, including women and young people" under MDG 7 (Eradicate extreme poverty and hunger).

(e) Linkages to Other Indicators: While increasing labour force participation is at best a transitional source of growth depending on the rate of population growth and the age structure, the productivity of labour determines in the long run the rise in per capita income. For a substantial number of countries, the productivity measures for the total economy and manufacturing are complemented with measures of unit labour cost, which are defined as labour cost per unit of output.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: Productivity represents the amount of output per unit of input. Output is measured as "value added", which is the total production value minus the value of intermediate inputs, such as raw materials, semi-finished products, services purchased and energy inputs. Value added, called "gross domestic product" (GDP) in the national accounts, represents the compensation for input of services from capital (including depreciation) and labour directly engaged in production. The GDP concepts for the total economy are expressed at market prices, which reflect the market value of the output produced. For the individual sectors, GDP at market prices is adjusted to basic price levels, i.e. indirect taxes on products are subtracted and subsidies on products are added. The adjusted GDP, therefore, represents the amount receivable by the producer for a unit of good or service produced.

Labour productivity growth may be due to either increased efficiency of workers themselves (without greater use of other inputs), or improvements or increases in inputs used by workers, such as physical capital, human capital or intermediate inputs. Estimated labour productivity may also show an increase if the mix of activities in the economy or in an industry has shifted from activities with low levels of productivity to activities with higher levels, even if none of the activities have become more productive.

Unit labour cost is defined as labour compensation per unit of gross value added produced. Total labour compensation is measured to include gross wages and salaries of employees in addition to other costs of labour that are paid by employers, including employers' contributions to social security and pension schemes. In addition to employees' compensation, estimated labour costs of the self-employed are included where possible, mostly imputed on the assumption that the labour compensation per self-employed person equals that of an employee. Therefore, this adjustment can only be made when the number of self-employed persons is known separately.

(b) Measurement Methods: For a constant "mix" of activities, the best measure of labour input to be used in the productivity equation would be "total number of annual hours actually worked by all persons employed". In many cases, however, this labour input measure is difficult to obtain or estimate reliably. For this reason, the labour productivity measures often show both gross value added per person employed and gross value added per hour worked.

Labour compensation estimates are obtained from the national accounts estimates so that value added (GDP) and labour costs are compatible.

Gross value added and total labour compensation figures, expressed in constant prices, may be taken from national accounts. Especially for sectors producing tradable goods, cross-country comparisons are important. To compare labour productivity and unit labour cost levels across countries, it is necessary to convert gross value added to US dollars on the basis of adjusted purchasing power parity (PPP). PPP represents the amount of a country's currency that is required to purchase a standard set of goods and services worth one US dollar. The use of PPPs takes account of differences in relative prices between countries. Had official currency exchange rates been used instead, the implicit assumption would be that there are no differences in relative prices across countries. The total economy estimates of gross value added used for KILM 18 are expressed in terms of 1990 US dollars, as the 1990 PPP made it possible to compare the largest set of countries. For the individual sectors, the base year is 1997. This year was chosen due to the availability of a new set of multilateral PPPs by industry for this benchmark year.

(c) Limitations of the Indicator: Limitations to the international and historical comparability of the estimates are summarized under the following four headings.

Output measures in national currencies

Output measures are obtained from national accounts and represent, as much as possible, GDP at market prices for the total economy and value added at basic prices for the individual sectors. However, despite common principles that are mostly based on the United Nations System of National Accounts, there are still significant problems in international consistency of national accounts estimates, in particular for countries outside the OECD. Such factors include different treatment of output in services sectors, different procedures in correcting output measures for price changes, in particular the use of different weighting systems in obtaining deflators and different degree of coverage of informal economic activities in developing economies and of the underground economy in developed economies in national accounts.

Employment

Estimates of employment are, as much as possible, for the average number of persons with one or more paid jobs during the year. As in the case of output estimates, the employment estimates are sensitive to under-coverage of informal or underground activities, which accounts for a substantial portion of labour input. In some cases, informal activities are not included in the production and employment statistics at all. In agriculture the labour force estimates include a substantial number of (part-time and seasonal) family workers. However, the estimates presented for the countries in this data set are meant to cover all economic activity.

Working hours

Estimates of annual working hours are often unavailable or are relatively unreliable. Even for developed economies, annual working hours are not consistently defined across countries. For example, statistics on working hours often refer to paid hours rather than to hours actually worked, implying that no adjustments are made for paid hours that are not worked, such as hours for paid vacation or sickness, or for hours worked that are not paid for. Moreover, statistics on working hours often are only available for a single category of the workforce (in many cases, only employees), or only for a particular industry (such as manufacturing) or for particular types of establishments (for example, those above a certain size or in the formal sector). As always, these problems are particularly serious for a substantial number of low-income economies. Whether and how the estimates of annual hours worked have been adjusted for such weaknesses in the primary statistics is often undocumented.

Total labour compensation

The national accounts of developing economies often do not provide estimates of labour compensation which explains the limited number of developing countries for which unit labour cost estimates are available.

Purchasing power parities

The International Comparison Program (ICP) price surveys to obtain PPPs are carried out for selected benchmark years only. Not all estimates are for the same year, so that it was necessary in Maddison (1995) to carry some data forward to 1990 with the use of national price indices. The precise nature of the ICP price surveys can differ across countries, principally for non-OECD countries. The ICP pricing procedures have been criticized for lack of comparability and reflection of the specified items between countries. Furthermore, the multilateral character of the estimates is affected by the fact that the PPPs were, in fact, estimated for six different regions, and "globalized" with particular interregional (binary) links. Finally, within each of the regions, the aggregation procedures of the PPPs differ.

(d) Status of the Methodology: The methodology is well established. The indicator is widely used in developed and developing countries.

(e) Alternative Definitions/Indicators: It could be useful to break down this indicator by age group and sex as we might see an evolution of the labour productivity with more experience and gender differences in pay for the same work.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Growth Domestic Product, gross value added per sector, the number of annual hours actually worked by all persons employed per sector, total labour compensation and the number employers and self-employed persons.

(b) National and International Data Availability and Sources: At the international level, the productivity indicator in ILO's KILM for the total economy covers 97 countries with coverage extending to all KILM regional groups (table 18a). Together, these countries represent more than 93 per cent of the world population and more than 98 per cent of world GDP. For a subset of countries (mostly in Europe and North America, with some in Asia and South America), separate measures are provided for manufacturing (31 countries), transport and communication (18 countries) and trade (15 countries). For agriculture, forestry and fisheries estimates include 113 countries. For unit labour cost, 14 countries are included in the KILM database.

(c) Data References: KILM is accessible at
http://www.ilo.org/public/english/employment/strat/kilm/
The estimates available in the database from both the OECD and the GGDC (Groningen Growth and Development Centre), were originally obtained from national statistical offices and, where possible, have been harmonized for differences in concepts and industry classifications and supplemented, where necessary, with national accounts statistics obtained directly from the individual countries. For non-OECD countries, the national accounts and labour statistics, which were assembled from national sources by international organizations such as the World Bank, the Asian Development Bank, the Food and Agriculture Organization (FAO), the ILO and the United Nations Statistical Office, are mostly taken as the point of departure. These sources are complemented by the series from Maddison (2003), in particular to cover the period 1980-90.

5. AGENCIES INVOLVED WITH THE DEVELOPMENT OF THE INDICATOR

(a) **Lead Agency:** The lead agency is the International Labour Office (ILO), located in Geneva, Switzerland. Contact: kilm@ilo.org

(b) **Other Contributing Organizations:** None.

6. **<u>REFERENCES</u>**

(a) **Readings:**

Yearbook of Labour Statistics (ILO, Geneva).

Bulletin of Labour Statistics (biannual) (ILO, Geneva).

Statistical yearbooks and other publications issued by the national statistical offices.

Surveys of Economically Active Population, Employment, Unemployment and Underemployment -An ILO Manual on Concepts and Methods (ILO, Geneva, 1992).
Sources and Methods: Labour Statistics, Volume 3 - Economically active population, employment, unemployment and hours of work (household surveys), third edition (ILO, Geneva, 2004).

Sources and Methods: Labour Statistics, Volume 4- Employment, unemployment, wages and hours of work (administrative records and related sources), second edition (ILO, Geneva, 2004).

Sources and Methods: Labour Statistics, Volume 5- Total and economically active population, employment and unemployment (population censuses), second edition (ILO, Geneva, 1996) (third edition under preparation).

ILO-comparable annual employment and unemployment estimates, in *Bulletin of Labour Statistics*, 2004-4 (ILO, Geneva, 2004)
System of National Accounts 1993 (Commission of the European Communities,

International Monetary Fund, Organisation for Economic Co-operation and Development, United Nations, World Bank, Brussels/Luxembourg, New York, Paris, Washington, D.C., 1993)

Current international recommendations on labour statistics (ILO, Geneva, 2000). See in particular: *Resolution concerning Statistics of the Economically Active Population, Employment, Unemployment and Underemployment,* adopted by the Thirteenth International Conference of Labour Statisticians (October 1982).

(b) **Internet sites:**
International Labour Office, Bureau of Statistics: the ILO's statistical database on labour statistics, including unemployment data and ILO-comparable estimates:
http://laborsta.ilo.org

International recommendations on labour statistics, including the resolution concerning statistics of the economically active population, employment, unemployment and underemployment:
http://www.ilo.org/public/english/bureau/stat/res/index.htm

Key Indicators of the Labour Market, Geneva, 2003 (available on CD-ROM; sample tables on web site):
http://www.ilo.org/public/english/employment/strat/kilm/

SHARE OF WOMEN IN WAGE EMPLOYMENT IN NON-AGRICULTURAL SECTOR		
Economic Development	**Employment**	**Core indicator**

1. INDICATOR

(a) Name: Share of women in wage employment in the non-agricultural sector

(b) Brief Definition: *The share of women in wage employment in the non-agricultural sector* is the share of female workers in wage employment in the non-agricultural sector expressed as a percentage of total wage employment in that same sector.

(c) Unit of Measurement: %.

(d) Placement in the CSD Indicator Set: Economic development/Employment

2. POLICY RELEVANCE

(a) Purpose: The indicator shows the extent to which women have access to paid employment, which will affect their integration into the monetary economy. It also indicates the degree to which labour markets are open to women in industry and services sectors which affects not only equal employment opportunities for women but also economic efficiency through flexibility of the labour market and the economy's capacity to adapt to changes over time.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): There are large differences in non-agricultural wage employment between men and women, in particular in developing countries. This is the result of differences between male and female rates of participation in employment as well as in the kind of employment they participate in. As economies industrialise the employment in the non-agricultural sector increases and the women participation in non-agricultural wage employment becomes increasingly important.

In almost all regions of the world, women are disproportionately represented in labour markets. Gender inequality in labour markets is manifested in wage gaps, occupational segregation, higher relative unemployment rates and women's disproportionate representation in informal employment, particularly in agriculture. There are also substantial differences between men and women in the type and quality of their employment activities. An extremely high number of women are confined to "female jobs" -low-productivity jobs- with low status, often insecure, unsafe, and poorly paid. Looking specifically at non-agricultural wage employment, there exist significant differences between men and women, particularly in the rural areas of developing countries. Women are more likely than men to work for family subsistence in agriculture, where it is now recognised that they make vital contributions to both agricultural production and importantly, to food security. However, these activities do not provide enough income to allow them to lift their families out of poverty let alone to fully integrate into the monetary economy.

Promoting gender equality and the empowerment of women thus eliminating all forms of gender-based discrimination in labour markets is essential to defeating poverty and fostering sustainable development. Policies aimed at eradicating the gender gap in education are crucial to allow women to develop the skills and competencies they need to better participate in the labour market and make their contribution to the global economy. Their increased role in turn will boost women's economic security that ultimately helps families out of poverty and hunger and leads to the improved health and education of their children that is fundamental for sustainable development.

(c) International Conventions and Agreements: On gender equality there are four key International Labour Organization Conventions: Equal Remuneration Convention, 1951 (No. 100); Discrimination (Employment and Occupation) Convention, 1958 (No. 111); Workers with Family Responsibilities Convention, 1981 (No. 156) and the Maternity Protection Convention, 2000 (No. 183). A number of additional ILO Conventions also make reference to gender equity, labour statistics, full and productive employment issues, etc. (see: http://www.ilo.org).

(d) International Targets/Recommended Standards: Eliminate discriminatory practices in employment (Beijing), Promote gender equality and empower women (MDG Goal 3) and in parallel, making the goals of decent work for all central to national development (Ministerial Declaration, ECOSOC).

(e) Links to other Indicators: The indicator has close links with the unemployment-to-population ratio indicator because both deal with employment as a principal path out of poverty and generator of production. These factors are a pre-requisite for sustaining growth while reducing poverty and hunger, and underpin the potential to reach the other MDGs in universal primary education, better health care and disease control, and environmental sustainability.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts:

The share of women in wage employment in the ***non-agricultural sector*** is the share of women workers in **wage employment** in the non-agricultural sector expressed as a percentage of total wage employment in that same sector.

The *non-agricultural sector* includes industry and services. 'Industry' includes mining and quarrying (including oil production), manufacturing, construction, electricity, gas, and water, corresponding to divisions 2-5 in the *International Standard Industrial Classification of All Economic Activities* (ISIC-Rev.2[36]) and to tabulation categories C-F (ISIC-Rev. 3[37]). 'Services' include wholesale and retail trade and restaurants and hotels; transport,

[36] http://laborsta.ilo.org/

[37] idem

storage, and communications; financing, insurance, real estate, and business services; and community, social, and personal services, corresponding to divisions 6-9 (ISIC-Rev. 2) and to tabulation categories G-Q (ISIC-Rev. 3).

Employment refers to people above a certain age who worked or held a job during a specified reference period (according to the ILO *Resolution concerning statistics of the economically active population, employment, unemployment and underemployment*,[38] adopted by the Thirteenth International Conference of Labour Statisticians (ICLS), October 1982). *Wage employment* refers only to wage earners and salaried employees, or "persons in paid employment jobs." Employees are typically remunerated by wages and salaries, but may be paid by commission from sales, piece-rates, bonuses or payments in kind such as food, housing, training, etc. These persons are in wage employment as opposed to self-employment – that is employers, own-account workers, members of producers' cooperatives or contributing family workers. (The different statuses in employment are defined according to the ILO *Resolution concerning the International Classification of Status in Employment* (ICSE),[39] adopted by the 15th ICLS (1993).

(b) Measurement Methods: The indicator is calculated by dividing the number of women in non-agricultural paid employment by the total number of persons in paid employment in the non-agricultural sector, and multiplying it by 100. This is the proportion of women in "paid employment jobs" (in other words "women employees") in the non-agricultural sector.

(c) Limitations of the Indicator: The indicator has a number of limitations, the main one being its volume factor which does not fully reflect the quality of employment, especially the economic benefits of such employment. Some examples of limitations are the following:

(i) In many countries (especially developing countries), non-agricultural wage employment represents only a small portion of total employment. As a result the contribution of women to the national economy is underestimated and therefore misrepresented.

(ii) The indicator is difficult to interpret, unless additional information is available on the share of women in total employment, which would allow an assessment to be made of whether women are under- or over-represented in non-agricultural wage employment.

(iii) The indicator does not reveal any differences in the quality of the different types of non-agricultural wage employment (that apply also to all jobs), regarding earnings, conditions of work, or the legal and social protection, which they offer. The indicator cannot reflect whether women are able to reap the economic benefits of such employment either.

---

[38] http://www.ilo.org/public/english/bureau/stat/download/res/ecacpop.pdf and ILO 2000: Current international recommendations on labour statistics, 2000 edition (Geneva).

[39] http://www.ilo.org/public/english/bureau/stat/download/res/icse.pdf and ILO 2000: Current international recommendations on labour statistics, 2000 edition (Geneva).

(d) Status of the Methodology:

The ILO *Resolution concerning statistics of the economically active population, employment, unemployment and underemployment*, was adopted by the Thirteenth International Conference of Labour Statisticians in Geneva in 1982.

Detailed guidelines on the application of the standards embodied in the resolution were published in *Surveys of economically active population, employment, unemployment and underemployment: An ILO Manual on Concepts and Methods, ILO, 1990.*

A Checklist of Good Practices for Mainstreaming Gender in Labour Statistics was adopted by the 17th International Conference of Labour Statisticians in 2003.

(e) Alternative Definitions/Indicators:

- Employment by sector (Given the importance of agriculture in most developing countries, emphasis was placed on the distinction between agriculture on the one hand and other branches of economic activity on the other).

- Employment by status in employment> Self-employment (In developing countries, a large proportion of the work force is self-employed, that not only encompasses employers (majority male) but includes contributing (unpaid) family workers, many of whom are female).

- Employment by occupation> (The share of women in managerial positions in all countries is very low)

- Employment in the informal economy> (In developing countries, the informal economy represents the main source of employment creation and income generation for the labour force in urban as well as rural areas).

Alternatively, all above-mentioned indicators can be combined together in a single composite indicator that covers all types of employment (both the wage and self employment in agriculture/non-agriculture and in the formal/informal economy).

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Statistics of paid employment by economic activity, disaggregated by sex.

(b) National and International Data Availability and Sources:

Data collection

Comprehensive, detailed statistics on total and paid employment disaggregated by sex, by branch of economic activity, occupation and status in employment are collected annually through a specialised ILO questionnaire on labour statistics sent directly to the official national sources in all member States and Territories. Statistics are also gleaned from national publications and websites.

These statistics are published, respectively, in the ILO *Yearbook of Labour Statistics* and the *Bulletin of Labour Statistics*, and are also available online in http://laborsta.ilo.org/.

To improve country coverage a special action inquiry to national statistical offices was sent out in 2003. It consisted of a questionnaire requesting data, as from 1990, on Paid Employment in Non Agricultural Activities, and Unemployment by Age Group, for totals, women and men separately, from all available data sources (i.e. labour force survey, establishment survey, administrative records, official estimates).
A number of validation and consistency tests are executed on the data received. These include qualitative as well as quantitative checks. All departures from the international standards or classifications are indicated with footnotes. Where necessary, countries are contacted for further clarifications.
The annual questionnaire is pre-filled with the statistics provided in the previous years (maximum of ten), so that when countries update their series they also have the possibility to review, verify and, where needed, modify the data previously provided.

Sources
National estimates are based on information from different sources, namely population censuses, labour force/household surveys, establishment surveys, administrative sources (mostly social security records) and official estimates that are based on results from several sources. Each source has its own characteristics and provides certain types of data. The first two and the last source may cover the whole relevant population. Results from establishment surveys and administrative records are likely to cover only large private and public sector employers, in particular in the developing countries.
Depending on the source, the measurement and coverage may differ between countries and within countries over time.

Availability of data
Only about half of the countries provide the data necessary for estimating the indicator with more or less regular frequency.
Not all available data perfectly match the indicator as defined above. Where paid employment data do not exist, a proxy series (total employment rather than paid employment) has been used. This is on the expectation that the share of women for total employment is not much different from that for paid employment.

(c) Data References: Data are published by the ILO in the *Yearbook of Labour Statistics*. The statistics are also available on Internet at: http://laborsta.ilo.org.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the International Labour Office (ILO). The contact point is the Bureau of Statistics; e-mail: stat@ilo.org; tel: (+41) 22799 8632; fax: (+41) 22799 6957.

(b) Other Contributing Organizations: UNDAW and UNIFEM are contributing agencies and provide comments on the analysis and interpretation of the MDG Goal 3.

6. REFERENCES

(a) Readings: The full text of the ILO resolution listed in section 3e above can be found in *Current International Recommendations on Labour Statistics* (ILO, Geneva, 2000), ; also available on the Bureau of Statistics' website at: http://www.ilo.org/stat. Further information can be obtained from another ILO publication: *Surveys of economically active population, employment, unemployment and underemployment: An ILO Manual on Concepts and Methods,* (ILO, Geneva 1990).

National methodologies are described in: *Sources and Methods: Labour Statistics*; Vol. 2 *Employment, Wages, Hours of Work and Labour Cost* (Establishment Surveys) (second edition, ILO, Geneva 1995); Vol. 3 *Economically Active Population, Employment, Unemployment and Hours* of Work (Household Surveys) Vol. 4 *Employment, Unemployment, Wages and Hours of Work* (Administrative Records and Related Sources) (second edition, ILO, Geneva 2004), and Vol.5 *Total and Economically Active Population, Employment and Unemployment (Population Censuses).* All volumes are also available on-line at http://laborsta.ilo.org.

(b) Internet sites: The general website of the International Labour Office, Bureau of Statistics: http://www.ilo.org/stat; and the LABORSTA database on labour statistics available at: http://laborsta.ilo.org.

INTERNET USERS PER 100 POPULATION		
Economic development	**Information and communication technologies**	**Core indicator**

1. INDICATOR

(a) Name: Internet users per 100 population.

(b) Brief Definition: Internet users are those who use the Internet from any location. The Internet is defined as a world-wide public computer network that provides access to a number of communication services including the World Wide Web and carries email, news, entertainment and data files. Internet access may be via a computer, Internet-enabled mobile phone, digital TV, games machine etc. Location of use can refer to any location, including work. The indicator is derived by dividing the number of Internet users by total population and multiplying by 100.

(c) Unit of Measurement: Number of users per 100 population.

(d) Placement in the CSD Indicator Set: Economic development/ Information and communication technologies

2. POLICY RELEVANCE

(a) Purpose: The number of Internet users is a measure of Internet access and use.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): As an information distribution system, the Internet and its usage provide opportunities for bringing education and information within the reach of all. It can significantly shorten time lags as well as opening up a new range of information resources. It also opens up significant, new economic opportunities as well as possibilities for more environment-friendly options for the marketplace. The Internet can allow businesses from developing nations to leapfrog into the development mainstream and offers considerable promise in facilitating the delivery of basic services, such as health and education, which are unevenly distributed at present.

(c) International Conventions and Agreements: WSIS documents and targets and ITU Strategic plan highlighting the need to bridge the national and international digital divide in ICTs

(d) International Targets/Recommended Standards: World Summit on the Information Society (WSIS) target 10 (2015): “To ensure that more than half the world's inhabitants have access to ICTs within their reach.”
Millennium Development Goals (MDGs) target 18 “In cooperation with the private sector, make available the benefits of new technologies, especially information and communications

(e) Linkages to Other Indicators: There are also other variables (e.g., hosts and subscribers) which provide a measure of how many people are accessing the Internet. This indicator is also related to other telecommunication indicators (e.g. main telephone lines, mobile cellular subscribers), as well as income and education indicators.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts. The Internet is a linked world-wide network of computers in which users at any one computer can, if they have permission, get information from other computers in the network. For most developed and larger developing nations, Internet users data are based on methodologically sound user surveys conducted by national statistical agencies or industry associations. These data are either directly provided to the ITU by the country concerned or the ITU does the necessary research to obtain the data. For countries where Internet user surveys are not available, the ITU calculates estimates based on average multipliers for the number of users per subscriber. The ITU is currently, through the *Partnership on Measuring ICT for Development*, trying to get more countries to collect more, better, and harmonized Internet users data[40]. The number Internet users are part of the core list of ICT indicators, which has been adopted by this Partnership. This means that more countries will start to collect this data through official surveys (such as a stand-alone household ICT survey or as a modules to existing household surveys) and that the quality of data should improve over time.

(b) Measurement Methods: Internet users data are collected through Internet user surveys. For countries where Internet user surveys are not available, data can be estimated based on average multipliers for the number of users per Internet subscriber.

(c) Limitations of the Indicator: Data for the indicator is not universally available in most developing countries although improvements in this area are currently being made.

(d) Status of the methodology: In the past, the number of Internet users was often based on multipliers (e.g., a certain number per Internet subscriber). As the commercialisation of the Internet has grown, so has the use of Internet use surveys by both market research companies as well as statistical offices to count the number of Internet users.

(e) Alternative Definitions:

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Total population, number of Internet users.

[40] The Partnership on Measuring ICT for Development was launched in June 2004, and currently includes the following members: Eurostat, ITU, OECD, UNCTAD, four UN Regional Commissions (ECA, ECLAC, ESCAP, ESCWA), UIS, the UN ICT Task Force and the World Bank. For further information on the objectives and activities of the Partnership, see http://www.itu.int/ITU-D/ict/partnership/.

(b) National and International Data Availability and Sources: A number of government agencies, typically communication regulators and national statistical agencies are compiling country-level Internet user data. At the international level, the International Telecommunication Union collects data across countries.

(c) Data References: *World Telecommunication Indicators Database*, International Telecommunication Union; *World Telecommunication Development Report,* ITU; Y*earbook of Statistics*, ITU.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the International Telecommunication Union (ITU). The contact point is the Head, Market, Economic and Finance Unit, Telecommunication Development Bureau (BDT), ITU; fax no. (41-22) 730-6449.

(b) Other Contributing Organizations: None.

6. REFERENCES

(a) Readings:
World Telecommunication Report, various years, ITU
Telecommunication Indicator Handbook

(b) Internet site: http://www.itu.int/ict

FIXED TELEPHONE LINES PER 100 POPULATION		
Economic development	**Information and communication technologies**	

1. INDICATOR

(a) Name: Fixed telephone per 100 population

(b) Brief Definition: The indicator is derived by dividing the number of fixed telephone lines by the population and multiplying by 100.

(c) Unit of Measurement: Measured as the % of population.

(d) Placement in the CSD Indicator Set: Economic development/ Information and communication technologies

2. POLICY RELEVANCE

(a) Purpose: Together with the indicator 'mobile cellular subscribers', this indicator is the broadest and most common measurement of the degree of telecommunication development in a country.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): Telecommunications and social, economic, and institutional development are closely linked. Modern communications is considered to be relatively benign to the environment. There is unlikely to be sustainable development without a well-developed communications infrastructure. Communications is critical to support sustainable development.

(c) International Conventions and Agreements: WSIS documents and targets and ITU Strategic plan highlighting the need to bridge the national and international digital divide in ICTs.

(d) International Targets/Recommended Standards: World Summit on the Information Society (WSIS) target 10 (2015): "To ensure that more than half the world's inhabitants have access to ICTs within their reach."
Millennium Development Goals (MDGs) target 18 "In cooperation with the private sector, make available the benefits of new technologies, especially information and communications

(e) Linkages to Other Indicators: The linkages between this indicator and other sustainable development indicators are many. For instance, a well-developed communication infrastructure will reduce the need for transport with beneficial effects on the environment. Another example is the requirement of telecommunications for the innovative delivery of health and educational services. Yet, another example is the potential of telecommunications for reducing economic and social gaps within an economy and assisting to reduce the need for urbanization. Access to telecommunications provides those in rural and remote areas with contact to the outside world, reducing their sense of isolation and providing them with a tool to improve economic, social and cultural awareness.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: Fixed telephone lines refer to telephone lines connecting a customer's terminal equipment (e.g., telephone set, facsimile machine) to the Public Switched Telephone Network (PSTN) and which have a dedicated port on a telephone exchange.

(b) Measurement Methods: The indicator is derived by dividing the number of fixed telephone lines by the population and multiplying by 100.

(c) Limitations of the Indicator: There is concern that fixed lines per 100 inhabitants does not always accurately reflect the degree of telecommunications development. First, there are other indicators of telecommunication development such as data network subscribers. Second, fixed lines on a country level does not indicate the breakdown of the distribution of lines into business or residential or urban and rural although this disaggregated information is available for some countries. The indicator provides no measure of the quality or reliability of the telephone service.

(d) Status of the methodology: The indicator is widely used in over 200 economies around the world.

(e) Alternative Definitions: If accessibility is a main interest, then the number of households with telephone (fixed or mobile) service may be more relevant especially for countries which have large households.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: The data needed to compile the indicator are fixed telephone lines and population.

(b) National and International Data Availability and Sources: The International Telecommunications Union (ITU) collects this information on an annual basis. Data are available for 1960, 1965, 1970, and annually from 1975 onwards. Population data is widely available from UN agencies.

(c) Data References: *World Telecommunication Indicators (WTI)* database, International Telecommunication Union; *World Telecommunication Development Report*, ITU; *Yearbook of Statistics*, ITU.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) **Lead Agency:** The lead agency is the International Telecommunications Union (ITU). The contact point is the Head, Market, Economics and Finance Unit, ITU; fax no. (41 22) 730 6449.

(b) **Other Contributing Organizations: None.**

6. **<u>REFERENCES</u>**

(a) **Readings:**
Definitions, methodology and other information regarding telecommunication indicators can be found in the ITU's *Telecommunication Indicator Handbook.*

Application of the indicator including country data can be found in the ITU's *World Telecommunication Development Report.* The data are also provided by the ITU to other agencies and appear in the following publications: UN *Statistical Yearbook,* World Bank *World Development Indicators,* UNDP *Human Development Report*, and OECD *Communication Outlook and EUROSTAT Communications Statistics.*

(b) **Internet site:** http://www.itu.int/ict

MOBILE CELLULAR TELEPHONE SUBSCRIBERS PER 100 POPULATION		
Economic development	**Information and communication technologies**	

1. INDICATOR

(a) Name: Mobile cellular telephone subscribers per 100 population

(b) Brief Definition: The indicator is derived by dividing the number of mobile cellular telephone subscribers by the population and multiplying by 100.

(c) Unit of Measurement: Measured as the % of population.

(d) Placement in the CSD Indicator Set: Economic development/ Information and communication technologies

2. POLICY RELEVANCE

(a) Purpose: This indicator, together with the fixed telephone lines, is the broadest and most common measurement of the degree of telecommunication development in a country.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): Telecommunications and social, economic, and institutional development are closely linked. Modern communications is considered to be relatively benign to the environment. There is unlikely to be sustainable development without a well-developed communications infrastructure. Communications is critical to support sustainable development.

(c) International Conventions and Agreements: WSIS documents and targets and ITU Strategic plan highlighting the need to bridge the national and international digital divide in ICTs.

(d) International Targets/Recommended Standards: World Summit on the Information Society (WSIS) target 10 (2015): "To ensure that more than half the world's inhabitants have access to ICTs within their reach."
Millennium Development Goals (MDGs) target 18 "In cooperation with the private sector, make available the benefits of new technologies, especially information and communications

(e) Linkages to Other Indicators: The linkages between this indicator and other sustainable development indicators are many. For instance, a well-developed communication infrastructure will reduce the need for transport with beneficial effects on the environment. Another example is the requirement of telecommunications for the innovative delivery of health and educational services. Yet, another example is the potential of telecommunications for reducing economic and social gaps within an economy and assisting to reduce the need for urbanization. Access to telecommunications provides those in rural and remote areas with contact to the outside world, reducing their sense of isolation and providing them with a tool to improve economic, social and cultural awareness.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: Mobile cellular telephone subscribers refer to users of portable telephones subscribing to an automatic public mobile telephone service using cellular technology, which provides access to the Public Switched Telephone Network PSTN.

(b) Measurement Methods: The indicator is derived by dividing the number of mobile cellular telephone subscribers by the population and multiplying by 100.

(c) Limitations of the Indicator: The indicator provides no measure of the quality or reliability of the telephone service.

(d) Status of the methodology: The indicator is widely used in over 200 economies around the world.

(e) Alternative Definitions: If accessibility is a main interest, then the number of households with telephone (fixed or mobile) service may be more relevant especially for countries which have large households.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: The data needed to compile the indicator are mobile cellular telephone subscribers and population.

(b) National and International Data Availability and Sources: The International Telecommunications Union (ITU) collects this information on an annual basis. Data are available for 1960, 1965, 1970, and annually from 1975 onwards. Population data is widely available from UN agencies.

(c) Data References: *World Telecommunication Indicators (WTI)* database, International Telecommunication Union; *World Telecommunication Development Report*, ITU; *Yearbook of Statistics*, ITU.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the International Telecommunications Union (ITU). The contact point is the Head, Market, Economics and Finance Unit, ITU; fax no. (41 22) 730 6449.

(b) Other Contributing Organizations: None.

6. REFERENCES

(a) Readings:

Definitions, methodology and other information regarding telecommunication indicators can be found in the ITU's *Telecommunication Indicator Handbook.*

Application of the indicator including country data can be found in the ITU's *World Telecommunication Development Report.* The data are also provided by the ITU to other agencies and appear in the following publications: UN *Statistical Yearbook,* World Bank *World Development Indicators,* UNDP *Human Development Report*, and OECD *Communication Outlook and EUROSTAT Communications Statistics.*

(b) Internet site: http://www.itu.int/ict

GROSS DOMESTIC EXPENDITURE ON RESEARCH AND DEVELOPMENT AS A PERCENT OF GROSS DOMESTIC PRODUCT		
Economic development	**Research and development**	

1. INDICATOR

(a) Name: Gross Domestic Expenditure on R&D as a Percent of Gross Domestic Product (GDP).

(b) Brief Definition: Gross domestic expenditure on scientific research and experimental development (R&D) expressed as a percentage of Gross Domestic Product (GDP).

(c) Unit of Measurement: expressed as a percentage (%).

(d) Placement in the CSD Indicator Set: Economic development/ Research and development

2. POLICY RELEVANCE

(a) Purpose: This ratio provides an indication of the level of financial resources devoted to R&D in terms of the share of the GDP.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): This indicator is required to assess the level and trends of R&D expenditure in relation to GDP, at a given point of time. Adequate R&D funding that is commensurate with economic growth and national income is necessary for ensuring sustainable development. Scientists are improving their understanding on policy-relevant issues such as climate change, growth in resource consumption rates, demographic trends, and environmental degradation. Changes in R&D investments in these and other areas need to be taken into account in devising long-term strategies for development. Scientific knowledge should be applied to assess current conditions and future prospects in relation to sustainable development.

(c) International Conventions and Agreements: None.

(d) International Targets/Recommended Standards: None.

(e) Linkages to Other Indicators: This indicator can be most closely linked with indicator 40: Investment share of GDP, in providing more precise complementary indications on the level of financial resources devoted to R&D.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: The *OECD Frascati Manual (2002)* defines gross domestic expenditure on R&D (GERD) activities as the total intramural expenditure on research and development performed on the national territory during a given period. This includes both current costs and capital expenditures. It includes R&D performed within a country and funded from abroad but excludes payments for R&D performed abroad.

(b) Measurement Methods: The indicator is calculated by dividing gross domestic expenditure on R&D by GDP and expressed as a percentage. Both data on R&D expenditure and GDP can be expressed in current values and in the national currency.

(c) Limitations of the Indicator: The indicator does not show the proportion of expenditure on R&D which contributes specifically to sustainable development. To date, most developed and a few developing countries are able to regularly collect and provide internationally comparable and timely data.
This indicator is widely used to measure the so-called R&D intensity. However, it is not always the most appropriate indicator when measuring S&T in developing countries. Researchers as a percentage of population, labour force, or employment, might be more pertinent indicators, since they focus on human capacities and skills rather than on expenditure.

There are several weaknesses of measuring only expenditure. Expenditure does not reflect the potential of R&D in a given country, but only the effort conducted in a given year. As a single figure, it hides the question if this effort comes from government, private, or foreign sources. A significant part of expenditure corresponds usually to researchers' salaries, and these depend on the position of researchers in society and also the ups and downs of the economy, and in particular the public sector in developing countries. Data on expenditure can also be of poorer quality, since accounting systems are usually not well set up to reflect R&D. Also, inflation and the existence of vast informal sectors make the analysis of these figures more difficult.

(d) Status of the Methodology:
Concepts and the corresponding definitions as well as suggestions for the collection of data as set out in the *Recommendation Concerning the International Standardization of Science and Technology* (UNESCO, 1978) still apply. The OECD *Frascati Manual (2002)* maps out proposed standard practices for surveys on research and experimental development for OECD countries. The UNESCO Institute for Statistics (UIS) is currently extending this work for non-OECD countries.

(e) Alternative Definitions/Indicators: None.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Gross domestic expenditure on R&D and GDP expressed in national currency.

(b) National and International Data Availability and Sources: Data on R&D expenditure for 1996 on are available for 114 countries. At the national level, the availability of these data depends on the existence and frequency of R&D surveys. To construct this indicator at the international level, the GDP data can be obtained from the World Bank whilst those relating to R&D expenditure can be obtained through UNESCO Institute for Statistics' (UIS) international surveys on scientific research and experimental development. At the national level, data on R&D expenditure are collected normally through special R&D surveys conducted by the ministry/department/council of science and technology and/or the central statistical office and/or specialized institutions, whereas those on GDP can be obtained from either the ministry of finance or the central statistical office.

(c) Data References: UNESCO Institute for Statistics (UIS) website: http://www.uis.unesco.org

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the United Nations Educational, Scientific and Cultural Organization (UNESCO). The contact point is the Director, UNESCO Institute for Statistics (UIS); email: uis@unesco.org and fax (1-514) 343-5740.

(b) Other Contributing Organizations: The OECD (Organisation for Economic Co-operation and Development) and EUROSTAT are two organizations that have been actively developing methodologies and collecting data from their respective member countries on R&D.

6. REFERENCES

(a) Readings:

UNESCO. *Recommendation concerning the International Standardization of Statistics on Science and Technology*. Adopted by the General Conference of UNESCO in 1978.

UNESCO. *Manual for Statistics on Scientific and Technological Activities.* 1984.

UNESCO. *Guide to the Collection of Statistics on Science and Technology*. 1984.

OECD (Organisation for Economic Co-operation and Development). *Proposed Standard Practice for Surveys and Research and Experimental Development,* "Frascati Manual". 2002.

(b) Internet site: http://www.uis.unesco.org

TOURISM CONTRIBUTION TO GDP		
Economic Development	**Tourism**	**Core indicator**

1. INDICATOR

(a) **Name:** Tourism contribution to Gross Domestic Product (TGDP).

(b) **Brief Definition:** The sum of the value added (at basic prices) generated by all industries in response to internal tourism consumption and the amount of net taxes on products and imports included within the value of this expenditure

(c) **Unit of Measurement:** national currency

(d) **Placement in the CSD Indicator Set:** Economic Development/Tourism.

2. POLICY RELEVANCE

(a) **Purpose:** GDP generated by visitor consumption is the most comprehensive aggregate illustrating the economic relevance of tourism. There is an increasing consensus on the importance of tourism as a strategic sector in the national economy insofar as it provides an essential contribution to the economic well-being of the resident population, contributes to the economic objectives of governments and shows its possible role as a relevant player in moving towards a more innovative economy.

(b) **Relevance to Sustainable/Unsustainable Development (theme/sub-theme):**

Tourism comprises the activities of persons travelling to and staying in places outside their usual environment for not more than one consecutive year for leisure, business and purposes other than being employed in the place visited

This activity of visitors refers both to non-residents, residents travelling in the country of residence and abroad for tourism purposes (leisure and others) and it is conceptualized as inbound, domestic and outbound tourism, respectively.

Although defined from the demand side, the economic analysis of tourism requires nevertheless the identification of the resources used by visitors on their trips, the consumption of goods and services that they acquire, and therefore the identification of the economic units that provide those goods and services. Both the demand and the supply perspectives are of particular importance.

These sets of flows (both physical and monetary) impact different areas such as travelling, physical planning at destinations, employment and general economic performance, natural and cultural heritage. Consequently, tourism impacts upon the sustainability of national and local economies and the environmental and socio-cultural resource base.

(c) International Conventions and Agreements: the United Nations Statistical Commission approved in 2000 the Tourism Satellite Account (TSA) conceptual framework as a new international standard in tourism statistics. As mentioned in the official document (*Tourism Satellite Account: Recommended Methodological Framework*) the TSA takes the form of a basic system of concepts, classifications, definitions, tables and aggregates linked ("satellite") to the standard tables of 1993 System of National Accounts (SNA) from a functional perspective. Consequently, TSA aggregates (such as Tourism GDP and related indicators) are comparable with other internationally recognized macroeconomic aggregates and compilations

(d) International Targets/Recommended Standards: UNWTO General Assembly approved in his last meeting (Dakar, Senegal 28 November-2 December 2005) the document "UNWTO Agenda 2010" which identifies the following expected results and performance indicators regarding statistics:

- two-thirds of members countries using United Nations tourism statistics standards;
- two-thirds of the countries of the world regularly providing statistical data for the *Compendium of Tourism Statistics*;
- one-third of member countries having a TSA compliant with United Nations standards;
- one-third of member countries publishing significant data on employment in tourism, within the framework of WTO/ILO cooperation;
- one-third of member countries engaged in improving knowledge of the "travel" item of the balance of payments, within the framework of WTO/IMF cooperation.

(e) Linkages to Other Indicators: the relationship of TGDP and other aggregates from the point of view of supply is indicated in the TSA official document

	Value added of tourism industries (VATI)	Tourism value added (TVA)	Tourism gross domestic product (TGDP)
Value added (at basic prices) generated by the supply to visitors by the tourism industries	Yes	Yes	Yes
Value added (at basic prices) generated by the supply to non-visitors by the tourism industries	Yes	No	No
Value added (at basic prices) generated by the supply to visitors by activities not in the tourism industries	No	Yes	Yes

	Value added of tourism industries (VATI)	Tourism value added (TVA)	Tourism gross domestic product (TGDP)
Value added (at basic prices) generated by the supply to non-visitors by activities not in the tourism industries	No	No	No
Net taxes on products and imports included in the value of internal tourism consumption (at purchasers' prices)	No	No	Yes

It is important to address three issues here:

- The only indicators strictly characterizing tourism supply emerge from tourism value added and tourism GDP. Value added of tourism industries (VATI) is a measure of the supply side of tourism but is not sufficiently well defined in terms of its links to visitor consumption to allow it to be the most accurate measure of tourism supply;

- Tourism value added and tourism GDP can provide measures of the economic importance of tourism in a country in the same sense as the GDP of any productive activity does. However, they do not refer to tourism as a productive activity comparable to productive activities in 1993 SNA. They are indicators emanating from a reconciliation of tourism consumption and supply, and their values will depend on the scope of measurement of visitor consumption that a country adopts;

- The estimation of tourism value added and tourism GDP relies on a number of measurement assumptions, and thus special care must be taken when using or interpreting these aggregates.

The TSA also identifies other related aggregates and indicators such as internal tourism consumption (both in cash and in kind), tourism employment and tourism gross fixed capital formation

3. <u>METHODOLOGICAL DESCRIPTION</u>

(a) Underlying Definitions and Concepts:

Travel relates to the displacement of persons between different geographic locations, for any type of purpose and for less than a year. Those who travel are usually called travelers. Travel can happen within a country or region or involve more than one country. Travel has an economic impact mainly in the places visited by the traveler, and has become an important field of economic observation. In

Not all travelers are visitors: Generally speaking, tourism is more limited than travel as it refers to specific types of trips: those that take the traveler outside his/her usual environment for less than a year and for a purpose other than being employed in the place visited. Individuals when taking such trips are called visitors. "Tourism" is therefore a subset of "Travel" both in an international context and in a domestic one. This distinction is crucial both for the compilation of data on flows of travelers and for analysis of mobility.

Tourism statistics identify tourism characteristic products as those products (following the Central Product Classification - CPC) which, in the absence of visitors, in most countries would probably cease to exist in meaningful quantity or for which the level of consumption would be significantly reduced and for which it seems possible to obtain statistical information.

Once the set of tourism characteristic products is defined, the identification of tourism characteristic activities (or tourism industries) may be closed, since they can be identified (following the International Standard Industrial Classification of All Economic Activites-ISIC) as productive activities that produce a principal output which has been identified as characteristic of tourism. Due to the criteria given for the determination of tourism characteristic products, some activities may be considered as characteristic of tourism because of the importance of this typical commodity for the visitors even though their typical output is not principally sold to visitors. This is the case for restaurants, or for transport services where commuting is important, or when the activity of freight transportation cannot be separated statistically from that of passenger transportation.

One important feature of tourism characteristic activities is that they must serve the visitors themselves, that is, there must be a direct contact between the provider of the product and the consumer. Although a direct physical relationship is very often involved in the delivery of the goods and services to the visitor, the term "direct contact" cannot be reduced to physical contact but must be used in a broader sense, in accordance with the objective of measuring the economic impact of tourism in a macroeconomic context.

Definition of GDP can be found in other CSD-ISD files

(b) Measurement Methods:

Physical indicators associated to the flow of visitors (number of tourism displacements – trips by overnight and same day visitors and their characteristics-, as well as overnights) continue to be basic of the measurement of tourism from the demand side , but it is no less true that countries now need additional information and indicators to improve the measurement of the economic contribution of tourism. Without doubt, the estimation of the expenditure associated to the different forms of tourism (inbound, domestic and outbound) is the main priority.

In the case of inbound and outbound tourism, the measurement and characterization of flows of visitors is usually based on that of non-residents entering the country for a duration of less than a year, and is performed at the borders, either using

Entry/Departure cards, or using surveys at the borders usually at the moment the non residents leave the country, although a few countries, combine in an integrated manner both instruments (administrative controls and surveys). Some countries, mainly from Europe where controls at the borders have disappeared, also make measurements in the place of accommodations (either as a complement to border surveys or as an alternative to them)

In the case of domestic tourism, as there are no borders to cross under administrative control, the observation of the flows of domestic tourism requires surveys and not just administrative procedures. UNWTO considers household surveys to be the most efficient and suitable instrument for measuring domestic tourism activity. Usually they use a stratified sample using demographic (size of habitat) and socio-economic criteria

Daily average expenditure by visitors has to be estimated mainly using specific questions within a survey applied to visitors. Alternative estimation methods are different type of administrative data (such as bank reporting systems, transportation expenditures provided by companies or transportation regulatory authorities, etc.). In addition, some components might be estimated from other sources, as for instance those related to vacation homes, time share and social transfers in kind

Finally, estimation of total visitor consumption takes into account the number of trips (estimated by the arrivals/ departures of visitors) and the average daily expenditure by visitors.

From the supply side, it should be remembered that in order for individuals to take tourism trips to a given country or location, an infrastructure of services must be in place to respond to their specific needs: basically this means that modes of transport and transportation facilities, different types of accommodation, food serving services, recreation facilities, as well as other services. The measurement of tourism supply is therefore linked to the proportion of visitors consumption of different type of industries output (not just tourism industries but others): estimation of tourism ratios is the key issue in this regard.

(c) Limitations of the Indicator:

The level of development of national systems of tourism statistics explains the basic limitations of Tourism GDP both in terms of number of information available and the coverage of basic variables.

The reconciliation of information on consumption and supply in the economy is at the core of the TSA exercise. UNWTO recommends, when obtaining and disseminating tourism statistics, to be sure that the data present a basic structure of consistency, internally and with the representation of the remainder of the economy.

This consistency should be checked and this control could cover the following aspects:

- overnights by visitors, supply of beds and bed occupancy rates in organized paid accommodation
- income per room or person night and expenditure per person night in organized paid accommodation
- consistency in the sequences of income per person night among categories of accommodation establishments
- consistency of expenditure by visitors as compared to total supply for some specific tourism products

(d) Status of the Methodology:

The methodology is well established in the TSA official text: nevertheless, an Inter-Agency Coordination Group on Tourism Statistics has been created in order to bringing closer the conceptual framework of TSA to the revision of 1993 SNA and Balance of Payment Manual (BPM5) and introduce editorial amendments to the present text for clarification purposes

(e) Alternative Definitions/Indicators:

UNWTO has designed as a complementary initiative to TSAs work in progress, the development of a number of macroeconomic indicators based on tourism statistics, Balance of Payment and National Account items generally available in most countries. It should be remembered that the TSA is a medium term project.
A total of 55 indicators have been identified and classified in the following groups:

1. Basic macroeconomic equilibria
2. Production
3. Consumption and prices
4. Employment and wages
5. Investment

UNWTO warns about the possibility that once certain countries have their own TSA, the results indicate a different situation regarding the impact of tourism on the economy to that initially foreseen using the indicators proposed here. However, it is also possible that the new data (TSA aggregates and related indicators) will offer greater credibility as they will be the result of rationalisation of the basic statistical research and the application of several consistency tests applied during development of the summary statistics.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: arrivals of international visitors, trips by resident visitors in the country of reference, international departures by resident visitors, expenditure and production of goods and services demanded by visitors, tourism share values (how much value of the variable is attributable to visitor consumption), tourism related imported goods.

(b) National and International Data Availability and Sources: about 70 countries are right now in either of these situations: a) they already have an established Tourism Satellite Account, b) expecting that the implementation of their TSA will be highly developed during the next three years and also; or c) countries that have recently developed relevant macroeconomic studies on the economic importance of tourism.

(c) Data References: UNWTO will start by 2007 to request TSA data and will distribute the results in the "Compendium of Tourism Statistics"

5. AGENCIES INVOLVED WITH THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: United Nations World Tourism Organization (UNWTO), located in Madrid, Spain.
Contact: Statistics and Economic Measurement of Tourism (stats@unwto.org)
World Tourism Organization
Capitán Haya, 42
28020 Madrid – Spain
Tel: (+34) 91 5678100
Fax: (+34) 91 5713733

(b) Other Contributing Organizations: European Commission, CARICOM

6. REFERENCES

(a) Readings:

Juan Falconi, (2003) *Measuring the Economic Contributions of Tourism: A Proposal for some Basic Indicators*, document published in the UNWTO publication "Enzo Paci Papers on Measuring the Economic Significance of Tourism, volume 3"
(http://www.unwto.org/statistics/tsa/project/indicators.pdf)

United Nations, World Tourism Organization, Organisation for Economic Cooperation and Development and Commission of the European Communities (Eurostat) (2001). *Tourism Satellite Account: Recommended Methodological Framework*. United Nations, New York.

World Tourism Organization. (2005). *Tourism as an International Traded Service - A Guide for Measuring Arrivals and Associated Expenditures of Non-Residents*
(http://www.unwto.org/statistics/border.pdf)

World Tourism Organization (2005). *Measuring Domestic Tourism and the Use of Household Surveys* (http://www.unwto.org/statistics/sts/strengthening/household.pdf)

World Tourism Organization. (2001). *Basic References on Tourism Statistic Measuring visitor expenditure for inbound tourism*
(http://www.unwto.org/statistics/basic_references/index-en.htm)

World Tourism Organization. (2006). *Compendium of Tourism Statistics*. World Tourism Organization, Madrid.

(b) **Internet site:** World Tourism Organization http://www.unwto.org/

CURRENT ACCOUNT DEFICIT AS PERCENTAGE OF GDP		
Global Economic Partnership	**External financing**	**Core indicator**

1. **INDICATOR**

(a) Name: Current account deficit as share of Gross domestic product (GDP)

(b) Brief Definition: The balance of the current account (deficit or surplus) in a country divided by Gross Domestic Product.

(c) Unit of Measurement: Percentage

(d) Placement in the CSD Indicator Set: Global Economic Partnership/ External financing

2. **POLICY RELEVANCE**

(a) Purpose: Current account balance is a part of the measure of an economy's savings. Along with net capital transfers and acquisition/disposal of non-produced, non-financial assets, the current account balance represents the net foreign investment or net lending/borrowing position of a country vis-à-vis the rest of the world.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): Persistent current account deficits or surpluses indicate a macroeconomic instability that is not conducive to sustained economic growth and, therefore, to sustained means of implementation of sustainable development goals. Persistent deficits require a reversal in the future, typically through a combination of increased savings (private and/or public), a depreciation of the real effective exchange rate and, possibly, a revaluation of external liabilities. In countries with incomplete financial markets, high current account deficits may, depending on the financing of the deficit, macroeconomic conditions and possible international capital market sentiments, also indicate a risk of future sudden reversal of international financial flows and, thereby, abrupt decrease in the means of implementation of sustainable development goals.

(c) International Conventions and Agreements: None.

(d) International Targets/Recommended Standards: None

(e) Linkages to Other Indicators: This indicator is closely linked to changes in international reserves, capacity to import, and capacity to service debt along with other measures of economic development and macro stability.

3. **METHODOLOGICAL DESCRIPTION**

(a) Underlying Definitions and Concepts: The current account covers all transactions (other than those in financial items) that involve economic values and occur between residents and non-resident entities. As per the current 5th edition of the Balance of Payment Manual, the main categories of the current account are goods, services, income (compensation of employees and investment income) and current transfers.

The counterparts of the current account are the capital and financial accounts. The major components of the capital account are capital transfers and acquisition/disposal of non-produces/non-financial assets. Standard components of the financial account are direct investment, portfolio investment, other investment and reserve assets.

In principle (ignoring measurement problems), the current account equals the inverse of the financial and capital account. Consequently, a current account deficit has to be financed through an increase in financial and non-financial liabilities or a decrease in reserve assets. However due to the difficulties in compiling the data, the balance is often achieved by inserting an errors and omissions row. In some cases the errors and omissions may be larger than other components, especially when the data compiling practices are poor.

Gross domestic product (GDP) at purchaser's prices is the sum of value added by all resident producers in the economy plus any taxes (less subsidies) not included in the valuation of output. No allowances are made for the depreciation of capital assets or the depletion and degradation of natural resources.

(b) Measurement Methods: The indicator is derived by dividing the current account by GDP.

(c) Limitations of the Indicator: The indicator does not provide information on the financing of a current account deficit, which may contain important information on the sustainability of the deficit. The indicator also does not indicate whether and at which point of time policy measures are appropriate to address current account imbalances.

(d) Status of Methodology: The methodology is generally well developed.

(e) Alternative Definitions/Indicators: Gross national income (GNI) may be chosen as denominator instead of GDP. The different component of the current account, especially the trade balance, may provide important information on its own.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Balance of payment data for the current account and national accounts data for GDP.

(b) National and International Data Availability and Sources: In most countries national statistical offices, central banks, or ministries collect balance of payment statistics and report them to the International Monetary Fund (IMF). The IMF publishes current account data in its Year book of Balance of Payments Statistics, and monthly International Financial Statistic (IFS**).** The World Bank publishes current account data in its *World Development Indicators* series (WDI) and *World Development Report* (WDR).

(c) Data References: Information on current account is included in the World Development Indicators of the World Bank, see about the data table 4.15.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the World Bank. The contact point is K. M. Vijayalakshmi ((202-473-3827), Kvijayalakshmi@worldbank.org.

(b) Other Contributing Organization The IMF, which is the source of international data on the current account.

6. REFERENCES

(a) Readings:

International Monetary Fund**,** Balance of Payment Manual, 5th edition, 1993.

International Monetary Fund, Year book of Balance of Payments, various years.

World Bank, Word Development Indicators, various years.

(b) Internet sites:

IMF: http://www.imf.org/external/np/sta/bop/

World Bank: www.worldbank.org/data.

SHARE OF IMPORTS FROM DEVELOPING COUNTRIES AND LDCS		
Global economic partnership	**Trade**	

1. **INDICATOR**

(a) Name: Share of imports from developing countries and from least-developed countries (LDCs)

(b) Brief Definition: The indicator is defined as the share of merchandise imports from least-developed countries (LDCs) and from other developing countries in total imports into the reporting countries in a given year.

(c) Unit of Measurement: %.

(d) Placement in the CSD Indicator Set: Global economic partnership/External financing

2. **POLICY RELEVANCE**

(a) Purpose: Imports from developing countries and from LDCs constitute a major source of external financing for development of those countries. For developed country importers, the indicator is a measure of the relative importance of North-South trade, whereas for developing country importers it is a measure of South-South trade. The nominator of this indicator alone is a useful absolute measure of North-South or South-South trade. A further breakdown by product group or by group of countries may be useful to identify a need for policy interventions.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): The major role trade can play in achieving sustainable development has been recognized in Agenda 21 and the Johannesburg Plan of Implementation as well as in other development oriented conferences. The indicator provides information on whether the actions called upon in these conferences as well as in multilateral and regional trading arrangements, especially in the World Trade Organization (WTO), to increase the trade opportunities of developing countries have indeed increased the role of trade for their external financing.

(c) International Conventions and Agreements: None.

(d) **International Targets/Recommended Standards:** There is no numerical target for this indicator. The JPOI calls for developing countries, especially the least developed among them, to secure their share in the growth of world trade commensurate with the need of their economic development.

(e) Linkages to Other Indicators: This indicator is linked with the other financial and international cooperation indicators, in particular with the indicator on average tariffs.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: The list of least-developed countries is determined by the Economic and Social Council of the United Nations. As of 2006, 50 countries are on this list. For the latest version, see http://www.un.org/ohrlls/
There is no commonly agreed definition of developing countries.

Merchandise trade covers all types of inward and outward movement of goods through a country or territory. Goods include all merchandise that either add or reduce the stock of material resources. Imports are typically valued at transaction value plus the cost of transportation and insurance to the frontier of the importing country or territory (c.i.f. valuation).

Merchandise trade is often disaggregated by product group, according to the Standard International Trade Classification (SITC) or according to the Harmonized System (HS) classification. SITC, revision 3, is the most current version of the SITC, whereas HS 2002 is the most recent HS classification.

(b) Measurement Methods: The indicator is derived by dividing imports from LDCs or developing countries by total imports.

(c) Limitations of the Indicator: The indicator does not include trade in services, due to limited data availability.

(d) Status of Methodology: The methodology is well established and constantly reviewed.

(e) Alternative Definitions/Indicators: If data availability permits, the indicator could be expanded to include trade in services. International trade in services is defined in the *Manual on International Trade in Services.* It includes trade in commercial services between residents and non-residents as recorded in the Balance of Payments (see the 5th edition of the Balance of Payments Manual), trade in services by foreign affiliates (foreign direct investment enterprises) as well as trade related to the movement of natural persons not included in the balance of payments. However, in most cases data on trade in services exists only for commercial services and does not include breakdowns by exporting countries.

Countries that wish to monitor their integration into the global economy, may wish to use total trade (exports plus imports), probably divided by Gross Domestic Product, as complementary or alternative indicator.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Merchandise imports, separated by exporting country.

(b) National and International Data Availability and Sources: United Nations Comtrade is the most comprehensive database on merchandise trade flows. It contains information on trade flows of close to 200 countries or areas. Data are submitted by national statistical authorities and standardized by the United Nations Statistics Division.

(c) Data References: United Nations Comtrade for merchandise trade, see http://comtrade.un.org

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the United Nations Statistics Division. Contact point is the Trade Statistics Branch, e-mail comtrade@un.org

(b) Other Contributing Organizations: None

6. REFERENCES

(a) Readings:

United Nations, International Merchandise Trade Statistics: Compiler's Manual, 2003.

United Nations, Manual on International Trade in Services, 2002

World Trade Organization, General Agreement on Trade in Services, Geneva, 1996.

(b) Internet site: http://unstats.un.org/unsd/comtrade/default.aspx

AVERAGE TARIFF IMPOSED ON EXPORTS FROM DEVELOPING COUNTRIES AND LDCS		
Global economic partnership	**Trade**	

1. INDICATOR

(a) Name: Average tariff imposed on exports from developing countries and LDCs

(b) Brief Definition: The indicator can be defined as the simple average tariff imposed on all exports from developing countries and LDCs. The **Simple average tariff** is the unweighted average of the effectively applied rates for all products subject to tariffs.

(c) Unit of Measurement: Percentage point

(d) Placement in the CSD Indicator Set: Global economic partnership/ Trade

2. POLICY RELEVANCE

(a) Purpose: Evaluate the restrictiveness of trade policy, especially in developed countries, toward developing countries and least developed countries (LDCs) measured by the average tariffs rates.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme) Tariffs raise the price of imports from developing countries and therefore reduce demand for their products and limiting their growth opportunities. This can result in a suboptimal mix of outputs, limiting growth and encouraging production of less sustainable outputs.

(c) International Conventions and Agreements: The Marrakesh Protocol to the General Agreement on Tariffs and Trade 1994 is the legally binding agreement for the reduced tariff rates. GATT is now the WTO's principal rule-book for trade in goods. It has annexes dealing with specific sectors such as agriculture and textiles, and with specific issues such as state trading, product standards, subsidies and actions taken against dumping. The WTO's rules — the agreements — are the result of negotiations between the members.

(d) International Targets/Recommended Standards: According to WTO, there is no legally binding agreement that sets out the targets for tariff reductions (e.g. by what percentage they were to be cut). However, within the Doha Development Agenda, which launched the current round of multilateral trade negotiations in 2001, countries committed themselves to the objective of duty-free and quota-free market access for products originating from LDCs.

Some countries have programs to voluntarily reduce or remove tariffs on the exports of developing countries, in addition to trade preferences given to developing countries under the Generalized System of Preferences (GSP) or the Global System of Trade Preferences

Among Developing Countries (GSTP). For example, the European Union has launched a program to eliminate tariffs on developing country exports of "everything but arms," and the United States offers special concessions to exports form Sub-Saharan Africa. However there are many restrictions built into these programs.

Millennium Development Goal (MDG) 8, target 12 is "Develop further an open, rule-based, predictable, non-discriminatory trading and financial system", and target 13 is "Address the special needs of the least developed countries, landlocked countries and small island developing states (SIDS).

(e) Linkages to Other Indicators: This indicator is closely linked with other measures of economic development. Subsidies to agricultural producers and exporters in OECD countries are another form of barrier to developing economies' exports.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: Simple averages are the unweighted average of all tariff lines as contained in a country's tariff schedule. Averages across groups of products, such as agricultural commodities, textiles, and clothing may be based on the Standard International Trade Classification or the Harmonized System. Tariff averages include ad valorem duties and ad valorem equivalents of non-ad valorem duties, where available.

The list of least-developed countries is determined by the Economic and Social Council of the United Nations. As of 2006, 50 countries are on this list. For the latest version, see http://www.un.org/ohrlls/
There is no commonly agreed definition of developing countries.

(b) Measurement Methods: Tariff rates are averaged at the most detailed tariff line or trade classification level available. Lines with no published tariff are not included. Ad-valorem equivalents to special rates maybe used where available. When effectively applied rates are not known, most favored nations rates may be used.

(c) Limitations of the Indicator: Average tariff rates may disguise high tariffs targeted at specific goods. Other barriers to trade, such as quantitative restrictions, phyto-sanitary standards, anti-dumping measures, and subsidies paid to domestic producers may further restrict developing country exports.

(d) Status of Methodology: The methodology is well developed.

(e) Alternative Definitions/Indicators: Average tariffs can also be computed as trade-weighted averages of effectively applied tariff rates or as simple or weighted averages of bound rates. The MDG indicator # 39 on tariff averages is calculated using effectively applied tariff rates and standardized trade weights, based on multi-year averages of import patterns of major developed countries (United States of America, European Union, Japan, Canada, Australia and Switzerland).

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Data from tariff schedules available from UNCTAD's TRAINS database and WTO files.

(b) National and International Data Availability and Sources: In most countries national statistical offices regularly collect data on trade and tariffs. Tariff data is provided to WTO and UNCTAD by each country. Availability varies from country to country
The World Bank's World Development Indicators (WDI) contain a table on average tariffs in the table reflect tariff schedules applied by high-income OECD members to exports of countries designated least developed countries by the United Nations.
UNCTAD, WTO and ITC jointly maintain a dedicated webpage "MDG –trade" that allows calculating variants of the MDG indicator # 39 on average tariffs. The webpage allows, among others, for calculating tariff averages for various developed countries as importer, for many country groups and individual countries as exporter and for various product groups.
The on-line version of UNCTAD's Handbook of Statistics includes among its international merchandise trade indicators simple and trade-weighted average tariffs imposed on non-agricultural exports from LDCs and from developing countries. Data is available for 153 countries, but availability across time varies.

(c) Data references
See 4 (b) above

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agencies: World Bank, UNCTAD, and WTO. The contact points are Azita Amjadi (aamjadi@worldbank.org), Aki Kuwahara (aki.kuwahara@unctad.org), and Jurgen Richtering (Jurgen.Richtering@wto.org).

(b) Other Contributing Organizations: None.

6. REFERENCES

(a) Readings:
World Development Indicators, table on tariffs, various years.

(b) Internet sites:
World Bank:
http://devdata.worldbank.org/wdi2006/contents/table6_7.htm
http://wits.worldbank.org/witsweb/default.aspx

World Trade Organization:
http://www.wto.org/english/thewto_e/whatis_e/tif_e/agrm2_e.htm

WTO, UNCTAD and ITC: http://www.mdg-trade.org

UNCTAD: http://stats.unctad.org/handbook

NET OFFICIAL DEVELOPMENT ASSISTANCE GIVEN OR RECEIVED AS A PERCENTAGE OF GROSS NATIONAL INCOME		
Global economic partnership	**External financing**	**Core indicator**

1. INDICATOR

(a) Name: Net Official Development Assistance (ODA) given or received as a percentage of Gross National Income (GNI).

(b) Brief Definition: This indicator is defined as the total ODA given or received as a share of GNI of the source or recipient country, respectively, net of repayment of principal. When ODA flows by donor countries are measured, ODA comprises bilateral disbursements of concessional funds to developing countries and multilateral institutions. When ODA receipts by developing countries are measured, ODA comprises disbursement of concessional finance from both bilateral and multilateral sources.

(c) Unit of Measurement: %.

(d) Placement in the CSD Indicator Set: Global economic partnership/External financing

2. POLICY RELEVANCE

(a) Purpose: The indicator is a measure of the size of flows that are both concessional, and aimed mainly at promoting development and welfare of developing countries. It conveys information about the borrower's receipts of aid from official lenders or official lender's concessional flows to developing countries.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): Financial resources are obviously needed for the attainment of sustainable development. Agenda 21 calls for the monitoring of the provision of financial resources, particularly in developing countries, so that the international community can take further action on the basis of accurate and reliable data.

(c) International Conventions and Agreements: None.

(d) International Targets/Recommended Standards: For developed countries, the United Nations has recommended that ODA should represent 0.7% of GNI.

(e) Linkages to Other Indicators: This indicator is particularly linked with the other financial and international cooperation indicators.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: Measurement of Official Development Assistance (ODA) is based on Balance of Payments concepts. See Annex 3 of the Development Assistance Committee (DAC) Statistical Reporting Directives for details (www.oecd.org/dac/stats/dac/directives). The definition of ODA is given in paragraph 32.

(b) Measurement Methods: Official Development Assistance (ODA) consists of grants or loans to developing countries that are undertaken by the official sector with the purpose of promoting economic development and welfare. Grants are defined as disbursements, in money or in kind, for which there is no repayment required. ODA loans are provided at concessional financial terms, that is with a grant element of 25 percent or more. The degree of concessionality is determined by the terms of a loan - interest rate, maturity, and grace period. ODA data are usually presented net. Net flows equal total new flows (gross disbursements) minus amounts received (e.g. repayments of principal, offsetting entries for debt relief, repatriation of capital, and occasionally recoveries on grants or grant-like flows).

Gross national income (GNI) is the sum of value added by all resident producers plus any taxes (less subsidies) not included in the valuation of output, plus net receipts of primary income (compensation of employees and property income) from abroad.

(c) Limitations of the Indicator: Not Available.

(d) Status of Methodology: The methodology is kept under review by the OECD DAC Working Party on Statistics and updated in the Directives referred to above**.**

(e) Alternative Definitions/Indicators: None.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Net Official Development Assistance (ODA) given or received and GNI data.

(b) National and International Data Availability and Sources: The unique source of the information is the Organisation for Economic Co-operation and Development (OECD)'s DAC statistical system. The OECD data are obtained from donor sources.

(c) **Data References:** The OECD DAC Development Co-operation Report (Statistical Annex) and Geographical Distribution of Financial Flows to Aid Recipients (annual publications).

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the Organisation for Economic Co-operation and Development (OECD). The contact point is the Statistics and Monitoring Division, Development Co-operation Directorate, OECD; e-mail dac.contact@oecd,.org.

(b) Other Contributing Organizations: None

6. REFERENCES

(a) Readings:

OECD.DAC *Development Co-operation Report*. 2005.

OECD.DAC *Geographical Distribution of Financial Flows to Aid Recipients*. 2006

(b) Internet site: http://ww.oecd.org/dac/stats

REMITTANCES AS PERCENTAGE OF GNI		
Global Economic Partnership	**External financing**	

1. INDICATOR

(a) Name: Remittances as share of GNI

(b) Brief Definition: Total annual current private transfers received by residents in a country plus compensation of employees earned by nonresident workers and migrants' transfers divided by Gross National Income (GNI).

(c) Unit of Measurement: percentage

(d) Placement in the CSD Indicator Set: Global Economic Partnership/ External financing

2. POLICY RELEVANCE

(a) Purpose: This indicator shows the extent of financial benefit for a country from temporary and permanent movements of its residents who are able to work abroad.

(e) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): For many developing countries, remittances are a major and stable source of external financing and thereby provide important means of implementation of sustainable development goals. As a result of increased globalization the importance of remittances has been rapidly increasing in the last decade.

(f) International Conventions and Agreements: None.

(g) International Targets/Recommended Standards: None

(h) Linkages to Other Indicators: This indicator is closely linked to current account, reserves, and other measures of international economic development, and measures of migration.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: Workers' remittances are defined in the Balance of Payment Manual. In the current, 5th edition, workers' remittances are defined as current transfers by migrants considered as residents (they are expected to stay and work for more then a year in the new economy) to residents in their country of origin. However, due to difficulty in classifying residents, the World Bank uses an extended definition of remittances which includes, in addition to worker's remittances, compensation of employees (net wages and salaries of nonresident migrants) and migrant's capital transfers. For the upcoming revision of the Balance Of Payment

Manual, total remittances are defined as the sum of personal transfers, net compensation of employees, capital transfers between households, and social benefits.
Gross national product (GNI) is the sum of value added by all resident producers plus any taxes (less subsidies) not included in the valuation of output, plus net receipts of primary income (compensation of employees and property income) from abroad.

(b) Measurement Methods: The indicator is derived by dividing remittances (as defined by the World Bank) by GNI.

(c) Limitations of the Indicator: It is difficult to measure the exact amount of remittances sent and received both in developed and developing economies due to money transfers through unofficial channels. Furthermore, the indicator does not provide information on the impact of temporary or permanent migration on human capital of a country, which can be negative (temporary or permanent loss of human capital in the form of 'brain drain') or positive (skill upgrading of temporary migrants in the form of 'brain gain').

(d) Status of Methodology: The methodology is generally well developed. The change for the 6th edition of the balance of payment manual increases the alignment with the 1993 System of National Accounts.

(e) Alternative Definitions/Indicators: Gross domestic product can be substituted for GNI as the denominator.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Balance of payment data for workers' remittances, compensation of employees, and migrants' transfers and national accounts data for GNI.

(b) National and International Data Availability and Sources: In most countries national statistical offices, central banks or Ministries collect balance of payment statistics and report them to the International Monetary Fund (IMF). However, in many countries data are incomplete and may not be comparable**.** The World Bank collects data on remittances based on the Balance of Payment Yearbook of the IMF, resorting to estimates in case balance of payments statistics are incomplete.

(c) Data References: Information on remittances is included in the *World Development Indicators* of the World Bank, see about the data in table 6.14.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the World Bank. The contact point is K. M. Vijayalakshmi ((202-473-3827), Kvijayalakshmi@worldbank.org

(b) Other Contributing Organizations: IMF

6. REFERENCES

(a) Readings:

International Monetary Fund, Balance of Payment Manual, 5th edition, 1993.

IMF, Committee on Balance of Payments Statistics, Annual Reports, various years.

IMF, Balance of Payments Statistics yearbook, various years.

World Bank, Word Development Indicators, various years.

(b) Internet sites:

World Bank: www.worldbank.org/data
IMF: http://www.imf.org/external/np/sta/bop/remitt.htm

FOREIGN DIRECT INVESTMENT (FDI) NET INFLOWS AND NET OUTFLOWS AS SHARE OF GDP		
Global Economic Partnership	**External financing**	

1. INDICATOR

(a) Name: Foreign Direct Investment net inflows and net outflows as share of GDP

(b) Brief Definition: *Foreign Direct investment (FDI)* is investment made to acquire a lasting interest in or effective control over an enterprise operating outside of the economy of the investor. *FDI net inflows* are the value of inward direct investment made by non-resident investors in the reporting economy, including reinvested earnings and intra-company loans, net of repatriation of capital and repayment of loans. *FDI net outflows* are the value of outward direct investment made by the residents of the reporting economy to external economies, including reinvested earnings and intra-company loans, net of receipts from the repatriation of capital and repayment of loans. These series are expressed as shares of GDP.

(c) Unit of Measurement: Percentage

(d) Placement in the CSD Indicator Set: Global Economic Partnership/ External financing

2. POLICY RELEVANCE

(a) Purpose: These indicators show the provision of external financing resources in the form of direct investments in the reporting economy from foreign investors and to external economies by domestic investors. Negative values of *FDI net inflows* for a particular year show that the value of disinvestment by foreign investors was more than the value of capital newly invested in the reporting economy. Negative values of *FDI net outflows* show that the value of direct investment made by domestic investors to external economies was less than the value of repatriated (disinvested) direct investment from external economies.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): For many developing countries, FDI inflows are a major source of external financing and thereby provide important means of implementation of sustainable development goals and growth of the private sector. Moreover, FDI is typically less volatile than foreign portfolio investment. In many cases, FDI also contributes to the transfer (spill-over) of technology and improvement of labor and management skills. Sustained increases in FDI inflows are often a sign of an improved investment climate. Although the largest share of FDI goes from high income economies to other high income economies, flows to developing countries are increasing and are very important in helping to support sustainable development. They now dwarf flows of official development assistance. In recent year, FDI flows between developing countries have also increased.

(c) International Conventions and Agreements: None.

(d) International Targets/Recommended Standards: None

(e) Linkages to Other Indicators: This indicator is closely linked with other measures of international and domestic economic development.

3. <u>METHODOLOGICAL DESCRIPTION</u>

(a) Underlying Definitions and Concepts: The internationally accepted definition of FDI is provided in the fifth edition of the IMF's Balance of Payments Manual (1993). Under this definition FDI has three components: equity investment, reinvested earnings, and short- and long-term inter-company loans between parent firms and foreign affiliates. The components of direct investment capital transactions are recorded on a directional basis (i.e., resident direct investment abroad and nonresident direct investment in the recording economy). The *FDI net inflow* records the net flow of nonresident direct investment in the recording economy, while the *FDI net outflows* records the net flow of resident direct investment abroad. Distinguished from other kinds of international investment, FDI is made to establish a lasting interest in or effective management control over an enterprise in another country. As a guideline, the IMF suggests that investments should account for at least 10 percent of voting stock to be counted as FDI. In practice, many countries set a higher threshold. Also, many countries fail to report reinvested earnings, and the definition of long-term loans differs among countries [41]

GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources.

(b) Measurement Methods: These indicators are derived by dividing net inflows and net outflows of FDI by total GDP.

(c) Limitations of the Indicator: Foreign direct investment does not include capital raised locally, which has become an important source of financing for investment projects in some developing countries. In addition, foreign direct investment data capture only cross-border investment flows that involve equity participation and thus omit non-equity cross-border transactions such as intra-firm flows of goods and services.

(d) Status of Methodology: The methodology is generally well developed.

(e) Alternative Definitions/Indicators: Total private capital investment (direct plus portfolio) as percentage of GDP may be used as indicator to measure the financing provided by foreign investors for development if volatility and technology transfers are

---

[41] For further details on concepts and recording methods, refer to the *Balance of Payment Manual 5th Edition*, International Monetary Fund (1993).

not major concerns. A sectoral breakdown of FDI inflows may provide additional information, but it requires information not included in the balance of payments records.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Data on foreign direct investment flows from the balance of payment records and GDP data from national accounts records.

(b) National and International Data Availability and Sources: In most countries national statistical offices, central banks or ministries collect the balance of payment statistics which contains records of resident direct investment abroad and nonresident direct investment in the recording economy. The World Bank publishes FDI data based on balance of payment data reported by the International Monetary Fund (IMF), supplemented by staff estimates using data reported by the United Nations Conference on Trade and Development (UNCTAD) and official national sources. UNCTAD publishes data on foreign direct investment in its annual *World Investment Report*. Because of the multiplicity of sources and differences in definitions and reporting methods, there may be more than one estimate of foreign direct investment for a country, and data may not be comparable across countries.

(c) Data References: Data on FDI is included in the World Development Indicators (WDI) publications and WDI Online database of the World Bank, see http://go.worldbank.org/3JU2HA60D0 and http://go.worldbank.org/6HAYAHG8H0

Data on FDI for developing countries that report to the World Bank's Debt Reporting System are included in the Global Development Finance (GDF) publications and GDF Online database, see http://go.worldbank.org/KHJME9OSU0, http://go.worldbank.org/HK59C6HQL0, and http://go.worldbank.org/6HAYAHG8H0

International Monetary Funds' data on FDI is available in the Balance of Payment Statistics database, http://www.imfstatistics.org/bop/

UNCTAD data on FDI is available in the World Investment Report and in the Foreign Direct Investment online database, available at http://www.unctad.org/Templates/Page.asp?intItemID=1923&lang=1

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The World Bank. The contact point is Data Help Desk: data@worldbank.org

(b) Other Contributing Organizations: The IMF, which is the source of international data on FDI flows published by the World Bank.

6. REFERENCES

(a) Readings:

International Monetary Fund**,** *Balance of Payment Manual*, 5th edition, 1993.

IMF Committee on Balance of Payments Statistics, *Annual Report,* various years.

The World Bank, *Word Development Indicators*, various years.

The World Bank, *Global Development Finance*, various years.

UNCTAD, *World Investment Report*, various years.

(b) Internet sites:

The World Bank: www.worldbank.org/data

World Development Indicators: http://go.worldbank.org/3JU2HA60D0

Global Development Finance (GDF) Volume I: http://go.worldbank.org/KHJME9OSU0

Global Development Finance (GDF) Volume II: http://go.worldbank.org/HK59C6HQL0,

IMF: http://www.imf.org/external/pubs/ft/bopman/bopman.pdf

UNCTAD: http://www.unctad.org/Templates/Page.asp?intItemID=1923&lang=1

MATERIAL INTENSITY OF THE ECONOMY		
Consumption and Production Patterns	**Material Consumption**	**Core indicator**

1. **INDICATOR**

(a) **Name:** Material Intensity of the Economy.

(b) **Brief Definition:** Ratio of Domestic Material Consumption (DMC) to Gross Domestic Product (GDP) at constant prices.

(c) **Unit of Measurement:** Kilograms per $1,000 of GDP.

(d) **Placement in the CSD Indicators Set:** Consumption and Production Patterns/Material Consumption.

2. **POLICY RELEVANCE**

(a) **Purpose:** The indicator provides a basis for policies to increase the efficient use of raw materials in order to conserve natural resources and reduce environment degradation resulting from primary extraction, material processing, manufacturing and waste disposal.

(b) **Relevance to Sustainable/Unsustainable Development (theme/sub-theme):** Improving the efficiency with which materials are used and consequently reducing stresses on the environment are the subjects of chapter 4 of Agenda21, Changing Consumption Patterns. Primary extraction of raw materials, processing of the materials into products, and ultimate disposal of the waste material has major environmental impacts. Reducing the material intensity of production and consumption of goods and services is essential to environmental protection and resource conservation. Reductions in intensity of material use can be achieved by more efficient use of natural resources in production and consumption, by recycling used and waste material, and by shifts in consumption patterns to less material intensive goods and services. The indicator allows an analysis of consumption of natural resources, as well as trends in recovery and recycling.

Per-capita consumption of the materials could also be determined, facilitating the interpretation of trends in material intensity.
The indicator can also be used as a proxy for assessing trends in industrial pollution. In the United States, for example, it is estimated that material-intensive industries account for about 70% of total air and water pollution. Throughput-to-pollution ratios can be used for this calculation, although technological change would affect the results.

(c) **International Conventions and Agreements:** The 2002 WSSD Johannesburg Plan of Implementation has set an objective for 'delinking economic growth and environmental degradation through improving efficiency and sustainability in the use of resources and production processes, and reducing resource degradation, pollution and waste.'

(d) International Targets/Recommended Standards: None.

(e) Linkages to Other Indicators: This indicator will of course be affected by changes in the DMC indicator. Moreover, this indicator is linked to other indicators which reflect the stage of economic development and the structure of the economy, such as share of manufacturing value-added in GDP and energy use per unit GDP.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: A commonly agreed measurement method is described in the Eurostat methodological guide.

(b) Measurement Methods: The calculated volume of DMC is divided by GDP at constant prices to compute material consumption per unit of GDP.

(c) Limitations of the Indicator: A ratio using GDP can be misleading as growth in GDP may be driven by relatively small quantities of high-value materials, whereas material consumption is dominated by construction materials. Therefore, it might be preferable to present the 2 elements of the ratio separately, in order to facilitate the analysis of the evolution of both.

(d) Status of the Methodology: The Eurostat methodological guide is a worldwide standard reference, and is used by EU and OECD countries and the London Group (UN). There is limited use of indicators of material intensity in some developed countries, with varying methodologies.

(e) Alternative Definitions/Indicators: Alternatively, an indicator measuring 'Resource productivity' ($/kg) can be compiled, by dividing GDP at constant prices by DMC. This is, in fact, the inverse ratio to material intensity and useful to calculate "eco-efficiency (€/impact)" an indicator which measures the environment impact.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: DMC and GDP at constant prices.

(b) National and International Data Availability and Sources: Data is available at national level for some countries having already established MFA and on an international level at OECD and ESTAT: Eurostat has EU15 estimations on DMC/GDP and will have estimations for EU25 by end of 2007 based on a questionnaire containing commonly agreed standard tables - developed by the ESTAT Task Force and coordinated with OECD.

(c) Data References: http://europa.eu.int/comm/eurostat

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is Eurostat.

(b) Other Contributing Organizations: OECD (a joint Eurostat-OECD guidance manual is planned for publication in 2007. United Nations Conference on Trade and Development (UNCTAD), World Resources Institute, and the Wuppertal Institute on Climate, Environment and Energy have contributed to the development of this indicator.

6. REFERENCES

(a) Readings:

Eurostat. *Economy-wide material flow accounts and derived indicators – A methodological guide, 2001*

Ndiaye, D. *Statistical Study on the Consumption of Metals.* Centre d'Economie des Ressources Naturelles, Ecole Nationale Supérieure des Mines de Paris. Paris, 1991.
World Resources Institute. *World Resources 1994-95,* part IV, Chapter 21, 1995.

Behrensmeier, R. and S. Bringezu. *On the Methodology of Analysing Macro-economic Material Intensity.* Wuppertal Institute on Climate, Environment and Energy, Wuppertal Papers, No. 34, April 1995.

Hammond, Allen, et al. *Environmental Indicators: A Systematic Approach to Measuring and Reporting on Environmental Policy Performance in the Context of Sustainable Development,* (Chapter VI and Appendix I). World Resources Institute, Washington, D.C., 1995.

Hoffmann, U and D. Zivkovic. *Demand Growth for Industrial Raw Materials and its Determinants: An Analysis for the Period 1965-1988.* UNCTAD Discussion Papers, No. 50, Geneva, November 1992.

(b) Internet site:
http://europa.eu.int/comm/eurostat

DOMESTIC MATERIAL CONSUMPTION		
Consumption and Production Patterns	**Material Consumption**	

1. INDICATOR

(a) Name: Domestic Material Consumption (DMC)

(b) Brief Definition: DMC is defined as the total amount of materials directly used in the economy (used domestic extraction plus imports), minus the materials that are exported.

(c) Unit of Measurement: metric tons.

(d) Placement in the CSD Indicators Set: Consumption and Production Patterns/Material Consumption.

2. POLICY RELEVANCE

(a) Purpose: The indicator provides a basis for policies to decouple the growth of the economy from the use of natural resources so as to achieve a reduction of environment degradation resulting from primary production, material processing, manufacturing and waste disposal.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): Improving the efficiency with which materials are used and consequently reducing stresses on the environment are the subjects of chapter 4 of Agenda21, Changing Consumption Patterns. Primary production of raw materials, processing of the materials into products, and ultimate disposal of the waste material has major environmental impacts. DMC is a useful indicator, as it provides an assessment of the absolute level of use of resources, and combined with GDP, it also provides insight into whether decoupling between the use of natural resources and growth of the economy is taking place.

(c) International Conventions and Agreements: The 2002 WSSD Johannesburg Plan of Implementation has set an objective for 'delinking economic growth and environmental degradation through improving efficiency and sustainability in the use of resources and production processes, and reducing resource degradation, pollution and waste.'

(d) International Targets/Recommended Standards: None.

(e) Linkages to Other Indicators: DMC is linked to indicators, such as 'Waste generation', 'Greenhouse gas emissions' and 'Energy Consumption'.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: The indicator is defined as domestic material consumption, broken down by component (exports, imports, domestic extraction), and by material (minerals, biomass, fossil fuels).

Direct (used) material inputs are defined as all solid, liquid and gaseous materials that enter the economy for further use in production and consumption processes. Water and air consumption are, apart from the water content of materials, not included. Quantitatively important "memorandum items" for balancing air and water should be included in the input. For example, air is used during the fuel combustion process.
Material inputs of domestic origin are classified into three main material groups:

- minerals (metal ores, other industrial minerals, construction materials),
- biomass (from agriculture reported by harvest statistics, from agriculture as a by-product of harvest, from grazing of agricultural animals, from forestry, from fishing, from hunting, from other activities),
- fossil fuels: hard coal, lignite, crude oil, natural gas, other.
- Imports are classified according to their level of manufacturing into:
- raw materials,
- semi-manufactured products,
- finished products
- other products (mostly products of the nutrition industry),
- packaging material imported with products,
- waste imported for final treatment and disposal.
- Each category of imports is further classified according to the basic material components of the commodities:
- fossil fuels (further subdivided by type of fuel),
- minerals (further subdivided by metals and non-metallic minerals),
- biomass (from agriculture, forestry, fishing or hunting).

The more complex the material mix of a manufactured product, the more critical its attribution to a "dominant" material category and conversion tables may need to be set up for the detailed attribution of imports to material categories.
Exports are classified in the same way as imports. This allows to account for DMC per category of materials.

Agricultural harvest is reported like in agricultural statistics as domestic extraction (from the natural system) while flows of nutrients between the soil and roots of agricultural plants are considered natural flows and not part of material flow accounts. Animal livestock is considered part of the economic system. Consequently, uptake of grass on meadows has to be accounted for as domestic extraction but production of meat and milk are flows within the economic system. Finally, the extraction of metal ores is accounted for as run-of-mine (ROM) or gross ore (i.e. including the sterile parts) and not as metal content.

(b) Measurement Methods: The sum of raw materials domestically extracted and imports constitutes the Direct Material Input (DMI). Deducting exports from DMI results in the Domestic Material Consumption (DMC). It is important to note that the term "consumption" as used in DMC denotes "apparent consumption" and not "final consumption". DMC, thus, is defined in analogy to "total primary energy supply" - TPES (see Haberl 2001). Conceptually, DMC most closely represents a "physical GDP equivalent".

(c) Limitations of the Indicator: A limitation of this indicator is that it does not include unused domestic extraction and indirect flows of imports and exports, thus it is only a proxy for the actual total material consumption.

(d) Status of the Methodology: The Eurostat methodological guide is a worldwide standard reference, used by EU and OECD countries and the London Group (UN). National data collection methods may vary significantly from country to country.

(e) Alternative Definitions/Indicators: Total Material Consumption (TMC) would be a more complete measure of material use compared to DMC, as it measures the total material use associated with domestic production and consumption activities, including indirect import flows, less export and associated indirect export flows. The main advantage is the possibility of showing the "real" environment impacts (through indirect flows) of production and consumption in the case of outsourcing "dirty" production/extraction to other countries. Some countries are already using this measure; however, there remain difficulties in calculating these indirect flows from a practical point of view.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Data on material flows in and out of the economy, i.e. consumption and trade of all materials. GDP data is needed for visualising it together with DMC in one graph, in order to assess whether a decoupling effect is taking place. Moreover, for country comparisons GDP per capita could be calculated, for which population data would be needed

(b) National and International Data Availability and Sources: Data are available at national level for some countries which have already established Material Flow Accounts (MFA). Economy-wide material flow accounts are generally compiled by national statistical offices. Eurostat has collected data from 15 EU countries, and has recently revised its questionnaire which will be used for all 27 EU Member States and associated countries.

(c) Data References: http://europa.eu.int/comm/eurostat

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is Eurostat.

(b) Other Contributing Organizations: OECD (a joint Eurostat-OECD guidance manual is planned for publication in 2007. United Nations Conference on Trade and

Development (UNCTAD), World Resources Institute, and the Wuppertal Institute on Climate, Environment and Energy have contributed to the development of this indicator.

6. REFERENCES

(a) Readings:

Eurostat. *Economy-wide material flow accounts and derived indicators – A methodological guide,* 2001.

Eurostat. *Development of material use in the EU-15: 1970-2001 - Material composition, cross-country comparison, and material flow indicators*, 2005.

Ndiaye, D. *Statistical Study on the Consumption of Metals.* Centre d'Economie des Ressources Naturelles, Ecole Nationale Supérieure des Mines de Paris. Paris, 1991.

World Resources Institute. *World Resources 1994-95,* part IV, Chapter 21, 1995.

Hammond, Allen, et al. *Environmental Indicators: A Systematic Approach to Measuring and Reporting on Environmental Policy Performance in the Context of Sustainable Development,* (Chapter VI and Appendix I). World Resources Institute, Washington, D.C., 1995.

Hoffmann, U and D. Zivkovic. *Demand Growth for Industrial Raw Materials and its Determinants: An Analysis for the Period 1965-1988.* UNCTAD Discussion Papers, No. 50, Geneva, November 1992.

(b) Internet site:
http://europa.eu.int/comm/eurostat

ANNUAL ENERGY CONSUMPTION, TOTAL AND BY MAIN USER CATEGORY		
Consumption and Production Patterns	**Energy Use**	**Core indicator**

1. INDICATOR

(a) **Name:** Annual energy consumption, total and by main user category

(b) **Brief Definition**: The amount of energy - liquids, solids, gases and electricity – used in a given year in a country, total, and by main user category.

(c) **Unit of Measurement**: Tonnes of oil equivalent

(d) **Placement in the CSD Indicator Set:** Consumption and Production Patterns/Energy Use

3. POLICY RELEVANCE

(a) **Purpose:** The indicator should be used in combination with energy intensity/efficiency indicators to measure the development of energy use, individual and industrial energy consumption patterns and the energy intensity of a society. When compared in time it shows the trend in the absolute amount of energy used in a country and its distribution among main economic activities and households.

(b) **Relevance to Sustainable/Unsustainable Development:** Energy is a key factor in industrial development and in providing vital services that improve the quality of life. Traditionally energy has been regarded as the engine of economic progress. However, its production, use, and byproducts have resulted in major pressures on the environment, both from a resource use and pollution point of view. The decoupling of energy use from development represents a major challenge of sustainable development. The long term aim is for development and prosperity to continue through gains in energy efficiency rather than increased consumption and a transition towards the environmentally friendly use of renewable resources. On the other hand, limited access to energy is a serious constraint to development in the developing world, where the per capita use of energy is less than one sixth that of the industrialized world.

(c) **International Conventions and Agreements:** Currently there are no international conventions or agreements that specifically refer to the regulation and/or limitation of energy use. However, calls have been made for the prudent and rational utilization of natural resources (Article 174 of the Treaty Establishing the European Community – Nice 2001), improved energy efficiency (The Energy Charter Protocol on Energy Efficiency and Related Environmental Aspects – Lisbon 1994) and a switch to cleaner forms of energy. The United Nations Framework Convention on Climate Change and its Kyoto Protocol call for limitations on total greenhouse gas emissions, which are dominated by CO_2 from the combustion of fossil fuels.

(d) International Targets/Recommended Standards: None.

(e) Linkages to Other Indicators: The indicator is closely linked with other indicators of the economy, with environmental indicators such as climate change, air quality and land use, and also with social indicators.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: Gross inland consumption of energy is a key aggregate in the energy balances. Total consumption of energy refers to "apparent" consumption and is derived from the formula that takes into account production, exports, imports and stock changes. Production refers to the first stage of production. International trade of energy commodities is based on the "general trade" system, that is, all goods entering and leaving the national boundary of a country are recorded as exports and imports. Bunkers refer to fuels supplied to ships and airplanes engaged in international transport, irrespective of the carriers' flag. In general, data on stocks refer to changes in stocks of producers, importers and/or industrial consumers at the beginning and the end of the year.

Consumption of energy by main user categories refers to final consumption. This is a different concept from the one used for total consumption. Apparent consumption refers to primary energy, and includes energy lost to the environment in transformation processes. Final consumption, on the other hand, mixes primary and secondary sources of energy and is linked to the concept of total energy requirement, not taking transformation losses into account.

The main user categories should be established ideally at the two-digit level of the International Standard Industrial Classification of Economic Activities (ISIC rev. 4), but at least on the one letter Alpha level. Domestic/household use is a separate category.

(b) Measurement Methods: Total energy requirement (gross inland consumption) is calculated from the following formula: Primary production + Imports – Exports – Bunkers +/- Stock changes = Total energy requirement. Consumption by main user categories is available from the national energy balances.

(c) Limitations of the Indicator: Apparent consumption may in some cases represent only an indication of the magnitude of actual gross inland availability. The actual value of the indicator is strongly influenced by a multitude of economic, social and geographical factors. When using it as an indicator of sustainability the indicator has to be interpreted in connection with other indicators of economic development and energy use, as smaller or larger values of the indicator do not necessarily indicate more or less sustainable development.

(d) Status of the Methodology: The methodology of energy balances has been developed by the United Nations Statistics Division, the International Energy Agency and Eurostat.

(e) Alternative Definitions/Indicators: None

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Energy commodity data for consumption at the national level and by main user categories. National energy balances.

(b) National and International Data Availability and Sources: Energy commodity data for production and consumption are regularly available for most countries at the national level; and for some countries, at the sub-national level. The data are compiled by and available from national statistical offices and country publications.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the United Nations Department of Economic and Social Affairs (DESA). The contact point is the Chief of Energy Statistics, Statistics Division.

(b) Other Contributing Organizations: Other organizations involved in the indicator development include the International Energy Agency of the Organisation for Economic Co-operation and Development (OECD/IEA) and Eurostat.

(c) Data References: United Nations: Energy Statistics Yearbook. United Nations: Energy Balances and Electricity Profiles: IEA: Energy Balances of the OECD Countries; Energy Balances of the non-OECD Countries..

6. REFERENCES

(a) Readings: Concepts and Methods in Energy Statistics, with Special Reference to Energy Accounts and Balances. United Nations, 1982. Energy Statistics: Definitions, Units of Measure and Conversion Factors. United Nations, 1987. Energy Statistics: A Manual for Developing Countries. United Nations, 1991. IEA/OECD/Eurostat – Energy Statistics Manual, Paris, France, International Energy Agency

(b) Internet Sites: United Nations Statistics Division:
http://unstats.un.org/unsd/energy/default.htm

International Energy Agency: http://iea.org
IAEA, UN DESA, IEA, Eurostat and EEA, 2005. *Energy Indicators for Sustainable Development*. Vienna, IAEA.

INTENSITY OF ENERGY USE, TOTAL AND BY ECONOMIC ACTIVITY		
Consumption and Production Patterns	**Energy Use**	

1. INDICATOR

(a) Name: Intensity of Energy Use, total and by economic activity.

(b) Brief Definition: Ratio of total energy use to GDP: ratio of energy use by economic activity to value added.

(c) Unit of Measurement: Tonnes of oil equivalent per unit of local currency or per US $

(d) Placement in the CSD Indicator Set: Economic/Consumption and Production Patterns/ Energy Use.

2. POLICY RELEVANCE

(a) Purpose: Trends in overall energy use relative to GDP indicate the general relationship of energy consumption to economic development and provide a rough basis for projecting energy consumption and its environmental impacts with economic growth. For energy policy-making, however, energy intensities by economic activities should be used.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): Energy is essential for economic and social development, but consumption of fossil fuels is the major cause of air pollution and climate change. Improving energy efficiency and decoupling economic development from energy consumption, particularly of fossil fuels, is essential to sustainable development.

(c) International Conventions and Agreements: Currently, there are no conventions or agreements that specifically refer to the regulation and/or limitation of energy use per capita. However, calls have been made for the prudent and rational utilization of natural resources (Article 174 of the Treaty Establishing the European Community — Nice, 2001), improved energy efficiency (The Energy Charter Protocol on Energy Efficiency and Related Environmental Aspects — Lisbon 1994) and a switch to cleaner forms of energy. The United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol call for limitations on total greenhouse gas (GHG) emissions, which result mainly from the combustion of fossil fuels.

(d) International Targets/Recommended Standards: Some voluntary targets at the national level have been established.

(e) Linkages to Other Indicators: This indicator is linked to indicators for total energy consumption, greenhouse gas emissions and air pollution emissions.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: The ratio of energy use to GDP is called "energy intensity". The indicator could be called "aggregate energy intensity" or "economy-wide energy intensity". The term "energy intensity" is also used for ratios of energy use by the different economic activities to output.

The ratio of energy use to GDP indicates the total energy being used to support economic and social activity. It represents an aggregate of energy consumption resulting from a wide range of production and consumption activities. In specific economic activities, the ratio of energy use to output is the "energy intensity" (if the output is measured in monetary units) or the "specific energy requirement" (if the output is measured in physical units such as tonnes or passenger-kilometers).
The energy intensity of a process (energy consumed per unit of output) is the inverse of the "energy efficiency" of the process (output per unit energy consumed).

(b) Measurement Methods:
Energy Use: Total energy consumption is obtained from national energy balances. For the economic activities, services/commercial consumption should be carefully separated from households, and manufacturing should be separated from other industrial uses and agriculture.
Unit: tonnes of oil equivalent
Output: GDP for total energy intensity, value added for intensities by economic activity.
Unit: GDP and value added are measured in local currency for national purposes. For the purposes of international comparison, they are measured in US dollars, converted from real local currency at purchasing power parity for the base year to which local currency was deflated.

(c) Limitations of the Indicator: The ratio of aggregate energy use to GDP, often called "energy intensity" or the "energy ratio", is not an ideal indicator of energy efficiency, sustainability of energy use, or technological development, as it has been commonly used. The aggregate ratio depends as much on the structure of the economy as on the energy intensities of sectors or activities, and changes in the ratio over time are influenced almost as much by changes in the structure of the economy as by changes in sectoral energy intensities.

Interpreting the ratio of energy use to GDP in terms of environmental impact or sustainability is also complicated by differences in environmental impact among energy sources.

Given the large number of factors that affect energy consumption, the ratio of total energy consumption to GDP should not be used as an indicator of energy efficiency or sustainability in itself but in combination with other energy indicators.

(d) Status of the Methodology: The ratio of energy use to GDP, as well as sectoral and sub-sectoral energy intensities, are in widespread use, but without a standardized methodology.

(e) Alternative Definitions/Indicators:

4. ASSESSMENT OF DATA

(a) Data needed to compile the indicator:

(i) Total energy consumption and energy consumption by economic activity;
(ii) Real GDP (and/or value added by economic activity) in local currency or PPP GDP in US dollars.

(b) National and international data availability and sources: Energy balances at national level are available from most countries. The Asia Pacific Energy Research Centre (APERC), Eurostat, the International Energy Agency (IEA), the Latin American Energy Organization (OLADE) and the United Nations Statistics Division (UNSD) compile collections of regional or international energy balances from countries.

GDP and Value Added data are available from national statistical sourcesThe IMF "International Financial Statistics" provides nominal and real GDP for most countries. Data on components of GDP are often available from regional development banks or national sources.

(c) Data References:
IEA: Energy Balances of Member Countries; Energy Balances of Non-Member Countries

Eurostat: Energy balances
Latin American Energy Organization/ Organización Latinoamericana de Energía (OLADE): "Informe de Estadísticas Energéticas 2005" DE AMÉRICA LATINA Y EL CARIBE/ Energy Statistics Report
Asia Pacific Energy Research Centre (APERC): APEC Energy Demand and Supply Outlook
UNSD: National Accounts Statistics; Energy Balances and Electricity Profiles
IMF: International Financial Statistics

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the United Nations Department of Economic and Social Affairs, Statistics Division.

(b) Other Contributing Organizations:

6. REFERENCES

Internet site: United Nations Statistics Division:
http://unstats.un.org/unsd/energy/default.htm

IAEA, UN DESA, IEA, Eurostat and EEA, 2005. *Energy Indicators for Sustainable Development*. Vienna, IAEA.

SHARE OF RENEWABLE ENERGY SOURCES IN TOTAL ENERGY USE		
Consumption and Production Patterns	**Energy use**	

1. INDICATOR

(a) Name: Share of renewable energy sources in total energy use

(b) Brief Definition: The share of energy from renewable sources in total energy used by the country.

(c) Unit of Measurement: %

(d) Placement in the CSD Indicator Set: Consumption and Production Patterns/Energy use

2. POLICY RELEVANCE

(a) Purpose: This indicator traces the use of renewable energy as a share of country's total energy use.

(b) Relevance to Sustainable/Unsustainable Development: Chapter 4 of Agenda 21 calls for an improvement of efficiency in the use of energy sources and for a transition towards the environmentally friendly use of renewable resources. Energy is a key aspect of consumption and production. Dependence on non-renewable sources can be regarded as unsustainable in the long term. Renewable sources, on the other hand, can supply energy continuously under sustainable management practices and their use in general create less environmental pressure. The ratio of renewable to non-renewable energy sources represents a measure of a country's energy sustainability.

(c) International Conventions and Agreements: Not available.

(d) International Targets/Recommended Standards: Some voluntary targets at national and regional levels have been established.

(e) Linkages to Other Indicators: Interpretation of this indicator is enhanced when combined with annual energy production, annual energy consumption per capita, and lifetime of proven energy reserves. It is also closely linked to some of the environmental indicators such as greenhouse gas emissions and land use change.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: The two elements comprising this indicator are the consumption of energy from renewable sources, and the total energy consumption.

Renewable sources refer to energy collected from current ambient energy flows or from substances derived from them. They can be classified as combustible or non-combustible. Non-combustible renewables include geothermal, solar, wind, hydro, tide and wave energy. Combustible renewables and wastes include biofuels (biogas, ethanol, biodiesel); biomass products (fuelwood, vegetal waste, pulp and paper waste, animal waste, bagasse), and the portion of industrial and municipal waste (produced by the residential, commercial and public service sectors and collected by the local authorities for disposal) that is used for production of heat and/or power.

The total energy consumption can be found in a country's energy balances under names that can be interchangeably used: "apparent consumption", "gross inland availability", or "total energy requirements"

(b) Measurement Methods: This indicator is computed by dividing the consumption of energy from renewable sources by the total energy consumption.

The total energy consumption is calculated from the following formula: Production of primary energy + Imports – Exports – Bunkers +/- stock changes. (Only production of primary energy is taken into account to avoid double-counting).

Consumption of energy from renewable sources can be calculated using a similar formula, naturally taking into account only renewable energy sources.

However, in some countries, consumption of renewable energy might not always be easily measurable, since exports and imports of energy, and electricity in particular, are often given as totals, without a breakdown by the source. It such cases, the production of energy from renewable sources could be used as a first approximation.

(c) Limitations of the Indicator: Data availability; the lack of standardized methodology; the need to use conversion factors; the challenges associated with summation of various forms of energy (e.g., after-losses electricity with pre-losses energy of fossil fuels). Due to potential export and import of renewable energy, there might be significant differences between production of renewable energy and the actual consumption by the country, so in some cases an adjustment to account for these flows might be necessary.

(d) Alternative Definitions/Indicators: None

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Consumption of energy from renewable resources and wastes; total energy consumption.

(b) National and International Data Availability and Sources: National data and estimates on renewable resources are available from national statistical offices and country publications for many countries. The United Nations Statistics Division and the International Energy Agency of the Organisation for Economic Co-operation and

Development compile data and estimates based on information from national and international sources. Due to the large variety of forms of renewables and their uses, data collection is difficult. Data availability for developing countries may be a limitation.

(c) **Data References:** United Nations: Energy Statistics Yearbook and Energy Balances and Electricity Profiles; International Energy Agency: Energy Balances of OECD Countries, Energy Balances of Non-OECD Countries; Eurostat, Energy Balance Sheets; World Energy Council: Survey of Energy Resources.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) **Lead Agency:** The lead agency is the United Nations Department of Economic and Social Affairs, Statistics Division.

(b) **Other Contributing Organizations:** Other agencies involved in the development of this indicator are the World Energy Council (WEC), the International Energy Agency of the Organisation for Economic Co-operation and Development (OECD/IAE), Eurostat, and the Economic Commission for Europe.

(c) **Data References:**

6. REFERENCES

(a) **Readings:**

World Energy Council: *Survey of Energy Resources*.

United Nations: *Energy Statistics Yearbook*

United Nations: *Concepts and Methods in Energy Statistics, with Special Reference to Energy Accounts and Balances--A Technical Report*
(http://unstats.un.org/unsd/publication/SeriesF/SeriesF_29E.pdf)

IAEA, UN DESA, IEA, Eurostat and EEA, 2005. *Energy Indicators for Sustainable Development*. Vienna, IAEA.

(b) **Internet Sites:** United Nations Statistics Division:
http://www.un.org/Depts/unsd

GENERATION OF HAZARDOUS WASTES		
Consumption and Production Patterns	**Waste Generation and Management**	**Core indicator**

1. INDICATOR

(a) Name: Generation of Hazardous Wastes.

(b) Brief Definition: The total amount of hazardous wastes generated per year through industrial or other waste generating activities, according to the definition of hazardous waste as referred to in the Basel Convention and other related conventions (see sections 3(e) and 7 below).

(c) Unit of Measurement: Tonnes per unit of Gross Domestic Product (GDP).

(d) Placement in the CSD Indicator Set: **Agenda 21:** Consumption and Production Patterns/Waste Generation and Management.

2. POLICY RELEVANCE

(a) Purpose: It provides a measure of the extent and type of industrialization in a country and in this connection the nature of the industrial activities including technologies and processes generating hazardous wastes.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): The generation of hazardous wastes has a direct impact on health and the environment through exposure to this kind of wastes. Normally, long-term exposure is required before harmful effects are seen. Reduced generation of hazardous wastes may indicate either reduced industrial activities in a country, introduction of cleaner production in the industrial processes, or changing patterns in consumers' habits, or changing in national hazardous waste legislation. The introduction of environmentally sound management systems for hazardous wastes implies reduction of risks to health and environment due to lesser exposure to hazardous wastes.
A review of different categories of wastes being generated provides an indication of the nature of industrial activities being undertaken in a country. In the case of other hazardous wastes such as hospital wastes, it is first of all a measure of the size of the population, and secondly, the percentage of this population being treated in hospitals and other medical care units.

(c) International Conventions and Agreements: The following conventions and agreements pertain to this indicator: *Basel Convention* on the Control of Transboundary Movements of Hazardous Wastes and their Disposal; *Bamako Convention* on the Ban on the Import into Africa and the Control of Transboundary Movement of Hazardous Wastes within Africa; *Waigani Convention* to Ban the Importation of Hazardous and Radioactive Wastes into Forum Island Countries, and to Control the Transboundary Movement and Management of Hazardous Wastes within the South Pacific Region;

Central American Agreement; Protocol for the *Prevention of Pollution of the Mediterranean Sea* by Transboundary Movements of Hazardous Wastes and Their Disposal; *Organisation for Economic Co-operation and Development (OECD), Council Decisions,* and *EC Council Directives* and Regulation on Waste and Hazardous Wastes.

(d) International Targets/Recommended Standards: No quantitative targets exist at the international level. In Agenda 21, Chapter 20, an overall target of "preventing or minimizing the generation of hazardous wastes as part of an overall integrated cleaner production approach" is provided. Targets exist at the national level in many countries.

(e) Linkages to Other Indicators: This indicator is linked to the amount of hazardous wastes exported or imported, as well as to the indicators on area of land contaminated by hazardous wastes, and expenditures on hazardous waste treatment or disposal. It is further directly connected to indicators related to material consumption and energy use, including intensity of material use, annual energy consumption per capita, and intensity in energy use. In a wider context, it is also related to the indicators on international cooperation concerning implementation of ratified global agreements.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: In order to facilitate the definition of whether a waste, as defined under the Basel Convention, is hazardous or not, the Technical Working Group established under the Basel Convention has developed lists of wastes that are hazardous and wastes that are not subject to the Convention, as well as an outline of a review procedure for the inclusion, or deletion, of wastes from those lists. These lists were approved at the Fourth Meeting of the Conference of the Parties (UNEP, 1998). It is expected that such lists will considerably facilitate the development and application of indicators of hazardous wastes as mentioned later.

In relation to the definition of hazardous wastes under the Basel Convention (article 1 of the Convention), it should be noted that under article 3 of the Convention, Parties should inform the Secretariat of the Convention (SBC) of wastes, other than those listed in Annexes I and II of the Convention, considered as hazardous under national legislation. Such information is being disseminated by the Secretariat to all Parties in order to enable them to respect such definitions in relation to planned transboundary movements involving such wastes.

(b) Measurement Methods: In relation to the Basel Convention, its Secretariat requests information from the Parties to the Convention on a yearly basis regarding the amount of hazardous wastes generated at the national level. This information is being introduced in the SBC database, which includes data and information on hazardous wastes related issues in accordance with Articles 13 and 16 of the Convention. Other agencies, such as OECD, are also collecting information on hazardous wastes generated by OECD countries.

(c) Limitations of the Indicator: The problem of defining whether a waste is hazardous or not will, in some cases, cause difficulties in relation to the use of an indicator on hazardous wastes generation. The quantity of the hazardous wastes generated alone may not reflect changes towards a more "sustainable" society. Consideration of the nature of the different kinds of hazardous wastes generated would be a better indicator of sustainable development progress. Availability and accuracy of data represents another limitation of this indicator. Finally, the nature of the waste itself makes it sometimes difficult to use them as indicators because wastes are often mixed and not produced to specifications.

(d) Status of the Methodology: The methodology has not at present been considered by Parties of the Basel Convention. Decision V/14 of the Fifth Meeting of the Conference of the Parties requested the Secretariat of the Convention to explore possibilities of developing indicators on hazardous wastes to facilitate decision-making and report thereon to the Conference of the Parties at its sixth meeting. However, the Conference of the Parties to the Basel Convention at its seventh meeting (October 2004) did not consider work on indicators as a priority issue for the current biennium and thus it was not included in the work programme of the Open-ended Working Group for 2005-2006.

(e) Alternative Definitions: The amounts and type of specific waste streams generated per year through industrial or other waste generating activities as defined in the Basel Convention represents an alternative indicator which would allow for normalization based on hazardous properties of the wastes (e.g., infectious, flammable, toxic, corrosive, ecotoxic).

Consideration of the waste management infrastructure at national level could constitute an indicator on the status of addressing hazardous wastes related issues in any particular country.

In general, hazardous waste indicators, in order to be useful for management, have to have some resonance with policy makers whether they are within the local community, or at the national level. There is, therefore, the need to develop hazardous waste indicators that reflect concern for the hazardous properties of waste, the implications of their impacts on the environment, on ecosystems and their functioning, as well as on human health. A profile or set of indicators that can address these multiple issues and meet the needs of a variety of users is essential. Such indicators would be broader than the indicator on generation of hazardous wastes as referred to in this paper and the Secretariat of the Basel Convention will take the lead in the further development of indicators on hazardous wastes in collaboration with relevant institutions.

4. <u>ASSESSMENT OF DATA</u>

(a) Data Needed to Compile the Indicator: Data on the generation of hazardous wastes.

(b) National and international Data Availability and Sources: Data are available for many developed countries, but, so far, few developing countries are collecting data on hazardous waste generation. The Parties of the Basel Convention are requested to provide data to the Conference of the Parties through the Secretariat of the Convention on a yearly basis.
Assistance to developing countries will be needed in identifying the main hazardous waste streams being generated in their countries in order to prepare and maintain inventories of hazardous wastes. In this connection difficulties may be encountered in relation to hazardous waste generation by small scale enterprises, since they are scattered and often operating on an informal basis and are therefore not registered. It may be less of a problem to identify amounts of hazardous wastes generated by larger industries, since they are normally registered.

(c) Data References: The primary source of data at the international level is the Secretariat of the Basel Convention.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the Secretariat to the Basel Convention (SBC), United Nations Environment Programme (UNEP). The contact point is the Executive Secretary, SBC; fax no. (41 22) 797 3454, e-mail: sbc@unep.ch.

(b) Other Contributing Organizations: Other organizations include: United Nations Statistics Division, UNEP, ICRED, OECD, European Topic Centre for Wastes, Denmark, US Environmental Protection Agency, Institute for Applied Environmental Economics, the Netherlands, European Institute of Business Administration, France, Technical University, Graz, Austria, Wuppertal Institute, CEFIC, Netherlands National Institute of Public Health and Environment, Canada. Additional organizations with expertise in the domaine of hazardous waste generation are: UN-ECE (Transport); IMO (Maritime); FAO (Pesticides); WHO; ILO; IAEA; UNIDO, SPREP.

6. REFERENCES

(a) Readings:

Basel Convention for the Control of Transboundary Movement of Hazardous Wastes and their Disposal.

Bamako Convention on the Ban of the Import into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes within Africa, 1991.

Waigani Convention to Ban the importation into Forum Island Countries of Hazardous and Radioactive Wastes and to Control the Transboundary Movement and Management of Hazardous Wastes within the South Pacific Region.

Protocol for the Prevention of Pollution of the Mediterranean Sea by Transboundary Movements of Hazardous Wastes and Their Disposal.

Bakkes, J.A. et al. *An Overview of Environmental Indicators: State of the Art and Perspectives.* Environment Assessment Technical Reports. Netherlands National Institute of Public Health and Environmental Protection in cooperation with the University of Cambridge, United Kingdom. June 1994.

Å. Granados and P.J. Peterson *"Hazardous Waste Indicators for National Decision-makers"*, Journal of Environmental Management (1999).

1. Reporting and Transmission of Information under the Basel Convention for the year 1993. Geneva, 1996.
2. Reporting and Transmission of Information under the Basel Convention for the year 1994. Geneva, June 1997, document SBC No. 97/014, 175 p.
3. Reporting and Transmission of Information under the Basel Convention for the year 1995. Geneva, May 1999, document SBC No. 99/004, 130 p.
4. Reporting and Transmission of Information under the Basel Convention for the year 1996. Geneva, June 1999, document SBC No. 99/006, 178 p.
5. Reporting and Transmission of Information under the Basel Convention for the year 1997: Part II (Statistics on generation and transboundary movements of hazardous wastes and other wastes). Basel Convention Series SBC No. 99/001, Geneva, November 1999, 148 p.

(b) Internet sites:

Secretariat of the Basel Convention: http://www.basel.int/
European Topic Centre on Waste: http://www.etc-waste.int/

GENERATION OF WASTE		
Consumption and Production Patterns	**Waste Generation and Management**	

1. INDICATOR

(a) Name: Generation of Waste.

(b) Brief Definition: The amount of all waste, both hazardous and non-hazardous, generated by main groups of industries or sectors of the economy, expressed per capita and per unit of value added (in US $) by economic activity (at constant prices). The recommended categories are based on the International Standard Industrial Classification of All Economic Activities (ISIC) Rev. 4 and include:

- manufacturing;
- mining and quarrying;
- construction;
- electricity, gas, steam and air conditioning supply;
- agriculture and forestry;
- all other economic activities;
- households.

It also can be compiled for the whole economy without the breakdown by economic activity. In this case, it should be divided by Gross Domestic Product (GDP) (at constant prices).

(c) Unit of Measurement: kg/capita and kg/US $.

(d) Placement in the CSD Indicator Set: Economic/Consumption and Production Patterns/Waste Generation and Management.

2. POLICY RELEVANCE

(a) Purpose: The main purpose is to show the trend in the generation of waste produced by different human activities. Waste generation per capita allows comparisons of countries with similar economies, while waste generated per unit of value added will show if there has been any decoupling of waste generation from economic growth. For each industry or sector selected, the two time series should be shown together to get the full benefit of the indicator.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): Sound and efficient use of natural resources is an important part of sustainable development. Waste represents a considerable loss of resources both in the form of materials and energy. The treatment and disposal of the generated waste may cause environmental pollution and expose humans to harmful substances and bacteria, and therefore impact on human health. Generation of waste is intimately linked to the level of economic activity in a country. It reflects society's production and consumption patterns, and wealthier economies tend to produce more waste. In many developed countries, a reduction in the volume of waste generated is an indication of a development towards less material-intensive production and consumption patterns, particularly as the economy moves from a heavy industry base to a more service base.

(c) International Conventions and Agreements: No international conventions or agreements exist covering the reduction of waste production. However, there is growing support in countries for the OECD's 3R's approach to tackling waste: Reduce, Reuse, and Recycle.

(d) International Targets/Recommended Standards: Some countries have set national targets for the reduction of waste within a specified time frame.

(e) Linkages to Other Indicators: This indicator is intimately linked to other socio-economic and environmental indicators especially those related to income-level and economic growth. Those would include: rate of growth of urban population, Gross Domestic Product (GDP) per capita, wastewater treatment, and waste treatment and disposal.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: The precise definition of what constitutes waste is variable, but principally it can be considered as materials that are not prime products (i.e. products produced for the market) for which the generator has no further use for his own purpose of production, transformation or consumption, and which he discards, or intends or is required to discard. It excludes residuals directly recycled or reused on the site of generation and pollutants that are directly discharged into ambient water or air as waste water or air emission.

Waste is produced through the extraction of raw materials, the production and consumption of goods and services; through the processing of waste from these services (e.g. incineration residues); and through end-of-pipe control or treatment of emissions. Waste statistics usually group waste according to main economic/industrial activities in which they are generated, for example agriculture and forestry waste; mining and quarrying waste, construction waste; waste generated during energy production; manufacturing industries' waste and other industrial waste; household and similar waste; and sewage sludge. The importance of these waste categories depends on the economy of the country, and countries may choose to focus only on the activities or sectors which are most relevant for them, or to combine groups of industries because of data constraints.

(b) Measurement Methods: To measure the generation of waste, four different methods can be used: surveys, administrative or other sources, statistical estimation procedures and a combination of the above methods.

Surveys on waste statistics can be carried out in order to gather the relevant information directly from enterprises or households. Survey method collects information on waste generation using a questionnaire on waste from enterprises (they can be waste generators or waste collectors and transport operators) or households. Since the number of waste collector and transport operators is limited, a census method can be considered. Administrative information source refers to any information which is collected and put together by the administration for purposes other than for waste statistics, but can also be used directly or with some additional effort to generate some of the information required for waste statistics, for example, data sets from environment agencies and other supervising authorities, associations and organisations in the public sector which organise or handle specific aspects of waste management. Administrative sources are primarily useful for filling in gaps but not for supplying the core data sets.

Statistical estimation procedures can be: the estimation of waste generation by waste factors to be applied to waste-related activities; the estimation of waste generation via models; the indirect determination of waste generation via waste treatment or waste collection.

To measure the generation of waste, a combination of the above methods can also be used. When using a combination of different sources, double counting and under-coverage should be avoided.

GDP and value added (at constant prices) are generally obtained from standard national accounts.

(c) Limitations of the Indicator: The classification of what is or is not waste is largely dependent on technological innovations achieved and applied; the borderline between waste/non-waste varies therefore by country, and even within a country. Currently there are no uniform definitions of municipal and industrial waste applied by the countries. The problems of varying definitions and classifications severely limit data comparability between countries or even between regions within countries.

Waste production can be expensive to measure at source, unless already done for other purposes, such as billing; thus, consistent and comparable statistics can be difficult to obtain.

Generation of waste is often mistakenly treated as a synonym for the amount of waste collected/treated/disposed of, which is measured by recording the weight or volume of waste removed and handled at the treatment or disposal site.

(d) Status of the Methodology: Not Available.

(e) Alternative Definitions/Indicators: Waste collection, which is easier to measure, may be a suitable proxy measure for this indicator in some countries.
In the absence of data on household waste, municipal waste - defined as waste collected by or on behalf of municipalities - can be used as a proxy. However it should be borne in mind that municipal waste includes waste from households, streets, commerce and trade, small businesses, office buildings and institutions (schools, hospitals, government buildings). It may therefore overlap with some of the industrial sectors. In some

countries a non-negligible proportion of household and similar waste is generated in areas with no municipal waste collection, and this needs to be taken into account.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Total weight of waste generated by manufacturing industries, mining & quarrying, construction, energy production (excluding mining), agriculture & forestry, and household and similar waste, as well as population data, and GDP and value added by economic activity (at constant prices).

(b) National and International Data Availability and Sources: At the national level, data sources would include ministries responsible for the selected economic/industrial activities, ministries responsible for urban affairs and the environment, and statistical agencies. At the international level, the United Nations Statistics Division (UNSD), OECD and Eurostat collect data on waste generation from their member countries, and some good results are available for developed countries. Data for most developing countries is sparse and comparability is limited.

(c) Data References:
UNSD Web site (http://unstats.un.org/unsd/environment/q2004indicators.htm)

OECD website (http://www.oecd.org/statisticsdata)

Eurostat website
(http://epp.eurostat.cec.eu.int/portal/page?_pageid=0,1136239,0_45571444&_dad=portal&_schema=PORTAL)
Economic information is available at
http://unstats.un.org/unsd/snaama/Introduction.asp

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the United Nations Statistics Division (UNSD). The contact point is the Chief, Environment and Energy Statistics Branch, UNSD. fax no. (1 212) 963 0623.

(b) Other Contributing Organizations: The United Nations Centre for Human Settlements (Habitat), the United Nations Environment Programme (UNEP), the World Bank, the World Health Organization (WHO), the Organisation for Economic Co-operation and Development (OECD), and Eurostat are involved in the development of waste indicators.

6. REFERENCES

(a) Readings: UNSD/UNEP Questionnaire 2006 on Environment Statistics – Waste Section.

Eurostat: A Selection of Environmental Pressure Indicators for the EU and Acceding Countries – 2004 Edition.

Eurostat: Manual for the implementation of Regulation (EC) No 2150/2002 on Waste Statistics.

Various publications from the Settlement Infrastructure and Environment Programme, Habitat.

OECD. *OECD Environmental Data Compendium 2004.* OECD, Paris, 2004.

European Environment Agency. *Europe's Environment: the third Assessment.* 2003.

United Nations (2006a). International Standard Industrial Classification of all Economic Activities, ST/ESA/STAT/SER.M/4/Rev.4.

United Nations (2005). *National Accounts Statistics: Analysis of Main Aggregates, 2004.* ST/ESA/STAT/Ser.X/35. Sales No. E.06.XVII.8.

(b) Internet site:

UNSD home page: http://unstats.un.org/unsd/environment/

WASTE TREATMENT AND DISPOSAL		
Consumption and Production Patterns	**Waste Generation and Management**	**Core indicator**

1. INDICATOR

(a) Name: Waste Treatment and Disposal

(b) Brief Definition: Percentage of Waste which is *i*) recycled; *ii*) composted; *iii*) incinerated; and *iv*) land-filled on a controlled site.

(c) Unit of Measurement: %.

(d) Placement in the CSD Indicator Set: Consumption and Production Patterns/ Waste Generation and Management.

2. POLICY RELEVANCE

(a) Purpose: The purpose of this indicator is to measure the proportion of waste generated which is recycled, composted, incinerated, or land-filled on a controlled site. It gives an indication of the environmental impact of waste management in the country. The proper treatment and disposal of waste is important from an environmental and social viewpoint but can be an economic burden on industries, municipalities and households.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): The way a country manages its solid waste has significant long-term implications for public health, the economy and the natural environment. Therefore it is essential to promote an environmentally sound solid waste treatment and disposal programme. Generally, adequate waste management indicates that the authorities are aware of the health and environmental risks and that they support or impose suitable measures to prevent or reduce waste. Solid waste recycling and composting is an important component of a sustainable approach to solid waste management. As well as reducing the amount of waste that needs to be disposed of, increasing the amount of waste recycled and composted reduces the demand for raw materials, leading to a reduction in resource extraction. There may also be a benefit of increased income generation for the urban poor through recycling schemes.

For waste that is not suitable for recycling or composting, incineration is often considered the next best option, if the incineration plants comply with legislation for emission standards, and if energy from waste incineration is recovered, as this will reduce the overall volume of waste.

If recycling, composting or incineration is excluded, waste should be landfilled on a controlled site, with suitable technical control in line with national legislation.

Uncontrolled landfilling may cause serious environmental problems to soil and ground water and should be avoided.

(c) International Conventions and Agreements: While no international agreements currently apply, there is growing international backing for the OECD's 3R's approach to tackling waste: Reduce, Reuse and Recycle.

(d) International Targets/Recommended Standards: No specific target for waste treated in different categories. Some developed countries have established voluntary targets for the proportion of waste recycled.

(e) Linkages to Other Indicators: This indicator is intimately linked to other solid waste management indicators. It is also associated with some of the indicators for human settlements and financial mechanisms, such as percent of population in urban areas, and environmental protection expenditures.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: The amount of waste treated or disposed of under different methods is closely related to the national policy on waste management: incentives for minimisation, recycling/recovery, stricter legislation for waste to be landfilled (e.g. ban on landfilling of combustible waste) and differentiated taxation.

Recycling is defined as any reprocessing of material in a production process that diverts it from the waste stream, except reuse as fuel. Both reprocessing as the same type of product, and for different purposes should be included. Direct recycling within industrial plants at the place of generation should be excluded.

Composting is defined as a biological process that submits biodegradable waste to anaerobic or aerobic decomposition, resulting in a product (compost) that is added to soil to improve fertility.

Incinerating is thermal treatment of waste during which chemically fixed energy of combusted matters is transformed into thermal energy. Combustible compounds are transformed into combustion gases leaving the system as flue gases. Incombustible inorganic matters remain in the form of slag and fly ash. Incinerating includes incinerating with or without energy recovery.

Landfilling is defined as depositing waste into or onto land, in a controlled manner. It includes specially engineered landfill and temporary storage of over one year on permanent sites. The definition covers both landfill in internal sites (i.e. where a generator of waste disposes of its own waste at the place of generation) and in external sites. Landfill waste includes all amounts going to landfill, either directly or after sorting and/or treatment. Controlled landfilling requires submission to a permit system and technical control procedures in compliance with the national legislation in force.

(**b)** **Measurement Methods:** The main sources of data on waste treatment and disposal are the treatment and disposal facilities, such as recycling plants, composting plants, incineration plants and landfills.

Data collection on waste treatment and disposal relies strongly on the use of administrative data collected for licensing and monitoring purposes such as facility registers, consignment notes, or waste management reports. Comprehensive waste facility registers are a prerequisite for the collection of facility-related information and for data on treated quantities.

Where data on waste treatment and disposal are not obtained from administrative sources, they are usually gathered through surveys. Statistics on waste treatment and disposal are usually based on surveys of all waste treatment and disposal facilities that are subject to the relevant obligations.
Due to the wide variety of waste treatment operations and waste streams, data often have to be drawn from different sources, which makes the harmonisation of definitions, classifications and reporting requirements an important issue.

(c) **Limitations of the Indicator:** Although the indicator gives relevant information about the existence and use of different waste treatment and disposal facilities, it does not give the full picture. For example, it does not give any indication of the level of control of the landfill sites, or the emissions of incineration plants. And in many countries, after the waste has been disposed of at a landfill site, it may be sorted mechanically or by scavengers and a fraction removed for reuse or recycling. It can be difficult to quantify this fraction. For practical reasons, the calculation of the waste incineration rate only considers waste incinerated through the registered waste management system. Households or industries incinerating their own waste are not included. Similarly, households and industries composting their own waste are not covered.

(d) **Status of the Methodology:** Not Available.

(e) **Alternative Definitions/Indicators:** The solid waste recycling rate would be more useful if expressed in terms of particular waste streams, e.g. percentage of paper waste recycled. It may also be useful to express the % recycled based on the usage of a particular commodity, for example volume of aluminium recycled per volume produced. This enables a better estimation of the level of resource conservation. The percentage of waste incinerated can be divided into two: incineration with or without energy recovery.

Since the total amount of solid waste treatment and disposal are difficult to measure, municipal waste treatment and disposal might be a viable alternative indicator.
The indicator could also be presented as the percentage of waste collected, rather than of total waste generated, as data on the latter can be difficult to obtain.

4. <u>ASSESSMENT OF DATA</u>

(a) Data Needed to Compile the Indicator: Total waste generated, weight of total waste recycled, weight of total waste composted, weight of total waste incinerated, and weight of total waste landfilled.

(b) National and International Data Availability and Sources: At national level, data sources would include ministries responsible for urban affairs and the environment, and statistical agencies. At the international level, the United Nations Statistics Division (UNSD), OECD and Eurostat collect available data on municipal and hazardous waste treatment and disposal from countries. Currently, some good results are available from developed countries, but data for developing countries are very scarce.

(c) Data References: UN Statistics Division Web site (http://unstats.un.org/unsd/environment/).

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the United Nations Statistics Division (UNSD). The contact point is the Chief, Environment and Energy Statistics Branch, UNSD. fax no. (1 212) 963 0623.

(b) Other Contributing Organizations: The United Nations Centre for Human Settlements (Habitat), the United Nations Environment Programme (UNEP), the World Health Organization (WHO), OECD, Eurostat and industry associations would be interested in the development of this indicator.

6. REFERENCES

(a) Readings:

UNSD/UNEP Questionnaire 2006 on Environment Statistics – Waste Section.

Eurostat: Manual for the implementation of Regulation (EC) No 2150/2002 on Waste Statistics.

UNEP. *Global Environmental Outlook*, 2007.

United Nations Department of Economic and Social Affairs, *Measuring Changes in Consumption and Production Patters: A Set of Indicators*, (ST/ESA/264), 1998.

(b) Internet site:

UNSD home page: http://unstats.un.org/unsd/environment/

MANAGEMENT OF RADIOACTIVE WASTE		
Consumption and Production Patterns	**Waste Generation and Management**	

1. INDICATOR

(a) Name: Management of Radioactive Waste.

(b) Brief Definition: Radioactive waste arises from various sources, such as nuclear power generation and other nuclear fuel cycle related activities, radioisotope production and use for applications in medicine, agriculture, industry and research. The indicator provides a measure of both the current status of radioactive waste management at any point in time and the progress made over time towards the overall sustainability of radioactive waste management.

(c) Unit of Measurement: a dimensionless indicator ranging from 0 (least sustainable condition) to 100 (most sustainable condition) in increments dependent on the progress towards safe storage or disposal. The factor may be calculated for each waste class used by a country or it may be presented as an average for all waste classes.

(d) Placement in the CSD Indicator Set: Consumption and production patterns/Waste generation and management.

2. POLICY RELEVANCE

(a) Purpose: The purpose is to represent the progress in managing the various radioactive wastes that arise from the nuclear fuel cycle and/or from nuclear applications. Quantitative information is required to indicate this progress by way of a baseline for full sustainability coupled with a knowledge of the key steps towards full sustainability.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): Radioactive waste, if not properly managed, can have a direct impact on health and the environment through exposure to ionizing radiation. In order to protect human health and the environment, appropriate waste management strategies and technologies must be employed. Fundamental principles of radioactive waste management, as well as activities such as minimization of waste arisings, involve systematically considering the various steps in treatment, conditioning, storage and disposal. Effective management of waste (control of inventory) has a positive impact regarding sustainability as it reduces the pressure on the environment and the commitment of resources. Waste management strategies seek ultimately to confine and contain the radionuclides within a system of engineered and natural barriers so that any releases to the environment are small compared to natural background.

(c) International Conventions and Agreements: The Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management

[Ref 1] entered into force June 2001. This convention binds Contracting Parties to manage spent nuclear fuel and radioactive wastes using sustainable waste management practices.

(d) International Targets/Recommended Standards: The International Atomic Energy Agency (IAEA) has established Safety Standards, Fundamentals, Requirements and Guides [Ref 2 - 4] applicable to the management of radioactive wastes. It has also established Basic Safety Standards for the Protection of Humans against Ionizing Radiation [Ref 5], that are consistent with recommendations of the International Commission on Radiological Protection (Ref 6,7).

(e) Linkages to Other Indicators: A large portion of radioactive waste arises from practices within the nuclear fuel cycle, therefore major current arisings are related to a significant generation of electricity by nuclear means with an equivalent reduction of environmental impacts by other energy sources (Chapter 4 of Agenda 21). This implies a reduction in the release of atmospheric pollutants; notably greenhouse gases, contributing to the protection of the atmosphere (Chapter 9 of Agenda 21). Since some radioactive waste arises from medical applications, such as treatment with radioisotopes or sealed radiation sources and nuclear medicine research, a link exists with the extent of these applications and with the protection and promotion of human health (Chapter 6 of Agenda 21). Additional links are with the transfer of environmentally sound technology (Chapter 34 of Agenda 21) and with the environmentally sound management of hazardous waste (Chapter 20 of Agenda 21).

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: Principles regarding the protection of future generations are formulated in the International Atomic Energy Agency's Safety Fundamentals [Ref. 4]. IAEA definitions and the classification of radioactive waste are given in relevant standards, accessible via [Ref 8].

(b) Measurement Methods:. Management progress is measured against key milestones related to both the processing of waste into forms suitable for either safe storage or for placement into a designated endpoint (the “form factor”) and to the placement of waste into an endpoint facility (“endpoint factor”). Each factor has four states with values assigned according to specified milestones. Determination of progress to towards sustainable waste management requires a knowledge of the status of the designated milestones, which is in turn related to (1) the rate of waste generation, (2) the rate that wastes are put into suitable forms and (3) the rate that wastes are placed into an endpoint facility. All rates have units m3/a or tonnes/a (mass is typically used for spent nuclear fuel that is declared to be waste). A five year moving average is recommended for the determination of these rates. Details of the methodology to calculate the indicator can be obtained via the contact point identified in Point 5 below or via the link “GUIDANCE FOR CALCULATING THE INDICATOR OF SUSTAINABLE DEVELOPMENT FOR RADIOACTIVE WASTE MANAGEMENT” before Point 4 below.

(c) Limitations of the Indicator: The management of radioactive waste is only a first approximation of its hazard. It is assumed that only improperly managed waste can have an impact on human health and the environment. The actual impact requires a site specific analysis taking into account the isotopic and chemical composition of the waste. This indicator gives a measure of progress towards reduction in the volume of waste that could impact upon health and the environment. As configured, this indicator does not seek to establish progress with historic waste management.

(d) Status of the Methodology: Safety assessment of the radiological hazard of radioactive waste disposal is considerably advanced and is used as the basis for regulatory decisions in many countries (the milestones of factors are related to specified regulatory decisions, such as the approval of a disposal facility for operation).

(e) Alternative Definitions/Indicators: None.

GUIDANCE FOR CALCULATING THE INDICATOR OF SUSTAINABLE DEVELOPMENT FOR RADIOACTIVE WASTE MANAGEMENT

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: the volumes or masses of the various classes of radioactive waste (1) arising annually, (2) processed to suitable forms and (3) consigned to an endpoint facility expressed in cubic metres per annum (m3/a) or tonnes per annum (tonnes/a) plus a knowledge of the status of specified milestones for the form and endpoint factors

(b) National and International Data Availability and Sources: At the national level, the volume or masses of radioactive waste arisings can be obtained from the waste accountancy records maintained by the various waste generators or, in consolidated form, from either national waste management organizations or regulatory bodies. Almost one third of the IAEA member states keep some type of national radioactive waste registry. The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management requires Contracting Parties to report an inventory of radioactive waste that is subject to the Convention. Through this mechanism, both the availability and the quality of data is likely to increase over time.

(c) Data References: The primary source for data includes national or provincial/state level governmental organizations. A secondary source may be databases managed by international organizations such as the IAEA or the Nuclear Energy Agency of the Organization of Economic Cooperation and Development (OECD/NEA).

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The International Atomic Energy Agency. The contact point is:

Indicator of Sustainable Development for Radioactive Waste Contact Point
International Atomic Energy Agency
Department of Nuclear Energy

Division of Nuclear Fuel Cycle and Waste Technology
Waste Technology Section
Wagramer Strasse 5, P.O. Box 100
A-1400, Vienna, Austria
E-mail: ISD-RW@iaea.org

(b) Other Contributing Organizations: Governments and inter-governmental organizations, possibly the European Commission (EC), the OECD/NEA, the United Nations Environment Programme (UNEP), non-governmental and other organizations, such as the International Union of Producers and Distributors of Electrical Energy (UNIPEDE) and the Electric Power Research Institute (EPRI).

6. REFERENCES:

[1] *The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management,* as adopted in September 1997 (IAEA Press Release PR 2001/05, 20 March 2001, http://www.iaea.org/worldatom/Press/P_release/2001/prn0105.shtml).
[2] IAEA's Safety Guides (Safety Series No. 111-G-1.1), 1994, *Classification of Radioactive Waste.*
[3] IAEA's Safety Standards (Safety Series No. GS-R-1), 2000, *Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety.*
[4] IAEA's Safety Fundamentals (Safety Series No. 111-F), 1995. *The Principles of Radioactive Waste Management.*
[5] IAEA's Safety Standards (Safety Series No. 115), 1996. *International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources.*
[6] ICRP Publication 46, 1996. *Radiation Protection Principles for the Disposal of Solid Radioactive Waste,* Pergamon Press, Oxford.
[7] ICRP Publication 60, 1991. 1990 *Recommendations of the International Commission on Radiological Protection.* Annals of the ICRP 21 (1- 3), Pergamon Press, Oxford.
[8] World Atom Internet site: http:/ww.iaea.org/worldatom/

MODAL SPLIT OF PASSENGER TRANSPORT		
Consumption and Production Patterns	**Transportation**	**Core indicator**

1. INDICATOR

(a) Name: Modal split of passenger transport

(b) Brief definition: Share of each mode (passenger cars, buses and coaches, and trains) in total inland passenger transport, in passenger-km.

(c) Unit of Measurement: % of passenger-kilometres

(d) Placement in the CSD Indicator Set: Consumption and Production Patterns/ Transportation.

2. POLICY RELEVANCE

(a) Purpose: To provide information on the relative importance of different modes of passenger transport at the global, regional and national levels.

(b) Relevance to Sustainable/Unsustainable Development (theme/subtheme) : Cars are less energy-efficient and produce more emissions per passenger-kilometre than either buses or trains. Therefore, the use of cars for passenger transportation has greater environmental and social impacts, such as pollution, global warming as well as a higher accident rate, than mass transit. Policies are needed which reduce the use of cars as a mode of passenger transport and support a shift towards the use of less environmentally damaging modes, such as public transport.

(c) International Conventions and Agreements: None.

(d) International Targets/Recommended Standards: No international targets have been established.

(e) Linkages to other indicators: This indicator is related to the indicators "Distance travelled per capita by means of transport", "Intensity of Energy Use in Transportation", “Emission of Greenhouse Gases”, and “Ambient Concentration of Air Pollutants in Urban Areas”.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying definitions and concepts: The indicator is defined as the percentage of each mode in total inland transport performance measured in passenger-km. Inland passenger transport includes transport by passenger cars, buses and coaches, and trains.

(b) Measurement method: The preferred method is to measure transport performance (passenger-kilometres) based on movements on national territory.

(c) Limitations of the Indicator: The indicator is based on inland transport only. Due to their predominantly international nature, there are conceptual difficulties in dealing with air and sea transport in a manner consistent with the inland modes (road, rail and inland waterways).

In addition, given that the environmental and social impacts are related to the use of vehicles rather than volumes transported, an indicator based on movements of vehicles (vehicle-kilometres) would be preferable. However, since transport statistics have been generally more concerned with following the movement of passengers than the movement of vehicles, the indicator is based on transport performance (passenger-kilometres). If comprehensive data on vehicle movements for all modes of transport become available the indicator could be modified.

(d) Status of the Methodology: An agreed methodology at the international level concerning passenger transport statistics has not yet been established. Moreover, the coverage of passenger transport for many countries is incomplete, mainly due to lack of data on transport by passenger car.

(e) Alternative definitions/Indicators: In the absence of reliable transport statistics, the number of vehicles (per 1,000 inhabitants) and/or the total length of roads (or paved roads), railway tracks and waterways maybe used.

4. ASSESSMENT OF DATA

(a) Data needed to Compile the Indicator: The indicator is compiled from series of passenger-kilometre for passenger cars, buses and coaches, and trains.

(b) National and International Data Availability and Sources: For some countries data on passenger transport performance are available through the Eurostat/ECMT/UNECE Common Questionnaire on Transport Statistics. Where data is unobtainable from these sources, data might be available through national statistical institutes, ECMT, UNECE or UIC.

(c) Data References:

ECMT: Trends in the Transport Sector.
http://www.cemt.org
UNECE: Annual Bulletin of Transport Statistics for Europe and North America.
http://www.unece.org
International Road Federation: World Road Statistics.
http://www.irfnet.org
UIC: International Railway Statistics.
http://www.uic.asso.fr/stats

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is Eurostat (the Statistical Office of the European Communities). The contact point is …

(b) Other Contributing Organizations:

6. REFERENCES

(a) Internet site: http://europa.eu.int/comm/eurostat

MODAL SPLIT OF FREIGHT TRANSPORT		
Consumption and Production Patterns	**Transportation**	

1. **INDICATOR**

(a) **Name**: Modal split of freight transport

(b) **Brief definition**: Share of each mode (road, rail and inland waterways) in total inland freight transport, measured in tonne-km.

(c) **Unit of Measurement**: % of tonne-kilometres

(d) **Placement in the CSD Indicator Set**: Consumption and Production Patterns/ Transportation.

2. **POLICY RELEVANCE**

(a) **Purpose**: To provide information on the relative importance of different modes of goods transport at the global, regional and national levels.

(b) **Relevance to Sustainable/Unsustainable Development (theme/subtheme)** : Road transport is less energy-efficient and produces more emissions per tonne-kilometre than either rail or inland waterways transport. Therefore, the use of road for freight transport has greater environmental and social impacts, such as pollution, global warming, as well as a higher accident rate, than either rail or inland waterways transport. Policies are needed which encourage the use of less environmentally harmful means for transporting freight, such as rail or waterways.

(c) **International Conventions and Agreements**: None.

(d) **International Targets/Recommended Standards**: No international targets have been established.

(e) **Linkages to other indicators**: This indicator is related to the indicators "Intensity of Energy Use in Transportation", "Emission of Greenhouse Gases", and "Ambient Concentration of Air Pollutants in Urban Areas".

3. **METHODOLOGICAL DESCRIPTION**

(a) **Underlying definitions and concepts**: This indicator is defined as the percentage of each mode in total inland transport performance measured in tonne-kilometres.
Inland freight transport includes road, rail and inland waterways.

(b) **Measurement method:** The preferred method is to measure transport performance (tonne-kilometres) based on movements on national territory.

(c) Limitations of the Indicator: The indicator is based on inland transport only. Due to their predominantly international nature, there are conceptual difficulties in dealing with air and sea transport in a manner consistent with the inland modes (road, rail and inland waterways).

In addition, given that the environmental and social impacts are related to the use of vehicles rather than volumes transported, an indicator based on movements of vehicles (vehicle-kilometres) would be preferable. However, since transport statistics have been generally more concerned with following the movement of goods than the movement of vehicles, the indicator is based on transport performance (tonne-kilometres). If comprehensive data on vehicle movements for all modes of transport become available the indicator could be modified.

(d) Status of the Methodology: Data collection methodologies are not harmonized at the global level.

(e) Alternative definitions/Indicators:

4. ASSESSMENT OF DATA

(a) Data needed to compile the Indicator: The indicator is compiled from series of tonne-kilometre for road, rail and inland waterways.

(b) National and International Data Availability and Sources: Data on goods transport performance are available through either national statistical institutes, ECMT, UNECE or UIC.

(c) Data References:
ECMT: Trends in the Transport Sector.
http://www.cemt.org
UNECE: Annual Bulletin of Transport Statistics for Europe and North America.
http://www.unece.org
International Road Federation: World Road Statistics.
http://www.irfnet.org
UIC: International Railway Statistics.
http://www.uic.asso.fr/stats

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is Eurostat (the Statistical Office of the European Communities).

(b) Other Contributing Organizations:

6. REFERENCES

(a) **Internet site**: http://europa.eu.int/comm/eurostat

ENERGY INTENSITY OF TRANSPORT		
Consumption and Production Patterns	**Transportation**	

1. INDICATOR

(a) Name: Energy Intensity of Transport

(b) Brief Definition: Energy use per unit of freight-kilometre (km) hauled and per unit of passenger-km travelled by mode.

(c) Units of Measurement: Freight: tonnes of oil equivalent (toe) per tonne-km. Travel: toe per passenger-km.

(d) Placement in the CSD Indicator Set: Consumption and Production Patterns/ Transportation.

2. POLICY RELEVANCE

(a) Purpose: Transport is a major user of energy, mostly in the form of oil products, which makes transport the most important driver behind growth in global oil demand. The transport indicators measure how much energy is used for moving both goods and people.

(b) Relevance to Sustainable Development: Transport serves economic and social development through the distribution of goods and services and through personal mobility. However, energy use for transport also leads to the depletion of resources and to air pollution and climate change. Reducing energy intensity in transport can reduce the environmental impacts of transport while maintaining the economic and social benefits.

(c) International Conventions and Agreements: There are no international conventions directly related to energy intensities in the transport sector. International conventions on energy emissions, such as the United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol, are indirectly related to transport energy intensities. The European Union voluntary commitments on carbon dioxide (CO_2) emissions by European, Japanese and Korean car manufacturer associations are for reductions in CO_2 emissions per kilometre for new automobiles.

(d) International Targets/Recommended Standards: Many industrialized countries have targets for reducing energy use and carbon emissions from transport.

(e) Linkages to Other Indicators: This indicator is part of a set for energy intensities in different sectors (manufacturing, agriculture, service/commercial and residential), with energy use per unit of gross domestic product (GDP) as an aggregate energy intensity indicator. These indicators are also linked to indicators for total energy use, greenhouse gas emissions and air pollution emissions.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: The transport indicators reflect how much energy is used to transport goods and people. The separation of freight transport and passenger travel is essential for energy analysis, both because they are largely based on different modes and because the activities driving energy use are different. The two activity measures (tonne-km and passenger-km) are quite distinct and are collected separately. However, separating the energy use in these two activities is often complicated given the way data are available from typical energy statistics.
Changes in intensities are affected by factors other than energy efficiency; therefore, analysing intensity trends provides important insights into how energy efficiency and other factors affect energy use. Annex 3 includes a decomposition method for energy intensities.

(b) Measuring Methods:
Energy Use: Ideally, for road transport, energy use should be measured for each type of vehicle or *means of transport*, including two-wheel vehicles, automobiles, sport utility vehicles (SUVs) and buses for personal travel, and small trucks, heavy trucks and miscellaneous road vehicles for freight transport. Outside of road transport, both freight and personal travel should be divided into trains, ships and aircraft for domestic transport. In general, however, national energy balances are only disaggregated by fuel and broad traffic type or *mode of transport*: road, rail, water, air and pipeline. Thus, they give no information on energy use by individual means of road transport or, even more importantly, on the split between personal travel and freight transport. International air or maritime transport should not be included.

Output or Activity: For assessing the efficiency of road vehicles, vehicle-km is a useful activity measure, assuming that data are available for each vehicle type. However, to be able to construct indicators across all modes for personal travel and freight transport, passenger-km and tonne-km, respectively, must be used as activity variables. This also provides a better indication of how efficiently energy is used to provide personal mobility and distribution of goods. For example, from this perspective, a bus carrying 20 passengers for 10 km (200 passenger-km) is less energy intensive (more efficient) than the same bus carrying 5 passengers for the same distance (50 passenger-km). Similarly, a fully loaded truck is less energy intensive than the same truck carrying a partial load.
Vehicle Intensities: Energy use per vehicle-km by vehicle and fuel type is an important indicator, as many standards for air pollution (and more recently, goals for CO_2 emissions reductions) are expressed in terms of vehicle characteristics, that is, emissions per vehicle-km.

Modal Intensities: Energy use per passenger-km or tonne-km should be disaggregated by vehicle type, namely, two-wheel vehicle, automobile/van, bus, airplane, local and long-distance train, metro (also known as 'subway' or 'underground'), tram, ship or ferry for passengers, and truck, train, ship or airplane for freight.

Note: Aggregate energy intensities for travel or freight are a meaningful summary indicator whose value depends on both the mix of vehicles and the energy intensities of particular types of vehicles. The energy intensities of public train and bus transport per passenger-km are significantly lower than the energy intensities for automobiles or air transport. Freight, rail and ship transport are commonly less energy intensive than is trucking per tonne-km. It should also be noted that fuel consumption per vehicle-km also depends on traffic conditions as well as vehicle characteristics.

The energy intensity of a vehicle depends on both capacity and capacity utilization. A large vehicle that is fully loaded generally has lower energy intensity per tonne-km than a fully loaded smaller vehicle, but a small vehicle fully loaded will have a lower energy intensity than a large vehicle with the same load.

For some developed countries, typical load factors for private automobiles are 1.5 persons per automobile. For rail and bus, load factors vary from well below 10% (e.g. United States city buses on average) to over 100% of nominal capacity at peak times (in many developing countries during most of the day). Typical load factors for trucking might be 60–80% of weight capacity when loaded, but trucks commonly run 20–45% of their kilometres empty, yielding a relatively low overall load factor. Underutilized transport capacity means more pollution and road damage per unit of transport service delivered; hence capacity utilization itself is an important indicator of sustainable transport.

(c) Limitations of the Indicator: Data availability may limit the disaggregation of the indicator to the desired level. Considerable work is often required to disaggregate energy balances into various modes of transport.

Some countries' transport energy statistics include fuel consumed by domestic airlines or shipping lines in international transport. Efforts should be made to exclude such transport and energy use from the indicators.

Measurement and interpretation of energy intensities are complicated by differences among products within a category, such as size (e.g. automobile weight), engine technology (e.g. gasoline or diesel) and utilization (vehicle occupancy if passenger-km is the measure of output).

(d) Alternative Definitions/Indicators: An alternative, simpler measure of energy intensity for transport could be overall average fuel consumption per passenger-km or tonne-km for all modes, but the results would be strongly influenced by the mix of modes and vehicle types, which varies enormously among countries and over time.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator

- Energy use by mode of transport, vehicle type and fuel for passenger travel and freight transport separately
- Distance travelled by vehicles, passengers and freight, including load factors

- Distance travelled by urban public transport and corresponding share of electric vehicles

(b) National and International Data Availability and Sources: National energy balances and energy statistics from the International Energy Agency (IEA) and Eurostat normally do not disaggregate road transport into individual means of transport, but this information is sometimes published by transport ministries. Few sources of energy data separate fuel consumption for air, rail or domestic shipping into that for passengers and that for freight, but national or private rail and shipping organizations may have this information. Energy use for local electric transport (commuter rail, metro, trams) is often published separately by national authorities.

Eurostat, the European Conference of Ministers of Transport (ECMT) and the United Nations Economic Commission for Europe (UNECE) are leading agencies for the collection of data on vehicle-, passenger- and tonne-km in Europe. Transport ministries in the United States, Canada, Japan, Australia and other countries publish similar data, often through their statistical agencies. In developing and transitional countries, fewer data are available.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agencies: The International Energy Agency

(b) Other Contributing Organizations: The International Atomic Energy Agency (IAEA)

6. REFERENCES

(a) Readings:

EEA, 2002. *TERM 2002 – Paving the Way for EU Enlargement – Indicators of Transport and Environment Integration*. Environmental issue report no. 32. Copenhagen, Denmark: European Environment Agency.

EEA, 2004. *Ten Key Transport and Environment Issues for Policy-Makers. TERM 2004: Indicators Tracking Transport and Environment Integration in the European Union*. EEA Report no. 3/2004. Copenhagen, Denmark: European Environment Agency.

Eurostat, 2003. *Calculation of Indicators of Environmental Pressures Caused by Transport – Main Report.* Luxembourg, European Communities.

Eurostat, 2003. *Energy Efficiency Indicators.* Luxembourg, European Communities.

Eurostat, 2004. *Glossary for Transport Statistics Document prepared by the Intersecretariat Working Group on Transport Statistics.* Third edition. Luxembourg, European Communities

Eurostat, various editions. *Transport and Environment: Statistics for the Tansport and Environment Reporting Mechanism (TERM) for the European Union.* Luxembourg, European Communities.

IAEA, UN DESA, IEA, Eurostat and EEA, 2005. *Energy Indicators for Sustainable Development*. Vienna, IAEA.

IEA, 1997. *Indicators of Energy Use and Energy Efficiency*. Paris, France: International Energy Agency (IEA)/Organisation for Economic Co-operation and Development (OECD).

IEA, 2001. *Saving Oil and Reducing CO2 emissions in Transport: Options and Strategies*. Paris, France: International Energy Agency.

IEA, 2004. *Oil Crises and Climate Challenges: 30 Years of Energy Use in IEA Countries*. Paris, France: International Energy Agency.

Schipper, L., Figueroa, M.J., Price, L., Espey, M., 1993. Mind the gap: The vicious circle of measuring automobile fuel use. *Energy Policy* 21(12): 1173–1190.

(b) Internet site:
The International Energy Agency: http://www.iea.org/