



Food Systems and Nutrition Patterns: Biodiversity, Resilience and Food Security

UNITAR Training Seminar

July 8, 2020



Opening Remarks

Robynne Anderson
President
Emerging ag inc.
[@Robynne_A](https://twitter.com/Robynne_A)



Interactive Quiz

Elise Golan, Ph.D.

Director for Sustainable Development
Office of the Chief Economist U.S. Department of
Agriculture



Interactive Quiz

According to the IPBES Assessment Report, which of the actions below is the top direct driver of change in nature with the largest relative global impacts so far?

Climate change

Direct exploitation of organisms

Changes in land and sea use

Pollution

Invasive alien species

The top five direct drivers in descending order:

1. Changes in land and sea use
2. Direct exploitation of organisms
3. Climate change
4. Pollution
5. Invasive alien species

Source: [Global Assessment Report on Biodiversity and Ecosystem Services](#). 2019.
Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES).
Page 12, Summary for Policymakers.

What percentage of the Earth's landmass (excluding Antarctica) is used for food production?

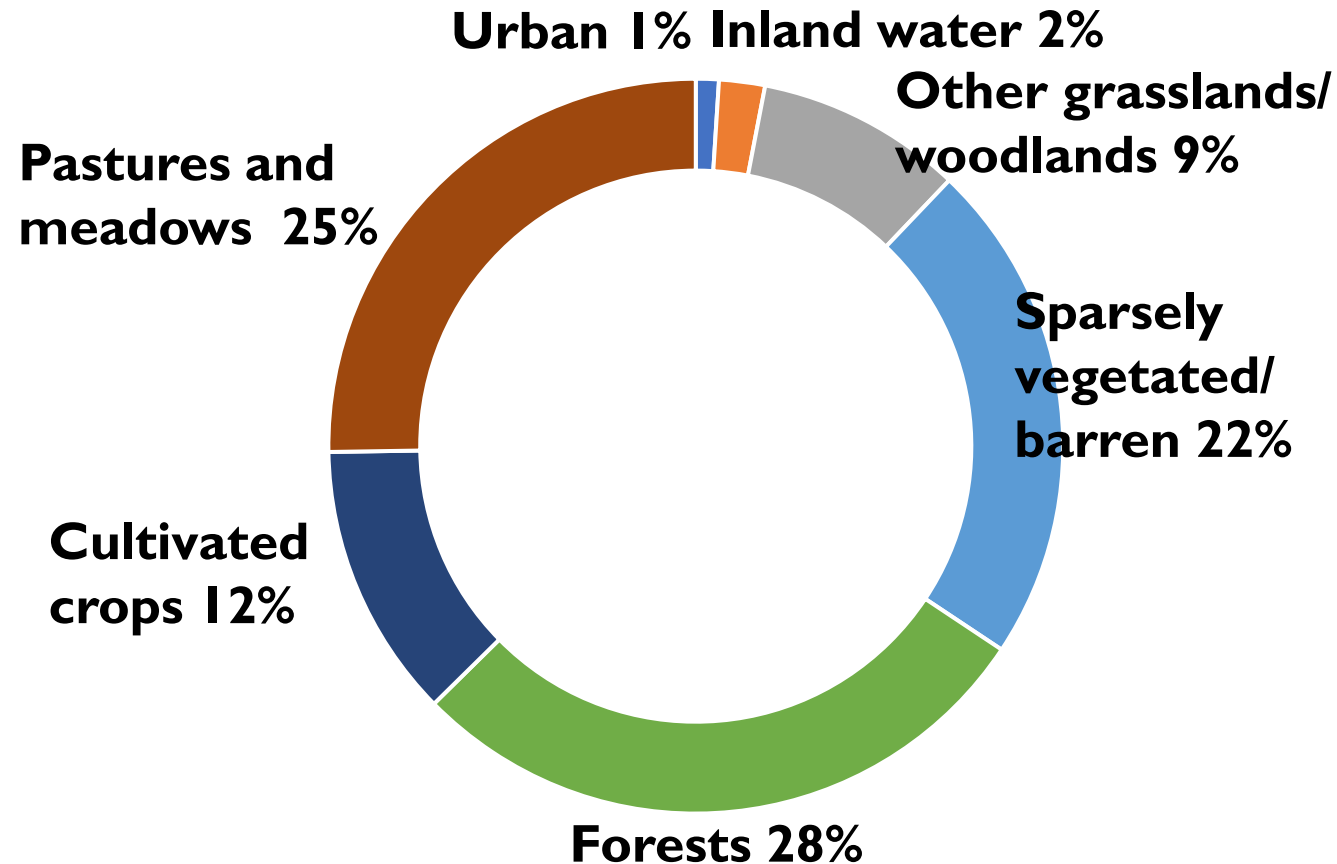
About 20%

About 40%

About 60%

About 80%

Thirty-seven percent of Earth's landmass (excluding Antarctica) is used for food production



Sources: As reported in WRI (2019), [*Creating a Sustainable Food Future*](#), from original source, FAO (2011), *The State of the World's Land and Water Resources for Food and Agriculture*.

Without agricultural productivity gains, how much more land will be needed to produce food to meet projected food demand in 2050?

Half of all remaining forestland

Most of all remaining forestland

All remaining forestland and most grasslands

Most of the world's remaining forestland



Source:WRI (2019). *Creating a Sustainable Food Future: A Menu of Solutions to Feed Nearly 10 Billion People by 2050*

Globally, food that is harvested but not consumed requires cropland equivalent to the size of which country?

Canada

China

Argentina

Ethiopia

Globally, the production of food that is harvested, but not consumed, requires cropland the size of China.



Source: Kummu, M. H de Moel, M. Porkka, S. Siebert, O.Varis, and P.J.Ward (2012), Lost food, wasted resources: Global food supply chain losses and their impacts on freshwater, cropland, and fertiliser use. Science of the Total Environment, Volume 489.

Which of these two salmon filets is more sustainable?

Top
Bottom
Impossible to tell



It is impossible to tell on the basis of the photos which salmon was raised, harvested, and processed in a sustainable manner.



source: <https://www.reference.com/pets-animals/salmon-swim-upstream-d555480847e93dcc>

If an area is planted with just two crops, does the landscape have low biodiversity?

True - the landscape has low biodiversity

False - the landscape does not have low biodiversity

It depends

It depends





FOOD SECURITY AND BIODIVERSITY THROUGH THE LENS OF DRR, CCA AND ECOSYSTEM BASED ADAPTATION

Dr. Naeem Shahzad

Head of Department Disaster Management
National University of Sciences and Technology of
Pakistan (NUST)



FOOD SECURITY AND BIODIVERSITY THROUGH THE LENS OF DRR, CCA AND ECOSYSTEM BASED ADAPTATION

DR NAEEM SHAHZAD

HEAD OF DEPARTMENT DISASTER MANAGEMENT

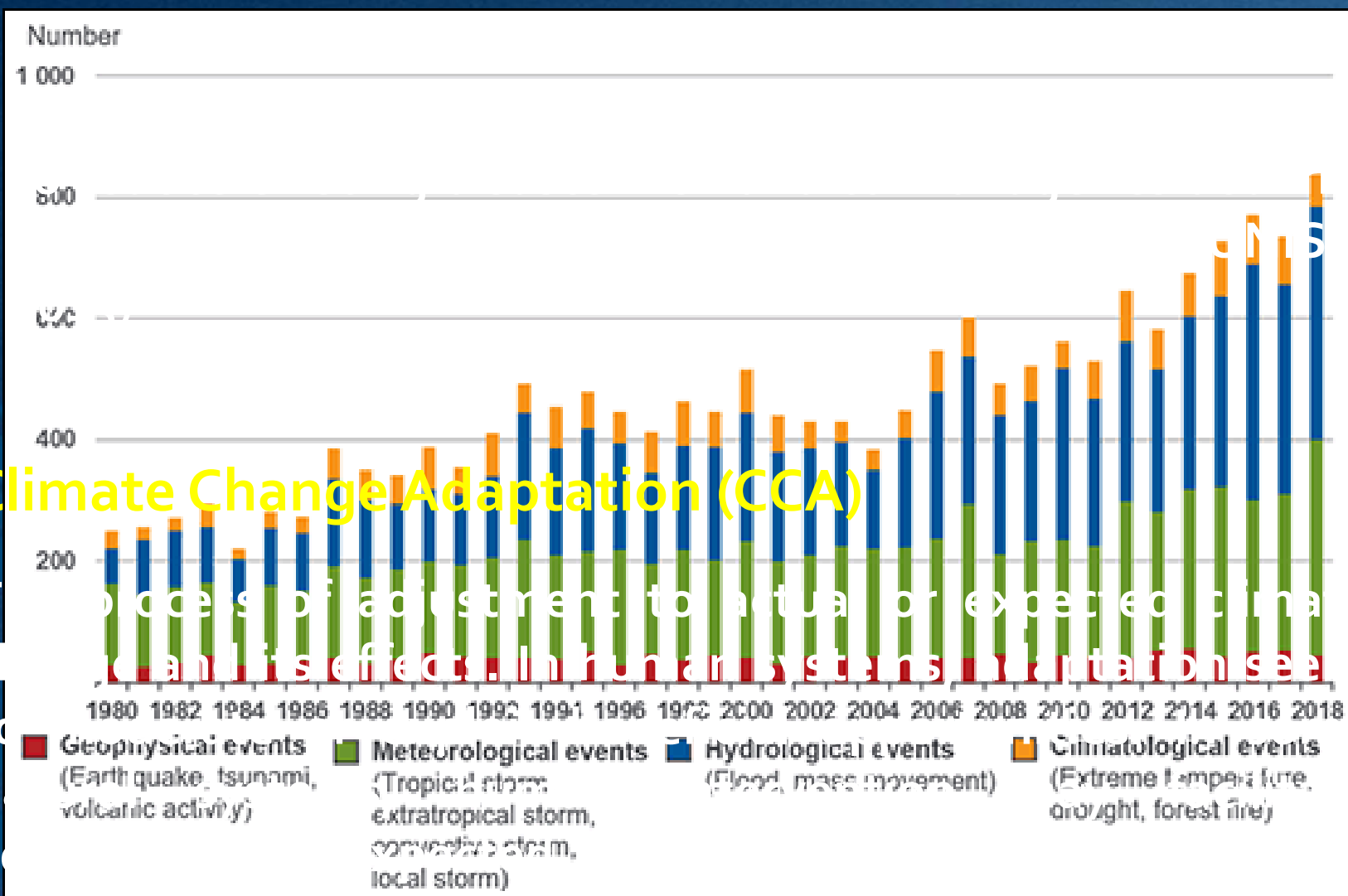
**NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY
(NUST), PAKISTAN**

JULY 8th , 2020



Disaster Risk Reduction (DRR)

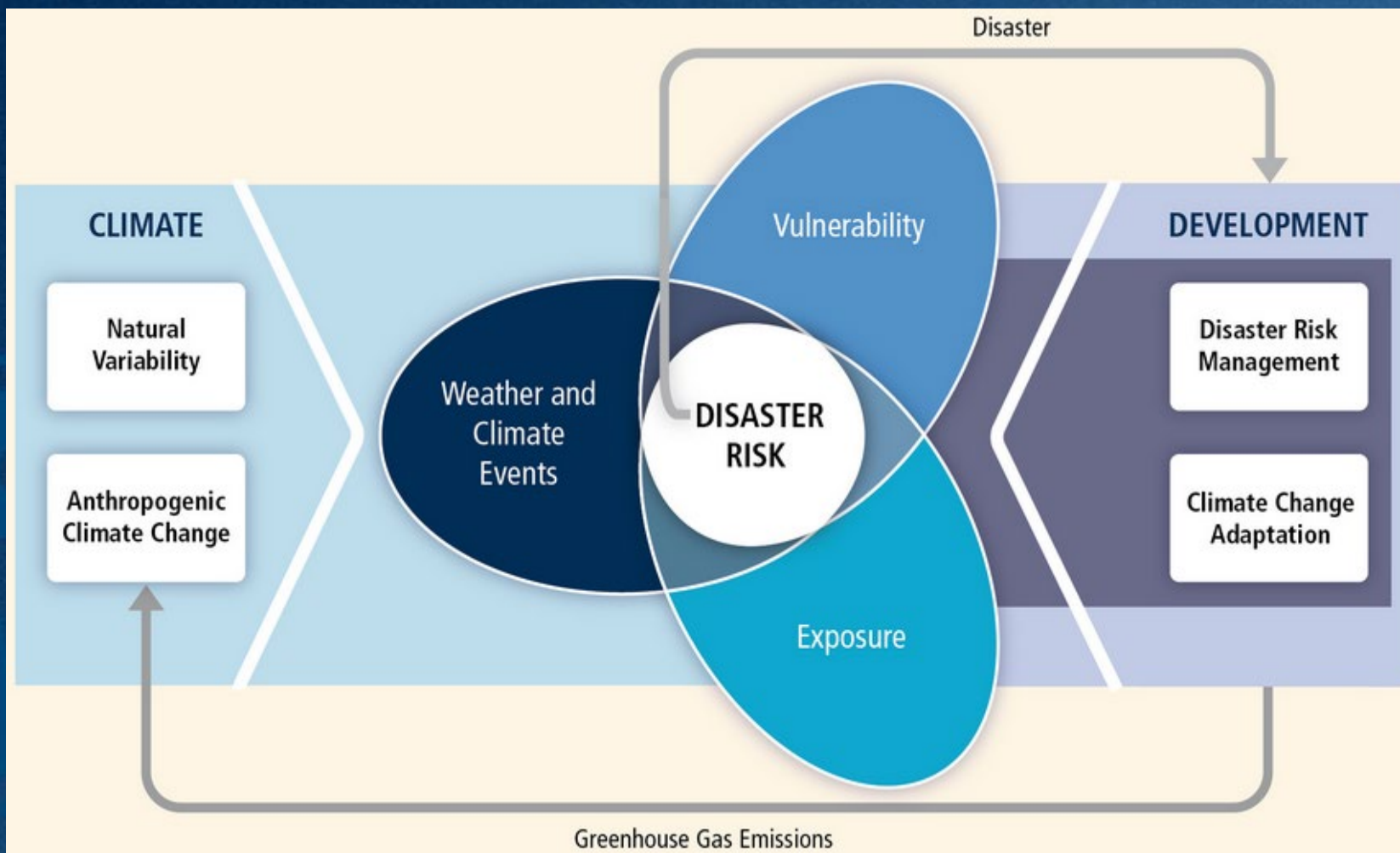
Climate Change Adaptation (CCA)



Source: © 2019 Munich Re, Geo Risks Research, NatCatSERVICE. As of March 2019.



How climate change is influencing disaster risks



Synergies between DRR and CCA

Climate change adaptation

Gradual effects of climate change – sea level rise, air temperature increases and changing snow melt patterns, e.g.

Common concerns

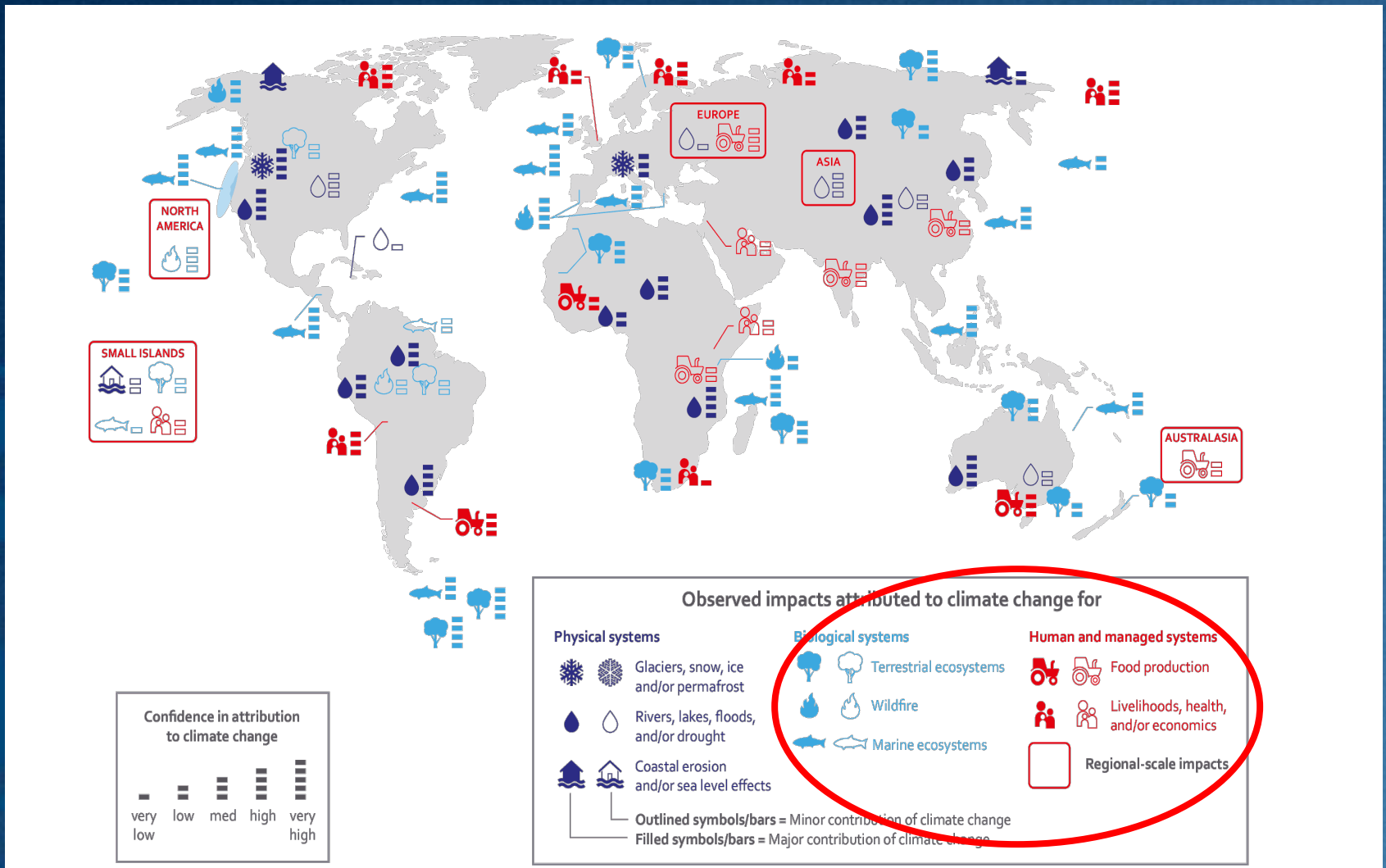
Increased frequency and/or intensity of climate-related hazards – floods, storms, droughts and landslides, e.g.

Hazards unrelated to climate – earthquakes, volcanic eruptions and chemical spills, e.g.

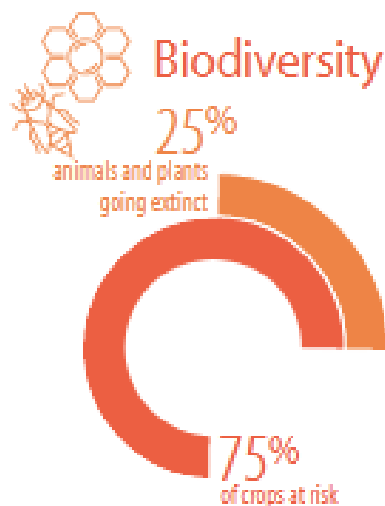
Disaster risk reduction



Global impacts of climate change



Human Survival and Global Commons



25% of animals and plants are threatened with extinction (nearly 1 million species), many in the coming decades

75% of our crops are at risk due to loss of pollinators



Air pollution kills approximately 8 million people annually

8 MILLION people die annually

Net-zero emissions must be reached in 2050 to keep global warming limited to 1.5°C



Oceans

The livelihoods of 60 million fishers depend on ocean resources



60 MILLION fishers depend on ocean resources



33.1% fish stocks are fished at unsustainable levels

50% of all coral reefs have been lost since 1870



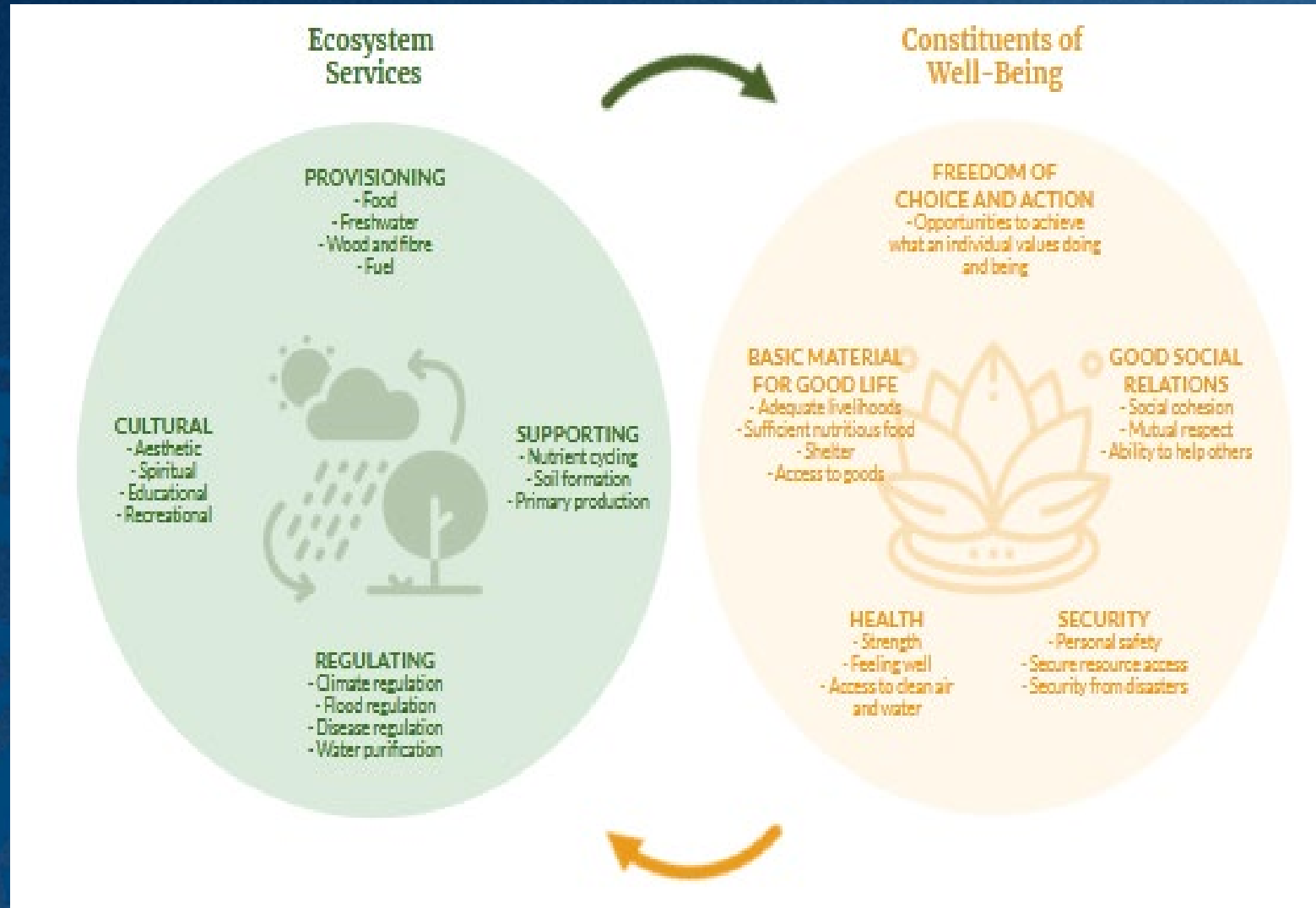
Land

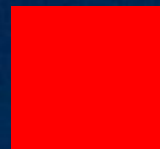
33% of all land is used for agriculture

20% of the Earth's vegetated land surface showed declining productivity from 1998 to 2013

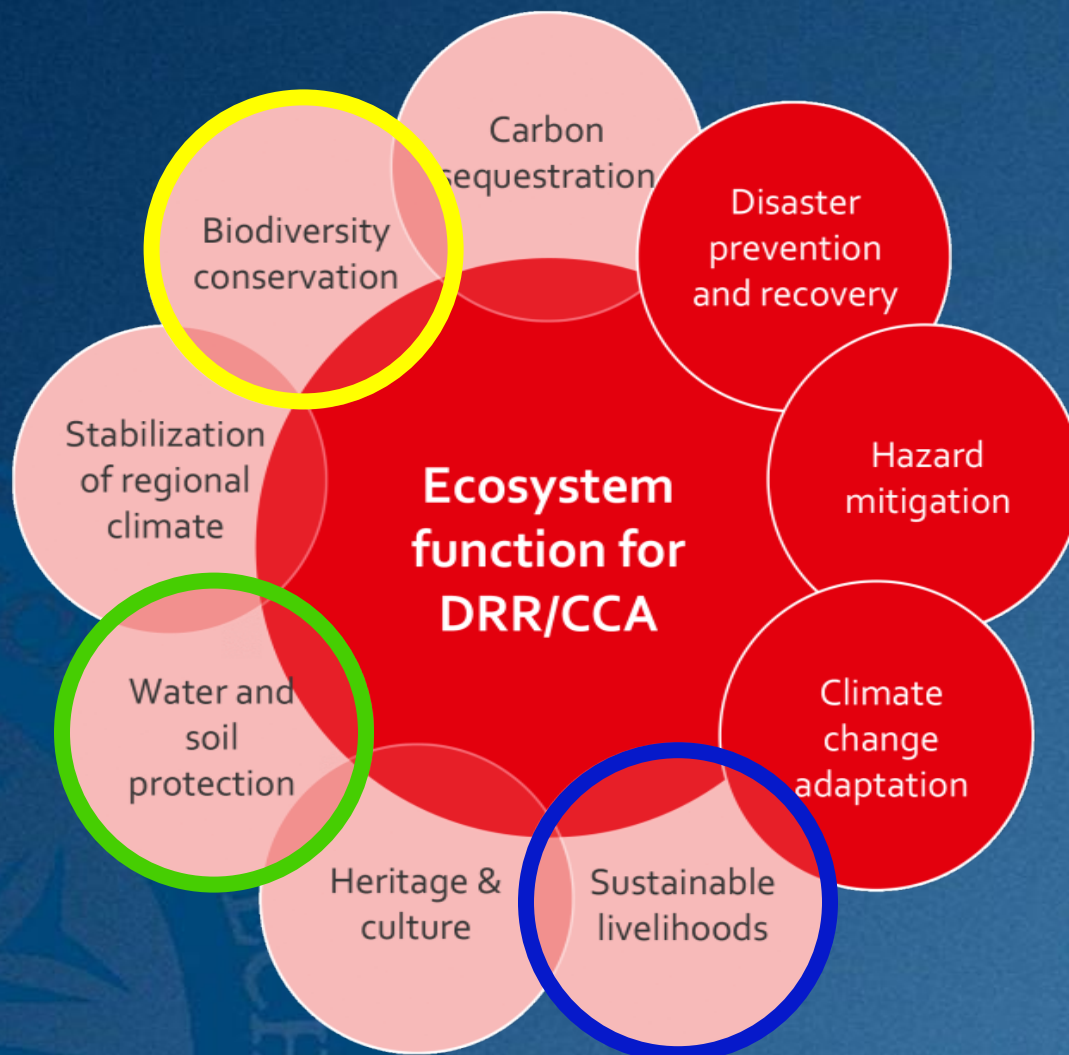
30.7% of land area covered by forest

Nature based solutions and their role for climate action





Strategies of DRR / CCA in ecosystem-based approaches









Food Systems and Nutrition Patterns: Biodiversity, Resilience and Food Security

Dr. Roseline Remans

Senior Scientist

Alliance of Biodiversity International

International Center for Tropical Agriculture (CIAT)

Biodiversity in our food systems has multiple dimensions and multiple roles



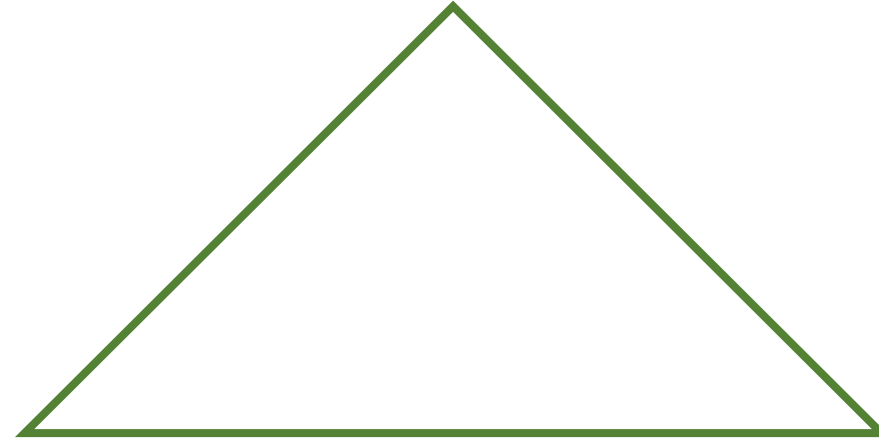
How to make biodiversity's role in food systems
visible and unlock its potential?

F  **C T**

**FOOD AGROBIODIVERSITY
CLARITY & TRANSPARENCY**



10 principles



supply chain
tool

agrobiodiversity
index

10 principles Agrobiodiversity benefits:



1
Healthy soils.
 When farmers follow **regenerative** practices, which includes planting a range of diverse crops, they build soil organic matter, safeguard their water supplies, enhance the environment, and improve the quality of the air they breathe.



2
Resilience to climate change.
 Industrial food production is dependent on chemical fertilizers, pesticides and farm technologies reliant on petroleum. These collectively account for nearly half of all human-generated greenhouse gas emissions. Crops that have grown in a region for hundreds if not thousands of years have proven themselves to be adapted to their environments and often require fewer inputs and water than recently introduced commodity crops. By returning to more biodiversity-friendly crops and farming practices, farmers have greater resilience to climate change.



3
Nutrient security.
 Throughout the world, food has traditionally provided nutrition and been used as a source of medicine. In many rural areas today, people now rely on ultra-processed food primarily produced from four "major" crops (wheat, corn, rice and soybean.) This energy rich, low nutrient diet lacks diversity and often end with diminished nutritional outcomes that lead to obesity, diabetes and cardiovascular disease. Increasing diversity in local food production has been shown to improve health outcomes and provide consumers with greater food security.



4
Livelihoods for women.
 The majority of the world's food is produced on small land holdings. When commodity crops are grown, they often require heavy equipment operated primarily by men. When production returns to more diverse crops, women have greater opportunities to work, and as these crops become more diverse and enter a local food system, women can also produce **value added goods** and find livelihoods across the value chain.



5
Knowledge Sharing.
 Sharing knowledge keeps traditional farming practices alive, and by planting traditionally diverse, bio-regionally adapted crops, farmers protect their natural resources while benefitting from a number of ecosystem services that can lower input costs, provide greater adaptability and increase their resilience to climate change.



6
Seed guardians.
 Growers can establish seed banks and other conservation practices to safeguard the genetic heritage of their crops for generations to come. The in situ and ex situ conservation of seeds also provides farmers with greater food sovereignty and helps strengthen food traditions in their communities.



7
Empower young farmers.
 In most regions around the world, the average age of farmers is nearly 60 years old. Greater effort must go to training the next generation of food producers or valuable knowledge will be lost.



8
Support everyone in the value chain.
 Food grown for local communities can stimulate development and lead to the creation of **value added products** that support local economies.



9
Promote responsible Conservation
 Support practices that safeguard the environment.



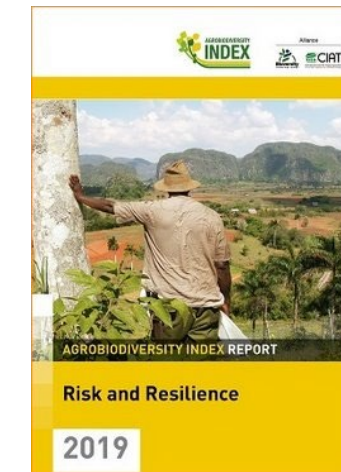
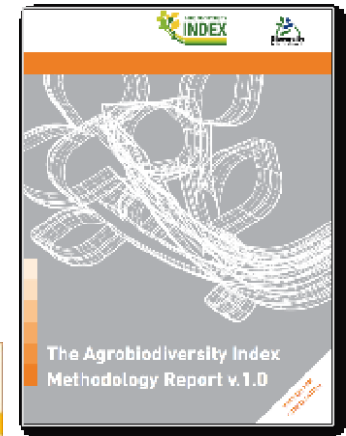
10
Preserve indigenous cultures.
 When a people lose their native foods, they lose their culture. In returning to indigenous foods, communities rediscover not only their traditions, but themselves.

Agrobiodiversity Index

22 indicators building a global grid on multiple dimensions of agrobiodiversity status, actions and commitment along the food system in conservation, production, and consumption

Category	Indicator	Pillar 1 Agrobiodiversity for healthy diets	Pillar 2 Agrobiodiversity for sustainable agriculture	Pillar 3 Agrobiodiversity for current and future use options
Commitment (3 indicators)	Level of commitment to enhancing agrobiodiversity in consumption and markets for healthy diets	Green	White	White
	Level of commitment to enhancing production and maintenance of agrobiodiversity for sustainable agriculture	White	Green	White
	Level of commitment to enhancing agrobiodiversity genetic resource management for current and future use options	White	White	Green
Actions (4 indicators)	Consumption and market management practices supporting the use and conservation of agrobiodiversity	Yellow	White	White
	Production management practices supporting the use and conservation of agrobiodiversity	White	Green	White
	Production diversity based practices	White	Green	White
	Genetic resource management practices supporting the use and conservation of agrobiodiversity	White	White	Yellow
Status (15 indicators)	Varietal diversity	Red	Red	Yellow
	Species diversity	Green	Green	Green
	Functional diversity	Green	Yellow	Yellow
	Underutilized/local species	Yellow	Yellow	Yellow
	Pollinator biodiversity	White	Yellow	White
	Soil biodiversity	White	Yellow	White
	Landscape complexity	White	Green	White

Data availability: Green Largely available Yellow Partially available but needs work Red Important data gap

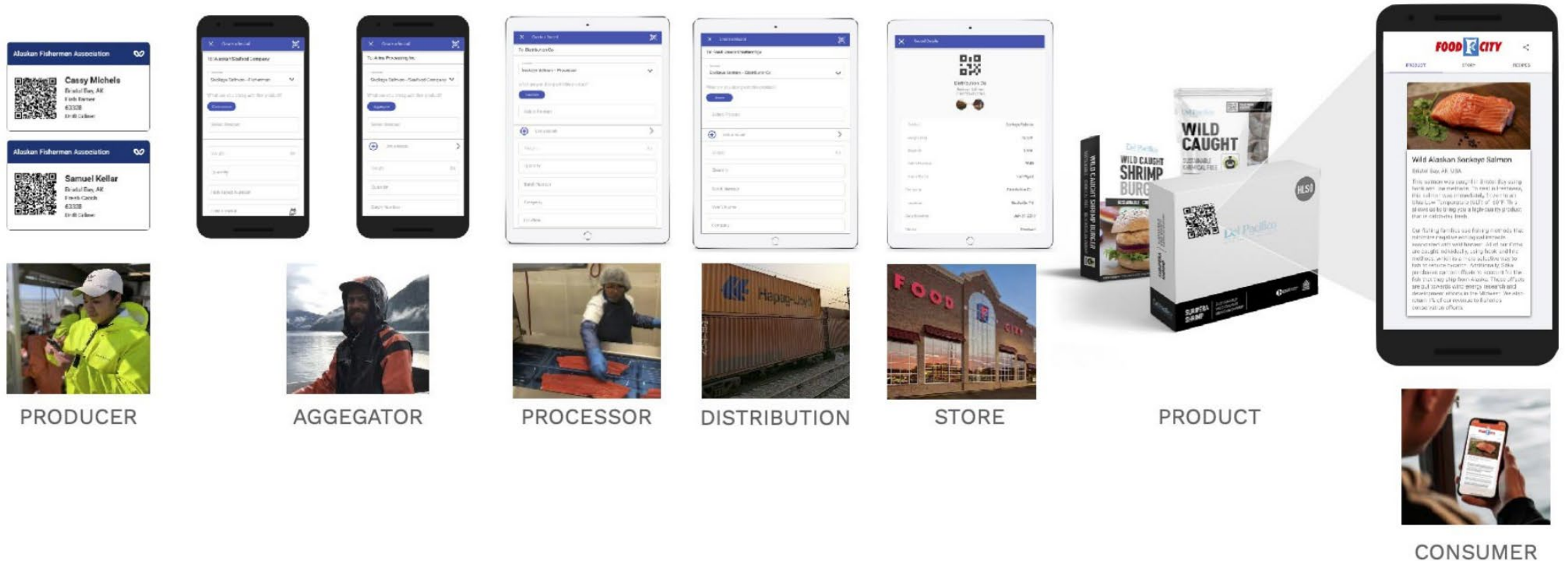


Supply chain tool for traceability & transparency

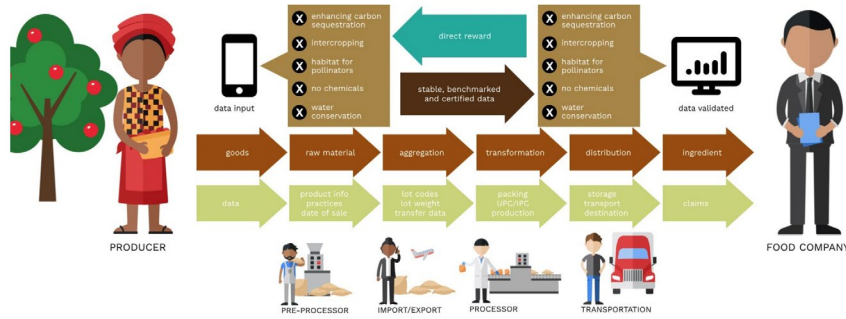


Supply chain tool for traceability and transparency

With Wholechain, records are created as a digital twin to products that accumulate information as they are transferred across supply chain stakeholders.



Supply chain tool for traceability and transparency



Localization and Farmer identity cards

1 FARMER BRINGS THE COMMODITY TO THE FIRST RECEIVER LIKE A COOPERATIVE OR PROCESSOR

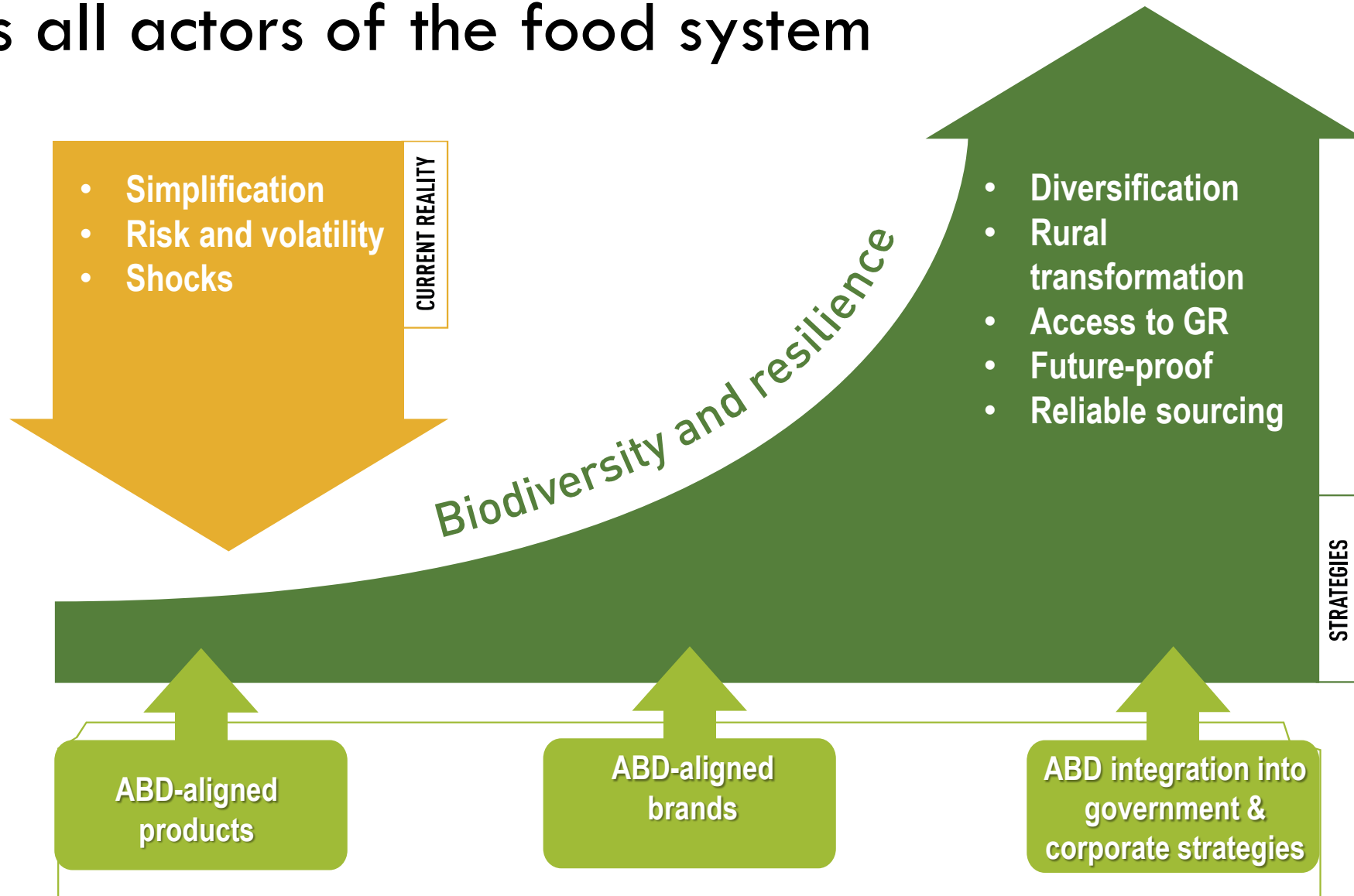
2 FIRST RECEIVER CREATES NEW RECORD IN THE FARMER'S ACCOUNT AND SELECTS THE CORRECT RECORD TEMPLATE

3 COLLECTOR SCANS THE QR CODE ON THE FARMER'S ID AND CONFIRMS THE DATA RECORD



Usability in remote and low connectivity areas

Creating & connecting incentives across all actors of the food system



<https://www.greenbrownblue.com/agrobiodiversity/>



Thank you!

Alliance



Dr. Ir. Roseline Remans
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RESEARCH PROGRAM ON
Water, Land and
Ecosystems



RESEARCH PROGRAM ON
Agriculture for
Nutrition
and Health

Led by IFPRI



Livestock biodiversity for sustainable, resilient food systems

Jimmy Smith

Director General

International Livestock Research Institute (ILRI)

Livestock biodiversity for sustainable, resilient food systems



Better lives through livestock

Jimmy Smith

Director General

International Livestock Research Institute (ILRI)

Food systems and nutrition patterns: Biodiversity, resilience and food security

HLPF SDGs learning, training and practice 2020, session 4

8 July 2020



Livestock biodiversity



- Many species, breeds
- Multiple uses
- Multiple systems
- Multiple ecologies

Conserving livestock biodiversity



ILRI's Azizi ('treasure') biorepository in Nairobi

- No genebank
- Complex, expensive cryo-methods
- Lacking international protocols

Animal genetic resources under threat

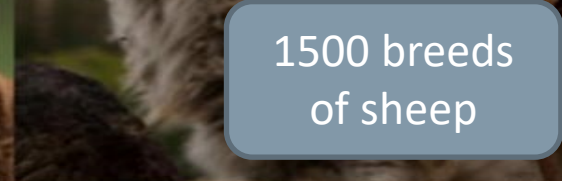
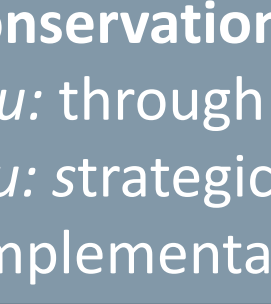


- 38 species; 8774 breeds for food
- 17% of breeds at risk of extinction
- 58% of breeds unknown risk status



Conservation:
In situ: through use
Ex situ: strategic and complementary

750 breeds of pigs



1500 breeds of sheep



1400 breeds of cattle



1800 breeds of chickens



700 breeds of goats

Use: essential roles in food systems

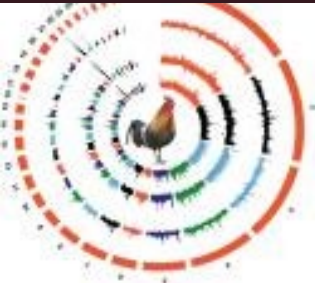


- Food production in all (extreme) environments
- Well managed: contribute to plant and animal biodiversity and thus resilience
- Often a means of adaptation to climate change

Research to tackle new challenges

Cell Research

www.cell-research.com



ARTICLE

863 genomes reveal the origin and domestication of chicken

Ming-Shan Wang^{1,2,3*}, Mahesh Thakur^{4,5}, Min-Sheng Peng^{6,7,8}, Yu Jiang⁹, Laurent Alain François Fantz^{10,11}, Ming Li¹², Jin An Zhang¹³, Sheng Wang¹⁴, Jeroen Peeters¹⁵, Nevenka Ottemo Olesko¹⁶, Chutrongkarn Sasannagorn¹⁷, Xing Guo¹⁸, Zhe-Qing Zheng¹⁹, Ali Esmailzadeh²⁰, Nalini Yasoda Hiranthugoda²¹, Hidayat Akhmal²², Sri Sulada²³



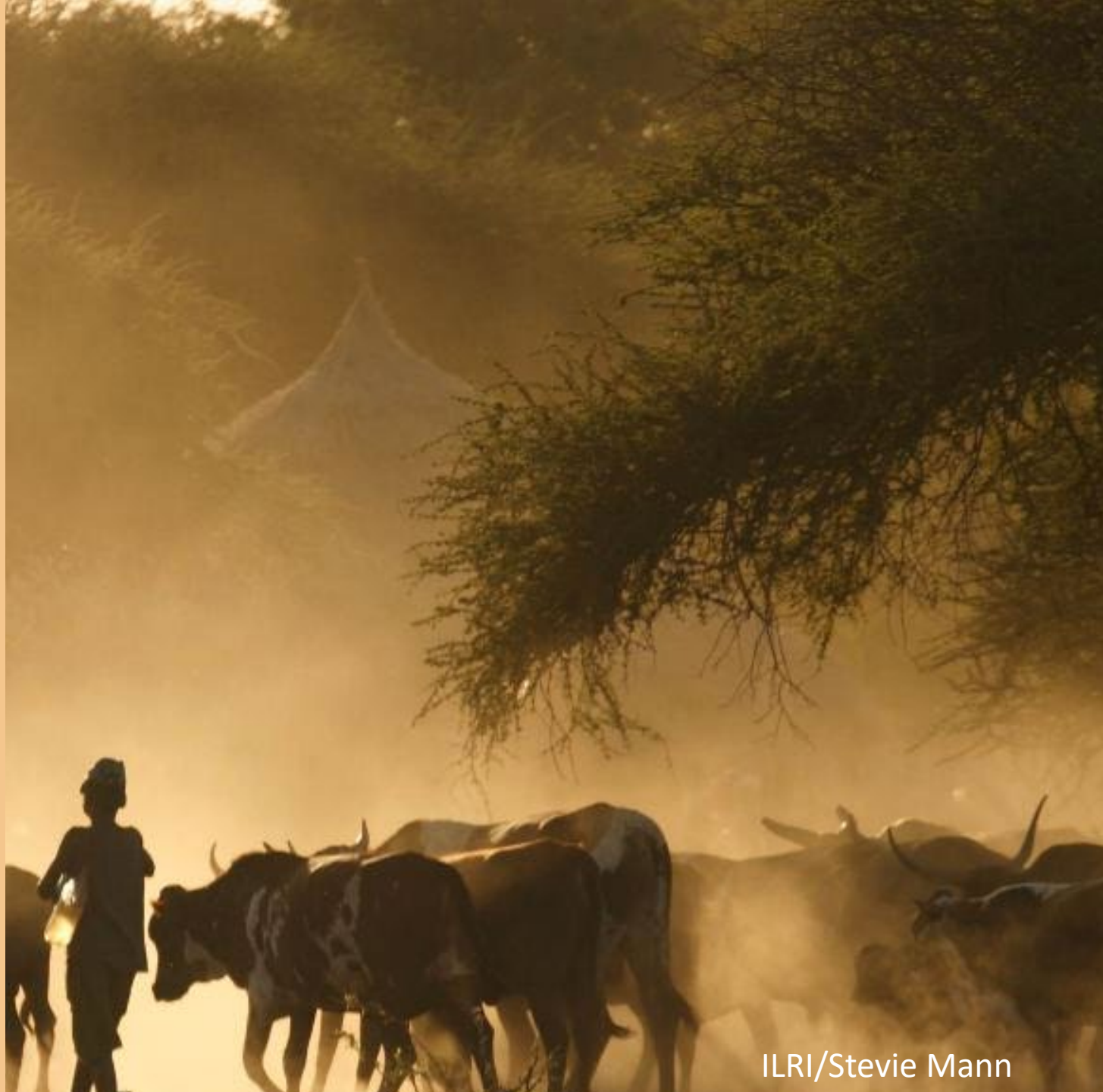
- Understanding diversity
- Genomics: traits for resilience to new stresses
- Deploying diversity

Livestock biodiversity

Multiple dimensions


Conservation depends
mainly on use

Essential for sustainable,
resilient food systems





ILRI

The International Livestock Research Institute (ILRI) is a non-profit institution helping people in low- and middle-income countries to improve their lives, livelihoods and lands through the animals that remain the backbone of small-scale agriculture and enterprise across the developing world. ILRI belongs to CGIAR, a global research-for-development partnership working for a food-secure future. ILRI's funders, through the [CGIAR Trust Fund](#), and its many partners make ILRI's work possible and its mission a reality. Australian animal scientist and Nobel Laureate Peter Doherty serves as ILRI's patron. You are free to use and share this material under the Creative Commons Attribution 4.0 International Licence .

*better lives
through
livestock*

ilri.org



Biodiversity and healthy ecosystems are essential to food security

Rene Castro

Assistant Director, Biodiversity

Food and Agriculture Organization of the UN (FAO)

Biodiversity and healthy ecosystems are essential to food security



Food systems and
nutrition patterns:
Biodiversity, Resilience
and Food Security

Rene.castro@FAO.org

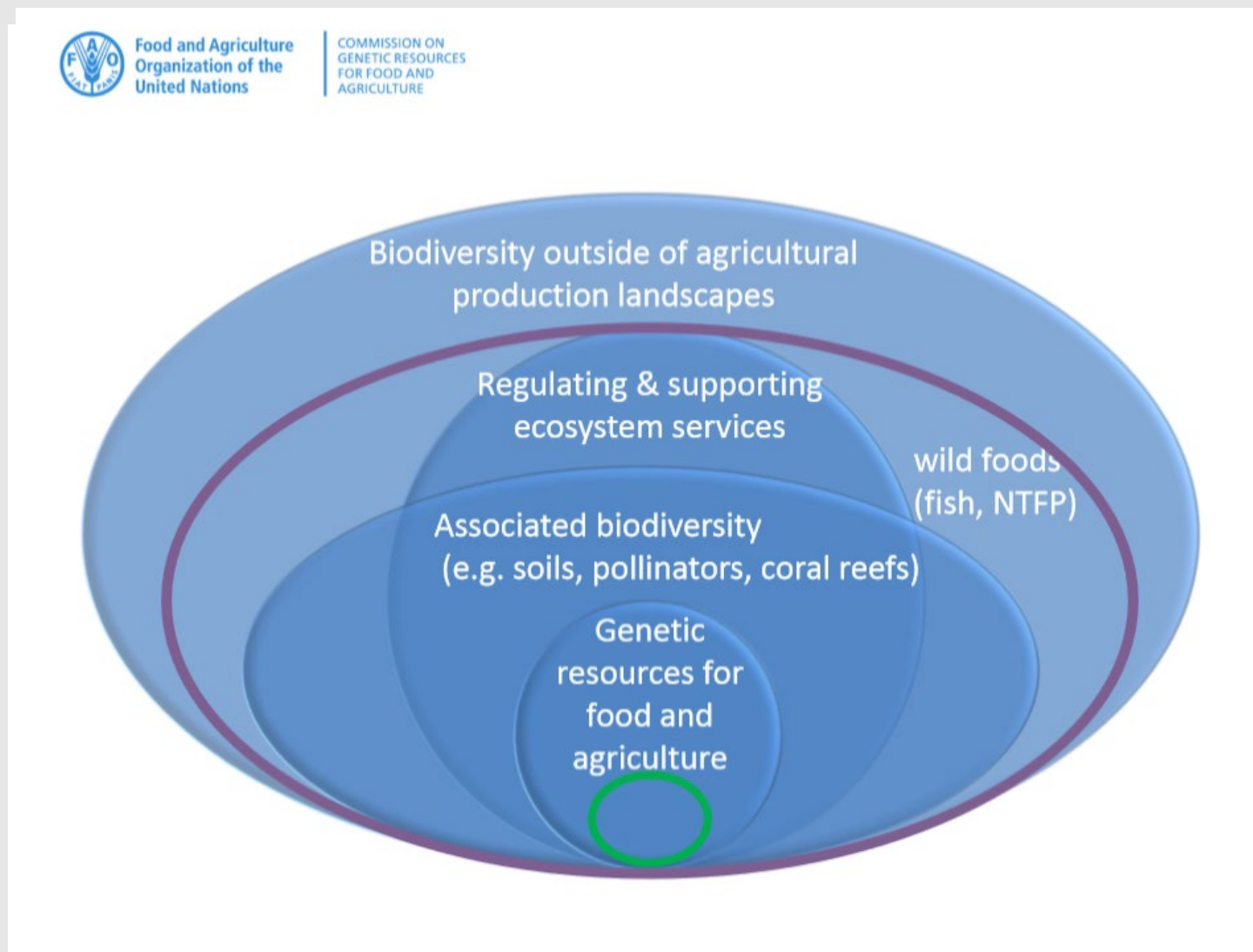
NY, June 8 2020

The COVID 19 waves should not be followed by a food security crisis and a climate Tsunami;



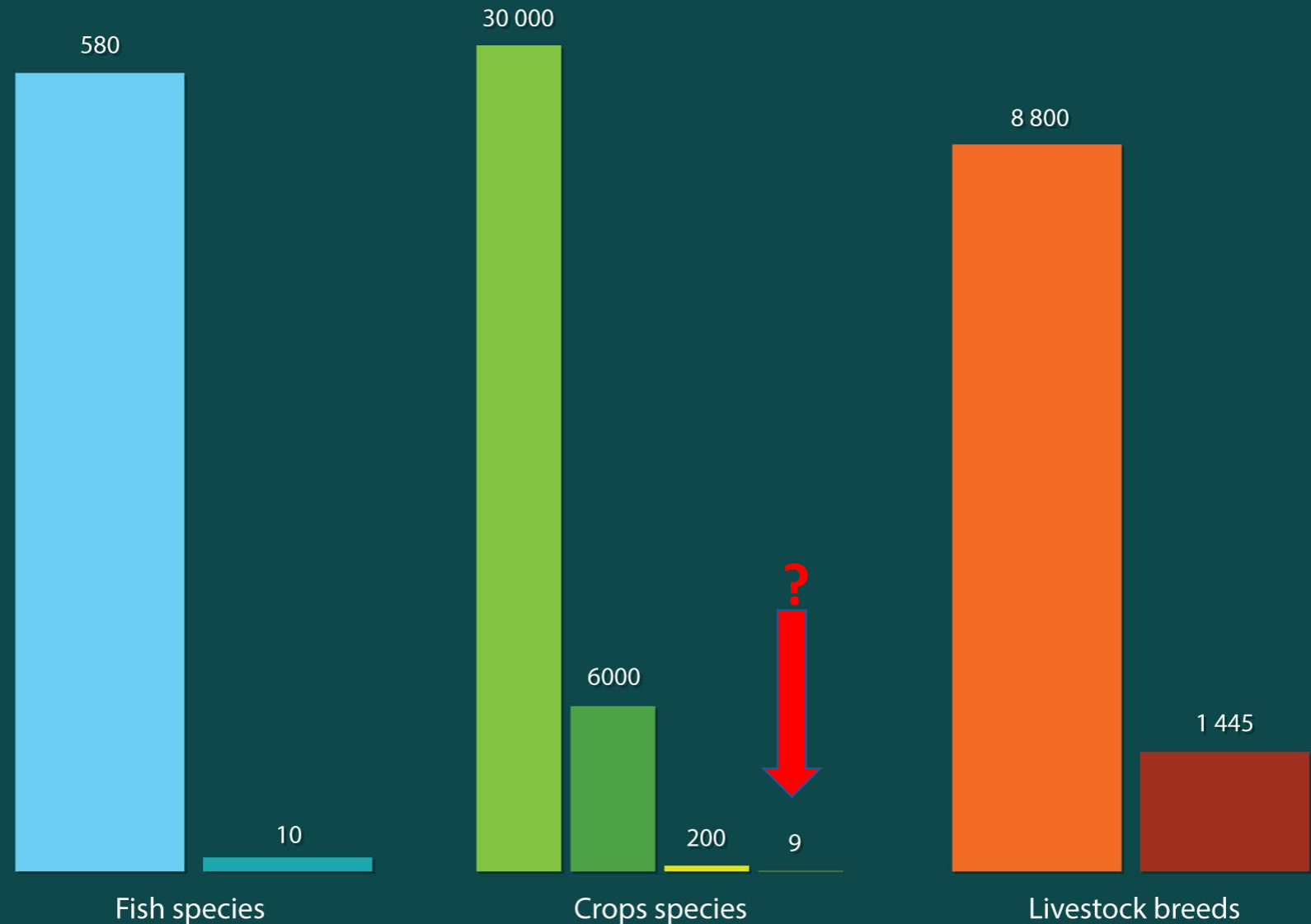
Ref: Cartoon cited by Andrew Chakhoyan, LinkedIn June 2020.

What is biodiversity for Food and Agriculture?



Biodiversity for food and agriculture is declining

(<http://www.fao.org/3/CA3129EN/CA3129EN.pdf>, FAO 2019)



Sources:

FISH SPECIES: State of the World's Fisheries and Aquaculture, 2018

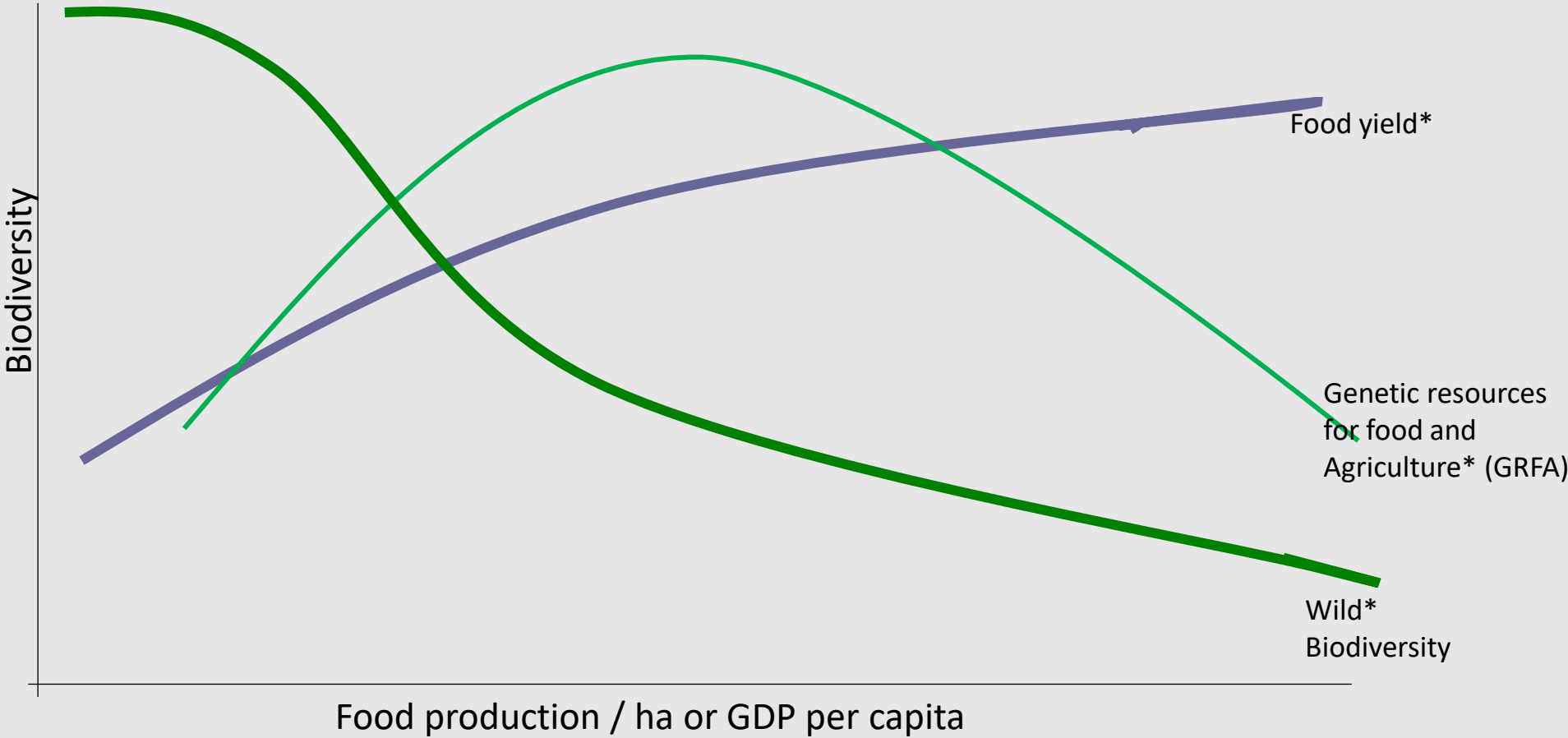
CROP SPECIES (Left to right): 1 -RBG Kew. 2016. The State of the World's Plants Report - 2016. Kew, UK, Royal Botanic Gardens.

2- IPK. 2017. Mansfeld's World Database of Agriculture and Horticultural Crops. [Cited 25 June 2018]. <http://mansfeld.ipk-gatersleben.de/apex/f?p=185:3>

3&4 -FAO. 2017a. FAOSTAT. [Cited 8 May 2018]. <http://www.fao.org/faostat/en/>

LIVESTOCK BREEDS: Domestic Animal Diversity Information System maintained by FAO. <http://www.fao.org/dad-is>

Biodiversity for food and agriculture is declining**



Ref: *Adapted from FAO presentation at 8th Trondheim Conference on Biodiversity 2016
**State of the World 's Biodiversity for Food and Agriculture, FAO 2019

Biodiversity in agriculture is key for nutrition and health



Utin lap Banana

B-carotene content= 8508 mcg/100g

Banana intake (g/d/p) = 93

Reference Daily Intake (RDI) for Vit A covered = 220%

by banana intake (%)



Cavendish Banana

B-carotene content= 26 mcg/100g

Banana intake (g/d/p) = 93

RDI for Vit A covered = 0.7%

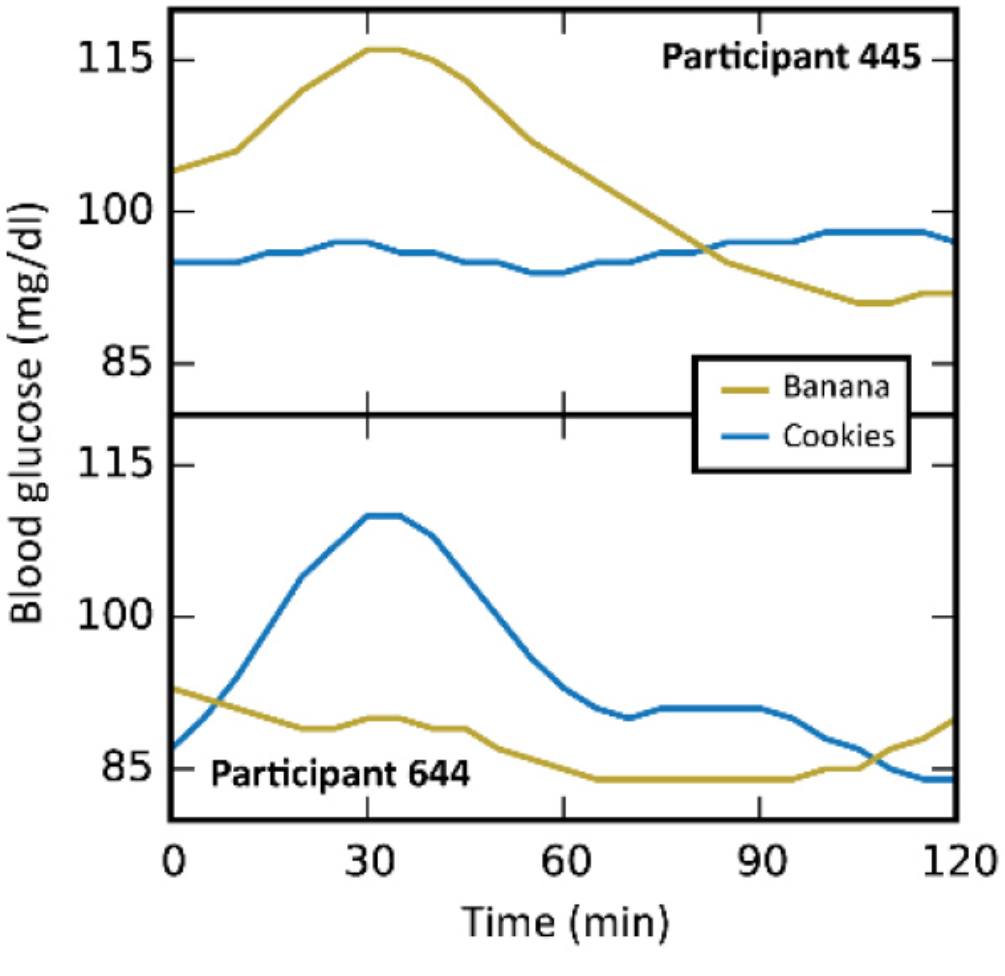
by banana intake (%)

Australian cultivars to fight malnourishment in women and children

TABLE 3. Comparison of selected ripe raw banana cultivars for impact on vitamin A intake in terms of recommended safe intake (RSI)

Local name of cultivar ^a	β -Carotene equivalents ^b /100 g	RAE ^c (μ g/100 g)	RE ^d (μ g/100 g)	Fruit weight needed to meet 50% of RSI for non-pregnant, nonlactating woman ^e (g)	Fruit weight needed to meet 50% of RSI for pre-school child ^f (g)
<i>Asupina</i>	1,554	130	259	97	77
<i>Kirkirnan</i>	1,089	91	182	137	110
<i>Pisang Raja</i>	976	81	163	153	123
<i>Horn Plantain</i>	946	79	158	158	127
<i>Pacific Plantain</i>	589	49	98	255	204
<i>Kluai Khai Bonng</i>	556	46	93	269	215
<i>Wain</i>	532	44	89	281	225
<i>Red Dacca</i>	367	31	61	410	328
<i>Lakatan</i>	354	30	59	424	339
<i>Sucrier</i>	333	28	56	446	357
<i>Lady Finger</i>	178	15	30	833	667
<i>Williams</i>	119	10	20	1,250	1,000

The Personalized diet: Individual Biome theory for better nutrition



Ref: The Personalized Diet
Eran Segal, PhD , and Eran Elinav, MD, PhD 2017

Growing (Mal)nutrition...and food waste

821 million
hungry

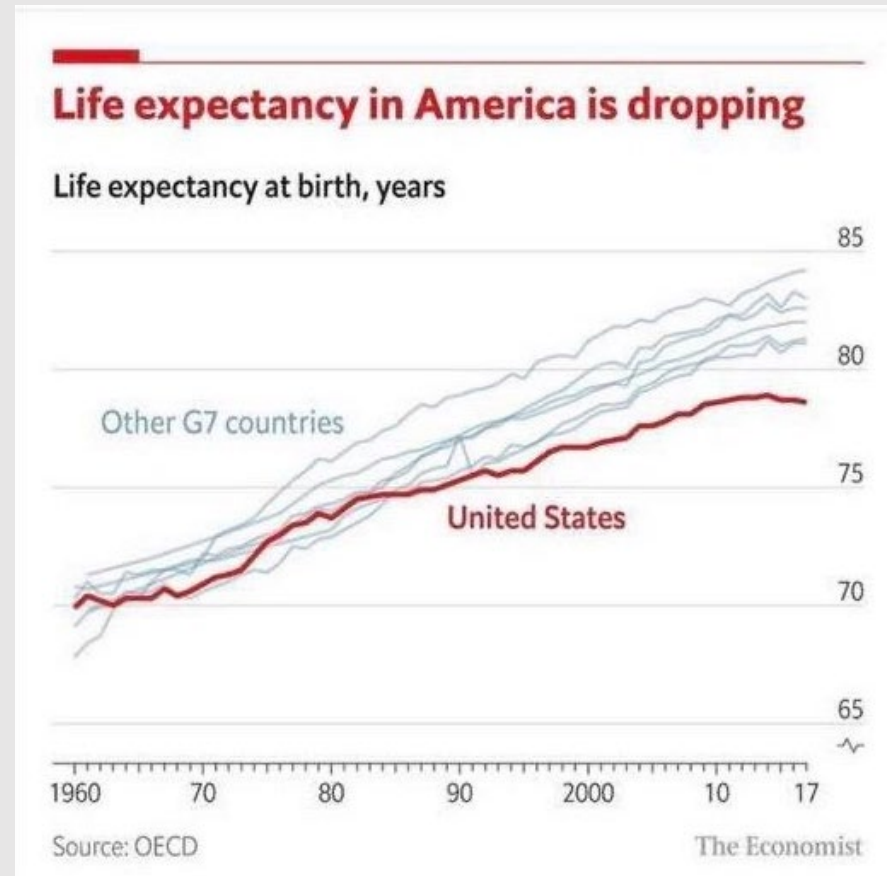
1.9 billion
overweight



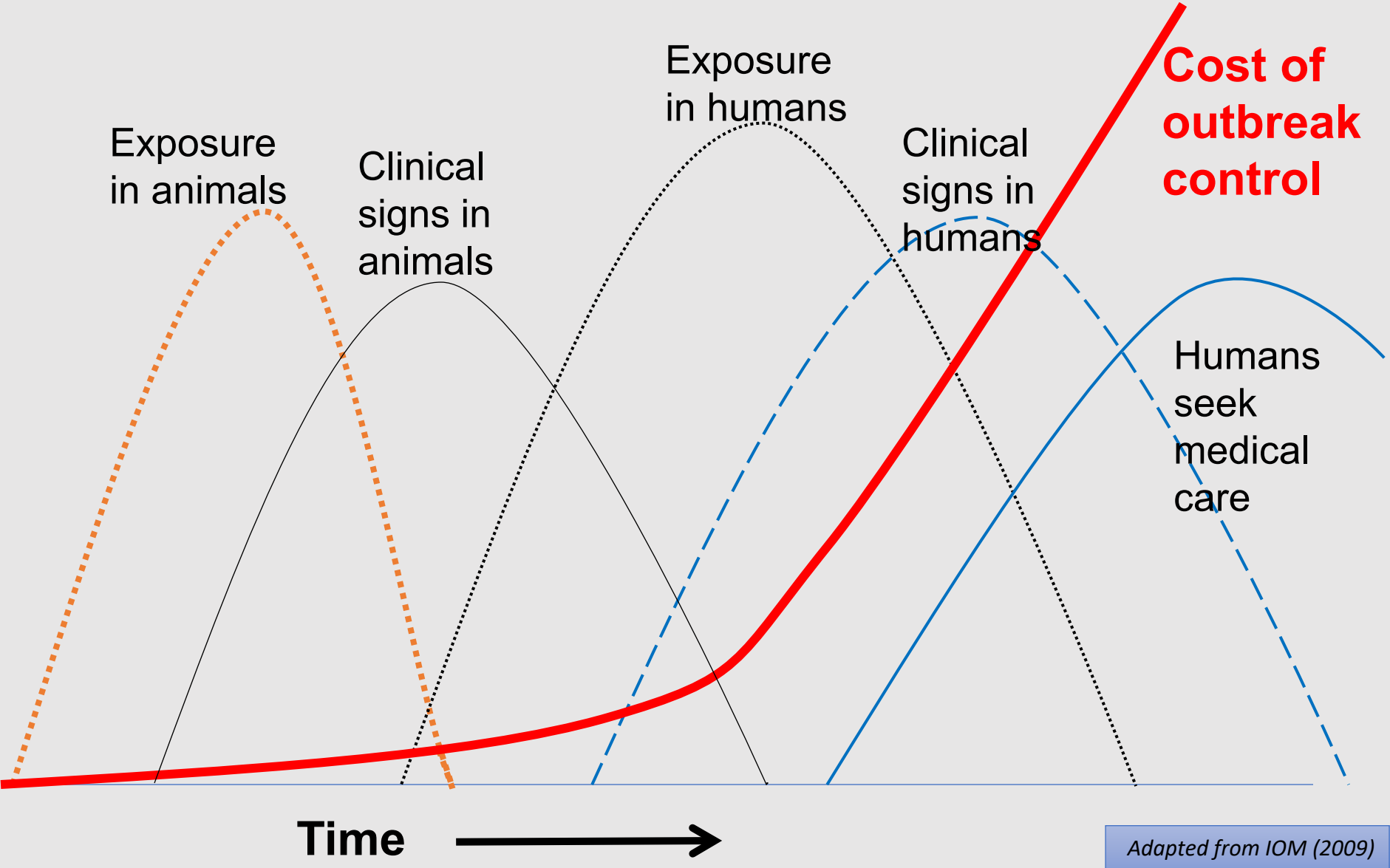
Conclusions: If we fail?

Life expectancy falling, more zoonotic diseases emerging and forced permanent migration and social chaos will follow.

Life expectancy falling in US and other OECD countries



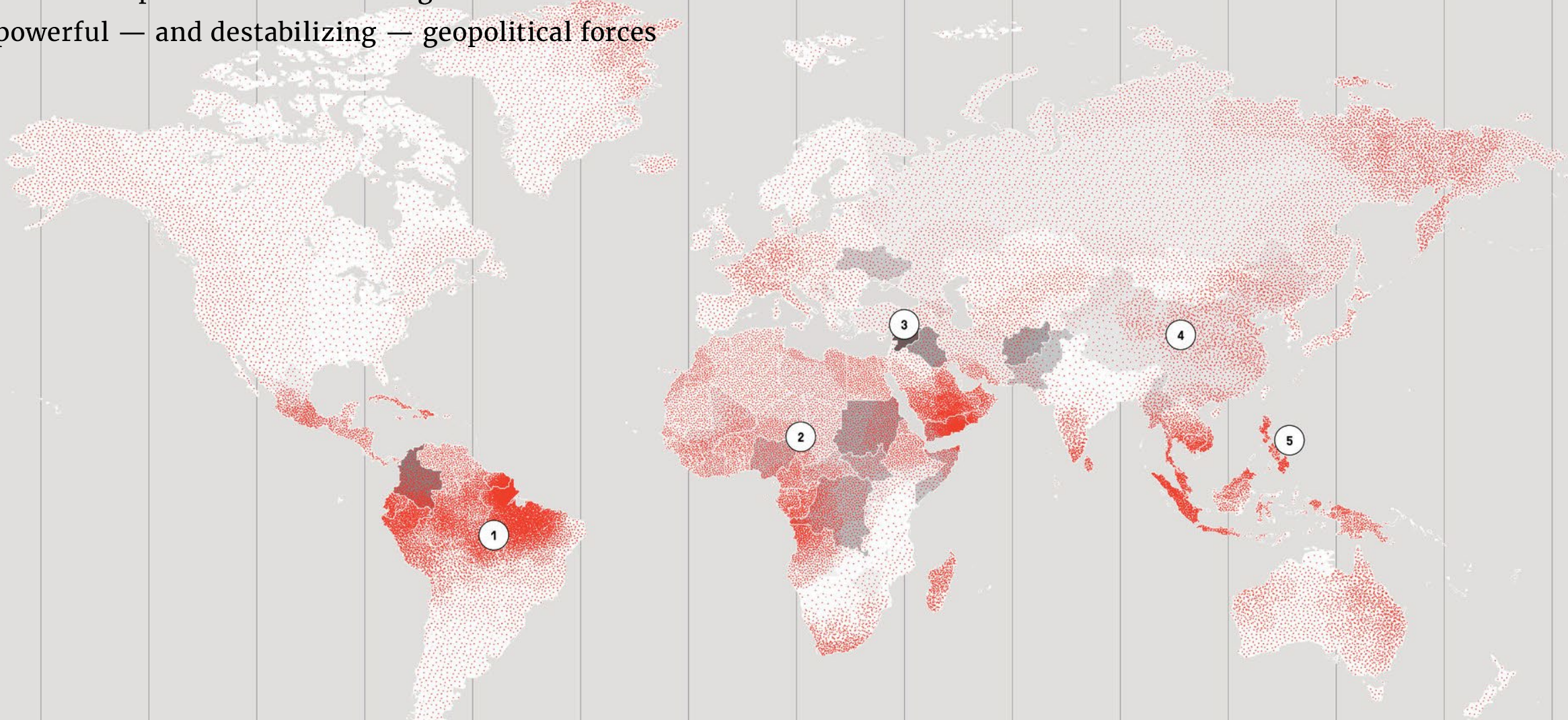
Root causes in zoonotic diseases spreading (like COVID 19). World needs One Health' approach: stop contagion at its animal source.



Ref: cited by Olga Jonas , Senior Fellow at Harvard Global Health Institute, June 16, 2020 as adjusted from OMI 2009; cited by Andrey Kuskin, LinkedIn, June 2020

How a Warming Planet Drives Human Migration

Climate displacement is becoming one of the world's most powerful — and destabilizing — geopolitical forces





Final Questions and Comments



THANK YOU

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