Digital Earth & AI for Bridging Data Gaps in Climate Action: A Pacific Case

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Presentation Outline

- Introducing **Papua New Guinea – A Pacific-SIDS Case**

- SDG 13*: **Urgent Call to (Climate) Action** in Pacific

- PNG: Highest **regression** in SDG 13.1

- PNG 2024 Landslide: **Reliability** of SDG 13.1.1 indicator

- **Bridge Gaps** with *Digital Earth & AI* for SDG 13.1.1

- "*Indicators we have*" vs "*Indicators we want*"

- **Starting Small**: Addressing SDG 13.1.1 within *Academia*

- **Final Thoughts**

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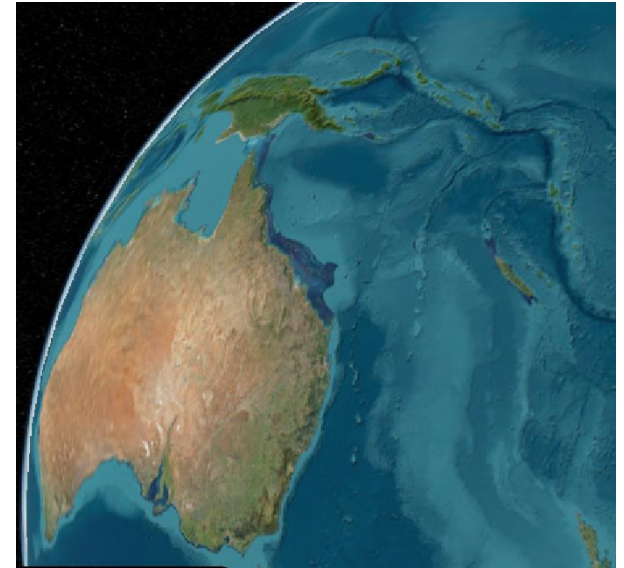
Introducing **Papua New Guinea**: A Pacific-SIDS Case

- Papua New Guinea (PNG), since 1975
  - ❑ Land of a 1000 tribes; 850 languages
  - ❑ 50th Independence Anniversary
  - ❑ Largest of Pacific Islands & SIDS
  - ❑ Shared challenges & vulnerabilities

"A resilient Pacific Region of peace, harmony, security, social inclusion and prosperity, that ensures all Pacific peoples can lead free, healthy and productive lives."

- PNG part of **Blue Pacific Continent**
  - ❑ *Collective identity:* 3 cultural-geographical sub-regions
  - ❑ 35% of SIDS, 60-70% ocean share
  - ❑ **Shared vision**: *2050 Strategy for the Blue Pacific Continent* (2022)
  - ❑ **New SDG Indicators** to close monitoring gaps
    - **Focus**: collective, culturally appropriate, and resilience-focused measures

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SDG 13. CLIMATE ACTION
Take urgent action to combat climate change and its impacts
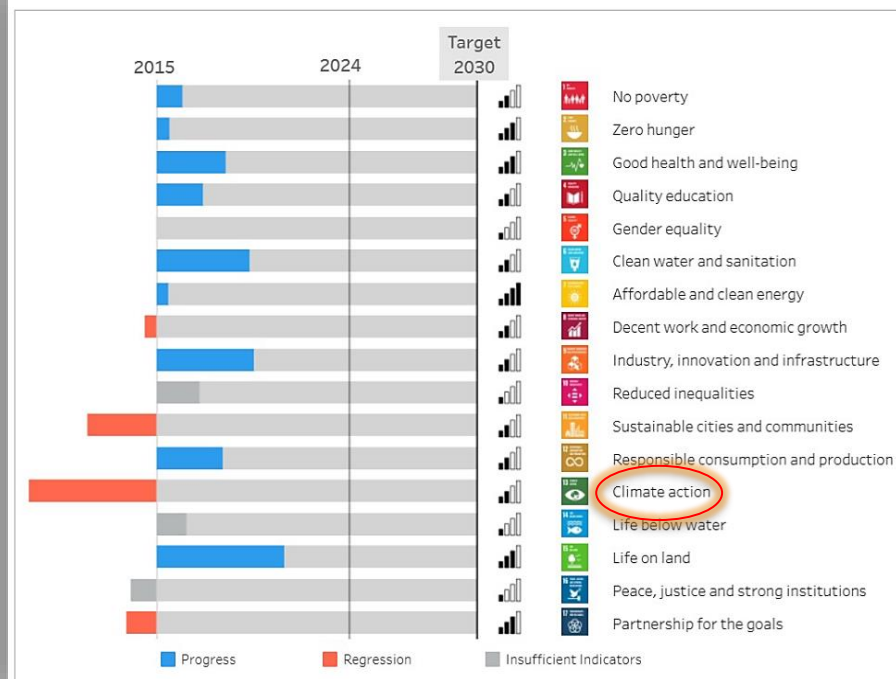
The Pacific Case

The PNG Case

Figure 1. Progress on Sustainable Development Goals in Asia and the Pacific, 2023

Support for climate action across Asia and the Pacific requires urgent attention
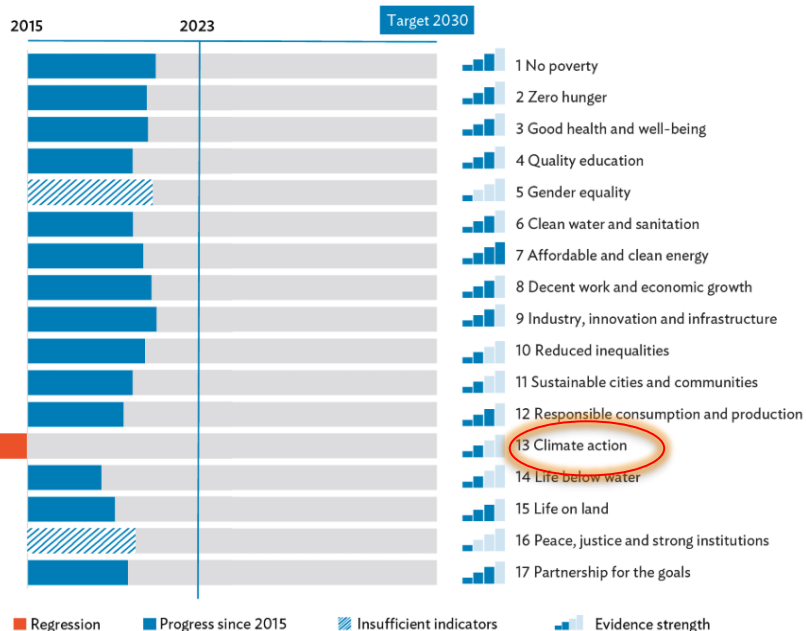
Figure 1. Snapshot of Progress developed with ESCAP Methodology

PNG 2025 NVR)

"Climate action is regressing alarmingly in Asia and the Pacific"
*ADB Key Indicators Database 21, Aug 2024*

The **PNG Case**:
## Data Gap Impact on Climate Action (SDG 13)

- **National SDG 13**: A Strategic Priority Area

- **Key challenge**: Data gaps & weak monitoring

- **Targets measured**: 86/169 SDG - 16% progressing, 44% need acceleration, 40% need reversing

- **SDG 13.1.1** indicator - strong negative trends

  – Numerator from UNDP, Weather Service, Health centres, Defence etc.

  – Denominator from National Statistics

Figure 2. Current Trajectory of 169 targets measured

Maintain
Accelerate
Reverse
Not assessed

14
38
35
82
169
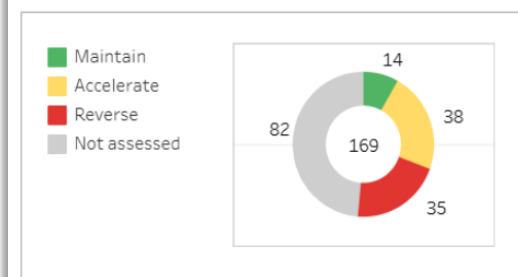
PNG 2025 NVR

Figure 41: Progress of selected indicators in Goal 13
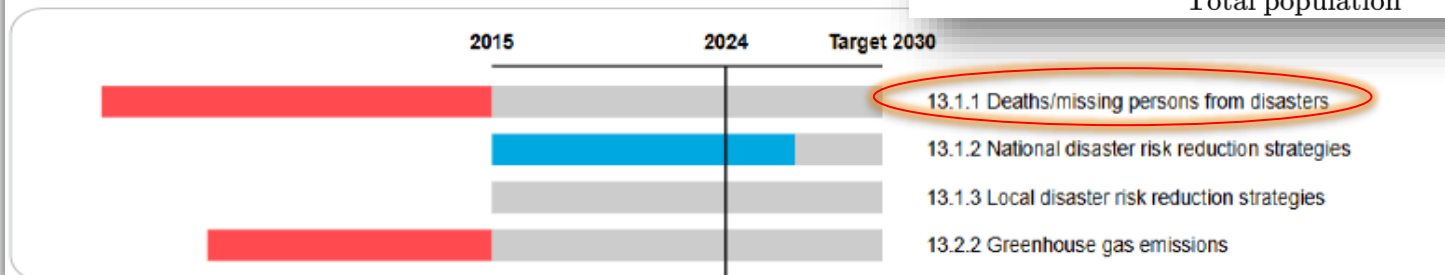
	2015	2024	Target 2030
			13.1.1 Deaths/missing persons from disasters
			13.1.2 National disaster risk reduction strategies
			13.1.3 Local disaster risk reduction strategies
			13.2.2 Greenhouse gas emissions

$$SDG\ 13.1.1 = \frac{Deaths + Missing + Affected}{Total\ population} \times 100,000$$

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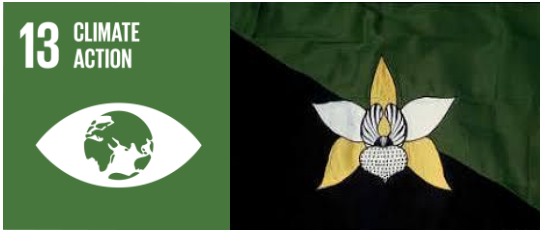
Enga Landslide (2024)
Reliability of Population Baseline Data

Papua New Guinea PM blames extraordinary rainfall for deadly landslide

James Marape says the estimated death toll is more than 2,000 people, as rescue efforts in Enga province continue

UN estimates more than 670 killed in Papua New Guinea landslide

Authorities are trying to establish evacuation centres on safer ground on either side of the massive swath of debris.

People in Papua New Guinea react as they search for through a landslide in Yambali village on Monday. Photograph: Juho Valta/AP

CHINADAILY HONG KONG

NEWS > Asia > Content

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More than 2,000 buried alive in PNG landslide, local authorities say

By Reuters

Villagers search through a landslide in Yambali, in the Highlands of Papua New Guinea, May 26, 2024. (PHOTO / AP)

".. it is difficult to get an accurate estimate of the local population,.. PNG's last credible census was in 2000 and many people live in remote mountainous villages."

- **Populations at Risk** from National statistics:
  - *Pop. Census Data - 2000 (reliable), 2011 (credibility?), 2020-24 (pending)*
  - Housing Income-Expenditure Survey & Demographic Health Survey (*out of date*)
  - Use of *proxies* to estimate

Bridging Data Gaps with DE + AI
Challenges in ***Pop. Vulnerability Estimation***

- Reliability of **Proxies** - for pop. statistics & geospatial (e.g. Glimmer), no ground truth

- Multiple data sources/types - Geospatial, national statistics, *others*

- Different granularity in **location** & **time** dimensions
  - *Geospatial -* fine grain <u>image</u>
  - *Statistic -* coarse grain (tabular) <u>time series</u>

- **Data integration**
  - Best method to combine? fuse/ condition/ meta/ auxiliary/ priors etc.

- **Data quality**:
  - *Geospatial -* low resolution images
  - *Timeseries -* uneven length in time lengths, sparsity

- Uncertainty measure
  - From data and model
  - How to measure? How to decrease? How to validate?

Bridging Data Gaps with DE + AI
Opportunities *in Pop. Vulnerability Estimation*

- **Key focus**: **Improve reliability** of *baseline data* *for SDG 13.1.1. indicator*

- **Impact**: Also improves reliability of 12/17 SDGs dependent on pop. Data

- **Research Question**: How **reliable** are proxy indicators for census-based SDG targets? **How to improve** using DE & AI?

- **Existing research** (geospatial + pop. data):
  - Does night-time lights improve prediction from sparse demographic-health survey? (Weber et al., 2018)
  - How to quantify uncertainty when survey counts are sparse? (Leasure et al., 2020)
  - Fill in census gaps in insecure districts. (WorldPop/UNFPA technical report, 2019)

- **Modelling**:
  - Tree-based algorithms + Bayesian hierarchical models; *cGANS, Diffusion models*
  - *Explore: Neighbour. Inference; Timeseries change detection; PINN models; Directional-CNN etc.*

13 CLIMATE ACTION

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Looking Ahead with Strategic Foresight
"Indicators we have" vs "Indicators we want"

- *Preferable future*: "*Measurable increase in reliability of SDG Indicators*"

- **Practical Entry Points**:
  - **Map Skills-base** – Uni.PNG – MSCS + Env. Sc. + Earth Sc. + Public Policy + CBAS (+ Others)
  - **Data + tools**:
    - **Data** - NSO fragments, DHS/HIES, Rural Household Survey, Geospatial (CBAS), public datasets
    - **Tools** - CBAS EarthMiner, CASEarth, Google Earth
  - **Partnerships**: Gov., National Statistics Agencies, Pacific + SIDS (participants), CBAS, ISDE,..

- **Starting Small**:
  - SDG 13.1.1. Improving denominator (populations at risk)
  - "In-house" pilot study at Uni.PNG

$$SDG\ 13.1.1 = \frac{Deaths + Missing + Affected}{Total\ population} \times 100,000$$

- **Urgent Need**:
  - **Build capacity** for *Geospatial Analysis using open data + tools* at Uni.PNG

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Strength & Challenges:
At the *University of PNG*

- **Pioneer** in **GIS & RS** education in PNG (20+ years)

- **Leading** national producer of EO expertise - 25-30 graduates + **75-150 professionals** (incl CCDA) trained yearly

- **Only** Earth Science (1973) and **Statistic** (1966) in PNG

- **Maths, Statistics & Computer Science** (MSCS) **mordernising** for **AI**

- **Research centers**: RS Center closed, None (yet) for MSCS, ES center

- **Infrastructure**: Internet constraints; no HPC; low resource/funding

- **Capacity**: 1 staff + 2 tutors, limited training opportunities (spatio-temporal data, radar & LiDAR, drones, AI, Geo-tech); 1 PhD in CS, 1PhD statistics

- **Silos** – Institutional (Industry-Academia), Academic (cross-discipline)

- **Climate Education**: SDG 13.3 **A lagging priority**.
"*Still pending*" NVR PNG 2025

My Final Thoughts

- **Digital Earth & AI high potential in bridging gaps**
  - Provide shared platform to track SDG progress despite weak national systems.
  - Need *participation*, *partnerships* & supporting *policy*
  - Build technical & research capacity
- **PNG - a special case?**
  - Landslides uncommon among SIDS, but isolation is not!
- **Case by case, indicator by indicator**
  - What do we (each SIDS) offer to Digital Earth for SDG? Our insight, our solutions
  - Derive inspiration from other SIDS – e.g. Story of Seychelles on TA
- **Peculiarities as strengths:**
  - Culturally appropriate, aligned with value system (what matters); language barrier
  - Improvise/build on established systems & norms
  - High flexibility for adaptability
- **Together we can do it.**