

# Climate Adaptation “Lessons from Papua”

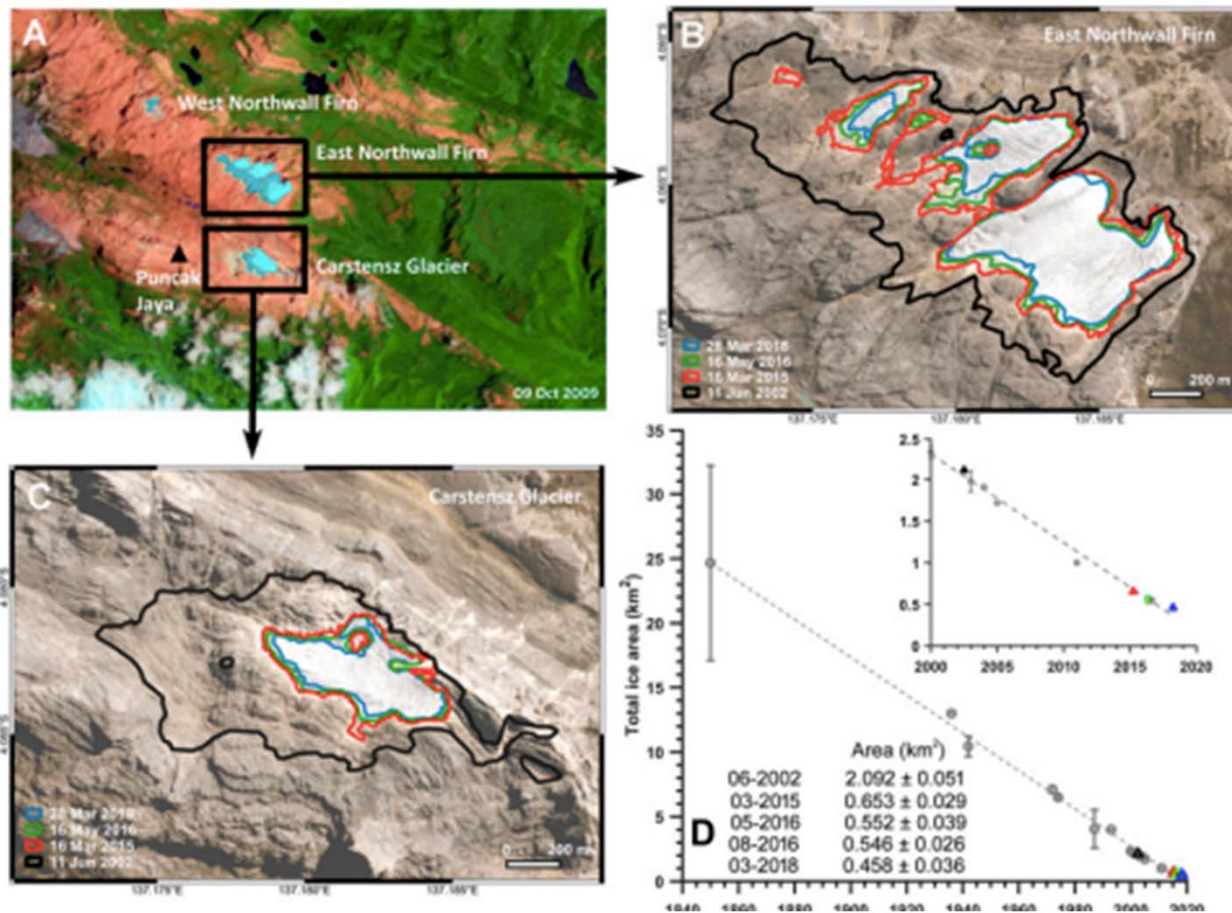


Iqbal Elyazar  
Principal Lead  
SHIELD PAPUA

[www.shieldpapua.id](http://www.shieldpapua.id)

Oxford University Clinical Research Unit Indonesia

# Climate Change Signals



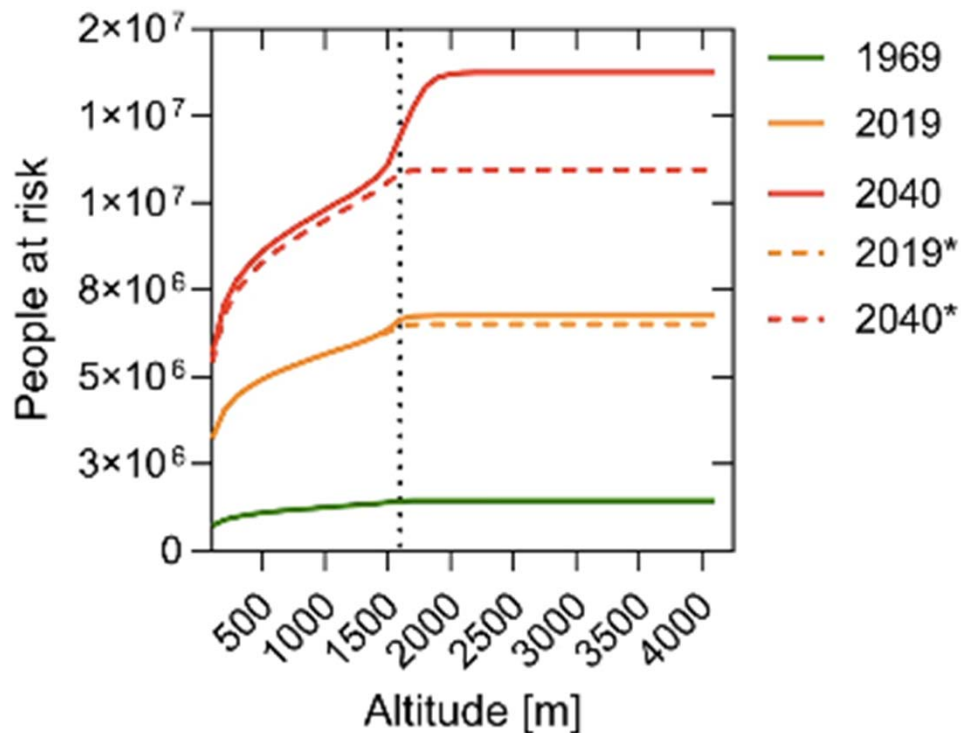
The last tropical glaciers are vanishing.

This signal reflects accelerating regional warming.

It is a live, unfolding crisis happening now

Permana DS, et al. Disappearance of the last tropical glaciers in the Western Pacific Warm Pool (Papua, Indonesia) appears imminent. Proc Natl Acad Sci U S A. 2019 Dec 26;116(52):26382-26388.

# Why This Matters



**Figure 5.** Cumulative population at risk estimates over altitude in 1969, 2019 and 2040. Solid lines are estimates accounting for population growth and climate change. Dashed lines (labeled \*) are estimates accounting only for population growth (i.e., using the  $R_0$  estimates of the 1960–1969 period). The vertical dotted line is the current insecticide-treated net distribution altitude threshold.

- Expand the malaria transmission range and population at risk
- Climate change = health system risk

# Environmental Drivers

- **Rapid forest loss at scale (~189,000 hectares per year)**, driven largely by conversion to industrial oil palm concessions.
- **Disaster intensity is being structurally amplified.** Extreme rainfall events are increasingly translating into **high-impact landslides and flash floods**. In **2019**, a single episode caused **>100 deaths, displaced over 4,000 people, and damaged ~500 homes**. The magnitude of this disaster was not incidental: it was **systemically intensified** by deforestation on steep slopes, expansion of settlements into debris-flow corridors, and inadequate drainage infrastructure.
- **Peatland fire risk is extensive.** Papua contains **~3.9 million hectares of peatland**, with **~620,000 hectares classified as highly fire-prone**.

# Redrawing The Risk

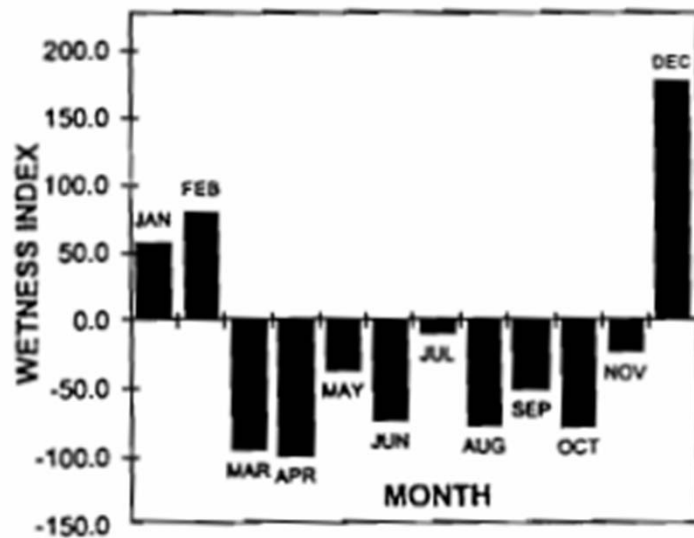


Fig 6—Annual precipitation deviation in Wamena, Irian Jaya, measured as a degree of 'wetness index' with respect to monthly 1973-96 mean (baseline = 0.0) compared to matched monthly indices in 1997. Monthly index computed as total rainfall x total rain days / total days in month. Those months below the baseline represent decreased rainfall and rain days.

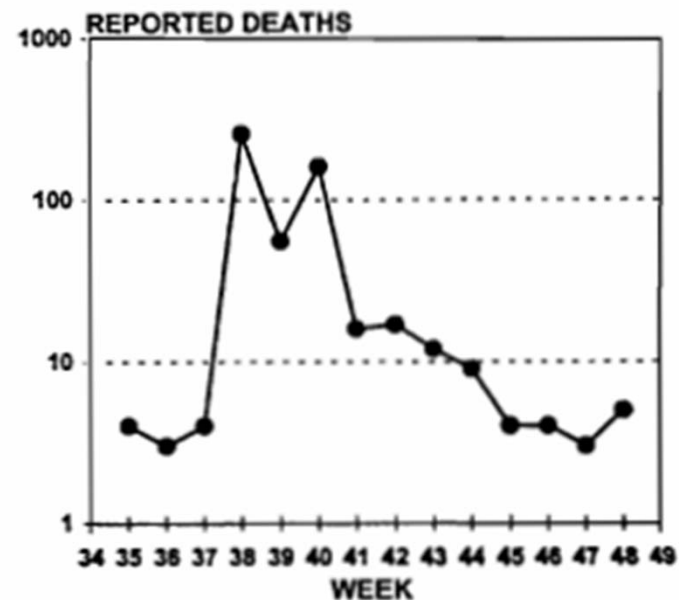


Fig 2—All reported drought-related deaths ( $\log_{10}$  scale) during the height of the highland epidemic beginning week 35 (24-30 August) to week 49 (1-7 December) 1997 as reported from 25-32 health stations in Jayawijaya district, Irian Jaya.

**Drought and food shortage; population moved from highland → lowland → highland. >550 deaths recorded**

Bangs MJ, Subianto DB. El Niño and associated outbreaks of severe malaria in highland populations in Irian Jaya, Indonesia: a review and epidemiological perspective. Southeast Asian J Trop Med Public Health. 1999 Dec;30(4):608-19.

# Reshaping Food Security

**A single crop sustains entire systems.**

In the highlands, sweet potato is the **primary daily calorie source**, anchoring food security for entire communities.

The same crop feeds pigs, the backbone of the ceremonial economy. Through pig feast, meat is redistributed, **protein is shared**, and **social ties are actively maintained**.

**When yields fall, the system fractures.**

Declining productivity do simply reduce food supply and **disrupts exchange networks**, weakens **nutritional safety net**, and heightens risks of **malnutrition, inequality, and social instability**.



# Reshaping Food Security

## A lifeline rooted in the forest.

In lowland and swamp regions of Papua, sago is the **core carbohydrate source** and a **critical buffer against hunger** when other foods fail.

## Climate shocks sever access at the worst moment

Droughts and floods damage crops and **cut communities off from sago forests**, disrupting harvest cycles precisely when reliance on sago is highest.

## Crisis forces dangerous coping strategies.

When fresh sago becomes inaccessible, households turn to **aged, improperly stored reserves**, often kept under unsafe, humid conditions.

## A hidden but lethal consequence.

This shift has been directly linked to sago haemolytic disease: a **severe, sometimes fatal toxic illness** triggered by fungal contamination, turning a survival food into a **source of acute health risk**.



Seymour M. Sago Haemolytic Disease: A Case Due to Climate-Induced Food Insecurity in Western Province, Papua New Guinea. *Trop Med Infect Dis.* 2021 Oct 23;6(4):190.

# Reshaping Food Security

## **Protein security is eroding at the shoreline**

In coastal Papuan communities, declining fish catches are already **tightening the supply of affordable protein** and undermining day-to-day food security.

**Ocean change is hitting both ecology and income:** Shifts in sea temperature, wave dynamics, and seasonal predictability are **reducing fishing days, shrinking catches, and cutting household earnings**—a direct hit to livelihoods.

## **A compounding risk to nutrition.**

As ocean conditions deteriorate, communities that rely heavily on marine resources face **declining protein availability**, increasing the risk of **nutritional deficits and economic vulnerability**.



# Indigenous Adaptation



# Indigenous Adaptation

## **Design that anticipates water.**

Among the Asmat people, the *Jew*, a **raised communal men's house**, is deliberately elevated to **minimise exposure to flooding and waterlogging**.

## **More than shelter**

This long, rectangular structure, built from locally sourced wood and positioned at the **centre of the village**, functions simultaneously as a **residence for adult men, a ritual space, a governance arena, and a site for intergenerational knowledge transfer**.

## **A living model of adaptation**

The *Jew* demonstrates that **climate adaptation is not new** in Papua. It is **deeply cultural**, integrating safety, social organisation, and ecological awareness into a single built form.

# Indigenous Adaptation

## Built for efficiency

About 4–6 meters in diameter, these compact structures use **earthen floors and a central hearth** to trap and circulate warmth, creating a stable indoor microclimate despite cold external temperatures.

## A system

Honai structures serve as **living, sleeping, and meeting spaces**, supporting daily life. Distinct units are often designated for **adult men and for women and children**, reflecting both environmental adaptation and social organisation.

## Embedded climate intelligence

It represents **generations of accumulated knowledge**, translating highland climate constraints into a **precise, functional built environment**.



# Indigenous Adaptation

## Architecture that reads the mountain climate

In the Arfak Mountains, the Moile people have raised Ibeiya house (often called “*thousand legs*”) rests on **dozens of short wooden posts**, lifting the structure above the ground and creating a distinctive multi-legged form.

**Materials tuned to environment:** Constructed from **bamboo, rattan, and grass thatch**, the house uses breathable, locally available materials that respond well to humidity and rainfall.

## Passive climate control built in

Elevation allows **air to circulate beneath the floor**, reducing dampness, while the layered organic materials help **stabilise indoor temperature**—cool when it is humid, warm when temperatures



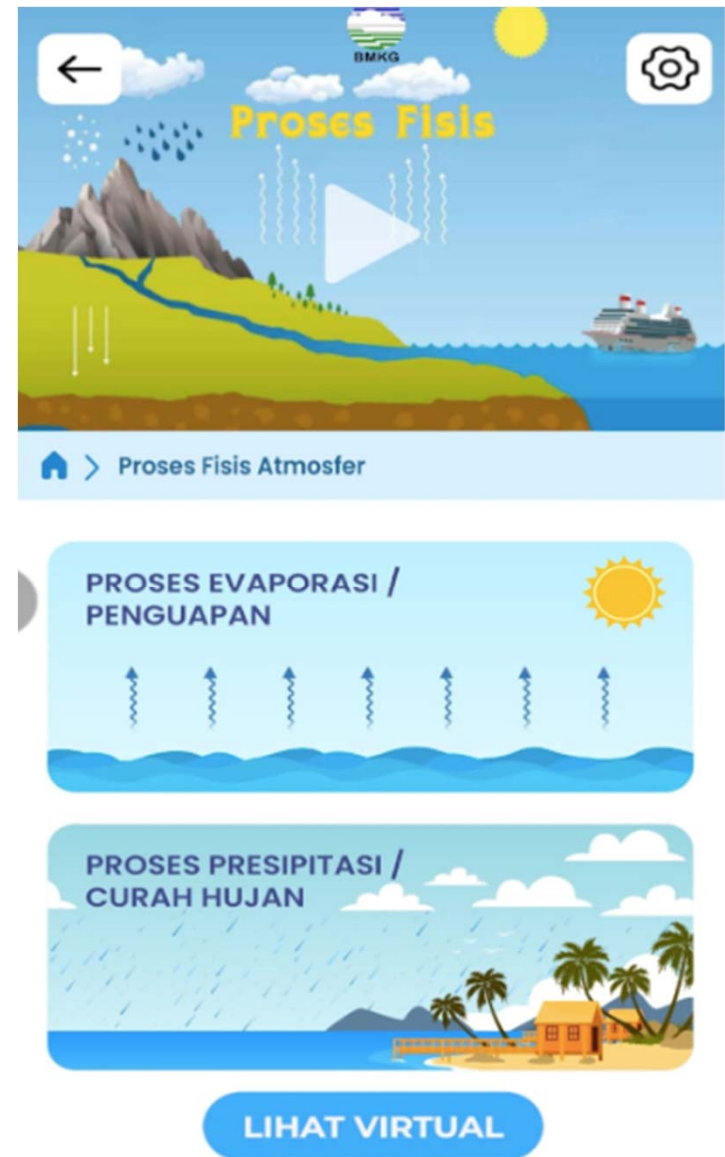
# Local Adaptation

## From forecasts to field action

Through National Agency of Meteorology/Climatology and Climate Field School, farmers and fishers are trained to **interpret climate signals and translate them into practical decisions:** adjusting planting calendars, selecting resilient crop varieties, and managing risk in real time.

## Proven impact on adaptive capacity

Evidence in Papua shows that participation in SLI **strengthens farmers' ability to respond to climate variability,** reducing exposure to crop failure and stabilising production.



# What Needs to Change

- **Fragmented intelligence and exclusion of local knowledge**

Climate, health, and environmental data systems operate in silos, while **Indigenous and community knowledge remains underutilized**, weakening situational awareness and response relevance.

- **Reactive system with no early warning backbone**

The absence of an integrated early warning system keeps decision-making **lagging behind events**, rather than anticipating and preventing impacts.

- **Uncoordinated response architecture**

Siloed institutions and disconnected workflows result in **duplication, delays, and inefficient resource use**, limiting the effectiveness of interventions.

# Policy Entry Points

- **From policy to place-based action**

Align the National Adaptation Plan with **DESA SEHAT IKLIM (Climate Healthy Village)** models and **Participatory Learning and Action (PLA)** so communities **co-design and implement adaptation on the ground.**

- **Resilient systems powered by integrated data**

Invest in **climate-resilient health infrastructure and services**, underpinned by **cross-sector data integration** to drive evidence-based decisions.

- **Coordinated action beyond borders**

Strengthen **cross-border collaboration** to manage shared climate and health risks, ensuring **synchronized response and resource use** across regions.

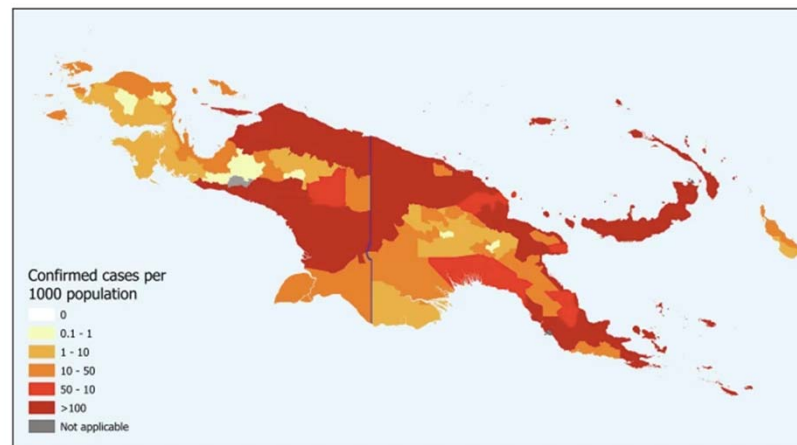
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# Two Nations, One Front: Indonesia and Papua New Guinea forge a One-Island approach to fight persistent malaria on New Guinea

[Hellen Dewi Prameswari](#), [Jacob Kisomb](#), [Pilly Mapira](#), [John B. Keven](#), [Hermawan Susanto](#), [Rahmad Isa](#), [Dedy Supriyanto](#), [Triwibowo A. Garjito](#), [Din Syafruddin](#), [Ermi Ndoen](#), [Iswahyudi](#), [Firmansyah](#), [Firdy Permana](#), [Nelson Chin](#), [Neil F. Lobo](#), [Edward D. Walker](#), [Ferdinand J. Laihad](#), [Sarthak Das](#), [William A. Hawley](#) & [Iqbal RF Elyazar](#) 

[Nature Communications](#) **16**, Article number: 10920 (2025) | [Cite this article](#)

**Fig. 1: Geographical distribution of confirmed malaria cases per 1000 population in the countries of Indonesian and Papua New Guinea.**



# Closing Message

- **Papua as a natural laboratory and regional model.**

Position Papua as a **real-world testing ground** for Asia–Pacific—where integrated climate–health solutions are developed, validated, and scaled.

- **From reacting to predicting and preventing.**

Build **anticipatory systems**, which link climate forecasts, environmental signals, and health surveillance to **detect risk early and trigger pre-emptive action** (for example: vector control, service surge, supply pre-positioning) before impacts escalate.

- **One Papua, one integrated system**

Unify the entire island under a **single climate–health intelligence and response architecture**—connecting data, institutions, and communities across regions to enable **coordinated, cross-provincial action and precisely targeted interventions**.

## CORE TEAM

Hover over a team member to see their profile details.



**Lenny Ekawati, DPhil**  
Expert Malaria Microscopist, Geocultural  
& Health Systems Research Scientist  
OUCRU ID



**Michael Christian, MD**  
Health Systems & Clinical Research  
Scientist  
OUCRU ID



**Adhi Andrianto, BSc**  
Health Informatics & Data Systems  
Engineer  
OUCRU ID



**Karina D. Lestari, MSc., PhD  
(Candidate)**  
Statistician & Spatial Data Scientist  
OUCRU ID



**Ihsan Fadilah, MD., DPhil  
(Candidate)**  
Applied Statistician  
OUCRU ID



**Rahmat Sagara, MSc., PhD  
(Candidate)**  
Infectious Disease Modelling Scientist  
OUCRU ID



**Yudha Perambang, MRSen**  
Remote Sensing and GIS Specialist  
OUCRU ID



**Aria A. Satwiko, MSc**  
Social Anthropologist & Implementation  
Researcher  
OUCRU ID



**I Nyoman Indra Kresna Wijaya,  
B.A.**  
Social Anthropologist & Community  
Systems Specialist  
OUCRU ID



**Assoc. Prof. Henry Surendra,  
PhD**  
Infectious Disease Epidemiologist &  
Implementation Scientist  
Monash University Indonesia



**Bimandra A. Djaafara, PhD**  
Infectious Diseases Modelling Scientist  
National University of Singapore



**Kartika Saraswati, MD., DPhil**  
Clinician & Infectious Diseases  
Epidemiologist  
National University of Singapore



**Sunardi, BA**  
Malaria Microscopist  
OUCRU ID



**Aa Raka Pratama**  
Malaria Microscopist  
OUCRU ID



**Annisa Mahardika**  
Malaria Microscopist  
OUCRU ID



**Novi Dwi Susilowati, BSc**  
Malaria Microscopist  
OUCRU ID



**Nurul Muyasaroh**  
Malaria Microscopist  
OUCRU ID



**Dewi Erita, BSc**  
Research Assistant  
OUCRU ID



**Dedi Sudiana**  
Field Coordinator and Laboratory  
Support Officer  
OUCRU ID



**Agus Rachmat, BSc**  
Public Health GIS & Field Epidemiology  
Specialist  
OUCRU ID



**Evelyn Puspaningrum, BSc**  
Sero-surveillance & Public Health  
Specialist  
OUCRU ID