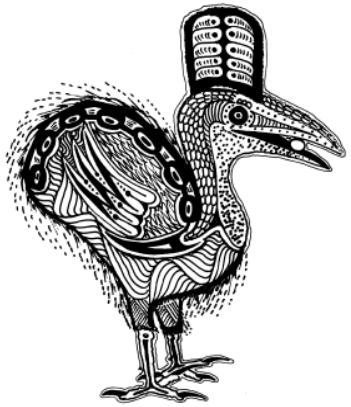
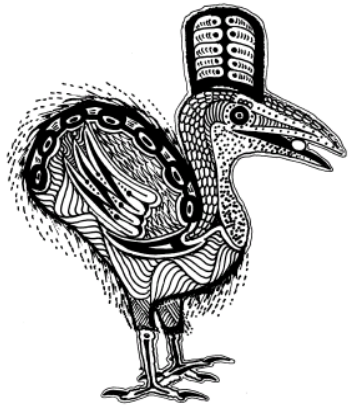
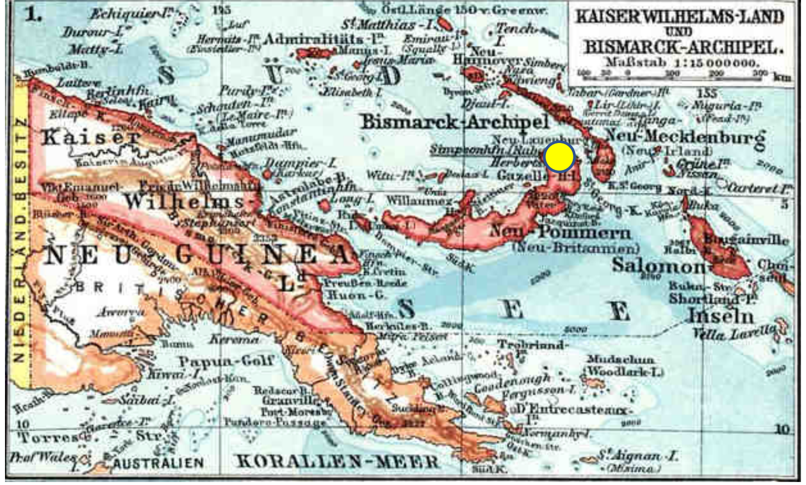
Biological research and biodiversity conservation in PNG: where are we now and where do we want to go?

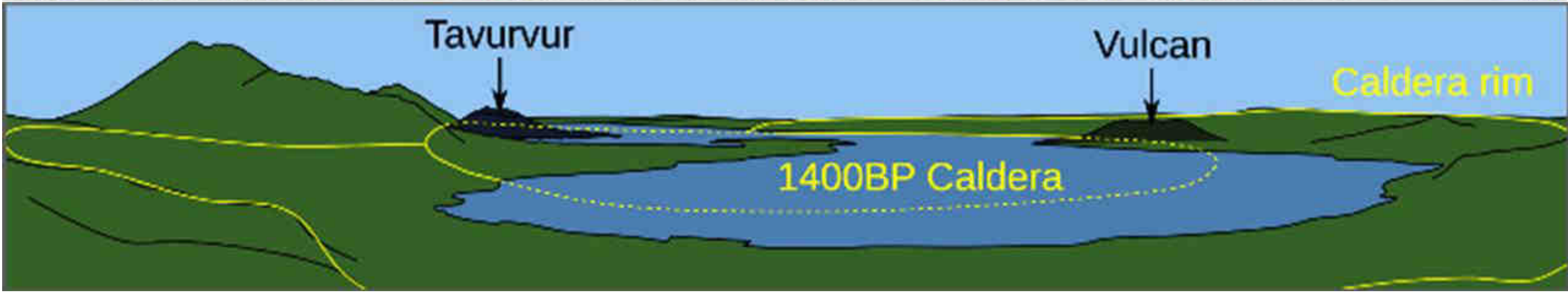


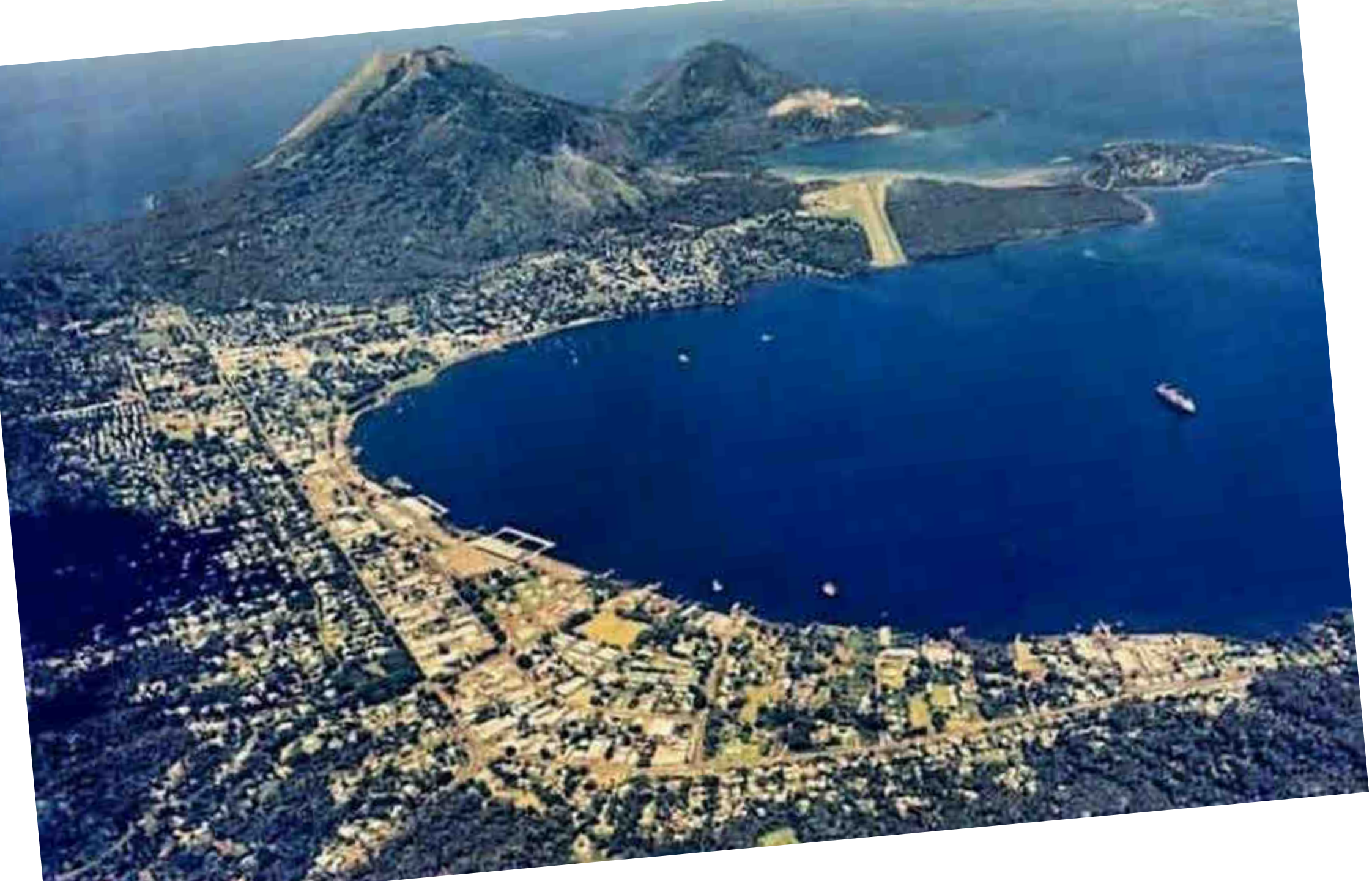


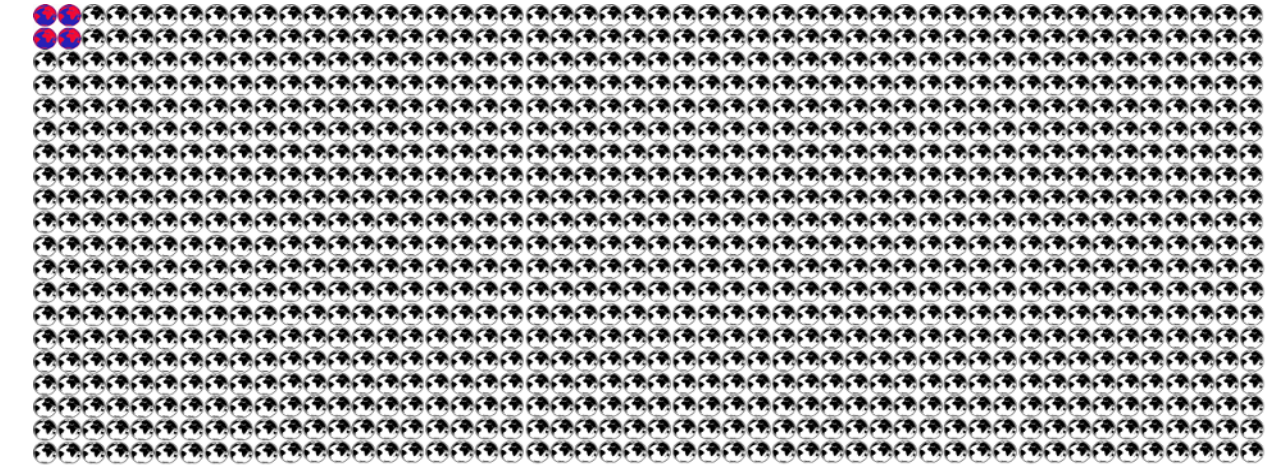
Vojtech Novotny

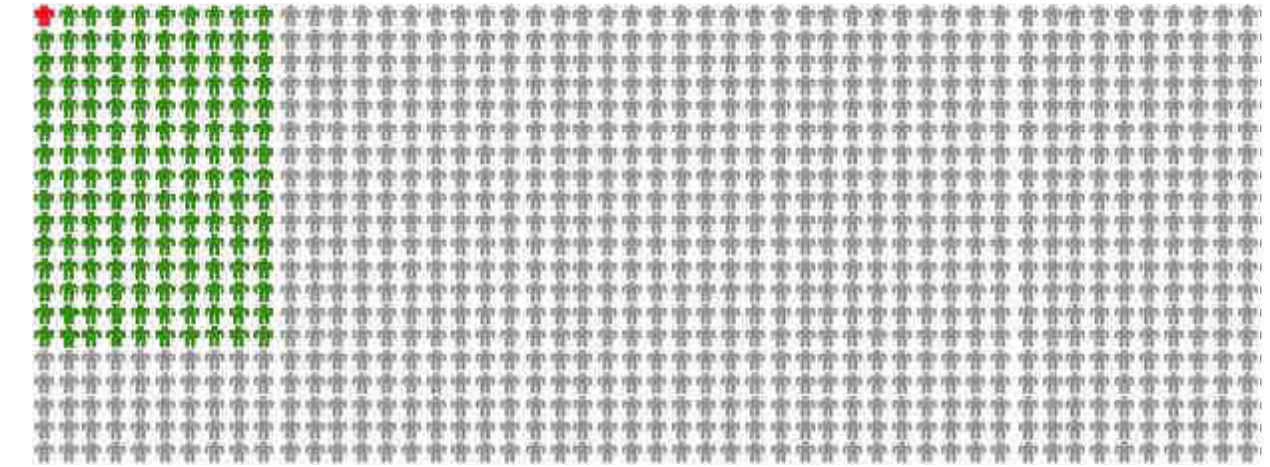
Biology Centre of the Czech Academy of Science

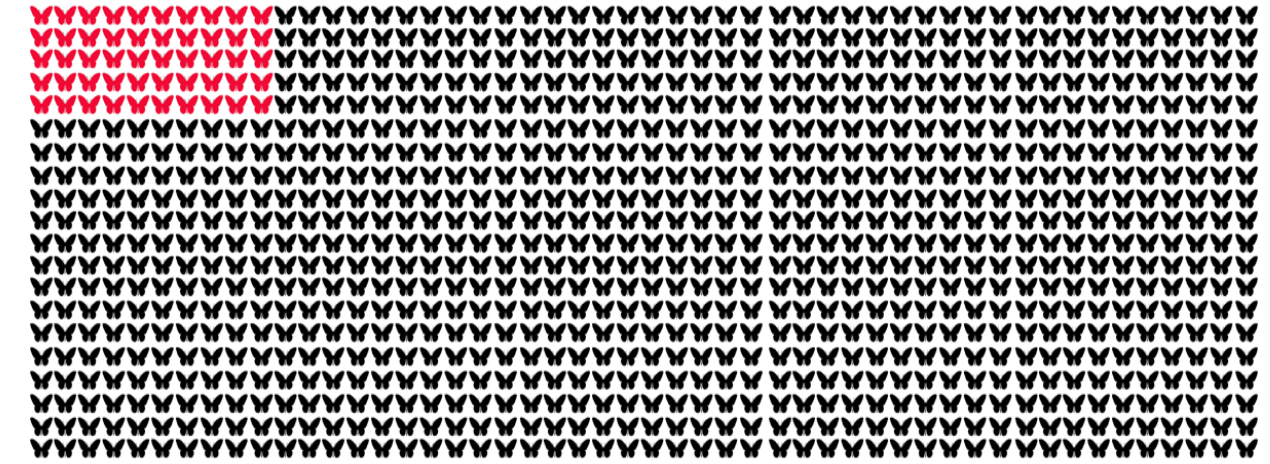

KAISER WILHELMS-LAND
UND
BISMARCK-ARCHIPEL.
Maßstab 1:15 000 000.
Admiralitäts-I.
Bismarck-Archipel
Neu-Mecklenburg
Neu-Pommern
(Neu-Britannien)
Salomon
Inseln
NEU GUINEA
Papua-Golf
KORALLEN-MEER
AUSTRALIEN
NIEDERLAND. BESITZ

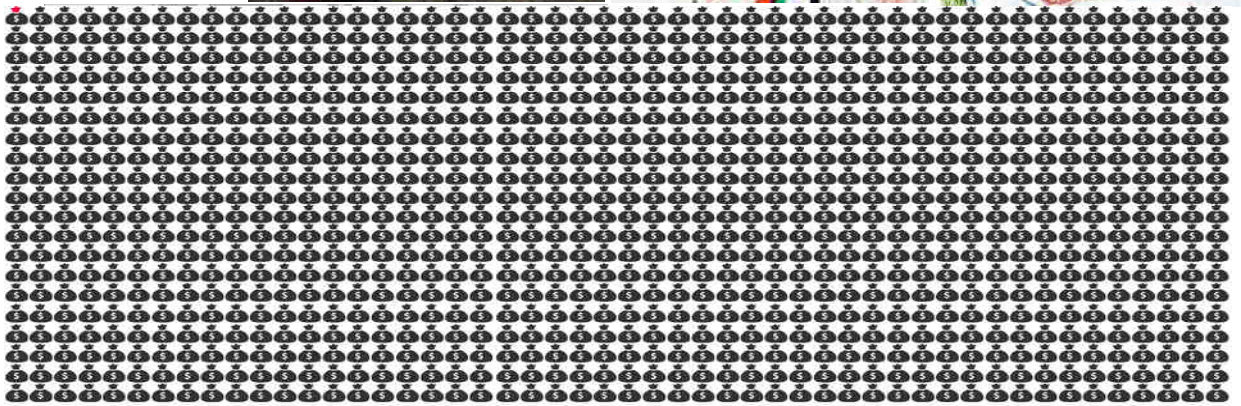

Tavurvur
Vulcan
Caldera rim
1400BP Caldera

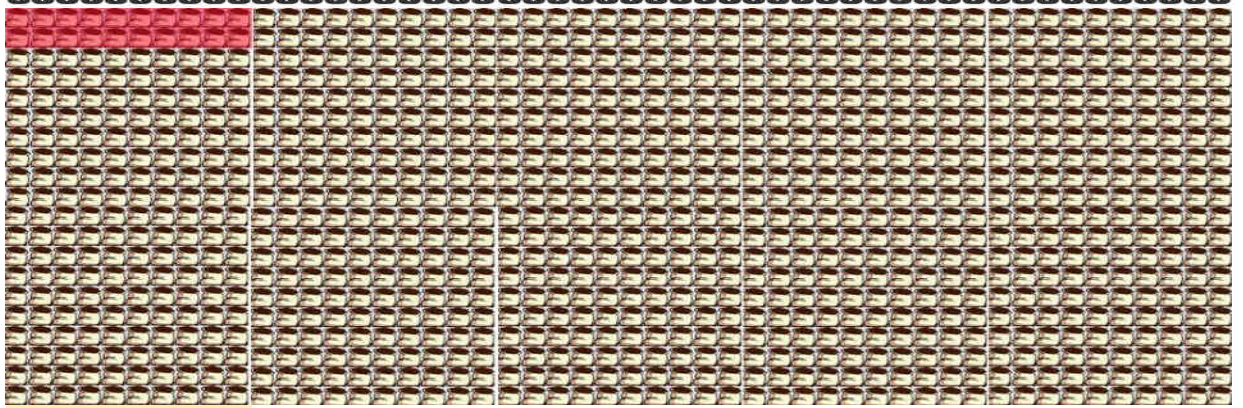


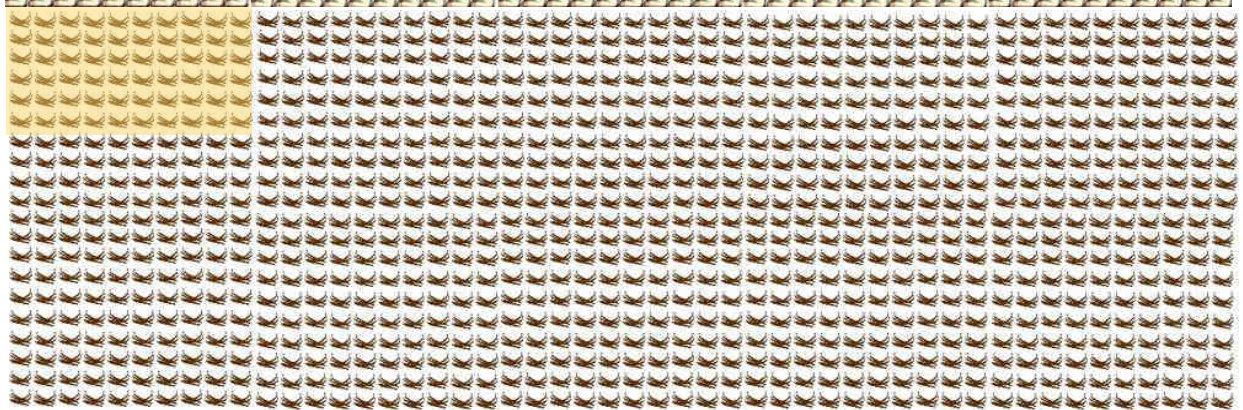


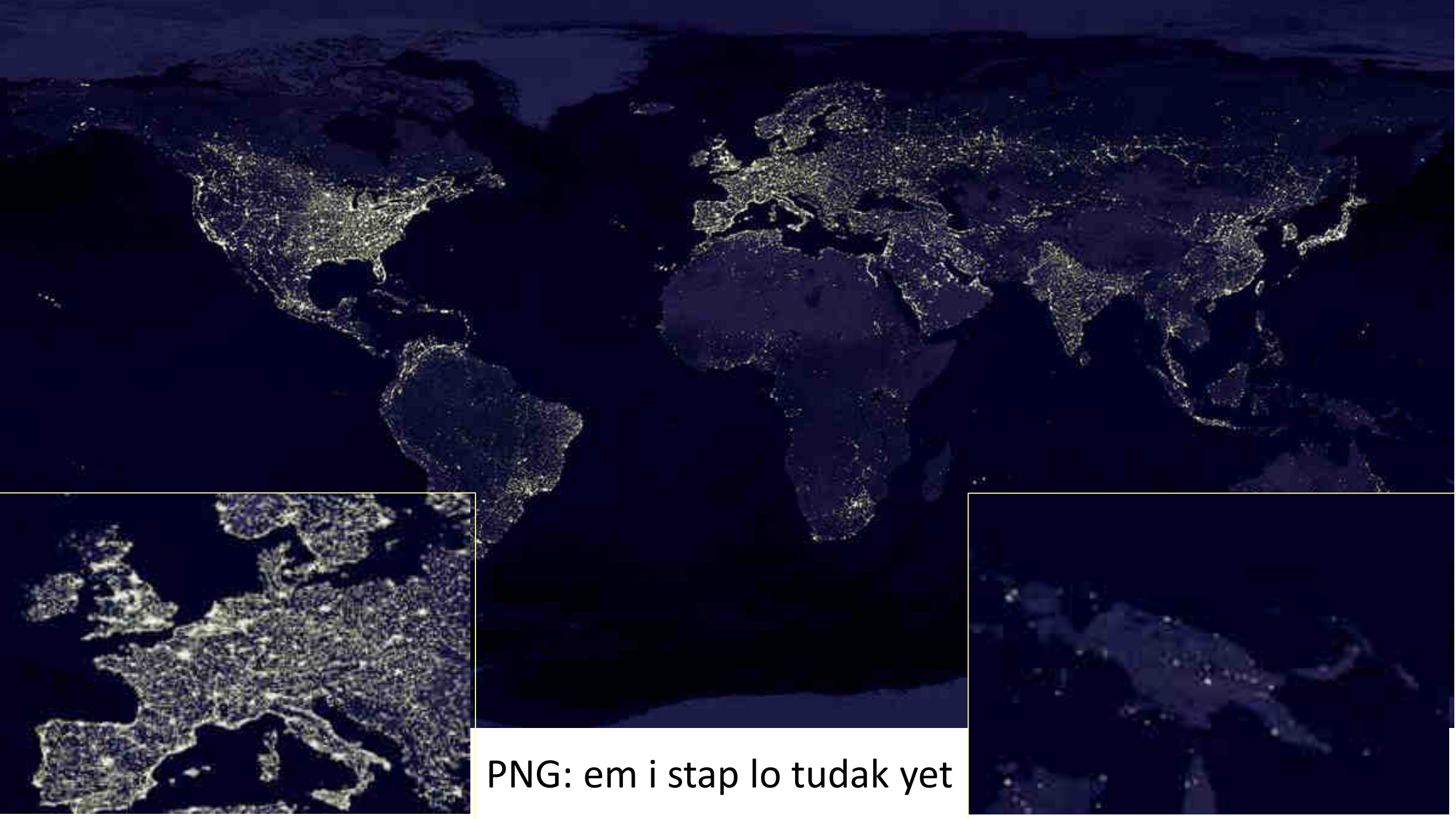










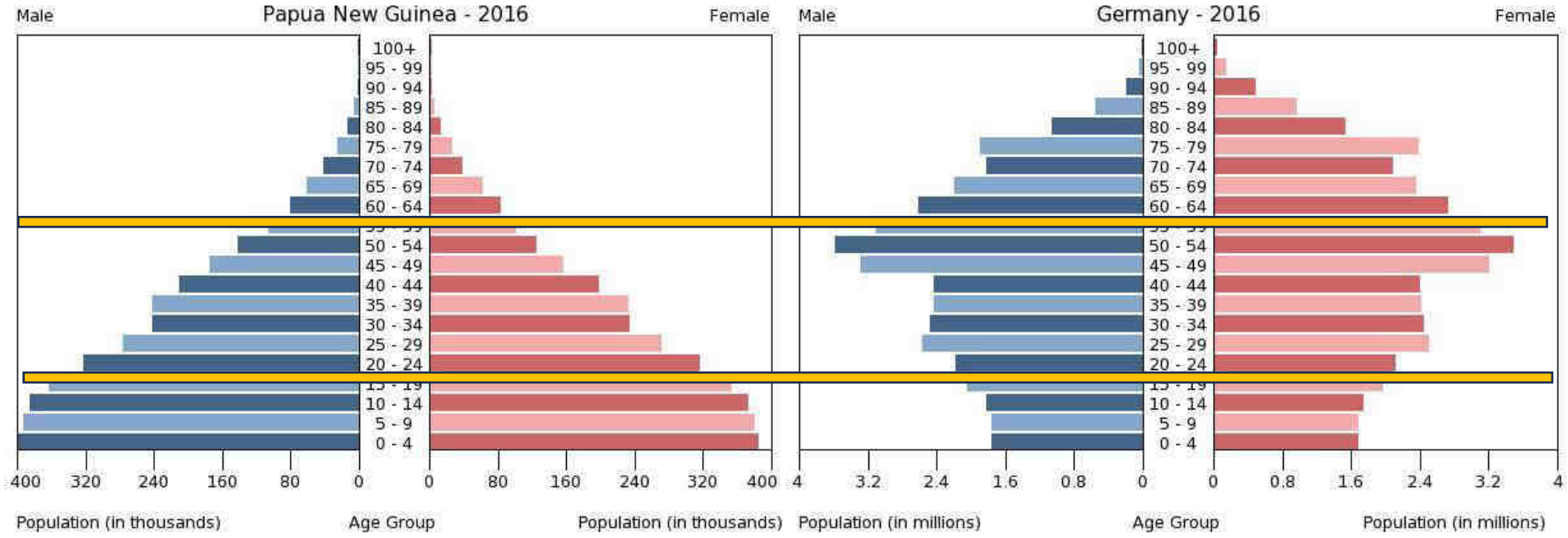


PNG: em i stap lo tudak yet

How will Papua New Guinea look in 2050 or 2100?

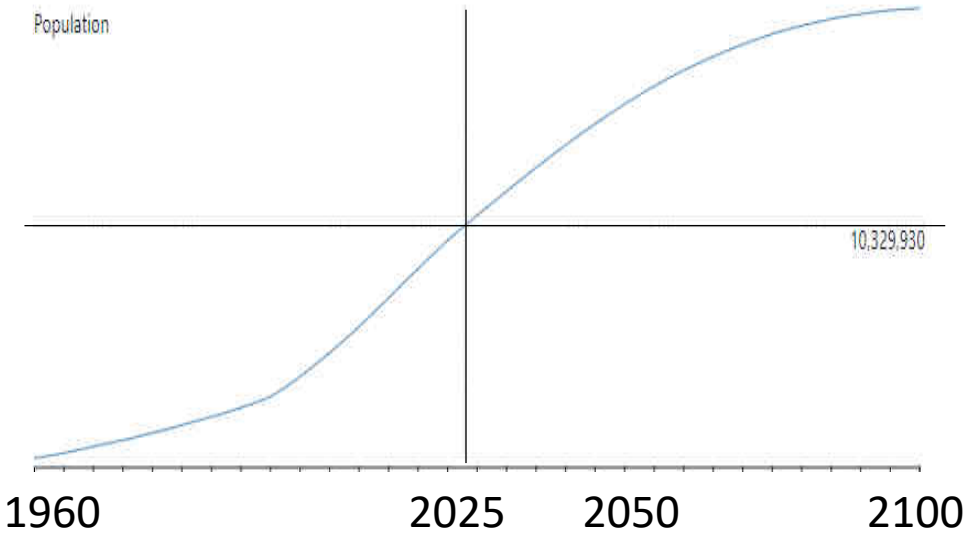
It will not run out of land

Youthful society with a competition-free future
(but also limited opportunities created by previous generations)

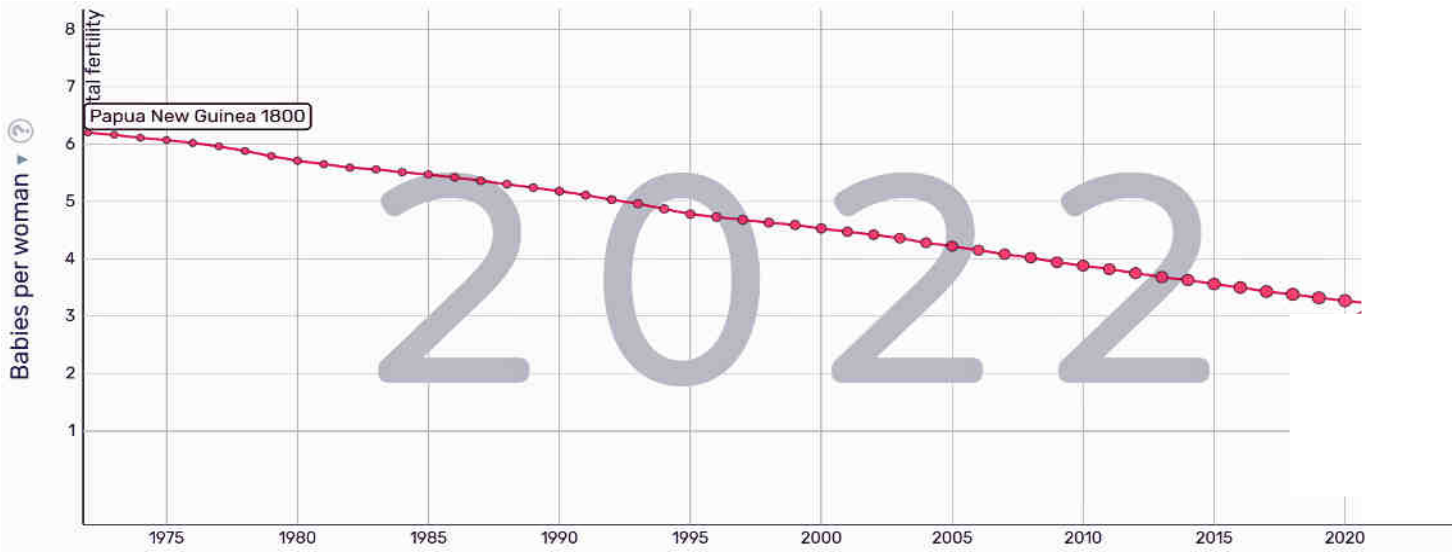


CIA World Factbook

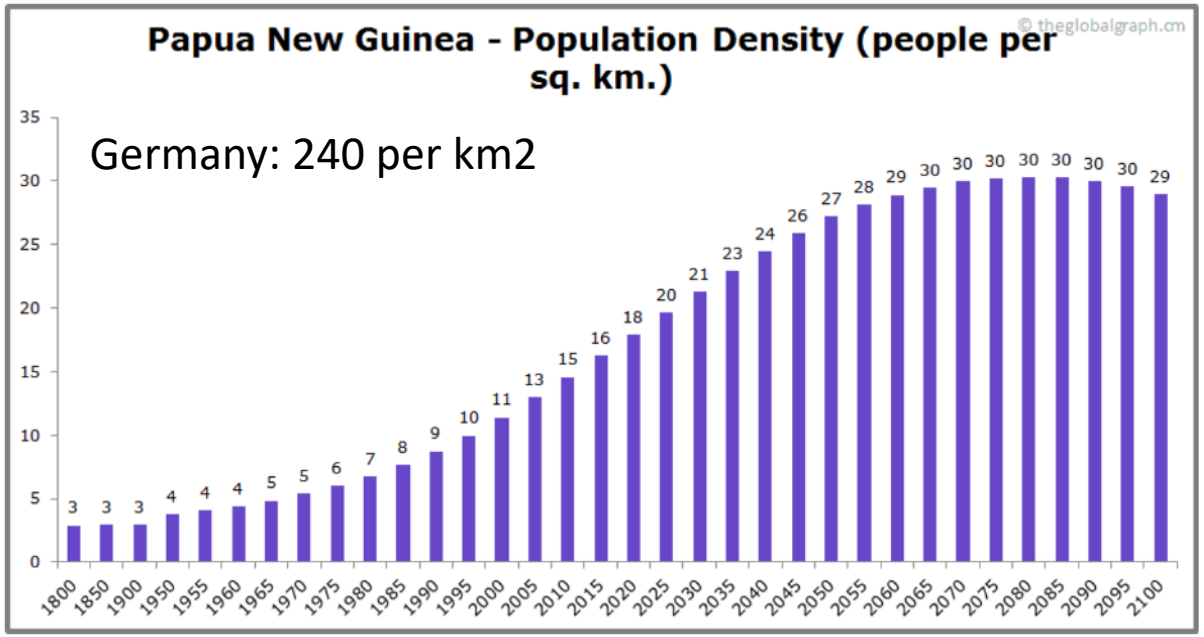
PNG population is growing fast

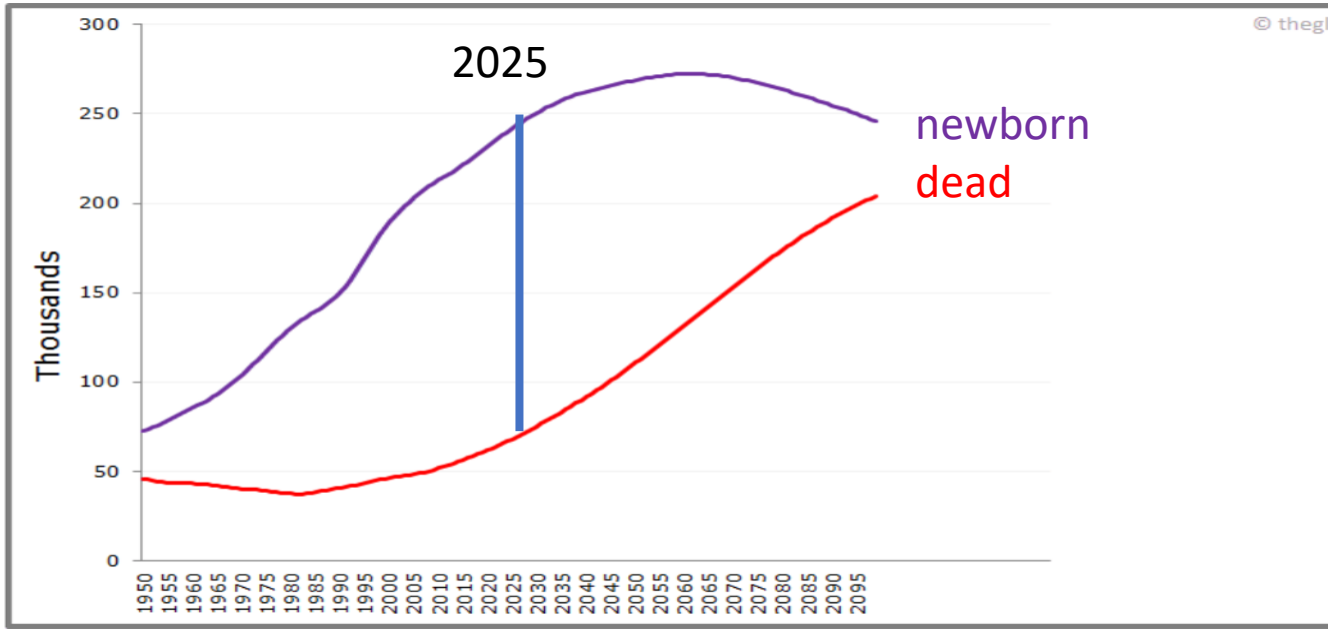


BUT the number of babies per woman is declining

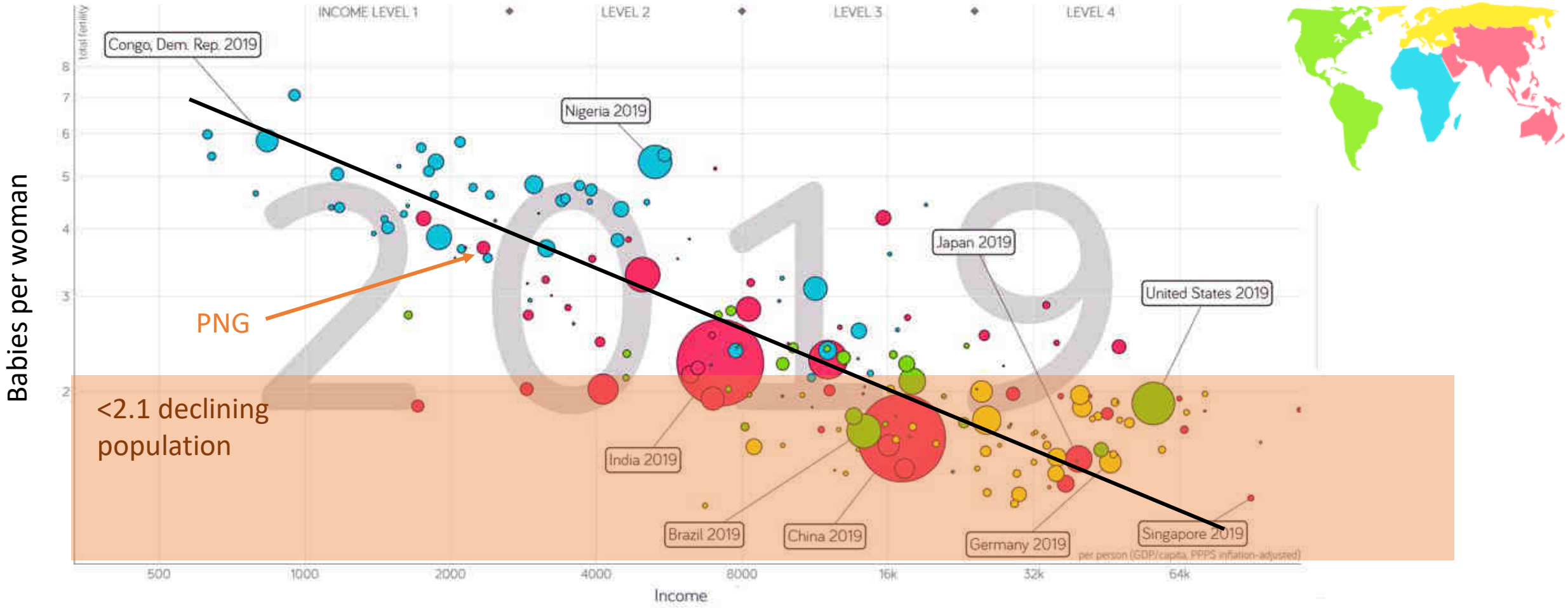


PNG will never run out of the land as population will peak in the late 21st century





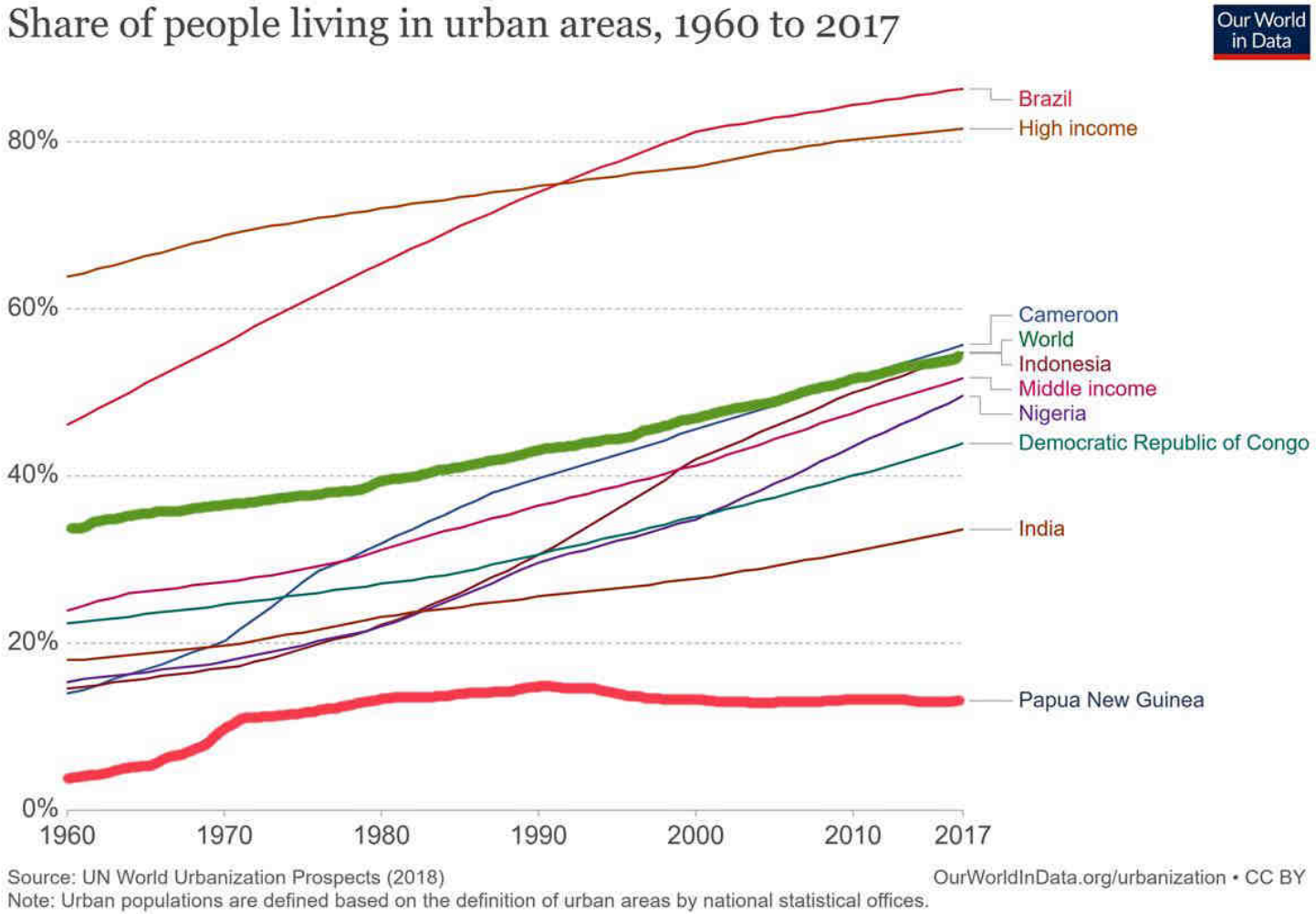
Human fertility is surprisingly predictable (and income-dependent)

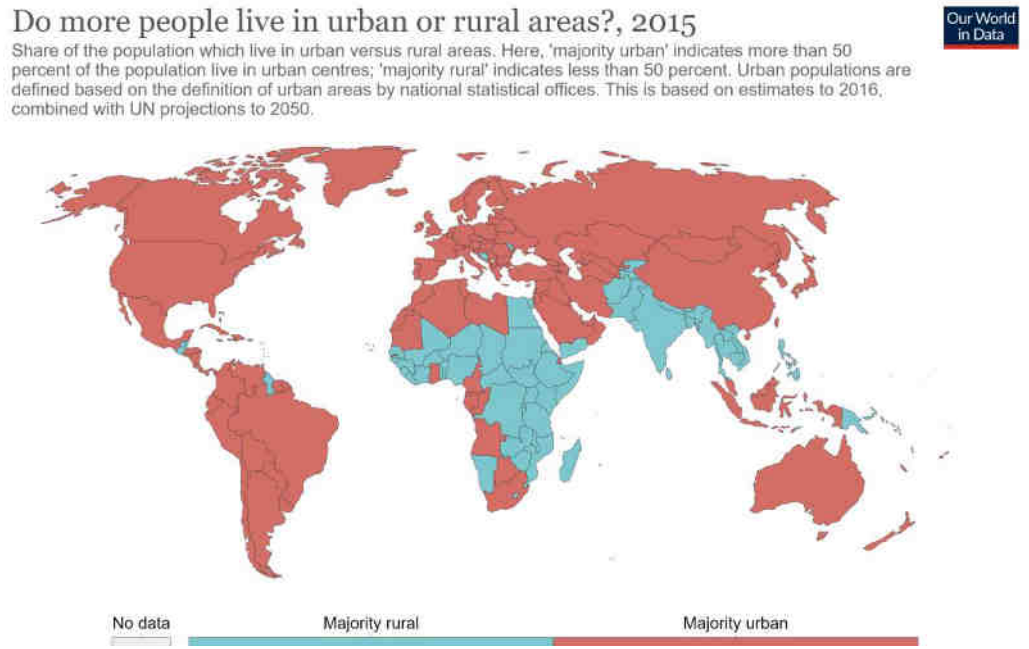


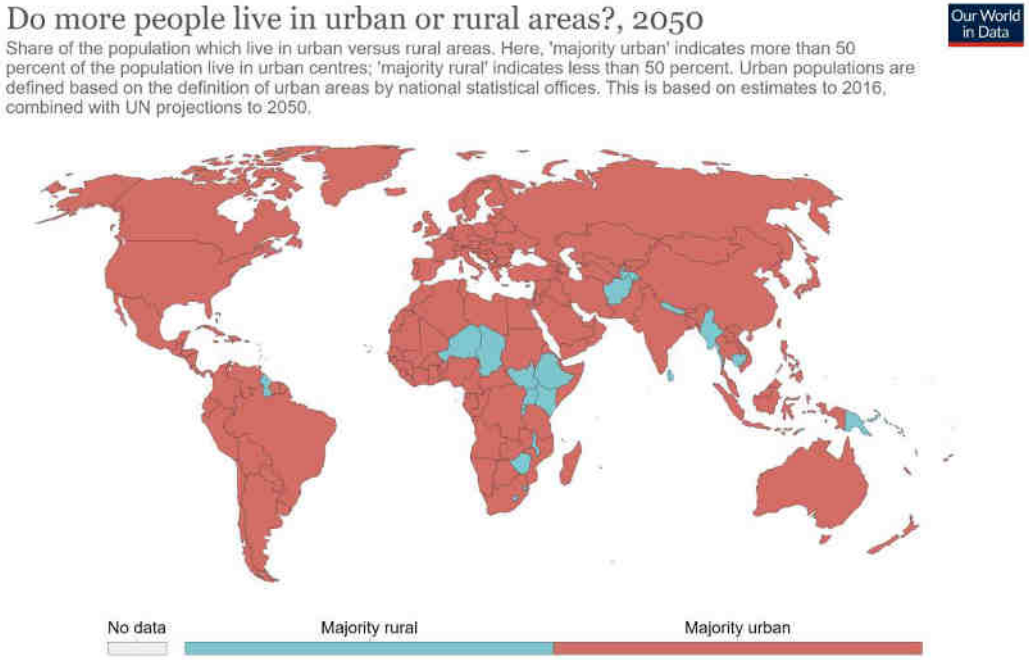
How will Papua New Guinea look in 2050 or 2100?

It may be one of the last rural countries in the world

Urbanization: PNG an exception from the global trend







How will Papua New Guinea look in 2050 or 2100?

PNG may be at a critical decision point for the future of its landscapes

What is a realistic scenario for the future of PNG landscapes?

Two human-inhabited landscapes in New Guinea:
forest-dominated lowlands…

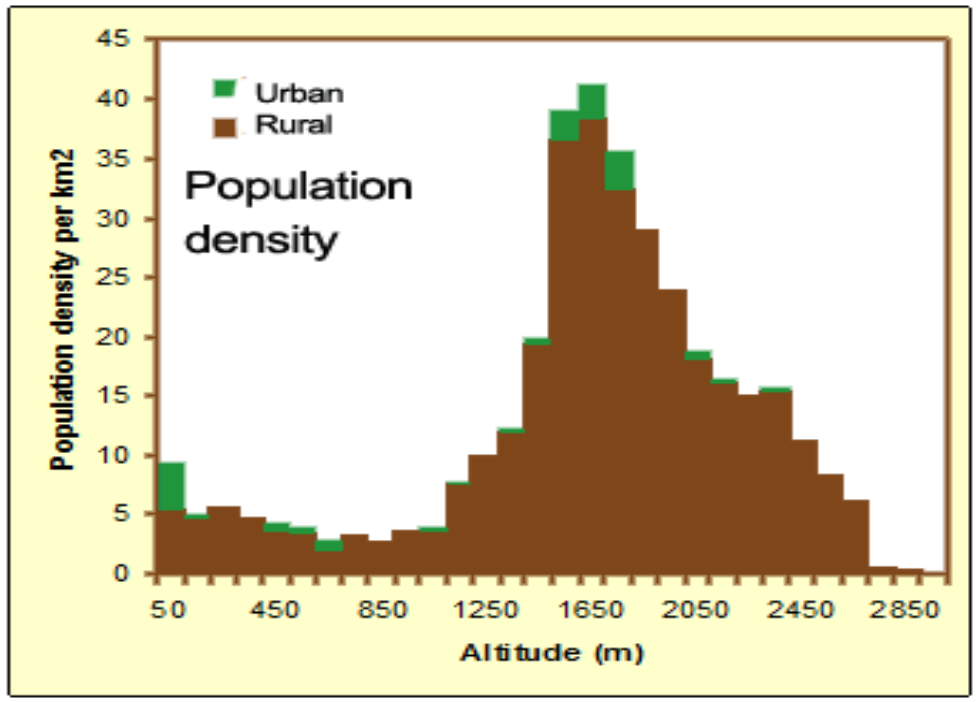

… and modestly cultivated highlands

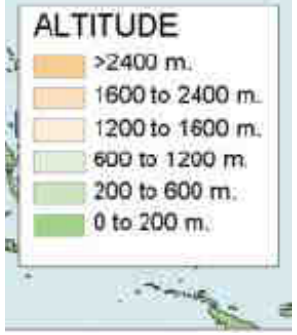
Europe

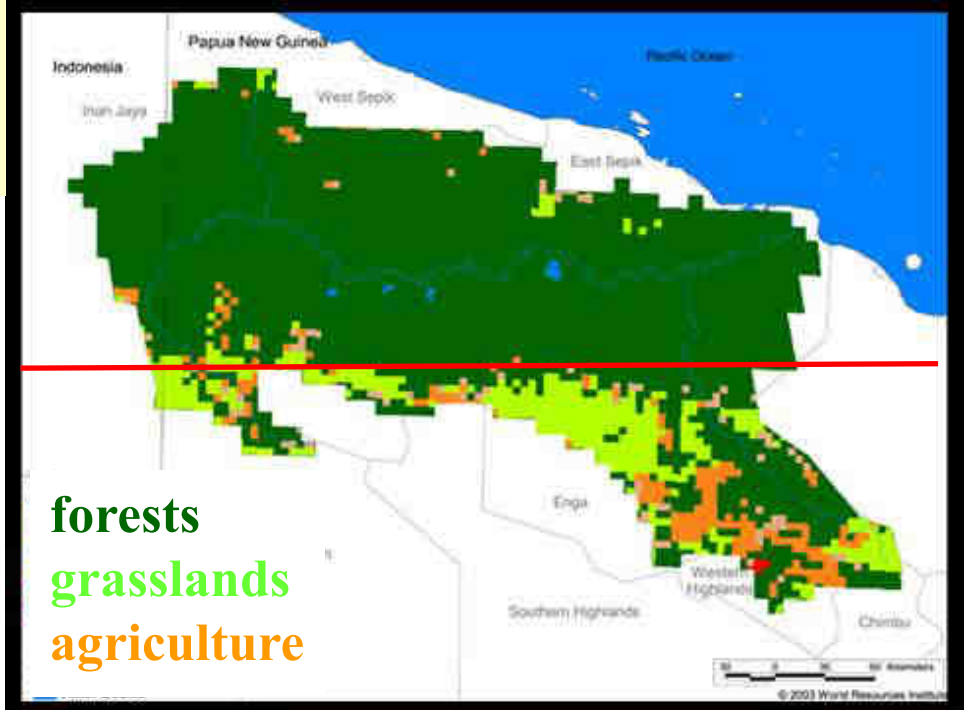
New Guinea

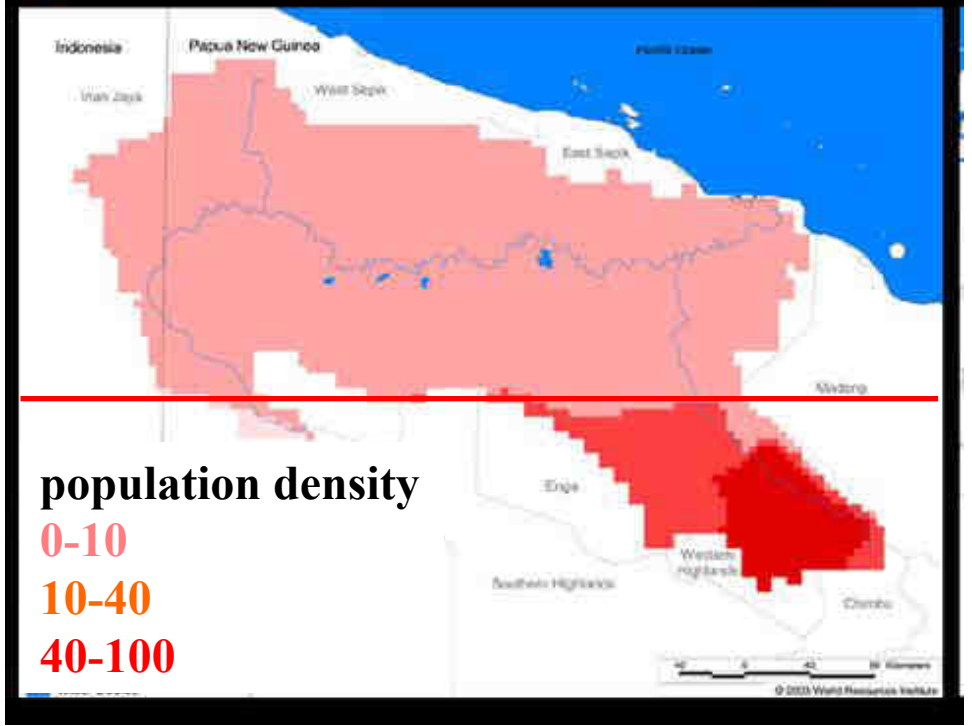
First contact in the Highlands in 1932

Two landscapes: lowlands vs. highlands
Sepik river watershed









Malaria: an important factor in human evolution

Common Erythrocyte Variants That Affect Resistance to Malaria

Gene	Protein	Function
FY	Duffy antigen	Chemokine receptor
G6PD	Glucose-6-phosphatase dehydogenase	Enzyme that protects against oxidative stress
GYPA	Glycophorin A	Sialoglycoprotein
GYPB	Glycophorin B	Sialoglycoprotein
GYPC	Glycophorin C	Sialoglycoprotein
HBA	α-Globin	Component of hemoglobin
HBB	β-Globin	Component of hemoglobin
HP	Haptoglobin	Hemoglobin-binding protein present in plasma (not erythrocyte)
SCL4A1	CD233, erythrocyte band 3 protein	Chloride/bicarbonate exchanger

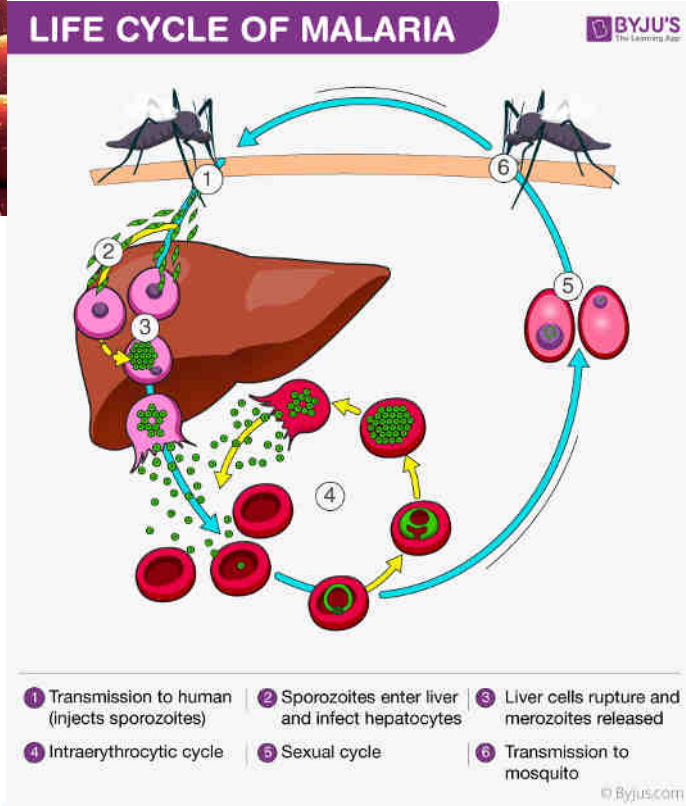
- 0–53% population in NG lowlands
- 10% of lowland populations, protects against malaria.
- up to 90% in lowlands, only 5% in mountains. Protects against severe malaria, but increases chances of mild infection, particularly in children.
- relatively harmful, up to 10% in some lowlands
- mild protection against malaria, total protection against cerebral malaria, homozygotes not viable

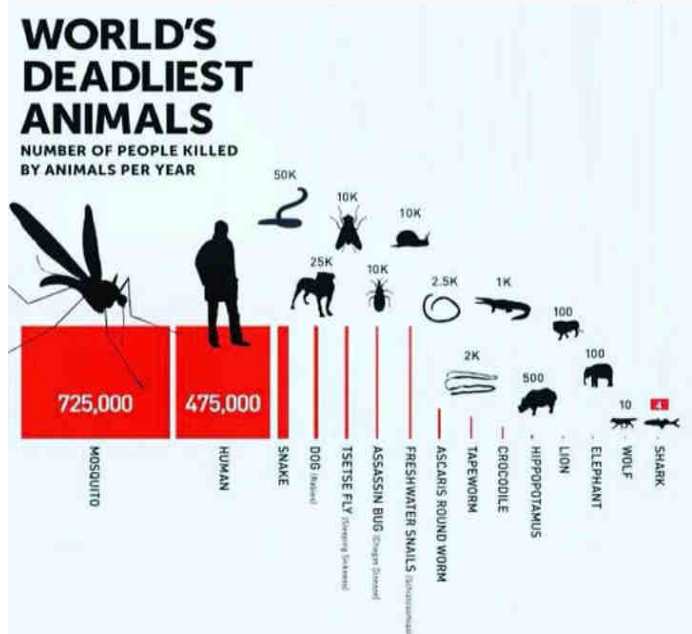
Am. J. Hum. Genet. 77:171–192, 2005

REVIEW ARTICLE

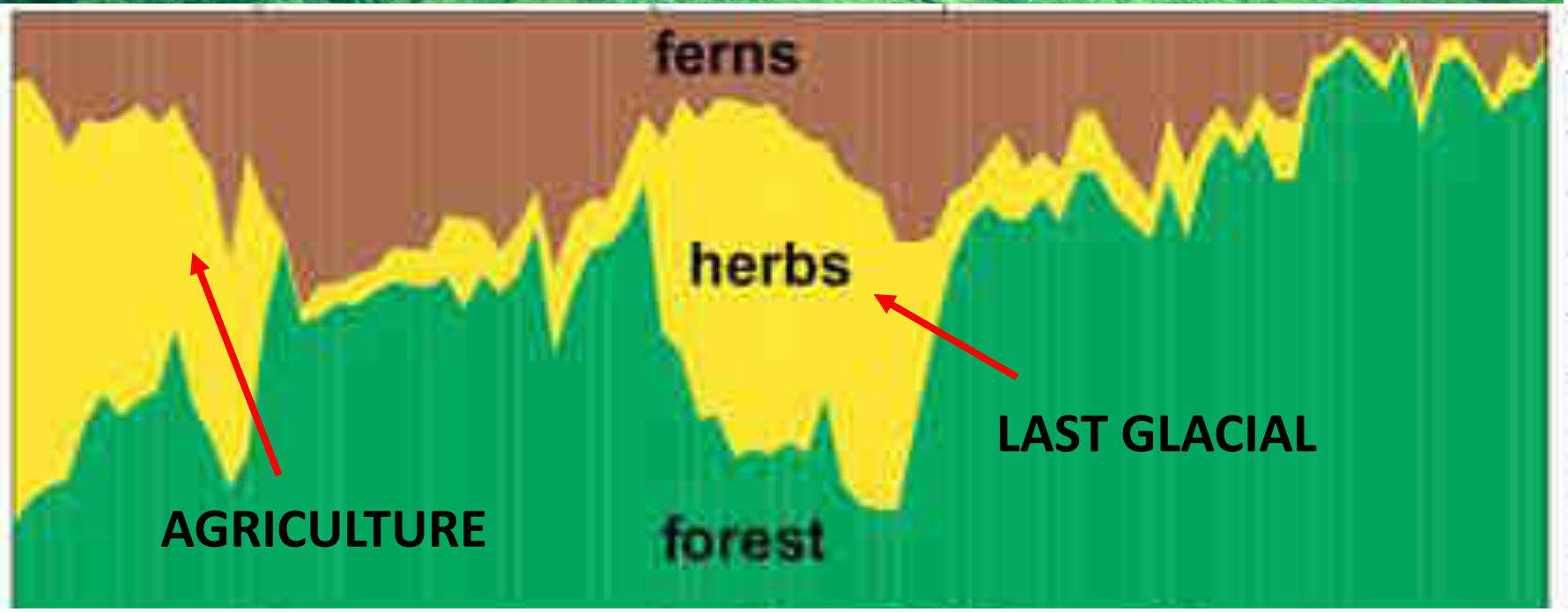
How Malaria Has Affected the Human Genome and What Human Genetics Can Teach Us about Malaria

Dominic P. Kwiatkowski

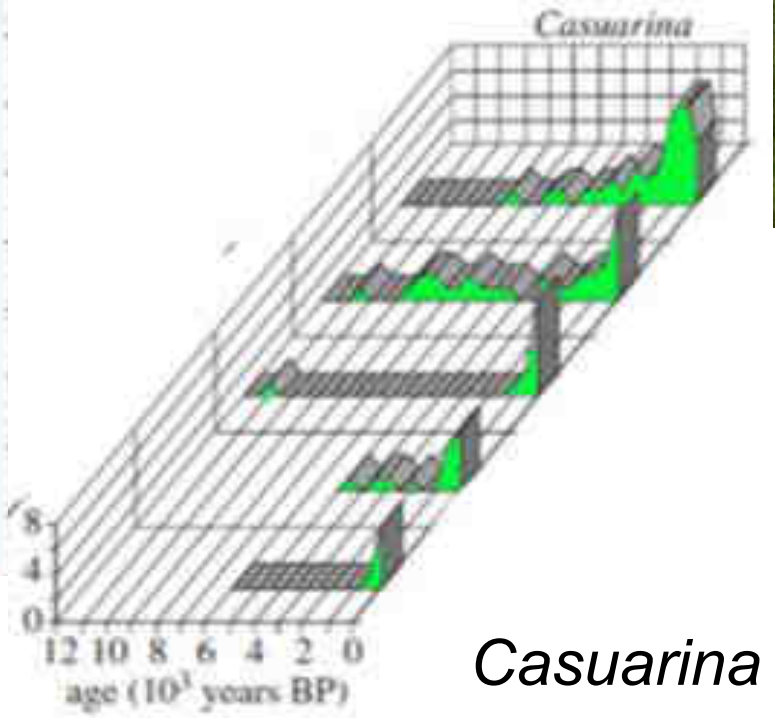




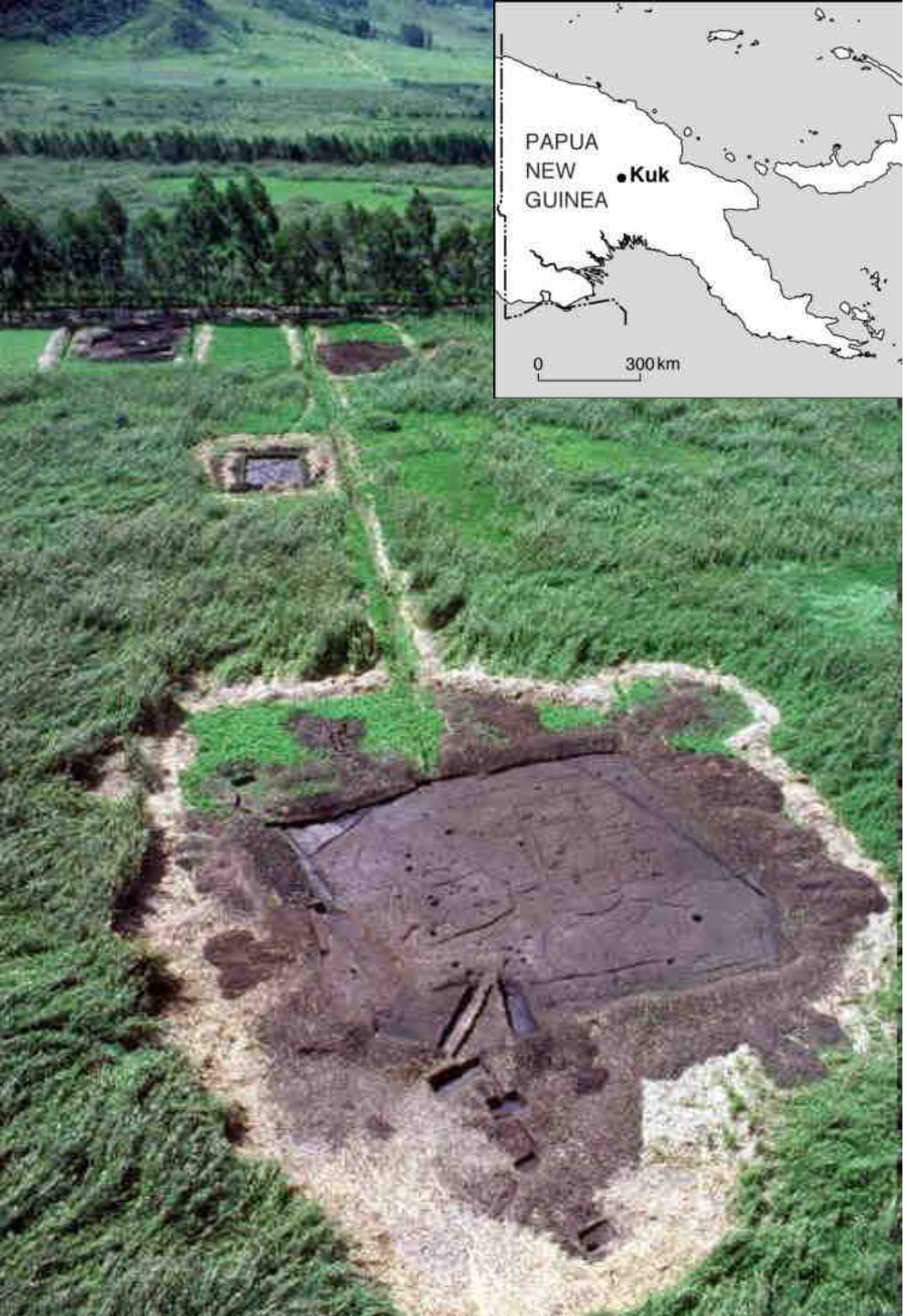
Highlands: 2000 years of sustainable agroforestry



1 5 10 15 20 30 thousand years BP

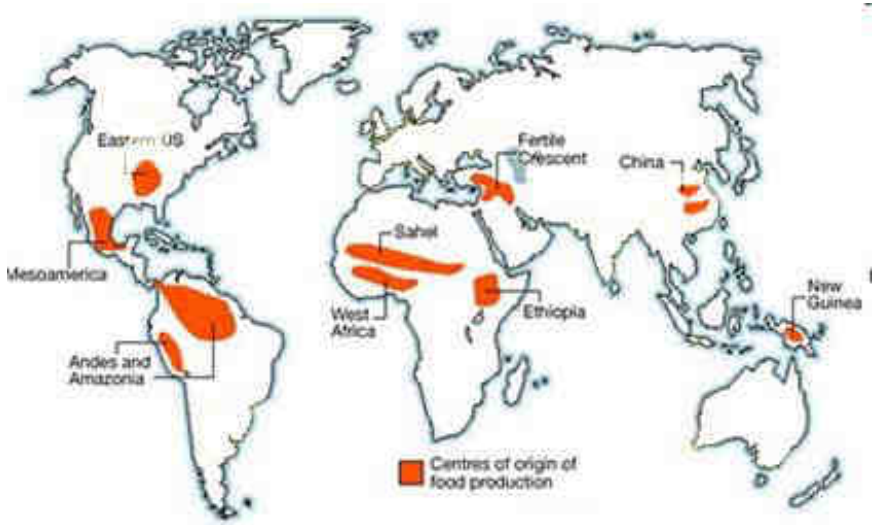


Casuarina



Agriculture was independently invented in New Guinea
by at least ~7000 to 6500 years ago
(taro *Colocasia esculenta* and banana *Musa* spp. cultivation)

Banana phytolith



Origins of agriculture

Denham et al. 2003. Science 301: 189

How will Papua New Guinea look in 2050 or 2100?

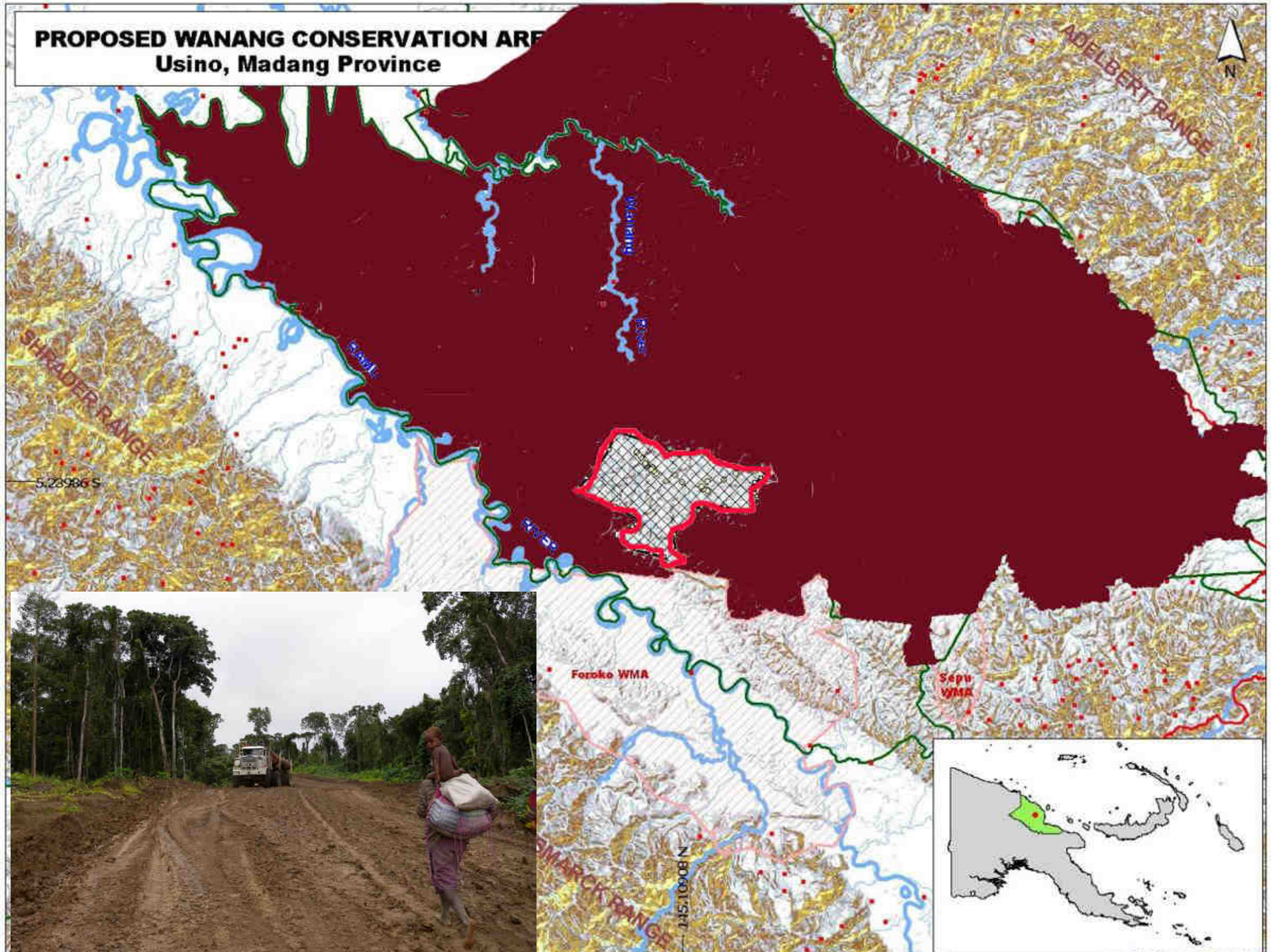
PNG as a biodiversity conservation paradise?

Opportunity cost of conservation:

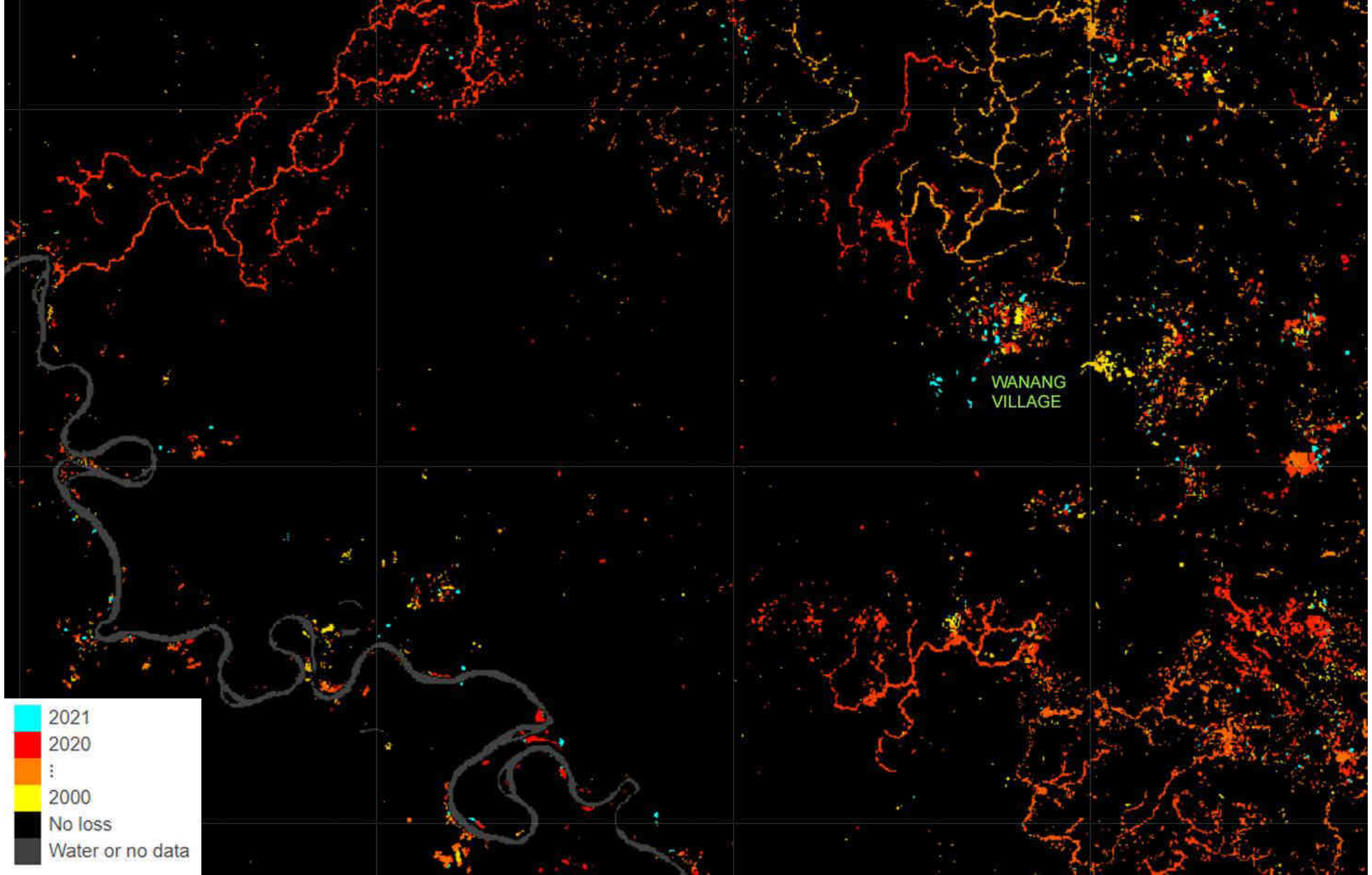
from near zero in remote sites to very high where in competition with alternatives

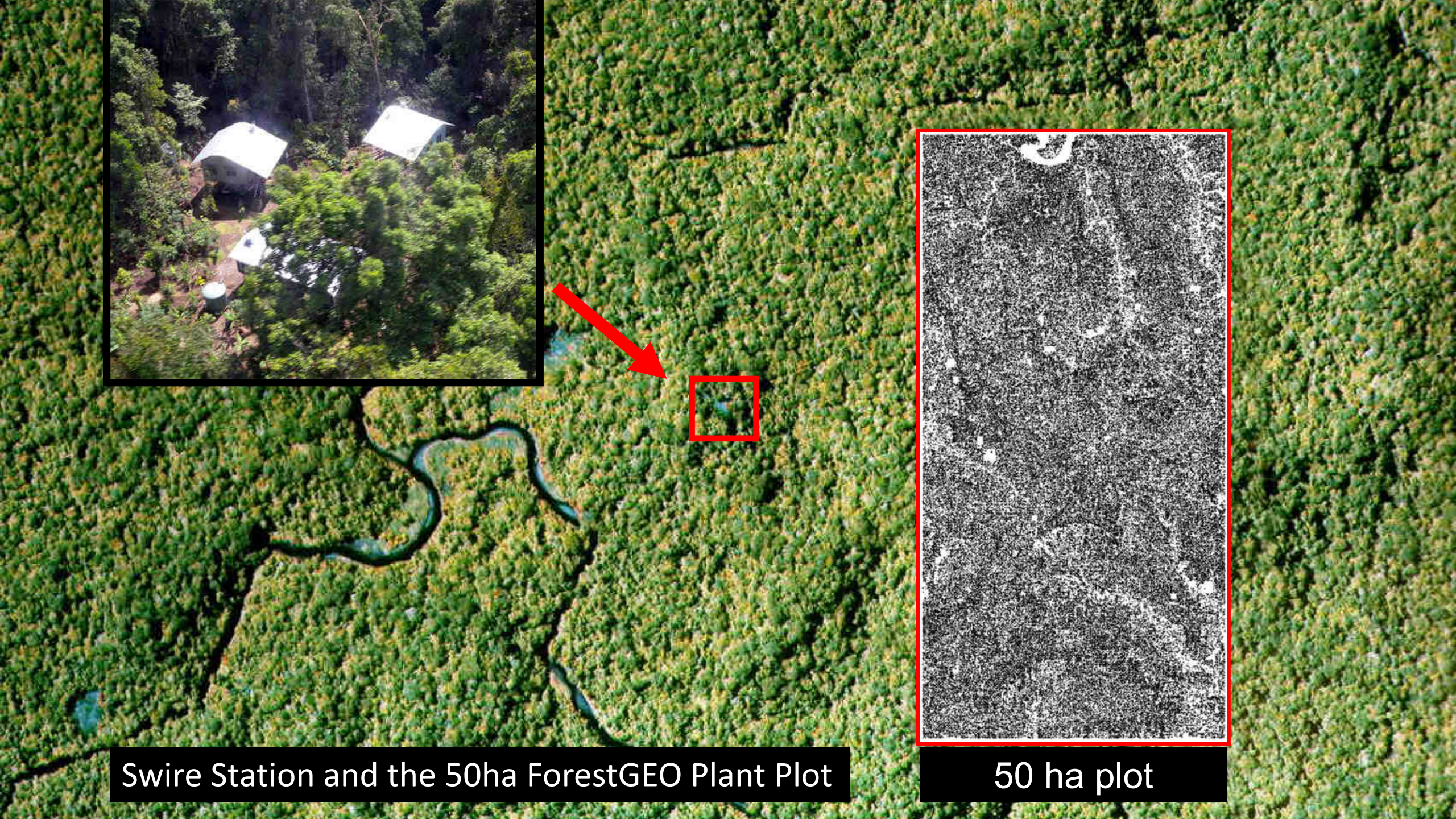
Crater Mt montane forest
no roads
no access to agriculture markets
no logging offers

Hyde Park (141 ha)
4th most expensive park in the world,
valued at GBP 18.7 bn
GBP 13,197 per m^2

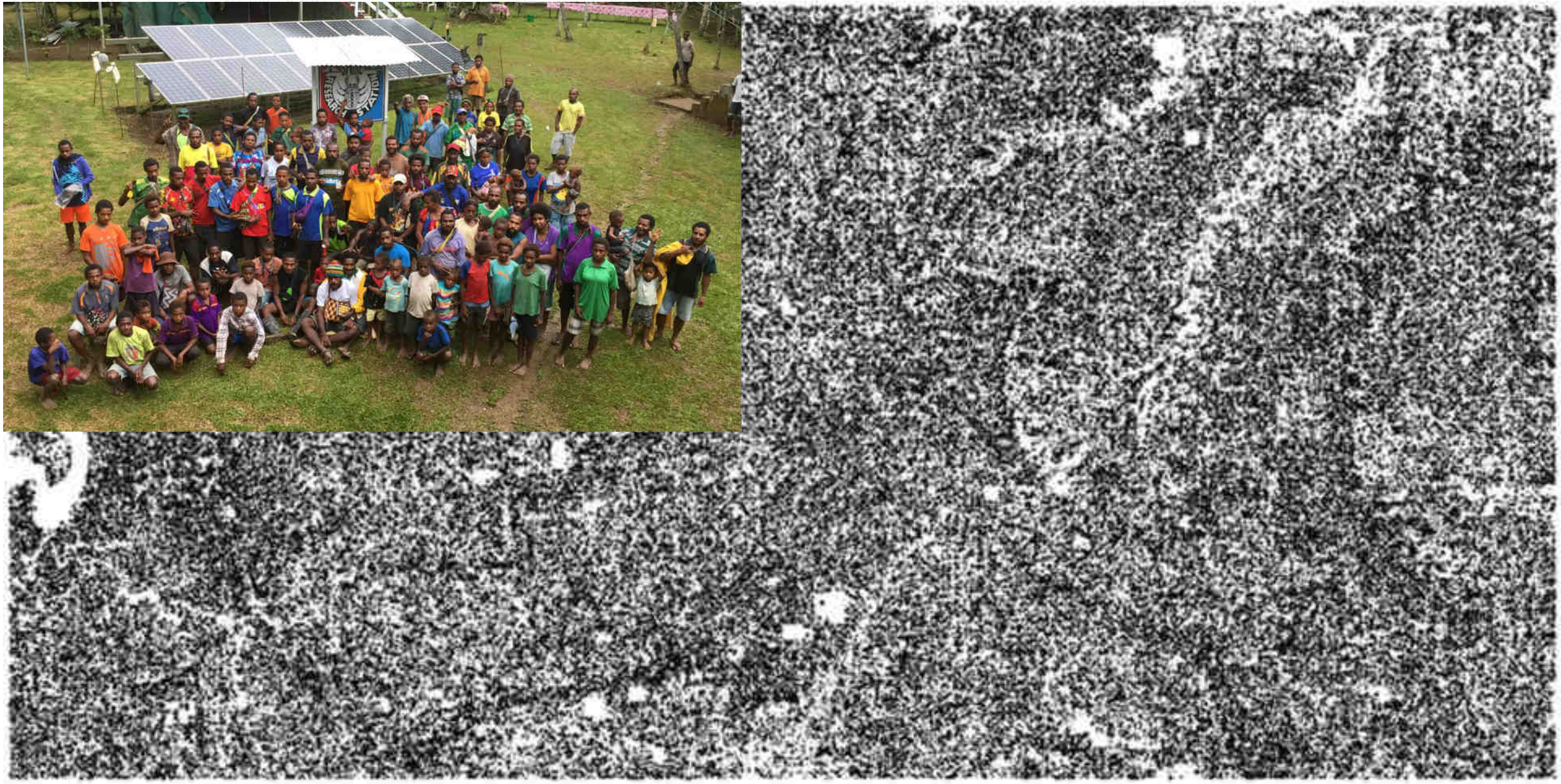

PROPOSED WANANG CONSERVATION ARE
Usino, Madang Province
N
ADELBERT RANGE
SHRADER RANGE
5.28936 S
Forroko WMA
Sepu WMA
BISMARCK RANGE
N 806'01"S

WANANG CONSERVATION
MAGHÜ
AREA


WANANG
VILLAGE
2021
2020
⋮
2000
No loss
Water or no data

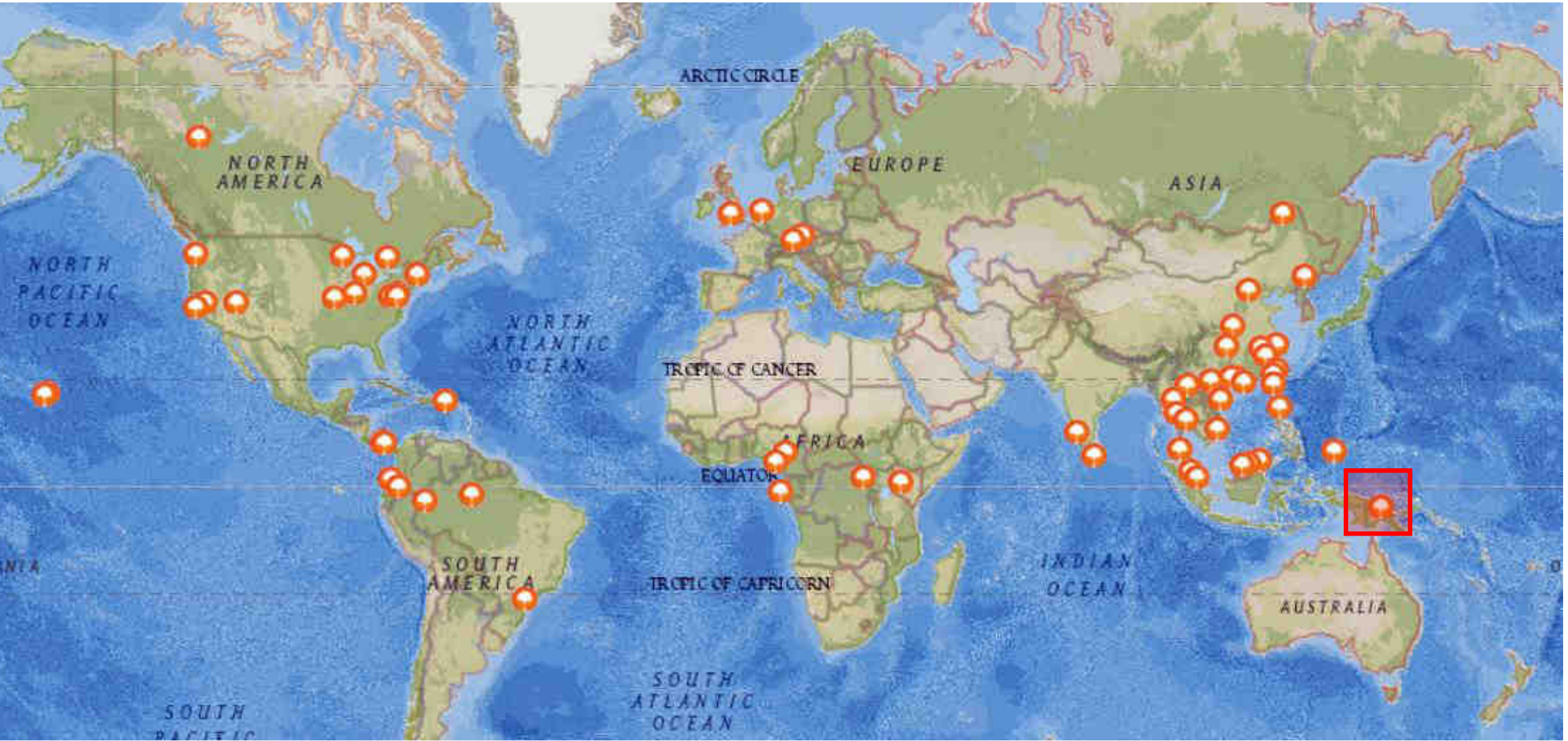

Swire Station and the 50ha ForestGEO Plant Plot
50 ha plot

ForestGEO survey team 2017: 288,000 trees from 560 species mapped



The ForestGEO network of forest dynamics plots

67 plots 26 countries 6 million trees 13,000 species (~25% of global total)

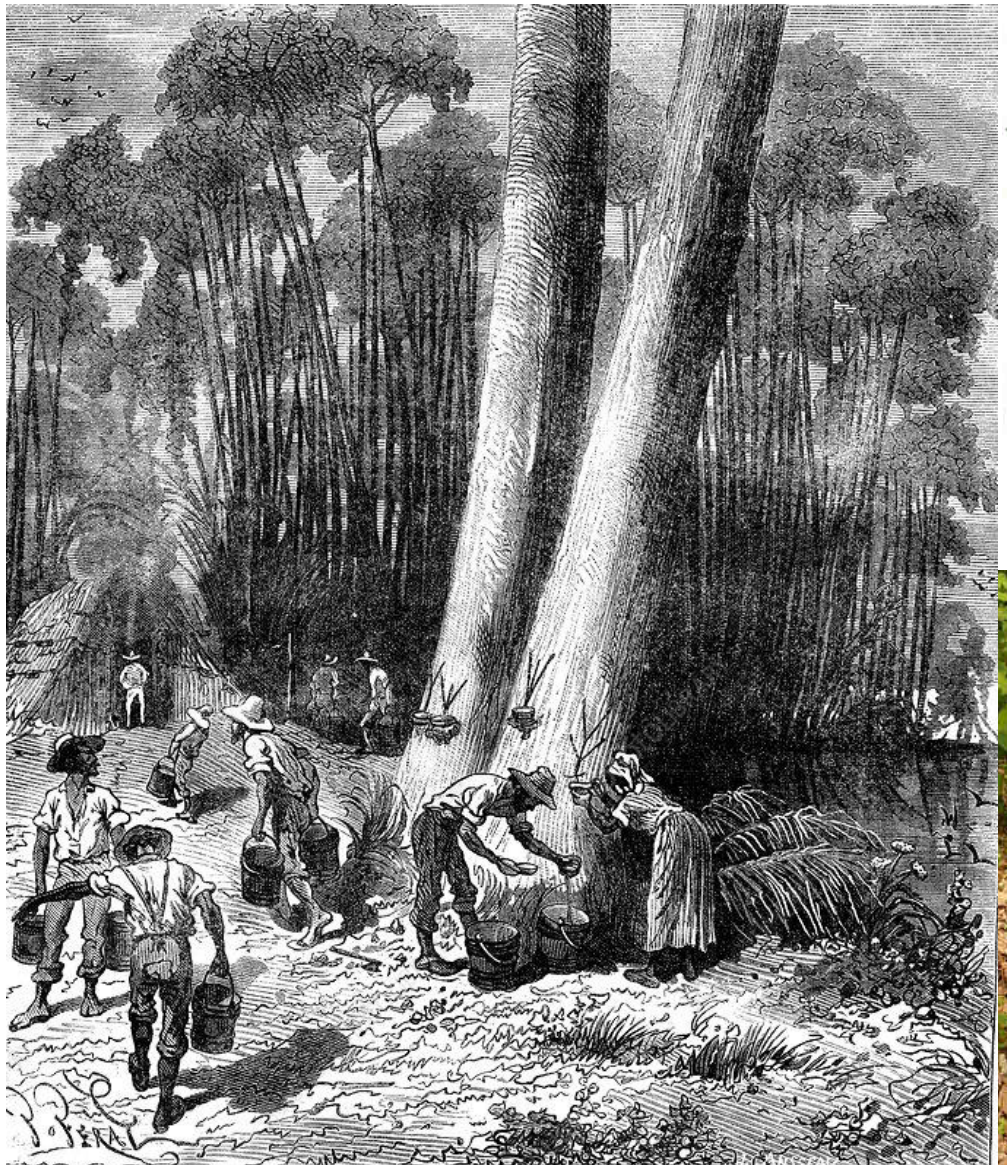



SWIRE
RESEARCH STATION
HAUS SAIENS
WANANG CONSERVATION AREA
MAGHU
Wanang paraecologist team:
Dominic Rinan (plants)
Jonah Filip (plants)
Byron Siki (plants)
Mark Mulau (birds)
WANANG ELEMENTARY SCHOOL
MOTTO
NEW GUINEA BINATANG RESEARCH CENTER
MADANG
P.O.BOX 604

Plant identification course for PNG and European students at the Swire Field Station

What about harvest of rainforest products to support conservation?

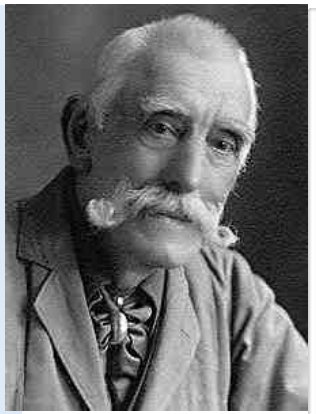
Rubber in the Amazon: the biggest “sustainable rainforest product harvest” gone wrong

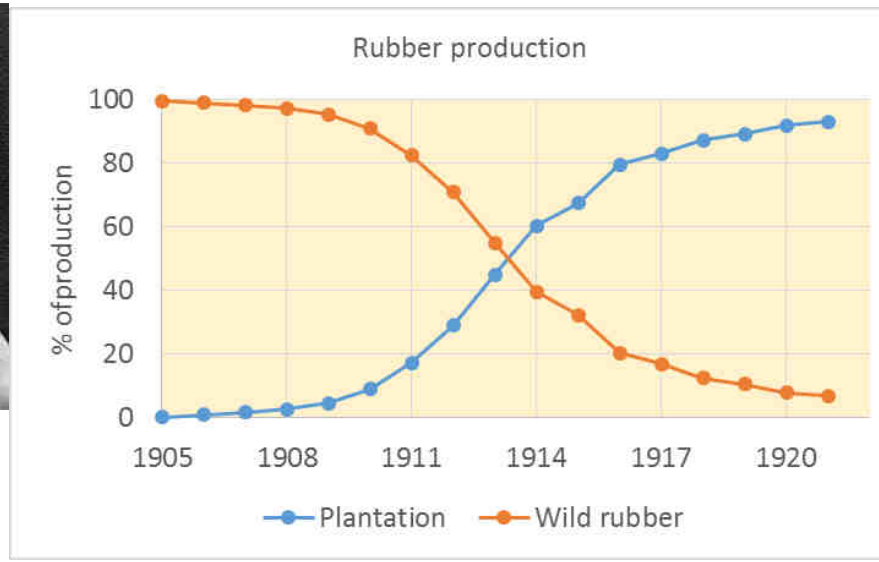


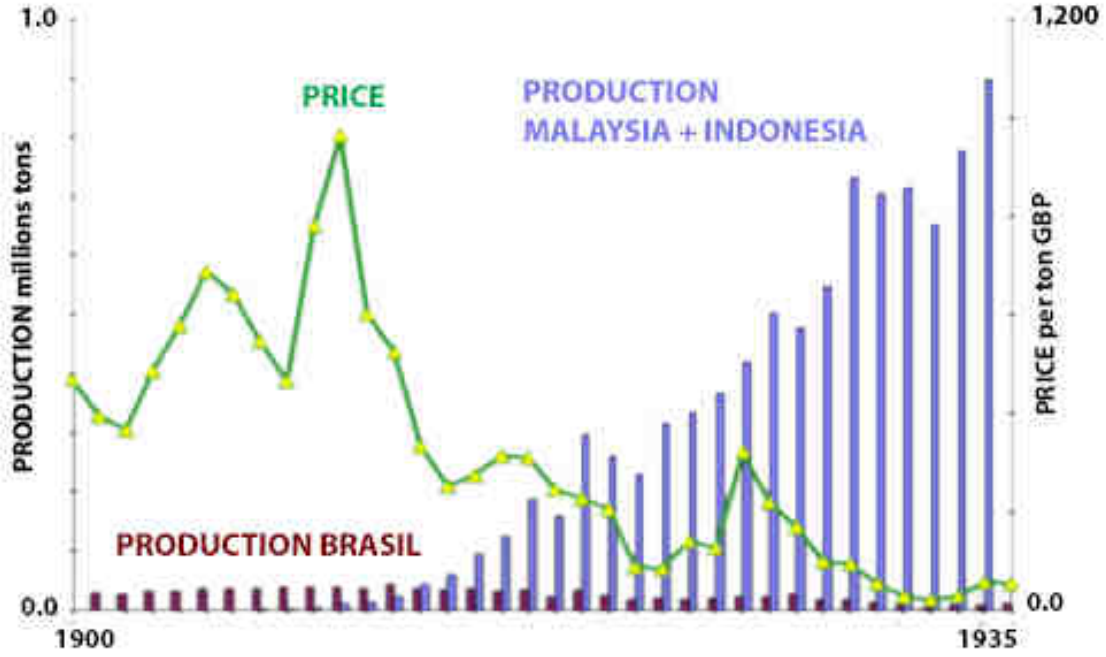
Rubber boom
1880-1912

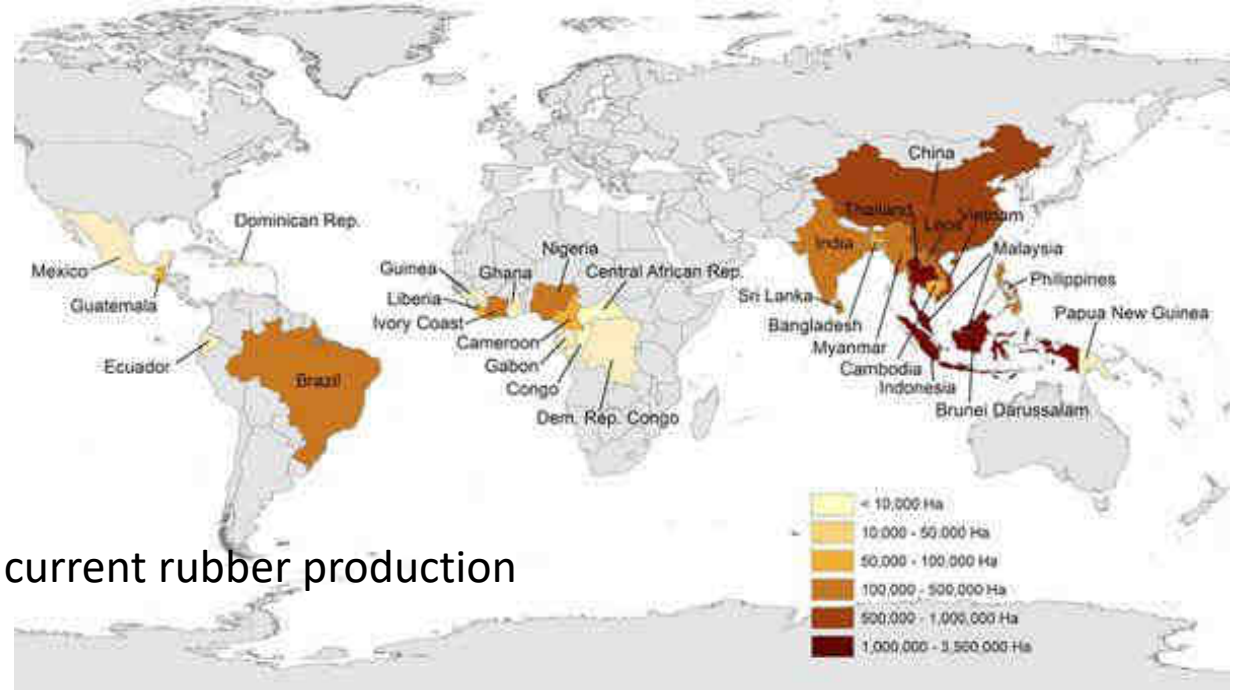
The end of the rubber boom in the Amazon 1880-1912

Henry Wickham stole 70,000 *Hevea* seeds in Brazil in 1876, brought them to Kew Gardens and the British used them to plant rubber in Asia





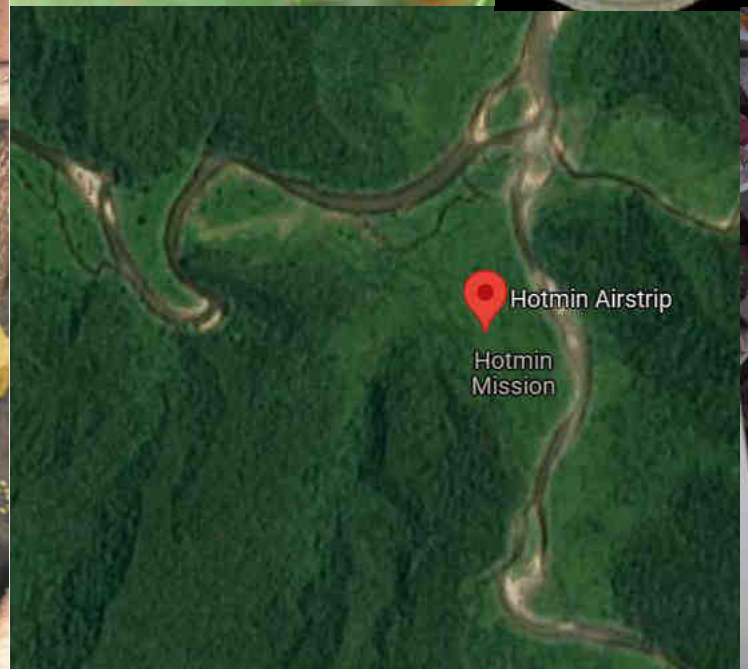




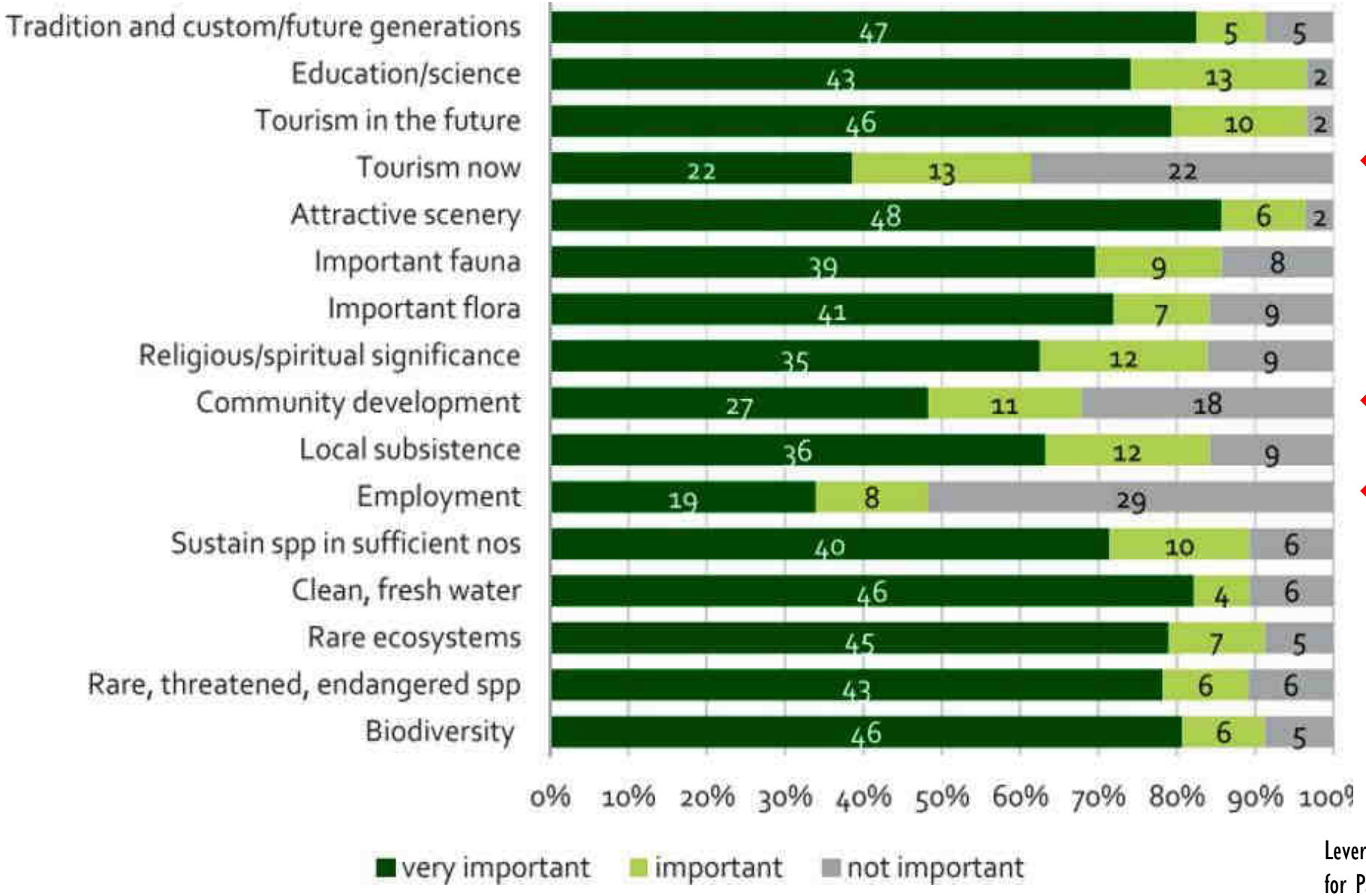
current rubber production

Sometimes there is gold in the forest: Gaharu harvest fever in the Hotmin village

Agarwood (gaharu) tree
[*Aquilaria,* Thymeleaceae]



Participants' perceptions of the level of importance of the benefits provided by protected areas in PNG



Underestimating Monetary Value and Community Development

Leverington, F. et. al, 2017. Assessment of management effectiveness for Papua New Guinea's protected areas 2017.

Conservation area	cathegories [dominant option in red]				KCA	MCF	MEC	WCA	TMC	KWA	YUS	CWM	KCP	WCF	MGC	KWM	LRB	LAK
Conservation success rated on 0 - 10 scale, low: 0-3, medium: 4-6, high 7-10	low	medium	**high**															
Legal form: indigenous, indigenous with governmental in process, governmental	**ind**	ind/gov	gov															
Conservation duration: short (<20 years), long (≥20 years), failed	short	**long**	closed															
Top threat to conservation: logging, swidden agriculture, indigenous hunting	**logging**	agric.	hunting	none														
Conservation focus on flagship species or entire ecosystem	species	**ecosyst.**																
Conservation area size: small (≤10,000 ha), large (>10.000 ha)	small	large																
Population impacted by conservation area: small (<0.1 ind/ha), large (≥0.1 ind/ha)	small	large																
Remote area (travel to the nearest town ≤6 hours one way): yes or no	**yes**	no																
Conservation management & enforcement: indigenous community alone, or with an NGO	ind	**ind+NGO**	ind+gov															
Monitoring/research	**yes**	no																
Funding/services delivery: indig. community alone, with an NGO, or the government	ind	**ind+NGO**	ind+gov															
Conservation income per person and year: low (£<2), medium (£2-10), high (>£10)	low	**medium**	high															
Conservation income per ha and year: low (£<0.25), medium (£0.25-2.50), high (>£2.50)	low	**medium**	high															
Business projects brought by conservation, others, both or neither	**conserv.**	other	both	neither														
Services brought/improved by conservation: education, health, both or neither	educ.	health	both	neither														
Visits by tourists (>100 per year), researchers & students or neither	tourism	**research**	both	neither														
Top unsatisfied needs: roads, services (health, education, etc.), income opportunities	**road**	services	income	no data														
Top benefits missed due to conservation: roads, mining employment, or none	**road**	mining	none															

14 conservation areas

top threat: logging

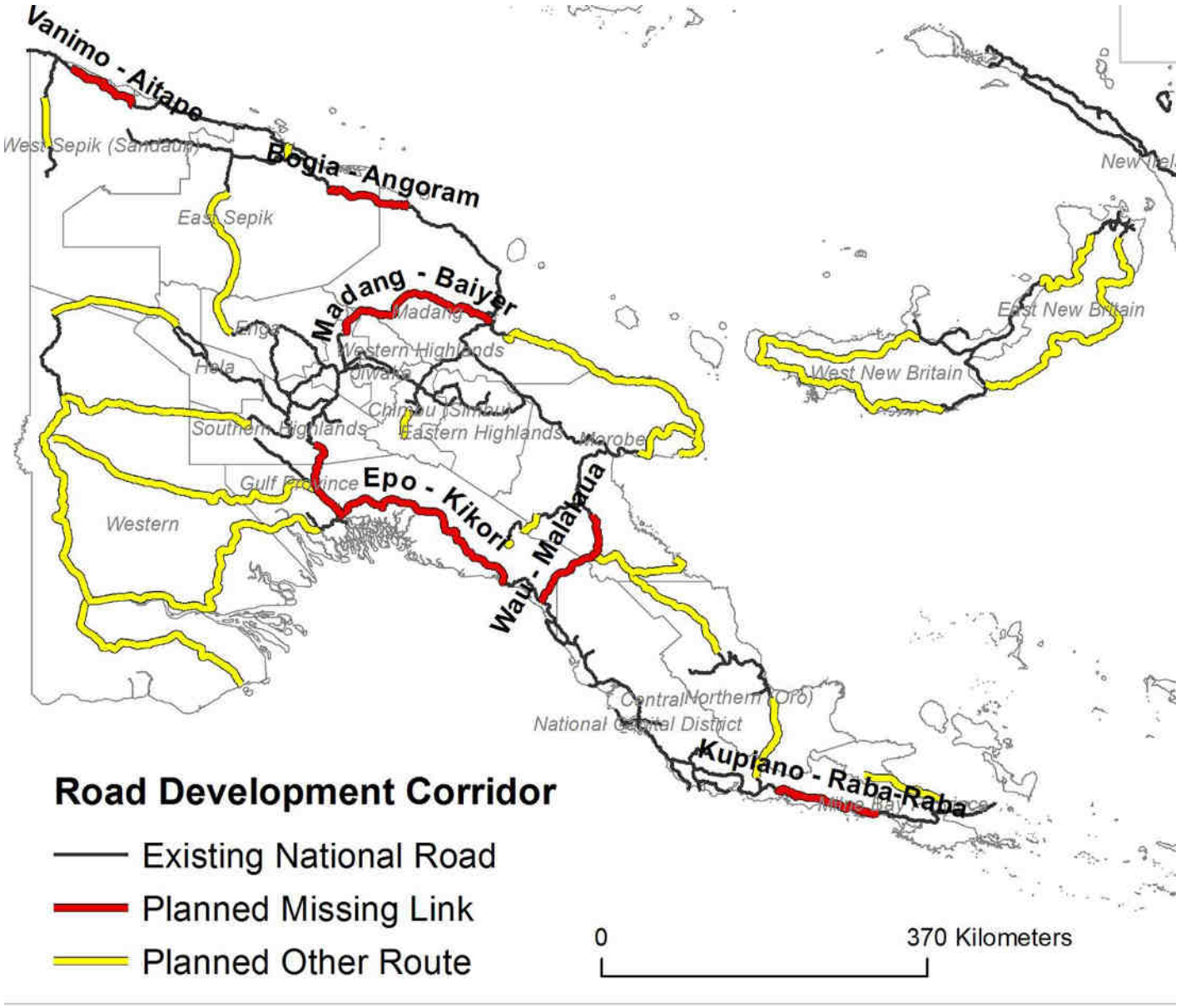
management: NGOs

research: yes

services: NGOs

business & services: mixed results

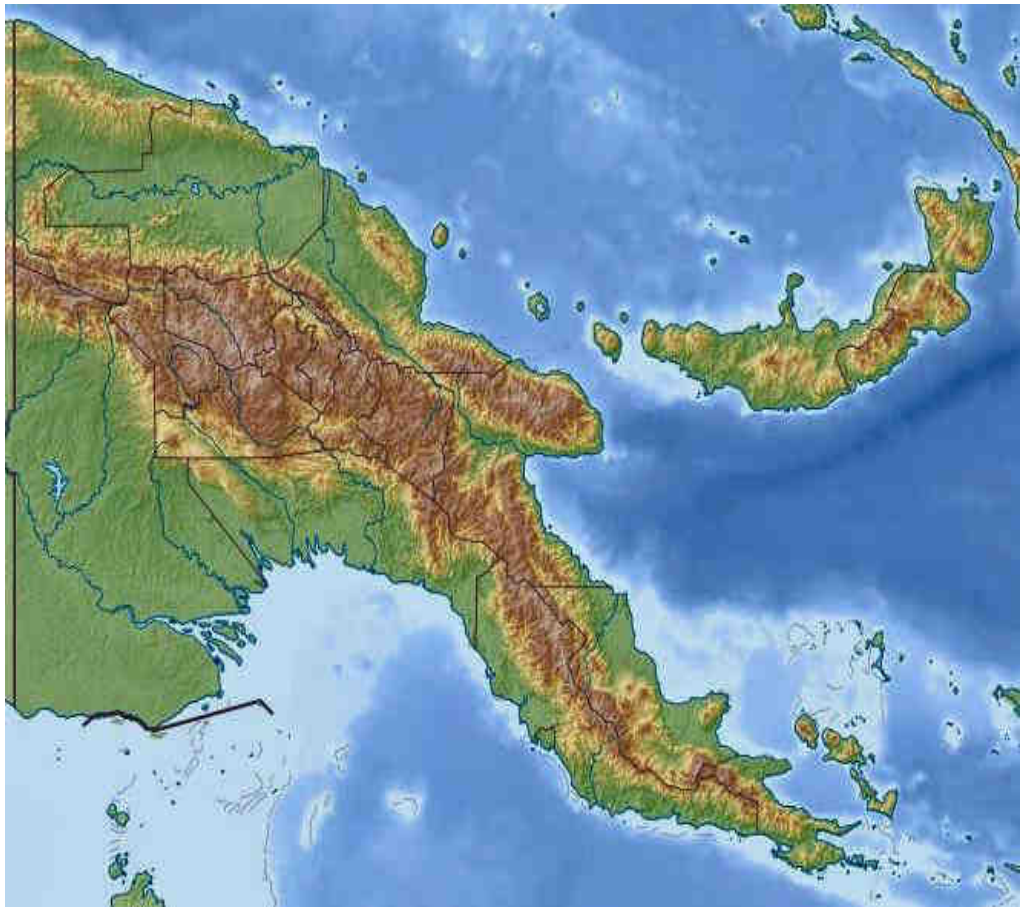
services missed: roads



RESEARCH ARTICLE

Infrastructure expansion challenges sustainable development in Papua New Guinea

Mohammed Alamgir[1]*, Sean Sloan[1], Mason J. Campbell[1], Jayden Engert[1], Regina Kiele[2], Gabriel Porolak[2], Thomas Mutton[3], Ambroise Brenier[3], Pierre L. Ibisch[4], William F. Laurance[1]*



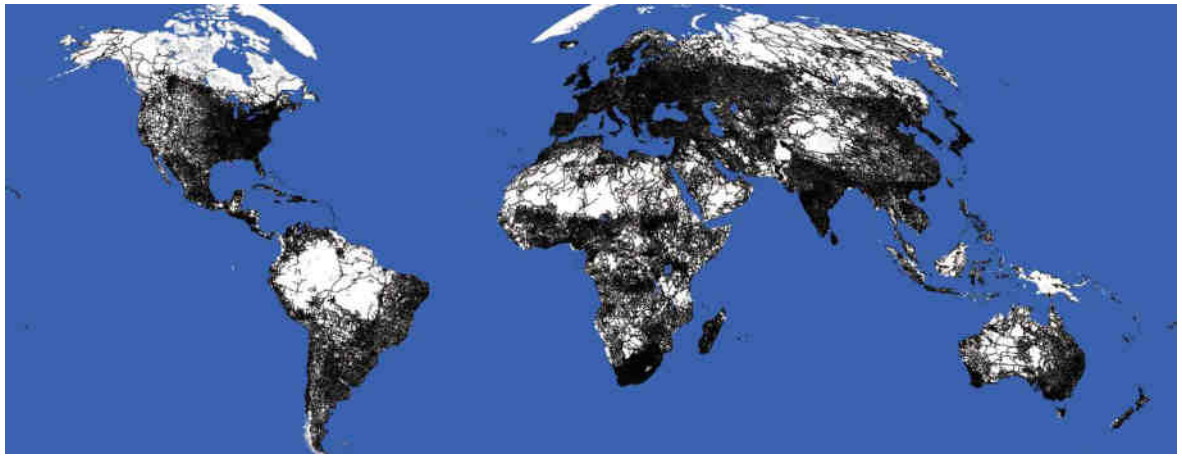
LETTER

doi:10.1038/nature13717

A global strategy for road building

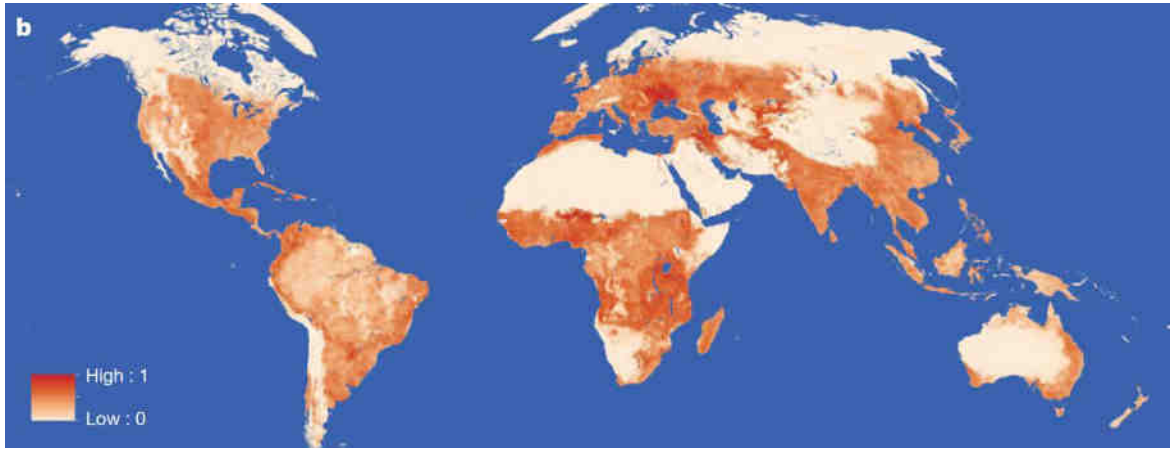
William F. Laurance[1], Gopalasamy Reuben Clements[1,2], Sean Sloan[1], Christine S. O'Connell[3], Nathan D. Mueller[4], Miriam Goosem[1], Oscar Venter[1], David P. Edwards[5], Ben Phalan[6], Andrew Balmford[6], Rodney Van Der Ree[7] & Irene Burgues Arrea[8]

Distribution of roads

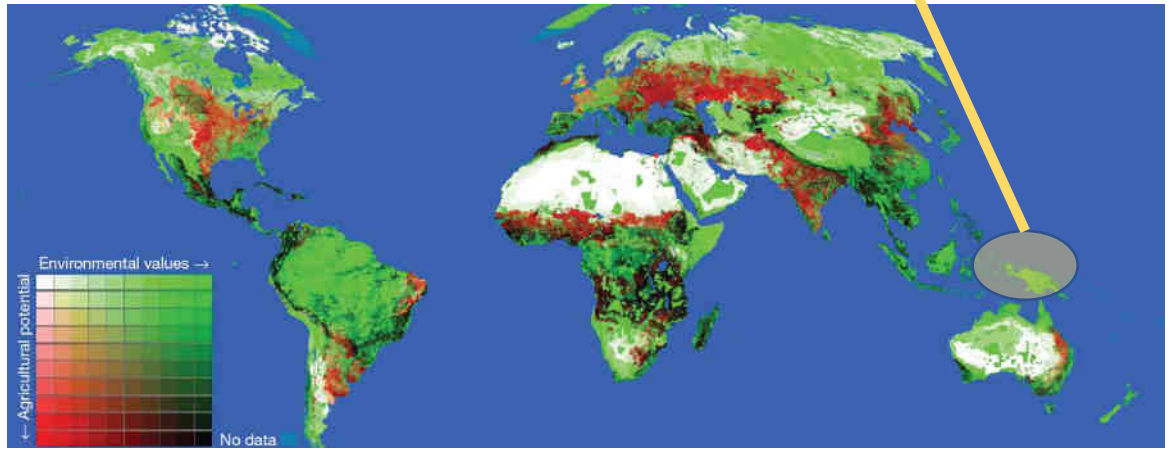


Distribution of biodiversity

Potential for agriculture intensification



Road building: desirable x undesirable



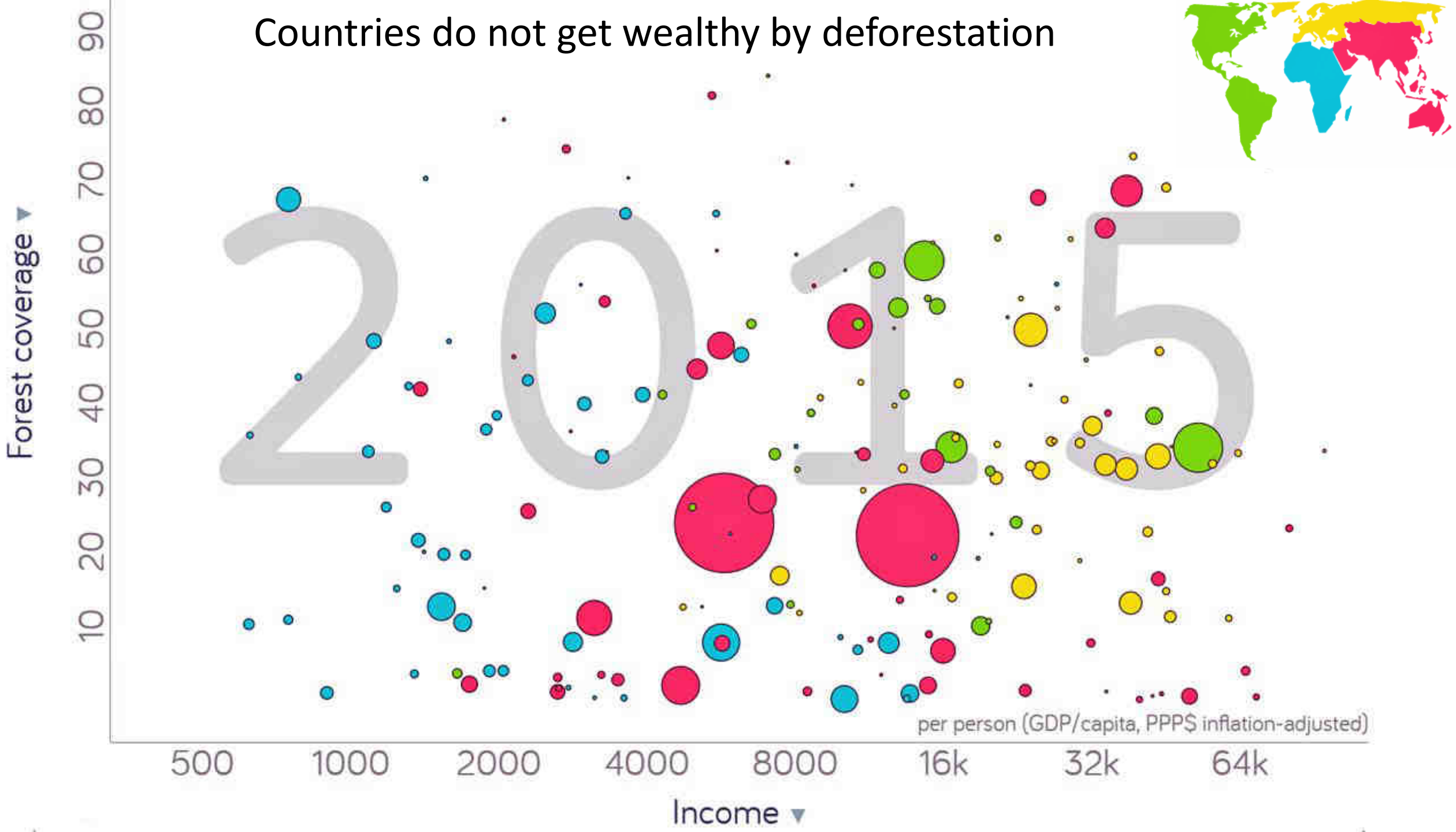
Roads are amongst the strongest logging incentives

How will Papua New Guinea look in 2050 or 2100?

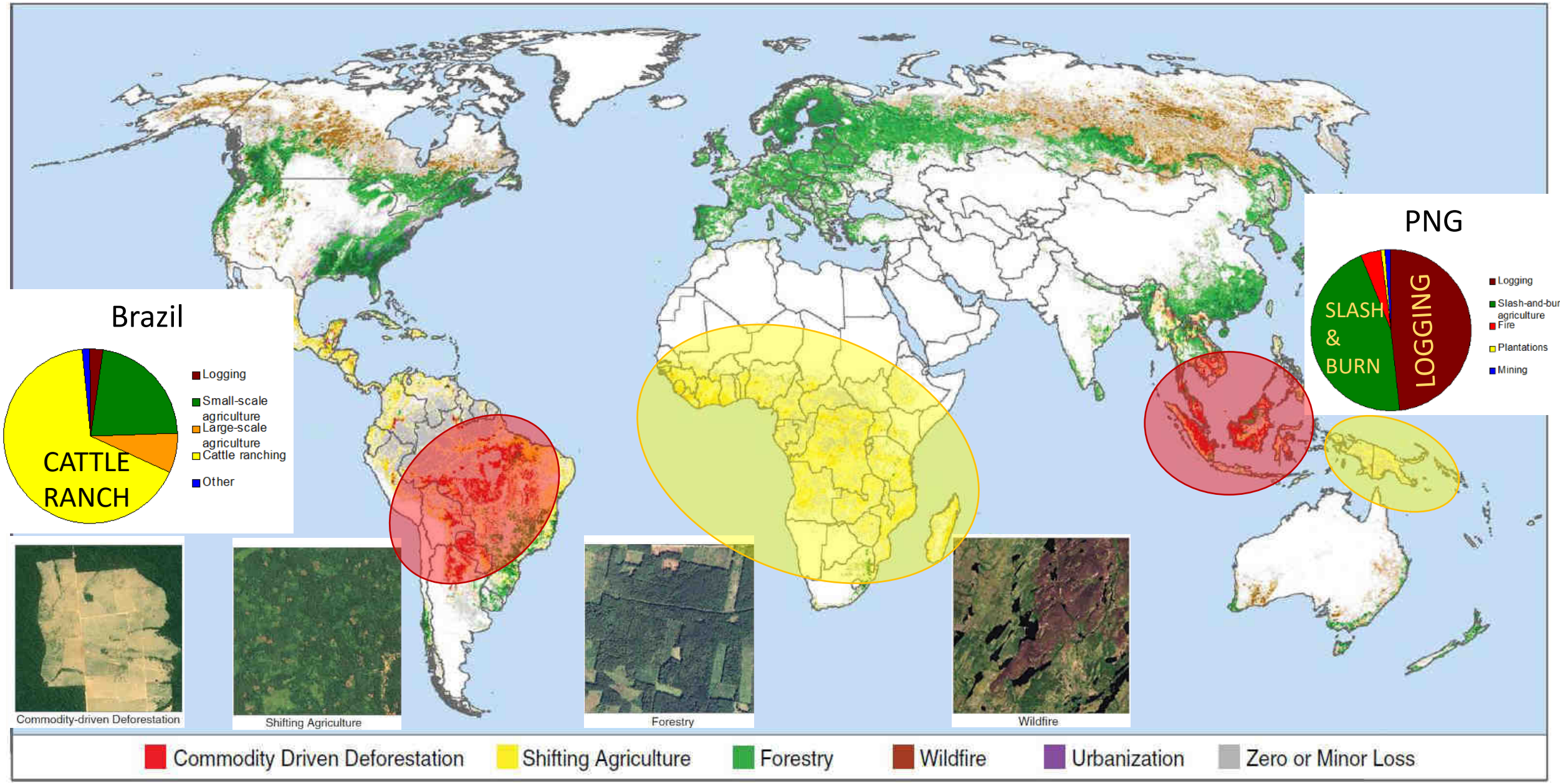
Will PNG cut down its forests?

Anthropic grasslands: a completely useless succession stage towards rainforest blocked by repeated anthropic fires.
Low biodiversity, low economic value, low ecosystem services.

Countries do not get wealthy by deforestation



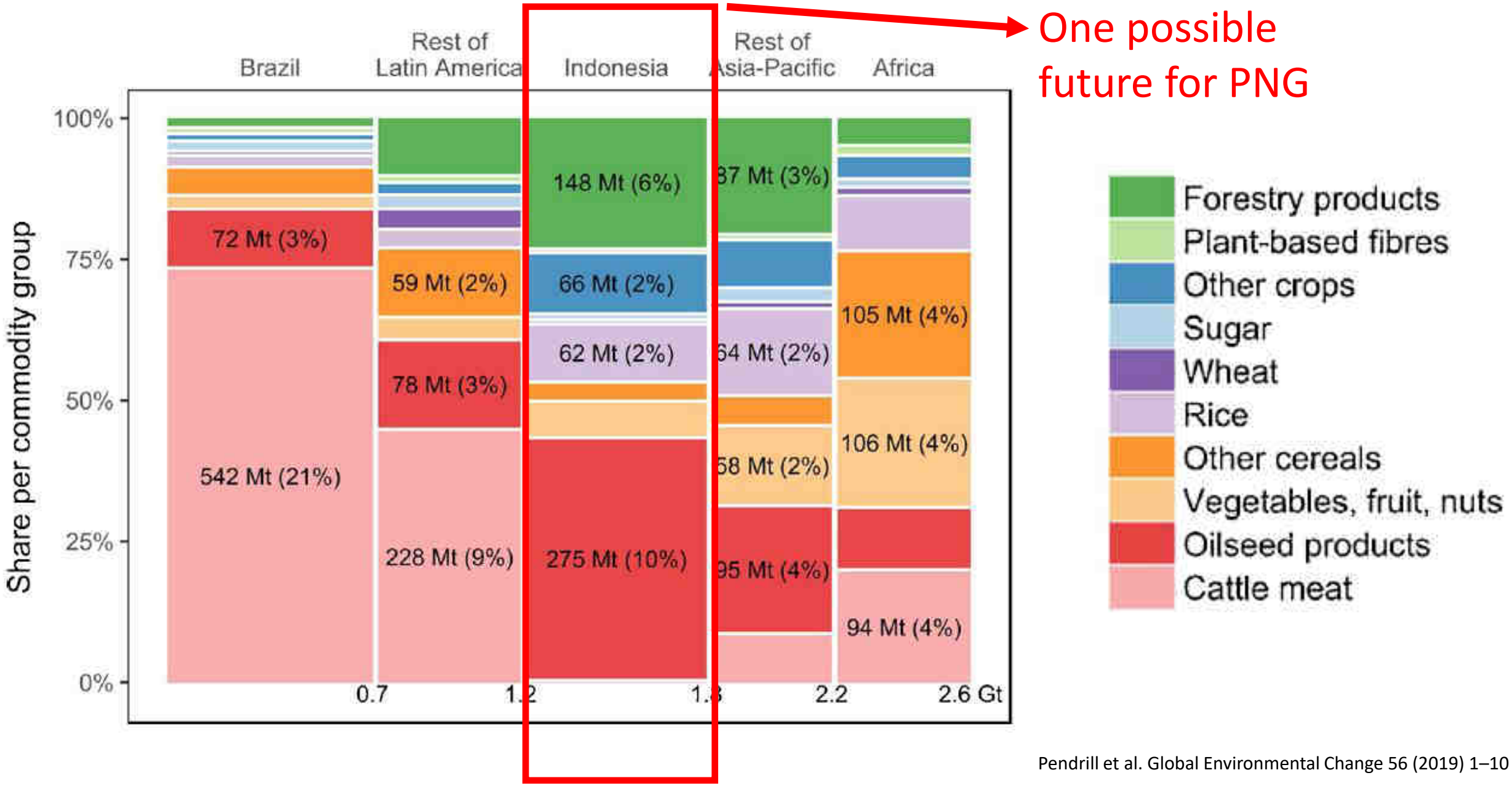
Primary drivers of forest cover loss: old (PNG & Africa) vs. new (Brazil & SE Asia)



Curtis et al., Science 361, 1108–1111 (2018)

Carbon emissions from deforestation due to agriculture and forestry activities

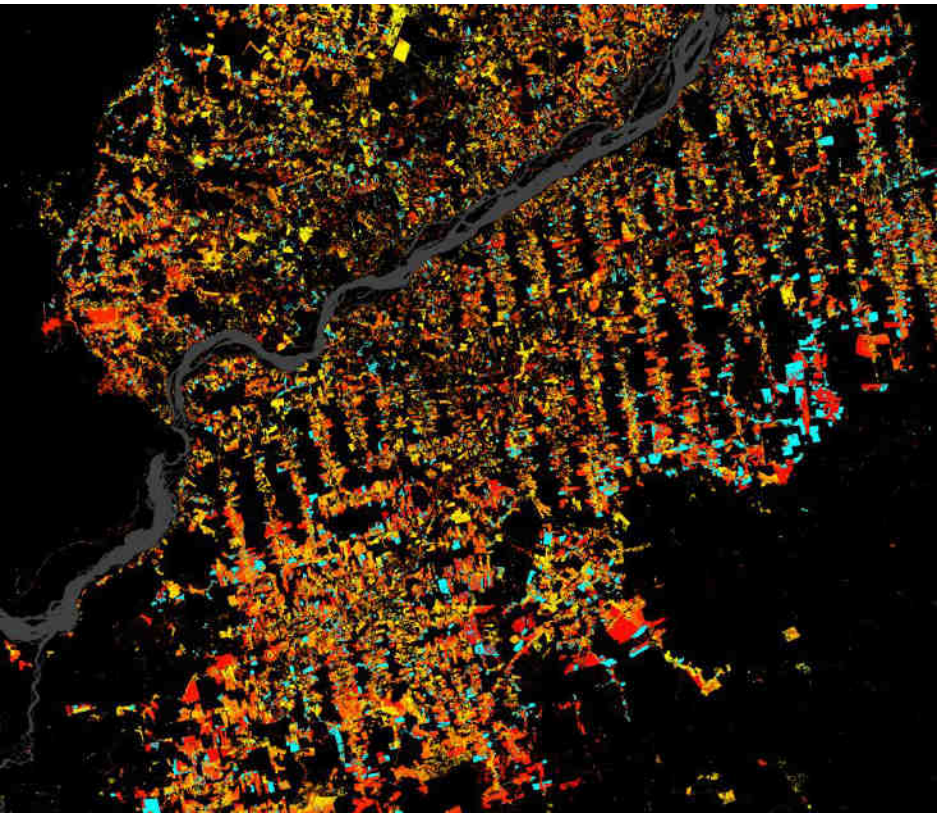
One possible future for PNG



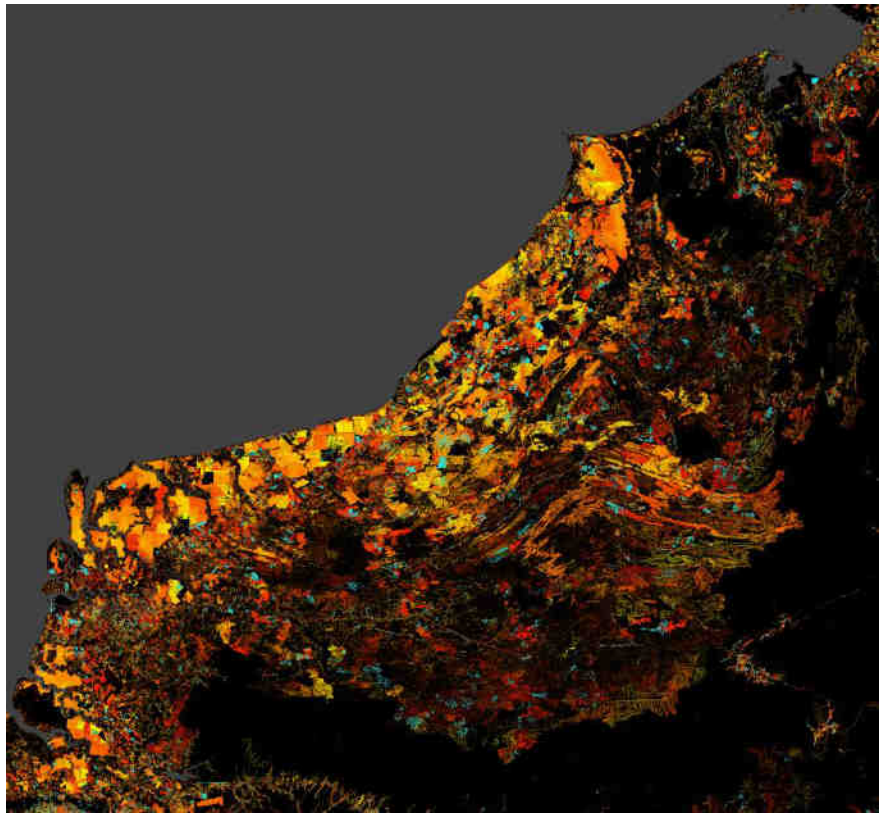
Pendrill et al. Global Environmental Change 56 (2019) 1–10

Deforestation patterns in the tropics

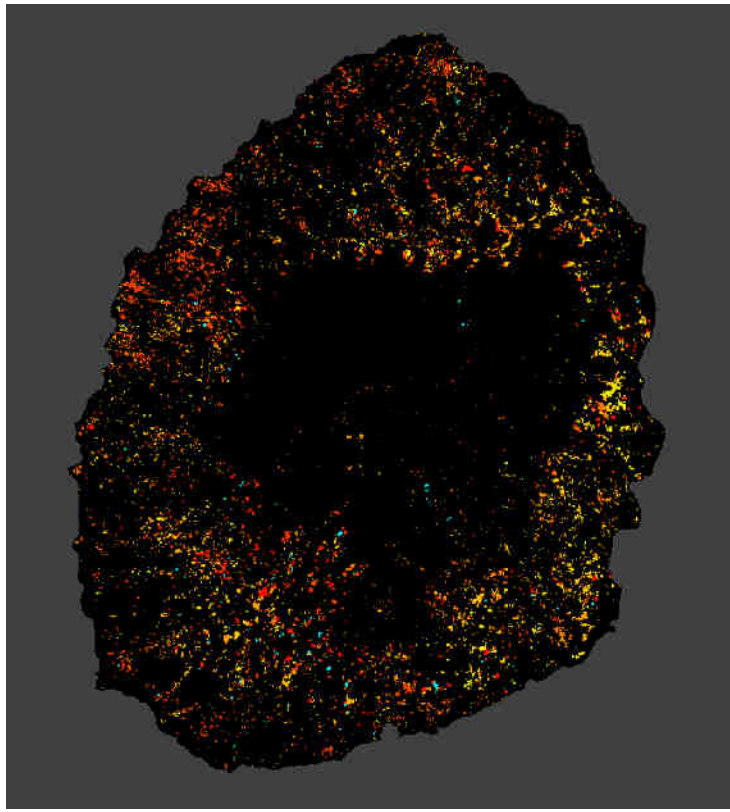
Settlement around the roads driving deforestation in the Amazon



Larger blocks of forest cut for agriculture, mostly oil palm, in NW Borneo

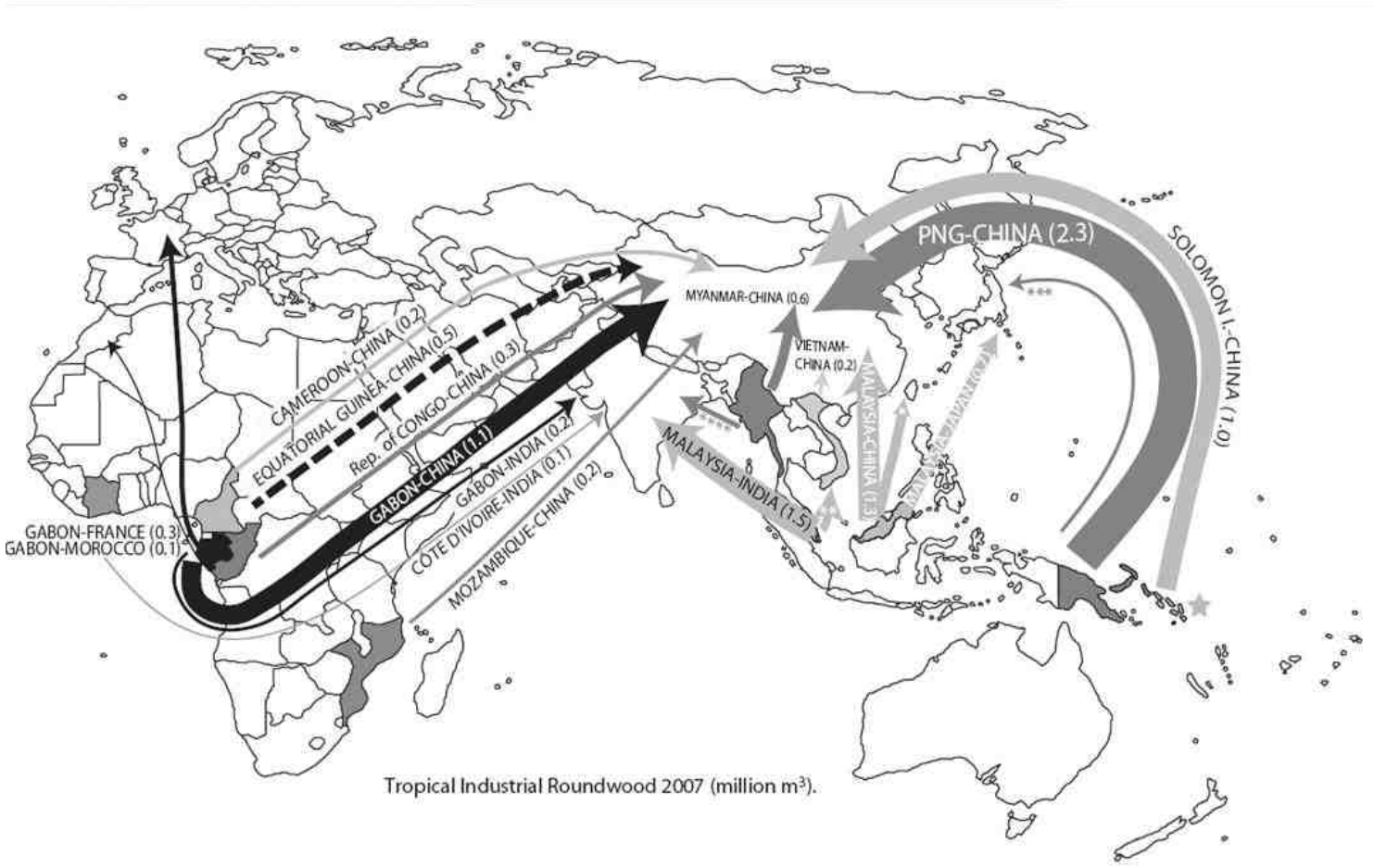


Small scale deforestation by swidden agriculture on the Karkar Island, PNG



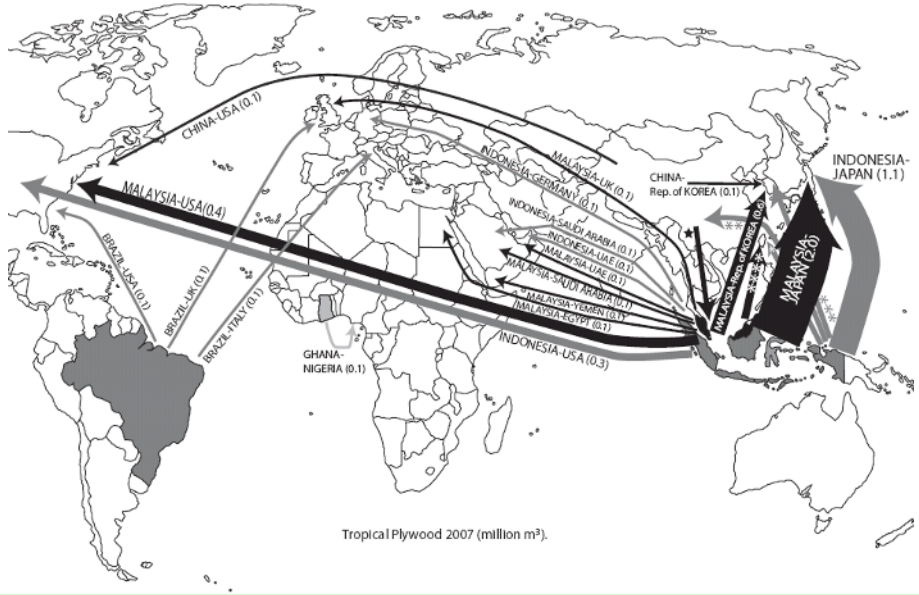
Trading in tropical logs [2007]

more sophisticated countries do not export unprocessed logs

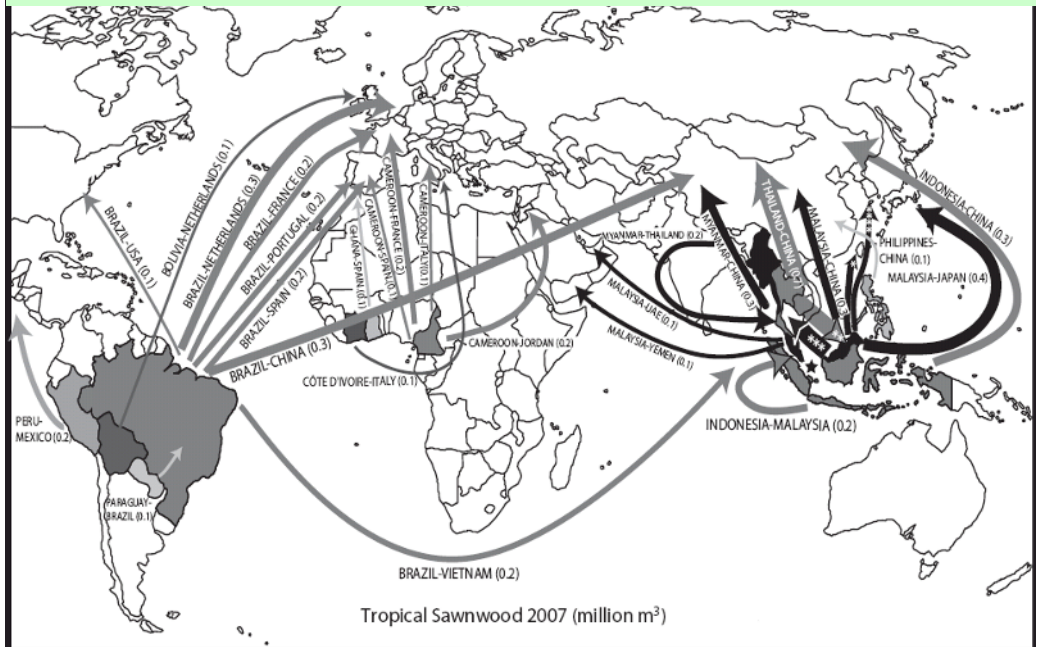


No exports of raw logs from S. America

Trading in tropical plywood [2007]



Trading in tropical sawnwood [2007]



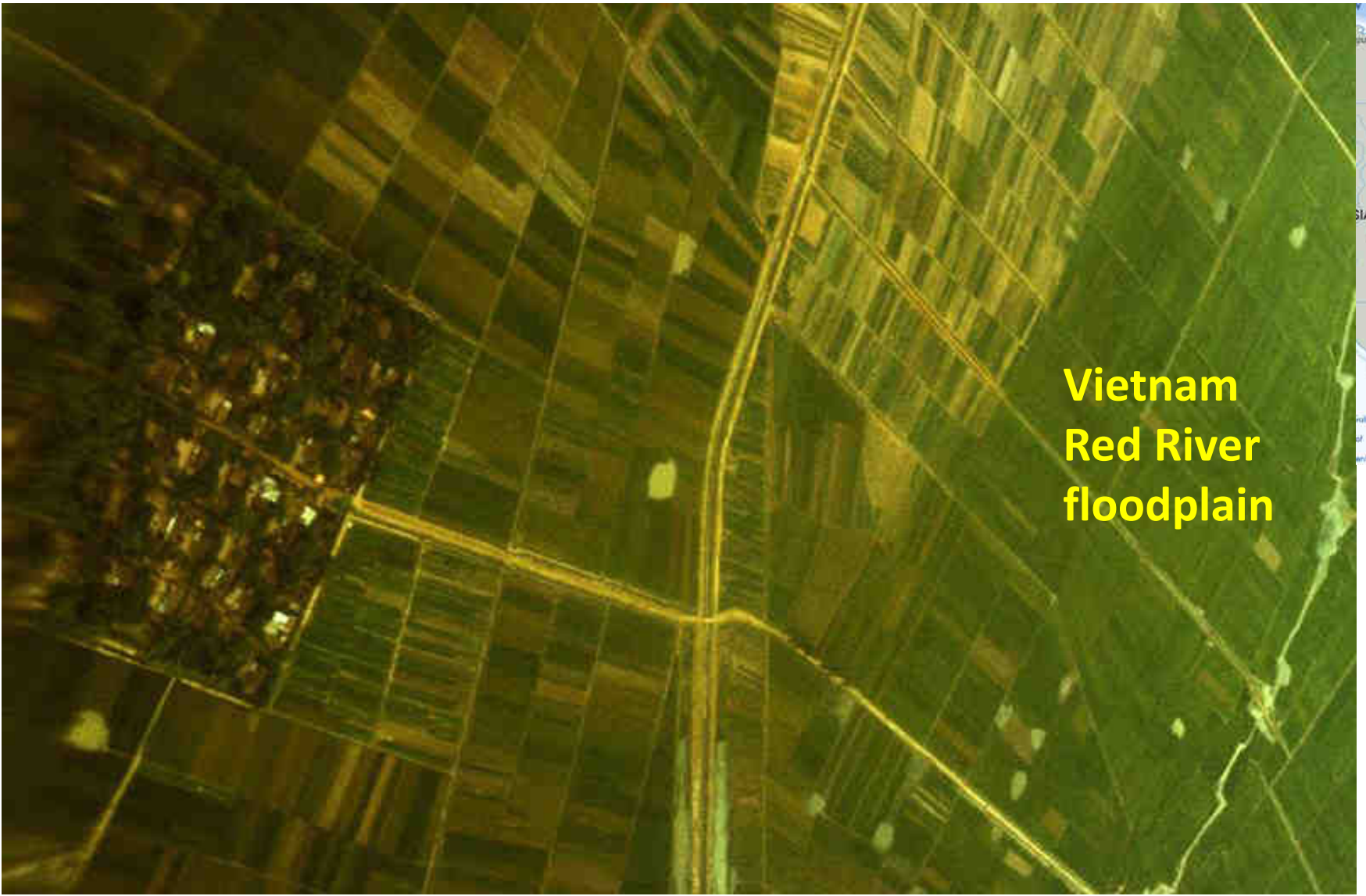
Local processing of timber is preferable to export of raw logs, but often a poor deal economically and socially

Timber processing in Sabah (Borneo)

How will Papua New Guinea look in 2050 or 2100?

PNG will never run out of food, but could it fund its development from agriculture?

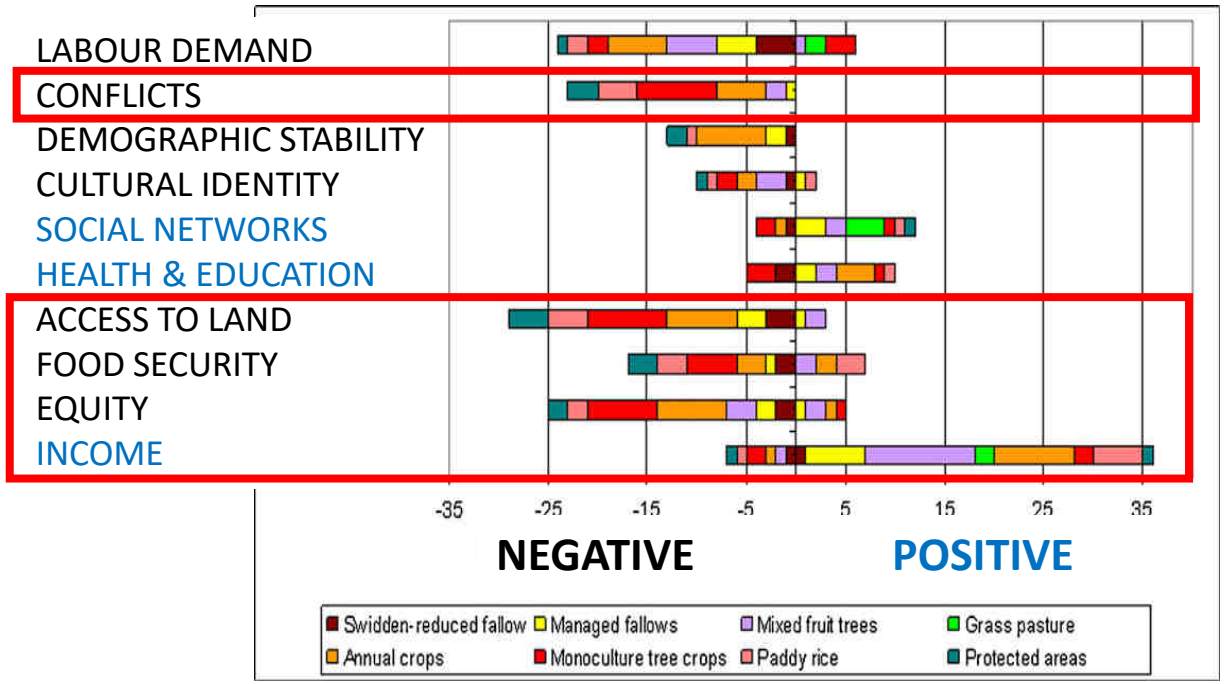
10 tons of rice per ha and year x 3,800 kcal per kg; Human energy needs ~2,500 kcal per day. Intensive paddy field can energetically sustain 42 people per ha which is 4x more than sweet potatoes

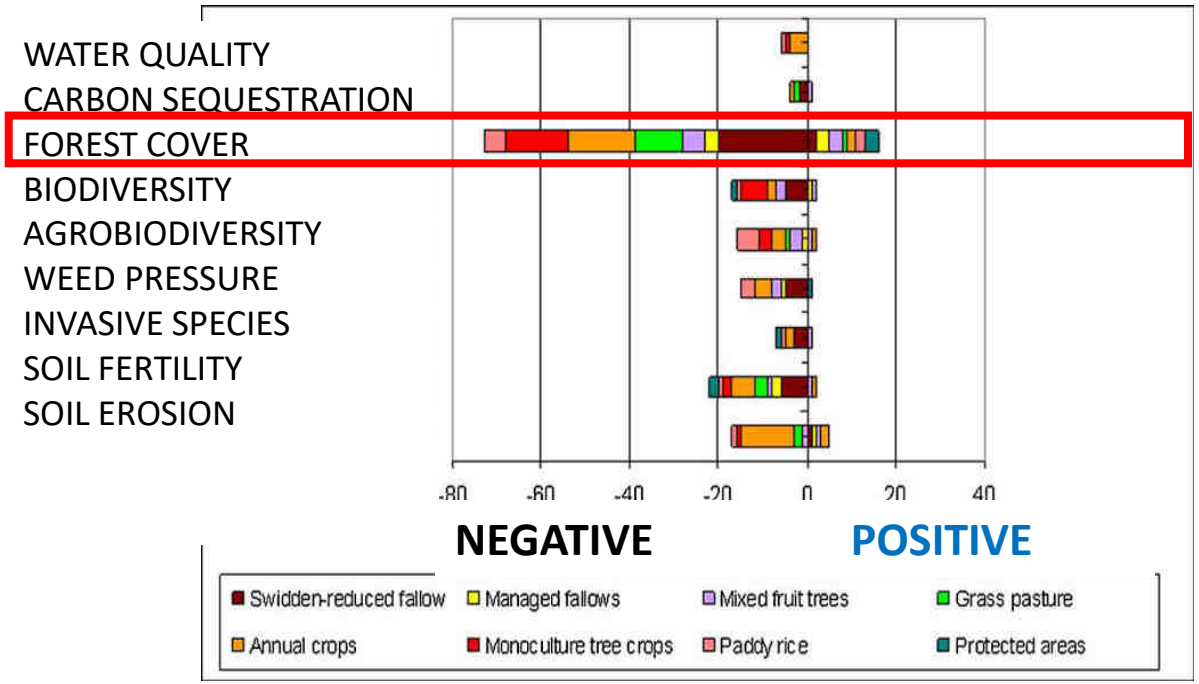


Sepik basin: 8,000,000 ha only a quarter of the area converted to paddy fields could feed 84 million people

TRANSITION FROM SWIDDEN AGRICULTURE

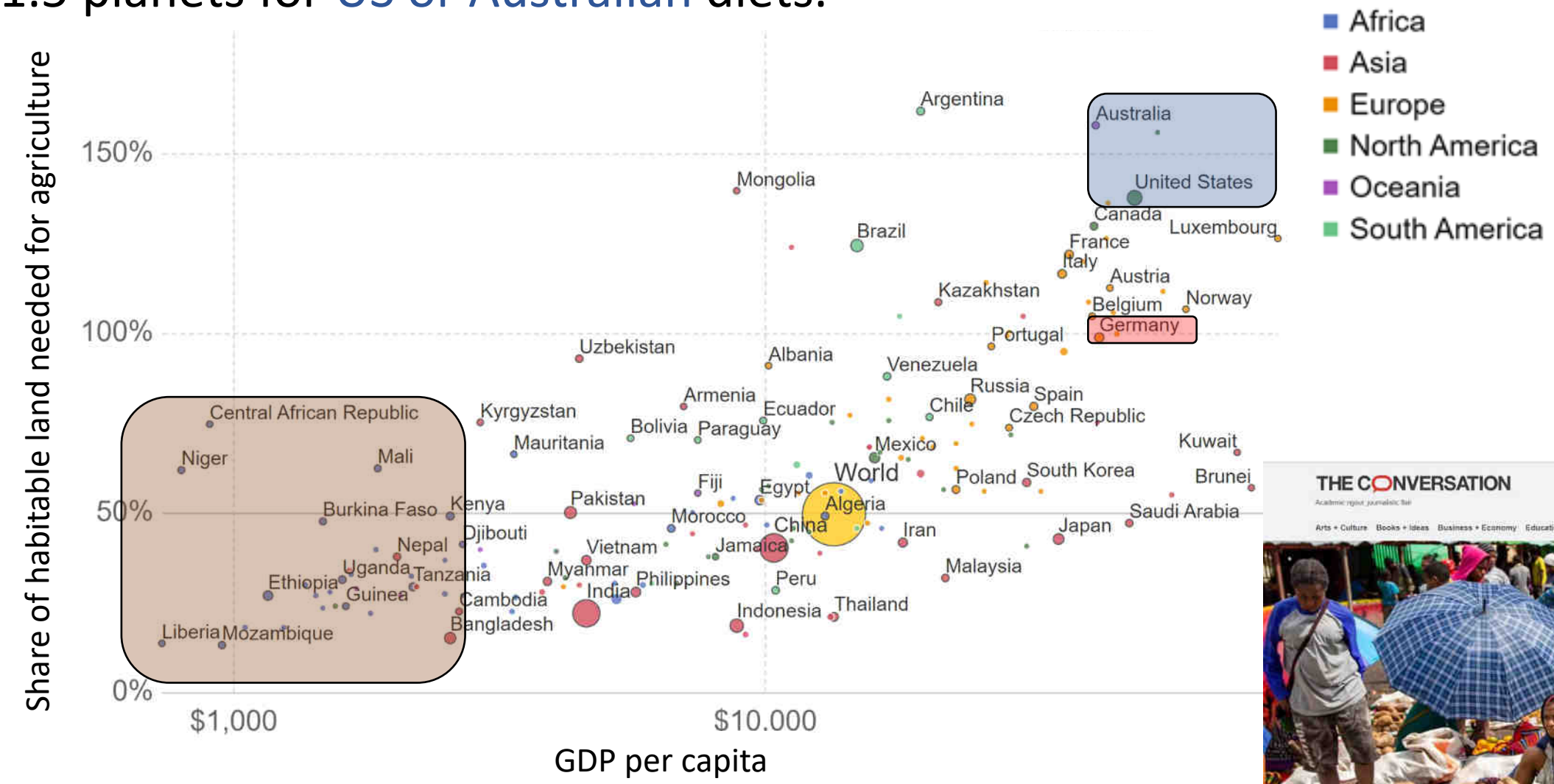
Increases incomes, improves health and education, but decreases food security, access to land, equality and forest cover, and increases conflicts.





Van Vliet et al. Global Environmental Change 22 (2012) 418–429

Swidden-agriculture is inefficient but resulting diets are environmentally friendly. We would need entire habitable land for agriculture to support German diet, and 1.5 planets for US or Australian diets.



Source: World Bank, HALF Index (Land Use) - Alexander et al. (2016), Population (Gapminder, HYDE(2016) & UN (2019))
OurWorldInData.org/agricultural-land-by-global-diets • CC BY

PNG crops: value of genetic resources

Bananas in this picture are more diverse than the entire banana stock in European supermarkets

USA

JAPAN

UK

GERMANY

AUSTRALIA

BRAZIL

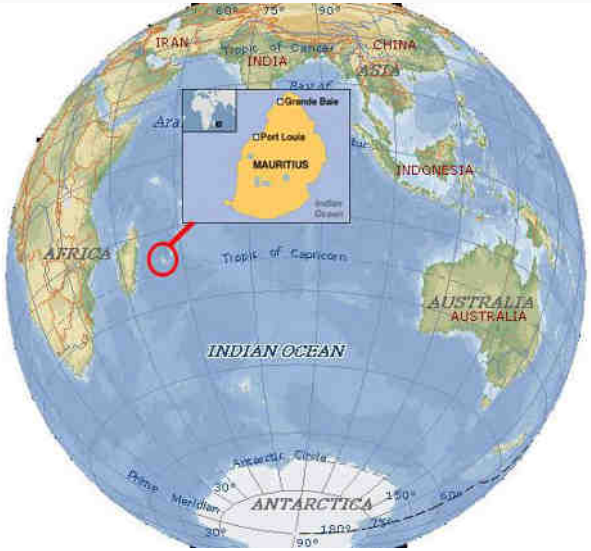
All supermarket bananas are clones from several banana plants grown in 1830 in the house of William Cavendish, the 6th Duke of Devonshire by their gardener Sir Joseph Paxton, originating from Mauritius

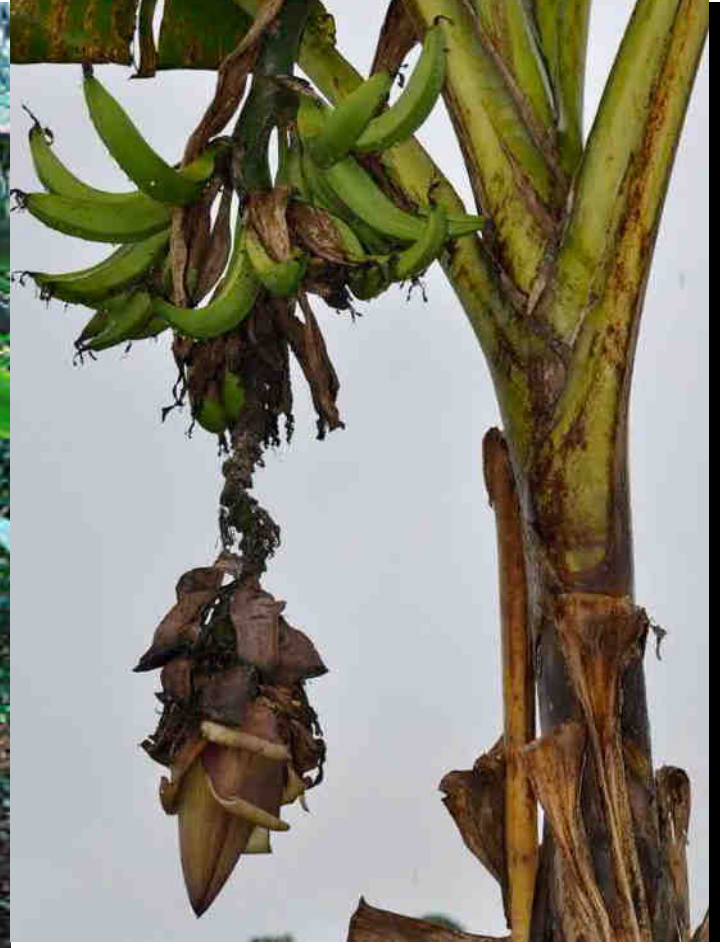
Cavendish variety replaced tastier Gros Michel which was wiped out bya fungus Fusarium oxyporum - “Panama disease”. Now that disease is adapting to Cavendish…

Gros Michel

Cavendish

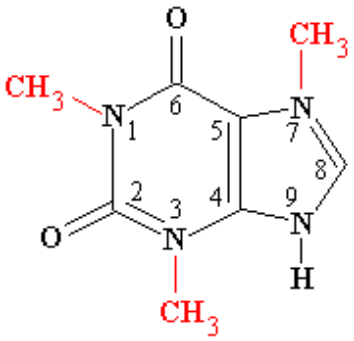
???





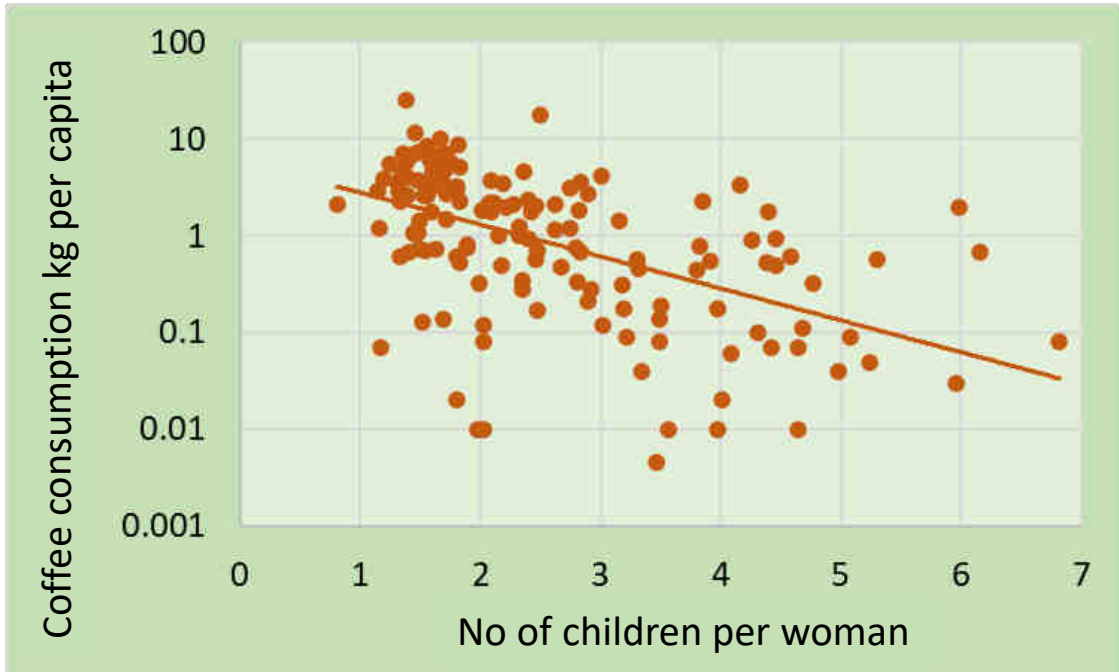
New Guinean banana genetic pool will be important when the next fungal disease comes

Coffee (Coffee arabica): a shrub from African rainforests that manipulates the behaviour of a vertebrate species *Homo sapiens* using an alkaloid caffeine, originally developed as a defence against herbivores.

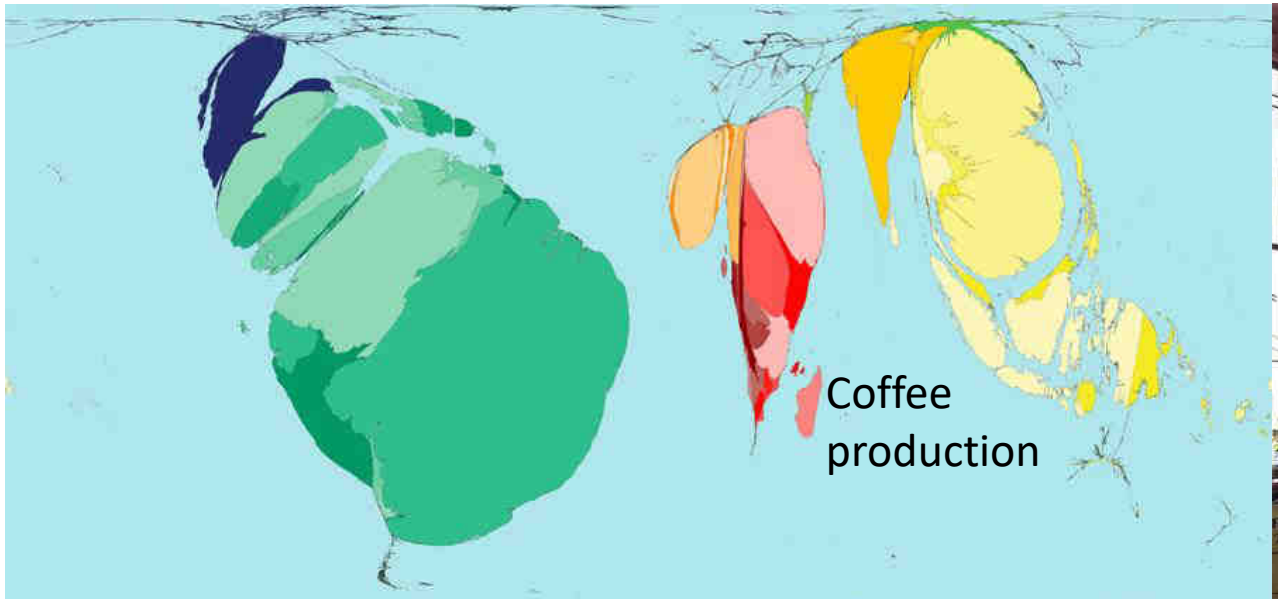


Caffeine

Happiness is not a parameter of natural selection



The world is divided into coffee growers, coffee drinkers and the Brazilians who do both



_shade_g/

Top 15 Coffee Producing Countries

Countries with the highest annual production (60 kg bags)

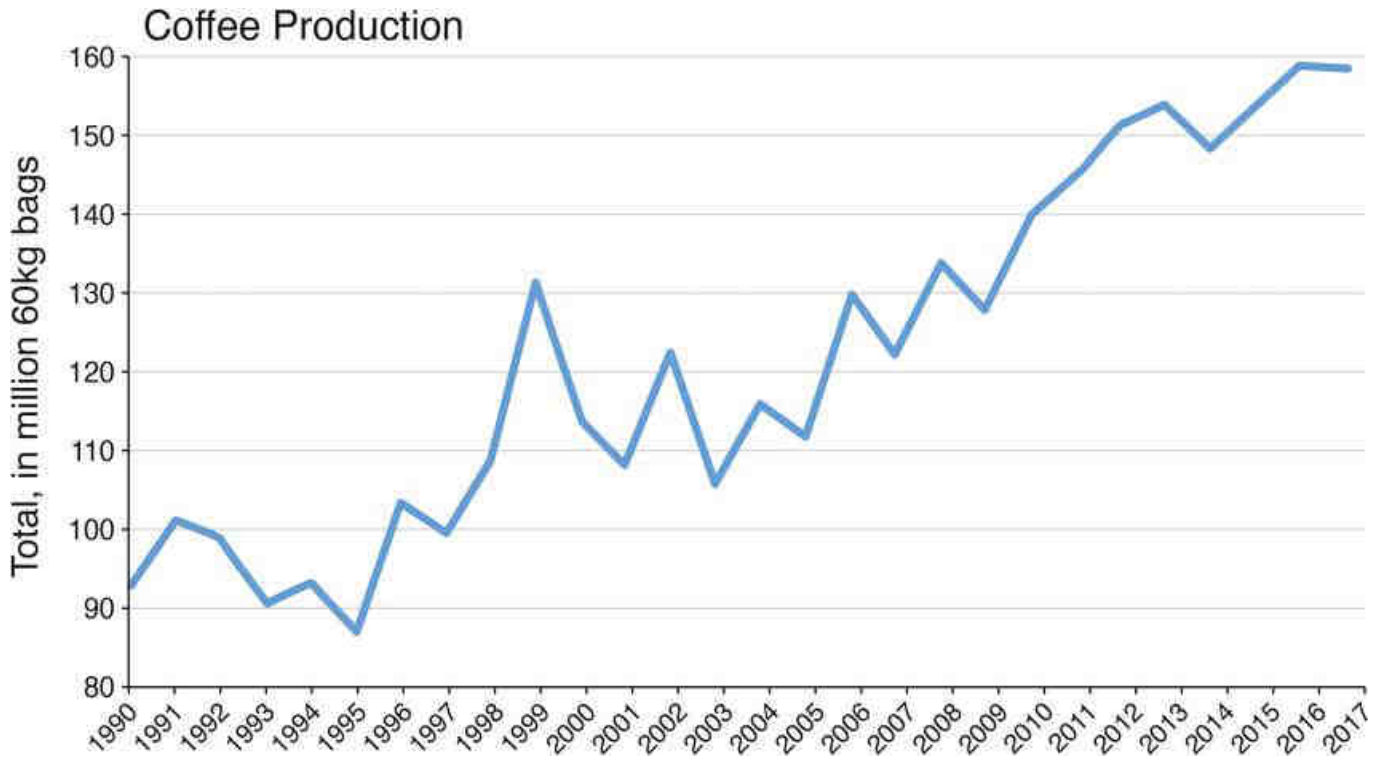
	Countries	Total
01	Brazil	45.4M
02	Colombia	12.9M
03	Ethiopia	8.4M
04	Honduras	5.3M
05	Peru	4.4M
06	Mexico	3.3M
07	Guatemala	3.3M
08	Nicaragua	2.5M
09	China	1.8M
10	Indonesia	1.4M
11	India	1.4M
12	Costa Rica	1.1M
13	Vietnam	1.1M
14	Uganda	1.0M
15	Papua New Guinea	0.9M

Data in Race

Source:- USDA Foreign Agricultural Service 2024/25

Global production of coffee keeps growing

PNG arabica coffee is in demand



DEVPOLICYBLOG

What ails PNG's coffee production? Elections and more

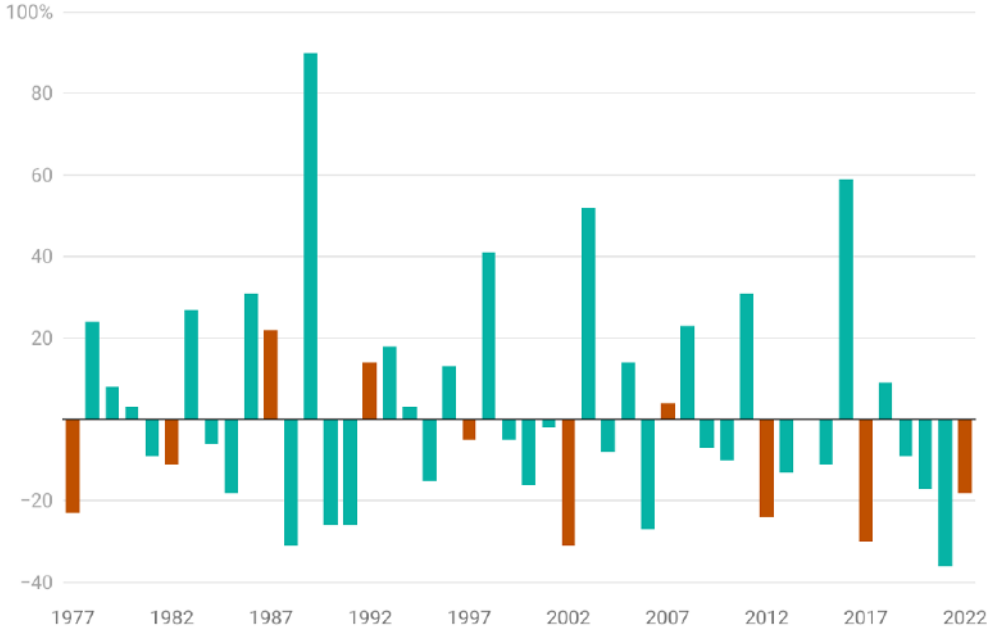
by Raymond Dorum, David Poka and Kingtau Mambon

17 July 2023

Sorting coffee beans in the PNG Highlands

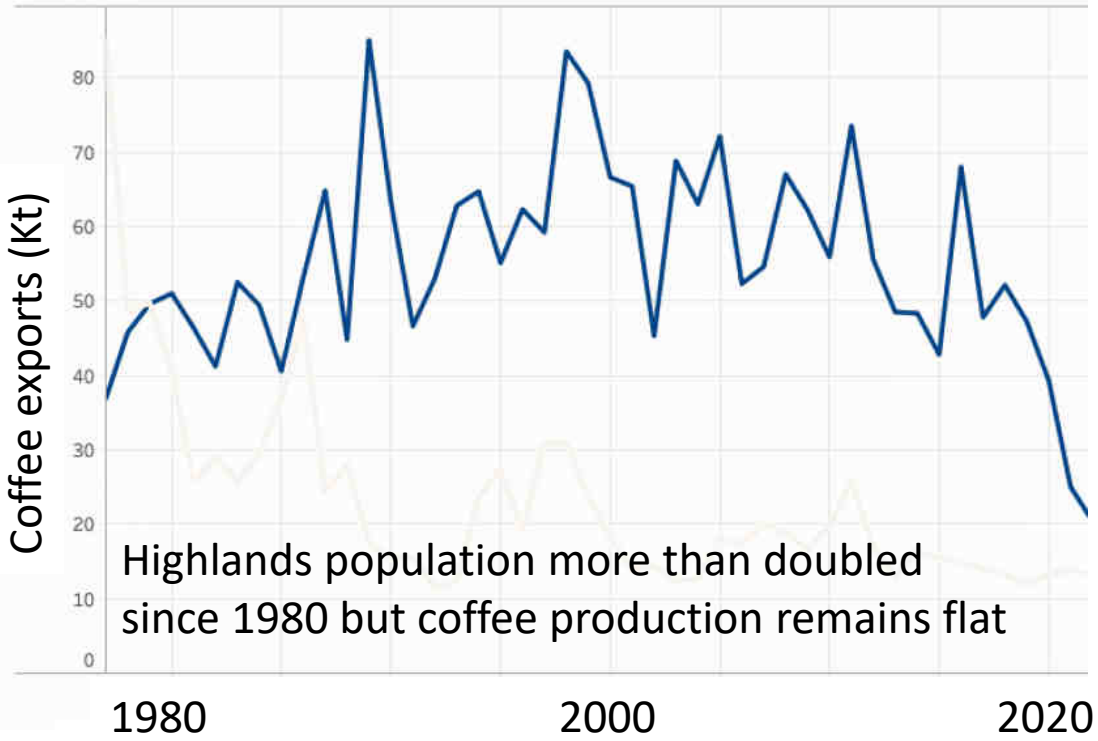
Figure 1: Growth rates of PNG's coffee exports (1977-2022)

Year-on-year growth; election years highlighted



Source: Bank of Papua New Guinea quarterly economic bulletin statistical tables; PNG Economic Database

Export volume of coffee (1977-2022)



Highlands population more than doubled since 1980 but coffee production remains flat

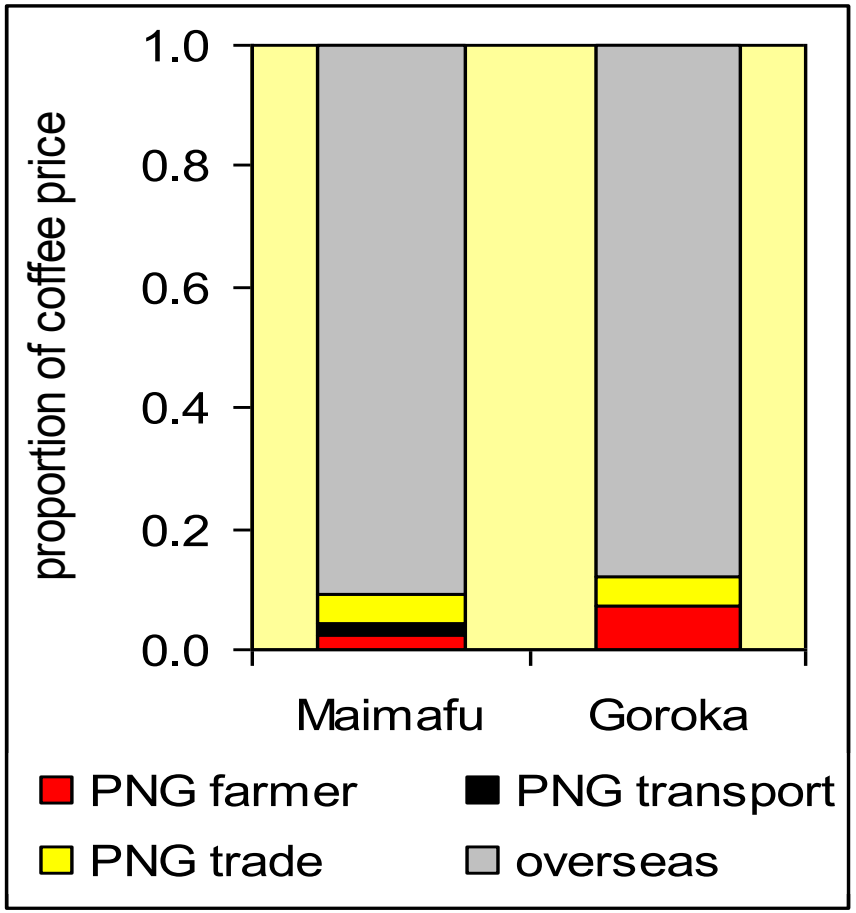
Coffee berry borer

AI Overview

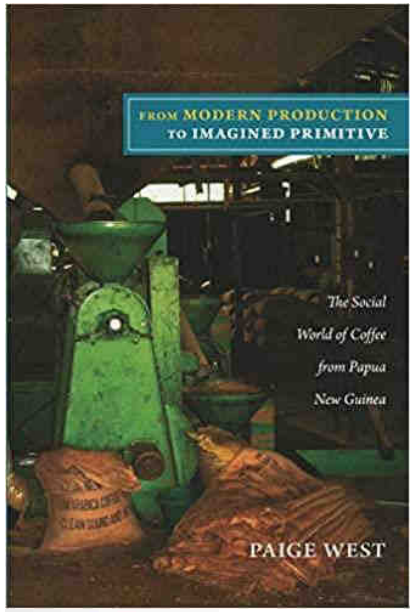
The coffee berry borer, Hypothenemus hampei, is a bark beetle native to Central Africa that has spread to all major coffee-producing regions worldwide, with the exception of Nepal and Papua New Guinea.

Farmers are not getting a good deal for their cash crops

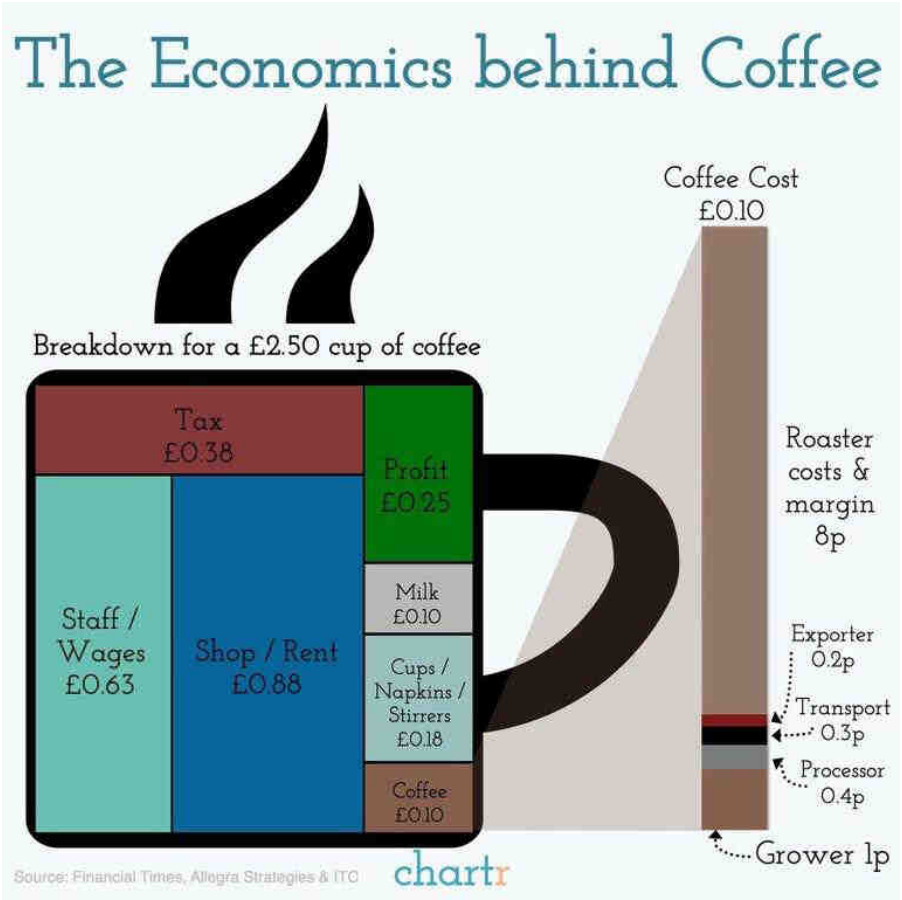
PNG farmers get 2-5% of the final price of their coffee beans sold in USA



coffee K25
coffee farmer 10 toea



Paige West

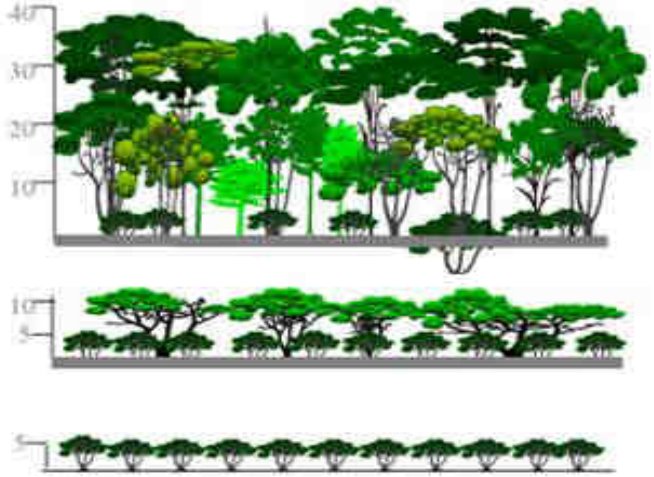


Shalene et al. BioScience 2014. 64:416-428

http://www.coffeehabitat.com/2006/02/what_is_shade_g/

Many flavours of coffee commercial models:
how to part the willing rich customers from their money for tropical farmers

- **organic**: caring about well-being of drinkers
- **fair trade**: caring about well-being of farmers
- **shade**: caring about environmentally-friendly agriculture
- **conservation**: arbitrarily linked to conservation projects



YUS Conservation Area

In 2017, YUS farmers sold 45 tons of conservation coffee at 30% premium earning US$ 80,000, i.e. $24,000 conservation-linked income

Tree kangaroos:
charismatic animals sell coffee!

DEVELOPMENT POLICY CENTRE

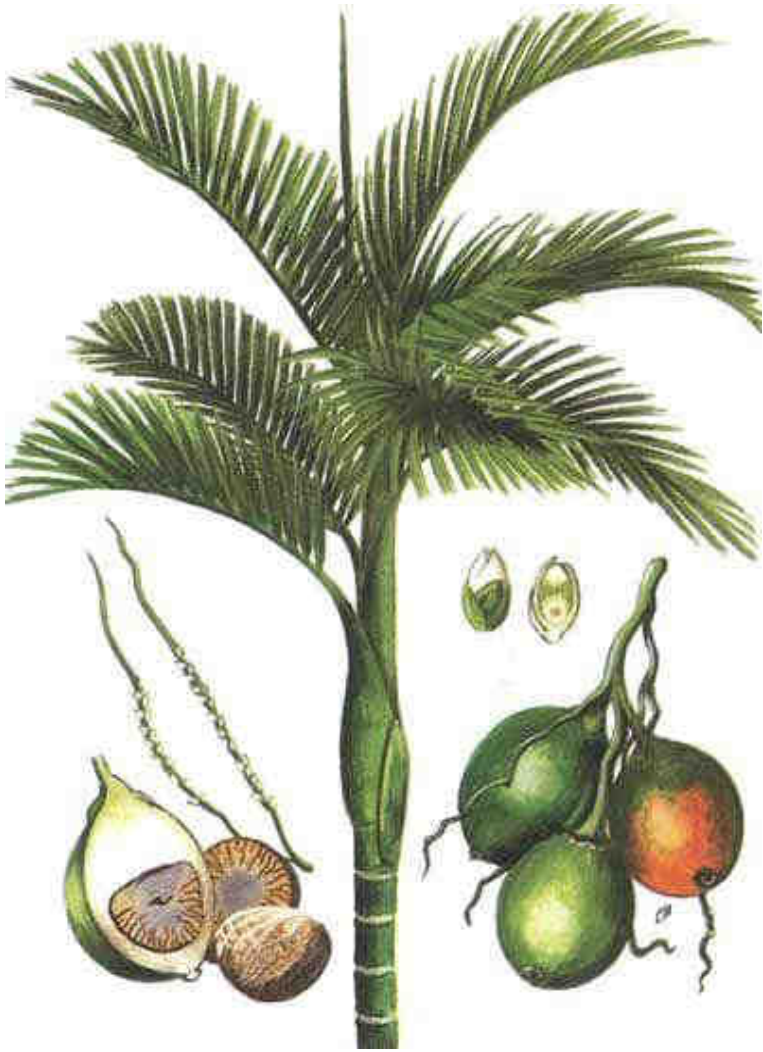
POLICY BRIEF 23
DECEMBER 2022

Returns on labour inputs to smallholder for cash crops in Papua New Guinea

R. Michael Bourke

Table 1. Returns on labour inputs for some lowland and highland crops for smallholders in Papua New Guinea

Crop	Product	Period to first harvest (years)	Yield[1] (kg/ha)	Price to growers[2] (K/kg)	Gross returns (K/ha)	Cash outlays[3] (K/ha)	Net returns (K/ha)	Labour inputs[4] (person-days per ha)	Returns (Kina/ person-day)
Vanilla[5]	Cured pod	1	240	200.00	48,000	200	47,800	290	165
Kava	Dry root	5	2,500	20.00	50,000	3,000	47,000	295	159
Betel nut[6]	Nuts	4	4,800	4.00	19,200	200	19,000	150	127
Oil palm	Fresh fruit	3	12,000	0.75	9,000	400	8,600	70	123
Tomato[7]	Fruit	0.3	7,000	3.00	21,000	150	20,850	225	93
Carrots[7]	Roots	0.4	9,000	2.00	18,000	150	17,850	215	83
Sweet potato	Tubers	0.3	12,000	1.20	14,400	100	14,300	250	57
Potato, Irish[8]	Tubers	0.3	18,000	1.80	32,400	10,000	22,400	400	56
SRC trees[9]	Firewood	2	10,400	0.90	9,360	150	9,210	170	54
Balsa[10]	Round log	5	200 m^3	35.00/m^3	7,000	1,860	5,140	115	45
Nutmeg[11]	Dried nuts	4	1,000	5.50	5,500	140	5,360	130	43
	Dried mace		200	1.00	200		200		
Cocoa, improved[12]	Dry bean	3	600	5.70	3,420	150	3,270	80	41
Galip nut	Nut-in-kernal	7	9,000	1.00	9,000	400	8,600	210	41
Peanuts[13]	Nut-in-kernal	0.3	1,500	6.00	9,000	100	8,900	220	40
SRC trees[14]	Charcoal	2	2,100	4.00	8,400	150	8,250	220	38
Cocoa, traditional	Wet bean	3	800	1.50	1,200	150	1,050	40	26
Arabica coffee	Parchment	3	900	4.50	4,050	150	3,900	275	14
Tumeric	Wet root	2	10,000	0.40	4,000	800	3,200	330	10
Cashew	Nuts	2	600	2.50	1,500	200	1,300	150	9
Robusta coffee	Parchment	3	1,000	2.50	2,500	150	2,350	275	9
Rubber	Cup lump	5	650	1.40	910	100	810	100	8
Cardamon	Dry capsule	2	250	6.50	1,625	350	1,275	200	6
Pepper	Dry corms	2	800	2.50	2,000	350	1,650	325	5
Coconut	Copra	7	500	0.60	300	50	250	65	4
Rice	Paddy	0.25	1,300	0.80	1,040	140	900	215	4
Patchouli	Dry leaf	1	700	1.25	875	150	725	200	4



Betelnut trading routes

PROVINCES
1 SOUTHERN HIGHLANDS
2 ENGA
3 WESTERN HIGHLANDS
4 SIMBU
5 EASTERN HIGHLANDS
Provincial border

LONG DISTANCE TRADE
Small volume
Large volume
Very large volume
Air transport

0 kilometres 400

T. L. Sharp 2012
PhD Thesis
Aust. Nat. Univ.

New crops of PNG: galip nut, *Canarium indicum* (Burseraceae)

Metroxylon sago - the sago palm

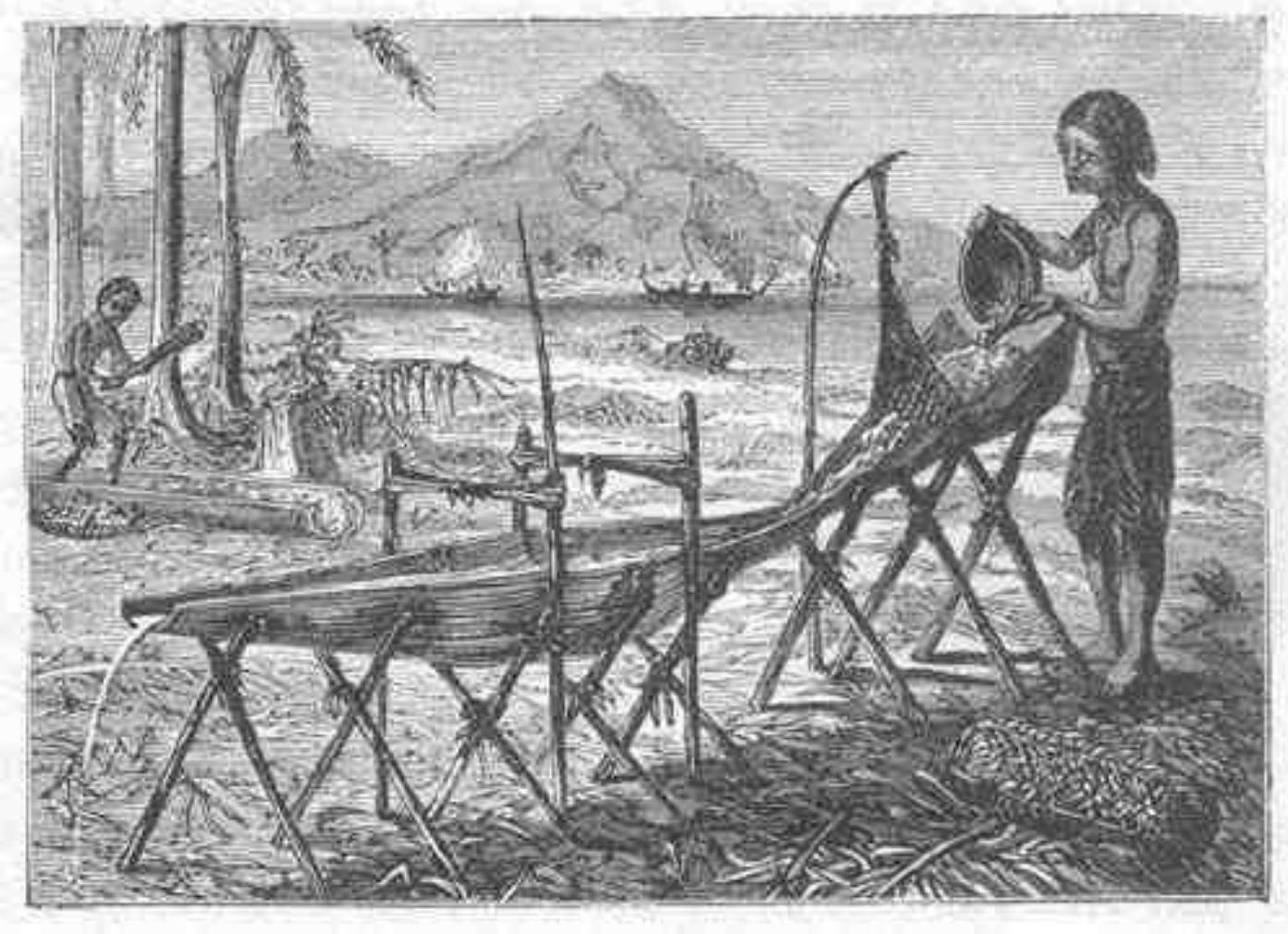
monocarpic,
reserves
accumulates as
starch in the trunk

Sago production

today on Sepik river, New Guinea

in 1860 on Ceram Island

(Alfred Russel Wallace, The Malay Archipelago)

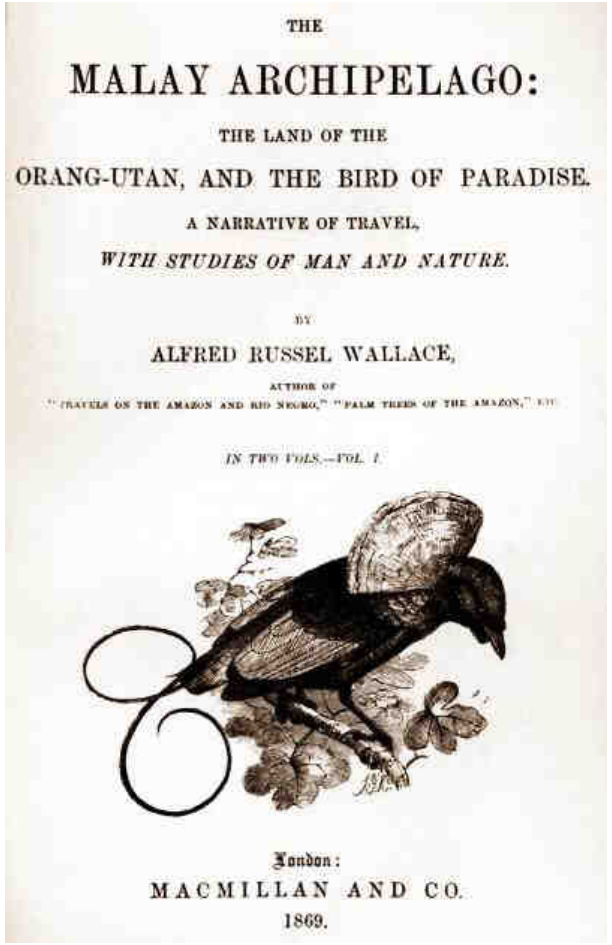


It is an extraordinary sight to witness a whole tree-trunk converted into food with so little labour and preparation. A good-sized tree will supply a man with food for a whole year. The labour to produce this is very moderate; in ten days a man may produce food for the whole year. The effect of this cheapness of food is decidedly prejudicial, for the inhabitants of the sago countries are never so well off as those where rice is cultivated.

The Malay Archipelago (1869) by Alfred Russell Wallace

Sago & fish subsistence:

a present-day hunter-gatherer societies



THE

MALAY ARCHIPELAGO:

THE LAND OF THE

ORANG-UTAN, AND THE BIRD OF PARADISE.

A NARRATIVE OF TRAVEL,

WITH STUDIES OF MAN AND NATURE.

BY

ALFRED RUSSEL WALLACE,

AUTHOR OF

"TRAVELS ON THE AMAZON AND RIO NEGRO," "PALM TREES OF THE AMAZON," ETC.

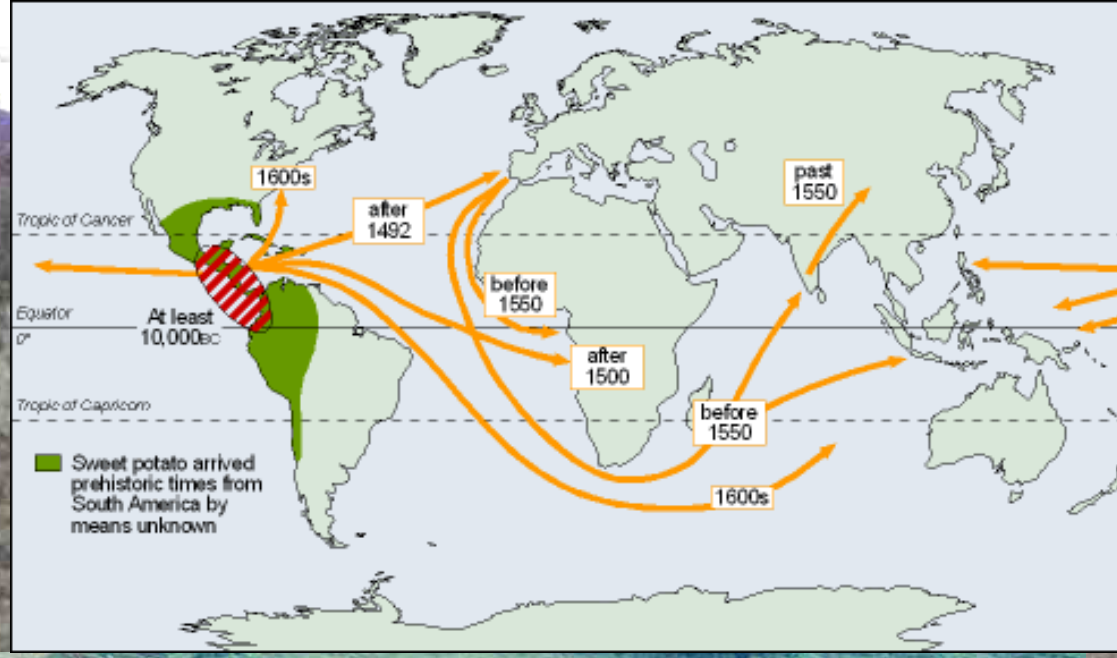
IN TWO VOLS.—VOL. I

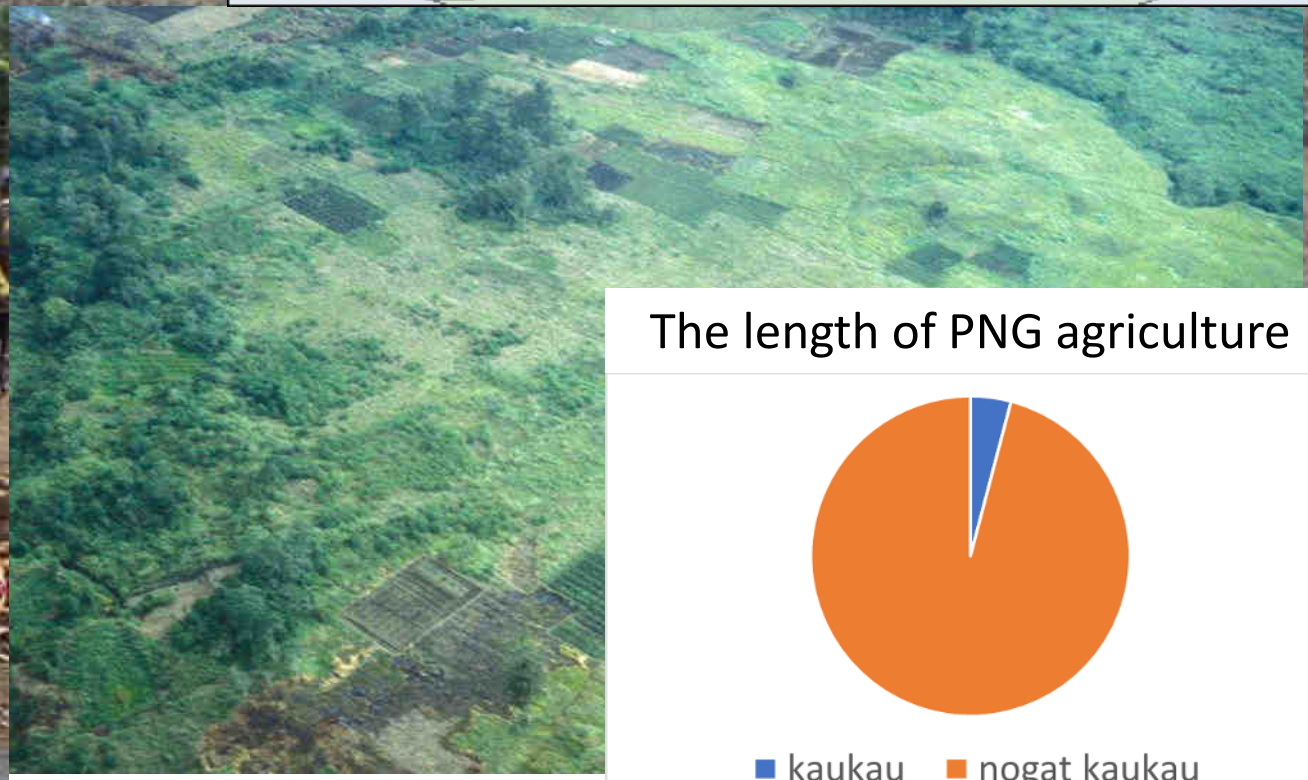
London:

MACMILLAN AND CO.

1869.

Ipomoea batatas,
Convolvulaceae,
sweet potato





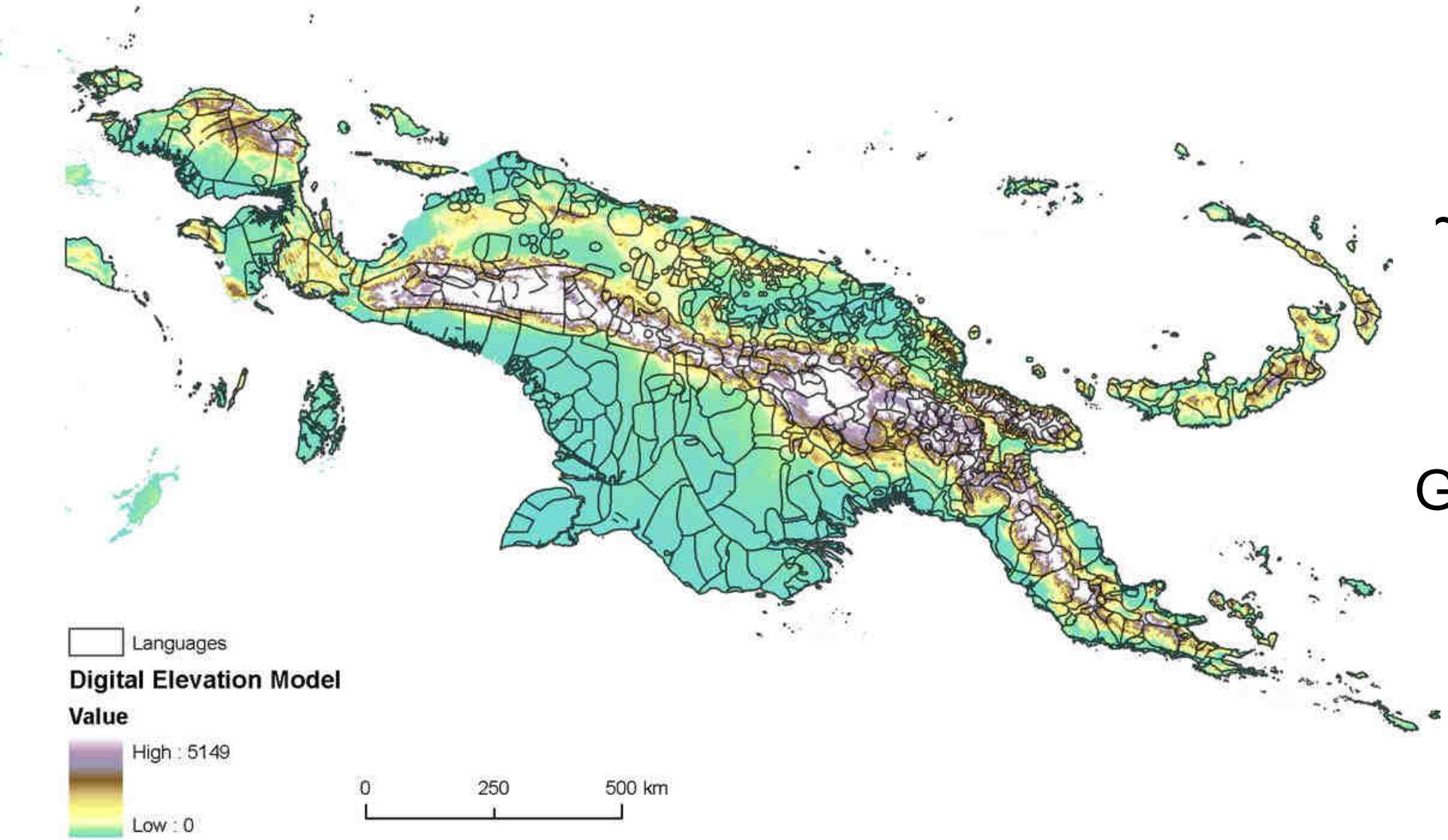
The length of PNG agriculture

kaukau nogat kaukau

How will Papua New Guinea look in 2050 or 2100?

PNG rainforests:
a treasure chest of medicine?
PNG tumbuna save:
an under-used source of information?

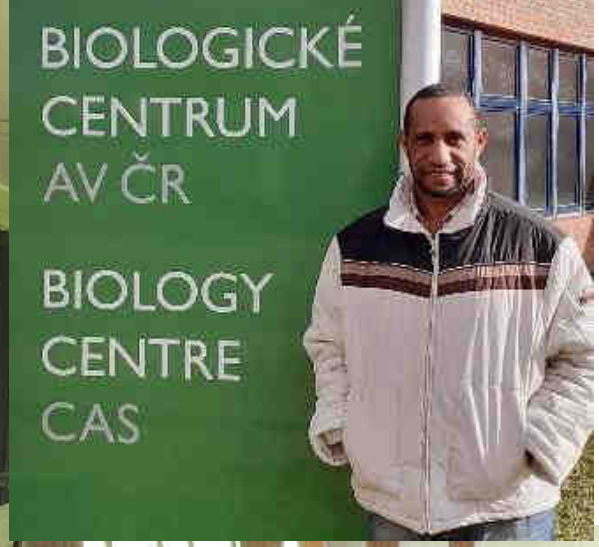
PNG – the global hotspot of linguistic diversity



New Guinea
11 million people
speaking
~1,000 languages

50% of New Guinean languages have 300-3500 speakers

6,190 students
392 languages



Alfred Kik
Language skills of PNG secondary school students

May 2021

PNAS
Proceedings of the National Academy of Sciences of the United States of America

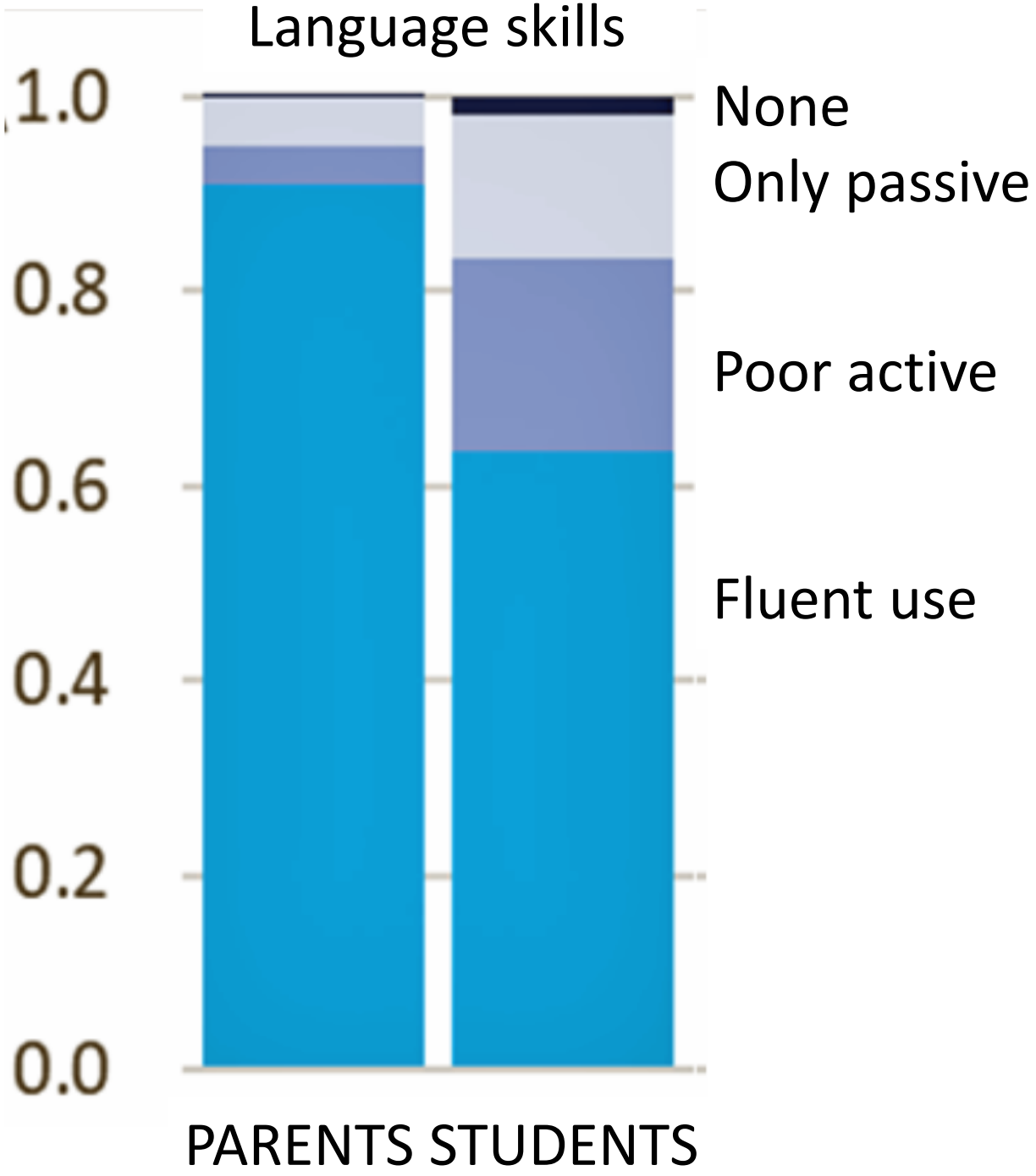
Language and ethnobiological skills decline precipitously in Papua New Guinea, the world's most linguistically diverse nation

Alfred Kik[a,b,c,1], Martin Adamec[d], Alexandra Y. Aikhenvald[e], Jarmila Bajzekova[a,c], Nigel Baro[f,g], Claire Bowern[h], Robert K. Colwell[i,j], Pavel Drozd[d], Pavel Duda[a], Sentiko Ibalim[a,c,f], Leonardo R. Jorge[c], Jane Mogina[k], Ben Ruli[f], Katerina Sam[a,c], Hannah Sarvasy[l], Simon Saulei[g], George D. Weiblen[m], Jan Zrzavy[a], and Vojtech Novotny[a,c,1]

Lae Secondary School: the tower of Babel of our age

Grade 11 and 12 classes:

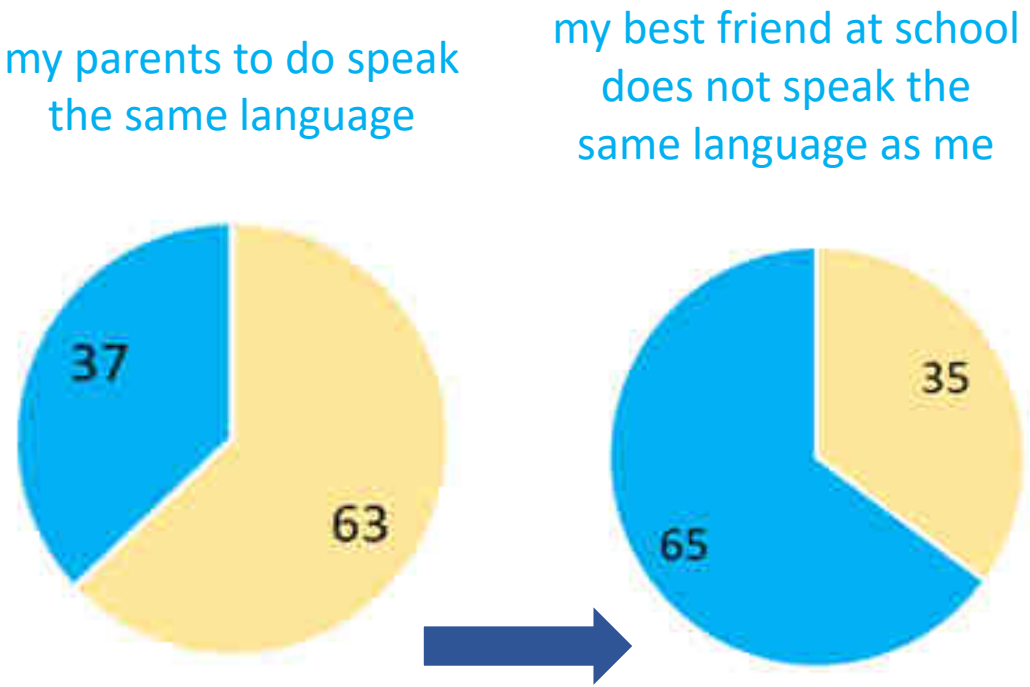
- 381 students speaking 126 languages
- two randomly chosen students speak the same language in 2 cases from every 100



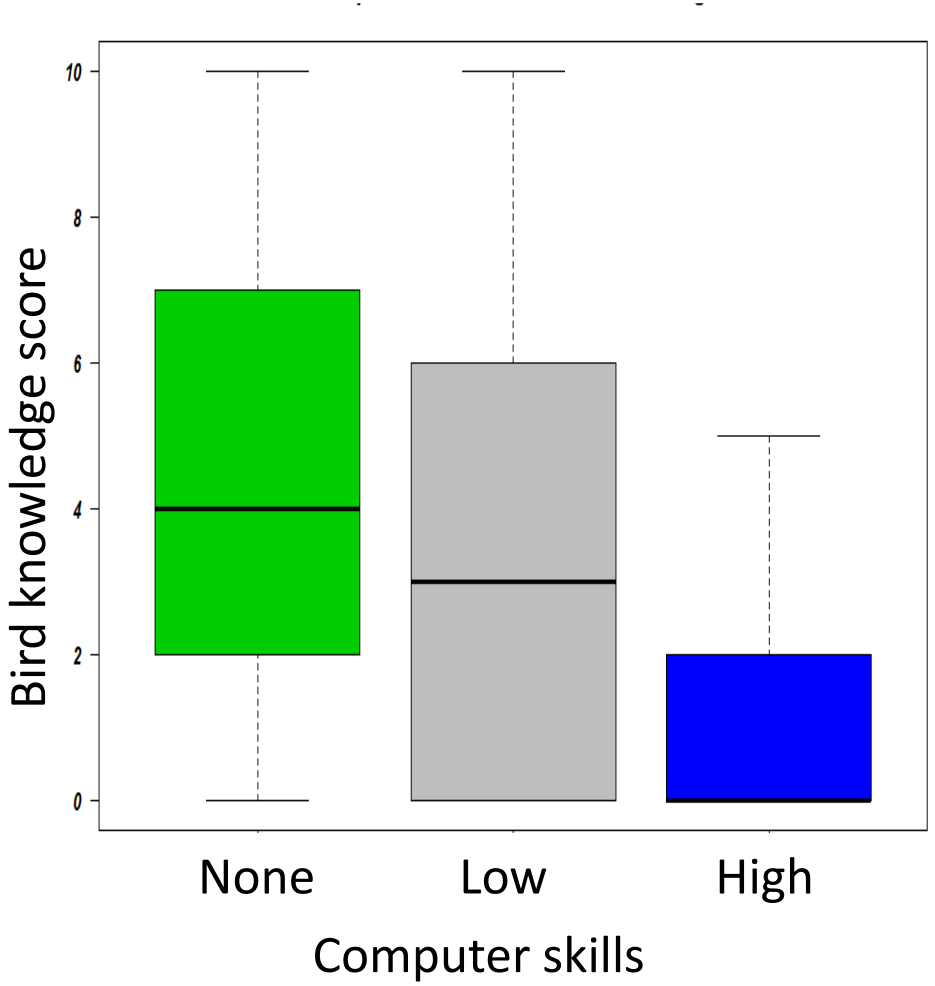
Main drivers of language loss:

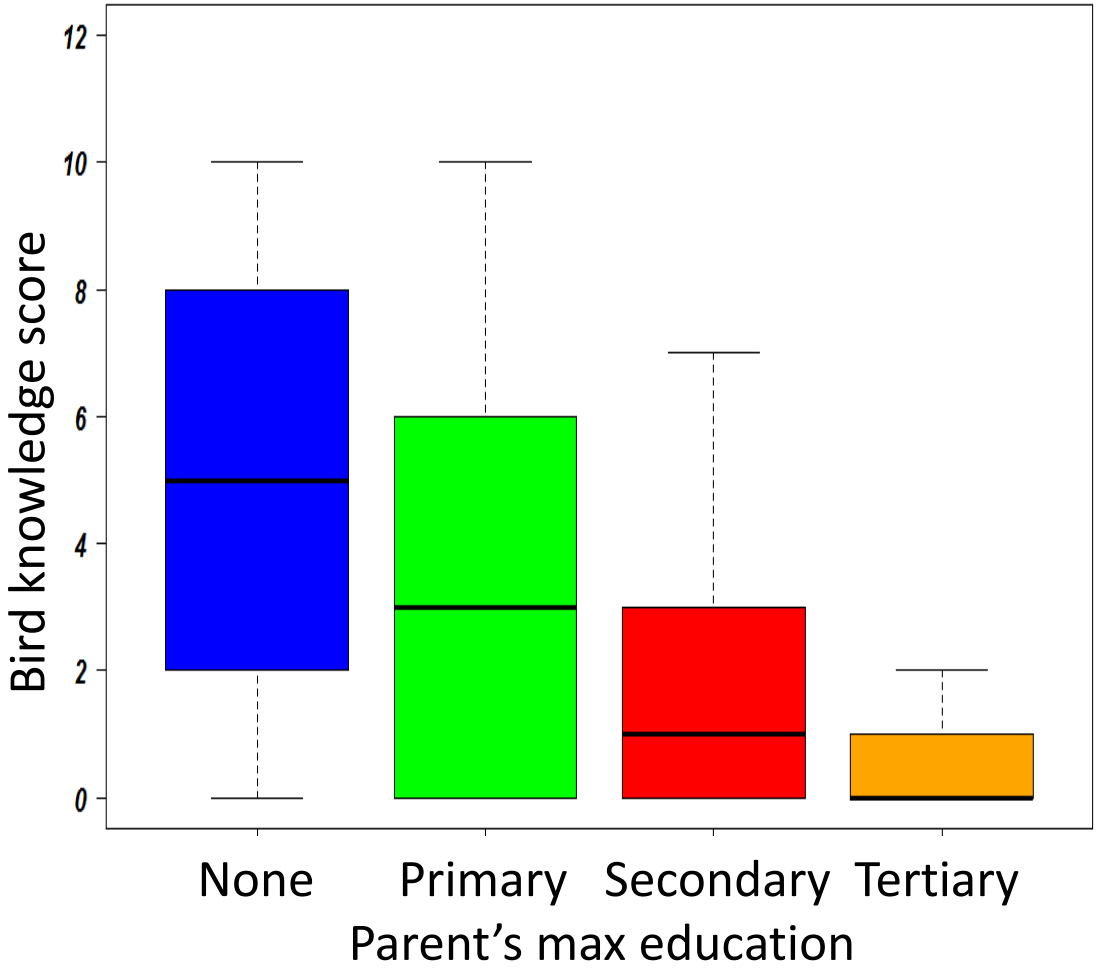
URBANIZATION

LINGUISTICALLY MIXED FAMILIES



Computer skills, and parent's education, are bad for the traditional knowledge of nature – such as birds



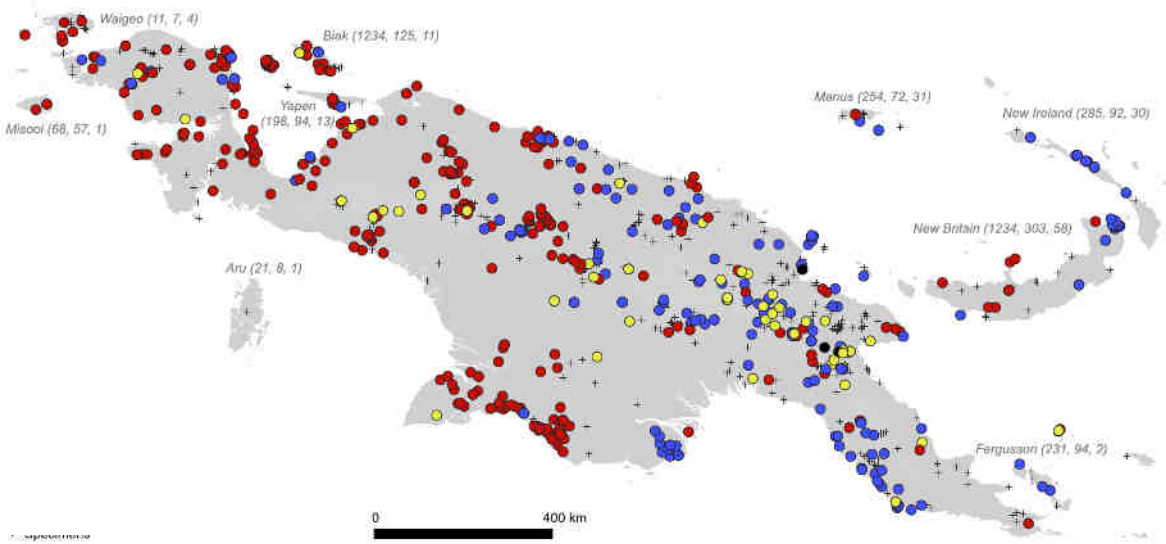


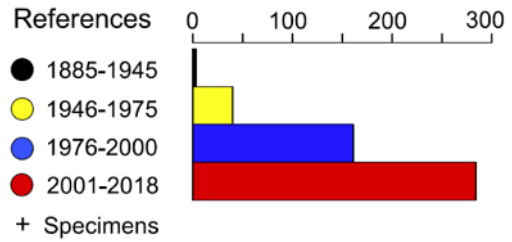
483 names for cassowary in Trans-New Guinea languages

ʔahi; ʔahi; ʔaipie; aiwal; aiyu; amamaːni'; amanani'; amanání(ná); amwiyə; amwiyə; amwiyə; amwiyə; apokwasɩ; aruay; asa; asʌu; augwaima; aumʌsi; awa; awa; awaʔ; awani; ʔaymʌ; ayuwar̃; bamuko; [beeho]; somoro; 'bɛ̈ndɨg̈oʀ̥t̪ʰ; biɑ; biɑ; biɑ; biɑ; biɑ; bia; bia; bia; bihi; bijɛ; 'boka; boke; 'boke; 'boke; 'boke; 'ᵐbon; buǏamɛʔ; bukemi; bukera; bundugwʌr; buyemi; čɛp; dai; dai; dai; daso; dau'aiʌ; dɛ; dɛi; *diadi; *diadi; *diari; *diari; *diari; *diari; *diari; *diari; diɔwa; diuɔ; diware; do'dʑ̥a; 'dowjə; duba; duga; dugwa; duwo; dyuga; ⁱeⁱe; egu; egu; egue; ehil; ehir; ehir; ehir; 'eːipiei; eir; ɛmban; ɛmban; ɛmban; ɛmbən; em'bʌn; esil; *esir; ɛsirɛ; ɛsrɛ; ewar; faiulu; fumi; fyulu; gamay-; gayɩma; gɛnagɛn; golúní; guⁱaⁱ; guia; guia; guia; guia; guia; guia; guia; guia; gwaimɛ; gwʌim; ˈhæːniʔ; ˈhæːniʔ; hæ'niʔ; hawədi; heːgar̃; hɛirɑ; hɛirɑ; hɛirɑ; hɛirɑ; hɑmɑ̄mu; hõboru; hom'boru; hɑwədi; ikuway; 'iruwʌru; isiwar; *i(u)va; iwal; iwar; iwar; iwař; iwʌːli; iwʌr; iwʌr; iwʌr; iwʌr; iwʌːr; iwʌːr; jadi; jai; jai; jari; 'jawaga; jogoy; jugu; jugu; kʰaǏim; kaɽim; kaki; *kaki; kaːki; kaːki; k-akubay; kar̃i; karim; karimeh; kasiwar; kasiwar; kasu; *kasuar; kasuari; kauli; kausar; kᵡa'wan; kawaune; ka'wəne; kazuʌ; kɛirɑ; kɛirɑ; keira; keira; kembo; kenakena; 'kʰəntʰ; kepiyɔ; keři; kesowa; kʰewed; khklino; kiri; kimau; kimow; *kiri; *kiri; kisᵉre; kivam; kivari; kiwa; kiwar; kiwar; kiwar; kiwar; kiwar; *kiwar; *kiwar; kiwʌr; kiwʌːri; ; kiya; kriːya; kíya'néfa; koaŋge; kobri; kobɪso; kobti; koˈd͡ʒo; kojä; koˈjo; koˈjoʔ; kokokoko; kɔkɔkɔkɔ; kɔkoře; komai; kɔsuwa; kɔu; kɔu; k̦ɔu̯s; k̦ɔu̯s; kɔyabi; kɔyaib; kɔyɛb; kɔyib; kpela; kʌpiya; krumbum; ˈkɑru; wɛ; ku; kɑu; k̦ɑu; kubuk; ˈkud͡ʒu; kue; kui; kuiau; kuje; kuji; kujo; kuju; kuʌl; kumbukɛ; kʰumsɔpʰ; kurʌːgurʉ; *kurumbum; kusua; kuwaira; kɑuˈwɛ; kuˈwɛ; kuwɛʔ; kuwi; *ku(y)a; *ku[y]a; kuyau; kwai; kwea; kwela; kwela; kwelâ; kwije; kʌwʌr̃; laima; laima; laima; laima; lamya; layma; lɛgiʔ; lem; magao; maiban; maiben; *maiben; mänáni; manáni(na); manání(ná); mařukpi; marupki; mařupkiʰ; masuguŋ; matuŋumba; mayaw; ɩmban; m'ba̠ndrre; mȧ̠; mbo; *mboke; meːb; mewa; mʌːgwa; mize̯ze̯; mᵊnani; mᵊnani; moke; moke; monʌ; moyam; moyam; mʌřupkɩ; mʌřupki; mʌsogump; mʌtsuɣump; muia; muia; muia; muia; *muiam; *muiam; muiaŋ; muiaŋ; muiaŋ; muiɑm; mujɑm; mujɑm; mujɑm; mukjɑm; muřup; múulí-yò; *muya(N); muyaŋ; *muyaŋ; nadina; nadina; ndiimbu; nim'ando; nime; nɨminda; ɩn; 'tanme; *(n,y)adina; *(n,y)adina; ʃoʔa; ʃoʔa; ɔba; ode; oiam; oiam; oiam; oiam; *oiam; oiyor; oloda; oľo'da; oľonɩ; oľoⁱna; ólonáː; oľoni; olóni; olóní; olóní; olonî; oloniq; omme; ondugu; *(on)dugu; *onjuku; oraino; orina; oroina; orona; orona; oroni; oroniq; pasi; pi; pi; pi; pi; pi; pi; pi; pi; pi; pi; pi; pi; pi; pi; pi; pi; pi; pi; pi; piru; piru; piru; pobobí; puele; puru; puru; qari; ɑruwɑi; ɑruwɑi; ɑruwɑi; sæ'niːβ; sakyu; samamu; sambɛp; ʌsaw; sawar; sawari; sʌbʌp; ; sebep; sebəp; sekɨ; sɛmbɛp; sɛp; sikina; sɑˈnip̚; sʷoʔa; soʔa; sogɛp; sɑwɑ; sɑwokwikwik; taiber; taiwar; tãrȕ; tõboro; tõbo'ru; toiyə; toːku; *tomboru; tomoro; tore; towe; tubor-e; tubuare; *tubu[are]; tubuar-e; tumboru; *ude; udi; uguřuʌ; ukail; ukura; umuis; undugu; unʌru; unsim; uːraŋ; uro; horomi; urup; usar; uːsibo; 'ut·i; uyau; vasa; vukerʌ; 'waiʌŋ; waiβa; wama; wamak; wathwřa; wayöŋ; wiːa; wiːa; wiːa; wiːa; wiːa; wiːa; wiːa; wiːa; wiːa; widʌ; wida; wiskis; wolos; ʔɑˈwɔn; ʔɑˈwɔn; wor'ibo; wʌpiya; wʌtʌlʌ; wulus; wʌuwʌ; yadina; yadina; yadina; *yadina; yari; yaka; yɛři; yakubi; yakuway; yaʔubi; yubay; zaur; *zaur;

[https://transnewguinea.org]

Traditional plant uses remain poorly documented





Indigenous Knowledge of New Guinea's Useful Plants: A Review

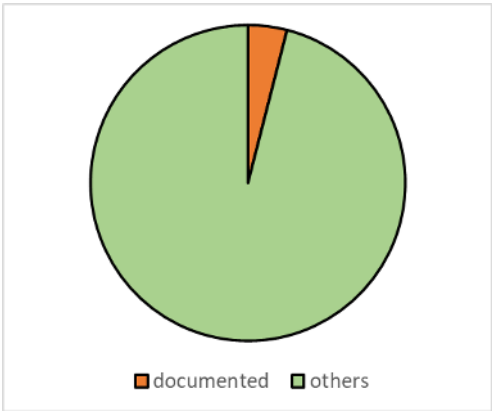
Rodrigo Cámara–Leret[*,1] and Zoe Dennehy[1,2]

19,948 plant uses for 217 from 1,100 indigenous groups

>100 plant use records available for 2.5% of groups

Kalam: ~500 plant uses

New Guinea: ~0.5M plant uses



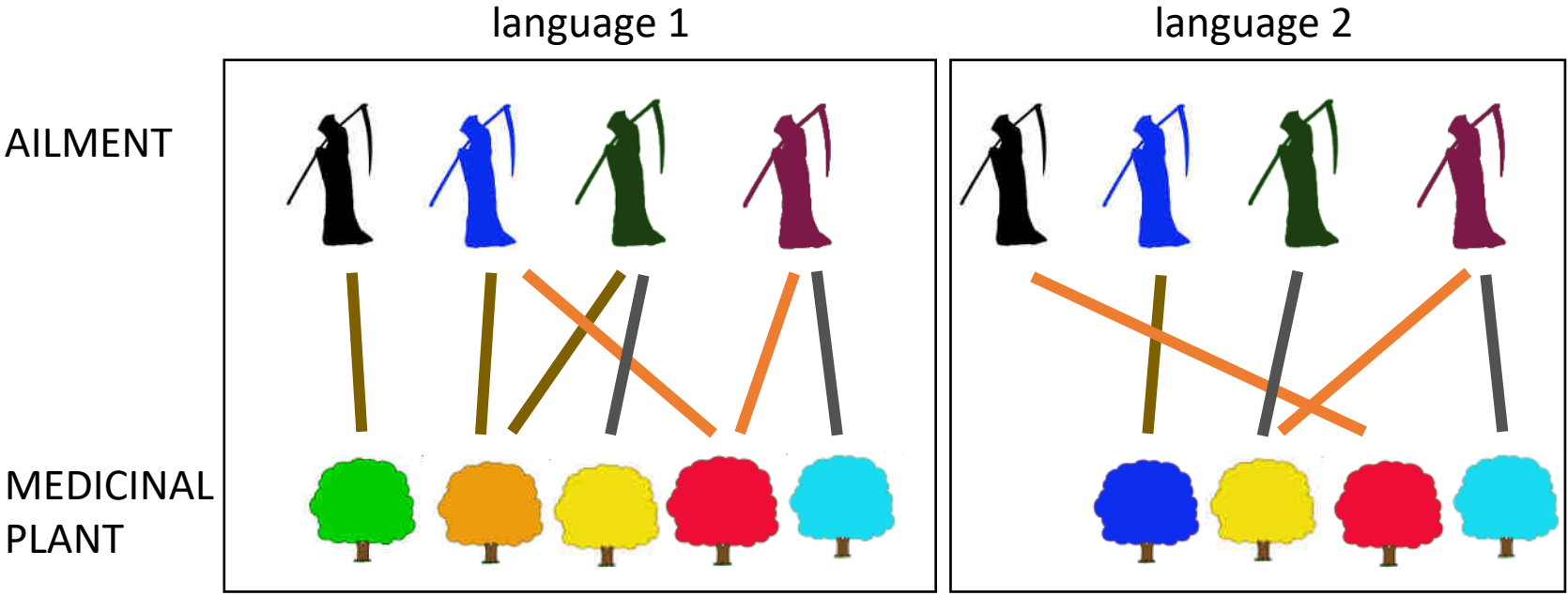
R. O. Gardner, Rec. Auckland Mus. 47, 5-50 (2010).

Most (84%) uses of a particular plant species to treat a particular illness are unique to a single language

Gnetum gnemon

Melanolepis multiglandulosa

SNAKE BITE
DIARRHOEA
MANY OTHER
AILMENTS



biological turnover – different plants 42% of interactions

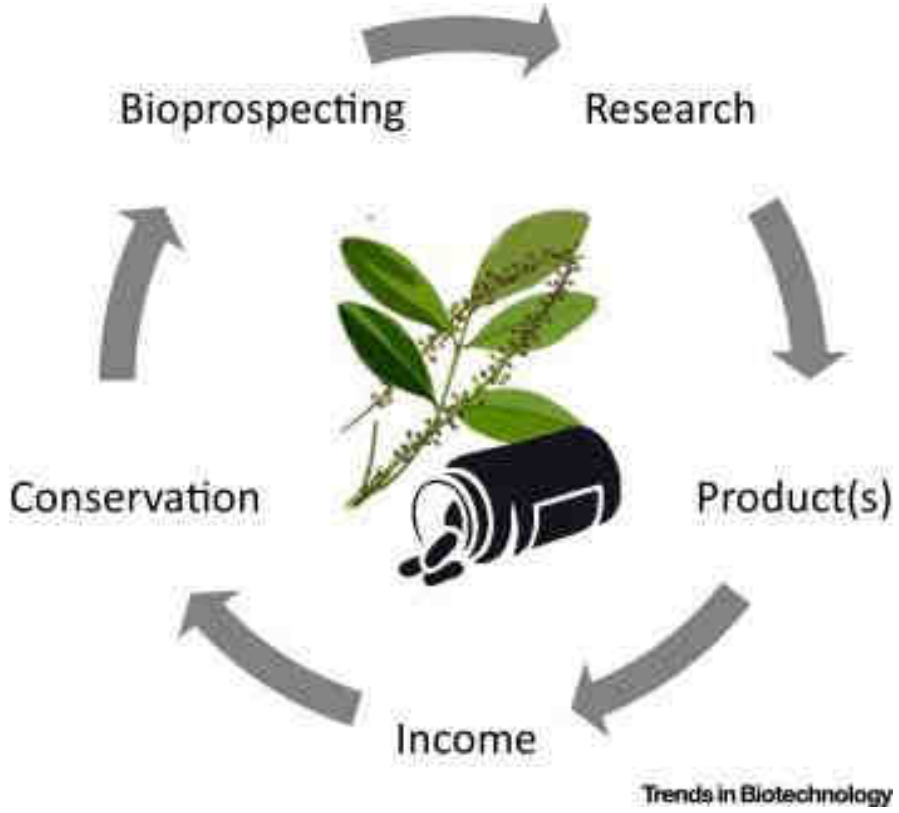
cultural turnover – different uses for the same plant 42%

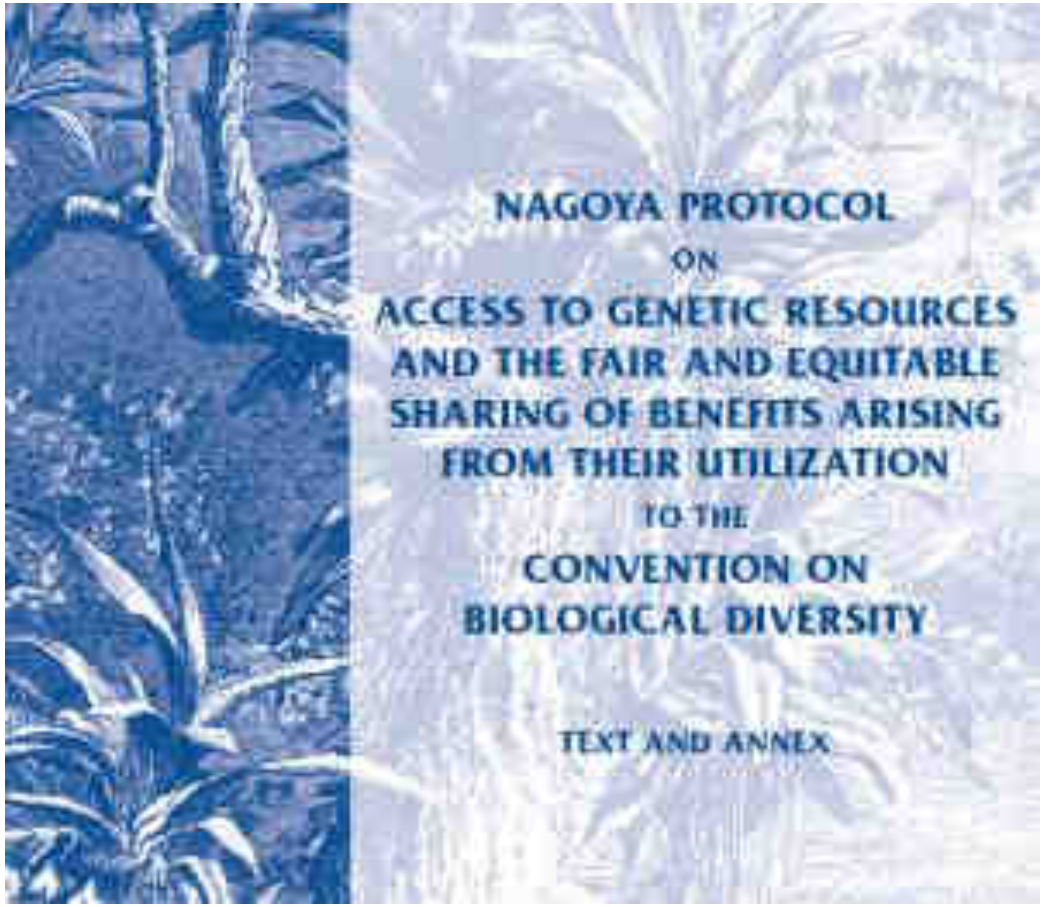
shared plant–ailment uses 16%

Valid medicinal uses will converge between languages:
a particular plant species always used for the same treatment

Cámara-Leret & Bascompte 2020
doi: https://doi.org/10.1101/2020.12.03.407593

Rainforest bioprospecting needs encouragement
it is not the golden opportunity companies are fighting for

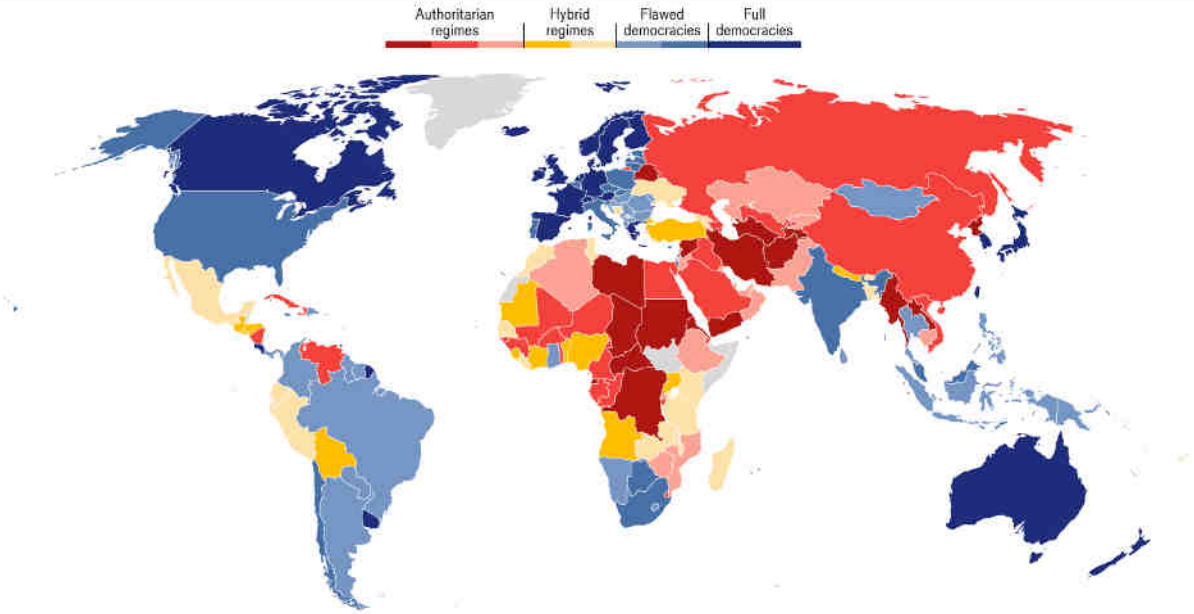




How will Papua New Guinea look in 2050 or 2100?

Can PNG research play in the international league?

The Economist



Good news:
PNG is fairly democratic
and
enjoys excellent academic freedoms

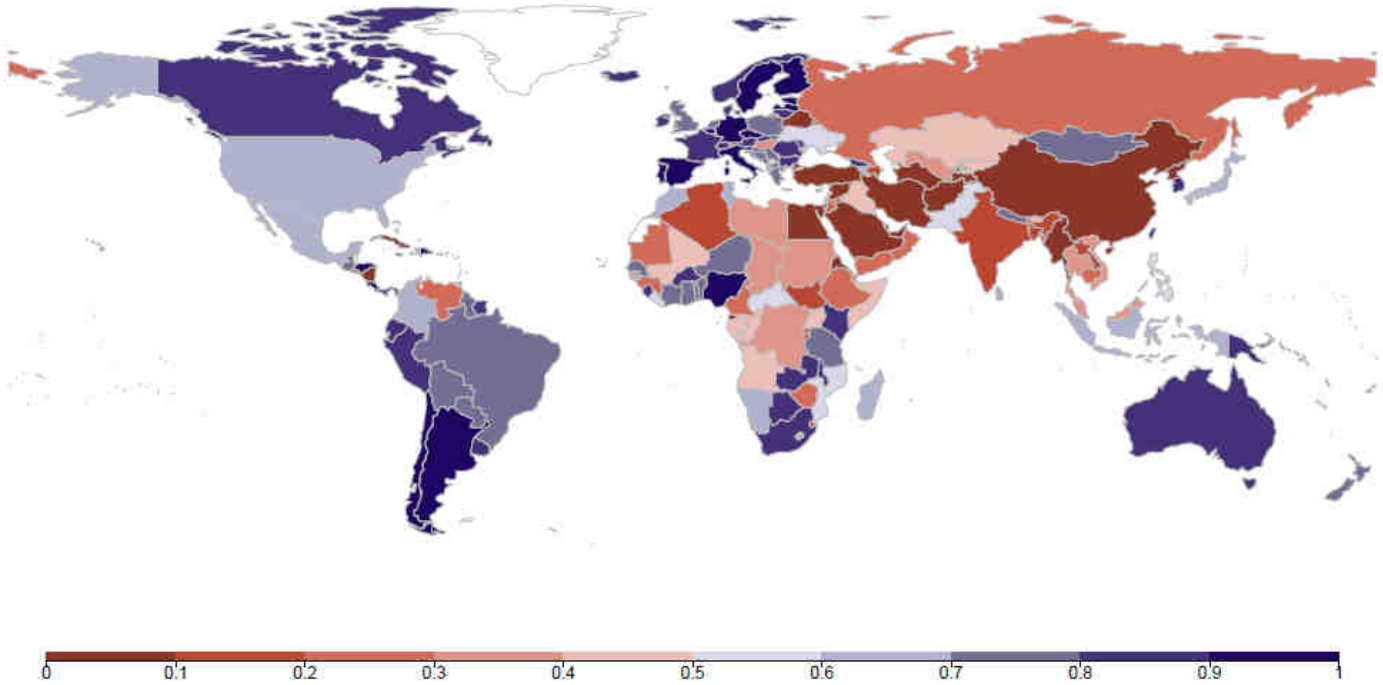
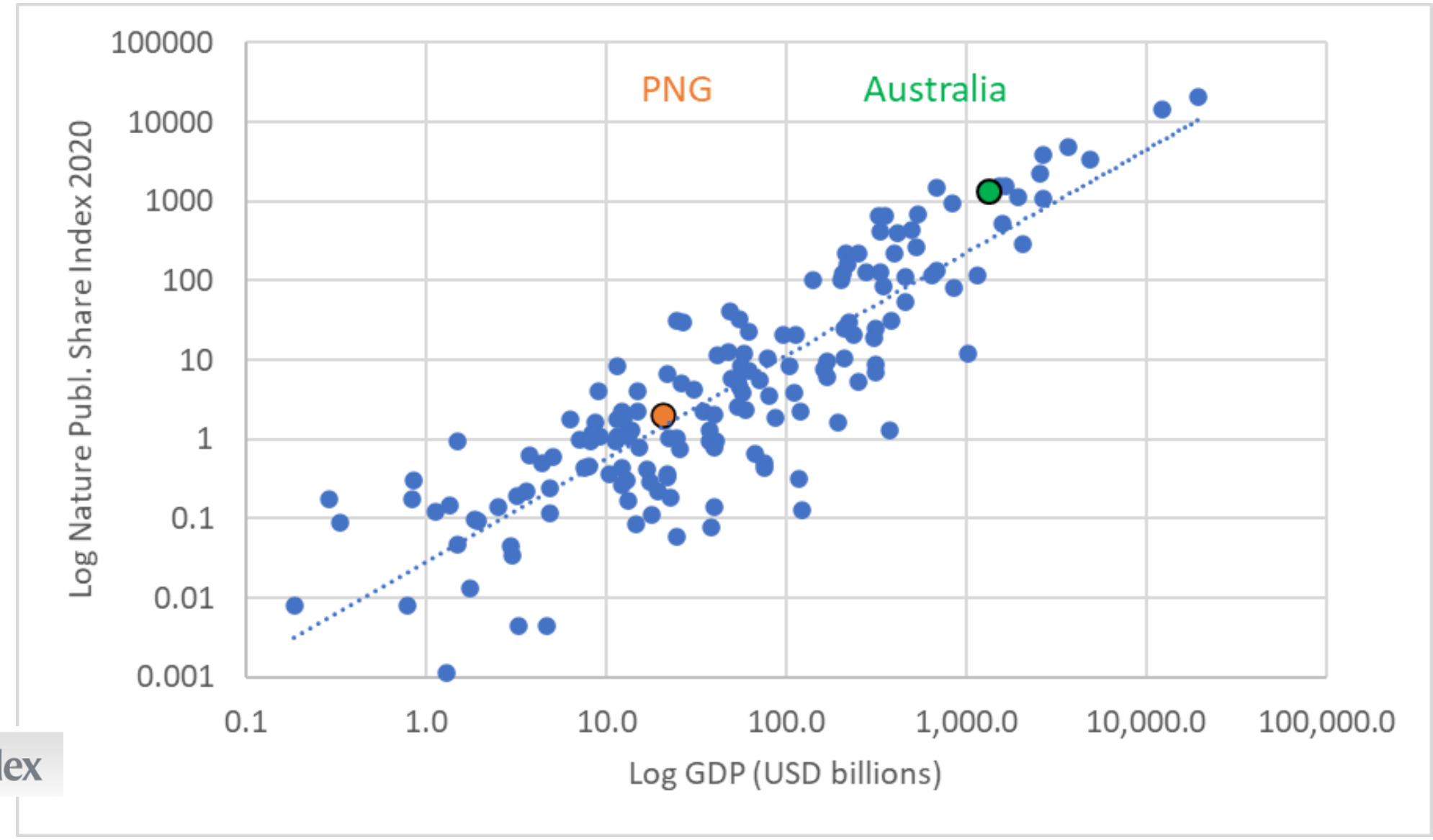


Figure 1: The State of Academic Freedom in 2023 (0–1, low to high)

Research productivity of Papua New Guinea: adequate to its economic situation (but it could do better!)



nature index

The main problems of PNG research [other than amount of funding]:

- low number of postgraduate students

[costs, lack of stipends]

- high teaching load of university staff

[no of staff]

- isolation between universities and research institutes

[cultural issues]

- low interest in and capability for international collaboration

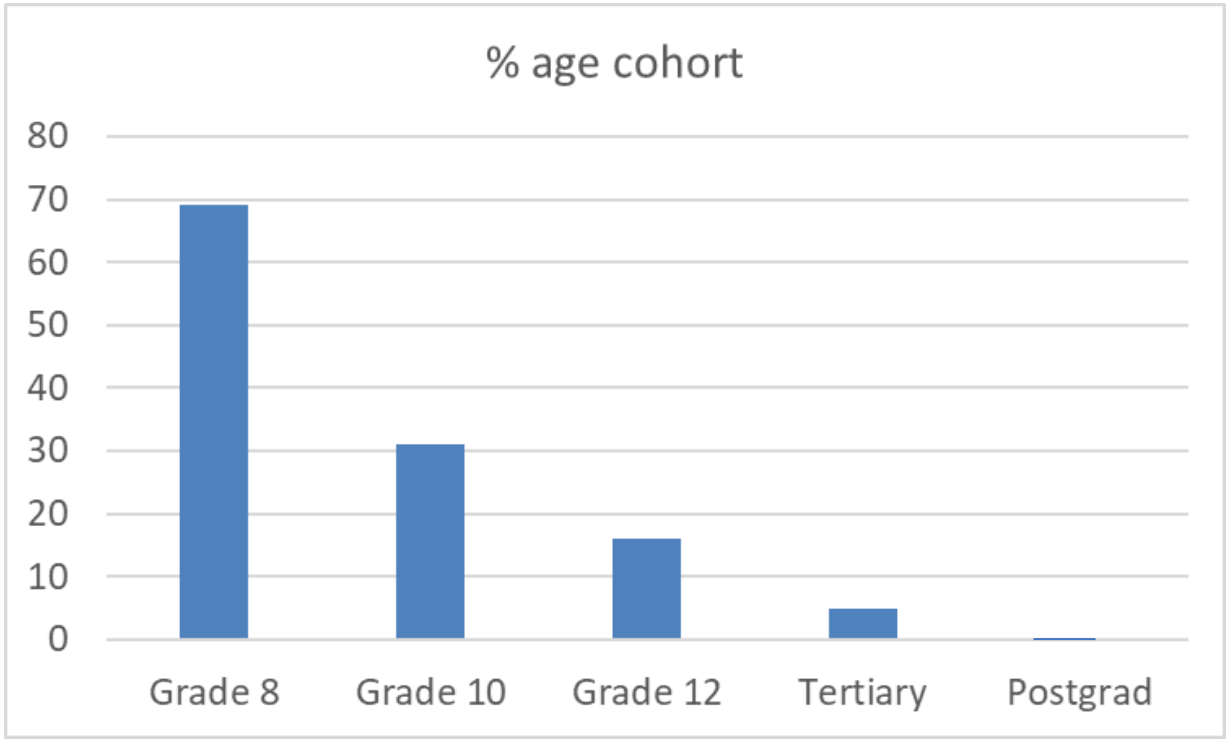
[cultural and organizational issues]

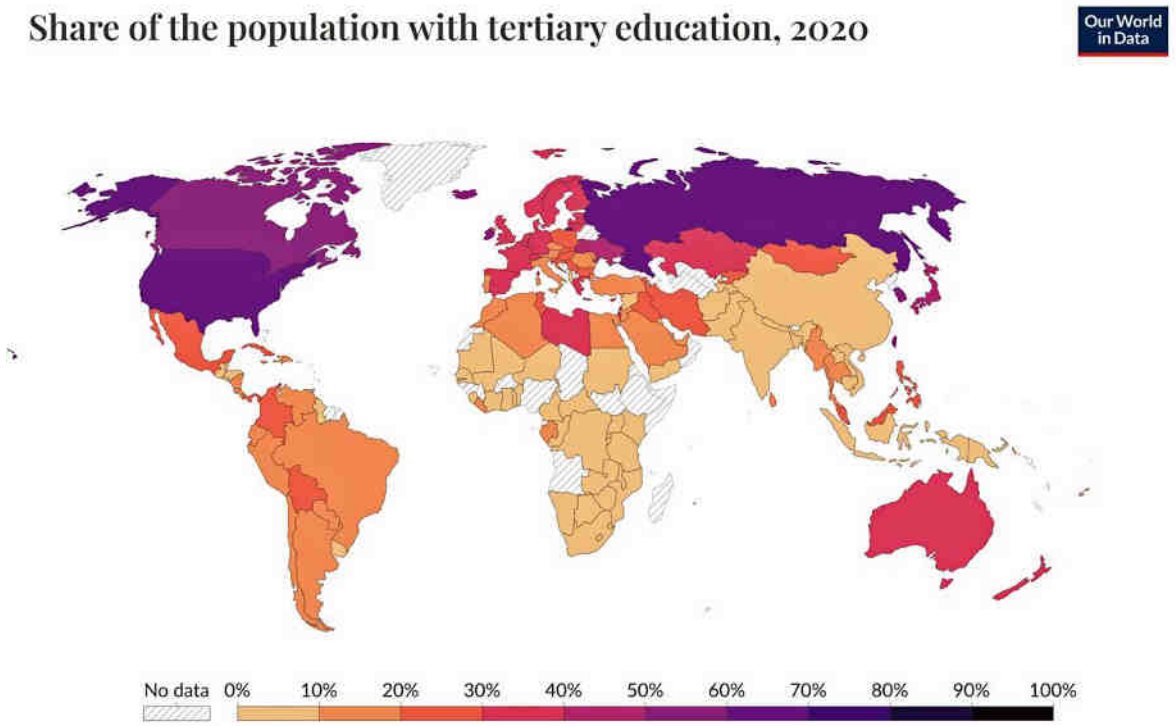
- research funding goes to institutions not a grant agency

[cultural issues]


Research & Consultancy Service
PROJECT PROPOSAL WRITING-OFFICE...24/7
SERVICES
1 Project proposal Plans
2 Year Plans
3 Audit/Annual Report
4 Submission, eg: NEC, etc
5 Marketing Survey
6 Social Mapping
7 IPA Registration
IPA business Name registration No. 6-84455
NCDC Trading Licence No. 2740

PNG: Tertiary (end secondary) education is too limited (and elitist)





2023 final grade exams:

141,366 grade 8 students (69% of the age cohort)

76,571 grade 10 students (31%)

31,252 grade 12 students (16%)

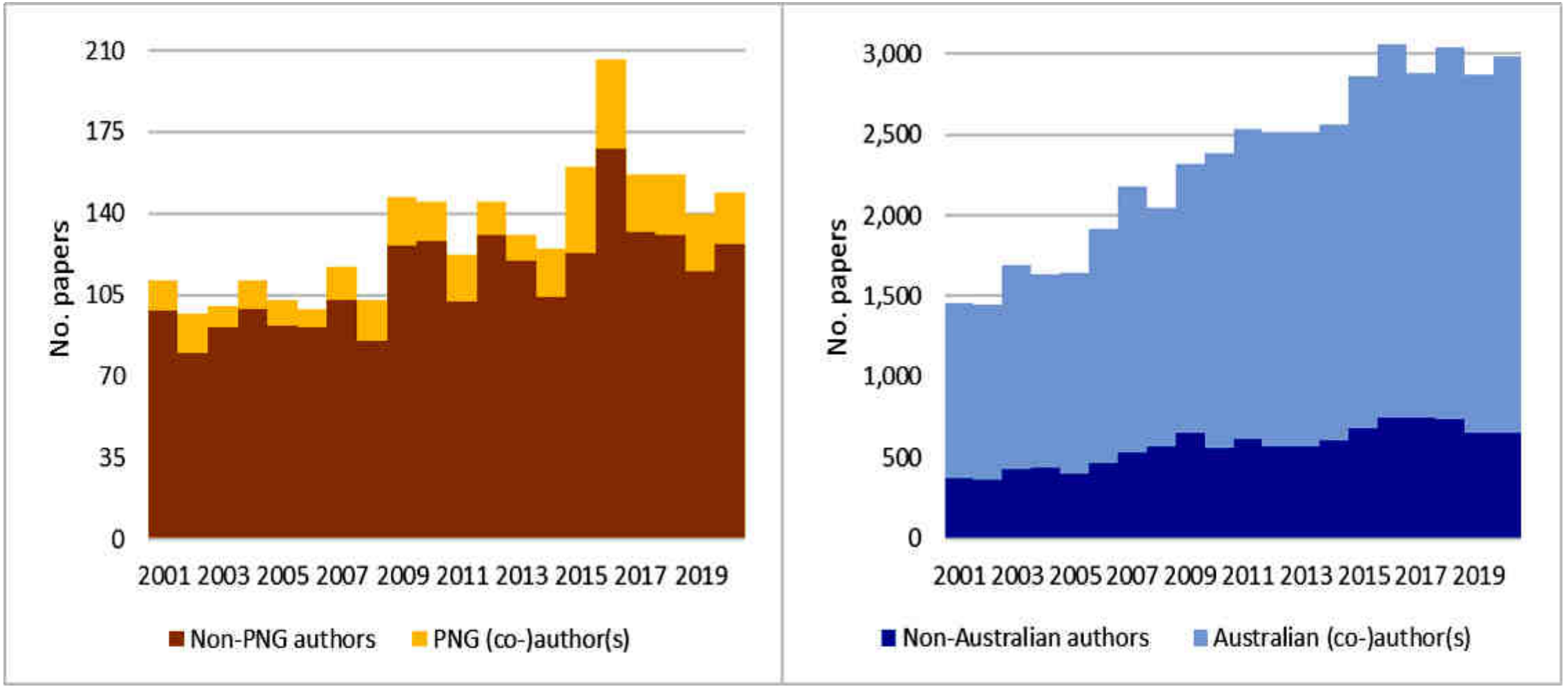
10,007 accepted tertiary students (5%)

Approx 200(?) Accepted postgraduate students (0.1%)

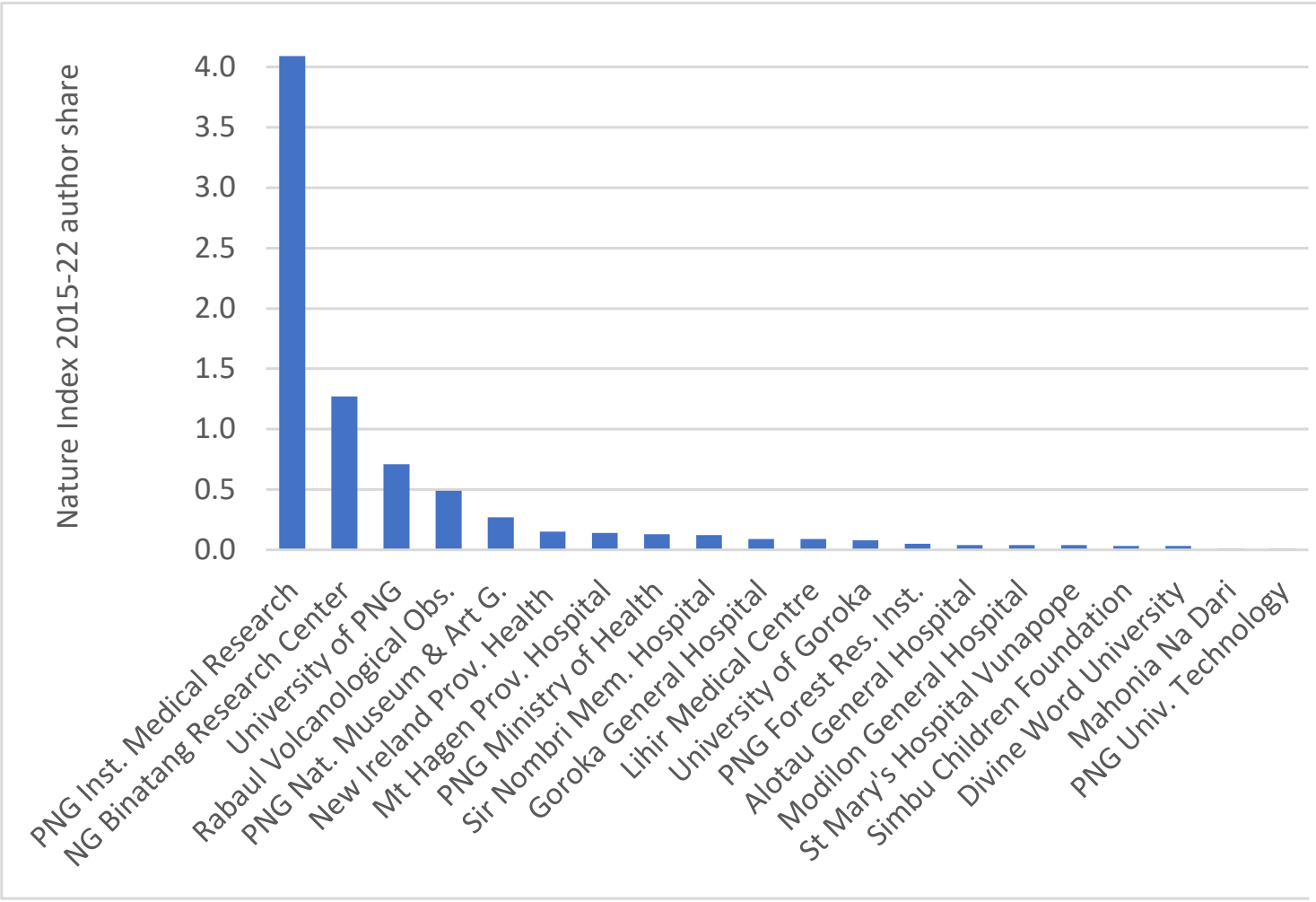
Source: DHERST PNG

researchers postdoctoral researchers postgraduate students technicians babies

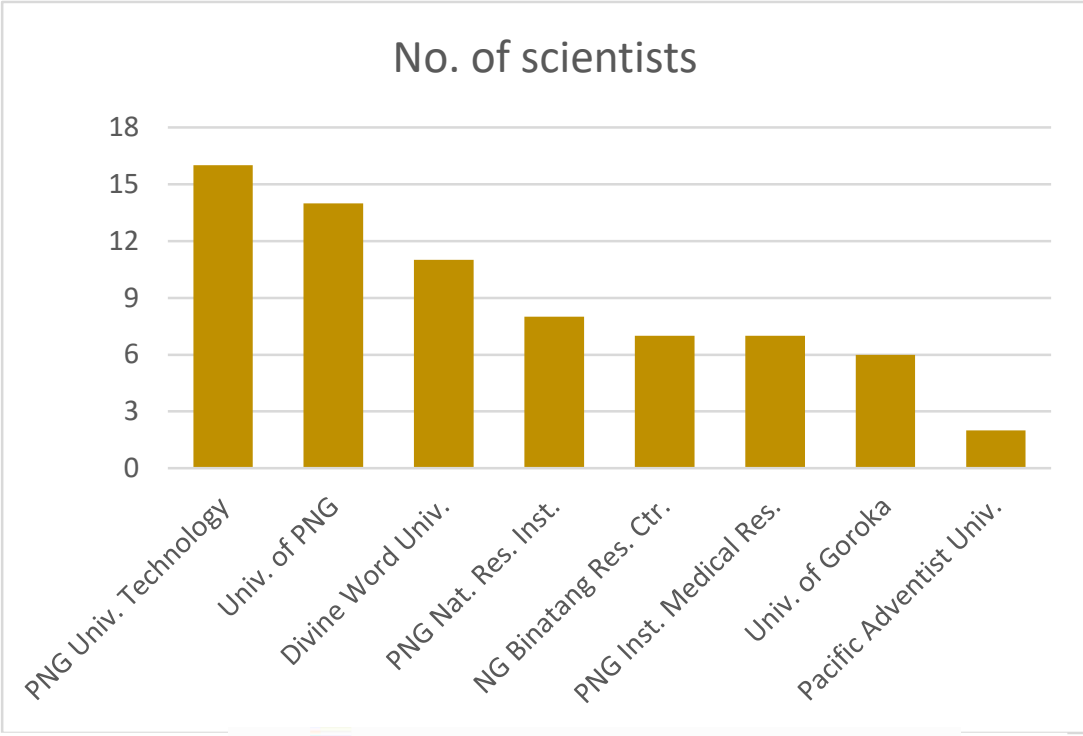
Biological publications on PNG and Australia: serious lack of PNG scientists

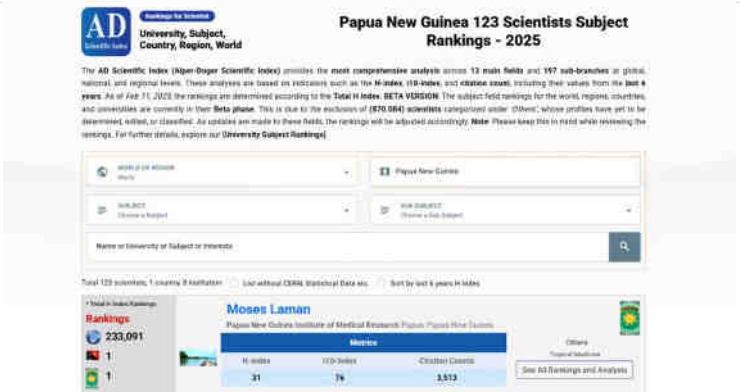


Share of PNG authors in **top research publications** (the Nature Index) by institutions



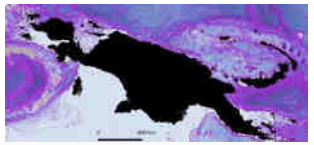
71 PNG scientists (from 1.4M in total) are listed in the **AD Scientific Index** of the world's most productive scientists 2023





Article

New Guinea has the world's richest island flora



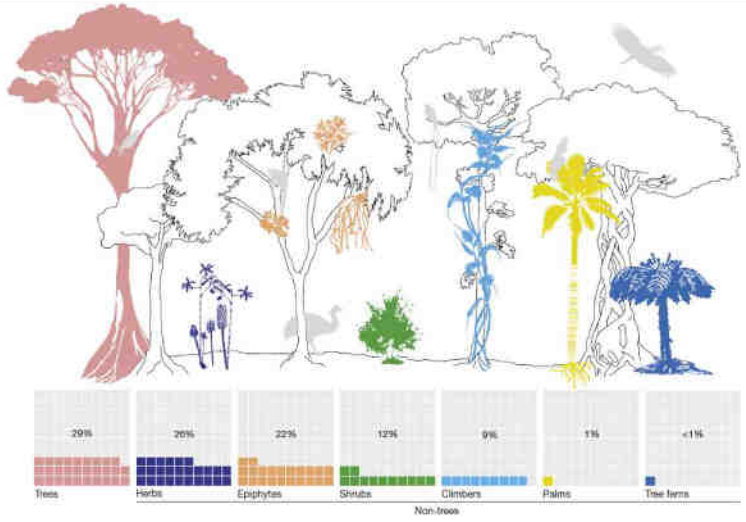
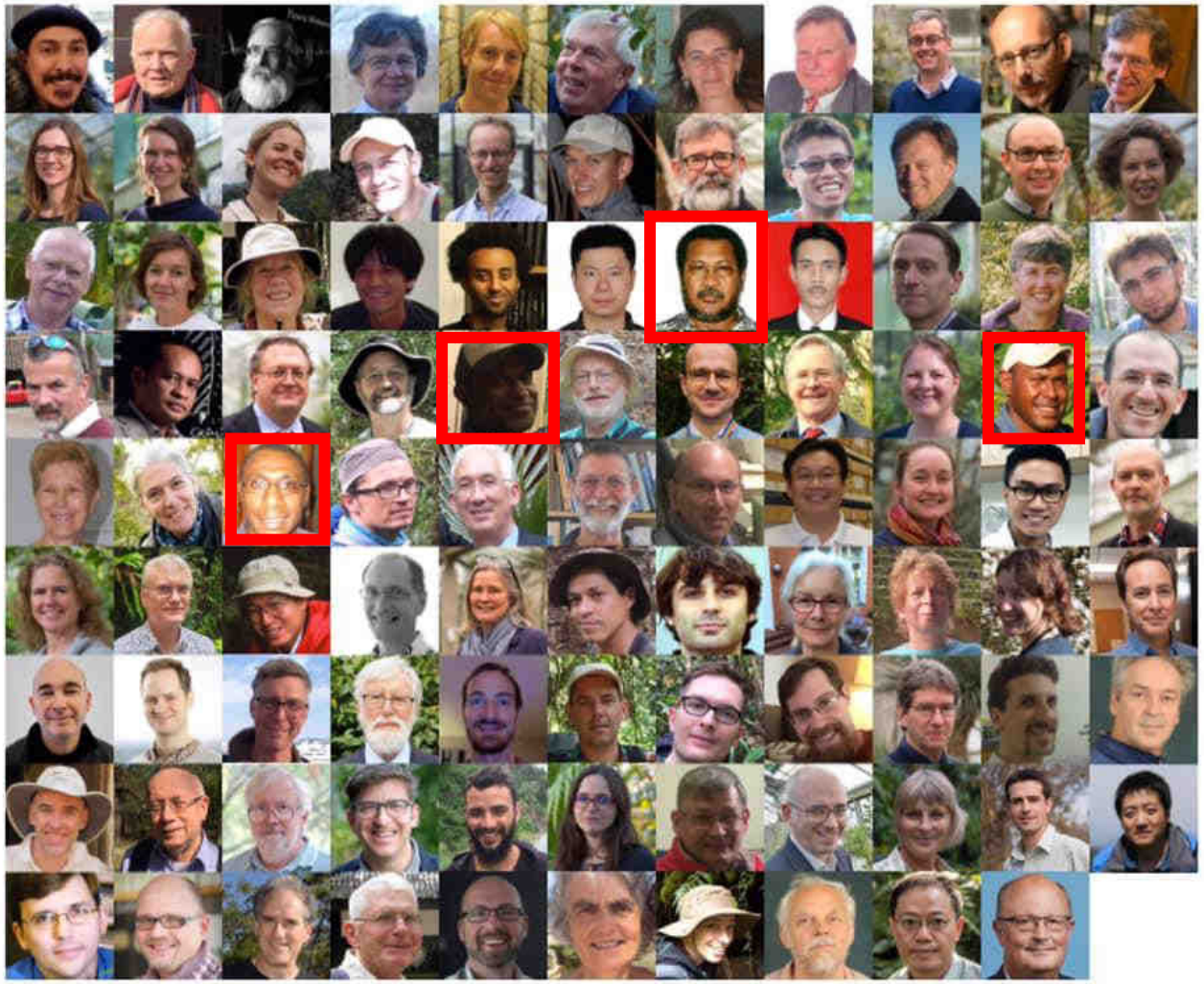


Fig. 3 | Breakdown of the New Guinea flora by life form. Fraction of species that are trees (pink), herbs (dark blue), epiphytes (orange), shrubs (green), climbers (light blue), non-climbing palms (yellow) and tree ferns (mid blue).

99 authors,
4 from PNG

[note also the lack of ~~female scientists~~ across the board]

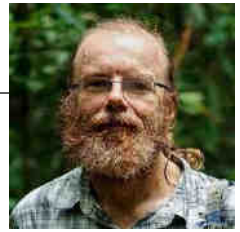


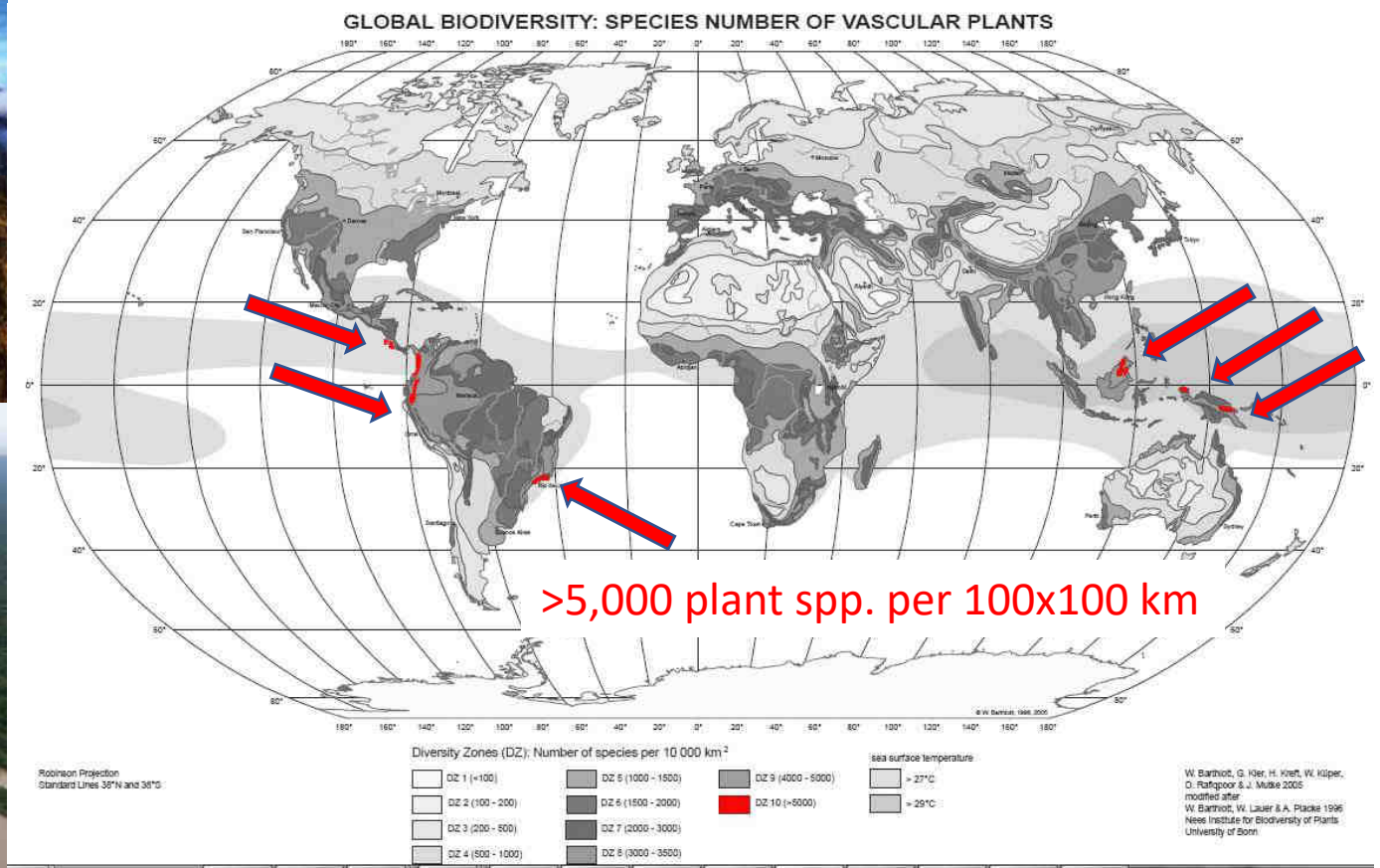
Ecology

An inventory of plants for the land of the unexpected

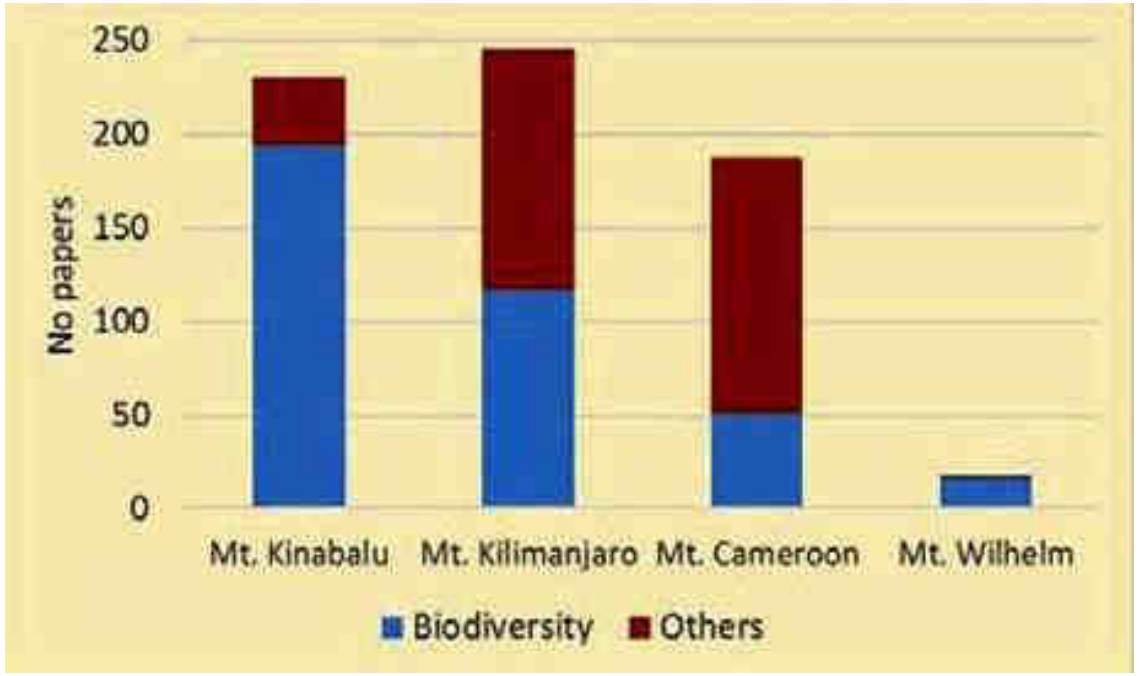
Vojtech Novotny & Kenneth Molem

New Guinea has the world's richest island flora, according to the area's first plant list catalogued by experts. Completing this list poses a formidable challenge that New Guineans are best placed to take up.





Mt Wilhelm: one of the six most diverse areas in the world



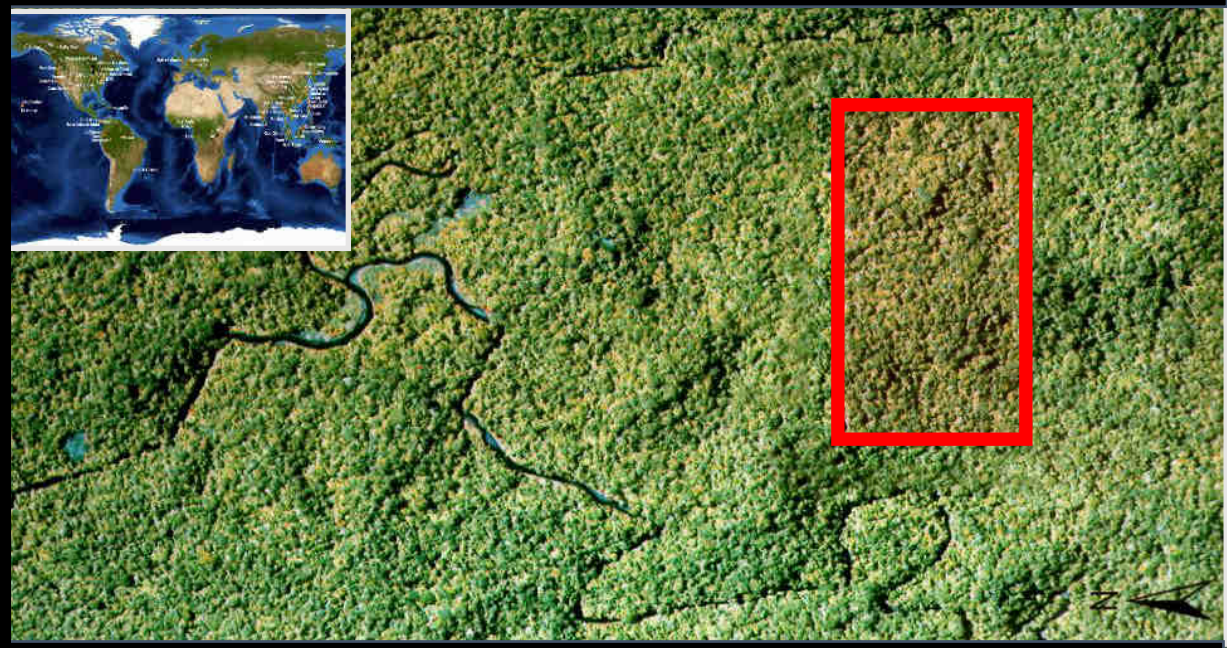
Papua New Guinea neglected by research but has much to offer in biology, geology, medicine…

Research publications (1975-2020) from four prominent tropical elevation gradients: *Novotny and Toko, 2021*

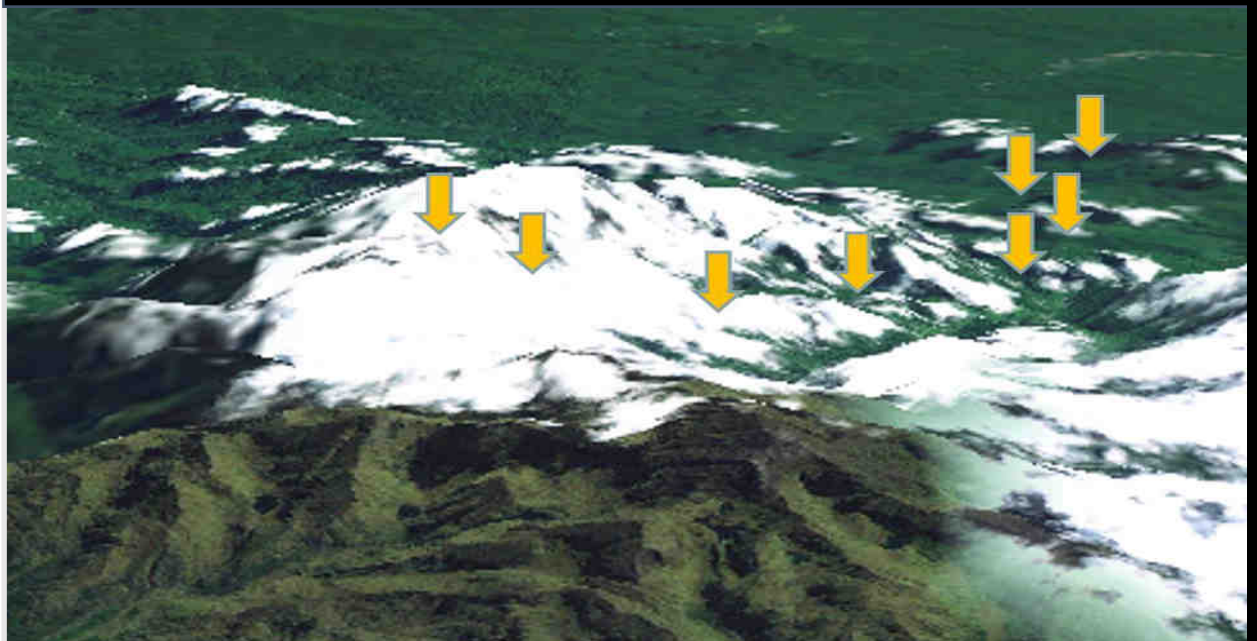



Swire field research station in Wanang

50 ha CTFS forest plot Wanang

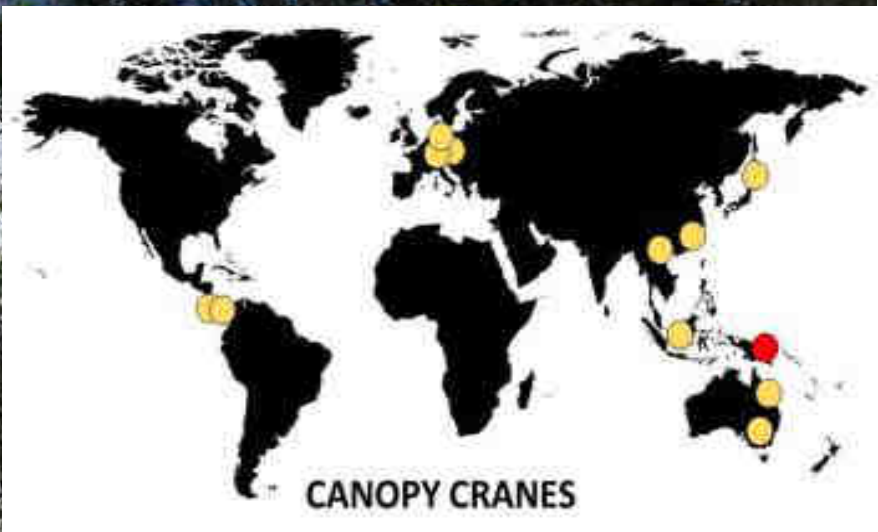


Rainforest altitudinal gradient Mt Wilhelm



Canopy crane in Baitabag

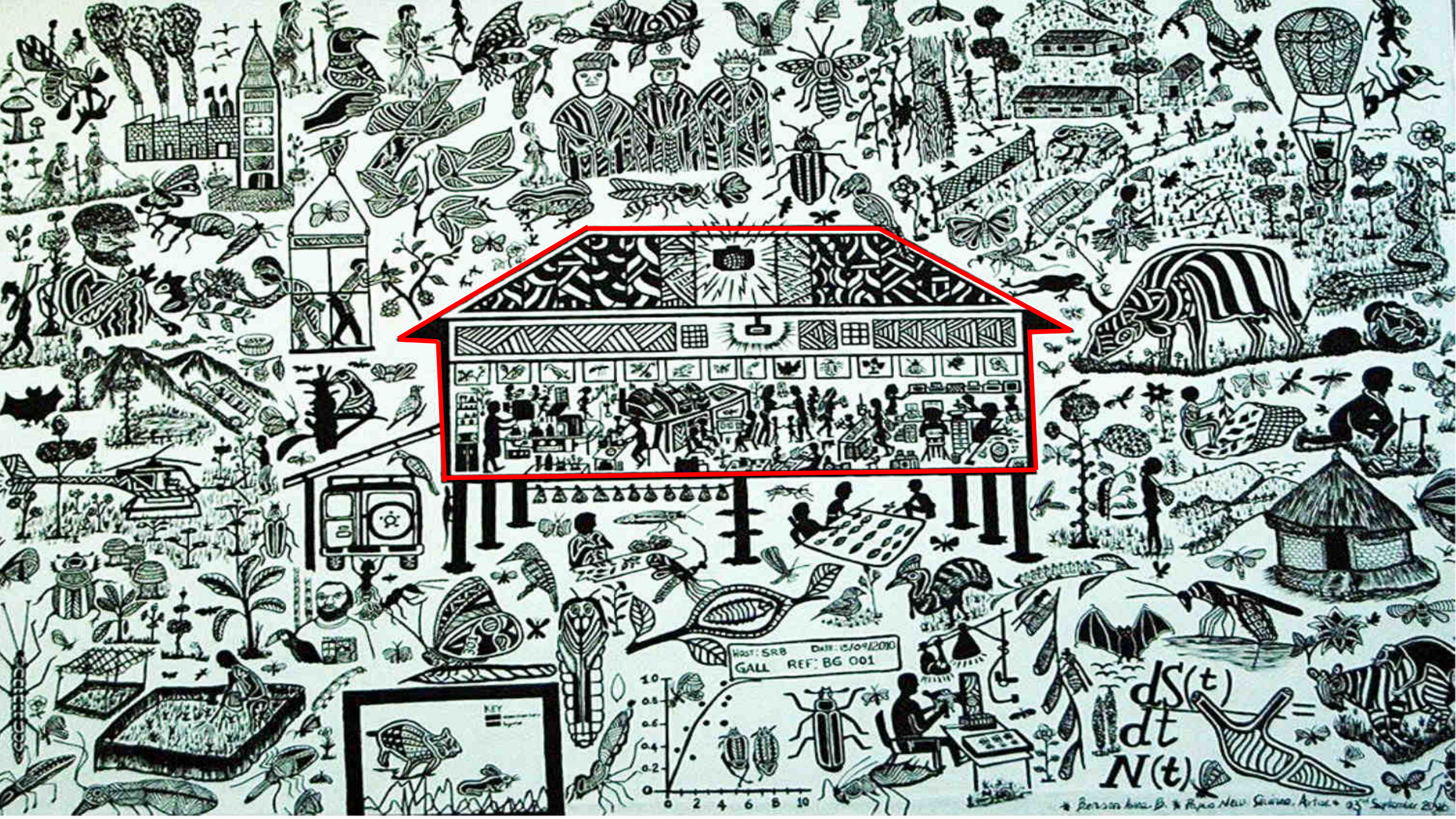
Canopy crane in PNG: 8th country in the world



National Forest Inventory: insect and bird surveys

ExxonMobil Environmental Impact Survey of the LNG Project

Monitoring rainforest regeneration along the pipeline


HOST: SRB
GALL REF: BG 001
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1.0
0.8
0.6
0.4
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0 2 4 6 8 10
$\frac{dS(t)}{dt} = N(t)$