DISRUPTION FOR HEALTHY FUTURES

Climate sensitive vector-borne diseases and outbreak response capabilities in the Pacific

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Order of presentation

- Introduction to VBDs
- The impact of climatic changes on VBDs
- VBDs of major interest in the Pacific
- Capacities required to prevent/identify/respond to VBDs
- Assessment of these capacities in Pacific
- Actions underway and needed

Source: https://wwwnc.cdc.gov/eid/article/20/6/13-1413-f1

Human impact

- Apprx. 40% percent of emerging zoonotic viruses are vector borne
- 1/6th human illnesses and disability suffered worldwide due to VBD
- > ½ world human population at risk of VBD
- Every year there are more than 1 billion cases and over 1 million deaths from vector-borne diseases, globally.
- Vector-borne diseases account for over 17% of all infectious diseases.
- Wide socioeconomic impacts – individual and societal
- Burden greatest for poor

Source: Campbell-Lendrum D et al 2015; WHO 2008, Murray et al 2012, Lozano R et al 2012

VBD AND MAJOR VECTOR DISTRIBUTION IN THE PACIFIC

MOHMS Fiji and WPRO 2015

Disease	Country/Region	PICT/PNG Vectors
Dengue	Pacific wide	*Aedes aegypti, Ae. albopictus, Ae. polynesiensis* and numerous others *in scutellaris* group
Chikungunya	FSM, New Caledonia, PNG, Tonga	*Ae. aegypti, Ae. Albopictus, Ae. polynesiensis*
Zika virus	Cook Islands, FSM, French Polynesia, New Caledonia, PNG	*Ae. hensilli, Ae. aegypti*
Lymphatic filiariasis	Pacific wide (except 6 countries)	*Culex quinquefasciatus, Anopheles farauti, Ae. albopictus,*
Malaria	PNG, Solomon Islands, Vanuatu.	*An. farauti, An. hinesorum, An. punctulatus*
Epidemic polyarthritis (Ross River Virus)	Cook Islands, Fiji, New Caledonia, PNG, Samoa, Tonga	*Ae. vigilax, Cx. annulirostris, Ae. polynesiensis*
Japanese encephalitis	Micronesia, North Mariana, PNG	*Cx. tritaeniorhynchus, Cx. annulirostris, Cx. sitiens*

Not as widespread but still climate sensitive (maybe under measured)

Disease/Disease group	Vector
West Nile fever	*Culex*
Relapsing fever (borreliosis) (Guam disease) Rickettsial disease (Babesia) Tick borne encephalitis	Ticks
Rickettsiosis	Fleas
Scrub typhus (Temotu fever)	Mites (incl. Trombiculid)

RAPID COMMUNICATIONS

Concurrent outbreaks of dengue, chikungunya and Zika virus infections – an unprecedented epidemic wave of mosquito-borne viruses in the Pacific 2012–2014

>120,000 reported affected

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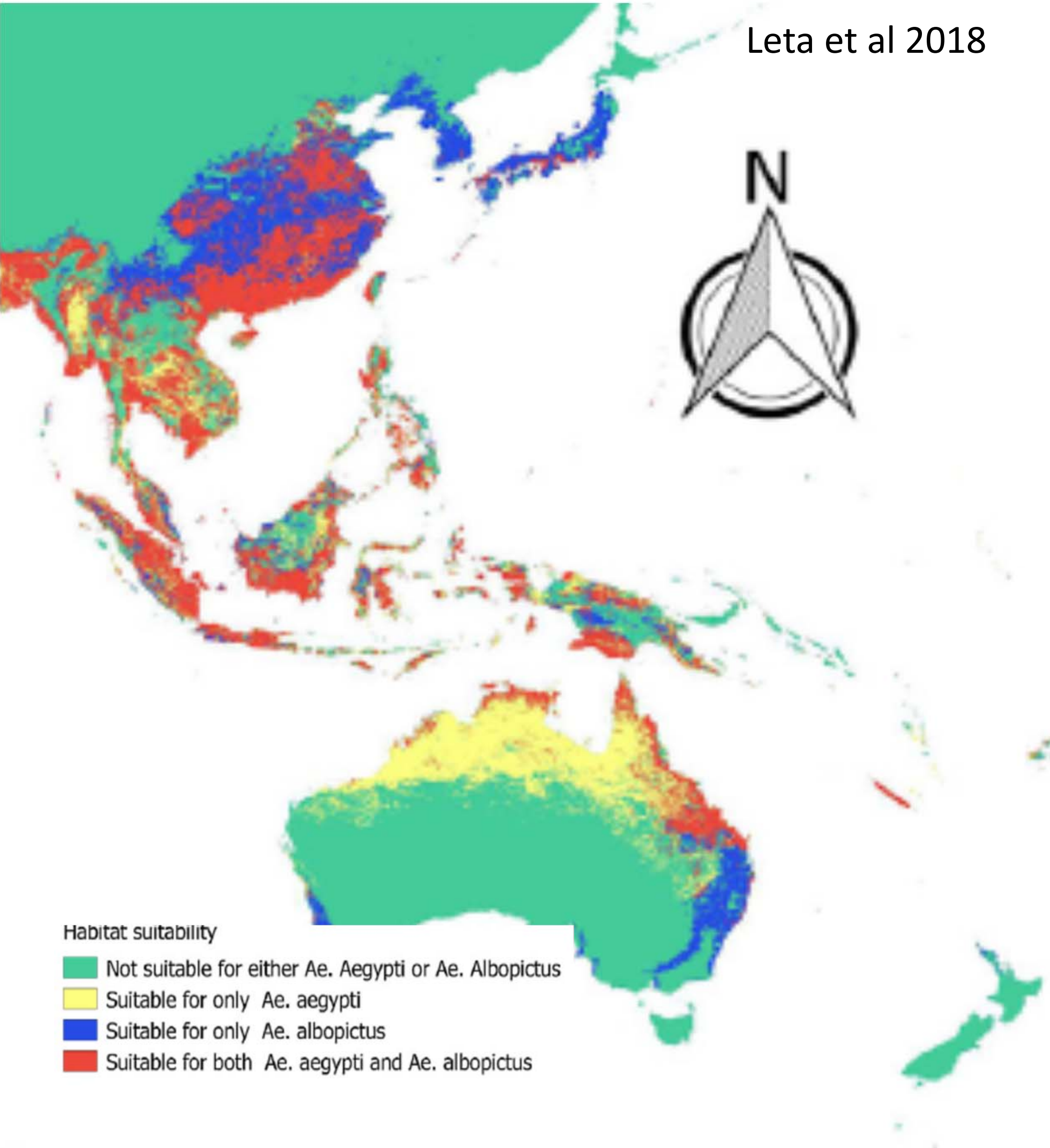
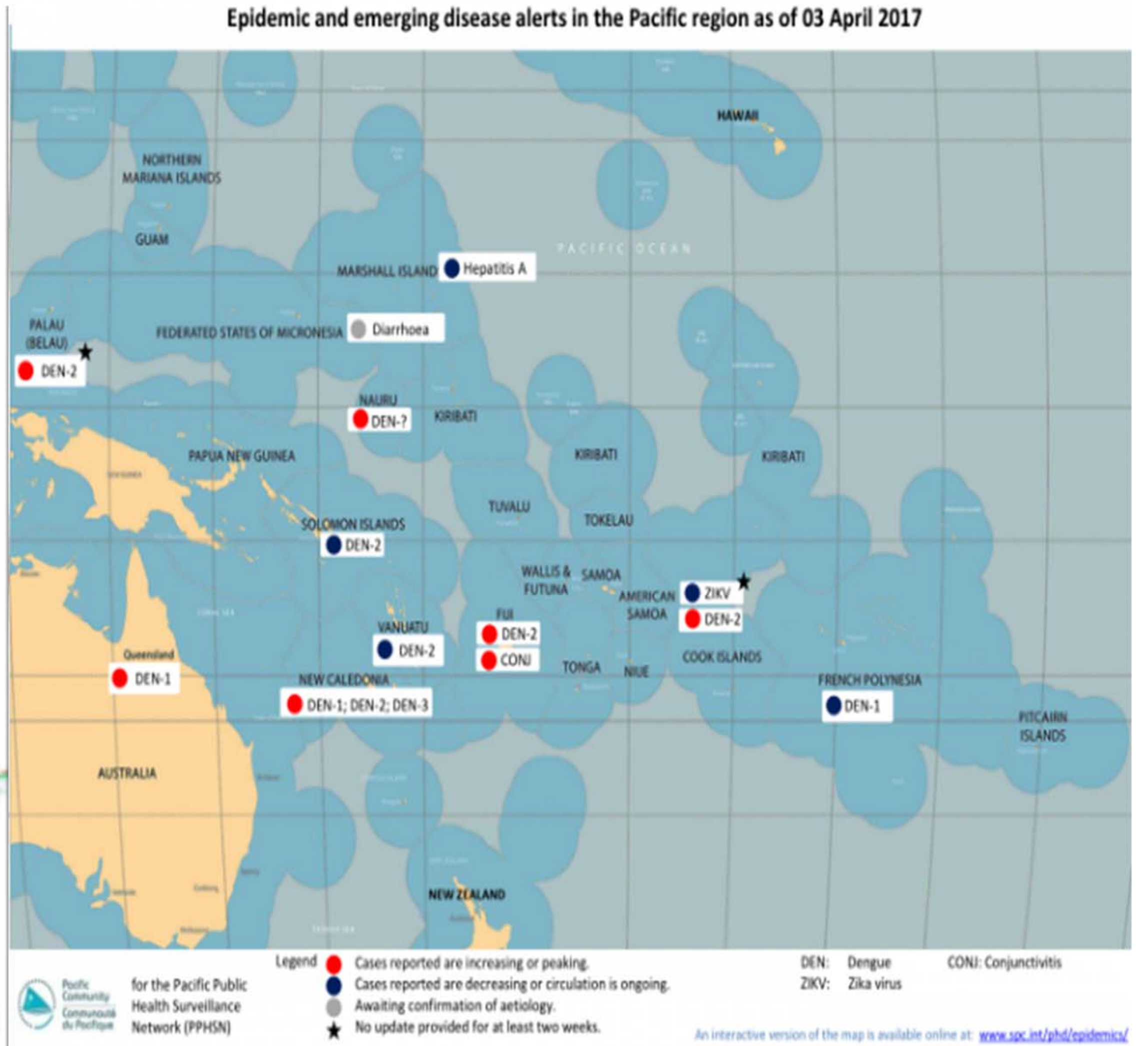
Citation style for this article:
Roth A, Mercier A, Lepers C, H
– an unprecedented epidemic
eurosurveillance.org/ViewArt

a and Zika virus infections
able online: http://www.

/ published on 16 October 2014

Since January 2012, the Pacific Region has experienced 28 new documented outbreaks and circulation of dengue, chikungunya and Zika virus. These mosquito-borne disease epidemics seem to become more frequent and diverse, and it is likely that this is only the early stages of a wave that will continue for several years. Improved surveillance and response measures are needed to mitigate the already heavy burden on island health systems and limit further spread to other parts of the world.





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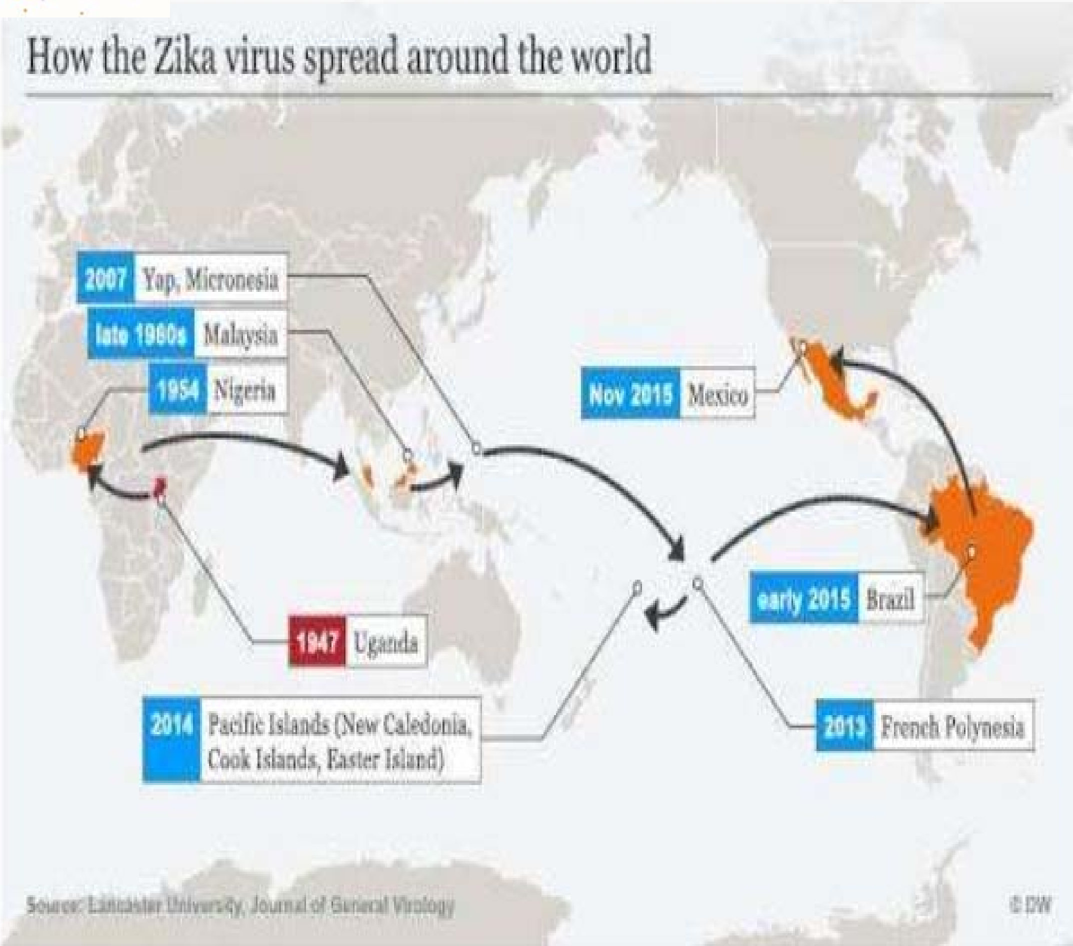

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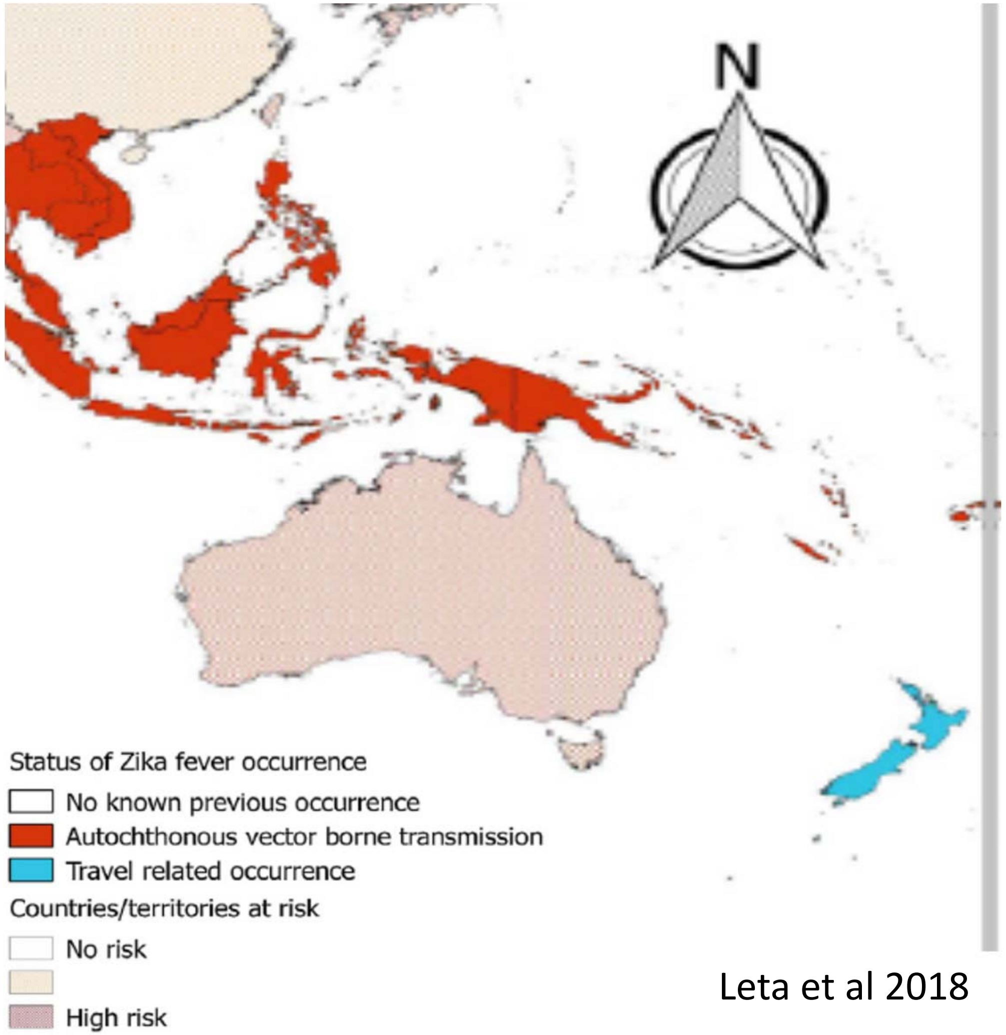
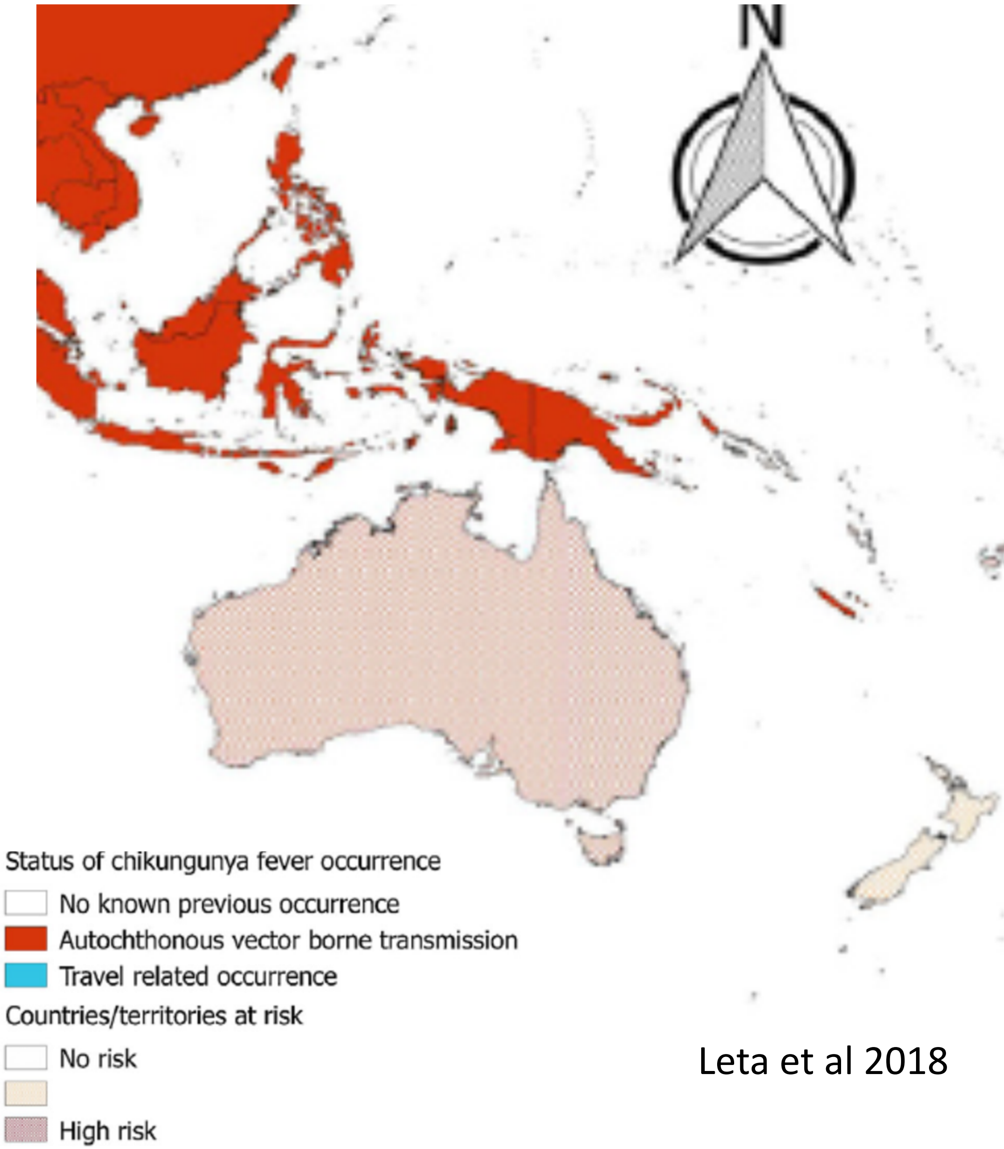


Leta et al 2018



Leta et al 2018

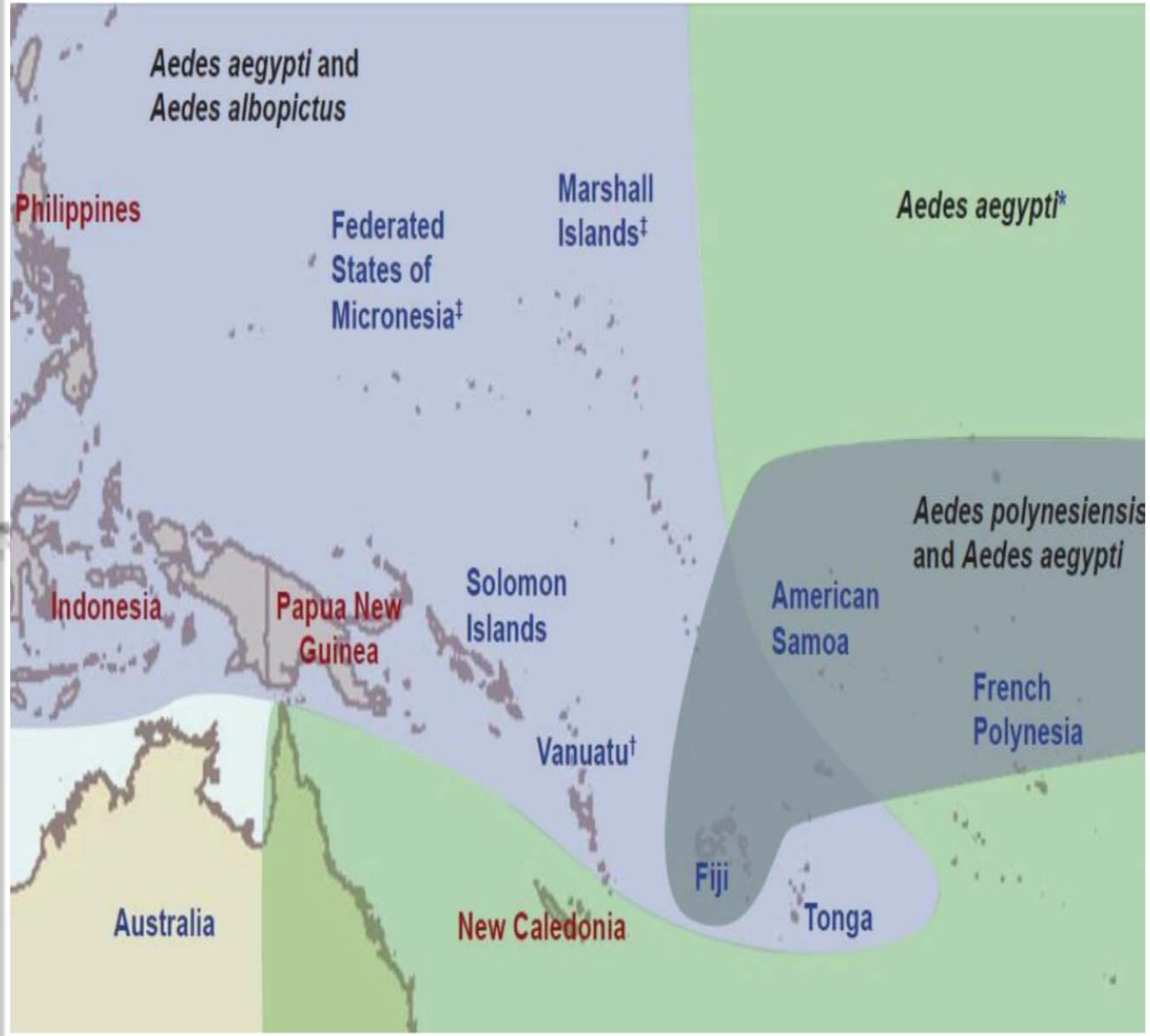


Figure 3: Distribution of chikungunya virus vectors in the Pacific

MOHMS and WPRO 2015

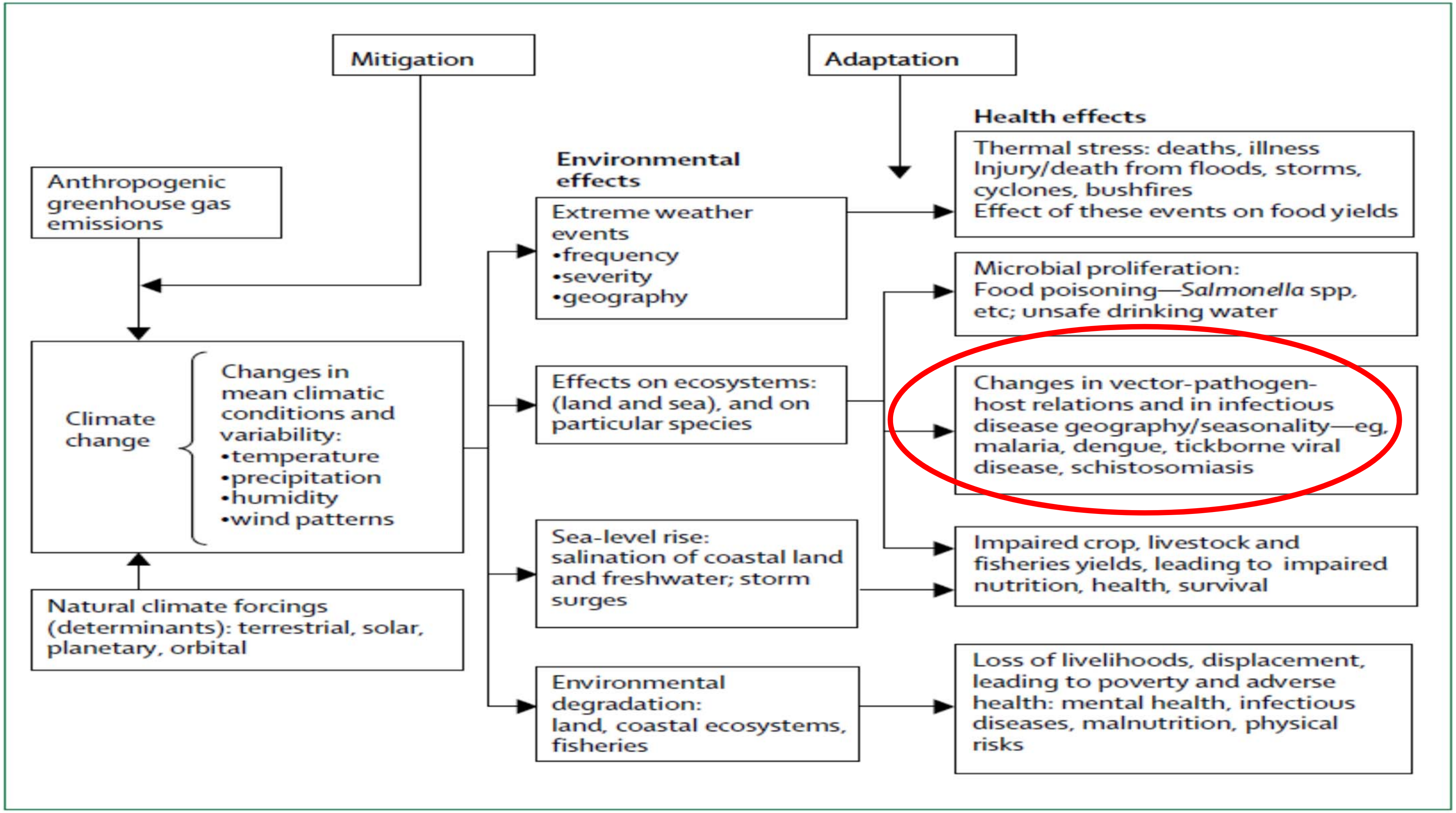


Figure 1: **Schematic summary of main pathways by which climate change affects population health**
Mitigation refers to true primary prevention (reducing greenhouse gas emissions). Adaptation (a form of late primary prevention) entails interventions to lessen adverse health effects.

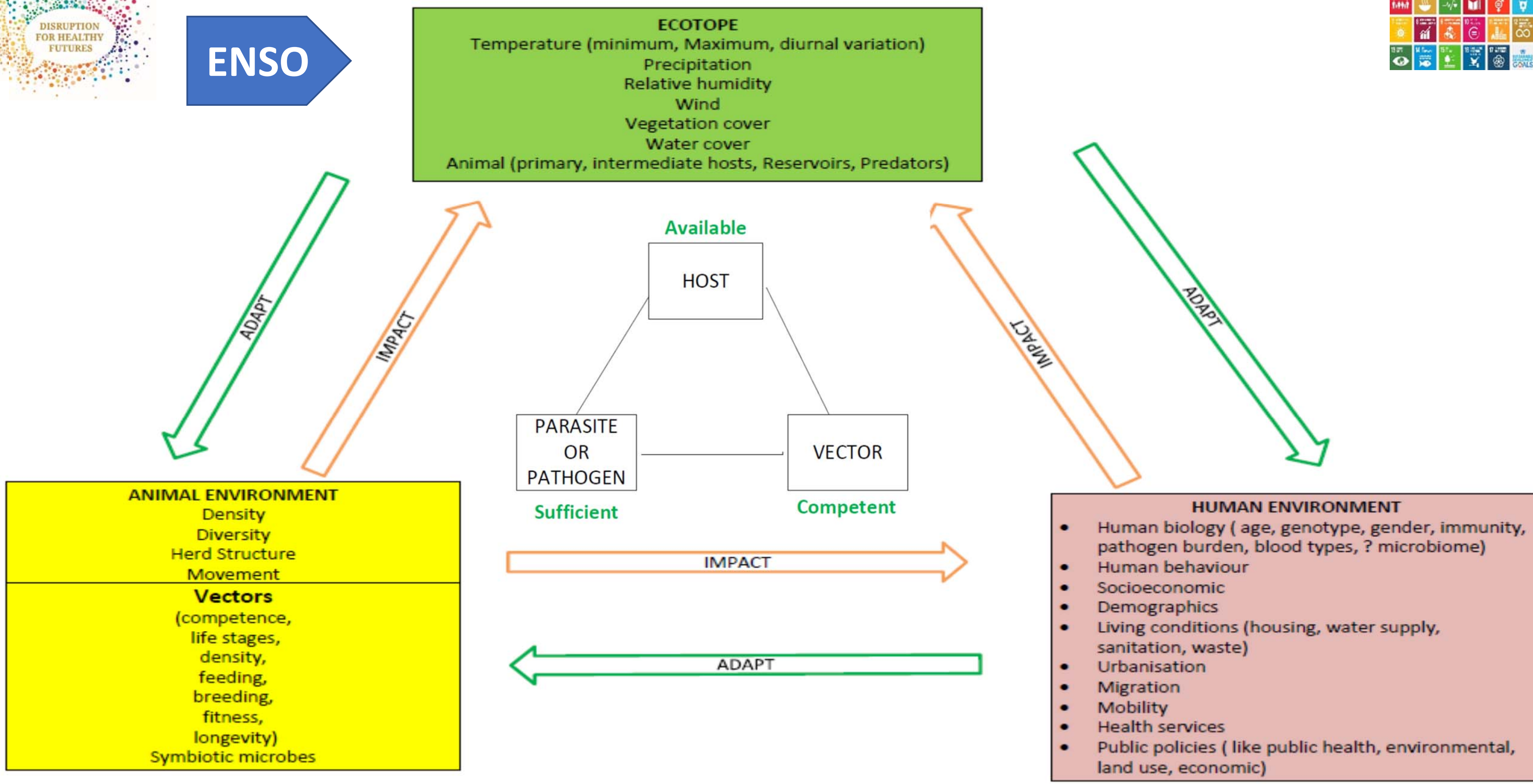
McMichael A et al 2006

Table 29-1 | Climate change projections for the intermediate low (500–700 ppm CO_2e) Representative Concentration Pathway 4.5 (RCP4.5) scenario for the main small island regions. The table shows the 25th, 50th (median), and 75th percentiles for surface temperature and precipitation based on averages from 42 Coupled Model Intercomparison Project Phase 5 (CMIP5) global models (adapted from WGI AR5 Table 14.1). Mean net regional sea level change is evaluated from 21 CMIP5 models and includes regional non-scenario components (adapted from WGI AR5 Figure 13-20). IPCC 2014

Small island region	RCP4.5 annual projected change for 2081–2100 compared to 1986–2005						
	Temperature (°C)			Precipitation (%)			Sea level (m)
	25%	50%	75%	25%	50%	75%	Range
Caribbean	1.2	1.4	1.9	−10	−5	−1	0.5–0.6
Mediterranean	2.0	2.3	2.7	−10	−6	−3	0.4–0.5
Northern tropical Pacific	1.2	1.4	1.7	0	1	4	0.5–0.6
Southern Pacific	1.1	1.2	1.5	0	2	4	0.5–0.6
North Indian Ocean	1.3	1.5	2.0	5	9	20	0.4–0.5
West Indian Ocean	1.2	1.4	1.8	0	2	5	0.5–0.6

Vector-borne infections	Mosquito-borne infections tend to increase with warming and certain changes in rainfall patterns: heightened transmission. Likewise tick-borne infections, although via more complex ecological changes	Mosquito reproduction and survival could be impaired by altered rainfall and surface water and by excessive heat: reduced transmission. Similar determinants may apply to ticks, snails and other vectors.

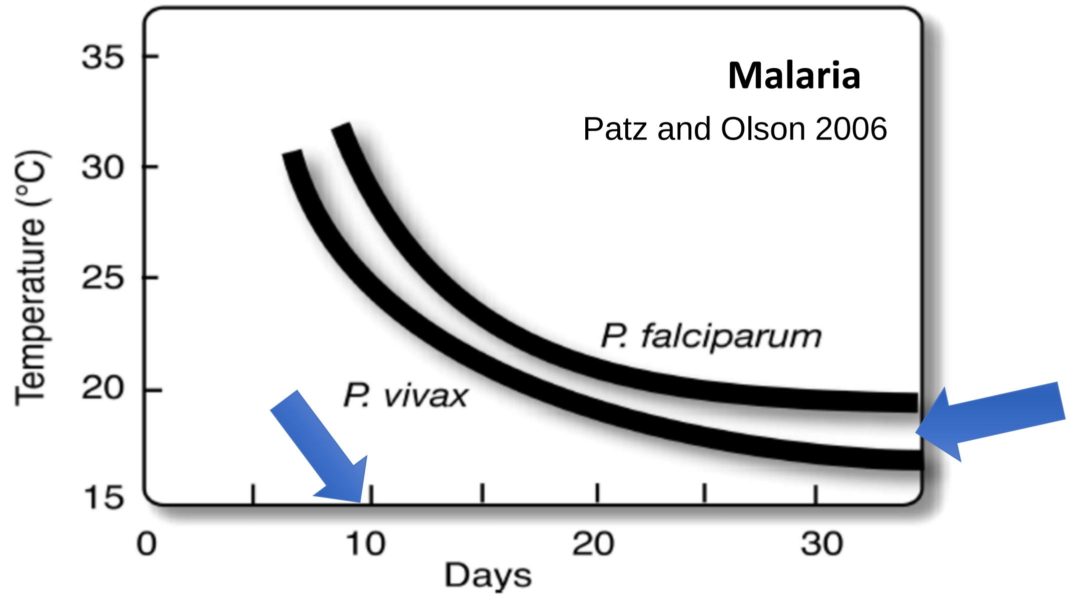
McMichael A et al 2006



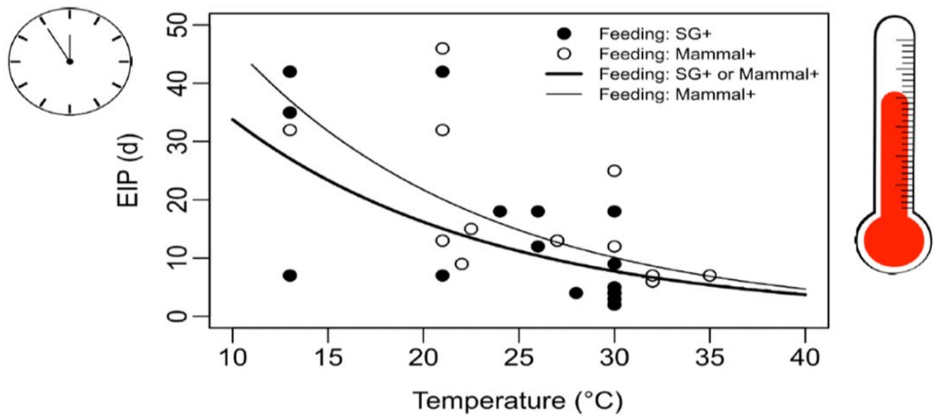
Adapted from : Wu et al 2016, Rodhain, 1985; Parham et al 2015; Campbell-Lendrum et al 2015

A pathogen/parasite

- Needs a certain temperature range to survive and develop
- Rising temperatures can affect reproduction and extrinsic incubation period and other aspects of parasite development rates
- Extended period of hot weather can raise the temperature of environments of -> change density of pathogens
- Rising temp. may limit proliferation of a pathogen by favouring competitor
- Combinations of factors often important



Temperature-dependence of dengue EIP



From Tjaden *et al. PLoS Negl Trop Dis* 2013

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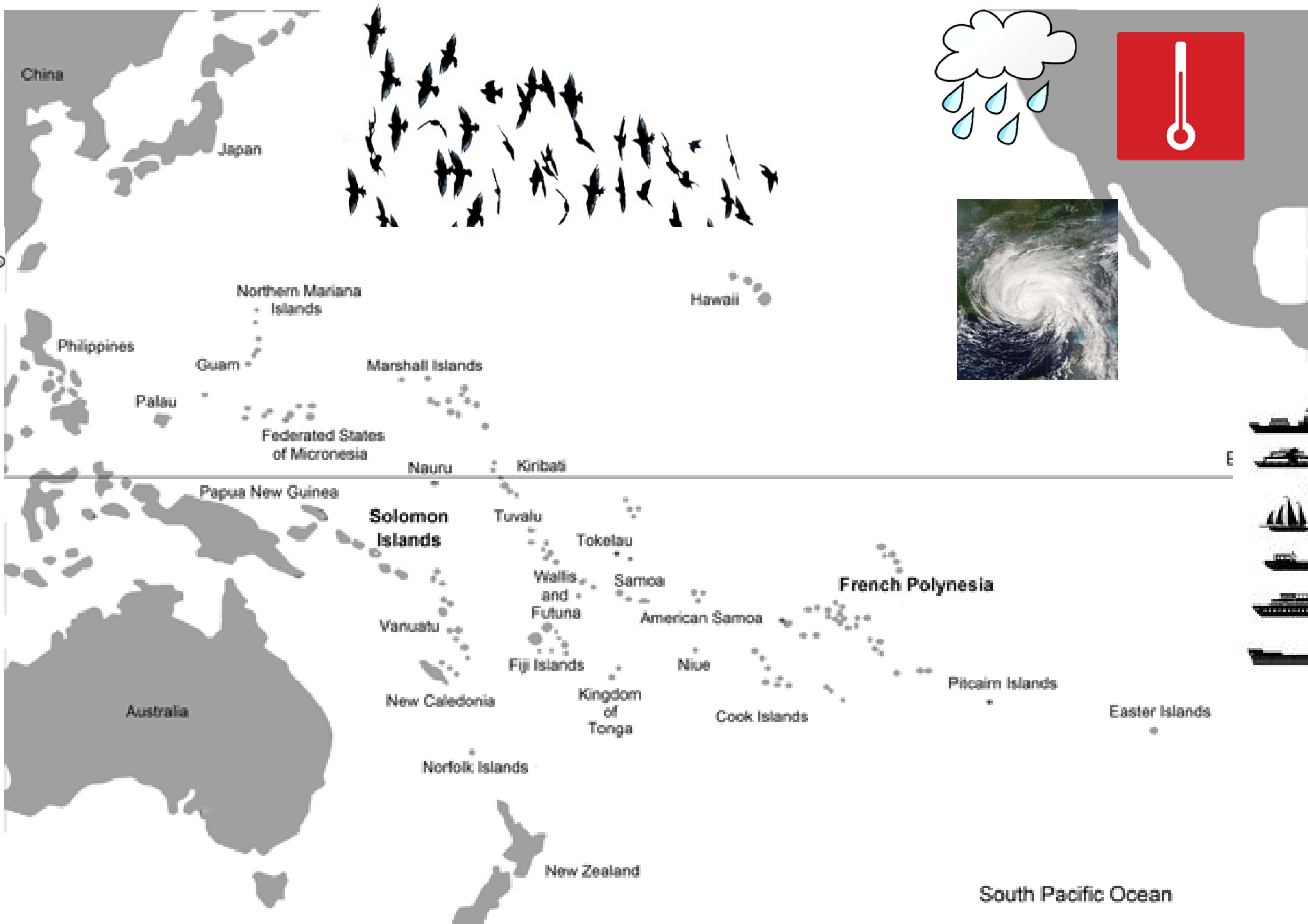

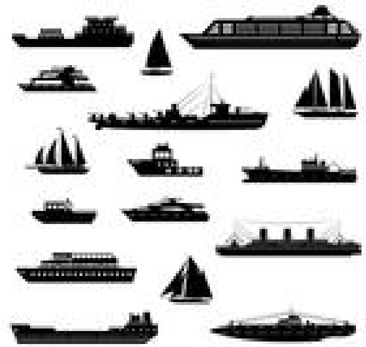

Source: https://wwwnc.cdc.gov/eid/article/20/6/13-1413-f1

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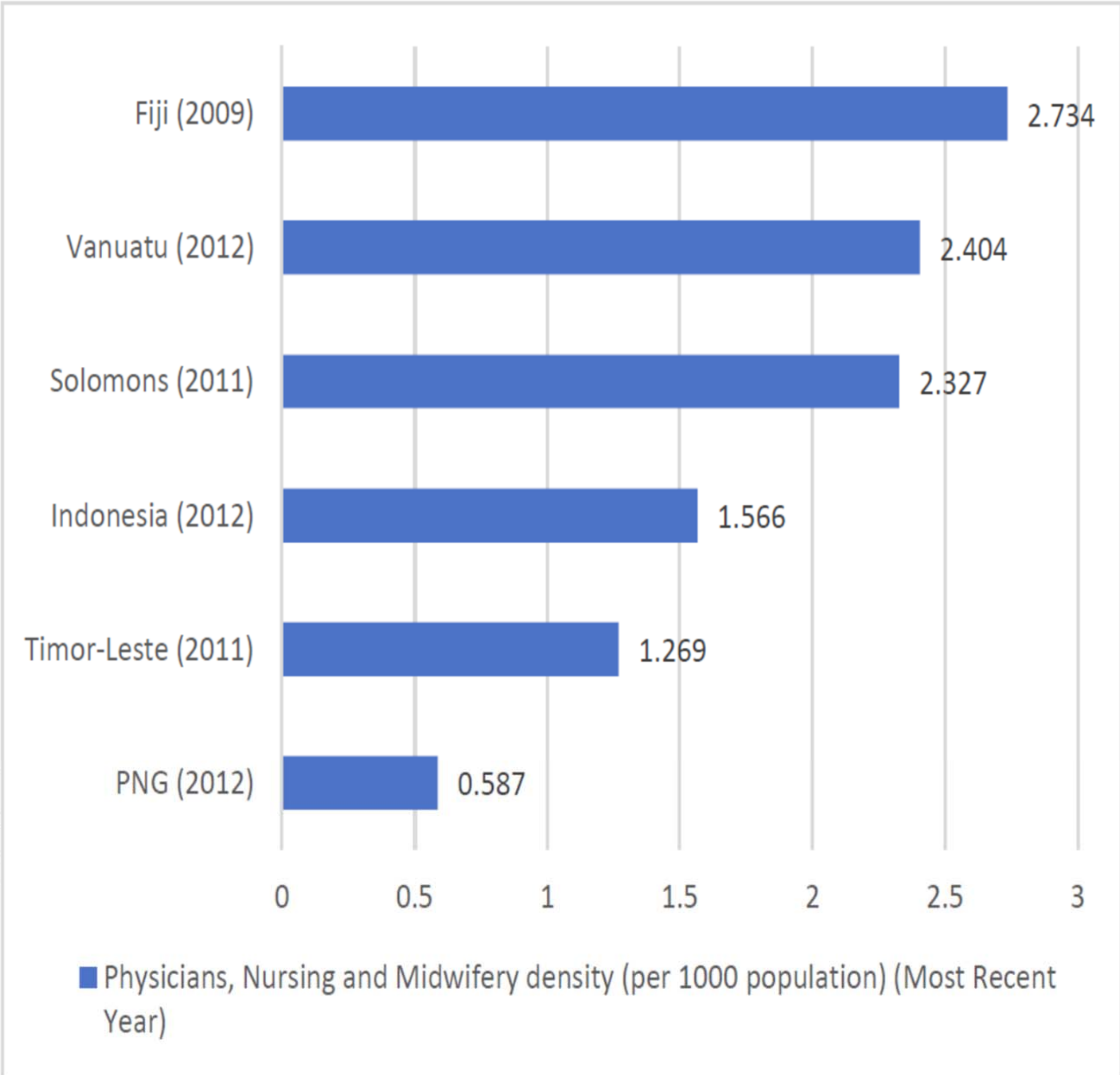
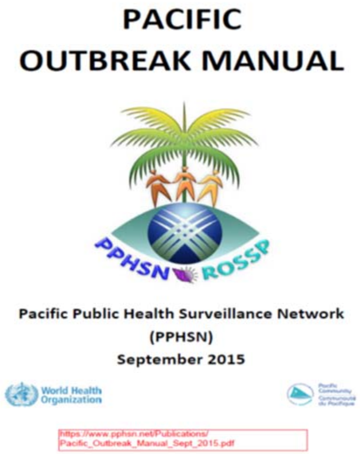
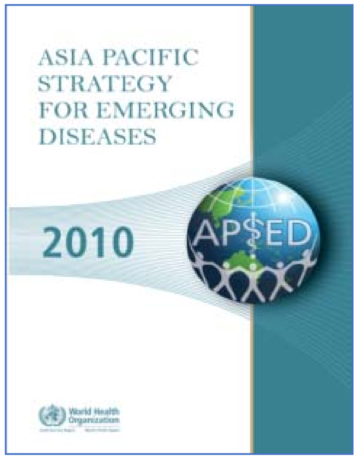


Source: WHO Global Health Observatory Data Repository: http://www.who.int/gho/database/en/

Strengths and opportunities

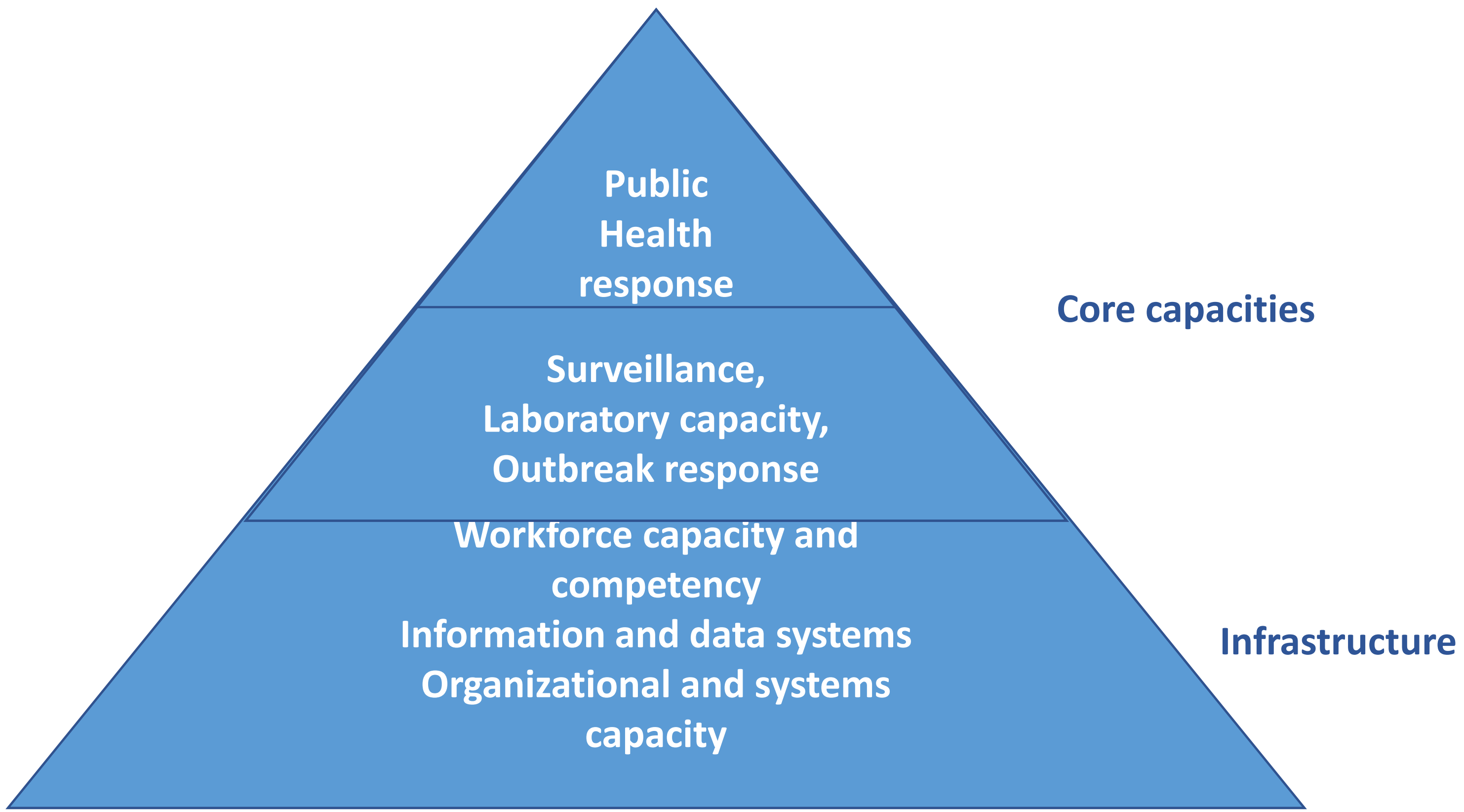
- Resilient communities and social structures
- Partners/Support
  - SPC
  - WPRO
  - Australian and New Zealand government
  - CDC
  - Pasteur institute
  - China
  - Pacific Public health Surveillance network (PPHSN), PacNET, LabNet, EpiNet, PICNet





- Fiji National University with SPC Data for decision making accredited training programme for Pacific
- PNG Field Epidemiology training program (with CDC and WHO)
- Pacific data for decision making
- Asia Pacific Strategy for Emerging Diseases (APSED)
- Asia Pacific Strategy for Strengthening of Health Laboratories
- APMEN
- Pacific Outbreak Manual
- PacELF

Core public health capacities for effective response to VBD – emerging, re-emerging or evolving



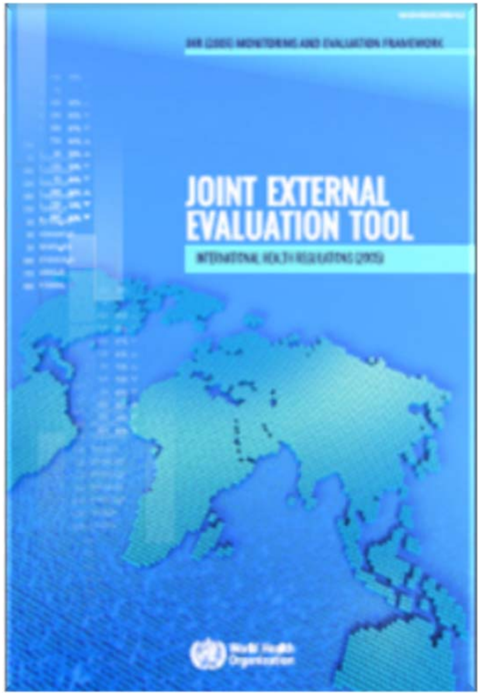
Source: WHO 2005

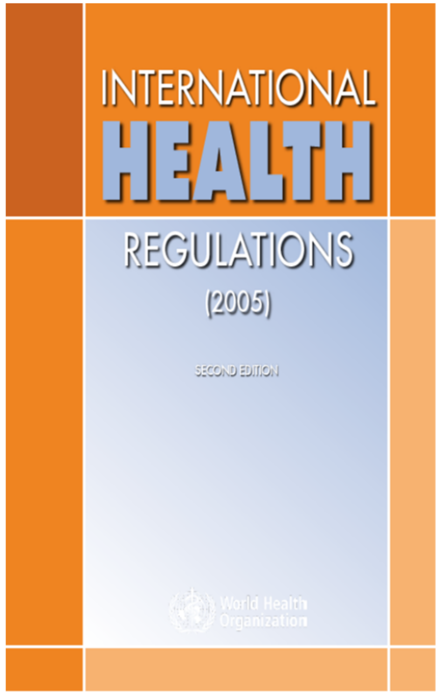
DISRUPTION FOR HEALTHY FUTURES

IHR 2015

- Strong national public health systems that are able to maintain active surveillance of diseases and public health events;
- Rapidly investigate detected events;
- Report and assess public health risks;
- Share information;
- Implement public health control measures

- 14 are State parties to IHR
- 6 assessed (2015) as gaps in core critical areas





Experience in vector control

- "The expertise of entomologist is critical to guiding vector control; however the world is facing an extreme shortage of entomologists" WHO 2014 pg 45
- Vector control capacity in pacific limited or insufficient No ongoing entomological surveillance system targeting vectors of dengue or other arboviruses except New Caledonia, Fiji and French Polynesia: Roth et al 2014
- Most data on mosquito distribution on data collected 2nd half 20th century
- Little done to build local infrastructure and skills needed to improve efficiency, monitor impact, sustain coverage with vector control interventions, and insecticide resistance monitoring

So what can we do?

- Support capacity building efforts commenced by Pacific island countries and territories and partner agencies
  - Advocacy for resourcing
  - Mentoring
  - Developing training opportunities in partnership
  - Apply research efforts to problems pacific partners identify and face – and implement as true partnerships
  - Tools development to support efforts
  - Innovative continuing professional development opportunities
  - Personal actions re: climate change

-> Flexible adaptive resilient health systems and Pacific neighbours partnerships to cope with changes the direction of which may be unpredictable

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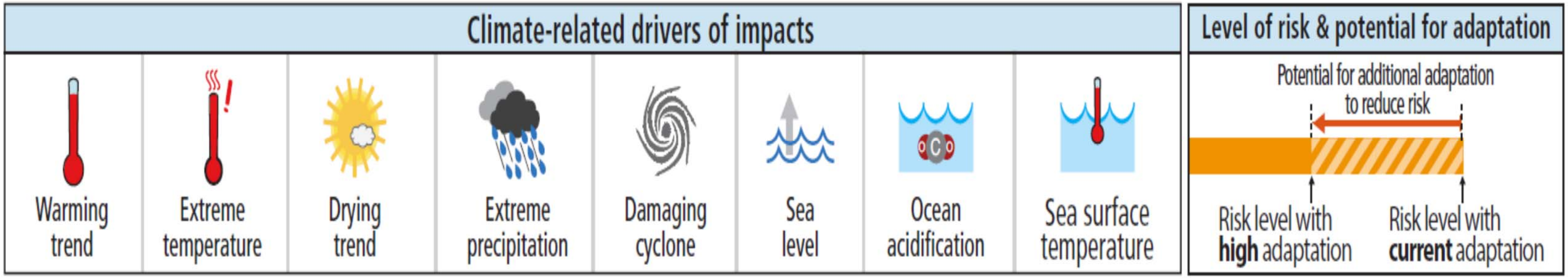
International Day of the Tropics

#WeAreTheTropics

29th June


Climate-related drivers of impacts
Warming trend
Extreme temperature
Drying trend
Extreme precipitation
Damaging cyclone
Sea level
Ocean acidification
Sea surface temperature
Level of risk & potential for adaptation
Potential for additional adaptation to reduce risk
Risk level with high adaptation
Risk level with current adaptation

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