

WHO Yellow Fever Risk Mapping

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On behalf of the WHO Yellow Fever
Informal Working Group

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WHO Consultation on Yellow Fever Risk

- Response to:
 - recognition of serious adverse events
 - changing epidemiology of yellow fever
 - differing risk maps between CDC and WHO
- Broad goals:
 - more accurate definition of risk areas
 - transparency of recommendations
 - inform country policy around IHR (2005)



Process: YF Geographic Risk

Two stage process

1. 2008 consultation: reviewed criteria for inclusion or removal of countries or areas from the list for YF transmission (Annex 1)
 - defined evidence for determining geographic risk of YF
 - created four risk classifications for YF transmission
2. Following 2008 consultation, informal working group formed:
 - ✓ systematically applied evidence to each country at risk for YF
 - ✓ developed country/area risk categorisation and maps
 - ✓ presented work to WHO Member States (March 2010)



Yellow Fever Informal Working Group

- WHO

- ✓ Gilles Pomerol
- ✓ Mona Lacoul
- ✓ Rosamund Lewis
- ✓ Ruth Anderson

- Tom Monath
- Annelies Wilder-Smith
- Otavio de Oliva (PAHO)
- Oyewale Tomori (AFRO)
- Hervé Zeller (ECDC)
- David Hill (NaTHNaC)

- CDC

- ✓ Mark Gershman
- ✓ Emily Jentes
- ✓ Erin Staples
- ✓ Nina Marano



Evidence Used for Risk Mapping

- Human and non-human primates: cases, clusters and outbreaks
- Human serology prior to YF vaccination; most data generated in 1950s and earlier
- Vegetation and altitude
- Vector distribution
- (YF vaccination coverage)



Yellow Fever Consultation

Creation of New Categories of Risk

- Endemic
- Transitional
- Low potential (risk) for exposure
- No risk



New Categories of Yellow Fever Risk

- **Endemic**, e.g. Nigeria
 - YF vectors and non-human primate hosts present
 - YF cases reported: human and non-human primate
 - YF cases in humans before vaccine coverage
 - Sero-surveys demonstrate evidence of infection
 - Stable transmission



New Categories of Yellow Fever Risk

- **Transitional**, e.g. Paraguay
 - Areas bordering endemic zone with periodic evidence of transmission during epizootic or epidemic expansion
 - YF vectors and non-human primate hosts present
 - Human cases may be reported at long intervals
 - Sero-surveys demonstrate past evidence of infection

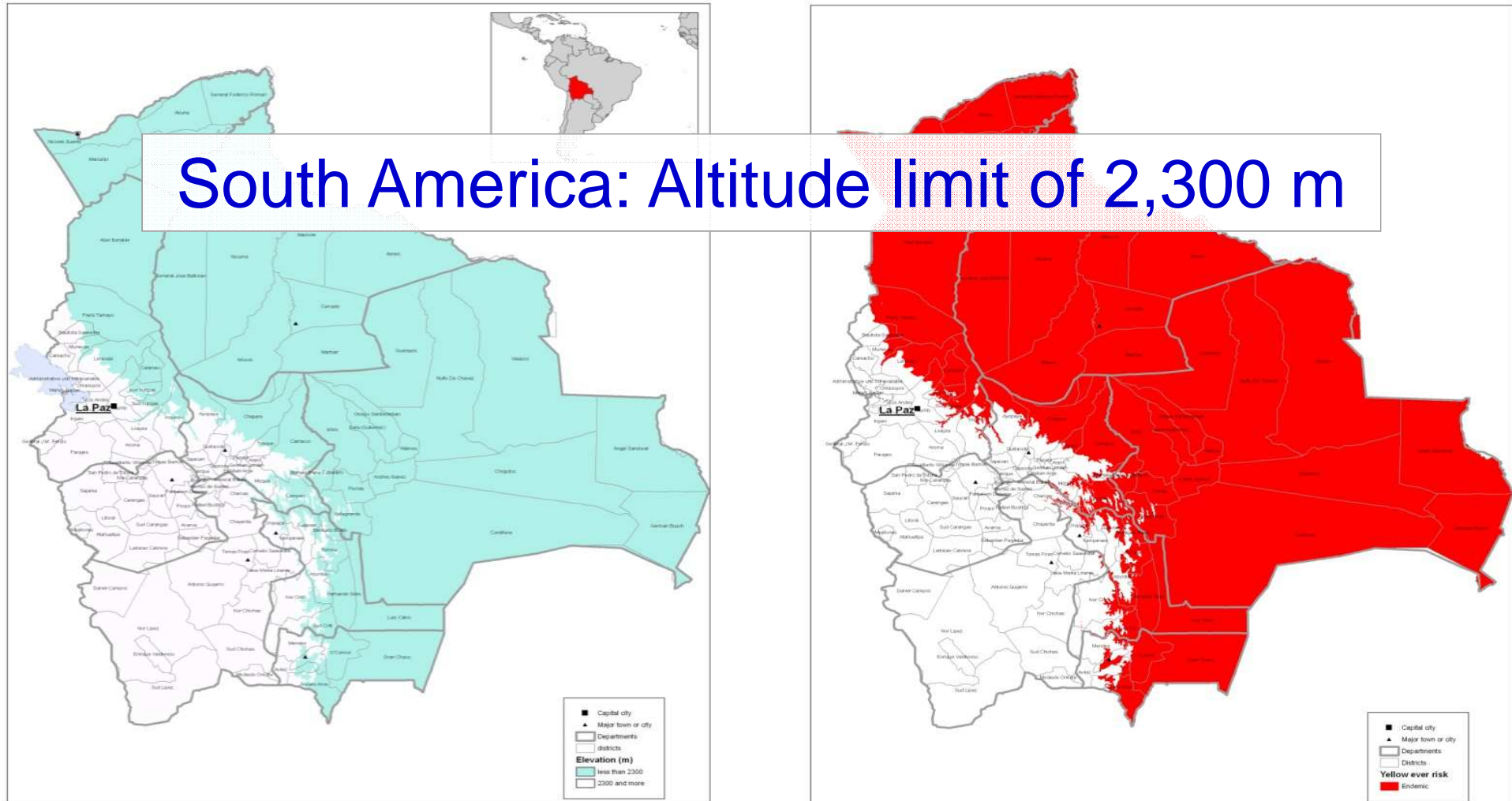


New Categories of Yellow Fever Risk

- **Low potential (risk)**, e.g. Tanzania
 - Areas bordering endemic or transitional areas
 - YF vectors and non-human primate hosts present
 - No human or non-human primate cases reported
 - Sero-surveys may demonstrate past evidence of infection, usually at low levels



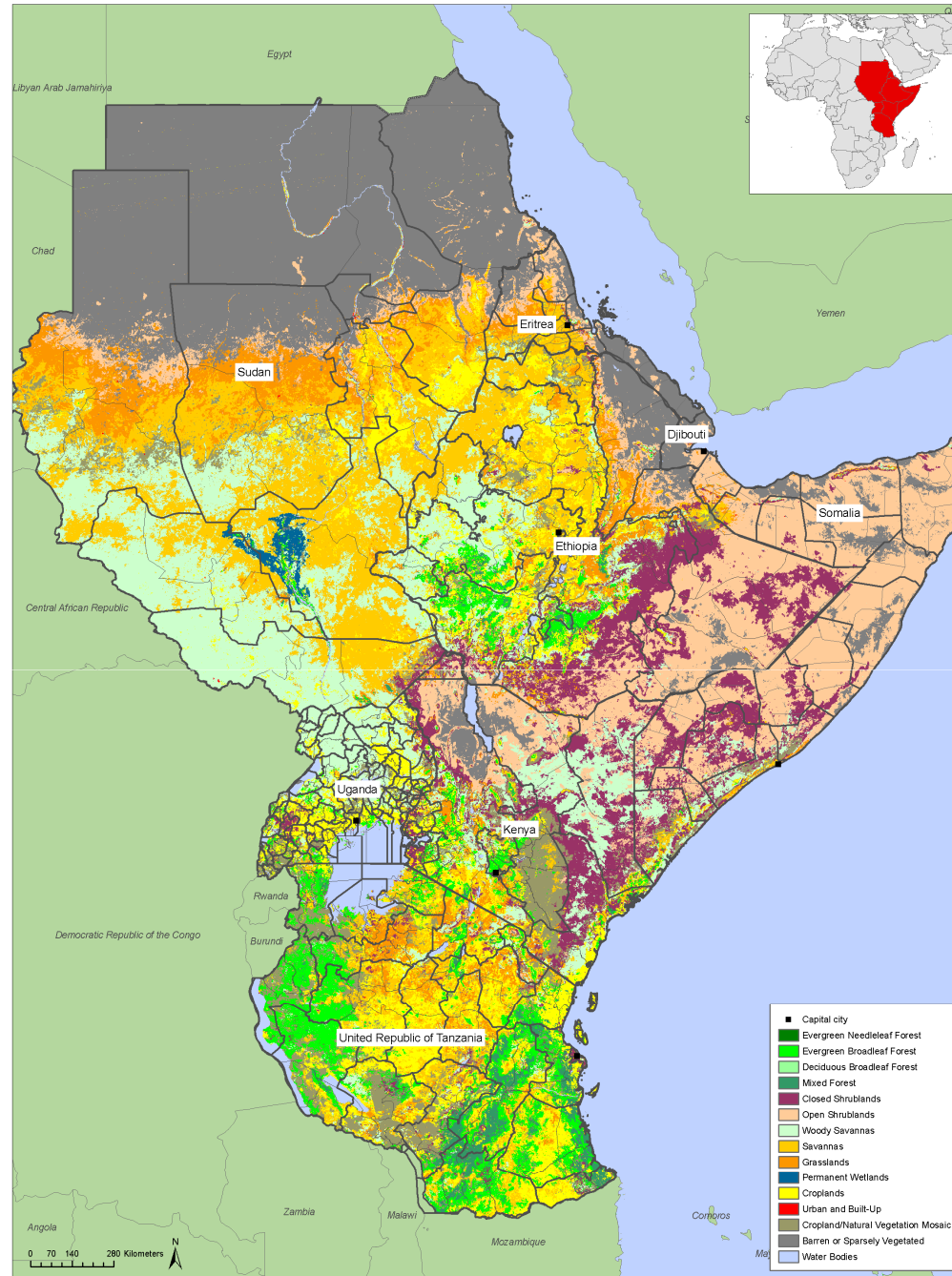
Use of Elevation Data: Bolivia



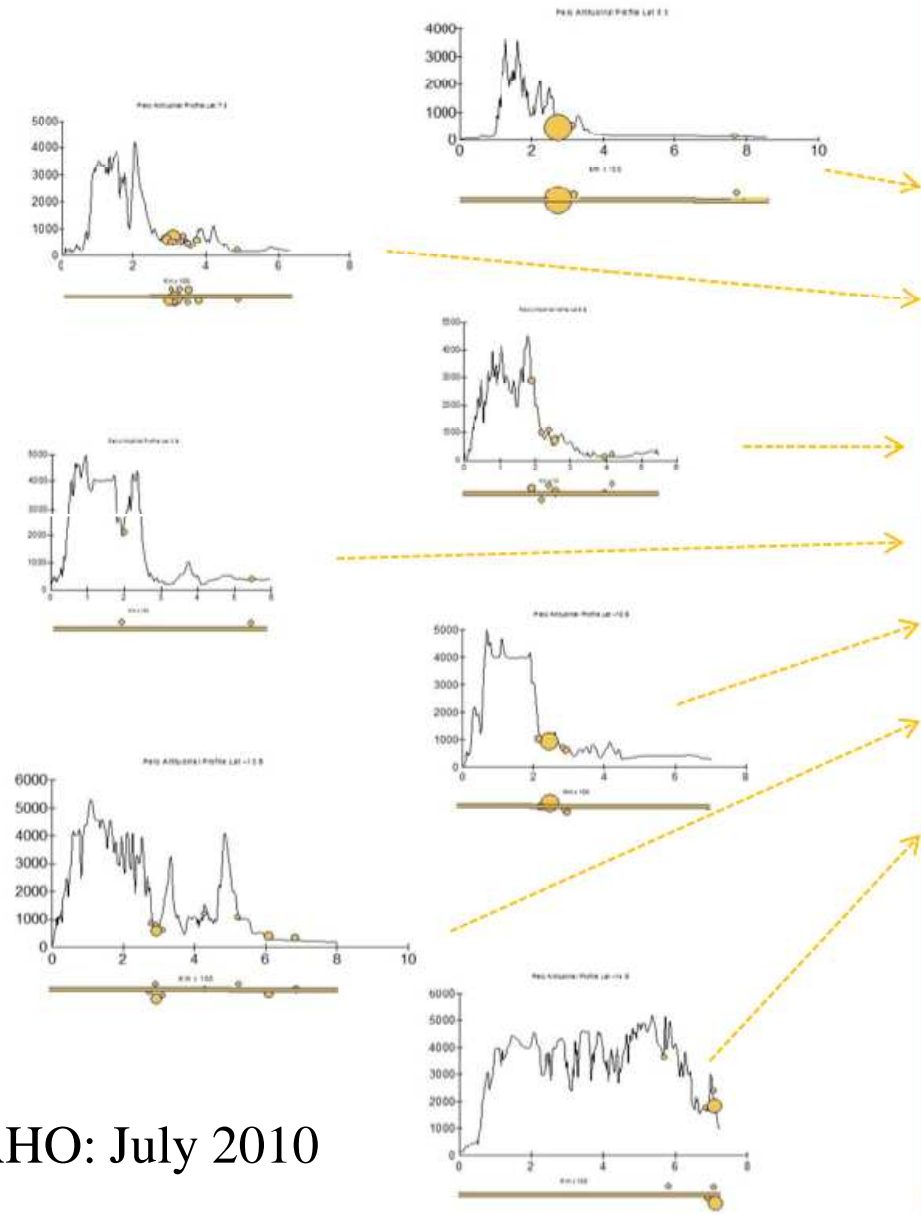
Areas below 2,300 m, determined from global digital elevation model (GTOPO30)

Areas below 2,300 m classified endemic

Regional land cover: Horn of Africa



Yellow Fever Risk Classification & Cases in Perú 2000-2010 over Altitudinal Profiles



PAHO: July 2010

New Categories of Yellow Fever Risk

Peru:

- no risk: coastal, south of La Libertad, Andes above 2,300 m
- low: Tumbes, and parts of Piura, Lambayeque, Cajamarca, and La Libertad
- transitional: eastern Piura state
- endemic: remainder of country



Special Considerations

- Examined high volume destinations, in attempt to simplify recommendations
- Low potential for exposure:
 - ✓ port cities in South America
 - Cartagena, Baranquilla, Port of Spain
 - ✓ Nairobi
 - ✓ Inca Trail (Peru)
- No risk:
 - ✓ transit of 12 h or less in international airports



Status Changes on a Country Level, Africa

Country	Previous	WG Recommendation
São Tomé & Príncipe	Endemic	Low potential
Tanzania	Endemic	Low potential
Somalia	Endemic	Low potential (sub-region)
Eritrea	No Risk	Low potential (sub-region)
Zambia	No Risk	Low potential (sub-region)

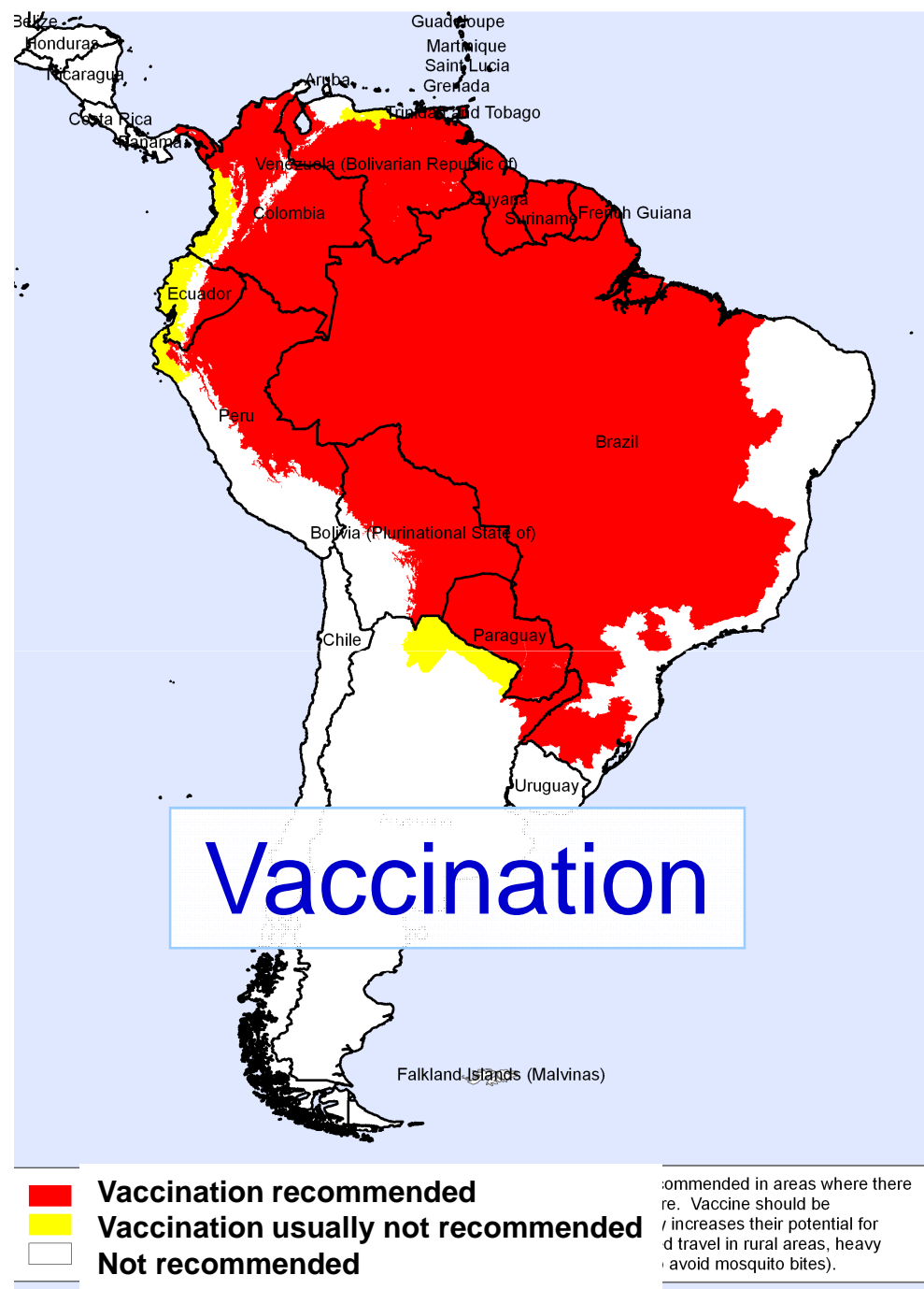
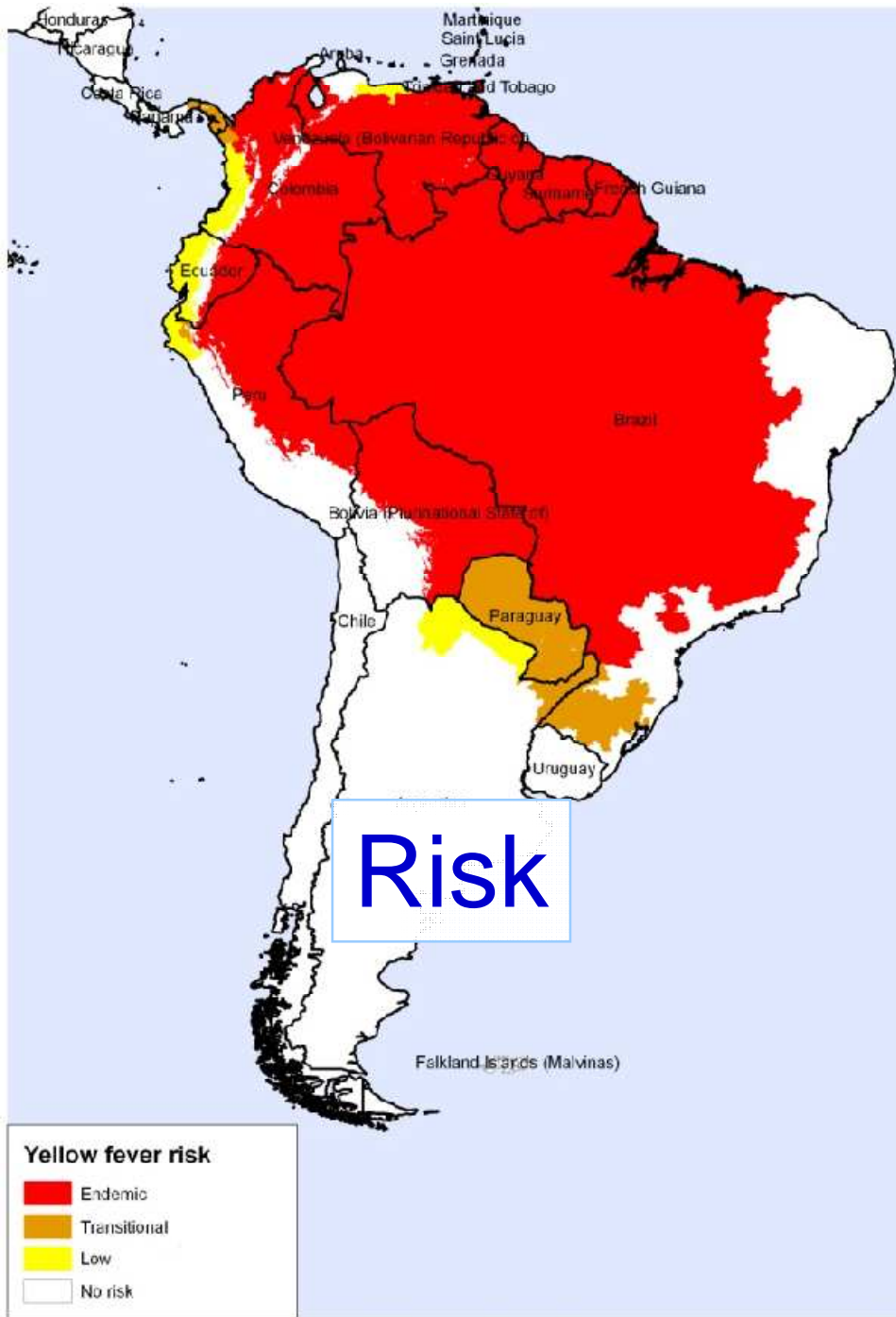


Yellow Fever Mapping:

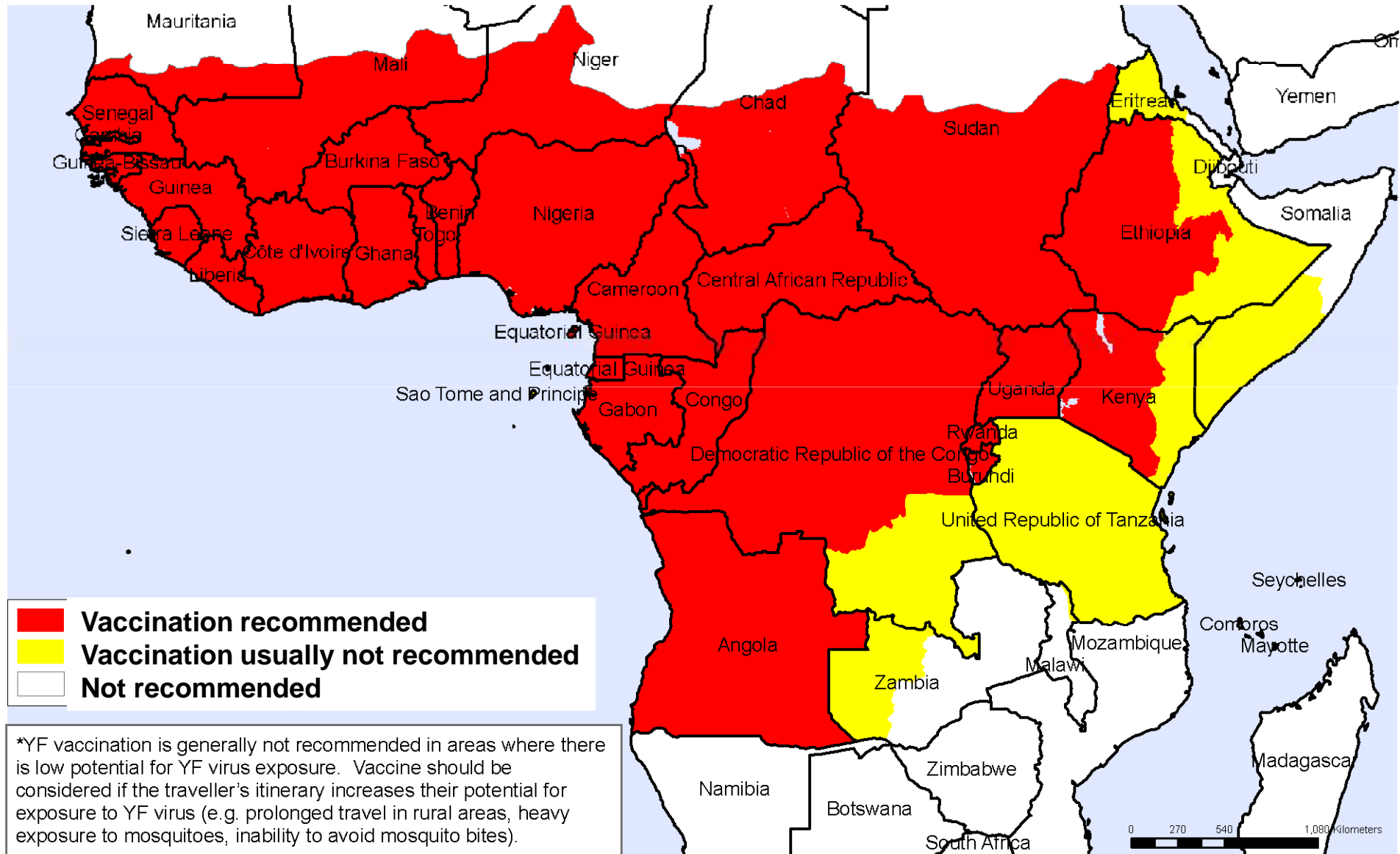
Shift from risk maps to vaccination maps

- Vaccination recommended
 - endemic
 - transitional
- Vaccination generally not recommended
 - low potential for exposure
 - exceptions: prolonged, often rural, extensive mosquito exposure
- Vaccination not recommended
 - no risk



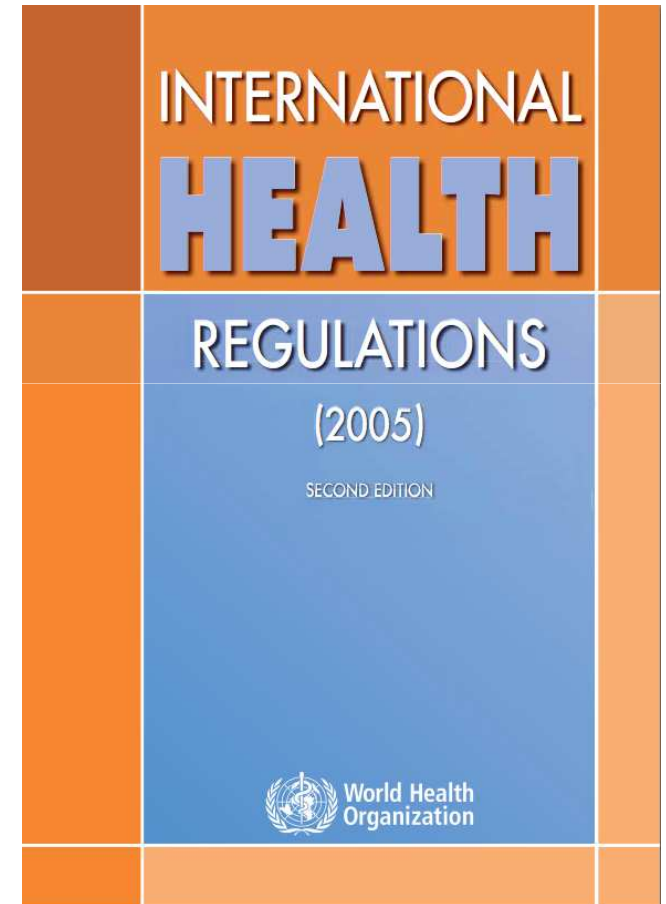


Africa: Vaccination Map



International Health Regulations (2005)

- Annex 1B, 2f:
 - ✓ to apply entry or exit controls for arriving and departing travellers
 - require vaccination from persons arriving from a country with a **risk** of YF transmission



IHR (2005): Annex 1B, 2f

Afghanistan, Australia, India and Tonga required YF vaccine from travellers arriving from countries with a (low) **risk** of YF transmission; e.g. Tanzania, Eritrea, Zambia.



Implications for IHR (2005)

Low ~~risk~~ countries

≡

Low potential for exposure

Thus, low risk countries will not appear in Annex 1

ANNEX I

Countries¹ with risk of yellow fever transmission² and countries requiring yellow fever vaccination



Implementation

- Member States have reviewed their YF requirements
- All changes incorporated into:
 - ✓ new vaccination maps
 - ✓ WHO: ITH 2011
 - ✓ CDC: YB 2012
 - ✓ Country requirements (Annex 1)
- Publication in *Lancet Infectious Disease*



Yellow Fever Risk Mapping

Dynamic
Respond to changing epidemiology





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Collection Type(s): PubMed Who LiveLink Tom Monath Other...

PubMed ID

WHO ID

Other ID

[Evaluation of the immunological and entomological indices of yellow fever in the subprefecture of Taï, Ivory Coast].

Bulletin de la Société de pathologie exotique (1990)

1994

Page Number(s): 7-10

1) Thonnon, J

2)

3)

4)

5)

6)

Reference Type:

Published: Yes No

Language(s): French

The authors report the results of a serological sample survey managed to evaluate the prevalence of yellow fever antibodies, connected with an entomological survey, in the area of Taï in Côte d'Ivoire. The refugee population has a high rate of non protected people, contrary to the Ivory population especially under 15 years old, because Côte d'Ivoire has included YF vaccine in his Expanded Programme on Immunization. A campaign of vaccination ... **READ MORE**

Journal Article Details

Reference Title:

Bulletin de la Société de pathologie exotique (1990)

Volume:

Issue:

Publication Country:

City:

File URL:

File Attached? Yes No

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----- KEYWORDS ----

----- NOTES / COMMENTS ----

Adolescent

Adult

Aedes

Animals

Antibodies, Viral

Child

Child, Preschool

Cote d'Ivoire

Female

Humans

Immunoglobulin G

Immunoglobulin M

Insect Vectors

Male

Middle Aged

Conclusions

- Robust process using best available evidence
- Transparency in decision making
- Attempts at ‘shrinking’ risk map
- Achieved globally agreed risk categorisation
- Implications for travel medicine practitioners
- Implications for Annex 1 (ITH) under IHR (2005)
- Continuous review of model and epidemiology

