CITES AND Importance of Biodiversity for animal and human health

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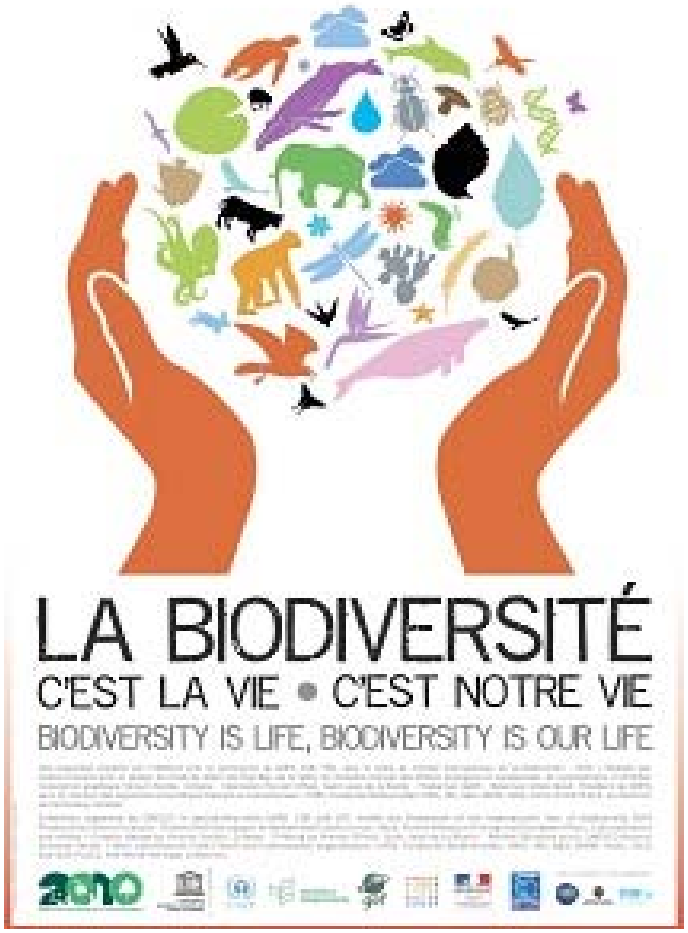
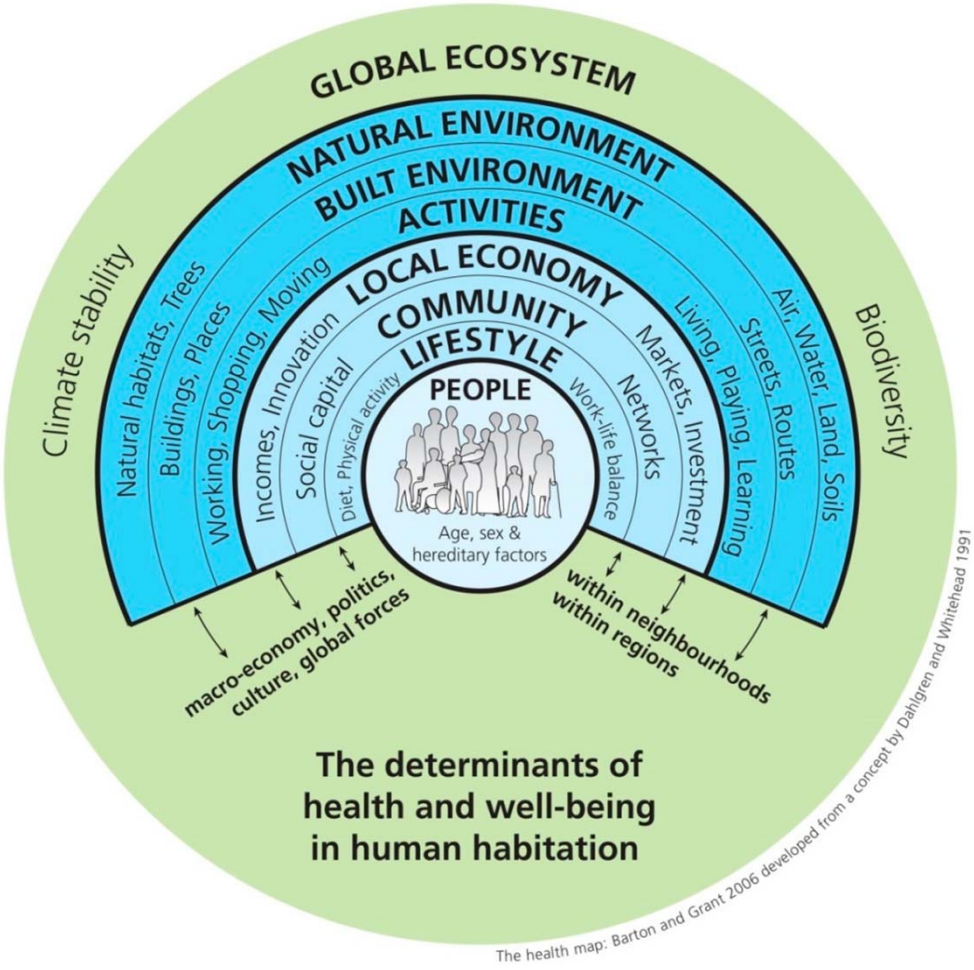
BIOLOGICAL DIVERSITY

- Biological diversity is the variability among living organisms and the ecological complexes of which they are part, including diversity within species, between species and of ecosystems (CBD 1992).
- Traditionally, it is defined at three levels of biological organization (species, ecosystem and genetic diversity), though a forth level has been recently proposed (molecular diversity); (Campbell 2003).
- It is generally regarded as a key determinant of ecosystem health, functioning and resilience

Biodiversity in broad terms



Biodiversity in natural landscapes/green spaces



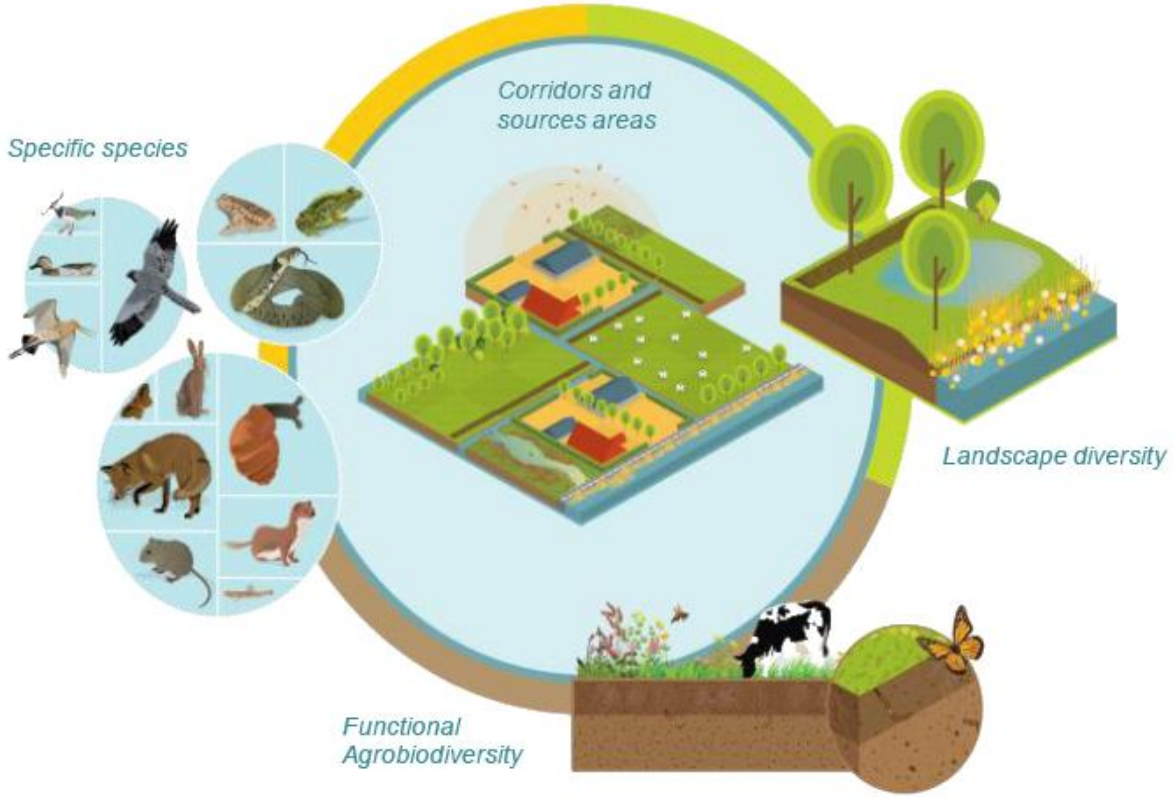
An Ecological Model of Health.

Green infrastructure

Neighborhood and national parks, parkways, forests, community gardens, and the myriad other forms of conserved private and public components of natural landscape (green spaces), taken together and considered as a system, are what constitute a community's green infrastructure.

Agricultural biodiversity

- genetic diversity of domesticated crops, animals, fish and trees;
- diversity of wild species on which agricultural production depends (such as wild pollinators, soil micro-organisms and predators of agricultural pests)

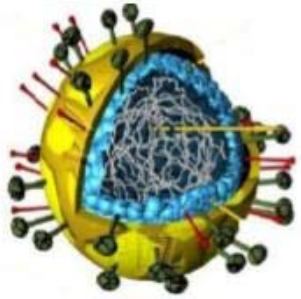


- diversity of wild species and ecological communities that use agricultural landscapes as their habitat

Microbial Biodiversity

Biodiversity and classification of micro-organisms

Biodiversity of Micro-organisms



Ecosystem services the basis of human well-being

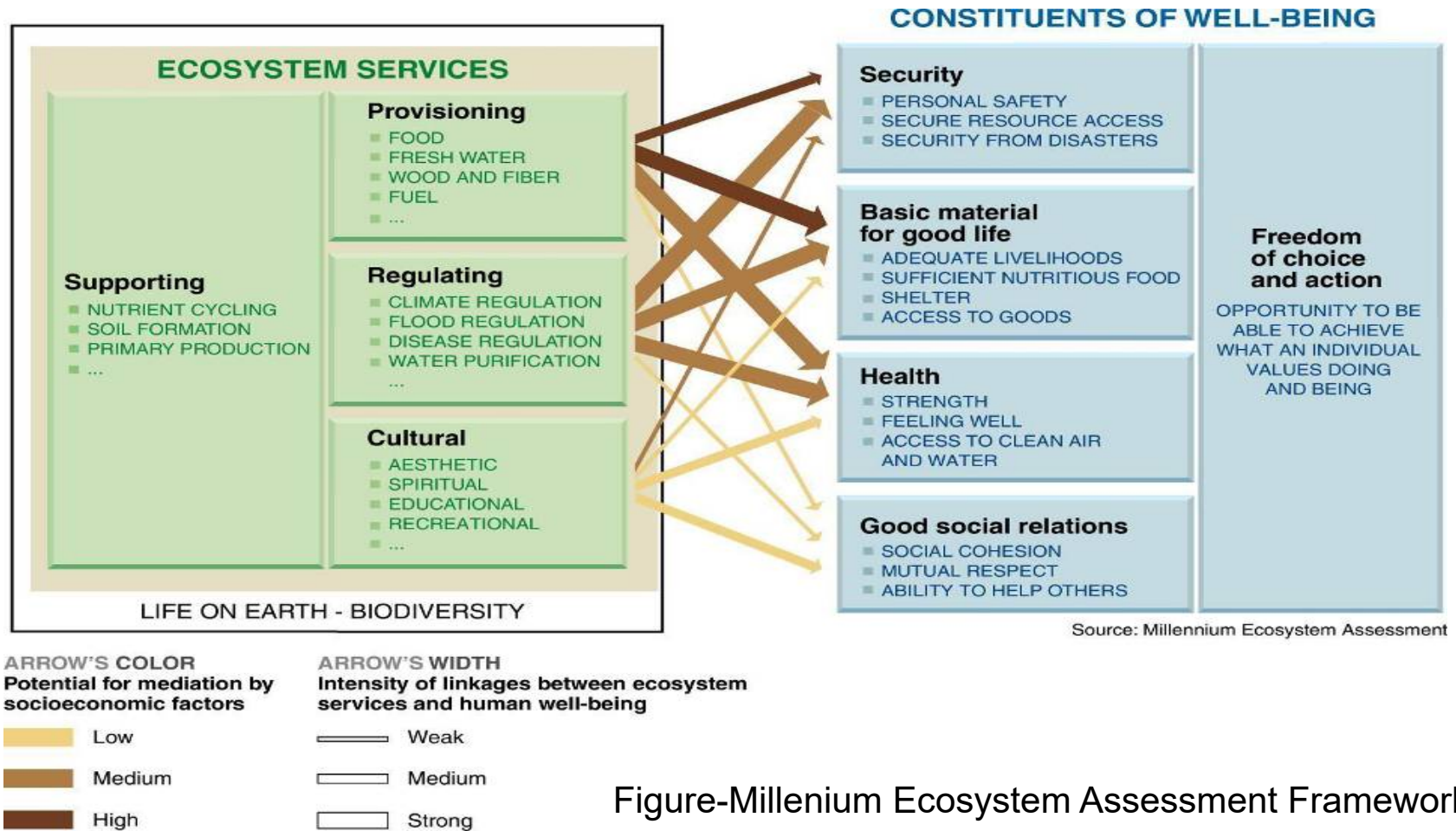
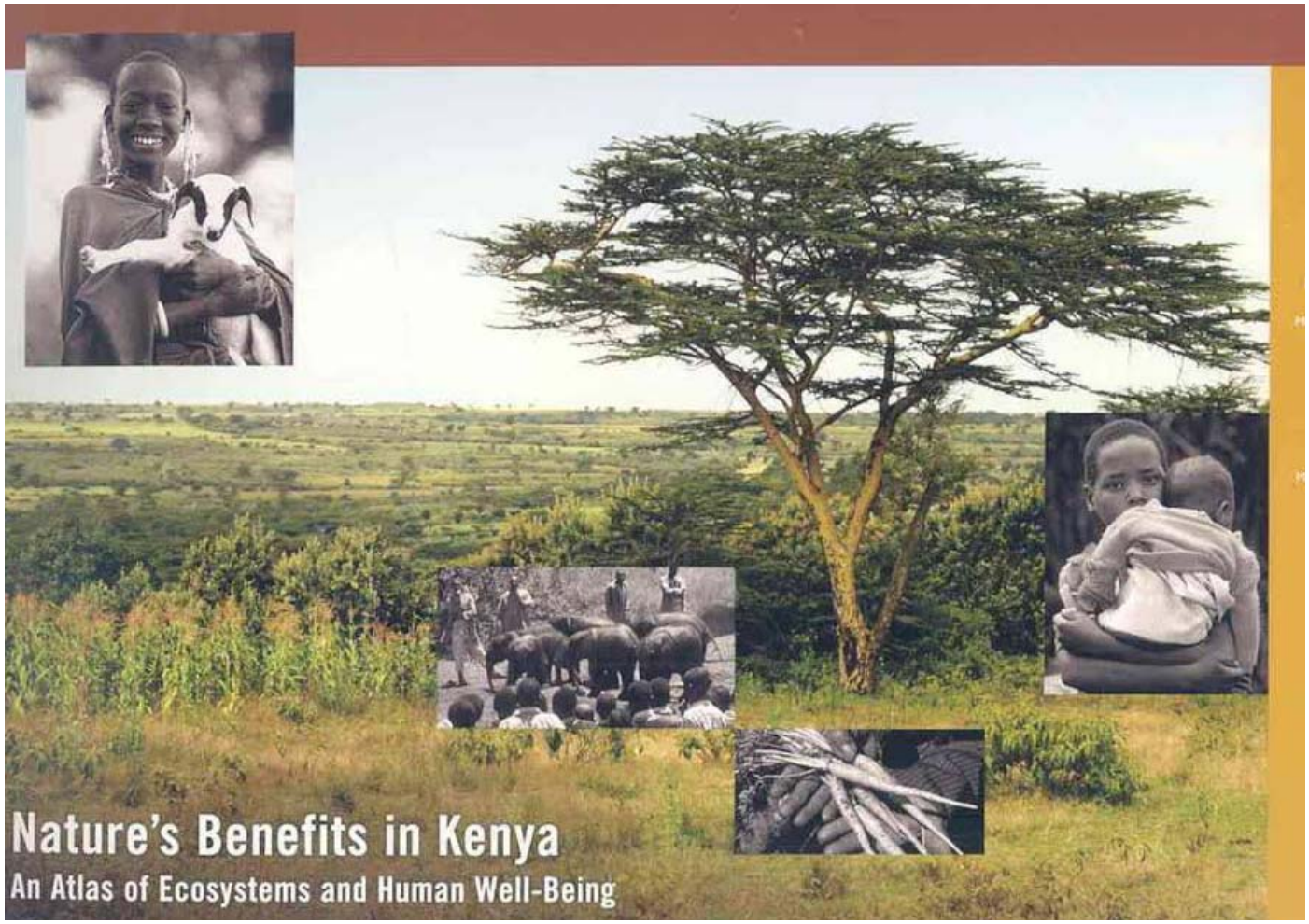


Figure-Millenium Ecosystem Assessment Framework

Provisioning services



Food

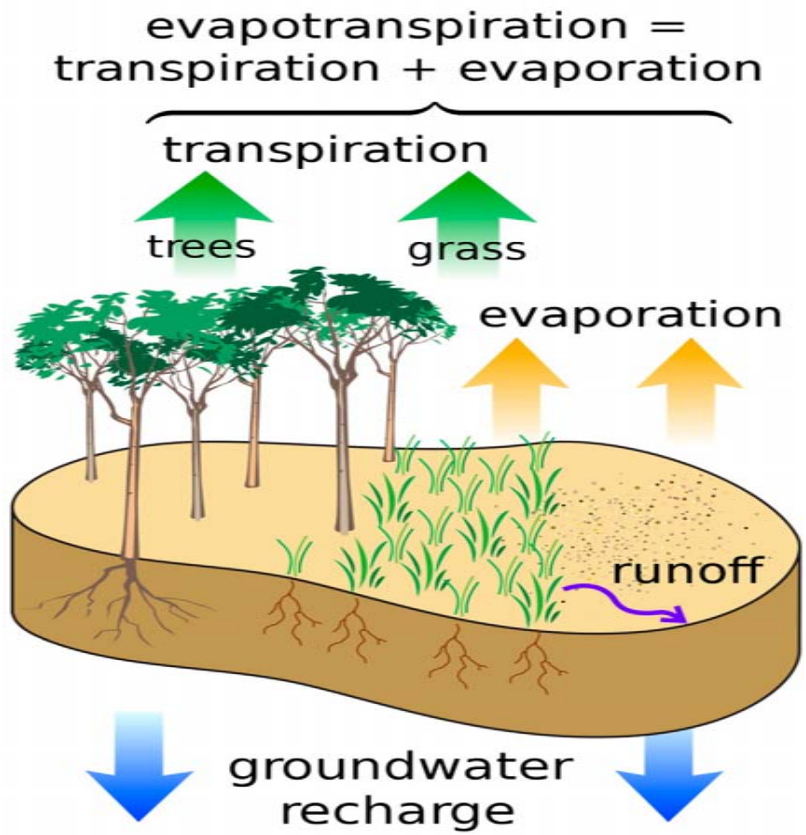
Fibre

Timber

Fuel

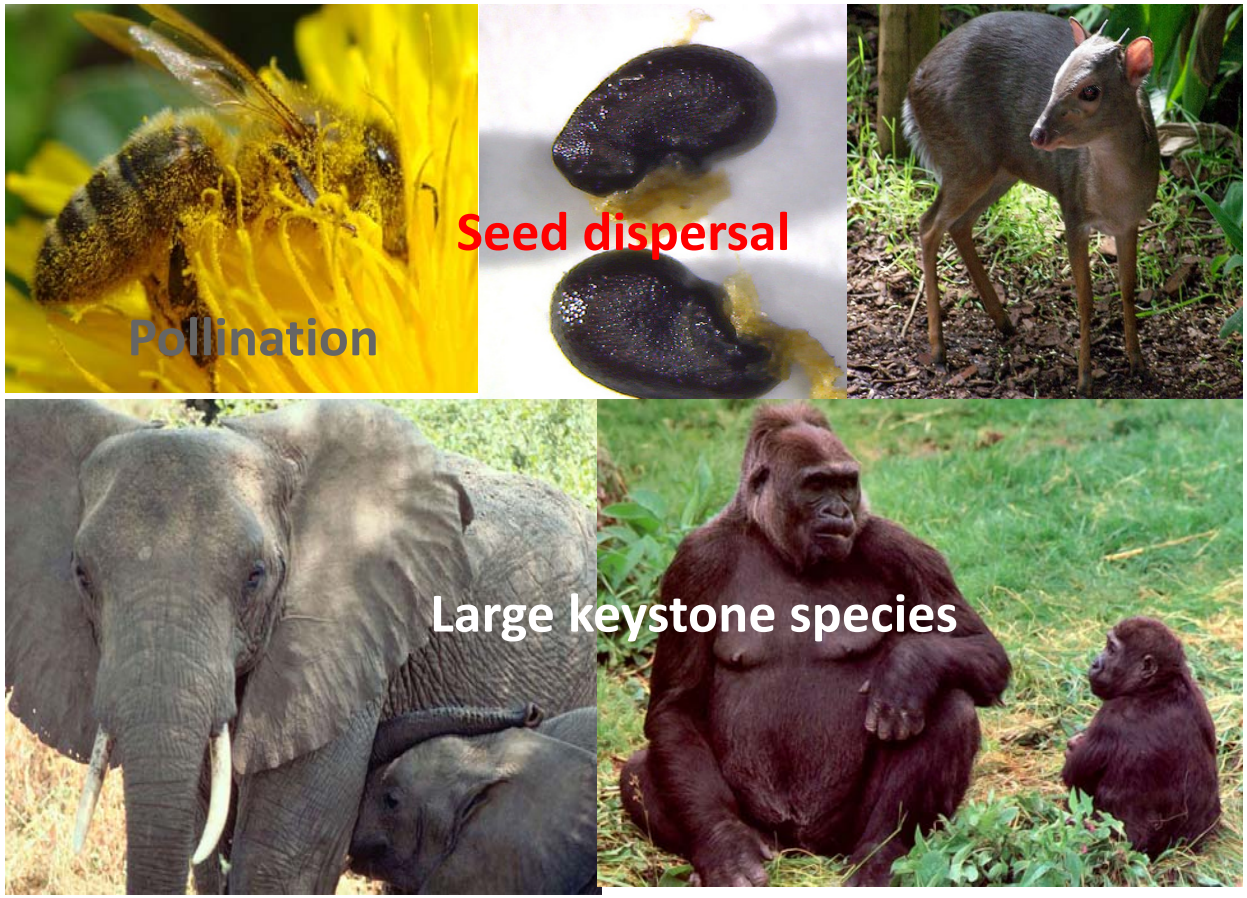
Medicine

Regulating services



- Rainfall
- Air purification
- Climate regulation
- Disease regulation

Regulating services



Cultural services

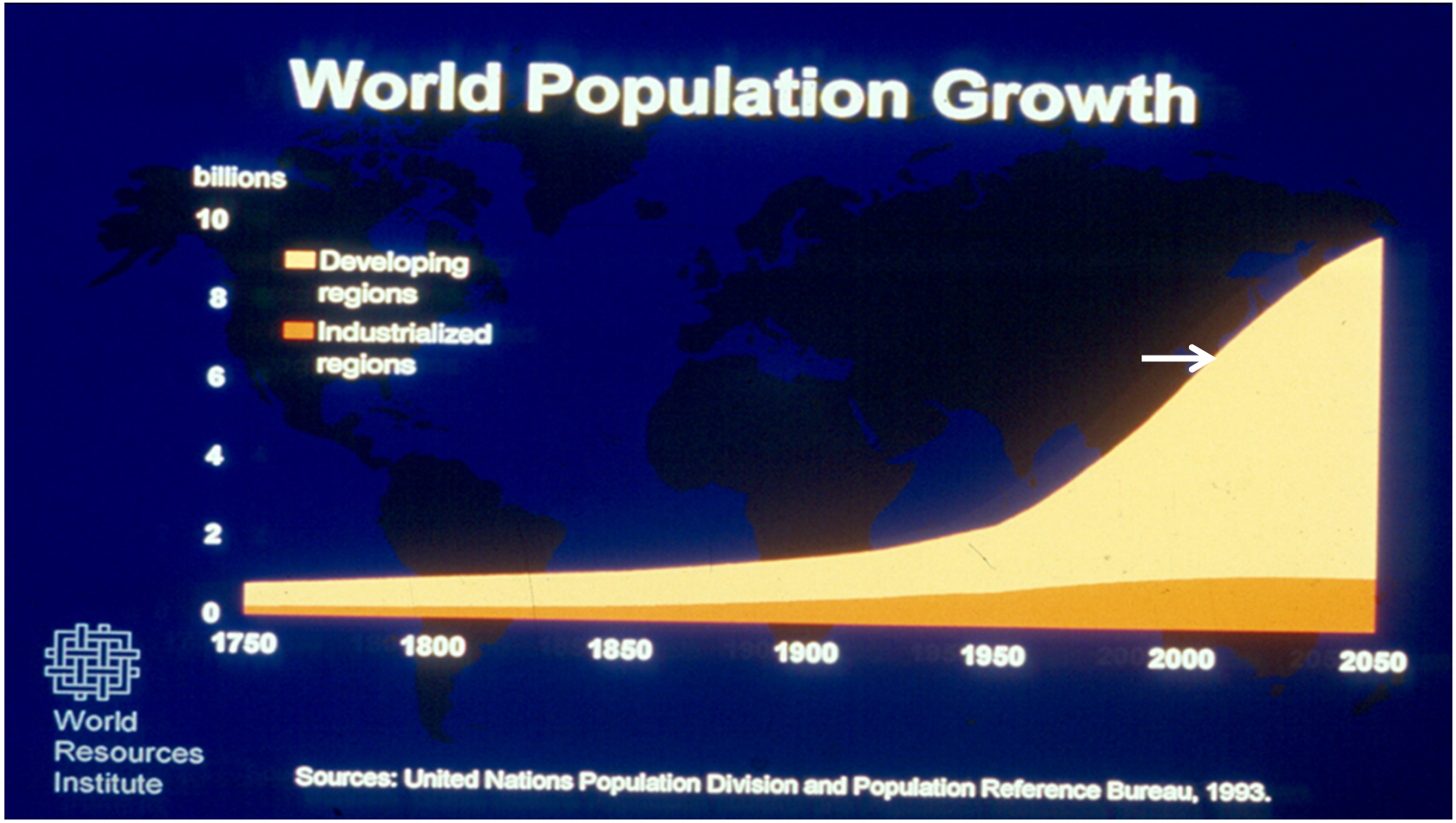
Health benefits of interacting with nature

- Physical health,
- Cognitive performance
- Mental health
- Social capital

Tourism-Economic benefit

. Int. J. Environ. Res. Public Health 2013, 10 918

Drivers of biodiversity change and emerging infectious diseases



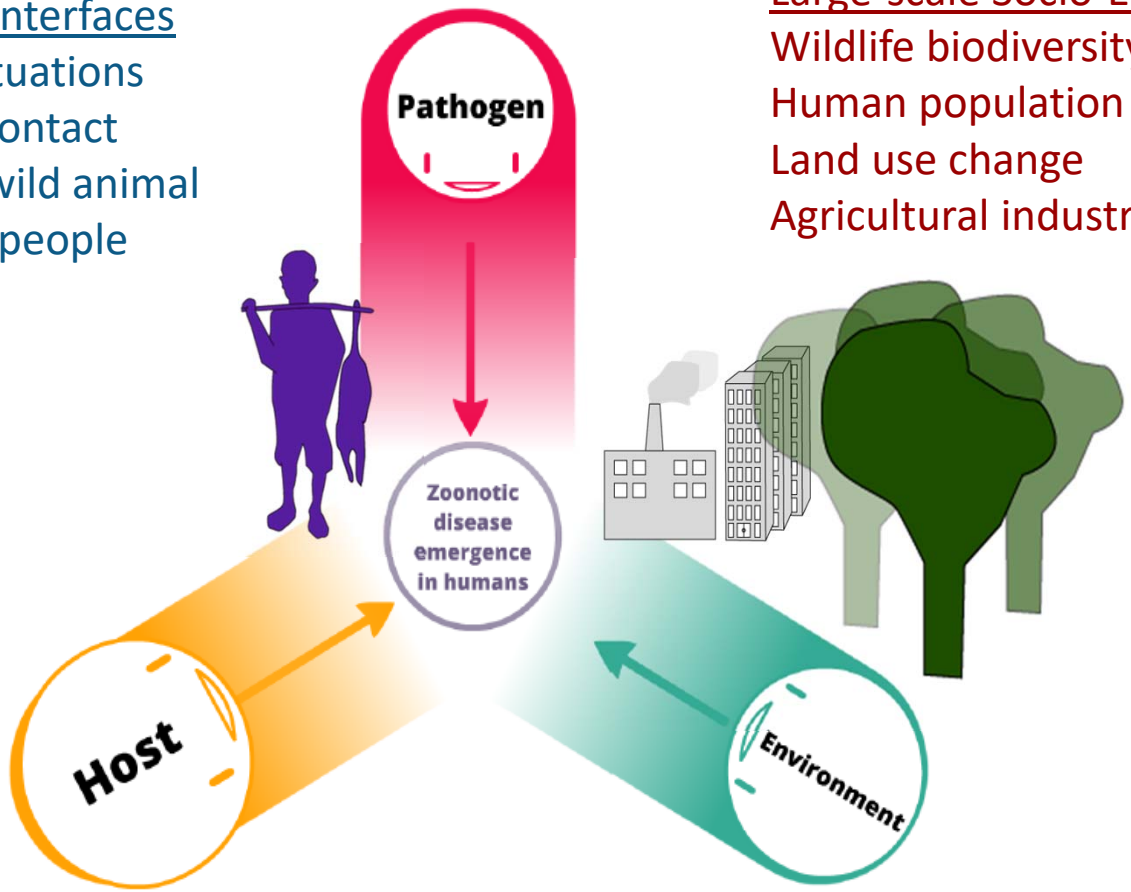
(Source: Africa Atlas of our Changing Environment, UNEP 2008)

1. Human demographics

- Rapid human population growth and urbanization-over 90% is taking place in Africa, Asia and Latin America where the following other factors prevail :
    - Low levels of literacy, awareness and poor health seeking behaviours
    - Poverty and rising economic inequalities-affecting lifestyles, preferences, behaviours and attitudes.
    - Political unrest in many countries which hampers infrastructural development
    - A high rate of underlying chronic human infections e.g HIV and tuberculosis
- Tremendous increase in global demand for animal protein, hence:
    - growth in livestock population,
    - Intensification of livestock and wildlife production systems-
    - new host parasite relationships
- Increase in keeping of companion animals-pets

High Risk Interfaces

Specific situations enabling contact between wild animal hosts and people



Large-scale Socio-Ecological Drivers

Wildlife biodiversity

Human population density

Land use change

Agricultural industry change

THE LANCET

"... with endemic and enzootic zoonoses causing about a billion cases of illness in people and millions of deaths every year...

emerging zoonoses are a rising threat to global health, having caused hundreds of billions of US dollars of economic damage in the past 20 years. "

Karesh, et al., The Lancet, Dec 1, 2012

Most EIDs are Zoonotic

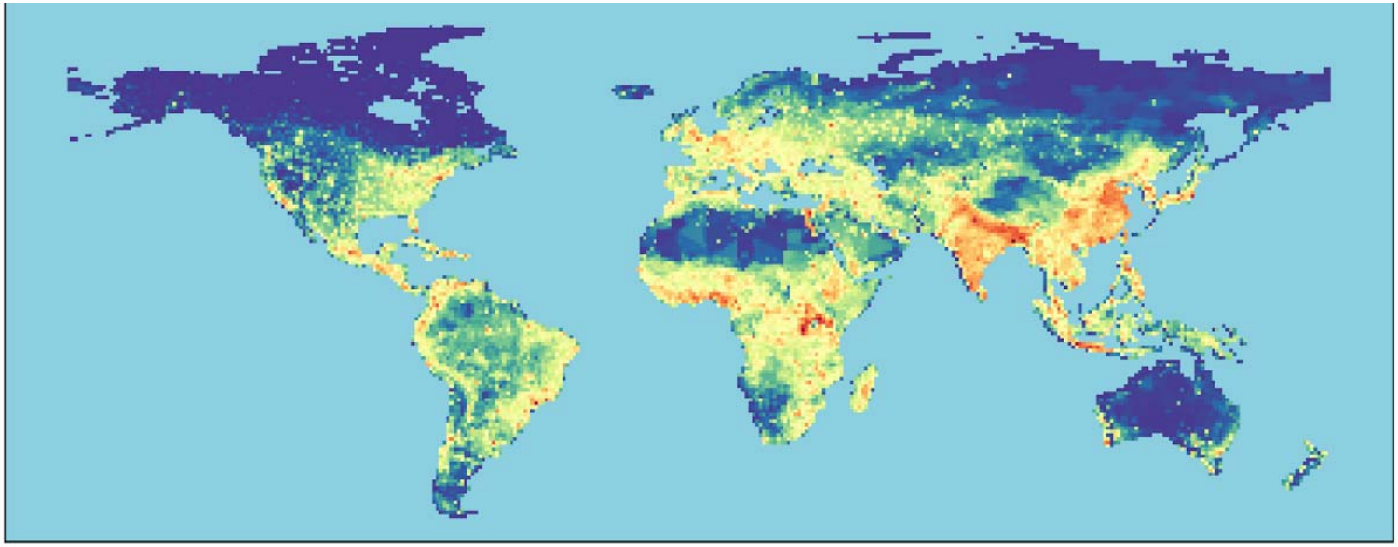
- > 60% of known human pathogens are zoonotic
- > 70% of *emerging* human pathogens are zoonotic; most originate in wildlife.

- **Endemic, enzootic, and emerging zoonoses (dynamic)**

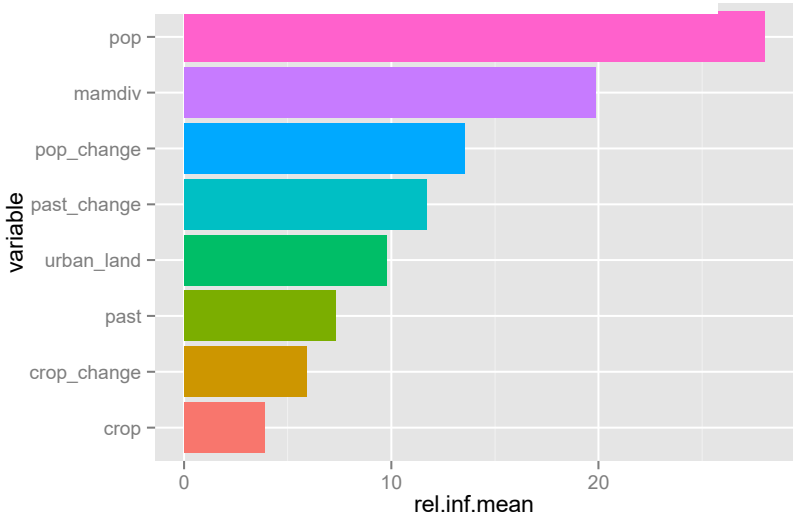
- Rate of disease emergence is increasing (not just detection)

- Complex process!

Relative risk of a new zoonotic EID



	relative influence (%)	std. dev.
population	27.99	2.99
mammal diversity	19.84	3.30
change: pop	13.54	1.54
change: pasture	11.71	1.30
urban extent	9.77	1.62
...	...	...



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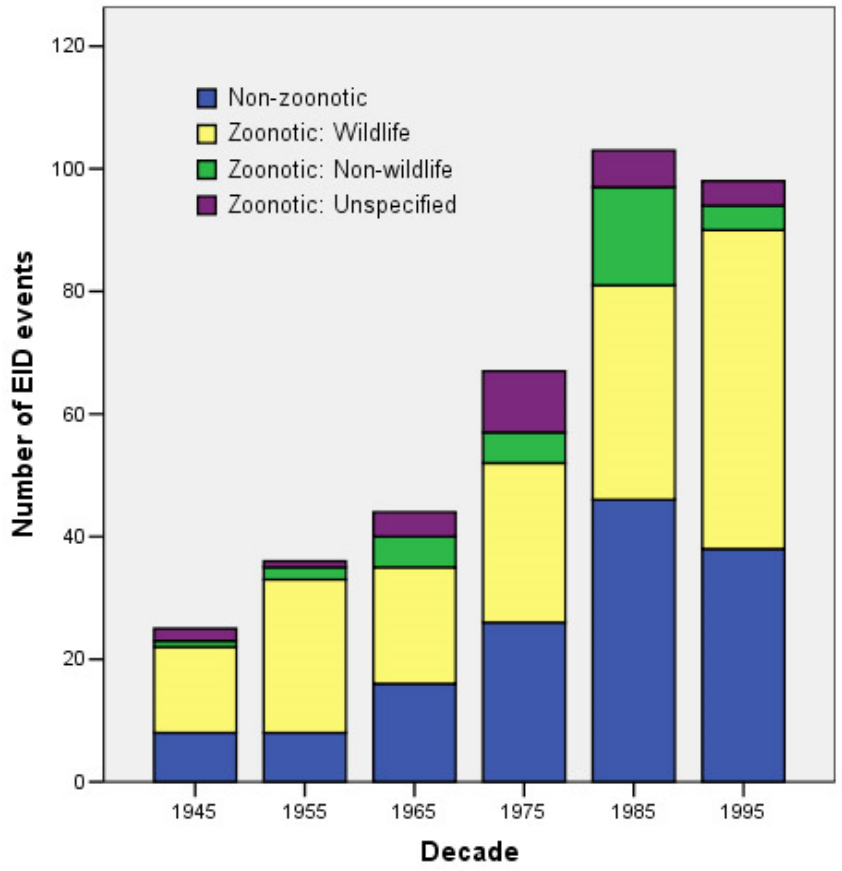
Temporal patterns in EID events



- EID events have increased over time, correcting for reporter bias ($GLM_{P,JID}$ F = 86.4, p <0.001, d.f.=57)
- ~5 new EIDs each year
- ~3 new Zoonoses each year
- **Zoonotic EIDs from wildlife** reach highest proportion in recent decade

EcoHealth Alliance

Jones *et al.* 2008

Deforestation

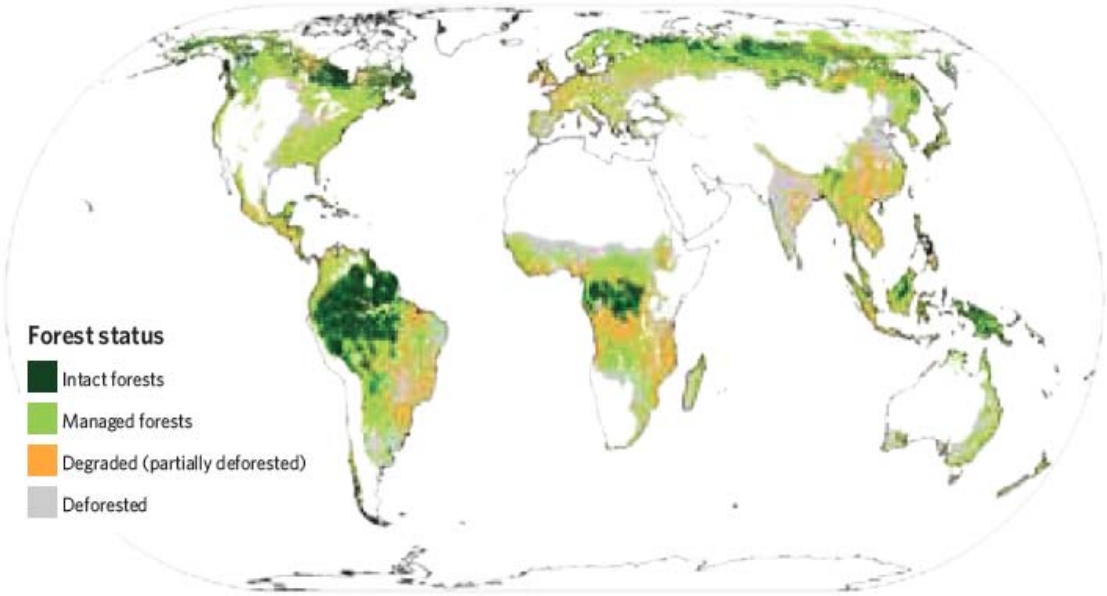
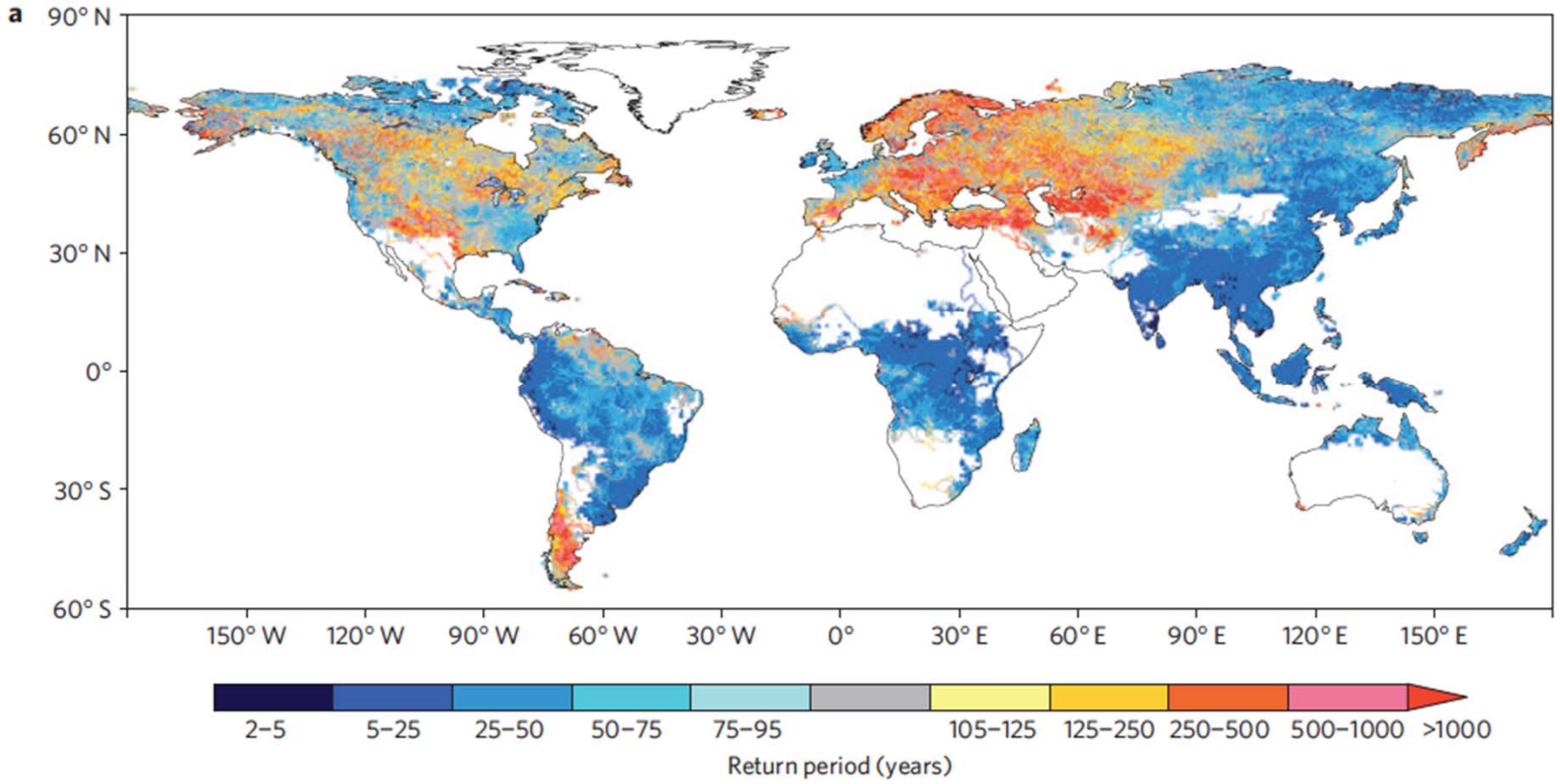


Figure 5.1. The extent of deforestation and forest degradation worldwide[69]. Intact forests refers to unbroken expanses of natural ecosystems greater than 50,000 hectares. Managed forests refer to forest that is fragmented by roads and/or managed for wood production. Degraded or partially deforested refers to landscapes where there has been a significant decrease in tree canopy density. Deforested refers to previously forested landscapes which have been converted into non-forest.

Global Biodiversity Outlook 4

Global Flood Risk- Vulnerable Regions



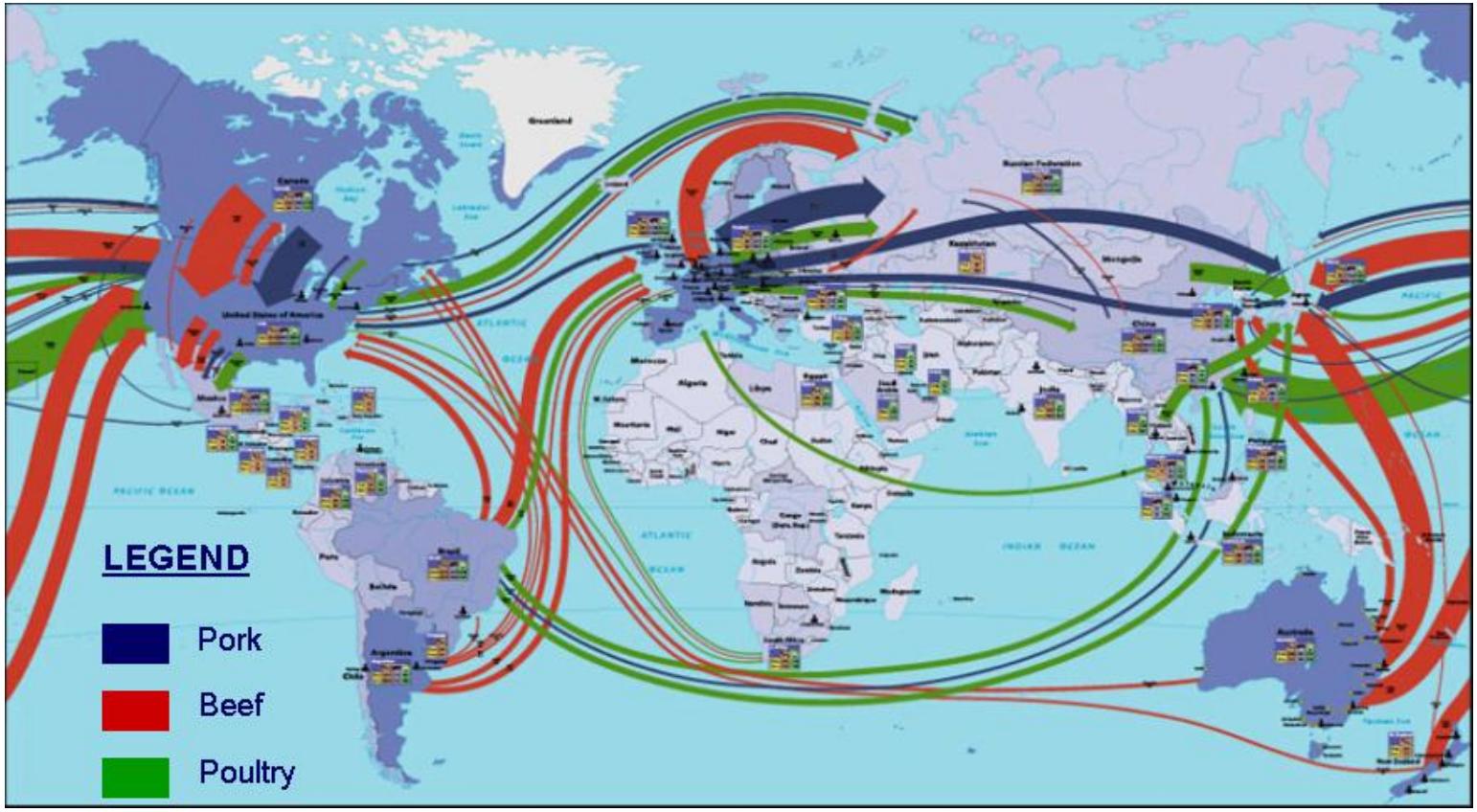
Hirabayashi et al., “Global flood risk under climate change”. 2013, *Nature Climate Change.*

Commercial bush meat trade

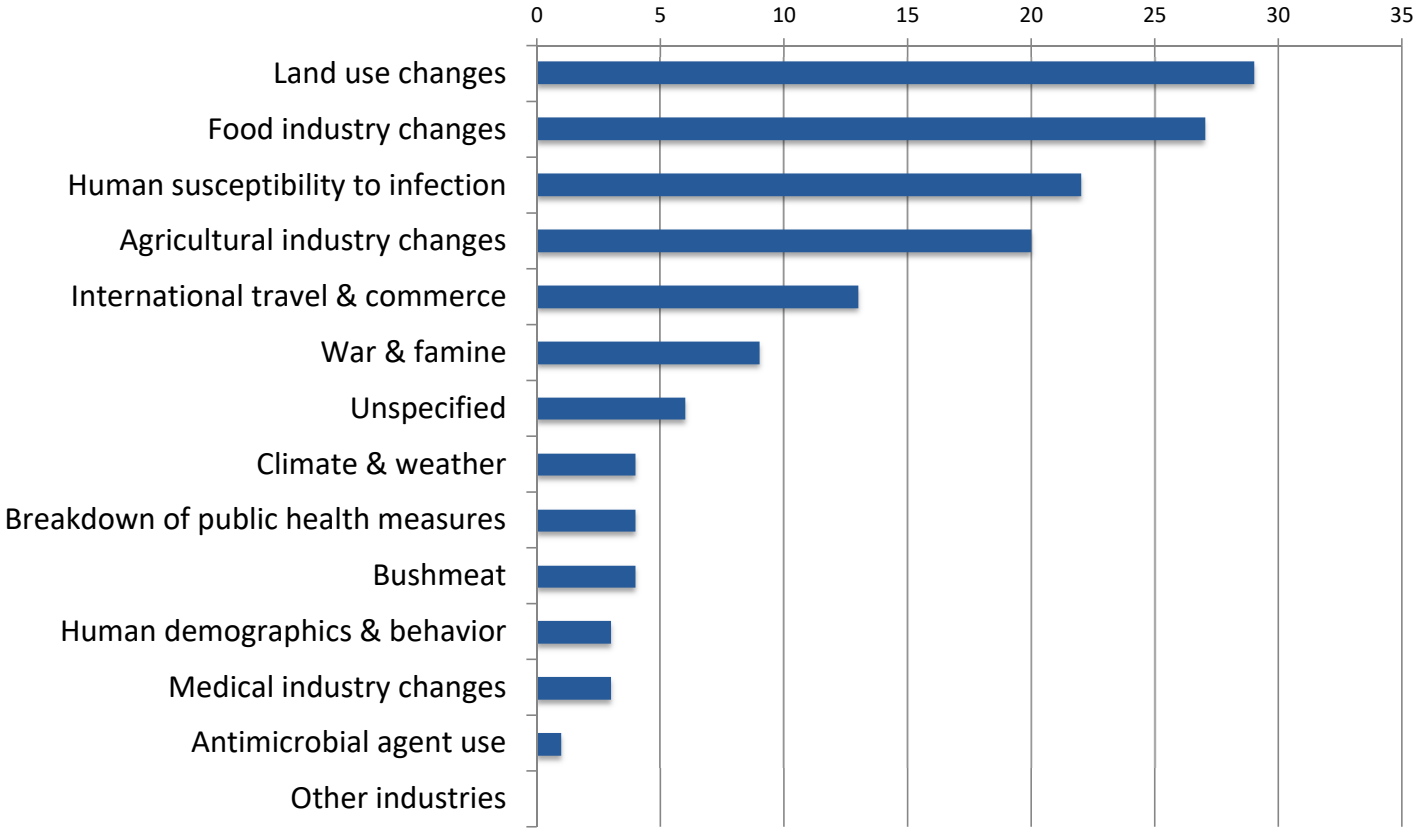
1 billion Kgs / Year (Central Africa)

Intensification of agricultural production

Increased international travel and trade



Drivers of Disease Emergence in Humans



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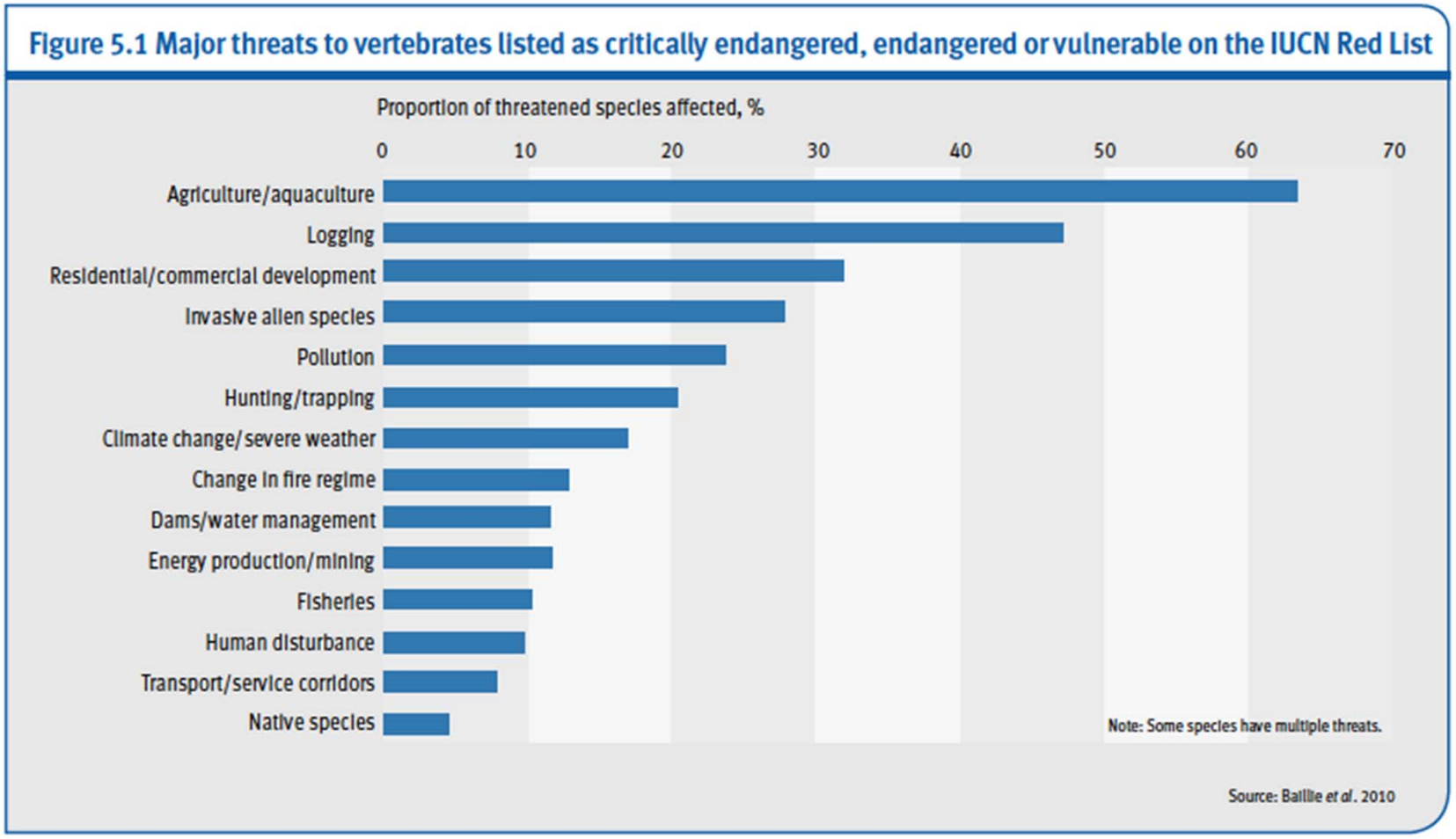
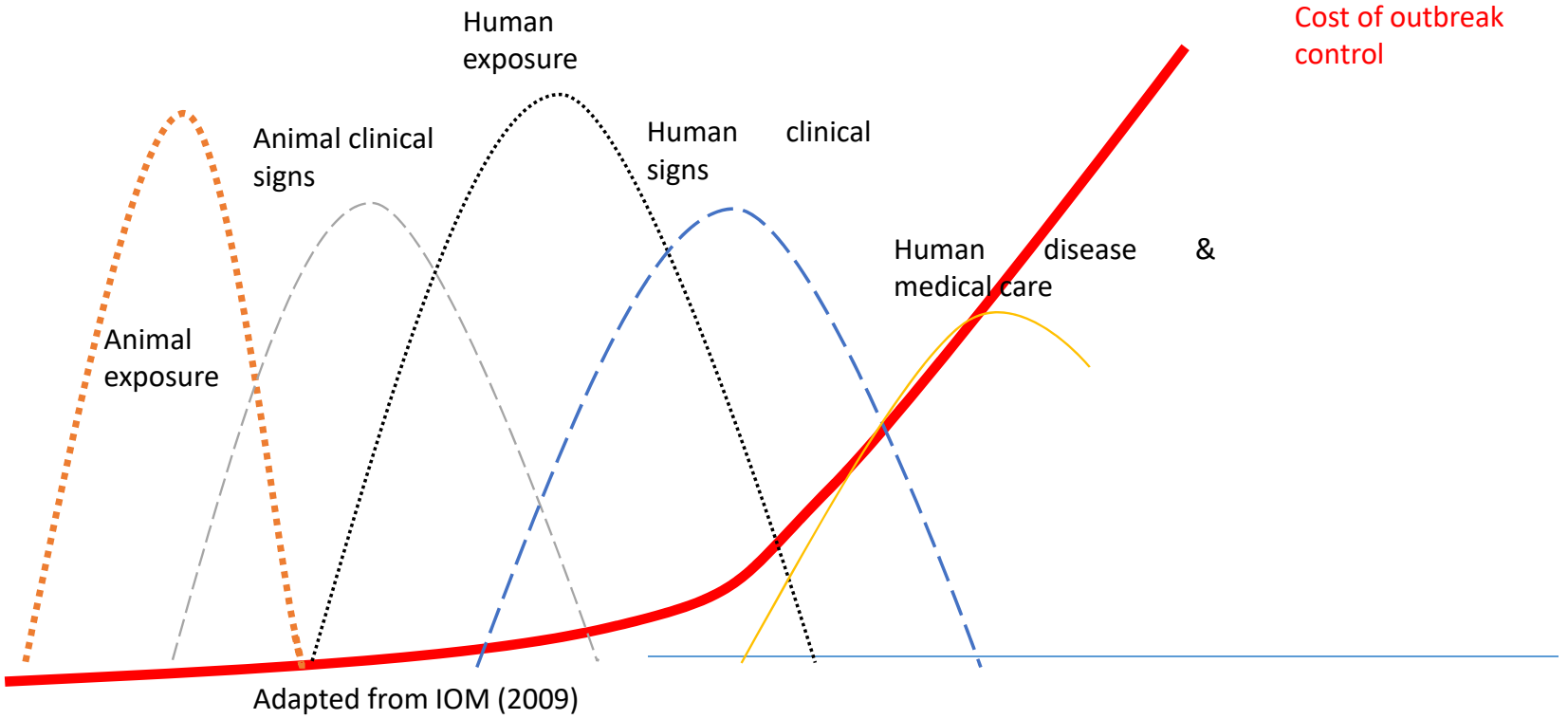
Loh *et al.* In Press

Drivers of loss of endangered species



UNEP GEO 5

Cost-effective to intervene early



Conclusion

- Although most emerging infectious diseases are known to originate from wildlife, the main driver of emergence of these diseases is human-induced alteration of ecosystems.
- The health consequences of loss of biodiversity should continue to be studied to generate evidence to inform future policies for sustainable development.
- Wildlife veterinarians and disease ecologists can contribute greatly to this type of evidence generation and in advocating for conservation of biodiversity
- Addressing drivers of disease “ upstream” will be a more cost-effective way to prevent the emergence of many diseases and improve the health of humans and animals.

Natural Versus Unnatural

"The emergence of zoonoses, both recent and historical, can be considered as a logical consequence of pathogen ecology and evolution, as microbes exploit new niches and adapt to new hosts…

Although underlying ecological principles that shape how these pathogens survive and change have remained similar, ***people have changed the environment in which these principles operate."***

EcoHealth Alliance

Karesh, et al., The Lancet, Dec 1, 2012

THANK YOU