DRAFT IN PROGRESS

Ecosystems and health

With ECOSHARE, we endeavour Ecosystem use as:

- Research base
- Reservoirs of disease dormant, in situ, threshold - jump to humans/exit containment areas
- Explore Human natural/genetic based resistance, and prevent introduction of new disease
- Unexposed population to known diseases for comparison to infected population
- Ancient isolated human genetics base to be tapped
- Start incorporating all high tech medical up and down stream activities and streamline to serve clans as well as commercial use
- Provide patent exemption to PNG
- ID new unknown disease AND anti bodies.
- Research new Fungi for use as antibiotics.
- Medical plants/organisms traditional cures prevention.

Compiled by Dr. Petra Von Dungern

Ecosystem services (ES) that are related to health are manifold. Some links are more obvious than others.

They are part of the following ES categories:

- **Regulating** (benefits obtained from environmental regulation of ecosystem processes): keeping infectious diseases (ID) in check (can be the case but can also be the opposite)
- **Provisioning** (i.e. products obtained from ecosystems): repository of genetic diversity = potential solutions for all sorts of problems facing humankind including medicines
- **Cultural** (nonmaterial benefits obtained from ecosystems): intellectual stimulation and sense of place and wellbeing, including the potential for discovery of novel biochemical pathways (→ intellectual property – there is potential overlap to provisioning services in this regard)

Benefits from ES arise at the local, regional and indeed global level.

Human health is a multifactorial and social concept and is far more than the absence of disease. According to the definition of WHO (1948) “Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity”.

Human health is linked to the health of an ecosystem which in turn is a function of biodiversity. In fact biodiversity is an indicator of the health of an ecosystem.

Biodiversity is an indicator of the health of an ecosystem

Biodiversity is an indicator of health for a given ecosystem. Human health is linked to the health of (an) ecosystem(s) and hence to biodiversity. These links are manifold, interconnected and interdependent, forming intricately complex webs of interrelationships.

Conceivably, “*species diversity provides a kind of insurance policy for ecosystems, buffering them against such stresses as temperature changes, diseases, and pests that can result in species loss and ecosystem disruption. This is known as “ecosystem resilience” or “ecosystem reliability” and is a function of there being a diversity of responses to stressors among diverse organisms*” (book conclusion of chapter 1, pp. 25-26). This is to say that genetic diversity of organisms are vital to the resilience but also to the stability of ecosystems.

Genetic diversity in turn is dependent on the (spatial and temporal) connectedness of different populations of a given species. Populations across a species range differ to varying degrees in their genetic composition. That means that local extinction of a species may not threaten its global survival but will be tantamount to the irretrievable loss of genes that were specific and exclusive to that local population. This is of concern as genetic variability is a valuable resource for example for agriculture (use of wild relatives of crop plants to increase disease resistance of commercial crops) (book p 25).

With higher species diversity there is also a higher likelihood of redundancy at the level of functional groups and, as a consequence of greater ecosystem resilience (p. 26). If one (or more) species in an ecosystem is lost or no longer able to perform its functional role, other species that can perform these same functions may be able to take their place (e.g. decomposer of leaf litter / pollinator of certain plants) (book p. 26)

Biodiversity and infectious disease transmission

Population and genetic diversity may also confer stability to an ecosystem. This is important for example in relation to infectious diseases (ID) where complex check and balances affect the emergence, transmission and spread of pathogens. This is because for an estimated 60% of human disease the responsible pathogen has lived and multiplied in other organisms before being transmitted to humans (book p. 287). Pathogens are an integral part of complex networks that include for example insect vectors that transmit pathogens to humans, the reservoir or host species, where pathogens multiply and become available for transmission. These networks also include other species that support, or in fact interfere with the interactions among pathogens, vectors, and hosts. (± verbatim p. 287).

A change in biodiversity has the potential to change the abundance of and relationships among these organisms and their physical and chemical environments which in turn has major implications for the spread of human infectious diseases (p. 287).

Types of infectious agents and modes of transmission

(box 7.1. in book, p. 288)

Examples

Deforestation → malaria

Water management → malaria, schistosomiasis
Maybe HIV

Zika Aedes aegypti

Urbanization dengue, yellow fever etc.

Vector, pathogen, and host diversity and human infectious disease

Book pp. 306

Diversity at the level of

Genes within local populations of species
Diversity of species composition of local communities
Diversity of communities as biological constituents of ecosystems

Incidence of infection may be influenced by:

- Genetic makeup of pathogens, vectors and hosts
- Number of species in each of these groups
- Diversity of habitats available in an ecosystem
- Variation in human behaviour (application of pesticides that select for certain species over others)

Greater biodiversity may be associated with

- Increased incidence of disease (tropics harbour greater pathogen diversity → higher risk of infection)
- Decreased incidence as greater diversity acts as a kind of buffer to risk (predators, competitors control abundance of rodent host reservoirs, eg Lyme disease)

Changes in various components of biodiversity may be more important for disease incidence than absolute amount of biodiversity in a given ecosystem

Diversity of vectors

Major vector borne pathogens and their diseases concentrated in the tropics

Highest in tropical rainforests and in woodlands and savannas at the edge of these ecosystems

Undisturbed ecosystems tend to have greatest diversity of disease vector species

Disturbed ecosystems: lower species diversity but disturbance appear to favour '**generalists' vectors** that

- bite wider variety of animals
- broader geographical distributions
- thrive in a wider variety of habitats

which can increase incidence of disease

more disease vector species can also mean higher chance of acquisition of vector borne disease by humans:

West Nile Virus
Lyme disease in California

Diversity of pathogens

Diversity of hosts

References (work in progress)

Chivian Eric and Bernstein Aaron eds (2008): Sustaining Life, Oxford University Press

WHO (1948) Definition of Health, Preamble to the Constitution of the World Health Organization as adopted by the International Health Conference, New York, 19-22 June, 1946; signed on 22 July 1946 by the representatives of 61 States (Official Records of the World Health Organization, no. 2, p. 100) and entered into force on 7 April 1948.

The Definition has not been amended since 1948.