



Rich biodiversity, healthy ecosystems and healthy people

The 2030 Agenda recognises that preserving biodiversity and healthy ecosystems are necessary components for reaching the Sustainable Development Goals (Transforming our world, 2015)¹. There are also crucial linkages between rich biodiversity and people's health that contribute to decreasing poverty rates, disaster risk reduction and sustainable development more broadly.¹

¹ Transforming our world: the 2030 Agenda for Sustainable Development. <https://sustainabledevelopment.un.org/post2015/transformingourworld>

Environmental determinants of health

The links between biodiversity and human health are complex and operate at multiple scales. Biodiversity is critical to ecosystem functions and creates direct and indirect benefits (ecosystem services) supporting the needs of humans and our societies. Examples of such benefits are nutrition security, energy provision, good health, livelihoods, freshwater and spiritual realisation. These are mediated by various social factors such as poverty, culture, age and gender. (WHO and CBD, 2015)²

All people are dependent on ecosystem services and biodiversity. However, people living in poverty are disproportionately dependent on them. Certain groups such as indigenous peoples and subsistence farmers who are more directly





Enjoying a bowl of 'osh' soup – made of six different grains and pulses – in the Pamir Mountains of Tajikistan. Photo credit: Jamila Haider

reliant on biodiversity and ecosystem services – especially on provisioning services such as timber, water and food – are also usually more vulnerable to biodiversity loss (WHO and CBD, 2015)².

Many of the direct drivers of biodiversity loss, such as climate change, invasive species, habitat loss, land-use change and pollution have a direct impact on health. There are also indirect effects on health due to biodiversity loss. Today's per-capita consumption, mainly from high income individuals, puts unsustainable pressure on the biosphere and threatens both biodiversity and the health of people. (WHO and CBD, 2015)². When biodiversity loss is of such an extent that ecosystem services no longer can meet social needs, then it indirectly impacts on people's livelihoods. It may influence income levels, local migration patterns and even, on occasion, causing conflict. Likewise, biodiversity conservation can contribute to moving people out of poverty (IIED, 2010)³. Thus, respective policies and activities of biodiversity and health are linked in numerous ways. (WHO and CBD, 2015)²

It is important to note that the roles that men and women play in the management of biodiversity are shaped by cultural norms and values. As a result, health impacts differ according to gender. (WHO and CBD, 2015)²

Livelihood and nutrition

In low-income rural settings productive terrestrial and marine ecosystems, both wild and managed, are important sources of livelihood and food for the local population. Child

and maternal malnutrition is a main contributor of disease in sub-Saharan Africa, and accounts for 1.7 million deaths globally per year and 176.9 million DALYs (DALYs = Disability Adjusted Life Years, the sum of years of potential life lost due to premature mortality and the years of productive life lost due to disability) (Forouzanfar et al. 2015)³.

Local food production plays a critical role in sustaining livelihoods, contributing to food security and food sovereignty, promoting rural development and reducing the amount of money people have to spend on purchasing food. Important sources of nutrition come from wild foods and a diversity of species, varieties and breeds. For instance, marine resources provide essential sources of protein, fats and minerals for many coastal and landlocked populations. Forest products provide important foods such as honey, bushmeat and fruits. Such wild foods are particularly important to households during periods of shock, for example when there is famine caused by droughts, crop failure or civil unrest. (WHO and CBD, 2015)².

There are several combined health, biodiversity and climate change related benefits from certain diets such as eating less red meat and more locally produced legumes.

Conversely, the growing global demand for processed foods such as refined fats, oils and sugar as well as the increase in meat consumption has led to a significantly bigger ecological footprint. The affects on human health of these diets include early onset of type 2 diabetes, coronary heart disease and other chronic non-communicable diseases (CBD and WHO, 2015)².

Agriculture

Agricultural biodiversity includes all the habitats and species that benefit or enhance ecosystem functions related to food production. A rich and varied biodiversity, both wild and cultivated, contributes to reducing malnutrition and its negative impacts on human productivity and health. Maintaining the diversity of local varieties, livestock, crops and agricultural ecosystems lowers the risk of losing entire harvests during drought or pest invasion, and lowers the vulnerability to changing parameters like environmental or climate change.

Pesticides and other chemical inputs in the agricultural sector have numerous negative impacts on both biodiversity and people's health. Although low-income countries use only 25% of the pesticides produced worldwide, they experience 99% of the pesticide-associated deaths (WHO, 2008)⁴. This is due to an often more intense and hazardous use of pesticides in these regions, and weaker regulatory, health and education systems.

2 WHO and CBD, 2015. World Health Organization and Convention on Biological Diversity. Connecting Global Priorities: Biodiversity and Human Health – A State of Knowledge Review. Report by the World Health Organization and Secretariat of the Convention on Biological Diversity, 2015. <https://www.cbd.int/health/SOK-biodiversity-en.pdf>

3 Forouzanfar MH et al. Global, regional, and national comparative risk assessment of 79 behavioral, environmental and occupational, and metabolic risks or clusters of risks in 188 countries, 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet*. 2015 Sep 11. doi: 10.1016/S0140-6736(15)61455-6

4 World Health Organization WHO (2003). WHO Guidelines on Good Agricultural and Collection Practices (GACP) for Medicinal Plants. Geneva, World Health Organization.



Rice field, Ahin Philippines. Photo credit: Pernilla Malmer.



Aloe vera. Photo credit: Azote

One ecosystem service that is of specific importance for the food security and the production of several of the most nutritious crops is pollination. Pollination is also negatively impacted by chemical use, habitat loss, monoculture farming and genetic defects. (Gilbert, 2016)⁵ Chemical inputs also reduce water quality – for instance, through eutrophication caused by excessive fertilizer use. Here, often the health of women, children and people living in poverty are most negatively impacted by water being left untreated.

Infectious diseases

Terrestrial and freshwater ecosystems play a role in the supply and purification of drinking water, irrigation and other human activities. Land-use change and an increased risk of both floods and droughts due to climate change raise the threat of water contamination and epidemic outbreaks. Diarrheal diseases are strongly associated with poor water quality, lack of sanitation, and poor hygiene. (CBD and WHO, 2015)²

The increasingly rapid and expanding global trade and travel systems are contributing to an accelerated spread of pathogens, animals, hosts, vectors, and infected humans around the globe. The combination of land-cover and land-use changes, migration, and climate change may cause old

diseases to become established in new locations, or new threats to emerge. Disease vectors, such as insects and ticks, are directly affected by ambient temperatures and the local climate and may spread into new areas with a changing climate. Ticks have been moving northwards and to higher altitudes in, for instance, the mountains of Central Europe, and some malaria mosquitos can now survive higher up in mountainous regions of Africa. Changes in land use may create new breeding sites for disease vectors, or promote interactions between different species and thereby facilitate disease transmission. Two thirds of known human infectious diseases are zoonotic (passed between animals and humans), and many emerging infectious diseases are related to wildlife. (CBD and WHO, 2015)²

Over the years intense insecticide use has contributed to chemical resistance in many areas. Ecosystems, both natural and managed, may provide biological control not only for disease vectors but also for micro-organisms, host and reservoir animals. Predators that feed on insect larvae are for example added to stagnant waters to help control diseases such as malaria and dengue fever.

Non-communicable diseases

Several non-communicable diseases (all diseases that are not infectious, such as type 2 diabetes, respiratory and cardiovascular diseases) have clear links to the management of our ecosystems services. Vegetation, and in particular trees, contribute to reduction of certain air pollutants through absorption or deposition of particulate matter on the leaf surface. (Bowler, 2010)⁶. Air pollution, both from traffic and industry, is one of the most significant health risks causing both respiratory and cardiovascular diseases worldwide. Air pollution caused by large-scale forest fires and slash-and-burn agricultural practices have also been shown to increase the number of deaths and hospital admittance.

Nature, that is both natural settings and domestic gardens and urban parks, has proven beneficial effects on both physical and mental health (Roe et al. 2013⁷; Aspinall et al. 2013⁸; Thompson et al. 2012⁹;) The use of nature for recreational physical activities has many positive effects on health (Maas et al. 2008¹⁰). Spending time in nature and even views of natural surroundings reduce stress, increase the sense of well-

5 Gilbert, Natasha, 2016. "Global biodiversity report warns pollinators are under threat". Nature. <http://www.nature.com/news/global-biodiversity-report-warns-pollinators-are-under-threat-1.19456>

6 Bowler, D.E., Buyung-Ali, L., Knight, T.M., & Pullin, A.S. (2010). Urban greening to cool towns and cities: A systematic review of the empirical evidence. *Landscape and Urban Planning* 97 (3): 147–155.

7 Roe J, Ward Thompson C, Aspinall PA, Brewer MJ, Duff E, Miller D, Mitchell R, Angela Clow (2013), Green Space and Stress: Evidence from Cortisol Measures in Deprived Urban Communities, *International Journal of Environmental Research and Public Health*, 10(9): 4086–4103.

8 Aspinall, P. A., Mavros, P., Coyne, R., Roe, J. J., (2013) Urban Brain: Analyzing outdoor physical activity with mobile EEG, *British Journal of Sports Medicine*, 06.03.2013, p. 1–7.

9 Thompson, C. W., Roe, J., Aspinall, P., Mitchell, R., Clow, A., & Miller, D. (2012). More green space is linked to less stress in deprived communities: Evidence from salivary cortisol patterns. *Landscape and Urban Planning*, 105(3), 221–229. Doi:10.1016/j.landurbplan.2011.12.015

10 Maas J, Verheij RA, Spreeuwenberg P, Groenewegen PP. 2008. Physical activity as a possible mechanism behind the relationship between green space and health: a multilevel analysis. *BMC Public Health*. 8: 206.



Different varieties of maize in Peru. Photo credit: Hanna Wetterstrand

being, and promote a sense of place and social cohesion, according to studies from high and middle income regions. These findings are valuable for informing urban planning in general and in low income and less developed countries.

Nature plays an important part in many local traditions and ceremonies, and specific places may have strong religious and pagan meanings that contribute to sense of place and community cohesion. Health benefits of these ecosystem services are less tangible than those captured by conventional health indicators or standard economic valuation. Nevertheless, biodiversity of species and ecosystems often play a crucial role in cultural activities by influencing language, art, literature, dance and music. (CBD and WHO, 2015)²

Medicinal resources

The avoidance of overuse, and unnecessary routine use, of antibiotics and other pharmaceuticals is essential for human health, to reduce the risk of antibiotic resistance and to reduce harm to beneficial and symbiotic microbial diversity. When released into the environment antibiotics and other pharmaceuticals can be harmful to biodiversity, with negative consequences on people's health.

The use of herbal medicine is an integral part of most cultures, and many plant species have healing properties that

are verified by traditional knowledge as well as scientific medicine. Between 25% and 50% of commercial drugs originate from natural substances (Kingston, 2011)¹¹. In order to protect traditional knowledge, innovations and practices about medicinal plants and its customary sustainable use, it is important to respect and recognize the indigenous peoples and local communities that are holders of the knowledge, as well as their cultures. Sharing of traditional knowledge about medicinal plants must be based on the knowledge holders free, prior and informed consent, and the equitable sharing of benefits arising from the use of the genetic resources. The CBD Tkarihwaïé:ri Code of Ethical Conduct¹² provides guidance for how to relate to such processes and the CBD Nagoya Protocol on Access and Benefit Sharing under the Convention on Biological Diversity¹³ outlines the conditions for Mutual Agreed Terms and benefit sharing arrangements related to genetic resources and the traditional knowledge about such resources, such as medical plants.

11 Kingston DGI. Modern Natural Products Drug Discovery and its Relevance to Biodiversity Conservation. *J Nat Prod.* 2011 Mar 25; 74(3): 496–511.

12 Tkarihwaïé:ri Code of Ethical Conduct to Ensure Respect for the Cultural and Intellectual Heritage of Indigenous and Local Communities Relevant to the Conservation and Sustainable Use of Biological Diversity. <https://www.cbd.int/traditional/code.shtml>

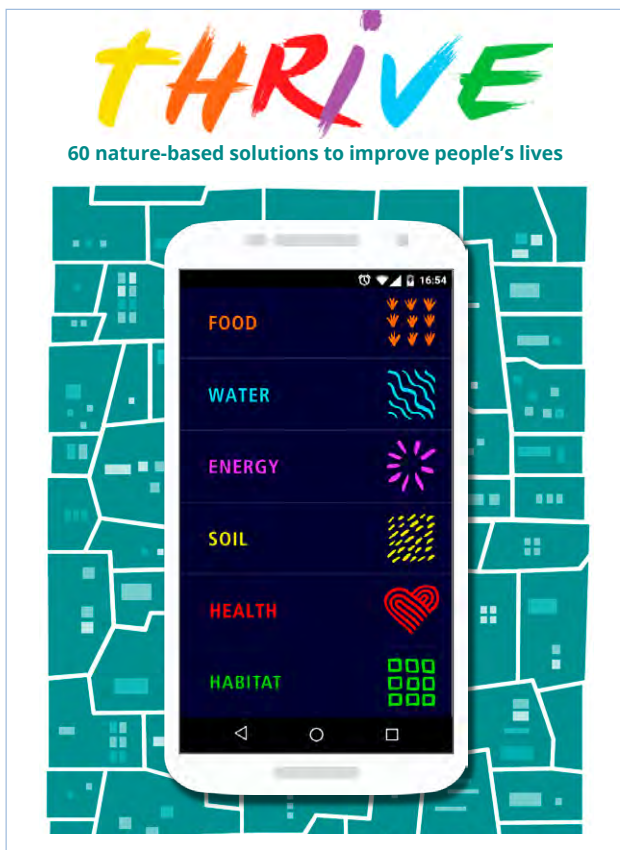
13 Nagoya Protocol on Access and Benefitsharing. <https://www.cbd.int/abs/>



Beans in the hand of boy in an indigenous community of Honduras. Photo credit: Hanna Wetterstrand

Definitions

- Biological diversity (biodiversity) is “the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems”. (CBD)
- Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. (WHO)
- Ecosystems are the functional unit of interaction between animals, place and the physical environment, e.g. a lake or a forest.
- Ecosystem services are the direct and indirect contributions of ecosystems to human well-being, including economic (welfare), social (well-being), and ecological (sustainability) benefits: e.g. food production, bio-energy, water purification, climate regulation, soil production, erosion control and mitigation of natural disasters.
- Resilience is the ability of a system (social and/or ecological) to cope over the long-term with substantial stressors such as environmental and climate change. There is a strong correlation between biodiversity and ecosystem resilience, and its ability to deliver ecosystem services.



A mobile application called Thrive with 60 nature-based solutions for the protection and sustainable use of natural assets in cities that can help improve human health across Sub-Saharan Africa, is one example of SwedBio's support related to health and biodiversity.

An evaluation by the World Health Organization concluded that there is a need for sustainable use and cultivation of medicinal plant species in order to protect them (WHO 2003)¹⁴. Protection of biodiversity, in particular in forest ecosystems, is important not only to avoid the risk of extinction of known medicinal plants, but also to protect plant species that could have future medicinal value.

If we manage to use medicinal plants more sustainably, there are a multitude of benefits to biodiversity, livelihood and people's health, especially in relation to ensuring affordability, accessibility and cultural acceptability (WHO and CBD, 2015)².

Closely connected to sustainable management of medicinal plants are protection of traditional medical knowledge, innovation and practices.

Climate change adaptation and disaster risk reduction

In the age of climate change we are in dire need of disaster-resilient communities. Resilient ecosystems and a secure delivery of essential ecosystem goods and services are essential to achieving that goal.

Increased biodiversity improves the ecosystem's resilience thereby contributing to climate change adaptation and reducing negative impacts of disasters and their direct impact

on people's health. (WHO and CBD, 2015)².

Measures that jointly contribute to human health, building resilience and to the conservation of biodiversity, and support the well-being of vulnerable populations should be prioritized.

Strategies for biodiversity and human health

A change in the above-described trends will require transformations. More widespread recognition of the linkages between health and biodiversity can help their integration into national public health and biodiversity strategies, and from there into programmes, plans and strategies in other sectors. There is a need for more integrative approaches that closely involve local communities and unite various disciplines and actors in order to continue to develop the understanding of the connections between health and biodiversity.

A better understanding of the different linkages between biodiversity, ecosystem services, and human health will also provide important tools for the development of sustainable, ecosystem-based solutions. Public health and other sectors of society can benefit as a result.

There is in general a need for raising awareness and enhancing co-benefits of biodiversity and health, including in the context of the implementation of the 2030 Agenda for Sustainable Development and Sustainable Development Goals.

Examples from SwedBio support

SwedBio has supported various partners in developing countries that work with biodiversity related issues. As this paper has shown, there are therefore many direct and indirect connections to health. Two of these are presented below:

- Support to SEARICE, Southeast Asia Regional Initiatives for Community Empowerment: SEARICE emphasize the direct contribution of biodiversity to food security, human well-being and nutrition, and promote the role of smallholder farmers for conservation and sustainable use of agricultural biodiversity. This is done through strengthening the technical capacity of farmers' groups by sharing techniques and knowledge. SEARICE also promotes Farmers' Rights and supports access and rights to seeds by addressing seed policies that may hinder the continued use and development of local crop varieties and the associated knowledge.

- Support to ICLEI's Cities Biodiversity Center: The SwedBio supported program Urban Natural Assets for Africa aims to improve human health and well-being, contribute to poverty alleviation and building resilience of the urban poor in Sub-Saharan cities by building local government capacity to enhance local implementation of the Aichi Biodiversity targets. As one example, ICLEI has developed a mobile application called Thrive, with 60 nature-based solutions for the protection and sustainable use of natural assets in cities that can help improve human health across Sub-Saharan Africa.

¹⁴ World Health Organization WHO (2003). WHO Guidelines on Good Agricultural and Collection Practices (GACP) for Medicinal Plants. Geneva, World Health Organization.

For more information on biodiversity and health see:

- Sustaining Life – How Human Health Depends on Biodiversity. Edited by Eric Chivian and Aaron Bernstein.
- The Convention on Biological Diversity www.cbd.int/en/health; the Connecting Global Priorities: Biodiversity and Human Health, a State of Knowledge Review
- www.cbd.int/en/health/stateofknowledge; and <https://www.cbd.int/health/publications/default.shtml>
- The UN Food and Agriculture Programme <http://www.fao.org/biodiversity/en/> and <http://www.fao.org/infoods/infoods/food-biodiversity/en/>
- The Economics of Ecosystem Services and Biodiversity www.teebweb.org
- The Millennium Ecosystem Assessment www.millenniumassessment.org
- SEARICE own web page: <http://searice.org.ph/>
- The Sustainable Development Goals www.sustainabledevelopment.un.org
- Urban Natural Assets for Africa program webpage. <http://urbis.org/project/urban-natural-assets-africa/>
- Whitmee S., et al. Safeguarding Human Health in the Anthropocene Epoch: Report of The Rockefeller Foundation-Lancet Commission on Planetary Health, The Lancet, (2015): 60901-1.
- Watts, N., et al. Health and climate change: policy responses to protect public health Report of the 2015 Lancet Commission on Health and Climate Change

About SwedBio

SwedBio is a knowledge interface at Stockholm Resilience Centre contributing to poverty alleviation, equity, sustainable livelihoods and social-ecological systems rich in biodiversity that persist, adapt and transform under global change such as climate change. SwedBio enables knowledge generation, dialogue and exchange between practitioners, policy makers and scientists for development and implementation of policies and methods at multiple scales.



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