

Chapter 1

Introduction



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Abstract This chapter provides a context for discussing the relevance of socio-ecological production landscapes and seascapes (SEPLS) to the nexus between biodiversity, health, and sustainable development. It begins with an introduction to the idea of a nexus approach to landscape and seascape management, which can help minimise trade-offs and create synergies among different sectors and various global goals for sustainability. With a view to the multiple benefits derived from SEPLS, which extend beyond biodiversity conservation to human and ecosystem health, the chapter then explores how SEPLS management on the ground can contribute to more sustainable management of natural resources, achievement of global targets for biodiversity and sustainable development, and good health for all. Finally, it describes the scope, objectives, and structure of the book, including an overview of the case studies compiled in the subsequent chapters.

Keywords Socio-ecological production landscapes and seascapes · Nexus · Interlinkages · Biodiversity · Health · Sustainability · One Health approach · Case studies · Science-policy-practice interface

1 Biodiversity-Health-Sustainability Nexus

The COVID-19 outbreak, officially declared as a global pandemic on 11 March 2020, has demonstrated the cascading effects of complex human-nature interactions on human health and well-being. Anthropogenic ecosystem changes, including deforestation, agricultural intensification, wildlife exploitation, mining, and infrastructure development, have created a “perfect storm” for the spillover of zoonotic diseases like COVID-19 (Settele et al., 2020). The continued expansion of human activities—including human encroachment into biodiverse habitats, international

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M. Nishi et al. (eds.), *Biodiversity-Health-Sustainability Nexus in Socio-Ecological Production Landscapes and Seascapes (SEPLS)*, Satoyama Initiative Thematic Review, https://doi.org/10.1007/978-981-16-9893-4_1

movement of people and goods, and unregulated rise in wildlife trade—has significantly increased the risk of zoonotic infections, impacting human lives, economies, and well-being. Pandemics are rather rare compared to small-scale outbreaks but are becoming more frequent due to a ceaseless progress in these underlying events (IPBES, 2020). This will likely lead to an exponential increase in the total cost associated with pandemics, including disease treatments, deaths, and socio-economic impacts (Allen et al., 2017; Berry et al., 2018).

At the same time, nature supports human life and contributes to good health and well-being in numerous ways. “Health” is attributed to not only pathogenic (i.e. disease causing) factors but also factors promoting overall well-being, and is defined as “a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity” (WHO, 2020; Marselle et al., 2021). Human well-being consists of tangible and intangible elements, including physical well-being (i.e. the quality and performance of bodily functioning), mental well-being (i.e. the psychological, cognitive, and emotional quality of a person’s life), and social well-being (i.e. being well connected to others in a local and wider social community) (Linton et al., 2016). Nature offers a wide range of contributions to people, fundamentally securing basic human needs and generally serving as a basis for attaining good quality of life and ensuring human health and well-being. These contributions include food and energy security, access to clean air and water, opportunities for recreation and relaxation, and sense of place (IPBES, 2019b). Biodiversity, comprising the variability among living organisms from all sources and the ecological complexes, underpins these contributions that are essential for human health and well-being (Marselle et al., 2021).

Nature’s contributions to people, however, are not always distributed equally to benefit all segments of society, while the costs and burdens associated with their production and use are often borne disproportionately by different groups of people (IPBES, 2019b). Ecosystem changes may benefit some populations but at the expense of others, especially the most vulnerable, signalling crucial trade-offs that need to be managed to pursue sustainable development. The COVID-19 pandemic has exposed this complicated challenge in our society. While all citizens are affected by infectious risks, some evidence shows that vulnerable groups—including not only the elderly and those with ill health and comorbidities, but also people of lower socio-economic status and ethnic minority—are hit harder by the environmental and other related stressors caused by the pandemic (Gaynor & Wilson, 2020; Tavares & Betti, 2021). A subset of factors (e.g. overcrowded accommodation, unstable work conditions and incomes, limited access to healthcare services, non-communicable diseases arising from poverty) conjointly makes those socially deprived and economically disadvantaged more vulnerable to the COVID-19 pandemic, often exacerbating existing inequalities (Amerio et al., 2020; EEA, 2020; Patel et al., 2020).

Rather than negative trade-offs, positive synergies for human health and well-being also exist as we can see, for instance, in sustainable farming practices that improve soil quality, agricultural productivity, and ecosystem functions such as carbon sequestration. Yet, sustainability cannot be achieved without carefully

handling trade-offs. This is even clearer today given that many of nature's contributions are declining and cannot be replaced by any current alternatives (IPBES, 2019b).

To better manage trade-offs and create and strengthen positive synergies, the idea of “nexus” has evolved. The term “nexus”, originated in the Latin verb *nectare* (meaning “to connect”), has been used in the published literature since the early nineteenth century in various disciplines (e.g. philosophy, governance, cell biology, economics) to trace, describe, and characterise complex interlinkages between multiple objects (Scott et al., 2015; De Laurentiis et al., 2016; Liu et al., 2018). This term was first used in the realm of natural resource use under the Food-Energy Nexus Programme of the United Nations University (UNU) (1983–1988), which aimed to develop an analytical framework and planning methodology for integrated solutions to food and energy scarcity through promoting South-South cooperation in the fields studied (Sachs & Silk, 1990; Scott et al., 2015). Concurrently, the water-resource dimension of the nexus between energy and agriculture started to gain recognition in the western United States in the mid-1980s, considering energy and environmental needs for water, agricultural-irrigation, and urban-industrial demands (Scott et al., 2015). Finally, nexus thinking has been increasingly applied to the study of interconnections between food, water, and energy, often called WEF or FEW nexus, mostly in the climate change context, but sometimes additionally with biodiversity conservation and human health (Albrecht et al., 2018; IPBES, 2019a).

The Global Assessment Report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) defines the concept of nexus as “a perspective which emphasizes the inter-relatedness and interdependencies of ecosystem components and human uses, and their dynamics and fluxes across spatial scales and between compartments,” adapting the definition posed by UNU Institute for Integrated Management of Material Fluxes and of Resources (UNU-FLORES) (IPBES, 2019a, p. 1047). This definition implies both a phenomenological perspective to capture the interactions among different subsystems (or sectors) within the nexus system and an analytic perspective to examine the links between the nexus nodes (e.g. water and energy), into either of which many varying definitions can be categorised (Zhang et al., 2018). The nexus perspective allows for better understanding of the functioning, productivity, and management of a complex system which involves trade-offs, and facilitation and amplification between the different components (IPBES, 2019a). This approach can thus help detect and minimise negative trade-offs, uncover positive synergies, and unveil unexpected consequences arising from these combined effects (Liu et al., 2018). This effort finally helps enhance integrated planning, governance, and management, and in particular helps identify and pursue pathways to achieve global goals and targets for sustainable development, many of which are interconnected (Nilsson et al., 2016; Weitz et al., 2018).

With this understanding, IPBES (2019a) drew on a nexus approach to analyse interactions between multiple sectors and objectives and identify key elements of sustainable pathways. For the sake of feasibility and comprehensibility for the analysis in the complex context, it applied the approach via six complementary

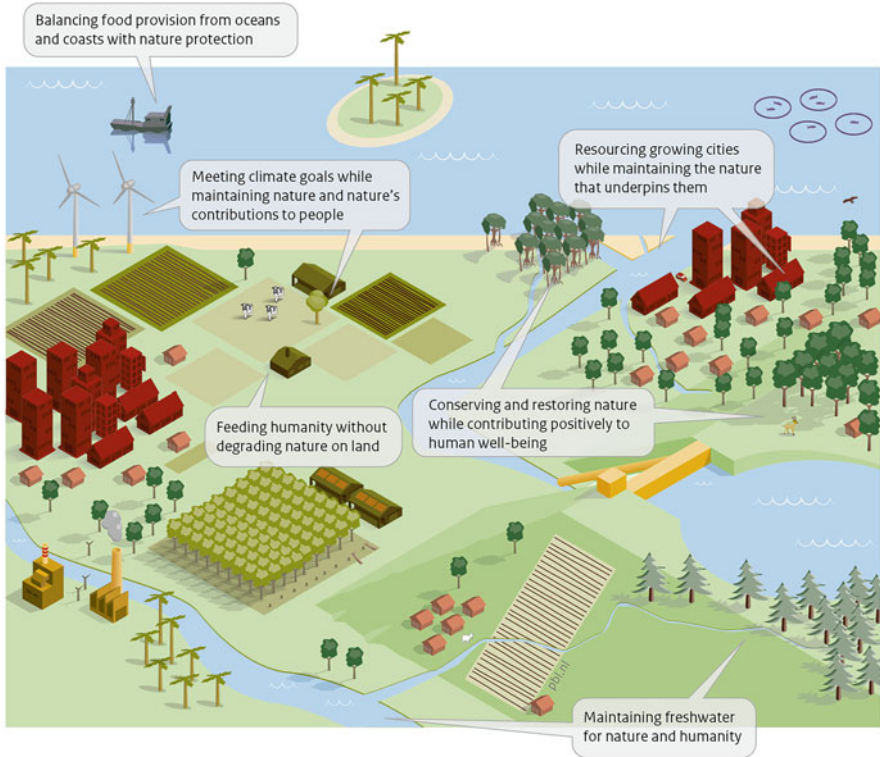


Fig. 1.1 The six interconnected foci of the nexus analysis in the IPBES Global Assessment (source: Chan et al., 2019). The six foci for the nexus analysis reflect key challenges in conserving nature and nature's contributions to people while achieving the SDGs given both trade-offs and synergies. These foci include (1) feeding humanity without degrading terrestrial natural resources; (2) meeting climate goals without incurring massive land-use change and biodiversity loss; (3) conserving and restoring nature on land while contributing positively to human well-being; (4) maintaining freshwater for nature and humanity; (5) balancing food provision from oceans and coasts with biodiversity protection; and (6) resourcing growing cities while maintaining the ecosystems and biodiversity that underpin them

foci (or lenses) to examine specific links between terrestrial, marine, and freshwater social-ecological systems in consideration of linkages to other entities (Fig. 1.1). This analysis revealed trade-offs and synergies in each of the foci as well as common threads in achieving a subset of sustainable development goals (SDGs) simultaneously. Pointing to significantly varying pathways across geographic contexts, the cross-scale nexus analysis highlighted the significance in integrating local and regional perspectives in global pathways towards sustainability. Despite the diversity of the pathways with different changes needed to achieve global goals at all scales, the analysis also suggested the following common constituents of sustainable pathways associated with seven SDGs relevant to nature (i.e. SDGs 2, 3, 6, 11, 13, 14, and 15): (1) safeguarding remaining natural habitats on land and sea,

(2) undertaking large-scale restoration of degraded habitats, and (3) integrating these activities with development through sustainable planning and management of landscapes and seascapes.

Cross-sectoral cooperation and planning have been increasingly called for to attain global environmental and societal goals, but effective policy integration, for instance across multilateral environmental agreements, is yet to be achieved (Azizi et al., 2019; IPBES, 2019a; van den Heuvel et al., 2020). Also, the nexus approach is still in its infancy for application and implementation, despite its great potential to promote cooperation, coordination, and policy coherence among different sectors (Liu et al., 2018). In this context, IPBES launched a new 3-year thematic assessment of “the interlinkages among biodiversity, water, food, and health” (the so-called nexus assessment) at its eighth plenary session in 2021 to be conducted between 2022 and 2024.¹ This assessment aims to advance understanding on the interlinkages among biodiversity, climate change, adaptation, and mitigation, including relevant aspects of energy, water, food, and health. It will also consider holistic approaches based on different knowledge systems to achieve global goals such as the 2050 Vision for Biodiversity and the 2030 Agenda for Sustainable Development, including those to attain good health for all.

In addition, IPBES organised a virtual workshop on the links between biodiversity and pandemics on 27–31 July 2020 to strengthen the knowledge base on links between biodiversity and current and future pandemics in response to the extraordinary situation caused by the COVID-19 pandemic. The report from this workshop (IPBES, 2020) warns of a daunting future, where without preventive measures, pandemics will emerge more frequently and spread more rapidly, resulting in more human deaths and more devastating socio-economic impacts. Pointing to human activities as the fundamental driver of the emergence of pandemics, the report also highlights the interconnectedness of the world community and the increasing threats to health and well-being arising from global inequality. The report, however, also says that escaping the era of pandemics is still possible, but requires transformative change to shift from the current reactive approach to a preventive one to prepare for future pandemics. Finally, it offers several policy options to foster transformative change and move towards preventing pandemics based on a “One Health” approach (i.e. an approach that integrates human health, animal health, and environmental sectors).

The One Health approach builds on the idea that human health, ecosystem health, and animal health are all interrelated, and that it is imperative to encourage mechanisms that ensure coordination and collaboration among the relevant sectors to strengthen the links between them (WHO, FAO, & OIE, 2019). From a heuristic view, we understand that the One Health approach is highly compatible with the

¹The IPBES Plenary at its eighth session in June 2021 approved the undertaking of the nexus assessment as outlined in the scoping report set out in annex 1 to its decision IPBES-8/1 for consideration by the Plenary at its eleventh session. The scoping report is available at: https://ipbes.net/sites/default/files/2021-07/20210719_scoping_report_for_the_nexus_assessment.pdf.

approach to managing socio-ecological production landscapes and seascapes (SEPLS). As discussed in the following section, SEPLS have been shaped and managed through strongly interlinked sets of traditional practices and production activities that have been adapted and transformed to maintain and improve the well-being of communities while absorbing shocks to the system, suggesting higher levels of resilience (Bergamini et al., 2013). To evade the pandemic era and achieve global goals for biodiversity and sustainability, strategies to build and strengthen resilience against systemic threats will be increasingly important and relevant in the coming decades. In this regard, the nexus analysis of SEPLS management should offer ideas and available means to devise such strategies.

2 Socio-Ecological Production Landscapes and Seascapes and Nexus Approaches

SEPLS are multifunctional and utilitarian conceptualisations of landscape and seascape use. Here the proximate population has recognised its reliance on the SEPLS for various material and intangible benefits and clearly acknowledged the interdependence of social and ecological components of a social-ecological system that is consequently factored into related decisions on the management of the SEPLS. Furthermore, the well-being of the population dependent on a SEPLS is entrenched in ensuring that multiple needs, such as securities of food, health, and energy, identity, culture, and ecological integrity, are met at the same time (Bergamini et al., 2013). This indicates that nexus approaches across different “sectoral priorities” need to be practiced in SEPLS contexts to simultaneously guarantee that these different needs are realised and are aligned during the implementation of relevant activities (Sarmiento & Frolich, 2020). It therefore is a natural extension in the reasoning that concepts such as “Community Health”² (Unnikrishnan & Suneetha, 2012) or “One Health” are understood and practiced *de facto* in local communities as the concept of health encompasses multiple dimensions from access to resources, and well-functioning ecosystems, to food and nutritional security, access to medical resources, and cultural practices, among others.

That said, contexts in which SEPLS operate have changed over time due to changing sociopolitical priorities and other factors. Consequently, decisions related to multiple activities in a SEPLS could be said to have become more sectoral or compartmentalised. This has brought on challenges to ensure the sustenance of endogenous nexus approaches that once were widely practiced—often requiring

²Community Health builds on the concept of health held by local and indigenous communities that relates not just to medical services, but involves access to food and nutritional security, access to cultural resources, medicinal resources, access to areas of cultural importance, rights to use and practice, and livelihood security.

purposive rejuvenation efforts, as the case studies in this volume will highlight. Drivers of these changes range from policy pressures (e.g. mono or simple cropping patterns, land-use changes for other development purposes) to changes in demographic profiles and priorities (e.g. in- and outmigration) and natural vulnerabilities (e.g. to floods or other natural calamities) (IPBES, 2019a).

As mentioned above, several global assessments are finding increasing evidence that tackling biodiversity loss and ensuring human well-being thereof are linked closely to effective and integrated management of landscapes and seascapes and strengthening the capacities and resources available to the local communities managing them. The increasingly robust emphasis by policy bodies to ensure biodiversity conservation, health, and sustainable development through calls for adopting coherent policies (such as the draft Global Biodiversity Framework or the One Health implementation mechanisms being set up in different countries) serves as a timely opportunity to refocus on the principles underlying SEPLS management—as context-dependent, multi-stakeholder, and multisectoral approaches that are designed to derive multiple benefits. Proof of this concept can be found in the experiences of the members of the International Partnership for the Satoyama Initiative (IPSI). Experiential knowledge and practical lessons in dealing with the nexus between the sectors can be found in the case studies, which can be taken advantage of as approaches to landscape and seascape management.

3 Objectives and Structure of the Book

This book focuses on the biodiversity-health-sustainability nexus in the context of the management and multiple benefits of SEPLS. The primary aim is to provide insights on how SEPLS management on the ground can contribute to enhanced ecosystem and human health, sustainable management of natural resources, and achievement of global targets for biodiversity and sustainable development.

To explicitly showcase the dynamics of the biodiversity-health-sustainability nexus in SEPLS, this volume brings together case studies on SEPLS management from different regions around the world, which delve into the relevance of SEPLS to various aspects of sustainability in the context of ecosystem and human health. The case studies highlight the roles, attitudes, and actions of those responsible for management, including smallholders, indigenous peoples, local communities, and other stakeholders, in conserving biodiversity—including agro-biodiversity—while ensuring the health of SEPLS and dependent communities. For example, they pertain to efforts that enhance ecosystem and human health, such as pesticide-free food production, high nutrition, good water quality, and sustainable tourism. Additionally, most case studies touch upon the impact of the COVID-19 pandemic on the livelihoods of ecosystem-dependent local communities and related changes in ecosystem health. In particular, the case studies address the following questions:

- What multiple benefits derived from SEPLS management have helped to ensure and enhance aspects of human health, and how?
- What are the trade-offs and synergies between efforts to attain ecosystem health, human health, and sustainability in managing SEPLS?
- How can we measure the effectiveness of SEPLS management in securing and improving ecosystem and human health, as well as sustainability?
- What are the challenges and opportunities in managing SEPLS to achieve biocultural diversity conservation and sustainable development while ensuring and enhancing ecosystem and human health?

The case studies commonly address the above key questions to elucidate the relevance of SEPLS management for long-term sustainability, ecosystem health, and human well-being. Chapters 2–12 present 11 case studies encompassing different types of ecosystems around the world, including six from Asia, two from Latin America, two from Africa, and one from Europe (Fig. 1.2). The case studies are divided into four broad thematic areas: (1) local and indigenous conceptualisation of health and well-being; (2) wider landscapes and seascapes and resilience; (3) water, tourism, and recreation; and (4) food and farming. Table 1.1 shows specific SEPLS types and key challenges faced by them in the case studies under each of the thematic areas.

Most of the cases primarily focus on the nexus at the local level, involving local communities and their health (Chaps. 2–5, 9–12) or ecosystem health and related human well-being in the context of recreation and tourism (Chaps. 6–8). To represent the nexus dynamics, each case study illustrates a unique linkage type (e.g. food–health, water management–well-being, rights–well-being, conservation–human well-being) in their SEPLS. The various interconnected challenges (e.g. pollution, climate change, deforestation, biodiversity loss, degradation, COVID-19 pandemic) are addressed using a combination of environmental (e.g. sustainable agricultural practices, enhanced water and ecosystem management), economic (e.g. economic diversification and opportunities, livelihood improvement), and community-oriented (e.g. promotion of traditional knowledge, capacity development, local documentation, improvement in health and well-being of local people) solutions. Importantly, many of the cases exemplify initiatives not only to address immediate problems, but also to collectively identify long-term solutions and ensure continuous delivery of multiple benefits from SEPLS, while maintaining and enhancing ecosystem and human health.

To conclude with the key findings from these case studies, Chap. 13 distils the relevant messages to offer implications for science, policy, and practice as well as their interfaces in better managing the biodiversity–health–sustainability nexus in the context of SEPLS. The synthesis of the case studies’ findings offers relevant insights into the local-level implementation of nexus approaches and methodologies for monitoring and evaluation, using localised tools and indicators compatible with global ones, and involving multiple disciplines and sectors relevant to nexus approaches.



Fig. 1.2 Locations of the case studies (regions, landscapes, and/or seascapes) (map template: Geospatial Information Section, United Nations). Note: Details of the case study locations, including geographic coordinates, are described in each chapter

Table 1.1 Overview of the case studies

Focused thematic areas	Chapter (Country)	SEPLS types	Key interlinkages	Problems and Challenges	Objectives
Local and indigenous conceptualisation of health and well-being	Chapter 2 (Bangladesh)	Forest, inland water, coastal and marine, wetland	Rights, conservation, well-being, health	Mangrove degradation, livelihood insecurity, COVID-19 outbreak	Conceptualise one health approach, enhance livelihood security, and promote customary sustainable practices and traditional knowledge
	Chapter 3 (Colombia)	Forest, traditional agriculture	Biocultural memory, conservation, human well-being, securing territorial rights	Loss of biodiversity, loss of cultural identity, armed conflict, poverty	Recover traditional knowledge and cultural conservation values to enhance quality of health
Wider landscapes and seascapes and resilience	Chapter 4 (Chinese Taipei)	Mountain, forest, agriculture, watershed, coastal, mountains	Eco-agriculture, SEPLS well-being, landscape-seascape connectivity	Dams and river dredging, tourism, loss of native varieties, outmigration	Promote eco-agriculture, weaving of traditional and modern knowledge, and cooperation between multiple stakeholders across different ecosystems at a landscape-seascape scale
	Chapter 5 (Mexico)	Forest, traditional agriculture	Agrochemicals, sustainable landscape management, health, cultural heritage	Pollution, recurrent diseases	Promote sustainable management of ecosystems, enhance landscape resilience, and raise awareness on traditional food production
Water, tourism, and recreation	Chapter 6 (India—peri-urban wetlands)	Peri-urban, wetlands	Bio-rights, health, climate	Pollution, lack of awareness	Create economic opportunities, enrich biodiversity, and improve human health and well-being
	Chapter 7 (Cambodia—Angkorian landscape)	Forest, watershed, agriculture, peri-urban, urban	Water management, forest management, tourism, human well-being	Climate change, deforestation, declined groundwater recharge, increased demand for food and water	Enhance water management, promote economic diversification, preserve cultural heritage, and improve human health and well-being
	Chapter 8 (Austria)	Mountain, forest	Human health, biodiversity	Climate change, tourism	Revitalise mountain livelihoods, and improve lifestyle

Food and farming	Chapter 9 (India—a biocultural hotspot)	Agriculture, mountain, forest	Food, health	Degradation of SEPLS, loss of biodiversity, climate change, food and nutritional insecurity	Promote local health traditions and local health baskets, and enhance human immunity to infectious diseases
	Chapter 10 (Kenya)	Forest, agricul- ture, semi-arid land	Food, nutrition, biodi- versity, local and tradi- tional knowledge, human health	Underutilised local foods, stigma, loss of cultural heri- tage, obesity, biased nutrition	Preserve traditional knowledge and cultural practices, create economic and livelihood opportunities, enhance human health and well-being, and ensure biological and cultural diversity
	Chapter 11 (Cambodia— agro-biodiverse landscapes)	Agriculture	Food security, human health	COVID-19 pandemic, food and health insecurity	Promote sustainable agricul- ture, facilitate capacity build- ing, promote organic fertilisers, and enhance agri- cultural biodiversity
	Chapter 12 (Ghana)	Forest, agriculture	Pesticides, agriculture, human and ecosystem health	Highly hazardous pesticides, pollution, and health impacts on humans and ecosystems	Phase out highly hazardous pesticides, promote integrated pest management, improve human and ecosystem health, and enhance agricultural cocoa production landscape

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