



Biosphere Security

Understanding the connections between conflict and biodiversity

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The world is experiencing increasing insecurity, conflict and geopolitical tensions at regional and global levels. Between 2010 and 2020, the number of state-based armed conflicts nearly doubled, as did the number of conflict deaths.¹ Over the same period, the number of refugees and other forcibly displaced people also doubled, from 41 million to 82 million.² The overall trend is unmistakable: peacebuilding is in crisis and the world is becoming less safe and less secure for a large proportion of its inhabitants.³ On top of this is an environmental crisis: human activity is affecting the earth's climate and ecosystems, putting the stability of the entire planet at risk.⁴

Science has made substantial progress in understanding how different aspects of the environmental crisis—primarily climate change and resource scarcity—are interacting with today's darkening security horizon.⁵ However, there are still major gaps in knowledge. For example, the relationship between biodiversity loss and conflict has received little attention. This is surprising, given the fundamental role played in human well-being and prosperity—even in modern technological societies and economies—by the earth's ecosystems and biodiversity (collectively referred to as the biosphere—see box 1).⁶ While the consequences for the physical environment of conflict can be evident, those for biosphere integrity can be less immediate or obvious. Yet they represent significant risks to biosphere security and thus global sustainability goals.⁷ In turn, biodiversity and ecosystem loss can also interact with or exacerbate conflict. As several areas of the world now experience the impacts of both biodiversity loss and conflict, it is crucial to understand these relationships.

This Hub Brief introduces the concept of biosphere security and provides a short overview of the current state of knowledge on the relationship between conflict and

¹ Black, R. et al., *Environment of Peace: Security in a New Era of Risk* (SIPRI: Stockholm, 2022).

² Black et al. (note 1).

³ On the failure of peacebuilding see e.g. de Coning, C., 'Adaptive peacebuilding', *International Affairs*, vol. 94, no. 2 (Mar. 2018); and Dodge, T., 'The failure of peacebuilding in Iraq: The role of consociationalism and political settlements', *Journal of Intervention and Statebuilding*, vol. 15, no. 4 (2021).

⁴ Rockström J. et al., 'Safe and just earth system boundaries', *Nature*, 6 July 2023; and Richardson K. et al., 'Earth beyond six of nine planetary boundaries', *Science Advances*, 13 Sep. 2023.

⁵ Black et al. (note 1).

⁶ Díaz, S. et al., *The Global Assessment Report on Biodiversity and Ecosystem Services: Summary for Policymakers* (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services: Bonn, 2019).

⁷ Rist, L., Queiroz, C. and Norström, A., 'Biodiversity, peace and conflict: Understanding the connections', *Social Science Research Network (SSRN)*, 1 Jan. 2023.

BOX 1. GLOSSARY

Biosphere

The biosphere is the relatively thin layer of the earth where living organisms exist. It includes all living organisms (including humans) and their interactions with each other and with their physical environment. It is a complex system that includes ecosystems, communities, populations and individual organisms.

Biosphere security

Biosphere security is a framing of human security that recognizes the biosphere as the foundation of all needs and activities in society and the economy, and thus as essential for all efforts to achieve security in food, water, energy, shelter and climate.

Biodiversity

Biodiversity refers to the richness and variety among living organisms from all ecosystems in the biosphere. It includes variation in genetic, phenotypic, phylogenetic and functional attributes, as well as changes in abundance and distribution over time and space within and among species, biological communities and ecosystems. Biodiversity is the cornerstone of biosphere integrity.

Ecosystem

An ecosystem is a community of interacting organisms and their physical environment.

Ecosystem service

Ecosystem services are the benefits provided by ecosystems to humans. They are often distinguished as provisioning, regulating, cultural and supporting services.

Nature's contributions to people

The concept of nature's contributions to people (NCP) was developed within the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) as a further evolution of the concept of ecosystem service. The NCP framework demonstrates that, while nature provides a bounty of essential goods and services (e.g. food, flood protection and many more), it also has rich social, cultural, spiritual and religious significance that needs to be valued in policymaking as well.

Resilience

Ecological resilience refers to the capacity of an ecosystem to respond to and deal with disturbance in a way that allows it to continue to provide valuable ecosystem services for people and society.

Teleconnection

Teleconnections refer to socioeconomic and environmental interactions over long distances.

the biosphere. It purposefully focuses on biodiversity loss as a driver of conflict and on conflict as a driver of biodiversity loss, given the vital roles that biodiversity plays in ensuring the functioning and resilience of the biosphere.⁸ It concludes by outlining a few broad, but critical, starting points in work towards a more comprehensive research agenda for biosphere security.

The biosphere as the foundation of society

Human civilization depends on a healthy biosphere—the thin and extraordinary layer of ecosystems and biodiversity that sustain life on planet earth. Biodiversity is crucial to the maintenance of biosphere integrity through two main roles. First, it provides critical ecosystem functions that underpin goods and services essential to human well-being. Second, it ensures the resilience and stability of ecosystems and the services they provide over time. Despite this, we are facing a biodiversity crisis, with current extinction rates being 100–1000 times higher than natural baseline levels.⁹

⁸ Folke, C. et al., 'Our future in the Anthropocene biosphere', *Ambio*, vol. 50, no. 4 (Apr. 2021).

⁹ Brondizio, E. S. et al. (eds), *The Global Assessment Report on Biodiversity and Ecosystem Services* (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services: Bonn, 2019).

Human well-being depends on the biosphere for clean air and water, for climate and temperature regulation, for living and fertile soil, for pollination of crop plants and wild foods, and for mental and spiritual well-being and cultural vitality (see figure 1).¹⁰ These and other core ecosystem services can be called nature's contributions to people.¹¹ They are provided by natural and semi-natural ecosystems and underpinned by functions that depend on biodiversity.¹² For example, through sequestration of carbon in plants and soils, the biosphere removes around 50 per cent of anthropogenic CO₂ emissions from the atmosphere each year—a massive subsidy to the world economy.¹³ Animal-based pollination contributes to 30 per cent of global food production, including several cash crops of major economic importance such as coffee, cocoa, almonds and soya beans.¹⁴ The emergence of zoonotic diseases is also mediated by biodiversity.¹⁵ Simply looking at the impact of a zoonotic disease such as Covid-19 demonstrates the enormous financial and human risks posed by biodiversity loss.¹⁶ While the science of ecosystem services, of nature's contributions to people and of biodiversity is complex, the message is clear: the loss of biodiversity undermines the very foundation of human existence. Reflecting this, in 2023 the World Economic Forum (WEF) listed biodiversity loss and ecosystem collapse among the four most severe global risks over the next 10 years.¹⁷

Biodiversity is also a key source of broad biosphere resilience.¹⁸ It encompasses variety not just of species, but also variety in genetic composition of those species, as well as in the functional roles that they fill in ecosystems. This, in turn, provides the means of responding and adapting to change, thereby avoiding potentially catastrophic shifts in the functioning of ecosystems.¹⁹ 'Regime shifts', as they are scientifically known, are large, abrupt and persistent changes in the structure and function of ecosystems. They are often associated with changes in biodiversity and have been empirically documented in a variety of well-known examples.²⁰ Such shifts can have serious socio-economic impacts because they substantially alter the availability of ecosystem services such as those described above. They are also often difficult to anticipate and costly, or even impossible, to reverse. For example, a regime shift in the Newfoundland cod fishery in Canada in the early 1990s directly affected the livelihoods of about 35 000 fishers and fish-plant workers and led to a decline of over US\$200 million per annum in local revenue from cod landings.²¹

¹⁰ Rockström et al. (note 4).

¹¹ Brondizio et al. (note 9).

¹² Millennium Ecosystem Assessment, *Ecosystems and Human Well-being: Synthesis* (Island Press, Washington, DC, 2005).

¹³ Rockström, J. et al., 'We need biosphere stewardship that protects carbon sinks and builds resilience', *Proceedings of the National Academy of Sciences*, 21 Sep. 2021.

¹⁴ Khalifa, S. A. M. et al., 'Overview of bee pollination and its economic value for crop production', *Insects*, vol. 12, no. 8 (Aug. 2021).

¹⁵ Keesing, F. and Ostfeld, R. S., 'Impacts of biodiversity and biodiversity loss on zoonotic diseases', *Proceedings of the National Academy of Sciences*, 27 Apr. 2021.

¹⁶ Morand, S. and Lajaunie, C., 'Biodiversity and Covid-19: A report and a long road ahead to avoid another pandemic', *One Earth*, vol. 4, no. 7 (July 2021).

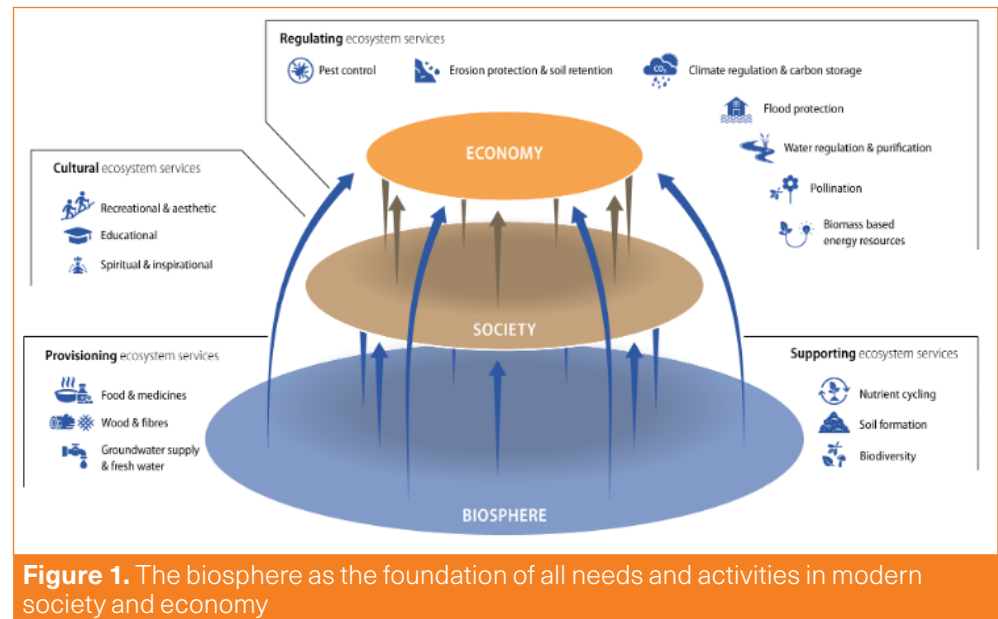
¹⁷ World Economic Forum (WEF), *The Global Risks Report 2023* (WEF: Geneva, Jan. 2023).

¹⁸ Folke et al. (note 8).

¹⁹ Kinzig, A. P. et al., 'Resilience and regime shifts: Assessing cascading effects', *Ecology and Society*, vol. 11, no. 1 (July 2006), p. 20.

²⁰ Sukhdev, P. et al., *The Economics of Ecosystems and Biodiversity (TEEB), The Economics of Ecosystems and Biodiversity: Mainstreaming the Economics of Nature, A synthesis of the approach, conclusions and recommendations of TEEB* (TEEB: Geneva, 2010); and Regime Shifts DataBase, <<https://www.regimeshifts.org>>.

²¹ Biggs, R. et al., 'Regime shifts', eds A. Hastings and L. Gross, *Sourcebook of Theoretical Ecology* (University of California Press: Berkeley, CA, 2012), pp. 609–617.



Biodiversity thus acts as both a resource base (by underpinning ecosystem functions and services) and an insurance policy for the future (by underpinning resilience). Despite these facts and evidence that biodiversity is relevant to every single Sustainable Development Goal (SDG) of the United Nation's 2030 Agenda, it remains chronically undervalued and largely missing in international targets.²² It has also been largely absent from the environment and peace agenda.²³

Conflict as a driver of biodiversity loss

Wars and other armed conflicts often lead to significant environmental damage, something that has been studied since the 1970s (see figure 2).²⁴ Physical scarring of the landscape, chemical pollution of soil and water, and toxic remnants of vehicles and bombed infrastructure are the most well-known and visible examples. Physical damage and pollution disrupt ecosystems and their constituent biodiversity. Vast stretches of crucial ecosystems can be destroyed during conflict, for example, the wetlands in Iraq or more recently in Ukraine.²⁵ If military operations have an impact on populations of keystone species (i.e. species that are critical to the survival of the other species in the system), then this could trigger knock-on effects that reverberate throughout an ecosystem.²⁶

While interstate war is the most damaging, intrastate conflict, including rebel or militia activities in biodiverse regions, is also known to have serious impacts, particularly via the targeting of high-value resources such as timber or wildlife. Examples from countries such as Myanmar show how the appropriation and liquidation of forest resources play an important role in the financing of war.²⁷ However, many

²² Reyers, B. and Selig, E. R., 'Global targets that reveal the social-ecological interdependencies of sustainable development', *Nature Ecology and Evolution*, vol. 4, no. 8 (Aug. 2020).

²³ Rist et al. (note 7).

²⁴ E.g. Westing, A. H., SIPRI, *Warfare in a Fragile World: Military Impact on the Human Environment* (Taylor & Francis: London, 1980).

²⁵ Conflict and Environment Observatory, 'The past, present and future of the Mesopotamian marshes', Sep. 2021, section 2.2; and Conflict and Environment Observatory and Zoï Environment Network, 'The coastal and marine environment', Ukraine Conflict Environmental Briefing no. 5, Feb. 2023.

²⁶ Rockström et al. (note 4).

²⁷ Forest Trends, 'Myanmar's timber trade since the coup: The impact of sanctions', Brief, Mar. 2023.

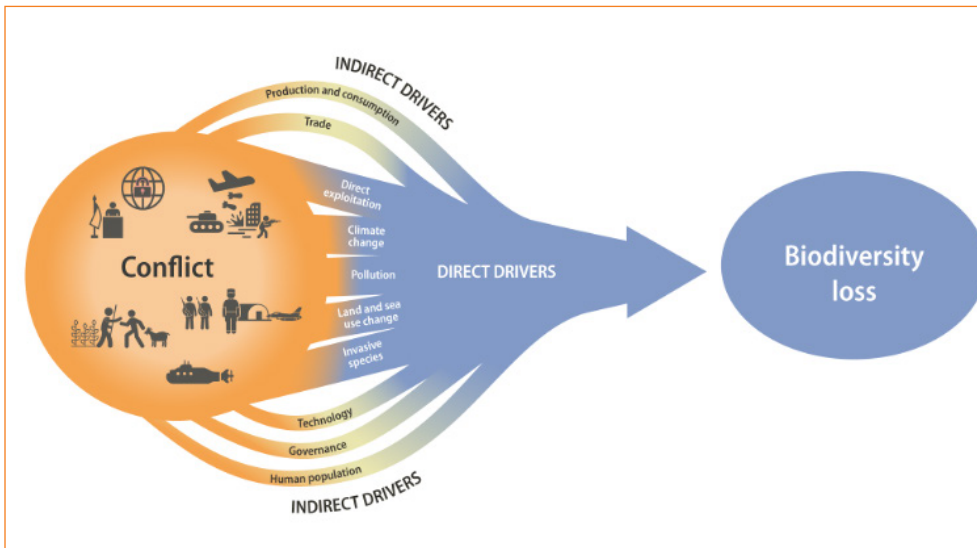


Figure 2. How conflict can lead to biodiversity loss

Source: Rist, L., Queiroz, C. and Norström, A., 'Biodiversity, peace and conflict: Understanding the connections', Social Science Research Network (SSRN), 1 Jan. 2023.

uncertainties remain about the conditions under which natural resource wealth accentuates or attenuates intrastate conflict and about the channels via which such processes happen.²⁸ Even mineral wealth tends to overlap with biodiverse regions, and its exploitation to finance armed conflict has serious implications for biodiversity.²⁹ Furthermore, in times of conflict, environmental protection activities and monitoring often decrease and the unsustainable exploitation of natural resources and environmental crimes can increase as a result of weak governance, further threatening biodiversity.

As a consequence of the disruption of normal ways of life, violent conflict often generates livelihood insecurity, in particular a lack of reliable access to water, food and energy. Such insecurity leads to a need to find new ways to get by. People draw on whatever is available, and this can often result in over-exploitation of local ecosystems with biodiversity loss as the ultimate consequence of this process.³⁰ In addition, livelihood insecurity can be a push factor for migration, which, if not managed well, can add pressure on natural resources—and thus biodiversity—at receiving locations.³¹

Other indirect effects of conflict on biodiversity include the opportunity costs of war for biodiversity protection. Military preparedness and the budget reallocations that take place in times of war, or when the risk of war is high, could lead to less investment in biodiversity conservation. War, military training and the maintenance of military institutions worldwide also generate considerable, and largely overlooked, pollution and carbon emissions (which dwarf many national domestic carbon budgets).³² Pollution, in particular, is a major driver of biodiversity loss globally. Such indirect and

²⁸ Nillesen, E. and Bulte, E., 'Natural resources and violent conflict', *Annual Review of Resource Economics*, vol. 6 (2014).

²⁹ Sonter L. J., Ali, S. H. and Watson, J. E. M., 'Mining and biodiversity: Key issues and research needs in conservation science', *Proceedings of the Royal Society B: Biological Sciences*, vol. 285, no. 1892 (5 Dec. 2018).

³⁰ E.g. Broek, E. and Hodder, C. M., *Towards an Integrated Approach to Climate Security and Peacebuilding in Somalia* (SIPRI: Stockholm, June 2022).

³¹ Black et al. (note 1).

³² Belcher, O., Neimark, B. and Bigger, P., 'The US military is not sustainable', *Science*, 28 Feb. 2020.

agriculture, which has breached European Union (EU) directives on preserving vulnerable habitats and is threatening the country's biodiversity.³⁶ Yet, moves by the Dutch government to dramatically limit nitrogen emissions in the agricultural sector have been met with extensive protests by farmers. In other instances, authoritarian environmentalism and nature protection have been linked to local conflicts in many locations. In India, for example, consideration of livelihood uses has historically been excluded in the name of biodiversity protection.³⁷

A new research agenda

The interconnected nature of the security and biodiversity crises demonstrates the potential for downward spirals of biodiversity loss and further conflict, with corresponding declines in human well-being. However, with caution, it also represents potential opportunities for tackling both issues in tandem since, when problems are interconnected, so are solutions. Peacebuilding is presently in a time of crisis, and biodiversity policy has also failed to result in action at the required scale. Thus, any attempts at integrating the two must be fully informed by the challenges that each field is facing. For example, certain peacebuilding efforts aim to focus on environmental management as an arena for cooperation and thus a facilitator of positive peace.³⁸

However, environmental management and biodiversity goals are often not in direct alignment, and trade-offs and unintended consequences must be carefully anticipated.³⁹ Narrowly focused actions to combat climate change can have devastating impacts on local biodiversity: for example, planting trees in ecosystems that have not historically been forests, and reforestation with monocultures, especially with exotic tree species.⁴⁰

Research efforts to unpack how biodiversity loss acts as a driver of conflict and how conflict acts as a driver of biodiversity loss must be ramped up. These efforts require the engagement of multiple disciplines (including social and political science) working closely together. They also need to involve non-academic actors (e.g. local or national government representatives, local and regional non-governmental organizations, and natural resource managers) in a process of knowledge co-production. This body of research needs to be oriented towards the policy world, which in turn must support the research effort and be open to the assessment and discussion of its findings. Specific research frontiers would include (but not be limited to) the following four areas.

1. Synthesizing, extrapolating and generalizing evidence compiled from local and regional case study observations.

This type of generalized knowledge claim can provide the insights and evidence needed to coordinate policy responses and decision-making at regional and global scales.

³⁶ Holligan, A., 'Why Dutch farmers are protesting over emissions cuts', BBC, 29 July 2022.

³⁷ Fanari, E., 'Struggles for just conservation: An analysis of India's biodiversity conservation conflicts', *Journal of Political Ecology*, vol. 28 (2021).

³⁸ Krampe, F., Hegaz, F. and VanDeveer, S. D., 'Sustaining peace through better resource governance: Three potential mechanisms for environmental peacebuilding', *World Development*, vol. 144 (Apr. 2021).

³⁹ Richardson et al. (note 4).

⁴⁰ Díaz et al. (note 6).

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2. Analysing global data sets on conflict and biodiversity in tandem.

This would allow understanding of the broad linkages and correlations between biodiversity loss and conflict at the global scale.

3. Understanding how ecological and social tipping points and regime shifts relate to security and conflict.

For example, research should study if the crossing of particular tipping points raises the risk of political instability, increased migration and threats to critical economic sectors.

4. Unpacking how conflict and loss of biodiversity interact across the complex and teleconnected chains of social, economic and biophysical dynamics.

For example, research could consider if any effects of conflict on agricultural output and international trade will lead to biodiversity loss at other distant locations due to associated impacts on land use (i.e. agricultural expansion and intensification) at these other locations.

Biodiversity loss and violent conflict are both grave threats to humanity; only a holistic understanding of the full set of interconnections between the two will offer lasting and sustainable pathways forward. The biosphere represents the foundation of human well-being; it is also the best insurance policy when facing times of growing crisis and uncertainty. Biodiversity and the living world must be safeguarded as a resource that meets the most basic human needs; in turn, healthy ecosystems can play their role in fostering healthy and peaceful communities and societies.

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The Stockholm Hub on Environment, Climate and Security provides evidence-based insights on building security and prosperity and strengthening resilience in the face of a changing climate. The Stockholm Hub combines the strengths of four leading research institutes: Stockholm Environment Institute (SEI), Stockholm International Water Institute (SIWI), Stockholm International Peace Research Institute (SIPRI) and Stockholm Resilience Centre at Stockholm University (SRC). The Hub is funded by the Swedish Ministry for Foreign Affairs.



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