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Biodiversity loss, consumption and telecoupling – Why do we need to look beyond our borders?

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Biodiversity loss is advancing rapidly, and the previous international goals for halting biodiversity loss have not been met. Besides protecting biodiversity within, e.g. Finland, it is essential to understand that our current way of life is causing global biodiversity loss through, for example, overconsumption. The current paper aims to increase understanding of the complex multi-level human impacts beyond our borders, resulting in significant global challenges. We discuss biodiversity loss and consumption with telecoupling, a phenomenon related to the geographical separation of consumption and production of goods and services that accelerates climate change and biodiversity loss in distant locations through international trade.

Introduction

The critical global challenges, climate change and biodiversity loss have been identified as the top two most severe risks to the future of humankind over the next ten years (World Economic Forum 2022). Moreover, it is clear that limiting climate change and halting biodiversity loss are mutually supporting goals (Pörtner et al. 2021). In this paper, the main focus is on biodiversity loss, yet climate change is also addressed since it has been a hot topic in academia and society for years. In contrast, biodiversity loss and its critical implications have, so far, received less attention.

It has become evident that biodiversity loss is advancing rapidly due to changing sea and land use (resulting in habitat loss, degradation and fragmentation), unsustainable exploitation of species, climate change, pollution and invasive non-native species (IPBES 2019). Unfortunately, the previous international goals for halting biodiversity loss have not been met and according to recent estimates, up to one million species risk vanishing within the next few decades (IPBES 2019). The biodiversity loss is also advancing in Finland; for example, 11.9% of the Finnish species evaluated in the last assessment of threatened species were classified as threatened, and 312 were assigned regionally extinct (Hyvärinen et al. 2019).

The current paper addresses the topical question of why it is essential to examine biodiversity loss beyond the borders of nation-states. The impacts of human activity are visible everywhere on Earth. Humans and the human-created systems in different places have become increasingly connected through flows of international trade, migration and ecosystem services. At the same time, other species and their habitats have been intentionally or unintentionally involved in this interaction. Here, we discuss telecoupling, a framework that aims to comprehend the complex multilevel human impacts beyond our borders, resulting in significant global challenges, e.g., climate change, biodiversity loss, and declining food and energy security (Liu et al. 2013).

Consumption and biodiversity loss

The global population has doubled since 1970, and consumption has increased dramatically in total and per capita spending (Liu 2022). Global consumption patterns significantly impact both climate change and global biodiversity loss, but previous research has mainly addressed climate change. Globally, household consumption emissions account for circa 70% of global greenhouse gas emissions (Dubois et al. 2019, Hertwich & Peters 2009, Ivanova et al. 2016).

Even though it is increasingly recognised that consumption patterns also lead to biodiversity loss, the effects are still more challenging to measure. While Lenzen et al. (2012) estimated that international trade accounted for 30% of threats to species globally, Wilting et al. (2017) were among the first to systematically quantify these losses in relation to land use and greenhouse gas emissions associated with the production and consumption of goods and services. Their analysis revealed that food consumption was the most important driver of biodiversity loss in most countries. The biodiversity loss per citizen varied between countries, but higher values were associated with increasing per-capita income. Similarly, the share of biodiversity losses due to greenhouse gas emissions in the biodiversity footprint increased with income (Wilting et al. 2017).

IPBES (2019) and Diaz et al. (2019) identified human activity and overconsumption as significant factors affecting the main drivers of biodiversity loss. They called for a transformative change, i.e., a fundamental, system-wide reorganisation across technological, economic, and social factors, including paradigms, goals, and values. The transformative change, in turn, requires leadership and management interventions, including concrete incentives for environmental responsibility, increased cross-sectoral cooperation, pre-emptive actions in institutions and businesses to stop nature's deterioration, more effective decision-making and stronger environmental laws (IPBES 2019).

According to IPBES (2019; see also Diaz et al. 2019), implementing such interventions targets eight specific keys to transformative change: biodiversity education and knowledge-sharing, inclusive and fair biodiversity conservation, and technological and social innovations and investments that facilitate the transformation. The remaining five keys are directly linked to consumption: decreasing total consumption and waste, enabling a good life not based on ever-increasing material consumption, letting go of outdated values while adopting new social norms for sustainability, and reducing inequalities that undermine individuals' abilities for sustainability. From the perspective of global responsibility, the last key is the most relevant: ”internalise externalities and telecouplings”, which will be discussed in more detail.

Telecoupling

The concept of telecoupling is increasingly used as a framework to understand globally distant interactions and their sustainability implications (Liu et al. 2013, Newig et al. 2019). It is an umbrella concept referring to socio-economic and environmental interactions over distances and a logical extension of research on coupled human and natural systems in which interactions occur within particular geographic locations (Liu et al. 2013). For example, the consumption of biofuels in Western countries can have significant environmental and socio-economic impacts in distant locations through land use change and other drivers of biodiversity loss (Liu et al. 2013).

Thus, telecoupling can be viewed as a transdisciplinary and multi-level solution to overcome the complexity caused by globalisation and the tendency to focus on single places and to remain entrenched within individual disciplinary silos (Liu et al. 2013, Hull & Liu 2018). The concept was first introduced by Liu et al. (2013) in an article titled ”Framing sustainability in a telecoupled world”. To better understand and integrate various distant interactions, they proposed a framework containing five major interrelated components: agents, causes, effects, flows, and coupled human and natural systems (Liu et al. 2013).

Agents include autonomous decision-making entities that directly or indirectly facilitate or hinder telecouplings. Causes are factors that influence its emergence and dynamics. Effects refer to socio-economic and environmental consequences or impacts of telecoupling. Flows are movements of material, energy, or information (e.g., manufactured goods, food, natural resources, organisms, knowledge, trade agreements, or financial data) between the systems that are transferred as a result of actions taken by agents. Finally, systems are coupled human and natural systems or integrated systems in which humans and nature interact. Each system is in a geographic location, has specific contexts, and consists of many human and natural elements and processes (e.g., climatic and soil conditions, habitats, accessibility, topographic features, economic and political institutions and policies).

For each telecoupling, systems can act as sending, receiving or spillover systems. Sending systems refer to origins, sources, or donors of material, energy, or information flows, such as exporting countries. Receiving systems, in turn, refer to destinations or recipients obtaining flows from the sending systems, such as importing countries. Finally, spillover systems affect or are affected by the interactions between sending and receiving systems, such as a third party in a trade agreement (Liu et al. 2013). According to Kapsar et al. (2019), the spillover system integrates unintended consequences into the telecoupling process to be recognised as a part of a much larger system. This contextualisation lays a foundation for systematically and consistently predicting the potential impacts of different policy actions and promoting the sustainable development of complex systems.

Consumption effects beyond our borders

Indeed, telecoupling is related to the phenomenon in which the consumption and production of goods and services have become geographically separated. Through international trade, consumption causes greenhouse gas emissions and biodiversity loss in distant locations, creating a geographical displacement between cause and effect (Irwin et al. 2022, Liu 2022).

For example, Nissinen and Savolainen (2021) estimated that Finland's consumption-related emissions are up to one-third higher than the officially reported emissions, as they include only emissions produced in a given country. Instead, according to Salo et al. (2021), the advantage of the consumption-based approach is that it also considers embedded emissions of imported goods (Peters & Hertwich 2008) and the overseas relocation of polluting industries, i.e., carbon leakage (Kanemoto et al. 2014). Even though Finland has a clear objective to be carbon neutral by 2035, climate strategies have given little weight to the consumption-based approach or set clear targets that acknowledge the emissions we produce beyond our borders (Sitra 2021).

The connections between final consumption and human activities that directly impact biodiversity loss are embodied in complex global supply chains that harness, manipulate, and transform nature's outputs into products and services, generating economic activity at each process stage (Irwin et al. 2022). Notably, according to Wilting et al. (2017), more than 50% of the biodiversity loss associated with consumption in developed economies occurs outside their territorial boundaries.

Irwin et al. (2022) used the ”extinction-risk footprint” to measure country-level contribution to species' extinction risk. The method quantified each country's role as both a steward of the biodiversity within its borders (territorial extinction-risk footprint) and a consumer of products whose supply chains extend beyond its borders (consumption extinction-risk footprint). The interplay between these generates a domestic footprint (the impact of a country's consumption on extinction risk within the country), an exported footprint (the impact of other countries' consumption on extinction risk within the country), and an imported footprint (the impact of a country's consumption on extinction risk outside of the country) for each country. The analysis of 188 countries revealed that 76 countries were net importers of extinction-risk footprint and 16 were net exporters of extinction-risk footprint. In 96 countries, domestic consumption was the largest contributor to the extinction-risk footprint.

Regarding policy interventions, the net importers of extinction-risk footprint (e.g., France, Germany, Japan, the UK, and the USA) must focus on ameliorating the impacts of their consumption by providing sufficient support to conservation and sustainable production in extinction-risk exporting countries. Furthermore, variations between the characteristics of each country's extinction-risk footprint highlight the need to tailor national policy interventions cognizant of the locations of both direct impact and consumption (Irwin et al. 2022).

Conclusions and discussion

Addressing and solving global challenges, such as biodiversity loss and climate change, requires a new approach that considers the complexity of networks and interactions and the extent of the impact of human activities. In addition, global actors at different levels need to bear responsibility for these challenges to achieve a more sustainable future.

Universities and scientists must also react to this need and create innovative and transdisciplinary approaches to tackle ecological crises. While telecoupling offers a possible framework for interdisciplinary research contexts, other frameworks or methods can also facilitate a profound understanding of the global effects of complex networks of human activities. For example, global responsibility (e.g., Silvola et al. 2021) provides another multi-level approach, while lifecycle assessment (e.g., Asselin et al. 2020) can be used as a more concrete tool in quantifying these global effects on biodiversity loss.

The authors of the present paper are involved in a transdisciplinary SRC-funded research project on Biodiversity-respectful leadership (BIODIFUL), which builds the perspective of leadership. Amid the plethora of leadership research, a multi-level appreciation of sustainable leadership connected to the natural environment is needed. To this end, BIODIFUL's scientific objective is to examine how individual (consumer-level), organisational (business-level), and societal (institutional-level) leadership can facilitate the transformation towards biodiversity-respectful activities. As BIODIFUL focuses on two systems, food and nature-based tourism and recreation, the telecoupling literature offers fruitful discussions on the agriculture and food industry, tourism, and also governance, which is closely related to leadership research (Duan et al. 2022, Eakin, Rueda & Mahanti 2017, Ibarrola-Rivas et al. 2020, Laroche et al. 2020, Newig et al. 2019, Newman et al. 2022). Moreover, it is an example of a framework that can enhance transdisciplinary research. Various scientific disciplines, such as ecology, economics, environmental science, geography, and political science, have already used telecoupling to study sustainability in multiple contexts and industries (Kapsar et al. 2019).

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