Food and Agriculture Organization of the United Nations

BIODIVERSITY IN ACTION

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REGIONAL OFFICE FOR EUROPE AND CENTRAL ASIA

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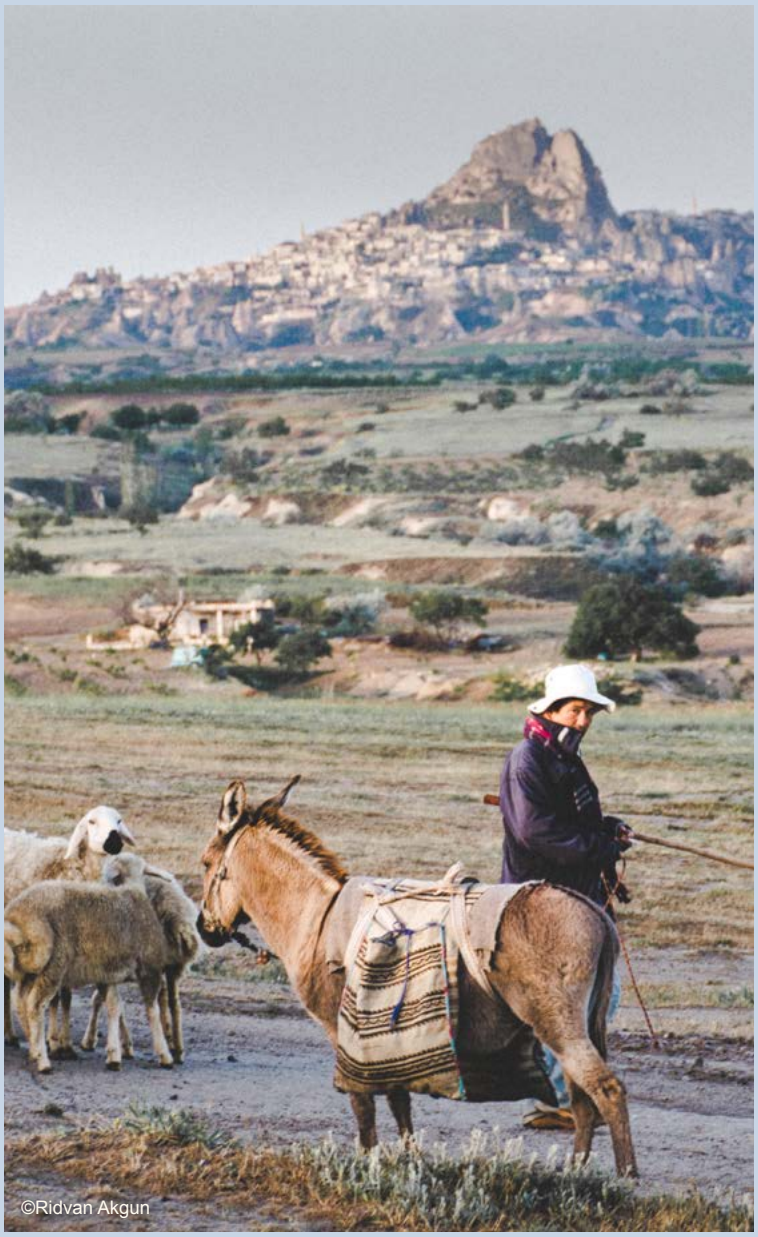
Biodiversity loss and climate change: Interlinked challenges and solutions for food security

Both climate change and biodiversity loss have distorting social and economic impacts on development and cause severe risks for food security, nutrition and livelihoods among rural populations in Europe and Central Asia, most of whom depend directly or indirectly on the agricultural sector. Marginalized communities, including indigenous peoples, play a fundamental role in protecting global biodiversity, and they also are the ones who suffer disproportionately from the impacts of climate change. While the number of people at risk from climate change and associated loss of biodiversity is progressively increasing (IPCC, 2022), the control and mitigation of negative interactions and trade-offs related to climate and biodiversity can bring positive outcomes for people and nature.



Interconnected challenges

Due to numerous and complex interlinks between the global challenges of climate change and biodiversity loss and their shared drivers, each challenge exacerbates the effects of the other, and both alter their joint tipping points.

Climate change, currently driving up to 16 percent of biodiversity loss, is estimated to become the "greatest pressure on biodiversity" by 2070, surpassing the effects of deforestation and agriculture (Newbolt, 2018). It already is influencing the severity and frequency of extreme weather events, such as wildfires and flooding, jeopardizing the resilience of agro-ecosystems and driving the loss of biodiversity for food and agriculture.

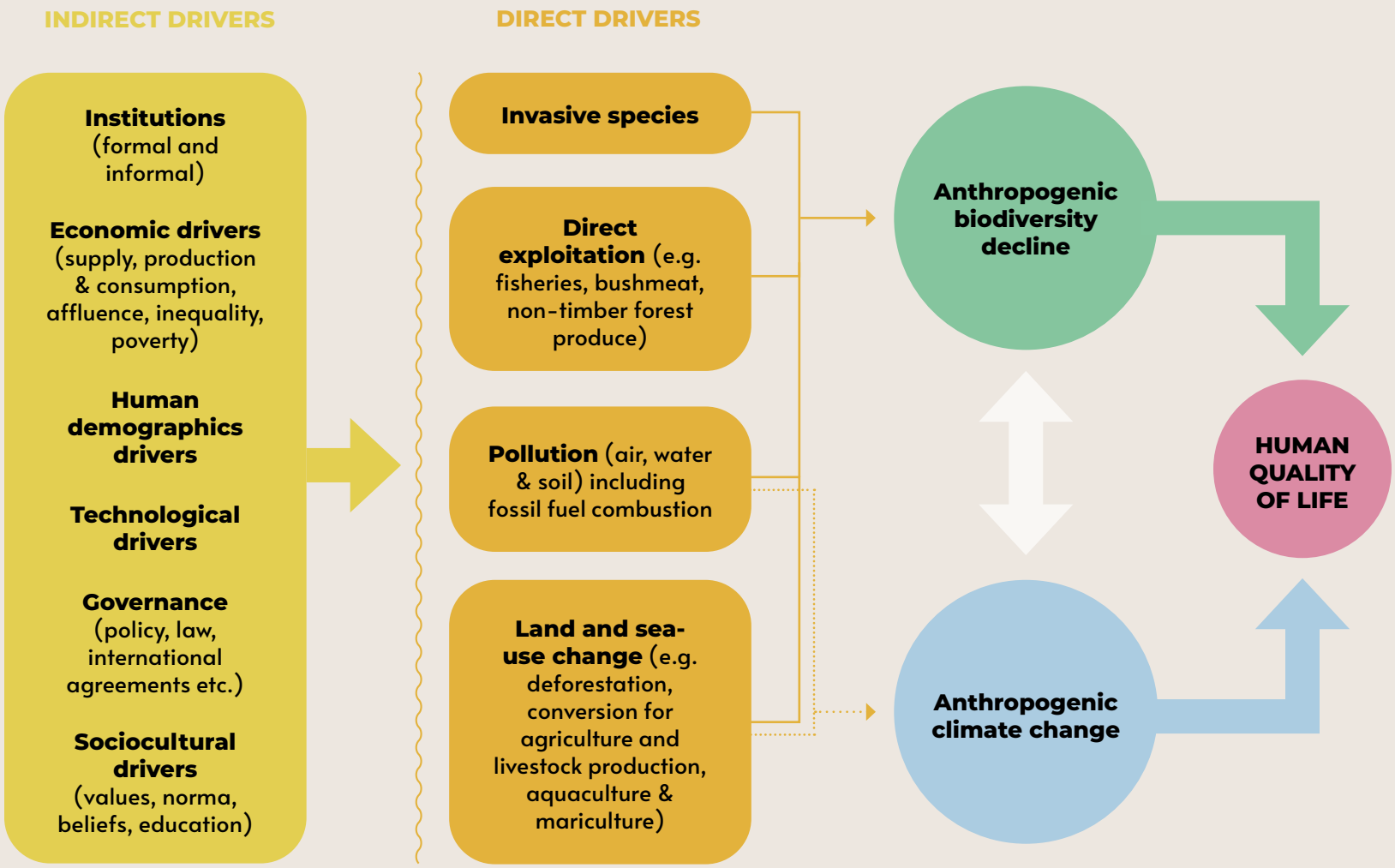


Figure 1.

Indirect and direct drivers of biodiversity loss and climate change due to human activities.
Climate change and biodiversity loss share common underlying drivers, and both impact (mostly in negative ways) people's quality of life.

Source: (Pörtner, Hans-Otto *et al.*, 2021).

Climate change

Climate change disturbs ecosystems, causing declines in biodiversity and changes in the species composition of flora and fauna. The ecosystems of marine, coastal, wetland and high mountain zones are the most sensitive to climate change. Water warming and acidification add to thermal stress, causing disruptions in physiological processes, changes in species' behaviours and biological cycles, and significant shifts in the geographical ranges or seasonal habitats of water species. The speeding of widespread soil erosion is putting fragile ecosystems and their biodiversity under increased risk. The excessive use of fertilizers and pesticides to counteract climate change-induced desertification processes threatens the biodiversity of soil and causes the loss of pollinators. Climate change also intensifies the exposure of local species and varieties to invasive species and pests, which explore new habitats with tolerable climate conditions.

Biodiversity loss

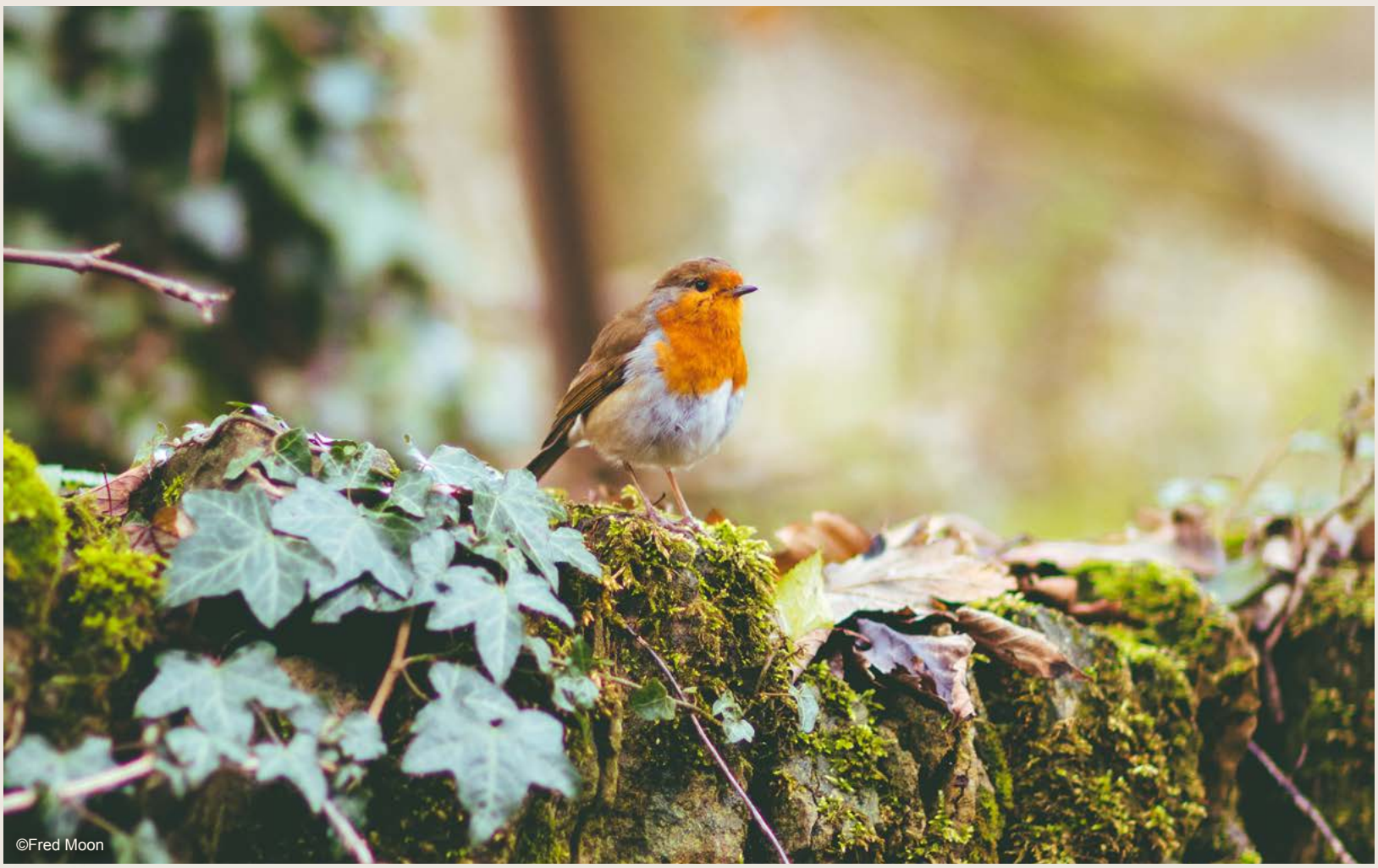
Biodiversity loss hampers the ability to mitigate and adapt to climate change. The loss of biodiversity for food and agriculture – including the loss of crop diversity and local varieties and lower in-field diversity – leads to a decline in the flow of ecosystem services upon which agriculture depends and undermines the resilience of agrifood systems against climate change. Biodiversity loss reduces ecosystem functioning, negatively affecting the ability of landscapes and waters to store CO2. The continued degradation of land, which currently stores four times more carbon than the atmosphere, is exacerbated by climate change threats and is turning many land ecosystems into CO2 emitters (IPCC, 2022). Climate change compromises the ability of agroecosystems and the biodiversity for food and agriculture they contain to provide the service of removing CO2. Furthermore, biodiversity loss threatens humans' ability to adapt to rising climate challenges, inevitably weakening their resilience to climate change. The reduction of biodiversity undermines ecosystems' ability to act as natural buffers against climate-induced extreme weather events, such as providing coastal protection from storms and rising sea levels, reducing flooding, buffering heatwaves and mitigating other risks caused by climate change.

Both climate change and biodiversity loss are major contributing factors to **food insecurity**. Climate change-accelerated heatwaves, droughts and floods damage crops, livestock, fisheries and farming infrastructure, adversely affecting productivity. Rising temperatures and more frequent weather extremes threaten the ecosystems and natural resources upon which agrifood system performance is highly dependent. The loss of biodiversity for food and agriculture, including genetic erosion, increases the vulnerability of agricultural systems to threats (such as pests, pathogens and climate change), decreases land productivity, and jeopardizes pollination. The complex effects of both crises disproportionally affect the food security of small-scale farmers, indigenous people and other vulnerable groups.

Interconnected solutions

The mutually reinforcing and complex nature of climate change and biodiversity loss requires the consideration of a variety of outcomes and the application of coordinated solutions, including nature-based solutions, that deliver the highest benefits and the fewest trade-offs, effectively mainstreaming them together. To activate and orchestrate transformative change within the climate–biodiversity nexus, policy models must be built on the solid evidence of cascading and iterative effects, must be context-specific, and must be integrated with the multiactor governance approach.

To reach the Sustainable Development Goal targets, greater synergies across multilateral environmental agreements – such as the United Nations Framework Convention on Climate Change (UNFCCC) and the Convention on Biological Diversity (CBD) – and policies and instruments are needed to facilitate the simultaneous cessation of biodiversity loss and the mitigation of and adaptation to climate change. The first joint Intergovernmental Panel on Climate Change (IPCC) and Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) report (Pörtner, Hans-Otto *et al.*, 2021) confirms that narrowly focusing on climate change can harm biodiversity, and vice versa, and reaffirms the availability of many policy instruments that acknowledge and build on their inseparable nature while maximizing co-benefits. The most recent IPCC and IPBES reports (IPBES, 2019; IPCC, 2022) continue shedding light on the interdependence of climate and biodiversity, highlighting the importance of carbon-rich ecosystems for both, as activities that prioritize the protection of intact ecosystems, the management of agricultural lands and the restoration of nature score high regarding the co-benefits of mitigation, biodiversity and adaptation.



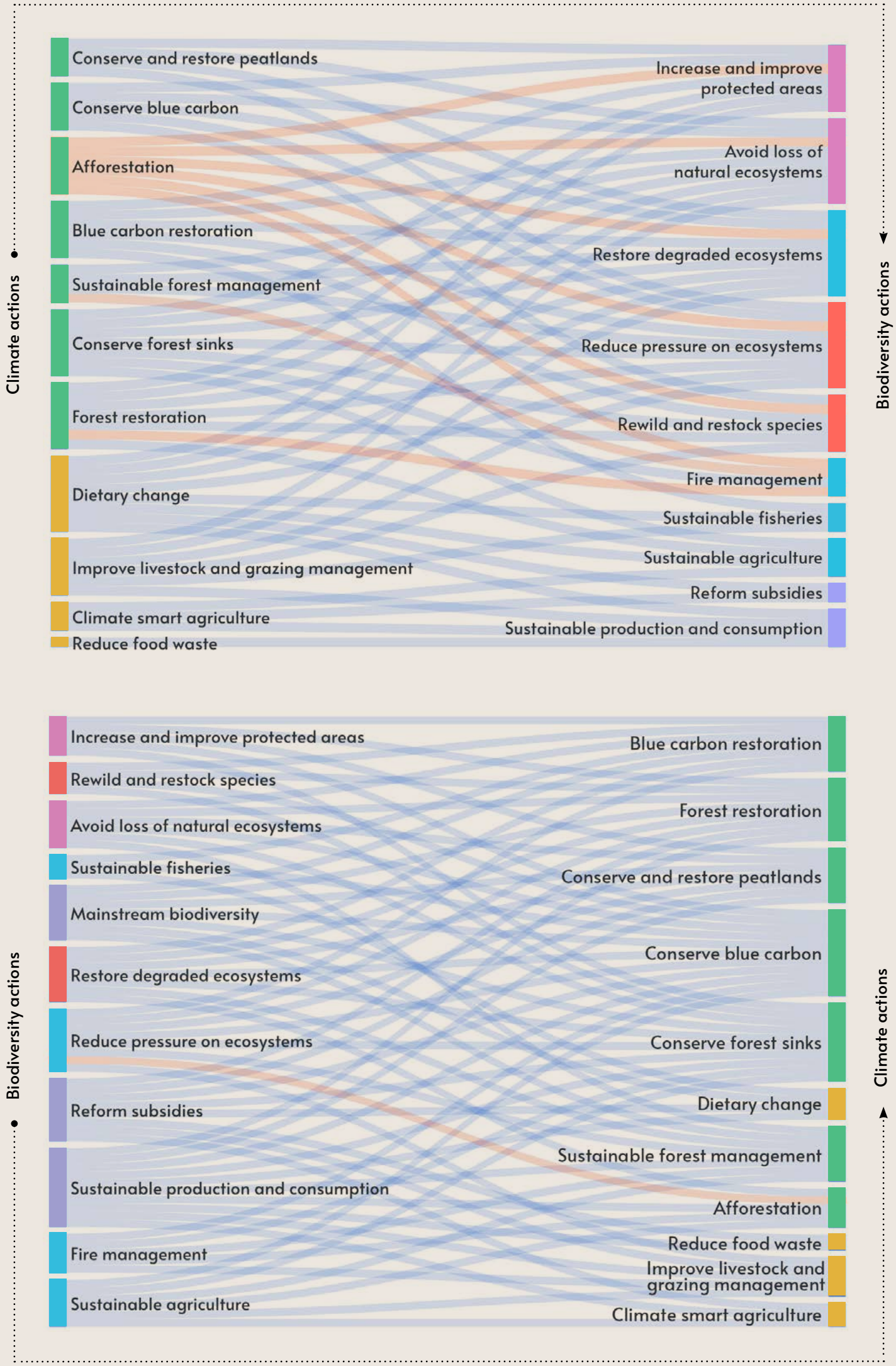
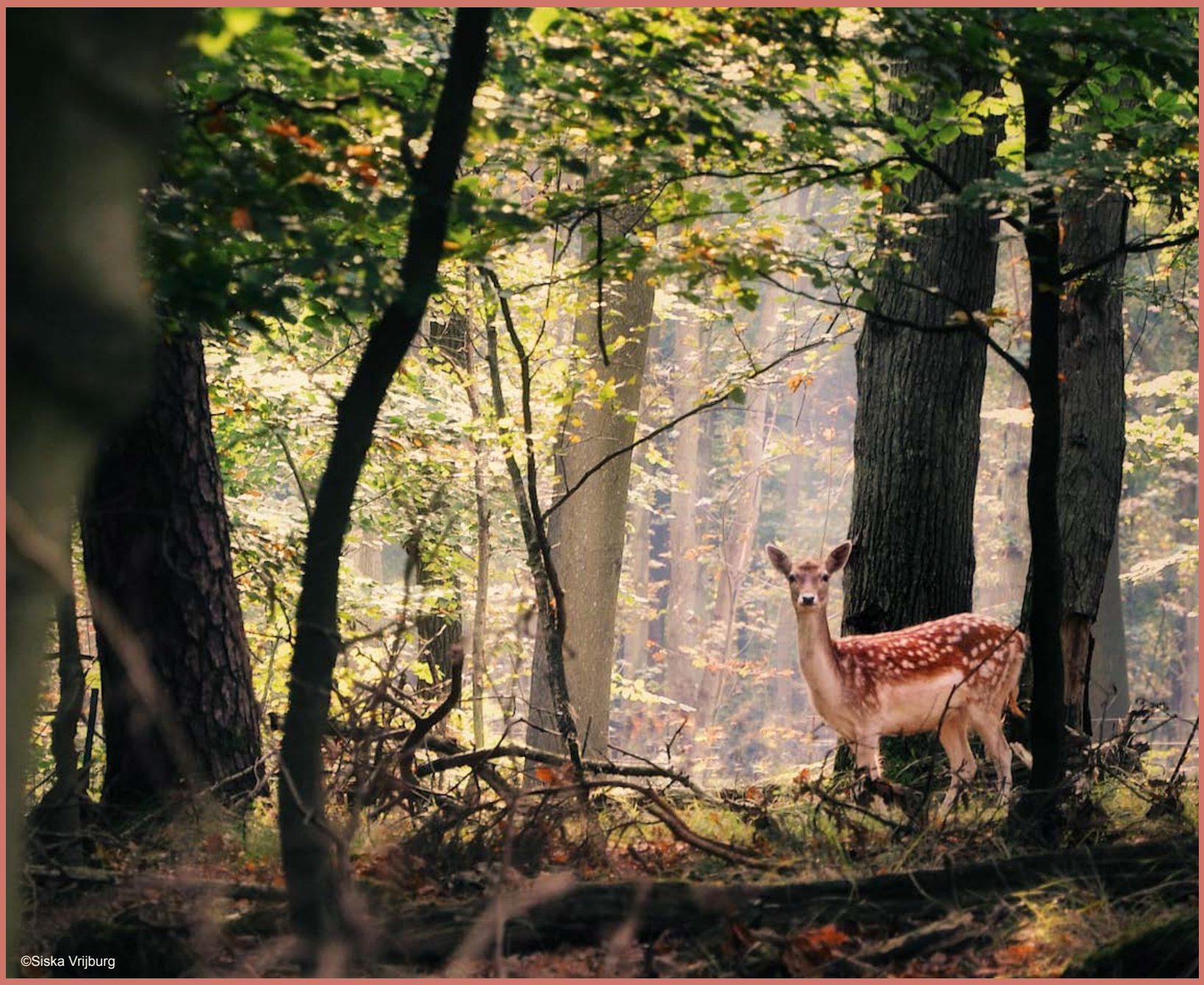


Figure 2.

Sankey diagram mapping the effects (positive and negative) of actions to mitigate climate change on actions to mitigate biodiversity loss, and of actions to mitigate biodiversity loss on actions to mitigate climate change. Blue lines represent positive effects, while orange lines represent negative effects. This network of interaction is evolving as many of the solutions are still in the ideation phase or have not yet been deployed at any sizable scale.

Source: Adapted from Pörtner, Hans-Otto *et al.*, 2021.



EXAMPLE

Afforestation and biodiversity

Afforestation in ecosystems that have not historically been forests and reforestation with monocultures – especially with non-native tree species – can contribute to climate change mitigation but often are detrimental to biodiversity and have controversial benefits for building resilience to climate change. For its part, the restoration of ecosystems with a high diversity of native plant species can improve carbon storage while increasing biodiversity and providing opportunities for co-benefits for climate change mitigation and biodiversity conservation. On the contrary, ecosystem restoration with inadequate location, species or planting density may have downsides for biodiversity.

FAO Strategies

The **FAO global strategies** on mainstreaming biodiversity across agricultural sectors (2020) and on climate change (2022) reflect on connections, synergies and complementarities and address both challenges jointly to enable the coherence of climate and biodiversity planning at global, regional and national levels. Both issues are directly linked to the FAO Strategic Framework 2022–31 and are established – along with gender, governance and nutrition – as cross-cutting themes.

The **FAO Strategy on Biodiversity** underlines the negative impacts of climate change on biodiversity – and thus on food security and nutrition – while acknowledging the contributions of biodiversity in making production systems and livelihoods more resilient to the effects of climate change. In line with this strategy, the FAO Framework for Action on Biodiversity for Food and Agriculture aims to promote the sustainable use and conservation of BFA to provide options for mitigating and adapting to climate change.

FAO's vision for climate change is that agrifood systems are sustainable, inclusive, resilient and adaptive to climate change and its impacts and contribute to low-emission economies while providing sufficient, safe and nutritious foods for healthy diets, as well as other agricultural products and services, for present and future generations, leaving no one behind.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Recognizing the threats posed by climate change to biodiversity and the provision of ecosystem services while valuing their role in adaptation and mitigation, the **FAO Strategy on Climate Change** emphasizes the fundamental role of safeguarding biodiversity and ecosystems for climate-resilient development. One of the strategy's principles, an agrifood systems approach, calls for climate action in synergy with action on biodiversity and other environmental and development goals that relate to agrifood systems. At the national level, FAO is committed to providing policy and legal support in integrating overlapping climate and biodiversity considerations into relevant national plans and coherently integrating biodiversity into the nationally determined contributions and climate objectives in National Biodiversity Strategies and Action Plans (NBSAPs).

Science and innovation underpin a wide range of approaches, technologies and practices that can contribute to making agrifood systems more biodiversity friendly and carbon neutral. Within its mandate to facilitate solutions to agrifood system challenges, FAO has endorsed the **Science and Innovation Strategy** (2022) to leverage the potential of science and innovation to overcome complex challenges, including climate change and biodiversity loss, in an equitable, inclusive and sustainable manner and to mutually reinforce respective FAO strategies.

One-third of global agricultural lands are degraded, and one-fourth are considered severely degraded. Halting degradation and restoring these lands is a priority of the **2021–2030 United Nations Decade on Ecosystem Restoration**, co-led by FAO and UNEP, and will significantly increase food production while benefiting biodiversity and helping tackle climate change.

Regional actions

All three FAO Regional Initiatives in Europe and Central Asia, through their programmes, contribute to actions that may simultaneously bring benefits to climate change mitigation and adaptation and biodiversity conservation and help fulfil restoration objectives that contribute to enhancing food security:

#1 Manage

(RI-3) Supporting countries' capacities to achieve land degradation neutrality (LDN) through enhancing the climate change-LDN nexus approach to sustainable soil, land and pasture management can contribute to **simultaneously improving soil biodiversity and its carbon content.** Thirteen countries in the region are implementing activities that aim at strengthening the enabling environment for LDN.

(RI-1) Capacity development on sustainable and innovative **fisheries and aquaculture** production and management practices for smallholders can help deliver **coupled biodiversity and climate objectives** via eliminating illegal, unregulated and unreported fishing; reducing overfishing and bycatch; broadening the range of cultivated species; and rebuilding stocks of exploited fish populations and the blue carbon sequestration they support.

(RI-3) Tailor-made **restoration solutions for forest landscapes** in the region – with due attention to local biodiversity and ecosystems complexity – are highly effective for both climate change mitigation and biodiversity, with large adaptation co-benefits. To combat the impacts of climate change and counteract the widespread regional threats of forest invasive species and forest fires, **climate-smart management approaches** (as well as knowledge sharing and capacity building) can bring benefits in the form of carbon- and species-rich forest ecosystems and increased food security.

#2 Adapt

(RI-3) Mainstreaming nature-based solutions (NbS) in agricultural sectors – ones that are **not narrowly focused on rapid carbon sequestration – while accounting for protecting and restoring biodiversity** can contribute to climate mitigation and enhance ecosystem adaptive capacity (higher genetic, species and ecosystem diversities reduce the exacerbation of climate change driven by ecosystem changes and allow for keeping adaptation options open), resulting in win-win outcomes for biodiversity and climate.

(RI-1) Enhancing the resilience of smallholders and family farms against climate change, shocks and crises via **biodiversity-based approaches such as supporting farmers' seed banks and promoting genetic variability** helps spread out risk and make systems more resilient to climate change while greatly benefiting biodiversity conservation actions.

(RI-3) By reducing agriculture's impact on natural capital and natural resources depletion and improving soil, water use efficiency and the provision of ecosystem services, **nature-positive agricultural approaches, practices and technologies** (applying fewer or greener agricultural inputs, employing integrated pest management, mimicking natural nutrient cycles, etc.), including based on traditional and indigenous knowledge, maintain and facilitate biodiversity while simultaneously contributing to agrifood ecosystems' capacity to adapt to climate change.

#3 Transform

(RI-2) Regional collaboration with public and private sectors and civil society organizations in target countries to address the problem of food loss and waste at consumer; retail; and hotel, restaurant and café levels has significant potential for **climate change mitigation while reducing the pressures of increased food/feed productivity and land use change that drive biodiversity loss.**

(RI-3) Supporting the enhancement of knowledge and capacities of countries in the region through the development of a regional Nationally Determined Contributions (NDC) policy analysis for 2022–23 and a guideline for the establishment of a measurement, reporting and verification system for forestry with a **nexus approach that acknowledges concurrent climate and biodiversity targets and exploits possible synergies and trade-offs** (such as the introduction of more qualitative targets) can harness transformational change.

EXAMPLE

Vulnerability and resilience

Vulnerability and resilience assessments are a prerequisite to understanding, foreseeing and opening up reflections on actions to support the long-term sustainability of Globally Important Agricultural Heritage Systems (GIAHS) sites. In this respect, the FAO REU sought to describe and test the guidelines to assess interrelated aspects and their co-influence, the vulnerability and resilience of traditional agroecosystems to climate change, and the conservation status of their biodiversity. It is designed as a science-based support tool to guide decision-makers in lining up tailored and effective actions and approaches to ensure the dynamic conservation of GIAHS in the most resilient manner, reaching the targets of adapting to climate change and combating biodiversity loss.

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More information is available at:

Biodiversity
https://www.fao.org/platforms/green-agriculture/en

Managing natural resources sustainably and preserving biodiversity in a changing climate
https://www.fao.org/europe/regional-initiatives/natural-resources/en/

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