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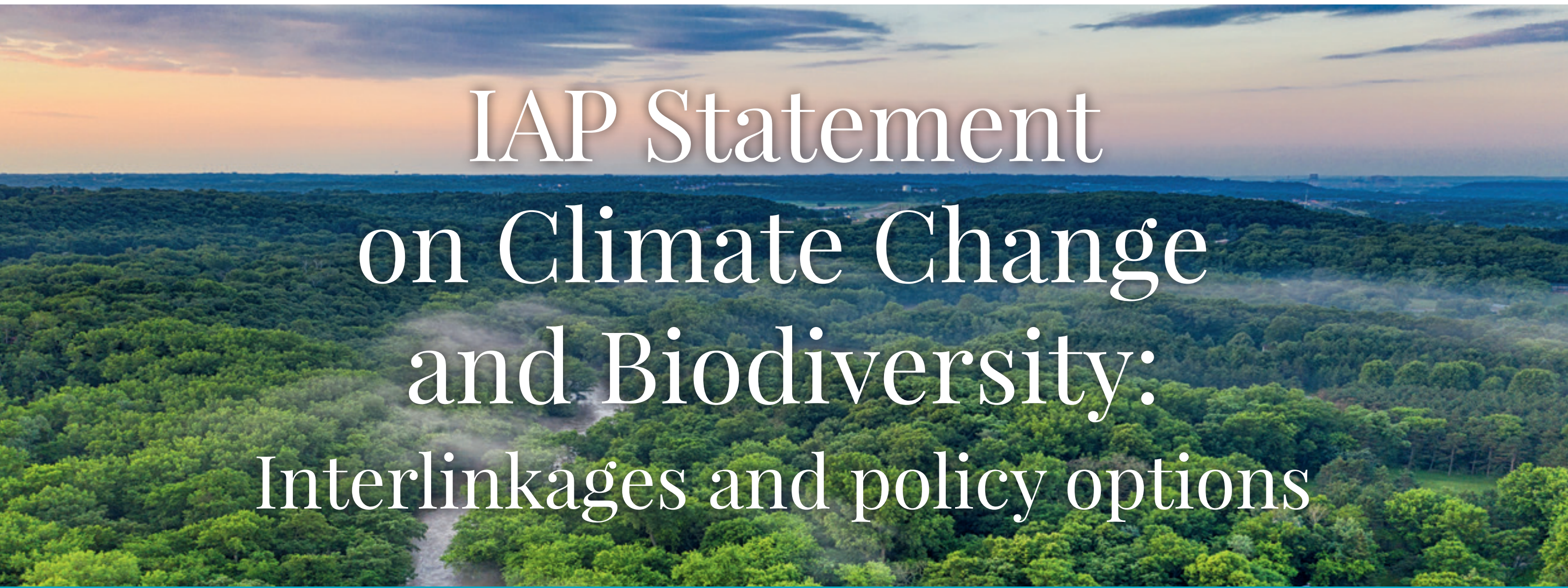

IAP Statement on Climate Change and Biodiversity:

Interlinkages and policy options

Climate change and biodiversity decline are major challenges of our time. Both are predominantly caused by human activities, with profound consequences for people and the ecosystems on which we depend. In 2021 and 2022, major United Nations conferences on biodiversity (COP15) and on climate change (COP26) will be held, providing an opportunity for governments to focus international attention on the interconnectedness and interdependence of climate change and biodiversity. Some policy measures are beneficial in both areas, helping to mitigate and adapt to climate change as well as to conserve and restore biodiversity. However, this is not guaranteed, and some climate actions can undermine biodiversity goals. This IAP Statement examines interconnections between biodiversity and climate change and outlines how measures that benefit biodiversity have the potential to support climate action, and how some aspects of climate action can support biodiversity. It also discusses instances where addressing climate change can undermine efforts to enhance biodiversity.

Key policy recommendations and principles for action

Policy recommendations:

- Build a sustainable food system with climate- and biodiversity-friendly agricultural practices, responsible food trade, and equitable food distribution.
- Reduce rates of natural ecosystem loss and degradation, protect, restore and expand natural ecosystems, and increase landscape connectivity.
- Ensure that expansion of renewable energy systems has positive biodiversity benefits built into its design.
- Recognise, respect and safeguard the rights and livelihoods of local and traditional users of ecosystems when implementing biodiversity and climate change actions.
- Discourage ecosystem-based approaches to climate mitigation that have negative outcomes for biodiversity, such as tree planting in inappropriate ecosystems, monocultures, and unsustainable energy crops.

Principles underpinning biodiversity and climate action:

- **Transformation.** Mitigation at the scale needed to keep the rise in global temperatures to 1.5°C, or to reverse global biodiversity decline, requires a transformative change in the way our societies consume and produce resources.
- **Collaboration.** Governments alone cannot achieve the transformations needed – coordinated climate and biodiversity actions from multiple stakeholders, including the private sector and civil society, are essential.
- **Integration.** Greater understanding of the biodiversity-climate relationship should help to end the separation between the national and international policy frameworks that currently address climate change and biodiversity decline.
- **Additionality.** Where Nature-based Solutions are implemented to help mitigate climate change, they should not delay or lower any ambition to reduce carbon dioxide emissions from fossil fuels or reduce energy use through more energy efficient technologies.
- **Best practice.** The success or failure of Nature-based Solutions and of other responses to climate change and biodiversity issues is dependent on the adoption of best practice and should be evidence-based and tailored to the location.
- **Equity**. The diversity of environmental and climate policies, from protected areas to payments for ecosystem services, should acknowledge the different dimensions of equity to ensure a sustainable and equitable future that leaves no one behind.

SECTION A. Understanding the interlinkages between climate change and biodiversity

A1. How climate change, biodiversity and ecosystems affect each other

What is biodiversity and why is it important?

Biodiversity is the variety and variability of life on Earth, from genes to ecosystems, and the interactions between species, together with the ecological and evolutionary processes that sustain it.

Countless interactions between organisms sustain human life on the planet, providing physical, cultural, recreational and spiritual benefits to society, often referred to as 'ecosystem services' or 'nature's contributions to people'. The loss of biodiversity can threaten these key benefits, including some as essential as supplies of food and clean water, or regulation of the climate. Biodiversity loss may also cause outbreaks of pests and pathogens.

How does climate change affect biodiversity?

Aspects of climate change, such as rising temperatures, changing rain and snowfall patterns and extreme weather events, have a range of impacts on biodiversity.

In marine environments, climate change is causing intensified marine heatwaves, loss of oxygen and sea level rise, which lead to already observed changes in biodiversity, ecosystem functioning and livelihoods such as fishing, particularly for coastal ecosystems[1]. The impacts of climate change are compounded by ocean acidification, which is also caused by increased carbon dioxide concentrations. Many terrestrial, freshwater and marine species have shifted their geographic ranges, seasonal activities, migration patterns, abundances and the ways in which they interact with other species in response to ongoing climate change[2].

The rapid pace of climate change in the 21st century, with a temperature rise in excess of 3°C possible within this century[3], could mean that many species fail to adapt or migrate at sufficient speed, particularly in more fragmented landscapes and for rare or specialist species. Some plant and animal species may become extinct[4] and certain populations will decline whilst others will increase, affecting species interactions such as predation, competition and the spread of diseases.

How do ecosystems affect the climate?

Ecosystems affect the climate in several ways, and their biodiversity

secures climate-regulating functions. Ecosystems influence the climate by altering the properties of the land surface and the flows of energy and matter in the oceans and on land. Vegetation increases the rate of water cycling to the atmosphere, which lowers surface temperatures, increases atmospheric humidity and affects local cloud formation and, in some cases, also the rate or intensity of rainfall. At a larger scale, these features affect atmospheric circulation and, hence, regional and global climate patterns.

Ecosystems, through vegetation, animals, microbes and soils, are major reservoirs of carbon. The total amount of carbon stored in the terrestrial biosphere is three times that found in the atmosphere as carbon dioxide[5]. Changes in these carbon reservoirs, caused by human activity and climate change, can significantly affect the Earth's climate.

The biodiversity within ecosystems makes them more resilient to varying and shifting climates and other disturbances.

A2. How is biodiversity changing and what role is climate change playing?

Wildlife worldwide has been negatively impacted by human activities causing a decline in abundance of many species in the last half-century[6,7,8]. Around one million animal and plant species are now estimated to be threatened with extinction as a result of human activity[4]. On average, local species richness, the number of different species in an ecosystem, is estimated to have fallen by around 14% due to human activity, but by more than 75% in the worst affected habitats[9].

The main driver of biodiversity decline in the past 50 years has been change in land and sea use (especially the expansion and intensification of agriculture, including tropical deforestation as the largest single cause of biodiversity loss), followed by direct exploitation of organisms, such as fisheries; climate change; pollution; and the invasion of species, especially on islands[4].

While climate change has yet to cause major species decline in some ecosystems, in others it has already resulted in severe reductions in population size, changes in composition, and extinction. For example, warming-induced coral bleaching has caused declines of up to 90% in coral populations in some regions, leading to shifts to alternative types of organisms such as macroalgae, or broad-scale transformations in coral species composition[10,11]. A 2°C warming is expected to cause a decline of greater than 99% of coral reefs[23]. On land, the impacts of climate change on the diversity of plants and vertebrates are predicted to exceed those of land use by 2050[12,13]. For mountain-top species, these changes could be particularly dramatic in the long term as they won't be able to migrate to higher elevations and are likely to face competition from species migrating from lower altitudes[14].

Species decline and other impacts of global warming would be significantly reduced by limiting warming to 1.5°C. A recent study suggests that whereas 4% of vertebrates, 8% of plants and 6% of insects have been projected to lose over half of their climate-determined geographic range at 1.5°C of warming, this will rise dramatically under 3°C warming to 26% of vertebrates, 44% of plants, and 49% of all insects. Under 3°C of warming, there may also be critical declines in some whole habitats, such as alpine, mountain and high-latitude ecosystems and some tropical forests[15,17].

A3. How can biodiversity support climate change adaptation and mitigation efforts?

Biodiversity and the ecosystem functions associated with it can support climate action in many ways, particularly through well-designed and implemented 'Nature-based Solutions' (NbS)[16].

These actions are intended to protect, sustainably manage and restore ecosystems that address societal challenges such as climate change, while providing human well-being and biodiversity benefits. These are reasonably well understood and available for deployment in terrestrial systems, but less advanced in marine systems[17].

NbS that support both climate change mitigation and adaptation include protecting and restoring ecosystems such as peatlands and seagrass meadows, and reforesting woodland and mangroves, thus enhancing soil and biomass carbon sequestration whilst increasing resilience to climate change impacts[14]. Scaling up nature-based

actions to their maximum possible extent has been estimated to result in a potential net absorption of around 11 billion tonnes of CO_2-equivalent per year until the mid-century at least, equivalent to around 27% of current fossil-fuel CO_2 emissions, through enhanced sinks and reduced sources of greenhouse gas (GHG) emissions[18,19]. However, NbS will allow us to meet climate targets only in tandem with strict and rapid decarbonisation of the economy; the carbon-holding capacity of the biosphere is limited compared to current and potential fossil fuel emissions.

While some NbS, such as improving soil carbon sequestration, can be applied without changing land use, a key consideration for others is how much land conversion is required and what potential trade-offs may emerge against existing uses and biodiversity.

SECTION B. Action plan – integrated policy options for climate change and biodiversity

How to develop a coordinated effort to combat both climate change and biodiversity decline? First, this section sets the scene by looking at the current international climate and biodiversity policy context. Second, it proposes six principles to guide a joined-up climate and biodiversity policy response. Third, it explores available options for better integrating global climate and biodiversity policymaking at a governance level. The final section provides guidance on which climate measures should be encouraged or discouraged based on their impacts on biodiversity.

B1. International policy context

In 1992, at the Rio de Janeiro 'Earth Summit', the international community established structures to address climate and biodiversity issues in the form of the UN Framework Convention on Climate Change (UNFCCC) and the Convention on Biological Diversity (CBD), respectively.

The year 2021 should be a historic turning point for the global environment as it marks the start of the *decade of action* towards the Sustainable Development Goals (SDGs), which integrate climate change and biodiversity with other socio-environmental targets to be achieved by 2030. Also, in 2021

and 2022, both the UNFCCC and CBD are due to hold their COP26 and COP15 conferences, respectively. In prospect are new targets to cut emissions, new goals for biodiversity, new forms of collaboration between the conventions, and a new ambition for progress and social justice as part of the hoped-for global recovery from COVID-19. This convergence of events presents a unique opportunity to build on previous academy work[20] and to make a major difference towards achieving a more sustainable and fairer future for people and nature. For example, were the post-2020 biodiversity targets to integrate climate change, they would result in more realistic targets which could also contribute to the mitigation and adaptation of climate change[21].

B2. Six principles to guide a joined-up climate and biodiversity policy response

Here we introduce six principles that should be considered to enable a joined-up climate and biodiversity policy response.

Transformation. Modelling and scenario analyses demonstrate that mitigation at the scale needed to keep the rise in global temperatures to 1.5°C, or to reverse global biodiversity decline, requires a transformative change in the way our societies consume and produce resources[22]. Such change would include rapid and far-reaching transitions in consumption supply chains, energy production and use, land use, infrastructure, and lifestyle[4,23,24]. The 2021 Dasgupta Review and recent international climate change and biodiversity assessments have highlighted the need to transform the economic system. Examples of ways to do this include: (i) complementing GDP (Gross Domestic Product) with measures that include multiple values for nature by reducing and redirecting some of the subsidies for, and financial investment in, fossil fuel, agriculture, fisheries, forestry, transportation and mining towards sustainable policies and practices; (ii) internalising environmental and social externalities (according to the International Monetary Fund these amount to about US$5 trillion in 2017[25]); and (iii) embracing a circular economy[2,5,26,27].

Collaboration. Governments alone cannot achieve the transformations needed – coordinated climate and biodiversity actions from multiple stakeholders, including the private sector and civil society are essential. Collaborations should be made at all

levels from sub-national (municipality, province/state) to national and international levels. Just as the Paris Agreement, based on governmental collaboration, has become a cornerstone to mitigate climate change, a global treaty for biodiversity could be decisive in providing an overall framework and goal to conserve the diversity of life on Earth[28].

Integration. Greater understanding of the biodiversity-climate relationship would help ending the separation between the national and international policy frameworks that currently address climate change and biodiversity decline. It is important for policymakers to look at impacts in both areas when considering any intervention.

Additionality. Where NbS are implemented to help mitigate climate change, they should not delay or lower ambition to reduce carbon dioxide emissions from fossil fuels or reduce energy use through more energy efficient technologies[29]. Early projections indicate that even ambitious deployment of NbS worldwide can provide only 0.1-0.3°C of lowered global peak temperatures, a significant contribution but not a solution to climate change in the absence of ambitious fossil fuel emissions reductions[30].

Best practice. The success or failure of NbS and of other responses to climate change and biodiversity issues is dependent on the adoption of best practice. In many cases, best practice will involve place-specific NbS: the appropriate solution for a specific location and context. The spread of best practice requires a well-defined framework for NbS that includes evidence-based standards and guidelines[31,32] to ensure that they avoid unintended or maladaptive outcomes[33,34] and that facilitates their monitoring.

Equity. The strong linkages between environmental policies and society make equity a key component of environmental governance[35]. The diversity of environmental and climate policies, from protected areas to payments for ecosystem services, should acknowledge the different dimensions of equity to ensure a sustainable and equitable future that leaves no one behind[36,37]. Early engagement with stakeholders who would be affected by environmental policies is fundamental to ensure equitable outcomes.

B3. Integration of global policymaking in both areas

The current separation in global governance frameworks means that scientific advice and policymaking for the deeply interwoven issues of climate change and biodiversity decline are handled by separate administrative and scientific organisations and by different intergovernmental conventions who have historically had limited interaction. If the two issues are to be managed holistically, links between the two governance systems need to be strengthened. In particular, scientists need to engage with policymakers to ensure that NbS achieve their potential to tackle both the climate and biodiversity crises while also contributing to sustainable development. This will require systemic change in the way we conduct research and run institutions[9].

Practical steps to do this could include:

- promoting holistic sustainability frameworks, such as the SDGs;
- aligning climate and biodiversity goals and targets at various scales;
- ensuring the new global biodiversity goals to be adopted by the CBD for the next decade are holistic and ambitious[38];
- increasing liaison between the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) and the Intergovernmental Panel on Climate Change (IPCC), through initiatives such as their joint workshop in December 2020;
- strengthening the role of the Joint Liaison Group on the Rio Conventions[1]; and
- exploring funding for NbS, particularly via the UNFCCC's planned forum on 'Finance for nature-based solutions'[39].

B4. Guidance on policy measures

This section sets out which land-based and sea-based climate policies are beneficial for biodiversity and should therefore be encouraged, and which are not and should therefore be discouraged.

Policy measures to encourage:

Building a sustainable food system. One third of crops are fed to livestock rather than humans[40], and a third of food globally is lost or wasted[41]. Animal agriculture is a major contributor to global biodiversity loss[42]. A reduction in meat and dairy consumption and a significant reduction in food loss and waste would not only significantly reduce GHG emissions[43,44], which itself benefits biodiversity through limiting climate change, it would also reduce pressure for deforestation with associated biodiversity loss and free land and resources for biodiversity recovery and the wider use of NbS[23]. As such, dietary shifts for people who can choose what they eat and reduction in food loss and waste create the enabling conditions that make other actions outlined below more feasible[44].

A revolutionary change in farming is essential to meeting the goals of the Paris Agreement and reducing biodiversity decline. To achieve that aim, further research on agriculture, which is underfunded compared to other key human activities, should be a priority. Moreover, farmers should be offered financial and other incentives to support climate and biodiversity friendly activities, such as agro-ecological practices[45].

Sustainable and responsible food trade, and equitable food distribution. Since the price of food and other products does not incorporate environmental externalities, too often, many countries benefit from cheap products that are grown unsustainably in other countries, with the latter having to bear the burden of environmental degradation without benefiting from the food. Avoiding importing food that has been produced unsustainably elsewhere, and instead supporting sustainable production modes and distributing available food fairly amongst those who need it is a critical part of a sustainable and responsible food system.

Reducing rates of natural habitat loss and degradation, particularly of forests. Deforestation, currently mainly in the tropics and subtropics, is the major contemporary cause of terrestrial biodiversity loss and local climate change, and has contributed 5.7 $GtCO_2$ annual emissions over the last decade, 14% of global CO_2 emissions[46]. Reducing deforestation and degradation rates can be achieved through both supporting *in situ* conservation, resourcing alternative development pathways and reducing international demand for products of deforestation[47]. Reducing deforestation would have the health co-benefit of lowering the risk of disease outbreaks caused by pathogens present in these areas passing from wildlife to humans[2].

Natural ecosystem restoration and expansion. Expansion of native ecosystems, through restoration and rehabilitation, in a network that facilitates connectivity and species migration, will enhance biodiversity and carbon storage in ecosystems. Natural forests have been calculated to be 40 times better than plantations at storing carbon[48]. A global forest restoration effort could absorb 2 $GtCO_2$/year. Ecologically appropriate restoration of non-forest ecosystems, such as savannas and grasslands, can increase carbon stocks in soils and maintain biodiversity.

Peatland preservation and restoration. Peatlands have been estimated to store more than 600 Gt or 20% of the global

1 The mandate of the Joint Liaison Group, which comprises the Executive Secretaries of the CBD, the United Nations Convention to Combat Desertification (UNCCD) and the UNFCCC, is to enhance coordination among the three Rio Conventions and explore options for further cooperation.

2 Although considerations of human health are not a primary focus of this Statement, such considerations are of critical importance in understanding the benefits of retaining biodiversity and tackling climate change, and thus are being addressed in an ongoing IAP project on climate change and health: https://www.interacademies.org/project/climate-change-and-health.

stock of soil carbon, twice as much as the world's forests[49], on only 3% of its land. Peatland preservation and restoration has multiple benefits for amenity, water resources, flood protection, biodiversity and the climate. For example, restored peatlands show renewed growth of *Sphagnum* moss species and attract invertebrates and birds[50]. Existing drained peatlands globally are expected to cumulatively release the equivalent of nearly 2 $GtCO_2$ that could be saved by restoration[51].

Extension and enforcement of Marine Protected Areas (MPAs). As well as restoring and protecting biodiversity, and helping it to be resilient to climate change, many MPAs support climate resilience, either by protecting the coastline from severe weather events, for example through coral reefs or mangroves, or by absorbing carbon dioxide in seagrasses, salt water reedbeds and muddy habitats[52,53]. To be effective, MPAs should be extended with new investment in their management and enforcement of protection rules.

Biodiversity friendly renewables. Upscaling of renewable energy production should avoid negative impacts on biodiversity where possible. For example, engineers can design offshore wind farms to be biodiversity friendly and attract species under water[54]. Techniques include structures on which new reefs can grow along with fish habitats and sea grass settlements. Overall, marine sites where renewable energy technologies are being deployed should be managed to optimise potentially positive effects, by adopting exclusion zones from other destructive activities such as bottom trawling and dredging and support the colocation of other industries such as mariculture that support wider benefits from nature[55]. On land, solar farms should avoid fragmenting habitats or becoming barriers to the movement of animals[56]. It is also important to source raw materials for renewables in a way that ensures minimal damage to biodiversity.

Increased landscape connectivity. Creating corridors (for example restoring river corridors planting and connecting conservation efforts) and increased coverage of semi-natural ecosystems in intensively used landscapes will assist species migration and support ecosystem

resilience in a changing climate. Increasing green spaces in cities is vital for adaptation as they have a cooling effect and support biodiversity and its connectivity. They contribute to climate change mitigation through carbon storage, and enable many biodiversity-associated mental and cultural welfare benefits to urban people[57,58].

Policy measures to discourage:

Tree planting in inappropriate ecosystems. Expanding tree cover in ecosystems that do not naturally support expansive tree cover (e.g. grasslands, grassland savannas, temperate peatlands) has negative consequences for biodiversity[59] and ecosystem functioning. In the case of peatlands, planting

trees can also have negative climate consequences by resulting in drainage and consequent release of soil carbon reserves.

Monocultures. Planting trees, either for bioenergy or as long-term carbon sinks, should focus on restoring and expanding native woodlands, as well as avoid creating large monoculture plantations that do not support high levels of biodiversity. Simple targets such as ‘numbers of trees planted’ ignore biodiversity considerations, such as long-term survival of trees or stewardship, and can be misleading, potentially contributing to policy failure and misuse of carbon offsets[32].

Unsustainable energy crops. The modelled benefits of Bioenergy with Carbon Capture and Storage (for example, the use of crops to generate power and fuel while capturing CO_2) to mitigate climate change are significant. However, the scale of some modelled deployments would either take up large amounts of land now used for food production or have negative effects on the amount of land available for preservation or restoration of natural ecosystems[60]. Policy should also limit use of fuelwood pellets and other feedstocks for bioenergy where it might intensify pressure on semi-natural ecosystems.

Disempowerment of indigenous and local communities: Biodiversity and climate change actions should recognise, respect and safeguard the rights and livelihoods of local and traditional users of ecosystems[61].

Conclusion

Climate change and biodiversity are inherently connected and addressing them is central to achieving the SDGs. While a warming planet leads to biodiversity decline, NbS can contribute to both climate change mitigation and adaptation. However, climate change and biodiversity are governed separately at the international and often at national levels, hindering solutions that could address both issues.

By better integrating climate and biodiversity policies at international and national levels, the full potential of biodiversity to support climate action could be leveraged, whilst at the same time helping to reverse the ongoing decline in biodiversity[62].

Research shows that, although some degree of climate change and biodiversity loss are unfortunately now unavoidable, we still have time to limit profound consequences for people and the ecosystems on which we depend. The year 2021 could be one of the turning points in history, in which the international community collaborated to make a long-lasting difference by streamlining and integrating climate change and biodiversity policies and embarking on a pathway towards a stable climate and a vibrant biosphere.

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Academies that have endorsed the Statement on Climate Change and Biodiversity (October 2021)

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Academy of Sciences of Albania
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