BiodivClim call text

The Funding Organisations in the BiodivERsA network
have joined efforts to organize and fund a

International call for transnational research proposals on

"Biodiversity and Climate Change"

(1) Context

Globally agreed priorities for the next decade have been expressed in the seventeen United Nations Sustainable Development Goals (SDGs)[1]. These include two goals explicitly linked to biodiversity and the value of nature to society (i.e. Goal 14, *Life below water*, and Goal 15, *Life on Land)*, as well as Goal 13, which focuses on climate action and refers to the key role of the UNFCCC and Paris Agreement process. Initial work has revealed that the 17 goals are intimately connected with one another[2] such that it will be difficult and undesirable to achieve any one of them without simultaneously considering the others[3]. The link is in some cases synergistic, meaning that addressing one goal will at the same time advance progress on another goal or make such achievements easier or more robust. In other cases, there are tensions and trade-offs between goals; here, the single-minded pursuit of one goal may undermine the possibilities of progress on another. Actions to achieve the SDGs should, as far as possible, be designed and implemented in an integrated manner. This is particularly important in cases where interactions are very strong, such as for challenges related to climate change and biodiversity, as also stressed in the recent IPBES Global Assessment report[4].

Connections between biodiversity and climate change are now recognised as being of vital importance. On one hand, the Aichi target 15 of the Convention on Biological Diversity states that improving biodiversity status can greatly help to enhance ecosystem resilience and the contributions biodiversity can make towards climate change mitigation and adaptation[5]. On the other hand, climate change affects other biodiversity pressures[6], highlighting the importance of considering interactions between direct and indirect drivers of biodiversity and of climate change[7]. These interactions are strong, bi-directional, and often - but not always - positive (i.e. actions in favour of addressing one are also beneficial to the other). For instance, the recent IPCC report on global warming of 1.5°C highlighted the synergies and trade-offs between actions that are often envisaged to tackle climate change-related threats to biodiversity loss. The recent IPBES global assessment[8], the assessment on Land Degradation and Restoration Assessment[9] and IPCC Special Report on warming of 1.5°C[10] also showed the considerable demands that may be placed on biodiversity due to both mitigation and/or adaptation actions to address the causes and consequences of climate change. While the main pressures on terrestrial biodiversity are currently habitat loss and degradation and the main drivers of biodiversity loss in the aquatic domain are overharvesting, pollution and habitat degradation[11], drivers such as human population growth, urbanisation, land use change, consumption life style and resource exploitation present key threats to biodiversity as a whole and some of these drivers can be directly or indirectly associated with climate change[12].

Climate-induced biodiversity changes have also subsequent effects on a range of ecosystem functions and services - and more generally nature's contributions to people - from the local to global scales[13]. This includes impacts on the processes by which ecosystems help to regulate the climate (e.g. regulation of greenhouse gas emissions) as well as diminishing valued landscapes and challenging long-held belief systems related to nature and stewardship. Feedback processes involving biodiversity and ecosystems may in turn amplify or diminish the effect of climate change, while societal responses to changing biodiversity and natural systems may shape the possible range of actions and approaches to biodiversity conservation and climate change[14]. Such feedback processes may also act through feedbacks of altered biodiversity status and ecosystem services on climate change drivers.

This growing understanding of the intricate relationships and feedback processes between climate change and biodiversity shows that our capacity to avoid approaching or overstepping these two planetary boundaries[15,16] requires that both aspects are considered in a holistic way. Addressing the impacts of climate change on biodiversity and feedbacks on climate requires integrative knowledge and new ways of thinking. Necessary approaches should not only identify challenges, but also lead to the actions and solutions that are needed to better preserve biodiversity, regulate climate and reinforce the resilience of socio-ecological systems. Such research could greatly contribute to the implementation of the post-2020 global biodiversity framework[17] and the Paris Agreement.

[1] https://sustainabledevelopment.un.org/?menu=1300
[2] In particular, it has been estimated that achieving 30% of the SDG targets depends on biodiversity and ecosystems (Conservation International)
[3] International Science Council (2017) A guide to SDG interactions: from science to implementation.
[4] IPBES. 2019. Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science- Policy Platform on Biodiversity and Ecosystem Services. E. S. Brondizio, J. Settele, S. Díaz, and H. T. Ngo (editors). IPBES Secretariat, Bonn, Germany.
[5] https://www.cbd.int/sp/targets/rationale/target-15/
[6] CBD. Global Biodivesity Outlook 3. https://www.cbd.int/gbo3/?pub=6667&section=6711
[7] Sotirov M. et al. (2018) Resilience through policy integration in Europe? Domestic forest policy changes as response to absorb pressure to integrate biodiversity conservation, bioenergy use and climate protection in France, Germany, the Netherlands and Sweden. *Land Use Policy* 79, 977-989.
[8] IPBES. 2019. Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science- Policy Platform on Biodiversity and Ecosystem Services. E. S. Brondizio, J. Settele, S. Díaz, and H. T. Ngo (editors). IPBES Secretariat, Bonn, Germany.
[9] https://www.ipbes.net/deliverables/3bi-land-degradation
[10] https://www.ipcc.ch/sr15/
[11] For drivers of biodiversity changes in oceanic islands, see, e.g., Caujapé-Castells J. (2010) Conservation of oceanic island floras: Present and future global challenges. Perspectives Plant Ecol Evol Systematics 12, 107-129.
[12] IPBES. 2019. Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science- Policy Platform on Biodiversity and Ecosystem Services. E. S. Brondizio, J. Settele, S. Díaz, and H. T. Ngo (editors). IPBES Secretariat, Bonn, Germany.
[13] Ibid
[14] Wang B. et al. (2018) Biodiversity matters in feedbacks between climate change and air quality: a study using an individual-based model. Ecol. Appl. 28, 1223–1231.
[15] Steffen W. et al. (2015). Planetary boundaries: guiding human development on a changing planet. *Science* 347/6223.
[16] Sterner T. et al. (2019) Policy design for the Anthropocene. *Nature Sustainability* 2, 14–21.
[17] https://www.cbd.int/post2020/

The tight coupling between climate, ecological processes and biological diversity offers important opportunities. Indeed, many studies have shown that actions nurturing diverse living organisms and their interactions and making ecosystem processes more resilient may be among the lowest-cost, least-regret and most rapidly-deployable ways of limiting global temperature rise to below the Paris Accord target[18]. Further, there are promising signs that in many circumstances, nature-based solutions (NbS[19,20,21]) have the potential to act as a cost-effective and sustainable approach to climate change mitigation along with adaptation of (socio-)ecological systems and land/sea-scapes to climate change, while providing wider sustainability benefits to people. In some cases, however, working with nature to mitigate or adapt to climate change can have detrimental and unintended or unanticipated consequences for biodiversity (e.g. widespread afforestation or planting of bioenergy crops) and consequently for the ecosystem processes underpinning the delivery of ecosystem services. It is therefore imperative that the interactions between biodiversity and climate change are understood with sufficient detail and confidence so they can be incorporated into decision-support models and tools – ranging from global earth system models to local best-practice guidelines. Such approaches should consider the role that climate change has on biodiversity and vice versa, the potential of nature-based solutions for climate change mitigation (where ecosystem services are used to reduce greenhouse gas emissions while conserving and expanding carbon sinks) and for climate change adaptation (the maintenance of ecosystem services that are necessary for good quality of human life and for reducing the impact of anticipated negative effects of climate change). In this way it may be possible to plot pathways which address these two great issues of our time, while improving human well-being[22].

(2) Priorities of the call

This call aims to support transnational research projects jointly addressing issues at the interface between biodiversity and climate change, and across a range of spatial and temporal scales in order to advance knowledge and support evidence-based and reflected decision-making. Projects addressing only biodiversity issues or only climate change issues will not be considered within the scope of the call.

Broad definitions of climate and biodiversity changes are considered for this BiodivERsA-EC COFUND programme. Applications should consider one or more of the different facets of biodiversity (i.e. changes in the different levels of biological diversity23) and their drivers. Applications should also consider one or more of the multiple components of climate change (including changing atmospheric composition and changes in the mean, variability and extremes of many relevant climate variables) and its drivers. This implies to account as needed for the social, political, economic and/or cultural phenomena directly and indirectly

[18] https://en.wikipedia.org/wiki/Paris_Agreement
[19] Cohen-Shacham, E. et al. (2016) Nature-based Solutions to address global societal challenges. IUCN, 97 pp.
[20] Eggermont H. et al. (2015) Nature-based solutions: new influence for environmental management and research in Europe. GAIA 24: 243 – 248. https://www.ingentaconnect.com/content/oekom/gaia/2015/00000024/00000004/art00010
[21] European Commission. (2015) Towards an EU Research and Innovation policy agenda for Nature-Based Solutions & re-naturing cities. Horizon 2020 Expert Group. ec.europa.eu/newsroom/horizon2020/document.cfm?doc_id=10195
[22] Note that Policies for such nature-based mitigation and adaptation have been developed and implemented to some extent in different parts of the world and it would also be valuable to analyze the lessons learnt.

underlying these biological and biophysical changes.

Projects may cover a broad range of methodological approaches (experimentation, data analysis from observations and monitoring[24], modelling, scenarios, quantitative and qualitative social science methods[25], participatory processes, or a combination of these). Preference will be given to projects that will seek to inform strategy and actions contributing to the achievement of major international policy goals (e.g. CBD Aichi targets, post-2020 global biodiversity agenda, UNFCCC Paris Agreement goals, UNCCD land degradation neutrality, UN Sustainable Development Goals) and regional policy goals (in particular EU policies). Applicants should consider how the knowledge they will produce can be scaled up or generalized beyond the studied location(s), disseminated in outreach actions and if possible embedded in order to maximize expected societal impact. Research projects should also look to provide information that will inform policy makers, authorities, institutions and practitioners concerned with decision-making, planning, designing and managing a broad range of environments and outreach to society.

The intention of this BiodivERsA programme co-funded by the European Commission is to support research projects in which the approaches and skills of natural sciences, social sciences and humanities are integrated as needed to address the specific objectives of each research proposal.
This programme also aims at funding transdisciplinary research projects demonstrating potential societal and policy impact. In this context, the participation of stakeholders (including private stakeholders) in research proposals is welcome.

This programme covers both continental and insular areas. Research on insular systems such as those of the Outermost Regions (ORs) and Overseas Countries and Territories (OCTs) will be of particular interest[26].

Research under this COFUND call will focus on the four following themes:
- Consequences of climate change on biodiversity and nature's contributions to people
- Climate-biodiversity feedback processes
- Potential of nature-based solutions for mitigating and adapting to climate change
- Synergies and trade-offs between policies on biodiversity, climate and other relevant sectors, and the role of agents of change

All environments can be considered, i.e. marine, freshwater and terrestrial –including urban. Projects can address one theme or more. Projects combining aspects from two or more of the following themes are encouraged.

[24] Including interactions between past climate changes and biodiversity as long as their relevance to current and future situations are made clear; e.g., Nogués-Bravo D. et al. 2018. Cracking the Code of Biodiversity Responses to Past Climate Change. *Trends Ecol. Evol.* DOI: 10.1016/j.tree.2018.07.005
[25] Including from behavioral and economic sciences
[26] Ors and OCTs are mostly islands which host unique flora and fauna. They are highly threatened by the impacts of climate change and frequent invasions by non-native species. Islands offer delimited fields of experiments where diversity drivers can be analysed. Developing strategies and approaches to adapt to climate change are of high priority for these threatened insular ecosystems. For instance, see James SA (2008). Climate change impacts on native plant communities in Melanesia. In: Leisz, S.J., Burke-Burnett, J. (eds.), Climate Change and Biodiversity in Melanesia. Bishop Museum Technical Report, no. 42(8).

Theme #1: Consequences of climate change on biodiversity and nature's contributions to people

Studies within this theme should address the individual/combined effects of multiple components of climate change on genetic, species, structural, functional and/or ecosystem diversity and the induced effects on nature's contributions to people at relevant spatial and temporal scales. The climate drivers of biodiversity change should be understood as both rather direct, biophysical drivers (changing climate conditions) and more indirect, social/political/economic/cultural drivers linked to climate change. Research on the cascading effects of climate change on biodiversity, ecosystem functioning and services will be highly welcomed.

In particular, we wish to improve the capacity to forecast biodiversity responses to ongoing and/or projected climate change and impacts, both in scope and confidence. As an example, how will species distributions be modified with climate change, considering important processes like dispersal, migration, biotic interactions and adaptation capacity of organisms[27], as well as the role of changed climatic variability? What is the sensitivity of different diversity facets (taxonomic, genetic, functional, structural, etc.) to climate change? How will climate change alter trophic webs and species assemblages? To what extent will species conservation statuses be altered by climate change (and with what implications for nature conservation approaches and actions in terms of, e.g., operative conservation units, *in situ* conservation strategies, reintroduction, reinforcement and/or translocation protocols) and what are possible comprehensive adaptation measures to prevent species loss and habitat changes? To what extent continental and insular biodiversity responses to climate change will differ considering, e.g., sea level rise, drought, extreme events? Will introduced species become invasive under an altered climate, how will societal responses to climate change affect these dynamics, and what will the implications for native species and habitats be? How will climate change modify species migrations? Research could support the development of early-warning indicators and observation systems to monitor and respond to accelerating future climate-driven biodiversity change and loss. Evaluation of vulnerability of species and habitats and analysis of the relationship between biodiversity change and climate change in relation to other factors such as land use patterns (agriculture, forestry, fisheries and water management, construction, mining of raw materials), fragmentation and habitat loss would also be welcomed.

In relation to the societal impact of climate change-altered biodiversity, relevant issues include: Will different ecosystem services and other related benefits be increased, decreased or become more vulnerable[28]? What will the impacts of these changes be in terms of the (re)distribution of benefits across society, and particularly regarding already disadvantaged groups[29]? More broadly, research analysing how social, political, economic and cultural responses to climate change – for example in terms of shifting values for nature, changing consumption practices, emerging forms of environmental behaviour[30], or changing forms of

[27] Peterson M.L. et al. (2018) Incorporating local adaptation into forecasts of species' distribution and abundance under climate change. Global Change Biol. https://doi.org/10.1111/gcb.14562 ; Tielbörger K. et al. (2014) Middle-Eastern plant communities tolerate 9 years of drought in a multi-site climate manipulation experiment. Nature Comm. 5, Article 5102.

[28] In this program, proposals focused on ecosystem services and Nature's contributions to people should be strong on how they will analyse the link between changes in biodiversity and changes in services/contributions. Proposals focused on ecosystem services without analyzing the dependency of changes in ecosystem services to changes in biodiversity would not fit to the call priorities

[29] https://www.espa.ac.uk/files/espa/ESPA%20Wellbeing%20Policy%20Brief%20FINAL%20WEB_0.pdf

[30] Fatik Baran Mandal (2011) Human Behavior and Biodiversity Loss: A Theoretical Analysis, Journal of Human Behavior in the Social Environment, 21:6, 601-605, DOI:10.1080/10911359.2011.583492; Hansen, PP., et al. (2018) BASIC : A Toolkit and Ethical guidelines for Applying Behavioural Insights in Public Policy – Draft consultation. OECD

economic production - may lead to impacts on biodiversity will be highly welcomed.

Research should account for the extent and speed at which climate change will impact biodiversity (both above and below the ground) and associated ecosystem services across regions and under different conditions/projections. It should also evaluate the thresholds of climate change above which biodiversity will be irreversibly changed and after which ecosystems will no longer function and deliver services in their current form (i.e. identification of tipping points) or which will lead to the loss of culturally important places with low degree of human intervention.

It is expected that research projects will clarify the relative importance for biodiversity of climate change in relation to other major drivers, like habitat loss or change, pollution, change in land/sea use including agriculture and fisheries, and underlying drivers of environmental degradation like consumption, modes of production, uneven development, and urbanisation. Research on how such pressures combined with climate change will affect biodiversity and the consequent changes in nature's contributions to people will be welcomed.

Theme #2: Climate-biodiversity feedback processes

Research addressing theme 2 will focus on the feedbacks of biodiversity change to climate, e.g., consequences of major modifications or loss of biodiversity on biophysical fluxes, biogeochemical cycles, and biogenic greenhouse gas emissions and removals in the Earth system (terrestrial and marine), with demonstrated effects on climate change. It will also encompass research seeking to understand how societal responses to biodiversity change (e.g. biodiversity status in food production, exploitation of biodiversity in land and ocean, changing values for nature and its conservation, set up of green bound or green taxes, shifting practices of consumption in relation to biodiversity) may have consequences for both the climate system and for the ways in which societal actors are (and are not) able to undertake effective mitigation of and adaptation to climate change.

Quantifying the feedback of biodiversity change on the climate system is often more difficult than analysing the impact of climate change on biodiversity dynamics and ecosystem processes. This is because the latter can be manipulated experimentally at local scales or studied in plot networks along climate gradients, while feedback to the climate system not only operates at the local scale but also emerges at the regional to global scales. Analysing climate feedbacks thus requires a range of approaches including the analysis of regional to global data, e.g., from remote-sensing to socio-ecological models representing biodiversity and qualitative studies of socio-cultural changes related to biodiversity change

Research may address the following questions: To what extent may changes in biodiversity and ecosystem functioning induced by climate change plus other global change factors buffer or reinforce climate change? What are the direct and indirect effects of biodiversity on the climate system? How can remote-sensing data be used to detect both changes in biodiversity and changes in the energy balance, carbon cycle and water balance influencing climate change? What are the social, governance, cultural and economic processes underlying the feedbacks of biodiversity change onto climate change? What role can human behaviours directly related to biodiversity have on the drivers of and responses to climate change (e.g. how might social protests over the loss of nature or conservation efforts also serve to keep key fossil fuel reserves in the ground)?

Theme #3: Potential of nature-based solutions for mitigating and adapting to climate change

Projects will analyse the potential for and effectiveness of nature-based solutions (NbS[31]) for climate change mitigation and adaptation along with other environmental, economic and social benefits, while preserving or strengthening biodiversity. This includes the qualitative and quantitative assessment of NbS's multiple benefits as compared to conventional grey/purely technological solutions and their cost-effectiveness. Relevant NbS in this context encompass, e.g., the use and management of an increased agrobiodiversity for more sustainable food supply systems in the face of climate change and for agrosystems promoting carbon sequestration and reducing greenhouse gas emissions; the development of forests with diverse and native tree species that can better cope with climate change; the preservation of coastal ecosystems –including mangroves– with low degree of human intervention helpful to mitigate and adapt to climate change and reduce associated disaster risks; the sustainable management of seagrass habitats or coral systems as CO_2 trappers and food suppliers; and more generally the promotion of nature to tackle issues linked to climate change while delivering societal benefits like improved wellbeing and quality of life or alternative employment in urban, peri-urban, rural and coastal areas.

While research on NbS is growing, it tends to focus on single interventions, sites or scales in the analysis of their benefits, limitations and potential. Research under this call could increase the understanding of the interaction between different kinds of NbS over different scales to enhance the delivery of multiple benefits and their assessment. This would explore, for instance: What are the landscape-wide effects of climate relevant NbS? What are the cumulated effects of the implementation of different NbS in a given territory? Under which circumstances can NbS enhance the efficiency and effectiveness of climate change adaptation and mitigation, while benefiting biodiversity and wider societal goals? How are the benefits and trade-offs in different NbS generated and distributed across space and time (e.g. which people/social actors/groups will benefit from NbS)? To what degree can NbS address relevant goals (e.g. SDGs) for different communities and stakeholders? Such research would also help reveal the potential as well as possible limitations of NbS to address these challenges.

Research may also evaluate social, technical, economic, cultural and political levers and obstacles to implementation of NbS to tackling the climate change challenge. Projects studying how local/national/regional authorities and stakeholders (e.g. national agencies and governments, municipal governments, regional authorities, utilities, insurance companies, urban development industry, financing sector, community groups etc.) can design, implement and manage NbS strategies to enable benefits for climate change and biodiversity will be welcomed.

Theme #4: Synergies and trade-offs between policies on biodiversity, climate and other relevant sectors, and the role of agents of change

Under this theme, research will assess the synergies and trade-offs between policies and strategies developed for (i) the preservation and restoration of biodiversity and related ecosystem services, (ii) climate change mitigation including future requirements for negative emissions and adaptation and development of the resilience of natural and managed socio-ecological systems, and (iii) tackling other key societal challenges like food and fibre supply and energy supply, poverty alleviation, alternative employment opportunities, and social

[31] The NbS definition used by BiodivERsA is given in Eggermont et al. (2015; Gaia). Projects under theme 3 will thus have to consider the economic, environmental and social benefits of NbS.

equity. Research may also consider the actions of multiple 'agents of change' (e.g. private corporations, investors, cities, communities) that are taking action on biodiversity and climate change to understand the impacts and consequences of this kind of action for biodiversity/climate change.

Research could address questions concerning structure, agency, politics and power that shape policy and governance processes related to biodiversity changes and their direct and indirect drivers. This could include the interactions between biodiversity policies/strategies (e.g. for protected areas, genetic resources, requirements for urban development), land-based climate mitigation policies/strategies (e.g., bioenergy, reforestation, increase in soil carbon), a wide range of adaptation policies/strategies (e.g., sea walls, flood control infrastructure), policies/strategies to develop renewable energies (e.g., wind, solar and hydro-power), agricultural/fisheries/aquaculture policies, as well as policies and strategies focusing on infrastructure development (housing, transport and utility provision), food security and health.

Studies will be welcomed which analyse how synergies and trade-offs between these different policies/strategies may be better taken into account in approaches, methods and policies used for nature protection (including the identification of areas to be protected), and how these approaches, methods and policies should change in the future due to climate change[32].

Research should study how integrated policy approaches and multilevel governance dynamics and processes can deliver multiple benefits in parallel, not least helping to improve biodiversity status and the mitigation of and adaptation to climate change. How can such integrated and holistic systems be designed, operationalized and promoted at international, regional, national and/or local scale? How can these systems and approaches contribute more effectively achieving the SDGs? What unintended consequences must be avoided and what are strategies to do so?

(3) Expected international added value

The richness and specificities in various places and regions mean that it is necessary to understand the details of local biodiversity, ecosystems and socio-cultural conditions if we are to develop a robust framework for action, since much of the decisions should be made at and relate to sub-global scales. However, research to be funded through this BiodivERsA programme supported by the European Commission will have to go beyond single study cases. The physical, biological and social processes associated with biodiversity loss and climate change both take place at a range of spatial scales, ranging from the local to regional and global. Therefore, a sufficient understanding of the spread and connection of these processes cannot be revealed by research at a single scale, but rather relies on studies at multiple scales. These in turn need to take explicit account of the ways in which processes at one scale drive or constrain processes at one or more other scales. Similarly, both biodiversity and climate phenomena contain unique details that are specific to a given location, but also include generalities that apply across many places. A robust understanding of biodiversity-climate change interactions is thus most efficiently and effectively developed

[32] Kueffer C et al. (2013) Reconciling conflicting perspectives for biodiversity conservation in the Anthropocene. Frontiers Ecol Env https://doi.org/10.1890/120201

through transnational collaboration. In addition, the contemporary situation of vast regional interactions/teleconnections often requires to take into account the global context.

In term of methods, transnational collaboration in model development and the inter-comparison of different models is a logical way to advance research on biodiversity-climate interactions. Further, the sharing of observations, experimental outcomes and case studies is a key approach to developing resilience to climate change of socio-ecological systems. Learning and information sharing is key to social adaptation. Therefore, all project participants will benefit from a collaborative approach to the problem; which by its nature has many international-scale elements.

As usual, it is expected that applicants will ensure that their work has clear novelty and adds to the existing knowledge base, including regarding previously funded, ongoing projects. Overlap with on-going international, European and national projects on this theme should thus be avoided. Complementing on-going research is however possible but should be clearly explained.

Applicants are encouraged to use existing resources and infrastructures for their project, including the data and information from the Copernicus programme - the European Union's Earth Observation Programme, the existing biodiversity research infrastructures, listed in the BiodivERsA mapping of biodiversity research infrastructures, etc.