

Grant Proposal

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Europa Biodiversity Observation Network: integrating data streams to support policy

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Abstract: Observations are key to understand the drivers of biodiversity loss, and the impacts on ecosystem services and ultimately on people. Many EU policies and initiatives demand unbiased, integrated and regularly updated biodiversity and ecosystem service data. However, efforts to monitor biodiversity are spatially and temporally fragmented, taxonomically biased, and lack integration in Europe. EuropaBON aims to bridge this gap by designing an EU-wide framework for monitoring biodiversity and ecosystem services. EuropaBON harnesses the power of

modelling essential variables to integrate different reporting streams, data sources, and monitoring schemes. These essential variables provide consistent knowledge about multiple dimensions of biodiversity change across space and time. They can then be analyzed and synthesized to support decision-making at different spatial scales, from the sub-national to the European scale, through the production of indicators and scenarios. To develop essential biodiversity and ecosystem variables workflows that are policy relevant, EuropaBON is built around stakeholder engagement and knowledge exchange (WP2). EuropaBON will work with stakeholders to identify user and policy needs for biodiversity monitoring and investigate the feasibility of setting up a center to coordinate monitoring activities across Europe (WP2). Together with stakeholders, EuropaBON will assess current monitoring efforts to identify gaps, data and workflow bottlenecks, and analyse cost-effectiveness of different schemes (WP3). This will be used to co-design improved monitoring schemes using novel technologies to become more representative temporally, spatially and taxonomically, delivering multiple benefits to users and society (WP4). Finally, EuropaBON will demonstrate in a set of showcases how workflows tailored to the Birds Directive, Habitats Directive, Water Framework Directive, Climate and Restoration Policy, and the Bioeconomy Strategy, can be implemented (WP5).

List of Acronyms

Acronym	Full name/description
AB	Advisory Board
BiodivERsA	Network programming and funding research on biodiversity and ecosystem services across European countries and territories
BIOFRESH	EU-funded research project, established an internet platform bringing together information and data on freshwater biodiversity
BioTIME	Project to assemble the BioTIME database and quantified temporal change in assemblage biodiversity across the planet
BISE	Biodiversity Information System for Europe
BKC	Biodiversity Knowledge Centre
BMCC	Biodiversity Monitoring Coordination Centre
BON	Biodiversity Observation Network
CA	Consortium Assembly
CAP	Common agricultural policy
CBD	Convention on Biological Diversity
CC	Consortium Coordination
Copernicus	European Union's Earth Observation Programme
DG ENV	Directorate-General for Environment
DMP	Data Management Plan
eBird	biodiversity-related citizen science project to document bird distribution, abundance, habitat use, and trends
EBV	Essential Biodiversity Variables
ECSA	European Citizen Science Association
eDNA	Environmental DNS
EEA	European Environmental Agency
EEA-RTD	European Environmental Agency - Research and Technological Development
EESV	Essential Ecosystem Service Variables
EFI+	European Fish Index - Project
EIA	Energy Information Administration
EIONET	European Environment Information and Observation Network
eLTER	European Long-Term Ecosystem Research
ESA	European Space Agency
FAIR	Findable, Accessible, Interoperable, Reusable
GBIF	Global Biodiversity Information Facility
GDPR	General Data Protection Regulation
GEO	Group on Earth Observations
GEOSS	Global Earth Observation System of Systems
HD	Habitats Directive
iNaturalist	online social network of people sharing biodiversity information to help each other learn about nature, crowdsourced species identification system and an organism occurrence recording tool
INCA	Integrated system for Natural Capital and ecosystem services Accounting
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
KIP INCA	Knowledge Innovation Project - Integrated system for Natural Capital and ecosystem services Accounting
LoS	Letter of Support
LTER	Long-Term Ecosystem Research
LUCAS	Land Use/Cover Area frame Survey
MAES	Mapping and Assessment of Ecosystems and their Services
MS	Member State
PEDR	Plan for Exploitation and Dissemination of the Results
PI	Principal investigator
RI	Research Infrastructures
SDG	Sustainable Development Goals

SDM	Species Distribution Model
SME	Small to medium-sized enterprise
SRA	Strategic Research Agenda
ToR	Terms of References
UNEP-WCMC	The UN Environment World Conservation Monitoring Centre
WFD	Water Framework Directive
WISE	Water Information System for Europe
WISER	Water Bodies in Europe - Integrative Systems to assess Ecological status and Recovery
WP	Work package

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1 Excellence

1.1 Objectives

Increased political and societal awareness of the biodiversity crisis is leading to a range of global and EU policies and initiatives aimed at reverting biodiversity loss, including the new Green Deal for Europe. However, the monitoring needed to guide these responses remains spatially and temporally fragmented across ecosystems and habitats in Europe, as in many regions in the world¹. There is a gap between the biodiversity data needs of policy-makers and authorities responsible for policy implementation on the one hand and the existing reporting streams and data sources on the other hand. The **EuropaBON** project aims to bridge this gap by **designing a European Biodiversity Observation Network**.

The project adopts the approach for the development of coordinated Biodiversity Observation Networks (BONs) from the Group on Earth Observations Biodiversity Observation Network (GEO BON)². This approach emphasizes **co-design with stakeholders** at all stages of the BON development, from assessment of current monitoring to implementation of a new design including new information streams. It aims at integrating data streams with models to produce relevant biodiversity indicators for policy and management, assessments and scenarios building on the **Essential Biodiversity Variables (EBVs)** and **Essential Ecosystem Service Variables (EESVs)** developed in GEO BON.

EuropaBON brings together a **community of practice working on different aspects of biodiversity and ecosystem service monitoring in Europe**, including different monitoring techniques for different taxa of flora and fauna and their habitats across terrestrial, freshwater and marine ecosystems.

More specifically, EuropaBON will:

- **Engage users** at the regional, national and European level (incl. national and sub-national authorities including statistical offices, land managers, NGOs etc.) to identify the data needs of policies and targets aligned with the new European Green Deal, such as the Biodiversity Strategy for 2030, Habitats Directive, Birds Directive, Water Framework Directive, Climate Strategy and Ecosystem Restoration goals, the Bioeconomy Strategy and national and EU wide initiatives on natural capital accounting. This will build on user engagement in previous projects such as ECO-POTENTIAL, ESMERALDA, EU BON, and MAES, as well as on ongoing projects such as MAIA, WEVALUENATURE and KIP INCA.
- **Adapt the generic EBVs and EESVs** and their characteristics (spatial, temporal and biological entity scope and resolution) to address the specific user needs. This will build on the generic essential variables identified in GEO BON, ECO-POTENTIAL and eLTER-Plus, but will for the first time specify the characteristics of all relevant EBVs and EESVs at the European scale to address policy needs.
- **Survey existing monitoring initiatives**, including long-term ecosystem monitoring and monitoring that responds to regulations (directives and strategies), remote sensing and citizen science, and assess how they can contribute to producing comprehensive biodiversity information under the EBVs and EESVs frameworks. This will build on previous databases from EEA (BISE, WISE), EU BON, WISER and EUPMS, but will now be matched to the EBV and EESV framework and associated workflows.
- **Identify gaps** in the current monitoring of European biodiversity, including thematic, taxonomic, geographic and temporal gaps, and how **novel technologies and modelling approaches** can assist in filling those gaps. Particular attention will be given to the needs of the Birds and Habitats Directive and the monitoring of Natura 2000 sites. We will be building on work from projects such as ECO-POTENTIAL and MS.MONINA which focused either on site level monitoring or a narrower range of biodiversity and ecosystem service variables, to consider national and European scale and the entire EBVs and EESVs set.
- Analyze the pathway from data collection to knowledge production in order to **identify good practices, bottlenecks and limitations on the mobilization and harmonization** of monitoring data to publicly accessible infrastructures (e.g., EEA, GBIF) and **on their policy uptake**. This will build on concurrent work being done in E-Shape, but will consider a wider range of data streams and variables.
- **Co-design workflows** needed for a more integrated biodiversity observation network that can close gaps and reduce bottlenecks, in dialogue with data producers and users to support EU policies and targets. This will build on conceptual ideas regarding EBV workflows developed in GLOBIS-B, the remote-sensing-enabled

¹ Proença, V. et al. (2017). *Biological Conservation*, 213, [256–263](#).

² Navarro, L.M. et al. (2017). *Current Opinion in Environmental Sustainability*, 29, [158–169](#).

EBV case studies at European pilot sites in GLOBDiversity and the ecosystem service mapping guidelines from ESMEALDA. But for the first time, workflows will be proposed for a wide range of EBVs at the European scale including the biodiversity monitoring protocols, modelling tools available, and analytical steps required.

- **Assess cost-effectiveness** of existing monitoring schemes and of the new monitoring design (including benefits related to ecosystem services, as well as co-benefits on education, Common Agricultural Policy goals, and business opportunities) with EBVs and EESVs workflows implemented at different levels of ambition.
- **Demonstrate** in a set of policy-oriented showcases how such EBVs and EESVs workflows allow to integrate different data streams and thus provide timely and relevant data across the EU member states and regions, including indicators to assess policy targets and ecosystem condition, current trends, short-term biodiversity and ecosystem services forecasts for the public, and support the development of long-term scenarios in IPBES and other initiatives.

Ultimately, EuropaBON aims at mobilizing a coalition of key players in national and EU level bodies to establish the ToR for a permanent **Biodiversity Monitoring and Coordinating Centre** that will implement and oversee a European Biodiversity Observation Network.

1.2 Relation to the work programme

EuropaBON responds to a call under the Horizon 2020 working programme on climate action, environment, resource efficiency and raw materials, also known as Societal Challenge 5. One of the key objectives of this challenge is moving to a greener, more resource efficient and climate-resilient economy in sync with the natural environment, demonstrating a strong commitment to supporting the UN's Sustainable Development Goals (SDGs). Research projects and actions under Societal Challenge 5 are expected to provide the knowledge that can be used to enhance social, economic and environmental resilience. Healthy and resilient ecosystems, characterised by a complete structural and functional diversity of species, are an essential requirement for social and economic resilience. Yet, the condition of ecosystems and the services they provide to the people and the economy are at risk (see also section 1.3). The extent of natural ecosystems has decreased, in particular of wetlands. Also, natural and semi-natural grasslands, peatlands, freshwater and coastal marine habitats have been degraded. Species abundances of several groups have declined considerably in many ecosystems. Landscapes and seascapes have become more uniform in their species composition and their diversity has been reduced³. As a consequence, 77% of the EU's most vulnerable habitats and 60% of protected species still have an unfavorable conservation status⁴.

Most of the knowledge to evaluate the state of Europe's ecosystems is based on studies and assessments. Such studies typically follow a conversion of evidence approach using a variety of sources including expert opinions. EU wide, consistent, harmonised, long-term, spatially explicit and regularly updated field-based data across all ecosystem types and spanning a wide range of taxa and species is currently lacking. As a result, the actual uptake and use of monitored biodiversity data in policy design, implementation and evaluation is still far too low.

Table 1.1: EuropaBON responses to the main challenge and scope of the call. WP: Work Package.

Challenges from the call	Expected contributions of EuropaBON
Main challenge of the call text:	
Harness scientific advances and bring together various EU level bodies and other organizations to strengthen current efforts and devise a structured and cost-effective EU-level approach to ecosystem monitoring	EuropaBON presents a strong consortium and an ambitious proposal that has the needed capacity, knowledge, and networks to deliver an EU wide, cost-effective biodiversity monitoring network that is able to fulfill the requested policy needs (WP1)

³ IPBES (2018). *Summary for policymakers of the regional assessment report on biodiversity and ecosystem services for Europe and Central Asia of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services*. Fischer, M. et al. (Eds.). [IPBES, Bonn, Germany](#).

⁴ EEA (2015). *State of nature in the EU: Results from reporting under the nature directives 2007–2012*, Technical report No 2/2015, Luxembourg: [Publications Office of the European Union](#).

combining in-situ, space and air-born monitoring.	
Scope: design an EU-wide framework for monitoring biodiversity and ecosystem services which:	
1) integrates different reporting streams, data sources and monitoring activities at international, EU, national and regional level (including remote sensing, citizen science and citizens observatories)	EuropaBON will assess the existing monitoring capability and reporting streams in Europe (WP3) and propose how they can be integrated in the co-design of the BON (WP4).
2) is cost effective	EuropaBON will not only consider cost-efficiency of existing monitoring schemes, but also new cost-effective techniques and benefits of a European biodiversity monitoring network (dedicated tasks under WP3 and WP4).
3) links to policy targets, indicators and assessments	EuropaBON will specifically ensure uptake of policy and user needs. Showcases will demonstrate (WP5) concrete examples on how the new design can support the major relevant EU policies.
4) builds on best practices in EU member states	EuropaBON will organize a series of workshops (WPs 2-5) to profit from the rich experience EU member states already have on biodiversity monitoring, and include the best practices in the WP5 policy showcases.
5) delivers timely data, which is comparable over time and across the EU member states	EuropaBON will identify and propose a set of workflows that will ensure regularly updated data streams on biodiversity (WP4). The project will raise awareness on current challenges concerning comparability and representativeness and discuss with relevant EU-wide expert groups and national agencies in EIONET how these challenges can be properly addressed (WP2).
The project should:	
6) provide an analysis of current programmes and gaps	EuropaBON has a dedicated task on reviewing ongoing biodiversity monitoring programmes and identifying their characteristics, gaps and bottlenecks at the EU- and national levels (WP3).
7) design accurate and cost-effective techniques for establishing regular and comprehensive monitoring systems	EuropaBON will identify and propose a set of work flows that will ensure spatially representative, cost-effective and regularly updated data streams on biodiversity, combining conventional and new monitoring techniques (WP4), and show how this can be done in concrete showcases (WP5).
8) play a coordination role	EuropaBON will propose a European coordination center to implement and oversee an operational European biodiversity observation network. This will be done in dialogue with relevant stakeholders from the scientific, civil society and user communities, as well as national and international authorities and funding bodies (WP2). Several agencies have already assured their support. For a list of LoS, please refer to section 6 of the proposal.
9) facilitate the work at Member State level	EuropaBON has already established contacts with national authorities to understand how a network can facilitate current reporting obligations. The showcases will demonstrate how a more integrated and innovative biodiversity monitoring network can support reporting obligations of the EU Birds and Habitats Directive and the Water Framework Directive (WP5).

10) work with KIP INCA partners, as well with the EEA	EuropaBON will work with INCA through the JRC whereas EEA has agreed to be part of the Advisory Board (WP1, WP2).
11) explore potential synergies with previous and future actions funded under the EU research	EuropaBON has identified key projects within the European research area (Table 2.2) that will be used to support all the work packages.

In response to this challenge, this proposal outlines an architecture for a European biodiversity monitoring system that will maximally be aligned with the needs of policy and key strategic objectives including the European Green Deal, the post 2020 biodiversity strategy, the Horizon 2020 and Horizon Europe work programmes and the sustainable development goals (see also section 2.1). EuropaBON offers a means to achieving better coordination of different monitoring actions taking place in Europe by mobilizing key stakeholders and their knowledge. The implementation of EuropaBON will allow improving decision making in policies that impact or govern the use of natural resources by enhancing the capacity of early warning, forecasting and communication among relevant actors to better cope with biodiversity change and its impacts on society. Table 1.1 provides more detail on how EuropaBON will address the different challenges and specific requests that are identified in the call of the Horizon 2020 work programme 2018-2020.

1.3 Concept and methodology

We live in a world of information and biodiversity data is no exception: the number of occurrence records in GBIF is growing at a pace of over 100 million records a year⁵, the number of structured monitoring programmes in Europe has grown over the last few decades⁶, citizen science websites reporting on the state and change of a wide range of taxa and environmental descriptors are on the rise, molecular methods are generating massive amounts of biodiversity data opening up the frontiers of biomonitoring and remote sensing products are becoming more accessible and relevant for biodiversity⁷. However, the uptake of such data for policy and management is hampered by temporal, spatial and taxonomic gaps, lack of standardisation and integration, quality constraints, limited availability of data in publicly accessible databases, little interoperability among data and infrastructures, and few suitable knowledge products readily usable for policy and management⁸. While reporting requirements for multiple national and EU policies continue to increase, much of those requirements are fulfilled with expert-based assessments, with limited data traceability, lack of reproducibility and very heterogeneous approaches across reporting bodies, including member states⁹. Similar gaps between biodiversity data availability and policy needs occur in other regions of the world, as exemplified in deficient reporting for the Convention on Biological Diversity.

To address this challenge, the Group on Earth Observations Biodiversity Observation Network (GEO BON) has recommended the adoption of Essential Biodiversity Variables (EBVs)¹⁰, and more recently, the related Essential Ecosystem Service Variables (EESVs). The key idea of the essential variables approach is to fully harness the power of the data that is becoming available from multiple data collection streams, through data mobilization and modelling for a set of complementary and relevant dimensions of biodiversity. Such spatially- and time-explicit EBV and EESV datasets can then be aggregated at different spatial scales and combined with ancillary datasets on pressures (e.g., threats to biodiversity) and responses (such as policies) to produce biodiversity indicators that can simultaneously meet policy and management needs at multiple levels. Comparable approaches can be used to provide short-term biodiversity and ecosystem service forecasts and assess long-term scenarios of socio-economic development and climate change¹¹. The development of EBV/EESV centered workflows, from data collection to knowledge product generation, tailored to the needs of different EU policies is at the core of the EuropaBON project (Figure 1). Below we explore the state of the art in each step of such workflows and identify the major coordination challenges that this action will address, both regarding the assessment of existing monitoring schemes (WP3) and the co-design of a

⁵ <https://www.gbif.org/analytics/global>, accessed on 27 January 2020.

⁶ Pereira, H.M. et al. (2010). *Frontiers in Ecology and the Environment*, 8, 459–460.

⁷ Skidmore, A.K. et al. (2015). *Nature*, 523, 403–405.

⁸ Pearce-Higgins, J.W. et al. (2018). *Journal of Applied Ecology*, 55, 2544–2551; Geijzendorffer, I.R. et al. (2016). *Journal of Applied Ecology*, 53, 1341–1350.

⁹ Ellwanger, G. et al. (2018). *Nature Conservation*, 29, 57–78.

¹⁰ Pereira, H.M. et al. (2013). *Science*, 339, 277–278.

¹¹ Honrado, J.P. et al. (2016). *Journal of Applied Ecology*, 53, 1299–1304.

European Biodiversity Observation Network (WP4). Finally, we discuss methods for assessing the cost-effectiveness of biodiversity monitoring.

The importance of innovation and novel technologies permeates all the steps of the EBV/EESV workflows in the EuropaBON and is addressed in a dedicated task in WP4 and demonstrated in the different showcases selected for WP5. This includes novel technologies for data collection, such as camera traps, eDNA and molecular biomonitoring, and automated image recognition or hyperspectral remote sensing, to the most recent developments in biodiversity modelling and data publishing, such as the lessons learnt from the biodiversity and ecosystem service intermodel comparison (IPBES Expert Group on Scenarios and Models)¹² or the adoption of the GBIF Darwin Event Core (originally developed in the EUBON project). Similarly, stakeholder engagement and the principles of co-design underpin all steps of the EBV/EESV workflows and are addressed in a central work package of the EuropaBON (WP2).

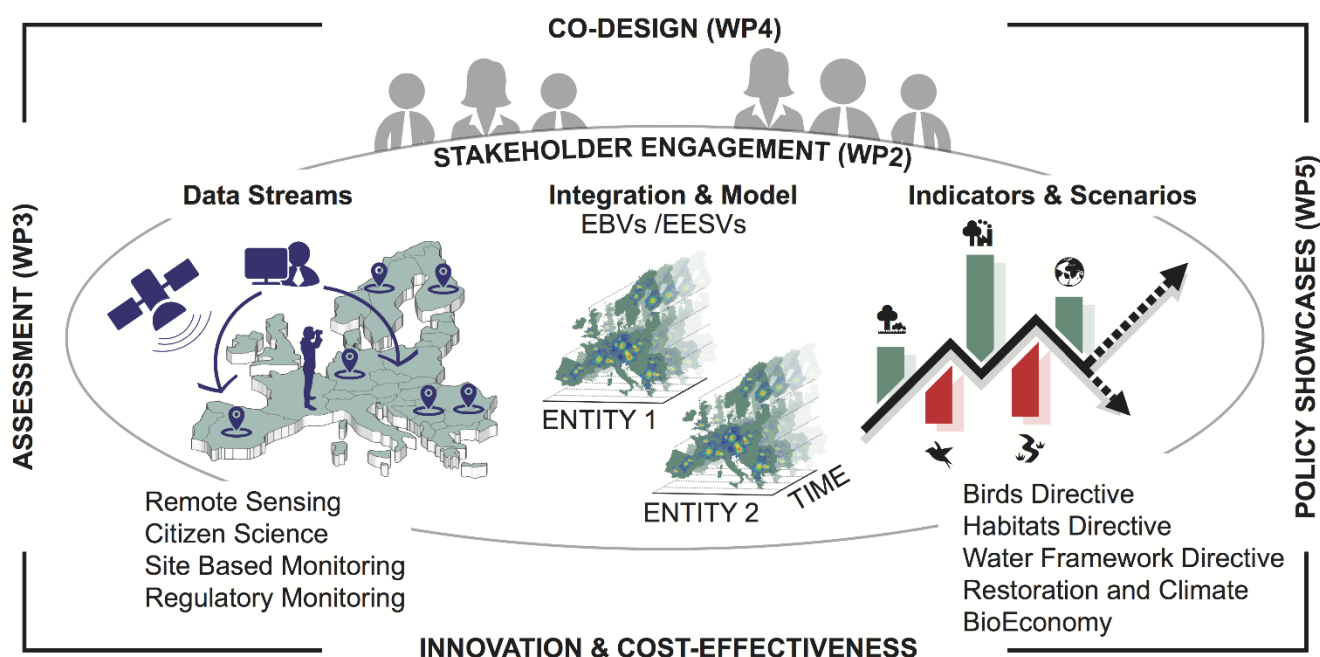


Figure 1: Workflows for Essential Biodiversity Variables (EBVs) and Essential Ecosystem Service Variables (EESVs). Multiple data collection streams are integrated through models and data mobilization into harmonized datasets and knowledge products, from which indicators, forecasts and scenarios can be derived to inform major environmental EU policies.

1.3.1 What is essential to monitor?

Biodiversity change is one of the most complex problems society faces. There are multiple dimensions of biodiversity change, from genetic composition over species distributions to ecosystem function. Several drivers, including land-use and habitat change, climate change, pollution, harvesting and biotic exchange, affect biodiversity. Furthermore, some of these drivers are very heterogeneous spatially and their dynamics and impacts on biodiversity need to be understood from the local to the global level. Therefore, policy makers, managers and scientists face a challenge: from the myriad of possible variables to monitor, which ones are essential? And at what spatial, temporal and taxonomic resolution do these variables need to be monitored?

The EBV framework addresses this question by taking two complementary approaches. On the one hand, a set of complementary variables addressing different dimensions of biodiversity have been identified and are being regularly revised by the GEO BON community¹³. A similar process is being carried out by GEO BON for identifying essential variables for ecosystem services. Most of these variables are key state variables in global biodiversity and ecosystem models and used in scenario projections, for instance in IPBES¹⁴. On the other hand, the particular biological entity

¹² Rosa, I.M.D. et al. (2020). *Global Ecology and Conservation*, **22**, e00886.

¹³ <https://geobon.org/ebvs/what-are-ebvs/>, accessed on 10.02.2020

¹⁴ Kim, H. et al. (2018). *Geoscientific Model Development*, **11**, 4537–4562; Akçakaya, H.R. and Pereira, H.M. (2016). In IPBES (2016). *Policy support tools and methodologies for scenario analysis and modelling of biodiversity and ecosystem services* (255–290), IPBES, Bonn, Germany; Chaplin-Kramer, R. et al. (2019). *Science*, **366**, 255–258.

or ecosystem attribute to be monitored should be identified together with stakeholders depending on the management or policy goals¹⁵. The choice of variables can be facilitated by developing narratives, together with stakeholders, about how ecosystems are believed to be changing, describing the different drivers and their impacts on biodiversity. Key variables and biological entities can then be extracted from these narratives and matched against the list of essential biodiversity variables, modelling tools, and data streams. For some policies like the water framework directive (WFD), the essential variables are given in its Annex V for the different taxonomic groups of aquatic flora and fauna, but can be checked against the EBVs and supplemented for more precise biodiversity monitoring.

In EuropaBON, policy makers and managers are involved (WP2) in the assessment of existing monitoring efforts in Europe (WP3) and the co-design of all aspects of the integrated and improved biodiversity monitoring system (WP4). The concept is further demonstrated in a set of policy-oriented showcases (WP5), which aim to show the integration of different data streams, each one requiring the monitoring of particular EBVs or EESVs (Table 1.2). Further refinement of the exact EBVs to be considered, the associated biological entities, and the spatial and temporal scope and resolution of the monitoring and projections, will be defined together with the stakeholders (T4.1, WP2, WP5).

Table 1.2: A list of some of the EBVs and EESVs to be considered by EuropaBON and the policy showcases where they will be demonstrated. Each showcase demonstrates how multiple data streams can be integrated and synthesized for end users.

Policy showcase	Data streams to be integrated	EBVs or EESVs	Ecological entity	Synthesis approach
T5.1 Birds Directive	Citizen science Remote sensing	Species distribution and population abundance	Selected bird species	Recent trend indicators
T5.2 Habitats Directive	Long-term ecological research Remote sensing Citizen science	Taxonomic diversity, ecosystem extent and ecosystem phenology, conservation status	Selected habitats	Current state and recent trend indicators
T5.3 Water Framework Directive	Regulatory monitoring Remote sensing Citizen science	Taxonomic diversity, biomass distribution and disturbance, ecological status	Algae, macrophytes, macroinvertebrates, fish	Current state and Recent trend indicators, long-term scenarios
T5.4 Soil Restoration and Climate Policy	Regulatory monitoring Remote sensing	Ecosystem live cover and carbon sequestration	Soil	Long-term scenarios
T5.5 Bioeconomy	Citizen science Remote sensing	Benefits and hazards from nature	Fructification for selected wild mushroom species, activity of disease carrying mosquitos, pollination by wild insect species, aerial biomass of bird migrants	Short-term forecasts

¹⁵ Guerra, C.A. et al. (2019). *Global Ecology and Conservation*, [18, e00601](https://doi.org/10.1016/j.gecco.2019.e00601).

1.3.2 Operational essential variables

One way to conceptualize an EBV or EESV is to imagine a hypercube with the value of the variable at each position in space, time, and for different biological entities (Figure 1)¹⁶. This hypercube starts as a sparse collection of observations and is progressively filled by different levels of data integration and modelling¹⁷. This allows to operationalize EBVs or EESVs as comprehensive data products that seamlessly integrate multiple data streams to produce spatially and temporally explicit estimates of the variable, in some cases with continuous wall-to-wall coverage. For instance, in the case of species distributions¹⁸ raw observations can include opportunistically collected point species occurrences from citizen scientists and environmental impact assessments, long-term in-situ monitoring carried out by experts with repeated surveys using standardized protocols at fixed sites, or more recently the use of molecular techniques (e.g., based on environmental DNA) which provide novel tools for the identification of cryptic, inconspicuous and invasive organisms. These data can be integrated into the species distribution hypercube¹⁹, but significant spatial and temporal gaps in observations remain. These gaps can then be filled through modelling and by using remote sensing data on the habitat of each species. This allows to derive spatially contiguous, biological variables that can be used to calculate biodiversity indicators at different levels of spatial aggregation of the EBV, for instance to obtain the trends in the area occupied by a given species in a country or region over time.

1.3.3 Data streams

There is a myriad of biodiversity data streams in Europe. Here, we classify them into four major classes: remote sensing, citizen science observations, long-term ecological research, and regulatory monitoring by agencies (also including long-term monitoring).

Remote sensing

Effective observation of rapidly changing ecosystems requires efficient and effective methods that allow periodic sampling of extensive areas at a fine spatial resolution and with a high temporal frequency. Satellite remote sensing plays a crucial role in providing such information. Free access to spatially contiguous, (near-)global satellite data streams, big data technologies and programmes such as Copernicus (the European Union's Earth Observation Programme) provides an opportunity to generate EBVs or EESVs with unprecedented detail and continuity to feed monitoring systems that support European policies. Despite the availability of Copernicus products with high temporal and spatial resolution, most of these are yet insufficiently tailored towards the needs of biodiversity and ecosystem monitoring. For instance, several Copernicus products already capture the abiotic and physical properties of ecosystems, but direct measurements of biodiversity or relevant fine-scale habitat features are either just newly released (e.g., the Small Woody Features (SWF) product which provides harmonised information on linear structures such as hedgerows) or not yet fully exploited in the currently available datasets (Sentinel-1, -2 and -5). Moreover, fusing these datasets with each other and with other remote sensing and in-situ information can provide unprecedented opportunities for generating indicators of biodiversity change. On top of this, new platforms such as the Sentinel-10 hyperspectral mission and lidar (laser ranging) mission of the Global Ecosystem Dynamics Investigation (GEDI) can further extend these continuous capabilities and provide novel tools for generating EBVs or EESVs.

Citizen science observations

Citizen science observations of biodiversity provide around 80-90% of all species data in Europe and can provide a major tool for innovation in open science and policy development²⁰. Citizen Science data can be split into two major categories: structured citizen science monitoring and opportunistic citizen science recording of observations. Structured citizen science monitoring is arguably the main source of data for biodiversity indicators such as the Common Bird Indicator²¹ and the Grassland Butterfly Indicator. It is also behind other extensive monitoring schemes, such as those for atlases of species distributions, from the national to the European level. Opportunistic data can be used to assess shifts in species distributions, using Bayesian statistics and occupancy modelling to integrate structured

¹⁶ Fernandez, N. et al. (2020). In Cavender-Bares et al. (Eds.) *Remote Sensing of Plant Biodiversity*, Basel, Switzerland: Springer International Publishing.

¹⁷ Kissling, W.D. et al. (2018). *Biological Reviews*, 93, [600–625](#).

¹⁸ Jetz, W. et al. (2019). *Nature Ecology & Evolution*, 3, [539–551](#).

¹⁹ Kissling, W.D. et al. (2018). *Biological Reviews*, 93, [600–625](#).

²⁰ Hecker, S. et al. (2018) *Citizen Science – Innovation in Open Science, Society and Policy*. London, UK: UCL Press.

²¹ Gregory, R.D. et al. (2019). *Ecological Indicators*, 103, [676–687](#).

and opportunistic data²², but does not give insights into changes in abundance or population sizes. Recording biodiversity has been made easier by the development of mobile apps that automatically record time and location and include some automated or (other) user feedback for data quality control. The rise of affordable audio-visual sensors and omnipresence of digital cameras, including those in mobile phones and tablets, makes it easier to upload photos for quality control or use camera trapping. Using artificial intelligence algorithms and machine learning that check for likelihood based on past records, considering both location and date, combined with image and audio recognition software for uploaded photos or audio files can substantially increase recording possibilities and also reduce the workload for the validation of data. With these novel tools, large datastreams can be collected and handled while maintaining a high data quality (e.g., EuroBird portal). Furthermore, the use of apps reduces the time lag between record and incorporation into databases substantially (eg. eBird, iNaturalist). EuropaBon will design workflows that leverage the datastreams being produced by citizen scientists.

Long-term ecological research

An increasing number of long-term ecological research (LTER) sites have been set up over the last few decades across Europe to address a range of scientific questions and provide long-term monitoring of ecosystems. Key findings from the LTER network in Europe include: showing that forest ground flora across Europe declines with the exceedance of critical loads of nitrogen²³, identifying the effects of climate change on stream invertebrate composition in Central Europe over a period of 25 years²⁴ and on terrestrial vegetation and limnic zooplankton in the Alps²⁵. Almost 20 years ago, LTER-Europe was founded, providing an umbrella network for the LTER sites. More recently, in order to renew efforts to expand harmonized and standardized data collection across sites, eLTER joined the ESFRI (European Strategy Forum on Research Infrastructures) roadmap. eLTER RI will comprise terrestrial, freshwater and transitional water sites. It will allow in-situ, co-located acquisition and gathering of essential variables ranging from biodiversity to socio-ecological data, across 250 LTER-Europe sites²⁶. During the five-year preparatory phase project, which started February 2020, the essential variables measured in the eLTER RI will be selected and approved. These observations will be made available through a data portal, building on data streams already available and strictly following the FAIR principles. Having eLTER as a partner in EuropaBON (for official LoS see section 6 of the proposal) will ensure that the ongoing developments, specifically data standard, work flows and data streams in eLTER and those foreseen in EuropaBON will be aligned, synergies used and redundancies avoided. This is considered in various tasks, namely T3.1, T4.1, T4.3 and T5.2.

Regulatory monitoring by agencies

Regulatory monitoring is carried out by regional, national and European agencies in response to reporting requirements of different plans and policies. For instance, EU member states implement national monitoring schemes to regularly report on the ecological status of water bodies under the Water Framework Directive (WFD). The biological WFD-related indicators have been inter-calibrated across countries²⁷, and the reported data are compiled and made available by EEA through the Water Information System for Europe (WISE). However, detailed record information on single species is not made interoperable, accessible and usable. Moreover, there are still many gaps and weaknesses in these data streams that need further attention, due to major differences in the actual monitoring and assessment systems used across Europe²⁸. There are a number of other databases with species level data based on WFD monitoring of each of the biological quality elements. These databases were compiled in EU research projects like WISER and EFI+, used for indicator development and can be made available for new activities if the data owners give their consent. For the Habitats Directive (HD) and Birds Directive, the EU member states regularly report conservation status for habitats and species (HD Article 17), often with an emphasis on Natura 2000 sites, but

²² Isaac, N.J.B. et al. (2019). *Trends in Ecology and Evolution*, [35](#).

²³ Dirnböck, T. et al. (2014). *Global Change Biology*, 20, [429-40](#).

²⁴ Haase, P. (2019). *Science of the Total Environment*, 658, [1531-1538](#)

²⁵ Rogora, M. et al. (2018). *Science of the Total Environment*, 624, [1429-1442](#).

²⁶ Haase, P. et al. (2018). *Science of the Total Environment*, 613, [1376-1384](#).

²⁷ Commission Decision (EU) 2018/229 (2018). *Establishing, pursuant to Directive 2000/60/EC of the European Parliament and of the Council, the values of the Member State monitoring system classifications as a result of the intercalibration exercise and repealing Commission Decision 2013/480/EU*, Luxembourg: [Publications Office of the European Union](#).

²⁸ EEA Report No 7/2018 (2018). *European waters - Assessment of status and pressures 2018*, Luxembourg: Publications Office of the European Union; [European Commission \(2019\). COMMISSION STAFF WORKING DOCUMENT European Overview - River Basin Management Plans Accompanying the document REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL implementation of the Water Framework Directive \(2000/60/EC\) and the Floods Directive \(2007/60/EC\) Second River Basin Management Plans First Flood Risk Management Plans SWD/2019/30 final, Brussels](#).

the monitoring and assessment systems have not been harmonised, and there is little knowledge on their comparability and representativeness. The quality of the underlying data differs substantially between member states and so does the reliability of the different conservation status assessments. In addition, there seems to be little harmonisation of the monitoring design and data collected for the WFD and the Habitats directive, in spite of clear potential for using the same dataset for multiple purposes. Regulatory monitoring in both the WFD and the Habitats Directive would benefit from adopting new molecular biomonitoring techniques using e-DNA and metabarcoding²⁹.

Altogether, many of the data streams listed above lack harmonization and integration, and several bottlenecks still exist in making these data representative, reliable, publicly accessible and usable. EuropaBON will develop an up-to-date inventory of these data streams (T3.1), identify gaps (T3.2) and bottlenecks (T3.2), building on previous projects and current monitoring practices. The potential of novel approaches for collecting biodiversity data will also be assessed, based on recent progress in the development and applications of such approaches (T4.2).

1.3.4 Integrating data and modelling EBVs and EESVs

The first step of data integration is to mobilize and harmonize raw data using interoperable and machine-readable (meta)data standards, to generate **EBV integrated datasets** (also known as EBV-ready datasets)³⁰. For instance, standards such as the Darwin Event Core and data infrastructures as GBIF are well fitted for mobilizing and harmonising species monitoring data. However, the raw observations in regulatory reporting (e.g., WFD, Habitats and Birds Directive) or in long-term, structured citizen science monitoring behind the Common Bird Indicator or the Grassland Butterfly Indicator³¹ are rarely available in public databases. This contrasts for instance with opportunistic citizen science data uploaded to iNaturalist (for official LoS see section 6 of the proposal) or eBird which is automatically pushed to GBIF. In addition, datasets integrating or combining multiple data streams or data from different countries, e.g., observation.org and artportalen.se, are also not readily available in an interoperable form, which limits their findability, accessibility, interoperability and reusability (FAIR principles³²).

Even after several datasets from different data streams are integrated and harmonized (e.g., with a shared taxonomy, common formats, standardized units, and being quality-checked), many spatial and temporal gaps still remain. In order to fill those gaps, spatial and temporal interpolation can be done with statistical models and artificial intelligence methods. In addition, environmental variables for which wall-to-wall datasets exists, such as climate variables, land-cover, or topography, can be used to model and predict the values of EBVs and therefore fill existing gaps in in-situ observations, resulting in **EBV modelled datasets**³³.

Two main classes of the latter models can be used for species population EBVs: inductive and deductive models³⁴. Inductive models go from specific to general and are based, for instance, on correlations between observations of species occurrences or abundances and the values of the predictor environmental variables (e.g., species distribution models SDMs)³⁵. Deductive models take the reverse steps of inductive approaches (from general to specific). They use information on the habitat use of species, for instance the list of habitats where the species is known to occur, to refine coarse geographic range maps of species to finer maps of occupancy. Inductive and deductive models can be combined: the distribution of a species that can only exist in grasslands can be projected over time by tracking the ecosystem extent of grasslands using remote sensing, filtering out from an inductive model (e.g., SDM based on climate) the areas where grasslands no longer occur³⁶.

Ecosystem function EBVs require the use of process-based models or other causal/correlative models (e.g., structural equation models) that allow to understand the direct and indirect influence of multiple environmental, land cover, or climatic drivers on the distribution and dynamics of specific functional variables. The use of process-based models allows both researchers, users and modelers to improve the transparency of the assumptions and theoretical knowledge supporting the definition of the functional variables. Once properly parameterized, these models can support the estimation of functional conditions under probable scenarios of climate or land-use change. Another example are models to assess the flows of ecosystem services. Such models usually start from service providing units (spatial distribution of species, habitats, or ecosystems) and then combine environmental data with specific knowledge about ecosystem processes to assess the capacity or supply to generate ecosystem services, while service

²⁹ Pawlowski, J. et al. (2018). *Science of the Total Environment*, 637, [1295–1310](#).

³⁰ Kissling, W.D. et al. (2018). *Biological Reviews*, 93, [600–625](#).

³¹ Pearce-Higgins, J.W. (2018). *Journal of Applied Ecology*, 55 (6), [2544–2551](#).

³² Wilkinson, M.D. et al. (2016). *Scientific Data*, 3, [160018](#).

³³ Kissling, W.D. et al. (2018). *Biological Reviews*, 93, [600–625](#).

³⁴ Jetz, W. (2019). *Nature Ecology & Evolution*, 3, [539–551](#).

³⁵ Araújo, M.B. and Peterson, A.T. (2012). *Ecology*, 93, [1527–1539](#).

³⁶ Rondinini, C. et al. (2011). *Philosophical Transactions of the Royal Society B: Biological Sciences*, 366, [2633–2641](#).

delivery often requires human population data also. Measuring EESVs can greatly enhance the accuracy of ecosystem services models. Too often, models need to take unrealistic assumptions due to a lack of consistent observations on EESVs³⁷.

EuropaBON will design workflows for EBVs and EESVs that allow raw data to be mobilized, harmonized, integrated and modelled (T4.3). The modelling tools available for each EBV and EESV will be assessed relative to their ease of use and predictive power, and their potential to be implemented in a sustained workflow-oriented e-infrastructure. The EBV framework and the use of modelling tools facilitate the integration of different data streams and heterogeneous monitoring methods. In addition, they can also guide the standardization of biodiversity monitoring protocols by identifying which measurements need to be made, where and of which biological entities, so that the potential of the modelling tools in producing robust biodiversity and ecosystem services trends is maximized. EuropaBON will use this framework to propose standardized data collection protocols for each EBV and EESV (Task 4.3), addressing also data publishing and sharing policies, analytical protocols and processing steps. These EBVs and EESVs workflows need to be open and reproducible to support reliable and repeatable reporting of biodiversity and ecosystem services trends by member states and European agencies.

1.3.5 Synthesizing EBVs for end users and policy support

EBVs are massive datasets that need to be interpreted and synthesized for users, such as policy officers, resource managers or even the general public. One approach to produce such synthesis is to produce indicators that summarize the trends of some aspect of biodiversity, but other syntheses such as maps and assessments are also possible. In EuropaBON will deliver various outputs that can be produced by synthesizing EBVs for specific users (WP5): indicators of current state, recent trends, short-term forecasts and long-term scenarios.

Indicators of current state and recent trends

Shortly after the adoption of the 2011-2020 Global Biodiversity Framework, the EBVs were first conceptualized in response to a call from the CBD to assess the availability and adequacy of biodiversity data to track progress towards the achievement of the Aichi Biodiversity Targets³⁸. Since then, multiple EBV products and derived indicators have been identified for their relevance to monitor the implementation of biodiversity conservation and sustainable development frameworks at the global and regional scales³⁹. More recently, the EBV framework was used to guide and communicate on the assessment of the state of nature in the Global Assessment of IPBES, with a section dedicated to each of the six EBV classes⁴⁰. Their scalability also makes EBVs adequate for assessments of the effectiveness of management and conservation policies, as well as to guide the design (or harmonization) of the biodiversity monitoring programmes that produce the underlying raw data, whether at the local, sub-national, or national scale.

Indicators of current state and trends in the biodiversity can be calculated at the scale of interest by integrating the relevant EBV over a spatial region. For instance, species population abundances of a selected group of species (e.g. pollinators) can be averaged and spatially integrated to calculate a composite indicator of mean species abundance over time⁴¹. They can also be combined with other datasets to calculate indicators of the impacts of intervention actions or of the benefits. For instance, to assess the effectiveness of protected areas, the spatial distribution of protected areas can be combined with changes in ecosystem extent or in species distribution⁴².

The choice of indicators to be derived from EBVs and EESVs depends on the policy needs and needs to be discussed with stakeholders. In EuropaBON we will identify the indicators (T2.3) to be produced in the EBV and EESV workflows (T4.3). The calculation of EBV-based indicators of current state and recent trends of biodiversity will be demonstrated in the showcases in particular policy contexts: Birds Directive (T5.1), Habitats Directive (T5.2) and Water Framework Directive (T5.3).

Short-term forecasts

Ecological questions being asked by policymakers, managers and citizens are often about the short-term future (e.g., coming days or weeks). These questions can refer to a wide variety of phenomena and the answers being given vary greatly in terms of the accuracy provided and of the scientific and technological capability that is used to achieve

³⁷ Schulp, C.J.E. et al. (2014). *PLoS ONE*, 9 (10), [e109643](https://doi.org/10.1371/journal.pone.0109643).

³⁸ GEO BON (2011). *Report prepared for the Convention on Biological Diversity*, [Pretoria, South Africa](https://www.biodiversity.org/publications/2011/01/13-report-prepared-for-the-convention-on-biological-diversity).

³⁹ E.g. Geijzendorffer, I.R. et al. (2015). *Journal of Applied Ecology*, 53, [1341-1350](https://doi.org/10.1111/1365-2656.12500).

⁴⁰ Ichii, K. et al. (2019). In IPBES (2019). *Global Assessment on Biodiversity and Ecosystem Services*, [Bonn, Germany](https://www.ipbes.org/global-assessment).

⁴¹ Brummitt, N. et al. (2017). *Biological Conservation*, 213, [252-255](https://doi.org/10.1016/j.biocon.2017.05.025).

⁴² Leberger, R. et al. (2019). *Biological Conservation*, 241, [180299](https://doi.org/10.1016/j.biocon.2019.05.025).

them⁴³. However, for most ecological phenomena, scientifically sound, short-term forecasts remain missing. This is in sharp contrast with forecasts made for the long-term (e.g., biodiversity changes in a 50-year horizon), which abound in the scientific and technical literature and that are regularly used to supporting decisions made for the long-term⁴⁴. A main reason for the scarceness of short-term ecological forecasts concerns the lack of data standardization among sources of biodiversity observation data. Short-term biodiversity forecasts require the automation of workflows into a continuous production loop, which includes procedures of data assimilation, model recalibration and the production and delivery of the predictions. There is now increased easiness in addressing the computational challenges involved and near real-time information on key environmental drivers is available from robust sources through standardized data sharing protocols (e.g., Copernicus imagery and meteorological observations). However, biological observation data, which are very often scattered across multiple sources, each using its own data-storage structure and often lacking interfaces for programmatic access, becomes a huge challenge to accommodate within the computational robustness and timeliness required for short-term model production.

The standardization of datastreams of biodiversity observation records that is aimed under EuropaBON, will represent a major step forward towards the wider implementation and availability of short-term biodiversity forecasting frameworks. Short-term forecasts for a range of ecosystem services in support of the bioeconomy will be demonstrated in T5.5.

Medium and long-term scenarios

Scenarios are a policy-support tool that allows to assess the impacts of different management actions⁴⁵. This is particularly important because there is often a time lag between the response of biodiversity and the implementation of management interventions. Therefore, monitoring only the state of biodiversity without taking into consideration this time lag, can mislead managers to believe that their actions are not yet producing effects. Models can be used to project the future state of EBVs and EESVs based on scenarios for different interventions on direct drivers over the mid-term (i.e. intervention scenarios over a few years to a decade) or for different plausible trajectories of indirect and direct drivers over the long-term (i.e. exploratory scenarios over several decades). For instance, the expected recovery of species populations can be projected based on different levels of ambition for protected area coverage and their spatial distribution in a medium-term intervention scenario. While the future impacts of land-use change and climate change on species populations can be projected for different socio-economic scenarios⁴⁶. It is also important to note that the EBVs and EESVs workflows allow for calculation of the same indicators for the past trends and future scenarios.

Although the full development of long-term scenarios is beyond the scope of EuropaBON, the model-based essential variables framework provides a seamless way of making biodiversity data streams available for scenario models. EuropaBON will demonstrate how EBVs about the state of soil functions can be projected into the future to inform the climate and ecosystem restoration targets of the EU (T5.4).

1.3.6 The economics of biodiversity monitoring

Biodiversity monitoring has rarely been in demand at such a scale but has often struggled to generate funds due to perceived high costs and limited commercial application, often resulting in their de-funding after a short time or in times of economic constraint⁴⁷. Professionally led biodiversity monitoring can deliver consistent high-quality data but is often expensive in terms of staff, materials and administration⁴⁸. As a result, much existing biodiversity monitoring has been organized by charitable organizations and conducted by volunteers with value equivalent to millions of €⁴⁹. Although properly structured voluntary schemes can return high quality data, even on rare invertebrate species⁵⁰, volunteer-oriented schemes often have high recorder turnover⁵¹, and may be limited by what monitoring methods different recorders are willing to undertake. For instance, a recent study in the UK found that farmers were less willing to undertake active pollinator monitoring methods than non-expert volunteers but that these volunteers

⁴³ Dietz, M.C. (2017). *Ecological forecasting*. Princeton, USA: [Princeton University Press](https://www.princeton.edu/libraries/subject/libraries/press/).

⁴⁴ Pereira, H.M. et al. (2010). *Science*, 330, [1496-1501](https://doi.org/10.1126/science.1196151).

⁴⁵ IPBES (2016). *Policy support tools and methodologies for scenario analysis and modelling of biodiversity and ecosystem services*, Bonn, Germany.

⁴⁶ Mace, G.M. et al. (2018). *Nature Sustainability*, 1, [448-451](https://doi.org/10.1038/s41895-018-0048-4).

⁴⁷ Lindemayer, D.B. et al. (2012). *Austral Ecology*, 37, [745-757](https://doi.org/10.1111/j.1365-3113.2012.00577.x).

⁴⁸ Targetti, S. et al. (2014). *Ecological indicators*, 45, [434-443](https://doi.org/10.1016/j.ecolind.2014.05.001).

⁴⁹ Levrel, H. et al. (2010). *Ecological Economics*, 69, [1580-1586](https://doi.org/10.1016/j.ecolecon.2010.05.001).

⁵⁰ Zapponi, L. et al. (2017). *Biological Conservation*, 208, [139-145](https://doi.org/10.1016/j.bioccon.2017.05.001).

⁵¹ Domrose, M.C. and Johnson, E. (2017). *Biological Conservation*, 208, [40-47](https://doi.org/10.1016/j.bioccon.2017.05.001).

were often unwilling to undertake lethal passive sampling methods⁵². Furthermore, volunteers are likely to select sites in a highly non-random fashion, based on e.g., ease of access and probability of the species being present reducing the statistical power of the resultant data⁵³.

Recent studies have attempted to explore methods of increasing cost-efficiency, suggesting that combining volunteer and professional data collection⁵⁰ and collecting information on multiple factors (e.g. climate⁵⁴) could reduce monitoring costs overall, while larger site networks would create schemes that are cheaper on a per-site basis⁵⁵. However, these studies have mostly considered hypothetical networks, rather than looking for opportunities to improve cost-efficiency in existing schemes through more collaborative approaches. Moreover, the cost-effectiveness of existing vs. novel technologies for biodiversity monitoring (e.g. field observations vs. automated acoustic recording or monitoring with eDNA) has rarely been assessed. This cost-effectiveness will depend on the effort required in the field, the effort required in the laboratory, the quality of the data collected, and the costs for equipment/instrumentation.⁵⁶ Furthermore, many of the wider benefits of monitoring, particularly its value to wider ecological research have not been assessed for comparison to these costs⁵³.

A key component of EuropaBON will be the assessment of the long-term costs in managing existing (WP3) and proposed schemes (WP4) to estimate the real costs of managing these schemes (including the value of existing voluntary work). This will be achieved using detailed interviews with stakeholders (WP2) and the best available data collected from monitoring schemes and research organizations. These costs will include all material, labor, administrative and other costs and account for relative cost differences between countries. The project will explore the cost-effectiveness of existing schemes, in terms of data produced per € spent. Through facilitating discussion between organizations, infrastructure operators, policy makers and researchers, the project will identify opportunities to enhance the cost-effectiveness of the schemes without compromising data quality or the long-term maintenance of monitoring efforts (WP2). Following this, the project will use expert Delphi panel methods to assess the benefits of the proposed schemes to wider ecological research and estimate the potential costs saved from increased efficiency compared to isolated research projects, providing a monetary value that can be contrasted with the proposed scheme costs (WP4). These key outputs will allow the commission, EU member states and conservation agencies to make informed decisions about monitoring that recognizes its full potential value to science and society.

2 Impact

2.1 Expected impacts

2.1.1 Expected impact on policy design and implementation at EU level

On 1 December 2019, the new European Commission took office. Only 11 days later it presented an ambitious agenda on biodiversity and climate. This agenda was adopted as the European Green Deal, the EU's new growth strategy to 2030. The Green Deal puts biodiversity central to EU policies, which is an important step in mainstreaming and integration. Commission president Dr. Ursula von der Leyen stated that "*Preserving and restoring our ecosystem needs to guide all of our work. We must set new standards for biodiversity cutting across trade, industry, agriculture and economic policy*". It is thus clear that 2020 will be a key year for biodiversity policy and that the next decade will require doubling efforts to implement the ambitious targets which will be agreed this year in the next global and European biodiversity strategies to 2030. New policy targets to stop biodiversity loss, to set restoration goals and to define further knowledge needs will be outlined in the next biodiversity strategy to 2030, and will be adopted by the European Commission during the first semester of 2020. The new strategy is expected to make particular reference to better biodiversity monitoring. This strategy will be further amended and operationalized by a Biodiversity Action Plan, which will be adopted in the first semester of 2021.

The design, testing and deployment of a scientifically sound, cost-effective and multi-purpose biodiversity monitoring network will be an essential cornerstone to deliver on the ambitions of the European Green Deal and the EU biodiversity strategy to 2030. Systematic and harmonized in-situ monitoring of essential biodiversity and

⁵² Garratt, M.P. et al (2019). *Global Ecology and Conservation*, [e0078.1](#).

⁵³ Tulloch, A.L. et al. (2013). *Diversity and Distributions*, 19, [465-480](#).

⁵⁴ O'Connor B. et al. (2020). *Ecological Informatics*, 55, [101033](#)

⁵⁵ Carvell, C. et al. (2016). *Design and Testing of a National Pollinator and Pollination Monitoring Framework*. Final summary report to the Department for Environment, Food and Rural Affairs (DEFRA), Scottish Government and Welsh Government: [Project WC1101](#).

⁵⁶ Griffiths et al. (2016). *Ecological Indicators*, 69, [213-223](#).

ecosystems variables across the EU is needed in order to support periodic evaluation of progress towards curtailing biodiversity loss.

EuropaBON is designed to meet these expectations i.e. not only to anticipate the new policy developments but also help implement existing policies, regulations and actions that require ecosystem and biodiversity data. The design of the monitoring network will be aligned with the key requirements outlined by these policy documents through consultation with the stakeholders at EU and MS level (WP2). To this end, EuropaBON has ensured that key stakeholders from the European Environment Agency, which are involved in the implementation of the biodiversity strategy to 2030, are part of the advisory board.

A better biodiversity monitoring system is essential not only to support new policy strategies but also to help implement existing legislation and actions that are dependent on knowledge about key biodiversity and ecosystem parameters. A pivotal project that will guide EuropaBON is the Mapping and Assessment of Ecosystems and their Services (MAES), an initiative of the Commission and the Member States under Action 5 of the EU Biodiversity Strategy to 2020. MAES has delivered an EU wide typology for ecosystems and provides definitions and guidance on ecosystem condition and ecosystem services including a conceptual framing and indicators. INCA (integrated system for natural capital and ecosystem services accounts), the EU's initiative on ecosystem accounting, is part of Action 5. Ecosystem accounts monitor the extent and condition of ecosystems and the flow of services to the economy. EuropaBON will ensure compliance with the MAES framework and it will enhance the impact of a European ecosystem accounting system by addressing how regularly monitored biodiversity and ecosystem variables can provide direct input to ecosystem accounts through inter-operable data systems. Once again, key stakeholders of MAES and INCA are on board of EuropaBON, either as partner (JRC) or through the advisory board. EuropaBON will also engage and liaise with other important international initiatives including the Ecosystem Services Partnership (ESP) as well as explore the potential to use the OPPLA – the EU repository for Nature Based Solutions to share results from the project.

Importantly, the impact of EuropaBON will clearly go beyond initiatives that directly relate to the EU biodiversity strategies to 2020 and 2030, as it will contribute to improving data flows for a variety of EU initiatives that explicitly require (or will require) regularly updated information on the state of ecosystems or the impacts of drivers, pressures and measures on biodiversity. Through various initiatives, the EU and national authorities and agencies are already putting much effort into the in-situ monitoring of land, freshwater, air quality, habitats, species and ecosystems. Most, if not all, of these initiatives are not aligned with each other. EuropaBON will collect information about the currently ongoing and planned monitoring schemes that exist at EU level and ensure maximal alignment.

In particular, the following policies initiatives will be considered:

- **The Habitats and Birds Directives:** Every six years, member states have to report the conservation status of habitats, species and the population status of birds. More consistent and harmonized monitoring of habitats and species will be designed by EuropaBON by integrating existing data streams and setting up new biodiversity monitoring with an emphasis on Natura 2000 sites, which will substantially reduce monitoring gaps and also reduce reporting burdens for member states.
- **The Water Framework Directive:** Every six years, member states have to report on the ecological status of surface waters by examining the composition and abundance of communities of phytoplankton, benthic flora, including algae and aquatic macrophytes, macro-invertebrates and fish. These data are summarized in ecological quality ratios so as to report ecological status class. But the monitoring scheme provides a wealth of information that can also be used to report status and trends of biodiversity in freshwater ecosystems and could thus contribute to the objectives of a European Biodiversity Observation Network.
- **The EU Pollinators Initiative:** Under Action 1 of the initiative, the Commission is currently preparing the design of an EU wide monitoring network for pollinators. The design for the pollinators network will be an integral part of EuropaBON, which will be facilitated by two consortium members with relevant roles in the process, the JRC and the University of Reading (who are managing and chairing the expert pool that will deliver a monitoring design).
- **The EU's Bioeconomy Strategy** has a dedicated action on the monitoring of the condition of biodiversity, ecosystems and ecosystem services, which underpin the bioeconomy. EuropaBON will be a key deliverable for this action, by designing and demonstrating workflows for ecosystem service forecasts that can support economic activities and business opportunities, and the EU citizens at large.
- **The National Emissions Ceiling Directive** establishes under its art.9 a network of monitoring sites that is representative of their freshwater, natural and semi-natural habitats and forest ecosystem types. The network

is currently being put in place to monitor the impact of air pollution on ecosystems. EuropaBON will work with the relevant stakeholders (European Commission and the EEA) to ensure a high level of integration with EuropaBON.

- Agriculture has a key impact on biodiversity but can also contribute solutions to enhance biodiversity. A key data set on crop statistics is the Land Parcel Information System (LPIS) (in combination with the Integrated Administration and Control System (IACS)). These data are not publicly available across the EU although they would be of considerable added value to understand the spatially explicit impacts of agriculture on biodiversity. The Commission is making efforts to unlock these data, in compliance with the Inspire Directive. EuropaBON will include relevant stakeholders in the co-design process to understand how these data can possibly contribute to the objectives of the monitoring network.
- The Commission has its own monitoring system to report land use: Land Use/Cover Area frame Survey (LUCAS). The scale of LUCAS as well as the type of data that is collected overlap to a certain extent with the objectives of any large-scale monitoring network on biodiversity and ecosystems. LUCAS is managed by Eurostat, the EU's statistical office. Eurostat is considered a key stakeholder at the EU level and as such the project will ensure an strong engagement with it.

The showcases in EuropaBON will effectively test how the design of the monitoring network can be improved in order to have more consistent, streamlined and harmonized data that can be used for the above-mentioned initiatives. In addition, a fully implemented EuropaBON will ensure integration of data streams in the reporting on progress towards the sustainable development goals (SDGs) in Europe⁵⁷. Alignment with the SDGs is a cross-cutting issue in Societal Challenge 5 of Horizon 2020 (see also section 1.2) and a key objective for EuropaBON. Special attention will go to improving the monitoring framework of the SDGs with special attention for goals SDG14 (life below water), SDG 15 (life on land), as well as SDG2 (zero hunger), SDG6 (clean water), SDG11 (sustainable cities), and SDG13 (climate action). EuropaBON will particularly address knowledge gaps in the measurement of goals 14 and 15 which are caused by the limited scope of the available indicators and the resulting problems to assess the EU's progress for these SDGs.

2.1.2 How will EuropaBON create impact in relation to the call text

Clearly, 2020 is a key year for biodiversity science and policy for many reasons. First, it marks the end of the global and European biodiversity strategies to 2020 and the adoption of updated policies and strategic planning for the next decade. Moreover, 2020 is a transition year between Horizon 2020 and Horizon Europe, the 9th EU framework programme for research and innovation. The Post-2020 Global Biodiversity Framework under the UN, Convention of Biological Diversity, the next EU biodiversity strategy to 2030 and Horizon Europe will beyond any doubt call for an enhanced monitoring of biodiversity and ecosystems using various data streams (ranging from remote sensing to in-situ data collection and citizen science). EuropaBON will support the new global and EU Biodiversity strategies by designing a novel, cost efficient and innovative system for biodiversity monitoring in Europe. This design will provide three major improvements: 1) all major taxonomic groups of flora and fauna in all major types of ecosystems will be covered by defining appropriate and applicable indicators in line with the Essential Biodiversity Variables (EBVs); 2) proposing better integration of data flows to ensure a spatially representative network of monitoring sites covering all common as well as rare/protected habitat types that can be used to assess current biodiversity status, and have sufficient monitoring frequency to reveal trends; 3) demonstrate with concrete showcases how points 1 and 2 can be achieved by combining conventional in situ monitoring with new methods ranging from molecular techniques and machine learning to citizen science, drones and remote sensing by satellites. Table 2.1 outlines in more detail how EuropaBON plans to have impact.

⁵⁷ Eurostat (2019). *Sustainable development in the European Union. Monitoring report on progress towards the SDGs in an EU context*, [Publications Office of the European Union, Luxembourg](#).

Table 2.1: EuropaBON responses to the expected impacts in the call text.

Expected impacts	Expected contributions of EuropaBON
1) implementation of the Bioeconomy Strategy, including the better use of Copernicus through calibrating with ground data	WP5 has a dedicated showcase on the Bioeconomy strategy, including outputs from a Nordic Center of Excellence for a sustainable bioeconomy related to forestry, agriculture and water. EuropaBON will also contact the Bioeconomy Knowledge Centre of the Commission as stakeholder to ensure policy relevance.
2) implementation of ecosystem-related EU policies, action plans, programmes and initiatives; in particular via the MAES and INCA processes	WP2 will analyze the current and future knowledge needs to continue supporting EU initiatives on biodiversity. JRC is coordinator of the MAES process and a key partner in INCA and can be a knowledge broker between EuropaBON and the Commission (see also Biodiversity Knowledge Centre). The strong links between the EuropaBON partners and the EEA with its topic centers for biodiversity and for water will also facilitate impacts of EuropaBON on the mentioned EU policies and processes.
3) scenarios, assessments and data in the context of initiatives, such as IPBES, GEO/GEOSS, the Global Biodiversity Information Facility or IPCC; and in EU initiatives on Nature-Based Solutions or sustainable agriculture	GEO is at the core of EuropaBON as it is based on GEO BON principles and experts (see also section on maximizing impact). EuropaBON will collaborate with GBIF (see LoS) to ensure that data collected is mobilized through GBIF infrastructure. Scientists from EuropaBON are involved in the various assessments of IPBES and IPCC and also work with nature-based solutions in various projects in dialogue with the agricultural sector.
4) proposing EU-level monitoring approaches of key EU ecosystem and biodiversity targets (including recommendations on the most accurate and cost-effective techniques)	WP4 is designed to deliver an inclusive and encompassing architecture for an EU wide biodiversity monitoring system (EuropaBON) with accurate and cost-effective techniques.
5) integration of citizen-science data (e.g., bird and butterfly records) and research data depositories (e.g., the European vegetation archive) into publicly accessible EU-level data bases	WP3 will assess how citizen science is used and can be enhanced in current monitoring schemes. WP4 will ensure the integration of citizen science in the design of EuropaBON (see LoS of iNaturalist and ESCA) and explore whether and how European research databases can be made more accessible at EU-level, e.g., through the European Open Science Cloud (EOSC). EuropaBON will adopt the guidelines for citizen science in environmental monitoring drafted under the EKC-KIP Citizen Science initiative.

2.2 Measures to maximise impact

2.2.1 Dissemination and exploitation of results

EuropaBON has developed a Plan for Exploitation and Dissemination of the Results (PEDR) based on a strong expertise to engage stakeholders, a proven scientific excellence of the partners, a strong connection with the international research community, and a direct interaction with the main target groups. The following measures will maximise the impact of EuropaBON:

- Dedicated Work Package (WP2) on communication and outreach and stakeholder engagement with stakeholder-oriented meetings

- Collaboration with key projects (see Table 2.2) and exploitation of their results
- A direct line to the new knowledge supporting mechanism for biodiversity policy of the EU, BKC, and to EEA and its topic centers for biodiversity (ETC-BD) and water (ETC-ICM), due to the direct involvement of EuropaBON consortium partners (JRC and NIVA) in these activities.
- A foundation in the research developments and community of practice of GEO BON⁵⁸
- An open data policy (see Table 3.1.b, T1.4 Knowledge management)
- Strategy for Horizon Europe: EuropaBON outputs will be directly relevant for this strategy

Communication and stakeholder engagement. A substantial part of the resources of EuropaBON will be dedicated to the full engagement of stakeholders (20% of personnel costs, plus 45% of other direct costs or 5% of the total budget is allocated to workshops). A dedicated work package (WP2) will stimulate the active involvement of a range of stakeholder groups. Their input and ownership of the design process are central to a successful proposal for a European Biodiversity Observation Network, and key stakeholders have already confirmed support to the project (see LoS).

Collaboration with key projects and international initiatives. Within the European research area, EuropaBON can rely on the extensive networking capacity of the consortium members to make maximum use of existing knowledge on biodiversity through their key roles in ongoing or recently finished projects under the EU’s framework programme for research and innovation. The consortium partners will also establish collaboration with other projects and initiatives that can benefit from EuropaBON. Partners already reached out to several national and international agencies to get their official support for this project (for a list of supporting agencies, please refer to section 6 of the proposal). The current involvement of the consortium partners in relevant international and national projects, particularly GEO BON, will guarantee an exchange of knowledge, expertise and results. Table 2.2 lists key projects, which deliver relevant outputs for the design of the monitoring network.

Table 2.2: Key research projects in which partners of EuropaBON are either participating, have participated, are in the advisory board, or which will be contacted to explore possible synergies. Projects in bold are funded under H2020 or FP7. Other projects are funded by ESA (for official LoS see section 6 of the proposal), the European Commission, EEA, BiodivERsA, Nordforsk, UN or other agencies. All ICETA projects will be managed by BIOPOLIS from November 1, 2021.

Acronym	Project title or description	EuropaBON partner
BIO_SOS	Biodiversity multi-source monitoring system from space to species	ICETA-CIBIO
BIOPOLIS	Teaming to upgrade to excellence in environmental biology, ecosystem research and agrobiodiversity	ICETA-CIBIO
BIOWATER	A Nordic Center of Excellence to integrate land and water management for a sustainable Nordic bioeconomy	NIVA
DCS4COP	Integrate data streams and generating high-quality information from the novel sensors of the Sentinel satellite series by implementing the Copernicus Water DataCube Service	NIVA, VITO
DIARS	Detecting of Invasive plant species and Assessment of their impact on ecosystem properties through Remote Sensing	VITO
E-Shape	Improve user uptake of earth observation data and forecasting capabilities for decision-making by EU governments and stakeholders	MLU, IIASA
eBMS & ABLE	European Butterfly Monitoring Scheme & Assessing Butterflies in Europe	UFZ
ECOPOTENTIAL	Improving future ecosystem benefits through earth observations	UFZ, MLU, ICETA-CIBIO, CREAM

⁵⁸ Pereira, H.M. et al. (2010). *Frontiers in Ecology and the Environment*, 8, [459-460](#).

ECOSTAT	Working group on Ecological status under the Water Framework Directive Common Implementation Strategy	JRC, NIVA
eLTER PLUS	European Long-Term Ecosystem, Critical Zone and Socio-ecological Research Infrastructure PLUS	UFZ, ICETA-CIBIO
ENRAM	European Network for the Radar surveillance of Animal Movement	UvA
EnvMetaGen	Creation of capacities for biodiversity surveys and Environmental monitoring using metabarcoding and MetaGenomics	ICETA-CIBIO
ESMERALDA	Guidelines for EU member states on how to map and assess ecosystems and their services	JRC, VITO, Pensoft
ETC-ICM	EEA's Topic Center for Inland, Coastal and Marine waters doing European assessments of ecological status and water quality indicators of Europe's waters and collaborating with ETC-BD on revision of EUNIS-types and potential for harmonization of status indicators for the WFD and Habitats Directive	NIVA, UFZ
EU BON	Building the European Biodiversity Observation Network	UFZ, Pensoft, CREAM
EUPMS	Design of EU monitoring scheme and pollinator indicators under the EU Pollinators Initiative	UREAD, JRC
EUROBIRDPORTAL	Combining and improving online bird portals data to display near-real-time spatiotemporal patterns of bird distribution across Europe	CREAF
EUROFLOW	Best practice management of e-flows to sustain river ecosystems based on responses of indicators for biodiversity and ecoservices	NIVA, UFZ
FUTUREBIOECON	Sustainable future use of European forests for developing the bioeconomy	CREAF
GEO BON	Improve the acquisition, coordination and delivery of biodiversity observations and related services to users including decision makers and the scientific community	MLU
GLoBAM	Monitoring, understanding and forecasting Global Biomass flows of Aerial Migrants	UvA
GlobDiversity	Remote sensing-enabled EBVs for terrestrial ecosystems	VITO, MLU
GLOBIS-B	Global research infrastructure to provide essential biodiversity data at different spatial and temporal scales	UvA, MLU
IPBES	Intergovernmental science-policy Platform on Biodiversity and Ecosystem Services	UREAD, MLU, UFZ, CREAM, NIVA, ICETA-CIBIO
LandSense	A citizen observatory and innovation marketplace for land use and land cover monitoring	IIASA
MAIA	Mapping and Assessment or Integrated ecosystem Accounting	VITO
MARS	Managing Aquatic ecosystems and water Resources under multiple Stress	NIVA, JRC
MS.MONINA	Multi-scale Service for Monitoring Natura 2000 Habitats of European Community Interest	VITO
Nature Map Earth	Nature Map Earth is developing an integrated global map of biodiversity, carbon storage, and other dimensions of nature by consolidating and crowd-sourcing data from many sources	IIASA

NewGen	Capacity building at CIBIO for research using Next-Gen Sequencing	ICETA-CIBIO
ØKOSTOR	Surveillance monitoring of ecological status of large Norwegian lakes	NIVA
PAPBIO	System to monitor biodiversity and ecosystem services, including ecosystem natural capital accounts	VITO
POSHBEE	Pan-European assessment, monitoring, and mitigation of stressors on the Health of Bees	UREAD
REFRESH	Adaptive strategies to Mitigate the Impacts of Climate Change on European Freshwater Ecosystems	NIVA, JRC, UREAD
SIEUSOIL	Develop sustainable and holistic soil management practices based on a harmonized land information system	VITO
TAO	From data to decision: collecting, mobilizing, and harmonizing Tropical Andes Observatory data for improved conservation planning	MLU
TerraNova	The European landscape learning initiative: past and future environments and energy regimes shaping policy tools	MLU
TROPIBIO	Expanding potential in TROPICAL BIOdiversity and ecosystem research towards sustainable life on land	ICETA-CIBIO
TRUSTEE	Train a new generation of scientists with complementary and interdisciplinary skills in ecosystem modelling, plant physiology	VITO
WeObserve	An ecosystem of citizen observatories for environmental monitoring	IIASA, CREAM
WISER	Tools for the integrated assessment and restoration of the ecological status of European surface waters	NIVA, JRC

Teaming up with the new EU’s mechanism on biodiversity knowledge support. EuropaBON will deliver the design of an EU-wide, coherent and seamless, and spatially representative biodiversity observation network that serves the specific needs of the EU and its member states. The development of such a monitoring design will be done in close communication with the authorities that are responsible for biodiversity policy implementation and that have the technical and financial capacity to implement the architecture of the network into an operational service. In the framework on the EU Biodiversity Strategy to 2030, the European Commission, in close collaboration with the European Environment Agency (EEA) is currently setting up a Knowledge Centre for Biodiversity (BKC). Knowledge Centres inside the Commission are virtual entities, bringing together experts and knowledge from different locations inside and outside the European Commission. Their job is to inform policy-makers in a transparent, tailored and concise manner about the status and findings of the latest scientific evidence. Once operational, the BKC will track and assess progress in implementing the EU 2030 Biodiversity Strategy and underpin further biodiversity policy developments. The BKC will specifically address scenario development and biodiversity monitoring. The BKC is considered a crucial partner for EuropaBON in the stakeholder engagement and co-design process. G. Dubois (JRC) has been appointed as the coordinator of the BKC and is one of the key participants in EuropaBON. Together with the EEA representatives on the Advisory Board, they can facilitate the exchange of expertise between EuropaBON and the BKC and ensure that policy requests reflected in the objectives of the monitoring network and resource constraints with respect to the future implementation are maximally considered in the final design. Importantly, the Commission closely collaborates with IPBES and provides financial support to maintain the secretariat. EuropaBON, through its contacts with the IPBES secretariat and with several participants having served or serving as lead authors of the various IPBES assessments, can already incorporate specific requirements that will serve future assessments.

GEO BON as foundation. At the core of EuropaBON is GEO BON, a flagship initiative of GEO and a key contributor to GEOSS. Its mission is to improve the acquisition, coordination and delivery of biodiversity observations and related services to users including decision makers and the scientific community. H. Pereira, the

coordinator of EuropaBON, is the co-chair of GEO BON and hosts the secretariat at iDiv/MLU. Clearly, EuropaBON can rely on a strong scientific foundation that has been developed in the frame of GEO BON, a global network of expertise on biodiversity monitoring, and a strong commitment to deliver a design of an operational monitoring system. This experience in combination with the presence of key taxonomic and methodological expertise on biodiversity monitoring in the EuropaBON consortium will significantly contribute to a successful outcome of this project.

An open data policy. EuropaBON underwrites strictly to the open access and open data principles (FAIR principles⁵⁹) that form the basis for dissemination and communication of Horizon 2020. Workflows will emphasize the mobilization of data streams to public repositories such as GBIF (for official LoS see section 6 of the propo, while modelled EBVs will be shared on the GEO BON data portal. Where possible and on request of the Commission and EEA, EuropaBON can ensure that its outcomes are communicated on BISE, the Biodiversity Information System for Europe.

A Strategy for Horizon Europe. One of the four overarching objectives of the recently established European Biodiversity Partnership (EBP) is “Improved monitoring of biodiversity and ecosystem services across Europe.” The EBP will work towards this objective by promoting the collaboration between national policy makers, R&I policy makers, and R&I program funders, building on the successful BiodivERsA platform. EuropaBON will collaborate with the partnership to define a strategic research agenda (SRA) both for Horizon Europe and for the national funding agencies of the partnership, with the goal of supporting the implementation of a Biodiversity and Monitoring Coordination Centre (BMCC) in the EU (Task 2.4). Based on the outcomes of EuropaBON, this agenda will deliver recommendations for potential follow-up phases (if identified to be necessary), creating synergies and collaboration between national and international research programmes. The SRA will be communicated as soon as possible to the Commission and a summary will be part of the Final Project Activities Report. It will provide identified research, coordination and support needs for testing or implementing the EuropaBON design in the Horizon Europe programme.

2.2.2 Communication activities

EuropaBON will involve the communication networks of all partners, to ensure a broad knowledge exchange and outreach to the different target groups at every stage of the project. EuropaBON will combine traditional and digital marketing tools and communication methods, which will be described in detail in EuropaBON’s Plan for Exploitation and Dissemination of Results (PEDR) by month 6 of the project. These activities will target specific stakeholder groups (Table 2.3).

The project will foster two-way communication with stakeholders – both co-creating knowledge, receiving know-how and expertise from stakeholders and delivering outputs, tools and attractive dissemination of results. The EuropaBON social media channels (Twitter, Facebook) will be operational from the very beginning of the project in order to be used to collect opinions on the ongoing activities and define expectations, as well as to build a community of stakeholders, scientists and the general public. The website will be the main tool for both storing important documents (public document library) and dissemination of project outputs. The project website will: 1) present the objectives, work plan and expected results of EuropaBON; 2) publish press releases and summaries for the general public and specific stakeholders; 3) publish regular project and sector-related news; 4) provide links to other EU initiatives or research projects in the field; 5) host a dedicated biodiversity policy platform for the needs of policy- and decision-makers with example products and tools from the showcases (WP5).

Table 2.3: Methods of knowledge exchange, communication and dissemination tailored for various target groups, as part of the project’s Plan for Exploitation and Dissemination of Results (PEDR)

Audience/ target groups	Dissemination/ Communication channel/method	Content	Success criteria
1. Policy makers and authorities implementing biodiversity policy and using the outputs of the monitoring, including	Project website + dedicated policy platform	The project website will contain up to date project results, including targeted policy recommendations and products and tools from the showcases.	Links to EuropaBON website on webpages of authorities

⁵⁹ Wilkinson, M.D. et al. (2016). *Scientific Data*, 3, [160018](https://doi.org/10.1038/s41597-016-0018-8).

DGENV, Eurostat, EEA, EIONET, National authorities, IPBES, IUCN.	Meetings and conferences, policy events	Partners will present the project to policy-makers at events of opportunity via presentations, infographics and briefs.	Number of events, number and type of participants, feedback
	Social media engagement with policy-relevant accounts	EuropaBON will engage with stakeholders and policy associations, aiming to reach their followers, incl. policy-makers.	Number of retweets, number and type of comments (quantitative and qualitative)
	Joint policy brief of prospective European monitoring coordination centre	The policy brief will include rationale, organisation, responsibilities and workflows for the coordination centre.	Presentation at high-level event in Brussels
2. Experts and practitioners involved in monitoring	Factsheets and guidelines	EuropaBON will produce documents communicating key results to biodiversity monitoring experts and data modelers, etc.	Number of downloads, number of distributed printed copies
	Workshops	EuropaBON will organize a series of workshops with expert and practitioners on biodiversity monitoring (WP2-5)	Number and type of participants, feedback
3. Environmental NGOs, Citizen “scientists” (incl. Birdlife international, European Butterfly Monitoring scheme (eBMS) and the general public	Participation at open events organised by NGOs and citizen science organisations	An engaging presentation for a non-specialist audience will be produced. This can also include the plans for establishing the ToR for a monitoring coordination centre	Number of events, number and type of participants, feedback
	Joint science- society-policy brief with ECSA	EuropaBON results of relevance for citizen science	EuropaBon session at ECSA conference/event
	Press releases	Press releases will contain key scientific progress and project outcomes and will be published in key science news outlets, such as EurekAlert!, CordisWIRE	Number of press releases, number of views, number of media outlets publishing the press releases
4. Scientists, including universities and research institutes	Presentations and posters at scientific events, materials displayed on project website	EuropaBON will present the project at scientific conferences, such as: GEO BON, IUCN, etc.	Number of events, number of participants, feedback
	Publications/special issue in an open access journal, documents available on project website	EuropaBON partners will compile a special issue	Number of articles
All groups	Project website	The project website will inform and discuss specific topics of common interest; engage interested parties through provision of general information about the project and access to its main outcomes.	Number of visitors, website impressions, visit duration

		Information point for all stakeholders, incl. journalists	
	Social media posts	Social media activity will cover events (e.g., live tweeting from meetings) and when there are project developments and new published results.	Number of likes, shares, followers
	Promotional materials	Leaflets, brochures, posters and stickers will be produced to raise awareness about EuropaBON. They will be distributed broadly at relevant events, and will be available for download at the project website.	Number of downloads of electronic copies

3 Implementation

3.1 Work plan – Work packages and deliverables

3.1.1 Brief presentation of the overall structure of the work plan

The EuropaBON project is proposed for a duration of **36 months**. It is structured into **five different work packages (WPs)**, each subdivided into specific tasks (Figure 2). Each WP has a WP leader and each task has a task leader. **WP1 oversees the coordination and management of the project**. Stakeholder engagement (WP2) is the hub of the project in which identified critical stakeholders will be engaged into assessment (WP3) and co-design (WP4) processes of the project, as well as in drafting policy support (WP5). While **WP2 is the ‘heart’ of EuropaBON**, **WP3 and WP4 will deliver on the call**. Drawing on the user needs identified in WP2 (T2.1), WP3 assesses different sources for existing biodiversity monitoring data in Europe (T3.1) to identify their current gaps and bottlenecks in terms of thematic content, spatial and temporal coverage (T3.2), data flows and availability (T3.3), as well as cost-effectiveness (T3.4). WP4 builds on WP3 to deliver a new design for biodiversity monitoring in Europe, by improving existing monitoring schemes to become more representative, maximize benefits and become better integrated into wider biodiversity policy (T4.3 and T4.4). The new design will close existing temporal, spatial and thematic data gaps by integrating multiple monitoring sources with EBV modelling (T4.1) and various new technologies (T4.2) at national and European level, in dialogue with major stakeholders. The **policy examples showcased in WP5** will demonstrate how EuropaBON could contribute to various major environmental policies of the EU by using the new design from WP4. The work in WP3-5 is always developed in a dialog with stakeholders facilitated by WP2 to assess whether the deliverables produced by the project meet the user requirements. Ultimately a coalition with key stakeholders will be formed to trigger the establishment of ToR for a Biodiversity Monitoring Coordination Center to implement EuropaBON after the project ends (T2.5).

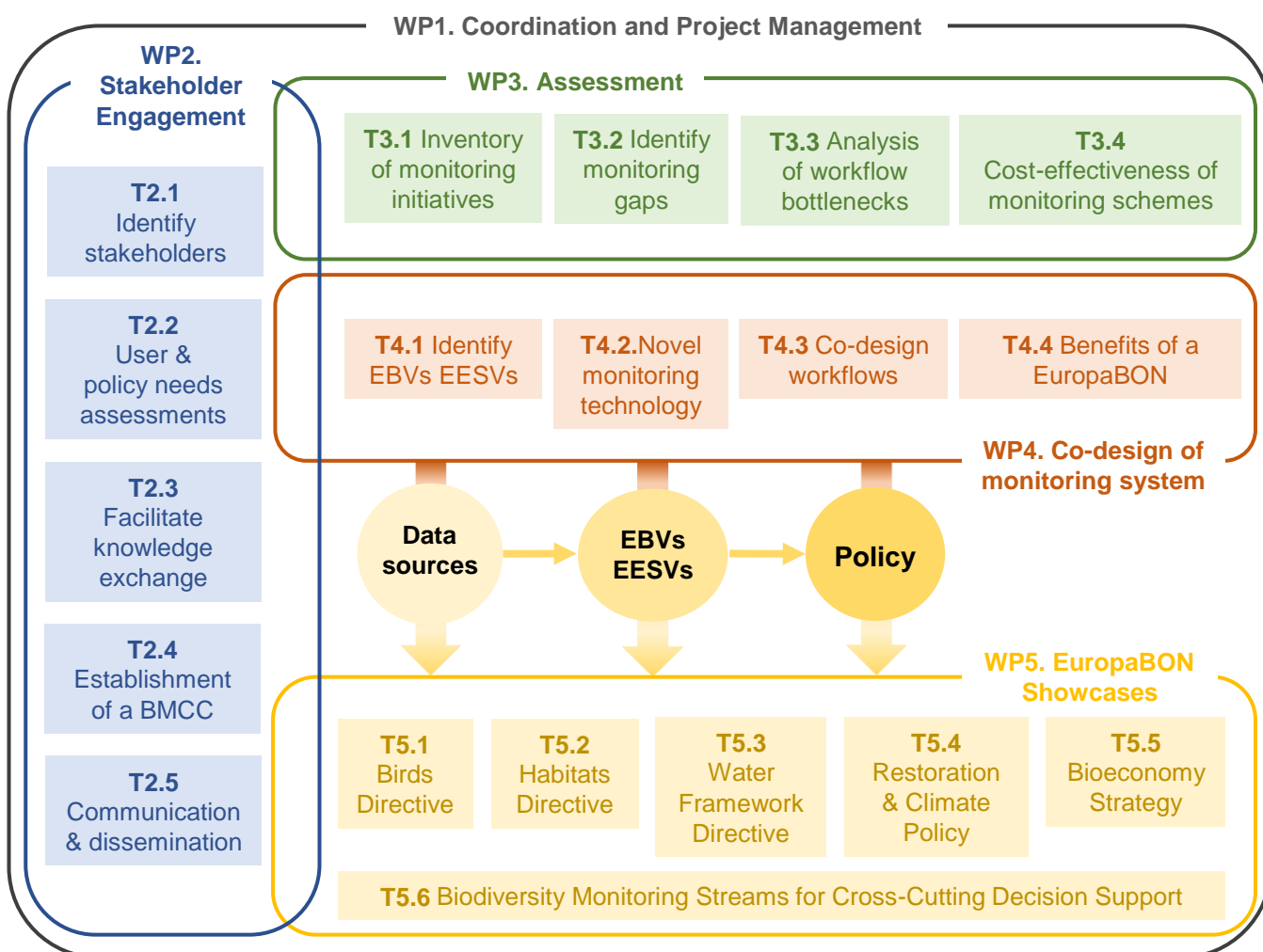


Figure 2: Illustration of work packages and tasks and how they link/interrelate.

Figure 3 provides a GANTT chart of the end month of the different tasks in the project work packages. It also shows the deliverables and their relation to each other, as well as milestones (workshops, meetings or other achievements). For more details on deliverables and milestones, please refer to Tables 3.1.c and 3.2.a, respectively.

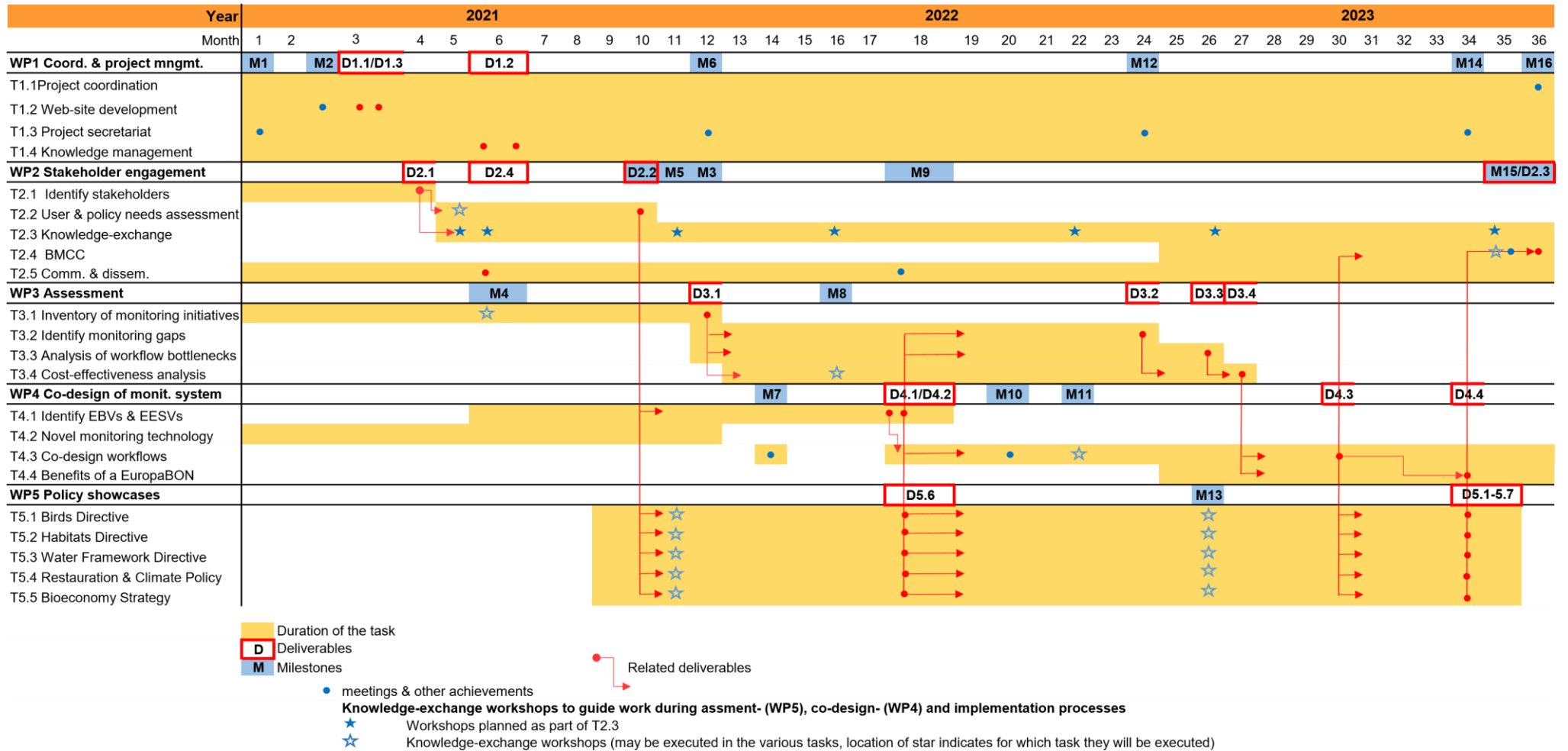


Figure 3: Graphical presentation of the work plan.

3.2 Management structure and procedures

3.2.1 Organizational structure and decision-making

EuropaBON will be led by the German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena- Leipzig, at Martin Luther University Halle-Wittenberg (MLU). The coordination unit at MLU (WP1) will be responsible for the **Scientific, Financial and Administrative Coordination** of the project. The project coordinator is also responsible for the contacts between the **European Commission** and the project Consortium. The **Consortium Coordination team (CC)**, which includes the project coordinator and all WP- and task leaders, will act as executive committee of the project, acting on behalf of the **Consortium Assembly (CA)** that includes all project partners. The **Advisory Board (AB)**, consisting of representatives of the, **EEA, GBIF, Biodiversity4All, the Microsoft European Biodiversity Partnership (EBP)**, the European Space Agency (**ESA**) and **Geo Engine** - a private geo-data processing company, as well as **two independent scientists** with strong connections to the **ESP (R. Chaplin-Kramer)** and to Pan-European Bird Monitoring Schemes driven by NGO's (**RSPB – R. Gregory**), will provide policy and scientific advice, and help connect EuropaBON to the relevant international initiatives. Figure 4 illustrates the management structure of EuropaBON.

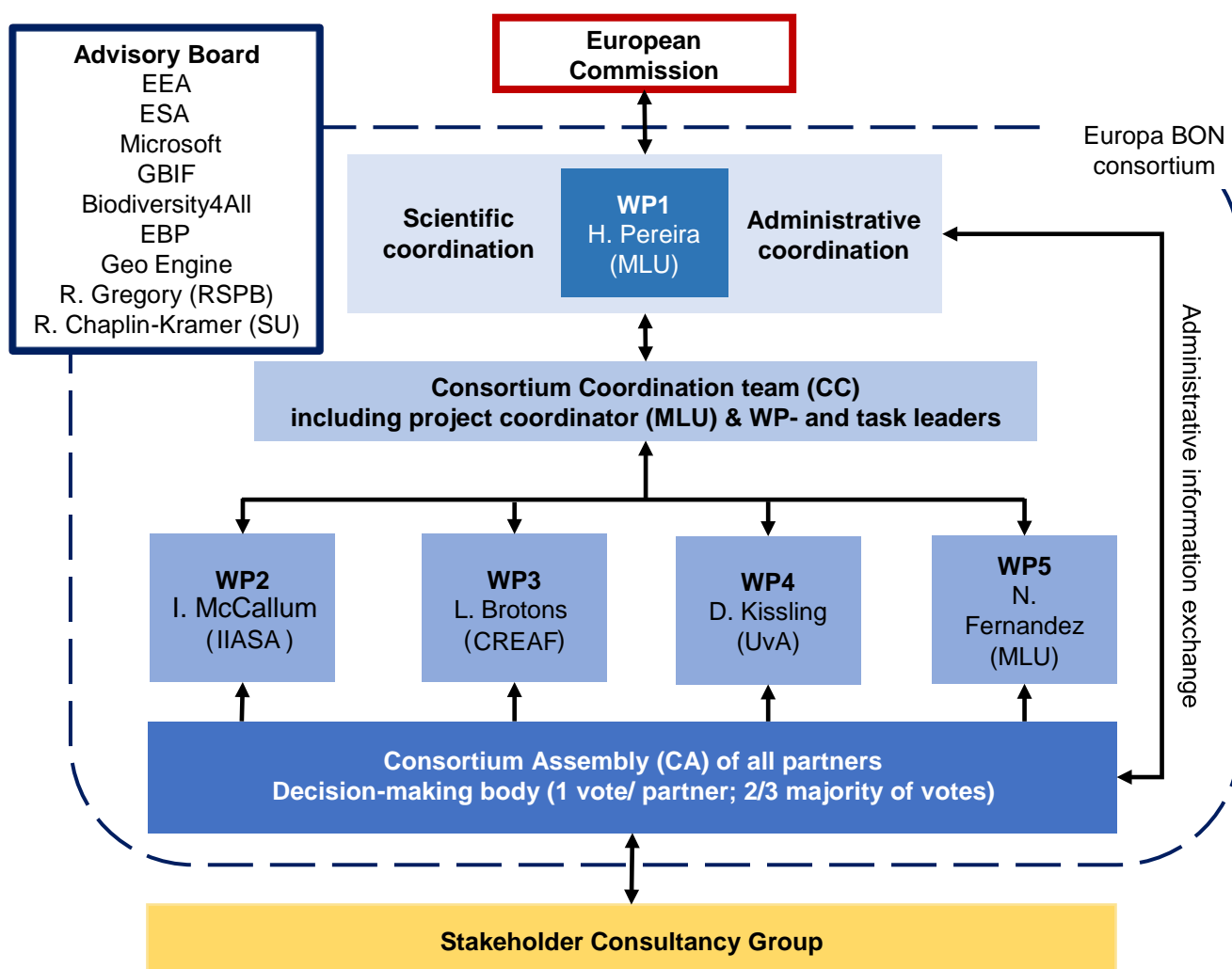


Figure 4: Management structure of EuropaBON.

The **coordinator of EuropaBON is Prof. Henrique Pereira (MLU)** who has outstanding experience in national and international research in the field of biodiversity change monitoring to inform policy and decision-making. He was work package coordinator for **ECOPOTENTIAL** (<https://www.ecopotential-project.eu/>), a project that aimed at improving future ecosystem benefits through earth observations, as well as **TerraNova** (<https://www.iucn.org/regions/europe>), a Marie Curie ITN aiming to reconstruct the history of Europe's nature and design landscape management strategies for ecosystem conservation and restoration. He leads a pilot showcase in the **E-Shape** (<https://e-shape.eu/>) project to improve user uptake of Earth Observation data and forecasting capabilities through GEOSS for decision-making by EU governments and stakeholders and he is Co-PI of the **TAO**

project, which aims at establishing a biodiversity observatory in the Tropical Andes that produces data to help inform policy and decision makers at the national and regional level. He also co-chairs **GEO BON** (<https://geobon.org/>), which aims at improving the acquisition, coordination and delivery of biodiversity observations and related services to decision makers and the scientific community. The project coordinator is supported by the scientific- and administrative coordinator, and iDiv's well developed infrastructure, including strong central services (outreach office, biodiversity informatics, bioinformatics), a Synthesis Centre (sDiv) fostering theoretical and synthetic thinking, as well as a PhD graduate school (yDiv). He is the leader of the consortium and the main representative of the project. He is also responsible for the contacts between the European Commission and the project consortium.

The **Scientific Coordination** (at MLU) manages and supervises all scientific activities. The scientific coordinator oversees the work packages, implements quality control and ensures that project deliverables are supplied in a timely manner. The scientific coordinator provides strategic guidance and devises changes in scoping and focus of different scientific tasks. The scientific coordinator works closely with the project coordinator and the work package leaders and ensures continuous information exchange among them. The scientific coordinator also coordinates relations between the WP leaders and the interdependencies among tasks.

The **Administrative Coordination** (at MLU) of EuropaBON is responsible for all administrative, financial, and logistical matters, including the organization of workshops and meetings. The administrative coordinator is also responsible for the free flow of administrative information between her and the different partners of the consortium assembly. The scientific and administrative coordination work in close contact with one another and the project coordinator, to ensure efficient and professional implementation of EuropaBON's management structure.

The **Consortium Coordination (CC)** is formed by the WP- and task leaders. It represents the consortium partners and implements the decisions made by the Consortium Assembly. The CC is chaired by the project coordinator as leader of WP1. The CC is responsible for the operational management of EuropaBON. It monitors scientific progress, supervises the production of deliverables, and evaluates and handles risks, challenges and demands of the scientific work plan. The CC will meet once every month through web meetings and once a year face-to-face during the Consortium Assembly meeting to evaluate progress and facilitate communication within and outside the project. The CC will also be responsible for addressing all conflicts that may arise during the course of the project and propose potential solutions to the CA.

The CC is also in direct contact with the **Advisory Board**, which consists of four representatives from the policy space, one representative of a global biodiversity data network, one from citizen science, a representative from a partnership that connects national/local and European Research & Innovation programs, and one from a private geo-data processing company, as well as two highly qualified scientists. This external expert group provides scientific feedback and advice on scientific challenges and demands to the CC. The CC meets at least yearly with the AB at the Consortium Assembly to discuss scientific progress and conceptual development. The advisory board includes:

- **Markus Erhard** from **European Environment Agency** is one of the coordinators of MAES together with A. Teller of DG ENV and J. Maes of JRC. He has the oversight within EEA to link the project partners to relevant colleagues in the EEA and the topic centres for specific aspects on freshwater, marine, urban and terrestrial biodiversity.
- **Dr. Jan-Erik Petersen** is the Head of Spatial Assessment Team at the **European Environment Agency**. EEA is a key partner when making proposals for a data infrastructure that should underpin the monitoring system, as they have the potential capacity and needed expertise to implement EuropaBON (given additional resources).
- **Tim Hirsch** is Deputy Director and Head of Participation of the **Global Biodiversity Information Facility (GBIF)**. Through its network of national and thematic nodes, GBIF will provide support to EuropaBON in mobilizing species-related data and biodiversity data-sharing. GBIF also provides an invaluable network of data contributors to be engaged in the design of the Europa-wide framework for monitoring biodiversity and ecosystem services.
- **Dr. Patricia Tiago** of the University of Lisbon and founder of the citizen science platform **Biodiversity4All**, will advise EuropaBON on the use of citizen science databases, and share her knowledge on biodiversity monitoring, trends for biodiversity change, and biodiversity monitoring schemes. Biodiversity4All is maintained by Associação Biodiversidade Para Todos, and the Portuguese node of iNaturalist, a joint initiative of the California Academy of Sciences and the National Geographic Society.
- **Prof. Xavier Le Roux**, lead scientist of the **European Biodiversity Partnership (EBP)**, coordinator of BiodivERsA and senior scientist (DR1) in ecology at the French Institute for Agronomic Research (INRA) will advise EuropaBON on drafting an SRA in support of the implementation of the BMCC and associated monitoring schemes. EuropaBON will benefit from consulting BiodivERsA's extensive database on European

Research & Innovation projects and biodiversity research infrastructures and their collaboration with key initiatives, such as OPPLA, EKLIPSE and ThinkNature and its successor NetworkNature throughout the project and particularly during stakeholder engagement.

- **Prof. Bernhard Seeger** is a computer scientist and the Dean of the Department of Mathematics and Computer Science at Philipps-Universität Marburg and co-founder of **Geo Engine** – a new start-up company specialising in the efficient processing of large spatio-temporal data sets. His knowledge and expertise on methods for processing and analyzing large data sets and event streams will be invaluable to EuropaBON.
- **Prof. Richard Gregory** is head of Species Monitoring and Research at the **Royal Society for the Protection of Birds (RSPB)** Centre for Conservation Science and holds an Honorary Professorship at the Centre for Biodiversity and Environment Research (CBER) at University College London. Richard Gregory is an expert in survey design, biodiversity monitoring and indicators, citizen science, climatic change impacts, conservation priorities, measuring natural capital, ecosystem services, alien invasive species, and the impacts of predation and wildlife diseases.
- **Prof. Rebecca Chaplin-Kramer** is a lead scientist for the Natural Capital Project, co-appointed at the University of Minnesota and **Stanford University**. Rebecca Chaplin-Kramer's research focuses on global ecosystem service assessment, linking earth observations and ecosystem service modeling. She is also a Coordinating Lead Author on the upcoming Values Assessment for the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) and a member of the Expert Working Group Consulting on NASA Biological Diversity and Ecological Forecasting Programs.
- **Dr. Marc Paganini** serves as technical officer in the Directorate of Earth Observation Programmes at the **European Space Agency (ESA)**. He is member of the Science, Application and Future Technologies Department working on Earth Observations (EO) exploitation and services development. His main field of expertise is the exploitation of EO satellite data for environmental governance and sustainable development. He is the ESA point of contact for the Convention on Biological Diversity (CBD), the UN Convention to Combat Desertification (UNCCD) and the Ramsar Conventions on Wetlands (source:<https://resilientcities2018.iclei.org/speaker/marc-paganini/>)
- **Philippe Vercruyse de Solart** is a Global Technology Strategist at **Microsoft**. He helps EU institutions with their digital transformation projects and helps them to grow, evolve and meet the changing needs of European citizens/ markets/ applications, as well as capture new business applications opportunities (source: <https://be.linkedin.com/in/philippevds>).

The **Work Package Leaders** actively communicate with the participants of tasks listed in the respective WP. They are responsible for the timely completion of tasks in their WPs and for producing the deliverables and achieving the milestones on time. They coordinate the different tasks and components thereof, and deal with all issues related to the scientific management, the conceptual development, and progress of the respective WP. They inform the scientific coordinator of any potential problems that may arise during the course of the project, e.g., financial, political, or progress-related.

The **Consortium Assembly (CA)** includes all 15 partners of EuropaBON. The CA will meet once every year to discuss progress and address potential challenges (see Figure 3). There will also be an additional CA Kick-Off meeting in the first month of the project to develop a consortium agreement and publication policy. The main tasks of the CA include WP- and task coordination, monitoring of project progress and milestones, denominating and resolving of technical and organizational problems, timely production of deliverables, and resolving of conflicts. Each CA member has one representative and one vote concerning decisions made by the assembly. Decisions are made based on a 2/3 vote.

During the project (T2.2) a **Stakeholder Consultancy Group** will be formed with the aim to identify specific user and policy needs for biodiversity monitoring. Here, special attention will be given to a balanced representation of academia/research institutes, governmental institutions, private companies, NGOs, and citizen science groups. These stakeholders will communicate with the CA and provide input on existing monitoring schemes in WP3 and on the practical needs of the communities and user groups involved with biodiversity monitoring and the cost-effectiveness of a EuropaBON in WP4. The stakeholder consultancy group will act as reviewers of the ToR for the BMCC and be actively involved in the BMCCs set-up and maintenance, thereby ensuring the availability of the project outputs beyond its official duration.

3.2.2 Appropriateness of the organizational structure and decision-making mechanisms

The project's organizational structure is designed in a way that allows for pursuing a clear joint vision, while at the same time fostering the creativity of all project participants. The CC will ensure that efforts are aligned towards common goals and communicate these to the scientific coordination and the AB. The management structure further ensures that organizational project management is separate from scientific project management and that information can be exchanged directly between partners and the administrative coordination. Decision-making by consensus follows a bottom-up approach and is open and explicit.

3.2.3 Addressing effective innovation management

EuropaBON considers innovation management as the highest priority. Innovation management plays an integral role during all communication processes - internally among partners and key project staff, and externally, between project partners and the different stakeholders. The communication team will make sure that all lessons learned will be disseminated widely so that this may catalyse the development of similar initiatives elsewhere in Europe. Innovation management tools will also be applied in project management and the implementation of the work plan. Tools used both internally and externally - during stakeholder-, as well as CC- and CA meetings include Brainstorming, Mind mapping, Document management, Roadmapping, and Idea management, among others. The goal is to apply novel methods that ensure the generation of ideas and stimulate the efficiency of the workflow within the consortium, as well as to transfer knowledge outside the consortium in an innovative way. The novel tools will be upgraded according to the project needs in order to safeguard a high productivity level.

3.2.4 Critical risks and mitigation measures relating to the project implementation

Risk management procedures will be implemented throughout the duration of the project and as part of WP1, with the active involvement of all partners through the CC. The CC will continuously monitor the risks listed in Table 3.2.b and WP and task leaders will identify potential additional risks and immediately inform the CC and the project coordination team to adopt the necessary mitigation measures.

3.3 Consortium as a whole

EuropaBON's consortium was planned very carefully. All partners have high-level and complementary expertise in the different areas of the project, ranging from networking and cost-effectiveness analysis, biodiversity monitoring, modelling and analysis, to stakeholder engagement, policy support and dissemination (Figure 5). The consortium greatly benefits from the involvement of partners in previous and ongoing EU projects (see Table 2.2) close connection with EEA and the European Commission (NIVA and JRC), regulatory monitoring agencies, NGOs and previous collaborative work on H2020 projects (e.g., ECOPotential), thereby strengthening trust among these partners and facilitating collaboration and coordination. The partners in the consortium already demonstrated strong collaboration and cooperation during the development of this proposal. All partners contributed to the work plan, WP- and task descriptions, budget development, figures and writing of the proposal, in a time-efficient manner. In the early stage of the proposal preparation, partners already demonstrated strong commitment to this project when they participated in a face-to-face proposal planning workshop organised by the coordinator MLU.

3.3.1 Gender dimension

Women are still largely underrepresented in the natural sciences, especially in high academic positions. This problem is also reflected in the EuropaBON consortium, which consists of only three partners with lead female PIs out of 15 partners in total. Another reason for this imbalance is that it takes time for the gender gap to narrow, as staff turnover in high-up academic positions is slow. EuropaBON takes gender balance very seriously and addressed this problem by improving the female:male ratio of key project staff (female/male ratio: 14:26), scientific and administrative coordination (both led by women at MLU) and the advisory board (female/male ratio: 4:6, EBP still pending) (for more information on key project staff, see section 4.1). Women are also leading T2.2 (UFZ), T4.2 (USTAN) and T5.3 (NIVA). Particular care will be taken to include women in stakeholder workshops and the stakeholder consultancy group.

3.3.2 Types of organizations involved

The consortium consists of several partners at universities and research institutes (n= 10) and government and public institutions (n= 3), as well as one private company (Pensoft) and one NGO (Dutch Butterfly) (Figure 5). This diversity in partner institutions ensures the right balance between research, monitoring practitioners and monitoring data analysis expertise, specialized skills in project dissemination and communication, as well as experts in stakeholder engagement, and policy support. Although our consortium is biased towards universities and other research institutes,

we will ensure sufficient outreach to NGOs, businesses, and citizen science groups through EuropaBON's advisory board and the stakeholder consultancy group (see section 3.2.1).

3.3.3 Geographical and thematic balance

The consortium also displays a high degree of geographical- and thematic diversity (Figure 5). Consortium members are distributed across Europe covering all major ecosystem types, including forests, grasslands, soils, wetlands, rivers/lakes, and coastal/marine ecosystems. We also have several ecological economists onboard (at UREAD). For the marine monitoring, including ecosystem services monitoring indicators, we have a strong expert group included (at USTAN), who will draw upon their collaborative network with other marine institutions. The participation of experts on networking, monitoring, and policy working on different ecosystem types is particularly important for this project, because the ecosystems differ in terms of environmental conditions, services, and threats. The choice of EBVs, EESVs, monitoring approaches and technologies, as well as the costs of monitoring will largely depend on the type of ecosystem involved. The selection of partners in EuropaBON reflects their contributions to tasks and WPs (Table 3.1.a), and attributed resources (Table 3.4.a).

3.3.4 Private organizations involvement

The involvement of SMEs is important as it creates new job opportunities relating to the management and analysis of remote sensing data, more specifically Copernicus products, as well as managing, planning and carrying out dissemination and communication activities for EuropaBON. VITO as a non-profit private organization, leads several consortia to bring the results of remote sensing research into operational Copernicus services and as such bridges this gap through involving partners from both the academic world as well as SMEs. These Copernicus products and the know-how facilitate SMEs to generate new businesses by providing downstream services for specific sectors. One of EuropaBON's partners, Pensoft Publishers, is a SME specializing in academic, open access book and journal publishing, software development and web design, project dissemination and science communication. By making monitoring data accessible and usable, and effectively communicating and disseminating project results, EuropaBON will successfully bridge the gap from the research environment to the private sector. In this way, the exploitation of monitoring and EO data by other SMEs (and large private companies) will be greatly facilitated.

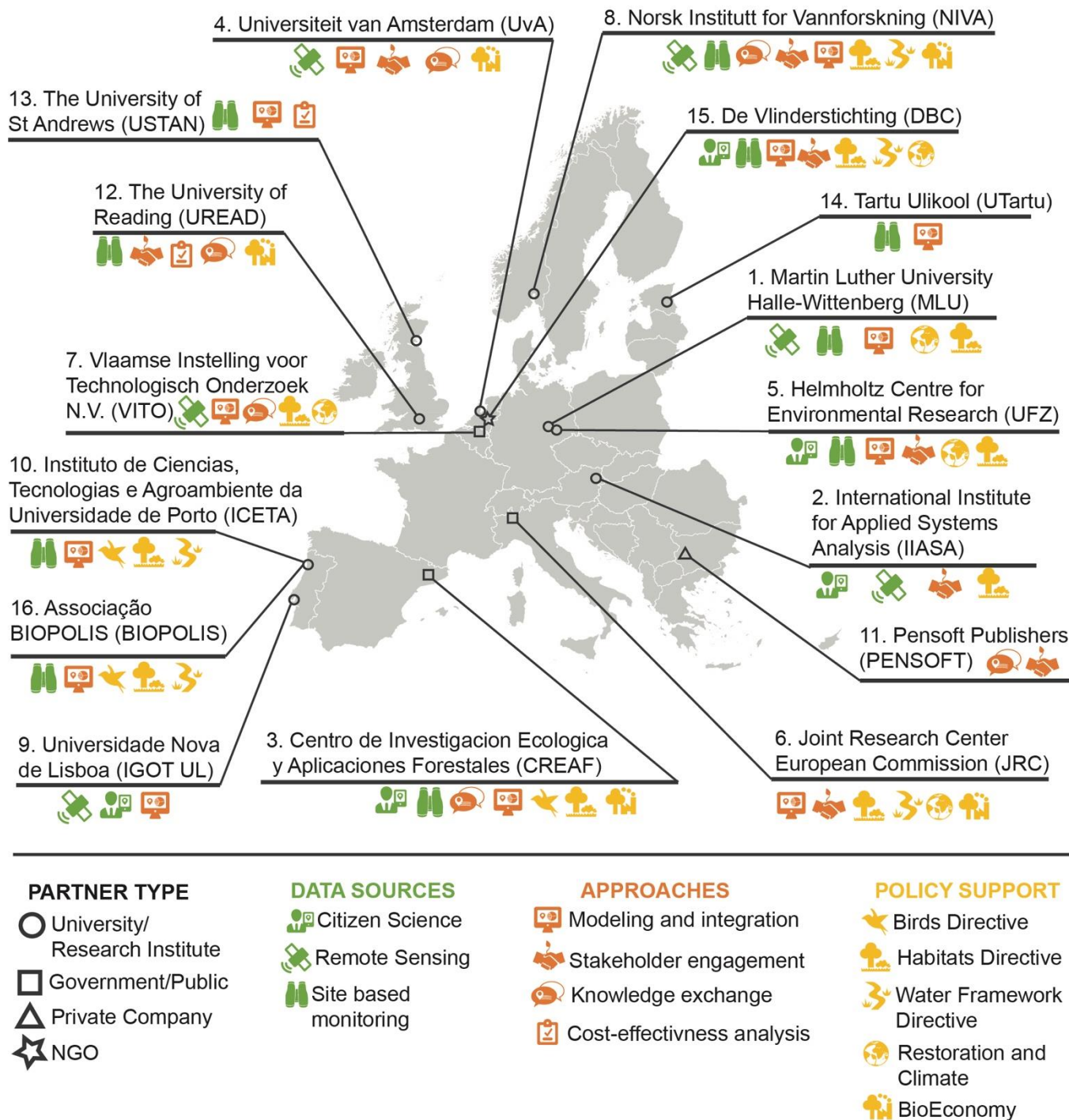


Figure 5 Geographic distribution of the partners and their thematic expertise.

3.4 Resources to be committed

EuropaBON is a **36-months project**, with a total estimated effort of **349-person months**. The total project budget is **3 Mio. €**. Project management and coordination under WP1 represent 9% (30 PMs) of the total effort. The project direct costs consist of approximately 90% personnel costs and 10% other direct costs. The latter covers travel expenses for project participants to attend meetings and conferences and costs for **14 workshops, four General Assembly Meetings and one high-profile event in Brussels** (see Figure 3, Table 3.2.a). About 10% of personnel effort will be invested into the coordination and management of the project (WP1). Although the costs for the operation of the CC and CA are mainly allocated to WP1, they also include HR costs of participating institutions related to their contributions to the CA and CC, and thus allocated to the WPs/tasks in which they participate. WP2 and WP5 will receive each about 20% of all PMs. The assessment in WP3 and the co-design of the new monitoring system in WP4 will receive the most personnel resources, i.e., 23% and 26%, respectively. Table 3.4.a gives an overview on the distribution of PMs per partner and WP and table 3.4b lists other direct costs for each participant for which the sum of the costs for 'travel', 'equipment', and 'goods and services' exceeds 15% of the personnel costs for that participant.

Table 3.4.b: Other direct costs listed for each participant for which the sum of the costs for 'travel', 'equipment', and 'goods and services' exceeds 15% of the personnel costs for that participant (according to the budget table in section 3 of the proposal administrative forms).

1/MLU	Cost (€)	Justification
Travel	4000	4 workshops/partner PI at 1000 EUR each – HP (WPs 2,3,4)
	4000	4 workshops/partner PI at 1000 EUR each – HB (WPs 2,3,4)
	4000	4 workshops/partner PI at 1000 EUR each – CG (WPs 2,3,4)
	2400	1000 EUR/12 PMs for postdoc/partner -HP (WP 2)
	1000	1000 EUR/12 PMs for postdoc/partner -HB (WP 2)
	1000	1000 EUR/12 PMs for postdoc/partner -CG (WP 2)
	1000	1 conference - HP (WP 2)
	1000	1 conference - HB (WP 2)
	1000	1 conference - CG (WP 2)
	Equipment	0
Other goods and services	4000	Certificate of Financial Statement (CFS) (WP1)
	8000	4 workshops for Consortium Assembly (T1.3) (WP1) Catering & renting of rooms at event: 1500 EUR Travel & lodging for six people: 6500 EUR <ul style="list-style-type: none"> From here on: All workshops listed under "Other goods and services" are workshops organised and paid for by the respective partner. Costs include expenses for catering at the event, renting of rooms, as well as travel and lodging expenses for participants. Workshops and other items listed under "Travel" include individual costs for travelling to- and lodging at project-related workshops and conferences for the respective beneficiary.
	18000	2 workshops for T2.3 at 10000 EUR each (WP2) Catering & renting of rooms at event: 1500 EUR Travel & lodging for 16 people: 16500 EUR
	18000	1 workshop for each showcase (2 showcases in total for MLU) of WP5 at 10000 EUR each (WP5) Catering & renting of rooms at event: 1500 EUR Travel & lodging for 16 people: 16500 EUR
Total	67,400	
3/CREAF	Cost (€)	Justification
Travel	4000	4 workshops/partner PI at 1000 EUR each (WP3 and WP5)
	3000	1000 EUR/12 PMs for postdoc/partner (WP3 and WP5)
	1000	1 conference (WP3 and WP5)
Equipment	0	

Other goods and services	10000	1 workshop for T3.1 at 10000 EUR (WP3) Catering & renting of rooms at event: 1500 EUR Travel & lodging for eight people: 8500 EUR
	10000	1 workshop for each showcase of WP5 at 10000 EUR each (WP5) Catering & renting of rooms at event: 1500 EUR Travel & lodging for eight people: 8500 EUR
Total	28000	
5/UFZ	Cost (€)	Justification
Travel	4000	4 workshops/partner PI at 1000 EUR each – AB (WP2)
	4000	4 workshops/partner PI at 1000 EUR each – IK (WP3, WP4)
	1000	1000 EUR/12 PMs for postdoc/partner – AB (WP2)
	1000	1000 EUR/12 PMs for postdoc/partner – IK (WP3, WP4)
	1000	1 conference – AB (WP2)
	1000	1 conference – IK (WP3 and WP4)
Equipment	0	
Other goods and services	10000	1 workshop for T2.2 at 10000 EUR each (WP2) Catering & renting of rooms at event: 1500 EUR Travel & lodging for eight people: 8500 EUR
	20000	2 workshops for T2.3 at 10000 EUR each (WP2) Catering & renting of rooms at event: 2000 EUR Travel & lodging for 16 people: 18000 EUR
Total	42000	
9/IGOT UL	Cost (€)	Justification
Travel	4000	4 workshops/partner PI at 1000 EUR each (WP 2, WP3, WP4 and WP5)
	2000	1000 EUR/12 PMs for postdoc/partner (WP5)
	1000	1 conference (WP5)
Equipment	0	
Other goods and services	10000	1 workshop for each showcase of WP5 at 10000 EUR each (WP5) Catering & renting of rooms at event: 1500 EUR Travel & lodging for eight people: 8500 EUR
	400	Additional processing power
	1000	Specialised software licensing
Total	18400	

EuropaBON has no large research infrastructure to declare.

4 Members of the consortium

4.1 Participants

Participant No	1	Participant short name	MLU
Participant full name	Martin-Luther-Universität Halle-Wittenberg		
<p>Participant Description</p> <p>Martin Luther University Halle-Wittenberg is an efficient, modern university, which maintains the highest requirements for teaching and research in social sciences and humanities as well as in natural sciences. The university invests into renowned scientists, high-tech equipment, and a modern research environment to foster research, research-training and cooperation with industry, policy makers, and public actors. About 2000, scientists are employed to conduct basic and applied research in various thematic areas. MLU executes research grants funded by national, EU, and international funding organizations as well as by industry with a total volume of more than 55 Mio. € per year. Experienced in EU-funded projects from FP3 onward, the university keeps ready an EU-office with highly qualified administrative staff to support EU project management and execution.</p> <p>The work will be carried out at the German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig, one of four research centres funded by the German Research Foundation (Deutsche Forschungsgemeinschaft, DFG) with an average annual budget of 8 Mio. € since October 2012. iDiv currently employs >170 scientists and administrative staff. It has strong central services (outreach office, biodiversity informatics, bioinformatics), a Synthesis Centre (sDiv) fostering theoretical and synthetic thinking as well as a PhD school (yDiv). iDiv and its founding institutions manage large biodiversity databases, including the global vegetation database sPlot and the global trait database TRY.</p> <p>MLU will host, coordinate, and manage the project and lead WP1 and WP5.</p>			
<p>Key Personnel Involved</p> <p>Henrique M. Pereira (male), Professor for Biodiversity Conservation at the German Centre for Integrative Biodiversity Research (iDiv), and Martin Luther University Halle-Wittenberg since 2013 and an Invited Professor at InBio/CiBio-University of Porto. He is also the Co-Chair of the Biodiversity Observation Network of the Group on Earth Observations (GEO BON) since 2013. He received his PhD in Biological Sciences at Stanford University (2002) and Habilitation in Ecology at the University of Lisbon (2011). He coordinated the Portugal Millennium Ecosystem Assessment (2003-2006), was the Director of Peneda-Gerês National Park (2006-2009), and a Research Group Leader at the Center for Environmental Biology of the University of Lisbon (2009-2013). He was one of the Lead Authors of the Global Biodiversity Outlook 3 and 4 scenarios reports for the Convention on Biological Diversity and Co-Chair of the Intergovernmental platform for Biodiversity and Ecosystem Services (IPBES) Expert Group on Scenarios and Models (2016-2019). He published >100 papers and book chapters, has an H-index of 45 and >12000 citations (Google Scholar), and serves as a subject editor of the journal <i>Ecography</i> since 2014. He was PI or co-PI of multiple grants from the Portuguese Science Foundation (>750 k €), WP leader in FP7 and H2020 grants (>17 Mio. €), and was involved as co-PI in the current DFG funding of iDiv (>35 Mio. €). His research revolves around global biodiversity change, with a particular emphasis on the development of monitoring and scenarios to inform policy. Henrique Pereira has been one of the leading developers of the concept of Essential Biodiversity Variables and of the Nature Futures Scenarios. His research interests include also modelling the impacts of land-use change on biodiversity and ecological rewilding. Role in the project: Henrique Pereira is the project coordinator and - with assistance from the scientific and administrative coordinator - will lead WP1.</p> <p>Nestor Fernandez (male) is a researcher at iDiv/MLU as well as an External Lecturer at the University Pablo de Olavide in Sevilla. He is also Scientific Member of the Secretariat and co-lead of the Data Task Force of GEO BON. He is author of >50 international publications with >2200 citations and a H-Index=29 (Google Scholar). His research is focused on the effects of human impacts on species and ecosystems, with a strong emphasis on applications for conservation management and policy. He also pursues the conceptual and technical implementation of remote</p>			

sensing in support of conservation assessments and has recently contributed to the development of conceptual frameworks and protocols for the implementation of Essential Biodiversity Variables (EBVs) as a suitable approach for the integrated monitoring of biodiversity change. He leads the production of data and metadata standards for the EBVs and coordinates the development of the GEO BON EBV Portal. Together with Prof. Pereira he currently co-leads the e-shape Pilot “MyVariable”, which promotes the development, dissemination and users-uptake of European-level EBV datasets. He is also PI of the H2020 ITN “TerraNova”, a member of the Advisory Board of ESA Project GlobDiversity, and co-lead of the EuroGEOSS Action Group for Ecosystems, among other responsibilities. **Role in the project:** Lead of WP5 and co-design of workflows in Tasks 5.1 and 5.2.

Laetitia Navarro (female) is the executive secretary of the Group on Earth Observations Biodiversity Observation Network (GEO BON), hosted at iDiv/MLU, since October 2016. She is a conservation biologist with expertise in global biodiversity change, ecological restoration and rewilding, as well as in biodiversity monitoring including at the science-policy interface. She has a BSc in Biology (2004) and MSc in Conservation Biology (2006) from the University Pierre et Marie Curie (Paris VI), France; MSc in Ethno-ecology (2007) from the Museum National d’Histoire Naturelle of Paris (MNHN), France; PhD in Conservation Biology (2014, summa cum laude) from the University of Lisbon, Portugal. Laetitia Navarro is author of 23 peer-reviewed publications accumulating >1600, citations ([Google Scholar](#)), H-index=17. She is a member of the interim Steering Committee of the Alliance for Biodiversity Knowledge since 2018, co-Lead of the Policy Support Task Force of GEO BON since 2017, Lead Author of the IPBES thematic assessment on land degradation and restoration (2015-2018), and Lead Author of the Global Biodiversity Outlook 4 (2014). At the moment, she is co-PI of the ERANet- LAC funded project TAO - “From Data to Decision: Collecting, Mobilizing, and Harmonizing Tropical Andes Observatory Data for Improved Conservation Planning”. **Role in the project:** Laetitia will co-lead WP5.

Helge Bruelheide (male) is Professor for Geobotany at the Institute of Biology/ Geobotany and Botanical Garden at Martin Luther University Halle-Wittenberg since 2004. He was the co-Director of iDiv from 2012-2019. He received his PhD from the University of Göttingen in 1995 and qualified as a professor in 2001. He is the speaker of the TreeDi, an International Research Training Group funded by the German Research Foundation (DFG) and the University of Chinese Academy of Sciences (UCAS) which investigates the role of tree-tree interactions in local neighbourhoods in Chinese subtropical forests. Helge Bruelheide is a member of several editorial boards (e.g., *Journal of Vegetation Science*, *Journal of Plant Ecology*) and committees, such as the International Association of Vegetation Science (IAVS), the global vegetation plot database (sPlot, which the European Vegetation Archive is part of). He has published more than 230 articles in international journals and an H-index of 51 and >10000 citations ([Google Scholar](#)). He is a council member of the Scientific Advisory Council of the Harz National Park and Hainich National Park. He has served for eight years on the DFG Review Board Plant Sciences (Fachkollegium 202). Helge Bruelheide has led writing the White Paper on a National Monitoring Centre for Biodiversity. He is one of the PIs of the sMon project at iDiv (Biodiversity Trends in Germany), which focuses on the retrospective analysis of existing time series of different taxon groups. **Role in the project:** He will be the leader of T5.2 BON in support of the Habitats Directive and coordinate the activities related to the task.

Carlos A. Guerra (male) is a researcher at the German Centre for Integrative Biodiversity Research (iDiv), and Martin Luther University Halle-Wittenberg since 2016, having served as a Scientist in Group on Earth Observations Biodiversity Observation Network (GEO BON) until 2018. Prior to that he completed his PhD at the University of Évora (Portugal). Between 2006 and 2015, he has served in several institutions including as a Protected Area Manager, Lecturer in spatial analysis and environmental risks, researcher assistant and group leader at the Center of Geomatics of the Polytechnic Institute of Viana do Castelo (IPVC, Portugal). Currently he co-leads the soil ecosystem function activity of the LUCAS program (a partnership with the EC’s Joint Research Centre) and SoilBON, a global biodiversity observation network for soil ecosystems. He has published more than 50 articles in international journals and book chapters, has an H-index of 16 (i10-index of 21) and >1200 citations ([Google Scholar](#)). His research is focussed on global and European change patterns of soil ecosystems, with a particular emphasis on the design and development of monitoring frameworks and scenarios to inform policy. He has worked and contributed to the development of the concept of Essential Biodiversity Variables (EBVs) with multiple applications across scales. His research interests include modelling the impacts of land-use change on soil

biodiversity and ecosystem function. **Role in the project:** Within EuropaBON, he will be the leader of T5.4 Restoration and Climate Policy and coordinate the activities related to the task.

Jessica Junker (female) conducted her PhD at the International Max-Planck Research School at the Max Planck Institute for Evolutionary Anthropology (MPIEVA), from which she graduated in 2015. She has since worked as a postdoctoral researcher in the Great Ape Evolutionary Ecology and Conservation Group at the former Department Primatology at MPIEVA. Her research focuses on tropical ecosystem conservation with a special focus on monitoring of great apes and other large mammals. Jessica Junker is author of >20 peer-reviewed publications accumulating >600, citations ([Google Scholar](#)), H-index=12. **Role in the project:** In the framework of EuropaBON, she will be responsible for the scientific coordination of the project and support the identification of a candidate set of EBVs and EESVs (WP4, T4.1).

Ute Jandt (female) received her PhD degree from Göttingen University. She has been an active member of the European Vegetation Survey of the International Association of Vegetation Science (IAVS). In 2008, she established the German Vegetation Reference Database (GVRD), which now has ~ 200,000 plot records and is actively engaged in the European Vegetation Archive (EVA). She is a member of iDiv and has carried out numerous projects in the DFG Priority Programme “Biodiversity Exploratories”. She is author of 62 peer-reviewed publications and has a H-index of 18 ([Google Scholar](#)). Recently, she initiated several resurvey projects of German vegetation plots. She is also one of the PIs of sPlot and sMon (Biodiversity Trends in Germany). **Role in the project:** Ute Jandt will be responsible for the workflow of Natura 2000 report data on extent and species composition from the national conservation agencies.

Karolin Dietrich (female) finished her Master studies in Baltic Sea Region Studies at the University of Latvia in 2016 and her Bachelor studies in International Relations and International Organizations at the University of Groningen in 2014. She has successfully completed a six months qualified training in EU fundraising and EU project management at the European Fundraising Academy (EUFRAK) in Berlin in 2018 and works since March 2019 as administrative assistant in the Biodiversity Conservation lab of Prof. Pereira and as an administrative assistant for the Group on Earth Observations Biodiversity Observation Network (GEO BON) at iDiv in Leipzig. **Role in the project:** Karolin Dietrich will be responsible for administrative, financial and logistical aspects of the project.

Relevant publications

- **Bruelheide, H., Dengler, J., Jandt, U.** (2018). Global trait–environment relationships of plant communities. *Nature Ecology and Evolution*, **2**, 1906–1917.
- Marques, A., ... **Pereira, H.M.** (2019). Increasing impacts of land use on biodiversity and carbon sequestration driven by population and economic growth. *Nature Ecology & Evolution*, **3**, 628–637.
- **Guerra, C.A., ... Pereira, H.M.** (2019). Finding the essential: Improving conservation monitoring across scales. *Global Ecology and Conservation*, **18**, e00601.
- **Navarro, L.M., Fernández, N., Guerra, C., ... Pereira, H.M.** (2017). Monitoring biodiversity change through effective global coordination. *Current Opinion in Environmental Sustainability*, **29**, 158–169.
- Rosa, I.M.D., **Pereira, H.M., ...** (2017). Multiscale scenarios for nature futures. *Nature Ecology & Evolution*, **1**, 1416–1419.

Relevant previous projects or activities, relevant to the proposal

- **GEO BON:** Since 2014 MLU hosts the secretariat of GEO BON, the Group on Earth Observations Biodiversity Observation Network, a global network that aims at improving the acquisition, coordination, and delivery of biodiversity observation to users, and one of the four flagships of GEO (Biodiversity Observation Network, BON). Henrique Pereira is the co-chair of GEO BON, L.M. Navarro the executive secretary and co-lead of the Policy support Task Force, and N. Fernandez the co-lead of the EBV data Task Force.
- **ECOPOTENTIAL:** MLU (H.M. Pereira) was the coordinator of WP2 of the ECOPOTENTIAL project, Conceptual Scientific Framework (2015-2019). ECOPOTENTIAL was a large European-funded H2020 project (grant agreement No 641762) that focuses its activities on a targeted set of internationally recognised

Protected Areas, blending Earth Observations from remote sensing and field measurements, data analysis and modelling of current and future ecosystem conditions and services. (Total: 15 Mio. €)

- **GLOBIS-B:** MLU (H.M. Pereira, L.M. Navarro, N. Fernandez) was one of the partners of the GLOBIS-B project (H2020-INFRA-SUPP-2014-2, 2015-2017). The project aimed at bringing together scientists with global research infrastructure operators and legal interoperability experts to address the research needs and infrastructure services required to calculate Essential Biodiversity Variables (EBVs). (Total: 1 Mio. €)
- **E-Shape:** MLU (N. Fernandez, H.M. Pereira) leads a demonstration Pilot on EBVs in the e-Shape EuroGEOSS Showcases project (H2020-SC5-15-2018, 2019-2023). The pilot aims at setting-up and promoting a sustainable organization dedicated to users' uptake of European Earth Observations resources, building on Copernicus and GEOSS through the development of co-design pilots (i.e. application-oriented products, services or solutions) built on a user-centric approach and delivering economic, social and policy value to European citizens. (Total: 15 Mio. €)

Participant No	2	Participant short name	IIASA
Participant full name	International Institute for Applied Systems Analysis		
<p>Participant Description</p> <p>Founded in 1972, IIASA is an international scientific institute that conducts policy-oriented research into problems too large or complex to be solved by a single country or academic discipline, or of common concern to many countries that require national and international cooperative action – such as climate change, energy security, population growth, and sustainable development. Funded by scientific institutions in the Americas, Europe, Asia Oceania and Africa, IIASA is independent and unconstrained by political or national self-interest; it is a not-for-profit, registered association in Austria. IIASA’s Ecosystems Services and Management program consists of four research centres, one of them being the Center for Earth Observations and Citizen Science (EOCS).</p> <p>EOCS research on Earth Observation, in collaboration with GEO and national space agencies, devises new approaches and technologies to collect, harmonize, and verify spatial information. At the core of these efforts is the Geo-Wiki platform, which provides citizens with the means to engage in environmental monitoring of the Earth. EOCS has extensive experience in land use and environmental assessment, and a track record in developing successful crowdsourcing mobile applications that allow for stakeholder involvement in the collection and use of information for early warning programs, risk analysis and decision making. Overall, the EOCS group is placed firmly at the intersection of Earth Observation and Citizen Science, having expertise in data quality assurance in citizen science, technical implementation, crowdsourcing and engagement. We are currently leading one of the H2020 funded Citizen Observatories, LandSense, along with the H2020 coordination and support action WeObserve. In addition, we collaborate in several H2020 and other citizen science projects, such as the SwafS-project EU-Citizen.Science, the GROW Observatory, or FloodCitiSense.</p> <p>IIASA is WP2 lead on Stakeholder Engagement, along with contributing to tasks 3.1 (Inventory of Monitoring Initiatives) and T5.2 (Habitat Directive Showcase).</p>			
<p>Key Personnel Involved</p> <p>Steffen Fritz (male) is Acting Director of Ecosystems Services and Management program. Dr. Fritz is head of the Center for Earth Observation and Citizen Science (EOCS) in the Ecosystems Services and Management (ESM) Program. He is a senior expert in Geographic Information Systems (GIS), remote sensing, data interoperability, land use and land cover as well as policy related land use modelling. Dr. Fritz is Coordinator of the H2020-funded WeObserve CSA, of the LandSense Citizen Observatory and of a European Research Council (ERC) grant entitled “Harnessing the power of crowdsourcing to improve land cover and land-use Information”. He has coordinated or been WP leader on several projects, e.g. the Austrian funded ASAP-7 LandSpotting project, the ASAP-8 FarmSupport project, the ESA-funded GEOSAF projects and European framework projects such as GEOBENE, EUROGEOSS, ENERGEIO and SIGMA. Dr. Fritz is a core member of the Citizen Science Global Partnership driving the up-take of citizen science data in official data streams globally, and particularly for SDG monitoring. He started <i>Geo-wiki.org</i>, a global land cover validation tool based on Web 2.0 and crowdsourcing. He also participates in the GEO Working Groups on Data Sharing and Global Land Cover Validation. Dr. Fritz was co-chair of the EU COST Action network: Mapping and the Citizen Sensor (2012-2016). He has an H-index of 52 and >9500 citations (Google Scholar) Role in the project: Steffen Fritz will act as the IIASA scientific lead, leveraging his 20+ years of experience in the domain of earth system monitoring.</p> <p>Linda See (female) is a Research Scholar. Dr. See has been a Research Scholar in ESM since October 2010. Prior to IIASA, she was a Senior Lecturer in Computational Geography and GIS in the School of Geography, University of Leeds for 11 years. With Dr. Fritz, she has jointly coordinated the FarmSupport and GEOSAF projects and was Coordinator of the Austrian ASAP-10 LACO-Wiki project. She is currently a WP leader for the newly funded FloodCitiSense project. She is an active member of the Geo-Wiki team and has worked on a number of crowdsourcing aspects including quality issues, community building, and a branch of Geo-Wiki concerned with validation of urban land cover. Dr. See chaired Working Group 1 of the EU COST Action network: Mapping and</p>			

the Citizen Sensor (2012-2016) and is a member of the ECSA Working Group on Data, Tools and Technology for Citizen Science. She has an H-index of 39 and >5900 citations ([Google Scholar](#)). **Role in the project:** Linda See will be responsible for stakeholder engagement (WP2), in particular in regards to the use of Citizen Science data.

Piero Visconti (male) is a Research Scholar. Piero Visconti is a Research Scholar with the Ecosystem Services and Management program (ESM) at IIASA and an honorary research fellow with the Centre for Biodiversity and Environment Research (UCL) and the Institute of Zoology of the Zoological Society of London as well as an Academic Visitor with the University of Cambridge Conservation Science Group. Dr. Visconti completed a PhD in Conservation Planning between James Cook University and the Global Mammal Assessment programme (GMA) at Sapienza University of Rome jointly in 2011. At IIASA, he is continuing to work on exploratory, normative and ex-ante sustainability scenarios, with a particular focus on pathways that promote biodiversity recovery, at EU, regional and global levels. He is also developing new research that integrates biodiversity feedback into food production models and new ecological models that can respond to different types of crop and livestock production systems while considering interactive effects of climate and land-use change. He has an H-index of 31 and >4000 citations ([Google Scholar](#)). **Role in the project:** Piero Visconti will provide his extensive network in the biodiversity community in terms of stakeholder engagement (WP2), will help co-organize a stakeholder workshop and will participate in the habitat directive case study.

Inian Moorthy (male) is a Research Scholar. Dr Moorthy has been a Research Scholar in ESM since April 2015. He has vast international experience in the field of quantitative airborne remote sensing and applied LiDAR research for vegetation condition mapping. His research interests within EO include geospatial data analysis, citizen science, and forest monitoring. Such interests are backed by strong collaborative research and development efforts with internationally renowned organizations including the Canadian Space Agency, Spanish Research Council and the European Space Agency. Furthermore, Dr. Moorthy is very proficient in project management, proposal building, mock-up design and scientific communication. He is currently the Scientific Project Manager of the H2020-funded LandSense Citizen Observatory. He has an H-index of 11 and >750 citations. **Role in the project:** Inian Moorthy will be the IIASA project manager for EuropaBON and in addition, link LandSense outputs to activities within T5.2 (Habitat Directive Showcase)

Relevant publications

- **Visconti, P.**, et al. (2019). Protected area targets post-2020. *Science*, **364** (6437), 239-241.
- **Fritz, S., See, L., ... Moorthy, I., ...** (2019). Citizen science and the United Nations Sustainable Development Goals. *Nature Sustainability*, **2**, 922-930.
- Lesiv M., Laso Bayas J.C., ... **See L., ...** (2019). Estimating the Global Distribution of Field Size using Crowdsourcing. *Global Change Biology* **25** (1), 174-186.
- **Fritz S., See L., Laso Bayas J.C., ...** (2018). A comparison of global agricultural monitoring systems and current gaps. *Agricultural Systems*, **168**, 258-272.
- Laso Bayas, J.C., **See, L., Fritz, S., ... Moorthy, I., ...** (2017). Crowdsourcing in-situ data on land cover and land use using gamification and mobile technology. *Remote Sensing*, **8** (11), 905.

Relevant previous projects or activities, relevant to the proposal

- **WeObserve:** An Ecosystem of Citizen Observatories for Environmental Monitoring – H2020 CSA.2017-2020. *Coordinator*. WeObserve brings together the current H2020 Citizen Observatories to mainstream COs for environmental monitoring. <https://www.weobserve.eu/> (Total: 1 Mio. €)
- **LandSense:** A Citizen Observatory and Innovation Marketplace for Land Use and Land Cover Monitoring - Horizon 2020. 2016-2020 IA. *Coordinator*. This is one of four citizen observatories funded by Horizon2020 in the field of Land Use Land Cover (LULC), which collects data with citizens and from authoritative, open access, and other citizen-based initiatives to provide valuable quality-assured in-situ data for SMEs, larger businesses, government agencies, NGOs and researchers. <https://landsense.eu/> (Total: 5.7 Mio. €)
- **EU-Citizen.Science:** The Platform for Sharing, Initiating, and Learning Citizen Science in Europe – H2020 CSA. 2019-2021. *WP leader*. EU-Citizen.Science aims at professionalising and accelerating Citizen Science

across Europe. <http://eu-citizen.science/> (Total: 2 Mio. €)

- **Nature Map Earth:** NICFI 2016-2020. Nature Map Earth is developing an integrated global map of biodiversity, carbon storage, and other dimensions of nature by consolidating and crowd-sourcing data from many sources. <https://naturemap.earth/> (Total: 1.5 Mio. €)

Participant No	3	Participant short name	CREAF
Participant full name	Centre de Recerca Ecològica i Aplicacions Forestals		
<p>Participant Description</p> <p>CREAF is a public research and innovation centre in terrestrial ecology, territorial analysis and environmental impact, which strives for excellence in knowledge generation, methodological development, transfer, training and dissemination. The centre aims to contribute to improving the conservation and management of our natural environment and territory on the local, regional and global scales by acting as a bridge between academia, public administrations and society. This is achieved through: Basic and applied research. CREAF conducts first-class, innovative basic and applied research and a center of excellence at both the national and international levels.</p> <p>Priority research lines of CREAF are: (1) biodiversity; (2) functional diversity and global change; (3) forest ecology and wildfires; (4) landscape analysis and geographical information systems; (5) soil ecology and restoration. CREAF's expertise includes conservation ecology, land use policy, forest biomass and production measurements, powerful GIS technologies, remote sensing, fire ecology, and modelling ecosystem processes. CREAF has participated in numerous EU projects (listed below) and is also a member or collaborator of relevant European and worldwide organizations on the domains of: Citizen Science: European Bird Census Council (EBCC, and being represented in this consortia by CREAF), European Citizen Science Association (ECSA), Earth Observation Systems and Geographical Information Systems: Group on Earth Observations (GEO); Open Geospatial Consortium (OGC), Copernicus Global Land, and Standardization Bodies: ISO/TC 211 Geographic Information/Geomatics; CEN/TC 287 OGC European Forum on Geospatial Standards. CREAF is involved in different International and European initiatives running in the project domain such as, among others, the Intergovernmental platform for Biodiversity and Ecosystem Services (IPBES); MRI-Mountain Research Initiative Advocacy Group for H2020; IBERO-REDD+ network, Pyrenean Observatory of Climate Change (OPCC) Scientific Committee; member of ALTER-Net; European Innovation Partnerships EIP-WATER Ecosystem Services for Europe (ESE) action group).</p> <p>CREAF coordinates and leads WP3 on the assessment of current monitoring and is involved in all WP3 activities (tasks 4.1–4.4). CREAF further contributes to leading on T5.1 (showcase on Bird's directive) and with minor contributions to tasks 2.2, 2.5, 4.1, 4.3 and 5.5.</p>			
<p>Key Personnel Involved</p> <p>Lluís Brotons (male), is a CSIC Seniors researcher, at the InForest JRU (CREAF-CTFC). He received his PhD in 2000 at the University of Barcelona. The approach taken by Dr. Lluís Brotons and his research group aims at understanding and predicting the impacts of the different components of global change such as climate or land use change and the interactions between them on ecological communities. To cover this need in terrestrial agro-forestry systems is based on the integration of different approaches ranging from ecology, statistical, landscape and species distribution modeling to remote sensing science and large-scale monitoring. Unraveling the causes of past changes in biodiversity patterns under environmental change (land abandonment, landscape fragmentation, climate change, agricultural intensification and perturbation of the disturbance regimes such as fires) allows the critical and adequate calibration and development of models of future ecosystem response to further change under specific future scenarios of socioeconomic change. He is amongst the world top 1% scientists in Environment/Ecology. He has published 288 articles (203 in indexed journals, H-index, Web of science: 42, Google scholar: 53), and he has been appointed as a Coordinating Lead Author for the “Modeling impacts of drivers on biodiversity and ecosystem properties and processes” included in the deliverable 3c of the initial working program (2014-2015) of the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES). Role in the project: Within EuropaBON, he will lead the development of WP 3 on the Assessment of existing monitoring capability in Europe and lead two of the tasks in this WP (tasks 3.1. and 3.3).</p> <p>Sergi Herrando (male) is the Scientific Director at the Catalan Ornithological Institute (ICO) and associate researcher to CREAF. In 2011 he received his PhD. At ICO, he is responsible for promoting research projects that aim at improving our understanding of the status of bird populations and the underlying causes driving these</p>			

changes. In this sense, his main activity is the research based on the data provided by monitoring projects and, especially, the development of bio-indicators. Since 2007 he has been the Spanish national to the European Bird Census Council (EBCC). He is the main promoter for the various monitoring and atlas projects that the ICO coordinates. Since 2013 he has been one of the two coordinators of the New Atlas of the nesting birds in Europe (EBBA2). Among the research projects, he has been involved in the EUBON project (FP7) aimed at the development of a European Biodiversity Observation Network. At the local level he is responsible for the Biosphere Reserve-Montseny Natural Park of the International Network for Ecological Research at Long Term (LTER). He has published more than 100 articles including leading international journals and has an H-index of 24 ([Google Scholar](#)). **Role in the project:** He will lead the Bird's Directive showcase (T5.1) and provide insights and expertise in the science-policy interface regarding bird monitoring in Europe.

Joan Pino (male) holds a PhD in Biology and MSc in Geographical Information Technologies. He is full professor of Ecology at the Autonomous University of Barcelona since 2006 and director at CREAM since 2019. He has written more than 1000 scientific publications, including articles in SCI journals and book chapters. He focuses his research on landscape ecology, particularly the relationship of landscape structure and dynamics with species richness and composition, and on the application of these results in land planning. In the last years, he started working on the application of landscape ecology on green infrastructure planning for ecosystem service provision, especially in urban and peri-urban areas. He also works on the ecology of biological invasions, particularly the study of species invasiveness and the invasibility of habitats and regions. This research has been mainly performed in the framework of 30 competitive projects, of which he led several, both national- (e.g. NOVFORESTS, FORASSEMBLY) and EU-funded (BIOPRESS, COCONUT, GROUNDTRUTH2.0), and more than 40 transference contracts. In all his research, he uses a spatially explicit perspective that includes the generation and analysis of digital cartography. He coordinates several information systems on biodiversity and the historical cartography of land, and a set of citizen observatories on biodiversity and ecosystem services. He has directed or co-directed 10 PhD theses and 15 MSc theses. **Role in the project:** Joan Pino will be mainly involved in WP3 on analysing the coverage of current monitoring efforts.

Anna Ramon (female) holds a degree in Biology (2005 UAB) and a Master's Degree in Scientific and Environmental Communication (2007 UPF). Since 2011 she is the Communication Manager of CREAM. Among her tasks include the definition of the CREAM communication strategy (the Communication Plan), the development of institutional material, the management of internal and external communication, support for the center's researchers in the realization of workshops, seminars and technical seminars, the development of specific communication plans for national and international projects, or the management of databases of public interest. Since her arrival at the center, CREAM has provided a new website, a blog of News and different channels on social networks. During her professional career she has always worked in the field of the dissemination of science and the Corporate Communication of Research Centers. In addition, she has collaborated with the radio program Sapiència de la Xarxa coordinating the section on the environment and she is also member of the Catalan Association of Scientific Communication. **Role in the project:** Anna Ramon will be involved in communication and stakeholder involvement activities

Relevant publications:

- Stephens, P.A., ... **Brotons, L. Herrando, S., ...** (2016). Consistent response of bird populations to climate change on two continents. *Science*, **352**(6281), 84-87.
- Titeux, N., ... **Brotons, L.** (2016). Biodiversity scenarios neglect future land-use changes. *Global Change Biology*, **22**, 2505-2515.
- Devictor, V., ... **Brotons, L., ... Herrando, S., ...** (2012). Differences in the climatic debts of birds and butterflies at a continental scale. *Nature climate change*, **2** (2), 121-124.
- Schmeller, D.S., ... **Brotons, L., ...** (2018). A suite of essential biodiversity variables for detecting critical biodiversity change. *Biological Reviews*, **93** (1), 55-71.
- Morán-Ordóñez, ... **Brotons, L., Herrando, S., ...** (2018). Efficiency of species survey networks can be improved by integrating different monitoring approaches in a spatial prioritization design. *Conservation Letters*, **11** (6), e12591.

Relevant previous projects or activities, relevant to the proposal

- **FutureBioEcon:** Sustainable Future of European Forests for Developing the Bioeconomy – FutureBioEcon. ERA-NET Sumforest call for projects, H2020, EU. Main researcher: Dr. Tord Snäll (SLU, Sweden). 2017-2020. Spanish coordinator. (Total: 0.95 Mio. €)
- **EUBON:** Building the European Biodiversity Observation Network - EUBON. Large-scale project, FP7, EU. CTFC-CREAF. Main researcher: Dr. Christopher Hauser (UULM, Germany). 2012-2016. (Total: 9 Mio. €)
- **NEWFORESTS:** New and old world perspectives for forest ecology and management in a context of global change - NEWFORESTS. FP7, Marie Curie IRSES (PIRSES-GA-2013-612645). Main Researcher: Dr. Lluís Brotons. 2013-2017. European Coordinator. (Total: 0.5 Mio. €)
- **ECOPOTENTIAL.** Improving future ecosystem benefits through earth observations. Large scale H2020 project. Main Researcher: Dr. Antonio Provenzalle (CNR, Italy). 2015-2019. (Total: 15 Mio. €)
- **LIFE Euro Bird Portal.** Combining and improving online bird portals data to display near-real-time spatiotemporal patterns of bird distribution across Europe. Main Researcher: Dr. Lluís Brotons. 2016-2019. LIFE project EU funded. (Total: 0.4 Mio. €)

Participant No	4	Participant short name	UvA
Participant full name	Universiteit van Amsterdam		
<p>Participant Description</p> <p>The University of Amsterdam (UvA) is the largest university in the Netherlands, with >30000 students, almost 5000 staff, and a budget of almost 500 Mio. €. UvA also ranks amongst the largest universities in Europe and is a core member of the League of European Research Universities (LERU). The Faculty of Science at the UvA is located at Amsterdam Science Park, one of the largest research hubs in Europe, and surrounded by numerous knowledge institutes and spin-off companies with their roots in science research. The UvA was involved in >200 H2020 projects (122 of which were coordinated), including 61 ERC projects, 56 Marie Skłodowska-Curie Actions (MSCA) Individual Fellowships, and 20 MSCA ITN projects.</p> <p>The work will be carried out at the Institute for Biodiversity and Ecosystem Dynamics (IBED), one of the institutes of the UvA Faculty of Science. IBED contains approximately 140 staff (including: 43 academic staff, 22 post-doctoral researchers, 32 PhD researchers, and 29 support staff) and has an annual research income of ca. 12 Mio. €. IBED merges research groups with expertise in ecology and evolutionary biology, physical geography, and environmental chemistry, with the mission to increase the understanding of the diversity and dynamics of ecosystems from the level of molecules and genes to entire ecosystems. IBED's research is supported by excellent research facilities, including infrastructure for big data storage and analysis (e.g. high-performance computing facilities, dedicated servers, UvA Geoportal, GIS studio, and Virtual labs). IBED researchers are currently involved in various EU projects (H2020 SponGES, H2020 Pandora, H2020 Superpests, LIFE MICA, etc.), have three ongoing ERC Starting Grants and one ERC Advanced Grant, and 3 MSCA Individual Fellowships.</p> <p>UvA coordinates and leads WP4 on the co-design of the monitoring system and is involved in all WP4 activities (tasks 4.1–4.4). UvA further contributes to tasks 3.3 (analysis of workflow bottlenecks), 3.4 (cost-effectiveness analysis of monitoring schemes) and 5.1 (BON in support of the Birds Directive).</p>			
<p>Key Personnel Involved</p> <p>W. Daniel Kissling (male) is Associate Professor for Quantitative Biodiversity Science at the Institute for Biodiversity and Ecosystem Dynamics (IBED), University of Amsterdam, the Netherlands, since 2014. He is also the co-leader of the Data Task Force of the Biodiversity Observation Network of the Group on Earth Observations (GEO BON) and head of the Biogeography & Macroecology (BIOMAC) lab at the University of Amsterdam. He received his PhD at the University of Mainz, Germany in 2008. He has published 100 scientific papers and has an H-index of 38 and >7900 citations (Google Scholar). He attracted funding of >1.8 Mio. € in the last 5 years, and is currently PI of the eEcoLiDAR project (eScience infrastructure for Ecological applications of LiDAR point clouds, funded by the Netherlands eScience Center), the frugivory & palm diversification project (funded by the Dutch Science Foundation NWO), and the Global Ecology project (funded by the Faculty of Science of the University of Amsterdam). He was also PI and scientific coordinator of GLOBIS-B, a Horizon 2020 project (2015–2018) funded by the European Commission to facilitate the development of workflows for Essential Biodiversity Variables (EBVs) and to foster collaboration among biodiversity research infrastructures worldwide. His main research interest is in data-intensive biodiversity science, especially in the fields of macroecology and global biodiversity change (past, present, and future). He uses large ecological and environmental databases together with informatics tools to understand and predict biodiversity patterns across space and time, taking advantage of recent advances in computing, data availability, numerical databasing, Geographic Information Systems (GIS), remote sensing, and statistical modelling. Role in the project: He will lead WP4 of the EuropaBON project and be responsible for developing the co-design of the monitoring system.</p> <p>Judy Shamoun-Baranes (female) is Associate Professor of Animal Movement Ecology at IBED, University of Amsterdam, the Netherlands and head of the Department of Theoretical and Computational Ecology. She received a PhD in Zoology at Tel Aviv University, Israel in 2003. She published 72 scientific papers and has an H-index of 33 and >3000 citations (Google Scholar). She has acquired >2 Mio. € in research funding in the last 5 years. She is PI of four projects on bird movement around the North Sea in relation to wind energy funded by Applied and</p>			

Engineering Sciences domain NWO, Rijkswaterstaat (Dutch ministry of infrastructure) and Gemini Windpark. She is WP leader and co-applicant of the BiodivScen ERA-Network project [GloBAM](#) “Towards monitoring, understanding and forecasting Global Biomass flows of Aerial Migrants” and was a lead applicant and vice-chair of the COST Action “European Network for the Radar surveillance of Animal Movement ([ENRAM](#))” (ES1305, 2013–2017). Her research focuses on understanding how intrinsic and external factors influence animal movement at different spatial and temporal scales, with a focus on birds. She combines radar measurements, GPS tracking, remote sensing and simulation modelling and is involved in the design and development of e-science infrastructures. **Role in the project:** She will contribute to the analysis of workflow bottlenecks (T3.3), to identifying novel technologies for biodiversity monitoring (T4.2), and provide a showcase demonstrating the potential of operational weather radar networks for monitoring and forecasting aerial biomass flows (e.g. bird migration in relation to wind parks and flight safety) (T5.1).

An additional (replacement for James R. Allan) postdoc with equivalent qualification will be hired on the project under a regular employment contract.

Relevant publications

- **Allan, J.R.** et al. (2019). Hotspots of human impact on threatened terrestrial vertebrates. *PLOS Biology*, **17**, e3000158.
- **Kissling, W.D.** et al. (2018). Towards global data products of Essential Biodiversity Variables on species traits. *Nature Ecology & Evolution*, **2**, 1531–1540.
- **Kissling, W.D.** et al. (2018). Building essential biodiversity variables (EBVs) of species distribution and abundance at a global scale. *Biological Reviews*, **93**, 600–625.
- van Gasteren, H., ... **Shamoun-Baranes, J.** (2019). Aeroecology meets aviation safety: early warning systems in Europe and the Middle East prevent collisions between birds and aircraft. *Ecography*, **42**, 899–911.
- Bauer, S., ... **Shamoun-Baranes, J.** (2017). From agricultural benefits to aviation safety: realizing the potential of continent-wide radar networks. *BioScience*, **67**, 912–918.

Relevant previous projects or activities, relevant to the proposal

- **GLOBIS-B:** UvA (W.D. Kissling) was the coordinator of the [GLOBIS-B project](#) “GLOBal Infrastructures for Supporting Biodiversity research”, a Horizon 2020 project within the coordination & support action funding scheme of the H2020-INFRA-SUPP-2014-2 call of the European Commission. The project brought together scientists with research infrastructure operators and legal interoperability experts to address the research needs and infrastructure services required to calculate Essential Biodiversity Variables (EBVs). (Total: 1 Mio. €)
- **LifeWatch-ERIC:** UvA (Faculty of Science) hosts the national node ('Virtual Laboratory and Innovation Centre') of [LifeWatch-ERIC](#), a European Infrastructure Consortium established by the European Commission to provide e-Science research facilities to scientists with focus on biodiversity and ecosystems. UvA was a founding partner for LifeWatch in 2008, coordinated its preparatory project, and since was involved in several LifeWatch related projects (e.g. [BioVEL](#), [Creative-B](#), [GLOBIS-B](#), [ENVRI](#), [ENVRIplus](#), [UvA-Bird Tracking System](#)). (UvA: > 8 Mio. €)
- **FlySafe:** UvA (J. Shamoun-Baranes) was one of the project leaders of [FlySafe](#), an integrated application promotion program of the European Space Agency. FlySafe demonstrated the use of space-based systems (e.g. remote sensing environmental data and ARGOS satellite telemetry) and non-space systems (bird detection radar and operational weather radar) to provide real time warnings and forecasts of bird migration for aviation safety (including military flight training). The project was followed up to create an operational system which is currently used by the Netherlands and Belgian air forces. (Total: 5 Mio. €)
- **ENRAM:** UvA (J. Shamoun-Baranes) was one of the project initiators and vice chair of [ENRAM](#): European Network for the Radar surveillance of Animal Movement (COST action ES1305). The project brought together researchers and developers in the fields of ornithology, entomology, meteorology, data science and radar engineering. ENRAM has improved data quality and classification algorithms of weather radar to visualize bird migration and has tested the potential of radar networks to study animal movement at a continental scale. (UvA: 0.6 Mio. €)

Participant No	5	Participant short name	UFZ
Participant full name	Helmholtz Centre for Environmental Research		
<p>Participant Description</p> <p>The Helmholtz Centre for Environmental Research (UFZ,) Germany, was established in 1991 as the first and only centre in the Helmholtz Association of National Research Centres to be exclusively devoted to environmental research in a great variety of fields. It currently employs more than 1100 people and conducts research to support a sustainable use of our natural resources to benefit both mankind and the environment. Founded in response to the severe pollution prevailing in Central Germany, the UFZ has become a world-wide acknowledged centre of expertise in the remediation and renaturation of contaminated landscapes, as well as the preservation of biodiversity and natural landscapes. UFZ is and was participating in more than 90 projects funded within FP7 and Horizon 2020, 33 of them coordinated by UFZ (collaborative and individual projects). UFZ is or was the host for 3 ERC grants (2 Starting Grants, 1 Advanced Grant,) and has coordinated 3 MSCA-ITNs. Since 2014 the UFZ is leading the European Topic Centre on Inland, coastal and marine waters funded by the European Environment Agency (EEA). Since 2020, UFZ leads the Long-Term Ecosystem Research (LTER) PPP (H2020) to implement the European LTER (eLTER), critical zone and socio-ecological systems Research Infrastructure, listed on the European Strategy Forum on Research Infrastructures (ESFRI) Roadmap.</p> <p>In EuropaBON, UFZ will participate in various WPs to link data users, providers and policy and introduce synergies between EuropaBON and eLTER, and relevant German networks (sMon and prospective NFDI4Biodiversity).</p>			
<p>Key Personnel Involved</p> <p>Aletta Bonn (female) is head of Department Ecosystem Services at the Helmholtz Centre for Environmental research (UFZ) and Professor at the Friedrich Schiller University of Jena within the German Centre for integrative Biodiversity Research (iDiv) with a research focus on biodiversity and people, ecosystem services and citizen science (H_{wos}=25, H_{gs}=35). With extensive work-experience at the science-policy interface as author UKNEA, IPBES) and co-coordinator of several ecosystem assessments (IUCN UK Peatlands, TEEB Germany) and as confounding Director of the European Citizen Science Association (ECSA) she has led the development of the German Citizen Science Strategy 2020. She led the scoping study for a Living Atlas Germany, is PI of the sMon project at iDiv (Biodiversity Trends in Germany), and co-author of the White Paper on a German National Monitoring Centre for Biodiversity. She is one of the PIs and WP science-society interface lead for the national NFDI4Biodiversity consortium applying for German NFDI (national research data infrastructures) grants. Role in the project: She will lead the User and Policy needs assessment (WP 2.2), contribute to assessments of monitoring schemes and the scoping of the European monitoring coordination centre.</p> <p>Ingolf Kühn (male) is Professor for Macroecology at the Helmholtz Centre for Environmental research (UFZ) and the Martin Luther University Halle-Wittenberg. He did his PhD in vegetation science at the Ruhr-University Bochum (2000) and joined UFZ in 2001. His research focuses on impacts of invasive species, land-use change and climate change on the functional composition of communities and ecosystems. He is a ‘Highly Cited» scientist and well-experienced in the analyses of large and complexly structured ecological datasets (WoS H-index: 56; >14,800 citations, Google Scholar). He is the speaker of the Integrated Project “Emerging Ecosystems – functional dynamics under Global Change” of the Helmholtz Programme “Terrestrial Environment”. Prof. Kühn is editor-in-chief of <i>NeoBiota</i> (listed in Web of Science) and associate editor of the <i>Journal of Vegetation Science</i>. He is chair of the Expert Panel Science Strategy of LTER-Europe and serves at several committees, such as the board and council of NEOBIOTA – the European Working Group on Biological Invasions and the International Review Panel within the field of Biology of the Independent Research Fund Denmark. Role in the project: He is the PI ensuring mutual synergies between EuropaBON and eLTER.</p> <p>Mark Frenzel (male; H-index: 18) holds a PhD in animal ecology and is a senior researcher in the group “Animal Ecology and Social-Ecological Systems” at the Department of Community Ecology (UFZ). He is managing the</p>			

long-term monitoring of insects and birds since 2009 within the TERENO project at the UFZ observatory Harz/Central German Lowlands. Since 2006 he is involved in the LTER business where he was managing at the European level harmonization and standardization of parameters and methods for LTER sites. Since then he participated in several LTER projects leading finally to the eLTER RI (European Long-Term Ecosystem Research Infrastructures). His research focuses on drivers of insect and bird diversity in agriculturally dominated landscapes. Moreover, he has another main emphasis on data management and is the UFZ spokesman in the national NFDI4Biodiversity consortium applying for German NFDI (national research data infrastructures) grants. His H-index is 19 ([Google Scholar](#)) and he has 2274 citations. **Role in the project:** He will establish the link to and mutual exchange with eLTER RI and the German Network for Long-Term Ecosystem Research LTER-D.

Martin Musche (male) is a researcher at UFZ. He did his PhD on multitrophic interactions at Martin Luther University Halle-Wittenberg in 2008. He is particularly interested in all topics related to biodiversity monitoring, data management and the analysis of time series. Martin Musche has published 23 scientific papers (H-index 11, 994 citations in Web of Science). Since 2006 he has been involved in the establishment and coordination of the German butterfly monitoring scheme. He has participated in several international research projects and has developed monitoring concepts for a number of national stakeholders. Most recently he has worked on the EU project eLTER H2020 aiming at the development of eLTER RI. **Role in the project:** He will be employed by project funds to do the analysis of synergies between eLTER and EuropaBON.

Relevant publications

- Steinbauer, M.J., ... **Kühn, I.**, ... (2018). Accelerated increase in plant species richness on mountain summits is linked to warming. *Nature*, **556**, 231-234.
- Haase, P., **Frenzel, M., Kühn, I., Musche, M.**, ... (2018). The next generation of site-based long-term ecological monitoring: Linking essential biodiversity variables and ecosystem integrity. *Sci. Total Environ.*, **613–614**, 1376–1384.
- Hecker, S., ... & **Bonn, A.** (2018). *Citizen Science – Innovation in Open Science, Society and Policy*. UCL Press, London.
- Kelling, S., ... **Bonn, A.**, ... (2019). Using Semi-Structured Surveys to Improve Citizen Science Data for Monitoring Biodiversity. *BioScience*, **69**, 170-179.
- **Musche, M.** et al. (2019). Research questions to facilitate the future development of European long-term ecosystem research infrastructures: A horizon scanning exercise. *J. Environ. Manage.*, **250**, 109479.

Relevant previous projects or activities, relevant to the proposal

- **EU BON:** I. Kühn was team member and WP co-lead in FP7 EU BON - Building the European Biodiversity Observation Network to develop an innovative approach in terms of integration of biodiversity information system from on-ground to remote sensing data, for addressing policy and information needs in a timely and customized way. (UFZ: 0.877 Mio. €)
- **ECOPOTENTIAL:** A. Bonn was the co-lead of WP12 of the ECOPOTENTIAL project, Capacity building and knowledge exchange (2015-2019), linking Earth Observation and field measurements, including citizen science (H2020 grant agreement No 641762) (Total: 15 Mio. €, UFZ: 0.425 Mio. €)
- **eLTER PLUS:** M. Frenzel, M. Musche and I. Kühn collaborate in the project eLTER PLUS (Advanced Community Project to perform a fitness check of the eLTER research infrastructure) to set up work flows and analyses of prospective eLTER biodiversity trend data as well as synthesizing existing and emerging knowledge. (UFZ: 1.244 Mio. €)
- **EnvEurope:** M. Frenzel was WP lead (standardization and harmonization of parameters and methods) in the Life+ project EnvEurope – Environmental quality and pressures assessment across Europe: the LTER network as an integrated and shared system for ecosystem monitoring. (UFZ: 0.122 Mio. €)
- **sMon:** A. Bonn is one of the PIs of the sMon project (Biodiversity Trends in Germany) for retrospective trend and driver analysis for different taxon groups in Germany in collaboration with agencies, natural history societies and museums. (UFZ: 0.076 Mio. €)

Participant No	6	Participant short name	JRC
Participant full name	Joint Research Centre		
<p>Participant Description</p> <p>As the European Commission's' science and knowledge service, the Joint Research Centre (JRC) supports EU policies with independent scientific evidence throughout the whole policy cycle. The JRC's directorate D (Sustainable Resources) aims to play a central role in creating, managing and making sense of scientific knowledge for EU policies related to the sustainable use of resources, encompassing environmental, economic and social dimensions. The Land Resources Unit (JRC.D.3) provides information to balance competing land use demands whilst securing access to natural resources and maintaining ecosystem services.</p> <p>JRC will use its pivotal role to facilitate the science-policy dialogue between the stakeholders at EU level and the consortium partners in the co-design process of EuropaBON. JRC will ensure alignment of EuropaBON with existing and new EU policy objectives. JRC will seek the integration of the results of EuropaBON in EU policy making processes through the Biodiversity Knowledge Centre.</p>			
<p>Key Personnel Involved</p> <p>Joachim Maes (male) was scientific project manager in the JRC's' Land Resources Unit, where he coordinated the JRC research program on natural capital and ecosystem services. He is an expert in the spatial quantification of ecosystem services at European scale and in natural capital accounting. He also coordinated the scientific activities of the EU MAES working group on Mapping and Assessment of Ecosystems and their Services, a group with experts from all the EU member states, the European Commission and the European Environment Agency. He leads the UN Statistical Division working group on ecosystem condition accounts under the SEEA EEA. He is deputy editor-in-chief of the scientific journal One Ecosystem. He has published 101 scientific papers and has an H-index of 36 and 6041 citations (Google Scholar). Joachim Maes recently changed position and is now a policy analyst for the European Commission, at DG Regional and Urban Development. Role in the project: Due to his change in position, he is no longer an official project partner, however, he will advise the project on task T2.4 (Aligning social network and technical design (build coalition), policy recommendation) and contribute to the showcases in WP5.</p> <p>Camino Liqueste (female) is a scientific officer in the JRC's' Knowledge Management for Sustainable Development Unit, working in the development of the new EC Knowledge Centre for Biodiversity. She has twofold career as environmental researcher and as EU policy-maker. Her main fields of expertise in research were EU wide analyses of ecosystem services and green infrastructure, and the connection between hydrological and oceanographic processes. She took part on numerous European research projects, published tens of scientific papers and chaired the marine group of the Ecosystem Services Partnership. As a EU policy officer, she was in charge of the implementation and the evaluation of the Marine Strategy Framework Directive, and she contributed to the implementation and the development of new EU policies on biodiversity and on maritime issues. Role in the project: She will support the project strengthening the links with EU decision-making and policy support and she will contribute to task T2.4.</p> <p>Grégoire Dubois (male) is scientific project manager in the JRC's' Knowledge Management for Sustainable Development Unit. He coordinates the Digital Observatory for Protected Areas and is currently setting up the new EC Knowledge Centre for Biodiversity. His main expertise is in geoinformatics and spatial statistics in support to environmental monitoring. His team is producing a number of the key global indicators used by the EU and the CBD Secretariat for monitoring progress of the Aichi Targets. He is a member of the IPBES task force on data and knowledge and regularly representing the EU at the CBD Conference of the Parties. He has published more than 50 papers in scientific journals and accumulated >1800 citations (Google Scholar). Role in the project: Grégoire Dubois will support the project in strengthening the reuse of the results of EuropaBON in EC decision and policy support tools.</p>			
<p>Relevant publications</p>			

- Vallecillo, S., ... **Maes, J.** (2019). How ecosystem services are changing: an accounting application at the EU level. *Ecosystem Services*, **40**, 101044.
- Polce, C., **Maes, J.**, ... (2018). Distribution of bumblebees across Europe. *One Ecosystem*, **3**, e28143.
- **Maes, J.** & Jacobs, S. (2017). Nature-Based Solutions for Europe's Sustainable Development. *Conservation Letters*, **10** (1), 121-124.
- Pettorelli, N.,..., **Dubois, G.**, ...(2017). Satellite remote sensing of ecosystem functions: opportunities, challenges and way forward. *Remote Sensing in Ecology and Conservation*. doi:10.1002/rse2.59
- **Dubois, G.**, et al. (2016). Integrating multiple spatial datasets to assess protected areas: Lessons learnt from the Digital Observatory for Protected Areas (DOPA). *International Journal of Geo-Information*. doi:10.3390/ijgi5120242

Relevant previous projects or activities, relevant to the proposal

- **KIP INCA** (Knowledge Innovation Project on the Integrated system for Natural Capital and ecosystem services Accounting, 2015 – 2020). JRC is partner of KIP INCA; INCA is an essential stakeholder for EuropaBON as key user of biodiversity data for ecosystem accounts. (Part of the JRC institutional work programme (1.2 Mio. €)
- **STING** (Science and Technology for Pollinating Insects). This project is an administrative arrangement between the JRC and DG Environment. The main aim of the project is to propose an EU wide monitoring network for pollinating insects. Joachim Maes is the scientific manager of the project. (0.75 Mio. €)
- **ESMERALDA** (Enhancing ecosystem services mapping for policy and decision making, 2016-2018, a coordination and support action under H2020). Joachim Maes was the deputy Coordinator of the project. (3 Mio. €)
- **The EC Knowledge Centre for Biodiversity**. The JRC coordinates knowledge services to process science-based evidence to inform policy-makers and to provide tools and services for all EU policy areas (<https://ec.europa.eu/jrc/en/knowledge>). The European Commission will establish by the end of 2020 a Knowledge Centre for Biodiversity (KCB) as announced in the EU Biodiversity Strategy for 2030. JRC will develop and host the KCB which will be chaired by JRC and DG Environment. The objective of the project will be to enhance ecosystem monitoring capacity and the KCB will be a key stakeholder in EuropaBON.

Participant No	7	Participant short name	VITO
Participant full name	Flemish Institute for Technological Research		
<p>Participant Description</p> <p>VITO, the Flemish institute for technological research, employs more than 800 professionals and provides high level services, multi-disciplinary assistance and applied research in the fields of environment, energy and materials. The Remote Sensing Unit employs more than 100 scientists and engineers with a yearly turn-over of 15 Mio. € and focuses on monitoring and modelling by means of earth observation to include image processing for environment, vegetation, climate and agriculture monitoring at different resolutions; and, the development of data platforms. VITO hosts several earth observation datasets, and is the main production center of the Copernicus Global Land Service (http://land.copernicus.eu), and recently started the production of Copernicus European Land Vegetation Phenology and Productivity. Data Platforms allow a large user community to process and analyze large time series of data and derive value from remote sensing products. The platforms serve as a node in a federation of platforms in various ESA (e.g. Food Security TEP) and EC R&D (e.g. NextGEOSS, Copernicus Applab, EO4GEO) projects as well as in the Belgian Sentinel Collaborative Ground Segment (CollGS). VITO is involved in the DIAS consortia. The Remote Sensing Unit has relevant expertise in agriculture and environment combining field observations, large statistical databases and geo-data with earth observation and model output in web-based services.</p> <p>In this project VITO, as a key institute in the Copernicus Land service, is responsible to evaluate the applicability of the Copernicus products to monitor biodiversity and ecosystem services (WP3), identify gaps and propose solutions (WP4) to tailor them to be used to assess the status and trends of natural capital (WP5).</p>			
<p>Key Personnel Involved</p> <p>Bruno Smets (male) graduated as an MSc in Electronics Engineering. He worked with teams across the world in the field of multimedia processing in the digital as well as the mobile domain. Bruno Smets has gained experience in software engineering ranging from small to large systems in sound and image processing and participated in standardization bodies. He is heavily involved in Copernicus, leading the Global Land Service (Land Cover, LAI/fAPAR, NDVI, Phenology, SSM) and European Land Service (Phenology and Productivity), through applying state-of-the-art technologies (Hadoop Spark, ElasticSearch) using a diverse set of Earth Observation data inputs (Proba-V, Sentinel-1, Sentinel-2, Sentinel-3). He is also responsible to setup an Ecosystem Natural Capital Accounting system, with a pilot in West-Africa for International Union for Conservation of Nature and Natural Resources (IUCN). Bruno has 23 publications and 390 citations (Google Scholar). Role in the project: Bruno will mainly participate in WP5, EuropaBON showcases T5.2 ad T5.4, and assist his colleagues in WP4, T4.2.</p> <p>Anne Gobin (female) graduated as MSc, Ph.D. Bio-Science Engineering, Katholieke Universiteit Leuven (KU Leuven,) and is project manager smart farming at VITO and is Guest Professor at the KU Leuven for the courses Applied Soil Science and Land Evaluation. Anne Gobin combines time series of high-resolution satellite data and weather information into crop models to simulate soil-water-carbon interactions. sheS has expertise in agri-environmental modelling, climate impacts on soil-crop-atmosphere systems, climate smart farming and land use dynamics. She has more than 70 peer reviewed publications, and an H-index of 18 (Google Scholar). Anne Gobin lived and worked abroad in Sri Lanka, Thailand, Nigeria, Denmark and The Netherlands. Short term stays included Mali, Italy, Vietnam, Czech Republic, Austria and Finland. Role in the project: Anne will contribute to WP4, T4.2.</p> <p>Ruben Van De Kerchove (male) is an Environmental Scientist specialized in the spatio-temporal analysis of ecosystems. After completing his Master and PhD in Geography at Ghent University (Belgium) in 2007 and 2012, respectively, he worked as a postdoctoral researcher at the Université Libre de Bruxelles. Since 2014, Ruben Van De Kerchove is part of VITO Remote Sensing's Land Use team responsible for several projects dealing with applications in biodiversity, with an H-index of 12 (Google Scholar). Currently he is among others responsible for the Sentinel-2 processing workflows in the framework of the Belgian Collaborative Ground Segment Terrascope & the Copernicus Global Land Service (Land Cover), as well as the ESA GlobDiversity project which includes the prototyping and upscaling of land surface phenology. Furthermore, he is part of the Sentinel-2 Quality Working</p>			

Group & Sentinel-2 Validation Team and consequently following closely changes in the processing & quality of Sentinel-2 data. **Role in the project:** Ruben will contribute mainly to WP4, T4.2.

Relevant publications

- Unberath, I., ... **Van de Kerchove, R.**, ... (2019). Remote sensing of coastal vegetation: Dealing with high species turnover by mapping multiple floristic gradients'. *Applied Vegetation Science*, **22** (4), 534-546.
- S. Skowronek, **Van De Kerchove, R.**, ... (2018). Transferability of species distribution models for the detection of an invasive alien bryophyte using imaging spectroscopy data. *International Journal of Applied Earth Observation and Geoinformation*, **2**, 68.
- Rocchini, R., ... **Van De Kerchove, R.**, ... (2017). Remotely sensed spatial heterogeneity as an exploratory tool for taxonomic and functional diversity study. *Ecological Indicators*, **9**, 85.
- Van De Vreken, P., **Gobin, A.**, ... (2016). Crop residue management and oxalate-extractable iron and aluminium explain long-term soil organic carbon sequestration and dynamics. *European Journal of Soil Science*, **67** (3), 332-340.
- Lacaze, R., **Smets, B.**, ... (2015). Sentinel-3 for the Copernicus Global Land Service: Monitoring the Continental Ecosystems at Global Scale, Proceedings of a workshop held 2-5 June, 2015 in Venice, Italy. Edited by L. Ouwehand. ESA SP-734, ISBN 978-92-9221-298-8, id.32

Relevant previous projects or activities, relevant to the proposal

- **Copernicus European Land Service:** VITO (B. Smets) has recently been awarded a new contract for European Environment Agency to extend the Copernicus European Land Service with a 10m Vegetation Phenology and Productivity product. It will provide a qualified product covering the EEA-39 from 2017 onwards. (VITO: 1.5 Mio. €)
- **WORLDCOVER (ESA) and U-TURN:** VITO (R. Van de Kerchove) is leading two projects related to land cover mapping, one being the Worldcover (ESA) project which will deliver a 10m land cover map over the entire world using the Sentinels, and second being U-TURN (Belgian Space Policy) performing land cover mapping using the LandSAT time-series from 1984 onwards. (VITO: 1.5 Mio. € for WORLDCOVER, 0.23 Mio. € for U-TURN)
- **GLOBDIVERSITY (ESA):** VITO (R. Van de Kerchove) is partner of the GlobDiversity (ESA) project. The project focuses on the development and engineering of Remote Sensed Essential Biodiversity Variables (RS-enabled EBVs). With RS-enabled EBVs, key characteristics of biodiversity can be observed and monitored with satellites and on a global scale. The focus is on fragmentation, canopy chlorophyll concentration and land surface phenology. VITO is responsible for scaling up demonstration at country/regional level. (VITO: 0.02 Mio. €)
- **SIEUSOIL:** The Sieusoil project (H2020-SFS-2018, 2019-2022) aims at developing a SINO-EU Soil observatory for intelligent Soil and Land Use Management. A research platform consisting of advanced crop and soil sensing tools, modelling and data fusion, digital soil mapping and farm management information systems will be developed to maximise land productivity and socio-economic benefits, while minimising the environmental impacts. VITO (A. Gobin) leads a WP on “Limiting factors to soil quality and soil productivity” and is in charge of a pilot study on “Flanders on soil management and spatial land suitability” (<https://remotesensing.vito.be/case/sieusoil>) (Total: 6.8 Mio. €, VITO: 0.45 Mio. €)

Participant No	8	Participant short name	NIVA
Participant full name	Norwegian Institute for Water Research		
<p>Participant Description</p> <p>NIVA is Norway’s leading institute for applied research and monitoring of aquatic biodiversity and ecosystems and develops tools for water management. NIVA’s broad scope of competence, research expertise and extensive data collections including all groups of aquatic biota and water chemistry represent an important resource for national and international projects. NIVA has a key scientific support role for the implementation of the Water Framework Directive (WFD) in Norway, operates most of the national WFD monitoring, developed the biological indicators and assesses ecological status in rivers, lakes and coastal waters. NIVA has served as key expert for EEA’s Topic Centre on Inland, Coastal and Marine waters (ETC-ICM) since 2007. NIVA is a partner in 15 projects under the EU Horizon 2020, including a European training and research network for environmental flow management in river basins (EUROFLOW) and has participated in projects under all the EU Framework Programmes, including 24 projects under the EU FP7. NIVA had 2 lead authors in the expert groups for the first IPBES report (2019). NIVA has about 220 water professionals working at the headquarters in Oslo, at the 3 regional offices or at the marine research station.</p> <p>NIVA will be the major partner on freshwater work in the project and will be the lead for T5.3 in WP5.</p>			
<p>Key Personnel Involved</p> <p>Anne Lyche Solheim (female), Senior researcher at NIVA with PhD in limnology from University of Oslo. Key expert in the EEA's Topic Centre (ETC-ICM) since 2007 on assessment of ecological status of rivers and lakes related to the WFD. She initiated the freshwater biological data flow from European countries to EEA in 2010 and supports the ETC Biodiversity related to revision of EUNIS habitat types. She has worked as visiting scientist at JRC on intercalibration of WFD biological indicators and is currently the co-lead for freshwater in the WFD-CIS expert group ECOSTAT. She has been a key contributor to several large EEA and ETC assessments, including the Status and Pressures on European Waters in 2012 and 2018, as well as PI for a cross-walk between the WFD and Habitats Directive types, status and pressures in 2015. She has been a WP-lead in several European research projects providing support for WFD implementation, e.g. REBECCA, WISER (WP lead on lakes), and MARS (WP lead on Communication and Dissemination). She is also the PI for designing, innovating and executing monitoring of large Norwegian lakes, including biotic and abiotic variables according to WFD requirements. Her research focuses on nutrients and climate change impacts on lake phytoplankton, incl. harmful algal blooms. She has published 43 scientific papers and 82 national and international technical/scientific reports. Her H-index is 29 and she has 2829 citations (Google Scholar). Role in the project: Anne Lyche Solheim will be the lead for T5.3 and also participate in other tasks (T2.4, WP3, WP4 and T5.2), contributing with ideas and knowledge based on European-wide assessments for EEA on the WFD and Habitats Directive, as well as WFD-monitoring of large lakes, focusing on harmful algal blooms. She will also coordinate the NIVA-team.</p> <p>S. Jannicke Moe (female), Senior researcher at NIVA with PhD from University of Oslo with focus on statistical modelling and analysis of ecological responses to climate change, eutrophication and pollutants, including probabilistic approaches to ecological risk assessment. She has been a member of the EEA's' Topic Centre for Water since 2007, with responsibility for the biological data flow from freshwaters reported from EEA member states to the Water Information System for Europe (WISE). She had lead roles, including database management in several WFD-related EU projects, e.g. REBECCA, WISER (WP lead on data service), REFRESH (task lead on ecological thresholds in lakes) and MARS (task lead on multiple stressors in lakes at European scale). She has published 39 scientific papers and has a H-index of 19 and 1568 citations (Google Scholar). Role in the project: Jannicke Moe will provide access to large-scale European datasets for all freshwater biota in EEA-WISE and from EU research projects for use in WP3-tasks and T5.3. She can also contribute to WP4-tasks, combining data-skills and modelling skills.</p> <p>Leonard Sandin (male) is a senior freshwater ecologist recently employed as a senior researcher at NIVA. He is a key expert on freshwater benthic fauna and fish. He is a former deputy head of institute and head of section (2016-</p>			

2018) at the Institute of Freshwater Research, SLU, Sweden. He was a WP leader or task leader in several EU FP5, FP6 and FP7 projects, including REBECCA, EuroLimpacs, RUBICODE and REFERESH, and is currently a management committee member in SMIRES. He has also been PI of numerous Swedish research and management projects related to freshwater biomonitoring, indicator development, methods development, and projects related to freshwater restoration. Dr. Sandin has published >60 scientific papers and book chapters, has an H-index of 36 and >5000 citations ([Google Scholar](#)). **Role in the project:** Leonard Sandin will be a senior expert in T5.3, as well as contribute to workshops and discussions in other tasks, focusing on fish and benthic fauna (T4.1), workflow (T4.3) and novel technologies (T4.2).

Marit Mjelde (female) is a researcher at NIVA and key expert in aquatic macrophytes taxonomy, ecology and biodiversity. She participates in national work with habitat types, threatened species and invasive species. She has been responsible for biodiversity monitoring and for NIVA's macrophyte database, including more than 900 lakes and is also responsible for national database for the Red List types "Calcareous lakes" and "Oxbow lakes". She is responsible for macrophytes monitoring and status assessment and has developed and intercalibrated the Norwegian indices for aquatic macrophytes (eutrophication, acidification and water level regulation). She has been involved in several international projects, e.g. REBECCA 2003-2006, WISER 2009-2012, European Red List of Habitats (2014-2016). She has 24 scientific papers, 200 technical/scientific reports and 20 Norwegian articles/book chapters. Her H-index is 14 and she has 1114 citations ([Google Scholar](#)). **Role in the project:** Marit Mjelde is the key expert on freshwater macrophytes in T5.3 and will join other tasks on indicators (T4.1), workflow (T4.3) and use of novel technologies with a focus on molecular methods (T4.2).

Relevant publications

- **Lyche Solheim A., ... Moe, S.J.,** Birk, S. (2019). A new broad typology for rivers and lakes in Europe: Development and application for large-scale environmental assessments. *Science of the Total Environment*, **697**, 134043.
- Couture, R.M., **Moe, S.J., ... Haande, S., Lyche Solheim. , A.** (2018). Simulating water quality and ecological status of Lake Vansjø, Norway, under land-use and climate change by linking process-oriented models with a Bayesian network. *Science of the Total Environment*, **621**, 713-724.
- **Moe, J., ... Hering, D.** (2013). The WISER way of organising ecological data from European rivers, lakes, transitional and coastal waters. *Hydrobiologia*, **704**, 11-28.
- Göthe, E, E., ... **Sandin, L., ...** (2019). Flow restoration and the impacts of multiple pressures on fish communities in regulated rivers. *J. of Appl. Ecol.*, **56**, 1687-1702.
- Anglès d'Auriac, ... **Mjelde M., ...** (2019). Detection of an invasive aquatic plant in natural water bodies using environmental DNA. *PLoS ONE*, **14** (7), e0219700.

Relevant previous projects or activities, relevant to the proposal

- **EEA-ETC-ICM:** NIVA (A. Lyche Solheim and S.J. Moe) is a key partner in EEA's [ETC-ICM](#) and have been task leads/key experts for work related to the WFD and Habitats Directive, including assessments of ecological status for lakes and rivers, using European biological data in WISE State-of-Environment (annual data) and in [EEA-WISE-WFD](#). (NIVA: 1 Mio. €)
- **WISER and MARS:** NIVA (A. Lyche Solheim, L. Sandin, S.J. Moe and M. Mjelde) have been WP leads and key researchers in these EU-FP6 and FP7 projects (2009-2012, 2014-2018) on development of WFD-indicators to assess status for phytoplankton, macrophytes, phytobenthos, benthic invertebrates and fish in rivers and lakes (WISER) and how they respond to multiple stressors (MARS). (NIVA: 1.6 Mio. € for both projects)
- **LifeWatch:** NIVA (S.J. Moe) participated in the pilot project (2011-2012) for establishing a Norwegian node of [LifeWatch](#). LifeWatch ERIC is a European Infrastructure Consortium providing e-Science research facilities seeking to increase our knowledge and deepen our understanding of Biodiversity organisation and Ecosystem functions and services. (NIVA: 0.01 Mio. €)
- **EuroLimpacs and REFRESH:** NIVA (S.J. Moe, L. Sandin and A. Lyche Solheim) has been WP lead, task lead or key researchers in these EU FP6 and FP7 projects (2008-2012, 2014-2017) on the effects of- and adaptation to climate change in freshwater systems (rivers, lakes and wetlands). (NIVA: 1.5 Mio. €, for both projects)

- **BIOWATER:** NIVA (A. Lyche Solheim) leads module 5 on Evaluation of options and policy advice in a Nordic center-of-excellence that provides solutions for land, environmental and water resources management in the face of increasing demands for biomass, land and water resources related to the green shift and bio-economic development. (NIVA: 0.1 Mio. €).

Participant No	9	Participant short name	IGOT
Participant full name	Institute of Geography and Spatial Planning		
<p>Participant Description</p> <p>The Institute of Geography and Spatial Planning (IGOT) is the School of Geography and Spatial Planning of the University of Lisbon. The IGOT is a pioneering project within the Portuguese higher education system, being the only school in Portugal dedicated entirely to teaching and research on Geography and Spatial Planning, since 2009. The IGOT comprises state of the art teaching, research and innovation in several topics of Social Sciences, Earth System Sciences and Spatial Planning namely those focused on the territory and the environment.</p> <p>The work will be carried out at the Centre of Geographical Studies (CEG), the research unit of IGOT. The Centre was founded in 1943 and its mission is fostering geographical research, promoting and disseminating geographical knowledge and contributing to social inclusion and sustainable development. The CEG, with 185 researchers and staff, 75 of which with PhD degree, is an institution offering a vibrant research environment, whose work is global in scope and addresses cutting-edge topics of contemporary Human and Physical Geography and Planning. International collaboration includes the participation in the EU-PolarNet, MSCA-ITNs, Horizon 2020, ESPON and other international projects. The high-quality research environment and facilities include a specialized library, vast map and photo archives, physical geography laboratory and the recent GEOMODLAB, a computational laboratory for spatial modelling and remote sensing. In EuropaBON, IGOT will lead T5.5, on the use of BON for supporting the Bioeconomy Strategy, and will participate in tasks 3.3 and 4.3.</p>			
<p>Key Personnel Involved</p> <p>César Capinha (male), Assistant Researcher (equivalent to Assistant Professor) for Biogeography and Predictive Modelling at the Centre of Geographical Studies (CEG) of the Institute of Geography and Spatial Planning, University of Lisbon (IGOT-UL). He is a Geographer and Spatial Modeler by training and received his PhD in Environmental Sciences at the University of Évora (2012). He published > 40 papers and book chapters, has an H-index of 18 and >1,800 citations (Google Scholar), and serves as subject editor of the journal <i>Diversity</i> since 2019. He is co-PI, task leader and researcher in several national and European research projects. César's Capinha's research deals mainly with the biogeography of invasive species and the prediction of ecological phenomena, including the dispersal of invasive species and the temporal dynamics of phenological events. He is also actively involved in the development of operational early warning systems for epidemics transmitted by invasive mosquito species. Role in the project: César will lead the Bioeconomy Strategy showcases (T5.5.) and assist colleagues in T3.3 and T4.3.</p>			
<p>Relevant publications</p> <ul style="list-style-type: none"> • Capinha, C. (2019). Predicting the timing of ecological phenomena using dates of species occurrence records: a methodological approach and test case with mushrooms. <i>International Journal of Biometeorology</i>, 63, 1015–1024. • Capinha, C. et al. (2018). Models of alien species richness show moderate predictive accuracy and poor transferability. <i>NeoBiota</i>, 38, 77–96. • Tiago, P., Pereira, H.M., ... Capinha, C. (2017). Using citizen science data to estimate climatic niches and species distributions. <i>Basic and Applied Ecology</i>, 20, 75–85. • Latombe, G., ... Capinha, C., ... (2017). A vision for global monitoring of biological invasions. <i>Biological Conservation</i>, 213, 295–308. 			
<p>Relevant previous projects or activities, relevant to the proposal</p> <ul style="list-style-type: none"> • WARDEN and TRIAD: C. Capinha is currently involved in two, nationally funded, research projects (as co-PI and as core researcher) developing operational early-warning systems for mosquito borne diseases: the WARDEN-project [PTDC/BIA-OUT/30089/2017] which aims to develop an early warning system for dengue and other arboviral diseases in Madeira island, and the TRIAD project which is implementing a system for near real-time forecasting of the dispersal of the Asian tiger mosquito in regions of Southern Europe [PTDC/GES-OUT/30210/2017]. (0.5 Mio. €). 			

Participant No	10	Participant short name	ICETA
Participant full name	Instituto de Ciências, Tecnologias e Agroambiente da Universidade do Porto		

Participant Description

Instituto de Ciências, Tecnologias e Agroambiente da Universidade do Porto (ICETA) is a private, non-profit institution that benefits from administrative and financial autonomy. ICETA has a long experience managing scientific institutions, and is currently responsible for managing the research projects, human resources, finances and legal affairs of two Associate Laboratories (InBIO - Research Network in Biodiversity and Evolutionary Biology and REQUIMTE - Network of Chemistry and Technology), and an additional R&D Unit (CECA, Animal Science Research Centre). The major aim of ICETA is to promote and support scientific and technological activities in Research and Development within other scientific and technical activities, to provide services and consulting, to support post-graduate and advanced training, to foment collaboration between several organisms, companies and institutions, both academic and non-academic.

The work will be developed by Centro de Investigação em Biodiversidade e Recursos Genéticos (CIBIO), which is a Research Unit in the field of biological sciences. CIBIO develops research in the area of biodiversity, advancing knowledge on the origins and maintenance of biodiversity, and applying this knowledge to address societal challenges related to climate and land use changes, environmental degradation, the loss and sustainable use of biodiversity and agrobiodiversity, and the management, restoration and sustainable use of ecosystems and their services. CIBIO has 160 researchers with a PhD, based in several universities and research institutes across Portugal. CIBIO is involved in several training programmes, from undergraduate to post-doctoral levels, being the main host institution of the Doctoral Programme Biodiversity, Genetics and Evolution and the Masters Course in Biodiversity, Genetics and Evolution. (BIODIV). The capacity of CIBIO to undertake excellent research and development is being upgraded through a Teaming project with the University of Montpellier, involving a contribution from the EC of 15 Mio. €.

ICETA/CIBIO has, until the exit of ICETA as the host/managing institution of CIBIO on October 31st 2021, and the transfer to Associação BIOPOLIS, contributed in the overall management of the EuropaBON project, and through the executant institution CIBIO directly to WP3, WP4 and WP5. From November 1st 2021, CIBIO is hosted and managed by Associação BIOPOLIS. The plan of contribution to the EuropaBON project through BIOPOLIS/CIBIO will remain the same as outlined for ICETA/CIBIO for the remaining duration of the project.

ICETA/CIBIO has contributed, and BIOPOLIS/CIBIO will from November 1st 2021 continue to contribute mostly to WP3, leading T3.2 and participating in T3.1, to WP4, participating in tasks 4.1 to 4.3, and to WP5, participating in tasks 5.1 to 5.3. ICETA/CIBIO brought, and BIOPOLIS/CIBIO will here continue to bring to the consortium its unique experience in the use of molecular tools for biodiversity monitoring and assessment, and its engagement with industry partners in environmental impact assessment and monitoring.

Key Personnel Involved

Pedro Beja (male), born 1965 in Lisbon, Portugal; BSc degree (1989), PhD (1995, University of Aberdeen); Research Professor, CIBIO/ICETA, University of Porto; Vice-Director of CIBIO, Vice-Director of InBIO and Member of the Direction Board of ICETA; holder of the EDP Biodiversity Research Chair (since 2012); Group leader of the Applied Population and Community Ecology research group. His research focuses on the conservation of biodiversity in human-dominated landscapes, including agricultural, forest and freshwater systems, with a special attention to the actual application of conservation research. Recently he is interested in the use of metagenomics in the fields of environmental monitoring, species-interactions, and ecosystem responses to anthropogenic stressors. He supervised 10 PhD- and 16 MSc-theses and 7 post-docs, currently supervises 11 PhD and 1 MSc theses and 4 post-docs; edited 3 books and 3 conference proceedings, and authored 140 papers in international peer reviewed journals; >5350,4 GS citations (in January 2020); H-index = 38 ([Google Scholar](https://scholar.google.com/citations?user=...)). **Role in the project:** Pedro will be involved mainly on WP3, particularly on T3.2, and also T5.3.

Francisco Moreira (male), born 1965 in Leiria, Portugal; BSc degree (1989), PhD (1996); Group leader of the CIBIO research group “Biodiversity in agricultural and forest ecosystems”; holder of the REN invited chair in biodiversity. Research interests include biodiversity impacts of agricultural and forest policies, fire ecology, and biodiversity impacts of anthropogenic infrastructures. He has published over 130 papers in international peer reviewed journals including *Frontiers in Ecology and the Environment*, *Global Change Biology*, *Methods in Ecology and Evolution*, and *Science*. >6500,7 [GS citations](#); H-index=42,3. Leading author of the IPBES assessment report on land degradation and restoration. **Role in the project:** Francisco will be involved on WP3 and WP5, mainly on T5.1 and T5.2.

Relevant publications

- Blackman, R.C., ... **Beja, P.**, ... (2019). Advancing the use of molecular methods for routine freshwater macroinvertebrate biomonitoring - the need for calibration experiments. *Metabarcoding and Metagenomics*, **3**, 49-57.
- Martins, F.M., ... **Beja, P.** (2019). Have the cake and eat it: Optimizing nondestructive DNA metabarcoding of macroinvertebrate samples for freshwater biomonitoring. *Molecular ecology resources*, **19**, 863-876.
- **Moreira, F.**, ... **Beja, P.** (2019). Priority questions for biodiversity conservation in the Mediterranean biome: heterogeneous perspectives across continents and stakeholders. *Conservation Science and Practice*, e118.
- Pe'Er', G., ... **Moreira, F.**, ... (2019). A greener path for the EU Common Agricultural Policy. *Science*, **365** (6452), 449-451.
- Pawlowski, J., ... **Beja, P.**, ... (2018). The future of biotic indices in the ecogenomic era: Integrating (e) DNA metabarcoding in biological assessment of aquatic ecosystems. *Science of the Total Environment*, **637**, 1295-1310.

Relevant previous projects or activities, relevant to the proposal

- **NewGen** (2012-2015): NewGen - Capacity building at CIBIO for research using Next-Gen Sequencing. ICETA-CIBIO was the coordinator and sole participant. Funded by a FP7 CAPACITIES project. (ICETA-CIBIO: 3.5 Mio. €)
- **EnvMetaGen** (2015-2020): EnvMetaGen - Capacity Building at InBIO for Research and Innovation Using Environmental Metagenomics (H2020-WIDESPREAD-2-2014: ERA Chairs). ICETA-CIBIO was the coordinator and sole participant. Funded by a H2020 Widening Project (ICETA-CIBIO: 2.23 Mio. €)
- **PORBIOTA** (2017-2020): PORBIOTA – Portuguese E-Infrastructure for Information and Research on Biodiversity. ICETA-CIBIO was the coordinator of 12 other institutions. (POCI-01-0145-FEDER-022127). Funded by FCT/COMPETE. (Total: 5.1 Mio. €, ICETA-CIBIO: 1.31 Mio. €)
- **TROPIBIO** (2019-2024). TROPIBIO - Expanding potential in TROPICAL Biodiversity and ecosystem research towards sustainable life on land (WIDESPREAD-03-2017: ERA CHAIRS). ICETA-CIBIO is the coordinator and sole participant. Funded by a H2020 Widening Project. (ICETA-CIBIO: 2.49 Mio. €)
- **BIOPOLIS** (2019-2026): BIOPOLIS: Teaming to Upgrade to Excellence in Environmental Biology, Ecosystem Research and AgroBiodiversity (WIDESPREAD-01-2018-2019: Teaming Phase 2). ICETA-CIBIO is the coordinator of 2 other institutions. Funded by a H2020 Widening Project. (Total: 15 Mio. €, ICETA-CIBIO: 10.08 Mio. €)

Participant No	11	Participant short name	PENSOFT
Participant full name	Pensoft Publishers Ltd		
<p>Participant Description</p> <p>Pensoft Publishers is a SME specializing in academic, open access book and journal publishing, software development and web design, project dissemination and science communication. The company’s project department is comprised of a motivated team of active scientists, project managers and science communicators. Among the services for projects offered by Pensoft are: 1) Development of project logo and brand identity; 2) website design, setup and maintenance; 3) setup of project management tools: internal communication platform, storage and mailing modules; 4) design, production and distribution of marketing collateral: flyers, posters, stickers, videos, other branded products; 5) Organization of events, workshops, summer schools; 6) Consultancy and development of communication strategies, plans for dissemination and exploitation and data management plans; 7) Press release writing and dissemination and liaison with journalists; 8) Social media setup and management; 9) Production and distribution of final results packages (policy briefs, factsheets, infographics) and booklets; 10) Design and development of interactive final project online information resources and tools.</p> <p>Throughout the last 20 years, Pensoft has been actively involved in managing, planning and carrying out dissemination and communication activities for a number of EU projects: STEP, ALARM, MOTIVE, SCALES, BESAFE, EU BON, ESMERALDA, IMPRESSIONS. Currently, Pensoft’s staff is participating as a WP Leader in the Horizon 2020 projects CLAIM, PoshBee, RENATURE, HOMED and Path2Integrity. In 2014 the company launched a novel Open Access book (re-)publishing platform, Advanced Books. Pensoft is well known among academics worldwide with its technologically advanced peer-reviewed Open Access journals, such as ZooKeys, Nature Conservation, NeoBiota, Biodiversity Data Journal (BDJ).</p> <p>Pensoft will be engaged with the development of project corporate design, website development and active dissemination of project outputs.</p>			
<p>Key Personnel Involved</p> <p>Pavel Stoev (male) is a Professor at the National Museum of Natural History, Bulgaria and Head of the Projects department at Pensoft. His research interests include systematics and biogeography of cave and soil-dwelling arthropods, distribution of invasive species, bioinformatics, and data management. His research combines taxonomic and ecological knowledge with bioinformatics to develop innovative publishing models and workflows. He has published more than 130 papers and 3 monographs. Web of Science: 552 citations, H-Index 15; SCOPUS: 507 citations, H-Index: 11; Google Scholar: 1921 citations; H-Index 22. Role in the project: Pavel will take part in T1.2. Management of the project website and web-based communication, T1.4. Knowledge management, T2.5. Communication and Dissemination.</p> <p>Margarita Grudova (female) has more than 15 years of experience in coordination and management of projects in the field of environmental protection, funded under different international programmes. Before joining the Pensoft’s Projects department she worked as a Chief expert at the Executive Environment Agency. She has specialised in project financial management and control as well as administrative and financial reporting for FP7 and H2020 funded projects. Role in the project: Margarita will be involved in T1.2. Management of the project website and web-based communication,</p> <p>Anna Sapundzhieva (female) is a communications expert, working in the dissemination and communication of multiple EU funded scientific projects. She is specialized in social media, public and media relations and news writing. She is also involved in the preparation and implementation of sustainable plans for exploitation and dissemination of scientific results. Role in the project: Anna will be involved in T2.5. Communication and Dissemination.</p>			
<p>Relevant publications</p>			

- Smirnova L., ... **Stoev P.**, ... (2016). Data sharing tools adopted by the European Biodiversity Observation Network Project. *Research Ideas and Outcomes*, **2**, e9390.
- Potts, S., ... **Stoev, P.**, ... (2015). Status and trends of European pollinators. Key findings of the STEP project. Pensoft Publishers, Sofia, 72 pp.
- Hoffmann, A., ... **Stoev, P.**, ... (2014). Improved access to integrated biodiversity data for science, practice, and policy – the European Biodiversity Observation Network (EU BON). *Nature Conservation*, **6**, 49–65.

Relevant previous projects or activities, relevant to the proposal

- **BESAFE** – EU FP7 (2011-2015), WP-leader. The project improved the understanding of the alternative ways in which concepts for the ‘value of biodiversity’ can be used to facilitate biodiversity policy making and governance at local, national and European to global scales. (Total: 3.8 Mio. €)
- **Pro-iBiosphere** – EUFP7 (2012-2014), WP-leader. The project investigated the ways to increase the accessibility of biodiversity data, improved the efficiency of its curation and increased the user base of biodiversity data consumers and applications. (Total: 1.3 Mio. €)
- **EU BON** - EU FP7 (2012-2017), WP-leader. The main objective of EU BON was to build a substantial part of the Group on Earth Observations Biodiversity Observation Network (GEO BON). (Total: 11.6 Mio. €)
- **ESMERALDA** - EU H2020 (2015-2018), WP-leader. The main objective of ESMERALDA was to streamline existing European ecosystem services research, exchange of information, data and methods; build on existing knowledge and experience, to enhance mapping and assessment of ecosystems and their services, and support national stakeholders. (Total: 3.1 Mio. €)
- **RENATURE** - EU H2020 (2018-2021), WP-leader. The project aims to establish and implement a nature-based solutions research strategy for Malta with a vision to promote research and innovation and develop solutions in a pursuit of economic growth, whilst at the same time improving human well-being and tackling environmental challenges. (Total: 0.99 Mio. €)

Participant No	12	Participant short name	UREAD
Participant full name	University of Reading		
<p>Participant Description</p> <p>Research at the University of Reading aims to solve some of the biggest problems facing people today, based on five themes: environment, food, health, heritage and creativity, and prosperity and resilience. The themes are open-ended and overlapping, crossing traditional boundaries and allowing us to nurture innovation and deliver impactful and curiosity-driven research. Working across continents and disciplines, our researchers explore ways to tackle climate change, improve human health, provide food security and understand human culture. The most recent (2014) UK Research Excellence Framework concluded that 98% of the University’s research was internationally-recognised, with 27% ranked world-leading. The University generated more than €40 Mio. in research income in 2016/17. It has 6,200 international students from 140 countries, representing 27% of all students at the Reading campus. 20% of research grants and contract income come from international sources. The School of Agriculture, Policy and Development, is ranked 9th in the world for agriculture and forestry. Our focus is to provide knowledge and solutions for the major challenges in our sector for food production, the sustainability of agro-ecosystems, biodiversity and ecosystem services, adaptation and mitigation to climate change, and international development. Our research is supported by significant external funding from national research councils, government, the European Commission, industry and charities. Our co-developed research has a well-established track record for impact, with long-term partnerships with a wide range of local, national and international stakeholders from industry, policy and NGO’s.</p> <p>Within this project, UREAD will provide its considerable expertise to the pollinator monitoring case study (WP5) and drive the innovative cost-effectiveness (WP2) and cost benefit analyses (WP4).</p>			
<p>Key Personnel Involved</p> <p>Simon Potts (male) is Professor of Biodiversity and Ecosystem Services and Director of the Centre for Agri-Environmental Research (20 staff and >30 PhD students). He is the Principal or Co-Investigator on multiple large-scale multi-partner projects focusing on: role of ecosystem services in sustainable agriculture and food security; understanding and managing environmental drivers of biodiversity and ecosystem services; and developing evidence-based management and policy options. His research has included multiple projects in Europe, Africa, South America and Asia in collaboration with academics, industry, policy makers and other stakeholders. Several of these projects he has coordinated, such as the EU FP7 Status and Trends of European Pollinators project (STEP, www.STEP-project.net), which had 24 partners from 14 countries, a 3.5M € budget, and delivered >200 peer-reviewed papers and >600 dissemination activities. Simon Potts has been awarded >9M € in grant income since 2010 (total award to projects >65M €) from EU, NERC, BBSRC, Darwin Initiative, Defra, FAO and industry. He served as co-chair of the UN Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) ‘Pollinator, Pollination and Food Production’ assessment. He chairs an international expert group for the European Pollinators Initiative to design and test a pan-European pollinator monitoring scheme which will be rolled out across all Member States by 2021. Other professional roles include: advisor to UK Parliament; Defra; Natural England; European Parliament; European Commission; European Environment Agency; UN IPBES, UNEP and FAO. He has published >190 papers including several in <i>Nature</i>, <i>Science</i>, <i>Ecology Letters</i>, <i>TREE</i>, <i>Proc. Roy. Soc. B</i>, and <i>Journal of Applied Ecology</i> (H-index = 58, Google Scholar). Simon was included in Thomas Reuters ‘Highly Cited Researchers’ list for each year 2016-2019 (“This list recognizes world-class researchers selected for their exceptional research performance, demonstrated by the production of multiple highly cited papers that rank in the top 1% by citations for field and year in Web of Science”). Role in the project: Within EuropaBON, he will lead the development of the pollinator monitoring showcase (T5.5) and provide insights and expertise in the science-policy interface (WP5).</p> <p>Tom Breeze (male) is a Research Fellow with expertise in ecological economics and social sciences. His career has included extensive work on the economic and social impacts of ecological management, including the economic values of pollinators, the societal benefits of pollinator monitoring, honeybee supply-demand dynamics, beekeeping</p>			

economics, public attitudes toward pollinator losses and understanding farmer motivations behind pollinator management. He is currently Res Co-I on 3 UK funded projects and 1 EU H2020 project (research project PoshBee), where he provides social and economic research expertise. He has also worked on several EU FP7 projects (STEP, LIBERATION) and was a lead author on the economics chapter of the IPBES Thematic assessment of pollinators, pollination and food production. Dr. Breeze has published 22 papers in journals such as *Nature*, *Trends in Ecology and Evolution*, *Ecosystem Services* and *Ecological Economics* (H-index = 12). **Role in the project** Within EuropaBON, he will lead the data collection and analysis of the cost-benefit aspects of the project (tasks 3.4. and 4.4.), building upon his considerable experience within this area.

Relevant publications

- **Potts, S.G., Breeze T.D.** et al. (2016). Safeguarding pollinators and their values to human well-being. *Nature*, **540**, 220-229.
- Stanley D.A., ... **Potts, S.G.**, Raine, N.E. (2015). Neonicotinoid pesticide exposure impairs crop pollination services delivered by bumblebees. *Nature*, **528**, 548-550.
- **Breeze, T.D.** et al. (2019). Linking farmer and beekeeper preferences with ecological knowledge to improve crop pollination. *People and Nature*, **1**, 562-572.
- Garratt, M.P., ... **Breeze, T.D., Potts, S.G.**, ... (2019.) Capacity and willingness of farmers and citizen scientists to monitor crop pollinators and pollination services. *Global Ecology and Conservation*, e00781.
- **Breeze, T.D.** et al. (2016). Economic measures of pollination services: Shortcomings and Future Directions. *Trends in Ecology and Evolution*, **31**, 927-939.

Relevant previous projects or activities, relevant to the proposal

- **IPBES:** Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services global assessment of ‘Pollinators, pollination and food production’ (2014-2016). Potts Co-chair, Breeze Lead Author, characterised the threats to pollination including pesticides, GM crops, land use, pathogens and climate change and identified the most effective practice and policy responses to protect and manage pollinators and pollination services. (Total: 23 Mio. €)
- **STEP:** Status and Trends of European Pollinators, EU FP7 (2010-2015). Potts Coordinator, Breeze PhD, documented the status and trends of European pollinators, identified the main drivers and effective management options for the protection of pollinators and sustainable use of pollination services. (Total: 3.5 Mio. €)
- **Resilient Pollinators:** (BBSRC) Potts PI, Breeze Res Co-I, integrates monitoring methods to model and map the distribution of pollinators and pollination services and their economic values, across the UK and will provide scenario based management recommendations to improve the resilience of pollination services in the food system into the future. (Total: 0.8 Mio. €)
- **NPPMF:** National Pollinator and Pollination service monitoring Framework (UK Government), Potts and Breeze, Researchers, worked with a partnership of organizations to design and test a fully costed pollinator monitoring framework for the UK, including a novel cost-benefit analysis to highlight the benefits of monitoring. (Total: 0.3 Mio. €)
- **PMRP:** The Pollinator Monitoring Research Partnership (UK Government), Potts advisor, continues the work of NPPMF with a fully funded, volunteer oriented pollinator monitoring scheme with an emphasis on citizen engagement. (Total: 0.4 Mio. €)

Participant No	13	Participant short name	USTAN
Participant full name	University of St Andrews		
<p>Participant Description</p> <p>The University of St Andrews is a premier university for biodiversity research. It combines a 600-year history with cutting edge research and teaching: it is jointly ranked third in the UK and 88th in the world, and the School of Biology ranks second in the UK for societal impact in the latest Research Excellence Framework. Particular strengths of the university relevant to this project include theoretical biology, environmental modelling, marine research and biological diversity studies. Specifically, St Andrews is home to the Centre for Research into Ecological and Environmental Modelling, the Scottish Oceans Institute, the directorate of the Marine Alliance for Science and Technology, and the Centre for Biological Diversity. These centres and institutions collectively reflect the University's strength in quantitative science underpinning solutions to modern environmental problems.</p> <p>The project team will be based within the Centre for Biological Diversity, where it will have access to a dedicated computing lab, as well as high performance computing, biodiversity monitoring and remote sensing expertise. The team will be immersed in a vibrant scientific community researching the origins, distribution and change in biological diversity. The Centre hosts the biodiversity database BioTIME, and employs a full time database manager.</p> <p>USTAN will contribute towards T3.1, T3.2, 3.3 and T3.4, and specifically target the marine realm, and will lead T4.2 on identifying novel technologies for the BON.</p>			
<p>Key Personnel Involved</p> <p>Maria Dornelas (female) is a Reader at the School of Biology, and Deputy Director of the Centre for Biological Diversity. She completed her PhD in Marine Biology at the James Cook University, Australia (2006). She is an elected member of the Royal Society of Edinburgh Young Academy of Scotland, and a member of the Royal Society Global Environmental Research Committee. She co-leads the biodiversity time series database BioTIME and contributed an indicator to the IPBES global assessment. She is Deputy Editor in Chief of the journal <i>Global Ecology and Biogeography</i>. She has published 67 papers, has accumulated >3700 citations and has an H-index of 25. (Google Scholar) She is a macroecologist who combines theory, data synthesis and field work to understand how biodiversity varies in space and time. Her research spans local to global scales, the poles to the tropics and many taxa. She develops novel methods to collect biodiversity data and quantify its change. Role in the project: Maria will lead T4.2 and will contribute towards T3.1 to T3.4.</p>			
<p>Relevant publications</p> <ul style="list-style-type: none"> • Dornelas, M. et al. (2019). Towards a macroscope: Leveraging technology to transform the breadth, scale and resolution of macroecological data. <i>Global Ecology and Biogeography</i>, 28 (12), 1937-48. • Blowes, S., Supp, S., ... Dornelas, M. (2019). The geography of biodiversity change over land and sea. <i>Science</i>. • Dornelas, M. et al. (2019). A balance of winners and losers in the Anthropocene. <i>Ecology letters</i>, 22 (5), 847-854. • Dornelas, M. et al. (2014). Assemblage Time Series Reveal Biodiversity Change but Not Systematic Loss <i>Science</i>, 344, 296-299. 			
<p>Relevant previous projects or activities, relevant to the proposal</p> <ul style="list-style-type: none"> • BioTIME: M. Dornelas was a named Senior Post-Doctoral Researcher on the ERC Advanced project BioTIME (2010-2015), which assembled the BioTIME database and quantified temporal change in assemblage biodiversity across the planet. (Total: 2 Mio. €) • BioCHANGE: M. Dornelas was a Co-investigator on the ERC PoC project BioCHANGE (2016-2018), which aimed to expand the BioTIME database and develop tools to make it accessible to scientists and policy makers. (Total: 0.1 Mio. €) 			

- M. Dornelas leads the St Andrews spoke of the Leverhulme Centre for Biodiversity in the Anthropocene (2020-2030, based at the University of York and led by Professor Chris Thomas). The centre aims to investigate how humans are transforming biodiversity in the Anthropocene. (Total: 11.8 Mio. €)

Participant No	14	Participant short name	UT
Participant full name	University of Tartu		
Participant Description			
<p>University of Tartu (UT) is Estonia's leading centre of research and training. It preserves the culture of the Estonian people and spearheads the country's reputation in research and provision of higher education. UT belongs to the top 1.2% of world's best universities.</p> <p>As Estonia's national university, UT stresses the importance of international cooperation and partnerships with reputable research universities all over the world. The robust research potential of the university is evidenced by the fact that the University of Tartu has been invited to join the Coimbra Group, a prestigious club of renowned research universities.</p> <p>UT will assist to solve T3.1, T4.2, T5.2 and T5.4.</p>			
Key Personnel Involved			
<p>Leho Tedersoo (male) is a Research Professor in Mycorrhizal Studies in University of Tartu, Faculty of Science and Technology, Institute of Ecology and Earth Sciences. He has published >150 ISI-indexed articles including 48 first-authored (two of these in Science magazine) and 35 senior-authored articles, most of which are published within the last 5 years. The senior-authored papers mainly stem from 8 successfully supervised PhD projects and 7 MSc projects as well as leading of international initiatives. Studies of Leho Tedersoo have been cited >16000 times (13500 times in the last 5 years, Google Scholar). In 2013, he received the first prize for the best series of studies (diversity of ectomycorrhizal fungi in tropical and temperate ecosystems) from the Estonian Ministry of Science and Development and in 2016 he received a young researcher prize from The Research Council of the Estonian President. The applicant is an independent researcher with several finished and ongoing national and international projects led by him. He has outstanding experience in leading large international projects with tens of participants and supervising graduate and undergraduate students. Role in the project: Leho Tedersoo will participate as a leader of UT workgroup.</p>			
Relevant publications			
<ul style="list-style-type: none"> • Tedersoo, L. et al. (2014). Global diversity and geography of soil fungi. <i>Science</i>, 346, 1078. • Tedersoo, L. et al. (2015). Analytical biases in microbial diversity studies. <i>Science</i>, 359, 936. • Tedersoo, L. et al. (2018). High-level classification of the Fungi and a tool for evolutionary ecological analyses. <i>Fung. Div.</i>, 90, 135–159. • Anslan, S., ... Tedersoo, L. (2017). PipeCraft: Flexible open-source toolkit for bioinformatics analysis of custom high-throughput amplicon sequencing data. <i>Mol. Ecol. Res.</i>, 17, e234–e240. • Nilsson R.H., ... Tedersoo, L. (2019). Mycobiome diversity: high-throughput sequencing and identification of fungi. <i>Nature Rev. Microbiol.</i>, 17, 95–109. 			
Relevant previous projects or activities, relevant to the proposal			
<ul style="list-style-type: none"> • Global diversity of soil fungi: Project funded by Estonian Science Foundation (2013 – 2019) involved processing >60000 soil samples from the world. Project leader. (Total: 0.8 Mio. €) • Mineral weathering of plants and fungi: Project financed by European Structural funds (2018 – 2019). Project leader. (Total: 0.2 Mio. €) 			

- **Sustainable use of soil resources in the changing climate:** Project financed by Norway-Baltic financial mechanisms (2020 – 2023) would involve microbial analyses of ca. 200 plots in North Europe. Coordinator of research activities of Postdocs and PhD students. (Total: 0.9 Mio. €)

Participant No	15	Participant short name	DBC
Participant full name	Dutch Butterfly Conservation		
<p>Participant Description</p> <p>Dutch Butterfly Conservation, the name De Vlinderstichting uses outside the Netherlands, was founded in 1983, with conservation and restoration of the Dutch butterfly fauna as its chief aims. Since then, it has extended those aims to include dragonflies and moths. Furthermore, our area of activity has grown over the border, where we now work with sister organizations in Europe. Dutch Butterfly Conservation carries out research and gives advice to those responsible for deciding the use, development and management of land in all sorts of areas. We have research workers with broad experience and expertise in ecology, specialized in butterflies, moths and dragonflies, as well as nature conservation.</p> <p>Dutch Butterfly Conservation has been running a monitoring project for butterflies since 1990 and dragonflies since 1999. These have both standardized counts for changes in abundance as occupancy modelling on opportunistic data to assess changes in distribution. Both transect counts and opportunistic data are mostly recorded by citizen scientists and therefore we have a long history of citizen science at DBC. We are one of the founding organisations of Butterfly Conservation Europe (BCE) and are one of the partners of the project “Assessing Butterflies in Europe” (ABLE). In this project we develop an EU wide monitoring network for butterflies. Besides trends of individual species we more and more use aggregate these trends as indicators for ecological changes, such as nitrogen deposition, climate change or landscape changes.</p> <p>DBC will bring its expertise with monitoring with citizen scientists (WP2, WP3) and the analysis of the resulting data (WP3, WP4) into the project.</p>			
<p>Key Personnel Involved</p> <p>Roy H. A. van Grunsven (male), Project Manager at DBC. He received his PhD in Biological Sciences at Wageningen University (2008). He has worked as a postdoc on the impact of artificial light on ecosystems at Wageningen University and at IGB-Berlin, Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB) Part of this work focussed on the impact on moths, both, attraction as shifts in behaviour and life history. The effects were also tested in a wider ecological context using experimental field sites in both the Netherlands and Germany.</p> <p>Since 2017 he coordinates the Dutch Dragonfly Monitoring Scheme. Including the analysis of data together with the governmental institution Statistics Netherlands and works to improve dragonfly monitoring in the Netherlands and the rest of Europe. The use of dragonfly communities as indicators for a.o. water quality and climate change have been developed over the last few years are currently being applied.</p> <p>He is also project leader of several research and conservation projects for dragonflies and butterflies. He is a member of the editorial board of the odonatological journal <i>Brachytron</i> and a member of the advisory board of the project “Species Conservation through Environmentally Sound Lighting” of Technische Universität Berlin (TU-Berlin) and IGB, funded by the German Federal Agency for Nature Conservation. Roy has an H-index of 20 and 1144 citations (Google Scholar). Role in the project: He will be involved in evaluating designs of citizen science monitoring schemes and their analysis (WP2, WP3, WP4)</p>			
<p>Relevant publications</p> <ul style="list-style-type: none"> • van Grunsven, R.H.A. et al. (2019). Long-Term Comparison of Attraction of Flying Insects to Streetlights after the Transition from Traditional Light Sources to Light-Emitting Diodes in Urban and Peri-Urban Settings. <i>Sustainability</i>, 11 (22), 6198. • Termaat, T., ... van Grunsven, R.H.A., ... (2019). Distribution trends of European dragonflies under climate change. <i>Diversity and Distributions</i>, 25 (6), 936-950. • Barmantlo, S.H., ... van Grunsven, R.H.A., ... (2019). Environmental levels of neonicotinoids reduce prey consumption, mobility and emergence of the damselfly <i>Ischnura elegans</i>. <i>Journal of Applied Ecology</i>, 56 (8), 2034-2044. 			

- Grubisic, M., van Grunsven, R.H.A., ... (2018). Insect declines and agroecosystems: does light pollution matter? *Annals of applied biology*, **173** (2), 180-189.
- van Grunsven, R.H.A., & Liefjing, M. (2015). How to maintain ecological relevance in ecology. *Trends in ecology & evolution*, **30** (10), 563-564.

Relevant previous projects or activities, relevant to the proposal

- **ABLE:** DBC is one of the partners in Assessing Butterflies in Europe. (ABLE) ABLE is a major new project that will use butterflies to indicate the future health of Europe's' environment. The main aim is to create a representative butterfly monitoring network across as many countries as possible in order to improve targeting and efficiency of conservation measures within the European Union. (DBC: 0.405 Mio. €)
- **ACTION:** The H2020 Project ACTION aims to create tools that facilitate Citizen Scientists doing research on pollution. RvG has a project on dragonflies and pesticides in this project and is mentor of one of the other pilots. (DBC: 0.2 Mio. €)
- Monitoring of Dutch dragonflies and butterflies with Citizen Scientists is one of the core projects of DBC. We have extensive expertise with the analysis of the data, interpretation and dissemination. DBC is currently running a GBIF-funded project to make European dragonfly data more accessible. This aims to open data that is currently stored in local databases and stimulate open data policies for odonatological organisations in Europe.

Participant No	16	Participant short name	BIOPOLIS
Participant full name	Associação BIOPOLIS		
<p>Participant Description</p> <p>The participant institution is Associação BIOPOLIS a private, non-profit institution that benefits from administrative and financial autonomy. Associação BIOPOLIS was created in the scope of the Project Teaming BIOPOLIS - Teaming to Upgrade to Excellence in Environmental Biology Ecosystem Research and Agrobiodiversity, funded by the European Commission in the scope of the Horizon 2020 Widening programme.</p> <p>As of November 1st 2021 Associação BIOPOLIS is replacing ICETA as the Participant/Managing institution.</p> <p>The work will be developed by Centro de Investigação em Biodiversidade e Recursos Genéticos (CIBIO), which is a Research Unit in the field of biological sciences. CIBIO develops research in the area of biodiversity, advancing knowledge on the origins and maintenance of biodiversity, and applying this knowledge to address societal challenges related to climate and land use changes, environmental degradation, the loss and sustainable use of biodiversity and agrobiodiversity, and the management, restoration and sustainable use of ecosystems and their services. CIBIO has 160 researchers with a PhD, based in several universities and research institutes across Portugal. CIBIO is involved in several training programmes, from undergraduate to post-doctoral levels, being the main host institution of the Doctoral Programme Biodiversity, Genetics and Evolution and the Masters Course in Biodiversity, Genetics and Evolution. (BIODIV). The capacity of CIBIO to undertake excellent research and development is being upgraded through a Teaming project with the University of Montpellier, involving a contribution from the EC of 15 Mio. €.</p> <p>BIOPOLIS will contribute mostly to WP3, leading T3.2 and participating in T3.1, to WP4, participating in tasks 4.1 to 4.3, and to WP5, participating in tasks 5.1 to 5.3. BIOPOLIS will bring to the consortium its unique experience in the use of molecular tools for biodiversity monitoring and assessment, and its engagement with industry partners in environmental impact assessment and monitoring.</p>			
<p>Key Personnel Involved</p> <p>Pedro Beja (male), born 1965 in Lisbon, Portugal; BSc degree (1989), PhD (1995, University of Aberdeen); Research Professor, CIBIO/BIOPOLIS, University of Porto; Vice-Director of CIBIO, Vice-Director of InBIO and Member of the Direction Board of BIOPOLIS; holder of the EDP Biodiversity Research Chair (since 2012); Group leader of the Applied Population and Community Ecology research group. His research focuses on the conservation of biodiversity in human-dominated landscapes, including agricultural, forest and freshwater systems, with a special attention to the actual application of conservation research. Recently he is interested in the use of metagenomics in the fields of environmental monitoring, species-interactions, and ecosystem responses to anthropogenic stressors. He supervised 10 PhD- and 16 MSc-theses and 7 post-docs, currently supervises 11 PhD and 1 MSc theses and 4 post-docs; edited 3 books and 3 conference proceedings, and authored 140 papers in international peer reviewed journals; >5350,4 GS citations (in January 2020); H-index = 38 (Google Scholar). Role in the project: Pedro will be involved mainly on WP3, particularly on T3.2, and also T5.3.</p> <p>Francisco Moreira (male), born 1965 in Leiria, Portugal; BSc degree (1989), PhD (1996); Group leader of the CIBIO research group “Biodiversity in agricultural and forest ecosystems”; holder of the REN invited chair in biodiversity. Research interests include biodiversity impacts of agricultural and forest policies, fire ecology, and biodiversity impacts of anthropogenic infrastructures. He has published over 130 papers in international peer reviewed journals including <i>Frontiers in Ecology and the Environment</i>, <i>Global Change Biology</i>, <i>Methods in Ecology and Evolution</i>, and <i>Science</i>. >6500,7 GS citations; H-index=42,3. Leading author of the IPBES assessment report on land degradation and restoration. Role in the project: Francisco will be involved on WP3 and WP5, mainly on T5.1 and T5.2.</p>			
<p>Relevant publications</p>			

- Blackman, R.C., ... **Beja, P.**, ... (2019). Advancing the use of molecular methods for routine freshwater macroinvertebrate biomonitoring - the need for calibration experiments. *Metabarcoding and Metagenomics*, **3**, 49-57.
- Martins, F.M., ... **Beja, P.** (2019). Have the cake and eat it: Optimizing nondestructive DNA metabarcoding of macroinvertebrate samples for freshwater biomonitoring. *Molecular ecology resources*, **19**, 863-876.
- **Moreira, F.**, ... **Beja, P.** (2019). Priority questions for biodiversity conservation in the Mediterranean biome: heterogeneous perspectives across continents and stakeholders. *Conservation Science and Practice*, e118.
- Pe'Er', G., ... **Moreira, F.**, ... (2019). A greener path for the EU Common Agricultural Policy. *Science*, **365** (6452), 449-451.
- Pawlowski, J., ... **Beja, P.**, ... (2018). The future of biotic indices in the ecogenomic era: Integrating (e) DNA metabarcoding in biological assessment of aquatic ecosystems. *Science of the Total Environment*, **637**, 1295-1310.

Relevant previous projects or activities, relevant to the proposal

4.2. Third parties involved in the project (including use of third-party resources)

There are no third parties involved in the project.

5 Ethics and Security

5.1 Ethics

Animals

EuropaBON's mission is to develop an integrated and standardized system for monitoring biodiversity and ecosystem health across Europe to effectively inform EU policy. As endangered species naturally form part of biodiversity, EuropaBON therefore also involves endangered species (as indicated in the administrative forms in section 4, part A). **EuropaBON does not experiment with animals or manipulate them or their behaviour in any way, and it only uses non-invasive monitoring techniques.** EuropaBON complies with the ethical principles and applicable international, EU and national law.

Non-EU countries

Partly, EuropaBON will involve non-EU countries: One of the consortium members (NIVA) is from Norway. Although not a member of the EU, Norway is a member of the European Economic Area (EEA). The GDPR was incorporated into the EEA agreement and became applicable in Norway on 20 July 2018. Norway is thus bound by the GDPR in the same manner as EU Member States and is also associated to Horizon2020 by Article 7 of the Horizon2020 Regulation ("legal entities from Associated Countries can participate under the same conditions as legal entities from the Member States"). Two of our partners (UREAD, USTAN) are from the UK, which, until very recently, was part of the EU. There is now a transition period until the end of 2020 during which current rules on trade, travel, and business for the UK and EU will continue to apply. **We hereby confirm that the ethical standards and guidelines of Horizon2020 will be rigorously applied, regardless of whether the country is in the EU, or not.**

5.2 Security

The EuropaBON project will not involve security issues:

- activities or results raising security issues: (NO)
- 'EU-classified information' as background or results: (NO)