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The network promoting pan-European research on biodiversity,
ecosystem services and Nature-based solutions

BiodivERsA

Mapping of Biodiversity Research Infrastructures



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What is BiodivERsA ?

BiodivERsA is the European network of programmers and funders of research on biodiversity, ecosystem services and nature-based solutions. It gathers 39 agencies and ministries from 25 European countries.

Since its beginning in 2005, BiodivERsA has developed a great array of activities ranging from research mapping and programming to research funding, promotion of stakeholder engagement throughout the whole research process, dissemination of research projects' outputs and knowledge brokerage.

BiodivERsA aims at strengthening the cooperation between biodiversity research programmers and funders, and identifying and developing shared biodiversity research strategies. A main objective is to further develop a coherent vision of research planning and funding within the European research area on biodiversity and ecosystem services. The ultimate aim is to provide policy makers and other stakeholders with adequate knowledge, tools and practical solutions for addressing issues related to biodiversity and ecosystem degradation and restoration, and developing nature-based solutions tackling major societal challenges. This will contribute to sustainable development in Europe, including Oversea Countries and Territories and Outermost Regions.

For more information on biodiversa: www.biodiversa.org

Infrastructures for biodiversity and ecosystem services research in Europe: A need to map them and to promote their visibility and use within BiodivERsA programmes

There are numerous and diverse research infrastructures for biodiversity and ecosystem services in Europe, funded at the regional, national and local scales, creating a complex landscape for researchers, as well as for initiatives like BiodivERsA. Therefore, a proper synthesis and critical analysis of existing biodiversity research infrastructures is a prerequisite to reflect upon the way to interact and develop complementarities between biodiversity research infrastructures and the BiodivERsA framework and activities.

The objective of this report is thus to investigate and analyse the European landscape of biodiversity research infrastructures in order to summarize available facilities, accessibility, and potential integration within the BiodivERsA framework. Existing gaps as well as potential barriers and opportunities for successful cooperation are also discussed.

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INTRODUCTION: THE
IMPORTANCE OF RESEARCH
INFRASTRUCTURES FOR BETTER
SUPPORTING BIODIVERSITY
RESEARCH IN EUROPE



European Union Member States, Associated countries and the European Commission (EC) are committed to halt the loss of biodiversity¹ and better manage it to increase the sustainability of human societies and activities. This calls for an unprecedented effort from governments, the EC, researchers, a range of stakeholders including NGOs and business, and citizens.

There is therefore a need for a powerful research agenda enhancing knowledge on biodiversity drivers and threats and on sustainable management and use of biodiversity. This vigorous biodiversity-targeted research program should be initiated at the European, national and local levels, with strong national support and integration of existing programs across borders².

To reach this goal, Europe must invest in adequate infrastructures to increase our knowledge of the impact of biodiversity change and loss on ecosystem functioning and services and their resilience in a changing world, and hence help decision makers in developing cost-effective management plans to reach the stated goals.

Biodiversity and many ecosystem services are under threat globally. This fact has been known for some years now. Since then, much scientific work has been conducted to find explanations to this unprecedented species extinction rate that the Earth system is experiencing³ and the lack of sustainability for the delivery of different ecosystem services. There is consensus that the main reason for this situation is closely linked to and use changes, climate change, pollution and atmospheric deposition of nitrogen, biotic introductions

and the increase of carbon dioxide in the atmosphere⁴. Global change is thus the most significant cause of the decline of biodiversity and degradation of ecosystem services. The changes in the properties of atmosphere and soil, as well as water (terrestrial and marine) are part of a highly branched network that ends up affecting the interactions between intra and inter species, and between the species and the environment in which they live. The complexity of these interactions often requires long term surveys and adequate approaches to help us understand the effects on ecological processes on which life on earth depends.

Since a few decades, researchers have been using increasingly sophisticated methods that have allowed them to unravel drivers of change or store long series of environmental data, aimed at finding the causes of biodiversity change and loss, and which processes and ecosystem services are affected by present and past environmental changes. In some cases, these sophisticated and usually expensive methods rely on what can be referred to as research infrastructures (RIs). Such RIs, when they are well established and have an adequate financial and technical support, offer the possibility for researchers to tackle the most pressing ecological and societal issues.

At the national level, securing biodiversity monitoring networks, data collections, and long-term experimental assays at a range of spatial scales is needed part of an ambitious, long-term research plan. At the European level, RIs for integration of data, methods and scientific communities are necessary to complement the national efforts⁵. Adequate RIs promoting the synthesis and

1. Biodiversity Strategy for 2030 : https://ec.europa.eu/environment/strategy/biodiversity-strategy-2030_fr#ecl-inpage-324

2. The planned European Partnership on Biodiversity will contribute to this effort: https://ec.europa.eu/info/files/european-partnership-rescuing-biodiversity-safeguard-life-earth_en.

3. Henrique M. Pereira, Paul W. Leadley, Vânia Proença, Rob Alkemade, Jörn P. W. Scharlemann, Juan F. Fernandez-Manjarrés, Miguel B. Araújo, Patricia Balvanera, Reimund Biggs, William W. L. Cheung, Louise Chini, H. David Cooper, Eric L. Gilman, Sylvie Guénette, George C. Hurtt, Henry P. Huntington, Georgina M. Mace, Thierry Oberdorff, Carmen Revenga, Patrícia Rodrigues, Robert J. Scholes, Ussif Rashid Sumaila, Matt Walpole. Scenarios for Global Biodiversity in the 21st Century. *Science* 330 :1496-1501.

4. Sala, O.E., Chapin, F.S., Armesto, J.J., Berlow, E., Bloomfield, J., Dirzo, R., Huber Sanwald, E., Huenneke, L.F., Jackson, R.B., Kinzig, A., Leemans, R., Lodge, D.M., Mooney, H.A., Oesterheld, M., Poff, N.L., Sykes, M.T., Walker, B.H., Wall, D.H., 2000. Global biodiversity scenarios for the year 2100. *Science* 287:1770-1774

5. EPBRS *Hanasaari declaration*. <http://www.epbrs.org>

meta-analysis of existing data on biodiversity and ecosystem services would also have much added value.

The European Union is very committed to offer facilities that allow scientists to study biodiversity and ecosystem services degradation. The European Commission has supported RIs through the successive Framework Programs, in particular

the H2020 Framework Program activity “Developing the European research infrastructures for 2020 and beyond”⁶, in complement to support to RIs from different initiatives taken at the national level.

6. <https://ec.europa.eu/programmes/horizon2020/en/h2020-section/research-infrastructures-including-e-infrastructures>



The importance of RIs for Europe was recognised by the creation of the European Strategy Forum on Research Infrastructures⁷ (ESFRI), the EU-funded MERIL⁸ project (Mapping of the European Research Infrastructure Landscape), and the Member Organisation Forum on Research Infrastructures (MOFRI)⁹ of the European Science Foundation (ESF). While ESFRI is mostly focused on the planning and construction of new pan-European RIs, MOFRI focuses on existing RIs. MOFRI also published a list of “Basic Requirements for Research Infrastructures in Europe”¹⁰, that includes the description of the minimum quality standards that RIs have to fulfil to be considered as such, which has been endorsed by ESF EUROHORCS. As regards MERIL, it aims at producing a comprehensive inventory of RIs of major relevance in Europe across all scientific domains, accessible to the public through an interactive online portal.

The competitive and open access to high quality RIs supports and benchmarks the quality of the activities of European scientists, and attracts the best researchers from all around the world¹¹. RIs are not only responsible for some of the greatest scientific discoveries and technological developments, but also build bridges between national research communities and scientific disciplines.

In this context, there is an increasing need to pool or coordinate national R&I efforts using new and more strategic approaches through specific joint activities. These joint activities should be based on the identification of challenges of common interest and, in the future, on a strengthened political commitment by countries, and their corresponding research funding agencies.

The BiodivERsA members consider a range of important objectives for the biodiversity research

domain and community for which BES-RIs could play a crucial role, namely:

- » To recognise the importance to properly describe the diversity of life forms and the ecosystem services they are connected to, which requires suitable archiving and easy access to biological collections and associated training;
- » To survey and understand the dynamics of biodiversity over adequate temporal and spatial scales, which requires long-term data series and therefore long-term observations in properly devoted terrestrial, aquatic or marine monitoring and/or experimental sites that are operated over the long term;
- » To archive and to facilitate access to biodiversity data as well as to ancillary databases;
- » To offer relevant tools to promote the use of existing biodiversity data via collaborative approaches such as e-infrastructures, as well as centres enhancing synthesis, meta-analysis and the (re)use of existing data with enough computational capability and capacity;
- » To allow the long-term monitoring of physical, chemical and biological data in soils, air and waters of key parameters that will facilitate the understanding of the dynamics of biodiversity and ecosystem functioning and services, which requires network-like facilities of physical sites in Europe. Some of these networks may get profit from the existing habitats already defined, i.e. the Natura 2000 network and existing EC FP7 and H2020 funded projects. The gathering of data must be homogeneous in all sites, continuous in time, and must cover as far as possible different habitats in Europe.

7. <http://www.esfri.eu/about-esfri#overlay=node/63>

8. <http://www.esf.org/serving-science/ec-contracts-coordination/meril-mapping-of-the-european-research-infrastructure-landscape.html>

9. <http://www.esf.org/coordinating-research/mo-fora/research-infrastructures.html>

10. http://www.dfg.de/download/pdf/foerderung/programme/wgi/basic_requirements_research_infrastructures.pdf

11. European Science Foundation. Research Infrastructures in the European Research Area. A report by the ESF Member Organisation Forum on Research Infrastructures (2013).

However, the integration of data in common and/or interoperable databases requires:

- » The development of methods to integrate and aggregate data varying in scale, precision and accuracy to answer local, regional and global research and policy questions;
- » Quality assessments and confident estimates based on data provenance, characteristics, collection bias, and processing;
- » Spatial and temporal sampling strategies to take into account statistical characteristics and cost efficiency;
- » Biodiversity informatics to discover and exploit links between ecological, species, genetic, molecular, climate, land-use, economic and social data; and
- » Tools and criteria for prioritization of data collection.





II. WHAT MIGHT BE CONSIDERED A RESEARCH INFRASTRUCTURE FOR BIODIVERSITY AND ECOSYSTEM SERVICES?



When elaborating the present report, it seemed imperative to strengthen the definition of a Research Infrastructure for biodiversity and ecosystem services (BES-RI) in order to better map the landscape of available BES-RIs in Europe. This definition should make clear not only the final objects of interest (organisms, soil chemistry and physics, climatic variables, ecosystems, etc.), but also the

location and the spatial coverage of the RI (local, national, regional, global, etc.). To map the BES-RIs, we first took into account the definitions produced by relevant entities and organisations at European or international level. We then proposed a definition in line with BiodivERsA objective and the purpose of this mapping exercise.

1. THE EC-ESFRI CONCEPT OF RESEARCH INFRASTRUCTURE

For the ESFRIs¹², the term ‘research infrastructures’ refers to **facilities, resources and related services used by the scientific community to conduct top-level research in their respective fields**, ranging from social sciences to astronomy, genomics to nanotechnologies¹³.

Examples include singular large-scale research installations, collections, special habitats, libraries, databases, biological archives, clean rooms, integrated arrays of small research installations, high-capacity/high speed communication networks, highly distributed capacity and capability computing facilities, data infrastructures, research vessels, satellite and aircraft observation facilities, coastal

observatories, telescopes, synchrotrons and accelerators, networks of computing facilities, as well as infrastructural centres of competence which provide a service for the wider research community based on an assembly of techniques and know-how.

RIs may be ‘single-sited’ (a single resource at a single location), ‘distributed’ (a network of distributed resources), or ‘virtual’ (the service is provided electronically). RIs are often at the centre of the knowledge triangle of research, education and innovation, producing knowledge through research, diffusing it through education, and applying it through innovation.

2. THE MERIL CONCEPT OF RESEARCH INFRASTRUCTURE

The European Science Foundation (ESF) published a report on “Basic Requirements for Research Infrastructures in Europe”¹⁴, where a minimum of basic requirements are presented and some recommendations are given. The requirements are well categorised, distinguishing:

- » general requirements (i) for management (adequate structure, skilled staff, costs, environmental impact), (ii) for good scientific practice and legal issues (acknowledgement by users, clear national laws, safe working, confidentiality),

and (iii) for information for potential users (Web page, description, contact details), and

- » specific requirements of the RI, in particular access to sites, instrumentation and/or data bases or data repositories.

Moreover, ESF is coordinating the MERIL project¹⁵ (Mapping of the European Research Infrastructure Landscape), a project supported by the European Commission under the FP7, and now under H2020, to map all RIs in Europe. This project has built a

12. http://ec.europa.eu/research/infrastructures/index_en.cfm?pg=what

13. ESFRI. Strategy Report on Research Infrastructures. Roadmap 2016. <http://www.esfri.eu/roadmap-2016>

14. Basic Requirements for Research Infrastructures in Europe. 2011. https://www.dfg.de/download/pdf/foerderung/programme/wgi/basic_requirements_research_infrastructures.pdf

15. https://portal.meril.eu/meril/static/static_documents

portal containing a list of identified RIs and intrinsic information, with a good search system.

According MERIL, a European RI is a **facility or (virtual) platform that provides the scientific community with resources and services to conduct top-level research in their respective fields.**

These RIs can be single-sited or distributed, or can take the form of an e-infrastructure. They can be part of a national or international network of facilities, or of interconnected scientific instrument networks.

The infrastructure should furthermore:

- » Offer top **quality scientific and technological performance** that is recognised as being of ‘more-than-national relevance’;
- » Offer **access to scientific users from Europe and beyond** through a transparent selection process on the basis of excellence;
- » Have **stable and effective management.**

MERIL has established a checklist of questions that define whether an RI is eligible to be included in MERIL (Table 1).

Table 1: MERIL eligibility checklist to evaluate whether a research facility should be considered as a research infrastructure sensu stricto.

MERIL eligibility checklist	YES	NO
1. Does the RI have a policy of providing access to users outside of the country in which it is located or by which it is coordinated?		
2. Does the RI provide clear access rules (for example application forms, open calls and contact information) and an access point for users on a publicly available web page?		
3. Does the RI provide a website in English (including the access rules)?		
4. Does the RI receive national, regional or European public funding?		
5. Does the RI have an appointed contact or manager responsible for the RI?		
6. The RI is of <i>more than national</i> relevance because it...		
a) can provide evidence that it is used by non-national (European or international) users by for example providing the number of non-national users per year		
b) is part of a European or international network		
c) has formal arrangements or agreements with international partners, for example with similar RIs in other countries		

An RI is considered eligible to be included in MERIL if it can answer “yes” to all questions 1-5 and if at least one statement under 6 (a, b, or c) applies.

The main objective prosecuted by MERIL here was simply to build up a list of RIs of European relevance. We can question if the requirements

identified above are sufficient to declare a facility to be considered as a RI. What is clear is that this questionnaire can be considered as a very good approximation. However, to what extent the current list of RIs identified by MERIL is adapted for our objective remains to be discussed.

3. THE CREATIVE-B CONCEPT OF RESEARCH INFRASTRUCTURE

CReATIVE-B (*Coordination of Research e-Infrastructures Activities toward an International Virtual Environment for Biodiversity*)¹⁶ was a Coordinated and Support Action (CSA) funded under the FP7-Infrastructures to promote the coordination between RIs on biodiversity and ecosystems worldwide, with the main aim of defining a roadmap for interoperability at the technological level, the governance level and the interrelation between the scientific communities using these BES-RIs.

This project looks at the BES-RIs as data offering services that need coordination and interoperability among them, and mainly focuses on BES-RIs that store biodiversity and ecosystem research data at global scale (e-infrastructures). This is also the objective of COOPEUS¹⁷ and COOP+¹⁸, two European funded projects.



16. http://cordis.europa.eu/result/rcn/164198_en.html

17. <https://www.coopeus.eu/>

18. <http://www.coop-plus.eu/>

4. DEFINITION USED BY BIODIVERSA FOR A RESEARCH INFRASTRUCTURE ON BIODIVERSITY AND ECOSYSTEM SERVICES

BiodivERsA, the network of national and local organisations programming and funding research on biodiversity, ecosystem services and nature-based solutions in Europe, aims at promoting pan-European research on biodiversity, ecosystem services and nature-based solutions, and at offering innovative opportunities for the conservation and sustainable management and use of biodiversity through financed research projects.

BiodivERsA has decided to pay attention to the RIs situation within the countries and territories of its members (from European mainland to Outermost Regions (ORs) and Overseas Countries and Territories (OCTs), recognising the importance of RIs for developing a forefront, excellent research. These BES-RIs are often supported by different initiatives mainly at regional, national or local level. The cooperation between these BES-RIs and the possibility for the research groups funded through BiodivERsA to access the latter may improve not only the quality of the research results, but also the use of these BES-RIs.

For this mapping exercise, BiodivERsA first considered what could be the definition of a BES-RIs in order to facilitate the identification and characterisation of existing RIs and assess how to interact with them. It should be clear that not all research facilities can be considered as RIs.

The definitions that have been mentioned above (EC-ESFRI and ESF-MOF-MERIL) are very inclusive, taking into account a great number of scientific disciplines, a large number of techniques (incl. specific ones, usually very expensive or very unique), the know-how, but also (and this is of utmost importance) the usability and accessibility by the scientific community. The EC also includes in its definition some characteristics about RIs' organisation and highlights that RIs play an important role not only for producing knowledge, but also for disseminating it, and for training and innovation. Moreover, it is also important to take into account the size of the RI (large, medium, small), its location (local or

distributed) and/or its very nature (real, virtual).

According to the RI definition provided by the EC and MOF-ESF-MERIL, and considering the criteria defined for RIs by other initiatives (see above), BiodivERsA has elaborated the following definition of what a BES-RI is (Box 1).

BOX 1: DEFINITION OF A RESEARCH INFRASTRUCTURE FOR BIODIVERSITY AND ECOSYSTEM SERVICE USED FOR MAPPING BES-RI BY BIODIVERSA

The definition below is the one used in the present report.

A BES-RI refers to a **facility, resource or service to develop cutting-edge research on biodiversity and ecosystem services**, possibly also on related fields, which can be single-sited or distributed. It should be able to transfer, share and preserve information and knowledge obtained, and provide easy access to interested researchers. In particular, it should meet all the following requirements:

- i. be (at least partly and explicitly) **devoted to study biodiversity per se, its functions within ecosystems and/or its role for ecosystem services**;
- ii. be useful for and **easily accessible by researchers** beyond the local and national communities (i.e. clear openness to communities abroad);
- iii. offer long series of **accessible environmental/biodiversity data** or valuable biodiversity and ecosystem services information; and
- iv. have a **web portal, in English**, with access to all the information.



III. TYPOLOGY FOR A CLASSIFICATION OF RESEARCH INFRASTRUCTURES FOR BIODIVERSITY AND ECOSYSTEM SERVICES ACROSS EUROPE

Elaborating a typology of BES-RIs is crucial to get them ordered in a systematic way to ease access for scientists, but also to help policy makers and program managers to identify possible gaps and prioritise funding. Any classification is to some extent artificial, but the objective is to make this classification useful for researchers and if possible research managers. In the case of BES-RIs, we assumed that many scientists organise their activity according to both scientific issues (ex: describing species and species assemblages, studying the distribution of biodiversity, or evaluating functional

diversity and its role for ecosystem functioning) and their biological object(s) (animals, plants, algae, fungi, bacteria, etc.) or level of organisation (molecules, organisms, ecosystems, landscapes, or whole terrestrial, marine, or freshwater environments at broader scale). This led us to propose a typology (see [Table 2](#)) to map the types of BES-RIs that exist across Europe. The categories of the table are non-exclusive; usually a specific BES-RI may serve for different purposes, it would then appear in different places within [Table 2](#).



Table 2: Typology used to map the BES-RIs across Europe.

		SERVICE TOWARDS WHICH THE RI IS ORIENTED									
		RIs in support to taxonomy, natural history, organisms characterisation			RIs for the management of and research on genetic resources	RIs for in situ biodiversity research			RIs providing generic support to field work and campaigns (incl. research); ex-vessels & generic platforms		
		Management of collections and of taxonomic information	Database of functional traits of organisms	Database of distribution of organisms	Past biodiversity dynamics (paleo)	Current and future biodiversity dynamics (incl. global change drivers)	Biodiversity and ecosystem functioning / services	RIs with focus on Protected, Endangered, Invasive, Alien species			
Organism level	Animals										
	Plants										
	Fungi										
Ecosystem to region level	Microorganisms										
	Terrestrial										
		Forests									
		Grasslands									
		Croplands									
		(Peri)urban areas									
	Other (specify)										
	Marine										
		Coastal areas									
		Open water									
		Deep sea									
		Other (specify)									
		Lakes									
	Freshwater & wetlands										
		Rivers & streams									
		Wetlands									
		Other (specify)									
Specific biomes		Arctic									
		Antarctic									
		Boreal									
		Tropical & sub-tropical									
		Other (specify)									

The typology used by BiodivERsA is organised as follows:

1. **Which service the RI is oriented for?**

- RIs in support to taxonomy and natural history, description of organism functional traits, and distribution;
- RIs for the characterisation and management of genetic resources;
- RIs supporting in situ, long-term biodiversity research focusing on (1) past biodiversity dynamics (paleo-surveys), (2) current and future biodiversity dynamics (incl. global change drivers), (3) the relationships between biodiversity and ecosystem functioning/services, and/or (4) the dynamics of particular protected, endangered or invasive alien species;
- RIs providing generic support to field work and campaigns.

2. Which **level of organisation** the RI is focused on:

- organisms (and then which types: animals, plants/algae, fungi, microorganisms, etc.),
- ecosystems and landscapes (and then which types): terrestrial, marine, freshwater and wetland, or others (to be specified).

3. **It can be specified if the BES-RI focuses on a specific biome:** i.e. Arctic, Antarctic, boreal, tropical & subtropical or others (to be specified).

This multiple-entry sheet was first distributed among BiodivERsA partners and they were asked to fill in the table with all the BES-RIs they know at local, national or regional level.

Fourteen agencies responded: BELSPO (Belgium), ETAG (Estonia), AKA (Finland), ANR (France), MoEP (Israel), RCL (Lithuania), RCN (Norway), FCT (Portugal), FRCT (Portugal - Azores), UEFISCDI (Romania), MINECO-AEI (Spain), GOBCAN (Spain - Canary Islands), TAGEM (Turkey) and JNCC (United Kingdom).

Two more sheets were completed for Germany and Sweden reusing the data sent by DFG and Formas for the previous BES-RI mapping exercise performed during the second phase of BiodivERsA (BiodivERsA2). Besides the sheet was completed for the Netherlands using the National Roadmap of Large-Scale Scientific Infrastructure¹⁹ produced by NWO.

These different sheets allowed to have a classification of BES-RIs in different countries (see Annexes) and to identify the number of types of RIs in these countries, by compiling the data provided in the different sheets (see [Table 3](#)).

From [Table 3](#) it is possible to deduce that most of the countries have well covered the needs for BES-RIs to support taxonomy (mainly animal, plant, fungi collections and the data attached to the samples). This is mainly due to museums and botanical gardens that keep large collections of multicellular organisms from their countries and abroad. These collections consist of data based on specimens collected and kept for many purposes, not only taxonomy. In most of the cases the data of these collections have an electronic format; in other cases, this process is in progress. These data constitute very valuable information that can be saved, processed and used by scientists and modelers to produce new, important knowledge that can benefit final users (policy-makers, conservationists, environmental managers, etc.).

It is clear that BES-RIs at local, or national level are mainly devoted to data acquisition and storage. This kind of facilities are principally developed and financially supported by the same kind of funders.

19. <https://www.nwo.nl/binaries/content/documents/nwo-en/common/documentation/application/nwo/permanent-commission/roadmap-large-scale-scientific-infrastructure/Roadmap+grote+onderzoeksfaciliteiten-en.pdf>

Table 3. Number of countries or ORs and OCTs having different types of BES-RIs, as identified by BiodivERsA partners in the 12 case studies presented in section V.3. of the present brochure. The darker the colour, the higher the number of BES-RIs identified.

		SERVICE TOWARDS WHICH THE RIs IS ORIENTED									
Organism level	Ecosystem to region level	RIs in support to taxonomy, natural history, organisms characterisation				RIs for the management of and research on genetic resources	RIs for in situ biodiversity research				RIs providing generic support to field work and campaigns (incl. research); ex-vessels & generic platforms
		Management of collections and of taxonomic information	Database of functional traits of organisms	Database of distribution of organisms	RIs for the management of and research on genetic resources		Past biodiversity dynamics (paleo)	Current and future biodiversity dynamics (incl. global change drivers)	Biodiversity and ecosystem functioning / services	RIs with focus on Protected, Endangered, Invasive, Alien species	
Animals		10	5	8	6	2	5	6	2	5	
Plants		11	9	9	7	1	6	8	3	6	
Fungi		10	5	8	4	1	4	4	1	4	
Microorganisms		10	6	6	5	1	3	4	1	2	
Terrestrial	Forests	7	3	6	3	1	4	7	3	3	
	Grasslands	5	2	5	1	1	2	5	3	2	
	Croplands	5	2	4	1	2	4	3	2	2	
	(Per)urban areas	3	1	3		1	3	3	2		
	Other (specify)	1		1			1	1		1	
Marine	Coastal areas	3	2	4		2	5	5		7	
	Open water	2	1	3		2	5	5		6	
	Deep sea	1	1	2		2	3	3		5	
	Other (specify)						1	1		1	
Freshwater & wetlands	Lakes	5	2	3		1	3	3	1	2	
	Rivers & streams	5	2	3		1	3	3	1	2	
	Wetlands	4	2	3		1	3	3	1	2	
	Other (specify)	1	1	1			1	1		1	
Specific biomes	Arctic	1		2			2	1		2	
	Antarctic	2	1	1		2	3	3	1	3	
	Boreal	1	1	1							
	Tropical & sub-tropical	3	3	2	2	2	2	3	1	1	
	Other (specify)	2				1	1	1		1	

An aerial photograph of a green roof installation. The roof is covered with rows of raised planters, each containing tall, green grasses. The planters are arranged in a grid pattern, and the grasses are growing densely. In the background, a fence and some trees are visible, suggesting an outdoor setting. The overall scene is lush and green.

IV. TOWARDS A BIODIVERSA
CATALOGUE OF RESEARCH
INFRASTRUCTURES FOR
BIODIVERSITY AND ECOSYSTEM
SERVICES IN EUROPE



During the second phase of BiodivERsA (BiodivERsA2, 2010-2014), a mapping exercise and a critical overview of available BES-RIs in the EU was conducted, with the aim of having a good understanding of the RI landscape and of encouraging their use within the BiodivERsA programme.

With the current mapping, we take one step beyond and complete the previous survey of major international and European BES-RIs according to the typology developed here. We also complete the previous study by conducting case studies of identification of BES-RIs within several countries and

regions, covering different zones of Europe.

This section gives an overview of the main global and European BES-RIs according to the typology developed by BiodivERsA. Besides, it gives an overview of 12 case studies developed by BiodivERsA organised under five regions (The Mediterranean with Portugal and Spain; Central western Europe with Belgium, France and the Netherlands; Northern Europe with Finland, Norway and Sweden; The Baltic with Estonia and Lithuania; and ORs and OCTs with Azores (Portugal) and Canary Islands (Spain)).

1. MAJOR GLOBAL BES-RIS

Six main BES-RIs at global scale have been identified: the Global Data Base of Plant traits (TRY), the Global Biodiversity Information Facility (GBIF), the Catalogue of Life, Species 2000, TraitNet and EPPO (Table 4).

This list is not exhaustive but allows to present a few major global BES-RIs in the catalogue being developed. We provide in the next section key information on each of these BES-Ris.



Table 4. Main global BES-RIs presented according to the BiodivERsA typology.

SERVICE TOWARDS WHICH THE RIs IS ORIENTED									
Organism level	RIs in support to taxonomy, natural history, organisms characterisation			RIs for the management of and research on genetic resources	RIs for in situ biodiversity research				RIs providing generic support to field work and campaigns (incl. research); ex-vessels & generic platforms
	Management of collections and of taxonomic information	Database of functional traits of organisms	Database of distribution of organisms		Past biodiversity dynamics (paleo)	Current and future biodiversity dynamics (incl. global change drivers)	Biodiversity and ecosystem functioning / services	RIs with focus on Protected, Endangered, Invasive, Alien species	
Animals	GBIF, Catalogue of Life, Species 2000	GBIF	GBIF						EPP0
Plants	GBIF, Catalogue of Life, Species 2000	GBIF, TRY, TraitNet	GBIF						EPP0
Fungi	GBIF, Catalogue of Life, Species 2000	GBIF	GBIF						EPP0
Microorganisms	GBIF, Catalogue of Life, Species 2000	GBIF	GBIF						EPP0
Terrestrial	Forests	GBIF	GBIF		GEOS				
	Grasslands	GBIF	GBIF		GEOS				
	Croplands	GBIF	GBIF		GEOS				
	(Per)urban areas	GBIF	GBIF		GEOS				
	Other (specify)								
Marine	Coastal areas	GBIF	GBIF		GEOS				
	Open water	GBIF	GBIF		GEOS				
	Deep sea	GBIF	GBIF		GEOS				
Freshwater & wetlands	Other (specify)								
	Lakes	GBIF	GBIF		GEOS				
	Rivers & streams	GBIF	GBIF		GEOS				
	Wetlands	GBIF	GBIF		GEOS				
	Other (specify)								
Specific biomes	Arctic	GBIF	GBIF		GEOS				
	Antarctic	GBIF	GBIF		GEOS				
	Boreal	GBIF	GBIF		GEOS				
	Tropical & sub-tropical	GBIF	GBIF		GEOS				
	Other (specify)								
TRY	A Global Data base of Plant traits - morphological, anatomical, biochemical, physiological or phenological features of individuals or their component organs or tissues - are a key to understanding and predicting the adaptation of ecosystems in the face of biodiversity loss and global change. Website: https://www.try-db.org/TryWeb/About.php								
GBIF	The Global Biodiversity Information Facility (GBIF) is an international open data infrastructure, funded by governments. It allows anyone, anywhere to access data about all types of life on Earth, shared across national boundaries via the internet. Website: http://www.gbif.org/								
Catalogue of Life	The Catalogue of Life is the most comprehensive and authoritative global index of species currently available. It consists of a single integrated species checklist and taxonomic hierarchy. The Catalogue holds essential information on the names, relationships and distributions of over 1.6 million species. This figure continues to rise as information is compiled from diverse sources around the world. Website: http://www.catalogueoflife.org/								
Species 2000	Species 2000 is an autonomous federation of taxonomic database custodians, involving taxonomists throughout the world. Our goal is to collate a uniform and validated index to the world's known species (plants, animals, fungi and microbes). Species 2000 is registered as a not-for-profit company limited by guarantee. Website: http://www.sp2000.org/								
GEOS	Global Earth Observation System of Systems (GEOS) is a set of coordinated, independent Earth observation, information and processing systems that interact to strengthen the monitoring of the state of the Earth. It facilitates the sharing of environmental data and information collected from the large array of observing systems contributed by countries and organizations within GEO. GEOS ensures that these data are accessible, of identified quality and provenance, and interoperable to support the development of tools and the delivery of information services. Website: https://earthobservations.org/geos.php								
TraitNet	Traitnet is dedicated to the advancement and integration of trait-based evolutionary and ecological research. Website: http://traitnet.ecoinformatics.org/								

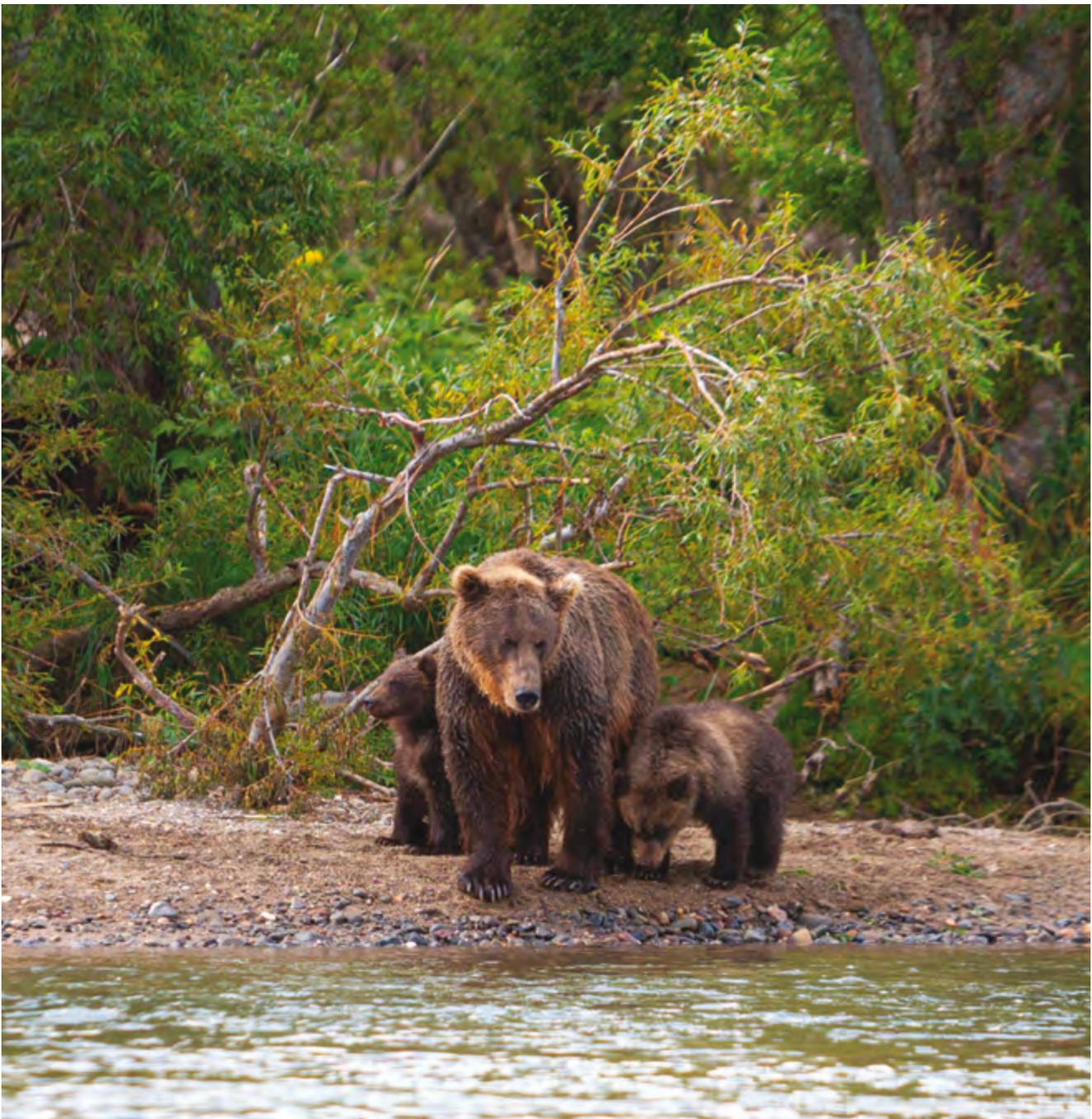
RIS MAINLY IN SUPPORT OF TAXONOMY, NATURAL HISTORY, COLLECTIONS AND BIODIVERSITY DISTRIBUTION

A. CATALOGUE OF LIFE

The Catalogue of Life is the most comprehensive and authoritative global index of species currently available. It consists of a single integrated species checklist and taxonomic hierarchy. The Catalogue holds essential information on the names, relationships and distributions of over 1.6 million species. This figure continues to rise as information is compiled from diverse sources around the world.

However, complete databases are being created at regional level, and these have particular significance in the mega-diverse regions.

A key element of the development programme for the Catalogue of Life (through originally the FP7 4D4Life project) consists in modelling the future integration of these major regional centres.



B. SPECIES 2000

Species 2000 is an autonomous federation of taxonomic database custodians, involving taxonomists throughout the world.

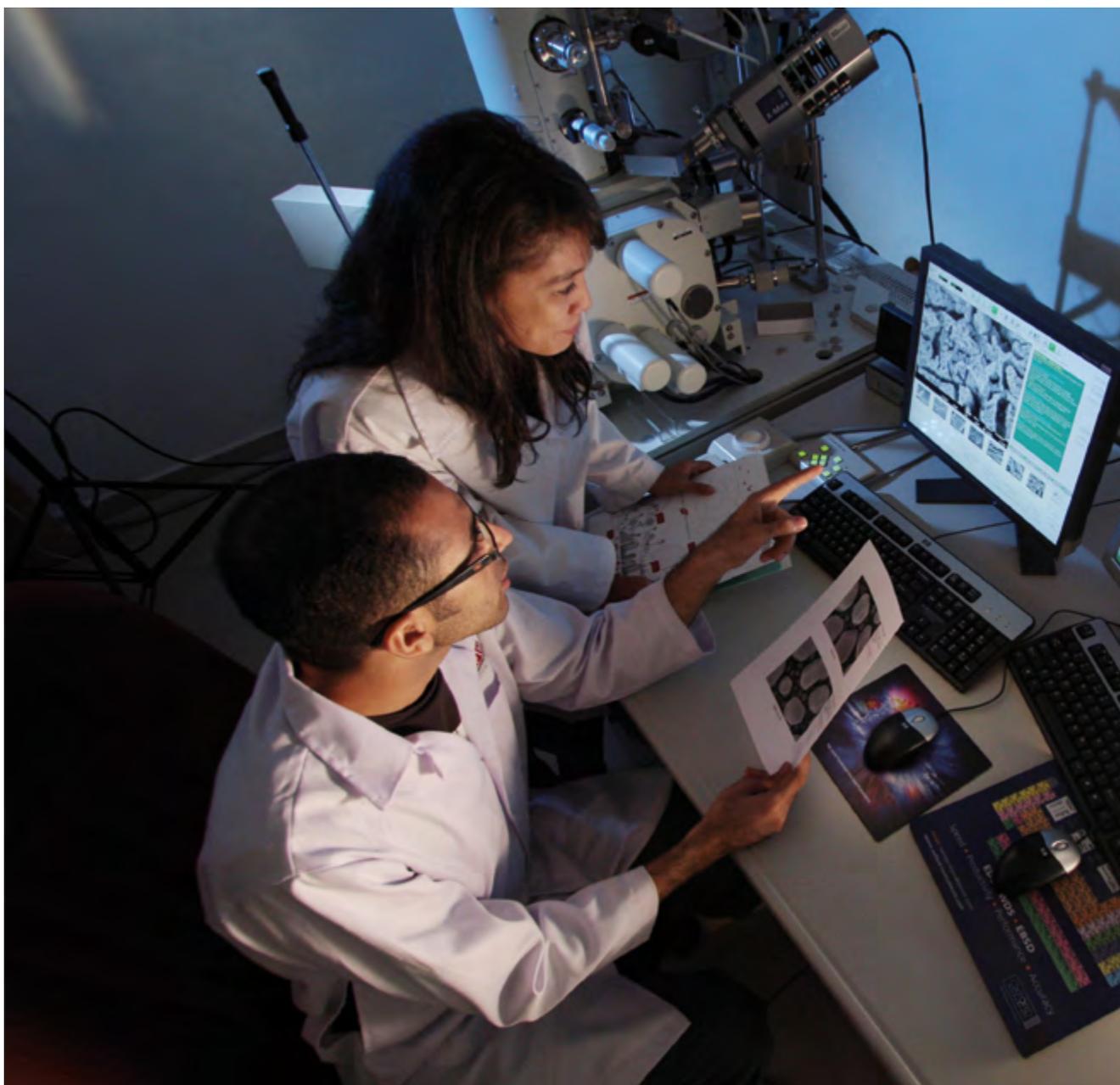
Its goal is to collate a uniform and validated index of the world's known species (plants, animals, fungi and microbes). Species 2000 is registered as a not-for-profit company limited by guarantee.

Table 5. List of the organisations that are member of Species 2000.

European Species 2000 registred organisations	Country	Website
TSJ BVBA	Belgium	n/a
Flanders Marine Institute (VLIZ)	Belgium	http://www.vliz.be/en/imis?module=person&persid=131
National Museum Prague	Czech Republic	https://www.nm.cz/en
Natural History Museum of Denmark	Denmark	https://snm.ku.dk/english/staffsnm/staff/?pure=en/persons/110843
Muséum National d'Histoire Naturelle (MNHN)	France	https://www.mnhn.fr/en
Institut de Recherche pour le Développement (IRD)	France	https://www.ird.fr/
Senckenberg	Germany	http://www.senckenberg.de/root/index.php?page_id=4907
LIAS/ the Botanische Staatssammlung Munchen	Germany	http://www.botanischestaatssammlung.de/
CABI Bioscience	International	https://www.cabi.org/
International Organisation of Palaeobotany (IOP)	International	https://palaeobotany.org/
International Organization for Plant Information (IOPi)	International	http://www1.biologie.uni-hamburg.de/b-online/ibc99/iopi/iopihome.html
International Legume Database & Information Service (ILDIS)	International	https://ildis.org/start
TIGR Reptiles Database	International	http://reptile-database.org/
The World Spider Catalogue	International	https://wsc.nmbe.ch/
The Orthopterists' Society	International	http://140.247.96.247/orthsoc/
Consortium for the Barcode of Life	International	http://www.barcodeofwildlife.org/index.html
Global Biodiversity Information Facility (GBIF)	International	https://www.gbif.org/
Botanic Gardens Conservation International (BGCI)	International	https://www.bgci.org/
National University of Ireland Galway	Ireland	http://www.seaweed.ie/guiry/
EcoServe	Ireland	http://www.ecoserve.ie/projects/sealice/
The Italian Research Council / Bari Section	Italy	https://www.cnr.it/en
University of Padova, Dept of Biology	Italy	https://www.unipd.it/en/
Museum & Institute Zoology - Polish Academy of Sciences (MIZPAS)	Poland	https://cetaf.org/museum-and-institute-zoology-polish-academy-sciences-0
Real Jardin Botanico, Madrid	Spain	http://www.rjb.csic.es/jardinbotanico/jardin/contenido.php?Pag=413&tipo=cientifico&cod=66&len=es
Ticksbase - The University of Utrecht	The Netherlands	http://www.catalogueoflife.org/annual-checklist/2011/details/database/id/30
CBS-KNAW Fungal Biodiversity Centre	The Netherlands	http://www.westerdijknstitute.nl/
Naturalis Biodiversity Center	The Netherlands	https://science.naturalis.nl/en/
London National History Museum	United Kingdom	https://www.nhm.ac.uk/our-science/departments-and-staff/staff-directory/chris-lyal.html

European Species 2000 registered organisations	Country	Website
Royal Botanical Garden (RBG), Kew	United Kingdom	https://www.kew.org/science/our-science/departments/collections-department
National Museum Wales (NMGW)	United Kingdom	https://museum.wales/staff/112/Graham-Oliver/
Thomson Zoological Ltd	United Kingdom	https://beta.companieshouse.gov.uk/company/00585164
Cardiff University	United Kingdom	https://www.cardiff.ac.uk/people/view/374882-hardisty-alex

» For more information: <http://www.sp2000.org/>



C. GBIF

The Global Biodiversity Information Facility (GBIF) is an international open data infrastructure, funded by governments.

It allows anyone, anywhere, to access data about all types of life on Earth, shared across national boundaries via the Internet. In 2019, GBIF gathered 96 participants worldwide.

Table 6. List of the European countries participating in GBIF, name of the institution Node, and webpage of each country node.

European GBIF participant	Node Institution	Webpages
Austria	GBIF Austria	https://www.gbif.at/
Belgium	Belgium biodiversity Platform	http://www.biodiversity.be/
Denmark	danBIF - Danish Biodiversity Information Facility	https://danbif.dk/
Estonia	GBIF Estonia	https://elurikkus.ee/?lang=eng
Finland	Finnish Biodiversity Information Facility	https://laji.fi/en
France	GBIF France	http://www.gbif.fr/
Germany	GBIF Germany	http://www.gbif.de/
Iceland	GBIF Iceland	https://www.gbif.org/country/IS/summary
Ireland	National Biodiversity Data Centre	http://www.biodiversityireland.ie/
Luxembourg	National Museum of Natural History	https://www.mnhn.lu
Netherlands	Netherlands Biodiversity Information Facility	http://www.nlbif.nl
Norway	GBIF Norway	http://www.gbif.no/
Poland	Polish Biodiversity Information Facility	http://www.ksib.pl/
Portugal	GBIF Portugal	http://www.gbif.pt/
Slovakia	GBIF Slovakia	http://www.ibot.sav.sk/
Slovenia	GBIF Slovenia	https://www.gbif.org/country/SI/summary
Spain	GBIF Spain	https://www.gbif.es/
Sweden	GBIF Sweden	http://www.gbif.se/portal/#/index
Switzerland	GBIF Switzerland	http://www.gbif.ch/
United Kingdom	National Biodiversity Network	http://www.nbn.org.uk/

» For more information: <http://www.gbif.org/>.

RIS MAINLY DEVOTED TO PROVIDE INFORMATION ON ORGANISM TRAITS

D. TRY

TRY is a Global Database of Plant traits - morphological, anatomical, biochemical, physiological or phenological features of individuals or their component organs or tissues, which are key to understand and predict the adaptation of ecosystems in the face

of biodiversity loss and global change. In 2020, the TRY initiative gathered more than 7,200 members, who are scientists who have either contributed trait records to the TRY database or who are working on a project using plant trait data via TRY.

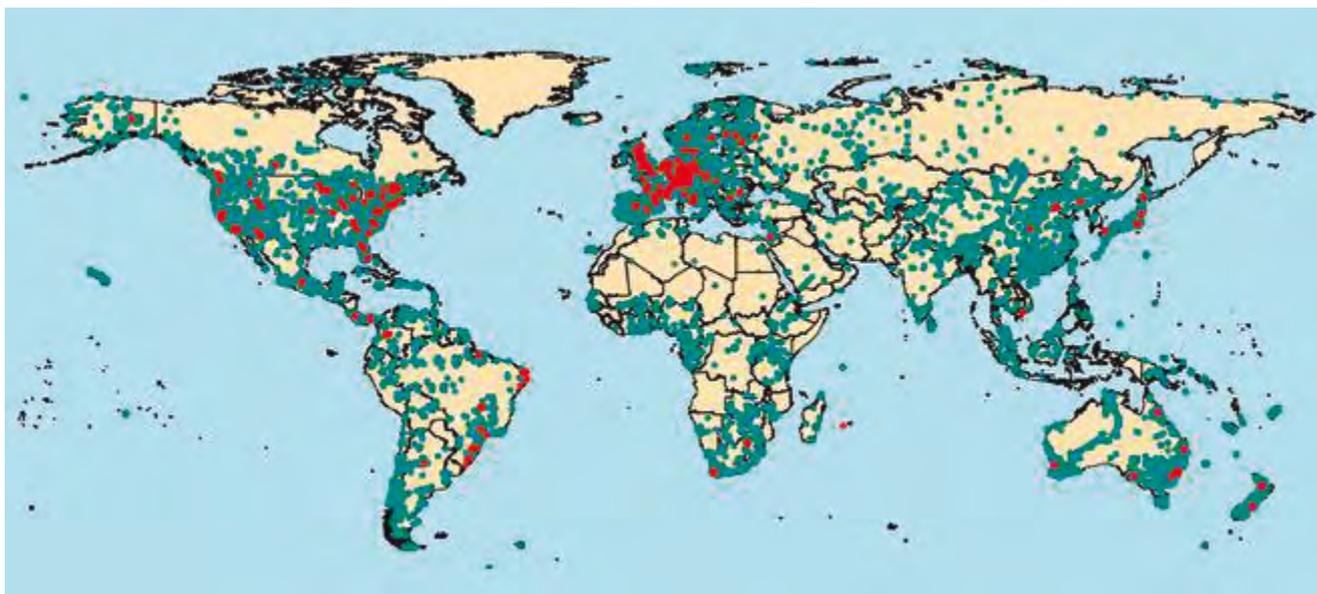


Figure 1. Measurement sites (green) and Institutes (red) involved in TRY (status 2019-03) (From the TRY website)

» For more information: <https://www.try-db.org/TryWeb/Home.php>

E. TRAITNET AND TRAITBANK

TraitNet is dedicated to the advancement and integration of trait-based evolutionary and ecological research. Traits are variously defined, but essentially concern species' properties that affect individual fitness and govern species' impacts and responses to their environment. Trait-based research spans an enormous array of ecological and evolutionary disciplines. While each discipline has sought to define traits, apply trait data to test theory, establish protocols for the quantification of traits, and build multi-user databases, little coordination or interaction has occurred across disciplines. TraitNet addresses this extraordinary opportunity to facilitate integration and synthesis across this array of disciplines. TraitNet is structured by five goals:

- » Identify key questions and Core Hypotheses in trait-based research;
- » Identify data gaps that hinder the advancement of intra- and inter-disciplinary trait-based research;

- » Coordinate the standardisation of collection and curation of trait data;
- » Build a model database to test explicit Core Hypotheses developed through TraitNet workshops;
- » Facilitate the development of cross-disciplinary computational tools for merging, disseminating, and sharing trait data.

These activities are structured around the design of a prototypical universal trait database, here referred to as TraitBank.

The participation in this RI is ad person, but scientists from several countries (USA, FR, CR, MX, NL, AR, DE, UK, IL, ZA, NZ, CA) and institutions (CGIAR, NCEAS, USDA, IES, NESCent, NIPHA, USGS, LTERNet, STRI) are sharing data within TraitNet.

- » For more information: <http://traitnet.ecoinformatics.org/>



RIS MAINLY DEVOTED TO SUPPORT IN SITU, LONG-TERM MONITORING

F. GEOSS

The Global Earth Observation System of Systems (GEOSS) is a set of coordinated, independent Earth observation, information and processing systems which facilitates the sharing of environmental data and information collected from the large array of observing systems contributed by countries and organisations within GEO. GEOSS ensures that the data are accessible, of identified quality and provenance, and interoperable to support the

development of tools and the delivery of information services

The ‘GEOSS Portal’ offers a single Internet access point for users seeking data, imagery and analytical software packages relevant to all parts of the globe. It connects users to existing data bases and portals and provides reliable, up-to-date and user friendly information – vital for the work of decision makers, planners and emergency managers.

2. EUROPEAN BES-RIS (CO-SUPPORTED BY COUNTRIES AND THE EC)

This part of the survey is largely based on previous studies made by several projects funded at the European level to characterise or coordinate European RIs. This is the case of MERIL, CReATIVE-B and COOP+. We also used the information available on websites, such as ESFRI and the EC participant portal. The survey demonstrates that EU has established a number of initiatives and projects devoted to overcome fragmentation of

RIs and to facilitate the access to research infrastructures. This includes several tools from the ESFRI (European Strategy Forum on Research Infrastructure), a range of projects and networks funded within the EU Research Framework Programme, as well as the EMRS and EuroBIS, two European RIs not supporting within the European Research Framework Programme ([Table 7](#)).

Table 7: Main European BES-RIs classified according to the typology used by BiodivERSA.

		SERVICE TOWARDS WHICH THE RIs IS ORIENTED									
		RIs in support to taxonomy, natural history, organisms characterisation			RIs for the management of and research on genetic resources		RIs for in situ biodiversity research			RIs providing generic support to field work and campaigns (incl. for biodiversity research); ex: vessels & generic platforms	
Organism level	Ecosystem to region level	RIs in support to taxonomy, natural history, organisms characterisation		RIs for the management of and research on genetic resources		RIs for in situ biodiversity research			RIs providing generic support to field work and campaigns (incl. for biodiversity research); ex: vessels & generic platforms		
		Management of collections and of taxonomic information	Database of functional traits of organisms	Database of distribution of organisms	Database of genetic resources	Past biodiversity dynamics (paleo)	Current and future biodiversity dynamics (incl. global change drivers)	Biodiversity and ecosystem functioning / services	RIs with focus on Protected, Endangered, Invasive, Alien species	RIs providing generic support to field work and campaigns (incl. for biodiversity research); ex: vessels & generic platforms	
Animals	Plants	EMBRIC	EMBRIC	EurOBIS	EMPHASIS						
		ERMS	EurOBIS	GLOBIS-B							
		GLOBIS-B	SYNTHESIS	SYNTHESIS							
		EMBRIC	ERMS	GLOBIS-B							
Fungi	Microorganisms	EMBRIC	EMBRIC	EurOBIS							
		ERMS	EurOBIS	GLOBIS-B							
		GLOBIS-B	SYNTHESIS	SYNTHESIS							
		EMBRIC	ERMS	GLOBIS-B							
Terrestrial	Forests		Trees4Future		TREES4Future	eLTER	ANAAE, eLTER, ExpeER, LifeWatch	ANAAE, eLTER, ExpeER, LifeWatch	ANAAE, eLTER, ExpeER		
	Grasslands					eLTER	ANAAE, eLTER, ExpeER, LifeWatch, INCREASE	ANAAE, eLTER, ExpeER, LifeWatch	ANAAE, eLTER, ExpeER		
	Croplands					eLTER	ANAAE, eLTER, ExpeER, LifeWatch	ANAAE, eLTER, ExpeER, LifeWatch	ANAAE, eLTER, ExpeER		
	(Peri)urban areas					eLTER	ANAAE, eLTER, ExpeER	ANAAE, eLTER, ExpeER	ANAAE, eLTER, ExpeER		
	Other (specify)										
	Coastal areas	(Up-Grade) BLACK-SEA SCENE	(Up-Grade) BLACK-SEA SCENE	(Up-Grade) BLACK-SEA SCENE		eLTER	EMSO	eLTER			
	Marine	Open water	EMBRIC	EMBRIC	EurOBIS		Fix03	EMSO	EMSO		
			SeaDataNet	SeaDataNet	SeaDataNet		JERICO	Fix03	EMSO		
		Deep sea	EMBRIC	EMBRIC	EurOBIS		MESOQUA	Fix03	EMSO		
			SeaDataNet	SeaDataNet	SeaDataNet		MESOQUA	Fix03	EMSO		
Other (specify)											
Freshwater & wetlands	Lakes		FIP	FIP							
	Rivers & streams			FIP							
	Wetlands			FIP							
		Other									
Specific biomes	Arctic					INTERACT	INTERACT	INTERACT			
	Antarctic										
	Boreal										
	Tropical & sub-tropical										
	Other (specify)										

A. INFRASTRUCTURES SUPPORTED BY THE EUROPEAN STRATEGY FORUM ON RESEARCH INFRASTRUCTURE (ESFRI) AND BUILT UNDER THE EUROPEAN RESEARCH INFRASTRUCTURE CONSORTIA (ERIC)

ESFRI²⁰ is a strategic instrument created in 2002 by the Member States and the European Commission to develop the scientific integration of Europe and to strengthen its international outreach. ESFRI gives national authorities the opportunity to explore common and integrated activities for the best development and use of Research Infrastructures of pan-European relevance. ESFRI developed a roadmap²¹ that describes the scientific needs for Research Infrastructures for the next 10-20 years, on the basis of a methodology recognised by all stakeholders, and taking into account input from relevant inter-governmental research organisations as well as the industrial community. In October 2006 ESFRI identified 35 pan-European research infrastructures, out of 74, that are of key importance for the development of science and innovation. Among them some are devoted to Biodiversity and Ecosystem Services research in Europe and were considered

to be of global significance. Recently, in 2016, ESFRI published the *Strategy Report of Research Infrastructures*²² including 29 Landmarks and 21 projects of research infrastructures. The twenty-one ESFRI Projects consist of nine from the 2008 Roadmap, six from the 2010 Roadmap, five new projects plus one reoriented project. The 29 ESFRI Landmarks listed are successfully implementing ESFRI projects that are delivering science services or effectively advancing in their construction.

Some infrastructures within ESFRI are e-infrastructures entirely devoted to biodiversity, i.e. **LifeWatch**. Another one is largely related to biodiversity but addresses more generally ecosystem research, focusing on long-term experimental sites and facilities, i.e. **ANAEE**, and a third one mainly centered in operating an array of around 800 autonomous profiling floats, i.e. **Euro-ARGO**, for ocean observation (Tables 8a and 8b).

B. INFRASTRUCTURES SUPPORTED BY THE EUROPEAN FRAMEWORK PROGRAMMES FP6, FP7 AND H2020

Apart from the relevant infrastructures identified in the ESFRI, there are other projects carried out with EU support to consolidate and provide access to biodiversity research infrastructures. In total

17 projects - funded under FP6, FP7 and H2020 schemes - responding to the definition of Research Infrastructure for Biodiversity in its broader sense have been identified (Tables 8a and 8b).

20. http://ec.europa.eu/research/infrastructures/index_en.cfm?pg=esfri

21. <http://www.ugent.be/nl/onderzoek/financiering/eu-int/esfri/esfri-roadmap2010.pdf>

22. <http://www.esfri.eu/roadmap-2016>

Table 8a. Overview of the BES-RIs resulting from FP6, FP7, H2020 and ESFRI-ERIC, and countries participating. X= participating country, O=Observing country.

Countries	ENVIRONMENTAL RIS FUNDED BY FP7						RIs FUNDED BY H2020								RIs FUNDED UNDER ESFRI-ERIC							
	ExpeER	Fix03	FP	INCREASE	MESOQUA	TREES4FUTURE	Up-Grade BLACKSEA SCENE	AQUACOSM	eLTER	EMBRIC	EUROFLEETS+	GLOBIS-B	INTERACT	JERICO	SEADATANET	SYNTHESYS+	ANAEE	EMPHASIS	EMSO	Euro-Argo	ICOS	LIFEWATCH
AT	X		X			X	X	X				X			X		X					
BE	X		X			X	X	X	X	X		X	X	X	X	X	X	X			X	X
BG						X		X						X	X					X		
CA										X		X										
CH	X																	X			X	
CV		X																				
CY						X									X			X				
CZ								X				X				X		X			X	
DE	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X		X		X	X	
DK	X			X			X			X		X	X	X	X		X			X		
EE										X				X	X			X				
ES	X	X				X		X		X	X		X	X	X		X	X	X	X		X
ET																						
FI	X					X	X	X		X		X	X	X	X	X	X	X		X	X	
FO										X		X										
FR	X	X			X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	
GE						X									X			X	X			
GL										X		X										
GR					X		X	X	X	X		X		X	X			X		X		X
HR													X	X								
HU				X				X								X						
IE		X								X			X	X				X	X	X		
IL	X							X	X						X	X		X				
IS										X		X			X							
IT	X	X		X		X		X	X	X	X	X	X	X			X	X	X	X	X	X
JRC						X									X							
LT															X							
LV								X							X							
MT													X	X								
NL	X	X		X		X	X	X		X	X		X	X	X			X		X	X	X
NO	X	X			X		X		X	X		X	X	X	X			X			X	
NZ										X												
PL	X					X	X	X		X		X	X	X				X		X		
PT		X				X		X	X	X			X	X				X	X			X
RO	X					X	X		X	X					X			X				
RS	X																	X	X			
RU						X						X			X							
SI								X							X							X
SE	X	X			X	X	X	X		X		X	X	X	X			X			X	
SK	X							X										X				O
TN								X														
TR						X	X			X					X							
UA						X									X							
UK	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
US										X		X			X							

Table 8b. List of acronyms of the BES-RIs listed in table 8a

ENVIRONMENTAL RIs FUNDED BY FP7	<p>EXPEER: Distributed Infrastructure for EXPERimentation in Ecosystem Research. » More information: http://expeeronline.eu/</p>
	<p>FixO3: Fixed Point Open Ocean Observatories Network » More information: http://www.fixo3.eu/</p>
	<p>FIP: Freshwater Information Platform. This platform provides up-to-date information on freshwater science as well as an array of research resources and tools for the assessment and management of freshwater ecosystems. The platform’s focus is on Europe. » More information: http://www.freshwaterplatform.eu</p>
	<p>INCREASE: Integrated Network on Climate Research Activities on Shrubland Ecosystems. » More information: https://www.project-increase.eu/index.html</p>
	<p>TREES4FUTURE: Designing Trees for the Future. Trees4Future is an integrative European research infrastructure project that aims to integrate, develop and improve major forest genetics and forestry research infrastructure. » More information: http://trees4future.eu/</p>
	<p>Up-Grade BLACKSEA SCENE: a network of leading environmental and socio-economic research institutes. » More information: http://www.blackseascene.net/</p>
RIs FUNDED BY H2020	<p>AQUACOSM: the EU-network connecting freshwater and marine large experimental research infrastructures. » More information: https://www.aquacosm.eu</p>
	<p>eLTER: European Long-Term Ecosystem Research (LTER) is an essential component of world-wide efforts to better understand ecosystems. Through research and monitoring, LTER seeks to improve our knowledge of the structure and functions of ecosystems and their long-term response to environmental, societal and economic drivers. » More information: https://www.lter-europe.net/</p>
	<p>EMBRIC: The European Marine Biological Research Infrastructure Cluster is designed to accelerate the pace of scientific discovery and innovation from marine Bio-Resources. » More information: http://www.embric.eu/</p>
	<p>EUROFLEETS+: Towards an alliance of European research fleets and new operational steps. » More information: https://www.eurofleets.eu/</p>
	<p>INTERACT: International Terrestrial Arctic Collaborative Network Integrating Activities. » More information: https://eu-interact.org/</p>
	<p>JERICO: Towards a Joint European Research Infrastructure Network for Coastal Observatories. » More information: http://www.jerico-ri.eu/</p>
	<p>GLOBIS-B: GLOBal Infrastructures for Supporting Biodiversity research. » More information: http://www.globis-b.eu/</p>
	<p>SEADATANET: Pan-European Infrastructure for Ocean and Marine data management. » More information: https://www.seadatanet.org/</p>
<p>SYNTHESIS+: Synthesis of systematic resources. SYNTHESIS+ helps to underpin new ways to access and exploit natural history collections, harmonise policy and provides insights for researchers, while fostering the development of new approaches to face urgent societal challenges. » More information: https://www.synthesys.info/</p>	

ANAEE: Analysis and Experimentation on Ecosystems. AnaEE offers access to experimental platforms on terrestrial and aquatic ecosystems across Europe. Analytical and modelling platforms as well as acquired data are also made available.

» More information: <https://anaee.com/>

EMPHASIS: European Infrastructure for Plant Phenotyping.

» More information: <https://emphasis.plant-phenotyping.eu>

EMSO: European Multidisciplinary Seafloor and water column Observatory. It to explore the oceans, to gain a better understanding of phenomena happening within and below them, and to explain the critical role that these phenomena play in the broader Earth systems.

» More information: <http://emso.eu/what-is-emso/>

Euro-Argo: European infrastructure for argo floats.

» More information: <http://eurogoos.eu/euro-argo/>

ICOS: Integrated Carbon Observation System.

» More information: <https://www.icos-cp.eu>

LIFEWATCH: LifeWatch ERIC is a European Infrastructure Consortium providing e-Science research facilities to scientists seeking to understand the complex interactions between species and the environment, through High-Performance, Grid and Big Data computing systems, and the development of advanced modelling tools to implement management measures aimed at preserving life on Earth.

» For more information: <https://www.lifewatch.eu/home>



C. OTHER EUROPEAN INFRASTRUCTURES NOT SUPPORTED BY THE EUROPEAN FRAMEWORK PROGRAMMES

CETAF: The Consortium of European Taxonomic Facilities is a taxonomic research network formed by institutions of reference in Europe. They hold 80% of the world's described biodiversity as specimens, collections and their data. They connect over 5000 researchers in European Natural History Museums, Natural Sciences Museums, Botanic Gardens and other research institutions. They contribute to Europe's knowledge-base by enhancing the synergies of our Member's collections and research capabilities.

» For more information: <https://cetaf.org>

ECORD: European Consortium for Ocean Research Drilling is a management structure of 15 members (14 European countries and Canada) for scientific ocean drilling as part of the International Ocean Discovery Program (IODP) "Exploring the Earth under the sea" and previously the Integrated Ocean Drilling Program – IODP from 2003 to 2013.

» For more information: <https://www.ecord.org/about-ecord/about-us/>

ERMS: The European Register of Marine Species is an authoritative taxonomic list of species occurring in the European marine environment, defined as up to the strandline or splash zone above the high tide mark and down to 0.5 (psu, ppt) salinity in estuaries. The register is actively maintained and daily updated in the framework of the MarBEF EU Network of Excellence by a board of taxonomic editors, which are world experts on the taxonomy of their relevant taxa. It is anticipated that the Register will become a standard reference (and technological tool) for marine biodiversity training, research and management in Europe.

» For more information: <http://www.marbef.org/data/erms.php>

EurOBIS: The European Ocean Biogeographic Information System is an online marine biogeographic database compiling data on all living marine creatures. The principle aims of EurOBIS are to centralise the largely scattered biogeographic data on marine species collected by European institutions and to make these data freely available and easily accessible. All data go through a number of quality control procedures before they are made available online [see standards], assuring a minimum level of quality necessary to put the data to good use.

From 2012 onwards, EurOBIS receives financial support through LifeWatch. EurOBIS is part of the central taxonomic backbone of LifeWatch which aims at standardising species data and integrating the distributed biodiversity data repositories and operating facilities.

» For more information: <http://www.eurobis.org/about>

Evoltree: EVOLution of TREEs as drivers of terrestrial biodiversity. The overall goal of the Network is to link four major disciplines, Ecology, Genetics, Genomics and Evolution, to address global issues that European forests are currently facing, such as environmental changes and erosion of biodiversity. During the four years of the EU support, EVOLTREE developed the necessary experimental and monitoring infrastructures and created a wide range of physical and electronic resources on which long term research can build upon.

» For more information: <http://www.evoltree.eu/index.php/network>

3. NATIONAL AND LOCAL BES-RIS IN EUROPE

As explained above, we conducted a pilot exercise to identify BES-RIs within several countries and regions (ORs and OCTs).

We selected 12 case studies that we present in this section. These case studies cover the following different zones of Europe:

- » Mediterranean with Portugal and Spain
- » Central western Europe with Belgium, France and the Netherlands

- » Northern Europe with Finland, Norway and Sweden
- » The Baltic with Estonia and Lithuania, and
- » ORs and OCTs with Azores and Canary Islands

Other case studies will be available on the [BiodivERsA website](#). Besides, BiodivERsA will continue this mapping exercise and aims at increasing the number of case studies available on its website in the coming years.



Figure 3: Map of the countries and territories illustrated in the case studies





A. MEDITERRANEAN ZONE

(PORTUGAL AND SPAIN)



A map of Europe with Portugal highlighted in dark blue. The rest of the map is in a light grey color. The text 'PORTUGAL' is centered over the map, and '3 BES-RIs identified' is written below it.

PORTUGAL

3 BES-RIs identified

PORTUGAL

3 BES-RIs identified so far.

Name of the organisation	Short description & Link
AIR Centre	<p>Atlantic International Research Centre (AIR Centre). This is the orchestrator of an internationally distributed, multi-stakeholder network, engaging researchers, governments, and communities towards the development and well-being in the Atlantic marine and coastal areas. The AIR Centre follows six lines of action regarding: marine and coastal resources and biodiversity (i), healthy and clean oceans (ii), Earth observation from deep sea to near space (iv), mitigation and adaptation to climate change (v) and data science (vi). The AIR Centre aims at providing data science applications to monitoring, analysis, modelling and management of marine ecosystems, migration patterns, water quality, aquaculture production, and establishment of smart thresholds for sustainable fisheries. The network also aims at developing tools for tracking and predicting the dispersal of marine pollutants, including real-time monitoring and management of water supplies, and recognition of patterns of transportations; processing large volumes of data from Earth Observation systems with dedicated infrastructures for data collection, curation, and analysis; fostering more accurate weather prediction and climate modelling systems, with special emphasis on ocean-related phenomena; systematic collection and modelling of data at the ocean-scale and correlation with biodiversity indicators; developing predictive and analytic models for control and mitigation of negative effects of invasive species in vital ecosystems; and increasing performance, availability and reliability of renewable offshore energies through data-driven condition monitoring, decision-support systems for maintenance, and self-learning and distributed algorithms.</p> <p>» More information: https://www.aircentre.org/about-us/</p>
COASTNET	<p>Portuguese Coastal Monitoring Network (COASTNET). This network aims at monitoring important ecosystems of the Portuguese coast through relevant chemical, physical and biological parameters, collected remotely in near real-time. CoastNet provides data visualisation capacity and free access to in-situ datasets. This Research Infrastructure will also provide multiple services such as: on-demand environmental quality assessments, advanced training research, innovation, public and private consultancy, laboratory support and data collection.</p> <p>» More information: https://coastnet.pt/##</p>
PORBIOTA	<p>Portuguese E-Infrastructure of the Portuguese Roadmap of Research Infrastructures (PORBIOTA). This is an online infrastructure created in 2013 dedicated to the collection, storage and management of all kinds of biodiversity data from the entire Portuguese territory. PORBIOTA promotes a national agenda on biodiversity survey and research, providing services to the administration, the scientific community and society in general. The consortium includes top national research centres (CIBIO, InBIO, CBA/FCUL, CBAA/ISA, IN+/IST, CESAM/UA, IMAR-MARE/UC), Natural History Museums, the Institute for Tropical Research (IICT), the Portuguese node of GBIF, the LTER Portugal network, ICOS Portugal, the Azores Biodiversity Portal, and the Institute for Nature Conservation and Forests (ICNF).</p> <p>» More information: http://www.porbiota.pt/en</p>

A map of Europe with Spain highlighted in dark blue. The rest of the map is in light grey. The word "SPAIN" is written in large, bold, dark blue letters over the highlighted area. Below it, the text "16 BES-RIs identified" is written in a smaller, bold, dark blue font. There are small white circles on the map: one on the northern coast of Spain, one on the eastern coast of Spain, and one on the coast of France.

SPAIN

16 BES-RIs identified

Table 10. Main Spanish BES-RIs classified according to the typology used by BiodivERsA.

		SERVICE TOWARDS WHICH THE RI IS ORIENTED										
Organism level	Ecosystem to region level	RIs in support to taxonomy, natural history, organisms characterisation			RIs for the management of genetic resources		RIs for in situ biodiversity research			RIs providing generic support to field work and campaigns (incl. for biodiversity research); ex. vessels & generic platforms		
		Management of collections and of taxonomic information	Database of functional traits of organisms	Database of distribution of organisms			Past biodiversity dynamics (paleo)	Current and future biodiversity dynamics (incl. global change drivers)	Biodiversity and ecosystem functioning / services	RIs with focus on Protected, Endangered, Invasive, Alien species		
Animals Plants Fungi Microorganisms		MNCN						ICTS Doñana	ICTS Doñana			
		RJB						ICTS Doñana				
		RJB, CECT										
		CECT										
		SIBOSC	IFN3, RSDB II	SIBOSC, IFN3	GENFORED	RSDB II	RSDB II					
Terrestrial	Forests											
	Grasslands											
	Croplands											
	(Peri)urban areas											
	Other (specify)											
	Coastal areas											
	Open water											
	Deep sea											
	Other (specify)											
	Lakes											
Rivers & streams												
Wetlands												
Other												
Freshwater & wetlands	Arcic											
	Antarctic	CNDP										BIO HESPERIDES
	Boreal											BAES, BIO HESPERIDES
	Tropical & sub-tropical											
	Other (specify)											
Specific biomes												

SPAIN

16 BES-RIs identified so far.

Name of the organisation	Short description & Link
BAES	<p>The inland polar research infrastructures currently available in Spain are the Spanish Antarctic Base (BAE) Juan Carlos I, located on Livingston Island and the Antarctic Spanish Base (BAE) Gabriel de Castilla, located on Deception Island. Both are summer bases, operating only during the austral summer, usually from November to February. These infrastructures are available for the whole research community (national and international)</p> <p>More information:</p> <ul style="list-style-type: none"> » BAE Juan Carlos I: http://www.utm.csic.es/es/instalaciones/jci » BAE Gabriel de Castilla: https://ejercito.defensa.gob.es/unidades/Antartica/antartica/index.html
BIO HESPERIDES	<p>Oceanographic Research Vessel (BIO) Hesperides. It is a vessel for global research. It provides instrumentation and laboratories that allow to investigate the resources and natural hazards, global change, marine resources, global ocean circulation and marine biodiversity. Its hull is reinforced for sailing in polar regions of Antarctica and the Arctic, which also serves as logistical support to the Spanish bases of the South Pole. The Hesperides belongs to the Spanish Navy and is based in Cartagena (Murcia). The Marine Technology Unit (UTM) of the CSIC is responsible for the maintenance of scientific equipment and provides technical staff for conducting oceanographic campaigns.</p> <ul style="list-style-type: none"> » More information: http://www.utm.csic.es/es/instalaciones/hes
BO García del Cid	<p>Oceanographic ship (BO) Garcia del Cid. It is a research vessel of regional scope. Its objective is to develop scientific work of various kinds (biological, geological, physical oceanography, etc) in the Western Mediterranean, Iberian Atlantic area and the Canary Islands. It is based in Barcelona and belongs to the CSIC, who is responsible for the maintenance and management of its scientific equipment and for providing technical staff for conducting oceanographic campaigns.</p> <ul style="list-style-type: none"> » More information: http://www.utm.csic.es/web/index.php/es/instalaciones/gdc
BO Mytilus	<p>Oceanographic ship (BO) Mytilus. It is a research vessel for coastal area, to be used in marine biology, physical oceanography and marine geology. It is available for use by universities, public marine research centres and private entities. It belongs to the CSIC, and is based in the port of Vigo. The Marine Technology Unit (UTM) of the CSIC is responsible for the maintenance of scientific equipment and provides technical staff for conducting oceanographic campaigns.</p> <ul style="list-style-type: none"> » More information: http://www.utm.csic.es/web/index.php/es/instalaciones/myt
BO Sarmiento de Gamboa	<p>Oceanographic Vessel (BO) Sarmiento de Gamboa. It is a multidisciplinary globally research non-polar vessel. It is equipped with instruments and laboratories that allow to investigate the resources and natural hazards, global change, marine resources, global ocean circulation and marine biodiversity. It is the first Spanish oceanographic vessel that can work with Remote Operated Vehicles at great depths and with Autonomous Underwater Vehicles. It belongs to CSIC and is based in Vigo.</p> <ul style="list-style-type: none"> » More information: http://www.utm.csic.es/web/index.php/es/instalaciones/sdg
CECT	<p>Spanish Type Culture Collection (CECT). It is composed by two laboratories (one for Prokaryotes -bacteria and archaea- and one for Eukaryotes -filamentous fungi and yeast), and four specialized laboratories (chemotaxonomy, molecular techniques, training and general microbiology laboratory for short stays of invited researchers) and a documentation room. Its services are: Strains supply; Strains deposits under three modalities: Public Deposit, Safe Deposit and Deposit for patent purposes under the regulations of the Budapest Treaty; Identification and characterization of strains; Freeze-drying of biological material; and Training and Guidance: Courses, training stays, etc.</p> <ul style="list-style-type: none"> » More information: https://www.uv.es/uvweb/spanish-type-culture-collection/en/spanish-type-culture-collection-1285872233521.html

Name of the organisation	Short description & Link
CNDP	<p>National Centre for Polar Data (CNDP). It comprises the Spanish Polar Archive and was set up at the initiative of the Spanish Polar Committee (EPC) whose Technical Secretariat is responsible for coordinating all activities relating to the National Antarctic Authority. It administrates the metadata generated by the Spanish investigations in the Polar field and the stores, manages and disseminates documentary collections, under the supervision of the EPC.</p> <p>» More information: http://hielo.igme.es/index.php/es/9-sin-categoria/73-centro-nacional-de-datos-polares</p>
GENFORED	<p>GENFORED. It is the Spanish network of forest genetic trials. It is coordinated by the Forest Research Centre of INIA and Centro de Investigación y Tecnología Agroalimentaria of Aragón (CITA). It integrates provenance, progeny and clonal trials of the main Iberian species (Mediterranean pines, evergreen oaks, Fagus and Populus).</p> <p>The primary purposes of GENFORED are (1) to provide a permanent site for the safe storage of data (repository) obtained from genetic trials of forest species, (2) to encourage data sharing among institutions to multiply its value and fostering dissemination of results and (3) to facilitate information exchange and the implementation of common validated protocols for the installation and measurement of forest genetic trials. Metadata about trials and tested materials will be available in the Trials and Tested Materials page.</p> <p>» More information: https://sites.cita-aragon.es/genfored/en/welcome-to-the-genfored-web-site/</p>
ICTS Doñana	<p>Global Change Observatory Doñana (GLOB). It aims at bringing together all existing environmental data related to Doñana in order to contribute to research, conservation and management of this natural space. Much of these data are generated year after year in a program of environmental monitoring and others are provided by research groups and collected from other sources. Data on natural processes and biodiversity form the basis of technical management reports. The data collected by this infrastructure focuses on Doñana Natural Area, but also contains data from outside this area. It also gives access and logistic support to the Spanish and international scientific community in their research activities within Doñana Natural Space.</p> <p>» More information: http://www.ebd.csic.es/icts-donana</p>
IEO Fleet	<p>SPANISH INSTITUTE OF OCEANOGRAPHY (IEO). The Institute has at present a fleet of eight research vessels (in addition to other smaller vessels) between 14 and 65 meters in length: Cornide de Saavedra, Ramon Margalef, Francisco de P. Navarro, Odon de Buen, José Rioja, J. M^a. Navaz, Lura and Alvariño Angeles. They are all equipped with the most modern electronic navigation systems and location and the means to collect samples of both water and sediment, determination of physical and chemical variables of sea water as well as for studies marine flora and fauna.</p> <p>» More information: http://www.ieo.es/en/flota</p>
IFN3	<p>National Forest Inventory (IFN). The IFN3 gives information to on the state and evolution of forests ecosystems through more than 100 indicators (incl. surface, tree and shrub species that inhabit them, their growth, distribution, and some characteristics of the soil they occupy). It also includes information related to regeneration, biodiversity, health, vitality, forestry and property regimes and protection indicators. It incorporates the value in monetary terms of environmental, recreational and productive aspects of their forest systems. Finally, it shows some indicators of the current situation in the context of pan-European criteria for sustainable management.</p> <p>» More information: http://www.magrama.gob.es/es/biodiversidad/servicios/banco-datos-naturaleza/informacion-disponible/ifn3.aspx</p>
MNCN	<p>National Museum of Natural Sciences (MNCN). With more than 10 million specimens preserved in various collections, the Museum can be considered as one of the main centres of reference for fauna. The Museum's collections are actively integrated into European networks and offer researchers the opportunity to collect large-scale data on highly diverse areas to adequately plan network of protected areas or model past and future changes in diversity.</p> <p>» More information: https://www.mncn.csic.es/en/colecciones</p>

Name of the organisation	Short description & Link
RJB	<p>Real Jardín Botánico (RJB). The Real Jardín Botánico's herbarium is the largest herbarium in Spain and one of the most representative in Europe. The herbarium includes over a million specimens organised according to standardised classification systems. It represents all plant groups and has a particularly important collection of specimens from the Iberian Peninsula, together with type specimens of South American plants gathered during historical expeditions.</p> <p>» More information: http://www.rjb.csic.es/jardinbotanico/jardin/?len=en</p>
RSDB II	<p>The European Forest Monitoring Networks II (RSDB II). It consists of a number of plots, 54 currently in Spain, located in the most representative forest ecosystems. assess the state and evolution of forest stands in accordance with a series of methodologies and protocols harmonized across Europe that are regularly developed, reviewed and updated. This network is one of the world's largest biosecurity systems, providing data to the international scientific community and collaborating on numerous reports with their results, both nationally and internationally.</p> <p>» More information: https://www.mapa.gob.es/en/desarrollo-rural/temas/politica-forestal/inventario-cartografia/redes-europeas-seguimiento-bosques/#para5</p>
SIBOSC	<p>Information System on Catalan Forests (SIBOSC). SIBosC combines the forest data generated from the sampling plots of the Ecological and Forest Inventory of Catalonia (IEFC) and from the Land Cover Map of Catalonia (LCMC) together with other layers of forest cartographic information like Fuel and Flammability Models (FFMM). In order to allow the user's access to all this information, software utilities have been developed: statistics of forest database, MiraBosc, and a geographic information system, MiraMon.</p> <p>» More information: http://www.creaf.uab.cat/MIRAMON/publicat/papers/lisboa98/SIBosc.htm</p>
SOCIB	<p>Coastal Ocean Observing and Forecasting System (SOCIB). It is located in the Balearic Islands. SOCIB is a multi-platform distributed and integrated system that provides streams of oceanographic data and modelling services to support operational oceanography in a European and international framework, therefore also contributing to the needs of marine and coastal research in a global change context. SOCIB is composed by three major subsystems: (1) an observing sub-system (Observing Facilities), (2) a forecasting and modelling sub-system (Forecasting and Modelling Facility) and (3) a data management sub-system (Data Centre Facility).</p> <p>» More information: http://www.socib.eu/</p>



A wide-angle photograph of a vast field of white tulips stretching towards the horizon under a clear, bright blue sky. The tulips are in full bloom, with their characteristic cup-like petals and green stems. The field is densely packed, creating a sea of white flowers. The sky is a uniform, deep blue with a few wispy clouds near the horizon.

B. CENTRAL WESTERN EUROPE

(BELGIUM, FRANCE AND NETHERLANDS)

A map of Europe with the country of Belgium highlighted in a dark blue color. The rest of the map is in a light grey color. The text 'BELGIUM' is centered over the map in a large, bold, dark blue font. Below it, the text '22 BES-RIs identified' is centered in a smaller, bold, dark blue font.

BELGIUM

22 BES-RIs identified

Table 11. Main Belgian BES-RIs classified according to the typology used by BiodivERSA.

		SERVICE TOWARDS WHICH THE RI IS ORIENTED									
Organism level	Ecosystem to region level	RIs in support to taxonomy, natural history, organisms characterisation				RIs for the management of and research on genetic resources	RIs for in situ biodiversity research				RIs providing generic support to field work and campaigns (incl. search); ex: vessels & generic platforms
		Management of collections and of taxonomic information	Database of functional traits of organisms	Database of distribution of organisms	RMCA		Past biodiversity dynamics (paleo)	Current and future biodiversity dynamics (incl. global change drivers)	Biodiversity and ecosystem functioning / services	RIs with focus on Protected, Endangered, Invasive, Alien species	
Animals		Darwin DB, INBO, RBINS		Bio-GR, OFFH	RMCA	RBINS, RMCA			BFIS	OFFH	
Plants		Alien Plants, Darwin DB, INBO, MBG	Alien Plants, BBPF, BeBIF	Bio-GR, OFFH	ITC, MBG		MBG		Alien Plants, BFIS, MBG	OFFH	
Fungi		Darwin DB, INBO		OFFH					BFIS	OFFH	
Microorganisms		BCCM /LM-Ugent, Darwin DB, INBO			BCCM-LMG				BFIS	OFFH	
Terrestrial	Forests	INBO, OFFH		OFFH					BFIS		
	Grasslands	INBO, OFFH		OFFH					BFIS		
	Croplands	INBO, OFFH		OFFH			ILVO, AnaEE		BFIS		
	(Per)urban areas	INBO, OFFH		OFFH			ILVO		BFIS		
	Other (specify)										
Marine	Coastal areas	WoRMS					Marine Atlas, MSO			MSO	
	Open water	biodiversity.aq, WoRMS					BMDC-MUMM, Marine Atlas				
	Deep sea	biodiversity.aq, WoRMS					Marine Atlas				
	Other (vessels)						ROV Zonnebloem, RV Belgica, RV Simon Steven, VLIZ-DC	ROV Zonnebloem, RV Belgica, RV Simon Steven		ROV ZonnebloemRV, RV Belgica, RV Simon Steven	
Freshwater & wetlands	Lakes	BioFresh, INBO, OFFH	BioFresh	BioFresh, OFFH					BFIS		
	Rivers & streams	INBO, OFFH		OFFH			ILVO		BFIS		
	Wetlands										
	Other (marine platform forms)	VLIZ-DC	VLIZ-DC	VLIZ-DC			Marine Atlas, VLIZ-DC	VLIZ-DC, BMDC-MUMM		MSO, VLIZ-DC	
Specific biomes	Arctic										
	Antarctic	biodiversity.aq	biodiversity.aq	biodiversity.aq			PE Station	PE Station		PE Station, biodiversity.aq	
	Boreal										
	Tropical & sub-tropical	RMCA			ITC						
	Other (specify)	BioFresh (European level), WoRMS (worldwide)									WoRMS

BELGIUM

22 BES-RIs identified so far.

To be noticed: the Belgian Biodiversity Platform strengthens biodiversity e-infrastructures such as the Belgian GBIF portal (<http://data.biodiversity.be>) providing free access to biodiversity data pertaining to Belgium (museum specimens and field observations) and the BeCRIS database and data portal holding information on Belgian biodiversity research capacity in topical areas (<http://becris.biodiversity.be>).

Name of the organisation	Short description & Link
Alien Plants	<p>Manual of the Alien Plants of Belgium (Alien Plants). This is a species checklist dataset published by the Botanic Garden Meise. It contains information on all (over 2.500) non-native vascular plants occurring in the wild in Belgium since 1800. The checklist is almost entirely based on a thorough herbarium revision of the main public Belgian herbaria, actively maintained, and updated regularly. Its purpose is to communicate information (descriptions and keys) on introduced plants that grow wild in Belgium.</p> <p>» More information: http://alienplantsbelgium.be</p>
BCCM	<p>Belgian Co-ordinated Collections of Micro-organisms (BCCM). This is a Belgian government funded consortium of seven scientific institutions, who manage and exploit a collection of microbial and genetic resources. The consortium comprises more than 86,000 publicly available strains of bacteria including mycobacteria and cyanobacteria, filamentous fungi, yeasts, diatoms and plasmids. The biological origin of the collection is very broad, including bacterial isolates from food, clinical, veterinary, agricultural, aquatic and other environmental sources. BCCM is embedded in the Laboratory of Microbiology, Department of Biochemistry and Microbiology, Faculty of Sciences of Ghent University a research team internationally renowned for its contributions to the description of new bacterial biodiversity and improvement of bacterial taxonomy (LM-UGent). The LM-UGent holds more than 16,000 bacteria strains representing some 1,300 species, subspecies or pathovars. Over 16,000 strains, representing some 1,300 species, subspecies or pathovars, encompassing plant associated and phytopathogenic bacteria, bacteria of medical or veterinary importance, marine bacteria and various groups of biotechnological interest. Most of the commonly used control, test and bioassay strains are incorporated.</p> <p>More information:</p> <p>» http://bccm.belspo.be/</p> <p>» LM-UGent: https://www.ugent.be/we/biochemicro/en/research/microbiology</p>
BFIS	<p>Belgian Forum on Invasive Species (BFIS). This is an informal structure animated by the Belgian Biodiversity Platform where in scientists interested in biological invasions are involved. It encourages interdisciplinary cooperation among scientists and favours information exchange and dissemination as a support to develop measures dedicated to the prevention and the mitigation of the impacts of invasive species. The BFIS is responsible for preparing and updating the reference list of alien species invading terrestrial, freshwater and marine ecosystems in Belgium, with a focus on organisms causing a strong detrimental impact on native biodiversity. The BFIS is the national node of the IUCN Invasive Species Specialist Group. It supports activities of the Belgian contact group on invasive species.</p> <p>» More information: http://ias.biodiversity.be</p>

Name of the organisation	Short description & Link
Bio-GR	<p>Biodiversity in the Great Region (Bio-GR). The Great Region, located between Rhine, Mosel, Sarre and Meuse, has a total area of 65.401 km². Biogeographically, it is spread over the oceanic and continental zones.</p> <p>The administrative complexity of the Great Region, four countries and five regional entities, offer a challenging opportunity for trans-boundary collaboration in terms of Nature Conservation. Since many years, administrations, scientists and naturalists gather primary biodiversity data that are crucial for science-based decisions making. The website offers a trans-boundary view on species observations related to Birds and Habitats Directive, this project will deliver a more accurate evaluation of Natura2000 network. By linking nature monitoring, scientific research and innovation technology, it exposes publically funded data to a wider public and raises biodiversity loss awareness.</p> <p>» More information: http://www.bio-gr.eu</p>
biodiversity.aq	<p>SCAR Antarctic Biodiversity Portal (biodiversity.aq). This is an international effort that seeks to increase our knowledge and understanding of Antarctic and Southern Ocean biodiversity. Funded by the Belgian Science Policy Office, it is building an innovative Antarctic biodiversity information system, giving access to a distributed network of contributing databases, according to the principles of the Global Biodiversity Information Facility. SCAR is a new data discovery tool using two complementary networks and will expand these by using an advanced technical architecture, capable of linking with many potential data resources and is also the data management tool and repository for the biodiversity-related research conducted at the Princess Elisabeth Station. Its implementation by the Belgian Biodiversity Platform ascertains that biodiversity.aq can take advantage of the relevant experience of the Belgian GBIF node. biodiversity.aq is recognised as an official SCAR Product and integrates SCAR Marine Biodiversity Information Network (SCAR-MarBIN), bringing together data from marine and terrestrial realms. SCAR-MarBIN establishes and supports a distributed system of interoperable databases, forming the Antarctic Regional OBIS Node. SCAR-MarBIN compiles and manages existing and new information on Antarctic marine biodiversity by coordinating, supporting, completing and optimizing database networking.</p> <p>More information: » https://www.biodiversity.aq/about/ » SCAR-MarBIN: http://www.scarmarbin.be</p>
Biofresh	<p>Freshwater biodiversity data portal (Biofresh). This is an online data portal with information on datasets (metadata), on species, on distribution information, and on conservation status. The aim of this data portal, which was started in the framework of the BioFresh project, and further developed under the Freshwater Information Platform, is to help scientists to advertise and publish their data(base) and to provide tools for the discovery, integration and analysis of open and freely accessible freshwater biodiversity data.</p> <p>More information: > http://data.freshwaterbiodiversity.eu</p>
BMDC-MUMM	<p>Scientific Service “North Sea Mathematical Model Management Unit” (BMDC-MUMM). This scientific service is responsible for monitoring various legal obligations (and rights) and their implementing decrees concerning the management of the marine environment. The MUMM also hosts the Belgian Marine Data Centre (BMDC), composed of a group of scientists within MUMM, whose expertise is oriented towards the management and the analysis of marine environmental data. Its major tasks are : to continuously assess and prognose the state of the North Sea to evaluate and improve the monitoring programmes to gather, validate, archive, manage marine and oceanographic data collected (mainly) by Belgian scientists in the frame of research projects and national and international monitoring programmes It is the BMDC’s policy to encourage the public to explore and use its datasets. Oceanographic data, including analysis tools, are put at the disposal of a wide range of users: scientists, policy makers, sea professionals and other stakeholders, at the national and international levels.</p> <p>More information: » MUMM: https://www.naturalsciences.be/fr/science/do/538/scientific-research/research-programmes/98 » BMDC: http://www.bmdc.be/NODC/services.xhtml</p>

Name of the organisation	Short description & Link
Darwin DB	<p>Darwin Database (Darwin DB). This is a database of the Royal Belgian Institute of Natural Sciences. This institute has 3 directorates dedicated to scientific research: evolution, biodiversity, and ecosystems. The collections are made up of approximately 37 million specimens and the Darwin database website is the main gate to glimpse the extent and diversity of the collections held by RBINS. Today, the Darwin database manages information on about 2.637.600 specimens (540.000 records) stored in the institute's depositories.</p> <p>» More information: https://darwin.naturalsciences.be</p>
INBO	<p>Research Institute for Nature and Forest (INBO). This is the Flemish research and knowledge centre for nature and its sustainable management and use. INBO conducts research and supplies knowledge to all those who prepare or make the policies or are interested in them as a stakeholder. Through its scientific research, INBO supports all agencies dealing with open space in the Flemish government, as well as in organisations involved in nature conservation, forestry, agriculture, hunting and fishery. INBO publishes its results as open data and provides data for international reporting. INBO has an Experts' Portal hosting research material from its scientists in open data (collections, publications, datasets, etc.). Three teams - library & Information (documents, metadata), Open Data & Open research (databases, applications, incl. GIS) and IT Operations (ICT infrastructures) & development – form the INBO Information and Data Centre on biodiversity and its applications for nature conservation in Flanders. The IDC ensures professional, high-quality acquisition and storage of data, information and knowledge supplied by an active network of external and INBO researchers, and the accessibility of such data, information and knowledge to the institution itself, policymakers, partner organisations and other players. The Information and Data Centre also ensures an effective, secure and integrated ICT infrastructure within INBO.</p> <p>More information: » https://www.inbo.be » IDC: https://www.inbo.be/en/research/andere-diensten/information-data-centre</p>
ITC	<p>International Transit Centre (ITC). This centre holds the world's largest collection of bananas, the International Musa Germplasm Collection, which is managed by Bioversity International. Hosted by the Katholieke Universiteit Leuven in Belgium, the genebank has more than 1,500 accessions, mostly cultivars, plus some improved materials and wild relatives, including DH Pahang, the accession that was used for sequencing the Musa acuminata genome.</p> <p>» More information: http://www.promusa.org/itc</p>
Marine Atlas	<p>MarineAtlas.be (Marine Atlas). This is a joint initiative of several Belgian federal administrations that generate, collect and maintain geo-referenced information related to the sea. Currently the marine atlas gives access to the geographical information contained in the Belgian marine spatial plans. This content will be continuously enriched with information corresponding to the various themes defined in the EU Directive "INSPIRE": Environmental monitoring, Energy resources and energy production, Geology... to name a few. MarineAtlas is developed by experts of the Operational Directorate "Natural Environment" of the Royal Belgian Institute of Natural Sciences: The Biodiversity and Ecosystems Data and Information Centre (BEDIC), The computer support team, The Scientific Web sites and Applications team (SWAP), The Geocell (a team of geographical experts, acquainted with marine and maritime issues, devoted to the upwards validation of the data and to their full description according to established standards).</p> <p>» More information: http://www.marineatlas.be/en/</p>

Name of the organisation	Short description & Link
MBG	<p>Meise Botanic Garden (MBG). This Botanic Garden has a high-quality infrastructure to support its research, including herbarium digitisation equipment, microscopes and a fully equipped molecular lab. Their collections include 18,000 plant species, an herbarium with 4 million preserved specimens, and an extensive archive and botanical library. Their science centre work on collection-based research of plant diversity, evolution, ecology, and conservation. They study a wide range of taxonomic groups, including plants, algae, fungi, and lichens from Europe, Central Africa, Antarctica, and other parts of the world and are committed to sharing their knowledge on plants and their environment with the research community, students, and the public.</p> <p>More information: » https://www.plantentuinmeise.be/en/pQ087IM/wetenschap/in-the-spotlight » Databases: https://www.plantentuinmeise.be/en/pQ7mzTZ/wetenschap/databases</p>
MSO	<p>The Marine Station Ostend (MSO). This is a coastal satellite laboratory available for all Flemish marine scientists. The MSO comprises multifunctional laboratories, provides storage capacity for scientific equipment and has space for public activities The Marine Station Ostend is housed in four former warehouses at the Halve Maan site on the Ostend east bank.</p> <p>» More information: http://www.vliz.be/en/marine-station-ostend</p>
OFFH	<p>Observatory for Fauna, Flora and Habitats (OFFH). This is an online tool allowing registered citizens to encode their biological observations within a dedicated database managed by The Department for the Study of the Natural and Agricole Environment. This Department is part of the Walloon Region administration, it develops and coordinates all programs for the acquisition, validation, valorisation and dissemination of socio-economic and environmental data in the fields of agriculture and the environment. The portal allows users to document their observations with pictures in order to facilitate the validation of the data by the Department, biodiversity experts and their integration into the data-centre related activities.</p> <p>More information: » http://biodiversite.wallonie.be (in French) » http://observatoire.biodiversite.wallonie.be/encodage (in French)</p>
PE Station	<p>Princess Elisabeth Antarctica Research Station (PE Station). The International Polar Foundation initiated Belgium's return to Antarctica, by conceiving, designing and building the "zero emission" Princess Elisabeth Antarctica research station, as a legacy project of the 2007-2008 International Polar Year. Princess Elisabeth Antarctica is solidly anchored upon the granite ridge of Unstained Nunatak, at an altitude is of 1382 metres, in the Droning Maud Land region of East-Antarctica. The zero-emission polar research station, which is approximately 220 Km from the Antarctic coasts, is an ideal logistics hub for field exploration in the 20°- 30° E sector of Antarctica. Its location and its infrastructures allow for sampling, measuring, and studying on site the biodiversity of the Antarctic region.</p> <p>» More information: http://www.antarcticstation.org/station</p>
RBINS Collections	<p>Royal Belgian Institute of Natural Sciences (RBINS). This is an institute which has one of the ten largest natural science collections in the world, and the third largest in Europe after Paris and London and estimate that it owns 38 million specimens. Its treasures include the Iguanodons of Bernissart, the Neanderthal of Spy, the shell collection of Dautzenberg, the four lunar rock fragments, the Tasmanian wolf or the insect collection of Baron De Selys Longchamps. Their collection is divided into six main themes: entomology, recent invertebrates, recent vertebrates, anthropology, palaeontology and geology.</p> <p>» More information: http://collections.naturalsciences.be</p>

Name of the organisation	Short description & Link
RMCA Collections	<p>Department of Biology of the Royal Museum of Central Africa (RMCA). This is a research and knowledge centre. Researchers manage a large collection of Afrotropical organisms and conduct international research on both specimens in collections and their natural environment in order to gain a better understanding of African biodiversity. They study the taxonomy and phylogeny of different groups of vertebrates and invertebrates and investigate the role of trees and animals in various ecosystems. The department focusses on four topics: Wood biology; Biological collection and data management; Invertebrates; Vertebrates.</p> <p>RMCA has launched several initiatives among which the Sub-Saharan Africa Biodiversity Network (SABIN) one which led to the development of the CABIN project (Central African Biodiversity Information Network). The CABIN project focuses on Congo RDC, Rwanda and Burundi.</p> <p>RMCA also have two services, JEMU (Joint Experimental Molecular Unit) and BopCo (barcoding facility for organisms and tissues of policy concern), which focus on certain molecular biology techniques and collaborate and his collection on African mammals are shared with African Mammalia, a database that diffuses data on African mammals. African Mammalia also brings together brings together the extensive specimen and tissue collections of the Royal Belgian Institute of Natural Sciences (RBINS) and the University of Antwerpen (UAntwerpen) providing taxonomical, ecological, geographical and genetic information, as well as measurements and data on parasitic and viral infections.</p> <p>More information:</p> <ul style="list-style-type: none"> » http://www.africamuseum.be/research/biology » African Mammalia: http://projects.biodiversity.be/africanmammalia » BopCo: http://bopco.myspecies.info (available to stakeholders as well) » CABIN: http://cabin.cybertaxonomy.africamuseum.be » JEMU: http://jemu.myspecies.info/organisation-and-objectives
ROV Zonnebloem	<p>Remotely Operated Vehicle Zonnebloem (ROV Zonnebloem). This underwater vehicle can dive to a depth of 1,300m. The ROV is mainly used for deep-sea research. It provides the opportunity to explore the largely unknown deep-ocean margins and their biodiversity. Zonnebloem is used to film and take samples from deep-sea canyons, cold-water coral reefs, carbonate mounds, mud volcanoes or cold seeps.</p> <p>» More information: http://www.vliz.be/en/rov-zonnebloem</p>
RV Belgica	<p>Oceanographic Research Vessel Belgica (RV Belgica). This is a ship owned by the Federal Science Policy Office (BelSPO) placed at the disposal of Belgian scientists: they can come on board to carry out their scientific research at sea. The Operational Direction Nature of the Royal Belgian Institute of Natural Sciences is responsible for ship management and planning and Of the organisation of scientific surveys at sea. The Measurement Service Ostend, part of the Royal Institute of Natural Sciences of Belgium, is responsible for the management of our oceanographic vessel RV Belgica, the measurement facilities at sea and the data management of sand and gravel extraction.</p> <p>More information:</p> <ul style="list-style-type: none"> » https://odnature.naturalsciences.be/belgica/en/ » Measurement Service Ostend: https://www.naturalsciences.be/en/science/do/536/scientific-research/research-programmes/98
RV Simon Steven	<p>Research Vessel Simon Stevin of VLIZ (RV Simon Stevin). This is a multidisciplinary research vessel deployed for coastal and oceanographic research in the Southern Bight of the North Sea and the eastern part of the English Channel. The ship meets the requirements of the various marine research disciplines in Flanders, and is equipped with all standard sampling equipment as well as sophisticated sonar technology for flow measurements and soil characterisation.</p> <p>» More information: http://www.vliz.be/nl/rv-simon-stevin</p>

Name of the organisation	Short description & Link
VLIZ-DC	<p>VLIZ Data Centre (VLIZ-DC). This Data Centre aims to be a service data centre making data and information of reliable quality accessible to a wide range of marine sciences in an efficient and open manner. It has for main objective the general data management to support Flemish marine research so as to preserve the knowledge, interpretation and usability of data over time. This includes: documentation: describing data sets and providing them with the required metadata; standardisation: creating structured data provided with standards; integration: collecting scattered data in dedicated and recognised data systems; archiving: preserving digital data for the next generations; redistribution: stimulating the use of data and facilitating data exchange. The Government of Flanders has also commissioned VLIZ to accommodate and support the EMODnet (European Marine Observation and Data Network) secretariat. For this purpose, a central portal site for observation data from European monitoring series has been created.</p> <p>More information: » http://www.vliz.be/en/data-centre-division » EMODnet: http://www.emodnet-biology.eu/portal/</p>
WoRMS	<p>World Register of Marine Species (WoRMS). This infrastructure provides an authoritative and comprehensive list of names of marine organisms, including information on synonymy. While highest priority goes to valid names, other names in use are included so that this register can serve as a guide to interpret taxonomic literature. This register of marine species grew out of the European Register of Marine Species (ERMS), and its combination with several other species registers maintained at the Flanders Marine Institute (VLIZ). Resources to build MarineSpecies.org and Aphia were provided mainly by the EU Network of Excellence 'Marine Biodiversity and Ecosystem Functioning' (MarBEF), and also by the EU funded Species 2000 Europe and ERMS projects. The content of WoRMS is controlled by taxonomic experts, not by database managers. WoRMS has an editorial management system where each taxonomic group is represented by an expert who has the authority over the content, and is responsible for controlling the quality of the information. Each of these main taxonomic editors can invite several specialists of smaller groups within their area of responsibility to join them.</p> <p>» More information: http://www.marinespecies.org/index.php</p>



FRANCE

13 BES-RIs identified

FRANCE

13 BES-RIs identified so far.

To be noticed: the French Foundation for Research on Biodiversity (FRB) has developed the Ecoscope, a portal giving access to meta-data for the main BES-RIs in France.

More information: <http://ecoscope.fondationbiodiversite.fr/ecoscope-portal/>

Name of the organisation	Short description & Link
AgroBRC RARe	<p>French Agronomic BRC Infrastructure (AgroBRC RARe). This is a national research infrastructure that brings together five networks of Biological Resources Centres (BRCs). All sectors of agriculture are concerned: plant and animal production, agri-food industries, non-food valuation of biomass, clean tech biotechnology. AgroBRC RARe aims at improving the national and European visibility of biological resources maintained by its constitutive BRCs and at facilitating their use by a large research community, from agriculture research to life sciences and environmental sciences. The capacity to maintain a large diversity of well documented resources, to collect new ones, to contribute to their characterisation, to distribute them and to manage the related data, gives a central role to AgroBRC in numerous research programs aimed at exploring the living world and at making value of biodiversity for agriculture and industry regarding food, environment and health. AgroBRC RARe supports interdisciplinary research and trans-sectorial scientific discussions for various fields of application and fosters technological developments for the conservation and characterization of resources. The added value of AgroBRC RARe relies on sharing skills, harmonising practices, triggering projects in comparative biology, and proposing a single entry portal to facilitate access to documented samples. AgroBRC RARe will provide an operational support to BRC managers and users, for the implementation of the Nagoya protocol and French biodiversity law on access and benefit sharing regarding the use of genetic resources.</p> <p>» More information: https://agrobrc-rare.org/agrobrc-rare_eng/</p>
CEBA	<p>Geoportal of the CEBA, Amazonian Biodiversity (CEBA). This is a network of permanent forest plots installed in French Guiana. The resources of interest for the portal are all georeferenced data, such as satellite images, topographic and thematic maps, aerial or terrestrial LIDAR data, and other datasets such as herbarium data. Created in 1968, CEBA's database is named the Guyafor Database. It compiles and coordinates data of 11 sites (Paracou, Bafog, Organabo, Risquetout, Montagne Tortue, Saut Lavilette, Acarouany (Javouhey), Montagne Plomb, Tibourou, Nouragues, Laussat) and their subdivisions of the Guianese permanent plots network. Each site contains georeferenced trees, botanically identified and regularly measured (diameter) for varying periods, depending to the site.</p> <p>» More information: http://vmcebagn-dev.ird.fr/geonetwork/srv/eng/search#fast=index&from=1&to=20&sortBy=title&sortOrder=reverse</p>
Ecotrons	<p>Analysis and Experimentation on Ecosystems-France, the Ecotrons (AnaEE-France Ecotrons). This research infrastructure provides a broad national and international scientific community (ecology, agronomy, biology, geosciences) with 5 experimental platforms for terrestrial and aquatic environments that constitute a conceptual and technological leap forward compared to observation and experimentation tools developed in nature. It is open to national and international scientists' consortia. The ANAEE-FR Ecotrons RI contributes to the ERIC AnaEE project, included in the ESFRI roadmap, and to the development of a European network of Ecotrons. Two Ecotrons are available in France. Ecotron Île de France is a system that allows small organisms and terrestrial and aquatic ecosystems to be confined and manipulated under highly controlled conditions in order to measure their functioning and sensitivity to climate change and Ecotron Montpellier allows precise control of environmental variables and automated measurement of the state and activity (flows) of organisms and ecosystems.</p> <p>More information:</p> <p>» Ecotrons Ile de France: https://www.anaee-france.fr/service/ecotrons/ecotron-idf</p> <p>» Ecotrons Montpellier: https://www.anaee-france.fr/service/ecotrons/ecotron-montpellier</p>

Name of the organisation	Short description & Link
FOF	<p>French Oceanographic Fleet (FOF). This infrastructure can carry scientific research and long-term observations in marine environmental sciences: geosciences, physical and biological oceanography, geochemistry and organic chemistry, paleoclimatology, marine biodiversity, etc. It participates in the education of students for the marine universities. It contributes to public service mission, monitoring and expertise. They possess: 4 deep sea vessels (Marion Dufresne, Pourquoi pas?, L'Atalante, Thalassa), 2 overseas vessels (Alis, Antea), 5 coastal vessels used in the Channel-Atlantic and Mediterranean (Thetys, L'Europe, Thalia, Côtes de la Manche, Haliotis), 7 station vessels, spread across all metropolitan coastlines, can achieve missions during one to three days; 4 deep-water submersible vehicles (Nautile, Victor 6,000, AsterX & IdefX, Ariane) and mobile equipment.</p> <p>» More information: https://www.flotteoceanographique.fr/en</p>
ILICO	<p>Seashore and coastal research infrastructure (ILICO). The is an infrastructure that was created in 2016 and aims at observing and understanding coastal and marine ecosystems. ILICO brings together a set of observation devices making it possible to collect samples and deploy different measuring instruments by federating 8 observation services, called "elementary networks" which are: COAST HF, CORAIL, DYNALIT, MOOSE, PHYTOBS, ReefTEMPS, SOMLIT and SONEL that produces data. Carrying out long-term monitoring also makes it possible to facilitate the understanding and anticipation of certain large-scale processes and phenomena that can impact coastal and coastal areas (quantification of the impact of certain extreme or intermittent events such as tsunamis or cyclones). ILICO's objective is to become a structuring and essential element of the research landscape for the themes it covers, at national and European level.</p> <p>» More information: https://www.ir-ilico.fr/en</p>
IN-SYLVA	<p>IN-SYLVA-France (IN-SYLVA). This is a national research facility, which coordinates the experimental tools and platforms of the research organisations working on forest management. IN-SYLVA was created to answer the social, economic and environmental challenges described in the The French National Forest and Wood Programme (PNFB): forest adaptation to climate change, job creation for an innovative forest sector, downstream and upstream integration in the forest sector. In-Sylva is original in that it couples silvicultural, biogeochemical and genetic approaches to promote an integrated vision of silviculture for an adaptive and sustainable management of forest stands. IN-SYLVA-France also provides services to the forest sector (for example, selecting appropriated genetic material for plantation, tool kits for silvicultural systems) as well as both academic and professional training. It supports a portal to bring network details to the attention of the scientific community and the public, a data access charter will provide the conditions for accessing to and using the data.</p> <p>» More information: https://www6.inrae.fr/in-sylva-france_eng/</p>
in Natura	<p>Analysis and Experimentation on Ecosystems in Natura (AnaEE-France in Natura). This is an infrastructure that aims at providing a coherent set of services dedicated to experimentation for the study of continental ecosystems in natura, analysis and modelling. This research infrastructure facilitates the use of experimental platforms, the emergence of innovative projects and the reuse of data. It brings together 32 installations on a national scale to study ecosystems in nature, in particular through contrasting management methods likely to generate different long-term trajectories. Ecosystem characterisation capacity is increased within the infrastructure through the provision of 9 analytical services for recording variables related to biological organisms, soil and biodiversity, along with matter flows. This infrastructure provides an information system enabling the advanced integration of databases and their coupling with modelling platforms. AnaEE-France Natura is the French node of the AnaEE ERIC project included within the ESFRI roadmap.</p> <p>» More information: https://www.anaee-france.fr/service/experimentation-in-natura</p>

Name of the organisation	Short description & Link
OZCAR	<p>Critical Zone Observatories: Research and Application (OZCAR). This is a national distributed research infrastructure associating most of the French observation sites dedicated to the observation and monitoring of the Critical Zone, CZ, the thin outer veneer of Earth's continents extending from the top of the vegetation canopy down to groundwater. OZCAR RI is supported by the French Ministry of Education and Research and, includes more than 60 highly instrumented sites/observatories for long-term measurements of biological, chemical and physical parameters of groundwater, river water, glaciers, soils, and wetlands in France and overseas. Each observatory focuses on one or more components of the Critical Zone but importantly OZCAR is covering most of the lateral and vertical compartments of the Critical Zone from mountains to coastal areas. Through environmental data portal and modelling platforms, OZCAR is not only a research infrastructure open to the scientific community, it is also aiming at advising policy makers and stakeholders on the water, soil, and biodiversity resource and the landscape scale.</p> <p>» More information: https://www.ozcar-ri.org/observatories/the-network/</p>
PNDB	<p>National Biodiversity Data Center (PNDB). This is a research infrastructure which aims at advancing the consolidation of knowledge to improve the understanding of the state and dynamics of biodiversity. The challenges of research lie in the complexity of interactions between the different levels of organisation of living organisms, abiotic factors and pressures. The PNDB's missions are part of a FAIR approach (Easy to find, Accessible, Interoperable, Reusable). The missions are:</p> <ol style="list-style-type: none"> 1. provide access to data, associated services and products derived from analyses: metadata; 2. promote scientific animation to identify gaps and encourage the emergence of devices supported by user and producer communities; 3. facilitate the sharing of practices with other research communities, encourage data sharing and reuse, be part of the reflection of the future Earth System infrastructure; 4. promote national and international coherence in accessing and using biodiversity research data, promoting products and services. <p>More information:</p> <p>» https://www.pndb.fr (in French)</p> <p>» Database: https://data.pndb.fr</p>
RECOLNAT	<p>Natural History Collections Network (RECOLNAT). This is a research infrastructure that offers valuing 350 years herbarium, fossils and animals stuffed and conserved in fluid. Public collections in France maintain more than 100 million specimens. This data source has remained neglected for decades but today it is revisited under cover of the debate on global change. Currently, more than 9 million items are being digitised. The collections represent a scientific heritage, an archive of biodiversity and a major research infrastructure. The French taxonomic collections are among the first in Europe, but many are under-utilised by researchers because inaccessible, for the establishment of common services, RECOLNAT facilitates access and provide better conditions of study. Remote observation images participate in a new way of working through a virtual laboratory. Researchers can then directly consult the specimens they have spotted. The information is accessible to everyone and everyone can participate in its development. Volunteers form networks of skills and expertise. A citizen science site already offers people to complete the herbarium label from images.</p> <p>» More information: https://www.recolnat.org/en/</p>

Name of the organisation	Short description & Link
RESOMAR databases	<p>Network of Marine Stations and Observatories (RESOMAR). This is a multidisciplinary structure that brings together French marine stations, observatories and laboratories which has, beyond the research carried out, a strong desire to structure the community. Two databases are set up by RESOMAR: the Pelagos and the Benthos databases. The Pelagos database holds coastal planktonic biodiversity data (including time-series). One of the objectives of the RESOMAR is to analyse these data to answer scientific questions about factors that control the abundance and distribution of organisms at different spatial and time scales in coastal marine systems. The Benthos database is one of the largest benthic databases in Europe. More specifically, the Benthos database includes 106 datasets, nearly 300,000 faunistic reports, 10,000 sampled stations and nearly 100,000 associated parameter values. These data are spread over the entire French coast and the oldest date from the early 1960s. You need to create an account to access both databases.</p> <p>More information:</p> <ul style="list-style-type: none"> » RESOMAR: https://resomar.cnrs.fr (in French) » Pelagos database: http://abims.sb-roscoff.fr/pelagos/?jsessionid=12C584F4F87B99B6FC12D8F576405E1A?execution=e1s1 (in French) » Benthos database: http://resomar-benthos.epoc.u-bordeaux1.fr/ (in French)
RéNSEE	<p>National network of experimental ecology stations (RéNSEE). This is a network made up of 5 experimental ecology stations installed in the heart of natural environments covering most of the biotopes (temperate and tropical, mountainous, as well as land and sea). From mountains to corals, the experimental ecology stations aim to acquire general and multidisciplinary knowledge on the study of the link between the dynamics, evolution and functioning of ecosystems and biodiversity. The objective is to propose scenarios for the conservation and management of natural resources in relation to the changing needs of human societies. The stations offer services allowing experimentation and observation, at various scales of time and space, lying between in vitro and in nature systems, instruments necessary for generalisation of the processes described on a small scale.</p> <ul style="list-style-type: none"> » More information: https://inee.cnrs.fr/fr/reensee (in French) » Five stations: Research Center in Experimental and Predictive Ecology (CEREPEP) south of Paris, Alpine station Joseph Fourier du Lautaret (SAJF) near Grenoble, Theoretical and Experimental Ecology Station (SETE) near Toulouse, the Nouragues station in Guyana (NETRS) and the CRIOBE Experimental Ecology Station (CORAIL) in French Polynesia.
ZA	<p>Zones Ateliers (ZA). This is a distributed infrastructure for the long-term observations of interactions between humanity and nature within a common conceptual framework composed of 14 ZA. A ZA is designed to offer a coordinated and coherent research operation, based on regional mechanisms and observatories. It offers a diversity of contrasting and complementary situations from the point of view of the ecosystems and social systems studied. The RI is organised around a structural research question, supported by hypotheses, a theoretical formalism and an operational framework common to all the ZAs. The focus of the RI is the description, understanding and prediction of the response of anthropic ecosystems to global change, the functioning of socio-ecosystems, and their management and governance. The multidisciplinary and interdisciplinary research coordinated by the RI includes long-term observation of landscapes, practices, biodiversity or ecosystem flows. The questions addressed in the ZAs are in direct contact with stakeholders in the regions. The system, as set up and coordinated, is open to national or international research communities other than those involved in the concerned ZA.</p> <p>The ZA network is a member of LTER Europe and of ILTER.</p> <ul style="list-style-type: none"> » More information: http://www.za-inee.org/en/node/793 » Large rivers and their watershed : ZA Seine, ZA Loire, ZA Bassin du Rhône and ZA Moselle. » Landscapes according to a climatic and anthropic gradient : ZA Antarctique, ZA Alpes, ZA Arc jurassien, ZA Armorique, ZA Plaine et Val de Sèvre, ZA Environnementale Urbaine, ZA Hwange and ZA PYGAR » The Land / Sea interface : ZA Brest-Iroise » Ecology, society and natural radioactivity : ZA Territoires Uranifères

A map of Europe with the Netherlands highlighted in dark blue. The rest of the map is in a light grey color with white outlines for country borders. The text 'THE NETHERLANDS' is centered over the map in a bold, dark blue font.

THE NETHERLANDS

5 BES-RIs identified

Table 13. Main Netherlands BES-RIs classified according to the typology used by BiodivERsA.

		SERVICE TOWARDS WHICH THE RI IS ORIENTED												
Organism level		RIs in support to taxonomy, natural history, organisms characterisation			RIs for the management of and research on genetic resources	RIs for in situ biodiversity research			RIs providing generic support to field work and campaigns (incl. search); ex. vessels & generic platforms					
		Management of collections and of taxonomic information	Database of functional traits of organisms	Database of distribution of organisms		Past biodiversity dynamics (paleo)	Current and future biodiversity dynamics (incl. global change drivers)	Biodiversity and ecosystem functioning / services		RIs with focus on Protected, Endangered, Invasive, Alien species				
Organism level	Animals	NIEBA	NIEBA	NIEBA										
	Plants	NIEBA	NIEBA, NPEC	NIEBA	NPEC									
	Fungi	NIEBA	NIEBA	NIEBA										
	Microorganisms	NIEBA, UNLOCK	NIEBA, UNLOCK	NIEBA, UNLOCK	UNLOCK	UNLOCK								
	Terrestrial	Forests	NIEBA	NIEBA	NIEBA		CESAR, UNLOCK	CESAR, UNLOCK	CESAR, UNLOCK					
		Grasslands	NIEBA	NIEBA	NIEBA		CESAR, UNLOCK	CESAR, UNLOCK	CESAR, UNLOCK					
		Croplands	NIEBA	NIEBA	NIEBA		CESAR, UNLOCK	CESAR, UNLOCK	CESAR, NPEC, UNLOCK					
		(Peri)urban areas	NIEBA	NIEBA	NIEBA		CESAR, UNLOCK	CESAR, UNLOCK	CESAR, UNLOCK					
		Other (specify)												
	Ecosystem to region level	Coastal areas	NIEBA	NIEBA	NIEBA									NMF
Open water													NMF	
Deep sea													NMF	
Other (specify)														
Freshwater & wetlands	Lakes	NIEBA	NIEBA	NIEBA										
	Rivers & streams	NIEBA	NIEBA	NIEBA										
	Wetlands	NIEBA	NIEBA	NIEBA										
	Other													
Specific biomes	Arctic													
	Antarctic													
	Boreal													
	Tropical & sub-tropical													
	Other (specify)													

THE NETHERLANDS

5 BES-RIs identified so far.

Name of the organisation	Short description & Link
CESAR	<p>Cesar Observatory (CESAR). This is a site used to monitor of long term tendencies in atmospheric changes, study atmospheric and land surface processes for climate modeling, validate space-borne observations, develop and implement new measurement techniques, train young scientists at post-doc, PhD and master level.</p> <p>The studies of atmospheric and land surface processes for climate modeling are relevant to biodiversity and ecosystem services are the studies on CO₂ and more generally greenhouse gases exchanges between ecosystems and atmosphere, in relation to the ICOS-ERIC.</p> <p>More information: http://www.cesar-observatory.nl/</p>
NIEBA	<p>Netherland Infrastructure for Ecosystem and Biodiversity Analysis (NIEBA). This is an infrastructure that provides researchers with easy and remote access to an abundance of validated data about life on Earth. NIEBA also provides options for analysing and modeling, using these data. It gives researchers access to large collections and corresponding physical and on-line facilities for research. NIEBA is a central hub in the European (ESFRI) infrastructures LifeWatch and DiSSCo. It provides remote access to digital information from biodiversity collections and databases from the Netherlands and other european countries, creating a virtual research space for the integration, analysis, modelling and evaluation of data.</p> <p>» More information: https://www.dtls.nl/wp-content/uploads/2016/12/Roadmap_UK_2016_2020_lowres.pdf</p>
NMF	<p>Pelagia Research Vessel (RV Pelagia) in the National Marine Research Facilities (NMF). The Pelagia is a vessel suited for research on both coastal seas and open oceans. It has a range of research facilities on board for biological sampling, chemical and physical analyses and seabed studies. The vessel is also a passport for researchers to use the seagoing facilities of the European partners participating in the Ocean Facilities Exchange Group (OFEG).</p> <p>» More information: https://www.nioz.nl/en/facilities/research-vessels</p>
NPEC	<p>Netherland Plant Eco-Phenotyping Centre (NPEC). This is a structure that facilitates state-of-the-art measurement of plant phenotypes to support research on genotype – phenotype associations. The NPEC facility consists of six modules each offering a dedicated phenotyping platform with its own measurement systems supporting specialized cameras and sensors. NPEC offers academia and collaborating corporate R&D many opportunities to carry out accurate and high-throughput plant phenotyping to study plant performance in relation to relevant biotic and abiotic factors across a range of scales, from cell to field.</p> <p>» More information: https://www.npec.nl/</p>
UNLOCK	<p>UNLOCKing Microbial Diversity for Society (UNLOCK). This Research Infrastructure provides scientists with an opportunity to accelerate how we map microorganisms and their ecosystems from all corners of the Earth. The core activities are the mapping and the understanding of microorganism and their ecosystems from all corner of the earth, in terms of genes, species and relationship with host (including human). Via the facilities the research teams can discover how different species of microorganisms coexist, they also can find out which factors affect the evolution of these ecosystems. The facilities enable the analyse and the characterisation of microbial diversity at DNA levels and provide equipment for high throughput research and for computer-driven analysis and design.</p> <p>» More information: https://www.dtls.nl/wp-content/uploads/2016/12/Roadmap_UK_2016_2020_lowres.pdf</p>







C. BALTIC STATES

(ESTONIA AND LITHUANIA)





ESTONIA

2 BES-RIs identified

Table 14. Main Estonian BES-RIs classified according to the typology used by BiodivERsA.

		SERVICE TOWARDS WHICH THE RI IS ORIENTED											
Organism level	Ecosystem to region level	RIs in support to taxonomy, natural history, organisms characterisation				RIs for the management of and research on genetic resources		RIs for in situ biodiversity research			RIs providing generic support to field work and campaigns (incl. for biodiversity re-search); ex. vessels & generic platforms		
		Management of collections and of taxonomic information	Database of functional traits of organisms	Database of distribution of organisms	NATARC	NATARC	NATARC	NATARC	Past biodiversity dynamics (paleo)	Current and future biodiversity dynamics (incl. global change drivers)		Biodiversity and ecosystem functioning / services	RIs with focus on Protected, Endangered, Invasive, Alien species
Organism level	Animals	NATARC	NATARC	NATARC	NATARC	NATARC	NATARC		KK-OBS	KK-OBS		KK-OBS	
	Plants	NATARC	NATARC	NATARC	NATARC	NATARC	NATARC		KK-OBS	KK-OBS		KK-OBS	
	Fungi	NATARC	NATARC	NATARC	NATARC	NATARC	NATARC		KK-OBS	KK-OBS		KK-OBS	
	Microorganisms	NATARC	NATARC	NATARC	NATARC	NATARC	NATARC		KK-OBS	KK-OBS		KK-OBS	
	Terrestrial	Forests								KK-OBS	KK-OBS		KK-OBS
		Grasslands								KK-OBS	KK-OBS		KK-OBS
		Croplands								KK-OBS	KK-OBS		KK-OBS
		(Peri)urban areas								KK-OBS	KK-OBS		KK-OBS
		Other (specify)								KK-OBS	KK-OBS		KK-OBS
	Marine	Coastal areas	KK-OBS										
		Open water	KK-OBS										
		Deep sea											
Other (specify)													
Lakes		KK-OBS							KK-OBS	KK-OBS		KK-OBS	
Freshwater & wetlands	Rivers & streams	KK-OBS							KK-OBS	KK-OBS		KK-OBS	
	Wetlands	KK-OBS							KK-OBS	KK-OBS		KK-OBS	
	Other												
Specific biomes	Arctic												
	Antarctic												
	Boreal												
	Tropical & sub-tropical												
	Other (specify)												

ESTONIA

2 BES-RIs identified so far.

To be noticed: the NATARC (National History Archives and Information Network) focuses on developing taxonomical and geological natural history databases and analytical tools with interoperable data-exchange. Access to and use of NATARC's biodiversity database does not discriminate between national and international users. Researchers can register as users in the database and then create their own datasets or/and use the existing and accessible datasets. Joining the database and storing small quantities of datasets is free; for larger (institutional) mergers, a pre-arranged agreement is needed. NATARC also provides users with access to different analytical toolboxes and a GIS-interface.

Name of the organisation	Short description & Link
KK-OBS	<p>Environmental Observatory's experimental station network (KK-OBS). This is a unified geo-climatically integrated field laboratories and automatic stations system.</p> <p>The Estonian Environmental Conservation Centre includes surveys and experimental studies of wildlife (bird species, fauna, flora, fish, other aquatic biota), the state of their living environment (atmosphere, sea, inland waterways, soil, earth's surface), as well as explorations of strategic natural resources. The important functions of the environmental conservatory are the atmosphere and the biosphere, including analysis of substance and energy flows between marine ecosystems, adaptation of terrestrial and aquatic ecosystems, global changes, in particular biodiversity and productivity changes. Water research projects carried out in several research institutions are linked to a single network for the measurement of seawater, lake waters, northern water bodies and atmospheric properties of the sea (including automatic stations and remote sensing), information processing and scientific analysis networks.</p> <p>» More information: http://kkobs.ut.ee/en</p>
NATARC	<p>National History Archives and Information Network (NATARC). Its main focus is developing taxonomic and geological natural history databases and analytical tools with interoperable data-exchange. It develops services related to hosting and computing of scientific repositories and data archives. Services are addressed to scientists of the whole world, but also to teachers, students, nature conservationists, government officials, organisations and others. This includes:</p> <p>* Hosting Biodiversity Databases in the PlutoF Cloud: in PlutoF cloud, each registered user can create an unlimited number of databases which can be opened up for everyone to use, can be kept private, or can be granted access to a chosen group of users. Databases and datasets can be exported into different formats. Best-known data collections hosted by PlutoF are databases of Estonian biorepositories, UNITE - a global identification key for fungal species based on DNA sequences, repository of studies of Estonian nature, bird observations, etc.</p> <p>* The public portal of Estonian eBiodiversity enables to search for information about species found in Estonia. Information about the presence of species in Estonia is based on scientific collections, DNA sequences, observations and published materials. The eBiodiversity is a web-based platform displaying information about Estonian biodiversity, derived from databases of taxonomy, ecology, phylogenetics, nature conservation etc, owned either by individuals, work groups or institutions.</p> <p>» More information: http://natarc.ut.ee/en/index.php</p>



LITHUANIA

2 BES-RIs identified

Table 15. Main Lithuanian BES-RIs classified according to the typology used by BiodivERsA.

		SERVICE TOWARDS WHICH THE RI IS ORIENTED								
		RIs in support to taxonomy, natural history, organisms characterisation			RIs for the management of and research on genetic resources		RIs for in situ biodiversity research			RIs providing generic support to field work and campaigns (incl. for biodiversity re-search); ex. vessels & generic platforms
		Management of collections and of taxonomic information	Database of functional traits of organisms	Database of distribution of organisms			Past biodiversity dynamics (paleo)	Current and future biodiversity dynamics (incl. global change drivers)	Biodiversity and ecosystem functioning / services	RIs with focus on Protected, Endangered, Invasive, Alien species
Organism level	Animals									
	Plants / Algae		AGBC							
	Fungi									
	Microorganisms									
Terrestrial	Forests									
	Grasslands									
	Croplands									
	(Peri)urban areas									
	Other (specify)									
Ecosystem to region level	Coastal areas									
	Open water									
	Deep sea									
	Other (specify)									
Freshwater & wetlands	Lakes									
	Rivers & streams									
	Wetlands									
	Other									
Specific biomes	Arctic									
	Antarctic									
	Boreal									
	Tropical & sub-tropical									
	Other (specify)									

LITHUANIA

2 BES-RIs identified so far.

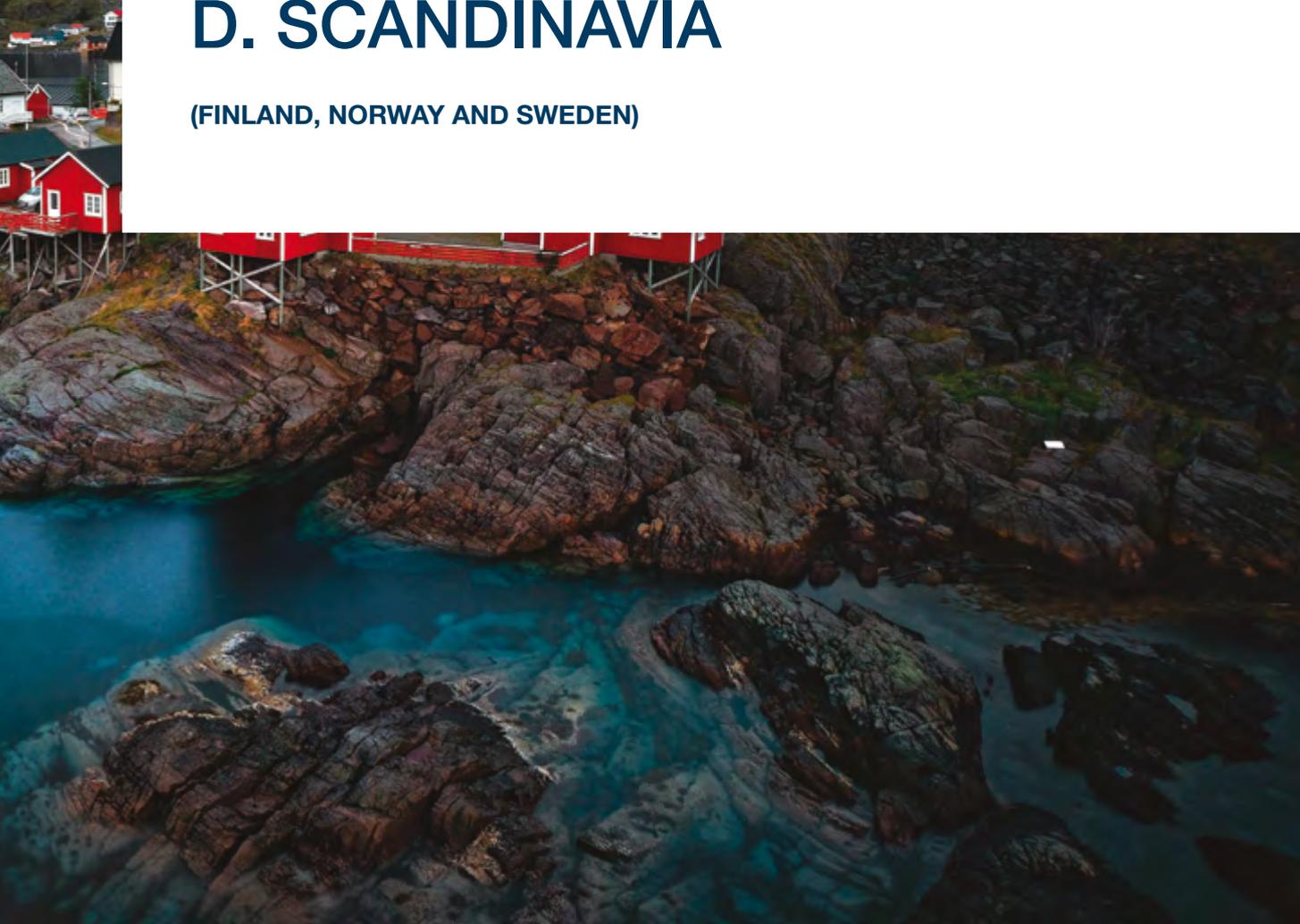
Name of the organisation	Short description & Link
AGBC	<p>Centre for plant genetics and biotechnologies (AGBC). It is designed for integrated studies of the impact of the changing climate and anthropogenic activities on the adaptability of plants and its management principles. Services provided by AGBC include analysis of plant metabolites and processing of the data through the use of capillary electrophoresis, cultivation of cells in a bioreactor, measurements of parameters of plant photosynthesis in vivo, qualitative and quantitative determination of compounds by gas (GC / FID) and high-performance liquid (UPLC / DAD / MS / ELSD) chromatography, studies and evaluation of the genetic potential and growth of plants under simulated environment conditions, and evaluation of plant architectonics, experimental evaluation interaction of the genotype with the natural environment in situ, study the interaction of the genotype with technological factors, and investigate the realisation of the potential of agricultural plants and their adaptivity under conditions of high agrophone.</p> <p>It is a RI of localised type, participating institution - Lithuanian Research Centre for Agriculture and Forestry (LAMMC).</p> <p>» More information: http://lammc.lt/en</p>
INECOM	<p>Infrastructure for Ecological Metabolomics (INECOM). This is a new distributed RI that aims at developing and applying innovative and ecologically relevant methodologies for studies of information transfer processes between organisms, allelopathic, antipredation, antifouling, antimicrobial, communication and other functions of secondary metabolites. The aim is to reveal their diversity and to better understand environmental factors that are able either to trigger increased emission of these compounds or to suppress their production. For a holistic approach in ecosystem research, the investigators will network with the aim to exchange and integrate information on metabolites and their effect in terms of structure, function, organism community and trophic level. The samples for chemical and biological analyses will be exchanged among the network members to achieve inter-calibration of the methods applied.</p> <p>More information: Participating institutions:</p> <p>» Nature Research Centre : http://www.gamtostyrimai.lt/en/reservations</p> <p>» Klaipėda University Coastal Research and Planning Institute : http://corpi.lt/en/</p>





D. SCANDINAVIA

(FINLAND, NORWAY AND SWEDEN)





FINLAND

3 BES-RIs identified

Table 16. Main Finnish BES-RIs classified according to the typology used by BiodivERsA.

		SERVICE TOWARDS WHICH THE RI IS ORIENTED												
Organism level	Biome	RIs in support to taxonomy, natural history, organisms characterisation				RIs for the management of genetic resources		RIs for in situ biodiversity research			RIs providing generic support to field work and campaigns (incl. search); ex. vessels & generic platforms			
		Management of collections and of taxonomic information	Database of functional traits of organisms	Database of distribution of organisms			Past biodiversity dynamics (paleo)	Current and future biodiversity dynamics (incl. global change drivers)	Biodiversity and ecosystem functioning / services	RIs with focus on Protected, Endangered, Invasive, Alien species				
Organism level	Animals	FinBIF	FinBIF	FinBIF	FinBIF									
	Plants / Algae	FinBIF		FinBIF	FinBIF									
	Fungi	FinBIF	FinBIF	FinBIF	FinBIF									
	Microorganisms	FinBIF	FinBIF	FinBIF	FinBIF									
	Terrestrial	Forests	FinBIF	FinBIF	FinBIF	FinBIF								
		Grasslands	FinBIF	FinBIF	FinBIF	FinBIF								
		Croplands	FinBIF	FinBIF	FinBIF	FinBIF								
		(Peri)urban areas												
		Other (specify)												
	Ecosystem to region level	Coastal areas			FinMARI	FinMARI				FinMARI		FinMARI		FinMARI
Open water					FinMARI				FinMARI		FinMARI		FinMARI	
Deep sea														
Other (specify)														
Lakes		FinBIF	FinBIF	FinBIF	FinBIF									
Freshwater & wetlands	Rivers & streams	FinBIF	FinBIF	FinBIF	FinBIF									
	Wetlands	FinBIF	FinBIF	FinBIF	FinBIF									
	Other													
Specific biomes	Arctic			FinMARI	FinMARI				FinMARI		FinMARI		FinMARI	
	Antarctic													
	Boreal	FinBIF	FinBIF	FinBIF	FinBIF									
	Tropical & sub-tropical													
	Other (specify)													

FINLAND

3 BES-RIs identified so far.

Name of the organisation	Short description & Link
FinBIF	<p>Finnish Biodiversity Information Facility (FinBIF). This is a national data centre for biodiversity information. It was set up by the Finnish Museum of Natural History (LUOMUS). FinBIF is a national service supporting species-related research, management, teaching, and life-long learning. It collects, archives, and distributes Finnish electronic datasets on biodiversity and provides visualisation and analysis tools in one single portal. FinBIF promotes open science and effective use of data by society at large, as well as data quality control, descriptions, and accumulation.</p> <p>More information: https://laji.fi/en</p>
FINMARI	<p>Finnish Marine Research Infrastructure (FINMARI). This is an infrastructure network that combines all major components of the Finnish marine research community. That infrastructure network includes field stations, research vessels and multi-purpose icebreakers, laboratory facilities, ferry boxes, fixed measurement platforms and buoys. FINMARI allies research infrastructure of 4 Finnish research institutes, 3 universities, and a state-owned shipping company. The infrastructure development plan is based on addressing the multi-scale variability of the marine environment through synergetic integration of the research foci of the partnership. FINMARI provides a unique contact point and access channel to all major Finnish marine research facilities.</p> <p>More information: https://www.finmari-infrastructure.fi/</p>
NaPPI	<p>National plant phenotyping infrastructure (NaPPI). This is a high-throughput plant phenotyping unit, imaging equipment, data management, greenhouse facilities and growth chambers (University of Helsinki) and a spectral imaging laboratory (University of Eastern Finland). It focuses on basic and translational plant research, plant breeding and plant production. Among other activities, the infrastructure enables the analysis of live plant material using high-throughput methods, data collection on plant growth, development, biomass, bioenergy and environmental responses. NaPPI combines the latest advances in plant genomics and molecular biology in translational research on plants. By improving plant productivity, food and basic raw materials can be produced in an ecological sustainable manner for the growing human population.</p> <p>More information: https://www.helsinki.fi/en/infrastructures/national-plant-phenotyping</p>



NORWAY

9 BES-RIs identified

Table 17. Main Norwegian BES-RIs classified according to the typology used by BiodivERsA.

		SERVICE TOWARDS WHICH THE RI IS ORIENTED										
Organism level	Organism level	RIs in support to taxonomy, natural history, organisms characterisation				RIs for the management of and research on genetic resources	RIs for in situ biodiversity research			RIs providing generic support to field work and campaigns (incl. search); ex. vessels & generic platforms		
		Management of collections and of taxonomic information	Database of functional traits of organisms	Database of distribution of organisms	Past biodiversity dynamics (paleo)		Current and future biodiversity dynamics (incl. global change drivers)	Biodiversity and ecosystem functioning / services	RIs with focus on Protected, Endangered, Invasive, Alien species			
	Animals	NBIC, NorBOL		NBIC	NorBOL			COAT, SIOS				
	Plants / Algae	NBIC, NorBOL		NBIC	NorBOL			COAT, SIOS				
	Fungi	NBIC		NBIC				SIOS				
	Microorganisms	NBIC		NBIC								
Ecosystem to region level	Terrestrial	COAT, NBIC		COAT, NBIC				COAT				COAT
	Forests	NBIC		NBIC								
	Grasslands	NBIC		NBIC								
	Croplands	NBIC		NBIC								
	(Peri)urban areas	NBIC		NBIC								
	Other (tundra)	COAT		COAT				COAT				COAT
	Coastal areas							Arctic ABC, NRV, NMD, SIOS	Arctic ABC, NRV, NMD SIOS			Arctic ABC, NMD, NRV
	Open water							Arctic ABC, NMD, NORMAR, NRV, SIOS	Arctic ABC, NMD, NORMAR, NRV, SIOS			Arctic ABC, NMD, NORMAR, NRV
	Deep sea							Arctic ABC, NMD, NORMAR, NRV				Arctic ABC, NMD, NORMAR, NRV
	Other (specify)											
Freshwater & wetlands	Lakes	NBIC		NBIC				SIOS				
	Rivers & streams	NBIC		NBIC				SIOS				
	Wetlands	NBIC		NBIC				SIOS				
	Other											
Specific biomes	Arctic	COAT, NBIC		COAT, NBIC				Arctic ABC, COAT, NRV Lance, SIOS	Arctic ABC, COAT, NRV Lance, SIOS			Arctic ABC, NRV Lance, SIOS
	Antarctic											
	Boreal											
	Tropical & sub-tropical											
	Other (specify)											

NORWAY

9 BES-RIs identified so far.

To be noticed: the Norwegian Biodiversity Information Centre, NBIC, is a national source of information on biodiversity which main function is to supply updated and accessible information on Norwegian species and ecosystems.

Name of the organisation	Short description & Link
Arctic ABC	<p>Arctic Ocean Ecosystems (Arctic ABC). This is a program that will design innovative autonomous drifting observatories to be deployed in Arctic ice-covered waters. Applied Technology, Biological interactions and Consequences in an Era of Abrupt Climate Change: ArcticABC will focus on providing essential new insight into a hitherto poorly known system, and to develop realistic projections relevant for ecosystem services and geopolitical consequences under circumstances of reduced ice cover. Virtually nothing is known about the overwintering strategies of key species in the Arctic Ocean, and their dependence on sea ice during the polar night and winter period, and predictions of their future under a decreasing ice-cover are frequently contradictory. Important gaps in knowledge include (i) the extent of dependence on sea ice for one of the most important species in the Arctic food chain - polar cod (<i>Boreogadus saida</i>), (ii) life-history traits and seeding processes of the flora and fauna assumed to be obligatory ice associates, and (iii) the existence and magnitude of the biological carbon pump in ice covered waters responsible for sequestration of organic carbon and atmospheric CO₂ to the deep ocean. Arctic ABC will fill these knowledge gaps by developing a new autonomous observational platform that is to be deployed in the Arctic drift ice. This will for the first time allow real-time monitoring of the succession of ice associated communities in the Arctic Ocean during the polar night and winter-spring transition. By combining this novel approach with the well documented drift patterns of the Arctic pack ice and ocean circulation within the Arctic Ocean, we will utilize state-of-the-art modelling tools to provide much needed projections as to how climate-induced changes at the base of the food chain are likely to propagate through the Arctic ecosystem.</p> <p>» More information: http://www.mare-incognitum.no/index.php/arcticabc</p>
COAT	<p>Klimaøkologisk Observasjonssystem for Arktisk Tundra (COAT). This is a long-term, ecosystem-based and adaptive observation system. It aims to unravel how climate change impacts arctic tundra food webs, and to enable prudent science-based management. The baseline of the approach is conceptual models. These models guide the monitoring design that may include management actions. They also guide the structure of statistical models that estimate impacts and derive predictions based on the monitoring data (Figure 1). The approach accommodates three adaptive loops driven by (1) new knowledge, (2) needs of stakeholders and (3) new technologies/methods.</p> <p>» More information: www.coat.no</p>
NBIC	<p>Norwegian Biodiversity Information Centre (NBIC). This is a centre which goal is to serve as a national source of information on species and ecosystems in Norway, and to make up-to-date information on biodiversity widely available and easily accessible to the society. NBIC focuses on knowledge, both by increasing the level of knowledge, and making it available. Our role as a National source for biodiversity knowledge requires a comprehensive interaction with the scientific community, and close cooperation with policymakers, managers and other data users.</p> <p>» More information: http://www.biodiversity.no/</p>
NMD	<p>Norwegian Marine Data Centre (NMD) (formerly Norwegian Oceanographic Data Centre). This is a data centre hosted by the Institute of Marine Research (IMR). It is Norway's national oceanographic data centre within the Intergovernmental Oceanographic Commission's network, and acts as Norway's focal point for international oceanographic data exchange. Some data held in these bases are of restricted availability.</p> <p>» More information: http://seadatanet.maris2.nl/v_edmo/print.asp?n_code=612</p>

Name of the organisation	Short description & Link
NorBOL	<p>Norwegian Barcode of Life (NorBOL). This is a network of Norwegian biodiversity institutions and individual scientists engaged in DNA barcoding of the fauna and flora of Norway. NorBOL assembles a comprehensive library of standardised DNA sequences (DNA barcodes) as a reference resource for research and management of biodiversity in Norway. DNA barcodes are linked to voucher specimens in scientific collections (museums) and deposited in a public, open-access database (BOLD).</p> <p>More information:</p> <ul style="list-style-type: none"> » NorBOL: http://www.norbol.org/en/ » BOLD DNA Data System: https://www.boldsystems.org
NORMAR	<p>Norwegian Marine Robotics Facility (NORMAR). This is a databank. Remotely operated underwater vehicles are important platforms for today comprehensive marine research. The technology is urgently needed for the Norwegian marine science community to effectively address the challenges of marine research.</p> <ul style="list-style-type: none"> » Main information: https://www.forskningsradet.no/prosjektbanken/#!/project/226126/no
NRV	<p>Norwegian Research Vessels (NRV). This are vessels dedicated to researches in the ocean. Norway has many research vessels for marine exploration, mainly based in Bergen (http://www.imr.no/om_havforskningsinstituttet/fasiliteter/fartoy/en), Tromsø (http://www.npolar.no/en/about-us/stations-vessels/lance/) and Oslo.</p> <p>More information:</p> <ul style="list-style-type: none"> » http://www.mn.uio.no/ibv/english/research/about/infrastructure/vessels/ » https://www.cmre.nato.int/research/research-vessels/nrv-alliance/57-centre-information/research
SIOS	<p>Svalbard Integrated Earth Observing System (SIOS). This is an international infrastructure project. There are 26 partners from Europe and Asia involved. The essential objective is to establish better coordinated services for the International Research community with respect to access, data and knowledge management, logistics and training. COAT (above) is the terrestrial part of the SIOS observational system. SIOS links the observations done by COAT with the other observational systems on Svalbard, in the SIOS Data Management System that addresses Earth System Science (ESS) in the following environments: atmosphere, cryosphere, terrestrial (soil moisture/water content), oceans.</p> <ul style="list-style-type: none"> » More information: https://sios-svalbard.org/ObservingSystem
Troll	<p>The Norwegian Research Station in Antarctica (Troll). This is a research station in Antarctica that is the base and starting point for biological, glaciological and geological field work during the summer season, and is a full-year base for continuous, long-term monitoring series in meteorology, radiation, atmosphere, upper atmosphere, environmental toxins and seismology.</p> <ul style="list-style-type: none"> » More information: https://www.npolar.no/en/troll/#toggle-id-3



SWEDEN

5 BES-RIs identified

Table 18. Main Swedish BES-RIs classified according to the typology used by BiodivERsA.

		SERVICE TOWARDS WHICH THE RI IS ORIENTED									
		RIs in support to taxonomy, natural history, organisms characterisation			RIs for the management of genetic resources		RIs for in situ biodiversity research			RIs providing generic support to field work and campaigns (incl. for biodiversity research); ex. vessels & generic platforms	
		Management of collections and of taxonomic information	Database of functional traits of organisms	Database of distribution of organisms	RIs for the management of genetic resources		Past biodiversity dynamics (paleo)	Current and future biodiversity dynamics (incl. global change drivers)	Biodiversity and ecosystem functioning / services	RIs with focus on Protected, Endangered, Invasive, Alien species	
Organism level	Animals	Artprojektet, ArbDatabanken, Dyntaxa	SWE-NPN		Artportalen, SWE-NPN						Artportalen, SWE-NPN
	Plants / Algae	Artprojektet, ArbDatabanken, Dyntaxa	SWE-NPN		Artportalen, SWE-NPN						Artportalen, SWE-NPN
	Fungi	Artprojektet, ArbDatabanken, Dyntaxa	SWE-NPN		Artportalen, SWE-NPN						Artportalen, SWE-NPN
	Microorganisms	Dyntaxa									
Ecosystem to region level	Terrestrial	Forests									
		Grasslands									
		Croplands									
		(Peri)urban areas									
		Other (specify)									
	Marine	Coastal areas									
		Open water									
		Deep sea									
		Other (specify)									
		Lakes									
		Rivers & streams									
		Wetlands									
		Other									
Specific biomes		Arctic									
		Antarctic									
		Boreal									
		Tropical & sub-tropical									
		Other (specify)									

SWEDEN

5 BES-RIs identified so far.

To be noticed: the Swedish Research Council supports a number of national and international infrastructures aimed at providing researchers with the facilities for carrying out research of the highest quality within all subject areas. The common feature of the infrastructures is that they are, or will be, freely accessible for use by researchers from all seats of learning (following peer review of applications).

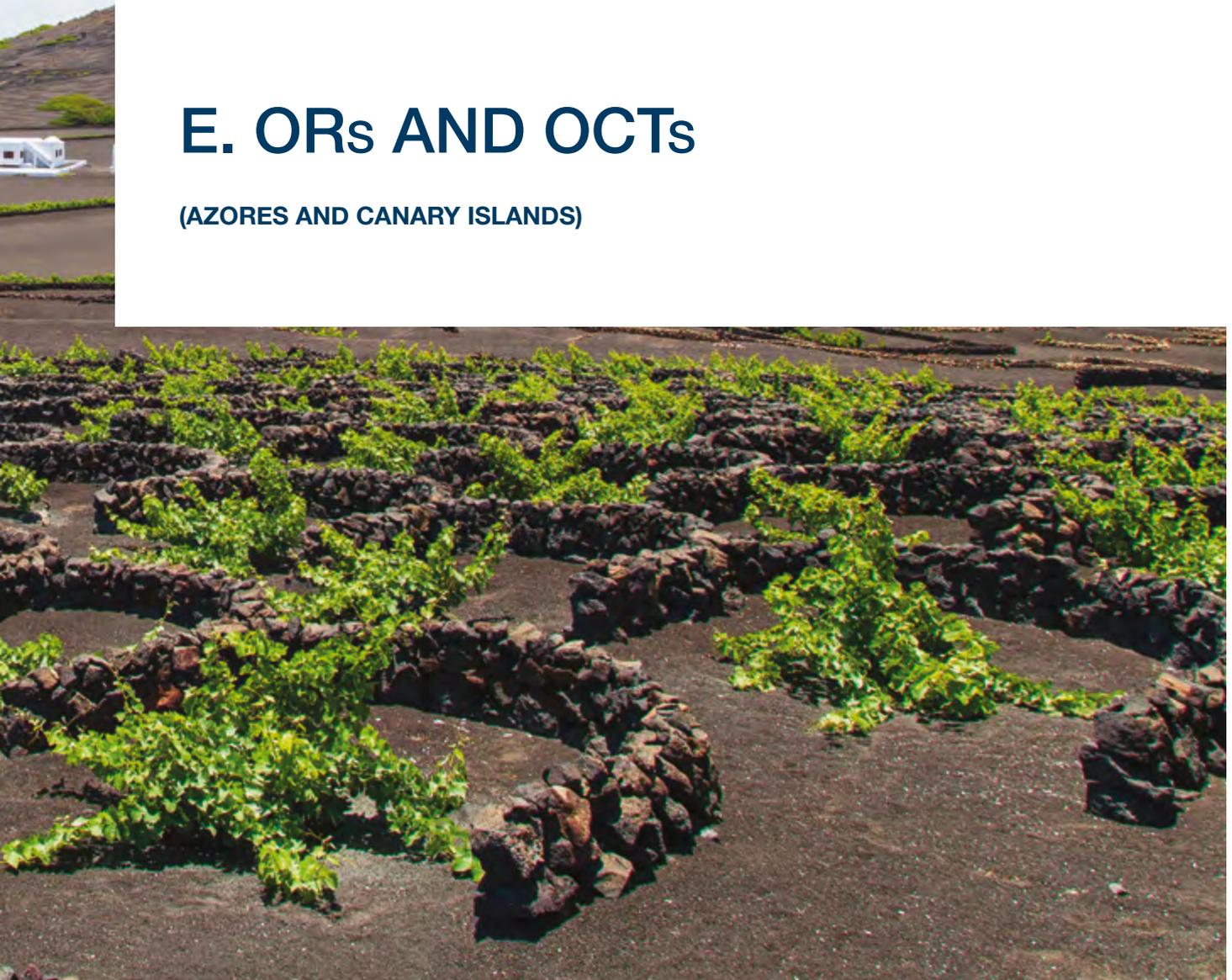
Name of the organisation	Short description & Link
ArtDatabanken	<p>Swedish Species Information Centre (ArtDatabanken). This is a centre that accumulates, analyses and disseminates information concerning the species and habitats occurring in Sweden. This is one of the Swedish University of Agricultural Sciences formal collaborative centres.</p> <p>» More information: https://www.artdatabanken.se/en/</p>
Artportalen	<p>Art Portal (Artportalen). This is a website for observations of the plants, animals and fungi. Art Portal is an important tool for professional as well as non-profit, conservation and a unique source of knowledge which leads to targeted conservation efforts and which in the future can help us to see trends in order to prevent environmental and climate problems. Art Portal is developed and driven by the Species database at the Swedish University of agricultural sciences jointly with Norwegian Arts database, on behalf of the environmental protection agency and Miljödirektoratet.</p> <p>» More information: https://www.artportalen.se</p>
Artprojektet	<p>Swedish Taxonomy Initiative (Artprojektet). This is in 2002 that the Swedish Species Information Centre (SSIC) was commissioned by the Swedish Parliament to identify all species of multicellular plants, fungi and animals in the country and to make the information available to scientists, conservationists and the public.</p> <p>» More information: https://www.artdatabanken.se/en/the-swedish-taxonomy-initiative/</p>
Dyntaxa	<p>Swedish Taxonomy Database (Dyntaxa). This is a taxonomic database of all multi-cellular organisms naturally occurring in Sweden. Use Dyntaxa to search for information about common names, scientific names, classification and other taxonomic information. Dyntaxa is a service provided by ArtDatabanken (the Swedish Species Information Centre) and the content is continually updated with the help of taxonomic expertise.</p> <p>» More information: https://www.slu.se/en/collaborative-centres-and-projects/dyntaxa/</p>
SWE-NPN	<p>Swedish National Phenology Network (SWE-NPN). This is a collaboration between universities, governmental agencies, and volunteers. The main goal is to collect, store and provide long-term environmental assessment data on nature's calendar. Professional observers and citizen scientists submit their observations through the web application naturenskalender.se. The Swedish University of Agricultural Sciences is the acting host for SWE-NPN.</p> <p>» More information: https://www.slu.se/en/collaborative-centres-and-projects/swedish-national-phenology-network/</p>





E. ORs AND OCTs

(AZORES AND CANARY ISLANDS)



AZORES

7 BES-RIs identified

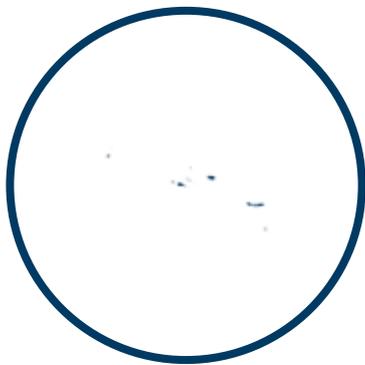


Table 19. Main Azorian BES-RIs classified according to the typology used by BiodivERSA.

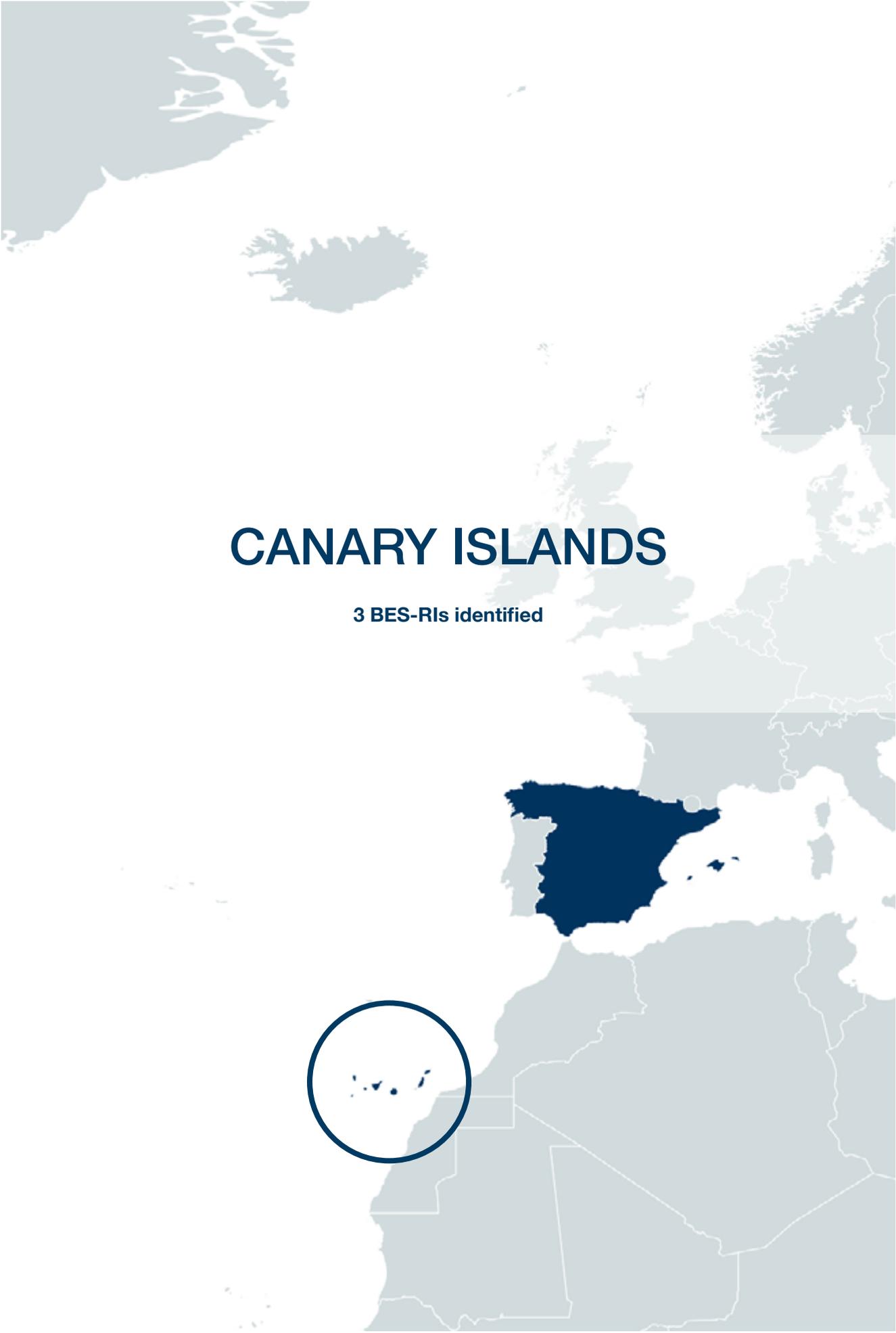
		SERVICE TOWARDS WHICH THE RI IS ORIENTED										
Organism level	Ecosystem to region level	RIs in support to taxonomy, natural history, organisms characterisation			RIs for the management of genetic resources			RIs for in situ biodiversity research			RIs providing generic support to field work and campaigns (incl. for biodiversity research); ex. vessels & generic platforms	
		Management of collections and of taxonomic information	Database of functional traits of organisms	Database of distribution of organisms	Past biodiversity dynamics (paleo)	Current and future biodiversity dynamics (incl. global change drivers)	Biodiversity and ecosystem functioning / services	RIs with focus on Protected, Endangered, Invasive, Alien species				
Animals		EDTB		BALA, ISLANDBIODIV, EDEN, MONICET, AZ, BIOPORTAL								
Plants / Algae		AVH: AZU-C and AZU-P, AZB/DB-Uac	BRYOTRAIT-AZO	AZ, BIOPORTAL & ATLANTIS DATA-BASE, ISLANDBIODIV, MOVECLIM						ISLANDBIODIV, MOVECLIM	ISLANDBIODIV	
Fungi				AZ, BIOPORTAL & ATLANTIS DATA-BASE								
Microorganisms												
Terrestrial	Forests			AZ, BIOPORTAL & ATLANTIS DATA-BASE						BALA, EDEN, ISLANDBIODIV, MOVECLIM	BALA, EDEN, ISLANDBIODIV, MONICET	
	Grasslands											
	Croplands											
	(Peri)urban areas											
	Other (specify)											
	Coastal areas											
Marine	Open water			MONICET								
	Deep sea			MONICET								
	Other (specify)			MONICET								
	Lakes											
Freshwater & wetlands	Rivers & streams											
	Wetlands											
	Other											
Specific biomes	Arctic											
	Antarctic											
	Boreal											
	Tropical & sub-tropical		BRYOTRAIT-AZO	AZ, BIOPORTAL & ATLANTIS DATA-BASE, MONICET						BALA, EDEN, ISLANDBIODIV, MONICET, MOVECLIM	BALA, EDEN, ISLANDBIODIV, MONICET, MOVECLIM	
	Other (specify)											

AZORES

7 BES-RIs identified so far.

Name of the organisation	Short description & Link
AVH	<p>Azores Virtual Herbarium (AVH). This is a resource for biologists, biogeographers and conservationists and provides details of herbarium specimens of plants endemic to the Azores.</p> <p>* The Cryptogamic Section of AZU Herbarium (AZU-C) contains a broad range of organisms including mosses, liverworts, hornworts, lichens, and fungi, with an estimated 13,000 specimens. Most of these come from the Azores and were collected from 1990. This collection is an important resource for biological studies, such as systematics, diversity and conservation, biological monitoring, climate change and ecology. It is a resource for academics, students, government, private organizations, and the public.</p> <p>* The Phanerogamic (Spermatophytes) Section of AZU Herbarium (AZU-P) contains around 5,000 specimens of the Azorean flora, from 144 families, including almost all native taxa of the Azores. Additionally, we have also a collection of Portugal's mainland flora with 1,800 specimens. This Herbarium is an important resource for biological, ecological and conservation studies and an important source of information for scientists, students, public and private organisations, and the general public.</p> <p>» More information: https://herbaria.plants.ox.ac.uk/bol/azoresvirtualherbarium/</p>
AZ_BIOPORTAL & ATLANTIS DATABASE	<p>Azorean Biodiversity Portal (AZ-BIOPORTAL). This is a unique resource for fundamental research in systematics, biodiversity, education and conservation management in the Azores (Portugal). It also provides an original platform for biogeographical and macroecological research on islands.</p> <p>The species database (ATLANTIS) is comprised of spatial grid-based (500×500 m) presence-absence information for ca. 5000 species, drawing on a thorough literature survey (dating back to the 19th Century) as well as on unpublished records from recent intensive field surveys in the Azores. Many species are also accompanied by images from collections and/or live specimen.</p> <p>» More information: http://azoresbiportal.uac.pt/</p>
BALA, EDEN & ISLANDBIODIV	<p>Long-Term Ecological Research Plots in several Azorean Islands used to monitor arthropods (BALA, EDEN & ISLANDBIODIV plots). This database is divided into three branches.</p> <p>* The Biodiversity of Arthropods of the Laurisilva of the Azores (BALA). This is a database that employs an extensive standardised sampling protocol in most of the native forest cover of the archipelago in 1999 and 2004 and 2010-2011. A total of 6,770 samples from 100 sites distributed amongst 18 fragments on seven islands were collected, resulting in almost 140,000 specimens captured. Overall, 452 arthropod species were recorded. This is a unique standardised biodiversity database.</p> <p>* Profiling Reliable Organisms as BIOindicators (EDEN). This is a database with dataset of Azorean Habitats that discriminates the arthropod biodiversity, at all strata (i.e, soil, litter, herbaceous & arborescent), within eight habitat typologies of the Azores, across five islands (from pristine forests to increasingly anthropogenic influenced herbaceous and arboreal habitats). The current dataset of 1,200 species and circa 150,000 individuals is linked with climatic, geographic, topographic and ecological variables for each specimen, site and voucher collection.</p> <p>* Understanding biodiversity dynamics in tropical and subtropical islands as an aid to science-based conservation action (ISLANDBIODIV). This project (2012-2015) employed an extensive standardised sampling protocol (COBRA) in ten plots 50x50 m in the Native forest of Terceira island. Overall, 59 beetles and spider species were recorded using several sampling techniques totalling 8,101 specimens.</p> <p>More information:</p> <p>» BALA: http://islandlab.uac.pt/projectos/ver.php?id=65</p> <p>» EDEN: http://islandlab.uac.pt/projectos/ver.php?id=71</p> <p>» ISLANDBIODIV: http://islandlab.uac.pt/projectos/ver.php?id=67</p>

Name of the organisation	Short description & Link
BRYOTRAIT-AZO	<p>BRYOTRAIT-AZO. This is a comprehensive trait dataset for the Azorean bryoflora that gathers all the published taxonomical, distributional and morphological data for the archipelago's 488 bryophyte taxa.</p> <p>» More information: http://islandlab.uac.pt/software/ver.php?id=26</p>
EDTB	<p>Insect Collection, Entomoteca Dalberto Teixeira Pombo (EDTB). This is the most complete collection of Arthropod in the Azores. It includes four main collections: A) a dry collection of beetle species; B) a collection of spider species in preserved ethanol; C) a collection of Hymenoptera preserved in ethanol; D) a reference collection of all arthropods collected during the Project BALA - specimens collected in seven islands from 1999 to 2011. It is currently the largest and most comprehensive scientific collection of Azorean biodiversity.</p> <p>» More information: http://parquesnaturais.azores.gov.pt/en/smaria-eng/what-visit/interpretation-centres</p>
MOVECLIM	<p>Long-term plots & database for bryophytes (MOVECLIM). This is a unique standardized biodiversity and ecological database for bryophytes, assembled using BRYOLAT sampling protocol in several Azorean Islands. Samples are collected in native vegetation, using an altitudinal gradient from 0 m to the top of the island, in 200 m altitudinal steps. Four islands have been surveyed, resulting in 2382 samples (Pico and Terceira -2012, Flores and São Miguel -2013).</p> <p>» More information: http://islandlab.uac.pt/projectos/ver.php?id=66</p>
MONICET	<p>MONICET. This is a platform bringing together observations made by whale watching companies as they go about their daily business of taking people to see those magnificent and intriguing creatures. While catering for a pleasant experience for their clients, skippers and guides note the species observed, count the animals, and record their position. They also take pictures of particular features of the animals, such as the fluke of a diving sperm whale. On land this information is uploaded to a dedicated online database. The MONICET platform converts the raw data provided by the committed participating companies into valuable information for the public, for the companies themselves and for scientists. On this site you can look at the patterns of species distribution, see how their numbers change in time, and investigate the movements of individual animals through photo-identification.</p> <p>» More information: http://www.monicet.net/en</p>



CANARY ISLANDS

3 BES-RIs identified

CANARY ISLANDS

3 BES-RIs identified so far.

Name of the organisation	Short description & Link
BEA	<p>Spanish Bank of Algae (BEA-Banco Español de Algas). This is a service of the Scientific and Technological Park Foundation of the University of Las Palmas de Gran Canaria (ULPGC), which objectives are the isolation, identification, characterisation, conservation and provisioning of microalgae and cyanobacteria. In addition, the Spanish Bank of Algae functions as a service facilitating the development of a new bio industrial sector based on the cultivation and application of microalgae and cyanobacteria.</p> <p>» More information: https://marinebiotechnology.org/en/</p>
JBVC	<p>Canarian Botanical Garden “Viera y Clavijo” (JBVC). This is an Associated Unit of CSIC and the centre is dedicated to the conservation and management of the terrestrial Canary Islands flora through three big areas of intervention: research, environmental education including dissemination, and the maintenance and exhibition of live collections of terrestrial plants, which are mainly endemic from the Canary Islands and Macaronesia (Canary Islands, Madeira, Azores, and Cape Verde), as well as from other world zones having floristic connections with Canaries. It is also part of Botanical Gardens Conservation International.</p> <p>» More information: http://www.jardincanario.org (in Spanish)</p> <p>» http://www.jardincanario.org/busqueda-de-la-flora-de-gran-canaria</p>
PLOCAN	<p>Oceanic Platform of the Canary Islands (PLOCAN). This is a general marine science and technology mobilisation initiative that seeks to obtain the international socioeconomic business competitiveness derived from access to the oceanic space, offers land-based and sea-based novel facilities to promote long-term observation and sustainability of the ocean, providing a cost-effective combination of services. PLOCAN is able to provide access and multidisciplinary logistic support through its onshore facility and two marine test sites (Taliarte harbor and offshore). The facility and test sites are located in the North-East coast of Gran Canaria Island, and the platform is integrated in the offshore test site. This includes a multidisciplinary observatory contributing to the monitoring and modelling of coastal, regional and global ocean phenomena and ecosystems at increasing geographical scales, from shallow waters to great ocean depths.</p> <p>» More information: http://www.plocan.eu/index.php/en/</p>





V. CONCLUDING REMARKS



There are important challenges to reinforce the consistency and efficiency of biodiversity research infrastructures in Europe, including the heterogeneity of the community's requirements and of, its data resources and tools; the gap between current practice and future vision; and the scale of implementation of a pan-European infrastructure.

To develop policies on priority areas, particular attention should be paid to:

- » Effective communication among policy makers, scientists, practitioners and the general public;
- » Wide agreement on metadata standards for data collection and processing;
- » The application of common protocols and agreed standards for the construction of and access to biodiversity-related databases;
- » Confidentiality issues, legal aspects and IPR of data, and protocols for data access and use;

ACCESSIBILITY OF BIODIVERSITY RIs IN EUROPE

While some successful groups or institutes have expanded their equipment to attract collaborations and guests up to a point where the facility can offer access or service for the scientific community at large, there have been very few top-down, centrally organised and funded major research infrastructures (RIs) that emerged for biodiversity in Europe. Large facilities with international visibility rarely emerge from bottom-up initiatives, and thus require strategic planning and political will. Top-down establishment of RIs improves organisational aspects such as management or access policies. Yet, although the efficient use of resources can be a potential benefit, the centralised organisation and administration of such RIs bring also the risk of bureaucracy and lack of flexibility. Management of access and operation becomes then an important issue and the financial investment requires to take care of shared use and scientific output. The

- » Digitisation and validation of existing data, including taxonomic synonyms and georeferencing of observations and specimens;
- » Automated artificial intelligence data parsing techniques for digitised versions of non-electronic data sources such as publications, field notes, catalogue cards and photographs.

The establishment of virtual research environments should be further supported, including data retrieval possibilities e.g. as offered by GBIF, but also for large scale and/or remote data analysis for the researchers (e.g. services offered by synthesis research centres, such as CESAB²³, sDiv, etc.). These research environments should be easy to use, accessible and available in open access. Researchers do need possibilities for large scale modelling processes and for processing big data sets to serve future needs.

EC, mainly in the ESFRI framework, is using structural funds for creating new research facilities with a management scheme able to handle the complexity and sophistication of new equipment.

At national level an important issue is access to RI, which is sometimes limited to national scientists and even sometimes to only part of the national community. In addition, the use of national biodiversity RIs by international research groups is sometimes difficult due to the disparity of management bodies and access proceedings, and the lack of coordination among them. In the end, these obstacles result in complicating the access to facilities, weakening the efforts of joint programming, and contributing in some cases to the low visibility of the existing facilities. There are however examples of success, such as the ICTS (Instalación Científica Técnica Singular) in Spain.

23. CESAB: <https://www.fondationbiodiversite.fr/en/about-the-foundation/le-cesab/>

In some cases, RIs are open to the international community provided that the projects PIs or co-PIs are nationals. This is the case in the French CESAB, where half of researchers involved in funded projects are not French.

In order to overcome these problems, the linking of biodiversity infrastructures with one single entry point for users and providers could be a mean to allow a friendlier use of the facilities and additionally a full panoramic perspective of the RIs landscape.

This linking could be enabled in a first step as an

e-application with informative purposes only. Its development, though, into an effective European scale mechanism that would allow joint programming and use of transnational biodiversity RIs would require a great institutional networking effort.

Besides, existing RIs could sometimes significantly improve their communication, for example by means of brochures or webpage summarising main features for each relevant infrastructure, and detailing access rules while promoting easy and quick access.

EFFECTIVE WAYS TO BETTER INTEGRATE RELEVANT INFRASTRUCTURES INTO THE BIODIVERSA FRAMEWORK

BiodivERsA recommendations and planned activities to better integrate relevant infrastructures into the BiodivERsA framework (and, beyond, into the framework of the future European Biodiversity Partnership) are the following:

- i. On the short term, BiodivERsA could **provide on its website the list of existing BES-RIs** with active links to their websites. When launching joint calls, applicants could be encouraged to have a look at this list and to consider using these existing resources and tools.
- ii. On a medium term, BiodivERsA could **organise a workshop** specifically dedicated to the access to and use of BES-RIs. The present synthesis would help identifying key RIs to be invited. One aim would be to develop a coordinated approach with major RIs that exist, mainly

at the European/international scale (Lifewatch, Eu-Bon, GBIF, ANAEE, etc.) in order to identify possible added value between BiodivERsA and RIs and ways to interact.

- iii. BiodivERsA could **mobilise some RIs coordinators** in some forthcoming activities such as mapping exercises, etc. This should be assessed on a case by case basis.
- iv. BiodivERsA will continue to **complete and update the present synthesis of BES- RIs, in particular for national RIs**. To this end, collaborating with the MERIL project (Mapping of the European Research Infrastructure Landscape) and other horizontal RI coordination projects that have or are planning to develop new approaches to pan-European RI management would be useful.

ANNEX 1: GLOSSARY

ANAEE – Analysis and Experimentation on Ecosystems

BES-Ris – Research Infrastructure for biodiversity and ecosystem services

CReACTIVE-B – Coordination of Research e-Infrastructures Activities toward an International Virtual Environment for Biodiversity

CSA – Coordinated and Support Action

EC – European Commission

ESF – European Science Foundation

eLTER – European Long-Term Ecosystem Research

EMBRIC – European Marine Biological Research Infrastructure Cluster

EMPHASIS - European Infrastructure for Plant Phenotyping

EMSO - European Multidisciplinary Seafloor and water column Observatory

ERMS – European Register of Marine Species

EPPO – The European and Mediterranean Plant Protection Organisation

ERIC – European Research Infrastructure Consortia

ESFRI – European Strategy Forum on Research Infrastructures

Euro-Argo - European infrastructure for argo floats

EurOBIS – European Ocean Biogeographic Information System

ExpeER - Experimentation in Ecosystem Research

FIP - Freshwater Information Platform

FP7 – 7th Framework Programme for Research and Technological Development

GBIF – Global Biodiversity Information Facility

GLOBIS-B - GLOBal Infrastructures for Supporting Biodiversity research

H2020 – Horizon 2020, the 8th Framework Programmes for Research and Technological Development

ICOS - Integrated Carbon Observation System

INTERACT - International Network for Terrestrial Research and Monitoring in the Arctic

MERIL – Mapping of the European Research Infrastructure Landscape

MOFRI – Member Organisation Forum on Research Infrastructures

ORs & OCTs – Outermost Regions & Overseas Countries and Territories



Reading this brochure you will...

... learn more about what a research infrastructure for biodiversity and ecosystem services (BES-RI) is.

... discover case studies and a mapping of local BES-RIs for several EU countries and territories, including overseas.

... discover a mapping of the main existing BES-RIs at the global and European level.



... have an overview of the main barriers for the use of existing BES-RIS.

... learn more about how BiodivERsA could better integrate BES-RI in its programme.



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