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The ERA-NET promoting European research on biodiversity

BiodivERsA database

ANALYSIS OF THE COMPETITIVE FUNDING LANDSCAPE FOR RESEARCH ON BIODIVERSITY AND ECOSYSTEM SERVICES IN EUROPE

The BiodivERsA database: Analysis of the competitive funding landscape for research on biodiversity and ecosystem services in Europe

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CONTENTS

INTRODUCTION 6

A/ THE BIODIVERSA DATABASE 8

A1. History and architecture of the database 10

A2. Access and rights 11

A3. Search features 11

A4. Database content and completeness 12

B/ ANALYSIS OF THE COMPETITIVE FUNDING LANDSCAPE FOR BIODIVERSITY RESEARCH 16

B1. Methods 18

B2. Results 20

C/ CONCLUSION AND PERSPECTIVES 28

INTRODUCTION

Research on biodiversity and associated ecosystem services in Europe: a fragmented landscape

Biodiversity – the variety of living organisms, their habitats and their genes - on which so much of human life depends, is under pressure and its degradation is one of the world's most pressing crises. It is estimated that the current species extinction rate is between 100 and 10000 times higher than it would naturally be (IUCN, 2004) raising issues for the preservation of living forms on Earth and putting at risk the ecosystem services they provide to humanity. If this trend continues, we could reach tipping points where these vital services are no longer sufficiently delivered. Hence, there is a strong and urgent need for more research on biodiversity and associated ecosystem services to better identify and understand the opportunities and risks associated with biodiversity management. New knowledge has to be gained at all scales, from national to regional and global, with a major challenge to promote approaches that cross national borders and gather different disciplines and types of actors.

Biodiversity research can be promoted as such through devoted activities, but is often promoted through non-specific programmes. Indeed, biodiversity appears in various research themes such as sustainable management and use of natural resources, ecotoxicology and environmental health, ecological engineering and green economy, management of protected areas, and global change impacts: this is true in many research strategies and priorities both at the international (Balian, 2013) and national (Sodke et al., 2013) levels, and in most funding schemes. Since there is not a unique and delimited entrance to fund biodiversity research, the total amount of funding allocated to biodiversity projects can hardly be quantified, and it is challenging to profile the type of research funded and analyse complementarities between countries or funding programmes. This requires to first sort and gather information from a range of sources. Nice examples of such an exercise are given by Matei et al. (2011), analysing the funding of the "biodiversity" topic within the 7th Framework Programme (FP7) "Environment" theme; and Chaveriat et al. (2011) zooming in on the landscape of biodiversity research in France.

The BiodivERsA ERA-Net and its activities to map the research landscape in Europe

This context is of major importance for BiodivERsA, a tool part of the European Research Area Network (ERA-NET) scheme of the European Commission (EC). Now in its second four-year funding phase (2010-2014), BiodivERsA brings together a network of 21 funding organisations from 15 European countries that aims at building a dynamic platform for encouraging excellent and policy-relevant research on biodiversity and associated ecosystem services at pan-European scale. The BiodivERsA network is now launching annual calls for proposals on topics that correspond to the most pressing issues that biodiversity and ecosystem services currently face, with budgets of 8 to 10M per call. Every year, the network updates its research agenda based on existing national, European and international agendas, ensuring that the most relevant topics are prioritized. This shared agenda avoids duplications and inefficiencies resulting from a fragmented approach.

In order to support these mapping activities, BiodivERsA has developed and regularly updates a database holding information about :
funding programs and associated calls for research proposals for research on biodiversity and associated ecosystem services in Europe; this includes thematic programs devoted to biodiversity, thematic programs including biodiversity issues, and blue sky programs where biodiversity research applications are eligible ; grants, fellowships and studentships

are also referenced research projects on biodiversity and associated ecosystem services funded through these programmes research institutes and other organisations (including stakeholders) involved in the projects funded, and researchers leading the projects. Besides allowing the analysis of the funding landscape for biodiversity research, the profile of funded research and the possible complementarities of biodiversity research priorities among countries and agencies in Europe, this database will also help scientists to identify potential resources and network opportunities to further develop their research. In addition, it will help at finding scientific expertise for specific policy questions. As such, the BiodivERsA database can be considered a valuable tool for strategic cooperation and expertise in the large, fragmented domain of research on biodiversity and associated ecosystem services.

A database to analyse the landscape of biodiversity research funding in Europe

The main goal of this brochure is to present the BiodivERsA database, and its use to analyse selected features of the European funding landscape for biodiversity research. This database aims at including the different funding schemes that can fund biodiversity research projects. At the European level, these instruments include the Framework Programme for research and development, European Research Council (ERC) grants, LIFE+, the European regional development fund, the European agricultural fund for rural development, and ERA-nets (the latters can mix EC and national funding sources). Funding opportunities will likely emerge under, and together with Horizon 2020, the new EU framework programme for research and innovation. At the national scale, funding sources for biodiversity research are similarly variable, including programs specifically targeting biodiversity, thematic programs including biodiversity issues, blue sky programs and ERA-nets.

The database focuses on competitive allocation of funds to research only, either at national or European level, excluding e.g. funding by national institutes of the part of the scientific community they are in charge of, or schemes that fund research at a local level. Since obtaining extensive information on all the competitive funding sources in a given country is hardly reachable, we mainly focus on the funding derived from the Framework programme at the European scale, and on BiodivERsA's funding agencies at the national one; the latters represent major players within their corresponding country. Though this analysis does not allow for a complete between-country comparison, it can still elucidate some major trends in the funding of biodiversity research in Europe. The major objectives are to:

- underline the level of biodiversity funding encompassing a multitude of funding schemes
- analyse temporal funding trends for the period 2005-2011
- compare the level of biodiversity funding by national agencies versus the Framework programme (through several key schemes) at the European scale

We hope this mapping activity will help a large range of stakeholders (researchers, institutes, funding agencies and policy makers) in getting a more comprehensive view of biodiversity research funding in Europe.

A/ THE BIODIVERSA DATABASE

A/ THE BIODIVERSA DATABASE

A1. HISTORY AND ARCHITECTURE OF THE DATABASE

The database has been developed during the 2005-2010 period. In 2011, the BiodivERsA consortium decided to move all data to a new online tool available from the BiodivERsA website (http://data.biodiversa.org). As such, the database can enjoy continuous updates and hands-on support, and serves as a user-friendly tool for any research manager or scientist interested in biodiversity research.

The BiodivERsA database uses the Common European Research Information Format (CERIF) standard, sponsored by the European Commission to facilitate exchange between Research Information Systems. This CERIF structure is built with the following objects and corresponding links between them (Figure 1).

» **Funding Programme**

(Organizational grouping of research projects or activities with a common funding and steering mechanism; one funding programme may run over several years and hence consists of several annual calls)

» **Calls for research proposals**

» **Funding organisation**

(Public, private or charitable organisation funding research open to external competition at national or international scale)

» **Project**

(Network of funded units within or outside a research program which has defined goals, objectives and timeframe)

» **Research organisation (orgunit)**

(Universities, research institutes…)

» **Person**

(Project leaders and people involved in the project)

Funding organisation information includes:

» identifiers (name, acronym and identifi
» cation
» number)
» activity description
» an address (street, city, country)
» an email and url
» telephone number and fax

Funding programmes/ Call information includes:

» identifiers (name and identification number)
» a budget number
» a description
» a start and end date
» keywords
» a url

Project information includes

» identifiers (title, acronym and identification number)
» project budget
» project abstract
» a start and end date
» keywords
» a url

Research organisation (orgunit) information includes:

» identifiers (name, acronym and identification number)
» type of institute (research institute or university)
» main type of activity (funding or research)
» an address (street, city, country)
» an email and url
» telephone number and fax

People information includes:

» identifiers (first name, second name and identification number)
» an address (street, city, country)
» an email and url
» telephone number and fax

Data have been imported either in CERIF xml or Excel format. They have been supplied by the BiodivERsA funding agencies themselves, but were in some cases completed with information found on the agency's project database websites. Moreover, projects were carefully screened to check whether it could unambiguously be defined as projects on biodiversity and associated ecosystem services. Biodiversity is defined here according to the United Nations Convention on Biological Diversity, as "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems".

All the projects included in the database address biodiversity and associated ecosystem services: this means that they at least partly but significantly explicitly analyse and account for biological diversity; projects focusing on services without any link to biodiversity (e.g. a project focused on C fluxes and sequestration without any focus on e.g. the diversity of soil microorganisms, soil fauna, plants or ecosystems) are not selected. The retained information was always validated by the partners; as such, data quality remains their responsibility.

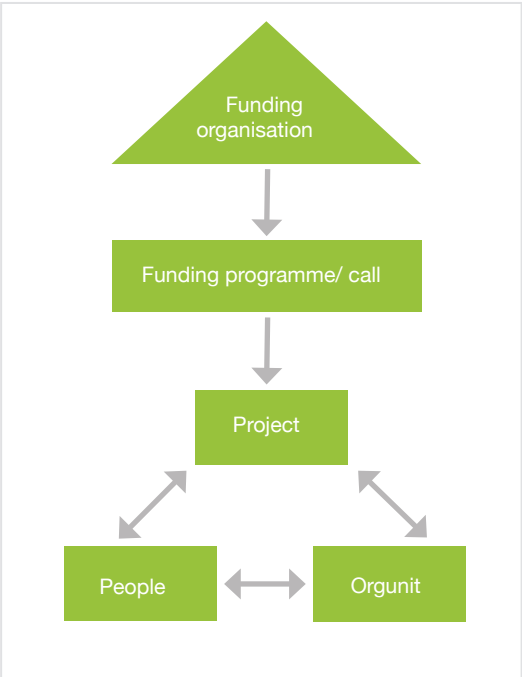


Figure 1
BiodivERsA database structure indicating the relationship between the CERIF objects

A2. ACCESS AND RIGHTS

Upon registration, information in the database is available to anyone interested in biodiversity research funding in Europe, though some sensitive data on people (email, telephone number, postal address) remain confidential. Consulting the database is free of charge, but users have to accept the Data Usage Agreement, which states in particular:

1. The BiodivERsA database (content and website), regardless of its informatics structure and host site, is own by the BiodivERsA consortium.
2. The BiodivERsA database is freely accessible to everyone; however, user registration is mandatory.
3. Data completeness and correctness are not guaranteed. Indications on possible gaps are provided on the database website, under Links (http://data.biodiversa.org/links)
4. Data quality is the responsability of BiodivERsA partners, i.e. the data sources.
5. The legal requirements for releasing the data are under the responsibility of the BiodivERsA partners.

A3. SEARCH FEATURES

The BiodivERsA database allows users to search for particular entities (funding programmes/calls, funding organisations, research organisations, projects, and people) and combinations of these, using keywords. In addition, searches can be narrowed, for instance to a specific country or source by referring to the funding agencies supplying the data (Figure 2-3)

A/ THE BIODIVERSA DATABASE

A4. DATABASE CONTENT AND COMPLETENESS

The BiodivERsA database presently includes 122 organisations that fund biodiversity research, 605 annual calls within 216 different funding programmes (including the biodiversity-relevant European FP6 and FP7 programmes, and BiodivERsA ERA-net calls), 6546 research projects, 2860 research organisations, and 5871 persons. Those data span the 2000-2014 time window, and currently cover 17 countries: Austria, Belgium, Bulgaria, Estonia, France, Germany, Hungary, Ireland, Italy, Lithuania, the Netherlands, Norway, Portugal, Spain, Sweden, Turkey, and the UK (see Table 1).

A few funding agencies accounted for are not part of BiodivERsA2; these include the Hungarian Scientific Research Fund (HSRF, Hungary), the National Innovation Office (NIO, Hungary), the Environmental Protection Agency (EPA, Ireland), Tübitak (Turkey), and the Italian Ministry of Education, University and Research (MIUR, Italy).

The highest numbers of funded projects on biodiversity referenced in the database are observed for UK (2655), Spain (1076), France (757) and Sweden (622), with data for UK and Sweden including the 2000-2002 period, and shorter periods for the two other countries.

The completeness of the database, as it stands now, can be assessed in terms of information about funding amounts for both the annual calls and the projects (Figure 4) and in term of information associated to projects (Figure 5). Budget numbers are presently given for 46% of the calls and 95% of the projects referenced (Figure 4). Completeness is above 75% for 7 countries for call funding information, and for 12 countries for project funding information.

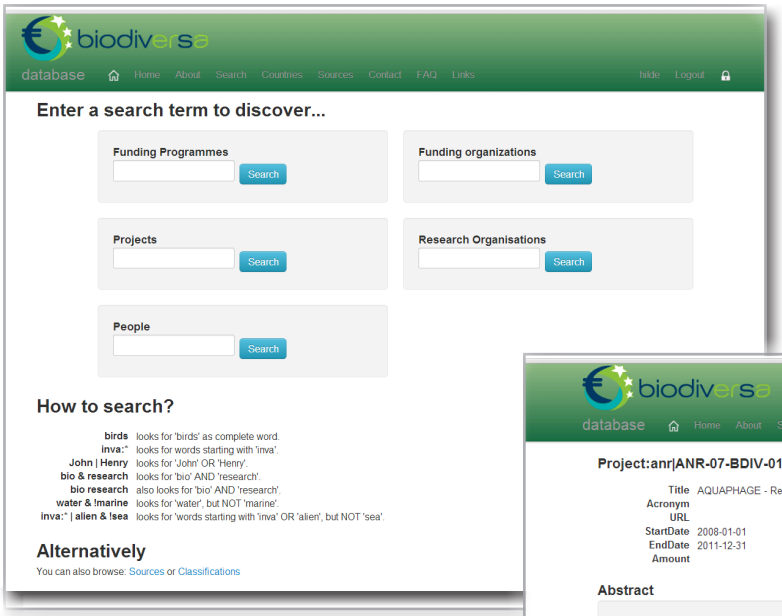


Figure 2
The BiodivERsA database has a user-friendly search engine and web navigation

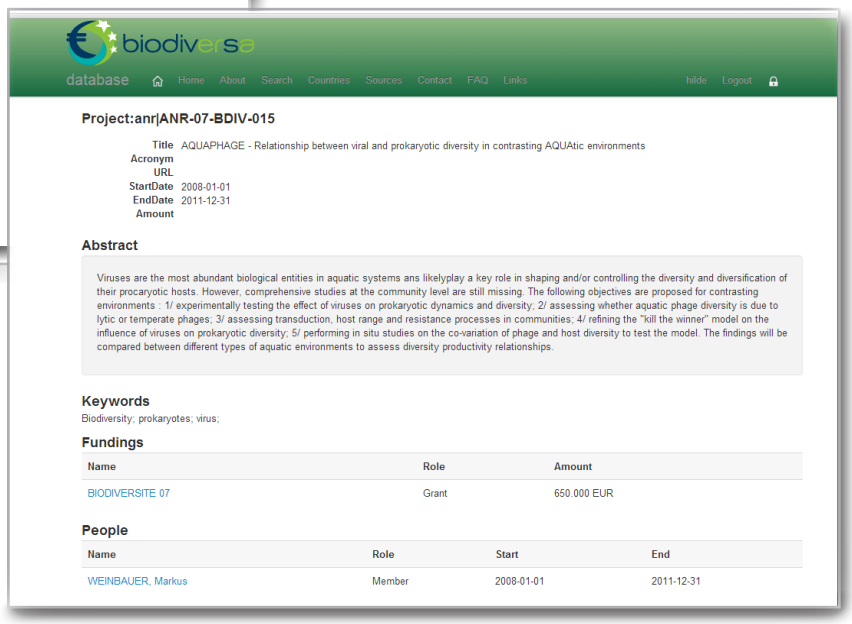


Figure 3
Example of the result of a search for a research project with associated information

	Calls (FP)	Projects	People	Orgunits	Time window
Austria (FWF)	17 (15)	81	60	58	2000-2012
Belgium (BELSPO)	38 (9)	119	242	120	2000-2012
Bulgaria (BNSF*)	22 (21)	54	53	22	2008-2011
Estonia (ETAG)	21 (7)	223	480	46	2003-2012
France (ANR, FRB, MEDDE)	54 (18)	757	189	124	ANR: 2005-2012 FRB: 2003-2012 MEDDE: 2009-2012
Germany (BMBF/PT-DLR*, DFG*)	38 (35)	6	8	10	Not speficied
Hungary (HSRF*, NIO*, VM*)	32 (10)	178	492	96	HSRF: 2003-2011 NIO: 2004-2008 VM: 2011-2013
Ireland (EPA*)	3 (3)	0	0	0	Not specified
Italy (MIUR*)	13 (13)	25	29	24	2005-2006
Lithuania (RCL)	2 (1)	14	14	7	2010-2014
Norway (RCN)	49 (7)	232	178	71	2000-2011
Portugal (FCT)	13 (6)	215	183	63	2002-2011
Spain (MINECO)	10 (2)	1076	696	83	2004-2011
Sweden (FORMAS, SEPA*)	20 (6)	622	677	294	FORMAS: 2000-2011 SEPA: 2001-2003
The Netherlands (NWO)	39 (15)	206	297	421	2000-2012
Turkey (MFAL, TÜBITAK*)	13 (2)	85	224	25	MFAL: 2004-2011 TUBITAK: 2006-2011
UK (DEFRA, NERC)	228 (56)	2655	1911	1149	DEFRA: 2006-2011 NERC: 2000-2011
European funding (EC)	15 (2)	82	0	58	FP***: 2003-2011
TOTAL unique entries**	605 (216)	6546	5871	2860	

* Agencies excluded from the budget analyses

** BiodivERsA calls and projects are shared among agencies, but are counted only once in this total number

*** Mainly the "Sustainable Development, Global Change and Ecosystems", "Support for coordination of activities" and "Policy Support" themes of the FP6, and the "Environment" and "Infrastructures" themes of the FP7.

Table 1

Information currently available in the database, with regard to the numbers of annual calls (number of different funding programmes, FP, is given between brackets; see Electronic Supplementary Material S1 for the full list), funded projects, people, research organisations (orgunits), and the general time window captured by funding data. Values are presented per country (funding agencies mentioned between brackets). Country values include pan-European schemes using national funds (ERA-nets) but exclude European funding coming from the European Commission, EC, which is listed as a separate entry.

A/ THE BIODIVERSA DATABASE

Project information is currently available for 83% of the calls. Abstract information can be considered fairly complete with no less than 88% of the projects holding an abstract (i.e. there are a few gaps in the entries of the Netherlands, Sweden and Bulgaria) and with just one country (Portugal) not providing this information due to privacy constraints. A significant part of the projects (80%) also holds contact details of the associated PIs and sometimes researchers, which illustrates the potential of the BiodivERsA database as an expert database. Similarly, a large part of the projects (88%) have associated research organisation information. Completeness is higher than 75% for 10 countries for project abstract, 14 countries for people information, and 12 countries for orgunit information.

The database already has a high-quality content, though it has not yet been completed by all BiodivERsA partners. In particular, data are incomplete for BMBF/PT-DLR and DGF (both Germany), BNSF (Bulgary), SEPA (Sweden), and VM (Hungary). The data from non-partner agencies captured in the BiodivERsA database also still have to be completed. Language issues sometimes also appear (e.g. FRB imports project summary either in English or French according to the language used for national programmes). The time window for which data are available also varies. For example, RCL (Lithuania) only started to fund research projects since 2009. Similarly, BNSF (Bulgaria) became an independent structure only since May 2008; before that date, national competition had been run from the Directorate of Scientific Research at the Ministry of Education and Science. In other cases, the time window has been constrained by CERIF export issues and/or agency policies (i.e. for FCT and VM).

For now, the BiodivERsA database includes a weblink (http://data.biodiversa.org/links/) to a document describing the status and major gaps for each particular agency. In addition, the database provides links to existing agency databases (i.e. for BELSPO, DEFRA, DFG, FCT, and RCN) and country-wide databases (i.e. the ENVIROBASE for the UK, and FRB database for France) were some of the missing data can be retrieved.
Despite some gaps, the numbers of funding programmes and projects referenced in the database are still very impressive, which clearly shows that the BiodivERsA database can be a useful tool for research managers and researchers to characterize the landscape of biodiversity research and associated funding schemes and amounts.

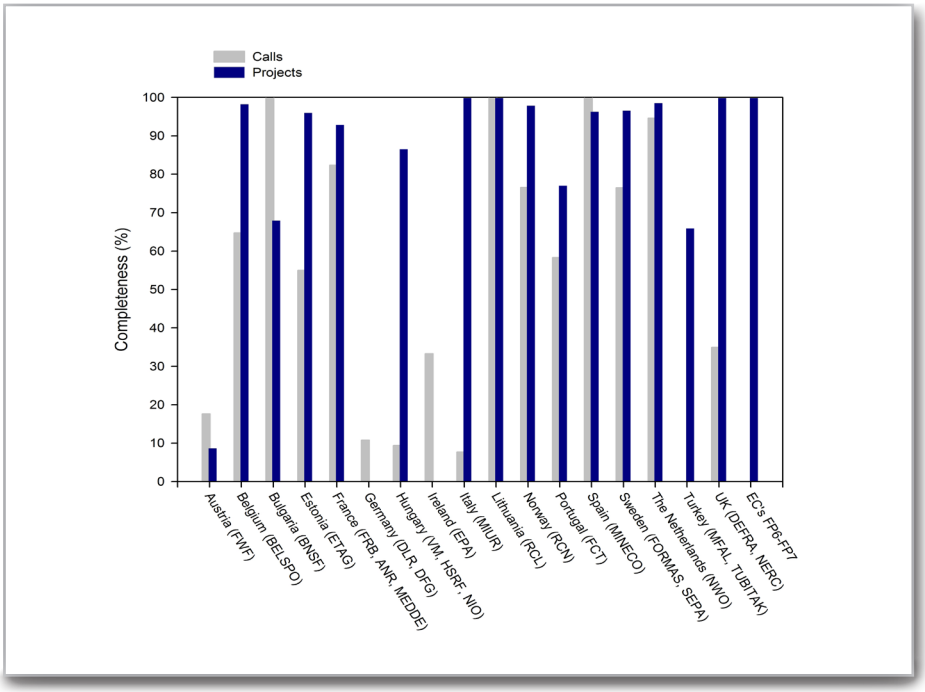


Figure 4
Current percentage of calls (grey) and funded projects (dark blue) in the database with budget figures, listed for country and for key schemes of the EC's FP6 & FP7 programmes.

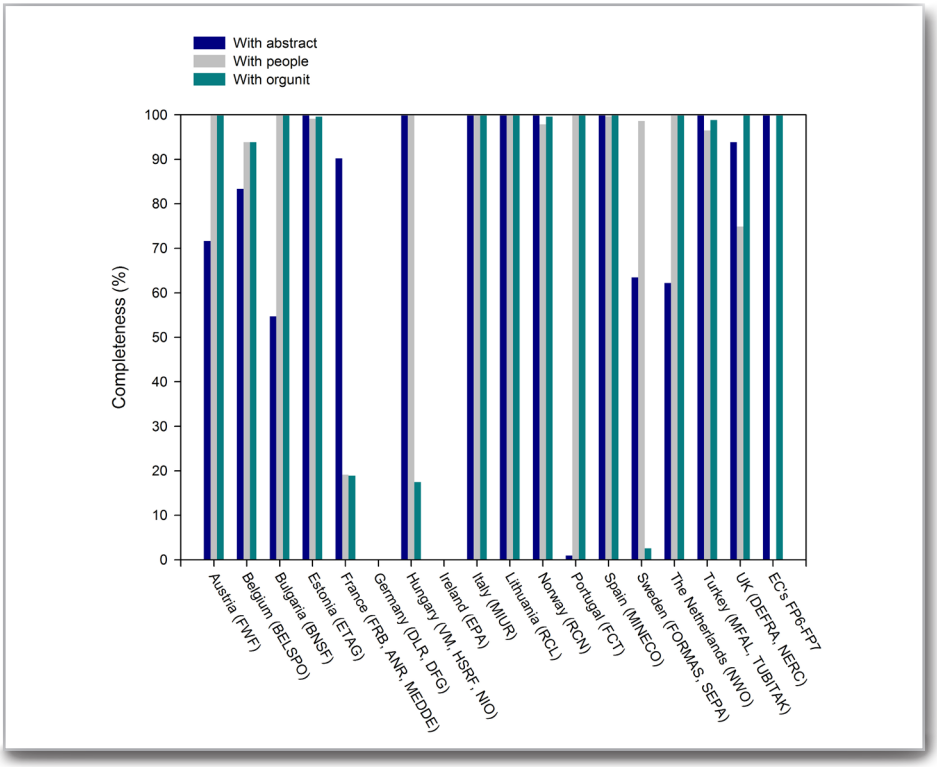


Figure 5
Current percentage of projects with associated abstract (dark blue), information on PIs or staff (people; grey), and orgunits involved (cyan green) listed per country and for key schemes of the EC's FP6 & FP7 programmes.

B/ ANALYSIS OF THE COMPETITIVE FUNDING LANDSCAPE FOR BIODIVERSITY RESEARCH

B/ ANALYSIS OF THE COMPETITIVE FUNDING LANDSCAPE FOR BIODIVERSITY RESEARCH

B1. METHODS

Some of the funding programmes referenced in the database run over several years (i.e. a series of annual calls), and the distribution of total budget among years was not explicitly known. In such cases, after checking that the programme objective (number of projects and project size) remained similar along time, we assumed equal spread of total funding programme budget over the years/calls. In the case of data provided by MFAL, we were advised to use umbrella budgets (i.e. a lump sum of money allocated to biodiversity research over a particular period) for the periods 2005-2006 and 2007-2013, respectively. For the analyses, we again assumed equal spread of money over the years for each period. Similarly, in the case of FWF, we used annual lump sums of money allocated to biodiversity research (and mainly derived from three funding programmes: *Erwin Schrödinger Fellowships*, *Stand Alone Projects*, and *Translational Research Programme*). For DEFRA, projects with a start date after July 2011 have not yet been included in the database; in that case, the 2011 expenditure was estimated by calculating the proportion of 2010 projects starting before July and using this to multiply up the 2011 figure. Agency money allocated to the BiodivERsA ERA-Net calls was also included in the analyses of amounts of funding allocated by national agencies.

Analysis of the type of calls

We distinguished between two types of calls supporting biodiversity research. The first type, referred to as "open calls *sensu latum*", includes thematic calls that are not biodiversity-specific but can fund some biodiversity projects (e.g. calls on environmental sustainability, ecotoxicology…), along with true open calls. The second type, referred to as "biodiversity-specific calls", targets biodiversity research projects only. For the moment, calls in support of biodiversity research infrastructures have marginally been included in our database, but BiodivERsA is currently referencing them and they will be included in the future.

Our objective was to assess the way biodiversity research is funded in Europe, in particular via biodiversity-specific calls or non biodiversity-specific ones.

Between country-comparison and analysis of temporal trends

Judging from the completeness of data entries (A4.), the main time window for the between-country comparison was set at 2005-2011. RCL (Lithuania) and BNSF (Bulgaria) have been excluded from the analyses due to some lack of data over this time frame; and VM (Hungary), BMBF/DLR and DFG (both Germany) have been excluded due to lack of data. This is unfortunate, for instance for Germany representing the second largest research community in Europe. Although budget data for a

few non-partner agencies are available (EPA, MIUR, TÜBITAK, NIO and HSRF), they were not included in any of the analyses due to likely too low completeness of data.

Our objective was to compare biodiversity research funding among countries, in particular funding amounts, types of funding schemes used, and temporal trends over a 7 year-period (2005-2011). For a few agencies, data are available since 2000 (RCN, BELSPO, NERC, NWO, FORMAS and FWF); those agency data were also used to assess trends over a longer period.

Accounting for the size of national scientific communities

In addition to the analysis of funding in terms of absolute values, funding amounts in each country were also normalised according to the estimated number of researchers from all scientific areas in each country (Full time Equivalent Unit – source Eurostat; http://epp.eurostat.ec.europa.eu).

Unfortunately, there are no data available to know precisely the size of the specifically targeted biodiversity research community within the overall research community of each country, except for a few countries like France (Chavriat et al., 2011). ETAG's MOBILITAS Postdoctoral Research Grant, MOBILITAS Top Researcher Grant and ERMOS were excluded from these analyses as they are mostly allocated for foreign scientists - postdocs and top researchers.

Linking observed temporal trends in funding to the situations of national economy and funders

To evaluate the influence of temporal trend in economic growth on that of biodiversity research funding, we analysed the relationship between changes in biodiversity research funding at national scale over the 2005-2011 period and changes in Gross Domestic Product (GDP; source Eurostat; http://epp.eurostat.ec.europa.eu). We also analysed the relationship between changes in biodiversity research funding by some national agencies over the same period and changes in total funding amount allocated to all (i.e. biodiversity or not) research projects by these agencies.

Comparison between total funding by national and EC sources

For the comparison with the EC contribution, we focused on biodiversity projects within the "Sustainable Development, Global Change and Ecosystems", "Support for coordination of activities" and "Policy support" themes of the FP6, and the "Environment" theme of the FP7. We thus included the funding of ERA-net tools by EC as they are a contribution of EC to support research at pan-European scale (e.g. BiodivERsA 1st and 2nd phases, and NET-BIOME). We excluded funding for biodiversity research infrastructures as it is only marginally archived in our database to date.

B/ ANALYSIS OF THE COMPETITIVE FUNDING LANDSCAPE FOR BIODIVERSITY RESEARCH

B2. RESULTS

B2-1. TYPE OF CALLS SUPPORTING BIODIVERSITY RESEARCH

Of the 605 calls in the database, 100 (i.e. 16.5%) classify as biodiversity-specific calls (Electronic Supplementary Material S1). These were funded by agencies in 14 countries: Austria, Belgium, Bulgaria, Estonia, France, Germany, Ireland, Italy, Norway, Sweden, Spain, Portugal, The Netherlands and the UK. Over the 2005-2011 period, the contribution of biodiversity-specific calls was high in Spain (100%), France (46.2% on average across 3 agencies) and to a lesser extent Belgium (37%) (Figure 6). For Spain, this is explained by the fact that MINECO only funds biodiversity research through annual calls within the programme *Earth Science & Global Change - subprogramme Biodiversity*. For France and Belgium, the existence of a national platform that launches biodiversity-specific calls for biodiversity research and/or stimulate and support such calls contributes to the high percentage. Other countries funded biodiversity research mainly through non-biodiversity thematic calls, open calls and blue sky programmes (Figure 7). However, some difference between agencies are observed within a single country. For example, the contribution of biodiversity-specific calls was relatively high for DEFRA (26.9% of calls), but low for NERC (2.3% of calls). Similarly, within France, the contribution of biodiversity-specific programmes was 100% for FRB, 29.2% for ANR and 22.2% for MEDDE. MFAL (Turkey) did not have any biodiversity-specific call. For Austria, Estonia, Portugal and Sweden, biodiversity-specific calls were restricted to BiodivERsA ones. Focusing on calls for which budget numbers are available, on average 50.6% of the total call budget, or 38.7% of the total budget of non-biodiversity specific calls, was allocated to biodiversity projects (Figure 7). The results of our analysis should be viewed with some caution, since funding amount is known for only half of the calls to date. The fairly high percentages for UK-DEFRA (78.4% of the total budget of non-biodiversity specific calls allocated to biodiversity projects), French MEDDE (39.2%), Belgium (36.6%), Portugal (35.7%) and Norway (31.8%) can be explained by the fact that most of their 'Open Calls s.l.' were still thematic calls with focus on environmental sciences. Examples include DEFRA's *Marine Environmental Call*; MEDDE's *GESSOL, DIVA and LITEAU programmes*; Belgium's *SSD programme - subtheme Atmospheric, Terrestrial & Marine Ecosystems*; Portugal's *All Scientific Domains – subtheme Biological Sciences*; and Norway's *MILJO2015, NORKLIMA and HAVKYST programmes*. Percentages were distinctly lower for the Netherlands (17.7%) where biodiversity research was funded by a vast number of true open calls besides a handful of non-biodiversity specific thematic calls, like the *National Programme for Sea and Coastal research*. A low percentage was obtained for Sweden (16.9%), which relates to the

fact that FORMAS is an agency focused on environmental sciences, agricultural sciences and spatial planning that mainly funds biodiversity research through open calls. The lowest percentage was obtained for Estonia (12%), due to the fact that ETAG mainly funds biodiversity research through true open calls while covering health R&D, environmental conservation and environmental technology R&D.

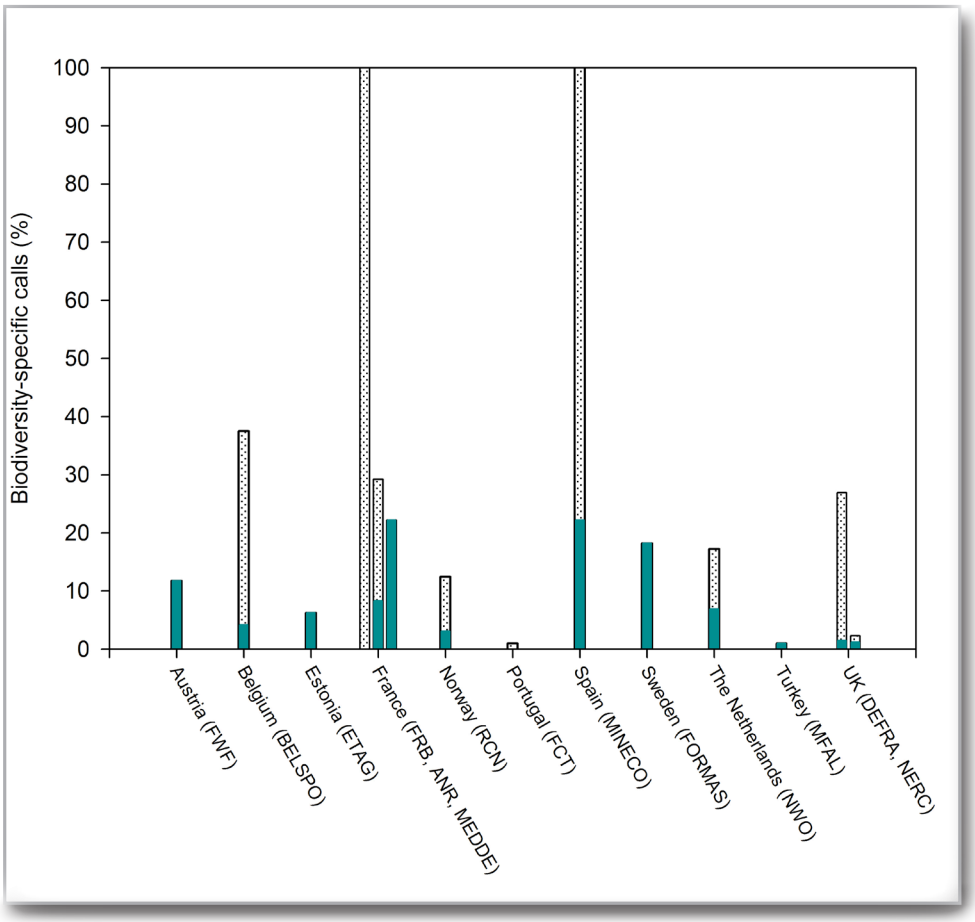
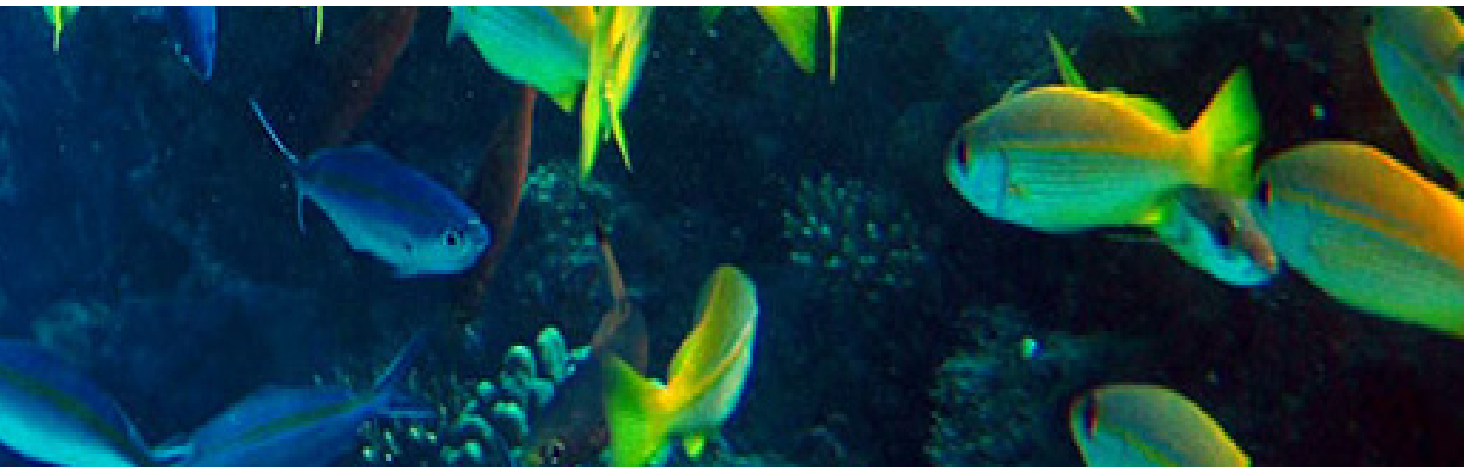


Figure 6
Percentage of biodiversity-specific calls as regards to the total number of calls that have funded biodiversity projects, per country and per agency, for the 2005-2011 period. The contribution of BiodivERsA calls to the total percentage of biodiversity-specific calls for a given agency is highlighted in cyan green.



B/ ANALYSIS OF THE COMPETITIVE FUNDING LANDSCAPE FOR BIODIVERSITY RESEARCH

B2-2. TEMPORAL VARIATION IN BIODIVERSITY RESEARCH FUNDING

Comparison of temporal trends in funding amounts between countries

The temporal evolution of the amounts of funding spent for biodiversity research over the 2005-2011 period by key agencies varied amongst the 11 European countries analysed (Figure 8). Overall, three groups of countries can be identified

-The first group, including 8 of the 11 countries studied, i.e. Estonia, France, Norway, Portugal, Spain, Sweden, The Netherlands and the UK - is typified by an increasing trend between at least 2005 and 2009 included. For Estonia, Portugal and Sweden, a steady increase was observed after 2005 until at least 2009 without major fluctuations. For Estonia, the observed trend is explained by the rapid and significant increase of funding for biodiversity research within ETAG's (formerly ETF) Open Calls and Mobilitas Postdoctoral
Research Grants. For Portugal and Sweden, this can be explained by increasing biodiversity budgets within the FCT All Scientific Domains – subtheme Biological Sciences programme and FORMAS budget, respectively (see below).
In contrast, fluctuations in annual funding amounts were observed for the other countries of this first group. The observed funding peaks in these countries seem to be largely due to the launching of key funding programmes, and/or an increase in money allocated to biodiversity research within 'Open Calls s.l.'. In the case of Norway, for example, there was a significant increase of budget allocated to biodiversity research after 2006 within the blue sky research programme Non Thematic Curiosity Driven and the non-biodiversity thematic programme The Oceans and Coastal Areas (HAVKYST). In 2008, there was also a peak contribution within the Norwegian environmental research towards 2015 (MILJO2015) programme and Climate Change and Consequences for Norway (NORKLIMA) programme (9.5 M€ and 10.4 M€, respectively). For France, increasing numbers after 2005 can be explained by

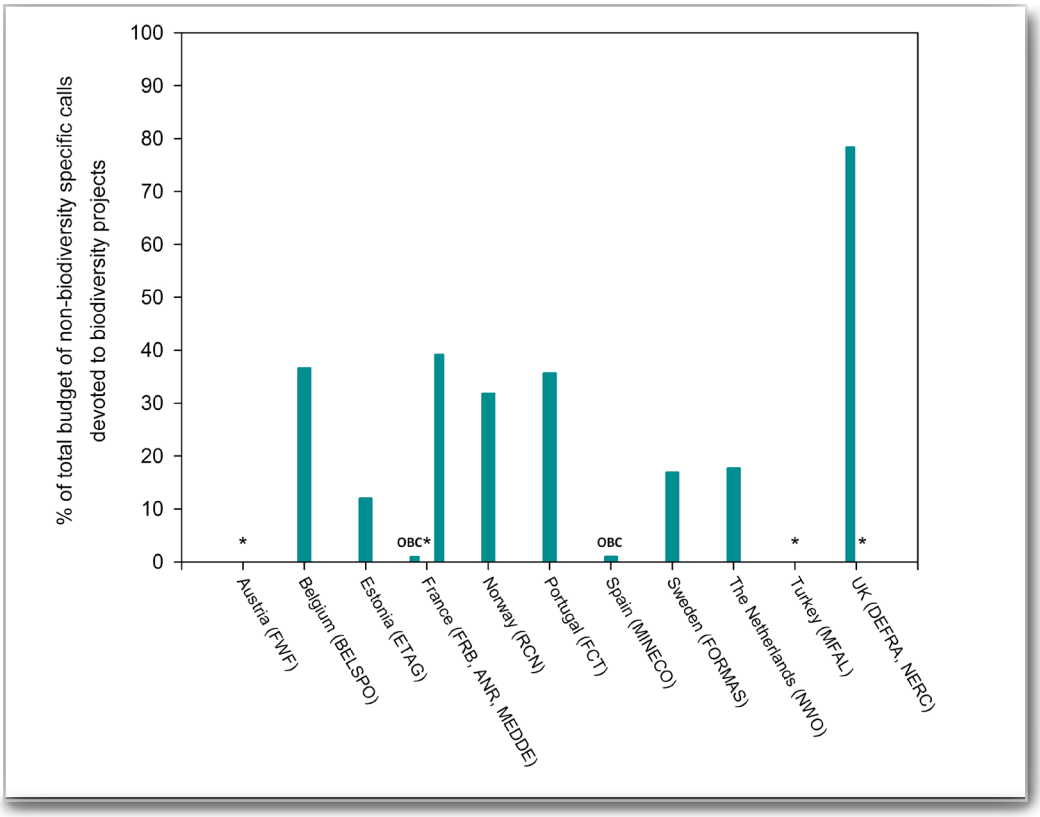


Figure 7
Percentage of budget allocated to biodiversity research in the total budget of the non-biodiversity specific calls that can fund biodiversity, for the 2005-2011 period. Values for agencies for France (i.e. ANR, FRB, MEDDE) and UK (DEFRA, NERC) are indicated separatedly. Asterik (*): no data, since call budget data are not sufficient (i.e. less than 10% of the calls with funding information) for FWF, ANR, NERC and MFAL. OBC: only biodiversity-specific calls for FRB and MINECO.

the launching of the large funding programme Biodiversité by ANR with significant funding in 2006, 2007 and 2008 (between 8-12 M€ per year). The peak in 2009 can be largely attributed to ANR's Sixth extinction programme, and SYSTERRA programme which allocated parts of its funding to (agro)biodiversity research. For the Netherlands, the higher funding amounts observed after 2007 seem to be linked to an increase of budget within the Open Programme, and launching of the National Programme on Sea and Coastal Research in 2009 (5.2 M€). However, part of this trend might be an artefact coming from lack of database entries within the Innovational Research Incentives Schemes Veni and Vidi before 2008, though these programmes are known to have funded biodiversity research since their launch in 2000. For Spain, there was an increase in the budget of the Earth Science & Global Change, subtheme Biodiversity programme since 2005, with a peak contribution of 19.5 M€ in 2009. For the UK, the peak of funding observed in 2010 can be largely explained by large contributions to biodiversity research within the Sustainable Marine Resources and Standard programmes (both up to 28 M€), the Consortium Grant Scheme (10.5 M€) and Ocean Acidification Programme (13.2 M€).

Following the period of increasing funding from 2005 to 2009/2010, funding for all these countries except Norway tended to decrease recently: for France, Portugal, Sweden, and to a lesser extent The Netherlands since 2009; and for Estonia, Spain and the UK after 2010.

-The second group, comprising Austria only, funding amount devoted to biodiversity research was rather constant between 2005 and 2011, without major fluctuations. Turkey may also belong to this group, but given that we have umbrella budgets only, data should be interpreted with care.

-The third group only includes Belgium, and is typified by fluctuating budget lines with a decreasing trend during the 2005-2011 period. Budget lines for 2000-2005 were mainly determined by the Scientific Support Plan for a Sustainable Development Policy-SPSD II programme (subtheme Global Change, Ecosystems and Biodiversity) which ran up to 2005, whereas those for 2006-2011 were mainly determined by the Science for a Sustainable Development-SSD programme (subthemes Biodiversity; Atmosphere, Terrestrial and Marine Ecosystems; and Climate) with shifting budgets over the years. The small peak in 2003 can be attributed to a 4 M€ contribution to a biodiversity project within the Multiannual Information Society Support Programme, whereas the launching of the Research Programme for Earth Observation-STEREOII programme is responsible for the peak observed in 2006.

Given that the size of the national scientific community remained fairly stable over the years in each country, budget lines of national funding normalized by the size of the scientific community looked very similar as the ones above (Electronic Supplementary Material S2). However, the mean normalized values vary between countries. The highest levels of funding were found in Norway (on average 601 €/Full time Equivalent Researcher, FER) which can likely be explained by a combination of relatively higher budget for biodiversity research and higher salaries. Mean annual funding levels are also high in Sweden (279 €/FER), Estonia (233 €/ FER), Belgium (169 €/FER), and Portugal (150 €/FER). In all other countries, the mean normalized value did not exceed 100 €/FER.

However, both absolute values (Figure 8) and values per FER (Electronic Supplementary Material S2) should be interpreted according to national characteristics of national research systems. For instance, average funding level is 83€/FER in France, which may be related to the fact that many French scientists have permanent positions and thus requested funding amounts for research projects do not include their salary costs.

B/ ANALYSIS OF THE COMPETITIVE FUNDING LANDSCAPE FOR BIODIVERSITY RESEARCH

Relationship between temporal trends in funding and the situations of national economy and funders

No significant relationship was observed between mean annual changes in biodiversity research funding and mean annual changes in Gross Domestic Product (GDP) over the 2005-2011 period (Figure 9). Countries for which GDP substantially increased during the last years (Estonia, Norway, and Sweden) tended to strongly increase funding for biodiversity research. However, countries with a roughly constant GDP showed a range of temporal trend in biodiversity research funding, from marginal change to increase (NWO, The Netherlands - though the relative increase in funding should be viewed with caution since the absolute values were particularly low in the mid 2000s, see Figure 8). In Belgium, biodiversity research funding strongly decreased (-26.8% per year on average) over the 2005-2011 period, though the decrease of GDP was weak (-0.6% per year).

Using values of annual total funding amounts for research (i.e. biodiversity or not) during the 2005-2011 period for some agencies, we were able to demonstrate that these values are good predictors of changes in biodiversity research at the national scale. For instance, the funding amounts for biodiversity research by FORMAS are tightly linked to the total funding amounts for research by this agency (Figure 10). This suggests that in agencies such as FORMAS, biodiversity research funding was roughly proportional to total funding during this period.

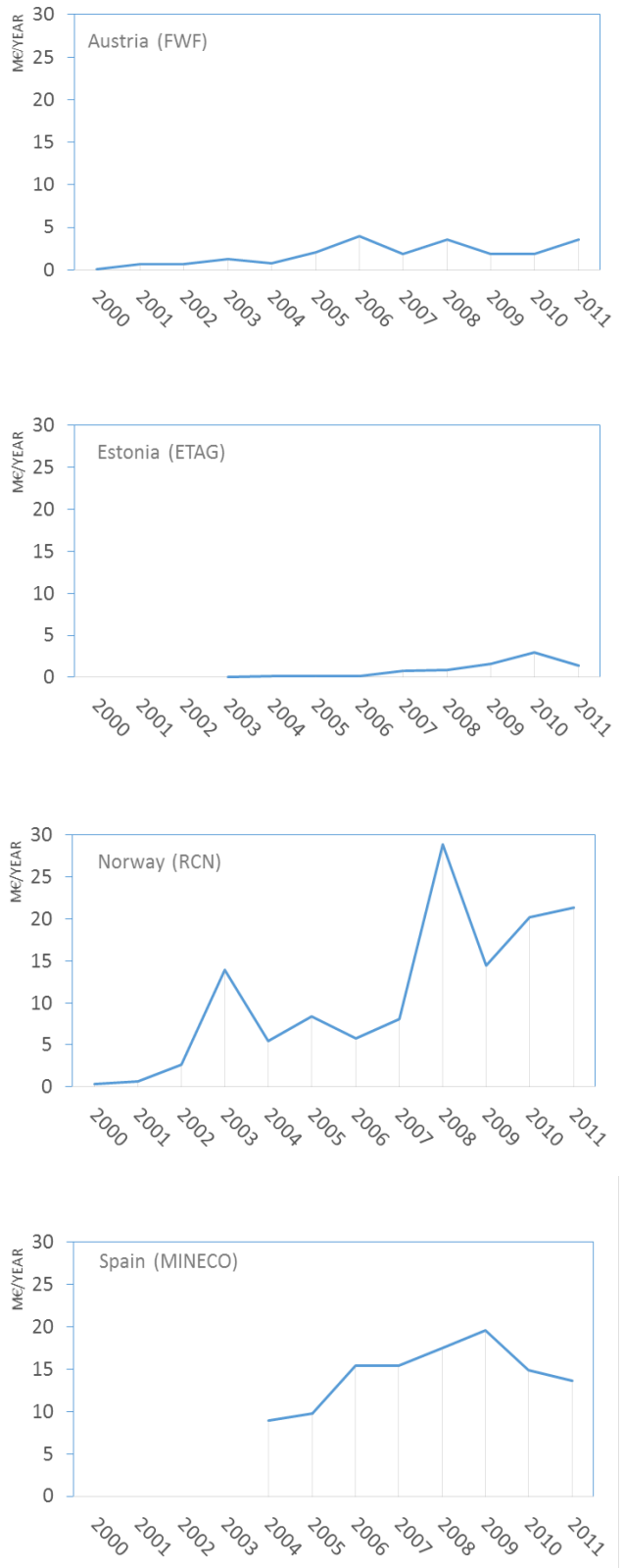
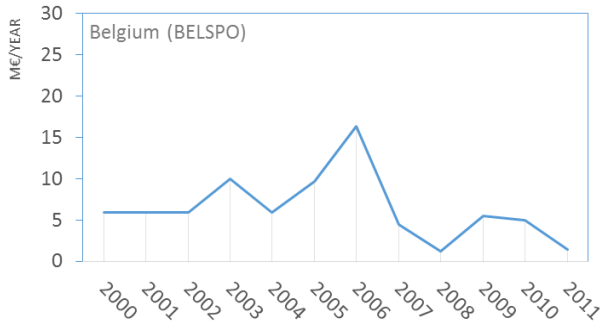
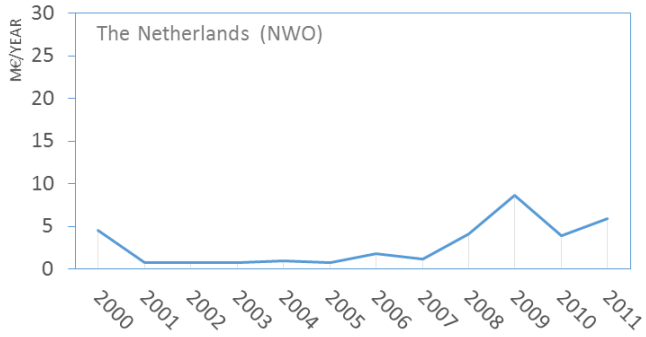
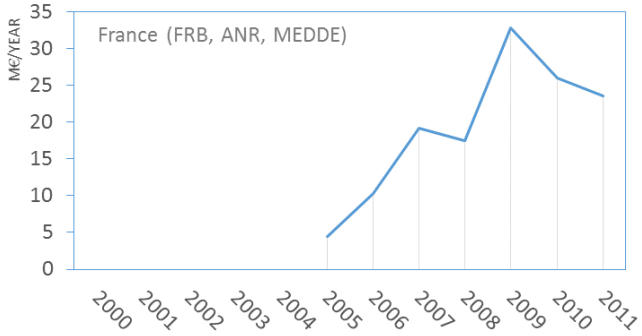
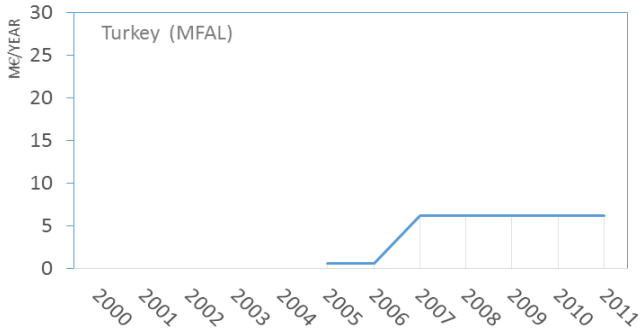


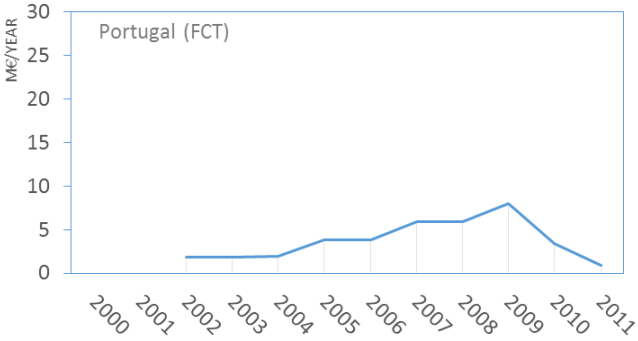
Figure 8
Temporal evolution of the annual amount of funding for biodiversity research by key national funding agencies in each country, in absolute numbers

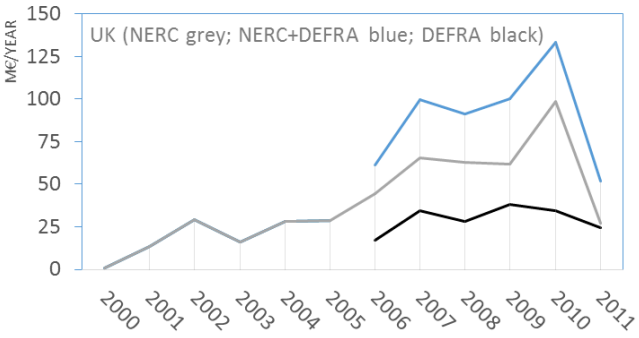

Belgium (BELSPO)
M€/YEAR
30
25
20
15
10
5
0
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011

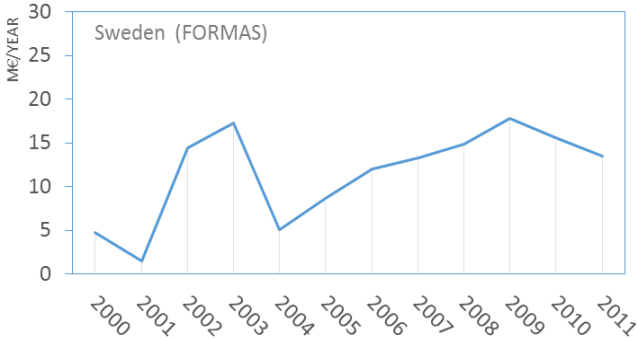

The Netherlands (NWO)
M€/YEAR
30
25
20
15
10
5
0
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011


France (FRB, ANR, MEDDE)
M€/YEAR
35
30
25
20
15
10
5
0
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011


Turkey (MFAL)
M€/YEAR
30
25
20
15
10
5
0
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011


Portugal (FCT)
M€/YEAR
30
25
20
15
10
5
0
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011


UK (NERC grey; NERC+DEFRA blue; DEFRA black)
M€/YEAR
150
125
100
75
50
25
0
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011


Sweden (FORMAS)
M€/YEAR
30
25
20
15
10
5
0
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011

B/ ANALYSIS OF THE COMPETITIVE FUNDING LANDSCAPE FOR BIODIVERSITY RESEARCH

Trends of amount of competitive funding derived from national funds in Europe, and comparison with that of EC-Framework Programme funding

The contribution of EC to biodiversity research through major Framework Programme themes over the 2005-2011 was lower than the joined contribution of national agencies: 18.8% vs 81.2% (Figure 11). Some data are missing in our database so that these actual figures may be viewed with some caution. However, data are missing for some key funding themes from the EC Framework Programme, as for some countries like Germany and some agencies in other countries. Thus, the current figures derived from the database likely provide a reliable view of the relative contributions of national funders and EC-Framework Programme for competitive funding of biodiversity research, excluding infrastructures. When assessing the temporal evolution of annual funding for the 14 national agencies aggregated (Figure 12), a steady increase of funding was observed until 2010, followed by a strong decrease (-37.7%) from 2010 to 2011. Concurrently, EC-Framework Programme funding for biodiversity research showed highest values in 2009, followed by a decrease thereafter (-9.2% from 2009 to 2010; and -31.0% from 2010 to 2011) (Figure 12). This supports conclusions of a previous report by Mattei et al. (2011).

→ These trends demonstrate that:

- Biodiversity research funding in Europe is largely dependent on national funders
- After a period of increased funding (2005 to 2009), biodiversity research may have entered a period (after 2010) of marked decrease of funding in Europe. However, analysis of funding for 2012 and 2013 will be needed to confirm the second conclusion. Comparison with temporal trends of funding for other research areas is also needed.

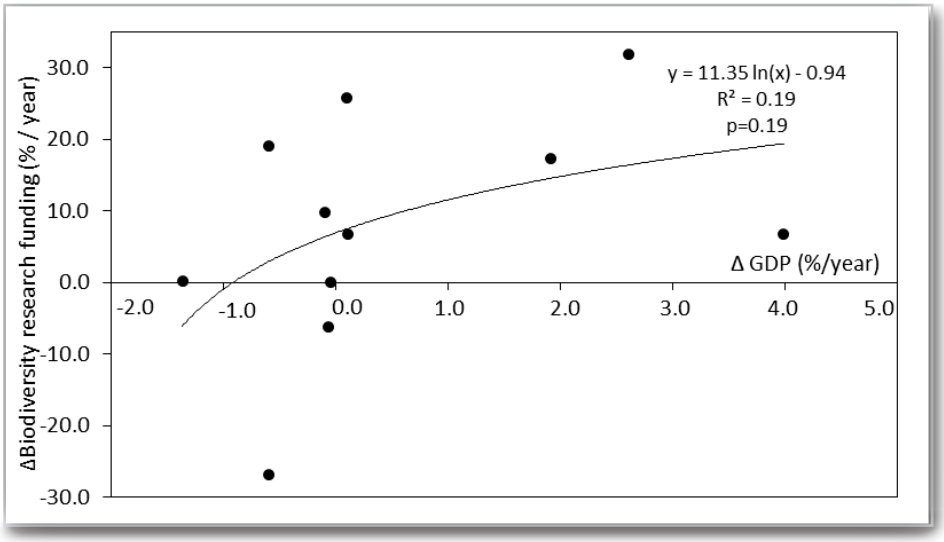


Figure 9
Relationship between the average change in competitive funding for biodiversity research (% per year) and average change in GDP (% per year) over the 2005-2011 period. One point corresponds to one country.

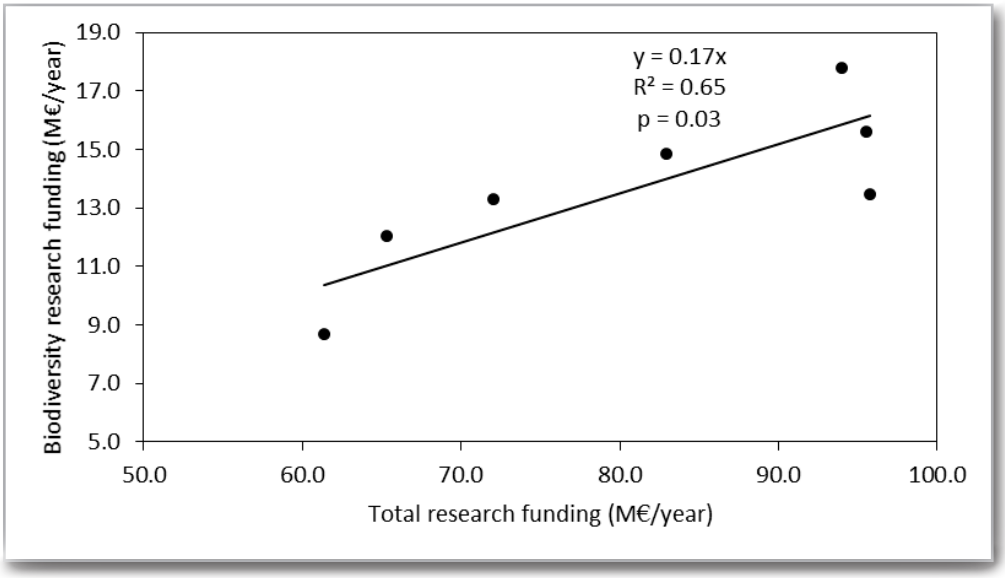


Figure 10
Relationship between the annual amount of funding allocated to biodiversity research by FORMAS (Sweden) and the annual, total amount of funding of research by the same agency along the 2005-2011 period. One point corresponds to one year.

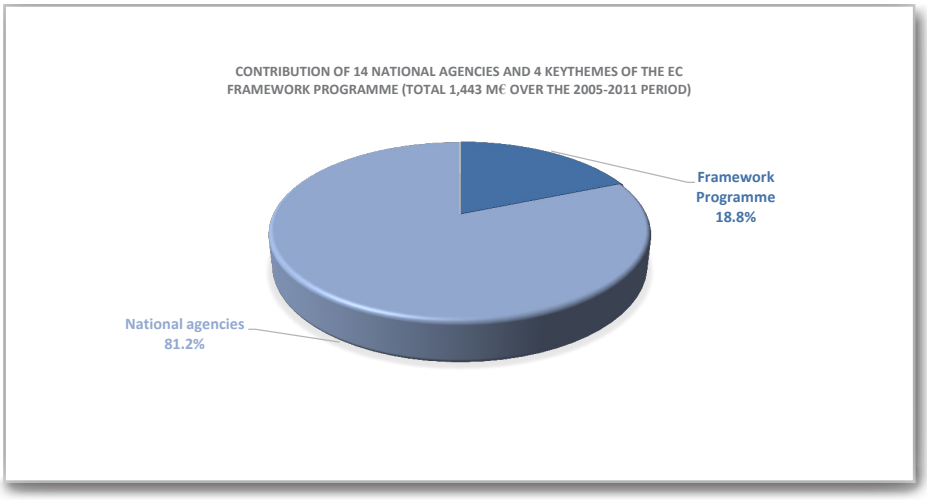


Figure 11.
Contribution to the total amount of competitive funding for biodiversity research over the 2005-2011 period by 14 national agencies from 11 countries (see Figure 8) versus funding by EC through 4 main schemes, i.e. FP6 "Sustainable Development, Global Change and Ecosystems", "Support for coordination of activities" and "Policy Support"" themes, and FP7 "Environment" theme.

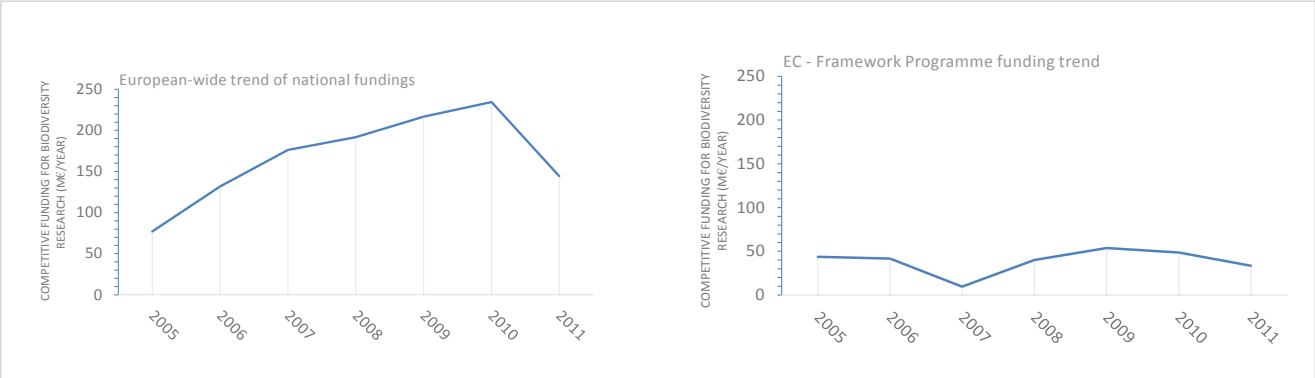


Figure 12
Temporal evolution of the annual competitive funding for biodiversity research aggregated for the 14 national agencies studied from 11 countries (left panel) and for EC-FP through 4 main schemes, i.e. FP6 "Sustainable Development, Global Change and Ecosystems" and "Support for coordination of activities" and "Policy Support" themes, and FP7 "Environment" theme (right panel).

CONCLUSION AND PERSPECTIVES

C/ CONCLUSION AND PERSPECTIVES

This report clearly shows that the BiodivERsa database is gathering and organising an impressive amount of information (e.g. on more than 6500 funded projects!). This figure can be compared, e.g. to the one thousands of projects identified on climate research at the European scale (CIRCLE-2 database, http://infobase.circle-era.eu/). This demonstrates the importance of the research conducted on biodiversity and associated ecosystem services in Europe, which is consistent with the size of the biodiversity research community: for instance, in France only, FRB has referenced more than 4000 researchers working at least partly on biodiversity, equivalent to around 1500 full time researchers (Chavriat et al., 2011).

Some gaps in the database will have to be filled in the near future, such as information on competitive funding for some countries (e.g. Germany and Bulgaria) and for some calls (since funding amounts are still needed for half of the calls identified). More generally, the database mainly delivers information related to calls and projects funded by the research agencies that are members of BiodivERsA, along with projects funded by EC through three main themes of the FP6 and FP7. We eventually aim at compiling information on other calls open to biodiversity research in Europe, at national and European level (including European Research Council grants, European Science Foundation, etc.).

Obviously, the BiodivERsA database needs continuous updating and input from the consortium partners, which highly depend on their available resources and data sharing policy. The improvement and enlargement of this database will contribute significantly to the development of the European Research Area, and help the identification of research gaps at the European level.

However, this database is already a useful tool for research managers and researchers to characterize the landscape of competitive funding for biodiversity research, and identify potential resources and network opportunities.

The BiodivERsA consortium will use the database to better develop its mapping exercises and understand national priorities and opportunities for cooperation and potential future partnerships. In particular, this will help BiodivERsA to improve the identification of existing gaps and future needs for new research programmes, new facilities, as well as detecting potential barriers for successful cooperation. A further step in this direction will be made in a forthcoming BiodivERsA booklet that will analyse the type of biodiversity research funded in Europe, associated temporal trends and possible complementarities among countries. Finally, our database may serve newly emerging initiatives like the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) by providing information on funded research in Europe and associated research organisations and experts.

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Electronic supplementary material

S1. - List of calls referenced in the BiodivERsA database (July 2013) listed per country

S2. - Temporal evolution of the annual funding for biodiversity research by key national funding agencies in each country, normalized by the national scientific community size (amount of money expressed per full time equivalent researcher; €/FER/year).
Available at: http://data.biodiversa.org/documents/download?name=booklet

BiodivERsA database:

Available at: http://data.biodiversa.org

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