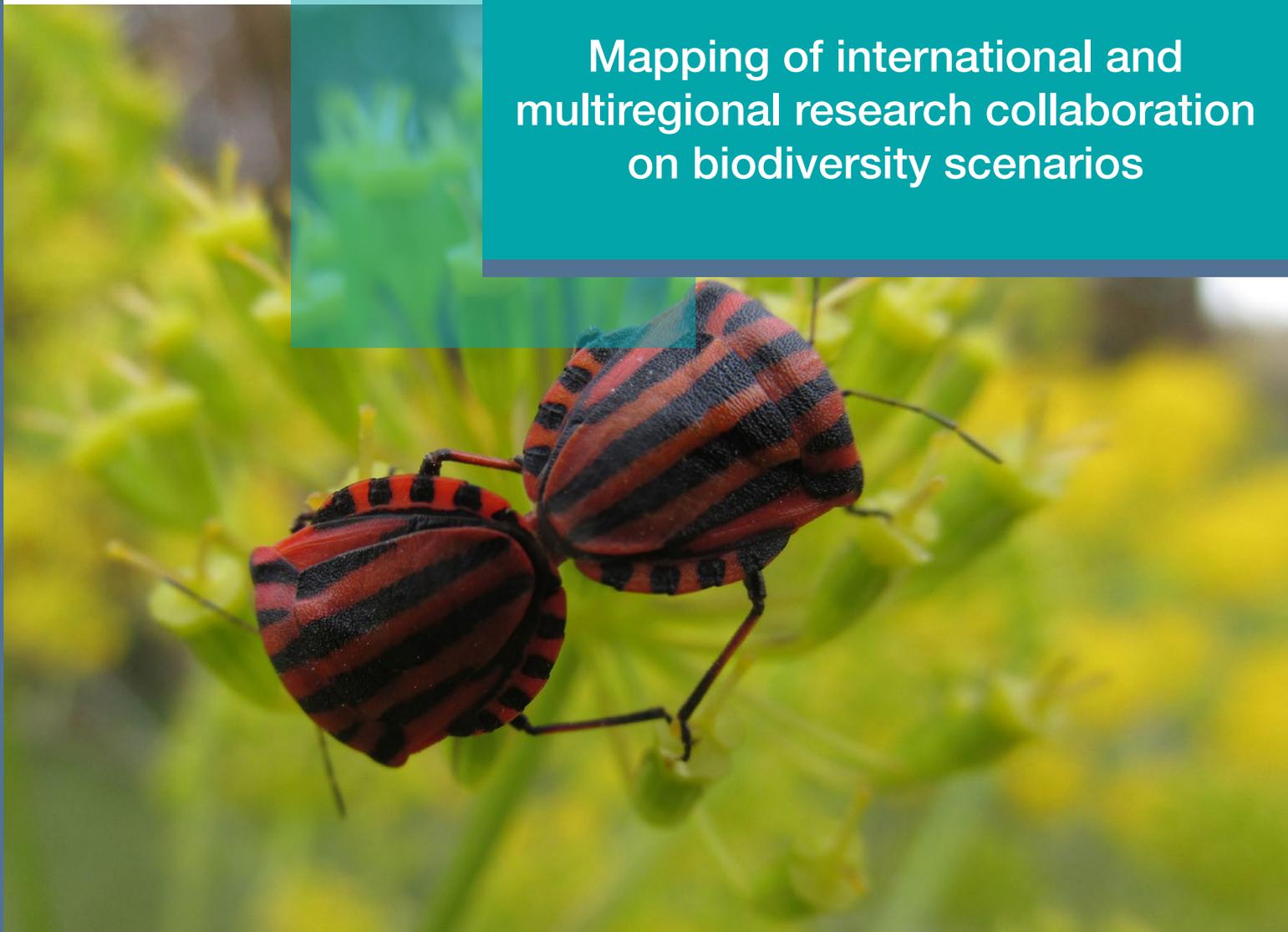




## Mapping of international and multiregional research collaboration on biodiversity scenarios



AN ANALYSIS OF COLLABORATION NETWORKS BASED ON PUBLICATIONS  
INVOLVING THE EUROPEAN RESEARCH AREA (ERA) AND OTHER WORLD  
REGIONS



## The BiodivScen partners

French Foundation for Research on Biodiversity (FRB), FRANCE [coordinator]

Ministerio de Ciencia, Tecnología e Innovación (MINCyT), ARGENTINA

Austrian Science Fund (FWF), AUSTRIA

Belgian Science Policy Office (BelSPO), BELGIUM

The Fund for Scientific Research (FNRS), Wallonia-Brussels Federation, Belgium (F.R.S.-FNRS) BELGIUM

São Paulo Research Foundation (FAPESP), BRAZIL

Bulgarian National Science Fund (BNSF), BULGARIA

Estonian Research Council (ETAg), ESTONIA

Suomen Akatemia (AKA), FINLAND

Agence Nationale de la Recherche (ANR), FRANCE

German Research Foundation (DFG), GERMANY

German Aerospace Center (DLR), GERMANY

Ministry of Agriculture (FM), HUNGARY

Environmental Protection Agency of Ireland (EPA), IRELAND

Research Council of Lithuania (RCL), LITHUANIA

Research Council of Norway (RCN), NORWAY

National Science Centre (NCN), POLAND

The Executive Agency for Higher Education, Research, Development and Innovation Funding (UEFISCDI), ROMANIA

The Slovak Academy of Sciences (SAS), SLOVAKIA

The Spanish State Research Agency (AEI), SPAIN

Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (Formas), SWEDEN

Swiss National Science Foundation (SNSF), SWITZERLAND

The Netherlands Organisation for Scientific Research (NWO), THE NETHERLANDS

The Scientific and Technological Research Council of Turkey (TUBITAK), TURKEY



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## BiodivERsA

Created in 2005, and transformed into a long term partnership in June 2018, BiodivERsA is a network of 39 agencies and ministries from 25 countries programming and funding pan-European research on biodiversity, ecosystem services and Nature-based Solutions on a competitive basis.

Over 2008-2020, BiodivERsA launched 10 calls; it funded 125 transnational research projects selected for their scientific excellence, societal/policy relevance and quality of stakeholder engagement for a total amount of over 235 million euro (including ca.150 million euro of money directly raised by BiodivERsA partners and the European Commission).

To further strengthen the European Research Area on biodiversity and ecosystem services, BiodivERsA has further developed a great diversity of activities ranging from research [mapping](#) and programming, to [stakeholder engagement](#), dissemination of projects' outputs and [knowledge brokerage](#).

For more information: [www.biodiversa.org](http://www.biodiversa.org)



## The Belmont Forum

Established in 2009, the Belmont Forum is a partnership of funding organizations, international science councils, and regional consortia committed to the advancement of interdisciplinary and transdisciplinary science. Forum operations are guided by the [Belmont Challenge](#), a vision document that encourages international transdisciplinary research for understanding, mitigating and adapting to global environmental changes.

Forum members and partner organizations work collaboratively to meet this Challenge by issuing international calls for proposals, committing to best practices for open data access, and providing transdisciplinary training. To that end, the Belmont Forum is also working to enhance the broader capacity to conduct transnational environmental change research through its [e-Infrastructure and Data Management initiative](#).

For more information: [www.belmontforum.org](http://www.belmontforum.org)

## BiodivScen

The Belmont Forum and BiodivERsA have joined forces to implement the joint programme "BiodivScen", for supporting international research efforts in the development of scenarios of biodiversity and ecosystem services. This programme runs from October 2017 to June 2023.

### The European Commission participation in BiodivScen



This programme is co-funded by the European Commission under the Horizon 2020 programme as an ERA-NET COFUND.

ERA-NET COFUND are funding tools aiming at strengthening the coordination of national and regional research programmes. The core activity of such a tool is to implement one substantial call for research proposals, which is co-funded by the European Commission.

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# INTRODUCTION

This report is intended to fulfil the sub-task 6.1.A. “Mapping of international and multi-regional research collaboration on biodiversity scenarios” of the BiodivScen workplan and, in particular, it is meant to fulfil the associated deliverable D6.1.

The main aim of subtask 6.1.A. is to perform a mapping of the international and multi-regional research collaboration networks between scientists working on scenarios of biodiversity and ecosystem services (hereafter “biodiversity scenarios”). In particular, the objective is to characterize collaboration networks between the European Research Area (ERA) and other world regions, along with their evolution over time, the countries leading the collaborations and the research domains covered.

The analysis was performed through bibliographic analyses, which are relevant tools to quantify scientific cooperation networks<sup>1</sup>. As scientific publications are the product of collaboration among researchers and institutions, they can give an overview of the structure and dynamics of research networks.

Therefore, the results of efforts to promote international research collaboration can be assessed by analysing co-authoring networks, their temporal trends, their geographical footprint and the domains they cover.

In this document, we report the results obtained from the analysis of the available publications, in order to study the existing research collaboration on biodiversity scenarios.

## COLLABORATION BETWEEN BIODIVERSA AND THE BELMONT FORUM FOR MAPPING THE RESEARCH LANDSCAPE

In the context of BiodivScen, the Belmont Forum and BiodivERsA have joined forces to perform activities, including a mapping of international and multi-regional research collaboration on biodiversity scenarios. Through this activities, the Belmont Forum and BiodivERsA will have a better understanding of the existing research collaboration, which could be useful for future activities.

<sup>1</sup> Dangles O., Loirat J., Freour C., Serre S., Vacher J. & Le Roux X. 2016. Research on biodiversity and climate change at a distance: collaboration networks between Europe and Latin America and the Caribbean. PLoS ONE 11(6): e0157441. doi:10.1371/journal.pone.0157441



A close-up photograph of several purple flowers, likely from the Campanulaceae family, showing the intricate details of the petals and the dark, spotted patterns on the inner surface. The flowers are set against a blurred green background of foliage. A semi-transparent white rectangular box is overlaid in the center of the image, containing the word 'METHODOLOGY' in a dark blue, sans-serif font.

# METHODOLOGY

## BIBLIOGRAPHIC SURVEY

The source of information for this study is the Web Of Science (WOS) version of the Clarivate Analytics citation databases ([www.webofknowledge.com](http://www.webofknowledge.com)), that includes the references of the main scientific publications of any discipline of knowledge (scientific and technological, humanistic and sociological) since 1945.

The study was possible through close collaboration with FECYT ([www.fecyt.es](http://www.fecyt.es)), the Spanish Foundation for Science and Technology, which manages the license in Spain.

We conducted a search on the WOS Core Collection of the peer-reviewed literature (articles and reviews) on biodiversity scenarios from all world countries without temporal restriction. The WOS Core Collection consists of several online databases with more than 21,000 scientific journals: the Science Citation Index Expanded, the Social Science Citation Index, the Arts

& Humanities Citation Index, the Emerging Sources Citation Index, the Conference Proceeding Citation Index, and the Book Citation Index.

To perform the analysis we conducted various searches on the WOS database that had to be refined repeatedly, given that “Biodiversity Scenarios” is a very broad, multi-faceted concept. When refining the keyword profile, errors in attribution to the target topics were estimated by sampling randomly 150 articles from all the articles retrieved with the keyword profile, evaluating their relevance to the topic “biodiversity scenarios” (Figure 1). The keyword profile was modified to improve the quality of the results. The final keyword profile was considered acceptable when no more than 8% of the 150 articles selected randomly did not correspond to the “biodiversity scenarios” topic.

C	D	E	F	G	H	I	J
BA	BE	GP	AF	BF	CA	TI	SO
ri, MM; Freitas, JS; Vieira, JGP; Scaldaferrri, M. M.; Freitas, J. S						Comparison of methods for estimates of molecular genetic diversity in genus <i>Croton</i> : influence	GENE
/u, CZ; Hong, W; Qiu, RZ; Qi, XH Hu, Xisheng; Wu, Chengzhen;						Impact of land-use change on ecosystem service values and their effects under different inter	GEO5
RA; Hinojosa, LF; Perez, MF; Ha Segovia, Ricardo A.; Hinojosa,						Biogeographic anomalies in the species richness of Chilean forests: Incorporating evolution in	AUST
Kiss, T; Adam, D; Csagola, A; Ní Cadar, Daniel; Kiss, Timea; Ad						Phylogeny, spatio-temporal phylodynamics and evolutionary scenario of <i>Torque teno sus virus</i> :	VETE
LM; Villarreal, ML; Niraula, R; Norman, Laura M.; Villarreal, I						Framing Scenarios of Binational Water Policy with a Tool to Visualize, Quantify and Valuate Ch	WAT
g, PC; Costa, L; Magalhaes, L; Te Roebeling, P. C.; Costa, L; Ma						Ecosystem service value losses from coastal erosion in Europe: historical trends and future pro	JOUR
, C; Zell, J; Bugmann, H; Elkin, C Temperli, Christian; Zell, Juer						Sensitivity of ecosystem goods and services projections of a forest landscape model to initializ	LANE
CS; Kofinas, GP; Pyare, S			Shanley, Colin S.; Kofinas, Gar			Balancing the conservation of wildlife habitat with subsistence hunting access: A geospatial-sc	LANE
en, H; Tyberghein, L; Belton, G; Verbruggen, Heroen; Tybergh						Improving Transferability of Introduced Species' Distribution Models: New Tools to Forecast th	PLOS
an, D; Termansen, M; Reed, MS Nainggolan, Doan; Termansen						Farmer typology, future scenarios and the implications for ecosystem service provision: a case	REGI
er, T; Bieling, C; Ohnesorge, B; S Plieninger, Tobias; Bieling, Cl						Exploring Futures of Ecosystem Services in Cultural Landscapes through Participatory Scenario	ECOL
; Widmer, A; Briner, S; Huber, F Hirschi, Christian; Widmer, Al						Combining Policy Network and Model-Based Scenario Analyses: An Assessment of Future Ecos	ECOL
t Chouquer, G			Chouquer Chouquer, G			Dialectic of disparity and diversity: transformation	QUEL
RC; Murayama, Y			Estoque, Ronald C.; Murayam			Examining the potential impact of land use/cover changes on the ecosystem services of Baguic	APPL
mero, C; Rehfeldt, GE; Duval, P Saenz-Romero, Cuahtemoc;						<i>Abies religiosa</i> habitat prediction in climatic change scenarios and implications for monarch bu	FORE

Figure 1. Example of the quality control of the query, checking the relevance of the papers to the target topic “biodiversity scenarios”. Control was conducted over a random sample of 150 items from the papers retrieved with the keyword profile. The relevance of papers was classified as good (in green), bad but with possible improvement through an adjustment of the keyword profile (yellow) or bad but without easy adjustment of the keyword profile to avoid retrieving these articles (orange).

The final keyword profile selected was in fact the combination of two separate queries, as follows:

#### 1. QUERY [1]

*TI = ((ecosystem and service\*) or (ecological and service\*) or species loss or biodiversity or (biological diversity) or (species richness) or (species diversity) or (functional diversity) or (biological conservation) or (species conservation) or (habitat conservation) or (genetic resource\*) or (genetic diversity) or (plant diversity) or (microbial diversity) or (bacterial diversity) or (fung\* diversity) or (weed diversity) or (animal diversity) or (mammal diversity) or (insect\* diversity) or (functional trait\*) or (virus diversity) or (bird diversity) or (invasive species) or (biological invasion\*) or (landscape diversity) or (habitat diversity)) AND TI = (scenario\* OR projection\* OR (prediction\* AND (future OR anticipat\* or 2020 or 2030 or 2040 or 2050 or 2060 or 2070 or 2080 or 2090 or 2100))) or “environmental impact statement\* OR (forecast\* NOT forecaster\*)”*

#### 2. QUERY [2]

*TS= (biodiversity) AND TI= (scenario\* OR projection\* OR (prediction\* AND (future OR anticipat\* or 2020 or 2030 or 2040 or 2050 or 2060 or 2070 or 2080 or 2090 or 2100))) or “environmental impact statement\* OR (forecast\* NOT forecaster\*)”*

Where TI=Title and TS=Topic

## DATABASE ANALYSIS

Once records from both queries were retrieved, they were imported into an Excel dynamic database. The database was processed to remove errors and inconsistencies (e.g. in the country name, in the affiliations and address fields, etc.). The aggregated list of records encompassing both QUERIES [1] and [2] was obtained by removing repeated records. This was the set to be analysed, which contained 758 records<sup>2</sup>. Hereafter, this set is named “the Database”.

For each country, we counted the number of papers with at least one author affiliated to that country. Then, computation was made for each continent.

In addition, we built plots on the change of the number of papers in the ERA and other continents since 1994, and evaluated the top 10 research topics related to biodiversity scenarios addressed by scientists from the ERA and other continents.

Further, we evaluated how the countries encompassed in the ERA (considered as a unit) related with the rest of the world.

- We aggregated the papers with at least one author affiliated to a country from the ERA. This subset is named hereafter the ERA-database.

- We listed the countries of the world that do not belong to the ERA.

- From the papers of the ERA database, we counted the number of papers with at least one author affiliated to a country not belonging to the ERA.

- The resulting database was named ERA-world.

Then, we evaluated how the countries encompassed in the BiodivERSA network (considered as a unit) related with the rest of the world.

- We aggregated the papers with at least one author affiliated to a country from BiodivERSA. This subset is named hereafter the BiodivERSA-database.

- We listed the countries of the world that do not belong to BiodivERSA.

- From the papers of the BiodivERSA-database, we counted the numbers of papers with at least one author affiliated to a country not belonging to BiodivERSA.

- The resulting database was named BiodivERSA-world.

Lastly, we evaluated how the results from [1] and [2] differ, establishing a comparison between ERA-world and BiodivERSA-world results.

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<sup>2</sup> Complete database is available under request

The **ERA-database** was built aggregating all the publications with at least one author affiliated in a country of the ERA (27 countries from EU plus 16 associate members: Austria, Belgium, Bulgaria, Czech Republic, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Portugal, Poland, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom, plus Albania, Armenia, Bosnia and Herzegovina, Faroe Islands, Georgia, Israel, Iceland, Montenegro, Moldova, North Macedonia, Norway, Serbia, Switzerland, Turkey, Tunisia and Ukraine).

The **BiodivERsA-database** was built aggregating the publications with at least one author affiliated in a country of BiodivERsA (21 European Union member states and 4 associated countries: Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Israel, Latvia, Lithuania, The Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Spain, Sweden, Switzerland, Turkey, United Kingdom).

Finally, the **BelmontForum-database** was built aggregating the publications with at least one author affiliated in a country of the Belmont Forum : Argentina, Australia, Austria, Brazil, Canada, China, Chinese Taipei, France, Germany, India, Italy, Ivory Coast, Japan, Mexico, The Netherlands, Norway, Qatar, South Africa, Sweden, Turkey, United Kingdom, United States of America.

To analyze the links and collaborations between the **ERA**, **BiodivERsA** and **Belmont Forum** with the rest of the world, topological plots or analyses were generated with the Tableau software (Tableau Software, 2003-2020). This allowed to provide a visual representation of the detected relationships. Given

the asymmetric nature of the compared sets (a single entity as ERA, BiodivERsA and Belmont Forum vs. a list of countries), several formats of plots (circular sectors, maps, histograms) were used to optimize the visual uptake of results. The general aim of the figures generated is to detect the main collaborations between the ERA, BiodivERsA and Belmont Forum and specific countries and other continents in general (e.g. dominant countries, etc.).



<sup>3</sup> Inter-American Institute for Global Change Research (IAI) and European Union are members of the Belmont Forum but are not considered in this analysis

A close-up photograph of a cluster of small flowers. The flowers are primarily white with pinkish-red centers and some pink variegation on the petals. The background is blurred, showing more of the same flowers and green foliage. A semi-transparent white rectangular box is overlaid on the left side of the image, containing the text "RESULTS AND DISCUSSION" in a dark blue, sans-serif font.

RESULTS AND  
DISCUSSION

## IMPORTANCE OF THE SCIENTIFIC PRODUCTION ON THE TOPIC “BIODIVERSITY SCENARIOS” PER COUNTRY OR CONTINENT

Publications on biodiversity scenarios are dominated by the USA, which publish twice as many scientific papers as the second more publishing country in the world, England (Figure 2). From there the distribution is smoother. Within the top-10 publishing countries (excluding USA) 7 are from Europe (England, Germany, Spain, France, The Netherlands, Italy and Switzerland, in that order), and the others are Australia, Canada and Brazil. The obtained distribution results from a combination of both scientific capacity and biodiversity richness. Relevant gaps are detected: no countries from Asia and Africa are among these top-10 publishing countries on the topic biodiversity scenarios (Figure 2). This shows a mismatch in the geographic location of the biodiversity hot-spots and the places where the science takes place, which explains some of the difficulties that research and conservation encounter worldwide.

However, the total number of papers on biodiversity scenarios published in Europe exceeds that of the American continent (Figure 3), which is dominated by the USA production. Actually, when European and American publications are considered together, they represent approximately three times as many papers as for the rest of the world.

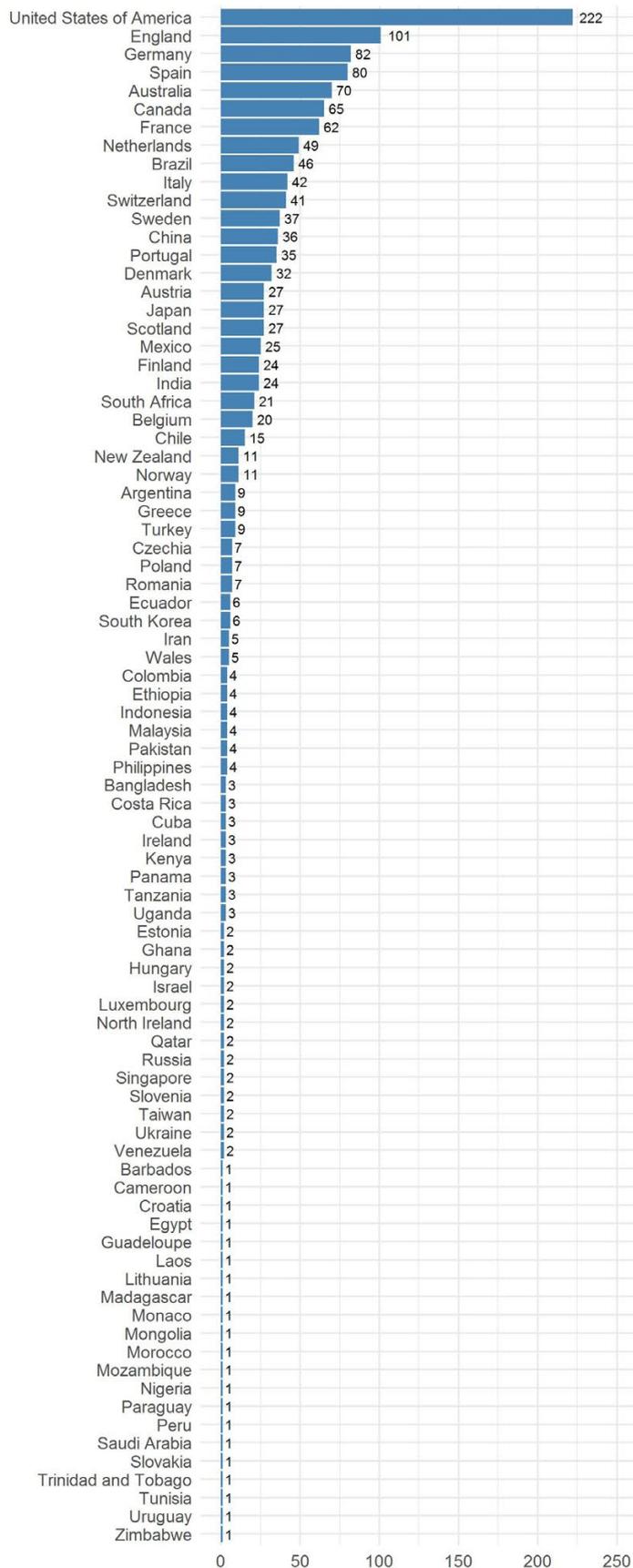


Figure 2. Number of papers on biodiversity scenarios with at least one author affiliated to each country in the world. Countries that are not in the plot did not publish any paper.

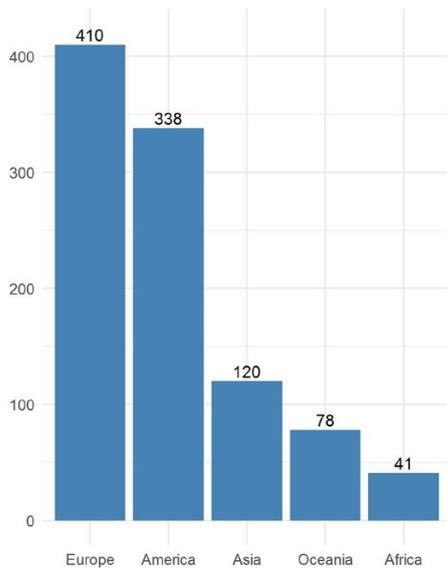


Figure 3. Number of papers on “biodiversity scenarios” over the 1945-2018 period with at least one author affiliated to each continent in the world.

## TEMPORAL EVOLUTION OF THE SCIENTIFIC PRODUCTION ON BIODIVERSITY SCENARIOS

The scientific production on biodiversity scenarios of the ERA, BiodivERsA and the Belmont Forum from 1994 has dramatically increased since 2010 (Figure 4). This is probably related to the general boost of scientific production in all research areas that took place during last decade. In any case, the evolution of scientific production in the ERA, BiodivERsA and the Belmont Forum have followed parallel paths. The ERA and BiodivERsA showed quite similar trends, as expected, since many countries are members of

both entities. The Belmont Forum followed the similar pattern until 2003, when the number of publications increased at a much higher rate than for BiodivERsA and the ERA. Current situation shows that the Belmont Forum approximately doubles the scientific production of BiodivERsA and the ERA. This can be explained because the countries that produce the most on each continent are members of the Belmont Forum.

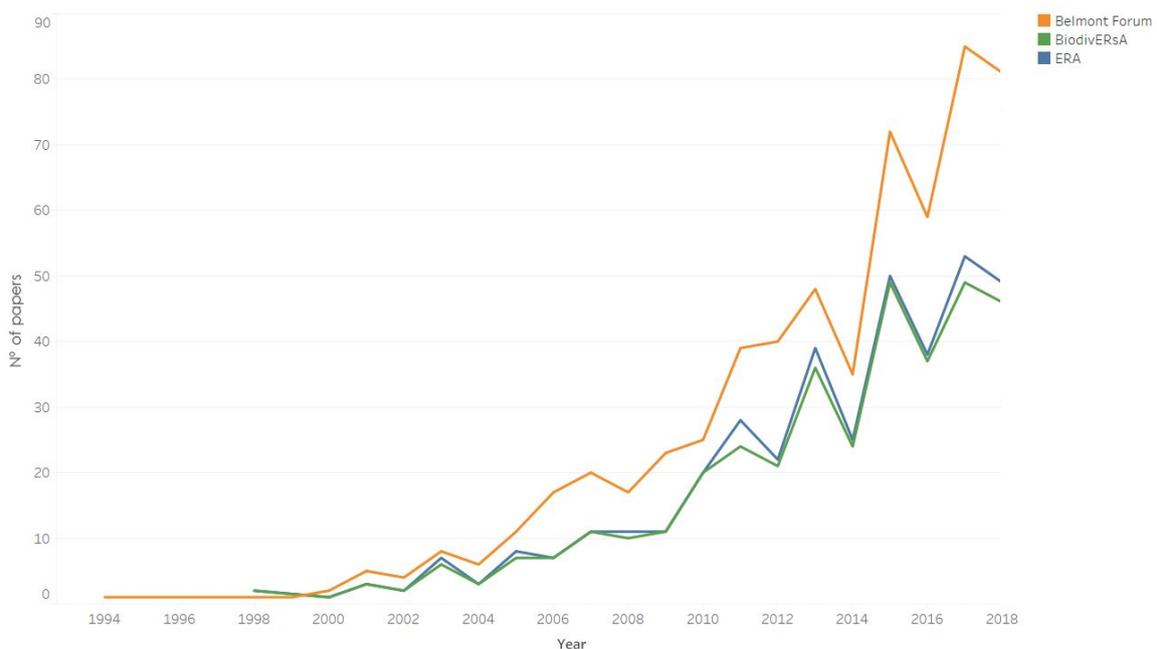
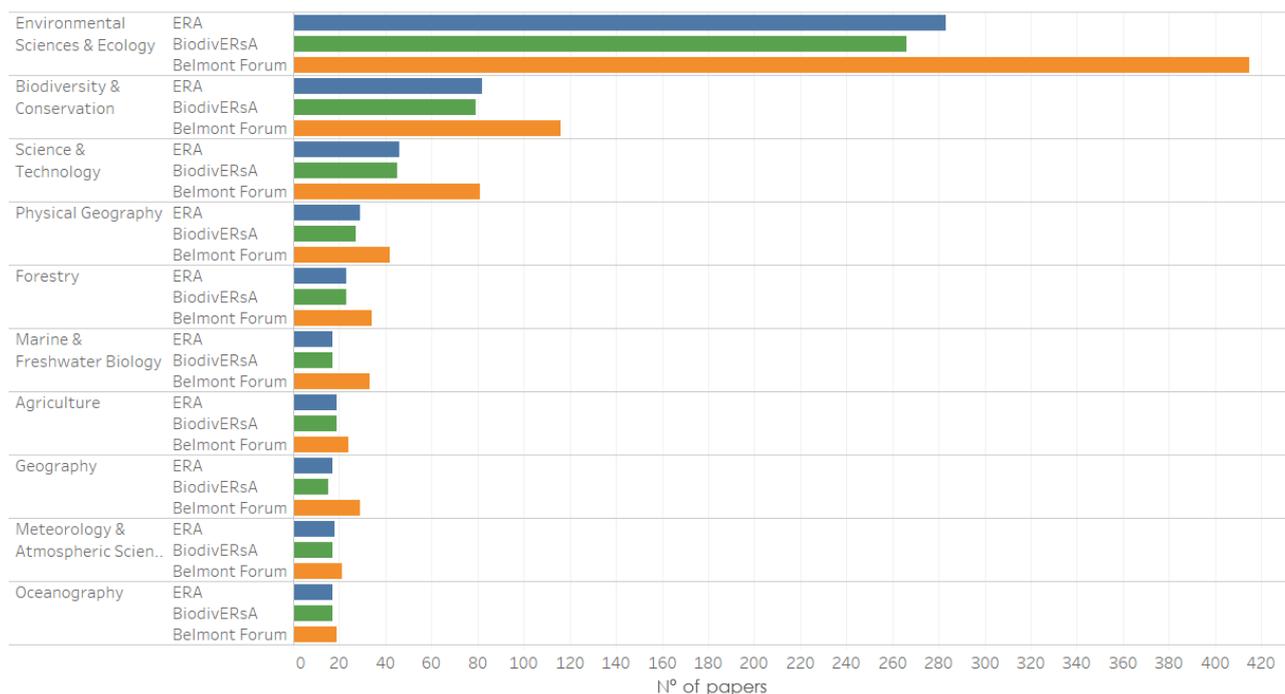


Figure 4. Temporal evolution of the number of papers on biodiversity scenarios with at least one author from BiodivERsA (green line), the ERA (blue line) and the Belmont Forum (orange line), from 1994 to 2018.

## MAIN DISCIPLINES MOBILIZED IN BIODIVERSITY SCENARIOS ARTICLES



**Figure 5.** Number of papers with at least one author from a country represented in the ERA (blue bars), BiodivERsA (green bars) and the Belmont Forum (orange bars) that mobilize different scientific disciplines (only the 10 disciplines having the highest frequency are presented).

The priority disciplines for the papers including researchers from countries represented in BiodivERsA, the ERA and the Belmont Forum were analysed. Figure 5 shows the top-10 disciplines (in terms of number of papers) encompassed within biodiversity scenarios. The selection of the top-10 disciplines was made based on the Belmont Forum database, as this was the database with the highest number of papers. These disciplines were defined in a quite broad sense (e.g. Oceanography, or Agriculture).

In general, the three groups analysed (i.e. the BiodivERsA, the ERA and the Belmont Forum databases) present similar ranking in the priority disciplines. The topic “Environmental Sciences and Ecology” leads the ranking with approximately three, three and four times as many publications as the next discipline for BiodivERsA, ERA, and the Belmont Forum, respectively. This can be explained by the breadth of the category which encompasses both the core basics sciences in biodiversity research field and applied aspects of environmental management. Also for this category, the difference in the number of published papers between the Belmont Forum and

BiodivERsA / the ERA is much higher than for the others topics.

These differences were more or less constant in relative terms up to the sixth discipline (countries part of BiodivERsA / the ERA produce approximately two thirds of the number of papers produced by the countries part of the Belmont Forum). For the next most published topics, the difference was reduced.



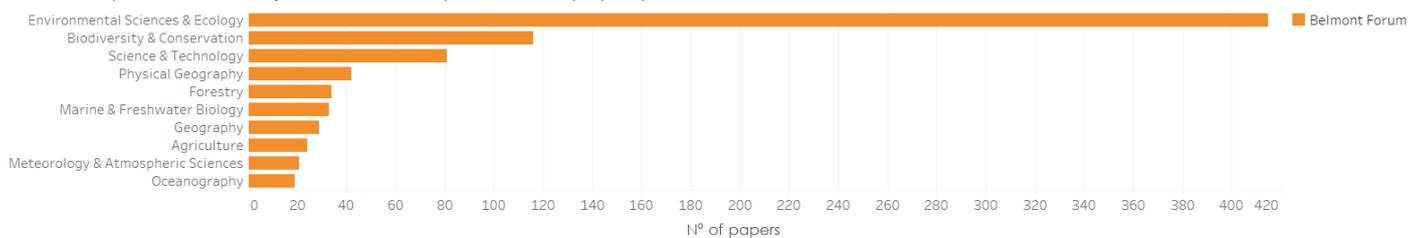
The following categories of Biodiversity and Conservation, and Science and Technology, gather between them an important contribution to the total number of papers. They reflect the priority for protection and the application of new technologies to biodiversity related research within the scientific community and research funders.

The rest of the disciplines shows similar contribution to the number of papers with small differences. Only for Meteorology and Atmospheric Science and Oceanography the contributions of the BiodivERsA, the ERA and the Belmont Forum databases were approximately the same, reflecting the extreme interest of European countries on climate change issues and oceanic studies.

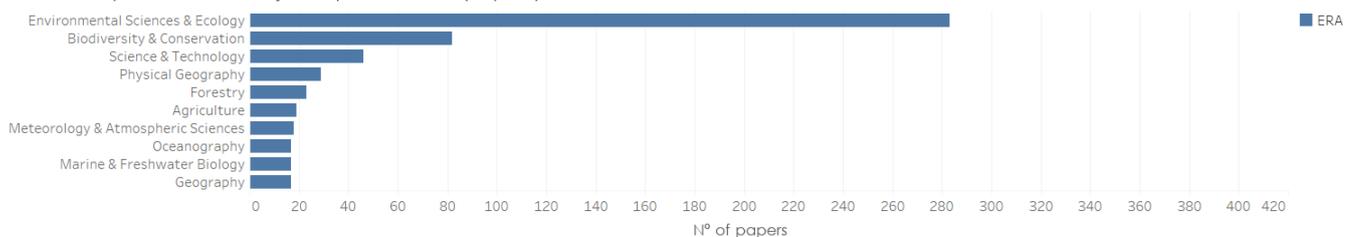
However, as mentioned above, this analysis was done considering the top-10 disciplines from Belmont Forum database. When the top-10 disciplines are listed for each initiative separately, differences in the respective rankings arise (Figure 6).

The top-5 disciplines are the same for the three initiatives compared: 1) Environmental Sciences and Ecology; 2) Biodiversity and Conservation; 3) Science and Technology; 4) Physical Geography; and 5) Forestry. However, the rest of the top-10 disciplines were ranked differently. For instance, Agriculture and Oceanography are more relevant for the ERA and BiodivERsA while Geography and Marine and Freshwater Biology receives more attention in the Belmont Forum, which may be explained because this initiative includes many countries with large extension of coasts.

Research topics addressed by Belmont Forum publications (Top 10)



Research topics addressed by ERA publications (Top 10)



Research topics addressed by BiodivERsA Forum publications (Top 10)

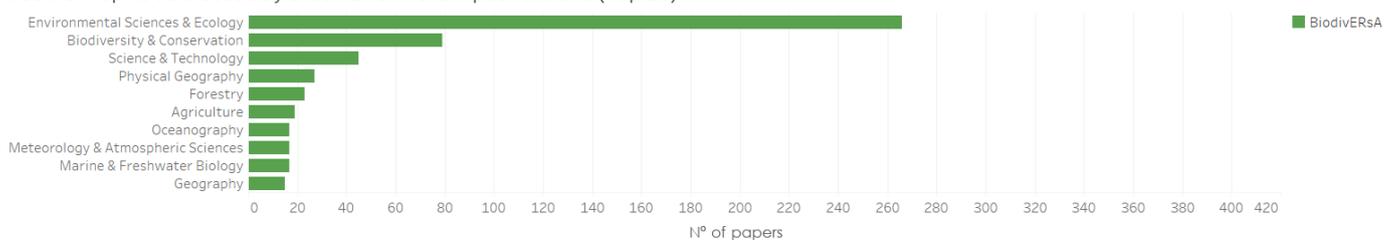


Figure 6. Ranking of the top-ten disciplines in terms of number of papers with at least one author from a country represented in the Belmont Forum (orange bars), the ERA (blue bars) and BiodivERsA (green bars).

## COLLABORATION NETWORKS BETWEEN THE ERA, BIODIVERSA AND THE BELMONT FORUM AND THE REST OF THE WORLD

When analysing papers published by ERA scientists and researchers from other continents and subcontinents, more than 40% of the ERA papers published in co-authorship with scientists from non-ERA countries come from collaboration with North America (Figure 7). The rest of the papers published by ERA scientists are quite evenly distributed among collaborations with South America, Asia, Africa and Oceania, in spite

of the large differences in population and scientific production of these continents and subcontinents (Figure 7). This is probably due to 1) the EU scientific policy, fostering scientific collaboration worldwide through specific calls and topics, some of them with focus on developing countries; and 2) the interest of European researcher in establishing linkages with the world biodiversity hotspots.

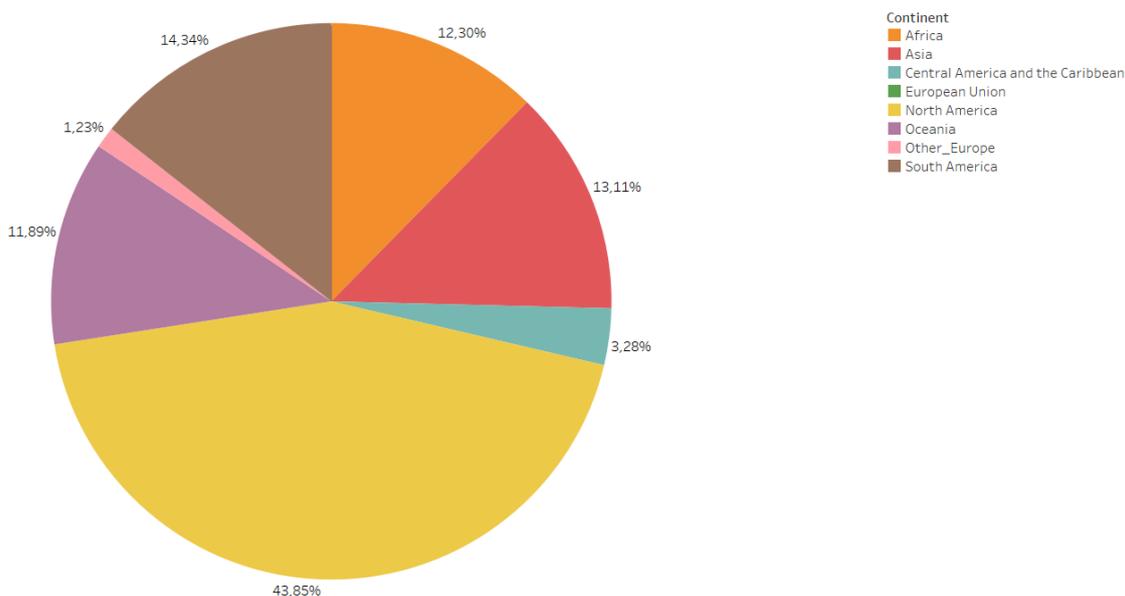


Figure 7. Percentage of papers with at least one author from an ERA country that were produced with at least one author from another continent, or produced only with ERA scientists. Continents have been disaggregated into subcontinents/subregions for a more accurate description of the existing collaborations.

These data can be disaggregated to the country level (Figure 8). The USA, followed at some distance by Canada and Australia are the three countries that present more articles in co-authorship with ERA scientists. The top-10 countries with more published collaborations with ERA scientists are the USA, Canada, Australia, Brazil, South Africa, Mexico, China, Chile, Japan and New Zealand. From this analysis some conclusions from the continental analysis can

be nuanced: 1) The low number of publications of ERA scientists in collaboration with some researchers located in biodiversity hotspots (Sub-Saharan Africa, North West of South America) is noticeable; 2) So is the low numbers of papers published by ERA researchers in collaboration with Russia and China scientists (considering the country size and scientific production).



When analysing papers published by scientists from BiodivERsA countries and researchers from other continents and subcontinents (Figure 9), the results are quite similar to those obtained for ERA collaborations. Some differences are that the percentage of papers published by researchers from BiodivERsA countries in co-authorship with scientists from North America are a bit lower than for the ERA case. The rest of the papers published by researchers from BiodivERsA countries are quite evenly distributed among

collaborations with the European Union (countries not member of BiodivERsA), South America, Africa, Asia and Oceania. The same hypothesis as for the ERA case on the causes of this collaboration distribution can be applied here, with the addition of European countries that are not BiodivERsA members, whose collaborations have been fostered for decades now by the European Commission's research programmes.

National collaborations of BiodivERsA

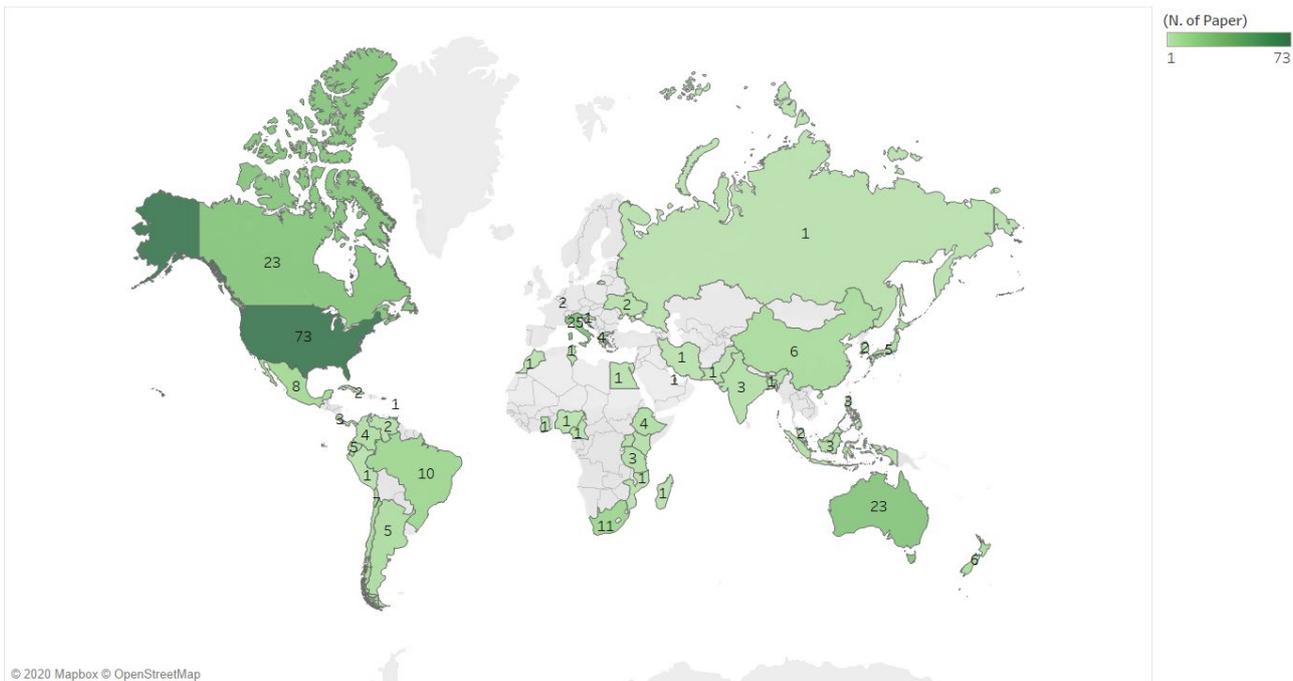
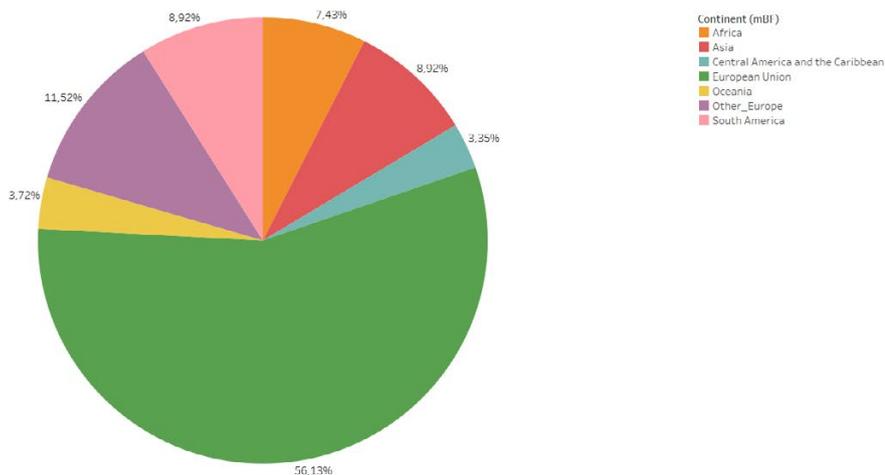


Figure 10. Distribution of papers with at least one author from a BiodivERsA country and at least one author from each country in the world. Data corresponds to the query results from the WOS Core Collection without temporal restrictions.

These data can be disaggregated to the country level (Figure 10). Again, the results are quite similar to those obtained when considering ERA collaborations.

The USA is the country that presents more articles in co-authorship with scientists from BiodivERsA countries, followed by Italy, Canada and Australia with approximately the same number of papers. The ranking of top-10 countries with more published collaborations with researchers from BiodivERsA countries is the USA, Italy, Canada, Australia, South Africa, Brazil, Mexico, Chile, China, and finally Japan, Argentina and Ecuador with the same number of papers. From this analysis some differences with the results for ERA collaborations can be extracted: 1) A strong collaboration with Italy, which is not yet a BiodivERsA member; and 2) the low number of collaborations with Asian (China and Japan) and some Oceanian countries (New Zealand).





**Figure 11.** Distribution of the papers with at least one author from a Belmont Forum country and at least one author from each continent in the world.

When analysing papers published by the Belmont Forum scientists and researchers from other continents and subcontinents, more than 55% of the Belmont Forum papers published in co-authorship with scientists from non-Belmont Forum countries come from collaboration with European Union countries (Figure 11). The rest of the papers published by ERA countries are quite evenly distributed among collaborations with countries from the rest of Europe, South America, Africa and Asia. Only a small number of papers are produced jointly with Oceania and Central America. These results confirm the strong relationship of the Belmont Forum with the European Union. Results related to the low level of collaboration with Oceania can be explained by the fact that Australia is a Belmont Forum member, so the numbers here refer to collaboration with other Oceanian countries. It is also noticeable that the percentage of published papers from the Belmont Forum countries in collaboration with the rest of the world is lower than the corresponding percentages for the ERA and BiodivERsA.

These data can be disaggregated to the country level (Figure 12). Spain, followed at some distance by Switzerland, Portugal and Denmark are the four countries that present more articles in co-authorship with scientists from Belmont Forum countries. The top-10 countries with more collaborations with scientists from the Belmont Forum countries are Spain, Switzerland, Portugal, Denmark, Finland, Belgium, Chile, New Zealand, and finally, Ecuador, Greece, South Korea with the same number of papers. From this analysis some conclusions can be derived: 1) Researchers from Belmont Forum countries have a higher publication rate in collaboration with some biodiversity hotspots (Sub-Saharan Africa, North West of South America) than BiodivERsA or the ERA; 2) The Belmont Forum also presents a very low number of papers published in collaboration with Russia and China scientists (considering the country size and scientific production); 3) Figures for European collaborations should be interpreted with caution as some countries with a large research community (e.g. Germany and France) are members of the Belmont Forum.



A photograph of a tree branch with clusters of yellow and red flowers and a large green fruit. The flowers are arranged in starburst patterns along the branch. The background is a dense forest with sunlight filtering through the leaves.

# CONCLUSIONS

This document has analysed the priorities, scientific productions and collaboration of three consortia, the ERA, BiodivERsA and the Belmont Forum, related to the research field of biodiversity scenarios.

Qualitatively, the preferred top research topics within the biodiversity scenarios for the three zones considered is “Environmental Sciences and Ecology”, with a dual focus on basic and applied science. “Biodiversity and Conservation”, and “Science and Technology” are also priority disciplines for the papers considered here.

Quantitatively, the analysis shows that scientific productions on biodiversity scenarios have dramatically increased during the last decade for the three zones considered (countries from the Belmont Forum, the ERA and BiodivERsA). Publications on biodiversity scenarios are dominated by the USA and European countries, with no Asian, African and Latin-American countries, with the exception of Brazil within the top-10 publishing countries.

As concerns the existing links, collaborations between European and North American countries dominated

the publication mapping when analyzing joint co-authorship between researchers from countries of the ERA, BiodivERsA and the Belmont Forum. The main difference between ERA and BiodivERsA collaborations is the papers produced with Italian authors, as Italy is not a BiodivERsA member and it has a significant scientific production in the biodiversity field. European countries dominate the Belmont Forum collaborations, headed by Spain. A clear gap has been detected: papers analysed here present very low number of published papers with Russia and China.

In spite of the efforts to establish collaborations with biodiversity hotspot countries, these relationships should be further fostered, especially in the case of the ERA and BiodivERsA, for which they are scarce. This implies a mismatch in the geographic location of the biodiversity hotspots and places where the science takes place, which can jeopardize conservation efforts. Therefore, collaboration with these “missing partners” should be encouraged.



## For more information

### For further information on this report

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