NETWORK OF TROPICAL AND SUBTROPICAL BIODIVERSITY RESEARCH IN OUTERMOSt REGIONS (ORs) AND OVERSEAS COUNTRIES AND TERRITORIES (OCTs) OF EUROPE IN SUPPORT OF SUSTAINABLE DEVELOPMENT

Analysis of the outputs of NETBIOME 1st Joint Call funded projects

Figure 1: Projet POMARE. Récolte par Bertrand Bourgeois. Credits : team POMARE
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Vabiome
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**NETWORK OF TROPICAL AND SUBTROPICAL BIODIVERSITY RESEARCH IN OUTERMOST REGIONS (ORs) AND OVERSEAS COUNTRIES AND TERRITORIES (OCTs) OF EUROPE IN SUPPORT OF SUSTAINABLE DEVELOPMENT**

**Introduction**

The European Overseas territories comprise 9 Outermost Regions (ORs) and 25 Overseas Territories and Countries (OCTs). The ORs are part of three European Union (EU) Member States (France, Spain and Portugal) and are integral part of EU. The OCTs are associated to EU and constitutionally depend on Denmark, France, the Netherlands and the United Kingdom. These territories are unique assets for European countries due to several particularities:

- Their marine and terrestrial biodiversity is exceptional and of global importance: they host an estimated one-third of the globally threatened species, including many endemic species.
- Their environments are particularly vulnerable to the impacts of climate change, natural hazards and pressures of human activities.
- ORs and OCTs’ Biodiversity asset is fundamental to their development, for it is the pillar of their economy. Its preservation is a crucial point for the sustainable development and resilience of local communities within a context where more and more diverse direct human pressures, natural hazards and/or climate change contribute to the progressing decline of their extraordinarily rich biodiversity. This also puts ORs and OCTs in a unique position for testing innovative strategies to mitigate their impacts and face pressures.

The importance of biodiversity and ecosystems services in European ORs and OCTs makes it essential to develop effective approaches to biodiversity governance, both locally and at the national and EU level. Bottom-up and solution-oriented scientific collaboration on subjects linked to issues facing these territories helps strengthen the quantity and level of knowledge available to contribute to the advance of science and give adequate tools to local, national and international policy-makers on matters of biodiversity and climate change. Moreover, ORs and OCTs have an important potential for economic development and innovation linked to the valorization of Biodiversity in such territories.

The aim of the ERA-Net NETBIOME project was to initiate and stimulate cooperation and coordination of research programs for the sustainable and integrated management of biodiversity, in a way that it would address the needs of the threatened ecosystems of the ORs and OCTs. To achieve these goals, the network brought together tropical and subtropical outermost regions and overseas territories of Europe. This joint work by ORs and OCTs and their international collaborators was a way to improve scientific

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knowledge on key issues, to raise awareness, to improve the management and conservation of local unique biodiversity and to bring closer the scientific teams established in remote areas from one another. It was also a quality tool to give a voice to and stand for the interest of these unique territories, which are of prime importance for global biodiversity management and conservation, but often set aside far from the decision-makers of their nations and of the European Union. The NETBIOME Era-Net consortium (FP7 2007-2012) was composed of 11 partners including Overseas Entities from five European Member States. In 2010 under the umbrella of this project, 8 project partners and 2 national research funding agencies have decided together to launch the first Joint Call for trans-national and trans-regional research entitled “Towards Biodiversity Management in support of Sustainable Development in Tropical and Subtropical EU”.

The call was targeted three main topics:

- The use, evaluation and valuation of biodiversity and the services and resources it provides, underpinning the sustainable use of natural resources (e.g. agriculture and fisheries) and including those with important cultural and aesthetic resonances;
- Improving Spatial Planning and Coastal Zone Management in order to support the sustainable management and use of biodiversity (marine and terrestrial) in the context of human pressures and global change;
- Characterizing biodiversity (from gene to ecosystem level and through to landscape) and the drivers of its evolution in a way that will enhance local capacity and improve policy decision-making.

In line with the practical aspirations and grass roots approach of NETBIOME, a thorough evaluation made through specialists’ peer-reviewing and an Evaluation Committee guaranteed the scientific excellence of the proposals; moreover, their potential to improve conservation management and the sustainable use of biodiversity at regional and local levels was also evaluated. ³

Participating Funding Agencies

- Agence Nationale de la Recherche (France)
- Regional Council of Reunion
- Regional Council of Guadeloupe
- Regional Council of French Guyana
- Regional Council of Martinique
- Government of New Caledonia/ADECAL
- Fundação para a Ciência e la Tecnologia (Portugal)
- Regional Government of Canary Islands
- Regional Government of Madeira
- Regional Government of the Azores

The total amount of funding available for this call was approximately 3.5 million Euros. Funding was provided for a maximum of a three-year period for collaborative projects.

³ NETBIOME-CSA Management of European Overseas (Sub)Tropical Biodiversity. Policy recommendations and priorities for research cooperation. March 2016
This first Joint Call received over 80 Manifestations of Interest. 35 projects were submitted, and finally 32 were eligible. Statistically, the 35 proposals initially received included a total of 210 applicants from 19 different regions, countries and territories, and the average number of partners per consortium was 6.6. Upon the completion of all the evaluation steps, 7 projects were finally selected for funding, corresponding to a success rate of 22.8% of the projects evaluated. For those projects the total amount of funding was about 3.1M€ sourced from national and regional funds, with an average of 448 000€ per project and a mean duration of 3 years. These granted projects involved 52 partners from 7 different ORs/OCTs, with an average of 7.4 partners per project ranging between 4 and 10 partners. Among the 52 teams, 46 came from public institutions and 6 from the private sector. The projects involved an average of 6 different regions/territories per project. It is also worth emphasizing that terrestrial ecosystems received more attention than the marine realm; in fact out of the seven projects granted, five addressed terrestrial field research while two focused on marine environment.

The NETBIOME project followed BiodivERsA’s blueprint and was supported via the BiodivERsA3 project for this comprehensive analysis of the scientific excellence as well as the society and policy relevance of the projects funded by this joint call. Such an extensive evaluation has been rarely done by research funding programs, probably because it is particularly challenging\(^4\). Nevertheless, the Era-NET NETBIOME was unique in its goals, its duration and its geographic impact, therefore it is very interesting to measure the excellence of the projects and the outputs for ORs and OCTs for research and policy in Europe and globally. The most accessible measurement that we used, inspired by BiodivERsA, was the number of papers produced, notably in high-impact journals\(^5\). Difficulties arose related to the time-scale of research and publication time lags, and also to the identification or the research papers that were derived from the funding of projects. As for the analysis of stakeholders’ engagement, the exercise tended to be even more challenging. To this end, we used the methodology developed in the BiodivERsA Stakeholder Engagement Handbook and the analysis of outputs of BiodivERsA projects\(^4\), having adapted it to the particularities of the NETBIOME projects. It is complex to demonstrate the social impact of a project given the delays that can exist between its life, its immediate aftermaths and the more diffuse and long-term impacts it can have on science, society of policy-making in a particular context.


\(^5\) We assume that excellent research gets published in excellent journals, even if the definition of such journals is more difficult than expected.
Part I. Methodology

The outputs of funded projects were analyzed using the information provided in the final reports of projects required by NETBIOME, which includes sections for academic and society/policy relevant products as well as interactions with stakeholders.

I.1. Assessment of the academic productions

The academic impacts of the NETBIOME funded projects were studied through the peer-reviewed publications produced, based upon the data made available to us by the project coordinators. The most recent impact factors (2015/2016) of the journals were obtained using the SCIJournal.org Impact Factor list\(^6\) as a baseline.

Based on a basic metric rationale (by quartile rankings) by taking each publication’s impact factor reference, we can see that 19 of the 57 publications were ranked under Outstanding, Excellent and Good (above the mean value of the impact factor 3.28). Seventeen of them ranked under Fair (falling within the average value), and 14 of them as poor.

Table 1 – Scientific Journal Impact Factor Ranking\(^7\)

<table>
<thead>
<tr>
<th>Scientific Journal (with JCR impact factor)</th>
<th>Number of publications</th>
<th>Impact Factor 2014-2015</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trends in Ecology and Evolution</td>
<td>1</td>
<td>16,735</td>
<td></td>
</tr>
<tr>
<td>Ecological monographs</td>
<td>1</td>
<td>8,037</td>
<td></td>
</tr>
<tr>
<td>Global Ecology and Biogeography</td>
<td>2</td>
<td>6,531</td>
<td>Outstanding &gt;75</td>
</tr>
<tr>
<td>Molecular Ecology</td>
<td>4</td>
<td>5,947</td>
<td></td>
</tr>
<tr>
<td>Journal of Biogeography</td>
<td>1</td>
<td>5,84</td>
<td>Excellent Q75</td>
</tr>
<tr>
<td>Journal of Ecology</td>
<td>1</td>
<td>5,521</td>
<td></td>
</tr>
<tr>
<td>Frontiers in Plant Science</td>
<td>1</td>
<td>4,495</td>
<td></td>
</tr>
<tr>
<td>PLoS ONE</td>
<td>3</td>
<td>4,411</td>
<td></td>
</tr>
<tr>
<td>Frontiers in microbiology</td>
<td>1</td>
<td>4,165</td>
<td></td>
</tr>
<tr>
<td>Heredity</td>
<td>1</td>
<td>3,805</td>
<td></td>
</tr>
<tr>
<td>Journal of Natural Products</td>
<td>3</td>
<td>3,662</td>
<td>Good Q50</td>
</tr>
</tbody>
</table>


\(^7\) Please note the ranking has been adapted compared to the Lemaitre et Le Roux (2015) analysis of outputs from 2008 BiodivERsA funded projects, and thus the two cannot be compared.
<table>
<thead>
<tr>
<th>Title</th>
<th>Volume</th>
<th>Impact Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metabolomics</td>
<td>1</td>
<td>3,661</td>
</tr>
<tr>
<td>Journal of hydrology</td>
<td>1</td>
<td>3,043</td>
</tr>
<tr>
<td>Phytopathology</td>
<td>1</td>
<td>3,011</td>
</tr>
<tr>
<td>Taxon</td>
<td>1</td>
<td>2,907</td>
</tr>
<tr>
<td>Ecology and Evolution</td>
<td>1</td>
<td>2,537</td>
</tr>
<tr>
<td>Virus Research</td>
<td>1</td>
<td>2,526</td>
</tr>
<tr>
<td>Tetrahedron Letters</td>
<td>1</td>
<td>2,347</td>
</tr>
<tr>
<td>Biodiversity and Conservation</td>
<td>1</td>
<td>2,258</td>
</tr>
<tr>
<td>Archives of Virology</td>
<td>2</td>
<td>2,255</td>
</tr>
<tr>
<td>Acta Oecologica</td>
<td>1</td>
<td>1,617</td>
</tr>
<tr>
<td>Letters in Applied Microbiology</td>
<td>1</td>
<td>1,579</td>
</tr>
<tr>
<td>Arctic Antarctic and Alpine research</td>
<td>1</td>
<td>1,455</td>
</tr>
<tr>
<td>Australian Journal of Chemistry</td>
<td>1</td>
<td>1,427</td>
</tr>
<tr>
<td>Journal of Ornithology</td>
<td>1</td>
<td>1,419</td>
</tr>
<tr>
<td>Cryptogamie Bryologie</td>
<td>3</td>
<td>1,389</td>
</tr>
<tr>
<td><strong>Fair Q25</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Genetica</td>
<td>1</td>
<td>1,343</td>
</tr>
<tr>
<td>Journal of Bryology</td>
<td>7</td>
<td>1,325</td>
</tr>
<tr>
<td>South African Journal of Botany</td>
<td>1</td>
<td>1,244</td>
</tr>
<tr>
<td>Phytotaxa</td>
<td>1</td>
<td>1,087</td>
</tr>
<tr>
<td>the Bryologist</td>
<td>1</td>
<td>1,077</td>
</tr>
<tr>
<td>Plant Pathology</td>
<td>1</td>
<td>1,038</td>
</tr>
<tr>
<td>Zootaxa</td>
<td>1</td>
<td>0,994</td>
</tr>
<tr>
<td>The Polish Botanical Journal</td>
<td>1</td>
<td>0,697</td>
</tr>
<tr>
<td>Arquipelago- Life and Marine Sciences</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Frontiers of Biogeography</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Société française d’Ichtyologie</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Methods in Molecular Biology</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Microsatellite Marker</td>
<td>1</td>
<td>N/A</td>
</tr>
</tbody>
</table>
I.2. Characterization of the international collaborations revealed by scientific papers

ORs and OCTs have developed long term cooperation with their surrounding geographical areas, given shareable contexts such as similar geoclimatic and socio-cultural characteristics, their relationship between nature and communities as well as the type of research capacities and infrastructures they host. The ORs and OCTs that participated in the NETBIOME call encompass several unique biodiversity hotspots and share similarities with other hotspots located in tropical and subtropical areas, which make them attractive partners for international research cooperation.

The international collaboration promoted by the NETBIOME call was analyzed and mapped in order to reach an accurate vision of the academic collaboration and co-authorship on scientific papers related to ORs and OCTs biodiversity that the projects allowed to bring forth. We analyzed the international networks of researchers based on the country’s author affiliation identified in the papers for a total of 57 Papers produced through the project’s lifetime. For each paper, the link between each author’s country of affiliation in a given paper was transformed into a link between countries collaborating in this paper, while the information on the number of co-authors from each country per paper was also collected. We then examined the links between countries based on the number of papers co-authored by these countries in order to measure the collaboration networks and the degree of closeness of each country to the center of the map, which is in an indication of their relative degree of collaboration with others.

A focus was given on the importance of the ORs and OCTs in the analysis and their contribution to research independently from their Member States. In many cases, we separated these entities from their Main Member State in order to evaluate their true strength and ability to collaborate with other relevant actors whether these came from their own territory or other countries/territories. We seek to identify in such cases, local issues that were common to these participating actors and not always having a close involvement by their Member State.

I.3. Assessment of stakeholder engagement and research products relevant for society/policy

The definitions and typologies used in this study for analyzing the stakeholder’s engagement and research products relevant to stakeholders are based on the methods adopted in the analysis of the outputs of BiodivERsA funded projects and the Stakeholder Engagement Handbook (SEH) (http://www.BiodivERsA.org/577). According to BiodivERsA’s 2008 output du call Analysis “A stakeholder is defined as any person or group (excluding other scientists) who influences or is influenced by the research project. Engagement means that they are actively involved, participate in- and/or are impacted by some aspect of a research project.”

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9. in the case of several addresses being associated to one author we have taken the researcher’s affiliation institution as the country of origin
However, some adaptations have been made to produce a more accurate, relevant and complete picture of the NETBIOME projects, including a more detailed variety of economic stakeholders, and further sub-categories under some main categories.

I.3.1. Types of stakeholders engaged

To this end, we distinguished 10 main types of stakeholders engaged in the research, divided in 32 subcategories and classified as follows:

Table 2 – Categories of Stakeholders

<table>
<thead>
<tr>
<th>Main type of stakeholder</th>
<th>Description of stakeholder category</th>
<th>Sub-categories (not exhaustive)</th>
</tr>
</thead>
<tbody>
<tr>
<td>International policy-makers or advisors</td>
<td>Policy makers and advisors and well as public authorities and agencies at the international, regional or European level</td>
<td>International policy makers or advisors&lt;br&gt;European policy makers or advisors</td>
</tr>
<tr>
<td>National and local policy makers and public authorities</td>
<td>Policy makers, public authorities and public agencies at national and local level</td>
<td>National and local government, policy-makers or advisers&lt;br&gt;Public authorities and public agencies</td>
</tr>
<tr>
<td>Knowledge and Technology Transfer Organisation (KTTO)</td>
<td>The goal of KTTO is to ensure the effective sharing and uptake of knowledge and technology for economic development and for societal benefit. They can have different organizational and legal status.</td>
<td>Competitiveness Cluster&lt;br&gt;Business incubators (incl. academic departments)&lt;br&gt;Technological platforms&lt;br&gt;Intermediates for training and advisors&lt;br&gt;Others</td>
</tr>
<tr>
<td>Direct economic operators of natural resources</td>
<td>Economic operators directly exploiting biodiversity and ecosystem services for the production of goods. This category includes farmers, forester, fishermen, aquaculture, tourism operators and the related professional organisations</td>
<td>Operators of land resources (farmers, foresters)&lt;br&gt;Operators of sea and water resources (fishermen, aquaculture..)&lt;br&gt;Tourism operators</td>
</tr>
<tr>
<td>Businesses</td>
<td>Economic actors with indirect use of biodiversity and ecosystem services</td>
<td>SMEs&lt;br&gt;Big companies (e.g. rail infrastructure, global companies, etc.)&lt;br&gt;Clusters</td>
</tr>
<tr>
<td>Funding support and investors</td>
<td>Public or private structure that are supporting innovation and transfer, through grants, loans or investment</td>
<td>Mixed Economy Companies&lt;br&gt;Development agencies&lt;br&gt;Venture capital, business angels&lt;br&gt;Banks&lt;br&gt;Others</td>
</tr>
<tr>
<td>Natural resource managers</td>
<td>Protected area &amp; wildlife managers</td>
<td>Protected area &amp; wildlife managers</td>
</tr>
<tr>
<td>---------------------------</td>
<td>------------------------------------</td>
<td>------------------------------------</td>
</tr>
<tr>
<td>Others</td>
<td>Others</td>
<td>Others</td>
</tr>
<tr>
<td>NGOs</td>
<td>NGOs and associations for nature protection</td>
<td>Other NGOs</td>
</tr>
<tr>
<td>Local communities</td>
<td>Hunters and fishermen (hobby)</td>
<td>Hunters and fishermen (hobby)</td>
</tr>
<tr>
<td></td>
<td>Local communities representatives</td>
<td>Local communities representatives</td>
</tr>
<tr>
<td></td>
<td>Landowners</td>
<td>Landowners</td>
</tr>
<tr>
<td>General public</td>
<td>General public (in conferences, science festivals,….)</td>
<td>General public (in conferences, science festivals,….)</td>
</tr>
<tr>
<td></td>
<td>Media</td>
<td>Media</td>
</tr>
<tr>
<td></td>
<td>Museums</td>
<td>Museums</td>
</tr>
<tr>
<td></td>
<td>Education structures (universities, schools,….)</td>
<td>Education structures (universities, schools,….)</td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>Others</td>
</tr>
</tbody>
</table>

I.3.2. Level of engagement of stakeholders in the research\(^{11}\)

Four levels of engagement are identified in the BiodivERsA Stakeholder Engagement Handbook, which correspond to different investments in stakeholder engagement for both researchers and stakeholders and often depend on the ultimate aims of engagement activities.

**Inform:** It corresponds to communication devoted (at least partly) to stakeholders but without specific activities and without involvement in the actual research. The objective is to make the information about the project or the outcomes accessible to those whom it may affect or interest, yet not involving any active exchange with them.  
*Examples: Interview of the scientists in newspapers; documentary about the research subject.*

**Consult:** Specific questions are asked to stakeholders, but without a full two-way-discussion or interaction. This level of engagement is designed, for example, to ask their opinion to stakeholders.  
*Examples: Physical or internet consultation of stakeholders on research subject or outcomes; basic consultation to obtain access to study sites.*

\(^{11}\) Please note the definitions used here differ slightly from those in the BiodivERsA Stakeholder Engagement Handbook, e.g. “collaborate” level is understood a bit more widely here, beyond involvement of stakeholders as project partners or advisory board members *stricto sensu.*
**Involve:** engagement with more opportunity for discussions and interactions than in “consult”. Here, stakeholders are more closely engaged in the research, and may also provide resources or data.

*Examples:* Organization of a workshop to review project questions or findings including two-way exchanges between researchers and stakeholders; discussion and provision of feedback to site owners.

**Collaborate:** Stakeholders involved to some extent in research activities and/or project decision-making. Fully active engagement is undertaken where stakeholders are partners in the research team, possibly contributing to the suggestion of research directions and perspectives.

*Examples:* Involvement of stakeholders in the project’s advisory or steering committee; co-production of a product co-authored by scientists and engaged stakeholders.

1.3.3. **Stage of engagement of stakeholders in the research projects’ life:**

We analyzed the stage of stakeholder engagement (before, during or after the period of the project). Stakeholders involved before the start of the projects often helped in framing the research questions or were consulted as part of preliminary work when building the project. Stakeholders engaged after the project often worked with researchers on preparing new projects, promoting outputs beyond the project’s life-cycle and even implementing or expanding training and monitoring schemes. Activities involving stakeholders during the projects’ lifespan were more diverse ranging from supporting organization of major events or help producing informational content to advertise the project’s achievements.

1.3.4. **Types of methods of engagement used by researchers and activities performed by stakeholders**

<table>
<thead>
<tr>
<th>Table 3 – Methods of Engagement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inform</strong></td>
</tr>
<tr>
<td>Conferences (presentations)</td>
</tr>
<tr>
<td>Practical demonstrations</td>
</tr>
<tr>
<td>Training sessions</td>
</tr>
<tr>
<td>paper tools, newspapers and magazines</td>
</tr>
<tr>
<td>Web tools (website, newsletters)</td>
</tr>
<tr>
<td>TV and Radio</td>
</tr>
<tr>
<td>Surveys/questionnaires (responding)</td>
</tr>
<tr>
<td>Interviews (giving)</td>
</tr>
<tr>
<td><strong>Consult</strong></td>
</tr>
<tr>
<td>Interviews (performing)</td>
</tr>
<tr>
<td>Web tools (for consultation, wiki, webinars ?etc.)</td>
</tr>
<tr>
<td>Surveys/Questionnaires (performing)</td>
</tr>
<tr>
<td>Informal consultations</td>
</tr>
</tbody>
</table>
I.3.5. Types of research products relevant to stakeholders

The types of research products relevant for stakeholders were identified and classified according to the degree to which they were actively intended for stakeholders. Once again this follows BiodivERsA’s methodology.

**Informative:** output not especially adapted for stakeholders but of interest for them
*Examples: Projects’ blogs, promotion flyers, reports with results of interest but not adapted for stakeholders…*

**Targeted:** output of interest and adapted to stakeholders but prepared by scientists without direct links with stakeholders.
*Examples: leaflets and other documents intended for dissemination to a wider audience, reports or recommendation for policy-making…..*

**Proactive:** output adapted, of interest for and prepared with stakeholders in a proactive manner, through their engagement in preparing the output and in its dissemination.
*Examples: reports co-developed with stakeholders, effective transfer of techniques or application of management protocols, direct contribution to policy reports or management plans…*

**Part II. Academic productions, international collaborations, stakeholder engagement and research products relevant to society generated at the level of the whole call**

**II.1. Academic productions**

The seven projects funded through the first NETBIOME joint call contributed to a total of 57 Papers published in international peer-reviewed journals with a mean value of 8 papers per project.

We can therefore see that there is a significant excellence in a fair amount of publications stemming from the OCTs and ORs. It is important to highlight that the projects are still producing articles and publishing in other or some of the journals shown in graph 1, thus
the research is still dynamic and the publishing ongoing. The potential for further
development on the research of tropical and subtropical ecosystems publications is
clearly a reality. The NETBIOME projects have contributed to finding further
opportunities to publish in high-level journals. The graph below illustrates that 33% of the
publications identified are referenced as either outstanding, excellent and good, whilst
30% are under the ranking of fair. The high quality and standard to which many of these
publications have been put through during the period evidences the relevance and
importance of tropical and subtropical biodiversity research among the scientific
community at a larger scale.

Graph 1- Impact Factor Publications

As for the notoriety of journals, there is a wide range of journals where NETBIOME’s scientific
findings have been published, most of them only including one publication. However, there are
some journals with several articles published in either excellent or very good ranked journals
definitions” (“Plos One”, “Journal of natural products” “molecular ecology”). The effort to attain a high
academic quality of the research conducted by the NETBIOME Network in order to disseminate
to the academic community the added value of findings and transferable knowledge is
remarkable. This latter is well evidenced by the fact that important findings and breakthroughs
particularly to their region and thematic have been accepted in top-level scientific journals.
The journal impact can also be depicted by impact factor ranking from highest to lowest as in Graph 3. Each color represents a certain quartile, red being outstanding, light red excellent, dark green good, light green fair and yellow, poor. The Y axis accounts for the highest impact ranking journal (Trends in Ecology and Evolution) whilst the Polish Botanical Journal is according to the SCI journal impact factor list, the lowest ranked. Again we see that there is an important quality standard to NETBIOME’s scientific publications given the journal ranking distribution.
II.2. International collaborations testified by scientific publications

International cooperation was developed and strengthened thanks to the NETBIOME call, which enabled partners from continental Europe, ORs and OCTs and other non-European countries to share knowledge and join forces on local as well as global issues. Networks of thematic researchers were created and existing collaborations were bolstered to longer terms as well as scientific collaboration on common matters.

Interestingly, the map of the research collaborations between countries observed in all the projects’ publications shows relations among the OCTs and ORs directly and in many cases even not conventionally linked to the corresponding Member State of affiliation as expected. As seen in Graph 4, the circle in black shows that the centrality in publications and collaboration is mainly led by France (mainland) and to some extent other EU countries (Portugal, Italy, UK and Germany), but that two ORs namely Azores and Reunion have also a strong central position on the scientific collaborations that are not only linked to Portugal and France correspondingly but to other OCTs and ORs and even third countries (depicted in dark blue). Cases such as the OCTs in the Pacific region extend their collaboration to even more remote regions including Latin America, South Africa and Asia.

OCTs and ORs (depicted in green on the map) are in many cases acting as hubs for collaboration amongst regions that are less likely to collaborate together given their geographical distances (as in the case of Asia and Latin America through the initiative of Canary Islands, Azores and Reunion). The NETBIOME network has therefore helped develop collaborative research links to very diverse and remote regions in some cases, and in others, reinforce the collaboration between EU Member States and OCTs and ORs to a larger extent. The international scale to which biodiversity research has been positioned probably explains the extent to which NETBIOME’s research topics have allowed scientific collaboration beyond regional frontiers.
The number of authors by Geographical region (graph below) shows as well the active participation of ORs on papers (139 publications), whilst OCTs have been accounted for 57 publications. Western Europe remains as expected with the major share of publications (216). However, it is important to highlight that OCTs and ORs often establish a transfer structure that emphasizes the project’s added value to be potentially replicated to similar areas in other parts of the world with similar characteristics. The case of Hawaii as part of the collaboration with the US illustrates well this dynamic.

Graph 4 - International Collaboration on the Framework of NETBIOME

Credit: map prepared by the Fondation pour la Recherche sur la Biodiversité (FRB), using the Gephi freeware (https://gephi.org/).

Graph 5 - Distribution of Publication’s authors by Geographical region
II.3. Types of stakeholders engaged

More than 170 stakeholders from very diverse backgrounds have been engaged by the NETBIOME research projects, with an average of 27 stakeholders per project.

Funded projects gathered a wide spectrum of stakeholders. The most engaged categories correspond to the general public followed by the public authorities and policy makers. It seems there is a common interest to attain a global awareness around the local communities to which the projects were addressed. The general public often involved students, other academic communities and online media coverage to a wider population on the territories. As for the public authorities category, they often involve local governmental civil servants and NGO’s representatives linked to the government. Nevertheless, there is still room for improvement for categories such as funding agencies, KTTOs and businesses that are yet to be integrated to the overall dialogue of stakeholders. Probably targeting events to these particular segments where such stakeholders can see the added value the project may bring in relation to their own sector of activity

Graph 6 – Distribution of Stakeholders by sub-categories
II.4. Level of engagement developed

The main level of engagement was “informative”. Few stakeholders were consulted, however a quite large proportion of the stakeholders were involved and many of them even participated directly and actively in the projects. The closest levels of engagement took place either via advisory boards or steering committees, or for stakeholders working on some aspects of the research, on the communication of the project or in some cases in a partnership for the development of new methods or tools\textsuperscript{12}.

\textsuperscript{12} Please note this definition of the “collaborate” level of engagement is slightly wider than that used in the BiodivERsA Stakeholder Engagement Handbook and in the analyses of BiodivERsA project outputs.
II.5. Stage of stakeholder engagement

The major part of the stakeholders was involved during the research project's lives. Nevertheless, some interactions occurred after the life of the project, mostly on further collaboration or the diffusion dissemination of the results (to other stakeholders or decision-makers). Only one project engaged an NGO previous to the start of the project as to include local perspectives from stakeholders in view to include them on the overall project Planning (C.f, Frag&Binv GEPOG (Groupe d'Etude et de Protection des Oiseaux en Guyane).

II.6. Roles of stakeholders in the research projects, and methods of engagement used by researchers

As for the methods of engaging stakeholders, more than 20% were done by the project partners in the form of formal and informal collaborations with local organizations or other
and international entities in most of the cases. The second most important method continues to be the dissemination of information through paper and web tools (mainly media) to engage different types of stakeholders in particular activities of the projects, followed by the face to face activities such as multi-stakeholder forums, conferences and consultations.

Graph 9 - Method of stakeholder engagement

II.7. Products informing, targeting, or proactively engaging stakeholders

Most of the outputs generated by the projects were mainly categorized as “informative” accounting for around 50% of the total stakeholders’ engagement typology. The open widespread of the main results in most cases have been through conferences, video projections or TV broadcasts portraying to scientific and academic communities, policies and even commercial/industrial sectors, the main assets the projects.

As for collaboration (in a large sense, accounting for 28% of the total) the activities undertaken are often described as multistakeholder forums, partnership meetings, informal consultations with key stakeholders as well as their active involvement in data collection.

Furthermore, the 19% representing a proactive involvement of stakeholders was related often to targeted workshop co-organizations as well as active participation in conferences. Interesting to highlight under the “consulted” category a significant recognition of Governments (E.g. French Polynesia or Azores) for the project’s methods and evidence-based data.
Part III
Highlights on academic findings, stakeholder engagement and research products relevant to society generated by each project

Frag&Binv
CONSEQUENCES OF FOREST FRAGMENTATION AND CONDITIONS FOR BIOLOGICAL INVASIONS: THE CASE OF CARIBBEAN BIRDS

One of the studied species: the yellow-headed Manakin.

Credits Frag&Binv team

Objectives
The transformation rate of natural ecosystems due to human activities has recently accelerated. Habitat fragmentation and biological invasions are 2 major human-induced threats to biodiversity which are both responsible for the decline on populations and species. This project aims at assessing the effects of fragmentation on several attributes of individuals/populations in a set of bird species showing a gradual specialization on forest habitat, addressing several main questions:

1. How does forest fragmentation affect population genetic diversity (through demographic changes (e.g. population size and migration between populations))?
2. Does forest fragmentation alter phenotypic (morphologic, immunologic…) quality of birds?
3. How does forest fragmentation influence birds resistance or exposure to parasites?
4. Are effects of fragmentation similar in all bird species?
In addition, a test focused on two recent hypotheses explaining the success of biological invasions (the so-called enemy release hypothesis and the hypothesis of different immune defense strategies in invaders), and their consequences for native species.

**Approach**

This project was led by 6 partners involving 4 territories: French Guiana, Guadeloupe, Martinique, and Montserrat. These territories face real problems of forest loss and fragmentation as well as introduction and/or invasion of species, thus threatening their high endemic biodiversity. The descriptive approach used to address most of these questions was based on a large field sampling scheme. Data and samples collected on birds were analyzed in the laboratory using different methodologies (molecular biology and population genetics, morphometrics, immunology, spatial analyses...).

**Main outputs**

- Significant inter-island genetic divergence revealed in 9 bird species (with an incipient species in one island of the Lesser Antilles), but patterns of genetic differentiation not always consistent with boundaries of subspecies previously described locally.
- Detection of genetic differentiation at a very small geographical scale in several bird species, partly due to forest fragmentation. This discrepancy between potential and realized dispersal suggests that habitat fragmentation consequences may have been underestimated in a priori mobile organisms. There are only a few previous studies showing genetic differentiation on such a small scale.
- At a regional level, discovery of a strong genetic differentiation within a single island in 2 forest bird species between the 2 parts of Guadeloupe (i.e. Basse-Terre and Grande-Terre). For one of the two species, levels of differentiation seem to be the highest reported in the literature for a bird species within an island of such small size. Ongoing identification of potential forest corridors to maintain connectivity within Guadeloupe.
- Discovery of new strains and new records of blood parasites, feather mites and microbes hosted by ticks in the Caribbean region (DNA sequences deposited in GeneBank and MALAVI databases).
- Clear link between parasite abundance and diversity and forest fragmentation (though varying among parasite lineages, host species, and territory), independent of the influence of climatic variables. Ongoing analyses of the effect of forest fragmentation on immune ability of birds and body condition.
- Evidence that habitat fragmentation has not the same effect in all species. In particular, forest specialist species are more sensitive to forest fragmentation than generalist ones.
- Development of a new integrative approach to optimize the parameterization of resistance cost surfaces, a challenge in landscape genetics. This approach showed that matrix components of the landscape do not equally constrain dispersal in a forest specialist bird species: urban areas and meadows are far more resistant than forests, agricultural areas being intermediate.
- Empirical support of two hypotheses proposed to explain successful biological invasions: fewer parasites and different immunologic profile in invasive populations compared with native ones.
- Set up of 170 molecular markers in 11 bird species for population genetics analyses.
- Comparison of the relative performances of two types of simple sequence repeats (SSRs) and demonstration that expressed sequence tags (EST) perform surprisingly better than genomic SSRs when genetic diversity is low. Hence,
using highly polymorphic loci does not always ensure a higher power to detect population genetic differentiation. These results challenge common practice in population genetic studies.

- Establishment of a shared methodology (writing of short manuals) in the 4 territories for capture of birds and data/samples collection and training of local stakeholders
- Numerous presence/abundance data (about 12000 birds captured, 150 species, 70 localities) provided to local stakeholders to increase local knowledge about species distribution and abundance

Overall, the Frag&Binv findings led to greater knowledge on local bird habitats, genetic particularities, patterns of population structure in connection with landscape structure, and responses to parasites in the study sites, which set the pace for a more successful management of biodiversity in forests on the French and British islands.

6 partners:
UMR CNRS Biogéosciences, Université de Bourgogne (Fr) / Office National de la Chasse et de la Faune Sauvage – Direction des Etudes et de la Recherche, CNERA Avifaune migratrice (Fr) / Office National de la Chasse et de la Faune Sauvage – Cellule Technique des Antilles françaises Martinique (Fr) / Groupe d’Etude et de Protection des Oiseaux en Guyane (GEPOG), Guyane (Fr) / CIBIO, University of Porto (Pt) / Department of Environment, Montserrat (UK)
Total budget: 792 300€ / Total Grant: 368 800€

ACADEMIC RESULT HIGHLIGHT

A significant and substantial population structure was reported at a very small spatial scale in several bird species, suggesting that the ongoing habitat fragmentation, especially in tropical forests, may have a deeper impact than previously thought on avian populations.

- More importantly, species responses to fragmentation (assessed through a comparison of genetic differentiation between continuous and fragmented forest landscapes) were positively correlated with levels of forest specialization (assessed from field census data), meaning that specialist species are more affected by forest fragmentation than generalist ones.
- This study provides a unique empirical evidence of the association between habitat specialization and genetic consequences of habitat fragmentation. Given the small spatial scale considered, the pattern observed is also remarkable for mobile organisms such as birds.

STAKEHOLDER ENGAGEMENT AND PRODUCTS RELEVANT TO SOCIETY/POLICY

- Frag&Binv provided a quantitative assessment evidencing that forest fragmentation has negative impacts at different organizational levels of biodiversity (individuals and populations) and that for almost all traits studied. Also, this project identified particular populations or landscape components deserving a special attention. As an example, a study suggests that some gene flow among populations of Plumbeous warblers in Guadeloupe occurs along the coast of the Grand Cul de Sac Marin, where mangroves and swamp forests may allow stepping stone dispersal between Grande-Terre and Basse-Terre. While some of these forest patches are already protected by the National Park of Guadeloupe, this is not the case for a particular forest corridor located in an urbanized area, which also deserve formal protection.

- The involvement of several types of stakeholders in the project supported the teams’ work to provide tangible elements for decision-making policies regarding nature and wildlife management frameworks. Researchers worked in close cooperation with the ONF (National Forest Office) on the different sites, the DEAL Martinique and the National Park of Guadeloupe provided logistical support to organize meetings with local stakeholders. Data collection was completed with the help of local associations for the environment. The teams created solid basis for developing new collaborative projects that will benefit from the work done in the project FRAG&BINV.

- Frag&Binv has already several partners within the consortium ranging from policy, environmental surveillance and management (ONCFS and Monsterrat government) to education, and conservation (GEPOGV)

- Frag&Binv held several multi-stakeholder forums in the different OCT’s to exchange with local stakeholders around issues related to landscape structure and forest fragmentation. The project was also presented to the Ministry of Agriculture, Land, Housing and the Environment of Montserrat.

- The results served for evaluating effects of past changes in land use and for future spatial planning in each territory: i.e., linking patterns of population structure with landscape features allowing identification of landscape components associated with low/high connectivity for regional schemes such as ‘Trame Verte et Bleue’ or ‘Schéma Régional de Cohérence Ecologique’ in French territories as well as for the management of hunted species populations.

- Numerous pictures (>100) have been published in the photo library of CNRS Images, a unit from the communication department of the CNRS. The pictures were taken during the field work in French Guiana/ Montserrat to illustrate the local biodiversity, local landscapes, and fieldwork performed for the project. Such interaction between the project FRAG&BINV and CNRS Images increased the scientific visibility of the project, and also contributed to popularization of science and public awareness about habitat fragmentation and conservation of biodiversity. CNRS Images were also published in portfolios, slideshows and two videos about the project. https://vimeo.com/158608283
The collected data will be used to publish a guide to help local decision-makers from Guadeloupe, Martinique and French Guiana with the integration of biodiversity in land use planning within the ecological networks “Trame verte et bleue” and “Schéma regional de coherence écologique” put forth by the French national government. The results point out precise issues supported with evidence-based local data on key-locations that need to be protected, species habits, etc. In Guiana, the local partner GEPOG (an association for bird protection) is in charge of the dissemination of the results. Such data is crucial for local stakeholders in these territories given the rarity of global inventories and the particularity of their activities. E.g, information stemming from Frag&Binv on the abundance of different bird species on various localities has been transferred to a consulting firm (BIOTOPE Agence Amazonie-Caraïbes - Antenne Caraïbes) in charge of developing the first phase of a bigger study related to biodiversity and planning guidelines for Martinique.

An educational program with local high school students from the agricultural college in Auxerre (supported by the Regional Council of Bourgogne), has been launched by the Frag&Binv team. It will involve research related to the issue of habitat fragmentation and field study. Students are currently producing a series of 10 posters about fragmentation as well as a Facebook page (https://www.facebook.com/Projet-Fragmentation-des-Habitats-Lyc%C3%A9e-La-Brosse-632870686885851/). A similar program will be launched in Martinique, Guiana and Guadeloupe allowing children to work together on the same subjects and possibly to travel to their counterpart’s region to study fragmentation.
initiative will help educate young citizens on matters of biodiversity conservation and raise awareness on local environmental problems as common global issues.
SEAPROLIF

DIVERSITY AND FUNCTIONING OF COASTAL MARINE BIOMES UNDER SIEGE: IMPLICATIONS OF SEAWEED PROLIFERATIONS ACROSS THREE OCEANS

Asparagopsis in the Azores. Credits: SEAPROLIF team

Objectives

Macroalgae proliferation is perceived as a serious threat to biodiversity, in particular in coastal ecosystem including coral reefs. The genus *Asparagopsis* (Rhodophyta), has been identified among the 100 most invasive species observed in subtropical and temperate regions in particular the *Asparagopsis taxiformis* and *Asparagopsis armata* species. Following recent reports of proliferation *Asparagopsis* in New Caledonia, French Polynesia and Reunion Island, SEAPROLIF aims to:

1. Characterize the algal populations along its distribution range
2. Establish the algal proliferation status and to monitor *Asparagopsis* populations and their interaction with coral (cnidarian) assemblages
3. Properly document the status of the species in each region, its potential invasiveness
4. Establish the impact on natural species, to support management and policy making

Approach

8 partners from France and Portugal were involved in the project developing an interdisciplinary approach that was implemented in 8 regions from both hemispheres and 3 oceans. The aim was to describe *Asparagopsis* lineages and populations using 3 complementary approaches rarely applied together in marine systems:

1. Phylogeographic analysis to identify clades and determine their native vs introduced status in the targeted areas
2. Metabolomic approach to test the relevance of chemical signatures to differentiate taxa/clades
3. Assessment of the microbial communities associated with algae using new-generation sequencing
The existence of specific mechanisms promoting *Asparagopsis* proliferation and its harmful ecological effects on cnidarians dominated benthic assemblages was tested experimentally in situ and in aquariums.

**8 partners**
IRD Institut de Recherche pour le Développement -UMR ENTROPIE, New Caledonia (Fr) / Agence pour la Recherche et la Valorisation Marines – Réunion Island (Fr) / Université des Antilles et de la Guyane – Guadeloupe (Fr) / Centre for Marine Sciences (Pt) / Station Biologique Roscoff (Fr) / Université de Nice-Sophia Antipolis (Fr) / UMR CNRS “Diversité, Evolution et Ecologie fonctionnelle” (Fr) / Department of Oceanography and Fisheries of the University of the Azores – Azores (Pt) Total budget: 1 494 472 € / Total Grant: 496 518 €

**Main outputs**

- Discovery of a new lineage within *A. taxiformis* and a new cryptic species within *A. armata* both restricted to the Pacific Ocean
- Metabolomics analyses highlighted a high and untapped chemical diversity. It led to the Isolation and characterization of 2 new halogenated compound with antibacterial, antifungal and cytotoxic activities
- No correlation found between the genetic lineage of the algae and the metabolomics phenotype.
- Although this was not initially planned, the SEAPROLIF team expanded its field of research to the Mediterranean Sea. The algae’s biological interactions in temperate areas differed from the tropical study sites. The comparative analyses of a proxy of the algae bioactivity showed that temperate individuals are overall more toxic than tropical ones

**A. taxiformis: a new lineage L5**

**A. armata: new entity A. armata2**

Phylogenetic tree (Neighbor Joining) based on cox2-3 sequences
Source: Dijoux et al. 2014 PlosOne

- The bioactivity of the chemical compounds produced by the algae, although higher for temperate than for tropical individuals, does not impact coral metabolism and photosynthetic efficiency.
- Confirmation of significant seasonal and interannual variability in algal cover but the proliferative status of the algae could not be clearly highlighted in the study; there is no real proliferation but rather temporal variation in relation to the life cycle of the species or in some cases a slow progression of the algae. The absence of clear pattern in species distribution and depth suggests that *Asparagopsis* does not necessarily kill other species.

**ACADEMIC RESULT HIGHLIGHT**

Biodiversity knowledge in the marine realm is particularly low, including supposedly well-known habitats like coastal ecosystems. The project’s endeavors have some way filled-in knowledge gaps, but considerable spaces remain. In the past few decades, the use of molecular tools has led to the discovery of hidden taxonomic diversity, revealing complexes
of sister species. A good example is the red algal genus *Asparagopsis*. The two species (*A. armata* and *A. taxiformis*) recognized in this genus have been introduced in many places around the world. Within the nominal species *A. taxiformis*, previous molecular analyses have uncovered several lineages, suggesting the existence of sister species or subspecies. A study of 188 specimens from 61 sites, (58 of which had never been sampled before) with DNA sequencing and phylogenetic analyses suggested the existence of two cryptic sister species with the discovery of a new clade within *A. armata*. This clade was found only in Western Australia, Tasmania and New Zealand, and is thus restricted to a subregional biogeographic unit. A new, fifth lineage for *A. taxiformis* restricted to the South Pacific and Western Australia was discovered as well. Except for this newly described lineage, all other lineages showed a global distribution influenced by introduction events. These results illustrate the difficulty in accurately defining cosmopolitan species. The project’s findings highlight the need for targeted (i.e., in poorly studied areas) and geographically extensive sampling efforts when studying taxa that have been introduced globally and that are likely to hide species complexes.

Dijoux L, Viard F, Payri C. (2014). The more we search, the more we find: discovery of a new lineage and a new species complex in the genus Asparagopsis. PLoS One, 9, 7 e103826

**STAKEHOLDER ENGAGEMENT AND PRODUCTS RELEVANT TO SOCIETY/POLICY**

- Through involvement of policy-makers, economic actors and citizens, the SEAPROLIF team has worked to build the foundations for a better understanding and monitoring of marine biodiversity and its interconnectivity in relation to global changes. A uniform, standard and perennial methodology has been developed for monitoring *Asparagopsis* on the 24 sites from the 8 regions.
- Several videos projects were created around the work of SEAPROLIF scientists to present the project and raise awareness on *Asparagopsis* proliferation. These include a 32' documentary involving all the partners and stakeholder of New Caledonia (ADECAL-Technopole) that was broadcast on the projects’ website and a video by ARVAM (Agency for Marine Research and Valorization) in La Réunion.
- World-scale dissemination of information concerning *Asparagopsis* was achieved through the creation of Wikipedia pages in English and French.
- The SEAPROLIF team in Noumea will work in collaboration with ADECAL Innovation and Technology Park of New Caledonia to examine the continuation of the study of possible applications of the compounds in *Asparagopsis*.
- Participation to meetings organized by the Pole de Compétitivité mer PACA.
HIGHLIGHTS ON SOCIETY/POLICY RELEVANT PRODUCTS

- One research Media company has assisted the SEAPROLIF consortium with their outreach, transfer of knowledge and dissemination to a global audience through its flagship publication *International Innovation*. Meta tagging process was done to increase the potential of the article discoverability online.
- In La Réunion where the species *Asparagopsis taxiformis* seems to be newly settled on the shallow reefs (2010), the species has been recently included in the protocol of the Reef Check monitoring, an approach to be spread in other French territories.
- The monitoring method has been integrated into the regular participative monitoring of IFRECOR and on all sites. Interest from the French coral reef initiative (IFRECOR) as invasive species are targeted for the next action plan (2016-2020) to be monitored at key stations of coral reefs around the three oceans.
- A new collaborative project inspired by SEAPROLIF was launched by team members to study the Harmful Algal Blooms of *Ostreopsis* that have been proliferating along the Mediterranean coastline during the past decade and are linked to deleterious effects on both the humans and ecosystem health. This project OCEAN 15 *Ostreopsis Chemical Ecology and Allelopathic Networks* (2016-2019) is developed within the framework of ANR Générique 2015, Comité 35 on Emerging Pathogens.

Typology of stakeholders engaged by SEAPROLIF

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<th>Stakeholder Type</th>
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<tr>
<td>National and local policy makers and public authorities</td>
<td>36%</td>
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<tr>
<td>Businesses</td>
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<tr>
<td>Funding support and investors</td>
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VABIOME
CHARACTERIZATION, PROTECTION, SUSTAINABLE USE AND VALORIZATION OF VANILLA BIODIVERSITY IN TROPICAL EU

Objectives

Vanilla is an emblematic patrimonial and endemic resource for tropical regions that combines a high socio-economic value with a natural image due to its traditional and sustainable mode of production and process.

Tropical EU regions offer a unique opportunity to study the genus in its global biodiversity, in order to better know, preserve the diversity and improve sustainability of vanilla production. The Vabiome project’s objective was to:

1. Inventory genetic diversity (field & forest) at the macro and micro-evolutionary scale for the preservation of endangered wild Vanilla species present in tropical EU
2. Assess the potential services wild species can offer for the improvement of cultivated species and the sustainability of vanilla crop production

Approach

Five partners from French ORs and OCTs in the Pacific, Caribbean and Indian Ocean set up a consortium in order to:

1. Inventory and characterize (genetic, phenotypic and mechanisms of evolution and diversification) the wide range of vanilla genetic resources both cultivated and natural in tropical EU
2. Assess their important agronomical traits (aroma, resistance to viruses and to root and stem rot (RSR) caused by Fusarium),
3. Test and develop crop improvement strategies such as hybrid breeding.

The participation of vanilla growers, vanilla conservation bodies and technical services facilitate the uptake of the results for long-term international conservation of the genus diversity as well as the sustainable aromatic exploitation.
Main outputs

- Important knowledge on the ecology and the evolution of species of the genus *Vanilla* (reproduction biology, ecology, genetics, cytogenetics, floral scents, *Fusarium* resistance)
- Development of tests (in laboratory and in green-houses) to assess resistance to root and stem rot (RSR) and detection of diagnostic molecular markers for further marker-assisted selection
- Demonstration that the root and stem rot (RSR) of vanilla is present worldwide and have the same causal agent, the fungi named *Fusarium oxysporum* f.sp *radicis-vanillae*
- Technical guidelines for the management of vanilla diseases were given to 51 growers in Raiatea (French Polynesia) following 4 years of survey of the sanitary status in shadehouses
- Successful hybridization between the species cultivated in Polynesia *V. ×tahitensis* and the wild *Fusarium*-resistant species *V. pompona*, from which 10 resistant hybrids are presently assessed on agronomical criteria
- A new variety of the species *V. planifolia*, named 'Handa' has been selected in La Reunion for its resistance to *Fusarium*. A COV application (Certificat d’Obtention Végétale) and plant patent have been deposited
- For the native and endangered vanilla species from Mayotte *V. humblotii*, creation of an ex-situ collection and establishment of a conservation action plan
- Young researchers & capacity building – 2 PhD Thesis, 12 Masters students

Web : www.vabiome.blogspot.com and video

ACADEMIC RESULT HIGHLIGHT

Root and stem rot (RSR) is a very detrimental disease of vanilla worldwide. *Fusarium oxysporum* is frequently associated with the disease but other *Fusarium* species are also reported. In an international study realized by the Vabiome team, 52 vanilla plots were surveyed in three of the most important vanilla producing countries (Madagascar, Reunion Island and French Polynesia) in order to determine the aetiology of RSR disease. *Fusarium oxysporum* was shown to be the principal species responsible for the disease, representing 79% of the isolates recovered

External view (a) and transversal section (b) of hairy zone of vanilla root where *Fusarium* infection occurs (c) 4 days after inoculation (Credits: PHIV, Cirad)
from the RSR tissues, 40% of which induced severe symptoms on inoculated plantlets. *Fusarium oxysporum* isolates were highly polyphyletic regardless of geographic origin or pathogenicity. *Fusarium solani*, found in 15% of the samples and inducing only mild symptoms on plantlets, was considered a secondary pathogen of vanilla. Histopathological preparations showed that *F. oxysporum* penetrated the root hair region of roots, then invaded the cortical cells where it induced necrosis in both *V. planifolia* and *V. × tahitensis*. As a whole, the data demonstrated that RSR of vanilla is present worldwide and that its causal agent should be named *F. oxysporum f. sp. radicis-vanillae*.


**STAKEHOLDER ENGAGEMENT AND PRODUCTS RELEVANT TO SOCIETY/POLICY**

- Vabiome included numerous and various local stakeholders during events and meetings. As an example, the project’s final press conference in Raiatea, French Polynesia, was organized by the *Etablissement Vanille de Tahiti* and gathered mayors of Polynesian towns, representatives of French public authorities (research delegates, administrative officers, advisors for agriculture and rural development) vanilla growers and transformers, teachers from local secondary schools from Uturoa, general public and local press. This public meeting was a great success and allowed high outreach to the general public, regional stakeholders (French Polynesia) and actors of the local vanilla agro-industry.
- The project was well known by local communities as the Vabiome team communicated regularly to the public, it generated more than 10 articles in the local press, a television report, several videos, and a website sharing results and information around the research project.

**Types of stakeholders engaged in VABIOME**

- General public; 44%
- Direct economic operators of natural resources; 15%
- Natural resource managers; 3%
- Businesses; 2%
- National and local policy makers and public authorities; 36%
- General public; 44%
HIGHLIGHTS ON SOCIETY/POLICY RELEVANT PRODUCTS

- The Conservation Plan of Vanilla humblotii in Mayotte was elaborated in collaboration with the Conservatoire Botanique National de Mascarin (CBNM) and shared with the French State’s competent services. It will be submitted to validation by the Conseil Scientifique du Patrimoine Naturel of Mayotte in 2017. This document will then be shared to all the Mayotte authorities that are competent in biodiversity conservation (State, Departement, ONF, Conservatoire du Littoral, natural reserves, etc). This will enable conservation actions in Mayotte and allow further communication about VaBiome results.

- A new collaboration with Eurovanille, a major global economic actor in the vanilla market was born from the work of the Vabiome consortium. The company has set two priority domains of research since 2016 and projected to 2018: The establishment of the vanilla DNA sequence and the introduction of newly obtained resistant genotypes of Vanilla planifolia into contaminated soil

- Project labelled by competitiveness cluster Qualitropic
MOVECLIM
MONTANE VEGETATION AS LISTENING POSTS FOR CLIMATE CHANGE

*In situ* lysimeters to record and follow cloud water interception and retention by liverworts
Credit: R. Carrayol

Objectives
Beside their striking diversity, islands host a particular and restricted endemic flora. High mountains hosts in many islands the best remnant native vegetation fragments allowing comparisons and studying the driving factors affecting the environment – climatic, land-use, implementation of conservation areas, etc.

Using a standardized methodology, MoveClim aims at making macro ecological comparisons of spore dispersing plants (ferns and bryophytes, thermally specialized to these environment) between islands-sites in order to:

1. Characterize the diversity of poorly known but species rich groups of plants
2. Elucidate the processes which govern species richness and its distribution along elevational transects and relate these to life history and functional traits of species
3. Link richness patterns to environmental and spatial predictors
4. Model the shift of species range with climatic scenarios
5. Establish permanent plots for long-term monitoring, managing responses for vegetation and raising directions for decision-making.

Approach
11 partners from 6 countries and 5 small islands (Reunion Island (Mascarenes), Pico (Azores), La Palma (Canarias), Guadeloupe (West Indies) and Tahiti (French Polynesia)) did the first global scale and multi island biogeographic analysis for bryophytes and ferns using:

1. A standardized methodology for collecting bryophytes and fern along elevational gradients of the 5 islands
2. Climatic sensors every 200 m along these high mountains to record temperature and relative humidity hourly
3. *In situ* experiments with a novel method (lysimeters) to estimate the role of cloud water in bryophyte water interception

11 partners
UMR PVBMT Université de La Réunion - Reunion Island (Fr) / Parc National de Guadeloupe – Guadeloupe (Fr) / Universidade dos Açores, Azores (Pt) / University of La Laguna, Canaria Islands (Sp) / Parc National de La Réunion – Réunion Island (Fr) / Conservatoire Botanique de Guadeloupe – Guadeloupe (Fr) / Délégation à la Recherche & ONG Te Rau Ati Ati A Tau A Hiti Noa - French Polynesia (Fr) / Muséum National
Main outputs

- Description of new species, understanding the role of bryophytes in ecosystem functioning especially in rich systems (Laurisilva, cloud forests...), monitoring the vegetation facing climate change, habitat disturbances (alien, destruction...). 14 species newly recorded bryophytes for some islands, 1 new species and a new genus of bryophytes for Science
- The key role of bryophytes in insular ecosystems services was quantified and brought useful results for conservation purposes, e.g. ground-dwelling bryophytes may be more robust than epiphytic bryophytes to disturbances in subalpine ecosystems
- Contribution to the understanding of the spatial organization of bryophyte diversity at multiple scales and the roles of spatial organization, climate and vegetation in shaping the natural diversity. A new pattern of species richness (double peak) along the elevational gradient was discovered with ground-dwelling communities of bryophytes along the Piton des Neiges gradient (Réunion, Mascarenes)
- The identification of elevational ranges of species enabled the modelling of future distribution. First species distribution modelling study under climate change scenarios was done for ferns of Tahiti (French Polynesia)
- Production of new collaborative tools (standardized methodology, manuals for production of standardized data, common R scripts, long term monitoring plots…)
- Young researchers & capacity building – 5 PhD candidates, 9 Masters students and 3 honors students.
- Web: http://moveclim.blogspot.com/

ACADEMIC RESULT HIGHLIGHT

The potential asset of Moveclim has been the development of a standardized inter island comparison of biodiversity patterns used for all the studied insular transects. Research was pursued to prove that the patterns found of diversity of bryophytes along the elevational gradient are congruent, meaning that the factors affecting the structure of diversity are similar across these islands. Attempting to identify the mechanisms of the assembly of communities is of great interest and a hot topic in research


STAKEHOLDER ENGAGEMENT AND PRODUCTS RELEVANT TO SOCIETY/POLICY

- The stakeholders (mainly represented by two National Parks and one NGO) indirectly promoted the project by liaising with decision makers informing about the type of research carried out in their parks consequently linking research and decision-making processes. Furthermore, the National Parks managers facilitated the fieldwork, collection and transfer of climatic data on a six-month basis.
- Promoting the collaborative research between OCTs was key to create an inter-ocean collaborative team benefiting and reinforcing skills on small and isolated
teams plus providing larger visibility to the international scientific community. Moreover, it highlighted the capacity and the dynamism of OCT research teams to carry out research on biodiversity hotspots and to put them in the spotlight.

- Possible development of a collaborative research team (University of La Réunion, South-Africa and USA) to explore the chemistry of bryophytes flora and its potential for pharmaceutical purposes.

- The collaboration is being pursued, and the two projects NETBIOME (Moveclim and Island Biology) are merging and skills are shared. Ongoing collaborative work on a scientific article about long term monitoring in islands and standardized methodology is being developed (Borges et al. in rev).

- Since February 2017, an ERASMUS program between University of Azores and Réunion has been created to facilitate exchange of students and staff.

HIGHLIGHTS ON SOCIETY/POLICY RELEVANT PRODUCTS

- The Society of Island Biology (SIB) was created at the Island Biology conference 2016 in Azores, as a result of two prior Net Biome projects

- The project dedicated a work package involving the role of bryophytes in water cycling (quantity and quality of the water) which is central in the island’s economy. The community was also informed about their biodiversity assets and threats, and raise awareness on Biogeography and Climate Change.

- Non scientific stakeholders were able to present and discuss the research carried out on the project and informing decision makers on island’s biodiversity value by providing a global perspective and cross fed research results ranging from oceans to European OCTs.
The network of islands has recently extended through the sistership between the National park of Réunion and the National park of the volcanoes on Big island (Hawaii). Scoping collaboration with the Mediterranean islands (Sardinia and Crete) as well as continental islands such as New Caledonia is also envisaged.
ISLAND-BIODIV
UNDERSTANDING BIODIVERSITY DYNAMICS IN TROPICAL AND SUBTROPICAL ISLANDS AS AN AID TO SCIENCE BASED CONSERVATION ACTION

Objectives

The project aimed to evaluate and value biodiversity as well as to inform decision makers for spatial planning and the sustainable management of biodiversity. To overcome the coarse spatial resolution of existing datasets, which is often insufficient for management purposes within insular ecosystems, the goal of ISLAND-BIODIV was to develop and implement a pragmatic approach for the quantification of plant and arthropod biodiversity within insular forest ecosystems, and address the following research questions:

1. To what extent can biodiversity within a given ecosystem within an island be considered to be homogenous across the landscape of that ecosystem?
2. Are there predictable patterns in the spatial variation of biodiversity among different functional groups within the same ecosystem?
3. How well do existing management strategies within each OR protect biodiversity and what realistic changes could be incorporated to maximize biodiversity conservation?

Approach

A coordinated program involving 6 partners from 3 countries was developed for the investigation of island forest ecosystems of 3 ORs (the Azores, Canary Islands and Mascarene Islands), in order to:

1. Implement standardized procedures and establish permanent biodiversity sampling plots
2. Investigate 3 ecologically interrelated communities of flowering plants, macroinvertebrates (spiders and beetles) and soil dwelling mesoinvertebrates (Collembola)
3. Combine traditional ecological sampling and survey techniques with modern DNA sequence based technology to address the taxonomic impediment within biodiversity assessment
4. Derive comparable biodiversity estimates through molecular phylogenetic analysis of phylogenetic diversity (PD), phylogenetic endemism (PE) and abundance weighted evolutionary distinctiveness (AED) metrics
6 partners
Instituto de Productos Naturales y Agrobiología, Consejo Superior de Investigaciones Científicas - Canary Islands (Sp) / University of La Laguna - Canary Islands (Sp) / Université de la Réunion – Reunion Island (Fr) / Université Paul Sabatier (Fr) / Azorean Biodiversity Group (CITAA and CE3C) - Universidade dos Açores – Azores (Pt) / Jardín Botánico Canario “Viera y Clavijo” – Unidad Asociada CSIC, Canary Islands (Sp)
Total budget: 1 000 611€ / Total Grant: 483 891€

Main outputs
- Discovery and classification of new species and new records of species, families and genera in the 3 ORs. Molecular data also revealing cryptic species previously considered as single species after morphological sorting
- Island flora DNA stored in GeneBank of Reunion Island (Univ. Réunion and Paul Sabatier), Azores (Azores herbarium) and Canaria (JBCSIC)
- Development of a novel Illumina sequencing protocol for the mitochondrial metagenomic analysis of soil invertebrates, for which morphological taxonomy fails to delineate the boundaries of biological species
- Establishment of standardized sampling protocols and templates for data entry and curation that facilitate downstream data analysis and the cross referencing of DNA sequence data with source specimens
- Investigation of the integrity of ecosystems with regard to the non-native or invasive species: while above-ground communities of beetles and spiders are largely devoid of introduced or invasive species, the soil biomes of all three islands appear to be substantially perturbed by introduced species (at least 25% of all Collembola species sampled across the three archipelagos, with as yet unknown consequences for ecosystem function)
- At the regional level, ongoing assessment of the geographical structuration of biodiversity and of the probable drivers of structuration to identify areas of concern (unusually high or low biodiversity)
- Long term extension of the methodology to the laurel forests of La Gomera (Canary Islands) and Terceira Natural Park (Azores)

Web: http://island-biodiv.org/

Geographic distributions of Collembola species introduced to the oceanic islands of Terceira, Tenerife and Réunion, as ascertained from DNA sequence data
Source: Cicconardi et al (2017)
ACADEMIC RESULT HIGHLIGHT

By measuring biodiversity in a quantitative and replicated way in comparable ecosystems across geographically independent regions, it was possible to investigate the integrity of ecosystems with regard to the non-native or invasive species. The ecological and evolutionary significance of biodiversity—valuation and implications for management and conservation were evidenced. New opportunities for the understanding of soil biodiversity and soil function have been identified, thus providing broad relevance to the scientific community.


STAKEHOLDER ENGAGEMENT AND PRODUCTS RELEVANT TO SOCIETY/POLICY

- Discussions with management of the Garajonay National Park in a Gomera yield positive feedback and interest in extending the methodology developed within ISLAND-BIODIV to the analysis of arthropod biodiversity within the Park. This resulted in a successful small grant application from the Ministry of Agriculture, Food and the Environment to the National Parks Authority of Spain, thus enabling the project to extend the sampling program of ISLAND-BIODIV to the laurel forests of La Gomera.

- Projects partners have engaged with policy makers where and when possible. In some cases, the participation of the Directors of the Natural Parks of the nine islands and also the Director of the Environment was secured. As an example, the participation of several stakeholders in Azores has evidenced (as shown in the graph), the important degree of participation from the general public and natural resource managers (See: http://cita.angra.uac.pt/ficheiros/noticias/1435657919.pdf), but also the participation of several NGOs. In Azores the ten plots are now part of a long-term monitoring scheme with SLAM traps with the support of the Terceira Natural Park.
HIGHLIGHTS ON SOCIETY/POLICY RELEVANT PRODUCTS

- The project will continue publishing research findings, and trying to extend the research program developed. Partners are keen to use whatever mechanism possible to continue Outreach to the broader community. One example has been the collaboration with MOVECLIM project.

- The project has generated a protocol that provides a basis for quantitative measures of species richness and turnover, two important measures biodiversity management.

- DNA sequence data generated by the project provides for a reference database that can be developed for rapid species identification and biodiversity assessment.

- Geographically referenced intraspecific genetic variation for arthropod species identifies species-level dispersal limitation and local extinction risk, an important measure for biodiversity management.
Objectives
The marine living resources from selected sites and habitat of three French OT’s and OR’s located in two oceans are a treasure box to be discovered and understood all around the world. The objective of the consortium was to explore marine invertebrates in order to act for their protection through chemical ecology studies and metabolites characterization leading to biotechnological applications in the fields of aquaculture, antifouling (biofilm inhibition), and medical applications. Biomimetic pathways were explored to obtain synthetic and semi-synthetic analogs for a sustainable use. The project aimed to:

1. Investigate biological properties of marine natural products as biofilms inhibitors and antibiotics (QSI, POI), anticancer agents (melanoma)
2. Exploit highly innovative techniques to discover new original chemical entities of marine origin
3. Develop chemical synthesis pathways for sustainable production of relevant compounds and explore their bioactivities

Approach
6 partners from 3 countries chose to give particular emphasis to sponges, since these are considered very important in coral reef ecosystems and environment. Metabolomic studies of some selected organisms are adequate to fully target the understanding of the biosynthetic pathways in order to use them in biomimetic synthesis of challenging complex natural metabolites. The activities carried out were the following:

1. Prospection, collection of samples on field expeditions, identification, sequencing and databases
2. Extraction, metabolomics, isolation and structural determination, biomechanistic analysis
3. Biological evaluations
4. Sustainable synthesis of natural products and analogs exploiting effective methods and biomimetic strategies

6 partners
IRD Institut de Recherche pour le Développement - French Polynesia (Fr) / Université de La Réunion - Reunion Island (Fr) / Naturalis Biodiversity Center (Nl) / University of Portsmouth (UK) / CNRS-Institut de Chimie des Plantes Naturelles (Fr) / Université Paris Sud (Fr)

Project labelled by competitiveness cluster Qualitropic
Total budget: 5 457 414€/ Total Grant: 520 000€

Main outputs
- Major progress in the comprehension of the role of some secondary metabolites in the environment. Several major results in each field were obtained which lead to further collaboration within the network set up for this project, but also allowed further development with OT’s Fisheries department (aquaculture and innovation).
- Chemical communication importance of invertebrates with environmental Vibrio species was shown and environmental friendly ecosystemic services of relevant compounds as a treatment of aquaculture fish larvae is being further studied
- New bioactive compounds and new bioactivities for known compounds were discovered from either Indian or Pacific Ocean marine sponges
- The most impressive study of Dactylospongia metachromia in terms of number of samples and surfaces covered, and comprehension of an original diastereomeric ratio of ilimaquinones, the major natural substances
- Sustainable biomimetic semi-synthesis of minor natural compounds
- Drug discovery approach with ongoing local developments, major results in the field of diabetes (this target was lately chosen as challenging for Oceania OR’s and OT’s)
- Young researchers & capacity building – 5 PhD students, 1 Postdoc, 10 undergraduate students.

Web: https://pomare.ird.fr/ and video

**ACADEMIC RESULT HIGHLIGHT**


* * Dysidea sp. © Eric Folcher/IRD*
Further development of the project’s results has been taken into account by policy makers in the “schéma directeur de la recherche et de l’innovation en Polynésie française” and the PASE scheme (Projet d’action stratégique de l’Etat en Polynésie française).

The consortium built strong links with local universities on Reunion Island and in French Polynesia strengthening participation of local researchers and students as well as building capacity for educational purposes.

The Project has disseminated its results (Booklets on sponge fauna) to the general public, KTTO and policy makers mainly (see graph). Such outreach has achieved in one hand the general public by raising awareness of the heritage knowledge and its protection, and on the other hand, potential partners and stakeholder support to further develop results.

Further collaboration with OT’s fisheries and environment departments has been pursued (Direction des ressources marines et minières - aquaculture and innovation, direction de l’environnement en Polynésie française), on sustainable aquaculture such as shrimp, fish, sponge and pearl farming13. Possible extension to human health pathogenic strains as enhancers of antibiotic activity.

Several publications such as stamps, informational brochures, leaflets and Georeferenced inventories related to sponges have been developed in order to raise awareness to communities and as tools for envisaging business opportunities

Types of stakeholders engaged in POMARE

13 The molecules of sponges could increase the survival of the larvae and thus improve the performance of these modes of production as molecules can inhibit the virulence of pathogenic bacteria. Molecules can also increase the effectiveness of existing antibiotics if used, preventing the formation of biofilms, since the planktonic beats are more antibiotic-resistant than the Bacteria in the form of biofilm.
HIGHLIGHTS ON SOCIETY/POLICY RELEVANT PRODUCTS

- Successful and innovative project Nature provided bio-inspired solutions have been created to cope with major problems on Environment and the conservation of health Bio-inspired ecosystemic uses.
- Developing the anti-diabetes compounds issued from Dactylospongia sponges: patents are pending. Development of the resource is ongoing, but is highly dependent on the ABS laws in French Polynesia.
- Preclinical studies and pharmacological investigations (precise mechanism of action on insulin secreting cells), early ADME/tox parameters and first in vivo studies are now imperious. New cytotoxic blue compounds may be of high interest for cancer dynamic phototherapy, and partners are being contacted for further developments-collaborations.
**SafePGR**

**TOWARDS SAFER PLANT GENETIC RESOURCES THROUGH IMPROVED VIRAL DIAGNOSTIC**

Female yam genotype at flowering stage  Credit: Safe PGR

**Objectives**

Plant Biological Resources Centers (BRCs) provide final users (farmers, extension officers) with genetic resources best suited to their needs. They also provide breeding programs with genitors that are critical for the development of crops adapted to environmental and societal changes. Their capacity to guarantee the sanitary status of the resources they conserve and distribute is essential to prevent the spread or emergence of diseases. The main species conserved and propagated by the plant BRCs of Guadeloupe, Madeira, Azores and Reunion Island are vegetatively propagated and prone to virus accumulation. Although sanitation methods exist for recovering virus-free plants from infected ones, only a small fraction of plant virus diversity is known and detection tools only exist for a limited number of viruses.

The general objective of the SafePGR project was to improve the knowledge of the diversity of viruses infecting the crops addressed by the partner’s BRCs, in order to develop or optimize diagnostic techniques, ultimately permitting the safe movement of plants between project partners and beyond.

**Approach**

Six crops were targeted (banana and plantain, sugarcane, yam, sweet potato, garlic and vanilla) and 7 research groups from Biological Resources Centers and virology labs of France and Portugal were involved in:
1. The analysis of the molecular diversity of the main viral families infecting the 6 targeted crops.
2. The optimization of classical diagnostic methods taking into consideration data generated through the analysis of viral diversity.
3. The development of new diagnostic methods based on metagenomics and deep-sequencing technologies.

Stakeholders such as plant protection agencies, diagnostic laboratories and regional councils were associated to the transfer of the results and diagnostic methods generated by the project.

**Consortium: 7 partners**

INRA (Institut National de la Recherche Agronomique), ASTRO Research Unit - Guadeloupe (Fr) / CIRAD (Centre de Coopération Internationale en Recherche Agronomique pour le Développement), AGAP Research Unit - Guadeloupe (Fr) / CIRAD, BGPI Research Unit (Fr) / CIRAD, PVBMT Research Unit - Reunion Island (Fr) / INRA, BFP Research Unit (Fr) / Biotechnology Centre, University of Azores – Azores (Pt) / University of Madeira, ISOplexis Gene Bank – Madeira (Pt)

Total budget: 1 444 121 € / Total Grant: 553 227 €

**Main outputs**

- A total of 21 new virus species were discovered, their genomes were sequenced and their molecular diversity was explored.
- Diagnostic tools were developed and implemented for all the viruses infecting the 6 crops targeted by the project.
- A comprehensive analysis of the viral status of the germplasm collections conserved by project partners was performed.
- Sanitation processes were significantly improved, leading to increasing numbers of virus-free accessions available for distribution to end users and ultimately to safer germplasm exchanges.
- A pipeline for bioinformatics analyses was developed. It performs automatically cleaning of nucleotide sequences generated by metagenomic approaches, their assembly into contigs and the identification of viral sequences among them through comparisons with international sequence databases.
- A comprehensive approach combining bioinformatics, metagenomics and classical molecular methods for the characterization of known and novel virus species.
- A record in capacity building: 3 MSc trained, 3 temporary staff recruited by the project have now secured permanent positions.
- A project website http://www2.antilles.inra.fr/safepgr/
ACADEMIC RESULT HIGHLIGHT:

An integrated and innovative approach combining bioinformatics, metagenomics and classical molecular methods led to the characterization of known and still-unknown viruses infecting 6 crops conserved in Biological Resource Centers in French and Portuguese overseas territories. Diagnostic tools and methods were developed for the detection of novel viruses and optimized for previously known viruses. Overall, for the six targeted crops, the project has more than doubled the number of viruses for which reliable detection assays are now available facilitating the implementation of sanitation programs.

Mapping NGS reads against viral references
© T. Candresse, INRA


STAKEHOLDER ENGAGEMENT AND PRODUCTS RELEVANT TO SOCIETY/POLICY

Some of the sanitation methods have been already successfully implemented in the frame of the yam and sugarcane sanitation programs carried out in Guadeloupe and Montpellier, respectively, resulting in a limited risk of spreading viruses through the distribution and exchange of infected germplasm.

New projects arose from the methodologies developed in the Safe-PGR, among which:

- E-SPACE flagship project funded by the Agropolis Foundation and focused on the surveillance of plant diseases, involves several Safe PGR partners
- Regional project on cassava sanitation in Reunion, Mayotte and Comoros
- MALIN project in Guadeloupe funded by the ERDF and the Guadeloupe Region, includes a NGS indexing platform in Guadeloupe that benefits from the outcomes of SafePGR
- RITA network project in Guadeloupe on the production of yam quality seeds, involves research institutions (INRA, CIRAD), extension services and economic actors.
HIGHLIGHTS ON SOCIETY/ RELEVANT PRODUCTS

- The project successfully transferred methods and tools to sanitizing programs and results in increasing virus-free accessions available for distribution to end users (farmers, extension officers...) and between ORs
- Project results are now irrigating quality seed production activities involving economic actors
- A network of partners with expertise in the diversity and diagnosis of viruses infecting germplasm conserved in OR’s germplasm collections has been created

Expertise, innovative methodologies and tools are transferable to other crops through an extension of the partnership to other OR’s BRCs
Conclusion:

This analytical exercise has allowed to identify several assets that OCTs and ORs have provided to the wider scientific community in terms of Biodiversity topics through the NETBIOME Projects. Different research topics (ranging from land use planning to marine management and climate change), have been tackled through the 7 funded projects.

Results and breakthroughs have been published in different research journals and other types of publications as well as shared on their local communities and neighboring territories, thus evidencing the importance of such particular research and the impact it has attained towards policy makers, academic community and local managers to mention the main ones. Some of the their outreach has even gone beyond the boundaries to which OCTs and ORs are often limited to. Examples of exchanges with researchers in regions such as Africa, Asia, Eastern Europe and Latin America, account for this collaboration.

However, it is important to highlight that some areas for improvement can be taken into consideration specially regarding certain stakeholder profiles which have been engaged to a lesser extent throughout the project’s lifecycle (businesses, funding agencies, KTTOs). There is also room for even better interaction among other regions, where the effort and findings made through NETBIOME’s projects can be of great relevance in terms of climate change mitigation, and spatial planning of small islands and territories (i.e. EU Mediterranean basin, and possibly the Atlantic basin).

• Academic excellence

The high quality on the research has been evidenced on the number of publications achieved (a total of 57 publications with some projects still publishing), with a fair number in highly ranked journals such as Plos One, Molecular Ecology, Global ecology and Biogeography. The overall publication’s mean impact factor averaged 3.28 for all NETBIOME’s project publications with an estimate of 8 publications per project.

Overall, there has been an interest of the NETBIOME network in keeping the scientific questions at the core of the program, yet providing room for societal and policy-related issues to cross-feed the findings. This is probably one of the main reasons that explain the quality developed in the publications and collaborations undertaken throughout the duration of the projects.

• High and effective stakeholder engagement and concrete products of interests for stakeholders

There has been a diverse range of stakeholder involvement before and during the project’s lifecycle. A particular added value has been identified with regards to NETBIOME’s capacity to harness local and international stakeholders of the overseas territories and outermost regions. This will be complementary in future BiodvERsA calls where stakeholder engagement is recognized as a key priority for ensuring impact and longer-term sustainability.

In prominence, most stakeholders remain considered as general public however, there is an active involvement from policy actors and local research structures in certain projects such as Pomare, Vabiome and Safe PGR where such actors have played an important role either to a longer term sustainability (Vabiome), or for evidenced-based information used to draw out policy making and national planning with regards to Biodiversity (Pomare, Safe PGR). Furthermore, it is clear that some projects have a natural link to external stakeholders from
business such as Pomare and Vabiome in the commercialization of sponges usage and vanilla products correspondingly, given their market potential.

In addition, examples where interdisciplinary collaboration, as a key component to successful exchanges, have been identified. The case of Moveclim evidences an extensive production of publications and hence a plethora of collaborations between different stakeholders stemming from various scientific disciplines. The same case goes for Frag&Binv and Island Biodiv these latter involving specifically local managers, forest, farmers on the recollection of data, dissemination of information and spatial planning processes. Capacity building was also an important achievement in some projects (mainly Seaprolif, Vabiome, Moveclim and Pomare), as numerous PhD Programs and Masters from across EU were involved in NETBIOME, some as a result of the previous collaborations undertaken given a particular interest towards ORs and OCTS, some others as an aftermath of the project’s experiences and contacts made with academics from EU and across the world.

Moreover, elements that have been issued for non-academic stakeholder such as stamps, TV broadcasts, tourist leaflets, preclinical examinations or cosmetic development have also been identified as byproducts from the projects. It is the case of Pomare where the sponge research has brought further commercial possibilities and even an identity to the French Polynesian territory through the sponge stamp printing. In addition, projects such as Frag&Binv have used their findings to provide tangible elements for decision-making policies regarding nature and wildlife management frameworks. The results served as well for evaluating effects of past changes in land use and for future spatial planning in each territory.

Further, the existent intra-collaboration with other projects within the NETBIOME network as the case of Moveclim and Safe PGR have also evidenced the importance and relevance of cross-feeding research and looking for further ways in which the projects can have a sustainable and complementary approach in future research. Several multi-stakeholder forums in the different OCT’s have also been carried out by projects such as Frag&Binv and Sea Prolif to exchange with local stakeholders around issues related to landscape structure and forest fragmentation as well as for a better understanding and monitoring of marine biodiversity and its interconnectivity in relation to climate change consequences respectively.

However, a main challenge remains as usual as to further funding for projects. The case of Frag&Binv illustrates well such hindrance as the educational program being carried out with the local high school students to the partner countries of the project is intended to go beyond the project funding, yet not enough resources have been made available to continue the valuable experience.

- The end of Era-NET NETBIOME and the new collaboration with BiodivERsA

BiodivERsA’s new partnership, which involves actors from ORs and OCTs, offers an opportunity for overarching scalable solutions that potentially may help define decision-making and policies of scientific research on a European scale for global solutions. NETBIOME’s experience encompasses among many, the promotion of sustainable development through a participatory approach, the reinforcement of human capital, a common overseas voice on shared biodiversity challenges and the importance of Europe’s cooperation in these key geographic regions. In turn, this will not only contribute to bridge the gap between science and decision-making, but also encourage further multi-stakeholder dialogues as well as the connections with neighboring countries for joint research activities and strategic synergies.
The experience stemming from OCTs and ORs with specific biodiversity in tropical and subtropical environments is thus an added value to the EU biodiversity agenda key to improving European policies and instruments as well as to help build better integrated, inclusive and consensus-based participatory approaches. Since such communities are smaller, there is an opportunity to contribute experience and scale up such exercises in the BiodivERsA context, for example on multidisciplinarity or engaging the local communities and other non-academic stakeholders. The examples of interactions between such stakeholders during the NETBIOME projects and also the lessons learnt to improve future collaboration are valuable contributions to the fine-tuning of the biodiversity dialogue and agenda for future BiodivERsA calls.

OCTs and ORs could play a strong role on the biodiversity dialogue for collaborations with platforms such as the Belmont Forum, which seeks to develop international research actions and accelerate delivery of the environmental research needed to remove critical barriers to sustainability.

Another opportunity that could be of great value is under the Natura2000 agenda since it is the largest coordinated EU network hosting research of core breeding and resting sites for rare and threatened species on which OCTs and ORs have a critical say. Or as one of the experts well put it: «It is now appropriate, and indeed imperative, for the EU to show real leadership and take initiatives, inter alia, through its experience with the Natura2000 network, and generally by mobilizing its technical capacity and scientific research. Overseas, the EU has a unique opportunity to play a major global role on one of the most important priorities of the 21st century: managing the interactions between biodiversity, climate change and human communities»

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<th>Pouteau, R., Meyer, J.-Y., Blanchard, P., Nitta J, Terorotua, M. &amp; Taputuarai, R. Fern species richness and abundance as indicators of climate change in high-elevation islands: evidence from an elevational gradient on Tahiti (French Polynesia). <em>Climatic Change</em></th>
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<tr>
<td>Lavocat Bernard E. &amp; Reeb C. Additions to the bryophyte flora of the Guadeloupe archipelago (Lesser Antilles).</td>
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<tr>
<td>Jimenez J.A. &amp; Hederson TAJ. <em>Didymodon afromontanus</em> (Pottiaceae), a new species for tropical Africa</td>
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<td>Henriques, D., Ah-Peng, C., Gabriel, R. Structure and application fo BRYOFILE-AZ , a trait database for Azorean bryophytes</td>
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<td>Borges, P.A.V., Cardoso, P., Gabriel R., Ah-Peng C., Emerson B., Challenges, advances and perspectives in island biogeography. <em>Frontiers of Biogeography</em> accepted</td>
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<td>Ah-Peng C., Williamson Cardoso A., Flores O., West A. Strasberg D., Hederson T.A.J. The role of epiphytes in interception, storage, and the regulated release of atmospheric moisture. <em>Journal of Hydrology</em></td>
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<td>Bardat J., Ah-Peng C &amp; T. Hederson,The genus Andreaea in the Mascarenes, Cryptogamie, Bryologie</td>
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*Frag & Binv Publications*


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