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Workshop Reports

3rd EU BON Stakeholder Roundtable (Granada, Spain): Biodiversity data workflow from data mobilization to practice

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Abstract

At the third EU BON roundtable, participants from global, European and regional projects, institutions, governmental organizations and universities met to discuss biodiversity data workflows across different scales and their current limitations. Furthermore, the roundtable focused on tools and products from EU BON and other projects that may help to improve data collection and evaluation. The roundtable, that took place from 10 to 11 December 2015 in Granada, Spain, particularly addressed the EU BON test sites to discuss data mobilization at the site level, workflows of data/information and the further usage for policy reporting and political processes. These issues were discussed with partners from EU BON and related biodiversity projects (LTER, GEO BON, LifeWatch, Ecoscope) and stakeholders of biodiversity data (regional biodiversity networks: the environmental information network of Andalusia (Rediam), the Center for Monitoring and Assessment of Global Change (CAESCG), the Life project ADAPTAMED as well as local scientists).

On the first day, the different approaches from global (GEO BON) and European initiatives (EU BON, LTER, LifeWatch, Ecoscope) were presented with a special emphasis on data collection, integration and analysis tools from EU BON. Furthermore, regional stakeholders pointed out their demands with regards to data mobilizations issues. A survey of the participants, conducted before the roundtable, showed that still gaps exist, not so much in terms of needed tools but more in the area of biodiversity data. On the second day, the workflow of biodiversity data and the current barriers as well as the possible solutions to overcome the problems was discussed. In the World Café session, smaller groups discussed details of the biodiversity data workflows, particularly on the topics of (1) data mobilization, (2) data and tools, (3) implementation, and 4) upscaling of data.

As outcomes of the discussions at the roundtable, several recommendations were drafted. There are several biodiversity data workflows existing at the test sites, that could be improved by additional / existing tools, guidelines and standards from projects such as EU BON and by an enhanced communication between local sites, regional networks (as “middle-ware”) and European networks. Recommendations are, for example, to prioritize developed EU BON tools for further usage in the project and through the portal, to better address the user groups on different levels and provide a detailed and specific description for the tools. For the end-users of the data it is important to develop either “easy-to-use” tools or provide results in a tailored way. Overall, it was agreed that a showcase for the workflow of biodiversity data from collection up to visualization is needed to showcase better the benefits of a European biodiversity network and enhance current functionalities by analyzing barriers and limitations in such an example of an “EU BON storyline”.

Keywords

Biodiversity data workflows, data integration, local and regional biodiversity networks, policy support, biodiversity portals, EU BON, test sites, data mobilization.

Rationale

In this compilation of the EU BON Stakeholder Roundtable (RT) reports we want to provide a summarized overview, providing shared experiences gained in three different workshops that were organized by the EU BON project from 2013-2015, with altogether more than 100 participants from over 20 countries (ranging from Norway to Israel, and from the United States to Estonia).

Here we summarize the results of the third Stakeholder Roundtable - in addition to this report, also the summaries of the first (Wetzel et al. 2016) and second (Vohland et al. 2016) EU BON Stakeholder Roundtable are available and published in RIO with open access.

EU BON - Building the European Biodiversity Observation Network (www.eubon.eu) is a project funded under the EU FP7 framework. It presents an innovative approach towards the integration of biodiversity data and information systems, both from in-situ and remote sensing data sources (Hoffmann et al. 2014). The aim is to address policy and information needs in a timely manner, customized for various stakeholders on different levels - from local test sites to European and international policy EU BON aims to provide integrated data and linkages of social science and policy networks as well as technological infrastructures (Wetzel et al. 2015). One of the key features will be the development of a new open-access platform for biodiversity data and tools.

The RT aimed to exchange ideas and discuss highly relevant issues with relevant stakeholders, from policy, citizen science and local/regional stakeholders in order to inform EU BON and adapt the working programme. Topics of the discussions were related to biodiversity information and its open-access and availability, data workflows and integration of citizen science as well as science-policy interfaces. We will start with a brief general overview of the project, particularly describing the overall framework and role of the stakeholder engagement in the policy and dialogue work package. Secondly, we provide detailed reports of each of the roundtables, outlining its aims, intentions, discussions as well as results and recommendations that were drafted based on the roundtable discussions, world café sessions and working groups which are now published for the first time in the new series of Pensoft Workshop Reports.

The Stakeholder Roundtables are a specific task and part of a Work Package (WP6, see Fig. 1) that focuses on the stakeholder engagement and the science-policy dialogue within EU BON. The main aim of the stakeholder roundtables is to carry out regular engagement with relevant political authorities and other stakeholders at European and national level in support of the delivery of the EU BON project. Furthermore, the roundtables seek to build up a stakeholder dialogue with exemplar sector-specific user communities to incorporate feedback loops for the products of EU BON (data, tools and models) as well as to develop improvements of existing biodiversity data workflows (e.g. from the monitoring species occurrences in the field to processing and analysing the data).

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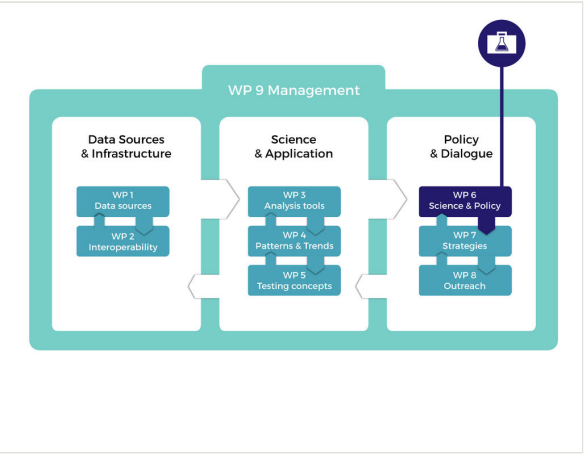

Figure 1.

EU BON Work Packages (WP) with the three sections (a) Data Sources and Infrastructure, (b) Science and Application and (c) Policy and Dialogue. The Stakeholder Roundtables are a specific task in the WP 6 that targets the stakeholder engagement and science-policy dialogue (credits: Pensoft).

The RT aimed to exchange ideas and discuss highly relevant issues with relevant stakeholders, from policy, citizen science and local/regional stakeholders as well as research in order to inform EU BON and adapt the working programme. Topics of the discussions were related to biodiversity information and its open-access and availability, data workflows and integration of citizen science as well as science-policy interfaces. We will start with a brief general overview of the project, particularly describing the overall framework and role of the stakeholder engagement in the policy and dialogue work package. Secondly, we provide detailed reports of each of the roundtables, outlining its aims, intentions, discussions as well as results and recommendations that were drafted based on the roundtable discussions, world café sessions and working groups which are now published for the first time in the new series of EU BON Project Outcomes.

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More specifically, the aims of the RT are defined in the EU BON's description of work as follows: “*This task will help to build and ensure regular and efficient linkages to relevant political authorities and other stakeholders at national and European level to support the*

development and delivery of the EU BON project. While stakeholder interactions will occur throughout EU BON, this task has two elements: the first is a support service for EU BON - mapping stakeholder engagement and providing contacts and support for stakeholder engagement to all relevant EU BON tasks. This will include establishing an overarching policy stakeholder group with contact points to relevant national and European level agencies and authorities involved in biodiversity and environmental policy, and GEO related activities. The second element will be a more focused series of three strategic stakeholder engagement processes that will occur at the beginning, middle and end of EU BON. Each interaction will take the form of an interactive workshop – at which high level stakeholders and scientists will work collaboratively to address three sets of questions: a) What major changes need to occur in order that current and future policy needs for biodiversity data are met? b) How effective are the current approaches for improving the availability and policy relevance of biodiversity data? c) What data strategies should be put in place to realise the lessons generated during EU BON?"

To address different stakeholders groups, the aims, guiding questions and invited groups were specifically adjusted in each of the workshops, resulting in three roundtables:

1. **"Biodiversity and Requirements for Policy" - 1st EU BON Stakeholder Roundtable (Brussels, Belgium).** *Addressed stakeholders: European policy (Commission, agencies, researchers), International Networks (Group on Earth Observations), EU funded projects with linkage to biodiversity data.*
2. **"How can EU BON support citizen science?" - 2nd EU BON Stakeholder Roundtable (Berlin, Germany).** *Addressed stakeholders: Citizen Science projects, citizen science networks, researchers and biodiversity networks.*
3. **"Workflow from data mobilization to practice" - 3rd EU BON Stakeholder Roundtable (Granada, Spain).** *Addressed stakeholders: European, national and regional networks (biodiversity data, Group on Earth Observations, ecological research), researchers from the field / sites, EU BON test site partners, political administration.*

Introduction

The 3rd EU BON stakeholder roundtable took place from 10 to 11 December 2015 in Granada, Spain. The meeting brought together participants from global, European and regional projects, institutions, governmental organizations and universities to discuss biodiversity data workflows across different scales. Other important issues to discuss were current limitations of workflows but also tools and products from EU BON and other projects that may help to improve data collection, analysis and use in policy and practice.

Aims of the roundtable

The roundtable focused on EU BON test sites, workflows of data/information and the further usage for policy reporting and political processes. These issues were discussed with partners from EU BON and related biodiversity projects (LTER, GEO BON, Life Watch, Ecoscope) and stakeholders of biodiversity data (regional biodiversity networks: the environmental information network of Andalusia (Rediam), the Center for Monitoring and Assessment of Global Change (CAESCG), the Life project ADAPTAMED as well as local scientists (see Suppl. material 1 for an acronym list).

Specific aims of the workshop:

1. Data mobilization: Mapping existing workflows of data/information and current barriers that prevent effective reporting, finding solutions to improve current workflows of biodiversity data and the potential for (EU BON) tools, protocols and standards using test site cases and stakeholders.
2. Outlining current limitations and gaps with regard to the biodiversity data workflows.
3. Identify the benefits for stakeholders by participating in the EU BON project (e.g. tools and services).

Key outcomes and discussions

First Day

Francisco Javier Bonet García as local host from the University of Granada opened the meeting and welcomed the participants. Anke Hoffmann as scientific coordinator of EU BON gave an overview about the FP7 EU project running from December 2012 to May 2017. Main objective of EU BON is to deliver integrated biodiversity data to different user groups, and key outcomes are strategies for data mobilization, software tools and models for a better biodiversity data recording, analysis and visualisation as well recommendations for integrated biodiversity monitoring schemes which may act as blueprint for global biodiversity monitoring.

Katrin Vohland as being responsible for the Stakeholder Roundtables within EU BON presented as targets for the 3rd Stakeholder Roundtable on data workflows the validation of stakeholder groups, the analysis of their requirements, and a gap analysis. The RT should be used to inform and interact with the EU BON community to make best use of the resources and fine-tune outstanding project activities (Fig. 2)

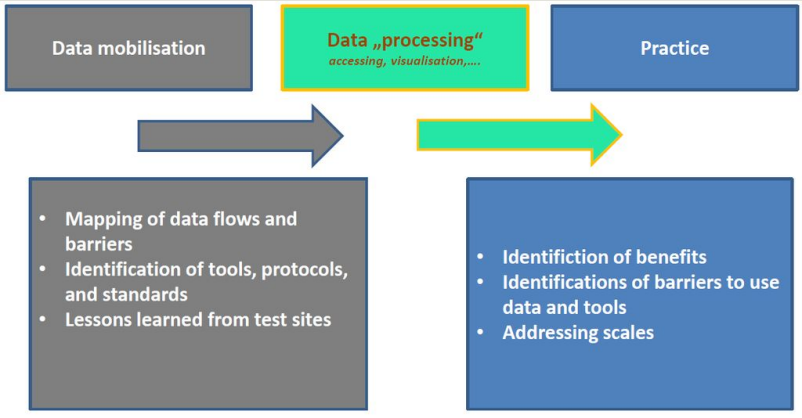

Figure 2.

Simplified workflow from data mobilization via processing to stakeholders from the practice.

Gary Geller (GEO Secretariat) introduced to the plenary the global acting GEO BON. Its mission is to improve the acquisition, delivery, and application of information on biodiversity change for decision makers. He sees still many gaps along the line of biodiversity observation, data storing and processing up to providing the data for decision makers. Therefore, GEO BON developed a tool box ("BON in a Box"), and supports national and regional BONs – where e.g. America, Africa and Australia are missing. It also works via thematic pillars (Fig. 3) for example on the marine and freshwater realm as well as on field sites, eco-services and on a Global System of Ecosystem Observatories.

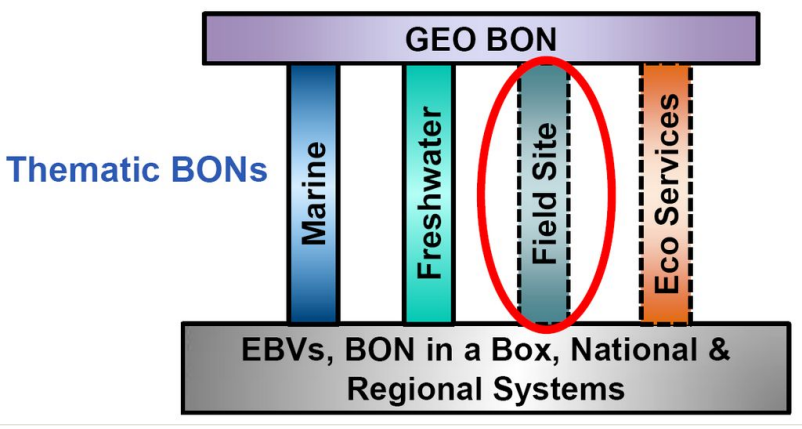

Figure 3.

Thematic pillars of GEO BON (Gary Geller, GEO Secretariat, 2015)

Carmela Marangi presented the project ECOPOTENTIAL as an answer to Call SC 16 2014: Making Earth Observation and Monitoring Data usable for ecosystem modelling and

services, starting on a local scale. There is a good basis with regards to data availability, but still challenges with regard to data heterogeneity, big data issues, and data quality. Work is based on protected areas and specific sites, including Sierra Nevada, which is also an EU BON observation site. Aim is to develop an ecosystem data framework, related to COPERNICUS, and to quantify ecosystem services. In situ data will be linked to satellite data. A virtual laboratory will be used to come from data to knowledge.

Michael Mirtl reported on the European Long-Term Ecosystem Research Network (LTER-Europe), which increasingly integrated socio-ecological data into the research infrastructure. Key questions to answer with this infrastructure are what drives major European ecosystems, and how these changes affect ecosystem functions. A challenge is the size and heterogeneity of the network; there are more than 400 LTER sites, different disciplines etc. Main conceptual pillars are long-term, in-situ data generation, a process orientation with a systemic approach. The „eLTER Eurofleet“ , a European fleet for terrestrial long-term ecosystem and biodiversity research is a symbol for the LTER approach to follow common ideas with test sites that have different capabilities and different systemic maturities. The idea to streamline different activities including EU BON is interesting but it is not so easy to implement. However, LTER already has some flagship projects in this respect, e.g. the eLTER H2020 Project (2015-2020), eLTER on the ESFRI roadmap and Ecopotential as a H2020 sister project (Fig. 4).

Figure 4.

First day of the Stakeholder Roundtable (credits: Dirk Schmeller).

Cédric Chaveriat presented the French project ECOSCOPE - Biodiversity research observatories - which is a national infrastructure and data hub for long term observatories on biodiversity research. Key aims are to provide an entry point for research and to provide an infrastructure for better access to biodiversity data and to understand its state and trends. It is mainly supported by the French Ministry of Research. Main users are scientist, participative science, and social science. Challenge is to open long-term data observatories, therefore a framework is set up, mainly based on metadata. There are many

functionalities, e.g. import and export metadata standards, or search and visualization of metadata.

Carlos Rodriguez (CSIC) shared his experiences in data mobilization, processing and modelling from the test site Doñana. A typical workflow scheme comprises data taken in the field, which come in different formats such as images, excel-sheets, pdfs, sensor logs, paper sheets, or senor logs. So raw data have to be processed, which is a limiting step in the whole process. In order to ensure quality and maturity of data, filter etc. can be used. Finally, the curated data including metadata can be published. In another step curated data are provided in two ways to local and national authorities: the first way is reporting e.g. numbers or trends, the second way is modelling e.g. ecosystem functions in order to develop management recommendations. The use of the numbers and trends, sometimes maps, seems to be accepted (by national park managers, farmers, …) while modelling outcomes face skepticism, perhaps because it is to complicate and/or time consuming to use, as for example a webpage has to be entered and understood.

The *discussion* dealt with the relationship between scientists, park managers and different end-users and the question, how direct the link is. It was concluded that in many cases the administration is in between, and also necessary as “translator”. In the Rhine Main Observatory, they rather would like to have “digested” information, ready to use information such as maps or numbers, they do not have the manpower or time to learn the tools as provided by EU BON. It was said, that sometimes the end-users wanted everything but do not know how to play around with different options. So the scientists provide simplified scenarios to develop prognoses e.g. for hypoxic waters. As another question arose which role SMEs may play – in relationship to e.g. researchers. Their function is mainly seen to take research outcomes for innovation, to adapt tools for the end users.

Clint Garcia Alibrandi (REDIAM) presented Rediam - The environmental information network of Andalusia (Spain). Andalusia has a rich diversity of ecosystems, and fauna and flora. Pressures come from urban developments, economy, infrastructure, but also environmental risks, floods, drought, fire; and modified plastic landscape agriculture and solar. The government has great responsibility in managing and planning environment, for which best possible data are needed. Therefore, Rediam was established. A team processes the data for different needs. Rediam is a distributed system, and serves at the same time as information catalogue for all users. Pillars of Rediam are the legal framework (European Directives, laws, Aarhus Convention, INSPIRE…) with the regional government of Andalusia as the center of Rediam. They work together with over 150 associated institutions which are producers, users and disseminator entities of environmental information e.g. universities, companies and public bodies. Rediam combines a considerable workforce (about 700 public employees including 70 technical experts) with a specific infrastructure dedicated to its objectives (operation, analysis, web portal, download of data...). The formats of information differs (images, reports, maps,...). Key challenge is to ensure the commitment of the partners providing (updated!) data and to maintain them. A positive side-effect of EU legislation with regard to openness of data is increasing transparency (of politics).

Francisco Javier Bonet García (University of Granada) introduced the EU Life project Adaptamed (Protection of key ecosystem services by adaptive management of Climate Change endangered Mediterranean socio-ecosystems). The project covers a transect from the Atlantic via Sierra Nevada to the Mediterranean Sea – and passes the three sites Doñana, Sierra Nevada, and Cabo de Gata. As the data handling cycle is most important, an adaptive management cycle was applied. The cycle starts with describing problems, define monitoring and data elevation scheme (including remote sensing), collect and analyse data, take action and ends with assessing the action before repeating cycle. Rediam is very supportive as regional overlaying scale, so scaling up becomes a carefully defined process. At national level, LTER and the Spanish ministries are addressed, globally those are processes such as GEO BON, SER-Europe, IUCN-MED, ILTER or LifeWatch. Challenges are the still imperfect cooperation between local stakeholders, scientists, managers, and the public. Language and particularly "technical language" of the different actors plays a role. Also limited funding (basically short term funding) makes maintenance of local observatories difficult. At the regional level, there is scarce participation of e.g. Rediam in global initiatives. However, regional institutions can act as a "middle-ware" and connect top-down and bottom-up approaches. It was concluded that global initiatives are paying more attention to local problems than to really address global challenges. However, the national level as powerful regulator was not present in the room.

Javier Cabello (University of Almería) presented the Andalusian Center for Monitoring and Assessment of Global Change (CAESCG). The center was established especially in order to assess the arid areas. It started with the Glocharid project. One result was the establishment of the Arid Iberian South-east LTSER Geo Data Base. The three lines of work are 1) monitoring, 2) working with regional managers to develop science-policy interfaces (scientific knowledge – public engagement – regulatory capacities as axes of a triangle), and 3) use remote sensing tools in order to manage ecosystem function.

Antonio Garcia (CSIC) gave an update on the current state of the EU BON Biodiversity Portal. Aim of EU BON WP2 is to develop an integrative portal for European biodiversity data. It aims to integrate biodiversity, ecosystem, and genetic data via a registry. The portal should showcase EU BON's analytical tools and results, and provide the interface to other initiatives such as GEOSS or DataOne. Currently, work is focused on GI-CAT as main broker which connects standardized data of different formats. GBIF is the main data repository. As problem occurred that the metadata from a specific GBIF accessor was not correctly translated as metadata and got lost. At the EU BON General Meeting in Cambridge (June 2015) it was decided to use Liferay as a content management system and to implement subsites e.g. for citizen science. The first prototype is for LTER and GBIF data, also to connect to the taxonomic backbone (i.e. taxonomic data of PESI). A vision for the future is a spatial EBV (Essential Biodiversity Variables) browser. Other developments mainly concern time based visualizations e.g. with CartoDB for GBIF data, to show species richness and trends with desktop tools and a web app, as well as a dashboard for species occurrence analysis.

Patricia Mergen (MRAC) demonstrated sample-data publishing with the GBIF IPT (Integrated Publishing Toolkit) as an EU BON outcome and answer to the challenge to publish such data sets. Based upon GBIF data an improved version of the IPT is developed and tested e.g. with insect traps and vegetation samples. An objective is to adapt the tool for EBVs. A test was run for species distribution based upon data from a training workshop given by Larissa Smirnova at a GBIF meeting in Madagascar (2015). The star schema sets the event in the core of different data sets. Metadata can be attached in different formats, e.g. EML. Seven key terms for encoding sample-based data have been identified. As metadata are key, a scheme is developed for easy entry. The tool can be linked to the Pensoft-data paper tool; some examples deal with aquatic invertebrates, Lepidoptera, macrophytes, and coral reef surveys. Challenges and next steps are the automatisation of analyzing the free text for metadata, further define controlled vocabularies and how to choose between event core, occurrence core, or taxonomic checklist. A GBIF-EU BON user guide will be available soon.

Florian Wetzel (MfN) presented the EU BON Data Workflow from data infrastructure, analysis including visualization up to frameworks. With regard to data availability, there was a gap analysis performed at the beginning of EU BON (Deliverable 1.1). There are fast developments; currently big biodiversity data become available, with stakeholders such as GEO BON, LTER, ECSA. The intention of the RT3 is to discuss the interrelations between EU BON and stakeholders at different scales, at local scales, for universities etc. The questionnaire which was sent around in advance shows a relatively equal distributed participation along the workflow chain. Another interesting outcome was that most participants provide biodiversity monitoring data, also citizen science data, but few socio-economic data. Most metadata are available online, however, access to the “real” data is restricted much more often. With regard to visualization, maps are more interesting in comparison to tools. Gaps are seen mostly by the environmental and socio-political data, less in analysis and tools (Fig. 5).

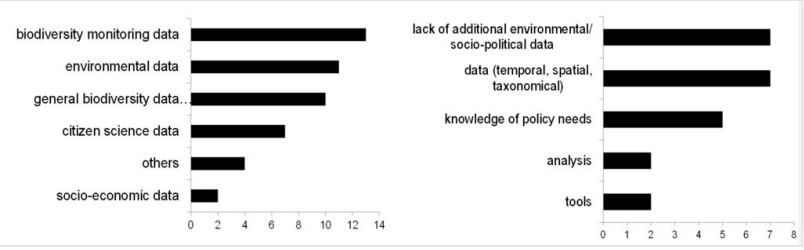

Figure 5.

Some exemplified results from the questionnaire send around in advance. Left: provision of data. right: Data requirements. N=20 (Florian Wetzel, MfN, 2015).

Quentin Groom (NBGB) gave an overview on EU BON Tools. One of the EU BON tools is GeoCAT, an online tool supporting the compilation of Red Lists by uploading own data and calculations provided by the system. Downscaling tools are tested with different models. Aquamaps are now also supported by EU BON. Data related tools are e.g. EuroLST

BIOCLIM to map climatic data, or GBIF IPT as part of the data publishing toolbox. GoldenGATE Image serves the data mining in taxonomic works. Tools for design and analysis comprise Roadmap, virtual ecologist as statistical package to improve survey design selection, and Cartogram to visualize spatial information. Under the several modelling tools there is Alpha-adjusted SDM for species distribution modelling, freshwater ensemble SDM, and Fourier to analyse the fragmentation of landscape.

Palma Blonda (CNR) presented the contribution of remote sensing for test cases and future developments at the test site level. For example, in the ECOPOTENTIAL project different spatial scales are linked, in order to provide data for e.g. the Habitats Directive. A methodology to adapt the remote sensing scale to the finer scales was developed; tools for upscaling was developed by MS Monina (EU FP7 project), using expert knowledge for habitat maps to fill the gaps between different domains. Landsense maps can be used to extract different indicators such as landscape fragmentation. Sentinel data could be used to calculate soil moisture. Key recommendation is to integrate high temporal and VHR data with in-situ data. Therefore agreements between space agencies and national/regional authorities are needed to get those VHR data for free. In addition, more emphasis should be put into adoption of the CORINE terminology.

Evelyn Underwood (IEEP) explained the link between biodiversity data flows and EU policy. This approach is more on the site of the users from the political area. Studies show that the data needs in protected areas to manage conservation interest are data on habitats, species, ecosystem function, etc., but also data to monitor the effectiveness of management. Natura 2000 specifically was driven by the concept of favorable conservation status, which does not only include data but is a negotiation process as e.g. reference levels have to be defined.

Dirk Schmeller (UFZ) gave insights into the project EuMon – i.e. on Metadata on biodiversity monitoring in Europe. This already some year old project developed a tool to cover metadata of biodiversity monitoring schemes in Europe, the searchable data base DaEUMon. A new feature will be a direct link to the source of the raw data.

Christos Arvantidis (HCMR) presented LifeWatch Greece and particularly LifeWatch tools that are open to EU BON and other stakeholders for modelling biodiversity on earth. In the area of virtual research environments (VREs), vLabs (virtual laboratories) are an interesting tool, providing computational capacity unlimited space and bringing transparency into science. LifeWatch is organized mainly in national hubs, and ready to submit final ERIC application. Examples of VRE are Dynamical Ecological online modelling providing maps e.g. TRIX index of Cyprus, or phosphate or oxygen in the sea by coupling physics, hydrology etc. and ecology models.

Wrap up:

- Albeit data mobilization being one of the key incentives to develop EU BON, the commitment to do so still remains a key issue in the workflow.

- There are different means to ensure and control data quality. With some care main attention should be put on completing metadata and exchange formats.
- The connection of different scales is of uttermost importance to link competencies and power of different actors at local, national, and regional level. Remote sensing offers options to link up scales, but the tool box of EU BON provides additional means.

In depth discussion of workflow

Katrin Vohland (MfN) gave an overview of the suggested framework, enriched by input from the first day (Table 1). Idea of that day was to fill and qualify the table in order to get a better overview on current success models of workflows, and on gaps and barriers. The results should then be taken to inform the EU BON community and beyond to adapt current activities more specifically to stakeholder demands.

Table 1.

Data workflow framework, filled with content from 1st day.

	Data mobilization	**Data processing**	**Data use by stakeholders**
Benefits	• *Transparency (of policies)*	• *Several tools (GeoCAT, GBIF IPT, VREs,..)*	• *Forecasting*
Challenges	• *Accessibility of long term data series* • *Commitment for continuous data update* • *Heterogeneity (and quality) of data* • *Lack of socio-economic data*	• *Link in-situ and remote sensing data (scales)* • *Technical problems at data (repository) interfaces*	• *Time and skills to go into (modelling) details lacking* • *Visibility of EU BON when providing integrated tools*
Solutions	• *European legislation; e.g. reporting duties*	• *More SMEs for innovative implementation*	• *Integrated and „digested“ data, preferably maps*

Different points were discussed, e.g. the scaling issue. Rediam was named as an example for an institution that is responsible for assembling regional data that is also used for national reporting. Generally, such kind of regional reporting data should be also available globally, e.g. via the European Biodiversity Portal.

It was also discussed why socio-economical data is lacking in many cases and not available. Often there are resources missing and field stations are mostly run by biologists who put mainly biological questions in the focus, and may not have competencies to get and analyse socio-economic data. Another large barrier are lacking funding schemes (e.g.

in EU calls) as interdisciplinary work needs more time, money for meetings and publishing opportunities.

Also ambivalent funding practices were discussed. One example is Andalusia where a considerable share, around 3/5 of the area, is protected and benefits financially from conservation-related activities, mainly from EU money. At the same time, economic activities take place within these protected park areas, e.g. cattle farming. There are 300 cattle farmers in Doñana, with access to the sanctuary. The community wants to better exploit the area and continue with their activities and making profit from the park status, while researchers aim to conserve biodiversity. In conclusion, they do not share a joint goal. Scientists have a double role as a “neutral” data provider but also for achieving nature conservation goals. In this respect, the EU BON biodiversity portal can play an important role in offering research-based data and information that could be used for (local) park management and discussions with stakeholders.

Another discourse was around the question for what kind of data open access should be provided, e.g. whether data should be released before (raw data) or after quality control. Also it was discussed what kind of incentives can be used to mobilize additional data, apart from money. One example are citizen science activities, where participants feel being rewarded by contributing to overall scientific questions. Reward mechanisms and according mindsets to acknowledge data have to be developed further, one option can be biodiversity data publication tools which provide citable references and data papers (e.g. Scopus and others).

World Cafés

The aim of the world cáfes was to discuss in smaller groups details of the workflow, 1) data mobilization, 2) data and tools, 3) implementation, and 4) upscaling. The single tables have been prepared by some participants in advance Fig. 6.

- **Data mobilization** (Dirk Schmeller, Veljo Runnel)

The “data mobilization” World Café focused on linking GBIF, citizen science, and other data sources. In particular, there was a discussion related to how museum collections could benefit from tools such as PlutoF. Participants agreed to search for ways to improve the functionality of PlutoF to support crowdsourcing for transcribing these collections. The main discussion focused on mobilizing data and identifying the benefits for both data providers and data users, and how this could be facilitated. Dirk also noted that we need to examine how the platforms developed through EU BON compete with existing platforms, and how we can provide added value. While the first case centered on data transcription, which is addressed in part by GBIF, there appear to be ways that we can provide additional functionality through tools such as PlutoF.

Figure 6.

Participants of the 3rd EU BON Stakeholder Roundtable discussing details of the workflow (credits: Katrin Vohland).

- **Tools and communication** (Quentin Groom, Johannes Penner, Stefan Stoll)

This World Café focused on improving communication between remote sensing specialists and ecologists, and between decision-makers and ecologists. One of the ideas that emerged centered on tools that support communication between these groups, yet there is concern regarding whether scientists should be setting the agenda, or responding to decision-makers' requests. Participants noted that the right stakeholders were not present at the workshop to address this issue appropriately, but that people would often rather have self-standing products that do not require further analysis. An Atlas of Breeding Birds, for instance, is useful for many different audiences, and can be used to derive further analyses/products.

- **Data portal and "helpdesk"** (Antonio Garcia, Patricia Mergen)

Helpdesk: Participants agreed that the 'Helpdesk' should be renamed to reflect the diverse functionalities of this tool. They also agreed that—based on the reviewers' comments—the platform would be better advertised on the EU BON website, with links to other tools and a ticketing system established through OpenProject (dispatched to respondents, with sustainability following the project, in accordance with the European Commission's requirements). Portal: It was suggested that guidelines for the "Helpdesk" should be integrated into the portal (e.g. how to use specific tools). Participants also highlighted the need to think about the needs of general users and stakeholders through the provision of simple components to analyse their data and to enable data filtering by country, time frame, etc. Other ideas that were raised included in the capacity for data contributors to track the use of their data through permanent URLs (DOIs) and licenses.

- **Upscaling information from different levels** (Carlos Rogriguez, Francisco Bonet)

Discussions suggested that Spain does not appear to have well-established bridges between data providers and users. Specifically, participants noted that decision-makers are not using 100% of the information available to them due to constraints in capacity and funding, and that the data provided often do not address the questions that are being asked. Furthermore, the data are often not available in the format decision-makers require, or, in some cases, decision-makers are not willing to accept the information provided. As a result, scientific knowledge is not always used to guide decisions. The consensus was that the 'value added' component of EU BON was the respect obtained by belonging to an international body with a corresponding mandate (with the European Commission commanding respect). Moreover, the biodiversity portal would offer a level of transparency by allowing anyone to retrieve the information used for decision-making, which would hopefully increase trust in these decisions. Moreover, the portal would offer a level of transparency by allowing anyone to retrieve the information used for decision-making, which would hopefully increase trust in these decisions. While data are currently being collated and used by local stakeholders, other links are less established due to a lack of standardised data flows (Fig. 7).

Figure 7.

Discussion at the second day of the roundtable (credits: Dirk Schmeller)

WRAP UP:

The most important question seems to be the validation of stakeholders of EU BON. It seems that the link between the project products and practitioner is more indirect, and that broker between the scientists and the practitioners are urgently needed. A good form may be SMEs which can combine their knowledge and innovative potential. The end-users are more interested in products such as maps or forecasts, and normally do not have the resources to apply the variety of tools.

Another consensus was that the ‘value added’ component of EU BON (from a local, site-based view) and data/information provided via the portal was the respect obtained by belonging to an international body with a corresponding mandate (with the European Commission commanding respect).

As political task remains the balance of interests between scales as well as local users and global thinking scientists. That was exemplified by the exciting discussion on ambivalence or competing interests at local scale e.g. how to manage national park, and what role biodiversity data may play. So funding schemes may become more open, to allow for more interaction, and to provide sufficient time for the necessary dialogues (Fig. 8).

Figure 8.

Excursion to Sierra Nevada. Missing: three meters snow (credits: Katrin Vohland).

Conclusions

As conclusions, a list with recommendations was created that reflect the discussions and basic outcomes of the Stakeholder Roundtable.

EU BON will support national and international authorities, as well as private stakeholders and the general public with integrated and scientifically sound biodiversity data analyses. The project intends to develop a full-scale model for a durable mechanism for higher level integration of biodiversity information providers and users through a network of networks approach scalable from local to global biodiversity observation systems. http://eubon.eu/show/project_2731/

a. Clarification of the targeted users of EU BON tools and products

EU BON develops a variety of tools and products which aim inter alia to “provide mechanisms for delivering integrated biodiversity information” and to “develop frameworks

and strategies for next generation management and use of biodiversity information at national and regional levels." However, it seems that only a minority of skilled scientists are able to understand and use EU BON tools and products. On the EU BON biodiversity portal, a clear guidance is needed for "professional" users (e.g. researchers, data managers, data analysists) and interested users with limited technical skills or scientific background knowledge. The national and regional levels have to be identified further, and not only with regard to their links to biodiversity data but also with regard to necessary skills and capacities.

b. EU BON tools and products should become more demand driven

Many tools and products within EU BON result from the ideas of the involved scientists, based on what they belief stakeholders might need (e.g. for local park managers or policy reporting on a national/European scale). The link between stakeholders, end users, and tool and product developers should become tighter. A stakeholder analysis at a meta level may not be adequate although a European project cannot consider every single user. However, some selected end users can serve as prototype in order to test and optimize the workflow from data mobilization into practice (see below the need for a "EU BON storyline showcase").

c. A better and more indicative presentation of EU BON tools is needed

There is a vast array of different tools developed and improved within EU BON. They serve for example to link specific databases, allow up- and downscaling, or modelling. They have names such as GeoCAT, GoldenGATE Imagine, PlutoF, or alpha-adjusted SDM, and only insiders have a rough idea what they may accomplish. It is strongly recommended to provide a webpage, where they are listed 1) according to an overall function such as data mobilization, data analysis, and data visualization, 2) a description of what the tool does, and 3) some examples or areas of application. Results and the derived list of tools from the Joint Workshop (WP2/3/4/6/7) in Cambridge (23-24 Nov 2015) could be used for this purpose. Primary access point for the webpage should be installed via the EU BON biodiversity portal.

d. Priorisation of tools

Thinking about the phase after EU BON becomes important, in particular to analyse who and how many users will have interest in a specific tool, and to focus the development on the most promising tools in order to guarantee effective use of resources and a sustainable further use and development of those tools. User-groups should find specific, recommended tools and products via the EU BON biodiversity portal and should be addressed via EU BON communication channels (webpage, newsletter, meetings etc.).

e. Implement and make use of entities such as SMEs at the interface between science and practice

A skilled interface between science and applicants from policy and administration is necessary as both groups use specific terminologies and follow specific procedures and

quality evaluation processes. SMEs may use this space as business model. However, SME business models must be built on the premise of open access, with their financial viability relying either indirectly on public funding, through the public users of the information, or on money earned through the development of software or specific tools for fee-paying users, rather than through selling the information itself.

f. Develop show cases for the workflow into user products such as maps

Repeatedly it was stressed that the stakeholders may be less interested in the tools which are difficult to handle but more in the products, especially maps. For a reality check it would be helpful to develop e.g. two showcases in order to analyse the whole workflow from data mobilization into the desired product. Potential users of EU BON derived data and tools can be REDIAM, the environmental information network of Andalusia, or for useable products IPBES, the Intergovernmental science-policy Platform on Biodiversity and Ecosystem Services. Such examples could be used to showcase better the benefits of a European biodiversity network and enhance current functionalities by analyzing barriers and limitations in a “EU BON storyline” of a biodiversity data workflow. However, also limitations of the explanatory power of maps exists, i.e. they have to be interpreted carefully and sufficient information has to be provided to avoid misleading interpretation. In addition to maps itself, also the underlying (spatial) data is needed for further usage, e.g. for governmental agencies and authorities.

g. Link up with more permanent infrastructures such as LifeWatch

There are permanent infrastructures being developed, in first line LifeWatch can be mentioned, but also GBIF, LTER and others. It would be important to link workflows and tools with these permanent infrastructures (as exemplified with the GBIF Integrated Publishing Toolkit for sample-based data) in order to make most effective use of the resources invested into EU BON.

h. Shift funding schemes in order to allow for more dialogues

EU BON is as most projects very output oriented. More time, skills, and capacity dedicated to dialogues and more profound user requirements would be extremely helpful. Such feedback-loops will be crucial to constantly improve biodiversity data and information workflows in order to meet the demands of the targeted stakeholders.

i. Further promote open access to data

A basic prerequisite for improving the European knowledge base is a free and open access to biodiversity data, particularly from local collection efforts and monitoring approaches. The EU BON Data Sharing Agreement, that promotes free and open exchange of data with obligations and guarantees, needs to be further disseminated and adopted by local stakeholders.

General synthesis and lessons learnt from the three EU BON stakeholder roundtables

In addition to the conclusions of the roundtables stated above, there are some general lessons learnt from the three stakeholder roundtables:

- The project EU BON started slightly overambitious – the discussions showed that the project will not serve all demands of all stakeholders. However, the roundtables gave good hints for strategic partners that are key for the further work of the project, e.g. the Global Earth Observation System of Systems (GEOSS), the Long Term Ecological Research Network (LTER) and the Group on Earth Observations - Biodiversity Observation Network (GEO BON).
- The stakeholder roundtables require a careful preparation: Feedback on topics and the planned sessions from the project partners are a precondition in order to get useful results out of the meetings and discussions. A profound expertise with regards to the main institutions and actors in the field of biodiversity data, biodiversity data analysis and policy is needed, as well as time to find key-people in the field.
- It is not always possible to get the desired stakeholders to the roundtable, due to manifold reasons: There are (still) language barriers existing, resources are often limited (e.g. travel money and time), and there is no joint understanding of added value of EU BON existing.
- Mediators are needed for a proper stakeholder engagement process – they have to get in touch with the stakeholder and brief the people beforehand, they should also show relevance of biodiversity networks and direct benefits that emerge from such processes.
- Mediators could be partners on a regional level, for example institutions that are bot involved in science and policy (regional environmental agencies), well-established networks covering many European countries (e.g. European Citizen Science Association) or main actors in the field or specific contact persons that work across different levels (i.e. on local as well as on more general/European level).
- It is important to have physical meetings organized in an open way, i.e. that the agenda, topics and discussions points could still be adjusted during the meeting. In the course of the roundtables it turned out that some discussions during the meeting where more fruitful than others, and more time should be spent on agenda items where dynamic interactions occurred which, in the end, resulted in valuable workshop results (i.e. nice best-practice examples, input for guidelines or recommendations. It is also important to have some dedicated time for social interactions included, where people can share their thoughts, develop ideas and a further work plan to solve the given tasks and generally learn from each other.
- Limit the number and time for presentations and talks at the meetings; they are needed in order to present the main activities and work of participating institutions and projects. However, the experience gained in the roundtables showed that

discussions and interactive sessions mostly produced the main results and key findings as well as possible solutions.

- It is important to reflect oneself when organizing roundtables and to adjust the presentations, language and examples used – they should be adjusted to the audience and stakeholders that participate. It is crucial to adjust presentations according to stakeholder knowledge/skills/interests, and not to give presentations in a usual "scientific" manner. It is also helpful to include a demo or training sessions: Show (visually) the products (portal, maps) and tools.
- Focus on some main products – e.g. what is essential for a BON and what do the key stakeholders really need in terms of EU BON products : 1. portal, 2. tools, 3. EBVs, 4. data mobilization, 5. visualisation of products.
- Think ahead: Sustainability is important – which products are needed in the future and need to be provided sustainably? The long-term goals and vision with regards to the projects products need to be integrated in the process in an early stage. In order to incorporate a demand and stakeholder-driven perspective it needs to be discussed with partners and the dialogue with stakeholders should already start in the project preparation phase.
- Time is needed for (individual) discussions, it is important not invite too many actors and schedule too many topics in a stakeholder roundtable. Hence it is more productive to focus on some aspects than to cover the whole thematic field in the sessions/discussions.

Some lessons learnt for BONs in general:

- The policy needs long-term biodiversity data for reporting on the progress, state and trends of biodiversity and the effects of biodiversity-related policy (conservation, nature-based solutions, ecosystem services, use of natural resources). One of the core services of EU BON, in the view of policy actors, is the long-term provision of biodiversity data (e.g. species occurrences, traits) and a proper and scientifically sound data analysis and storage.
- As raw data are very heterogeneous and need huge data storages ('big data', for example for satellite-derived data), a profound thematic and technical expertise in various fields is needed, to integrate and standardize data from several research areas, to make this data openly available and derive information and ultimately knowledge that satisfy the needs of policy actors. Participants from European authorities stated in the roundtables (e.g. EC, EEA etc.), that politicians do need maps and visualized products that are easily understandable.
- There are many interactions of citizens with scientists, and many citizen-science initiatives. However, the interactions of citizen science and European policy and its actors need to be strengthened. BONs can facilitate in this process but also supply tools and infrastructure for data handling, data standardization and curation and upload - in order to provide free access of data.

- The role of BONs for local stakeholders (protected areas, research sites in the field, conservation manager) is firstly to provide an overarching framework and, together with European policy, act as an acknowledged authority for reliable biodiversity data that provides policy-relevant information or downscaled data for the local level/sites.
- The discussions at the roundtables showed that the main users of EU BON will be scientists, trained professionals at governments and authorities on regional, national and European level.
- BONs are both social and technological networks – and strengthening interactions with key stakeholders is essential, both with end-users from European policy, national and international authorities, researchers and data providers from the local level.

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Supplementary material

Suppl. material 1: 3rd EU BON Stakeholder Roundtable – Acronyms

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