BIFA PROJECT "DEVELOPMENT OF THE BIODIVERSITY DATABASE SYSTEM IN VIET NAM"

A PROPOSAL ON ROAD MAP ON PARTICIPATION OF VIET NAM IN GLOBAL BIODIVERSITY INFORMATION FACILITY (GBIF) AND COORDINATION MECHANISM FOR SHARING INFORMATION TO GBIF

Ha Noi, 12/2016

TABLE OF CONTENTS

ABBREVIATION

BCA	Biodiversity of Conservation Agency
CBD	Convention on Biological Diversity
DARD	Department of Agriculture and Rural Development
DONRE	Department of Natural Resources and Environment
HoD	Head of Delegation
IEBR	Institute of Ecology and Biological Resources
GB	Governing Board
GBIF	Global Biodiversity Information Facility
JBIF	Japan Biodiversity Information Facility
MARD	Ministry of Agriculture and Rural Development
MONRE	Ministry of Natural Resources and Environment
MOST	Ministry of Science and Technology
MOU	Memorandum of Understanding
NFP	National Focal Point
PPC	Provincial People Committee
SWOT	Strong- Weak- Opportunity- Threat
VEA	Viet Nam Environment Administration
VBIF	Viet Nam Biodiversity Information Facility

LIST OF TABLE AND FIGURE

List of Figure

List of table

I. OVERVIEW ABOUT GBIF

1. General introduction

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

It allows anyone, anywhere to access data about all types of life on Earth, shared across national boundaries via the Internet.

By encouraging and helping institutions to publish data according to common standards, GBIF enables research not possible before, and informs better decisions to conserve and sustainably use the biological resources of the planet.

GBIF operates through a network of nodes, coordinating the biodiversity information facilities of Participant countries and organizations, collaborating with each other and the Secretariat to share skills, experiences and technical capacity.

GBIF's vision: "*A world in which biodiversity information is freely and universally available for science, society and a sustainable future*."

Currently, there are 37 Voting participants, 17 Associate Country Participants, 39 other Associate Participants and three GBIF Affiliates (Fig. 1). In Southeast Asia, Indonesia and Philippines became Associate Country Participant from 2004 and 2005, respectively.

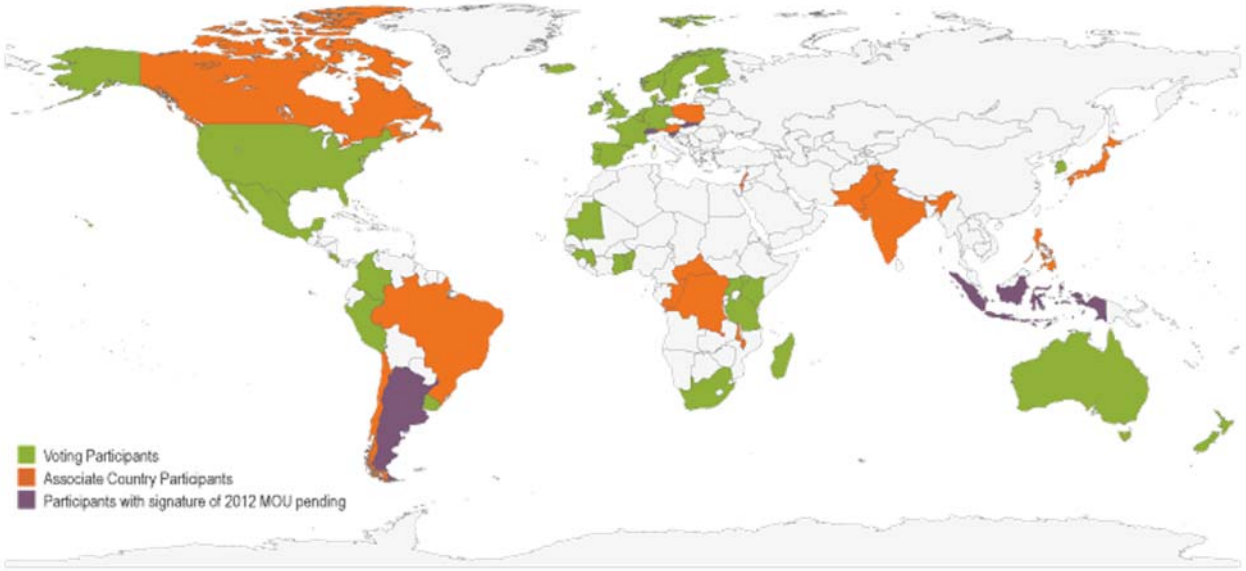

Figure 1. Map of GBIF Country Participants

a) Purpose of GBIF

The purpose of GBIF is to promote, co-ordinate, design, enable and implement the compilation, linking, standardisation, digitisation and global dissemination and use of the world's biodiversity data, within an appropriate framework for property rights and due attribution. GBIF works in close co-operation with established programmes and organisations that compile maintain and use biological information resources. The Participants, working through GBIF, establish and support a distributed information system that enables users to access and utilise considerable quantities of existing and new biodiversity data.

b) Goals of GBIF

It is the intention of the Participants that GBIF:

- be shared and distributed, while encouraging co-operation and coherence;
- be global in scale, though implemented nationally and regionally;
- be accessible by individuals anywhere in the world, offering potential benefits to all, while being funded primarily by those that have the greatest financial capabilities;
- promote standards and software tools designed to facilitate their adaptation into multiple languages, character sets and computer encodings;
- serve to disseminate technological capacity by drawing on and making widely available scientific and technical information;
- make biodiversity data universally available, while fully acknowledging the contribution made by those gathering and publishing these data.

c) Some facts about GBIF

- It provides a single point of access (through this portal and its web services) to hundreds of millions of records, shared freely by hundreds of institutions worldwide, making it the biggest biodiversity database on the Internet.
- The data accessible through GBIF relate to evidence about more than 1.6 million species, collected over three centuries of natural history exploration and including current observations from citizen scientists, researchers and automated monitoring programmes
- More than 1,400 peer-reviewed research publications have cited GBIF as a source of data, in studies spanning the impacts of climate change, the spread of pests and diseases, priority areas for conservation and food security. About one such paper is published each day.
- Many GBIF Participant countries have set up national portals using tools, codes and data freely available through GBIF to better informed their citizens and policy makers about their own biodiversity.

2. Governance (How decisions, advice, management and funding are organized in GBIF)

The GBIF Governing Board

Pursuant to Paragraphs 4.2 and 4.3 of the GBIF MOU, the Governing Board will consist of one Representative from each Participant. The Governing Board is the means by which GBIF Participants make collective decisions. Currently meeting once a year, it consists of one representative from each Participant country and organization. The Governing Board meets in a Participant country that offers to host it. The meeting is organized by the Secretariat in collaboration with the hosting country. The formal proceedings of the Board are associated with a number of other events at the same location, including meetings of nodes, standing committees, training events and the annual Science Symposium.

Only representatives from Voting Participant Countries (those countries making a financial contribution to GBIF's central fund) have the right to vote on the Governing Board. Representatives from Associate Participants, both countries and organizations, are encouraged to attend the Governing Board and take part in its discussions, but may

not vote.

The Secretariat of the Convention on Biological Diversity (CBD) is invited to designate a non-voting representative to the Governing Board.

The Governing Board has established Rules of Procedure, further elaborating on the provisions of the Memorandum of Understanding (MoU) regarding the structure of the board, meetings, requirements for participation and the establishment of subsidiary bodies.

Observers

Countries, organizations or other international bodies that have not signed the MoU, but are interested in the activities of GBIF, may be recognized by the Governing Board as observers. A number of former Participants that have not yet signed the latest MoU are also classified as observers to the Governing Board.

The Executive Committee

The Executive Committee operates on behalf of the Governing Board when the Board is not in session and within the areas of responsibility delegated to it by the Governing Board. Among its functions are monitoring of the performance of the Secretariat in carrying out the decisions taken by the Governing Board including implementation of the Strategic Plan and the Work Programme, and management of the budget.

GBIF's standing committees

As required under its rules of procedure, the GBIF Governing Board has set up three standing committees to act as advisory bodies, each with its own terms of reference and with its officers and membership elected by the Governing Board. They are: the Science Committee, the Budget Committee and the Participant Node Managers Committee (including the Nodes Steering Group) (Fig. 2). The functions and membership of each committee are described hereafter.

- Science Committee: The GBIF Science Committee is an advisory committee that oversees the development and progress of the GBIF work programme and makes recommendations to the Governing Board, the Executive Committee and the Secretariat. Among its other functions, the Science Committee is responsible for the selection of winners of the Ebbe Nielsen Prize and GBIF Young Researchers Award, and of speakers at the annual GBIF Science Symposium.

- Budget Committee: The Budget Committee is an advisory committee dealing with various financial issues relating to the administration of GBIF funds. Among other functions, it oversees the audit of the annual accounts submitted to the Governing Board, and it provides guidance for the selection of GBIF's auditing company. The committee makes recommendations to the Governing Board, the Executive Committee and the Secretariat. Its terms of reference can be found here.

- Participant Node Managers Committee: The Participant Node Managers Committee (also referred to as the Nodes Committee) serves as a forum for sharing information about the status and best practices of GBIF Participant nodes. It also acts as an advisory committee making recommendations to the Governing Board, the Executive Committee, the Science Committee and the Secretariat concerning issues relevant to the nodes. The Nodes Steering Group (NSG), established in 2011, consists

of the Chair and Vice Chairs of the Participant Node Managers Committee, and regional representatives from each of the six GBIF regions (Africa, Asia, Europe, Latin America, North America and Oceania). Among its objectives are to formulate specific recommendations to the relevant GBIF bodies based on feedback provided by Participant nodes, and to provide advice on the GBIF Work Programme relevant to nodes.

GBIF task groups

According to its rules of procedure, the GBIF Governing Board may establish and assign responsibilities to ad hoc committees or task groups. The terms of reference, guidelines and budgets for these groups are set by the Governing Board or by the Executive Committee on its behalf. Current task groups: Task group on accelerating the discovery of bio-collections data; Task group on data fitness for use in agrobiodiversity; Task group on data fitness for use in distribution modeling.

How GBIF is funded

The GBIF Secretariat, advisory committees and work programme are funded by GBIF's Voting Participants through an annual basic financial contribution based on a formula linked to the Participant country's GDP. Countries whose per capita income falls below US$13,000 per year are entitled to a 50 per cent discount on this contribution.

In addition to the basic financial contributions, both Voting and Associate Participants may make supplementary financial contributions to fund specific parts of the work programme or for other purposes agreed to by the Governing Board.

The Secretariat may also accept income from additional sources, such as foundations, agencies, research councils and private companies, for the purposes set out in the Memorandum of Understanding and the GBIF Strategic Plan.

The GBIF budget

The Secretariat budgets, administers and reports on GBIF funds in accordance with a set of financial regulations approved by the Governing Board.

GBIF uses the calendar year as its financial year, and follows a rolling budget in which an adopted budget is amended at intervals to reflect changing circumstances. The Governing Board approves the budget two to three months in advance of the financial year, typically in October. When the draft financial report for the previous year is ready in April/May, the budget is revised by the Executive Committee taking any variations into account.

Each country Participant in GBIF is responsible for funding the establishment of a Participant node, digitization programmes, meetings and workshops at the national or organizational level.

GBIF finances are audited by an international auditing company.

The GBIF Secretariat

The GBIF Secretariat, located at the Natural History Museum in Copenhagen, Denmark, is charged with developing, executing and reporting on the GBIF work programme.

The tasks of the Secretariat include:

- operating the GBIF portal and associated informatics products
- coordinating activities of the network related to data mobilization, publishing and management
- monitoring data gaps and use of GBIF-mediated data for science, and
- operating central communication and collaboration services

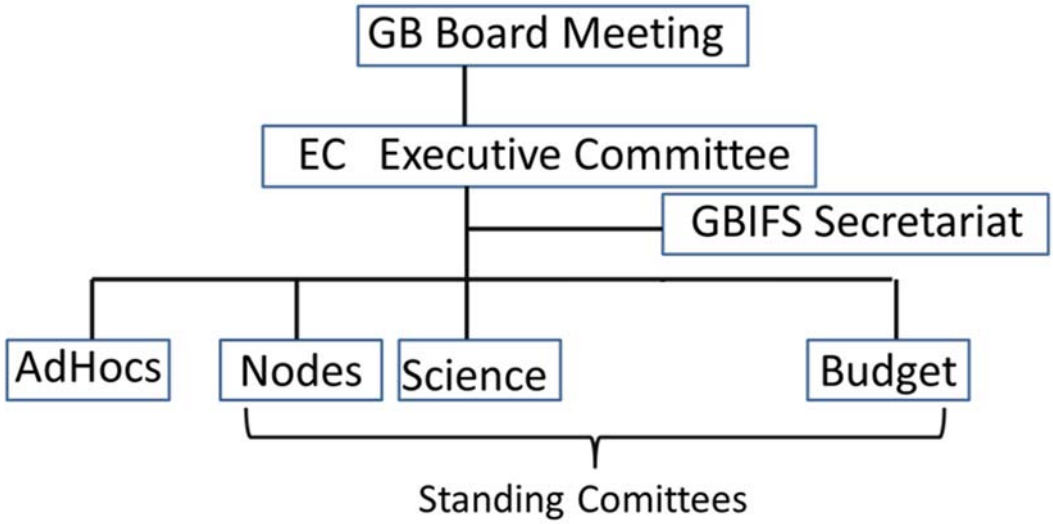

Figure 2. The organization of GBIF

3. Infrastructure (How GBIF works as a global informatics infrastructure)

The GBIF informatics architecture provides an open platform to connect and access biodiversity databases around the world.

The distributed infrastructure spans across the hundreds of institutions participating in GBIF enabling users to discover, access, integrate and help curate the growing content shared on the network.

The GBIF architecture encompasses well-known community-developed data standards and protocols enabling **interoperability at global scale**. As an open infrastructure, a growing number of tools and workflows are able to connect and participate in the GBIF network.

For convenience, the infrastructure can be considered in terms of a number of sequential processes:

- Digitization: The initial capturing of information in electronic form, through imaging, databasing, maintaining spreadsheets etc.

- Publishing: The act of making data sources available in a well known format (standard) and with appropriate metadata for access on the internet.

- Integration: The process of aggregating published data sets, applying consistent quality control routines and normalizing formats.

- Discovery and access: By building network wide indexes, discovery services are offered for users through portals and for machines by extensive web service APIs.

Registry: The registry is a core component of the architecture responsible for providing the authoritative source of information on GBIF Participants (Nodes), institutions (e.g. data publishers), datasets, networks their interrelationships and the

means to identify and access them. As a distributed network, the registry serves a central coordination mechanism to (e.g.) allow publishers to declare their existence and for data integrating components to discover how to access published datasets and interoperate with the publisher.

Occurrences: The network that publishes occurrence records through GBIF spans hundreds of publishing institutions worldwide. Data holders manage content in either spreadsheets or databases and then use specific publishing tools to expose those data for querying and access over the internet. The existence of the dataset and the technical protocols required to access the data are entered into the GBIF registry. Aggregators such as the GBIF global portal and national GBIF data portals, crawl datasets and build sophisticated indexes to allow users to efficiently search and access content across datasets. This page briefly describes the architecture and operations performed in the global GBIF portal when crawling and indexing occurrence data for user search and download.

Occurrence processing: Every single occurrence record in GBIF goes through a series of processing steps until it becomes available in the GBIF portal. Internally the processing is glued together by a messaging system that keeps our processing code independent of each other. The process can be divided up into 3 main parts: crawling datasets into fragments, parsing fragments into verbatim occurrences and interpreting verbatim values.

GBIF Tools Overview: The outcome of each of these steps is available through the API. Every single occurrence record therefore has a raw fragment, verbatim and interpreted view. The corresponding timestamps lastCrawled, lastParsed and lastInterpreted indicate the exact last time each step has run. GBIF makes available several free to use, open-source tools and services. The table below lists GBIF's most widely used and talked-about tools. They span several categories of use, such as data assessment, data cleaning, data publishing, data visualization, and metadata authoring.

Table 1. Lists GBIF's most widely used tools

Categories of use	**Short Description**
Data publishing, Metadata authoring, Data discovery	Publishes primary occurrence data, species checklists and taxonomies, and general metadata about data sources. It can also serve as a repository for data referenced in an article.
Data discovery	Enables participants to establish a simple, GBIF-compliant web presence
Data assessment	Validates that a Darwin Core Archive complies with the Darwin Core Text Guidelines
Data cleaning	Atomizes scientific names, and validates that a scientific name is a well-formed 3-part name

4. Benefit of joining GBIF

a) For researcher

If Vietnam joins GBIF, more Vietnamese researchers will become familiar with GBIF. They can locate more information about species from around the world such as specimens, habitat, distribution and taxonomic status. They can publish their data to

GBIF and use data of GBIF. GBIF tools for web-enabled taxonomy facilitate rapid progress in describing new species, collaborative research and preparing monographs. Data on specimens can be used in research activities such as systematics and building predictive models.

b) For institution or individual with biodiversity data

GBIF offers tools and advice for publishing biodiversity datasets via the Internet, enabling them to be discovered and cited in research and policy applications. This can raise the profile of a project or institution, attract recognition for those involved in digital data gathering and curation, and help users to comply with legal or regulatory requirements for data management.

c) For national government

Participating in GBIF will allow Vietnam to become part of a global network of collaborators, helping Vietnam to meet the country's biodiversity information needs. A range of capacity enhancement activities, including mentoring and training, enable Vietnam to benefit from more than a decade's experience and development of free tools to mobilize biodiversity datasets and make them accessible for research and policy. GBIF supports setting up of a Vietnam national biodiversity web portal. Participation on GBIF will benefit Vietnam in developing NBDS which is just in the first stage. Moreover, it will assist with contributions to data and information requirements for intergovernmental processes such as the Convention on Biological Diversity (CBD).

The important benefits in being a member is that each participant is involved in the community, having engagement in regional or inter-nodal activity, which allows the participant to absorb state-of-the-art information and application of the biodiversity data through the direct communication. This information can be utilize for increased development and access to biodiversity data, predicting and avoiding possible future conflicts (such as licensing issue).

The following table outlines a wide array of actors, stakeholders and sectors that generate, use or need biodiversity data. At present GBIF observes a dispersion and fragmentation of data around the world. GBIF’s work is meant to address this issue at the same time actively work to narrow the digital divide. In fact, GBIF's strategy to provide open access to data, and its distributed architecture, effectively contribute to overcoming these barriers, which are particularly prevalent in many developing countries. GBIF can, in the longer term, provide important contributions to the poverty reduction goals of these countries by providing access to a variety of data necessary to support and address poverty alleviation. This potential lies not only within environmental/biodiversity conservation - but also in relation to development of agriculture and fisheries, health improvement as well as development of higher education and research. The table below illustrates some of the main areas where – over the longer term - fully developed national GBIF nodes will be able to support poverty reduction through improved local livelihoods.

Table 2. Actors, stakeholders and sectors where GBIF activities can make an impact

Beneficiaries	Areas of Interest
GBIF Participants	GBIF provides useful services that make it easier for them to meet their own strategic needs (e.g., implement national biodiversity strategies and action plans, manage and conserve their own biodiversity, promote scientific research, etc.).
Researchers who use natural history or culture collections	GBIF-mediated specimen- and name-level data are used in research activities such as systematics building predictive models and others; GBIF tools for web-enabled taxonomy facilitate rapid progress in describing new species and collaborative research and preparing monographs.
GBIF Data Providers	GBIF data providers are recognized as sources of assistance and tools related to specimen, observational and names data. Data providers get full recognition and are cited in various scientific publications.
Molecular research (e.g. DNA barcodings, phylogenetic analysis)	GBIF-mediated species-level data and information architecture enable seamless integration between gene or other sequence data and voucher specimen data, and from there to ecological context for gene evolution (for example).
Agriculture	GBIF data of use in integrated pest management, measuring the impact of agriculture on biodiversity (and vice versa), locating wild relatives of crop plants, pollinators, etc. and how this in turn address matters to food security and poverty alleviation.
Natural Resource Management (e.g. forestry, fisheries)	GBIF-mediated, easy to access scientific data contribute to good decision-making, support appropriate management of biodiversity resources and address the Millennium Development Goals.
Geospatial / Ecological modelling community (e.g. Climate Change, Spread of Invasive Species, Emergent Diseases)	GBIF's robust data can be used for niche-modelling and other kinds of analyses that address urgent questions and issues which impact the daily lives and quality of life in developing countries.
International biodiversity related conventions (e.g. CBD, Ramsar, CITES, CMS)	GBIF's primary data underpins the kinds of information needed by countries to address the effective implementation of

	Conventions (e.g. 2010 targets to reduce the rate of biodiversity loss, monitoring the status to biodiversity, etc.).
National planning agencies or authorities and other Ecosystem managers	GBIF-mediated data are used to compile lists of taxon occurrences in priority areas and underpin policy and natural resource management decisions at national and regional levels while highlighting the services provided by different ecosystems around the world.
Conservation	GBIF-mediated data used to track species and populations, assess the status, and identify areas for priority action and the CBD 2010 target to decrease the rate of biodiversity loss. GBIF data network is also a means to publish and archive survey data and establish base line data against which monitoring activities can effectively be made.
Sustainable development	Such as ecotourism. GBIF-mediated data can be used to plan and target species and areas to produce value-added products and services
General Public	Will use GBIF to seek answers to all sorts of questions about biodiversity (e.g. via Species Banks and others).

(Source: GBIF, 2006)

By becoming members of GBIF, countries benefit directly in several ways, among them:

- Access to GBIF seed money grants to allow countries to apply for funds to digitize their collections and other biodiversity data sources
- Access to training workshops in biodiversity informatics and financial support to attend and participate in these events are provided by GBIF to representatives of its members.
- Participation at the NODES Committee Meetings: These open fora discuss themes of high relevance to the day-to-day work of Nodes, look at ways on how best to address the technical needs and organisational challenges of the GBIF Nodes, share lessons and promote learning from each other's experiences.
- Immediate access to an international network of experts: These experts in biodiversity informatics can provide advice and support in matters dealing with the establishment of national nodes and/or their respective networks as well as other technical aspects.
- Access to mentors: GBIF members who have more experience and/or knowledge in the establishment of national nodes and their networks can provide mentoring support to those Nodes in greater need. GBIF has a programme to foster these activities.
- Participation in projects that deal with repatriation of data to countries of

origin. Using GBIF and with a simple query, countries can benefit from getting free and open access to biodiversity data housed in different parts of the world.

- Participation in defining the GBIF Work Programme and its budget: All GBIF members actively participate in the discussions regarding the work programme and its budget.

d) For member of the public, educator or wildlife enthusiast

GBIF offers great opportunities to explore and contribute to the global body of evidence documenting the huge diversity of life on our planet. Find out what records are available for our country, region or neighbourhood by exploring the country pages and occurrence data on this portal. Contact your GBIF national node to find out about activities such as bioblitzes and other events that help you to become a 'citizen scientist', and consider sharing your observations or images through networks such as iNaturalist, eBird and the Encyclopedia of Life (EOL).

GBIF.org as a global biodiversity data platform can play an important role in the agrobiodiversity landscape by mobilizing and connecting biodiversity datasets that can support research and development for food security and ecosystem services resilience. As part of a broader global strategy on fitness for use of biodiversity data, GBIF and Bioversity International convened a Task Group on Data Fitness for Use in Agrobiodiversity in March 2015. The Task Group identified the need to bridge ecological and agricultural data that are relevant for agrobiodiversity and agroecology uses. In general, the plant ex situ conservation data are in a good state with developed data and metadata solutions.

5. Terms of use

5.1. Open data

A piece of content or data is open if anyone is free to use, reuse, and redistribute it subject only, at most, to the requirement to attribute and/or share-alike (Open Knowledge Foundation (2012)). In other mean, open data is free access, copyright and redistributable. However, we need to note that free data is not always open data. Free is just one of component. Data owners have Copy Rights. This is sometime to prevent usability. Open data should be re-use not only by owner but also by others. We can re-release open data even in worked data (not only raw data). High usability and accessibility is desirable of open data. Therefore, open data require standard file format and common data platform.

5.2. Data sharing

a) Data sharing agreement – background

The goals and principles of making biodiversity data openly and universally available have been defined in the GBIF Memorandum of Understanding, paragraph 8 (see Annex 1).

The Participants who have signed the MoU have expressed their willingness to make biodiversity data available through their nodes to foster scientific research development internationally and to support the public use of these data.

Data Publishers often participate in several data sharing arrangements at different levels (thematic, community, national, global).

GBIF data sharing should take place within a framework of due attribution.

b) Provisions

When registering their services with GBIF, the Data Publishers agree as follows:

Biodiversity data accessible via the GBIF network are openly and universally available to all users within the framework of the GBIF Data Use Agreement and with the terms and conditions that the Data Publisher has identified in its metadata.

GBIF does not assert any intellectual property rights in the data that is made available through its network.

The Data Publisher warrants that it has made the necessary agreements with the original owners of the data that it can make the data available through the GBIF network.

The Data Publisher makes reasonable efforts to ensure that the data it serves are accurate.

Responsibility regarding the restriction of access to sensitive data resides with the Data Publisher.

The Data Publisher includes stable and unique identifiers in its data so that the owner of the data is known and for other necessary purposes.

GBIF Secretariat may cache a copy and serve full or partial data further to other users together with the terms and conditions for use set by the Data Publisher. Queries of such data through the GBIF Secretariat are reported to the Data Publisher.

Data Publishers are endorsed by a GBIF Participant, if applicable, before their metadata is made available by the GBIF Secretariat.

GBIF Secretariat is not liable or responsible, nor are its employees or contractors, for the data contents or their use; or for any loss, damage, claim, cost or expense however it may arise, from an inability to use the GBIF network.

c) Service levels

GBIF Secretariat

Services provided by the GBIF Secretariat are managed in accordance with the GBIF Work Programme.

GBIF Secretariat's service provision includes software components and updates, interfaces, indexing and registry services, helpdesk, and training to assist the Participants to maintain Internet portals.

GBIF Participants

GBIF Participants keep the GBIF Secretariat informed of their contact and service information.

GBIF Participants maintain services that enable new and existing Data Publishers in their domain to be integrated within GBIF network, and the data owners be identified, as appropriate.

5.3. Data use

a) Data use agreement – background

The goals and principles of making biodiversity data openly and universally available have been defined in the GBIF Memorandum of Understanding, paragraph 8 (see Annex 1).

The Participants who have signed the MoU have expressed their willingness to make biodiversity data available through their nodes to foster scientific research development internationally and to support the public use of these data. GBIF data sharing should take place within a framework of due attribution.

b) Provisions

Using data available through the GBIF network therefore requires agreeing with the following:

The quality and completeness of data cannot be guaranteed. Users employ these data at their own risk.

Users shall respect restrictions of access to sensitive data.

In order to make attribution of use for owners of the data possible, the identifier of ownership of data must be retained with every data record.

Users must publicly acknowledge, in conjunction with the use of the data, the Data Publishers whose biodiversity data they have used. Data Publishers may require additional attribution of specific collections within their institution.

Users must comply with additional terms and conditions of use set by the Data Publisher. Where these exist they will be available through the metadata associated with the data.

c) Citing data

Data retrieved from the GBIF network shall be cited according to the "dataset citation provided by the publisher", as shown on the dataset or occurrence page on the GBIF portal. If the publisher-provided citation is either missing or incomplete, the user shall observe the "default citation" given on the dataset or occurrence page.

5.4. Licenses

a) Licensing for species occurrence datasets published through GBIF

In 2014, the GBIF Governing Board sought to address the need that both data publishers and data users have for greater clarity on how data may be used when shared via GBIF.org. Following the Secretariat's community consultation in 2013 and 2014, the Governing Board established a general policy to:

Ensure that all species occurrence datasets within the network are associated with digital licenses equivalent to one of the following three choices supplied by Creative Commons:

- CC0, under which data are made available for any use without restriction or particular requirements on the part of users
- CC-BY, under which data are made available for any use provided that attribution is appropriately given for the sources of data used, in the manner specified by the owner
- CC-BY-NC, under which data are made available for any use provided that

attribution is appropriately given and provided the use is not for commercial purposes

GBIF strongly encourages data publishers to opt for the most open choice available (CC0). GBIF community member Peter Desmet concisely summarized the rationale in 2012:

For starters, there's very little copyright to be had in our data, datasets and databases. Copyright only applies to creative content and 99% of our data are facts, which cannot be copyrighted. We do hold copyright over some text in remarks fields, the data format or database model we chose/created, and pictures. If we consider a Darwin Core Archive (which is how we are publishing our data) the creative content is even further reduced: the data format is a standard and we only provide a link to pictures, not the pictures themselves.

Figuring out where the facts stop and where the (copyrightable) creative content begins can already be difficult for the content owner, so imagine what a legal nightmare it can become for the user. On top of that different rules are used in different countries. Publishing our data under CC0 removes any ambiguity and red tape. We waive any copyright we might have had over the creative content and our data gets the legal status of public domain. It can no longer be copyrighted by anyone.

Giving credit is a good thing but legally enforcing it can lead to the opposite affect: a user may decide not to use the data out of fear of not completely complying with the license (see paragraph above). As hinted at the beginning of this post, CC0 removes the drastic legally enforceable requirement to give attribution, but it does not remove the moral obligation to give attribution. In fact, this has been the common practice in scientific research for many decades: legally, you don't have to cite the research/data you're using, but not doing so could be considered plagiarism, which would compromise your reputation and the credibility of your work.

Under CC BY-NC, the user cannot use the data(set) for commercial purposes. This seems fine from an academic viewpoint, but the license is a lot more restrictive than intuitively thought. See Hagedorn, G. et al. 2011.

Significantly differing interpretations exist on what is considered commercial or non-commercial use, ranging from straightforward for-profit use, like re-sale of data over use for publications in commercial journals, to works that include websites that display advertisements as a means of cost recovery.

b) The useful of standardized, digital licenses

GBIF's mission is to promote free and open access to biodiversity data, and data limitations introduced at the initial stages of publication multiply as datasets are aggregated to address big questions.

Large-scale research generally requires the foundations of 'big data' to be as free from restrictions as possible. For example, the Global Biodiversity Informatics Outlook identifies the "Open access and reuse culture" as one of the essential foundations for biodiversity informatics. Global initiatives like the Research Data Alliance are addressing these same issues for all research data. Many countries are increasing pursuit of policies to make data (particularly publicly funded data) open and accessible. Given its mission, GBIF has a responsibility and a place in improving understanding of these trends.

Until now, users of GBIF data have agreed to abide by the Data Use Agreement, and data publishers have likewise agreed to the terms of a Data Sharing Agreement. Both of these agreements refer to additional 'terms and conditions' that data publishers may attach to datasets and include in their metadata.

As a result, many GBIF data publishers include their own licensing details in the metadata they provide for each dataset. Submitted in free text and expressed in a wide variety of non-standard formats, these additional terms and conditions make it difficult if not impossible for users of GBIF.org to understand the rights relating to large data downloads, particularly those that include data from multiple institutions. These conditions prove particularly problematic when data are used through web services in automated tools unable to parse usage restrictions outlined only in human-readable text.

c) For data users

For data users, standardizing and limiting the set of potential licenses means that data are easier to use with confidence, thus promoting (re)use of data. This change shifts the burden away from the user, who would have to read through each individual license to determine whether data use is permitted—a situation whose uncertainty could discourage data use. Supported by an appropriate set of filters by information networks like GBIF, users can easily scan and limit downloaded datasets to those whose licenses support the intended use.

Users need to be aware that even for datasets stating CC0, the GBIF data use agreement still applies, meaning, for instance, that proper attribution and citation of sources is required. Those will be supported by a new citation mechanism that provides a persistent reference to the datasets contained in the download), for easy inclusion in e.g. publications.

d) For data publishers

GBIF recognizes that publishers need to document use of their data and wish to receive due recognition for their efforts in collecting, digitizing, curating and publishing species occurrence data.

Complementary to adopting a more transparent and least restrictive licensing approach, therefore, all necessary efforts will be made to support tracking and reporting of data use, and to provide tools that ease and encourage citation by data users. While it is problematic trying to enforce adherence to licenses (see the discussion of their applicability, above, and limited legal leverage), supporting the development of norms and community best practice can help to ensure that the need for attribution is understood, and the practice supported by appropriate tools and procedures.

GBIF is proceeding with a work plan to establish a citation model built upon the Digital Object Identifier (DOI) system. Upon implementation, each dataset (or any object such as imagines) will have a DOI, and all citations will reference the datasets used through persistent DOIs. Under this citation model, data users can be supplied with stable, easy-to-cite source references for their downloads, which will include references to all concerned datasets—a model that will improve publishers' ability to track the use of their data in both print publications and digital applications.

e) Other licenses

Some licenses can be considered almost equivalent to the three listed above. Those include PDDL (very similar to CC0) and ODC-By (equivalent to CC BY). The recommendation for datasets published under those licenses is to consider the corresponding equivalent CC license. The previously cited article discusses and weights of the pros and cons of the other open data licenses. However, data published through GBIF will need to come under one of the three CC versions listed above.

f) 'Commercial use' in the context of GBIF

Interpretations vary widely about how to define commercial use. Some would limit it narrowly if straightforwardly to for-profit practices like re-sale of data in contrast with use for example in publications in commercial journals. Broader constructions would extend it, for example, to websites displaying advertisements as a means of operational cost recovery. We do not expect to propose or impose a resolution to this conversation, but what we hope to describe here is our current practice with regard to 'commercial' and 'non-commercial' designations.

GBIF provides its open access infrastructure to support scientific understanding and improve biodiversity and conservation outcomes. We will continue to promote attribution (CC-BY) as the standard practice for citing GBIF-mediated data, believing that it reflects an established norm across the communities we serve to cite original work.

The new version of our Integrated Publishing Toolkit (IPT) will allow publishers to select CC-BY-NC 4.0 as the most restrictive of the standard machine-readable license by default. Both users and publishers should recognize the grey areas that exist in defining commercial and non-commercial use. We believe that restrictive interpretations of non-commercial use run counter to the spirit and the letter of open access in general and GBIF in particular.

Users who make use of data that carries the CC-BY-NC license should do so in good faith. We strongly encourage them to communicate with publishers if a broad but reasonable interpretation of non-commercial use might construe the benefits they receive as commercial in nature.

GBIF supports publishers' use of CC-BY-NC, and GBIF will make reasonable efforts to honor the intent of such licensing, even where its inheritance extends additional restrictions to other aggregated data that are more freely licensed by themselves.

However, GBIF has neither the interest nor the resources to enforce CC-BY-NC by legal means. If users severely infringe upon these licenses or act in bad faith, publishers may choose to pursue legal actions; GBIF will not participate in them. We would advise publishers uncomfortable with this position either to limit ("narrow") the data elements they share or to remove the data from access through GBIF.org.

5.5. Disclaimer

a) Names and boundaries of countries, territories and islands

Names of countries, territories and islands are based on recommendations made through the ISO-3166 standard.

b) Maps and boundaries

GBIF does not guarantee the accuracy of the maps available through its portal and web services. The boundaries, colors, denominations or other information shown on maps do not imply any judgement on the part of GBIF concerning the legal status of any territory, or the endorsement or acceptance of such boundaries. Users must observe the copyright and licensing provisions included with all maps.

c) Data

GBIF does not guarantee the accuracy of the biodiversity data served through its portal and web services. Use of data accessed through the portal and web services is at the user's own risk. Users must observe the provisions of the Data Use Agreement and data publishers must observe the provisions of the Data Sharing Agreement.

II. HOW TO JOIN GBIF

According to the GBIF Memorandum of Understanding (MoU), a GBIF Participant can be a country, economy, inter-governmental or international organization, other organization with an international scope, or an entity designated by them, that has signed the MoU and expressed its intention to observe its provisions. The process of joining is quite simple. Just follow the steps below:

1. Choose our category

If we wish to join GBIF on behalf of a national government, there are two categories to choose from:

Voting Participants: countries that are willing to observe the provisions of the MoU and to make a financial contribution to the GBIF budget. These Participants have voting rights on the GBIF Governing Board, as well as other benefits.

Associate Country Participants: countries that are not yet making financial contributions to GBIF. Associate Participants may take part in the deliberations of the Governing Board, but may not vote. The category of an Associate Participant Country is a temporary category of up to five years duration from the date when the country signs the MoU. During this period the Associate Participant Country may decide to become either a Voting Participant, or an Observer, or may withdraw from GBIF.

Other Associate Participants are international organizations, intergovernmental organizations, other organizations with an international scope, and economies, that are willing to observe the MoU provisions. These Participants may send representatives to the GBIF Governing Board, may endorse data publishers and take part in collaborations such as regional meetings, mentoring programmes and training events. However, they are not eligible to become Voting Participants, and are not required to make a financial contribution to the GBIF budget.

2. Send a Letter of Intent

In order to become a Participant in GBIF an appropriate government agency, or senior representative of an organization, should send an official Letter of Intent to the Chair of the Governing Board (see below), expressing intent to sign the MoU.

The letter should state that the country/organization is, in principle, in agreement with the intentions listed in the MoU and should, in particular, outline the willingness to establish a Participant Node, share biodiversity data and actively participate in the implementation of the GBIF Work Programme.

Letters of Intent signed by a Minister or ministerial department should include information on the agency or institution that has been designated to sign the MoU and represent the country on the GBIF Governing Board.

If a country wishes to become a Voting Participant it must, in addition, express its willingness to make a financial contribution to GBIF as outlined in Paragraph 9 of the MoU, and establish the details in a financial arrangement with the Secretariat.

The GBIF Executive Committee will consider all petitions for Participant status and will determine if the application meets the requirements of the MoU and GBIF

Rules of Procedure. If a petition is granted, a MoU signature copy will be sent. In the case of Voting Participation, the Secretariat will in addition specify the financial contributions in a financial arrangement.

For further details of the procedure see Article IV – Requirements for Participation in the Rules of Procedure agreed by the Governing Board.

The letter of intent should be addressed to:

Chair of the GBIF Governing Board

GBIF Secretariat

Universitetsparken 15

DK-2100 Copenhagen Ø

Denmark

3. Sign the Memorandum of Understanding (MoU)

Once the petition to join GBIF, expressed in the Letter of Intent, has been received and approved by the Executive Committee, the applicant will be informed and the designated minister, official or other representative may sign the MoU. As soon as the signature is received by the Secretariat, the country or organization becomes a GBIF Participant and will be informed about further procedures such as appointing a Head of Delegation and node manager.

III. INTRODUCTION AND EXPERIENCES FROM SOME COUNTRIES

We selected some GBIF participating countries to learn about their vision, mission, organizational model and operational mechanism. These countries provide a well-organized pattern. In addition, we also choose Tanzania, a new participant of GBIF that possesses biodiversity information facilities similar to Vietnam, and to learn the participation process from this country.

1. Japan

Japan has participated as a voting member of GBIF since its inception (in 2001). Node Managers have included Dr Keiichi Matsuura, National Museum of Nature and Science (2002-2003); Dr Motomi Ito, Tokyo University (2003-2012); and Dr Tsuyoshi Hosoya, National Museum of Nature and Science (2012- present).

Until 2010, the activity in Japan to provide biodiversity information to GBIF was under the jurisdiction of the Japan Science and Technology Agency (JST). After the tenth meeting of the Conference of the Parties of the Convention on Biological Diversity, held in Nagoya, Japan, in October 2010, biodiversity issues that had been under the Ministry of Education, Culture, Sports, Science and Technology (MEXT) were switched to the Ministry of Environment (MOE). This change in governance resulted in a remarkable change in the governance of the Japan Node (JBIF). In 2012, JBIF was renewed and current structure was established.

a) Vision and mission

JBIF's aim is to "promote the collection and application of biodiversity information in Japan and accelerate contribution to the international community", based on the following six major strategies: 1) Raise awareness about biodiversity information, 2) Improve museums' abilities to function as repositories of biodiversity data, 3) Raise awareness within the general public and government agencies about the importance of biodiversity information, 4) Enhance the visibility of the Japan Node in the GBIF community, 5) Promote cooperation with related projects, 6) Assume cooperative leadership in Asian activities.

b) Structure

JBIF has a two-layered structure. There is a higher decision-making group (Node Steering Committee; meeting twice a year) consisting of 16 people from various national institutes, agencies, and local museums, that endorses and directs the activity of the Working Group. The Working Group consists of 09 people from various National Institutes, (meeting on an irregular basis, but at least twice at the occasion of the Node Steering Committee meetings). Some members of Working Group overlap with Steering Committee members in order to enhance communication. All members are participating on a voluntary basis (Figure 3).

The Head of Delegation role is officially assigned to the Ministry of Foreign Affairs. Node manager works as a point person between JBIF and GBIF and manages Working Group. The major supporting agency for GBIF activities in Japan is Ministry of environment (MOE), while the major institutes involved in the activity are under the jurisdiction of MEXT, namely universities, national

institutes, and local and national museums.

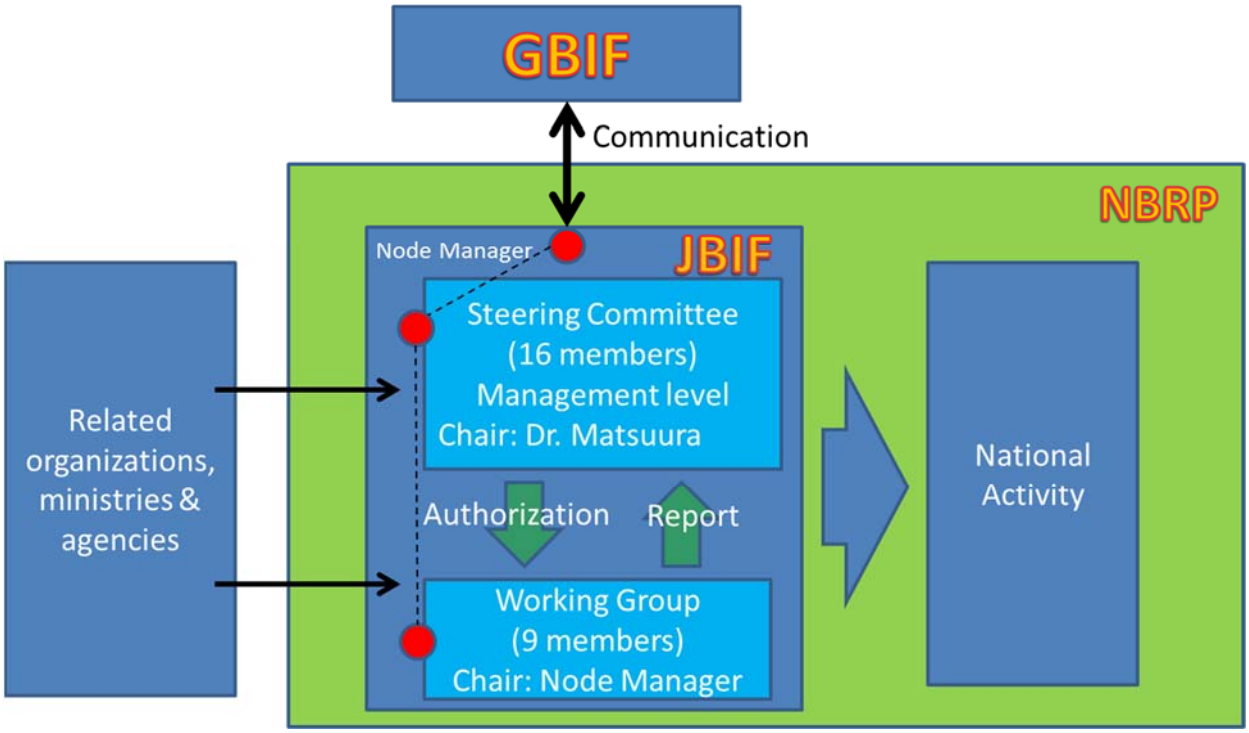

Figure3. JBIF organization structure

c) National funding

The Government provides funding for data management through the National BioResource Project (NBRP), to the National Institute of Genetics, Tokyo University, and National Museum of Nature and Science, and domestic activities concerning GBIF are partially supported. Additional funding is being obtained by the members themselves or through their organizations. The financial contribution to GBIF is made by the Ministry of the Environment of Japan.

d) Data publication flow

Japan provides data to the GBIF from the National Institute for Genetics and the National Museum of Nature and Science. The National Museum of Nature and Science receives specimen data from museums across the country and provides it both domestically and internationally through the GBIF and the Science Museum Net (S-Net). The National Institute for Genetics, in cooperation with the laboratory of Professor Motomi Ito at the University of Tokyo, is engaged in an ongoing effort to assemble the biodiversity information that has already been made public, from article reprints to the results of research projects at various universities and research institutions, and is publishing this information on the GBIF. The Japan Node set strategic targets at the commencement of the third phase of the project (NBRP) in 2012, and improvements in data maintenance and collaboration have been underway since then.

e) Japan Node Activities and web portals

S-Net: integrating and disseminating information from local museums and research institutes

"Science Museum Net", abbreviated as S-Net, is an information portal for natural history and science museums operated by the National Museum of Nature and Science (URL: http://science-net.kahaku.go.jp/). In addition to nature history specimen information provided by 71 domestic museums and research institutions (currently 3.62 million data as of Sept. 2015), you can search for researchers and curators (501 people listed as of Sept. 2015).

To promote the open sharing of data from museums and research institutions abroad, annual workshops are held to exchange views, helpdesk support is offered, and information is aggregated through the Natural History Museum Network of West Japan, a non – profit organization.

Promoting the communication and use of biodiversity information through education

The Japan Node holds training workshops and practice sessions for biodiversity information providers. The training workshops are led by either the National Museum of Nature and Science or the NPO Natural History Museum Network of West Japan and offer providers practical training in high-level analytical techniques through a mix of technical courses, data utilization, and simulation exercises. The goal is to have museum officials from across the country gather several times a year to exchange views and share ideas about GBIF.

Global Biodiversity Information Facility (GBIF) Japan Node (JBIF) web portal

Established by the National Institute for Genetics, this website is the official portal for the Japan Node of GBIF. On this page you can find information regarding events on biodiversity and download guidebooks, manuals (some Japanese translations available), and Gbits (in Japanese) – the official bulletin of the GBIF. The main features of this page are as follow:

- Search for biodiversity information (in Japanese)
- Explanations of GBIF data formats and data registration process
- Latest information on research and events
- GBIF publications (guides and manuals)
- Japanese editions of Gbits bulletin
- Links to other useful sites

"Science Museum Net" web portal

Established by the National Museum of Nature and Science, this website enables us to retrieve information from domestic science and natural history museums. We can search (in Japanese) for natural history specimen data (the same dataset is also available on GBIF) from museums and research institutions across Japan as well as for information on their curators and research staff. Additionally, various tools are provided for data maintenance. The main features of this page as follow:

- Retrieve natural history specimens information
- Search curators and research staff
- Tools to search the Red List and dictionaries of place names
- Formatting tools for GBIF

2. Australia

Australia is voting GBIF participant since 2001. The Atlas of Living Australia (GBIF Australia) was initiated by a group of 14 (now 17) partner organisations. The Atlas was formally established through the National Collaborative Research Infrastructure Strategy (NCRIS), which was originally administered by the Australian Department of Science and Innovation – now the Department of Education. The Atlas is hosted by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and has a partner base including Australian Museums, Herbaria and other biological collections.

The intent was to create a national database of all of Australia's flora and fauna that could be accessed through a single, easy to use web site. Information on the site would be used to improve understanding of Australian biodiversity and assist researchers to build a more detailed picture of Australia's biodiversity; and to assist environmental managers and policy makers develop more effective means of managing and sustaining Australia's biodiversity.

a) Vision and mission

The Atlas of Living Australia's core mission is to "share biodiversity knowledge".

The vision is to bring together information on all the known species in Australia - aggregated from a wide range of data providers including at least: museums, herbaria, researchers, community groups, government departments, non-government agencies, consultants, individuals (or citizens) and universities.

b) Structure

The Atlas of Living Australia's Management Committee provides strategic guidance for the project. The committee includes representatives from the partner community (museums, herbaria, CSIRO), as well as other NCRIS capabilities, Federal and State agencies. The committee represents and engages with key partners, data publishers and the overall collection and user community.

c) National funding

Funding for the Atlas of Living Australia was provided by the Australian Government under the National Collaborative Research Infrastructure Strategy (NCRIS) and the Super Science Initiative (SSI), part of the Education Investment Fund. The Atlas partners have provided considerable in-kind contributions.

The basic financial contribution to GBIF is made by Atlas of Living Australia, CSIRO National Research Collections Australia.

3. France

France is voting GBIF participant since 2001. GBIF France has the mandate to promote GBIF activities and tools at the national level and to represent France in the GBIF community. The node provides information on best practices and standards used by GBIF and helps data publishers to connect data to the GBIF network using the tools developed by GBIF. The node also organizes training events and interacts with all the organizations working on biodiversity at national level. GBIF France also provides support to francophone countries to help them to contribute to GBIF.

The GBIF France node was created in June 2006 and hosted by the Muséum

national d'Histoire naturelle (MNHN) in Paris. In the beginning the node was just hosted by the MNHN, but, in 2011, GBIF France was officially integrated into the MNHN and is now under the Direction des collections of the MNHN.

a) Vision and mission

GBIF France's missions are to: collect metadata on primary biodiversity data resources; assist connecting data to the GBIF network using GBIF standards, protocols and tools; organize training sessions (data publishing, data quality, use of GBIF-mediated data); inform on GBIF, tools, activities, calls, training material & opportunities; promote and facilitate the use of GBIF-mediated data and tools by biodiversity data users; collaborate with other national and international facilities on biodiversity, and with the GBIF Secretariat; contribute to the development of common tools with the GBIF community; and contribute to the CEPDEC program.

b) Structure

The GBIF France node includes two part-time coordinators and four full-time positions (node manager, IT specialists and a data engineer).

The node has a board that meets once a year. It includes representation from four Ministries (Education and Research, Foreign Affairs, Environment and Ecology, and Agronomy) and most of the organisations working on biodiversity at national level.

c) National funding

The GBIF France node is funded by the Ministry of Education and Research (Ministère de l'Education nationale, de l'Enseignement Supérieure et de la Recherche, MESR). From 2013 and for four years, GBIF France is funded through a French National Research Agency (L'Agence nationale de la recherche, ARN) project called e-ReColNat.

The basic financial contribution to GBIF is made by the Direction Générale pour la Recherche et l'Innovation (DGRI).

4. United States

United States is voting GBIF participant since 2001. The United States Geological Survey (USGS) hosts the U.S. Node to GBIF since the U.S. joined GBIF in 2001. The USGS-coordinated National Biological Information Infrastructure (NBII) served first as the primary implementation vehicle for the node. Since NBII's cancellation in 2010, the USGS Core Science Analytics, Synthesis and Libraries Program implements the node. The Biodiversity Information Serving Our Nation (BISON) project comprises most node activities.

a) Vision and mission

The U.S. node to GBIF represents an integral part of the U.S. Geological Survey's activities to collect, organize and share biological information. As with other initiatives, the U.S. GBIF node streamlines access to U.S. biodiversity information and links it with broader geoscience data to address critical societal issues.

b) Structure

BISON is the primary project contributing to the node. It provides a specialized view of GBIF records for the U.S. and assists with provision of U.S. records to GBIF.

The White House Office of Science and Technology Policy (OSTP) coordinates EcoINFORMA, a broader U.S. government effort to organize and share data on biodiversity, environmental health and ecosystem services.

The Biological and Ecological Informatics Working Group is made up of representatives from numerous U.S. government agencies. It helps organize and prioritize contributions to both EcoINFORMA and BISON.

c) National funding

Since establishing the node in 2001, the United States Geological Survey has fully funded direct implementation of the U.S. Node to GBIF as a key contribution to its broader biodiversity informatics activities.

The basic financial contribution to GBIF is made by the National Science Foundation, the Smithsonian Institution, the U.S. Department of State and the U.S. Department of Agriculture.

5. Tanzania

The Capacity Enhancement Pilot programme for Developing countries (CEPDEC) has been conducted in Tanzania over three years as a partnership between Global Biodiversity Information Facility (GBIF) and the Tanzania Commission for Science and Technology (COSTECH). The aim of the programme was to build capacity through training, mentoring, and supporting digitalization of primary biodiversity data and information in Tanzanian institutions to make this openly accessible as advocated by the GBIF network. Access to biodiversity information is expected to contribute substantially to sustainable social and economic development in Tanzania allowing for wider exposure of the data for furthering science, conservation and development. In justifying the programme, succinct links were drawn to Tanzania's strategies for growth and the millennium development growth.

CEPDEC in Tanzania was to establish a functional biodiversity data sharing infrastructure integrated in the GBIF framework. To achieve this, the programme followed a road map that highlighted four distinct outputs. As a pilot project to be emulated in other developing countries the process and experiences of the programme summed up as best practises and lessons learnt are consultatively compiled in this report to provide guidance and justification for continued support to the initiative of ensuring open access to biodiversity information globally. For each output a number of activities were projected and the processes of achievement or challenges thereof are documented as the best practise or lesson learnt.

Output 1: Functional GBIF node in the country to provide long-term, unified access to all relevant sources of biodiversity information for Tanzania to be used in science environmental management. This output included the development of the portal, mentoring and the administrative framework for the national node.

Best practices

- Infrastructure for networking developed in accordance with national needs incorporating and/ or utilising existing frameworks enables sustainability
- Appropriate mentor selection considering expertise and capacity (resources) facilitates access to wide variety of supported activities
- Board for oversight of activities affords node acceptance and facilitates

stakeholder contribution

- Technical requirements encourages distribution of responsibilities and expertise among participants
- Host node is neutral with mandate for node functions this enables stakeholder by-in
- Node staff permanently employed by host and node activities incorporated into organisational structure ensures sustainability

Lessons learnt

- IT Capacity of staff is necessary to ensure functionality of the portal
- Mentor contribution requires careful and collaborative planning to meet programme time lines
- Logistics for instituting and organising board meetings are resource intensive
- Capacity, expertise and time for node activities requires careful planning; resource mobilisation in addition to participant contribution is critical for sustainability of activities
- Permanent staffing for secretariat activities requires re-organisation and/ or employing of staff at the host institution
- Node activities best linked to other institutional functions for appropriate impact
- Exploit options for data acquisition e.g. registered research

Output 2: National networks of data providers and users of biodiversity information who are able to access and exploit data for scientific, conservation and development questions. Activities for this output included a data providers survey and needs analysis, some digitalisation initiatives and training in data management and analysis.

Best practice

- To initiate the network an effective communication strategy to engage stakeholders facilitates by-in and participation
- Identification of institutions and organisations with available data (location, format, quantity and utility) establishes basis for sharing
- Aligning needs for data and information with national development policies justifies initiative
- Selecting node host as neutral but competent organisation builds confidence in stakeholders

Lessons learnt

- IT requirement for operations and updating of the portal necessary for maintaining dynamism: local software development will provided tools tailored for national needs
- Mechanisms (logistics and training) for digitalisation of non-digital data needed to ensure wider determine priorities for digitisation; consider options for data entry harmonisation; determine harmonisation modes for effective sharing
- Demonstrated value for open access biodiversity information a key strategy for stakeholder by-in
- A viable strategy for digitalisation is necessary for continued publication of

data through the portal

- Participant mandates need to be linked to TanBIF activities for complementation

Output 3: A set of tools and procedures for developing and sustaining a national Node prepared and communicated to existing and potential GBIF members. The activities included adaptation of training materials and availing these to participants. Furthermore, specific procedures and manuals were to be prepared.

Best practice

- Viable products such as the Q-GIS tool demonstrate the potential impact that TanBIF can have on biodiversity conservation

Lessons learnt

- Products developed for use have to be more than internet based hard copies of some of the products are needed to reach a wider public given the national context for sharing information.

Output 4: Options and partnerships for funding of GBIF capacity enhancement in individual developing countries identified and facilitated. It was intended that a regional workshop would be held and the best practices shared.

Best practice

- Training of participants to utilize tools for sustainable development is an important outreach strategy for biodiversity informatics; tool testing in young nodes, avails learning opportunity for improvement for GBIF

Lessons learnt

- Staffing for outreach is critical for furthering awareness and utility of the tools; digitization requires resources that need to be considered by participants' operational budgets for sustainability
- In Tanzania, external support to CEPDEC amounted to 425,500 Euros provided by the Royal Danish Government through the GBIF secretariat. Internal support was afforded in kind by COSTECH through staff salary, time and infrastructure.

In general, CEPDEC Project in Tanzania has been very successful. Majority of the expected outcomes were realized. A functional GBIF national node, the Tanzania Biodiversity Information Facility (TanBIF) has been established using a participatory approach. TanBIF continued to expand, and its Participants have realized ownership. Networks of experts were formulated, expanded and supported implementation for CEPDEC project. The Government of the Republic of Tanzania participated fully in TanBIF activities and realized the importance of TanBIF in the biodiversity management. Development of tools such as TanBIF Portal and QGIS Software for biodiversity data and information sharing, repatriation and analysis will aid Tanzania to manage biodiversity sustainably through informed scientific evidence base. The launching of TanBIF Portal and QGIS Tool by high-level government officials position TanBIF in a high national and international platform. It is worth concluding that CEPDEC Project opened a new chapter of sustainable biodiversity information and data management system in Tanzania. Biodiversity stakeholders should take

advantage of the tools and infrastructure developed for TanBIF in making sound decision on biodiversity management and its related issues. Additionally, this initiative should be taped and adapted in other developing countries.

6. General comments

By learning from some GBIF participants, we have some general comments:

- Their vision and mission are to collect, organize and share biodiversity information

- Their structure includes key partners in the field of biodiversity data.

- Their major funding for the GBIF activities comes from governmental sources.

- Stable funding is required for sustainable participation in GBIF.

IV. ACHIEVEMENTS AND CHALLENGES IN DEVELOPMENT AND MANAGEMENT BIODIVERSITY DATABASE IN VIETNAM

1. Achievements

Vietnam has become a member country of the Convention on Biological Diversity (CBD). In response to the requirement, the Government of Vietnam (GOV) enacted the Biodiversity Law in 2008, which is followed by the National Biodiversity Strategy to 2020, vision to 2030 (approved in 2013) and the Master Plan on Biodiversity Conservation (approved in 2014). Biodiversity database development was mentioned in the Master Plan. Some schemes have been developed to implement it, which also includes a proposal for building national biodiversity database "*Survey, inventory and building biodiversity database*". The Vietnamese Government shows a strong commitment to achieve biodiversity conservation as well as sustainable development.

In recent years, strong international integration has been contributing to capacity building, awareness raising and management support for biodiversity database development.

The Biodiversity Conservation Agency (BCA), an arm of Vietnam's Ministry of National Resources and Environment charged with the management of the country's biodiversity database, proposes to strengthen national capacity in database management and to promote GBIF in the country as an opportunity for information exchange at the global level.

The National Biodiversity Database System (NBDS) is officially launched in Hanoi in January, 2015. The database system was jointly developed by the Biodiversity Conservation Agency (BCA), the Vietnam Environment Administration (VEA) and the Ministry of Natural Resources and Environment (MONRE), through the "Project for Development of the National Biodiversity Database System" cooperated by the Japan International Cooperation Agency (JICA) since November 2011. NBDS is designed correspondingly to international standards to store nation-wide biodiversity data including lists of species of fauna and flora in taxonomy. The development of NBDS helps BCA implementing effective management on biodiversity by gathering necessary data for assessing, monitoring and reporting the status of biodiversity. NBDS is also expected to provide a base of biodiversity information for decision makers, government officers, researchers and the public as well (http://www.jica.go.jp/). During more than 3 years of implementation, the technical cooperation project has developed numbers of results, such as;

- The first stage of NBDS generation has been established. It is ready for storing, importing, exporting and analyzing biodiversity data. A Master Scheme of NBDS which is an official proposal to GOV for the entire scope of NBDS

development and utilization.

- Prioritized list of required activities and budget.

- Official guideline for developing biodiversity monitoring indications in Vietnam both at national and local level.

- The System Architecture of NBDS that describes every details of structure and design of NBDS. The technical guideline for basic survey and monitoring of coastal wetland based on the basic survey on biodiversity at Xuan Thuy National Park in Nam Dinh province.

- Draft circular for collaboration mechanism on data sharing with other agencies.

- The major stakeholders for the biodiversity information facility been identified including MONRE/VEA/BCA, MOST, PPC (Provincial People's Committee), Department of Natural Resources and Environment (DONRE belong MONRE) and Department of Agriculture and Rural Development (DARD belong to Ministry of Agriculture and Rural Development (MARD)), national parks, protected areas, research institutes, universities, NGOs, international organizations and individuals.

- An informatics infrastructure (of MONRE/VEA) is in place to support the publishing of biodiversity data from the country's institutions to the Internet.

While remarkable achievements have been seen as above, there still exist challenges and remaining works. In order to ensure further NBDS utilization and development, it is essential that MONRE will soon approve the Master Scheme of NBDS to determine necessary activities and budget to operate and upgrade the database's function. Equal importance is the promulgation of the draft circular on collaboration mechanism among data holders, which enables sharing, exchanging and exploiting biodiversity data (http://www.jica.go.jp/).

2. Challenges

Construction and management of biodiversity databases in Vietnam are just in the beginning stages. There are some challenges as follow:

- Biodiversity data is scattered all over the country. A considerable portion of the data is still non-digital (i.e. Paper). Most digital data is in desktop format (MS-Word, Excel, etc.). It is therefore difficult to search/find nation-wide information on biodiversity.

- Biodiversity data are not shared between different organizations. There is not any coordination mechanisms in building, using, and sharing biodiversity data between agencies, research institutes and universities.

- Biodiversity monitoring at the national scale has not yet been done. There is not any standard method for biodiversity monitoring. Human resource and funding for biodiversity research is very limited.

- The importance of biodiversity databases are not fully understood. Awareness of the role of the database of the leaders, officials, scientists working in the field of biodiversity are not high.

- The value of biodiversity is not quantitatively assessed at the national scale.

- Biodiversity information in Vietnam has not been standardized yet, or verified by experts.

- Biodiversity information management is not performed in a uniform way.

- The needs of biodiversity information users have been not yet been assessed at the national level. The currently developed databases have not yet meet the needs of users.

- The ability to manage, exploit and use the biodiversity database is limited by the spontaneous and sporadic training, lack of specialized training staff in IT and on biodiversity database management.

- Although institutions and laws have gradually improved, they are not yet fully addressing the management of biodiversity data. Documents providing guidelines on building and managing of biodiversity data are very few. There are not any human and funding resources in charge of biodiversity databases. Funding for the projects related to a biodiversity database is also not officially mentioned.

- Although the issue of building biodiversity databases has been mentioned in the Master Plan, it did not specifically mention any financial or human resources for this work as well as participation in GBIF.

- A node designated to coordinate biodiversity data sharing activities nationally has not yet been designated.

- The national sources of biodiversity data have not yet been documented. The state of national data holdings has not yet been assessed (e.g. digital/non-digital format, approximate size and scope of collections, use of standards).

- A strategy has been initially developed to assist the biodiversity information facility in mobilizing national biodiversity data sources in a systematic way. Nonetheless, data mobilization priorities for the biodiversity information facility have not yet been discussed and agreed with stakeholders. The strategy to assist data holders in making a case for investment in the mobilization of their data (e.g. through addressing known gaps or targeting specific use cases) is not yet in use.

- A national biodiversity website has been developed. However, there are few

data on the website and it is not ready to serve user needs. In the future, when the website starts to work, it must complement and add value to other available biodiversity information websites to serve the needs of key (defined) user groups for the biodiversity information facility.

V. WORK FLOW FOR DATABASING AND PUBLISHING FROM NATIONAL BIODIVERSITY DATABASE SYSTEM (NBDS) TO GBIF

Under the support from Biodiversity Fund for Asia (BIFA, invested from Ministry of Environment of Japan) project and JICA, NBDS will be continued to develop. The first step of databasing and publishing is the identification of the main national sources of biodiversity data (literatures, specimens). Meanwhile, a national data mobilization strategy is being developed. An infrastructure including Vietnam Biodiversity Information Facility (VBIF) is in place to promote and support national digitization, accumulation and publication activities. The data is digitized according to the Darwin Core standards. The Integrated Publishing Toolkit (IPT) is used to publish and share biodiversity datasets through the GBIF network. Finally, the data is downloaded/analyzed and used by users (Figure 4).

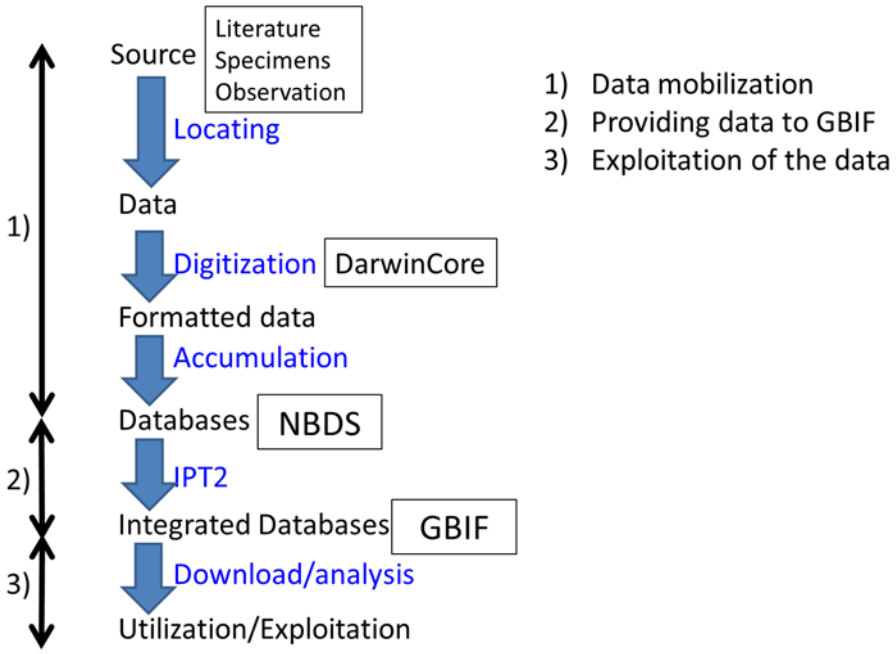

Figure 4. The workflow for databasing and publishing from Vietnam

VI. A ROAD MAP FOR VIETNAM TO PARTICIPATE IN GBIF

1. Legal Framework and Practices

The Law on Biodiversity was passed by the XIIth National Assembly on November 13, 2008 in the fourth session, officially came into force on 1st July, 2009. The Biodiversity Law is the first law to regulate the conservation and sustainable development of biodiversity in Vietnam.

As stipulated in clause 5, Article 71 of the Law " The Ministry of Natural Resources and Environment shall specify basic survey activities and the supply, exchange and management of biodiversity information; and uniformly manage the national database on biodiversity".

Vietnam is the member of several international conventions related to biodiversity conservation, including the Convention on Biological Diversity (CBD Convention), the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Convention on the Conservation of Wetlands of International Importance (Ramsar), etc. These international conventions require and emphasize the significance of data and information systematization for biodiversity conservation.

The CBD Convention also affirmed the importance of biodiversity information as "Aware of the general lack of information and knowledge regarding biological diversity and of the urgent need to develop scientific, technical and institutional capacities to provide the basic understanding upon which to plan and implement appropriate measures. The Ramsar Convention mentions that: The Contracting Parties shall encourage research and the exchange of data and publications regarding wetlands and their flora and fauna". Article 20 of the Cartagena Protocol on Biosafety also regulates the sharing of information and the establishment of the Biosafety Clearing-House.

In order to facilitate the database development in the country, enhancing cooperation in database and raising the public awareness on biodiversity, participation in the Global Biodiversity Information Facility (GBIF) is an indispensable requirement.

The participation in GBIF will support the national efforts in biodiversity conservation, especially while the first generation of the National Biodiversity Database System (NBDS) is released. However, it also requires the national focal point and the stakeholders to be prepared in many aspects.

2. Objectives

2.1 The Overall objective

Development of biodiversity database system that meets the management requirements and utilization of biodiversity data and information in Vietnam, interconnection with the Global Biodiversity Information System (GBIF).

Biodiversity information in Vietnam is freely accessed on national and global scale under the close collaboration of stakeholders.

2.2 The Specific objectives

- The National Biodiversity Database System (NBDS) are well functioned, interconnecting with the GBIF to support the biodiversity state management from the central level to local level.

- Promoting the accumulation, digitization, utilization, sharing, updating and development of biodiversity data and information across the country.

- Mobilizing resources and enhancing international cooperation on the development of biodiversity database.

- Strengthening capacity of the NFP/ Head of delegation, Node manager and nodes to operate and maintain the NBDS.

3. Major tasks

3.1 Strengthening the functions, tasks, organization and operation of the national focal point (NFP) and/ or Head of Delegation (HoD), node manager and the nodes

- To strengthen the functions, tasks and operation mechanisms of the NFP, node manager and nodes to GBIF

- To improve functions in terms of data inputting, processing and exporting, meeting the online demands on publishing, updating, exchanging, sharing and managing data on biodiversity.

- Complete the standards and structure of data content at NFP, node manager and nodes

3.2 Upgrading and developing the information technology infrastructure, data management software systems of NFP, node manager and nodes

a) Provide IT infrastructure for connecting NBDS to GBIF. To supplement and upgrade information and telecommunication infrastructure to meet the requirements of operating the system of NFP, node manager and nodes including servers, transmission lines, work stations...ect, in specification as:

- IPT2 will be installed into servers. IPT2 is a GBIF tool to support the connection and update of data from countries member to GBIF;

- Internet bandwidth is steady and sufficient;

- Connection between IPT2 server at Viet Nam's Node manager with GBIF server;

- IPT2 will be installed and operated on server managed by Node manager.

b) Continuously completing the functions of NBDS for nationwide data collection, updating, storage, sharing, and then connecting and sharing data with GBIF:

- Examining and evaluating the effectiveness and stability of NBDS 1st generation.

c) Propose needed activities to upgrade functions, data structures standards and data content for data collecting, updating, sharing and utiliziing and managing in NBDS 1st generation.

- Upgrade the NBDS 1st generation to better adaptation to GBIF

3.3 Human resources training for the need of the operation and development of biodiversity data at NFP/ HoD, node manager and Nodes

- To establish a network of the national focal point, the ministrial focal points and local focal points along with arrangement of appropriate human resources at the central level and local level to satisfy the requirements of biodiversity database development.

- Develop guidelines for surveying, monitoring, biodiversit indicator development and biodiversity reporting; Enhancing the capacity for local staff.

- Implement the capacity building activities regarding to development, updating, management, exploitation and utilization of biodiversity database for people in charge, prioritizing the personnel at in line ministries and organizations at central level and local level

- Study tours in the country and abroad for learning experiences on the development, operation and maintainace of national biodiversity database for central and local officials.

3. 4. Accumulating and setting standardizing biodiversity data and information at NFP/ HoD, node manager and Nodes

- Carry out a number of needed activities such as collection, accumulation, evaluation digitization and input the biodiversity data and information from relevant organizations and individuals. Verify and standardize them in terms of data structure and compatibility at NFP/ HoD, node manager and Nodes

- Update, maintain and manage every existing biodiversitydata in accordance with standard data and software architecture at NFP/ HoD, node manager and Nodes

4. Implementation Solutions

4.1 Promote policy formulation incorporating the establishment, maintenance, update, development, management of biodiversity databases at NFP/HoD, node manager and Nodes

- To accelerate the elaboration of legal documents guiding the construction and development of a biodiversity database.

- To elaborate, promulgate, amend and supplement legal documents, regulations and techno-economic norms related to monitoring, collection, processing and management of the baseline data on biodiversity in unified standard for the

application national wide;

- Develop the regulations to deal with violations related to the provision, exchange and sharing of biodiversity information and data.

- Develop mechanisms to promote and encourage provinces across the country to update baseline data into database systems; Establish coordination mechanism among ministries and agencies. Engage local governments and public in data provision, exchange and sharing. Running NBDS systematically from central level to local level.

- Strengthen the supervision, guidance and training activities regarding to national biodiversity database system for relevant stakeholders.

- Review and formulate the incentive policies, for staff working in management, biodiversity baseline investigation and monitoring, especially for staff working at the remote, isolated, border and island areas.

- 4.2 *Promote international cooperation on the biodiversity database system development at NFP/HoD, node manager and Nodes*

- Enhance bilateral and multilateral cooperation with other countries, foregin organizations and individuals.

- Consider and propose the participation of Viet Nam in international conventions, treaties, forums, networks, new initiatives relating to biodiversity information management and sharing. At the same time, pushing up the implementation of involeved conventions relating to biodiversity data and information.

- Strengthening international cooperation in human resources training, collaborative research projects in terms of advanced technologies for the database system development

- Participate in international training courses on capacity building and biodiversity data and information sharing.

4.3 *Step up research and application of scientific and technological advances in the development of national biodiversity database system at NFP/ HoD, node manager and Nodes*

- Conduct researches and application of scientific and technological advances and software in the development and management of biodiversity databases;

- Promote scientific research, development and application of advanced technologies in investigating, transmitting, processing, managing, analyzing, evaluating and providing baseline biodiversity data and information as well as biodiversity monitoring;

- Strengthening research and development of new technologies to improve the capacity and effectiveness of the biodiversity data providing, updating and exchanging, exploration and utilization.

4.4 Strengthen the communication, education, training and publich awareness raising in information and data on national biodiversity at NFP/ HoD, node manager and Nodes

- Promote awareness raising, increasing accountability and participation of stakeholder in unified management of biodiversity data.
- Strengthening communication to raise public awareness and communities' responsibility in management and sharing of biodiversity data; Facilitate supporting mechanisms to increase community participation in the provision, sharing and exchange of biodiversity data.
- Hold training courses to guide and disseminate the development, exchange, sharing and utilization of biodiversity data.
- Establish a network and mechanisms for the exchange of biodiversity data and information across the country.

4.5 Mobilize and diversify sources of investment to establish, maintain, update, manage and utilize and develop the national biodiversity databases at NFP/ HoD, node manager and Nodes

- Guarantee funding for the establishment, maintenance, update, , management and development of biodiversity databases.
- Create favorable mechanisms for domestic and foreign organizations and individuals to invest and transfer technologies in construction and development of biodiversity databases.
- Apply economic instruments and financial mechanisms to encourage the establishment and development of consultancy services on the collection and supply of data and information on biodiversity.

5. Roadmap for participation of Viet Nam into GBIF

5.1 Proposed roadmap for participation of Viet Nam

The participation of Viet Nam into GBIF should track the guidance of the guidance of GBIF Secretariat. On the other hand, Viet Nam also takes into consideration of typical context of the country. Therefore, a customized roadmap is proposed under 3 key phases, in detail:

Phase I: Discussion prior to participate in GBIF

- Step 1: Establish a core local team to facilitate the participation in GBIF

Study about GBIF. Knowledge exchange about GBIF's participation. Study tour (to Japan) in combination with desk study about the experience of relevant countries who are the member of GBIF.

- Step 2: Understand the motivation of Viet Nam for joining GBIF:

The first task for this group of stakeholders is to define the long term vision, goals and missions for the Participant Node; focus should be on how the Node will

address the needs and priorities of Viet Nam, and how it will complement with other biodiversity-related or information-related initiatives. GBIF vision for biodiversity information is free and universally available. The goals of Vietnam when participating in the GBIF community should be: (1) biodiversity data housed in Vietnam are shared globally on the Internet; (2) enlist the cooperation and international aid to develop NBDS; (3) to coordinate the collection, analysis, reporting and archiving of all kinds of biodiversity related information in Vietnam.

- Step 3: Identify drivers (science: research infrastructure and environment (policy, decision making) and priorities (producing highly processed information, publishing primary data) at highest level for establishing a biodiversity information facility.

The National Focal point for GBIF's participation will assess their own biodiversity data gaps (taxonomic, spatial, temporal, and thematic), to understand data and information needs, to engage new communities (and mobilise new data types), and to devise strategies to effectively respond to those needs. Independently of the drivers or priorities motivating the mobilisation of biodiversity data, well established and fully functional Participant Nodes are instrumental in helping Participants achieve their own biodiversity data-related goals and targets. The Vietnam node will assess biodiversity needs and gaps in order to build strategies for database development.

- Step 4: Organize a meeting with key stakeholders to consult about the participation of Viet Nam, determine their willing as well as possible positions of key stakeholders

- Step 5: Assign formal roles, including: Head of Delegation (potentially BCA/VEA/MoNRE) and temporary Node Manager (potentially Institute of Ecology and Biological Resources (IEBR)).

Phase II- Preparation for participatory process

- Agree roles in the process: BCA and Node will make final recommendation based on consulting with invested stakeholders.

- Preparatory studies: content needs assessment, data holders inventory, stakeholder mapping etc.

- Identify relevant examples from GBIF network such as Japan, Tanzania and some other countries.

- Identify key stakeholders who will be invited to contribute. It is very important for the Head of Delegation to convene a group of representatives from the key biodiversity stakeholder institutions. This will be ensure their ownership of the process from the beginning. Key stakeholders will include BCA, IEBR and Center of Multidisciplinary Integrated Technologies for Field Monitoring (FIMO).

Phase III- Participatory process

- **Scoping the biodiversity information facility and node**

- Define priorities for the biodiversity information facility
- Define key roles for the node in support of the biodiversity information facility. The node's roles are (1) to establish a national data network for biodiversity research & information flow; (2) to train, and disseminate key technology to assist data publishers for sharing data. Once a biodiversity information facility has been scoped, including the long-term vision and goals for the node coordinating it, the group will need to discuss the implementation plans for the node. These should include aspects such as the collaborative framework, infrastructure requirements, governance structure, funding, membership of governing and/or advisory bodies, and the node's roles and responsibilities. The key decision on where to locate the node will also need to be addressed.

- Defining implementation mechanism for the biodiversity information facility and node

- Define formal agreements (data sharing/use agreements) to supports effective collaboration. BCA/VEA/MONRE considers the level of cooperation to sign an official MOU with key stakeholders who are potential to be Node manager or node for future VBIF.
- Discuss internally and with partners to establish necessary mechanisms such as: model for informatics infrastructure; governance and representation model
- BCA/VEA/MONRE in the capacity of the focal point to consider institutional location for the node
- Discuss a team for the node and node manager role
- Discuss funding models for the node

After this process, a node must be designed. The responsibility of coordinating a biodiversity information facility is built into the nodal institution's planning. The major stakeholders for the VBIF are identified. A strategy for the VBIF is agreed with stakeholders. The strategy is resourced. Especially a collaborative framework must be defined and agreed by the relevant stakeholders and partners to form a biodiversity information facility.

5.2 The expected tasks and function of future VBIF

When the VBIF come into operation and support the following tasks:

a) Implementing a national biodiversity data mobilization strategy

The main national sources of biodiversity data are identified. A national data mobilization strategy is developed. The VBIF supports national digitization activities. An infrastructure is in place to support data publishing. The VBIF provides assistance to data holders in publishing data.

b) Meeting biodiversity information needs to the national level

The needs of biodiversity information users are (annually) assessed. The VBIF

analyses the availability of biodiversity data. The VBIF promotes data use. The VBIF maintains a website to support the user community. VBIF service are integrated into research & policy process.

c) Supporting improved management of biodiversity data nationally

The node has a plan to ensure the mobilized data are fit for use. The VBIF supports national data holders in managing their data through the training courses. The node performs quality checks of published data. The VBIF participates in biodiversity information management initiatives.

In general, there are several meetings which must be held with the participation of stakeholder leadership including management agencies, research institutes, universities, museums, non-governmental organizations, publishers, magazines, experts. The objectives of these meetings are: (1) to be aware of as well as the benefits of joining GBIF; (2) to discuss the motives of participation in GBIF, road map, strategy, action plan, detailed activities, stakeholders, human and financial resources; (3) to propose and approve a memorandum of understanding, which clearly defines the roles and responsibilities of the participants, is very important; (4) to assign Head of Delegation, Node Manager, Steering Committee, Working Group.

5.3. Potential data holders and users in Vietnam

Forty-four institutes, universities, museums, editors and publishers of scientific research and non-governmental organization are considered as holding and using biodiversity data (Table 1). In which, the organizations having museum collection are the main holders. Besides, around thirty one national parks, sixty four protected areas and thirteen species protected areas also hold a lot of biodiversity information.

Non-government organizations such as World Wildlife Fund (WWF), BirdLife International, and International Union for Conservation of Nature (IUCN) have conducted many projects on biodiversity in Vietnam. Consequently, they have much biodiversity data on Vietnam. Vietnamese and foreign experts working with biodiversity in Vietnam must be also included as data holders.

In 64 provinces and cities throughout Vietnam, Department of Natural Resources and Environment (DONRE belong Ministry of Natural Resources and Environment) and Department of Agriculture and Rural Development (DARD belong to Ministry of Agriculture and Rural Development) possess biodiversity information.

The list of data holders and provider can be seen at the ANNEX A.

5.4 . Proposal for organization and coordination mechanism of future VBIF

5.4.1 Proposal for organization of future VBIF

In the beginning, VBIF will including key stakeholders as BCA, IEBR and Center of Multidisciplinary Integrated Technologies for Field Monitoring (FIMO). However, when VBIF fully established, it will include two layers, a steering committee and a working group (Fig. 5).

The Steering committee is a team of 6-7 people nominated by stakeholders to

represent them in GBIF decision making, under the leadership of the Head of the Delegation (HoD). The steering committee should include representatives of the major stakeholders. The steering committee actively engages in guiding and implementing the node's work and helps to ensure that the relevant actors feel ownership of the node's work.

HoD is the person officially assigned by BCA to act as its representative to the GBIF Governing Board (GB), taking part in the global-level decision making. Node manager is the person nominated by BCA to manage the activities of the node to coordinate a biodiversity information facility. He/she works between VBIF and GBIF. HoD manages Working Group as well as consulting the relevant stakeholders about GB's issues

The Working Group consists of 16 people (younger generations) from various organizations (agencies, institutes, universities and museums) (Table 2). They are usually focused on specific areas such as user support, scientific liaison or technical development.

Some members of Working Group overlap with Steering Committee members in order to enhance communication. The major supporting agency for GBIF activities in Vietnam is BCA (MONRE). VBIF will also seek support from JICA, BIFA and other organizations to provide funds and technical support. However, the basic financial contributions to VBIF need to be identified as soon as possible.

Node team will come from several host situations such as management agencies (BCA, Department of Nature Conservation of MARD) and research institutes (Vietnam Academy of Science and Technology (VAST) (Ecological and Biological Resources (IEBR), Institute of Oceanography (IO), Institute of Marine Environment and Resources (IMER), The Institute of Biotechnology (IBT), Institute of Genome Research (IGR) and Vietnam National Museum of Nature (VNMN)). They will be key biodiversity stakeholder institutions. Of course, the Node should include other members: Faculty of Biology of University of Science (HUS), Forest Inventory and Planning Department (FIPI, MARD), Vietnam National University of Agriculture (VNUA, MARD), Informatics organization (such as Center of Multidisciplinary Integrated Technologies for Field Monitoring (FIMO)). It is necessary to consider that Node's members not only work for VBIF but also work for NBDS. Because, the node team is divided among several host institutions, one institution must be designated to coordinate node activity and act as the main contact point for interactions with the GBIF Secretariat and the global network.

The highly potential node manager can be IEBR, under the Vietnam Academy of Science and Technology (VAST). At the Workshop Introducing GBIF, BCA and some relevant stakeholders such as Institute of Ecology and Biological Resources (IEBR), Vietnam National Museum of Nature (VNMN), Vietnam National University of Forestry (VNUF), Faculty of Biology of University of Science (HUS) showed their willingness to participate in GBIF in the future. Especially, the initial consensus reached between the leaders of BCA and IEBR. Director of IEBR, Pr. Nguyen Van Sinh, agreed that IEBR can become the coordinator of the node of Vietnam.

IEBR is the leading agency in the field of biodiversity research of Vietnam. It is holding a large amount of biodiversity information with experienced experts.

Ministry of Natural Resources and Environment (MONRE) will recommend with VAST in order to IEBR become a key stakeholder of VBIF. Another alternative is Vietnam node is integrated into the IEBR. In this case, the node will have a minimal formal organizational structure.

It is must be assured that cooperation between management agencies, research institutes and other related organizations can overcome the challenges and ensure the Node's role as facilitation/coordination.

The proposed organization structure as well as the coordination is presented in the Fig 5.

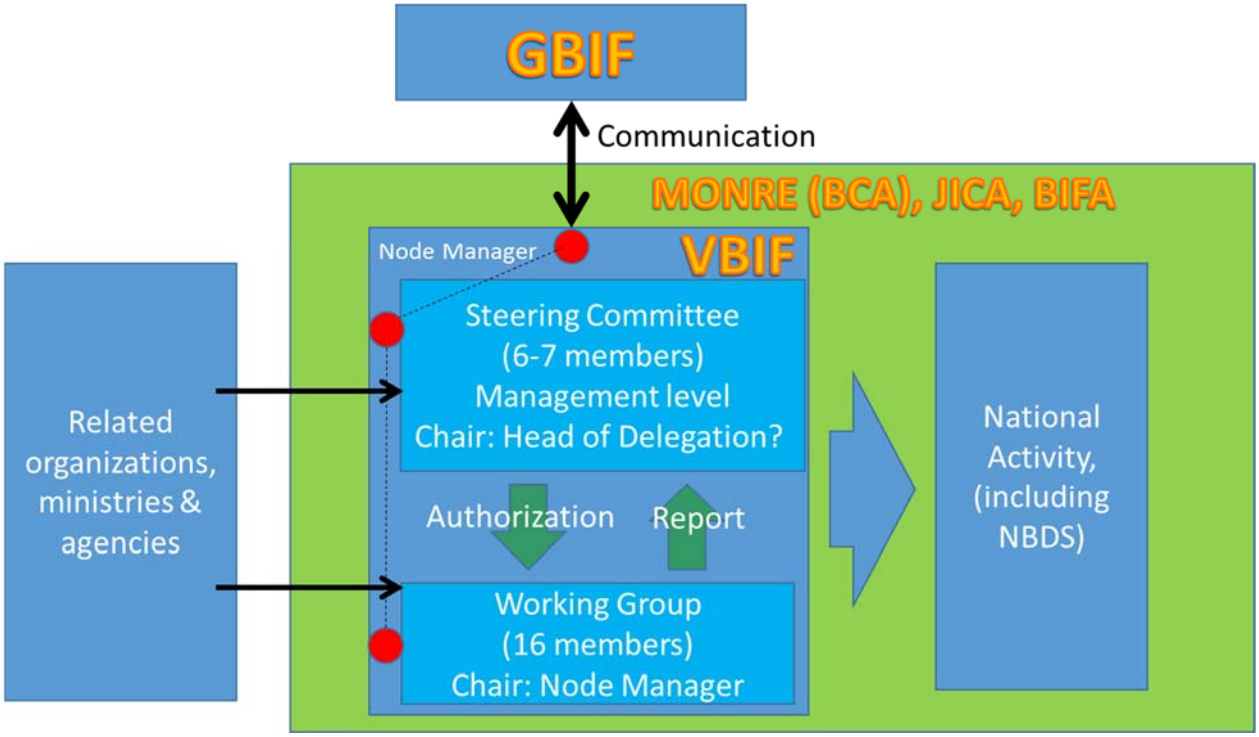

Figure 5. The organization of Vietnam Biodiversity Information Facility (when it is fully established)

Align with the setting up of the 2 main layers for running VBIF, consideration of potential nodes or potential members of future VBIF also have been taken via consultation with national stakeholders.

The list of potential members of VBIF is shown in the Table 1 below.

Table 3. The list of potential members of Vietnam Biodiversity Information Facility

Nº	Layer	Affiliation

1	Steering Committee	BCA (VEA/MONRE) (HoD)
2		Department of Nature Conservation (MARD)
3		Institute of Ecology and Biological Resources (IEBR, VAST)
4		Institute of Oceanography (IO, VAST)
5		Institute of Marine Environment and Resources (IMER, VAST)
6		Institute of Genome Research (IGR, VAST)
1	Working Group	BCA (VEA/MONRE)
2		Institute of Ecology and Biological Resources (IEBR, VAST)
3		Institute of Oceanography (IO, VAST)
4		Institute of Marine Environment and Resources (IMER, VAST)
5		The Institute of Biotechnology (IBT, VAST)
6		Institute of Genome Research (IGR, VAST)
7		Vietnam National Museum of Nature (VNMN, VAST)
8		Southern Institute of Ecology (SIE, VAST)
9		Institute of Tropical Biology (ITB, VAST)
10		Faculty of Biology, Ha Noi National University of Education (HNUE)
11		Faculty of Biology, University of Science (HUS)
12		Forest Inventory and Planning Department (FIPI, MARD)
13		Vietnam National University of Agriculture (VNUA, MARD)
14		DONRE
15		Informatics organization (Center of Multidisciplinary Integrated Technologies for Field Monitoring (FIMO))
16		Vietnam National University of Forestry (VNUF)

5.4.2 Proposed Mechanism of Coordination for VBIF

In the early stages of joining GBIF, BCA/VA/MONRE need to establish one task force working to understand and grasp GBIF standards, protocols, and data transfer tools. Experts will be sent abroad to visit and learn from the experience. Launch a project to proceed to collect and transmit data to NBDS and GBIF. The training will also be conducted to disseminate widely to stakeholders in Vietnam on how to develop and share biodiversity database in line with international standards.

Data sources will be initially identified. Data will come from two main sources. The first source is through the Department of Conservation Department's diversity collected from national parks, nature reserves and provinces. The second source comes from a number of topics from the Institute of Ecology and Biological Resources, specialized institutes, universities and museums. These data are contained in specialized literature, reports, articles of survey, survey, or sample collection programs, etc. The data collected will be checked by experts, digitized in Darwin Core

format and included in the NBDS. Then, some data will be selected for inclusion in GBIF through the second edition of ITP2. VBIF as well as the BCA will make recommendations to GBIF in support of business to digitize biodiversity collections and information, as well as provide consultancy, training programs, Manipulate, manage and publish data.

VBIF is a system or network of individuals and agencies, coordinated by a focal point, forming a common infrastructure to build and share biodiversity information for Party involved. NBDS is the national database on biodiversity. Therefore, VBIF's activities need to help further developing NBDS, build connections with national and international databases. Through it, biodiversity information will be digitized, shared and used with maximum efficiency. VBIF is established with the primary objective of meeting the demand for information on biodiversity in the country. The Executive Board of VBIF is also a key member of the NBDS. Therefore, VBIF's activities will always be associated with the NBDS.

The BCA is the IEBR, the two key bodies in the VBIF, whose cooperation is based on consensus of the two sides' leaders or on legally binding documents that may be developed in the future.

5.4.3. Potential node in Vietnam

The choice of a node is very important for GBIF participation. In Vietnam, there are many agencies working in the field of biodiversity. However, based on the conditions of capacity, knowledge, human resources as well as willingness to participate, only BCA and some institutes of VAST can become the node of Vietnam. The following analysis shows the strengths and weaknesses of each organization.

Potential Nodes in Vietnam with their advantages and disadvantages can be seen at ANNEX B.

6. SWOT analysis to evaluate participation of Vietnam in GBIF

SWOT analysis is an acronym for strengths, weaknesses, opportunities, and threats—and is a structured planning method that evaluates those four elements of a project. It involves specifying the objective of project and identifying the internal and external factors that are favorable and unfavorable to achieve that objective.

- Strengths: characteristics of project that give it an advantage over others
- Weaknesses: characteristics that place project at a disadvantage relative to others
- Opportunities: elements that project could exploit to its advantage
- Threats: elements in the environment that could cause trouble for project

Identification of SWOTs is important because they can inform later steps in planning to achieve the objective. First, decision makers should consider whether the objective

is attainable, given the SWOTs. If the objective is not attainable, they must select a different objective and repeat the process.

SWOT analysis aims to identify the key internal and external factors seen as important to achieving an objective. SWOT analysis groups key pieces of information into two main categories:

- Internal factors – the strengths and weaknesses internal to the organization
- External factors – the opportunities and threats presented by the environment external to the organization

A SWOT analysis will allows participants to creatively brainstorm, identify obstacles and strategize possibly solutions/way forward to these limitations. The use of a SWOT analysis by a organization are as follows: to organize information, provide insight into barriers that may be present while engaging in social change processes, and identify strengths available that can be activated to counteract these barriers.

A SWOT analysis is used here to (1) identify barriers that will limit goals of participation in GBIF; (2) explore the solutions to problems of participation in GBIF.

Table 4. SWOT analysis to evaluate participation of Vietnam in GBIF

	Positive/Pros	**Negative/Cons**
Internal elements	Strengths • The Biodiversity Conservation Agency (BCA) was proposes to strengthen national capacity in database management and to promote GBIF in the country as an opportunity for information exchange at the global level. • BCA is recognized at the national level as responsible for coordinating biodiversity data sharing activities nationally. • Human resources: Four staffs have been trained about GBIF; BCA staffs. • Physical resources: VN has NBDS already. A portal of NBDS has been developed. • A circular on collaboration mechanism among data holders, which enables sharing, exchanging and exploiting biodiversity data, has been drafted.	Weaknesses • Except BCA, there is not any institution responsible for coordinating biodiversity data sharing activities nationally and built this obligation into its planning and function. • Human resources: Lack of staff can work full time for biodiversity database in stakeholders. • Physical resources: NBDS is on the first generation. It's functions and interface has not been yet finalized. Few data are housed in NBDS. • Financial resources: There is not specific funding for NBDS as well as other biodiversity databases. • Activities: There are very few activities and process in terms of biodiversity databases such as symposiums, meetings, education and training that have been organized.

	Positive/Pros	Negative/Cons
	• Financial resources: Vietnam government may be support limited funding? • Activities: Some activities related to NBDS will be held. The Sustainable Natural Resources Management Project – by JICA (NBDS phase II) will be implemented from 2015 to 2020. • Some "open-minded" Data Holders already identified. • As a result of NBDS project, the main major stakeholders for the biodiversity information facility been identified including MONRE/VEA/BCA, MARD, MOST, PPC, DONRE, DARD, national parks, protected areas, research institutes, universities, NGOs, international organizations and individuals. • Vietnam has became a member country of the Convention on Biological Diversity • Government of Vietnam enacted the Biodiversity Law in 2008 • National Biodiversity Strategy to 2020, vision to 2030	• Experience: Lack of experience on how to establish and operate a Node; how to develop cooperation between related stakeholders in Vietnam • Motivation, drivers and priorities for joining GBIF need to be made clearer. • Data is scattered across a multitude of sources and formats (museum collection specimens, reports, published literature, researchers' own computers). Sources of biodiversity data (documents, specimens) have not yet been completely located. • More data holders need to be identified. Sources of biodiversity data (documents, specimens) have not yet been completely located. • The needs of biodiversity information users have not been assessed at the national level. • The gaps in the available biodiversity data (taxonomic, spatial, temporal, and thematic) have not yet fully identified. • The state of national data holdings has not yet been comprehensively assessed (e.g. digital/non-digital format, approximate size and scope of collections, use of standards). Almost biodiversity data has not yet digitized. Most digital data is on desktop format (MS-Word, Excel, etc.). Digital data were not followed Darwin core. • There is little contact among management agencies, data users and data holders. • Collaboration and support between stakeholders is weak. • The coordination team or node have not yet been designed in order to have a communications

	Positive/Pros	Negative/Cons
		operational and a comprehensive plan for the biodiversity information facility. • Inter-institutional agreements have not yet in place to support stakeholder engagement in the biodiversity information facility. • A strategy / set of priority activities for the node and biodiversity information facility has not yet been described, agreed and adopted by stakeholders. Long-term purpose of the node with plans for the medium and short term has not yet been stated. • A strategy has not yet been developed to assist the biodiversity information facility in mobilizing national biodiversity data sources in a systematic way. Consequently, data mobilization priorities for the biodiversity information facility have not yet been agreed with stakeholders. The strategy assist data holders in making a case for investment in the mobilization of their data (e.g. through addressing known gaps or targeting specific use cases) not yet in use.
External elements	Opportunities • Economy: Vietnam's economy is growing and the government is concerned with building a national database. There will be more resources for building biodiversity database. • Legislation: Policies, decisions may be issued in order to facilitate providing, exchanging and managing biodiversity information. A circular on collaboration mechanism among data holders, which enables sharing,	Threats • Economy: The economic development is unsustainable and does not ensure a stable budget for building national biodiversity database system. • Legislation: Policies, decision may be not issued. • Funding sources: Funding is not available now. In the future, the funding may be very limited and unstable. • Future trend in the field of biodiversity database: Biodiversity is not an

	Positive/Pros	Negative/Cons
	exchanging and exploiting biodiversity data will be issued in this year. • Funding sources: A proposal for BIFA funding maybe accepted. • Future trend in the field of biodiversity database: The construction of biodiversity database is increasingly regarded by the agencies and organizations. • The trend of cooperation: between national agencies and international is increasing. This will give Vietnam the chance to participate in GBIF.	institutional priority. The important of biodiversity database do not fully understand. There is not a specific strategy for biodiversity database at national level. • The trend of cooperation: A collaborative framework may be not defined and agreed to by the relevant stakeholders and partners. There is not any coordination mechanisms between agencies, research institutes, museums and universities in building, using and sharing biodiversity data. • The resources for coordinating biodiversity data sharing has not been allocated to the team or node. No staff members are assigned to the node yet. In addition, whether or not the node or coordinating team has sufficient staff members and stable funding sources to implement the strategy has not yet been guaranteed. • There is not any mechanism in place for national biodiversity data holding institutions to share experience and expertise relating to digitization; to promote incentives for data publishing (e.g. through data management policies attached to public research grants, data paper publishing, use of licenses to share biodiversity information). • Limited human resources in charge of biodiversity databases from stakeholders. • Biodiversity data have not yet been shared between different organizations. Data holders are not willing or reluctant to share their data. • Biodiversity data is scattered all

	Positive/Pros	Negative/Cons
		over the country. • Biodiversity monitoring at national scale has not yet been done; lack of human resource and funding; no standard survey methods for biodiversity. • The ability to manage, exploit and use the database is limited due to lack of training. • Few people have an understanding about GBIF. The use of biodiversity data available through the GBIF network and other institutions has not yet promoted. • Biodiversity data and services have not yet well recognized and used by research and national agencies (to deal with economic sectors, for example in spatial planning, environmental impact assessment, agricultural policy and public health).

SWOT analysis displayed some main tasks for Vietnam before joining in GBIF as follow:

- A node for participation in GBIF must be established. Human and financial resources for the node's activity must be identified to ensure its sustainability.
- A MOU for participation in VBIF must be proposed and approved by key members.
- A collaboration framework in building, using and sharing biodiversity data between relevant stakeholders should be built.
- The activities in terms of biodiversity database (building, sharing, using) must be conducted more and more.
- It is vital that there should be a national funding for activities relative to biodiversity database.

7. Prioritized Activities

- Identify sources of biodiversity data and develop strategies to mobilize these sources of data.

- Carry out need assessment for biodiversity data, analyzing available biodiversity data to promote the provision and utilize of data. Ensure the compatibility between the accumulated data to the needs of utilization, contributing to the maintenance of the NBDS.

- Secure a stable, long-term financial resource for data collection, development and use of biodiversity data

- To promote the activities of digitization, saving, utilization, exploitation and sharing (following international standards) information on bio-diversity in research institutes, universities, museums and related organizations.

- Conduct training and dissemination of advanced technologies and tools in data process and sharing. Supports data holders parties in the country in data verification, management and quality assurance

- Raise awareness about the importance of biodiversity data for management agencies/ organizations and community.

- Develop a mechanism for cooperation and support stakeholders in the development and sharing of biodiversity data.

8. Budget for Implementation

- The budget for implementation of the roadmap shall be allocated from the State budget on the basis of programs and projects, specifically, from annual budget line for environment, budget line for business, budget line for investment, science and technology, and other sources of budget.
- For the annual State budget for implementing the roadmap allocating for in line ministries and agencies, the focal management agency shall have to elaborate detailed budget estimates and submit Ministry of Finance to consider and allocate to the focal management agency.
- Other funding sources: Creat the favourable conditions to attract resources from domestic and foreign organizations as well as different international sources.
- Diversify investment resources from businesses, organizations and individuals inside and outside the country. At the same time, it is needed to establish a mechanisms and incentive policies to mobilize investment in maintenance, update and development of biodiversity databases at National Focal Point (NFP) and nodes

VII. CONCLUSIONS AND RECOMMENDATIONS

Vietnam has seen the benefits of joining GBIF. The country wishes to become a member of GBIF before the next Asia Region meeting in June 2017. A temporal core team for VBIF is identified for further establishment. The country now needs to prepare the participatory process such as such as identification of objectives, activities, action plan and institutional arrangement, financial and human resources, infrastructure for participation in GBIF. Now, the most important tasks are establishment for a participant node, including its mandate, institution allocation, governance structure and funding model. Therefore, a launch project is necessary to establish a node and start to publish Vietnamese biodiversity data following global standards, protocol and tools of GBIF.

The node needs to be designed in order to have communications operational and a comprehensive plan for the biodiversity information facility. Inter-institutional agreements on information sharing and resources supporting is essential to support stakeholder engagement in the biodiversity information facility. A board and other governance structure must be established to support the work of the node with its stakeholders. The node's governance structure will provide the necessary expertise to guide the development of the biodiversity information facility. A strategy/set of priority activities for the node and biodiversity information facility must be described, agreed upon and adopted by the stakeholders. The resources for coordinating biodiversity data sharing must be allocated to the team or node. The staff members should be assigned to the node. The node or coordinating team need must have sufficient staff members and stable funding sources to implement the strategy. Node manager and his/her staffs' missions must be incorporated into their organizational functions.

VBIF organization should include representatives of the authorities (BCA (MONRE), Nature Conservation Department (MARD)), some related institutes of Vietnam Academy of Science and Technology (VAST), Center of Multidisciplinary Integrated Technologies for Field Monitoring (FIMO) and other university departments and organizations. This organization must ensure the participation of key members in the field of management, research and use of biodiversity information. They not only work for VBIF but also effort for NBDS.

National Biodiversity Database System (NBDS) is a hub (center bridge) where linking to other biodiversity databases in the country and globally. Meanwhile, VBIF's role in building and developing the relationship between NBDS with other databases. After all, national biodiversity information facilities are networks of people and institutions that produce, manage and use biodiversity data, together supporting the

needs of the country for biodiversity information. This network has not yet been built and developed in Vietnam and there are much work that must be done to realize this function.

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ANNEX A. INTELLECTUAL PROPERTY

GBIF Memorandum of Understanding - Paragraph 8: Intellectual property

1. Applicable Law

Nothing in this MOU should be read to alter the scope and application of Intellectual Property Rights and benefit sharing agreements as determined under relevant laws, regulations and international agreements of the Participants.

2. Access to Data

To the greatest extent possible, GBIF is an open-access facility. All users, whether GBIF Participants or others, should have equal access to data in databases affiliated with or developed by GBIF.

3. Intellectual Property Rights to Biodiversity Data

GBIF promotes the free dissemination of biodiversity data and, in particular:

a. should not assert any proprietary rights to the data in databases that are developed by other organisations and that subsequently become affiliated to GBIF;

b. should seek, to the greatest extent possible, to make freely and openly available, with the least possible restrictions on reuse, any data commissioned, created or developed directly by GBIF; and

c. should respect conditions set by Data Publishers that affiliate their databases to GBIF.

When establishing affiliations or linkages with other databases, GBIF should seek to ensure that the data so made available will not be subject to limitations on the further non-commercial use and dissemination of those data, apart from due attribution of their source.

4. Attribution

GBIF should seek to ensure that the source of data is acknowledged and should request that such attribution be maintained in any subsequent use of the data.

5. Access to Specific Data

Nothing in this MOU should be read to restrict the right of owners of databases affiliated with GBIF to block access to any data.

6. Validity of Data

It should be a condition of access to and use of GBIF that users acknowledge that the validity of the data in any databases affiliated with GBIF cannot be assured. GBIF should disclaim responsibility for the accuracy and reliability of the data as well as for the suitability of its application for any particular purpose.

7. Legitimacy of Data Collection

Where the collection of new data has entailed access to biodiversity resources, GBIF should ask for reasonable assurances from the Data Publisher that such access was consistent with applicable laws, regulations and any relevant requirements for prior informed consent.

8. Intellectual Property Rights to Biodiversity Tools

GBIF may claim appropriate Intellectual Property Rights available within applicable national jurisdictions over any tools, such as search engines or other software products that are developed by GBIF while carrying out the GBIF Work Programme.

9. Technology Transfer

The Participants acknowledge that, subject to any relevant Intellectual Property Rights, GBIF should seek to promote the non-exclusive transfer, on mutually agreed terms, to research institutions, particularly in developing countries, of such informatics technology as it has available, especially in conjunction with training and capacity development programs.

ANNEX B. LIST OF POTENTIAL DATA HOLDERS IN VIET NAM

No	Data holder	Specimens data	Observation records	Note
	Vietnam Academy of Science and Technology (VAST)			
1	Institute of Ecology and Biological Resources (IEBR) http://www.iebr.ac.vn/	X	X	Arthropods, vertebrate, mammal, invertebrates, reptiles & amphibians, fishes, mollusks, parasite, aquatic invertebrates, bird, plants, nematode, DNA, remote sensing, etc.
2	Institute of Oceanography (IO) http://www.vnio.org.vn/	X	X	Marine fauna and flora of Vietnam
3	Institute of Marine Environment and Resources (IMER) http://www.imer.ac.vn/		X	Marine fauna and flora of Vietnam
4	The Institute of Biotechnology (IBT) http://www.ibt.ac.vn/			DNA data on DNA of fauna and flora of Vietnam
5	Institute of Genome Research (IGR) http://www.igr.ac.vn/			DNA data on DNA of fauna and flora of Vietnam
6	Vietnam National Museum of Nature (VNMN) http://vnmn.ac.vn/en/	X	X	Fauna and flora of Vietnam
7	Institute of Highland Central (Viện Nghiên cứu Khoa học Tây Nguyên) http://www.tni.ac.vn/	X	X	Fauna and flora of Vietnam's Central Highlands
8	Southern Institute of Ecology (SIE) http://sie.vast.vn/	X	X	Fauna and flora of South Vietnam; 20000 specimens (60% digitalized)
9	Institute of Tropical Biology (ITB) http://itb.ac.vn/		X	Fauna and flora of South Vietnam; fish collection; Herbarium
10	Mientrung Institute for Scientific Reseach (MISR) http://misr.com.vn/		X	Fauna and flora of Central Vietnam
11	Institute of Resource, Environment and Development in Hue City		X	
	Ministry of Natural Resources and Environment (MONRE)			
12	Institute of Strategy and Policy on Natural Resources and Environment (ISPONRE) http://isponre.gov.vn/			
13	Ha Noi University of Natural Resources and Environment (HUNRE)		X	Data on diversity of land snails in Vietnam

No	Data holder	Specimens data	Observation records	Note
	http://hunre.edu.vn/			
14	Ho Chi Minh University of Natural Resources and Environment (HCMUNRE) http://www.hcmunre.edu.vn/		X	
	Ministry of Education and Training (MOET)			
15	Thai Nguyen University of Agriculture and Forest (TUAF) http://tuaf.edu.vn/			
16	Thai Nguyen University of Education http://dhsptn.edu.vn/			Fauna and flora of Northeast Vietnam
17	Thai Nguyen University of Science http://us.tnu.edu.vn/			
18	Vinh University http://vinhuni.edu.vn/		X	Data on fish diversity of Central Vietnam
19	Hue University of Agricultural and Forestry (HUAF) http://huaf.edu.vn/			Fauna and flora of Central Vietnam
20	Hue University of Science (HUSC) http://www.husc.edu.vn/			
21	The University of Da Nang – University of Education http://ued.udn.vn/			
22	Can Tho University (CTU) (Colleague of Aquaculture and Fisheries (CAF)) https://www.ctu.edu.vn/		X	Data on fish in South Vietnam
23	Ho Chi Minh Nong Lam University (NLU) http://hcmuaf.edu.vn/			Data on fish South Vietnam
24	Ha Noi National University of Education (HNUE) http://hnue.edu.vn/		X	Fauna and flora of Vietnam
25	Hanoi Pedagogical University 2 http://www.hpu2.edu.vn/		X	Fauna and flora of Northeast and Northwest Vietnam
26	Da Lat University http://www.dlu.edu.vn/			
27	Tay Bac University (UTB) http://www.utb.edu.vn/		X	Data on land snail in Northwest Vietnam
	Vietnam National University, Ha Noi			
28	University of Science (HUS) (Faculty of Biology) http://hus.vnu.edu.vn/	X		Fauna and flora of Vietnam
	Vietnam National University, Ho Chi Minh			

No	Data holder	Specimens data	Observation records	Note
29	University of Science (HCMUS) http://www.hcmus.edu.vn/		X	Fauna and flora of South Vietnam
	Ministry of Agriculture and Rural Development (MARD)			
30	Forest Inventory and Planning Department (FIPI) http://www.fipi.vn/	X	X	Data on plant biodiversity in the forests of Vietnam
31	Vietnam National University of Agriculture (VNUA) http://www.vnua.edu.vn/		X	Data on insect
32	Vietnam National University of Forestry (VNUF) http://www.vfu.edu.vn/		X	Data on plant
33	Vietnamese Academy of Forest Sciences (VAFS) http://vafs.gov.vn/		X	Data on plant
34	Research Institute of Marine Fishery (RIMF) http://www.rimf.org.vn/		X	Data on marine fish diversity
35	Research Institute for Aquaculture No1 (RIA1) http://ria1.org/ria1/		X	Data on fish
36	Research Institute for Aquaculture No2 (RIA2) http://vienthuysan2.org.vn/		X	Data on fish in the South Vietnam
37	Research Institute for Aquaculture No3 (RIA3) http://www.ria3.vn/			Data on fish in the Central Vietnam
38	Institute of Coastal and Offshore Engineering (ICOE) http://www.icoe.org.vn/			
	Editors and publishers of scientific research			
39	Journal of Marine Science and Technology (VAS) http://vjs.ac.vn/index.php/jmst			Articles on marine fauna and flora of Vietnam
40	Journal of Biotechnology (VAST) http://vjs.ac.vn/index.php/vjbt			Articles on DNA
	Journal of Biology (VAST) http://vjs.ac.vn/index.php/vjbio			Articles on fauna and flora of Vietnam
41	**Non-governmental organization (NGO)**			
42	International Union for Conservation of Nature (IUCN) https://www.iucn.org/			Report of threatened species Vietnam
43	World Wildlife Fund (WWF) http://www.worldwildlife.org/			Report of fauna and flora of Vietnam
44	Birdlife http://www.birdlife.org/			Report on bird of Vietnam

ANNEX C. POTENTIAL NODES IN VIETNAM AND ANALYSIS OF THEIR POTENTIALITY

Type of host/designated institution	Positive	Negative
Biodiversity Conservation Agency (BCA)	• Very strong mandate, capacity to influence and support policy and decision making • Easily aligned with national biodiversity policies, strategies, and programme	• Challenges to operate at the technical level, and to provide technical support (e.g. to the scientific community) • Easily affected by political changes • May find difficulties in addressing needs from other ministries (e.g. from science or economic).
Institutes of Vietnam Academy of Science and Technology (VAST), such as: Institute of Ecological and Biological Resources (IEBR), Institute of Oceanography (IO), Institute of Marine Environment and Resources (IMER), The Institute of Biotechnology (IBT), Institute of Genome Research (IGR) and Vietnam National Museum of Nature (VNMN).	• Potential for developing capacity on biodiversity informatics easily and quickly • Full knowledge of the biodiversity-research realm • Knowledge of the challenges and requirements to digitize and manage natural history data	• Lack of mandate (a strong and clear institutional mandate in terms of biodiversity database), institutional supports and funding; difficulty to formally engage with government institutions • May not be perceived as neutral by all stakeholders, depending on how the institute fits within the Participant's overall institutional landscape (for example if there is overlap or competition for resources). It may need big efforts to demonstrate neutrality (e.g. if it is not competing for funds, etc.). Neutrality is essential to build trust in the data sharing activities at all levels • It may find difficulty to engage with other communities holding other types of biodiversity data (e.g. observations, ecological data, etc.) • In some cases it makes it difficult for the Node to serve the needs of users outside the scientific community (e.g. policy makers) • Require some external investments to get the capacity to provide technical support (including knowledge, technologies (e.g. software, hardware), staff (enough

		experienced personnel to cover all the relevant areas as defined in the Node's work plan, and mandate (the Participant Node should be empowered to perform its duties at the appropriate level) • May become very science-driven, putting less emphasis on supporting policy and decision making for the conservation and sustainable use of biodiversity • May become very dependent on funded projects • The Node's staff may get heavily involved in the institution's internal activities