# **Global Biodiversity Information Facility Node for Benin (GBIF Benin)**

# **Report of the Training workshop on Biodiversity Informatics**



# (26-29 November 2012, Faculty of Agricultural Sciences, University Abomey-Calavi, Benin)

December 2012

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#### Introduction

In the framework of the project "A technological Package for the Implementation of the National Biodiversity Information System (NBIS) of Benin", a training workshop on Biodiversity Informatics was organised on 26-29<sup>th</sup> November 2012 by the Global Biodiversity Information Facility of Benin (GBIF Benin). This course took place at the Faculty of Agricultural Sciences of the University of Abomey-Calavi, where GBIF Node for Benin is located.

Participants (40 persons altogether) included Lecturers, Researchers, Master and PhD Students, Research Assistants from the Faculties involved in biodiversity data management at the host University (the Faculty of Agricultural Sciences, the Faculty of Letters, Arts and Human Sciences, and the Faculty of Sciences and Techniques), representatives of the Forest Service, the Ministry of Nature and Environmental Protection, and environmental NGOs (Photo 1). The list of participants is provided in Annex 1.

The course was coordinated by two Costa Rican Computer Programmers, experts in Biodiversity Informatics: Mr Manuel Vargas Del Valle and Mr Aurelio Sanabria Rodriguez. Both are affiliated at the National Institute for Biodiversity (INBio) of Costa Rica. INBio is providing technical assistance to GBIF Benin in the project "A technical package for the implementation of the NBIS of Benin".



Photo 1: Lecturers, PhD students and Master students at the inception ceremony

#### 2. Workshop objectives and methodology

The objective of the training workshop was to build regional capacity to integrate, cure and publish biodiversity information of Benin and other African countries by introducing participants to the use of tools, protocols and standards developed by international initiatives. Workshop participants were expected to: (i) know various online tools usable to get biodiversity data, (ii) learn some basic Geographic Information Systems skills and tools, (iii) acquire basic skills for biodiversity data modelling, (iv) get familiarised with the *Atta* system for content management and the NPT (Nodes Portal Toolkit) for data querying, and (v) learn how to prepare datasets in order to integrate them to Benin's National Biodiversity Information System.

The workshop was structured in several subjects developed throughout the four days (Annex 2). Basically, the training method consisted in presentations related to the subjects. Each presentation was generally followed by practical exercises involving the use of computer and specific software. In this purpose, desktops were available to participants in the computer room of the Faculty where the workshop took place<sup>1</sup>. In addition, some participants used their own laptop during practical exercise sessions (Photo 2). Internet access was available, and played a critical role during the workshop.

Two translators (English-French-English) have been recruited for the workshop in order to facilitate communication between participants and the trainers (Photo 3). This was crucial because the majority of participants were not fluent at speaking or listening English.

Participants were provided with useful materials. These included PowerPoint files of presentations, and the software used during the workshop.

<sup>&</sup>lt;sup>1</sup> The opening ceremony was the only event having taken place elsewhere, in the Conference room of the Faculty.



Photo 2: Session of practical exercise in the computer room of the Faculty of Agricultural Sciences



Photo 3: Trainers and translators sitting side by side

# 3. Key activities

The main sequences of the training workshop were as follows: (i) opening ceremony, (ii) presentation of the project "A technological package for the implementation of the National Biodiversity Information System (NBIS) of Benin", (iii) lectures and practical exercises, and (iv) closing ceremony.

#### **3.1. Opening ceremony**

The inception ceremony (Photo 4) included the welcome address of Prof. Jean C. Ganglo (GBIF Node Manager for Benin), the opening address of Prof. Guillaume Amadji (Vice-Dean of the Faculty of Agricultural Sciences), and the presentation by Mr Manuel Vargas of the ongoing work about biodiversity data at INBio (Costa Rica).

Prof. Jean C. Ganglo welcomed all participants and then, he presented briefly the Global Biodiversity Information Facility (GBIF) through the following elements: history of the Organisation created in 2001, member countries, objectives and mission. He talked about the importance of biodiversity, and the interest to publish data on GBIF website. The creation of Benin's national system of information on biodiversity was announced. He insisted on the importance of this workshop in the context of Benin. Finally, he introduced the trainers (Mr Manuel Vargas and Mr Aurelio Sanabria) and the head GBIF delegation in Benin (Dr Gaston Akouehou from the Forest service of Benin).

In the opening address on behalf of the Dean of the Faculty absent because of duty travel, Prof. Guillaume Amadji, Vice-Dean made a quick reminder about the creation of GBIF. He highlighted the importance of preserving biodiversity, as well as archiving related data. He illustrated his speech with examples of plant and animal species that have become scare during the recent decades. He ensures participants about the commitment of the Faculty for continuous supports to initiatives related to the sustainable management of biodiversity. Lastly, he wishes full success to participants about the workshop.

Mr Manuel Vargas began methodically his presentation by showing participants the location of his country (Central America) on a map. He also provided basic data on Costa Rica's independency (1821), territory (52,100 km<sup>2</sup>) and population (4.5 million). Then, he presented the location of his workstation, the mission of INBio, the on-going work at the institute (focus on unknown species, mainly insects), the biodiversity of Costa Rica and the status of Costa Rica's species. The presentation was partly dedicated to the project "A technological Package for the Implementation of the National Biodiversity Information System (NBIS) of Benin" (Photo 5). The opening ceremony ended by Mr Vargas' responses to participants' questions.



Photo 4: Addresses during the opening ceremony

From left to right, Dr Gaston Akouehou (Head of delegation of GBIF-Benin), Prof. Akpovi Akoegninou (Head of Benin's National Herbarium), Prof. Guillaume Amadji (Vice-Dean of the Faculty of Agricultural Sciences), Prof. Jean C. Ganglo (GBIF Node Manager for Benin), Mr Manuel Vargas (trainer), and Mr Aurelio Sanabria (trainer)



Photo 5: Mr Manuel Vargas giving his presentation during the inception ceremony

# **3.2.** Presentation of the project "A technological package for the implementation of the National Biodiversity Information System (NBIS) of Benin"

This was an overview of the project "A technological package for the implementation of the National Biodiversity Information System (NBIS) of Benin". The project funded by JRS Biodiversity Foundation will support the publication of biodiversity data from Benin. This is the contribution of Benin to the global effort to make biodiversity data freely available for

human needs. Project activities include the training of Beninese stakeholders on Biodiversity Informatics and related issues (as in this workshop), the provision of financial support to prepare data in the appropriate format for publication. Financial support is on case-by-case basis. Participants were encouraged to publish their data on GBIF platform. The interest of data publishing was developed. This contributes to providers' promotion in the scientific world. Their property right is acknowledged through proper citation by data users. Examples of data providers in Benin were given: the Laboratory of Forest Sciences, and the National Herbarium of Benin.

#### 3.3. Lectures and practical exercises

Lectures and related practical exercises represented the main components of the training workshop. These started after the closing ceremony on Monday through the end of the course on Thursday (see annex 2). Various subjects were developed in this framework:

- National biological collection status and future perspectives;
- Introduction to the importance, uses and benefits of biodiversity information;
- Generating managing and sharing biodiversity data and information;
- Analysis and uses of biodiversity data;
- Data publishing and presentation tools.

All these themes were developed by the two Costa Rican trainers/facilitators (Photos 6 and 7), except the "National biological collection status and future perspectives" presented by Beninese experts. Further details on the content of lectures are provided on section 4 (Summary of lectures and related practical exercises).





Photo 6: Trainer providing explanation to participants with the assistance of the translator

Photo 7: Session of practical exercise

#### 3.4. Closing ceremony

The closing ceremony was the last event of the four days training. It was headed by Prof. Guillaume Amadji, Vice-Dean of the Faculty. The first stage was the evaluation of the workshop. Participants were to fill in an evaluation form including various items. The evaluation showed that, overall, the training workshop was very relevant to participants and was well organised. Participants were delighted to attend the course and promised to disseminate the knowledge gained among their colleagues.

Besides the evaluation, the following persons delivered an address during the ceremony: the GBIF Node Manager for Benin, the trainers, and the Vice-Dean of the Faculty (Photo 8).



Photo 8: Closing ceremony of the training workshop

Prof. Ganglo, GBIF Node Manager for Benin, started his address by summarising the workshop, with emphasis on the skills gained by participants. The Costa Rican trainers were cheerfully thanked for the quality and the relevance of their job. Participants were encouraged to take advantage of the skills acquired to share information on biodiversity of Benin through the data portal of GBIF Benin and to train their colleagues for this purpose. Finally, Prof. Ganglo told his gratitude to the translation team whose work was essential to the success of the workshop.

Following Prof Ganglo's address the trainers also thanked the translation team for their tremendous efforts to enable communication between them and workshop participants. They thanked participants for their interest in the training and gave assurance about their availability to keep communication by e-mail, so as to provide clarification to people willing to learn more about Biodiversity Informatics.

Prof. Guillaume Amadji (Photo 9) told his satisfaction that the training course was a successful event, given the evaluation results. He thanked the trainers for their generous work which is a contribution to the development of Benin. After thanking participants for their good behaviour, he ended his address by encouraging them to use their new skills to write high quality scientific articles.



Photo 9: Address of the Vice-Dean of the Faculty during the closing ceremony

#### 4. Summary of lectures and related practical exercises

#### 4.1. National biological collection status and future perspectives

Four presentations were done in the framework of the national biological collection status and future perspectives. These were about the on-going work on biodiversity management in various Beninese organisations (Laboratories of the University of Abomey-Calavi, National forest service, and environmental NGOs). A total of four presentations were given to workshop participants in this framework.

The first presentation was given by Dr Gaston Akouehou, the representative of the Forest Service, a department of the Ministry of Nature and Environmental Protection (Photo 10). Dr Akouehou is also the Focal point for biodiversity in Benin. His presentation was about the state of implementation of the "Strategic plan 2011-2020 for Biodiversity". This presentation showed that various actions are on the way about biodiversity in the country. These actions involve various stakeholders across the country: universities, NGO, government led project, private sectors. However, biodiversity data are not easily available to data seekers. Efforts are needed to strengthen national capacities on biodiversity management through bilateral and multilateral funding.



Photo 10: Dr Gaston Akouehou presenting the "Strategic plan 2011-2020 for Biodiversity"

The second presentation was given by Mr Josea Bodjrenou, the Executive Director of "Nature Tropicale", an environmental NGO (Photo 11). He presented his organisation and its activities related to biodiversity conservation. These include the protection of migratory species such as sea turtles, and the conservation of wetlands. The strategies used are information,

environmental education for behaviour change, promotion of sustainable family farming, promotion of the use of renewable energies, and eco-tourism in wetlands and coastal regions.



Photo 11: Presentation of the Director on "Nature Tropicale" environmental NGO

Professor Emile Fiogbé, from the Faculty of Sciences and Technics, presented the biological diversity of Benin's watercourses and lakes (Photo 12). His Laboratory has carried out the inventory of flora and fauna in watercourses and lakes, the characterisation of the water (degree of encroachment by invasive species), and the mapping of watercourses and lakes studied. It emerged from this presentation that the diversity and abundance of aquatic species are correlated with water quality.



Photo 12: Prof. Emile Fiogbé presenting the achievements of his Laboratory on the biodiversity of Benin's watercourses, lakes and lagoons

The last presentation was given by Professor Philippe Lalèyè (Photo 13), Director of the Laboratory of Hydrobiology and Aquaculture of the Faculty of Agricultural Sciences. The Laboratory has conducted several studies on the ecological functioning of aquatic areas, the biology and ecology of aquatic flora and fauna, and the development of aquaculture in Benin. Studies have shown that Benin's watercourses, lakes and lagoons have a rich diversity of organisms including plankton, fishes, shrimps, etc. However, water resources are facing heavy pressure because of intensive fishing in recent decades (use of prohibited fishing nets). This represents a threat to the country's aquatic biodiversity, but so far there is no evidence of extinction of aquatic species in the country. The problem might be addressed thanks to the implementation of sustainable management measures and aquaculture development as well.

All these presentations were followed by debates, based on participants' questions (Photo 14).



Photo 13: Prof. Philippe Lalèyè during the opening ceremony



Photo 14: Interaction among participants after presentations

#### 4.2. Introduction to the importance, uses and benefits of biodiversity information

In this presentation, participants were provided with the definition of biodiversity and the various types of biodiversity data (molecular data, environmental data, species data, etc.). Biodiversity is the variation of organisms, and encompasses the diversity inside the species, among species, and the diversity of ecosystem (CDB, 1992). Biodiversity data includes primary data and secondary data as well. The life cycle of biodiversity data is as follows:

- Collection of primary data;
- Digitisation;
- Validation;
- Publication;
- Integration;
- Analysis;
- Uses;
- Quality control.

Regarding the importance of biodiversity information, this is very useful for decision making, especially for biodiversity conservation. For instance, species data (occurrence data) and the environmental data can be associated, and manipulated in GIS software to predict the impact of climate change on endangered species. In light of this kind of analysis, areas where the species are threatened can be located. This is a sound basis for decision-making, e.g., conservation and management decisions. Quantum GIS and Maxent software are often used. In this domain, Costa Rica has a consistent experience thanks to INBio. The institute

generates and shares information on the biodiversity of Costa-Rica to educate people, help public policies and support concrete conservation actions.

The regional and global initiatives to share biodiversity information were presented. Among others, there are the Global Biodiversity Information Facility (GBIF), the Encyclopaedia Of Life (EOL), and the Biodiversity Information Standards (TDWG).

#### 4.3. Generating managing and sharing biodiversity data and information

The starting point of this lecture is that the management of biodiversity data depends on the type of data. There are different levels of biodiversity, so that specific divisions of informatics are involved at each level. Three illustrative examples were provided:

- The molecular data, which is the alignment of sequence of genes, structure of proteins, etc., are managed by the Bioinformatics;
- Data on vegetation, energy stream are handled with the Ecoinformatics.
- Species data such as taxonomy, evolution, distribution, morphology are in the scope of Biodiversity Informatics, the main object of this workshop.

Given that Biodiversity Informatics was the scope of the training workshop, the remainder of that lecture was focused on the kind of data used in this field (section 4.3.1) and the proper use of GBIF data portal (section 4.3.2).

#### 4.3.1. Data used in Biodiversity Informatics

The data used in Biodiversity Informatics are collected through surveys, inventories, biological collections, digitalization of existing collections and remote sensing (GIS tool). These are primary data defined as "digital text or multimedia data record detailing facts about instance of occurrence of an organism, i.e. on the what, where, when, how and by whom of the occurrence and the recordings" (Chavas et al., 2010). There are three categories of primary data: occurrence data, taxonomic data and the metadata.

Occurrence data of species are related to the presence of the species in a given location. The description includes country name, province, city or village, locality, and the geographic coordinates of the site where the occurrence has been recorded. Geographic coordinates are indispensable to spatial analyses. Additional information such as the description of habitat, soil, and meteorological conditions could be useful.

Taxonomic data are essential to identify the species, so that they must be accurate. The Catalog of Life provides information on taxonomic name, while the Encyclopedia of Life gives taxonomic information. The collection of specimen (to be conserved by the institution) is helpful to identification by specialists.

Metadata (also helpful to data users) refer to additional information, e.g. the project or occasion in which framework the collection was done, collector name, collection date, identifier's name, bibliographic references supporting data collection methods, etc.

Primary data are combined with environmental data (secondary data) in GIS System to support decisions. The outcome of this combination is a raster map showing the geographic distribution of species.

#### 4.3.2. Exploitation of GBIF data portal

GBIF allows free access to biodiversity information through a data portal. This portal contains to date about 390 million records of specimen data, with about 340 million having geographic coordinates. Participants did practical exercises on the exploitation of biodiversity data available on GBIF portal. The first stage consists to enter the data portal (http://data.gbif.org). It is important to enter the correct taxonomic information at the beginning of the search. Then data seekers are easily guided step-by-step until the download of data in the form of zipped file. The teaching was based on *Anopheles gambiae* (malaria vector) data. Then participants repeated the procedure several times for other species of interest to their work.

#### 4.4. Analysis and uses of biodiversity data

The analysis and uses of biodiversity data is closely related to the manipulation of the information in various ways, for deeper understanding and practical decision makings. Various tools are available depending on the objectives. However, the Geographical Information System (GIS) have gained a crucial importance in this field. Participants were trained to use Quantum GIS (QGIS), and Maxent which are open access software. Regarding the use of QGIS, participants acquired many skills:

- installing the software;
- running the software;
- displaying vector data;
- displaying raster data;

- elaborating new maps;
- combining vector data and raster data in a single map;
- etc.

Maxent was used in modelling the ecological niches of species. Besides practical cases on species of interest, participants gained a clear understanding of the way the program perform and how to interpret properly the outcome of the modelling (Photo 15).



Photo 15: Participants elaborating maps using Quantum GIS

#### 4.5. Data publishing and presentation tools

4.5.1. Publication tools: Integrated Publishing Toolkit (IPT)

This lecture provided information about the nature of data that can be published, who can publish biodiversity data, and the procedure for data publishing.

Publishable resources include occurrences data, taxonomic data, and metadata. Both individuals and institutions can publish data.

Data publication is performed via the GBIF Integrated Publishing Toolkit (IPT) managed by an administrator. Before publishing data, each country or institute must create a session on the GBIF IPT (<u>ipt.gbif.org</u>).

The best standard of exchange for publication on GBIF data portal is the model of Darwin Core. The Darwin Core Archive (DwC-A) is a simple way to exchange information across GBIF through a unique archive. The archive is composed of three files: a dataset containing taxonomic and occurrences data formatted in the standard Darwin Core, the metadata in the

format EML (Ecological Metadata Language), and a descriptor file. Data providers willing to convert spreadsheets in the Darwin Core standard can use GBIF Darwin Core Archive Spreadsheet Templates. This file is available for free from the following link: <a href="http://tools.gbif.org/spreadsheet-processor/index-fr.php">http://tools.gbif.org/spreadsheet-processor/index-fr.php</a>. After downloading the template, providers have to past their data in this file by respecting the adequate column. The next stage is to upload the prepared file or e-mail it at <a href="mailto:spreadsheets@tool.gbif.org">spreadsheets@tool.gbif.org</a>. BRAHMS systems, Atta or Specify (for taxonomy) have been developed to handle heavy files.

#### 4.5.2. Nodes Portal Toolkit (NPT)

The interest of the Node Portal Toolkit is related to the fact that besides GBIF site, each member country can create and manage its own website linked to the one of GBIF. The practical session on this subject was about the portal of GBIF Benin. Two home pages were shown to participants: GBIF's page and the one of GBIF Benin. The latter is dedicated to information about institutions collaborating with GBIF in the country, species data (occurrence data, taxonomic data and metadata), distribution maps, etc. Benin's data portal is still under development with the technical assistance of Costa Rican partners.

#### Conclusions

The training workshop on Biodiversity Informatics was a successful event. It gave opportunity to Beninese participants to share the on-going work in various institutions about biodiversity, and to acquire useful skills: exploiting biodiversity data available for free on the internet, especially from GBIF data portal, manipulating biodiversity data using GIS tools, modelling the spatial distribution of species, publishing biodiversity database, and understanding the functioning of the IPT and NPT.

The training combined presentations and practical exercises. The evaluation showed that participants were very happy with the knowledge gained during the four days workshop. They are now expected to use the acquired skills to publish their biodiversity data, improve their work, especially by publishing high quality article, and disseminate their knowledge among colleagues who did not have the opportunity to attend the training workshop.

# Annex 1: Course agenda

## Day 1. Morning Session.

### Introduction (9:00 a.m.)

- Welcome and presentation of the instructors (Jean Glanglo, 20 min).
- Presentation of the project "A Technological Package for the Implementation of the National Biodiversity Information System (NBIS) of Benin" (Manuel Vargas, 20 min).
- Presentation of participants (10 min).
- Workshop objectives and methodology (Manuel Vargas, 10 min).
- Coffee break (10:00 10:30 a.m.).

### Part I: National Biological Collections Status and Future Perspectives (10:30 a.m.)

- The National Biodiversity Information System of Benin (Jean Ganglo, 30 min).
- Experiences of Beninese institutions in managing biodiversity information (two or three previously selected participants, 2 h).
- Lunch break (1:00 2:30 p.m.).

## Day 1. Afternoon Session.

# Part II: Introduction to the importance, uses, and benefits of biodiversity information (2:30 p.m.)

- The biodiversity data life cycle: collection of primary data, digitization, validation, publication, integration, analysis, uses, and quality control (Manuel Vargas, 1 h).
- Coffee break (3:30 4:00 p.m.).
- Regional and global initiatives to share biodiversity information: Global Biodiversity Information Facility (GBIF), Encyclopedia of Life (EOL), Biodiversity Information Standards (TDWG), among others (Aurelio Sanabria and Manuel Vargas, 1 h).

#### Day 2. Morning Session.

# Part III: Generating, Managing, and Sharing Biodiversity Data and Information (9:00 a.m.)

- Introduction to standards to integrate and share biodiversity data and information: Darwin Core, Plinian Core, metadata standards, among others (Manuel Vargas, 1h).
- Coffee break (10:00 10:30 a.m.).
- Protocols and tools for publishing and integrating data: GBIF spreadsheet templates, Integrated Publishing Toolkit (IPT), and GBIF portal (Aurelio Sanabria, 2:30).
- Lunch break (1:00 2:30 p.m.).

### Day 2. Afternoon Session.

#### Part IV: Analysis and Uses of Biodiversity Data (2:30 p.m.)

- Elements of cartography (Manuel Vargas, 1 h).
- Coffee break (3:30 p.m.).
- Introduction to Geographic Information Systems (Manuel Vargas, 1 h).

#### Day 3. Morning Session.

#### Part IV: Analysis and Uses of Biodiversity Data (9:00 p.m.)

- Practical session on GIS and data modeling (Manuel Vargas, until lunch break).
- Lunch break (1:00 2:30 p.m.)

#### Day 3. Afternoon Session.

#### Part V: The Atta system for biodiversity content management (2:30 p.m.)

- Introduction to the *Atta* system (Manuel Vargas, 1h).
- Coffee break (3:30 p.m.).
- Atta practical session (Manuel Vargas, 1 h).

#### Day 4. Morning Session.

# Part VI: Data publishing and presentation tools (9:00 p.m.)

- IPT and NPT (Aurelio Sanabria, 1 h).
- Coffee break (10:00 10:30 a.m.).
- NPT practical session (Aurelio Sanabria, 2.5 h).
- Lunch break (1:00 2:30 p.m.).

# Day 4. Afternoon Session.

Part VII: Wrap up session and closure (2:30 p.m.)