

UNIVERSITY OF ABOMEY-CALAVI
FACULTY OF AGRICULTURAL SCIENCES

GLOBAL BIODIVERSITY INFORMATION FACILITY NODE
FOR BENIN (GBIF-BENIN)

NBIS PROJECT BENIN – COSTA RICA
(Financial support of JRS)

**Training workshop on capacity building and biodiversity data mobilisation
for the sustainable development of Benin**



**(19-21 September 2013, Faculty of Agricultural Sciences, University
Abomey-Calavi, Benin)**

REPORT

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Introduction

In the framework of the activities of the Global Biodiversity Information Facility node for Benin (GBIF-Benin), a training workshop entitled “Building capacity and mobilising biodiversity data for the sustainable development in Benin” was organised on 19-21 September 2013. This took place at the Faculty of Agricultural Sciences, University of Abomey-Calavi). Sixty-six (66) persons attended the training workshop. Participants included, mainly, Lecturers, Researchers, Master and PhD Students, Research Assistants from Faculties, Colleges, Laboratories, and Departments of the University of Abomey-Calavi and the Agricultural University of Kétou. Representatives of the Forest Service, the Ministry of Environment, the Ministry of Agriculture (especially the National Institute of Agricultural Research), environmental NGOs, and International Research Centres operating in Benin also attended the training workshop.

Various subjects related to Biodiversity Informatics, the Global Biodiversity Information Facility and its activities, especially in Benin, were presented by national experts: Prof. Jean C. Ganglo, Dr Gaston Akouehou, Dr Gérard Gouwakinnou, Mr Jaures Gbetoho, and Prof. Paul Yédomonhan).

The remainder of this report presents the workshop objectives and methodology (section 1), the key activities carried out during the workshop (section 2), the summary of lectures and practical exercises (section 3), and the main conclusions emanating from the workshop.

1. Workshop objectives and methodology

The global objective of the workshop was to contribute to the sustainable development of Benin, thanks to the mobilisation of biodiversity data and the use of Biodiversity Informatics in decision making about natural resources. The specific objectives included:

- present GBIF and GBIF Benin to participants;
- introduce participants to Biodiversity Informatics;
- sensitise participants about the importance of data mobilisation and publication, and the opportunities related to biodiversity data use;
- introduce participants to the mobilisation and publication of biodiversity data on GBIF portal;
- introduce participants to the Geographic Information System and niche modelling.

The workshop was structured in several subjects and activities (see agenda in Annex). Basically, the training method consisted in presentations of the subjects by selected experts.

These generally include practical exercises involving the use of computer and specific software. In this purpose, desktops with internet access were available to participants in the computer room of the Faculty. In addition, some participants used their own laptop during practical exercise sessions. Participants received power point files with many screen shots that can guide them if they were to practice after the training session. Workshop activities took place in three venues: the library of the Faculty of Agricultural Sciences (opening ceremony), the computer room of the Faculty (most of the lectures and practical exercises, and the closing ceremony), and the National Herbarium of Benin (digitisation of plant specimens). Coffee breaks and lunch breaks were offered to participants throughout the training workshop.

2. Key activities

The main sequences of the training workshop were as follows: (i) opening ceremony, (ii) presentation GBIF and GBIF Benin, (iii) introduction to Biodiversity Informatics, (iv) lectures and practical exercises, and (v) closing ceremony (Annex).

2.1. Opening ceremony

The opening ceremony was chaired by Prof. Brice Sinsin, Chancellor of the University of Abomey-Calavi. He was assisted by Prof. Joseph Hounhouigan, the Dean of the Faculty of Agricultural Sciences (University of Abomey-Calavi), Dr Gaston Akouehou (Biodiversity focal point of Benin, representing both the Minister of Environment and the General Director of the Forest Service), and Prof. Jean Ganglo (GBIF Node Manager in Benin).

The ceremony began with the welcome address of the Dean of the Faculty of Agricultural Sciences. Prof. Joseph Hounhouigan thanked all participants for attending this course. Then he insisted on the importance of biodiversity, the threats on biodiversity, and highlighted the importance of biodiversity information to its conservation. His speech also included a quick reminder of the objectives and activities of GBIF, since its creation in 2001, and the urgency for Benin to contribute to the mobilisation of biodiversity information.



Photo of the Dean (Professor HOUNHOUIGAN Joseph) of the Faculty

Following the Dean of the Faculty of Agricultural Sciences, Dr Gaston Akouehou built his speech on the objectives of the Convention on Biological Diversity (CBD), and the position of GBIF in regard of these objectives. He said the Ministry of the Environment was fully committed to support any initiative linked to CBD, especially GBIF activities. He ended his speech by exhorting all participants to follow closely the lectures, so as to be able to contribute to sustainable biodiversity management.



Photo of Dr AKOUEHOU Gaston, Head of delegation of GBIF-Benin

In the opening address, the Chancellor of the University of Abomey-Calavi put emphasis on the importance of biodiversity, and the necessity of its sustainable management to meet humans' needs. Biodiversity conservation is a duty assigned to everybody. Prof. Brice Sinsin insisted on the need of scientific research, and collaboration at both local and global levels to meet biodiversity conservation objectives. This justifies the creation of GBIF, an organization playing a huge role in mobilising and sharing biodiversity data. Before launching the workshop, he invited participants to take advantage of this unique opportunity of capacity building.

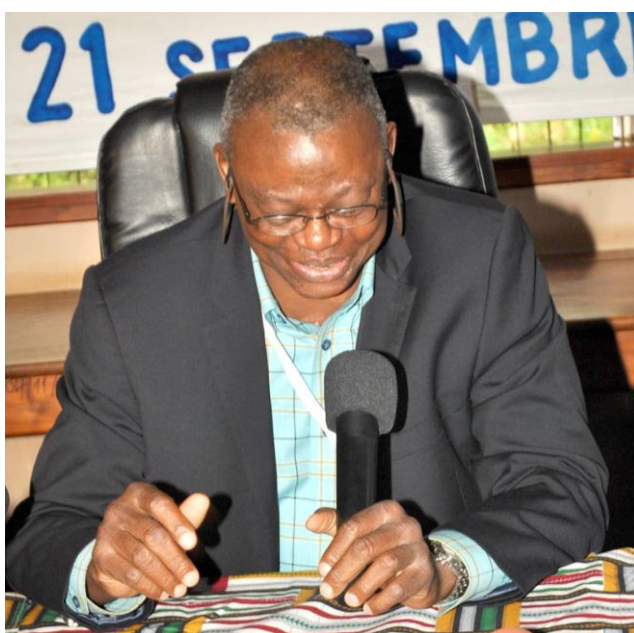


Photo of the chancellor (Professor SINSIN Brice) of the University of Abomey-Calavi

After the opening address, Prof. Jean Ganglo, the GBIF Node manager in Benin, presented the workshop objectives. He took this opportunity to thank the University of Abomey-Calavi (especially the Chancellor), the Faculty of Agricultural Sciences (especially the Dean), for their full support in organising this training workshop. He also mentioned the support from the Ministry of tertiary education. Overall, the workshop was intended to contribute to the sustainable development of Benin, thanks to the mobilisation of biodiversity data and the use of Biodiversity Informatics in decision making about natural resource. He ended his presentation by wishing all participants a pleasing attendance to the three days activities.



Photo of Professor GANGLO C. Jean, Node Manager of GBIF-Benin

2.2. Introduction to Biodiversity Informatics

Participants were introduced to Biodiversity Informatics by Prof. Jean Ganglo, GBIF Node Manager in Benin. First, Prof. Ganglo defined biodiversity as encompassing the diversity of ecosystems, the diversity of species, and the diversity of genes within species. He insisted on the importance of biodiversity to human being and the ongoing threats on it. He pointed out that the guarantee for a safe future of the humanity depends on successful efforts in biodiversity conservation. Second, the presenter stated that according to Peterson et al. (2010), biodiversity informatics is a new field of science in charge of biodiversity data management at large scale via computers. The presenter underlined that the biodiversity informatics is of upmost importance in biodiversity conservation. At this stage biodiversity informatics (BI) encompasses three main activities: data extraction and capture, data compilation and serving, and data display and visualization (Peterson et al., 2010). The presenter largely developed the three categories of BI activities and illustrated data display and visualization with concretes examples of *Anopheles gambiae* distribution map in Benin and the main results on palm species distribution in Africa with regard to environmental and



Photo of the participants during the opening ceremony in the Library of the Faculty of Agricultural Sciences

non environmental factors constraints (Blach-Overgaard et al., 2010), and the effect of climate change on African baobab and the necessity of new strategies of the species conservation (Sanchez et al., 2011). Prof. Ganglo pointed out that the species distribution models, especially that of African baobab suffered from the lack of occurrence data on the targeted species. This could result in poor accuracy of the models, hence the urgency to mobilise and publish biodiversity data. He underlined that actually the lack of biodiversity data mobilisation in Benin precludes reliable strategies of biodiversity conservation in the country. He then urged the participants to do their best to successfully contribute to biodiversity data mobilisation and publication on GBIF site. The presentation was followed by debates showing the high interest of participants in Biodiversity Informatics.

2.3. Presentation of the Global Biodiversity Information Facility

This presentation of Dr Gaston Akouehou consisted in giving participants an overview of what the Global Biodiversity Information Facility (GBIF) is really. Emphasis was put on the history and the scope of the activities of this organisation. As stated, the Global Biodiversity Information Facility (GBIF) was established by governments in 2001 to encourage free and open access to biodiversity data, via the Internet. Through a global network of countries and

organizations, GBIF promotes and facilitates the mobilization, access, discovery and use of information about the occurrence of organisms over time and across the planet. Actually, GBIF is composed of 52 country members among which 35 voting members, and 35 international organizations.

2.4. Presentation of the Global Biodiversity Information Facility in Benin (GBIF Benin)

In this presentation, Prof. Jean Ganglo (GBIF Node Manager of GBIF-Benin) traced out the history of Benin's membership in GBIF. The country joined GBIF in 2004, and became a voting member in 2011 after the payment of the convenient rights. A diversified range of activities has been carried out by GBIF Benin, especially in recent years. These include two meetings respectively in 2010 and 2011 to sensitise national biodiversity institutions about the mobilisation of biodiversity information. In 2011 and 2012, students were trained on GIS tools, the mobilisation and publication of biodiversity data, the use of GBIF website (information search and data downloading); and further trainings are planned to strengthen their capacity. To date, 32000 data were mobilised, 7000 already published and 25000 are under publication. Many materials are purchased to help mobilise biodiversity data. Among others, the data mobilised could be use in the field of Biodiversity Informatics to define conservation area for species... The achievements of GBIF Benin were highly appreciated by participants. However, there is a need of further work, especially with animal species data mobilisation.

2.5. Lectures and practical exercises

Lectures and practical exercises were given by experts. The following subjects were covered:

- biodiversity data collection and digitising;
- introduction to GIS and the use of QGIS;
- digitisation of plant specimens at the National Herbarium of Benin;
- use of GBIF website: information search and data downloading;
- niche modelling.

Further details on the content of these lectures are provided on section 3 (Summary of lectures and related practical exercises).



Photo of the practical session in the computer room of the Faculty of Agricultural Sciences

2.6. Closing ceremony

The sequence of the closing ceremony was as follow: evaluation of the workshop, interventions of participants' representatives, addresses of the main trainers, speech of GBIF Node Manager in Benin, representing the Dean of the Faculty of Agricultural Sciences and the Chancellor of the University of Abomey-Calavi.

The evaluation showed that, overall, the training workshop was very relevant to participants and was well organised. Participants were satisfied and 90% of them stated that they were able to publish biodiversity data, download data from GBIF portal, use Quantum GIS, and Maxent for niche modelling. The expected valorisation of the knowledge gained during the training workshop includes: dissemination among colleagues, publishing scientific articles, and modelling species distribution.

The representatives of the participants were selected among the following categories: the lecturers (teaching staff), members of environmental NGOs, forest service workers, and PhD students. All of them thanked the organisers and trainers and suggested the extension of the

training to other aspects of the management of natural resources. They made the commitment to digitise and publish data on the specimens available in their institution.

In their address, the main trainers (Jaures Gbetoho and Gérard Gouwakinnou) thanked participants for attending the course. They encouraged participants to apply the tools learned during the workshop. They ensure participants of their availability to assist them in case of difficulties; and thank Prof. Jean Ganglo for associating them to this training. Likewise, the moderator (Augustin Aoudji) also thanked the participants and Prof. Jean Ganglo.

The last speaker of the closing ceremony was Prof. Jean Ganglo, GBIF Node Manager in Benin. He thanked participants for attending the course and shared with them his satisfaction about the success of the workshop. He welcomed the demand of further training by participants and presented some innovations for improved effectiveness. These include the proper-registration of participation, the selection of another venue more comfortable, compared to the computer room of the Faculty of Agricultural Sciences. He encouraged participants to practice the knowledge gained during the course, especially publishing biodiversity data on GBIF portal. This will be a criterion for admission in future training workshops organised by GBIF Benin.

3. Summary of lectures and related practical exercises

3.1. Biodiversity data collection and digitising

In this session, participants were shown how important biodiversity information is, and how to generate it. Biodiversity information is important for decision making, especially to educate people, elaborate concrete conservation strategies. Species data could be manipulated in GIS to show the current distribution. Combined with environmental data, the future distribution could be predicted in the context of global change.

The starting point of this process is the collection of species data which is done thanks to surveys, inventories, biological collections, digitisation of existing collections and remote sensing (GIS tool). These data must be published on GBIF data portal, for availability to anyone involved in biodiversity conservation. The standards of publication vary according to the type of data.

Primary data is “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 species data also called primary data: occurrence data, taxonomic data and metadata. Occurrence data

are data related to the presence of the species in a given location. The geographic coordinates of the location are necessary, with information on country name, province, city or village, locality 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 are useful. Taxonomic data are essential to identify the species. These could be found in the Flora of Benin for plant species, but generally in the Catalogue of Life and the Encyclopaedia of Life. The collection of specimen (to be conserved by the institution) or a representative picture (with camera) is helpful for identification by specialists. Metadata refer to additional information on the data collected. It is useful to assess the quality of data provided, and includes the context or occasion in which the collection was done, collector name, collection date, identifier's name, bibliographic references, data collection methods, etc.

The format of publication of primary data on GBIF portal is Spreadsheets templates which is compatible with the standards developed in Darwin Core archives. Participants were trained on how to fill the GBIF Spreadsheets templates. This file could be downloaded at the following URL: <http://tools.gbif.org/spreadsheet-processor/index-fr.php>. After downloading, the data providers have to fill each column with the corresponding data and fill the metadata.

3.2. Introduction to GIS and initiation on QGIS

Geographical Information System (GIS) is very useful to represent, analyze, and visualize biodiversity information. A Geographical Information System is a collection of software that allows creating, visualizing, querying, and analyzing geospatial data. Geospatial data refers to information about the geographic location of an entity. Therefore, geographic coordinates, like latitude or longitude values, are necessary. There are two categories of spatial data in GIS: the vector data and the raster data. In the vector data, the information is represented in the form of successive points with their geographic coordinates. In raster data, the information is contained in cells or pixels of a numeric image. The information is represented by the particular disposition of these cells in the image grid. In this case, the accuracy of representation decreases with the size of the pixels.

Quantum GIS is a major open access software to analyse spatial data. It accepts vector data and raster data with various extensions. Participants were trained on how to get it and how to install it. They were also trained on how to display spatial data, mainly vector data and species occurrence data (coordinates), for analyses and niche modelling. The result could be export as image or PDF files.

3.3. Digitisation of plant specimens at the National Herbarium of Benin

Participants were introduced to the collection and digitisation of plant specimens at the National Herbarium of Benin, located on the campus of Abomey-Calavi. The National Herbarium holds a collection of about 50000 specimens of about 3000 plant species.

A specimen is a representative part of a plant, which is enough to allow botanical determination. Specimens of a same plant could be taken at different locations and constituted a sample for that species. The number of specimens per sample ranges between 1 and 4 (maximum). On each specimen, a determination label is pasted. This contains collector name, collection date and location, geographic coordinates, habitat description. Samples are classified according to their taxonomic position in cupboards: alphabetically according to the family, and then the species. Specimens are digitised using an appropriate scanner and data are saved on a computer. Participants were shown the digitisation equipment (scanner and computer), and were initiated to the practice of digitisation of plant specimens.



Photo of plant specimen samples at the National Herbarium of Benin



Photo of the cupboard containing plant specimens at the National Herbarium of Benin



Photo of a practical session on plant specimen digitisation

3.4. Use of GBIF website: information search and data downloading

During this session, thanks to the availability of internet connection, participants were trained to how they can access to the GBIF website, be it by directly typing the address (www.gbif.org) in their browser or by googling by using the name “Global Biodiversity Information Facility” or simply ”GBIF”. Once on the home page, they were instructed to how to access the data portal and how they can choose to browse by species, country or by dataset

or how they can directly search for one of the above feature. *Prosopis africana* a savannah tree species in Benin was used as a case study; and participants were initiated to the main steps until data download. They were also shown how they can view the matching records of their search online as a map or as a table. They were also introduced to the possibility of creating a quick online niche model of the species of interest from the matching records using OpenModeller. Finally, data downloading using the available file formats and the advantage and disadvantage of each format were stressed. Records of *Prosopis africana* were downloaded and further used as input for GIS training, which was also part of this training workshop.

3.5. Niche modelling

The session on niche modelling includes three parts: basic of biological and environmental data collection for distribution modelling, fundamentals of species distribution niche modelling, and a practical case of species distribution modelling.

3.5.1. Basic of biological and environmental data collection for distribution modelling

This session started by presenting to the participants the importance of the emergent field of Biodiversity Informatics, and particularly the species distribution modelling (SDM) and the main areas of conservation and agricultural production it can be used for. After this, the two main types of data (biological and environmental) required by Maxent for SDM were presented. This was followed by the concept of true and false absence and the advantage of using true absence data and disadvantage of using false absence data. After this step, the main sources of biological data and the links to access their websites were shown among which VerNet which has now joined GBIF. After this, the main environmental variables that can be used in distribution modelling (temperature, rainfall, bioclimatic variables, land cover, NDVI, land use, soil, human population density, etc) were presented. For each of these variables, the nature (categorical or continuous) was stressed and the links to download them were provided to participants. A demonstration of how to download climate data from Worldclim (www.worldclim.org) or from the CCAFS (CGIAR Research Program on Climate Change, Agriculture and Food Security: www.ccafs.org) was done.

3.5.2. Fundamentals of species distribution niche modelling

During this session, the main steps for a correlative species distribution modelling were described from data collation to the result via environmental data processing, biological data partitioning for model running and validation. At this point, the importance of Geographical

Information System (GIS) in distribution modelling was raised. Moreover, the necessity to understand spatial resolution and spatial scale as well as the main sampling condition for a good model output was also presented to participants. There were made aware of the on-going discussion of the use of AUC (Area Under Curve of the Receiver Operating Characteristics) for validating the species distribution model and the alternatives statistics such as TSS (True Skill Statistic), the Kappa coefficient. Moreover, the issue of correlation among candidate environmental layers when projected to other climate or to other spatial region and the bias this could induce in species distribution results was discussed with participants.

3.5.3. Practical case of species distribution modelling

This session was practical and participants followed and simultaneously performed the species distribution modelling with Maxent. They were directed to the website of Maxent to register and download the program. The possibility to join the discussion group of the users of this program was also shown to participants. The file formats required by Maxent and how this can be prepared was also briefly explained. The basic setting of the program were showed and participants were referred to the tutorial of Maxent to gain more knowledge about the setting in Maxent and which effect this could have on the outcome of the model.

The practical Maxent running demonstration was based on the presence records of *Sclerocarya birrea* in West Africa. Distribution modelling was performed for the species under present conditions and was also projected in the future (2050) under A2 scenario of IPCC with the CSIRO (Commonwealth Scientific and Industrial Research Organisation) climate model.

After the model run, participants were initiated to the interpretation of the model outputs which included the map of present and future distribution, the values of AUC, the pictures generated by the jack knife test and the contribution of each selected variable to the outcome of the model. Which files should be selected among those generated after the program run for further use in a SIG software to show the map of the distribution was insisted on.

All participants to the training were provided with a folder which contains the relevant scientific literature, training manual, presentations from each session, formatted files with which they could practice distribution modelling after the training. They were also directed to websites where they can get information and download shapefiles of all countries in the world and also to the world database of protected areas (www.protectedplanet.org) where the shapefiles of all protected areas can be obtained.

Conclusion

The training workshop entitled “Building capacity and mobilising biodiversity data for sustainable development in Benin” was clearly a successful event, as shown by the higher number of participants than expected and their faithful and interested participation. This was for participants a capacity strengthening opportunity in the following areas: biodiversity data collection and digitising, introduction to GIS and the use Quantum GIS, digitisation of plant specimens, data mobilisation and publishing on GBIF portal, and niche modelling.

The training combined presentations and practical exercises. The evaluation showed that the workshop was fairly well organised, and participants were very happy with the knowledge gained in this occasion. They are now expected to use the acquired skills especially publishing their biodiversity data in GBIF portal to improve the visibility of Benin.

Annex: Agenda of the training workshop

Training workshop: “Building capacity and mobilising biodiversity data for sustainable development in Benin”

Agenda

Day 1: Thursday 19 September 2013

Plenary session

Time	Theme	Responsible
09:00-10:00	- Opening ceremony - Objectives of the training workshop	Augustin Aoudji (moderator) Jean C. Ganglo
10:00-10:30	Coffee break	
10:30-11:30	- Presentation of participants - Presentation of the Global Biodiversity Information Facility	Gaston S. Akouehou
11:30-13:00	- Introduction to Biodiversity Informatics - Presentation of GBIF-Benin	Jean C. Ganglo
13:00-14:00	Lunch break	

Parallel sessions

1) Training (Moderator Augustin Aoudji)

Time	Theme	Responsible
14:30-15:30	- Exploitation of GBIF data portal	Gérard Gouwakinnou
15:30-17:00	- Elements of cartography - Introduction to the Geographic Information System	Jaures Gbetoho

Day 2: Friday 20 September

Parallel sessions

1) Training (Moderator Augustin Aoudji)

Time	Theme	Responsible
09:00-10:00	- Data collection and publication	Jaures Gbetoho
10:00-10:30	Coffee break	
10:30-13:00	- Digitalisation of plan specimens	Paul Yédomonhan
13:00-14:30	Lunch break	
14:30-15:30	- Protocols and tools for publishing and integrating data - Data publishing on GBIF portal	Jean C. Ganglo
15:30-16:30	Coffee break	
16:00-17:00	- Introduction to Quantum GIS	Jaures Gbetoho

Day 3: Saturday 21 September

Parallel Sessions

1) Training (moderator Augustin Aoudji)

Time	Theme	Responsible
09:00-10:00	- Basic of biological and environmental data collection for distribution modelling - Fundamentals of species distribution niche modelling, - Practical case of species distribution modelling	Gérard Gouwakinnou
10:00-10:30	Coffee break	
10:30-13:00	- Practical case of species distribution modelling - Results analysis and interpretation	Gérard Gouwakinnou
13:00-14:30	Lunch break	
14:30-15:30	-Workshop evaluation by participants	Augustin Aoudji
15:30-16:00	Coffee break	
16:00-17:00	- Closing ceremony	Jean C. Ganglo