Labef

Laboratoire de Biomathématiques et d'Estimations Forestières

ANNUAL REPORT

2016

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1. Presentation of the laboratory

1.1. Brief description

The Laboratory of Biomathematics and Forest Estimations (LABEF in French) is part of the school of Environment Planning and Management, Faculty of Agronomic Sciences. The Laboratory is headed by Prof. Romain Lucas GLELE KAKAÏ, Full Professor of Biometry and Forest estimations. LABEF is a research institution. Activities of the Laboratory focus mainly on fundamental and applied research in Forestry and Agroforestry with key emphasis on biological modeling and socio-ecological phenomena using modern statistical tools.

Using these insights, the Laboratory works on the development and popularization of innovative statistical methods and innovative solutions for forest restoration and management, for the optimal delivery of their multiple ecosystem services.

1.2. History, Mission, Objectives, Vision

In spite of being a fundamental tool in understanding, modelling and prediction, mathematics in general and biostatistics in particular has received little attention in biological sciences and particularly forestry in Africa. To address this issue, the LABEF was created on May 27th, 2014 by Romain GLELE KAKAÏ. Before its creation in 2014, members of LABEF had already been working synergistically and with other partner laboratories since 2008.

The Laboratory of Biomathematics and Forest Estimations aims at analyzing the applicability of mathematics tools in life sciences and at understanding the interactions between ecological processes, anthropogenic factors and structure of terrestrial ecosystems, with a clear link to management and policy.

Our mission is to enhance understanding of biological systems through effective use of biomathematical tools for sustainable forestry and development. The vision of the Laboratory is to be a leading institution in developing mathematical tools for biologists and supporting decision makers in Forestry for better life. In addition, LABEF has a good background in scientific writing and statistical analysis and is frequently solicited by other national and international institutions for capacity building in statistical analysis.

1.3. Organization of the Laboratory with a focus on the research department

LABEF is organized in 4 different departments under the supervision of the head of the laboratory namely: fundraising departement, social life department, administrative department, and research department. The research department includes four interrelated units namely: Unit of Biomathematics and Applied statistics; Unit of Forest Methods; Unit of Forest Ecology and Management and the Unit of Forest and People.

- **The research unit on biomathematics and applied statistics** falls into biology and mathematics and are interested in applications of mathematics in the field of biology. This unit is interested not only in the use of mathematical theories in biology but especially publishing scientific notes describing the application of different mathematical tools in life sciences.
- **The Forest Methods unit** falls thus into the overall perspective (assess the wood resources, biomass, mineralomass and carbon stock available in forest ecosystems). Hence, it provides essential information for policy planning and forest resources management of the development of accurate and robust methods for estimating forest resources.
- The goal of **Forest Ecology and Management** is to understand these ecological processes and patterns (forest ecosystems and forest ecosystem services, patterns and processes that govern the ecology of species and the system of which these species are parts, seed ecology and systems)

and to develop accordingly clear and applicable management policies for forest managers and decision makers.

- The **Forest & People research unit** is in line with this issue and undertakes investigations on forest governance approaches, their effectiveness and replicability, their socio-economic and ecological outcomes, decision making process, benefit sharing etc.

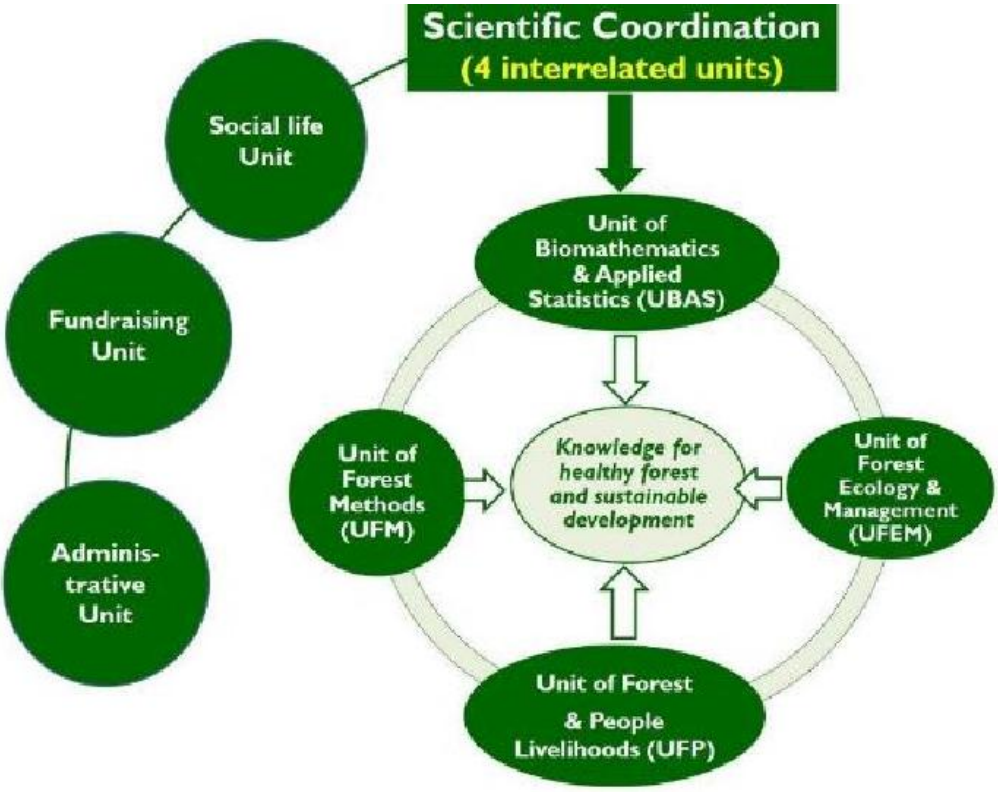

Figure 1: Descriptive chart of the organization of the Laboratory

1.4. Training offers at LABEF

LABEF offers the Master programme in Biostatistics at the Faculty of Agronomic Sciences of the University of Abomey-Calavi (Republic of Benin). The Laboratory offers also some short training, modular trainings, monthly conference and internship as part of its capacity building activities.

1.5. Human resources of LABEF

LABEF has in total 45 affiliates. The LABEF has one full Professor, one associate professor, five assistant professors, six new doctors and one secretary (Figure 2).

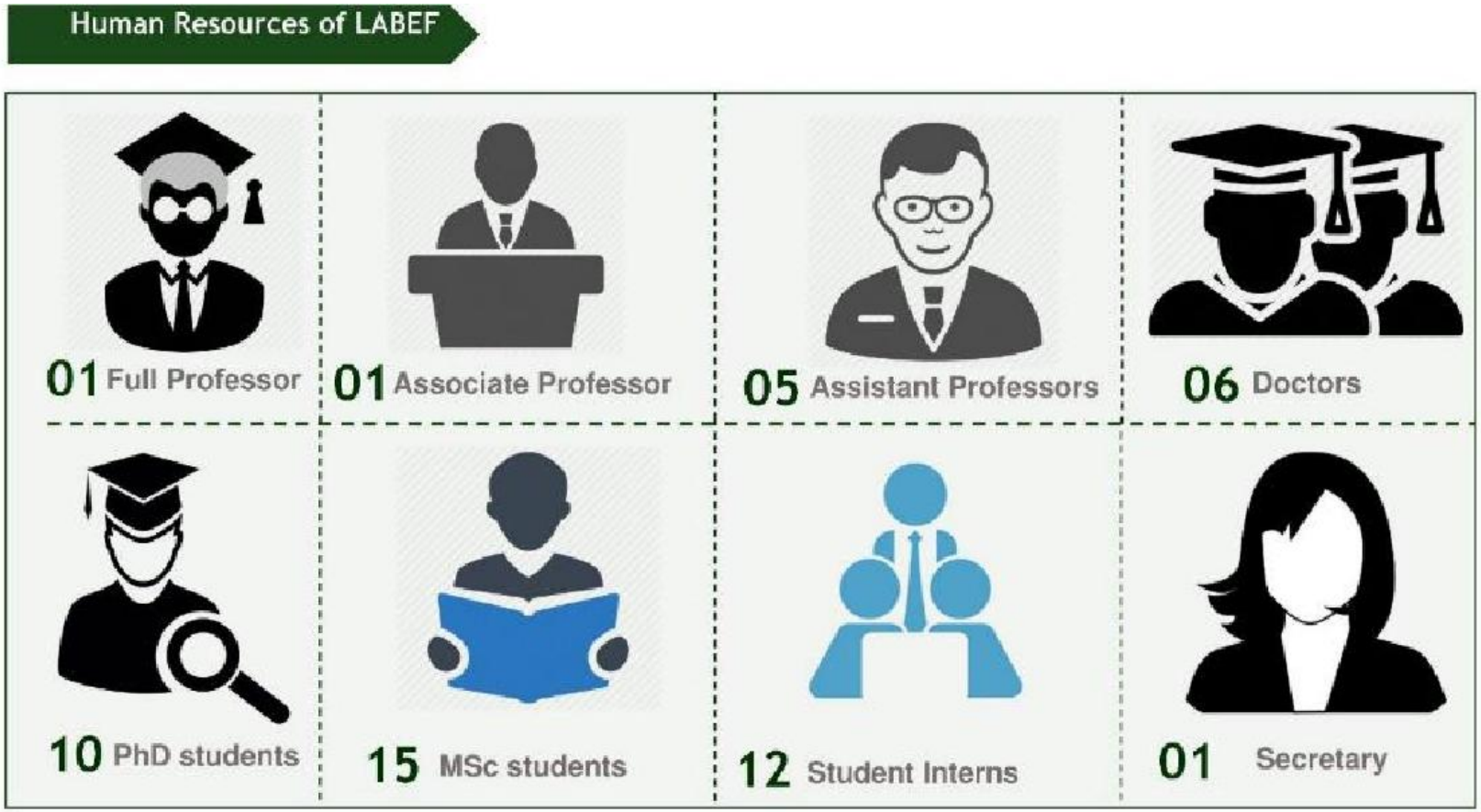

Figure 2 : Synthetic chart showing Human resources of LABEF in 2016.

2. Data collection and analysis

Data collection for this report was mainly based on research activities performed by researchers and students of the Laboratory during the year 2016.

Firstly, information related to dissertations (ongoing doctorate and masters' studies), scientific articles (published, in press or under review) in peer-review journals (with impact factor or not) and those published through proceedings, books of abstracts and technical reports were obtained from and individual form filled by each affiliate. For each type of publication, the relevant field of specialization was assessed. Then, two categories of papers were obtained: articles with Impact Factor and articles without Impact Factor. Only the publications of which address of authors and/or co-authors refer to LABEF were considered. Furthermore, collaborations and co-publications with scientists from developed countries and African countries have been detailed throughout the report. Moreover, the ratio between the number of publications produced individually or by co-publication with national, regional or international teams and the total number of publications in the laboratory was computed. English/French ratio for the published papers was also computed. Data were also collected on the types of grants researchers from LABEF got during the year: Small grants (≤10 000 USD), medium grants (between 10 000 USD and 50 000 USD) and Large grants (> 50 000 USD).

Information related to conferences and seminars (organized by the laboratory and the ones to which the researchers from the laboratory have participated), research projects, grants, prices and awards are presented in the report.

An "appendices" section has been inserted at the end of the report. This section presents the abstracts and the full reference of published papers in peer review journals.

3. Scientific activities in LABEF in 2016

Figure 3: Synthetic chart showing LABEF achievement in 2016. *SRG: Small research grants; MRG: Medium research grants; LRG: Large research grants*

3.1. Trend in scientific publications at LABEF until 2015

From 2009 to 2015, members of LABEF published more scientific papers in journals with impact factors (Figure 4a), except in 2009, 2010 and 2015 where the number of papers in journals without impact factor was higher than the one published in impact factor journals.

Moreover, the total number of scientific papers published by LABEF's members until 2015 is 139 with an almost an even number of papers published in impact factor and journals without impact factor (Figure 4b).

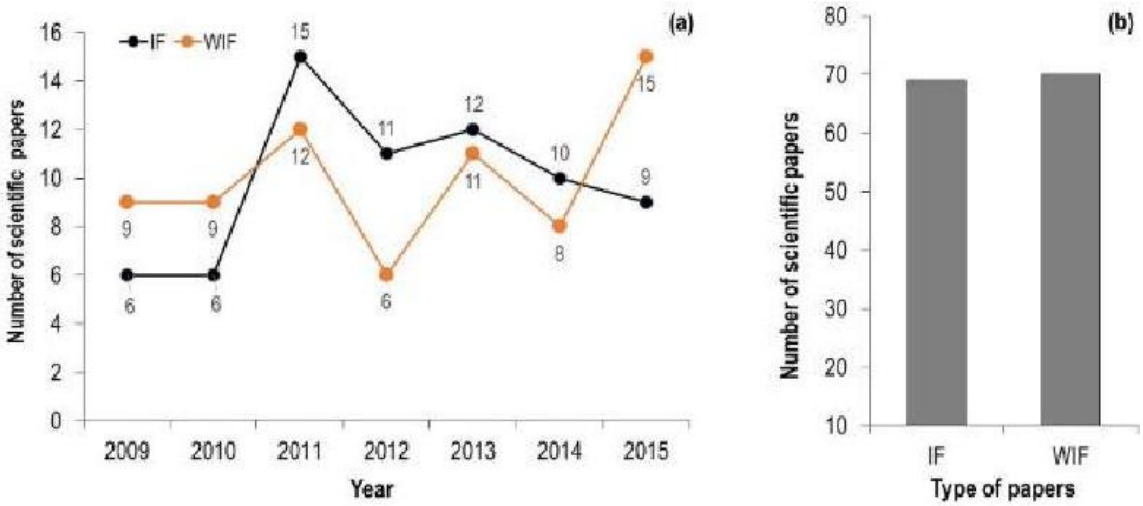

Figure 4: Trend in scientific papers publication until 2015.

3.2. Research and publications of LABEF in 2016

3.2.1. *Type of research in LABEF*

During the year 2016, a total of 32 scientific papers have been published (Figure 5). The published articles were mostly produced through national teams (See appendix 1.3 -1.10 and appendix 2). About 56.25 % of the original research papers from the Laboratory were published in international journals with Impact Factor.

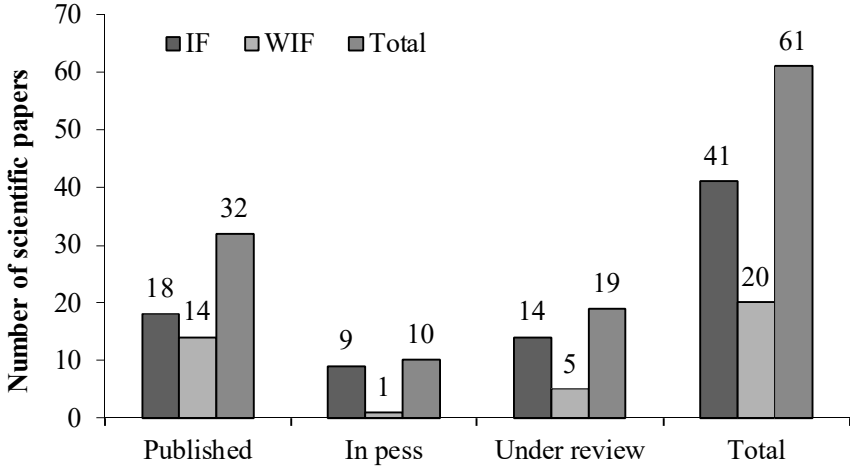

Figure 5: Spectrum of scientific productions of LABEF in 2016.
Legend: IF = Impact Factor; WIF = Without Impact Factor

3.2.2. *Collaboration for publications in LABEF in 2016*

LABEF works with a wide range of both local and international partners for research and capacity building. Research teams within LABEF used to publish their research papers in collaboration with national and international scientists (Figure 5). At country level, most of the publications were written with researchers from Benin (55 %). However, some high and fruitful collaboration existed with scientists from Denmark, Burkina-Faso, Germany, USA and Belgium (Figure 5).

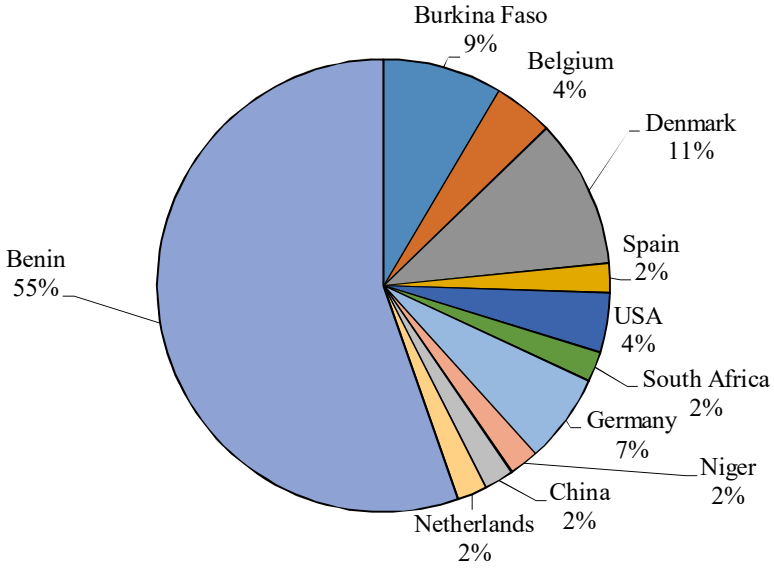

Figure 6: LABEF co-publications in peer review journals at country scale in 2016.

At the continent level, most of the publications were produced in collaboration with researchers from Africa (81 %; Figure 6) whereas Asia and Australia were not represented at all in scientific collaborations. Moreover, the overall French/English ratio of the paper published in 2016 is 1/5, meaning that 5 papers were published in English for only one published in French.

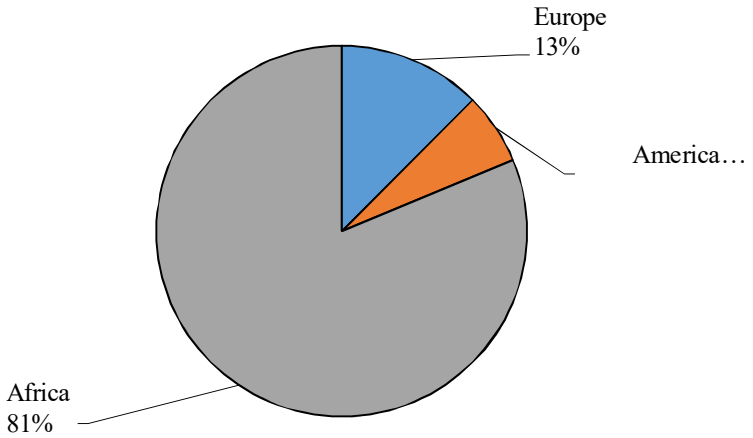

Figure 7: LABEF co-publications in peer review journals at a continent level in 2016.

3.2.3. *Theses in LABEF (defended and ongoing)*

During the year 2016, LABEF has some 10 doctorate candidates under the supervision of the Director of the Laboratory or other guest researchers and associate members of the Laboratory. Most theses were in the field of Forest Ecology and management (Figure 7, Appendix 1.1). Number of doctorate students have already defended their theses by the ending year 2016 resulting now in 6 new Doctors. Currently in the Laboratory of biomathematics and forest estimations, almost half of the Doctorate students are in the first year of researches (Figure 1).

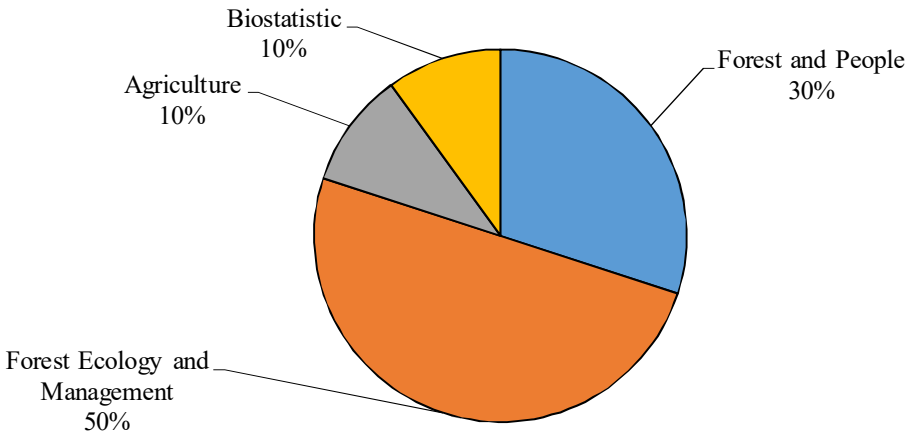

Figure 8: Spectrum of ongoing doctorate thesis and related field of research in 2016.

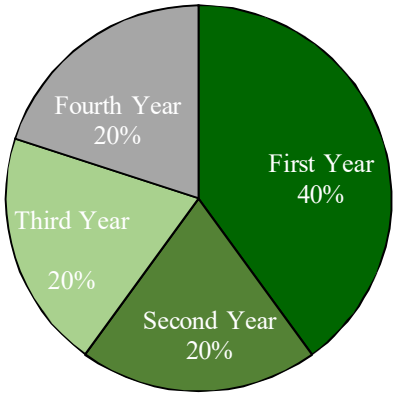

Figure 9: Typology of Doctorate students in LABEF based on the number of year related to their research activities.

3.2.4. *Masters in LABEF*

The number of enrolled students in Master degree in LABEF were 4. These students were enrolled in Master in Biostatistics and Master in Natural resources management (See appendix 1.2).

3.2.5. *Articles in LABEF*

a) Published articles

During the year 2016, most of the papers published in peer reviewed journals with Impact factor has been of Forest Ecology and Management (33 %) and Biodiversity conservation (33 %) while the least represented category was Forest biometrics (Figure 10).

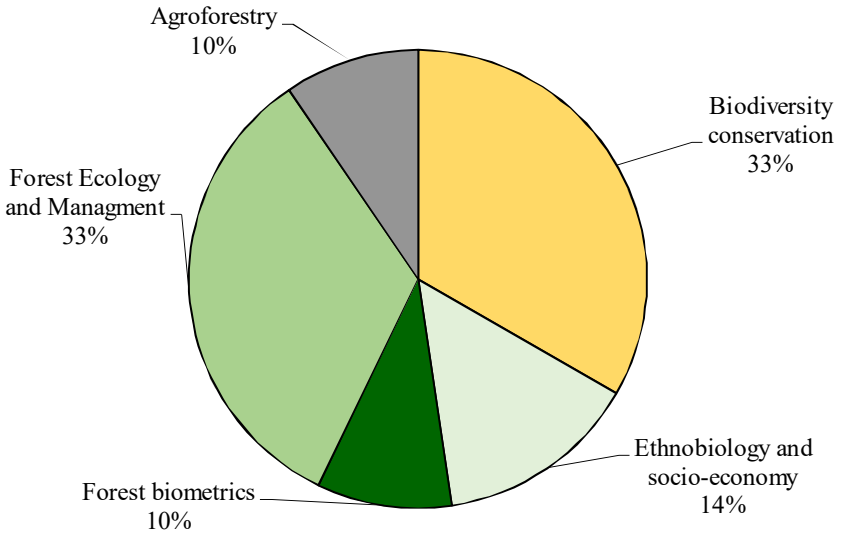

Figure 10: Articles published in journals with IF according to the main fields of research in 2016.

During the year 2016, most of the peer reviewed papers published by researchers without impact factor were of Ethnobiology and socioeconomics field (34 % Figure 11) and followed by biodiversity conservation (27 %).

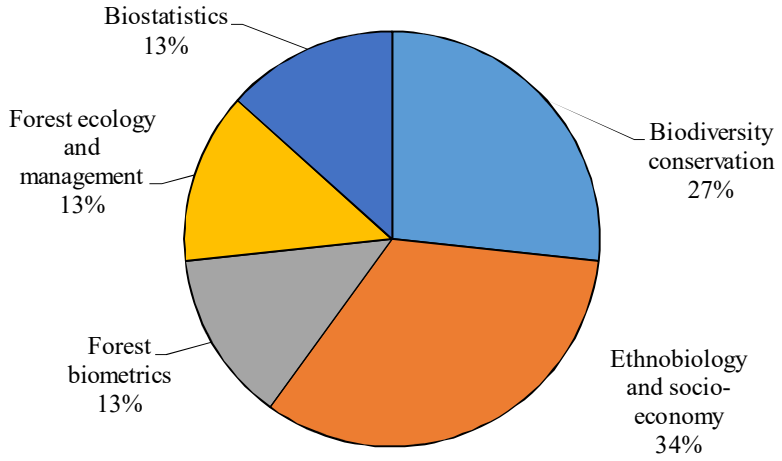

Figure 11: Articles published in journals without IF according to the main fields of research in 2016.

b) Articles in press

Most of the articles in press in LABEF in 2016 belong to Forest ecology and management field (46 %) followed by Ethnobotany (31 %) (Figure 12).

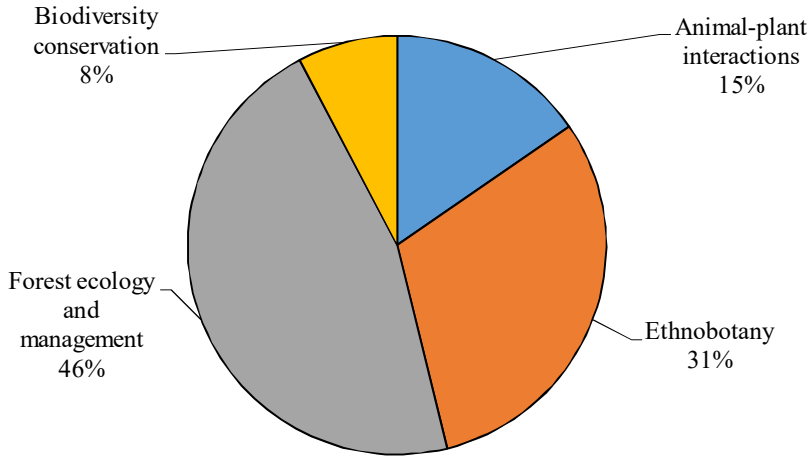

Figure 12: Articles in press according to the fields of research in 2016.

c) Articles under review

Researchers from LABEF submitted manuscripts which are under review in 2016. These manuscripts mainly belong to Agroforestry field (27 %) and Biodiversity and Socioeconomics research areas (20 % each) (See Figure 13).

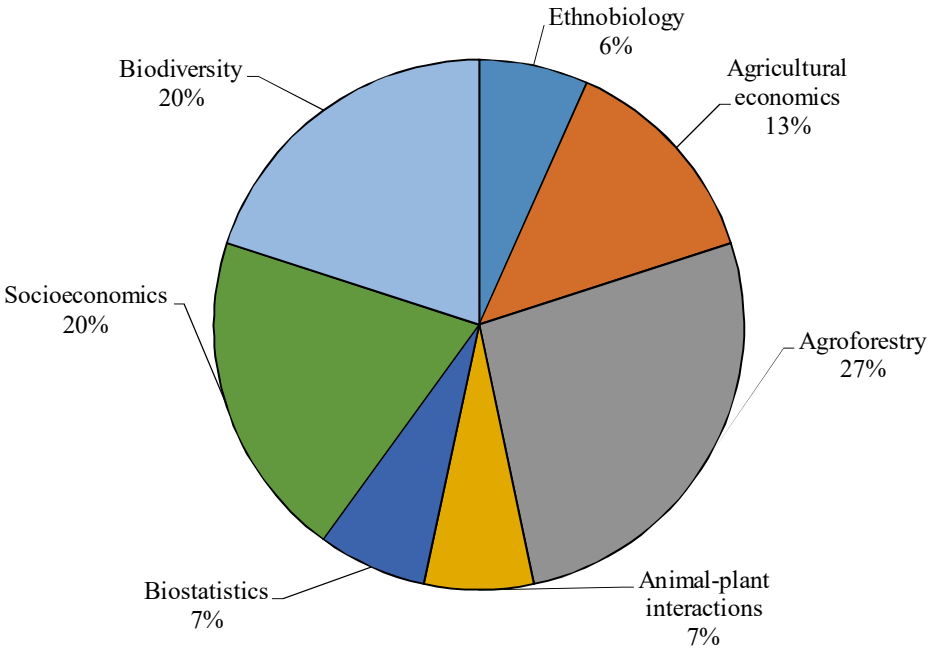

Figure 13: Articles under review according to the fields of research in 2016.

3.2.6. *Participation in international conferences and workshops*

LABEF has registered participation of several of its researchers to local and international conferences (Figure 14). The researchers of the Laboratory organized/hosted 11 conferences/workshop (among which a Humboldt Kolleg) and have taken part in some 13 International conferences/workshops in Africa and elsewhere. The lab representatives were mostly represented in conferences organized locally in Benin (39 %), and international conferences in Ghana (22 %) and Togo (13 %; Figure 14). About 2/3 of these conferences were held in Africa (Figure 15). Details related to these conferences/workshops are listed in appendix 1-11. Most of the conferences and seminars at which the researchers at LABEF have been fully or partially been supported by Local, regional or international organization and foundations. These seminars mainly addressed biodiversity conservation, species distribution, spatial patterns, animal-plant relationship, and environmentally friendly agriculture for livelihoods improvement.

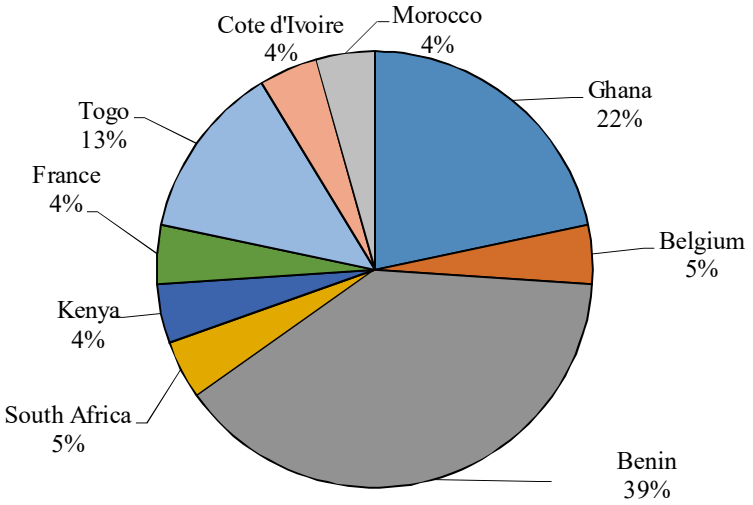

Figure 14: Level of participation of LABEF's researchers to workshops/conferences at a country level

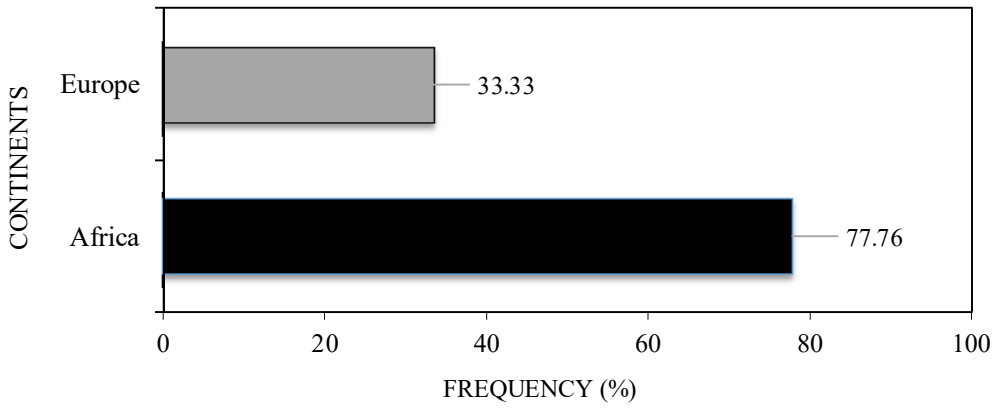

Figure 15: Level of participation to conferences/workshops at the continent level

Outcomes from the conferences have been often published in books of abstracts. Most of the published abstracts are of the field of Ethnobiology (Figure 16).

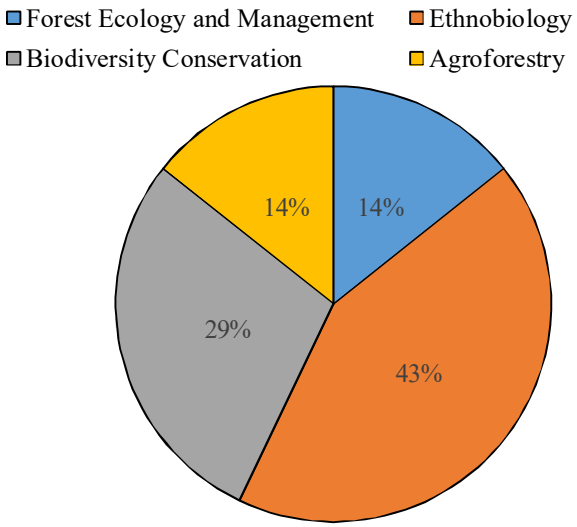

Figure 16: Indices of publications specialization in books of abstracts in 2016

3.3. Projects, promotion and awards

Research activities in LABEF were mainly funded by international foundations and institutions. Three main categories can be identified: small research grants (~56 %), Medium research grants and large research grants (~23 % each respectively). Those research grants were either national, regional or international cooperation projects (FNRSIT, Sustainable Cotton Production in Africa with Danish partners, Insect as feed for West Africa with Switzerland partners, integrated sweet potato weevil (*Cylasspp.* With Bill & Melinda Gates Foundation, promoting environmentally friendly practices for sustainable baobab leaves production with RUFORUM, etc.). Sixty percent of these supported projects are still ongoing (Figure 17). Most of the doctorate students and other researchers are involved in these projects. Details (objectives, status, etc.) on these projects and grants are described in appendices 1.12 and 1.13.

Two of LABEF researchers have received special award for outstanding young scientist: AGNES (African German Network for Excellence in Science; see appendix 1-14).

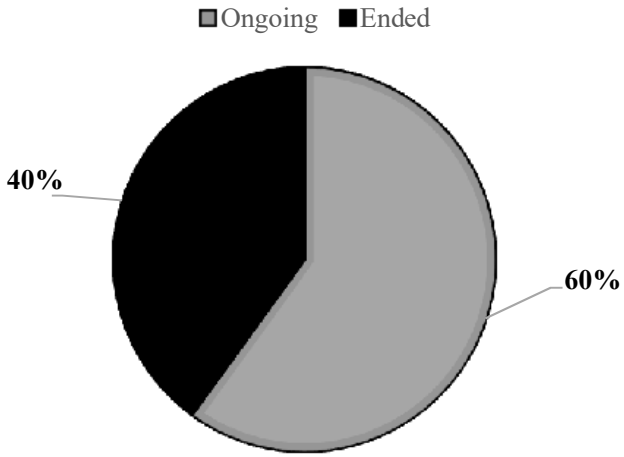

Figure 17: Status of grants managed by LABEF during the year 2016.

4. The master programme in Biostatistics

4.1. Overview

The Master programme in Statistics with major in Biostatistics offers an extensive and unique training in recent statistical methods and tools toward their applications in Life sciences. At the end of the training, graduated students can easily go into professional life as Biostatistician or engage in research in Biostatistics by integrating a doctoral school. This training is open to Bachelor Degree holders in Life Sciences domains (agronomy, health, biology, environment, etc.), or in Mathematics/Statistics or Master Degree holders wishing to acquire knowledge and know-how in the field of data collection and analysis. The Master in Biostatistics has fully trained a batch of students who defended their thesis) and is currently holding its 4th batch of students. Distribution of students according to years and nationalities are illustrated by Figures 17 and 18. From two nationalities for the first cohort (Togo and Benin), the programme includes twelve nationalities for the third cohort, indicating an expansion of the master scope in Africa (Figure 18).

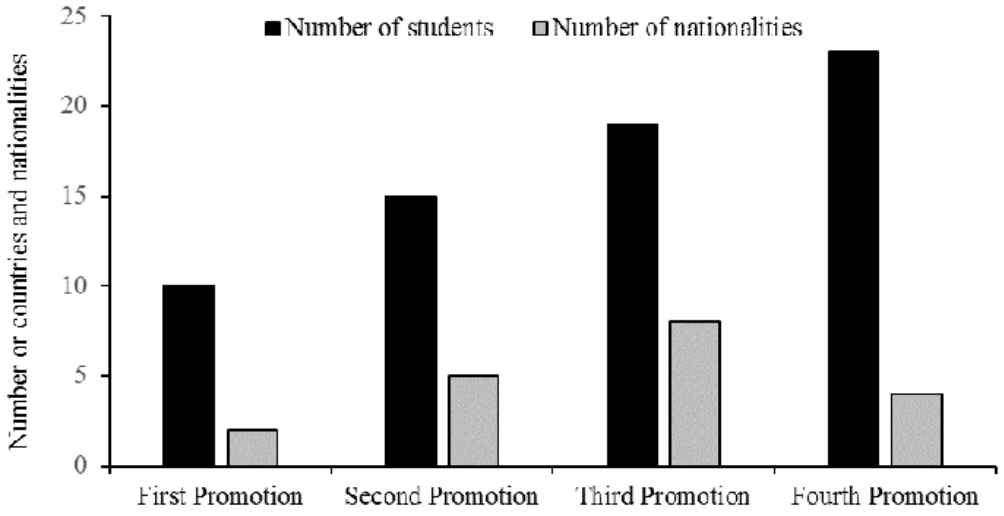

Figure 18: Number of students and nationalities involved in the master programme in Biostatistics.

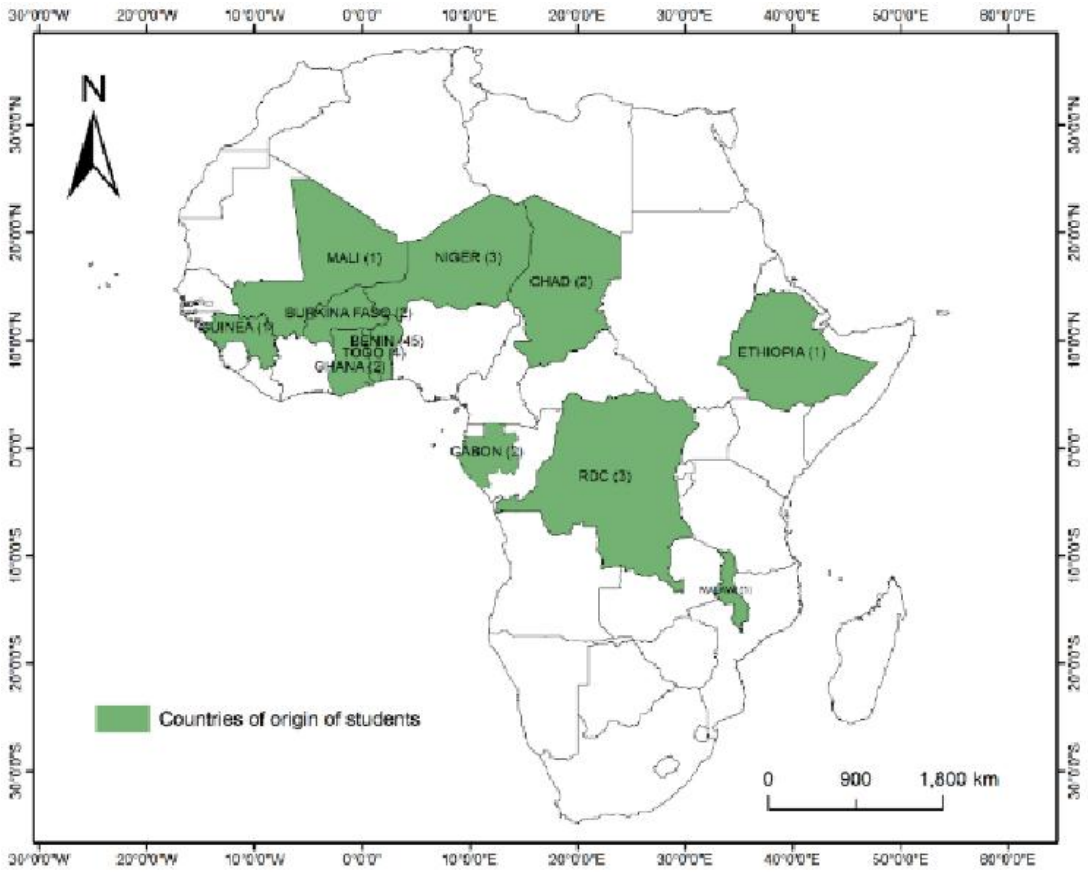

Figure 19: Geographic distribution of Africa showing the countries involved in the master programme.

The map of Africa showing the countries that have already participated in the training (Figure 19) reveals that several African sub-regions (East, Centre, South and West) are involved in the programme. However, very little participation of women (1 or 2) was noticed until 2016 where this number has increased fourfold. The programme is supported by an Intra-ACP Academic Mobility Programme (AGREEMENT NUMBER 2013-4177/001-001) and Ruforum who provide grants to students to register and follow the course.

4.2. What are Professional perspectives?

The field of Biostatistics is expanding. It deals with various sectors. The abilities this training gives in data collection, management, statistical analysis and valorization allow graduates to practice job of Biostatisticians in charge of Statistical Studies in various sectors. Biostatisticians are needed in Food Enterprises, Projects, Health Sector (Units of Clinical research), Department of Medical Information, etc.), Public and Private Research Institutions, Non-Governmental Organizations (NGO), International Organization (FAO, UNDP, World Bank, etc.); Education and International Research Institutions.

4.3. What are required conditions?

Applicants should hold a Bachelor or a Master degree in agronomic sciences, biological sciences, pharmaceutical sciences, environment sciences or mathematics. Admission to the training is based on the quality of application (and if necessary an interview). Selection takes into account academic records, professional experience, prerequisites in Statistics/Mathematics and Motivation.

4.4. How to apply?

Visit the website www.labef-uac.org and fill in the online application form (http://labef-uac.org/application).Candidates from Benin could submit their applications to the secretary of the programme, located at the Laboratory of Biomathematics and Forests Estimations.

4.5. Required documents

Required documents for the Master are as follows:

- Motivation letter (to the Coordinator of the Master)
- Certified copies of academic degrees
- Certified copies of academic transcripts
- Certified copy of the Certificate of Birth
- Curriculum vitae
- Program of the courses already followed by the applicant during his previous training.

5. Visiting researchers and Internships in LABEF

Contrary to previous year, Labef has recorded a high number of interns and trainers. However, the lab limited this number and was able to satisfay only 13 interns (both local and international students and researchers). Details of the trainees/interns are summarized in table 1 below.

Table 1. List of interns hosted by LABEF during the year 2016

Full name	Highest degree	Provenance	Duration of stay
HOUETOHOSSOU Ariane	BSc	Université d'Agriculture de Kétou, Bénin	6 months
DOGBO Flora	BSc	Ecole Nationale des Sciences et Techniques Agricoles de Djougou, Bénin	8 months
OROUNLA Rachidath	BSc	Université d'Agriculture de Kétou, Bénin	8 months
TAHI Souand	BSc	Université d'Agriculture de Kétou, Bénin	6 months
AGOUNDE Gafarou	BSc	Université d'Agriculture de Kétou, Bénin	6 months
ANATO Lognidé Serge Eunock	BSc	Faculté des Sciences Agronomiques, Université d'Abomey-Calavi, Bénin	6 months
LOKOSSOU Elisée	BSc	Faculté des Sciences Agronomiques, Université d'Abomey-Calavi, Bénin	6 months
DEGBELO Ismax Sononkpon Terrence	BSc	Faculté des Sciences Agronomiques, Université d'Abomey-Calavi, Bénin	6 months
DOSSOU-YOVO Cornille Perlet Sèdoté	BSc	Faculté des Sciences Agronomiques, Université d'Abomey-Calavi, Bénin	6 months
DOKOU Frumence Paterne Sènami	BSc	Faculté des Sciences Agronomiques, Université d'Abomey-Calavi, Bénin	6 months
SESSOU Orion	BSc	Faculté des Sciences Agronomiques, Université d'Abomey-Calavi, Bénin	6 months
Dr SANE Seyni	PhD	Université Cheik-Anta Diop, Sénégal	1 month
Dr Bassiaka Ouattara	PhD	Université Joseph Ki-Zerbo Ouaga 1, Burkina-FASO	3 months

6. Scientific seminars at LABEF

Seven free-of-charge scientific seminars took place at LABEF during the year 2017. The areas covered include biomass modelling, statistical methods and their application in R (decision tree analysis and **Common components and specific weights analysis), plant breeding and** crop improvement, population dynamics in the context of **non-timber forest products harvesting and ethics (plagiarism).** Table 2 summarizes the details of the scientific seminars hosted at LABEF in the year 2016 while figures 20 and 21 show pictures of participants and lecturers at two of the seminars. Appendix 6 presents the abstracts of the topic presented during those seminars.

Figure 20: Family picture of participants to the training on « Decision trees analysis: Principles and application in Biological Sciences » March 2016.

Figure 21: Dr. David Cross giving lecture to participants to the training on the topic: « Application of mixed model analysis for crop improvement: prediction of genetic values with BLUP and Bayesian methods », April 2016

Table 2. Details of scientific seminars hosted at LABEF in the year 2016

n°	Presenters	Date	Topic	Affiliations	Contacts
1	Mr. Ablo Paul Igor Hounzandji	January	*Models of biomass and mineralomass for forest management: what progress?*	- Université catholique de Louvain, Belgique - Laboratoire de Biomathématiques et d'Estimations Forestières, Université d'Abomey-Calavi, Bénin	*ablo.hounzandji@uclouvain.be, pauligor29@gmail.com,*
2	Dr. Ir. Valère K. SALAKO & Prof. Dr. Ir. Romain GLELE KAKAÏ	March	*Decision Tree Analysis: Principles and Applications in Biological Sciences (as part of UAC's Innovation Week)*	- Laboratoire de Biomathématiques et d'Estimations Forestières, Université d'Abomey-Calavi, Bénin	salakovalere@gmail.com gleleromain@gmail.com
3	Dr. David CROS	April	*Application of mixed model analysis for crop improvement: prediction of genetic values with BLUP and Bayesian methods*	- CIRAD – Cameroun	david.cros@cirad.fr
4	Tchandao MANGAMANA, & Prof. Romain GLELE KAKAÏ	May	*Common components and specific weights analysis: application in R*	- University of Kara - Laboratoire de Biomathématiques et d'Estimations Forestières, Université d'Abomey-Calavi, Bénin	tchanesso@yahoo.fr gleleromain@gmail.com
5	Dr. Orou G. Gaoué	June	*Heterogeneity and population response to non-timber forest products harvesting*	- Department of Botany, University of Hawaii at Manoa, Honolulu, HI, USA	ogaoue@gmail.com
6	Mr. Eric E. AGOYI & Mr. Fréjus A.K. SODEDJI	July	*Principles of plant breeding: overview, case studies, applications in conservation strategies, and promotion of agroforestry practices*	- Makerere University, Uganda	ericagoyi@gmail.com frejusariel@gmail.com
7	Dr. es sc. agr. Guy Apollinaire MENSAH	November	*Plagiarism in the documents of valorization of the results of scientific research*	- National Institute for Agronomic Research (INRAB)	ga_mensah@yahoo.com, mensahga@gmail.com

7. General discussion and conclusion

Various types of publications were produced by researchers in 2016 as it was the case in previous years. From year to year, researchers from LABEF try to publish more papers in journals with impact factor. The global trend of published papers in peer review journals in LABEF, is increasing since 2009 (when first members have started working together). This can be explained by the increase of researchers, research projects and grants for holding a doctorate thesis, doctorate students and MSc students since 2009. Indeed, with more projects and grants, more papers were published with lower cost per publication and impact factor unit. It is also due to the increase in collaborations and partnerships with outstanding international Universities (E.g. University of Kansas in USA, University of Stellenbosch in South Africa, etc.). The number of published articles in journals with Impact Factor has considerably increased since 2009. This means that researchers are improving their publication skills and the quality of their investigation.

Another reason for this is the change in the requirements before defending a doctorate thesis at the Faculty of Agronomic Sciences which hosts LABEF (i.e. having published in the time frame of the doctorate studies at least 2 original research papers). As such, the scientific capacity of research teams in the laboratory is high. Published articles in 2016 were mostly produced at African level (76 % of them are mainly Beninese).

Agroforestry and Forest Ecology and management are currently the main fields producing scientific publications in the laboratory.

The Master in Biostatistics has fully trained a batch of students who defended their theses and is currently holding its 3rd batch of students. Trends of the origin of students involved showed an interesting variability and a good coverage of African regions. This is really promising and reveals a relatively good sharing of the programme across Africa. However, for the coming years, an increase in the current number of nationalities being involved would denote the trust in the programme and its successfulness in capacity building.

For now, little scientific collaboration are ongoing with scientists from Latino America, Australia, Middle East and northern Africa. This is due to the fact that few of LABEF researchers travelled to these parts of the world and did not really connect with researchers for scientific collaborations. Moreover, since 2009, articles have been mostly published with researchers from Africa than elsewhere. As such, regional scientific collaborations should be maintained while international collaborations should be really encouraged for more scientific impact and more achievement for next years.

The laboratory hosted 13 researchers for internships in 2016. Those researchers were all from the West African regions. This is relatively low compared to the laboratory expectations but constitutes a good starting for a new institution and should be highly encouraged in the coming years as it will increase visibility of the laboratory.

Acknowledgements

We would like to thank all the great contributors to the current report especially the different heads of Research-Units from the Laboratory.

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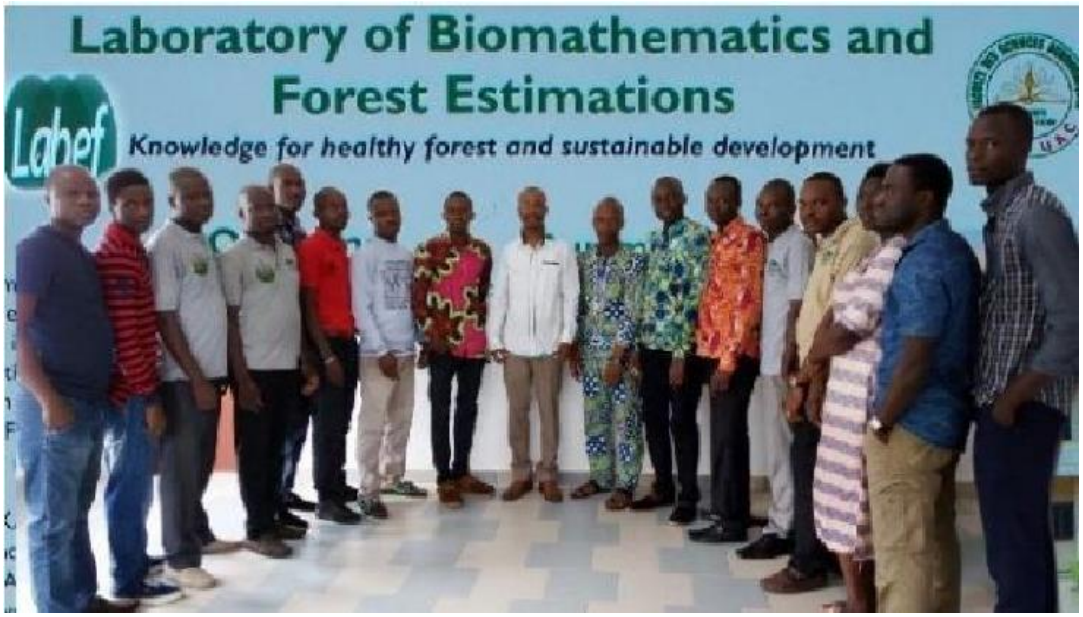
Appendices



Group photo of some members of LABEF

Appendix 1: Scientific activities report of the Laboratory of Biomathematics and Forest Estimations (LABEF)

Appendix 1-1: Ongoing PhD thesis

N°	Student full name	Level	Research topics	Field of Research
1	Donou Hounsode Marcel	4th year	Usage, Ecologie et Biologie de la Conservation des palmiers raphias au Bénin (Afrique de l'Ouest)	*Forest resources management*
2	Sinasson S. K. Gisèle	4th year	Ethnobotany and Ecology of *Mimusops andongensis* Hiern and *Mimusops kummel* Bruce ex A. DC: implications for the species management and conservation in Benin (West Africa)	*Ethnobotany, Plant ecology and conservation*
3	Akpona T. Jean Didier	3rd year	Biodiversity, Prioritization, population ecology and conservation of woody plant species in Benin (West Africa)	*Forest resources management*
4	Kisito Gandji	3rd year	Modelling ethnobotanical patterns of *Moringa oleifera* Lam. in Benin (West Africa)	Ethnobotany
5	Eclou Innocent	2nd year	Assessment and analysis of agro-ecological aspects of cotton farming systems for a sustainable cotton production in Benin.	*Environmental chemistry and agronomy*
6	Atanasso A. Justin	2nd year	Effects of abiotic and biotic factors on the early recruitment of the threatened *Afzelia africana* Sm. ex Pers. (Fabaceae-Ceasalpinioideae) in the Pendjari Biosphere Reserve (Benin, West Africa)	*Conservation biology*
7	Gnonlonfoun Isidore	1st year	Dynamics of savanna plants: effects of trophic interactions between elephants and woody plants in Pendjari Biosphere Reserve in Benin, West Africa	*Savanna ecology, Population ecology*
8	Houndonougbo S. H. Juliano	1st year	Ecology, conservation and domestication of the African locust bean tree *Parkia biglobosa* (Jack.) R. Br. (Mimosaceae) in Benin, West Africa	*Conservation biology*
9	Kenou Christel	1st year	Conservation and domestication of *Garcinia kola* and *Garcinia afzelii* (Clusiaceae) in Benin under climate change	*Climate change,*
10	Amagnide G. A. Y. Guénolé	1st year	Empirical comparison of plotless sampling techniques in vegetation studies	*Biometry*

Appendix 1-2: Ongoing Master degree in 2016

N°	Student full name	Research topics	Field of Research
01	Tovissode C. Frédéric	Empirical performance of stochastic EM algorithms in non-linear mixed models with flexible random-effects distributions: toward a guided framework for mixed modeling	*Biostatistics*
02	Honfo S. Hermann	Extension of EM Algorithm for fitting Non-linear Mixed Effects models: Improved Laplace Approximation-EM Algorithm	*Biostatistics*

Appendix 1-3: Articles published in peer-review journal with IF in 2016

Disciplines	N°	Authors' Names	Title of the article	Journals	Impact Factor
Environmental science	1	Adjahossou S. G. C.; Gouwakinnou G. N.; Houehanou D. T.; Sode, A. I.; Yaoitcha A. S.; Houinato M. R. B.; Sinsin B.	Efficacité des aires protégées dans la conservation d'habitats favorables prioritaires de ligneux de valeur au Bénin	*.Bois et Forêts des Tropiques 3 2 8 (2), 67 – 76*	0.192
Environmental science	2	Sèwadé C., Azihou A. F., Fandohan A. B., Houéhanou D. T., Houinato M.	Diversité, priorité pastorale et de conservation des ligneux fourragers des terres de parcours en zone soudano-guinéenne du Bénin	*Biotechnologie, Agronomie, Societé et Environnement* 20 (2), 113-129.	0.457
Plant morphology	3	Hounkpèvi A., Azihou A. F., Kouassi K. E., Porembski S. & Glèlè Kakaï R.	Climate- induced morphological variation of black plum (*Vitex doniana* Sw.) in Benin, West Africa	*Genetic Resources and Crop Evolution* 63(6): 1073-1084.	1.258
Ethnobiology	4	Gbedomon R. C., Assogbadjo A. E., Salako V. K., Fandohan A. B., Glèlè Kakaï R.	Exploring the spatial configurations of home gardens in Benin.	*Scientia Horticulturae 213: 13–23.*	1.538
Social forestry and Socio-economy	5	Gbedomon C. R., Floquet A., Mongbo R., Salako K. V., Fandohan A. B., Assogbadjo A., Glèlè Kakaï R.	Socio-economic and ecological outcomes of community based forest management: A case study from Tobé-Kpobidon forest in Benin, Western Africa.	*Forest Policy and Economics 64: 46–55*	2.00
Conservation	6	Agbahoungba S., Assogbadjo A. E., Chadare F. J., Idohou R., Salako V. K., Agoyi E. E., Glèlè Kakaï R. L. 2016.	Ecological diversity and conservation of Wild Edible Fruit Trees species in the Lama Forest Reserve in Benin (West Africa).	*Bois et Forêts des Tropiques* 329 (3): 53-65.	0.192
Forest biometrics	7	Mensah S., Assogbadjo A., Salako V. K., Ago E., Glèlè Kakaï R. 2016.	Accounting for tree spatial distribution in a comparison of plot sizes and shapes in dense forest and woodland in Benin (West Africa)".	*African Journal of Ecology* 54: 87–94.	0.80
Plant ecology	8	Sinasson Sanni G. K., Shackleton C. M., Glèlè Kakaï R. L., and Sinsin, B.	Forest degradation and invasive species synergistically impact *Mimusops andongensis* (Sapotaceae) in Lama Forest Reserve	*Biotropica*	1.944
Ecosystem Management	9	Shackleton C. M., Ruwanza S., Sinasson Sanni G. K. et al.	Unpacking Pandora's Box: Understanding and Categorising Ecosystem Disservices for Environmental Management and Human Wellbeing	*Ecosystems*	3.751
Forest modelling	10	Mensah S., Veldtman R., Seifert T.	Allometric Models for Height and Above Ground Biomass of Dominant Tree Species in South African Mistbelt Forests.	Southern Forests: a Journal of Forest Science	0.696

Disciplines	N°	Authors' Names	Title of the article	Journals	Impact Factor
Functional ecology	11	Mensah S., Glèlè Kakaï R., Seifert T.	Patterns of biomass allocation between foliage and woody structure: the effects of tree size and specific functional traits.	*Annals of Forest Research*	0.741
Forest precision	12	Mensah S., Assogbadjo A. E., Salako V. K., Ago E. E., Glèlè Kakaï R.	Accounting for tree spatial distribution in a comparison of plot shapes and sizes in dense forest and woodland in Benin (West Africa).	*African Journal of Ecology*	0.875
Biodiversity and Conservation	13	Mensah S., Houéhanou T. D., Assogbadjo A. E., Anyomi K. A., Ouedraogo A. & Glèlè Kakaï R.	Latitudinal variation in the woody species diversity of Afzelia africana Sm. habitats in West Africa	*Tropical Ecology*	0.887
Forest ecology	14	Mensah S., Veldtman R., Ben du Toit, Glèlè Kakaï R. & Seifert T.	Aboveground biomass and carbon in a South African Mistbelt forest, and the relationship with tree species diversity and forest structures.	*Forests*	1.583
Functional ecology	15	Mensah S., Ruan Veldtman, Assogbadjo A. E., Glèlè Kakaï R. & Seifert T.	Tree species diversity promotes tree carbon storage through functional diversity and dominance.	*Ecology & Evolution*,	2.537

Appendix 1-4: Articles published in peer-review journal without IF in 2016

Disciplines	N°	Authors' Names	Title of the article	Journals
Conservation	1	Gbedomon R. C., Salako V. K., Chadare F. J., Glélé Kakaï R. & Assogbadjo A. E.	Gendered motivation for home gardening and maintenance of Agrobiodiversity: a case study in Benin, west Africa	*Annales des Sciences Agronomiques 20 (2) : 93-106, 2016*
Ethnobotany	2	Donou H. M. T., Assogbadjo A. E., Houehanou D. T., Glèlè kakaï R. L., Agbangla C.	Facteurs socio-économiques influençant l'usage des raphias au Benin (Afrique de l'Ouest).	*Revue CAMES Science de la vie, de la terre et agronomie* 4 (2), 1-17
Ethnobotany	3	Houehanou D. T., Assogbadjo A. E., Chadare F., Zanvo S., Sinsin B.	Approches méthodologiques synthétisées des études d'ethnobotanique quantitative en milieu tropical.	*Annales des Sciences Agronomiques* 20, 187-205.
Species distribution modelling	4	Hounkpèvi A., Tosso F., Gbèmavo D. S. J. C., Kouassi E. K., Koné D. & Glèlè Kakaï R.	Climate and potential habitat suitability for cultivation and in situ conservation of the black plum (*Vitex doniana* Sweet) in Benin, West Africa	International Journal of Agronomy and Agricultural Research 8(4): 67-80.
Predictive Biogeography	5	Moutouama J. K, Fandohan A. B, Biaou S. S. H, Amahowe O. I, Moutouama F. T, Natta A. K.	Potential climate change favored expansion of a range limited species, *Haematostaphis barteri* Hook f.	*Journal of Agriculture and Environment for International Development 110 (2): 397-411*
Ecology	6	Camara M., Gbemavo D. S. J. C.., Salako V. K., Kouame F. N., Sambou B., Glèlè Kakaï R. L.	Woody plant species diversity in the last wild habitat of the Derby Eland (*Taurotragus derbianus derbianus* Gray, 1847) in Niokolo Koba National Park, Senegal, West Africa.	*International Journal of Biodiversity Conservation 8(2): 32-40*

Disciplines	N°	Authors' Names	Title of the article	Journals
Ethnobiology	7	Pomalégni S. C. B., Gbemavo D. S. J. C., Kpadé C. P., Babatoundé S., Chrysostome C. A. A. M., Koudandé O. D., Kenis M., Glèlè Kakaï R. L., Mensah G. A.	Perceptions et facteurs déterminant l'utilisation des asticots dans l'alimentation des poulets locaux (Gallus gallus) au Bénin.	*Journal of Applied Biosciences* 98:9330 – 9343
Ethnobiology	8	Alohou E. C., Gbemavo D. S. J. C., Ouinsavi C., Sokpon N.	Local perceptions and importance of endogenous beliefs on sacred groves conservation in South Benin.	*International Journal of Biodiversity Conservation*
Biostatistics	9	Glèlè Kakaï R., Salako V. K., Padonou E. A., Lykke A. M. 2016.	Méthodes statistiques multivariées utilisées en écologie.	*Annales des Sciences Agronomiques* 20: 139-157.
Biostatistics	10	Glèlè Kakaï R., Salako V. K., Lykke A. M. 2016.	Techniques d'échantillonnage en étude de végétation.	*Annales des Sciences Agronomiques* 20 : 1-13.
Forestry	11	Akpona T. J. D., Idohou R., Assogbadjo A., Salako K. V., Glèlè Kakaï R.	History, Impact of Soil Types on Stand Structure and growth of the Dry Zone Mahogany (*Khaya senegalensis* (Desr.) A.Juss.) in Plantation in Benin (West Africa)	*Environment and Ecology Research 4(4): 193-199*
Forest methods	12	Glèlè Kakaï R., Salako V. K., Padonou E. A., Lykke A. M.	Méthodes statistiques multivariées utilisées en écologie.	*Annales des Sciences Agronomiques 19(1) : 9-26.*

Appendix 1-5: Articles in press in peer-review journal with IF 2016

Disciplines	N°	Authors' Names	Title of the article	Journals	Impact Factor
Animal-plant interactions	1	Houndonougbo J., Idohou R., Salako V. K., Fortune A. A., and Glèlè Kakaï R.	Local perceptions of elephant-*Borassus aethiopum* (Arecaceae) interactions in the Pendjari National Park in Benin	*Bois et Forêts des Tropiques 331(1): 33-43*	0.192
Ethnobotany	2	Assogba G. A., Fandohan A. B., Salako V. K., Assogbadjo A. E.	Ethnobotanique de *Bombax costatum* (Malvaceae) dans les terroirs riverains de la Réserve de Biosphère de la Pendjari, Bénin.	*Bois et Forêts des Tropiques xx-xxx*	0.192
Forest ecology and management	3	Gandji K., Salako V. K., Assogbadjo A. E., Orekan V. O. A., Glèlè Kakaï R. L., Sinsin B.	Evaluation of the sustainability of participatory management of forest plantations: The Case study of the Wari-Maro Forest Reserve, Benin (West Africa).	*Southern Forests: a Journal of Forest Science*	0.696
Animal-plant interaction	4	Salako V. K., Houéhanou T. T., Yessoufou K., Assogbadjo A. E., Akoègninou A., Glèlè KakaïR. L.	Patterns of elephant utilization of *Borassus aethiopum* Mart. and its stand structure in the Pendjari National Park, Benin, West Africa.	*Tropical Ecology*	0.887
Forest Ecology and management	5	Assogbadjo A. E., Mensah S., Glèlè Kakaï R.	The relative importance of climatic gradient versus human disturbance in determining population	Southern Forests: a Journal of Forest Science	0.696

Disciplines	N°	Authors' Names	Title of the article	Journals	Impact Factor
			structures of *Afzelia africana* Sm. ex Pers. in West Africa		
Ecosystem services	6	Mensah S., Veldtman R., Seifert T.	Potential supply of floral resources to managed honey bees in natural mistbelt forests	Journal of Environmental Management	3.131
Ecosystem services	7	Mensah S., Veldtman R., Assogbadjo A. E., Ham C., Glèlè Kakaï R., Seifert T.	Ecosystem service importance and use vary with socio-environmental factors: A study from household-surveys in local communities of South Africa	Ecosystem Services	4.307
Forestry	8	Akpona T. J. D., Glèlè Kakaï R., Akpona A. H., Assogbadjo A.	Biodiversity, ethnobotanical knowledge and socioeconomic factors supporting local people's choice of woody plants species in Benin (West Africa)	*Sourthern Forest*	0.612
Ecology	9	Akpona T. J. D., Assogbadjo A., Fandohan B. Glèlè Kakaï R.	Inventory and prioritization of logged timber species for conservation and sylviculture in Benin: A multicriteria approach.	*Bois et Forêts des Tropiques*	0.192

Appendix 1-6: Articles in press in peer-review journals without IF in 2016

Disciplines	N°	Authors' Names	Title of the article	Journals
Conservation Biology	1	Gbemavo D. S. J. C., Gandji K., Gnangle P. C., Assogbajo A. E., Sokpon N., Glèlè Kakaï R. L.	*Adaptation écologique et modélisation du rendement du Jatropha curcas L. en fonction des caractéristiques morphologiques le long d'un gradient climatique*	*Agronomie Africaine*

Appendix 1-7: Articles under review in peer-review journal with IF in 2016

Disciplines	N°	Authors' Names	Title of the article	Journals	Impact Factor
Plant ecology	1	Hounkpèvi A., Kouassi K. E. & Glèlè Kakaï R.	Effects of climatic variability and local environment patterns on the occurrence and population structure of African black plum (*Vitex doniana* Sweet)	*Tropical ecology*	1.126

Disciplines	N°	Authors' Names	Title of the article	Journals	Impact Factor
Traditional ecological knowledge	2	Hounkpèvi A., Fandohan A. B., Kouassi K. E., Kouamé N. F. & Glèlè Kakaï R..	Use values and traditional ecological knowledge on impacts of climate change on the black plum (*Vitex doniana* Sweet)	*Journal of Ethnobiology*	1.273
Ethnobiology	3	Fandohan A. B., Chadare F. J., Gouwakinnou N. G, Tovissode C. F, Bonou A., Djonlonkou F. S., Houndelo L. F. H., Sinsin C. L. B., Assogbdjo A. E.	Usages traditionnelles et valeur économique de *Synsepalum dulcificum* (Schumach. & Thonn.) Daniell	*Bois et Forêts des Tropiques*	0.192
Management of Natural Resources and Animal Nutrition	4	Pomalégni S. C. B., Gbemavo D. S. J. C., Gnanglè P. C., Djossou S. R., Kenis M., Babatoundé S., Glèlè Kakaï L. R, and Mensah G. A.	Seed cake of *Jatropha curcas* (L.), potential substrate to produce maggots as food for reared monogastric animals.	*The Journal of Animal & Plant Sciences (JABS)*	0.422
Geostatistics	5	Hounmenou C. G., Savi M. K., Romain L. Glèlè Kakaï	Ripley's approach for trees spatial structure analysis : Theory and application in R.	*Journal of Vegetation Science*	3.151
Pharmacometrics	6	Hounmenou C. G., Allabi A. C. Glèlè Kakaï R. L	Parameter estimation in nonparametric nonlinear mixed effect model: application to sparse data from population pharmacokinetic	*Pharmaceutical Statistics*	1.235
Agroforestry	8	Salako V. K., Kénou C., Dainou K., Assogbadjo A. E., Glèlè Kakaï R.	Impacts of human disturbances and ecological variation on spatial patterns and neighbourhood distance of the agroforestry palm *Borassus aethiopum* Mart. in Benin, West Africa	*Agroforestry systems*	0.910
Agroforestry	9	Gbedomon R. C., Salako V. K, Adomou A., Glèlè kakaï R., Assogbadjo A. E.	Revisiting the efficacy of home gardens in biodiversity conservation: a case study from Benin, West-Africa.	*Biodiversity and Conservation*	2.258
Climate change	10	Salako V. K., Vihotogbé R., Houéhanou T., Sodé I., Glèlè Kakaï R.	Predicting the potential impact of climate change on the declining agroforestry species *Borassus aethiopum* Mart. in Benin: a mixture of geostatistical and SDM approach.	*Agroforestry systems*	0.910
Agroforestry	11	Goudegnon O. A. E., Salako V. K., Gouwakinnou N. G., Oumorou M.	Morphological variation in trees, fruits and seeds traits of *Lannea microcarpa* in the Sudanian zone of Benin, West Africa: implication for its domestication.	*BASE*	0.457
Ethnobotany and ethnoecology	12	Sanni S. G. K., Shackleton C. M., Assogbadjo A. E. and Sinsin B.	Local Knowledge on the Uses, Habitat and Change in Abundance of Multipurpose *Mimusops* Species in Benin	*Economic Botany*	1.109
Climate change	13	Sinasson S., G. K, Shackleton, C. M., and Sinsin B.	Reproductive phenology of two *Mimusops* species in relation to climate, tree diameter and canopy position in Benin (West Africa)	*African Journal of Ecology*	0.875

Disciplines	N°	Authors' Names	Title of the article	Journals	Impact Factor
Conservation Biology	14	Gandji K., Salako V. K., Tovissodé Frédéric C., Assogbadjo Achille E., Glèlè Kakaï Romain L.	Morphological diversity of the agroforestry species *Moringa oleifera* Lam. as related to ecological conditions and farmers' management practices in Benin (West Africa)	*Agroforestry systems*	0.910

Appendix 1-8: Articles under review in peer-review journal without IF in 2016

Disciplines	N°	Authors' Names	Title of the article	Journals
Ethnobotany	1	Pomalégni S. C. B., Gbemavo D. S. J. C., Kpadé C. P., Kenis M., Mensah G. A.	Traditionnal use of fly larvae by small poultry farmers in Benin	*Journal of Insects as Food and Feed*
Agricultural Economics	2	Sodjinou E., Mongbo L. R., Chikou Arsène F. M., d'Ameida A.	The role of Farmer-to-Farmer education in promoting productivity in Fish Farming in West Africa	*Aquaculture Economics & Management*
Agricultural Economics	3	Sodjinou E.	Role of education in fish farming efficiency improvement: Evidence from Benin	*Aquaculture Research,*
Agricultural Economics	4	Sodjinou E.	Does Peer Training Improve Small-Scale Productivity? Evidence from Fish Production Units in Benin, West Africa	*Agricultural Economics*
Agricultural Economics	5	Sodjinou E., Mongbo L. R.	Effect of feeding practices on small-scales fish farming efficiency in Benin, West Africa	*Aquaculture*
Ethnobotany	5	Atanasso J. A., Chadare F. J., Padonou E. A. [1], Ahouansikpo E., Koura K., Houehanou T., Assogbadjo A. E. and Sinsin B.	Habitats and utilizations of *Lippia multiflora* Moldenke: a local perception of four ethnic groups in Benin (West Africa)	*Agronomie Africaine*
Plants Management and conservation	6	Atanasso J. A., Padonou E. A., Ahouansikpo E., Koura K., Chadare F. J., Houehanou T., Assogbadjo A. E. and Sinsin B.	Caractérisation écophénotypique de *Lippia multiflora* Moldenke au Bénin (Afrique de l'Ouest)	*BASE*

Appendix 1-9: Abstracts in books of abstracts in 2016

Field of research	N°	Authors' Name	Title	Full References
Production systems and climate change mitigation	1	Hounkpèvi A., Kouassi E. K., Koné D. & Glèlè Kakaï R. 2016.	Impacts of climate change on the potential habitat suitability for cultivation and conservation of the black plum (*Vitex doniana* Sweet) in Benin.	Hounkpèvi, A., Kouassi, E. K., Koné, D. & Glèlè Kakaï R. 2016. Impacts of climate change on the potential habitat suitability for cultivation and conservation of the black plum (*Vitex doniana* Sweet) in Benin. Abstracts book of the first edition of the International congress of *Association Ivoirienne des Sciences*

Field of research	N°	Authors' Name	Title	Full References
				Agronomiques (AISA), Yamoussoukro-Côte d'Ivoire, 16-20 February 2016.
Climate change	2	Salako V. K., Vihotogbé R., Assogbadjo A., Glèlè Kakaï R.	Predicting the potential impact of climate change on the declining agroforestry species *Borassus aethiopum* Mart. in Benin: a mixture of geostatistical and SDM approach	Humboldt Kolleg – Utilizing and conserving natural resources under climate change in Africa, Ouidah, Republic of Benin, 5-7 December 2016.
Ethnobotany and ethnoecology	3	Sinasson G. K. S., Shackleton C. M., Assogbadjo A. E., Sinsin B.	Local knowledge on the uses, habitat and abundance of multipurpose *Mimusops* species in Benin (West Africa)	Book of Abstracts, Page 46. Society for Economic Botany (SEB) Conference on "Cultural Resilience and Resource extraction: Preserving Plants and People of Degraded Ecosystems".
People and social	4	Arodokoun U., Odoulami R., Idohou R.	Méthodes d'animation et d'intervention en milieu réel. Village de Hinvi Dovo, Commune d'Allada au Sud-BENIN	Editions Universitaires Européennes. 20 p
Animal-plant interactions	5	Salako V.K., Glèlè Kakaï R.	Stand-level spatial analysis of elephants-induced damages predicts spatial isolation in the dioecious palm *Borassus aethiopum Mart. (Arecaceae)* in the Pendjari National Park	Tropical Biology Association Alumni Group (TAAG) conference, 9-12 June 2016. Accra, Ghana. Oral communication.
Agricultural Economics	6	Dossou G., Aihounton B., Sodjinou E., Floquet A., Yabi J. A., Mongbo R.	Coton biologique ou coton conventionnel : que choisir ? Analyse à partir des réalités du terrain au Centre et Nord Bénin	JSIL 2016
Humboldt Kolleg	7	Akpona T. J. D., Glèlè Kakaï R.	Biodiversity, ethnobotanical knowledge and socioeconomic factors supporting local people's choice of woody plants species in Benin (West Africa).	Biodiversity, ethnobotanical knowledge and socioeconomic factors supporting local people's choice of woody plants species in Benin (West Africa). Book of abstract on Utilizing and Conserving Natural Resources under Climate Change in Africa. P29.
GEOBON Open science conference	8	Akpona T. J. D.	Capacity building, prioritization and definition of biodiversity monitoring indicators in Benin.	Capacity building, prioritization and definition of biodiversity monitoring indicators in Benin. Book of abstracts of GEOBON Open Science conference.
Biostatistics	9	Sero B. N.	Methods of contrast analysis for optimization: a preliminary review for a simulation study (unpublished)	-
Climate change	10	Idohou R., Assogbadjo A., Glèlè Kakaï R.	Knowledge gaps of wild palms	Humboldt Kolleg – Utilizing and conserving natural resources under climate change in Africa, Ouidah, Republic of Benin, 5-7 December 2016.

Appendix 1-10: Technical Reports and books in 2016

Field of research	N°	Authors' Name	Title	References
Climate smart agriculture	1	Kénou C.	Overview of interesting extension services for climate smart agriculture in West Africa	Overview of interesting extension services for climate smart agriculture in West Africa. In Sala S, Rossi F, David S. (Eds) Supporting agricultural extension towards Climate-Smart Agriculture: An overview of existing tools. FAO, Italy p. 28-30.
Agricultural Economics	2	Sodjinou E.	Guide pratique d'analyse financière d'une entreprise agricole : Théorie et application à la pisciculture	SODJINOU E. (2016). Guide pratique d'analyse financière d'une entreprise agricole : Théorie et application à la pisciculture. Bibliothèque Nationale, Porto-Novo, 64p.
Socioeconomics	3	Sodjinou E., d'Almeida A. F. M., Mensah G.A., Hessavi P., Adjile A., Chikou A., Ahounenou J., Mongbo R.L., Houssou P., Adegbola P.Y.	Aliments, ressources alimentaires et pratiques de nourrissage dans les exploitations piscicoles du Sud-Bénin	Sodjinou E., d'Almeida A. F. M., Mensah G. A., Hessavi P., Adjile A., Chikou A., Ahounenou J., Mongbo R. L., Houssou P., Adegbola P. Y. (2016). Aliments, ressources alimentaires et pratiques de nourrissage dans les exploitations piscicoles du Sud-Bénin. Institut National des Recherches Agricoles du Bénin, Bibliothèque Nationale, Porto-Novo, 50 p.
Socioeconomics	4	Chikou A., Sodjinou E., d'Almeida A. F. M., Mensah G. A., Adjile A., Mongbo R. L., Ahounenou J., Houssou P., Adegbola P.Y.	Comment produire à coût réduit des aliments à base de vers de terre destinés à nourrir les poissons d'élevage au Bénin ?	Chikou A., Sodjinou E., d'Almeida A. F. M., Mensah G. A., Adjile A., Mongbo R. L., Ahounenou J., Houssou P., Adegbola P. Y. (2016). Comment produire à coût réduit des aliments à base de vers de terre destinés à nourrir les poissons d'élevage au Bénin ?, Bibliothèque Nationale, Porto-Novo, 44p.
Biodiversity	5	Akpona A.H., Djagoun C.A. M.S., Akpona T.J.D., Idohou R., Glèlè Kakaï R.	Quels indicateurs pour le suivi efficace de la biodiversité au Bénin?	Akpona A.H., Djagoun C.A.M.S., Akpona T.J.D., Idohou R., Glèlè Kakaï R. 2016. Quels indicateurs pour le suivi efficace de la biodiversité au Bénin? Policy brief, COP13, Cancun, 5p.

Appendix 1-11: Participation to workshops/conferences in 2016

N°	Title and period	Type of presentation	Country	Name of the participants from LABEF
1	Exploring the spatial configurations of home gardens in Benin. Poster presentation in the Third African Congress on Conservation Biology, September 2016	Poster	El Jadida, Morroco	Gbedomon Rodrigue Castro
2	Evidence of the capacities of local communities for the conservation of forest resources. Oral presentation in the Third African Congress on Conservation Biology, September 2016	Oral presentation	El Jadida, Morroco	Gbedomon Rodrigue Castro

3	Tropentag 2016, 19 – 21 September, 2016	poster	Austria	Houehanou Thierry
4	First edition of the International congress of *Association Ivoirienne des Sciences Agronomiques (AISA)*, Yamoussoukro-Côte d'Ivoire, 16-20 February 2016	Oral	Cote d'Ivoire	Hounkpèvi Achille
5	Longitudinal data analysis: fitting an optimal variance-covariance structure under linear mixed effects models framework. November 28 – December 02, 2016	Oral	Benin	Amagnide Gbènakpon Aubin Yamonan Guénolé
6	Etude de l'efficacité des biopesticides tels que le neem (*Azadirachta indica* A. Juss), le moringa (*Moringa oleifera* Lam.), et le jatrophat (*Jatropha curcas* L.) contre les bactéries (Pantoea stewartii smith, Pantoea ananatis Serrano et Sphingomonas spp)*, Octobre 2016*	Oral	Togo	Hounmenou Gbêmêmali Castro
7	Parameter estimation in nonparametric nonlinear mixed effect model: application to sparse data from population pharmacokinetic, Octobre 2016	Oral	Togo (JSIL 2016)	Hounmenou Gbêmêmali Castro
8	Parameter estimation in nonparametric nonlinear mixed effect model: application to sparse data from population pharmacokinetic, Décembre 2016	Oral	Benin (SADA 2016)	Hounmenou Gbêmêmali Castro
9	7ème Semaine Africaine des Sciences Agricoles, 13-16 Juin 2016	-	Rwanda	Kénou Christel
10	Atelier sous-régional de renforcement des capacités en cartographie numérique et SIG. Organisation Internationale de la Francophonie (OIF) /Projet EOF	-	Benin	Kénou Christel
11	Conference: "Les analyses par arbres de décision: principes et applications en sciences biologiques". Week of science and technology of the University of Abomey-Calavi, 21 - 25 March 2016,	Oral	Cotonou, Benin.	Salako Kolawolé Valère
	Society for Economic Botany (SEB) Conference on "Cultural Resilience and Resource extraction: Preserving Plants and People of Degraded Ecosystems". 5th -9th June 2016.	Oral	Kentucky, USA	Sinasson Sanni Koupamba Gisèle
12	Integrated Land Use Systems" at the University of Freiburg (Germany), from May 23 to June 10, 2016	Oral	Germany	Mensah Sylvanus
13	Training in Biodiversity indicators	Oral presentation	Belgium	Akpona T. Jean Didier
14	GEO BON Open science conference on Earth Observations and Biodiversity Observation	Oral	Germany	Akpona T. Jean Didier
15	Rufford workshop	Workshop	Ghana	Rodrigue Idohou Akpona T. Jean Didier Savi Koissi Merveille
16	Humboldt Kolleg conference on Utilizing and conserving natural resources under climate change in Africa	Oral	Benin	Akpona Tèwogbadé Jean Didier
17	Ruforum Biennial Conference 14th -21st October	Poster	South Africa	Sero Baro Nadejda
18	Toward a revisiting of permutation test: case of one way ANOVA	oral	SADA, Benin	Savi Koissi Merveille

Appendix 1-12: Research projects of LABEF in which you have been involved in 2016

N°	Title of the project	Sources of Funding	Objectives of the project	Status
1	Improving the efficiency of conservation and management strategies of the threatened tree species, *Afzelia africana* Sm. using morphological and molecular tools on its West African populations	Georg Forster Research Fellowship (HERMES)	(1) assess morphological variation of *A. africana* among populations of different climatic zones and disturbance degrees in West Africa; (2) assess the genetic diversity and structure of populations of *A. africana* sampled from different disturbance degrees and different climatic zones on a latitudinal gradient (3) evaluate hypothetic gene pools sharing the morphological groups; (4) describe the mating system and patterns of gene dispersal of various populations	Ongoing
2	Biologie de la Conservation et Ethnopharmacologie des Ligneux médicinaux de la pharmacopée béninoise (BIOCEL)	Fonds National de la Recherche Scientifique et de l'innovation Technologique	(i) Evaluer la diversité et la disponibilité des principales espèces ligneuses médicinales employées pour le traitement des maladies humaines et animales les plus récurrentes ; (ii) Déterminer les aires prioritaires de conservation des principales espèces ligneuses médicinales; (iii) Evaluer *in vivo* les propriétés médicinales des principales espèces ligneuses utilisées pour le traitement des pathologies animales la plus récurrente.	Ongoing
3	Assessing the effects of abiotic and biotic factors on the early recruitment of the threatened *Afzelia africana* Sm. ex Pers. (Fabaceae-Ceasalpinioideae) in Benin (West Africa)	-	To study the effects of abiotic and biotic factors in the early recruitment of the threatened *A. africana* Sm. in the Pendjari biosphere reserve	Ongoing
4	Identifying suitable ecotypes for Agroforestry Fruit Trees for future climates	The Alexander von Humboldt Foundation	1. Comparing inter-annual variation in plastic traits among different ecotypes of three key AFT species. 2. Examining how ecotype-specific plasticity could affect species distributions under current and future environments, using different demographic indicators. 3. Modeling and mapping current and future potential range of different ecotypes of three key AFT species. 4. Combining results from different plasticity indicators to derive more plausible predictions.	Ongoing
5	Promoting environmentally friendly practices for sustainable baobab leaves production for food and nutritional security in smallholders farming systems in Benin	RUFORUM	Develop a set of agro-ecological practices to improve the production of the daily used baobab leaves by building capacity of local farmers and NGOs on how to propagate and grow baobab treelets in small garden plots using environmentally friendly practices	Ongoing
6	Project SCOPA (Sustainability of Cotton Production in Africa)	DANIDA	The overall aim of the project is to increase knowledge about the sustainability of cotton production in SSA, where we will particularly focus on organic cotton production.	Ongoing

N°	Title of the project	Sources of Funding	Objectives of the project	Status
7	PEARL Integrated sweet potato weevil (*Cylas* spp.) control for sustainable sweet potato production in Benin and Ghana	Bill & Melinda Gates Foundation	This four year project aims to provide alternative methods for controlling Sweet Potato weevil.	Ongoing
8	Formulation d'aliments techniquement efficaces et économiquement rentables pour la pisciculture au Bénin	PPAAO	L'objectif principal du présent projet est de mettre au point des aliments techniquement efficaces et économiquement rentables à base de ressources alimentaires localement disponibles pour une pisciculture plus productive et rentable au Bénin.	Ended
9	Quantifying The Effects Of Land Uses On Ecosystem Services Provided By Trees And Forests In A Landscape Context	AFF	1. Assess the importance of ecosystem services valued by local communities 2. Quantify the biomass and carbon storage potential in natural and planted forest ecosystems 3. Quantify the availability of forage to honey bees in the Mistbelt forests and compare with agricultural fields	Ended
10	Etat de la biodiversité et perspectives de gestion durable de la forêt classée de Pénéssoulou	Office National du Bois	✓ Inventorier les espèces de flore et de faune de la FCP et connaître leur biodiversité par des indices de biodiversité appropriés ; ✓ Préciser le statut régional de conservation des espèces identifiées sur la liste Rouge de l'IUCN. ✓ Connaître les utilisations faites des ressources biologiques par les populations riveraines et identifier les menaces pesantes sur leur conservation.	Ended

Appendix 1-13 Research Grants in 2016

N°	Title of Grant	Beneficiaries	Status
1	Rufford Small Grant: Towards botanic garden setting through community-based knowledge for forest genetic resources conservation and training students in Sudanian zone of Benin	Houehanou Thierry	Ongoing
2	Equipment Subsidy Grant of the Alexander von Humboldt Foundation	Fandohan Adandé Belarmain	Ongoing
3	Conservating and domesticating *Garcinia kola* and *Garcinia afzelii* (Clusiaceae) in Benin under climate change	Kénou Christel	ongoing
4	AFF Research Grant	Mensah Sylvanus	Ended
5	IFS Research Grant	Mensah Sylvanus	Ongoing
6	RUFORUM Graduate Research Grant: Promoting environmentally friendly practices for sustainable baobab leaves production for food and nutritional security in smallholders farming systems in Benin (West-Africa).	Assogbadjo Achille, Salako Valère, Idohou Rodrigue, Glèlè Kakaï Romain	Ongoing
7	CV Raman Fellowship for international student	Akpona T. Jean Didier	Ongoing
8	Promoting environmentally friendly practices for sustainable baobab leaves production for food and nutritional security in smallholders farming systems in Benin.	Sero Baro Nadejda	Ongoing

Appendix 1-14: Prizes and nomination in 2016

N°	Title of prize / nomination	Nominee
1	African-German Network of Excellence in Science (AGNES) Grant for Junior Researchers	Dr. Ir. Idohou Rodrigue
2	African-German Network of Excellence in Science (AGNES) Grant for Junior Researchers	Dr. Ir. Salako Valère
3	African-German Network of Excellence in Science (AGNES) Member of the advisory committee	Prof. Dr. Romain GLELE KAKAÏ

Appendix 1-15: List of interns/trainees received in 2016

Full name	Highest degree	Occupation	Instituion of origin	Aim of the stay	Duration of stay
HOUETOHOSSOU Ariane	BSc	Student	Université d'Agriculture de Kétou, Bénin	Stage d'introduction aux méthodes statistiques d'analyse des données	6 months
DOGBO Flora	BSc	Student	Ecole Nationale des Sciences et Techniques Agricoles de Djougou, Bénin	Stage sur les méthodes de propagation des essences forestières et introduction aux méthodes statistiques d'analyse des données	8 months
OROUNLA Rachidath	BSc	Student	Université d'Agriculture de Kétou, Bénin	Stage d'introduction aux méthodes statistiques d'analyse des données	8 months
TAHI Souand	BSc	Student	Université d'Agriculture de Kétou, Bénin	Stage d'introduction aux méthodes statistiques d'analyse des données	6 months
AGOUNDE Gafarou	BSc	Student	Université d'Agriculture de Kétou, Bénin	Stage sur les méthodes d'étude socio-économique et introduction aux méthodes statistiques d'analyse des données	6 months

ANATO Lognidé Serge Eunock	BSc	Student	Faculté des Sciences Agronomiques, Université d'Abomey-Calavi, Bénin	Stage sur les méthodes de propagation des essences forestières et introduction aux méthodes statistiques d'analyse des données	6 months
LOKOSSOU Elisée	BSc	Student	Faculté des Sciences Agronomiques, Université d'Abomey-Calavi, Bénin	Stage sur les méthodes de propagation des essences forestières et introduction aux méthodes statistiques d'analyse des données	6 months
DEGBELO Ismax Sononkpon Terrence	BSc	Student	Faculté des Sciences Agronomiques, Université d'Abomey-Calavi, Bénin	Stage sur les méthodes de propagation des essences forestières et introduction aux méthodes statistiques d'analyse des données	6 months
DOSSOU-YOVO Cornille Perlet Sèdoté	BSc	Student	Faculté des Sciences Agronomiques, Université d'Abomey-Calavi, Bénin	Stage sur les méthodes de propagation des essences forestières et introduction aux méthodes statistiques d'analyse des données	6 months
DOKOU Frumence Paterne Sènami	BSc	Student	Faculté des Sciences Agronomiques, Université d'Abomey-Calavi, Bénin	Stage sur les méthodes de propagation des essences forestières et introduction aux méthodes statistiques d'analyse des données	6 months
SESSOU Orion	BSc	Student	Faculté des Sciences Agronomiques, Université d'Abomey-Calavi, Bénin	Stage sur les méthodes de propagation des essences forestières et introduction aux méthodes statistiques d'analyse des données	6 months
Dr SANE Seyni	Doctorat	Senior lecturer	Université Cheik-Anta Diop, Sénégal	Capacity building in statistics	1 months
Dr OUATTARA Bassiaka	Doctorat	Senior lecturer	Université Joseph Ki-Zerbo Ouaga 1, Burkina-FASO	Project writing and capacity building in statistics	3 months

Appendix 2: Abstracts of the publications in LABEF in 2016

1- Woody plant species diversity in the last wild habitat of the Derby Eland (*Taurotragus derbianus derbianus* Gray, 1847) in Niokolo Koba National Park, Senegal, West Africa

Camara M.,[1,2*] Gbemavo C. D. S. J.,[3] Salako V. K.,[3] Kouame F. N.,[1] Sambou B.,[2] & Glèlè Kakaï R. L.[3]

[1] Wascal GRP Climate Change and Biodiversity, University Félix Houphouët-Boigny, 31 BP 165 Abidjan 31, Côte d'Ivoire.
[2] Institute of Environmental Science, Faculty of Science and Technic, University Cheikh Anta Diop of Dakar, BP 5005 Dakar.
[3] Laboratory of Biomathematic & Forest Estimation, Faculty of Agronomic Science, University of Abomey-Calavi, 04 BP 1525, Cotonou, Benin.

International Journal of Biodiversity and Conservation 8(2): 32-40

Abstract: The Niokolo Koba National Park (NKNP) in Senegal is the last refuge of the critically endangered antelope of the subspecies Derby Eland, *Taurotragus derbianus derbianus* Gray. Woody plants, that provide shelters and forage for the Eland in NKNP, were assessed for their floristic diversity to characterize its confined habitat. Hence, 156 square plots of 20m x 20m were established randomly in the confined area of the Derby Eland. In each plot, list of plants species, their number of individuals, and the environmental factors (soil hardness and type, altitude, percentages of vegetation cover and fire occurrence) were noted. Fifty (50) trees species belonging to 40 genera and 29 families were recorded. The most represented families were *Combretaceae* (13.92%), *Leguminosae-mimosoideae* (12.66%), *Leguminosae-caesalpinioideae* (11.39%), *Leguminosae-papilionoideae* (7.59%), *Rubiaceae* (7.59%) and *Tiliaceae* (6.33%). The most abundant species were *Combretum glutinosum* Perr. ex DC., (28.79%), *Pterocarpus erinaceus* Poir. (12.42%), *Crossopteryx febrifuga* (Afzel. ex G. Don) (7.30%), *Strychnos spinosa* Lam. (7.18%) and *Hexalobus monopetalus* (A. Rich.) Engl. & Diels (7.06%). Altitude, fire occurrence and vegetation cover were the most important environmental factors influencing the distribution of plants species. Results suggest conservation defenders of Eland, for a sustainable management plan, to invest in in-*situ* fencing in order to increase possibilities of conservation of this critically endangered species in its native area.

Key words: Plant inventory, specie composition, confined habitat, wild, sustainable management.

2- Socio-economic and ecological outcomes of community based forest management: A case study from Tobé-Kpobidon forest in Benin, Western Africa

Gbedomon R.C.,[1] Floquet A.,[2] Mongbo R.,[1] Salako V.K.,[1] Fandohan A.B.,[3,4] Assogbadjo A.E.,[5,1] Glèlè Kakaï R.[1]

[1] Laboratoire de Biomathématiques et d'Estimations Forestières, Université d'Abomey-Calavi, 04 BP 1525, Cotonou, Benin
[2] Laboratoire d'Analyse des Dynamiques Sociales et du Développement, Université d'Abomey-Calavi, 02 BP 778, Benin
[3] Unité de Foresterie, Agroforesterie et Biogéographie, Université d'Agriculture de Kétou, BP 43, Kétou, Benin
[4] Abteilung für Biometrie und Umweltsystemanalyse, Albert-Ludwigs-Universität Freiburg, Freiburg, Deutschland
[5] Laboratoire d'Ecologie Appliquée, Université d'Abomey-Calavi, 01 BP 526 Cotonou, Benin

Forest Policy and Economics 64: 46–55

Abstract: Community forestry, promoted as a "win–win" forest management strategy yielded a variety of results that includes both failure and relative success. The willingness of government to hold control over forest resources while transferring only part of property rights to local communities is one of the major constraints. Therefore, there is a need to explore alternative approaches which enhance the position and accountability of local communities in community forest management. This study evaluated socio-economic and ecological outcomes of community forestry in a context of important property rights conceded to local communities. The study was conducted using focus groups discussions, forest income evaluation and assessment of forest resources and their dynamics. Findings showed that institutional designwith important property rights conceded to local communities partially empowered local communities and reduced threatswhile improving the condition of forest resources. The approach also yielded positive economic outcomes that enabled bordering populations to make up to 25% of their global annual income fromthe forest. However, the sustainability of this scheme of forest management was mostly limited by the financial dependency on local non-governmental organization, by local institutions and discrepancy in forest benefits sharing among local forest users.

Keywords: Community forestry, Traditional institutions, Socio-economic and ecological outcomes, Benin

3- Influence of the landscape context on stand structure and spatial patterns of the doum palm (*Hyphaene thebaica* Mart.) in the Republic of Benin (West Africa)

Idohou R.,[1] Assogbadjo A. E.,[1,2] Azihou F.,[2] Glèlè Kakaï R.,[1] Adomou A.[3]

[1] *Laboratory of Biomathematics and Forest Estimations, Faculty of Agronomic Sciences, University of Abomey- Calavi, 01 BP 526, Cotonou, Benin*

[2] *Laboratory of Applied Ecology, Faculty of Agronomic Sciences, University of Abomey-Calavi, 01 BP 526, Cotonou, Benin*

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Agroforestry Systems DOI 10.1007/s10457-016-9920-4

Abstract: *Hyphaene thebaica* Mart. (doum palm) is an agroforestry tree with high ecological and economic value, but currently its populations are harvested excessively, which is likely to increase in the future. This study assessed the current status of this species with regard to increasing landscape modification and human pressure in Benin. We compared the structure of adult palms in farmlands to those within the Biosphere Reserve of Pendjari (BRP). In addition, spatial patterns and sex ratio of the species were compared between both land use types. Results showed that mean diameter (adult palms) and density (adult palms and seedlings) were significantly higher (Prob. <0.001) in BRP than in farmlands. However, no significant differences were noticed for doum palm height and density of juveniles (Prob. <0.05). The pair correlation function showed globally a random pattern for all palm life stages, albeit with a weak aggregation in farmlands. In the BRP, a strong aggregated pattern is observed for seedlings, whereas all other palm life stages showed globally a random pattern. Moreover, no spatial association was observed within palm life stages and between palm life stages and other tree species, but did exist between females and seedlings in the BRP. The sex ratio did not depart from 0.5 in both land use types. We conclude that in spite of the land use difference, the doum palm species is still well preserved. However, rapid land-use intensifications may lead to increasing pressure on the species populations in the future.

Keywords: Conservation, Distribution, *Hyphaene thebaica*, Point pattern analysis, Sex-ratio

4- Patterns of biomass allocation between foliage and woody structure: the effects of tree size and specific functional traits

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Annals of forest research 59(1)

Abstract: Biomass allocation is closely related to species traits, resources availability and competitive abilities, and therefore it is often used to capture resource utilisation within plants. In this study, we searched for patterns in biomass allocation between foliage and wood (stem plus branch), and how they changed with tree size (diameter), species identity and functional traits (leaf area and specific wood density). Using data on the aboveground biomass of 89 trees from six species in a Mistbelt forest (South Africa), we evaluated the leaf to wood mass ratio (LWR). The effects of tree size, species identity and specific traits on LWR were tested using Generalised Linear Models. Tree size (diameter) was the main driver of biomass allocation, with 44.43 % of variance explained. As expected, LWR declined significantly with increasing tree diameter. Leaf area (30.17% explained variance) and wood density (12.61% explained variance) also showed significant effects, after size effect was accounted for. Results also showed clear differences among species and between groups of species. Per unit of wood mass, more biomass is allocated to the foliage in the species with the larger leaf area. Inversely, less biomass is allocated to the foliage in species with higher wood density. Moreover, with increasing diameter, lower wood density species tended to allocate more biomass to foliage and less biomass to stems and branches. Overall, our results emphasise the influence of plant size and functional traits on biomass allocation, but showed that neither tree diameter and species identity nor leaf area and wood density are the only important variables.

Keywords: aboveground biomass, leaf area, leaf to wood mass ratio, Mistbelt forest, South Africa, partitioning, species identity, trunk diameter, wood density.

5- Aboveground Biomass and Carbon in a South African Mistbelt Forest and the Relationships with Tree Species Diversity and Forest Structures

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Forests, 7: 79

Abstract: Biomass and carbon stocks are key information criteria to understand the role of forests in regulating global climate. However, for a bio-rich continent like Africa, ground-based measurements for accurate estimation of carbon are scarce, and the variables affecting the forest carbon are not well understood. Here, we present the first biomass study conducted in South Africa Mistbelt forests. Using data from a non-destructive sampling of 59 trees of four species, we (1) evaluated the accuracy of multispecies aboveground biomass (AGB) models, using predictors such as diameter at breast height (DBH), total height (H) and wood density; (2) estimated the amount of biomass and carbon stored in the aboveground compartment of Mistbelt forests and (3) explored the variation of aboveground carbon (AGC) in relation to tree species diversity and structural variables. We found significant effects of species on wood density and AGB. Among the candidate models, the model that incorporated DBH and H as a compound variable ($DBH^2 \times H$) was the best fitting. AGB and AGC values were highly variable across all plots, with average values of 358.1 $Mg.ha^{-1}$ and 179.0 $Mg.C.ha^{-1}$, respectively. Few species contributed 80% of AGC stock, probably as a result of selection effect. Stand basal area, basal area of the ten most important species and basal area of the largest trees were the most influencing variables. Tree species richness was also positively correlated with AGC, but the basal area of smaller trees was not. These results enable insights into the role of biodiversity in maintaining carbon storage and the possibilities for sustainable strategies for timber harvesting without risk of significant biomass decline.

Keywords: climate regulation; non-destructive sampling; allometric equations; wood density; carbon density

6- Vegetable Contamination by the Fecal Bacteria of Poultry Manure: Case Study of Gardening Sites in Southern Benin

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Abstract: A study was conducted in southern Benin to assess the contamination of vegetables by fecal coliforms, *Escherichia coli*, and fecal streptococci as one consequence of the intensification of vegetable cropping through fertilization with poultry manure. For this purpose, on-farm trials were conducted in 2009 and 2010 at Yodo-Condji and Ayi-Guinnou with three replications and four fertilization treatments including poultry manure and three vegetable crops (leafy eggplant, tomato, and carrot). Sampling, laboratory analyses, and counts of fecal bacteria in the samples were performed in different cropping seasons. Whatever the fertilization treatment, the logs ofmean fecal bacteria count per g of fresh vegetables were variable but higher than AFNOR criteria. The counts ranged from 8 to 10 fecal coliforms, from 5 to 8 fecal streptococci, and from 2 to 6 *Escherichia coli*, whereas AFNOR criteria are, respectively, 0, 1, and 0. The long traditional use of poultry manure and its use during the study helped obtain this high population of fecal pathogens. Results confirmed that the contamination of vegetables by fecal bacteria is mainly due to the use of poultry manure. The use of properly composted poultry manure with innovative cropping techniques should help reduce the number and incidence of pathogens.

7- Accounting for tree spatial distribution in a comparison of plot sizes and shapes in dense forest and woodland in Benin (West Africa)

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African. Journal. Ecology, 54, 87–94

Abstract: The study examined simultaneously, the effect of tree spatial distribution, inventory plot size and shape on the estimation error of basal area in two contrasting environments. Twenty and fifteen square plots of 1 ha each (divided into 100 quadrats of 0.01 ha) were randomly set in dense forest and woodland, respectively. Thirteen subplots of various shapes and sizes were obtained from the association of adjacent quadrats. Estimation error was calculated using residual mean square of one-way ANOVA, based on replications of subplot within 1 ha plots. Tree spatial distribution was measured using Green index. Weighted linear regression and mixed effect models were applied to Box & Cox transformed data. In general, the estimation error of basal area decreased with increase in subplot size. However, the effects of tree spatial distribution and plot shape varied with the vegetation type. Where trees tended to be aggregated, estimation error increased with degree of aggregation, and rectangular plots of 0.24 ha produced an acceptable precision. It was concluded that 0.24 ha rectangular plots can be used in tropical environments where the target parameters vary constantly according to one direction, while square plots of the same size are optimal for reliable analysis in case of randomness.

Key words: estimation error, inventory plot, nonrandomness, structural parameters, vegetation, West Africa

8- Perceptions et facteurs déterminant l'utilisation des asticots dans l'alimentation des poulets locaux (*Gallus gallus*) au Bénin

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Journal of Applied Biosciences 98:9330 – 9343

Abstract: Objectives: The maggots are an important but underused source of animal protein in the diet of local chickens. This study aims to analyze the perceptions of traditional poultry farmers and the factors determining the use of maggots in the diet of local chickens (*Gallus gallus*) in Benin. Methodology and Results: 960 traditional poultry farmers were randomly surveyed in 48 villages. The main data collected were sociolinguistic characteristics, information on livestock and the choice of using maggots. Factors determining the use of maggots were analyzed by canonical discriminant analysis. A generalized linear mixed effects model was used to analyze factors determining the desire of adopting maggots. Three groups of traditional poultry farmers were distinguished and their characteristics were studied. The geographical location and the sex of the poultry farmer are the factors that determine the desire of using of maggots. Conclusion and Application of Results: Group 2 are the poultry farmers wishing to use maggots (Group 2) with 81.68% of the respondents, those of Group 1 are already using maggots with 5.73% of respondents, and finally the Group 3 consists of traditional poultry farmers who are against the use of maggots, with 12.59% of respondents. Poultry farmers in Group 1 differ from those of Groups 2 and 3 by their herd size and annual income, those in Group 2 differ from those of Group 3 by gender, socio-cultural group and seniority in the breeding. The traditional poultry farmers have a perfect knowledge of maggots and the majority agrees to the use them in the diet of local poultry. This acceptance must be accompanied by the organization of large-scale awareness sessions and accompanying actions for the production of maggots to facilitate the adoption of maggots in the food practices of poultry farming in Benin.

Keywords: Fly, feeding, perception, traditional poultry farmers, Benin.

9- Facteurs socioeconomiques influençant l'usage des raphias au Bénin (Afrique de l'Ouest)

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Science de la vie, de la terre et agronomie 04 (01)

Abstract: The objective of this study was to assess the socio-economic factors that determine the use of raffia and level of knowledge of their uses in Benin. Thus, data on the socioeconomic haracteristics of the respondents were collected during an investigation throughout the territory of Benin with a semi-structured questionnaire. A binary logistic regression and Poisson regression were performed on the data to identify socio-economic and occupational factors affecting use of raffia in Benin. It showed that socioeconomic factors such as age, sex, education level, type of user and the main activities are those affecting knowledge level of raffias' uses in Benin. These socio-economic and occupational factors differ among raffias' species. *R. hookeri:* The higher the education level, the higher the level of knowledge of the uses of *R. hookeri*. Processors have a higher level of knowledge of uses (VUR) than the gatherers. The evaluation of the predicted VUR, showed a positive linear relationship between VUR and age for all professional and socioeconomic variables and shows predicted VUR increase when respondents are aging. ***R. sudanica***: Non-users of raffia, both men and women, uneducated and main activities individually contribute over time to decrease the number of reported uses (VUR) contrary to processors and educated. Gatherers, with time, will have a steady level of knowledge and VUR does not exceed unity. In conclusion, we believe that the evaluation of ethnobotanical and economic values of raffia should consider the type of user, gender, age, education level and main activities.

Keys words: *Raphia hookeri*, *Raphia sudanica,* use value, socio-economic factors, Benin

10- Techniques d'échantillonnage en étude de végétation

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Annales des Sciences Agronomiques 20 - spécial Projet Undesert-UE: 1-13

Abstract: Decisions in forest management are based on estimations of the stock and evolution of their potential. As such, accuracy of these estimations is crucial for reliable decisions. Sampling techniques are methods developed to allow good estimations based among others on the objectives, the extent of the vegetation, the features of the forest and the available resources. There is however a huge number of sampling techniques in the literature which often make difficult the choice for a non-specialized user. This papers deals with the reviewof the most used sampling techniques, conditions of their utilization and their advantages and limits.

Keywords: Sampling, Estimation, Methods, Forest Management

11- Méthodes statistiques multivariées utilisées en écologie

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Annales des Sciences Agronomiques 20 - spécial Projet Undesert-UE : 139-157

Absract: This article addresses the multivariate statistical methods such as ordination and classification methods commonly used in ecology. The ordination methods summarize the information in the matrix of data by minimizing the loss. The ordination methods are the Principal Component Analysis; the Principal Coordinate Analysis; the Correspondence Analysis; the Multiple Correspondence Analysis; the DetrendedCorrespondence Analysis; the Canonical Redundancy Analysis; the Canonical Correspondence Analysis; the Non-metric Multidimensional Scaling; and the Canonical Discriminant Analysis. The classification methods groupas possible similar individuals. They are the agglomerative classification (also called hierarchical cluster); the Typological analysis; the Decisional Discriminant Analysis; and the Multivariate Analysis of Variance (MANOVA). These methods have the advantage of allowing the extraction of the main information in a multivariate matrix.

Keywords: Multivariate statistical methods; ordination methods; classification methods.

12- Approche méthodologique de construction et d'interprétation des structures en diamètre des arbres

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Annales des Sciences Agronomiques 20 - spécial Projet Undesert-UE:99-112

Abstract: Establishing and analyzing tree diameter distribution is crucial for adequate management. In this paper, we describe a procedure for establishing tree diameter distribution, using diameter data from our available data set for Lama and Wari-Maro forest reserves in Benin. Diameter structures were established based on tree size class and adjusted to the Weibull distribution. Log-linear analysis was performed to test whether the observed distribution fitted well with the theoretical Weibull distribution. Finally, we highlighted how to use these structures to draw stand management options.

Keywords: diameter class; theoretical distribution; Weibull; shape parameter; adjustment

13- Aperçu sur les méthodes statistiques univariées utilisées dans les études de végétation

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Annales des Sciences Agronomiques 20 - spécial Projet Undesert-UE : 113-138

Abstract: Statistical methods are valuable tools in vegetation studies to better understand and assist in decision making in ecology and management. This manual presents an overview of the most used univariate statistical methods in vegetation studies. It presents practical properties (definitions, applicability and non-parametric alternative) of statistical methods, tests for proportions, the Chi-2 test of independence, the G test, tests for group means (Student t-test, ANOVA models). Some guidelines for the modeling of vegetation parameters (simple and multiple linear regression and logistic regression, Box-Cox transformations for pseudo-linear regression) are also considered. The special feature of this manual is the description of the statistical methods using practical examples from vegetation studies without addressing theoretical principles.

Keywords: statistical tests; biological modeling; univariate traits; ecology.

14- Climate-induced morphological variation of black plum (*Vitex doniana*) in Benin, West Africa

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Genet Resour Crop Evol DOI 10.1007/s10722-016-0409-9

Abstract: There are evidences that plant morphology is shaped by genotype, but local environment mainly climate influences morphology as well. In this study the morphological variability of *Vitex doniana*, a multipurpose tree species was characterised in relation with climatic parameters in order to provide insights to the species possible responses to future climate change. Morphological data were collected on 102 trees randomly selected along unfixed transects in the three climatic zones of Benin. Data were collected on fruiting trees at three levels: tree (trunk and canopy), leaves and fruits. Variance components were estimated for identification of variability sources regarding leaves and fruits characteristics. The most important discriminant descriptors regarding climatic zones were selected through a stepwise discriminant analysis. Relationship between those discriminant morphological traits and bioclimatic variables were assessed through a redundancy analysis. Our findings confirmed that there is an important variability of morphological traits of the species and climate, mainly some of its extremes parameters plays a non-negligible role. Trees in the Sudanian region are the biggest with fruits producing little pulp while individuals in the more humid Guinean region present a higher amount of pulp whereas Sudano-Guinean trees are the tallest with larger leaves. Although the climateinduced variability of the species is relatively low, the study gives insights in probable effects of climate variability on its morphology. Population genetic studies are required for a better understanding of climatic impacts on *V. doniana* in order to develop selection and domestication schemes which could contribute to its conservation.

Keywords Agroforestry species Benin Bioclimatic variables Plant morphology Savannah *Vitex doniana*

15- Climate and potential habitat suitability for cultivation and insitu conservation of the black plum (*Vitex doniana* Sweet) in Benin, West Africa

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International Journal of Agronomy and Agricultural Research 8 (4): 67-80

Abstract: Sustainable management actions are needed for several indigenous agro forestry plant species like the black plum (*Vitex doniana* Sweet) because they are facing increasing pressures due to the rapid human growth and threats such as climate change. By combining species distribution modelling using the Maximum Entropy Algorithm (MaxEnt) and representation gap analysis, this study accessed the impacts of current and future (2050) climates on the potential distribution of *Vitex doniana* in Benin with insight on the protected areas network (PAN). The model showed a high goodness-of-fit (AUC = 0.92 ± 0.02) and a very good predictive power (TSS = 0.72 ± 0.01). Our findings indicated annual mean rainfall, annual mean diurnal range of temperature and mean temperature of the driest quarter as the most important predictors driving the distribution of *V. doniana*. Under current climate, about 85 % of Benin area is potentially suitable for its cultivation. This potential suitable area is projected to increase by 3 to 12 % under future climatic conditions. A large proportion (76.28 %) of the national PAN was reported as potentially suitable for the conservation of the species under current climate with increase projections of 14 to 23 % under future climate. The study showed that *V. doniana* can be cultivated in several areas of Benin and that the PAN is potentially suitable for its conservation. These findings highlighted some of the opportunities of integrating *V. doniana* in the formal production systems of Benin and also its potentialities in ecosystems restoration under the changing climate.

Key words: Climatic envelope, MaxEnt, Species distribution modelling, Representation gap analysis, *Vitex doniana*.

16- Litterature review on feeding, food consumption and food digestibility of grasscutter (*Thryonomys swinderianus*)

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Annales des sciences agronomiques 19(2): 401-417

Abstract: Grasscutter (*Thryonomys swinderianus*) is a rodent mammal hystricomorphic and phytophagous. Of all the rodents in Africa, grasscutter is the largest after the porcupine (Histix cristata). In its habitat, it is under pressure because of its popularly appreciated meat which is prone to no taboo at all. There are initiatives in various African countries to promote its breeding in close captivity. Studies focused on grasscutter' ecology, ethology, Ecoethology, nutrition, pathology, selection scheme, reproduction, biology and on technical feasibility of grasscutters husbandry in real peasant environment. Research work carried out on feedstuffs in order to define a rational breeding technique revealed disparate information in the literature. Some authors consider that food standards used in grasscutter husbandry remain rudimentary and currently practiced strategies are inadequate. Others recommend the use of pelleted feed for better externalization of its production performance. In the nature, grasscutter has a very wide food spectrum and it causes damage on crops that are recognized as part of its diet. In close captivity, a combination of green fodder and concentrated food ingredients can cover its food needs. The forage species used in diet are mainly gramineous. Among them can be cited along *Panicum maximum*, *Pennisetum purpureum* and *Paspalum vaginatum, Echinochloa* spp. Grasscutter Food digestibility can be evaluated in vitro (gas test of Hohenheim) with its fresh droppings and in vivo (coefficient of apparent digestibility evaluation).

Keywords: digestibility, food, grasscutter, food spectrum rationing table.

17- Méthodes et dispositifs d'inventaires forestiers en afrique de l'ouest : état des lieux et propositions pour une harmonisation

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Annales des Sciences Agronomiques 20 - spécial Projet Undesert-UE: 15-31

Abstract: Forest inventories are tools generally intended to assess the quantitative and qualitative importance of plant material and its evolution over time. Inventory techniques used in different countries in West Africa are numerous and diversified; this situation negatively impacts comparison of forest inventory results between different countries and decision making at regional level. The aim of this work is to propose suggestions for adequateharmonization of forest inventory techniques and designs in the West African countries. These recommendations follow several regional meetings between experts of flora and vegetation of West Africa.

Keywords: vegetation; inventory; techniques; variability; harmonization; West Africa

18- Spatio-temporal dynamic of suitable areas for species conservation in West Africa: eight economically important wild palms under present and future climates

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Agroforest System DOI 10.1007/s10457-016-9955-6

Abstract: Sustainable conservation of tropical resources required understanding of their distribution for effective assessment and definition of conservation priorities. In tropical areas, wild palms are highly valued keystone resources with growing demand for both subsistence uses and commercial trade. Here we focused on eight such species (*Borassus aethiopum* Mart., *Eremospatha macrocarpa* (G.Mann & H.Wendl.) H.Wendl., *Hyphaene thebaica* Mart., *Laccosperma opacum* (G.Mann & H.Wendl.) Drude, *Phoenix reclinata* Jacq., *Raphia hookeri* G.Mann & H.Wendl., *Raphia sudanica* A. Chev., and *Raphia vinifera* P.Beauv.). This study tested (i) how those palms distributions may be affected under future climate scenarios, and (ii) if species are effectively conserved currently and under future forecasts for their native distributional areas. Finally, we defined spatial priorities for the species' conservation. Available bioclimatic and soil data layers were used for the modelling with maximum entropy approaches, and resulting maps were overlaid on the existing protected areas network. Results showed that much of the distribution of the species will remain largely stable, albeit with some expansion and retraction in some species; relationships with protected areas networks suggest that protected portions of species distributions will also remain stable. The areas identified as highest conservation priority differ between models even though the highest-priority areas holding most palm species are located along the coast (from Guinea to Nigeria). Further development of these analyses could aid in forming a more complete picture of the distributions and populations of the species, which in turn could aid in developing effective conservation strategies for this botanically important family.

Keywords: Biodiversity Ecological niche GIS Representative concentration pathways Zonation

19- Effectiveness of protected areas for the conservation of favourable and priority habitats for valuable tree species in Benin

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Bois et Forêts des Tropiques, 328 (2)

Abstract: The aim of this study was to assess the effectiveness of protected areas in Benin for the conservation of favourable and priority habitats for the following tree species of socio-economic importance: *Afzelia africana*, *Anogeissus leiocarpa*, *Burkea africana*, *Daniellia oliveri*, *Detarium microcarpum*, *Prosopis africana* and *Khaya senegalensis*. We combined maximum entropy (Maxent) techniques with GIS to predict potentially favourable areas for cultivating and conserving these species. Zonation software was used to model priority habitats. Data points where the species were present were collected and linked to bioclimatic variables derived from monthly temperature and rainfall figures from the Africlim database and to edaphic (soil) variables. In term of environmental determinism, the most favourable areas were predicted by bioclimatic variables such as mean diurnal temperature range (Bio2), mean annual rainfall (Bio12), potential evapotranspiration (PET) and a biophysical ground variable. The most favourable protected areas for the seven tree species extended northwards from the Ketou listed forest (7°43'N) in the Guinean zone, from the Agoua listed forest (8°30'N) in the Sudano-Guinean zone and from the Pendjari National Park area (10°35'N) in the Sudanian zone. Gap analysis of habitat conservation showed that the protected area network was effective in the Sudanian zone (9°75'-12°27'N), minimally effective in the Guinean zone (6°50'-7°40'N) and not effective at all in the Sudano-Guinean zone.
Keywords: favourable habitats, environmental determinism, protected areas, priority habitats, Benin.

20- History, Impact of Soil Types on Stand Structure and Growth of the Dry Zone Mahogany (*Khaya senegalensis* (Desr.) A.Juss.) in Plantation in Benin (West Africa)

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Environment and Ecology Research 4(4): 193-199

Abstract: The reported declines in populations of several native species have biological, cultural and economic implications as cattle and illegal logging. To understand factors supporting endangered species conservation and management in Benin, we focused on plantations of dry zone Mahogany (*Khaya senegalensis* (Desr.) A.Juss.) in sudano-guinean zone of Benin. This study illustrates how the dry zone mahogany is established in plantations in Benin. It discusses the challenges for its appropriate conservation and management in Benin.

Keywords: *K. senegalensis*, Plantation, Conservation, Dendrometrics Parameters, Benin

21- Use of Raffias' species (Raphia spp.) and its impact on socioeconomic characteristics of harvesters in Benin (West Africa)

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Abstract: Raffias' species are used in handcrafts, constructions, food processing etc. But in Benin, any quantitative ethnobotanical study was not evaluated for their use and socioeconomic impact of uses on average income. This study investigated the importance of use of raffias' species and the impact of socioeconomic characteristics of informants on the household income. Ethnobotany quantitative approach was used and data on use, products prices and the quantity sold were collected using a semi-structured questionnaire administered during an interview. The result showed that raffias' species in Benin are used principally for craft (CI = 1.41 for *R. hookeri* and 1.68 for *R. sudanica*), but *R. hookeri* was most important for people in Guinean zone than those in soudanian and soudano-guinean zones. The frequently uses were the beds, mats, baskets and roofs. The most part of the plant used is the rachis for both species and the less used is the nut. Education level, gender and main activities were socioeconomic variable which influenced the annual income from exploitation of raffias species. The uneducated, men and farmers took more income from raffias' species than others. Also, the development level of areas where the species are found, influence the income from their exploitations. To evaluate better the contribution of raffias' species to regional and national gross product, it will be necessary to study the value chain of the main products, but also take into account the informant categorie defined in this study regarding operators.

22- Identification of potential areas for wild palm cultivation in the Republic of Benin through remote sensing and ecological niche modeling

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Genet Resour Crop Evol DOI 10.1007/s10722-016-0443-7

Abstract: Wild palms contribute significantly to food security and local economy in tropical areas, and particularly in sub-Saharan Africa. In light of this importance, eight palm species were explored [*Borassus aethiopum* (L.) Mart, *Eremospatha macrocarpa* (G. Mann et H. Wendl.) H. Wendl., *Laccosperma opacum* (G. Mann et H. Wendl.) Drude, *Hyphaene thebaica* (L.) Mart, *Phoenix reclinata* Jacq., *Raphia hookeri* G. Mann et H. Wendl., *R. sudanica* A. Chev., and R. vinifera P. Beauv.] as targets for conservation, domestication, and cultivation in Benin. Cultivation potential was evaluated in a coarse-resolution, first pass effort using ecological niche models to relate known occurrences of each species to vegetation indices (VEG), gross primary productivity (GPP), and soil characteristics (SOIL), and model outputs were related to human distribution and land-use patterns. Results showed that wild palms responded differentially to different suites of environmental factors: some species showed best model performance with VEG? GPP? SOIL, others with GPP+SOIL or VEG+ GPP, or with a single factor. Two species had broad potential distributions across the country; others had potential areas in the north (2 species) or the south (4 species). *Raphia hookeri* and *R. vinifera* showed greatest overlap in terms of ecology and distribution, whereas *L. opacum* and *R. sudanic*a had the lowest similarity. These models constitute initial steps toward a sustainable scheme for planning exploration of the possibility of cultivation of these species.

Keywords: Cultivation, MODIS, West Africa, Wild palms

23- Allometric models for height and aboveground biomass of dominant tree species in South African Mistbelt forests

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Southern Forests 1–12

Abstract: Novel species-specific equations for the estimation of height and aboveground biomass were established for four dominant tree species (*Syzygium gerrardii* Burtt Davy, *Combretum kraussii* Hochst., *Trichilia dregeana* Sond. and *Croton sylvaticus* Hochst.), in the Northern Mistbelt Forests of South Africa. A non-destructive sampling methodology was applied, which was based on measuring standing trees, selecting smaller branches and taking core samples. The species-specific aboveground biomass equations were fitted using predictor variables such as diameter at breast height (DBH) and total height (*H*). The relative error of estimation was used to examine the accuracy of a pantropical biomass equation versus our established specific model. Biomass values were afterwards up-scaled from tree to stand level for each species, based on the selected models and the forest inventory data. As expected, the DBH–height relationship varied among studied species. The incorporation of both DBH and *H* in the biomass models significantly improved their precision. A model with DBH2 × *H* as a single variable was suitable for three out of the four studied species, with more than 98% of explained variance. An existing pantropical biomass equation for moist forests showed larger relative error of estimation, especially in the upper range of tree diameter. The estimated aboveground biomass density varied significantly among studied species, with the highest values recorded for *S. gerrardii* (87.7 ± 15.4 Mg ha−1), followed by *T. dregeana* (29.4 ± 14.7 Mg ha−1), *C. sylvaticus* (24.3 ± 11.5 Mg ha−1) and *C. kraussii* (20.1 ± 6.7 Mg ha−1). It is also found that species-specific production of biomass at the tree level is not always sufficient to reflect the stand-level biomass density. The results from this study contribute to accurately predict aboveground biomass, thereby improving the reliability of the estimates of forest biomass and carbon balance.

Keywords: biomass density, correction factor, diameter–height relationship, minimal destructive sampling, Mistbelt forests.

24- Forest degradation and invasive species synergistically impact *Mimusops andongensis* (Sapotaceae) in Lama Forest Reserve, Benin

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Biotropica 0(0): 1–10

Abstract: Harvesting of Non-Timber Forest Products (NTFPs) can threaten target species, especially those with limited distribution and density. Exploited species also face threats from habitat fragmentation, fire, and invasive species. We assessed the impact of human disturbances and invasive species on the population of a key multipurpose NTFP species, Mimusops andongensis, in Lama Forest reserve (Benin). The densities of adult trees and regenerative stems decreased with increasing degradation. Mimusops andongensis contributed less to total tree density with increasing human disturbance. There were significantly fewer *M. andongensis* recruits with increasing cover of invasive *Chromolaena odorata*. Smaller diameter individuals predominated in non-degraded and moderately degraded sites while in degraded sites, the structure showed a negative exponential trend with the density of small diameter individuals being less than two trees/ha. Larger individuals were also rare in degraded sites. The low density of both mature trees and seedlings in degraded sites may undermine the long-term viability of *M. andongensis*, despite existing protection against NTFP harvesting and other anthropogenic pressures. Management should emphasize facilitating recruitment subsidies and limiting the presence of C. odorata. Abstract in French is available with online material.

Key words: anthropogenic pressure; biological invasion; demographic structure; diameter class distribution; Non-Timber Forest Products.

25- Ecological diversity and conservation of wild edible fruit trees species in the Lama Forest Reserve in Benin

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Bois et Forêts des Tropiques, 329 (3)

Abstract: Understanding interactions between forests and neighbouring human communities is crucial to participative management of forest resources. This study aimed to determine the ecological diversity of wild edible fruit tree (WEFT) species in the Lama Forest Reserve, a protected area in southern Benin, and strategies for their conservation. An inventory of WEFT species was carried out in 53 systematically delimited plots in typical dense forest, degraded dense forest and young and old fallows in the Lama Forest Reserve. An ethnobotanical survey was conducted with 136 respondents and the WEFT species habitats were identified by applying a Simple Correspondence Analysis to the density data. A list of priority species was generated using the Compound Ranking System method. The results revealed ten WEFT species, including *Dialium guineense*, *Diospyros mespiliformis*, *Drypetes floribunda*, *Mimusops andogensis* and *Pterocarpus santalinoides* in typical dense forest; *Pancovia bijuga*, *Psidium guajava* and *Lecaniodiscus cupanioides* in degraded dense forest; and Ficus capensis and Spondias mombin in fallows. Unlike the other species, the average density of D. guineense,

D. mespiliformis, D. floribunda, L. cupanioides and M. andongensis varied significantly ($P < 0.01$) from one vegetation type to another. The WEFT species recorded were mainly used for food and medicinal purposes. Top priority species for conservation were *P. guajava*, *S. mombin*, *F. capensis*, *P. santalinoides* and *P. bijuga*. More protection efforts should target the degraded dense forest and fallow areas to ensure the conservation of these species. Further, priority WEFT species need to be included in plantation programs to reduce pressure from riparian populations.

Keywords: conservation, Lama forest reserve, diversity, wild edible fruit tree

26- Gendered motivation for home gardening and maintenance of agrobiodiversity: a case study in Benin, West Africa

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Abstract: Home gardening is a commonly encountered agricultural practice in Benin, consisting of cultivating or maintaining desired plant around homesteads. While the multiple ecosystem services they provided to population is widely acknowledged, motivation for home gardening is still poorly understood in Benin. This study aims at elucidating the daunting question of motivation for home gardening in Benin focusing on gender and how this motivation affects the capacity of home gardens to maintain agro-biodiversity. 360 households with home gardens participated to the study through interview and garden inventories. Clustering analysis, correlation and regressions were used to distinguish and discriminate home gardens with regard to their driven motivation, explore the discrepancies across gender and assess the relationship between plant species diversity and motivation of gardeners. Findings showed that food and medicinal plant production were the main motivations of home gardens in Benin. Food production was the main motivation of women while men were mostly motivated for medicinal plant production. Home gardeners mostly men were also found to have multiple motivations for gardening. Home gardens with medicinal, both medicinal and food and with multiple motivations were found to have higher plant species richness. This study suggests that the motivation of home gardeners is a key driver of the maintenance of agrobiodiversity in home gardens.

Keywords: Home gardens; Motivation; Agro-biodiversity; Conservation, Benin

27- Exploring the spatial configurations of home gardens in Benin

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Abstract: Although home gardeners could logically install plant species at different places around their homesteads, there is no quantitative evidence of how home gardens (HGs) are spatially configured and how these spatial configurations (SCs) discriminate plant species within HGs. Using spatial position analysis with respect to homestead and garden inventories, this paper explores the SCs of 360 HGs and assesses their constituent species as well as their prevalence across seasons, agro ecological zones (AEZs) and phytogeographical districts (PDs) in Benin. The association between SC and species composition was tested using correlation coefficients and Jaccard dissimilarity. A non-metric multidimensional scaling and a canonical discrimination analysis were

performed to detect SCs discriminating AEZ and PDs. Relative frequencies of each SC were calculated per PD and displayed on the Benin map using ArcGIS 10.0 software. Eight SCs were distinguished, and 90.55% of HGs contained at least two SCs. Except for yards, SCs shared no or few species. The occurrence and prevalence of SCs varied across AEZs and PDs. Because HGs have multiple SCs and dynamic components, their size and shape may not always be objective indicators in the HG horizontal structure analysis.

Keywords: Spatial configurations Home Gardens Species composition West Africa

28- Strengthening capacity building in data analysis in West African Universities and research institutions: A three-year experience of the Master programme in Biostatistics at the University of Abomey-Calavi, Benin

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Abstract: Scientific research plays a key role in development, especially in economic growth of countries. Scientific innovations, the main outcome of scientific research, require the use of modern statistical and mathematical methods in research works. InAfrica, especially sub-SaharanAfrica, Statistics is underutilized and some situations misused in biological researches. The master programme in Statistics, major Biostatistics at the University ofAbomey-Calavi has been created and implemented by the Laboratory of Biomathematics and Forest Estimations at the Faculty of Agronomic Sciences in order to fill this gap. This master programme has four semesters and is taught in English with lecturers mainly coming from Benin and Togo, but also some come from United States ofAmerica (USA) and Belgium.Analysis of the three-year experience of this programme reveals an increasing trend of the number of students involved with a total of 44 students coming from 12 African countries. Defense of the first batch of students in this master programme (24-29 February, 2016) targeted some modern statistical and mathematical methods including linear and non-linear mixed effects models, matrix projection models, ordination methods, generalized linear models, survival analyses and efficiency analyses with applications in biology. The current challenges linked to this master programme can be lessened through a partnership with the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM), universities and research institutions in other countries in West Africa (Ghana, Nigeria), Eastern Africa (Uganda, Kenya) and Southern African (SouthAfrica) to share and improve curricula in Biostatistics training.

Key words: Biological researches, innovations, modern statistical and mathematical methods, scientific research.

29- Effectiveness of inventory plot patterns and spatial distribution of trees and recruits in West African forest estimates: Recent findings and perspectives

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RUFORUM Working Document Series 14 (1): 497-506.

Abstract: Forest inventories constitute an important tool in decision-making by assessing quantitative and qualitative pattern of plant material and its evolution over time. Inventory techniques used in different countries in West Africa are numerous and diversified. This situation does not allow comparison of forest inventory results between different countries and decision making at regional level. Many studies have attempted to determine optimal inventory plot (shape and size) for different vegetations types. However, most of these studies have been undertaken outside Africa and did not take into account most common vegetation types of Africa. Recent studies in West Africa have focused on the comparison of inventory plot sizes and shapes and spatial pattern of trees and recruits on the floristic and dendrometric analysis of dense forest and woodland. From these studies, the

direction and shape of inventory plots do not influence the precision of the quantitative analysis of vegetation. However, square plots were suitable in practice. On the contrary, plot size is significantly correlated with the precision of floristic analysis and estimation efficiency. Where trees tended to be aggregated, estimation error increases with degree of aggregation, and rectangular plots of 0.24 ha resulted in more precision. In terms of regeneration, shape and size of subplots highly influence the estimation of the density of recruits and rectangular subplots were most efficient for the estimation of the density of recruits in dense forest. As for stem diameter distribution of regeneration, only the plot size had a significant effect on the mean absolute error of the stem diameter structure. Further studies are required in order to cover all the vegetation types met in Africa.

Key words: Error, non-randomness, plot shape, plot size, plot structure, regeneration, vegetation

30- Tree species diversity promotes aboveground carbon storage through functional diversity and functional dominance

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Abstract: The relationship between biodiversity and ecosystem function has increasingly been debated as the cornerstone of the processes behind ecosystem services delivery. Experimental and natural field-based studies have come up with nonconsistent patterns of biodiversity–ecosystem function, supporting either niche complementarity or selection effects hypothesis. Here, we used aboveground carbon (AGC) storage as proxy for ecosystem function in a South African mistbelt forest, and analyzed its relationship with species diversity, through functional diversity and functional dominance. We hypothesized that (1) diversity influences AGC through functional diversity and functional dominance effects; and (2) effects of diversity on AGC would be greater for functional dominance than for functional diversity. Community weight mean (CWM) of functional traits (wood density, specific leaf area, and maximum plant height) were calculated to assess functional dominance (selection effects). As for functional diversity (complementarity effects), multitrait functional diversity indices were computed. The first hypothesis was tested using structural equation modeling. For the second hypothesis, effects of environmental variables such as slope and altitude were tested first, and separate linear mixed-effects models were fitted afterward for functional diversity, functional dominance, and both. Results showed that AGC varied significantly along the slope gradient, with lower values at steeper sites. Species diversity (richness) had positive relationship with AGC, even when slope effects were considered. As predicted, diversity effects on AGC were mediated through functional diversity and functional dominance, suggesting that both the niche complementarity and the selection effects are not exclusively affecting carbon storage. However, the effects were greater for functional diversity than for functional dominance. Furthermore, functional dominance effects were strongly transmitted by CWM of maximum plant height, reflecting the importance of forest vertical stratification for diversity–carbon relationship. We therefore argue for stronger complementary effects that would be induced also by complementary light-use efficiency of tree and species growing in the understory layer.

Key words: carbon stock, community weight mean, functional richness, maximum plant height, niche complementarity, structural equation modeling

31- Latitudinal variation in the woody species diversity of *Afzelia africana* habitats in West Africa

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Tropical Ecology 57(4): 717-726,

Abstract: This study assessed the woody flora composition of *Afzelia africana* Sm. habitats along a latitudinal gradient, from the northern limit of the species distribution to the Guinean littoral forest. Data were collected from 201 sample units located in different vegetation types that span four bioclimatic zones: Guinean, Sudano-Guinean, Sudanian and Sahelo-Sudanian zones. The woody flora diversity was described by computing the estimated species richness and the Shannon diversity index within EstimateS 9.1, based on the observed species richness. A sample-based randomization procedure with 95 % confidence intervals was used to compare the patterns of plant richness between vegetation stands. A Non-Metric Multidimensional Scaling was performed on presence-absence data matrix to explore the patterns of woody species composition in natural stands. A Canonical Correspondence Analysis was further applied to correlate the patterns of habitat differentiation with climatic variables (temperature, precipitation) and altitude. A total of 165 woody species were recorded, with the highest species richness in SaheloSudanian zone. There was no significant difference in richness between samples from Guinean, Sudano-Guinean and Sudanian zones. Plots in the Sudanian and Sudano-Guinean zones were similar but distinct from those of Guinean and Sahelo-Sudanian zones, a pattern that is supported by precipitation and temperature distributions. Results also suggest important cooccurring species characteristic of each habitat as inferred from the Important Value Index (IVI). It is recommended that habitats of *A. africana* in Sudanian and Sudano-Guinean zones receive similar management and conservation plans while the Guinean and the Sahelo Sudanian zones can be treated separately.

Keywords: Climatic gradient, conservation ecology, floristic composition, importance value index, multidimensional scaling.

Appendix 3: Abstracts of some doctoral research proposals of students in LABEF in 2016

Marcel DONOU (Doctorate student)

Use, Ecology and Conservation Biology of raffias' species in Benin (West Africa)

Abstract: Non-timber forest products (NTFP) have been harvested by human populations for subsistence and trade. Palm trees, like any other NTFPs contribute to household economy and strengthen food security through the use of their organs such as spine, sap and stipe. But several palm trees are threatened in Africa because of overexploitation and habitat loss. For example, in Benin there are wild palms like *Raphia hookeri*, *Raphia vinifera* and *Raphia sudanica* used by local populations for food, construction and craft industry. But social or environmental changes in Benin leads to a change of NTFPs uses mainly the raffia's species. It is therefore important to determine the socioeconomic and ecological impacts of raffia's use for a better management of their populations. In the absence of long-term studies, investigations on population structures, which can be easily achieved from single surveys of size class distributions, are one of the best ways to obtain urgently needed data to investigate the demographic health of harvested populations. The present proposal aims to assess the socioeconomic context of raffias' species exploitation, the raffias' uses ant it impact on socioeconomic characteristics, the propagation ways and the impact of traditional ecological knowledge on conservation of raffias' species. These informations are important in order to (i) obtain an indication on the status of the raffia populations, (ii) assess its harvesting tolerance and (iii) estimate to what extent their actual use is sustainable. The project will be carried out in all departments of nine phytogeographical areas spread over the three climate zones of Benin. Ethnobotanical and forest inventories will be used for the data collection.

Keywords: Use, raffia, harvest intensities, land-use, TEK, Benin.

Gisèle K. SINASSON (Doctorate student)

Ethnobotany and Ecology of Mimusops andongensis Hiern and *Mimusops kummel* Bruce ex A. DC*: implications for the species management and conservation in Benin (West Africa)*

Abstract: Forest resources in general and NTFP (Non-Timber Forest Products) species in particular are facing threats to their conservation and rational management, because of the many services they provide for human wellbeing. Likewise, many NTFP species also face multiple pressures such as land use change, altered fire regimes or increased herbivory from domestic livestock and competition from invasive species. Current environmental stress from climate change added to abovementioned threats significantly modify species habitats and model their growth, survival and success in reproduction. However, our understanding of the effects of multiple stressors on useful species is limited. Hence, a better understanding of the species uses along with their autecology, in the context of both individual and multiple threats is crucial for conservation and management issues. This needs species to be well described and easily recognizable within their habitats. Agroforestry using vegetative propagation is seen as an important mean to maintain local uses of indigenous species and promote long-term sustainable conservation, especially if natural regeneration is low and viable seeds difficult to get. Useful species includes species still neglected by development and conservation agencies, and yet exploited by local people such as *Mimusops andongensis* and *Mimusops kummel*. Therefore, this project seeks to (i) clarify which of the two *Mimusops* species exists in the different climatic zones of Benin, (ii) assess the ecological habitat of both species and impacts of change in ecological factors, (iii) assess local knowledgeon the species uses, occurrence habitat and threats faced, (iv) characterize their population structure and phenology according to ecological gradients, (v) characterize their growth dynamics in their habitats and (vi) assess their vegetative propagation potential. For that purpose, we are using a multidisciplinary approach including social survey, phenological monitoring, taxonomic, ecological and morphological assessment, niche modeling, tree-rings analysis and propagation experiments.

Keywords: Ethnoecology, growth dynamics, neglected and underutilized species, niche modeling, plant ecology, plant morphology, plant phenology, taxonomic differentiation.

Tèwogbadé Jean Didier AKPONA (Doctorate student)

Management strategy of endangered timber species in Benin: prioritization and population stability analysis

Abstract: Forests and protected areas in West Africa are valuable cultural landscapes. They provide a wide range of ecosystem services for human well-being. Besides agricultural activities, harvesting of timber and non-timber forest products (NTFP) is crucial for household income, food, and health. To maintain these important ecosystem services, some frequently used tree species are spared when land is cleared for agriculture. However, most indigenous timber species are affected by high anthropogenic pressure. The ongoing exploitation of natural resources affects plant population structure. Though Benin is a moderate forest country with vegetation dominated by savannahs and woodlands, forest logging takes an important place in population activities around protected areas. This situation could be explained by population increase, poverty, agriculture, etc. Many species are used in forest exploitation, yet very low information is available in their sylviculture. To fill this gap, this PhD project aims to (i) document the current timber species involved in logging according to climatic zones ; (ii) prioritize timber species involved in logging in order to propose a national conservation strategy; (iii) assess the combine effect of land use and climate on population structures of priorities timber species; (iv) conduct germination tests and seedling growth of priorities timber species; (v) document the diversity of pollinators and local perception on ecosystem services provided according to different habitats in Benin ; (vi) model distribution and habitat suitability of priorities species in Benin. The findings of this research will help to redefine reforestation program in Benin.

Keywords: Inventory, timber species logging, prioritization, distribution, modeling, anthropogenic pressure, Pollinator's, climate change.

Kisito GANDJI (Doctorate candidate)

Modelling ethnobotanical patterns of Moringa oleifera Lam. (Moringaceae) in Benin (West Africa)

Abstract: *Moringa oleifera* Lam. is an agroforestry food plant native to India, is produced and used in many countries in Africa, Asia, Latin America, and the Caribbean. *M. oleifera* can be used as a climate change mitigation strategy. The effects of climate change are making droughts more of a norm than an exception. This is a pattern that places some of the most vulnerable communities in an increasingly precarious position when it comes to meeting basic food needs. Shortages and hunger reach "emergency" levels and warrant aid; and families, communities, agricultural practices and lands will have suffered greatly. Moringa can play a key role in the fight against desertification because it grows fast and well in dry areas, and in areas where strong winds and long dry spells occur simultaneously causing serious soil erosion. Compared to all others vegetables, *M. oleifera* has the highest content of vitamins A and C with good amounts of protein, phosphorous and calcium. To know which aid is really durable to combat food shortages and efficient for climate change mitigation, it is good to look at the potential that is already available in developing and third world countries. *M. oleifera*is a very simple and readily available solution. Despite its very high nutritional value and its important role in climate change mitigation, *M. oleifera* is still underutilized and neglected. The species grows in countries where there are the highest rates of malnutrition and where there are the strong impacts of climate change. This constitutes an opportunity to these populations. This PhD researchaims to sustainably contribute to the improvement of the level of use and cultivation, and also to a better biomass production of *M. oleifera* in Benin. This will be achieved through: (i) critical review of the existing literature on *M. oleifera*; (ii) assessment of the impact of sample size on the precision of ethnobotanical indices of *M. oleifera*; (iii) quantitative assessment of ethnobotanical patterns of *M. oleifera*; (iv) identification of key factors driving cultivation and use of *M. oleifera;* and (v) assessment of the morphological diversity of *M. oleifera*. The study is being conducted in Benin, a West African country based on the main ethnic groups consuming and using the species and within each of the three biogeographical zones of the country. The outcomes will be very useful for the promotion of the species, for mitigation of climate change effects and for food security.

Keywords: *Moringa oleifera* L., neglected and underutilized species, sample size, ethnobotanical indices, ethnobotanical patterns, cultivation, use, morphological diversity, Benin.

Innocent Sènandé ECLOU (Doctorate candidate)

Assessment and analysis of agronomic and ecological aspects of cotton farming systems for a sustainable cotton production in Benin (West Africa)

Abstract: Cotton is the main cash-crop in Sub-Saharan Africa whose estimated population of 856 million in 2010, is projected to exceed two billion shortly after 2050. It plays a very important role in the economy of several African countries, including Benin Republic. However, most current cotton production systems are not sustainable and this could become a significant obstacle to the future development of these countries. Particularly in Benin Republic (West Africa), the massive use of pesticides and other agrochemicals in conventional cotton production methods results in severe environmental and health problems. But No study was conducted in Benin Republic on persistence and degradation of pesticide residues in soils under cotton cultivation. Yet we know that Organic cotton which by definition is cotton produced without chemicals, appears as a solution. However, low productivities observed in biological or organic cotton production systems are an obstacle to the adoption by farmers of these cropping systems. Nevertheless, the existence of biological or organic cotton shows that it is possible to produce cotton without using chemicals. It is in this context this study intends to evaluate and analyse the agro-ecological impacts not only of conventional and organic cotton production systems currently used in Benin but also some innovative cotton production methods which could give good yields and protect more environment and human health. This doctoral thesis study seeks to: (i) review the existing literature on cotton production in Africa, (ii) analyse effects of different cotton production practices on its agronomical performances, (iii) analyse effects of different cotton practices on soil fertility characteristics, (iv) assess pesticide residues impacts following different cotton farming systems, (v) Quantify pyrethroid and organophosphate pesticide residues in soils from cotton production area and (vi) analyse pyrethroid and organophosphate pesticides persistence and degradation in incubation study. This study is being conducted in two different cotton agro-ecological zones of Benin Republic. This research project is funded by the Kingdom of Denmark.

Appendix 4: Abstracts of interns hosted by LABEF in 2016

Abstract of the internship report of Dr. Seyni SANE

***Funder**: INTRA-ACP ACADEMIC MOBILITY SCHEME PROJECT Inter-University Cooperation to Train Crop Scientist for Enhancing Agriculture in Africa (CSAA) AGREEMENT NUMBER 2013-4177/001-001*

Abstract

This internship for capacity building took place in the Laboratory of Biomathematics and Forest Estimations (LABEF) of the Faculty of Agronomic Sciences (FSA) at the University of Abomey-Calavi (UAC) in Benin. This internship is within the framework of the program of the inter-university mobility of training of the scientists of ACP countries to improve agriculture in Africa. The objective is to build capacity of scientists in statistical methods applied to biological sciences (biostatistics). For three (03) months, various methods of statistical analysis were reviewed and applied with real world data. The activities during the internship strictly followed the schedule established. A bibliographical review of the various statistical methods was made as well as the application of these methods in the software R and MiniTAB. The methods of data collections in particular the sampling and the experimental design were analyzed as well as their conditions of use. Descriptive and inferential statistical methods were studied and applied in the software R and MiniTab. The applications of the statistical methods in the software were done under the close supervision of lecturers and/or the researchers of the laboratory. This internship allowed me to improve my knowledge in the domain of statistical methods, their applications in R and MiniTAB but also to acquire new knowledge in data processing. These new capacities will allow me to better teach and use statistical methods in my home University (UCAD).

Keywords: capacity building, statistical methods, LABEF/UAC, UCAD, CSAA, Intra-ACP

Appendix 5: Abstracts of the scientific seminars in LABEF in 2016

Seminar of January

Models of biomass and mineralomass for forest management: what progress?

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Abstract: So far, forest managers have used volume tables for wood market volume estimation purposes. On the other hand, the use of tables to evaluate biomass and mineral content, the mineralomass, is rather very recent as a response to new assignments to managers in the context of climate change and sustainable forest management (maintenance of the soil functions). In this context, the objective of the EMERGE project was to estimate the total volume, total biomass and complementary biomass of wood energy found mainly in the crown for the main European tree species. In addition to these models, estimates of mineral and calorific value were considered in order to study more finely the exports in mineral elements and the recoverable energy. In connection with several other projects, including the Agreement Framework on Forestry Research and Extension, EMERGE has resulted in the creation of a data warehouse of exceptional size. These data produced the first generic models of biomass (six species) and mineralomass (mainly beech and oak). These models, in addition to their direct interest in inventories made by national forest managers or inventories to characterize forest resources, are obviously critical tools that are integrate into growth models in order to simulate the evolution of forest resources depending on the different constraints and potentialities.

Keywords: wood, sustainable forest exploitation, volume, biomass, mineralomass, project EMERGE

Seminar of March: Two-day seminar

Decision Tree Analysis: *Principles and Applications in Biological Sciences*

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Abstract: Today, methods for handling complex data are one of the most appealing areas in biological modeling. This is because we increasingly need to understand complex biological phenomena for reliable decisions making. A decision tree is a decision-making tool representing a set of choices in the graphical form of a tree. The objective of decision tree analyzes is to determine a set of logical partitioning conditions of the type *"If ... - Then ..."* in order to predict as precisely as possible the expected values or classifications of a set of observations. The different possible decisions are located at the ends of the branches (the "leaves" of the tree), and are reached according to the decisions taken at each stage or step of the decision process. There are two general types of decision trees based on the type of the response variable: *classification trees and regression trees*. For classification trees, the response variable is nominal whereas for the regression trees the response variable is numerical (either continuous or discontinuous), the aim being to predict the value of the response variable as near as possible to the true value. The decision tree is a tool used in various fields including security, data mining, biological and social sciences, etc. Decision tree analysis can be used for *segmentation*, *stratification*, *prediction*, *data reduction* and *selection of variables*, *exploration of the data structure*, *identification of interactions between "predictor" variables* and the discretization of continuous variables. Decision trees have the advantage of being readable and quick to execute, simple of understanding and interpretation, and less demanding in terms of data preparation. In addition, decision trees provide the ability to manage both numerical values and categories; the ability to validate a model using statistical tests; and have excellent performance over large data sets. During this two-day seminar, the lecturers will introduce examples of real world data for which the classical methods (linear regression, generalized linear models, linear/quadratic/logistics discriminant analysis, etc.) perform poorly or do not meet the required conditions

for application (normality, homoscedasticity, equality of the variance-covariance matrix, etc.). They will then present the principles of the analysis by decision tree, its advantages and limitations. The presentation will end up with two examples of applications on real world data in the R software, in particular using R software packages: *"rpart"*, *"tree"* and *"randomForest"*. How to report the results of a decision tree analysis in a scientific document will be discussed with the participants.

Keywords: Regression, classification, data structure, selection of variables, forecasting.

Seminar of April

Application of mixed model analysis for crop improvement: prediction of genetic values with BLUP and Bayesian methods

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Abstract: The selection of elite individuals among a population of candidates requires partitioning the observed phenotypic values (data records) into genetic and environmental effects. This can be done based on a linear mixed model where the genetic values are considered random. One of the major interests of the mixed model is its ability to exploit the genetic correlations arising from the relatedness between individuals. The mixed model can be analyzed with best linear unbiased predictor (BLUP) methodology and with Bayesian approaches. Until recently, the relatedness between individuals was estimated based on pedigree. However, this yields expected relationships, which can differ widely from the value of interest, i.e. the realized relationships. The traditional pedigree-based relationships are now being replaced by molecular relationships computed from a large number of markers covering the whole genome. This opened the way to genomic predictions of genetic values, which gives the possibility of predicting the genetic value of individuals without data records, providing they were genotyped with the same markers as the individuals used to calibrate the genomic model. This new approach is expected to revolutionize plant breeding. This talk will first give basic information regarding the genome and SNP markers and will present the model of quantitative genetics, gene effects and the computation of pedigree-based and genomic relationships. In a second part, it will show how to predict genetic values by mixed model analysis and will present the genomic selection approach.

Keywords: linear mixed model, BLUP, quantitative genetics, genomic predictions, breeding value

Seminar of **May**

Common components and specific weights analysis: application in R

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Abstract: Common component and specific weight analysis (CCSWA) is a relatively new multiblock method and constitutes an extension of the principal component analysis (PCA) in the case where at least two groups of quantitative variables were measured on the same individuals. The improvement of the CCSWA compared to PCA is the relative good knowledge of how the various variables groups contribute to the interpretation of common components. Starting from a single group of variables measured on the individuals, the presenter will briefly described the principle of PCA. With 4 groups of variables measured on the same individuals, the limits of the PCA in describing relationships between these groups of variables will be presented. The relevance of CCSWA in the simultaneous description of the relationships between these groups of variables will then be shown. After describing the principle of CCSWA, a script adapted from Qannari et al. (2000) for the application of the method in R will be presented. The dataset to be used is

about the perceptions of five ethnic groups on (i) causes of soil degradation, (ii) erosion factors, (iii) adaptive measures to erosion and (iv) techniques for improving soil fertility and crop yield.

Keywords: CCSWA, PCA, multiblock analysis, perception, soil degradation.

Seminar of June

Heterogeneity and population response to non-timber forest products harvesting

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Abstract: Harvesting wild plants for non-timber forest products (NTFP) serves as a valuable source of food and medicine for local communities and potentially contributes to poverty alleviation. However, frequent harvest at high intensity can lead to plant population decline, and jeopardize the ability of future generations to benefit from these ecosystem services. To assess the sustainability of NTFP harvest, a growing number of studies have used matrix projection models to estimate the effects of harvest on the long-term population growth rate, and its elasticity to changes in population vital rates. These models assume that harvesting is a population-level treatment. However, harvest takes place at the individual plant level where products such foliage, bark or fruits are extracted. As a result, in a harvested population, some individuals may be unharvested. If unharvested individuals are overachievers (e.g., faster growth, better survival, more reproductive output than the average), they may compensate for the negative effects of harvest on the demography of harvested individuals. The rate of biomass removed by harvest at the individual level is a random variable. I investigate to what extent greater or less heterogeneity in NTFP-harvest intensity affects plant population dynamics and response to biomass loss. In this talk I will use four years of demographic data on African mahogany to measure individual tree level harvest heterogeneity, and to parameterize an integral projection model which accounts for such heterogeneity. In West Africa, *Khaya senegalensis* trees are frequently defoliated by pastoralists to feed cattle and debarked for medicinal purposes. At the individual tree level, I found greater heterogeneity in within year harvest intensity for foliage than for bark. Foliage and bark harvest has negative effects on the mahogany population dynamics. Changes in individual tree level harvest heterogeneity alter the overall effect of harvest on population dynamics and this has implications for foliage sustainable harvesting limits. This talk will highlight the importance of accounting for individual level heterogeneity in biomass loss due to harvesting in designing sustainable harvest strategies.

Keywords: NTFPs harvesting, ecosystem services, demographic models, heterogeneity.

Seminar of July

Principles of plant breeding: overview, case studies, applications in conservation strategies, and promotion of agroforestry practices

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Abstract: Plant breeding is the science, art, and business of improving plants. It seeks to fulfill human needs and improve the living conditions of humankind, through the development of plant cultivars that bear more desirable traits such as higher yield, better palatability, easy harvesting/processing ability, resistance/tolerance to drought, diseases and other biotic and abiotic stresses. Successful plant breeding programs should well understand and make efficient use of its principles. After an overview of the major principles of plant breeding, the presenters will cover case studies of two mating designs (Diallel with soybean lines and North Carolina II with maize lines), a case study on genotype by environment interaction with soybean lines, and thereafter an application of molecular breeding where the focus will be on Quantitative Trait Loci (QTLs) mapping in aF2 population. Finally, emphasis will be put on how and which

the above mentioned principles can be used in defining conservation strategies and promoting agroforestry systems.

Key words: Plant breeding, mating design, Quantitative traits loci

Seminar of November

Plagiarism and autoplagiarism in the documents of valorization of scientific research

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Abstract: Scientific research, the utilization of research results, various types of scientific writings and documents of valorization of the results of scientific research are at the heart of many concerns and interpellations of researchers and lecturer-researchers on a planetary basis on one hand and constitute keywords of questionings appearing unceasingly in the process leading to the utilization of the results of scientific research on the other side. "**Scientific research"** is a methodical study in order to prove an assumption or to answer a precise question (< https://explorable.com/fr/definition-of-the-research >).The concept of valorization is centered on those six following categories of comprehension not mutually exclusive:- i- academic or professional valorization;- ii- scientific valorization;- iii- technological valorization; -iv- social valorization; -v- economic valorization; -vi- political valorization. The two types of distinguished writings are –i- functional, real or social writings and –ii- fictional or imaginary writings. However, scientific writings (such as tales, novels, news, reports, testimonies, etc.) are classified differently (such as according to the support, the topic, the recipient, the literary nature, the mode of stating, the type of dominating text, the tone, etc.). Different types of documents of utilization of the results of scientific research are as follows:-i- the research report (technical and research report);-ii- thesis report;-iii- the acts of conference (communications, résumés/abstracts and posters); -iv- scientific papers [article a priori (ab origin) and article a posteriori];-v- the factsheets;- Technical-economic referential; - vii- sensitization work;- viii- patent;- ix- the Technical Information Document (TID);-x- the Technical and Informative Document; -xi- the policy brief; etc. The writings in sciences take several forms of physical presentation such as the form of paper, the dummy form, the electronic form, etc. Admittedly, the valorization of a research result needs **the validation of the result** which is the recognition of the scientific and technical value of the result. This validation can come from a scientific community or users at the basis and various methods can be used for that. All scientific writing focuses and is inspired by former writings following a synthesis or bibliographical analyses relating to the topic or the field. Any scientist or author of a scientific writing must learn how to correctly quote his sources and its scientific publication can take advantage from it. **Plagiarism**, it is the fact of adapting the ideas or the words of someone else by passing them for his[1]. The **autoplagiarism** consists in the re-use of what one wrote in other publications without quoting them[2]. Bergada (2013)[3] mentioned this: plagiarism is first of all the theft of the original creation; the **autoplagiarism** is not a theft; those involved in plagiarism and autoplagiarism equally disagree with fundamental right of the reader to the access to the origin of the knowledge sources; scientific plagiarism, autoplagiarism and frauds cause significant collateral damages. Plagiarism and the autoplagiarism are wounds of scientific research and in the scientific writings. Plagiarism and the autoplagiarism can be voluntary or involuntary. Plagiarism and the autoplagiarism are out of place in the scientific writings.

[1] http://www.univ-angers.fr/fr/formation/anti-plagiat/c-est-quoi-le-plagiat.html
[2] www.20minutes.fr›Sciences
[3] Bergada Michelle, 2013. Autoplagiat, Plagiat et fraude scientifique. http://responsable.unige.ch/assets/files/auto-plagiat.pdf

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