# Current questions in sustainable fisheries, water management and higher education

## BOOK of ABSTRACTS

## SUSFISH Workshop & West Africa Symposium 2013

**Vienna, Austria, 23. – 28 of June 2013**

Edited by Andreas Melcher, Raymond Ouedraogo, Moumini Savadogo and Jan Sendzimir

**SUSFISH - Sustainable Management of Water and Fish Resources in Burkina Faso**

Funded by APPEAR (Austrian Partnership Programme in Higher Education and Research for Development) Project 56, financed by the Austrian Development Cooperation


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http://susfish.boku.ac.at/
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# Content

## West Africa Symposium — Institut Français Vienne



## Symposium Session 1 Sustainable Water Management



## Symposium Session 2 Higher Education, Perspectives and Partnership

# Acknowledgements

This workshop and symposium was undertaken as part of a three-year APPEAR project financed by the Austrian development cooperation, named SUSFISH (Sustainable Management of Water and Fish Resources in Burkina Faso). The project, whose aim is to promote sustainable water management and fisheries towards social development and poverty reduction in West Africa, was launched in November 2011 and is being undertaken by a consortium of in total 7 institutions of higher education and development in Burkina Faso and Austria, namely:

- Institute for Environment and Agricultural Research, Ministry of Research and Innovation, Ouagadougou, Burkina Faso
- General Directorate for Fish Resources, Ministry of Animal and Fish Resources Ouagadougou, Burkina Faso
- International Union for Conservation of Nature and its Resources (IUCN), West and Central Africa, Programme Burkina Faso
- Polytechnic University of Bobo-Dioulasso, Burkina Faso
- University of Ouagadougou, Burkina Faso
- University of Vienna, Austria
- International Institute for Applied Systems Analysis (IIASA), Laxenburg Austria
- BOKU University of Natural Resources and Life Science, Vienna, Austria

This workshop and symposium was also done in close cooperation with the program 'IRD G-eau' and APPEAR project "MEAMP Elements for a Burkina Faso national pharmacopoeia: monographs redaction and quality control of endangered antimalarial medicinal plants" and finally but not least the Institut Français de Vienne.

We want to thank all donors, partners and people who supported and are still supporting our work – especially Mrs. Gritschi Kerl for sharing all her knowledge and great experience with us.

## Farewell of the Workshop and Symposium

- French Ambassador in Vienna S.E. Dr. Stephane GOMPERTZ,
- Burkina Faso Ambassador/Représentant in Vienna S.E. Mme Solange Rita BOGORE
- The Head of the BOKU Department WAU Prof. Herwig WAIDBACHER
- and the Head of BOKU Institute IHG Prof. Stefan SCHMUTZ.

# Introduction

A number of challenges, including climate change and population growth, threaten the fair and sustainable availability of water and fisheries in West Africa. Over the past 40 years, Burkina Faso has built hundreds of reservoir dams to increase the reliable storage and delivery of water, and as a result hundreds of fisheries have become established in a vast network of reservoir lakes. However, inland fisheries production has plateaued at the same time that quality (size) of fish has dramatically declined, thereby limiting the fecundity and productive potential of the fishery. Improving fishery management policies and practices will require substantial increases in what is reliably known about the biophysical and socio-cultural factors that influence these trends.

The Institute of Hydrobiology and Aquatic Ecosystem Management (IHG) and the Centre for Development Research (CDR), **University of Natural Resources and Life Science** (BOKU) and the **Institut Français de Vienne** have joined to organize a workshop and a symposium to review scientific research on how to make inland fisheries and water management sustainable in West Africa and how to use these ideas and tools to build capacity in academia, government and among local practitioners. Results of the APPEAR project SUSFISH (Sustainable Management of Water and Fish Resources in Burkina Faso) were discussed also.

As of November 2012 a Memorandum of Understanding (MoU) was signed between the **University of Ouagadougou** and the BOKU in order to strengthen collaboration in building scientific capacities in higher education in Burkina Faso. As a first result of this partnership four Austrian "Applied Limnology" students got a BOKU scholarship and the opportunity to do their master thesis field work in Burkina Faso. For three month they sampled fish and benthic invertebrates together with students from the University of Ouagadougou in the Nakambe basin. On the other hand four Burkinabe students (3 PhD, 1 Master) will start their lectures in September 2013. They are especially integrated into the BOKU master program "Applied Limnology", coordinated by the BOKU – IHG, and they got an additional APPEAR scholarship.

The overall goals of these meetings were to:

- present SUSFISH results and to discuss further steps and publications.
- strengthen SUSFISH partnership and network.

Questions to be answered:

1. What are the questions that were addressed so far in SUSFISH research?
2. What are the findings from natural and social science researchers? Corollary: what are good sources of information that we should study?
3. What questions remain to be addressed in the coming months? This will help identify factors that will be looked at by SUSFISH researchers and those that will not be examined, which we must look at on our own (literature review, interviews)
4. Which scientists are able to contribute on a systems analysis, both before, during and after the November 2013 field visit in Burkina Faso?

**This book gives abstracts of the different presentations and the key findings of the workshop and the symposium. For more information you can find the associated presentation at susfish.boku.ac.at - as a PDF file for download.**

# SUSFISH Summary in French

**SUSFISH : Projet Gestion durable de la pêche et des ressources en eau au Burkina Faso**

Des centaines de plans d'eau artificiels de taille variable ont été construits à partir des années 1950 pour répondre aux épisodes de pénurie d'eau au Burkina Faso, pays sahélien. Dispersés sur toute l'étendue du territoire national, ces réservoirs offrent l'opportunité d'intensifier les productions agro-sylvo-pastorales. Utilisés comme pêcheries, ils fournissent une source de protéines animales de bonne qualité. Mais leur surexploitation est une source de menace pour les services qu'ils offrent aux populations.

Le projet gestion durable de la pêche et des ressources en eau contribuera au développement de méthodes standardisées d'évaluation de l'état écologique des écosystèmes. Il vise spécifiquement à renforcer les capacités scientifique, politique et technique du Burkina en matière de gestion des pêcheries, à travers une coopération renforcée entre des chercheurs autrichiens et burkinabè, de même que celles des institutions de gestion et de formations dans les domaines de l'eau en général et des ressources halieutiques en particulier.

Les résultats serviront à améliorer la formulation, la mise en œuvre des politiques, ainsi que les enseignements dans les écoles professionnelles et les universités du Burkina Faso et auront des effets notables dans le domaine de la santé et celui de la sécurité alimentaire.

# Technical Summary and Key Findings

The SUSFISH workshop was held from the 23rd to the 26th of June, 2013 at the BOKU University in Vienna. A public symposium was conducted on the 27th and 28th of June 2013 at the Institut Français de Vienne and introduced sustainability science research currently being pursued by French scientists in Burkina Faso (IRD Institut de recherche pour le développement) and other nations of Africa.

The workshop was organized to show the potential for sustainable solutions that can emerge when a diversity of perspectives from social and natural sciences, from academia, government and informed lay community are integrated in the pursuit of policy reform.

This week more than 100 visitors from 12 countries attended more than 30 scientific presentations and discussions, also prepared for the public. One highlight was the Austrian film premiere "Les grands Barrages en Afrique de l´Ouest" a documentary film produced by IUCN and ECOWAS (Economic Community of West African States). Speakers came from 12 different scientific and public institutions, working in theory and practice on concepts of life sciences, development research, biology, ecology, food security, sociology, anthropology, medicine, education, gender, system analyses and political topics. Beyond that, intensive and fruitful discussions about partnership, higher education, participation, gender but also climate change, human impacts ecosystem services helped us to understand each other better.

Several recent developments and news remind us how complex and essential integrated approaches are. Based on the experiences of the past years and new findings, we want to reflect on

whether sustainable solutions are possible on regional, national and international level. Today's development challenges demand integrated approaches that allow leveraging on synergies to obtain multiple benefits concurrently.

## Preliminary Findings from SUSFISH Research Activities

- More than 75 fish species and 61 families of macro-invertebrates have been identified and their spatial distribution described. *Auchenoglanis* gen. and *Hydrocynus* gen could be used as sentinel genera. *Clarias* sp and *Sarothorodon* sp increase with pressures, unlike other species, e.g. *Alestes* sp and *Schilbe* sp., which are sensitive and decrease in number as pressures rise.
- There are important differences between the communities of benthic invertebrates in rivers and in reservoirs. Water plant habitats exhibit a higher taxa richness and diversity than sediment habitats.
- An official list of fish species, a national database of meta information on existing biophysical characteristics of fisheries, the diversity and conservation status of fish species and benthic invertebrates, the pressures on fish populations and methods of water assessment based on fish and macroinvertebrates are under development
- The population of direct fisheries stakeholders is estimated at about 32 700 persons (14% are women and 82 % men), 3 000 fishmongers (54% are woman). Between groups of stakeholders some disparities in the access to fish resources are noticeable: man vs. women, allochthon vs autochthons, youth vs. elderly, etc. In SUSFISH, the gender concern aims at integrating gender issues at all stages of research.
- The results of social science research show first, that macro-level policies and legislation are not known at regional and local levels. The national organization in charge of fisheries is unknown as well because no tangible activity is undertaken in the field or to target the direct stakeholders. The field police fisheries officers (foresters) are not inclined to work on fisheries in the areas of monitoring, surveillance and control. As a result, prohibited fishing methods are more and more used. Second, both republican and traditional institutions make relatively important contributions to the governance of water and fish resources. But the two systems have to be harmonized
- We observed that in Burkina Faso, fish intake contribute in improving food and nutrition security. Income from fish sales also helps improve the household food and nutrition security.
- As for capacity building and education strengthening, more than 3 PhD students and more than 20 master ones are already involved in SUSFISH. Several others are also expected to be assisted.

# SUSFISH Workshop 22. – 26 June 2013

## *BOKU University of Natural Resources and Life Sciences*

## Workshop Presentation Abstracts

## SUSFISH Session 1 - Natural Sciences

### WS01 SUSFISH

### Sustainable Management of Water and Fish Resources in Burkina Faso

Andreas H. MELCHER, Florian PELOSCHEK & Jan SENDZIMIR

In response to threats of chronic water scarcity and episodes of severe drought, since 1950 hundreds of reservoirs were created to provide a dispersed network of water storage facilities throughout Burkina Faso. As fisheries, these reservoirs also became important new sources of food. However, pressures of overfishing, intensive agriculture and sedimentation threaten the services (fish, water quality) these reservoirs provide. To establish sustainable management of natural and man-made aquatic systems, Burkina Faso requires methods and tools for the standardised assessment of the water quality and ecological status of rivers. The purpose of this project is to strengthen in-country capacities for science, policy and practice so as to establish the basis for sustainable fisheries in Burkina Faso. This means building scientific capacity to monitor and assess the dynamics of reservoir services (fish, water), the educational capacity to train scientists and technicians in these concepts and methods, and institutional capacities in management and policy formulation, that are linked with research and education in the sphere of water and fisheries in Burkina Faso.

The innovations this project will introduce are: most current methods and technology of monitoring fish populations and water quality, the current methodological standard for Europe in statistical modelling that rigorously establishes bio-indicators by linking sets of species (fish and benthic invertebrates) with water quality parameters, the frontier of social science research into the effectiveness of republican and traditional forms of governance and how to harmonize them, current experiments with scenario development to allow managers and planners to explore policy development far into the future, systems analysis of the ecological, economic and social factors that can individually or by interaction create opportunities or barriers to sustainable fisheries management, the latest in educational (lectures, training manual) techniques to sustain the use of the projects innovations in future generations of scientists, policy makers, managers and local practitioners. The results will be used to formulate and implement fish and waters policies, in education (universities and governmental agricultural professional schools) and will have practical relevance for food security and health care.

Our project uses a holistic approach to fisheries that integrates multiple perspectives (academic, policy and local practice). This requires both a multi-disciplinary team skilled in the natural, human and policy sciences and the involvement of fishery policy makers to develop and implement more

sustainable strategies suitable to the environmental and political context of Burkina Faso. Academic input (researchers/lecturers) should provide the scientific background necessary to formulate policies in natural resources and poverty reduction and strengthen education in universities. Incorporating the inputs of local politicians and fisherman with those of national scale decision-makers and academics will orient academic and policy research along the most practical lines.

Major thematic foci of SUSFISH include:

1. Build capacity to study, monitor and manage sustainable fisheries [overall goal of the project].
2. Develop water management and assessment methods based on fish that are applicable for use in Burkina Faso
3. Identify, evaluate, and prepare existing data for fish, environment and pressures for a national database. Actually to evaluate the status of conservation of fish in Burkina Faso.
4. Analyze the relationships between pressures (incl. overfishing, land use, continuity) and the dynamics in fish assemblages and in water quality.
5. Develop ecological awareness by using appropriate case studies to demonstrate the importance of ecological services and biodiversity to the nation's food security and health care.
6. Support the implementation and dissemination of project results by (a) integration of the project results in the education policies and on-going national programmes, (b) workshops and international conferences.

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## WS02 Fish Assemblages and Habitat Use in the Upper Nakambe Catchment

Paul MEULENBROEK

This study, supported by the BOKU University of Natural Resources and Life Science, Vienna and the University of Ouagadougou, analyses fish assemblages and their habitat use in the Upper Nakambe catchment of Burkina Faso located in the central part of West Africa. The study gives an overview on the available habitat conditions and their effect on fish community composition and abundances as well as on habitat use of single species. Furthermore the conducted fishing methods, electric fishing and the traditional cast net fishing are compared and their pros and cons are discussed.

To answer these questions we sampled 157 fish habitats, caught 18,335 individuals and recorded a total number of 16 families, 35 genera and 70 species in four different river reaches. There are lists provided with the spatial distribution of the caught species, ranges for different habitat parameters and usage curves of four key species; i.e. *Labeo cubie* shows a coarser substrate usage than *Bagrus bajad*; and the habitat of *Chelaethiops bibie* exhibits high occurrences for Xylal. The results of this research make important contributions to the general knowledge on habitat use and ecology of fish in semi-arid areas of Africa. They can be used as a management tool to monitor and maintain the health and sustainability of fishery ecosystems, which in turn contributes to food security.

## WS03 Human impacts on the fisheries management in Burkina Faso

Sebastian STRANZL

Fish is an important protein source for the population of Burkina Faso. However, overfishing, fragmentation, agriculture and other human pressures lead to a decline in the fish population's diversity and biomass. Biological indicators like fish or benthic invertebrate indices are essential for assessment of water and ecosystem health and sustainable management to assure food security and healthy waterbodies. The goal of this thesis is to characterize fish assemblages in the sampling area, to find out about human pressures which lead to a decrease of fish populations, to find species sensitive to pressures and to propose measurements for improvement.

In a first step the sampling sites in the Nakambe catchment between the reservoir of Loumbila north of Ouagadougou and the border of Ghana were selected together with our supervisors. These sites are: Koubri, Kougri, Loumbila, Bagre, Ziga and the protected area of Nazinga. All sites are exposed to more or less human pressures. Altogether, 37 sites and 137 habitats were selected. Each habitat was fished electrically by us and with a castnet by local fishermen. On site, adjacent landuse, obvious stressors and physical parameters were noted. Water samples were taken from selected sites and transferred to a private laboratory in Ouagadougou for chemical analysis.

The length of each fish was measured and a species list was created. Unknown species were conserved in alcohol and taken to Austria for further determination. The proportions of Clarias gen. and Sarotherodon gen. increase with the number of pressures, whereas sensitive genera like Alestes gen. and Schilbe gen. decrease. We found some sentinel genera which only occur in low-pressure sites like Auchenoglanis gen. and Hydrocynus gen. This work can be a basis for a fish index which will be created by Burkinabe students in the frame of the SUSFISH project.

## WS04 Benthic invertebrate assemblages in the Upper Nakambe Basin

Daniel TRAUNER & Thomas KOBLINGER

This study analyses benthic invertebrate (BI) assemblages in the Sub Sahelian landlocked country Burkina Faso, West Africa. It investigates if and how river and reservoir BI communities discriminate and how the taxa composition reacts to anthropogenic stressors. Furthermore the study examines different habitats (sediment and various water plants) and different sampling areas and gives information about the uncertainty of sampling.

Sampling took place at the beginning of the dry season between October and December 2013. The 26 sampling sites (rivers and reservoirs) were situated in the catchment of the Nakambe river and included the capital Ouagadougou, agriculturally impacted sites in Koubri and Bagre, the drinking water reservoir of Ziga, protected water bodies in the game park Nazinga and potential reference sites from the area around Bobo Dioulasso (Mouhoun catchment) and Banfora (Comoe catchment).

In total, out of 20 000 specimen 105 taxa were determined. Specialists confirmed the high potential for the discovery of new species. NMS and Cluster analysis showed a separation between riverine and reservoir BI communities, indicating the requirement for separate treatment for further investigation. It is clearly shown that water plant habitats exhibit a higher taxa richness and diversity (Shannon-Wiener Biodiversity Index) than sediment habitats. Furthermore water plant samples display a clearer picture of the species composition after fewer sampling units than sediment samples. Agricultural pressure changes the taxa composition (no. of taxa, abundance). The SASS (South African Scoring System) was applied to river samples and showed a reaction of the biota to different intensities of anthropogenic pressures. However, this system would have to be modified for application to BI communities in Burkinabé water bodies. This work aims to be the foundation for the development of a national bioassessment method based on benthic invertebrates.

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## WS05 APPEAR PhD Project:
## Fish diversity and assessment of aquatic ecosystems in Burkina Faso

Komandan MANO

Burkina Faso, an arid landlocked-country in the central part of West Africa is drained by four main rivers (Nakambé, Nazinon, Mouhoun and Comoé) and small rivers. All these rivers belong to three international catchments (Volta, Comoé and Niger) which flow outside of the country. In response to chronic water scarcity more than 1400 reservoirs are created on seasonal rivers. They harbor about 147 fish species and more than 30 000 fishermen operate there. Like fisheries, these reservoirs also became new sources of food and are attractive for many activities such as agriculture, extensive livestock, , vegetable farming mining. However human pressures inclusively overfishing or sedimentation threaten the services (fish, water quality) these reservoirs provide.

To establish sustainable management of natural and artificial reservoirs, it requires methods and tools for standardized assessment of the water quality and ecological status. In this doctoral thesis we study fish community and possibilities to assess the ecological status of waters in Burkina Faso. The objective of this study is to assess:

- fish assemblages distribution in different bioregions and basins
- the effect of habitat quality on species richness, abundances and diversity
- anthropogenic impacts on fish
- the ecological status of aquatic ecosystem within arid countries using fish assemblage

The first sampling campaign was undertaken from July to September 2012. Some sites in Boura, Kou, Lera, Cascades, Moussodougou, Tingrela and Sourou (Di, Gouran, Debè, Nissan, Lery) from Nakambé, Mouhoun and Comoé catchments were sampled. Actually, due to political instable situations in the neighboring countries Mali and Niger it is not possible to sample north in the Niger catchment.

For sampling methods like gillnet, castnet and electro-fishing are used. The samples are compared to commercial fishermen´s landings.

A total of 54 species belonging to 19 families was identifed. The most frequent species are: *Barbus macrops, Brycinus nurse, Clarias anguillaris, Ctenopoma kingsleyae, Distichodus rostratus , Gymnarchus niloticus, Hemichromis bimaculatus, Hemichromis fasciatus, Heterotis niloticus, Lates niloticus, Marcusenius cyprinoides, Marcusenius senegalensis, Oreochromis niloticus, Parachanna obscura, Paradistichodus dimidiatus, Polypterus senegalus, Sarotherodon galilaeus, Schilbe intermedius, Siluranodon auritus, Synodontis punctifer, Synodontis schall, Tilapia zillii, Mormyrus rume. Some taxa such as Brycinus nurse sp, Hemichromis sp, Sarotherodon sp, Tilapia sp, Clarias sp, Barbus sp, Labeo sp, Synodontis sp, Mormyridae sp.* still need a better determination. This will be done by help of experts from Burkina Faso, Austria, France and Belgium.

All results of this study should help to understand fish behavior and improve the implementation of scientific and ecological findings into practice. Additionally the results also should help to conserve fish communities and water resources in reservoirs and rivers in similar aquatic ecosystems in Sub-Saharan Africa.

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## WS06 APPEAR PhD Project: Benthic invertebrates in Burkina Faso

Idrissa KABORE

Sustainable management of freshwater and its biological resources are one of the major challenges that policy makers and scientists have to focus on for human well-being, especially in southern countries. Biological organisms are more and more used to highlight effects and interactions between human impacts and water. In Burkina Faso waters (rivers and reservoirs), which constitute principal water resources, are most threatened by pollution and other human pressures such as agriculture using pesticides and chemical fertilizer. In addition we realize expanding domestic waste centers disposal into rivers and their tributaries and a decline of benthic invertebrate communities. In this framework the overall goal of the Susfish project is to develop a diverse set of methodological and technical resources to assess the integrity and long-term sustainability of water quality and fisheries in Burkina Faso. This ongoing doctoral thesis aims are (1) to describe benthic invertebrate assemblages and their habitat and (2) to develop a national benthic invertebrates based assessment method to evaluate the ecological status of water bodies.

Benthic invertebrates are sampled by using multi-habitat sampling methods. In addition environmental parameters and all available information on human pressures will be analysed as well. At present we focus at eight study regions, belong to four main river basins. The samples are collected at the beginning and the end of rainy season. Due to the conflicts in the neighboring countries Mali and Niger it is not possible to sample in northern Niger catchment.

From July to December 2012 the benthic fauna was studied in 24 stations belonging to rivers, reservoirs, ponds and lakes to address their distribution and dynamic pattern and to assess the relationship between benthic fauna and freshwater quality. The first results of the benthic organisms

composition showed a great diversity. Insects from eight orders and 54 families are dominating (66%), second frequent group are the mollusks (28%) with two orders (Bivalvia and Gasteropoda) and 10 families. Additionally we have also found the crustacean (3%), Oligochaeta (2%) and the arachnids (1%) that are less represented.

All data will be stored in a new hierarchical database applicable for Burkina Faso. The results of this study should help to increase the knowledge on benthic invertebrates in Burkina Faso. An additionally the result should also use to formulate and implement benthic communities based monitoring tool into water policies, in education (universities, IUCN, governmental professional school) and may help to preserve biodiversity and water resources in reservoirs and rivers. The findings will have practical relevance for food security and health care in West Africa.

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**WS07 Biodiversity and conservation (WP 2)**

Moumini SAVADOGO

The objectives of this WP is to establish an official list of fish species, a national database of meta information on existing biophysical characteristics of fisheries, the diversity and conservation status of fish species and benthic invertebrates. The ecological approach that will be developed to monitor fish and water resources will be directly use for future assessments of aquatic ecosystems that will be incorporated in the national database and serve as the basis for recommendations for changes to policy and practice to achieve the national biodiversity strategy. The introduction of fish species in Burkina Faso is restricted by law (Assemblée des Députés du Peuple, 1997). But no reliable list of species exists. The official and reliable species list that we will make will be the reference for the implementation of that law. The expected result is a national database of meta-information on biophysical characteristics of fisheries, the diversity and conservation status of fish species and benthic invertebrates and the pressures on fish populations.

In compliance with the work plan, we identified the key sources of data (libraries, websites, and individuals from research institutions, universities and development agents) on (i) bio-physical characteristics of fisheries (river size, catchment size, turbidity, etc.), (ii) the diversity and conservation status of fish species and benthic invertebrates, land use, chemical water quality, etc.) and the pressures on fish populations (over-fishing, etc.) . More than 150 documents have been collected and reviewed at national, regional and websites (West African databases and global databases). The list of species is computed as well as the list of the documents collated. The project research team has been trained by IUCN experts on the principles and tools required for the evaluation of the species conservation status.

At date the total estimated number of described fish species in Burkina Faso is estimated at 131. The first estimations indicated 114 described species in the Volta River catchment (Roman, 1966) and the most recent results indicated 131 species in the Pendjari River, which belongs to the Volta basin (Ahouanssou Monchto 2011). No evaluation has been done using the criteria of the IUCN Red List. However there are some indications of 10 threaten species that have not been observed since 1968. Eight (8) species are considered as endemic (Lévêque et al. 1990 et 1992, Lévêque et al. 1991,

Paugy et al. 2003, Lalèyè et Entsua-Mensah 2010). The final database will be finalized by November 2013 and the national Red-list of fish by April 2014.

The status and distribution of freshwater biodiversity in Western Africa has been assessed by IUCN red list experts (Smith and al., 2009) as follows:

- The inland waters of western Africa support a high diversity of aquatic species with high levels of endemism. Many of these species provide direct benefits to people. The conservation of these species is most important to the livelihoods and economies of the regions' people.
- Estimated numbers of inland water-dependent species by major taxonomic group in West Africa: 563 fishes, 90 molluscs, 287 Odonates, 35 Crabs representing 2 to 5% of global described species.
- More than 14% of species across the region are currently threatened, and future levels of threat are expected to rise significantly due to a growing population and the corresponding demand of natural resources. Threatened species, comprising critical endangered, endangered and vulnerable) are estimated at 26%, 9%, 18% and 40% for fishes, molluscs, odonates and scrabs respectively.
- The major threats to species diversity are the habitat losses and degradation (agriculture, deforestation, mining, human settlements and dams), water pollution, droughts and invasive alien species.
- Species information remains very limited for many species within the region. Even for described species 11% (fishes) to 20% (crabs) couldn't be assessed due to data Deficiency.

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## WS08 Fish communities and water quality indicators (WP 3)

Adama OUEDA

The Fish-Based Index (FBI) of biotic integrity for the assessment of waters will become a core part of the university curricula in Burkina Faso for teaching statistical modelling and for training in applied field monitoring methods. Such methods and concepts will form part of the core competence of the Fisheries department, Ministry of Animal and Fish, which must contribute to the monitoring of waters as required by the national government. The FBI will be used to rank the aquatic ecosystems like reservoirs in terms of the degree to which they are impacted, and these findings will inform policy decisions about prioritizing remedial measures.

Expected results are (1) data on factors critical to water quality and fisheries management identify will be entered into the project database (physic-chemical parameters, fish species assemblages and especially the impacts of dams on fish), (2) development and verification of valid Fish-based and a macro-invertebrate-based methods to assess index of biotic integrity of waters and water quality (3) Some scientific and technical basis to monitor the ecology of waters and for factors of risks of riverside communities health, (4) Descriptions of ecological services critical to sustainable fisheries and environmental health.

According to the time table and the methodology established during the kick off meeting (March 2012) more than 60% of planned activities has been achieved or is in progress. Activities such as a base line survey, sampling design development and training need assessment were fully completed.

About field sampling, 9 of the 14 selected sites were already visited during 3 sampling campaigns. A team of 18 persons (10 students) took part in the field work. More than 75 fish species and 61 families of macro-invertebrates have been identified. Chemical data about nutrients, ions and some generics parameters like pH, Oxygen, Conductivity was measured and made available in a data base. We still collecting and organizing environmental from field protocol GIS databases. The last activity about modeling the functioning of aquatic ecosystems already begins with analyses made by the students involved in the WP3 activities.

## SUSFISH Session 2 - Social Sciences

### WS09 Impact of national policies on fish and water (WP 4)

Henri Zerbo & Raymond Ouedraogo

One of the SUSFISH project research topics will analyze the impacts of policies, legislations and institutions in the management of fish and water resources. As a landlocked and Sahelian country, Burkina Faso does not have much surface water. The original water bodies and water courses are intermittent. For that reason the Burkinabe commercial fisheries were not developed until the ’70s. This was favored by the development of artificial lakes following the drought of 1973-74.

Then, several policies, laws and institutions have tried to ensure a sustainable management of fish and water resources. Nowadays it is necessary to assess their interactions and impacts at macro, meso and micro levels. The methodology consisted in a literature search, a survey of institutions at the international and national (macro), regional (meso) and local (micro) levels. We used the sustainable livelihoods approach due to its ability of center attention on the five major components: the context of vulnerability, capital assets, policies, institutions & processes, strategies and results of livelihoods.

As preliminary results, we found that macro-level policies and legislation are not known at regional and local levels. The national organization in charge of fisheries is unknown as well because no tangible activity is undertaken in the field or to target the direct stakeholders. The field police fisheries officers (foresters) are not inclined to work on fisheries in the areas of monitoring, surveillance and control. As a result, prohibited fishing methods are more and more used. Actually the methods of management have differed depending on the ministry charged to manage fisheries, e.g. the ones in charge of environment or of agriculture, or of livestock breeding. The nomadism of fisheries institutions (from one ministry to another) was highly criticized by all stakeholders. The insufficiencies in the direct stakeholders’ organisations and their illiteracy do not allow the regulatory texts to be well known. It is hoped that the capacity of the four most important fisheries (Bagre, Kompienga, Sourou and Ziga reservoirs) will improve thanks to their management committee. The implementation of a closed fishing season will improve the recruitment of fishes. Four other smaller fisheries are under the concession schemes which give a private body, e.g. the local fishermen association, exclusive right of access to the resource. Nevertheless the fisheries stakeholders are motivated to cooperate for the development of their activities.

## WS10 Gender and Fisheries prospectives in the SUSFISH project

Colette KABORE

Women have been involved in the SUSFISH project's formulation and will be involved in its implementation under the direction of a gender and fish expert position from the GDRF, Mrs Colette KABORE, engineer in fisheries and aquaculture. The GDRF took advantage of the Sustainable Fisheries Livelihoods Program in West Africa to increase its capacity in gender. As a result Mrs Colette KABORE of the Fisheries Department, Ministry of Animal and Fish Resources has trained and now continues to work in the gender domain. She has taken part in the meetings to formulate the present project. She will also be involved in the implementation of the project in coordination with the social scientists of the University of Bobo-Dioulasso, and should take the project's findings and apply them on gender issues in the future. Women are also targeted in the social part of the research. They have an important stake in the appropriation and the management of water and fish resources, which will be assessed by the project's research tasks.

Sustainable management of the water resources and fisheries became an imperative and could not succeed without an appropriate approach that integrates the fundamental principles of gender. The overall objective is to favor the participation of stakeholders, particularly vulnerable groups in the process of research in order to guarantee an appropriation and a valuation of the results.

In SUSFISH, the gender approach aims at integrating gender issues at all stages of research.. It concerns integration of gender vision in the protocol and the amendment of the tools gathering to allow the participation and the expression of the needs for all stakeholder particularly vulnerable groups. We organized a workshop on gender internalization, focusing on how women and young people in work teams can develop the sensibilities and the creation of good conditions for women participation in fieldworks. Research on sustainability has inspired the team to schedule raising awareness's in a frame that encompasses the fisheries sector. Gender profiles present the disparities of access to the resources between women (20%) and men (80%). In certain fisheries used by both migrants and autochthons, vulnerable groups, particularly women, had relatively low power of control and decision-making in the use of water and fish resources. , This trend correlates with the increasing imbalance in well-being between men and women, rich and poor, etc. In Burkina Faso we counted: 32 699 fishermen among whom 14 % were women; 2 983 transformers among which 82 % were women;(DGRH, 2010); 3 375 wholesale fish merchants among whom 54 % were women.

While men and women complement each other in fisheries activities, numerous obstacles limit women's activities in fishing. Women are charged with many different tasks which require competence and time, and also being on the ground e.g. production and repairing of nets; processing and selling of fish. Traditional roles limit and restrict the actions of women. They are also limited in their time and mobility through their responsibilities for raising the children and for the household activities, the assignment of traditional roles, perceptions and stereotypes about women influence behavior, create barriers and perpetuate beliefs that affect the participation of women in the fishery

These trends are only recently becoming evident because research has been for a long time insensitive to gender issues. The specific needs and the strategic interests of each category of stakeholders are rarely taken into account in many strategies of development. The main objectives of this work team are: (1) to strengthen the contribution of the vulnerable groups particularly woman in the governance of fisheries and (2) to integrate research better for contributing to value

vulnerable groups and particularly woman ‘s and young people role in sustainable management of fisheries.

The government of Burkina Faso is conscious of the importance of gender issues in sectorial strategies of development. It is translated by creation of the Ministry of the Promotion of Women and Gender, the adoption of the National Policy in Gender in Burkina Faso; promotion of gender as a principle of the ‘’Stratégie de Croissance Accelerée et de Développement Durable’’ .

We can report some results and impacts of the project including: Improvement of gender sensibility of the team and the target groups; harmonization of gender concept during the workshop on internalization of gender in SUSFISH project; elaboration of protocols and data gathering with integration of gender approach; organization of awareness to sensitize students to gender issues; association of women in research team; elaboration of strategies to integrate gender on management of fisheries; elaboration of an article in order to improve the visibility of gender in fishery. It is recommended to improve access of vulnerable groups to resources and employment; strengthening skills of women; lighten duties and tasks for women; facilitating vulnerable groups participation in decision-making and good communication strategy.

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## WS11 Governance, societies and fishing (WP 5)

Patrice TOE

The results of the social science research will clarify the relative importance of republican and traditional contributions to the governance of fisheries and will be used to harmonize them in the formulation and the implementation of water and fish policies. These and other project insights from social science are important for many government agents that study or oversee fisheries but lack any training in social science, especially the staff of the Fisheries department, Ministry of Animal and Fish Resources. The community-based and participatory approaches to fisheries management as set by law and considered by the fisheries strategy requires knowledge and skills that rely on social studies, so these project insights will also inform academic training programs for fisheries scientists and natural resource managers. The results will also directly help with implementation of the fisheries concessions for small size fisheries (exclusive right of access to fish) and the participatory management for the large size ones.

Expected results:

- Analyse institutions within the Republican and Traditional domains of governance in Burkina Faso with emphasis on how the presence or absence of links between these domains influences the sustainability of fisheries, especially the connections between legality and legitimating, and the socio-economic features of fisheries;

- Identify interactions between stakeholders’ strategies and policies

## WS12 Fisheries health and food security. WP 7

Leon B. SAVADOGO

Project research results will provide a scientific and technical basis to develop methods to assess health risks for riverside communities by using the ecological status of waters and fish. Food and diet practices for children and pregnant women that associate or can associate with fisheries will be identified. Health risks associated with fishery activities will be identified and described. These results will be incorporated in academic training curricula and will inform health policy formulation and implementation.

Expected results: Critical analysis of connections between fisheries, environment, health and food security; some scientific and technical basis to monitor the ecology of waters and for factors of risks of riverside communities health are developed

The main objective of this WP is: “Food supply and health care illustrated in appropriate case studies”.

Poverty leads to poor health status and poor health also contributes to monetary poverty. In Burkina Faso, poverty is more rural and peri-urban and the country is characterized by recurrent droughts and irregular rainfall. Poverty profile manifests itself in various ways: food insecurity, poor access to clean water and endemic malnutrition. In 2012, prevalence of undernourishment in Burkina Faso was high (26%). Malnutrition is a main reason for under-five years old mortality (more than 50%). Fish can improve the nutritional status. FAO statistics show that fish is source of 22 % to 50 % of protein in sub Saharan Africa and fish contribution to caloric intake can rise 80 calories daily.

We observed from a survey in 360 households, that, in Burkina Faso, fish intake contributes in improving food and nutrition security: 96 % of surveyed households consume fish and for 67% of households fish is part of the constituents of their daily diet as animal protein source. Fish contribution on household diet total Kcal and protein is very high in Burkina Faso rural population: fish contribution to the total diet Kcal range from 31 to 45% and the fish contribution to the total diet protein range from 25% to 78% depending on the diet. Fish is an affordable source of animal protein for the rural and poor population.

We assessed the contribution of fish in fishermen economy and could show that fish sale gain is used to improve the household food and nutrition security in 80% in all study sites. In this WP, we are analysing the microbiology and quality of main fish consumed in Burkina Faso. We assessed fishing health risks, water related diseases morbidity in fishermen communities and in their households. We will evaluate the impact of women involved into fish management (fishing, transformation and fish sale) in households food security and nutrition improving.

## WS13 Systems analysis of environmental, economic, socio-political/cultural factors that influence sustainable fisheries

Jan SENDZIMIR

The outputs of Work-package 8's research as well as its process of participatory scenario development will have immediate impact on the policy of managing aquatic ecosystems in Burkina Faso. Over the longer term they can be used both in education and in future policy formulation and implementation. Methods of systems analysis and the research findings from its application to identify leverage points for policy interventions to make fisheries more sustainable can all be incorporated in academic curricula at the university level. Future policy processes in Burkina Faso can employ the methods of scenario development to determine challenges and opportunities in establishing sustainable fisheries management. This is made possible by the fact that these methods will be learned by the team members and staff of Southern Partners who apply them during the course of the project in collaboration with Northern partners.

Staff from the UNIVERSITY of VIENNA will cooperate with the departments of linguistics and sociology at the University of Ouagadougou, to organize a workshop on research methods in Ouagadougou. Researchers of all partner institutions will be involved to develop an appropriate methodological approach to address the plurality of languages within the SUSFISH research project. Two challenges must be addressed: 1. to enhance scientific language to facilitate communication within the multinational team of researchers and practitioners, 2. to reflect on the input of local experts on fish stock, natural diversity and fishing. The workshop participants will develop a joint strategy not only to communicate the results of the scientific cooperation to the local people but rather to involve them as experts in the setting. Their knowledge, which is linked to language, will influence (enrich) the findings of the natural sciences research. Through the involvement of local experts a deeper understanding of complex underlying processes/correlations in socioeconomic and "socioecologic" systems will be achieved. The expected results range from (a) plurilingual material (biographic narratives), which can be used for further terminology work on fisheries and ecologic management in Burkina Faso and might be useful for the analysis of the historic dimension in ecologic development processes (see WP 7: glossary) (b) input for innovative approaches in the dissemination strategy (c) the involvement of various groups of the local society (even those who could not reached before) in the research process (d) a fostered dialogue between researchers, practitioners and local community on sustainable fisheries policy.

Expected results: Data and opinions on factors critical to sustainable fisheries management entered into project database.

- Systems analysis of critical factors identifying barriers and bridges to establishing sustainable fisheries in Burkina Faso.

- Report on policy recommendations for establishing sustainable fisheries based on scenarios developed in group exercises with stakeholders.

## WS14 Communication & scientific language: Language practices in transcultural research cooperation

Gabriele SLEZAK

The purpose of this paper is to contribute to the discussion about the hierarchical structure of knowledge production, transfer and exchange in transcultural research projects by drawing attention on the communicative processes between the actors involved. In order to understand the challenges of transcultural communication, it is helpful to reflect on language concepts in relation to the scientific knowledge hierarchies on a global level.

First, I consider understanding a fundamental aspect of developing, applying and sharing research methods within a project team. When multilingual practices and translocal contextualization, reconceptualization and the translation of knowledge are involved, this process of understanding becomes quite complex.

Second, in terms of experience, expertise, age, personality and authority however, individual capacities to actively participate in understanding processes are strongly interrelated to biography, social status and the repartition of communicative resources.

And third, language plays a key role in the highly elitist Burkinabè tertiary education sector. Statistically, Burkina Faso has more than 60 languages, with French being the official language. The education system traditionally followed a restrictive policy of monolingualization, with French being the language of instruction. It reinforces the predominance of "Western" (scientific) knowledge, languages and communicative patterns to the detriment of their "Southern" counterparts. In terms of language ideologies, a European language such as French or English is generally associated with "modernity" and with symbolic and economic power, and is referred to as the "written standard." In contrast, African languages, notwithstanding variations across the country, generally assume a marginalized position from the political, symbolic and economic points of view.

The interplay between power and knowledge asymmetries with language and communication processes is rarely reflected upon in the context of transcultural research cooperation. To allow for knowledge production to be inclusive, a broad approach addressing the challenges of linguistic diversity is needed. Joint research programs should therefore include reflections on how knowledge is linguistically produced, which plurilingual communication processes are involved and how knowledge is translated into scientific language.

## WS15 WP 6 Higher Education and research

Adama OUEDA

Project outputs, such as data, assessment methods, and findings about the ecology and governance of fisheries, can be incorporated in academic curricula and used directly in future research in natural and social science of fisheries. A number of southern team members can use these products in educational organizations in Burkina Faso. Especially two of them have high

administrative positions that allow them to set educational goals and otherwise influence the academic curricula of Burkina universities. Some staff of the Fisheries Department, Ministry of Animal and Fish Resources can also use these results in their lectures in the three national agricultural schools (the national school of foresters at Denderesso, the national school of agriculture of Martourkou, both located next to Bobo-Dioulasso and the national schools for husbandry and animal health located in Ouagadougou). The schools can also use the gained knowledge to improve the fisheries course; for this reason, they will be involved in the assessment of the technical abilities of field fisheries staff who they train.

All partners are involved in education. Some staff of the Fisheries Department, Ministry of Animal and Fish Resources teach in the three governmental agricultural schools that train field fisheries staff. The others are lecturers and high positioned personalities in the two most important Universities of Burkina. For instance Prof. KABRE is the current technical advisor to the Minister of Secondary and Higher Education and Prof. TOE is the head of Department of Rural Sociology and Economy of the University of Bobo-Dioulasso. Therefore, this is an important asset to use the expected results in education.

In addition, the teams of Prof. KABRE and Prof. TOE have involved about 20 master and PhD students in the SUSFISH research. Actually, every year, students seek for field supervision of their research at the Fisheries Department, Ministry of Animal and Fish Resources. Unfortunately almost every time they are rejected due to lack of financial means. The involvement of students in the project is a direct benefit to their education.

Expected results: (1) Use the main results of all WPs to strengthen the national capacities in sustainable management of fish in education and research, (2) Strengthen the capacity of the partners in human resources and field work approach techniques, (3) Training manuals and links for use of assessment and analysis techniques developed in the project, (4) New curricula at Burkina Faso universities enhanced with links to project publications and databases. (5) Student theses (Masters and Doctoral), Peer-reviewed publications and Fish ecology hand-out, (glossary and English, French, Morè dictionaries). (6) Website enriched with project findings (BOKU and IUCN), (7) Conferences, Symposia on techniques, science and policy.

Numbers of these expected results are already achieved. About 20 students are involved in SUSFISH research activities, some as Master students and three as PhD students. Some of the master students have already defend their thesis and continue to contribute to the research activities of their respective institution. A list of 17 publications are planned to be submitted before December 2013. Finally activity like the last SUSFISH Symposium in June 2013 contributed to strengthen capacity and partnership among SUSFISH partners, especially for southern partners.

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## WS16 APPEAR PhD Project: Potential of aquaculture in Burkina Faso

Phillipe SAWADOGO and Adama OUEDA

The world's population is still growing, and this situation will lead to a continuous increase in demand for food. Fish and fishery products are sources of protein and essential micronutrients for valuable nutritional balance and health. However with the depletion of fisheries, aquaculture is emerging as a viable alternative to meet the increasingly growing of fish products. Compared to

other countries in sub-Saharan Africa, Burkina Faso's aquaculture continues to produce little, less than 400 tonnes (2008), despite its theoretical potential estimated to 110 000 tonnes per year.

The promotion of aquaculture in a particular area requires prior knowledge of its potential and risk assessment. Today, policy makers, researchers, extension workers, donors and other stakeholders in the field of aquaculture are confronted with two major challenges in the promotion of aquaculture: (1) Identify where and under what conditions different types of aquaculture would be feasible and (2) What major risks and constraints need to be overcome for each type of aquaculture. The overall goal of this study is to assess the aquaculture potential in Burkina Faso in the framework for a best contribution in the implementation of its national strategy for sustainable development and management of fisheries and aquaculture. This study aims to (1) study well established aquaculture systems in West Africa, (2) assess the potential for implementing viable aquacultures in Burkina Faso, based on the other West African countries experiences, (3) examine two cases of studies on aquacultures (Intensive system in Bagre District and semi-intensive in Bazega District).

The present study will be undertaken in Burkina Faso and in preselected West African countries: Nigeria, Ghana, Benin and Ivory Coast where aquaculture is well established. The expected results of this study are:

The potential of Burkina Faso's aquaculture at small scale and at commercial scale for two major species such as the Nile Tilapia (*Oreochromis niloticus*) and the catfish (*Clarias gariepinus*) is accurately known.

The viable aquaculture systems in West Africa are analysed;

The quality of Bagre district fish food is known;

The natural fish food production in semi –intensive fish farm systems is evaluated

From March 2013 to September 2013, we will collect data regarding biophysical, socio-economic and institutional factors from different Ministries in charge of Water resources, Agriculture, Livestock and Fish resources, Industry and Trade, Environment and other institutions such as the National Office for soil resources, the Navigation and Security Agency (ASECNA), and the Wildlife Agency (OFINAP). We started our literature review from FAO and SARNISSA web sites, the library of the Institute for Research and Development (IRD-Burkina Faso) and Sciencesdirect.com.

The method of site evaluation based on the coupling of a geographic information system (GIS) to a multi-criteria decision making methods (MCDM) will be used. GIS allows the location of sites while multi-criteria analysis facilitates qualitative assessment. Surveys (individual and focus group) will be conducted for collecting qualitative and quantitative data on potential sites that will be identified by the literature review and aquaculture experts. Data analysis will be done using R Software, SPSS, GIS software and SAQUA (Suitability Analysis and Query for Aquaculture) developed by the World Fish Center. This study will contribute to a best understanding of aquaculture potential and improve decision making for a sustainable development of aquaculture in Burkina Faso.

## WS17 Fish migration and Archimedes screw – hydro connect - Fish Lift INSIDE (Excursion)

Bernhard ZEIRINGER & Walter ALBRECHT

Freshwater fish depend on a complex system of differing habitats since a variety of life-history-demands need to be fulfilled. Often their life requires moving between habitats. Migrations are undertaken for different reasons, such as the change of life-stages, spawning, or food uptake. They are also essential to ensure the dispersal of species and the maintenance of genetic fitness of the populations.

Dams and weirs constructed for hydroelectric power production or river regulation can block or delay upstream fish migration and thus contribute to the decline and even the extinction of species that depend on longitudinal movements. Mortality rates resulting from fish passage through hydraulic turbines or over spillways during their downstream migration can be significant. Experience shows that mortality in the course of downstream migration can also be a major factor affecting fish stocks. Habitat loss or alteration, discharge modifications as well as delays in migration caused by constructed barriers are significant issues. Addressing these pressures by the implementation of appropriate measures (such as fishways, fish-friendly turbines) constitutes a major challenge for the improvement of environmental conditions. While significant knowledge and practical experience for the planning and design of measures to ensure upstream migration of different fish species is available, effective measures for downstream migration still need further development.

The Archimedes' screw, historically used as a facility to lift water to higher levels, is now commonly used as a turbine for power generation. Water entering the screw induces rotation that drives an electric generator. 'Hydro connect' and 'fish Lift INSIDE', a new Archimedes' screw concepts of the inventor Walter Albrecht, combine a water power plant and a fish pass in a single machine. This turbine type basically consists of a main screw rigidly coupled with a hollow pipe. Within the central cylindrical shaft is a counter-rotating screw lifting a small amount of water upstream. Due to its low rotational frequency and therefore its insignificant shear forces or pressure changes this type of turbine is fish-friendly and enables migration in both directions.

We monitored fish behavior in and around a prototype of the 'Hydro connect' in a small alpine river to demonstrate the operational capability for upstream migration. The main research questions were (1) which fish species migrate upstream (2) which life stages migrate upstream and (3) is the passage harmful for fish. Four different fish species (Brown trout *Salmo trutta fario*; Grayling *Thymallus thymallus*, Bullhead *Cottus gobio* and Rainbow trout *Oncorhynchus mykiss*) were stocked downstream of the hydro power plant and upstream migration was recorded over nine days. Within the investigation period 151 out of 372 stocked fish migrated upstream. All species and all life stages were able to migrate upstream. After passing the turbine in both directions no injured fish were detected. Further research with other species has to be carried out in order to investigate the capability of the innovative fishpass.

# West Africa Symposium 27.-28 June 2013

## *Institut Français Vienne*

Welcome by S.E. G. ROUSSON
Introduction by J.L. STEFFAN & A.H. MELCHER

Austrian film premiere:
"***Les grands Barrages en Afrique de l´Ouest***" a documentary film produced by IUCN and ECOWAS (Economic Community of West African States).

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Key note

**SY01 Eau et biodiversité au Burkina Faso. Etat de la recherché**
**Water and Biodiversity in Burkina Faso**

Adama OUEDA

Le Burkina Faso est un pays de l'Afrique de l'ouest soumis à un climat tropical caractérisé par des variations pluviométriques considérables avec deux saisons très contrastées. Cette situation entraîne une faible disponibilité des ressources en eaux de surface surtout en saison sèche qui dure de 8 à 9 mois. Pour pallier ce problème, de nombreux aménagements ont été donc réalisés sur les cours d'eaux dans tout le pays. Ces aménagements ont eu et ont des impacts sur la qualité des eaux et sur la faune et la flore qui les habitent.

La conférence fera le tour de la question en abordant successivement :

-Le problème de la disponibilité de l'eau et les solutions mises en place pour le résoudre,

-Les conséquences des aménagements sur la quantité et la qualité des ressources en eaux,

-L'état et l'impact des aménagements sur la biodiversité aquatique,

-La contribution de la recherche à la compréhension et à la résolution des problèmes liés à la gestion des ressources en eau.

## SY02 Why and for whom to develop fisheries in Burkina Faso?

Philippe CECCHI

In Burkina Faso, fisheries of the numerous reservoirs scattered in rural areas contribute to fulfill domestic requirements. Importations of fishery products are however increasing, even if the number of production's sites is permanently growing. Intensification of fisheries could be discussed in using the network created by these numerous water masses. Different strategies could be promoted, depending on the size of the targeted sites.

Fisheries associated with large reservoirs, which production concerns mainly the principal urban markets, are already managed with the aim of preserving the resource and controlling its exploitation. But most of the production sites are related to medium-size infrastructures and to small reservoirs whose number is in permanent augmentation. Their real productivity remains underestimated. These small-scale fisheries are closely linked to local markets: 70% of the rural population live less than 15 km from at least two reservoirs. Their exploitation is mainly assumed by fishermen who are also engaged in agricultural activities using the same water resource, namely irrigated-cultures. In such case, fisheries' expansion should explicitly acknowledge and cope with the complementarity of activities implemented by local stakeholders.

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## SY03 Fisheries management in West Africa

M. Henri ZERBO & Raymond OUEDRAOGO

This paper aims at describing fisheries in the 16 West African countries: 15 member countries of the Economic Community Of West African Stated (ECOWAS) and Mauritania. It analyses the typology, the importance of capture fisheries and aquaculture, the potentials constraints, threats and opportunities. About 10 million people work in fisheries in Africa, of which 70% in West Africa. Because it contributes increasingly to the economy, food security and poverty lessening, fishing is an important asset for development in West Africa.

The fish production of the ECOWAS increased from 300 000 t in 1960 to 1 854 000 in 2000, which corresponds to 1.4% of the world fish production. Including Mauritania, West Africa produces 2 million tons per year. In West Africa people consume fish more than in Africa in general (11.8 kg/pers/yr, vs. 8.2). Within West Africa there are big differences in fish consumption between countries: 2.1 in Niger and 27 in Senegal. There are also important differences between inland and coastal countries. The stocks of West African countries exhibit some sign of over-exploitation, especially for demersal species because of the inadequacy and incoherence in policies and institutions and the illegal, unreported, and unregulated fishing. Dominated by foreign boats, the West African industrial fisheries are all marine. It exploits high commercial species and contributes to 38% of the total sub-regional production. The remaining 62% belong to the artisanal fisheries,

which use smaller boats and employ the majority of fishermen population. Women mainly work in the post-harvest activities (processing and selling).

West Africa is granted many rivers, lakes, reservoirs and lagoons. Local people fish these waters for food and income. Inland fisheries are artisanal and use gillnets, cast nets, traps and longlines. Some canoes are motorized. The production of inland fisheries is high in Mali, Nigeria and Ghana but they meet important post-harvest losses. The development of aquaculture aims at meeting the gaps between the decreasing landings and the increasing demand for fish. It is thought that the region has important assets for aquaculture development. At present most important species for aquaculture are tilapia, African catfish and the shrimps.

Many institutions such as ECOWAS, the West African Economic and Monetary Unions (UEMOA), the New Partnership for African Development (NEPAD), the IUCN and Wetlands International are involved in fisheries. In 2005 the ECOWAS developed an agricultural policy and regional programme for the development of fisheries and aquaculture and the programme for capacities building. A regional committee for the monitoring of the coherence of fisheries policies in West Africa was set in 2010. A diversity of initiatives in other regional institutions and NGOs exists.

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## SY04 Fish and benthic invertebrate assemblages in the Upper Nakambe catchment

Sebastian STRANZL, Thomas KOBLINGER, Paul MEULENBROEK, Daniel TRAUNER, Otto MOOG, Thomas HUBER & Andreas MELCHER

Fish is an important protein source for the population of Burkina Faso. This study, supported by the BOKU University of Natural Resources and Life Science, Vienna and the University of Ouagadougou, analyses fish and benthic invertebrates' assemblages and their habitat use in the Upper Nakambe catchment of Burkina Faso located in the central part of West Africa. The study gives an overview on the available habitat conditions and their effect on biotic community composition and abundances as well as on habitat use of single species. The main objectives of this study is to characterize fish and benthic invertebrates assemblages in the sampled area, to find human pressures which lead to a decrease of biota, to find species sensitive to pressures and to propose measurements for improvement.

Sampling took place at the beginning of the dry season between October and December 2013. The 26 sampling sites (rivers and reservoirs) were situated in the catchment of the Nakambe river and included the capital Ouagadougou, agriculturally impacted sites in Koubri and Bagre, the drinking water reservoir of Ziga, protected water bodies in the game park Nazinga and potential reference sites from the area around Bobo Dioulasso (Mouhoun catchment) and Banfora (Comoe catchment). On each sampling site, adjacent land use, obvious stressors, physical and environmental parameters were noted additionally. Water samples were taken from selected sites and transferred to a private laboratory in Ouagadougou for chemical analysis.

To answer these questions we sampled 157 fish habitats, caught 18,335 individuals and recorded a total number of 16 families, 35 genera and 70 species in four different river reaches. There are lists provided with the spatial distribution of the caught species, ranges for different habitat parameters and usage curves of four key species; i.e. *Labeo cubie* shows a coarser substrate usage than *Bagrus bajad*; and the habitat of *Chelaethiops bibie* exhibits high occurrences for Xylal. The results of this

research make important contribution to general knowledge on habitat use and ecology of fish in semi-arid areas of Africa. They can be used as a management tool for a healthy ecosystem and a sustainable fishery that in turn contributes to food security. However, overfishing, fragmentation, agriculture and other human pressures decline the fish population's diversity and biomass. Biological indicators like fish or benthic invertebrate indices are essential for assessment of water and ecosystem health and sustainable management to assure food security and healthy water bodies. This is a basic work for developing fish based assessment methods.

For benthic invertebrates we investigated in particular if and how benthic river and reservoir communities discriminate and how the taxa composition reacts to anthropogenic stressors. In total, out of 20 000 specimen 105 taxa were determined. Specialists confirmed the high potential for the discovery of new species. NMS and Cluster analysis showed a separation between riverine and reservoir BI communities, indicating the requirement for separate treatment for further investigation. It is clearly shown that water plant habitats exhibit a higher taxa richness and diversity (Shannon-Wiener Biodiversity Index) than sediment habitats. Furthermore water plant samples display a clearer picture of the species composition after fewer sampling units than sediment samples. Agricultural pressure changes the taxa composition (no. of taxa, abundance). The SASS (South African Scoring System) was applied to river samples and showed a reaction of the biota to different intensities of anthropogenic pressures. However, this system would have to be adapted for Burkinabé water bodies. This work aims to be the foundation for the development of a national bio assessment method based on benthic invertebrates.

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## SY05 Conservation and Ecosystem services in West- and central Africa

Aime NIANOGO & Moumini SAVADOGO

Human beings depend on nature, especially in West and central Africa where more that 80 % of the population rely exclusively on natural resources for their livelihoods. For example human diarrhea, malaria, yellow fever and sickle cell anemia are routinely and successfully treated with local plants: sickle cell anemia, treated with a combination of *Fagara xanthoxyloides* and *Calotropis procera* (Nikiema et al, 2010); diarrhea, hemorrhoids, gingivitis, coughs… but also low milk production in young mothers treated with *Acacia nilotica* extracts; also used for tanning leather, dye production (Wickens et al. 1995, Lompo, 2005). Several animal diseases treated: Plants such as *Zanthoxylum zanthoxyloïdes, Carica papaya, Newbouldia leavis*, and *Morinda lucida* are active against the eggs and larvae of nematodes very frequent in West African small ruminants (Hounzangbe-Adote, 2005). The ecosystems provide food and energy from sustainable forest management, efficient wood stoves promoted to limit firewood consumption and the use of solar energy. Annual income from forest products is estimated in Burkina Faso at €112 to 144 for woodcutters, or 40,17% of total income for women (of which 56% from Non timber forest products), 35,63% for men (26% from Non Timber Forest Products).

Globally 40% of the world's economy is based on the use of biological resources, 780 million people lack access to clean water, more than 70,000 plant species are used in traditional and modern medicine, and coral reefs provide coastal protection and other valuable services worth an estimated US$ 170 billion a year. Despite this importance, our biodiversity is under intensive pressure. The status and distribution of freshwater biodiversity in Western Africa has been assessed by IUCN red

list experts (Smith and al., 2009). This report indicates clearly that the inland waters of Western Africa support a high diversity of aquatic species with high levels of endemism. Estimated numbers of inland water-dependent species by major taxonomic group in West Africa: 563 fishes, 90 molluscs, 287 Odonates, 35 Crabs representing 2 to 5% of global described species. More than 14% of species across the region are currently threatened and future levels of threat are expected to rise significantly due to a growing population and the corresponding demand of natural resources. Threatened species, comprising critical endangered, endangered and vulnerable species) are estimated at 26%, 9%, 18% and 40% for fishes, molluscs, odonates and scrabs respectively. The major threats to species diversity are related to habitat losses and degradation (agriculture, deforestation, mining, human settlements and dams), water pollution, droughts and invasive alien species. It indicates also that species information remains very limited for many species within the region. Even for described species 11% (fish) to 20% (crabs) couldn't be assessed due to data deficiency.

The international union for conservation of nature, founded in 1948 is the world's largest global environmental organization. It works to influence, encourage and assist societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable. IUCN provides the latest science and knowledge on ecosystems and biodiversity and their contribution to human well-being, runs hundreds of field projects around the world to better manage natural environments and helps governments, communities, NGOs and the private sector develop environmental laws, policies and best practice. The flagship products of IUCN related to science and knowledge about biodiversity and guiding action on the ground include the Red List of Threatened Species™, the Red List of Ecosystems, the World Database of Protected Areas, a new list of Key Biodiversity Areas.

The SUSFISH project and specially the present symposium is an opportunity for IUCN to expand its cooperation with Austrian and French partners for adapting approaches to Biodiversity Conservation as well as filling the science and knowledge gaps to adapted decision making.

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## SY06 Health, fisheries and food security in Burkina Faso

Leon SAVADOGO

This article addresses the health and poverty situation in Burkina Faso. In Burkina Faso, poverty is more rural and peri-urban. The country is characterized by recurrent droughts and irregular rainfall. Precarious health and hygiene conditions are a direct consequence of environmental factors. In rural sites, clean water remains scarce and the use of contaminated water is widespread, thus contributing to a high prevalence of diarrheal illnesses and parasitic infestations.

What are indicators to describe health in Burkina Faso. Malaria, respiratory infections and other communicable diseases such as measles and meningitis are common. Burkina Faso has one of the worst health status profiles in the West African sub-region: (1) high rates of infant and child mortality and (2) maternal mortality. The deterioration in health indicators has been greater among the poorest groups than among the rich. Current nutritional status in Burkina Faso. Under-nutrition, and high mortality and morbidity, have persist. Compared to Sub Saharan Africa countries,

prevalence of under nutrition is high, 25.9% in 2012. In Burkina Faso, in rural areas, under-nutrition often occurs during the lean season.

Linkage between fish intake, fishing and food security and nutritional Status. The term 'food security', was defined by FAO as 'Food security is a condition when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life'. This definition includes the nutritional aspect that is described as 'access to nutritious food to meet their dietary needs'. How fish intake and fisheries can contribute to improving nutritional status. Fish is more nutritious than staple foods, providing animal protein, essential fatty acids and micronutrients.

Fish consumption can improve human nutritional status. FAO statistics show that fish provide 22 to 50% of protein intake in sub Saharan Africa, and its contribution to caloric intake is 80 calories daily. Basic determinants of nutritional status are: available natural resources, technology and national economic policies. Underlying determinants are: health services: accessibility and qualities in care and prevention, household food security. Immediate determinants are: disease and dietary intake.

Roles of fish-related activities and interventions in improving food and nutrition security. It is possible to improve nutritional status through influencing dietary intake directly, and raising productivity and household income. Several interventions related to fish intake, aquaculture and capture fisheries can be implemented. Two main orientations: (A) fish related interventions which focus on improving dietary intake: promoting household fish consumption and (B) fish related interventions which focus on household food security: aquaculture, small fisheries, trading and marketing with an emphasis on the role of women. Empowering women in those related activities can be a way to achieve better results.

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## SY07 Fisheries and society in Burkina Faso: Towards a "retraditionalization" of local practices?

Vincent-Paul SANON & Patrice TOE

Burkina Faso is a country poorly endowed with natural surface water resources. Its river systems flow mostly intermittently. To address these acute water problems, especially after the big drought of the 70s, the Government undertook to construct numerous water supply structures (reservoir dams) throughout the country to promote farming and fishing in order to increase self-sufficiency.

These developments revolutionized the activity of fishing, pulling considerable changes both in quantities of the product stemming from fishing and in the practices of the populations. These realizations also have social implications (with a new rural organization of the rural middle) as well as an economic implication. So, they translate a certain technocracy and an ideology, involving a pooling of the resources with the aim of a sustainable development. The result on the ground ends in a confrontation of two logics: one based on the legality represented by the State and the other one on the legitimacy which often leads in " retraditionnalisation " of the local practices, often annulling the efforts of development.

## Symposium Session 2
## Higher Education, Perspectives and Partnership

### SY08 APPEAR - From a new idea to successful partnerships

Elke STINNIG

The consortium Austrian Agency for International Cooperation in Education and Research (OeAD-GmbH) and Latin-America Institute (LAI) implements the new program of Austrian Development Cooperation (ADC) for the promotion of academic partnerships between 'South and North'.

According to the development policy trend in Europe and the ADC 'Strategy on Higher Education and Scientific Cooperation' the new 'Austrian Partnership Programme in Higher Education and Research for Development - appear' for the period 2010-2014 supports partnerships between higher education institutions in Austria and ADC key regions. The objectives are to improve the quality in teaching and research, to make the management and the administration at the involved institutions more effective and to strengthen the scientific dialogue nationally and internationally.

Under the superordinate goal of poverty reduction Appear also contributes to a discourse in society about quality and orientation of development in general. The institutional partnerships are based on a cooperative collaboration and mutual respect for different cultural contexts and approaches. It is also based on issues that are of high relevance particularly for the partners in the 'South'. The exploitation of the results also follows a participatory approach – for example through mutual exchange of teaching staff or joint publications and presentations.

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### SY09 Higher Education in Burkina Faso: Through mutations, to support sustainable development

Adama OUEDA

After its independence in 1960, Burkina Faso (former Upper Volta) was engaged in the way to development and welfare by establishing a number of institutions including higher education institutes. In 1965 the first Higher Institute was created, which quickly evolved into a university.

Since then many changes and improvements were made to the Higher Education system. However, in a changing world, Burkina Faso is still in search of the right formulas for meeting its ambitions. Indeed, many problems such as inadequate curricula, overstaffing and the effects of misunderstanding of democracy rules, plague the education system.

Recent changes in the Higher Education system of Burkina Faso, therefore sought to address such concerns by creating new public universities, encouraging the creation of private universities and diversifying training and curricula. These changes also aims to fit the Higher education system in Burkina Faso to the international standard, then to allow, among other things, the mobility of the students and make them more competitive in the international job market.

## SY10 Gender in fisheries and water management

Colette KABORE

La gestion durable des Ressources en eau et halieutiques est fondamentale et ne saurait aboutir sans une prise en compte de l'approche genre. L'objectif global est de permettre une participation de toutes les parties prenantes et particulièrement les groupes vulnérables pour garantir une appropriation et une valorisation des résultats de la recherche.

La méthodologie utilisée au vue de la transversalité genre est l'intégration de son approche aux différents stades de la recherche. Il s'agit notamment de l'intégration de la vision genre au protocole, l'amendement des outils de collecte de données pour permettre la participation et l'expression des besoins de tous particulièrement des groupes vulnérables. L'organisation de l'atelier d'internalisation du genre, l'implication de femmes et jeunes aux équipes pour avoir toutes les sensibilités ; la création de conditions favorables à la participation de femmes aux enquêtes sur le terrain. La recherche de la durabilité a conduit l'équipe à programmer des sensibilisations dans un cadre qui dépasse la pêche, la conduite d'étude spécifiques.. Les plaidoyers sont faits à toutes les rencontres pour une considération continue des inégalités genre.

Le profile genre au niveau des communautés de pêche présente des inégalités d'accès aux ressources entre femmes (20%) et hommes (80%). Sur certaines pêcheries entre les migrants et les autochtones. Un faible pouvoir de contrôle et de prise de décision sur l'utilisation des ressources par les groupes vulnérables particulièrement les femmes et les jeunes. Cela entraine un déséquilibre croissant de la balance de bien être entre femme et homme ; entre riche et pauvre etc. Le Burkina Faso compte près de 32 699 pêcheurs dont 14 % de femmes ; 2 983 transformateurs de poisons dont 82 % de femmes;(DGRH, 2010); et 3 375 de commerçants de poissons dont 54 % de femmes. Les rôles des femmes et des hommes sont complémentaires dans le secteur des pêches.

De nombreux obstacles limitent les activités de la femme dans la pêche. La femme est chargée d'accomplir de multiples tâches qui lui occupent du temps et l'obligent à travailler au sol. C'est par exemple le tissage et la réparation des filets. La transformation du poisson et sa commercialisation. Le rôle traditionnel attribué à la femme restreint ses interventions du fait qu'elle doit veiller au bien être des enfants et s'occuper des tâches ménagères. Les perceptions et les stéréotypes développés à l'égard de la femme influencent son comportement et créent des barrières qui affectent sa participation active aux activités de pêche.

Par ailleurs, la recherché est restée longtemps peu sensible au genre. Les besoins spécifiques et les intérêts stratégiques des catégories socio-professionnelles et économiques ont été peu considérés dans les stratégies de gestion des pêcheries. La préoccupation actuelle est :

- Comment renforcer la contribution des groupes vulnérables particulièrement des femmes et des jeunes à la gouvernance des pêcheries ?
- Comment la recherche peut mieux contribuer à valoriser le rôle des groupes vulnérables et particulièrement les femmes et les jeunes dans la gestion durable des ressources en eau et halieutiques ?
- Le Gouvernement du Burkina Faso est conscient de l'importance que doit jouer le genre dans les stratégies sectorielles de développement. Cela s'est traduit par la création d'un Ministère de la Promotion de la Femme et du Genre, l'adoption de la Politique Nationale

Genre(PNG), ''la promotion du genre'' comme principe dans la Stratégie de Croissance Accélérée et de Développement Durable du Burkina Faso.

- Nous pouvons noter déjà quelques résultats atteints dans la mise en œuvre du projet. Il s'agit notamment de l'amélioration de sensibilité au genre par l'équipe du projet et des groupes cibles. L'harmonisation du concept et la proposition des pistes d'intégration du genre; l'élaboration de protocoles et outils de collectes de données qui intègrent les disparités genre; l'implication de femmes dans les équipes de recherche ; l'organisation de conférence sur le genre et la recherche scientifique de concert avec l'Association des Femmes Scientifiques et le projet d'élaboration de stratégie d'intégration du genre au développement des pêcheries.
- Il est recommandé de promouvoir l'accès aux ressources et à l'emploi par les groupes vulnérables particulièrement les femmes et les jeunes ; renforcer les compétences techniques et alléger les tâches des femmes; Faciliter la participation active des groupes vulnérables aux prises de décision et de développer une stratégie de communication adaptée.

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## SY11 Rural transformation - ideas and concepts for improved outcomes

Birgit HABERMANN

Rural transformation that enables farmers to develop their own agenda based on their knowledge and innovations is gaining more and more ground in research for development. At the same time, researchers are called upon a thorough re-thinking of research and knowledge production practices.

Rather than updating buzzwords and searching for new approaches, more attention should be paid to gender and disciplinary balance; cooperation with informed and updated stakeholders; showing respect and competence, as well as sound knowledge of methods when working with farmers; developing good relations, knowing people's interests, their possible fears and reservations; and to work with farmers during a reasonable time span extending beyond conventional project life times of 2 to 3 years. Finally for sustainable outcomes, research should also pay more attention to continuous monitoring and organisational learning, in order to avoid duplications and redundancies.

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## SY12 Adaptive science to integrate natural and social factors

Jan SENDZIMIR

The societies and ecosystems of the Sahel appear increasingly vulnerable to climatic and economic uncertainty at the beginning of the twenty-first century. For more than one hundred years severe episodes of drought and famine have driven massive livestock losses and human migration and mortality. Soil erosion and tree loss reduced a woodland to a scrub steppe and fed a myth of the Sahara desert relentlessly advancing southward. Since 1990 this myth has been shattered by the

dramatic reforestation of more than 5 million hectares in the Maradi and Zinder Regions of Niger. No single actor, policy, or practice appears behind this successful regreening of the Sahel. Multiple actors, institutions and processes operated at different levels, times, and scales to initiate and sustain this reforestation trend.

We used systems analysis to examine the patterns of interaction as biophysical, livelihood, and governance indicators changed relative to one another during forest decline and rebound. It appears that forest decline was reversed when critical interventions helped to shift the direction of reinforcing feedbacks, e.g., vicious cycles changed to virtuous ones. Reversals toward de-forestation or reforestation were preceded by institutional changes in governance, then livelihoods and eventually in the biophysical environment. Biophysical change sustained change in the other two domains until interventions introduced new ideas and institutions that slowed and then reversed the pattern of feedbacks. We propose to apply such systems analysis to examine what factors act as barriers or bridges to sustainable fisheries in Burkina Faso.

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## SY13 ERA ARD Network
## Promoting collaboration in European agricultural research for the world´s poor

Karla Urbana KRIEGER

Agricultural Research for Development (ARD) plays a critical role in fighting poverty and hunger and in supporting more rapid and sustainable development in the poorest countries of the world. Most developing countries rely on agriculture as the engine for their economic growth, and more than 70% of the poor live in rural areas. In Europe, agriculture and food chains are increasingly confronted with challenges such as food safety, animal health and welfare as well as agro-biodiversity that clearly have a global dimension.

ARD is research that addresses the agricultural challenges and issues faced by developing countries, emerging countries and countries in transition. Agriculture is used in its broad sense and includes crops, livestock, forestry, fisheries, environment and natural resources management.

ARD includes capacity-building and research into agricultural production, productivity, storage, processing and marketing; dissemination, up-scaling, uptake and distribution of the research products; as well as policy, institutional and societal issues. Agricultural Research for Development: a vital contribution to facing the challenges of the planet.

# Additional Program

Visit of the Institut Français, Dr. Guillaume ROUSSON

Visit of the BOKU University of Natural Resources and Life Sciences:

- BOKU ZIB, Dr. Margarita CALDERON PETER
- BOKU CDR Center for Development Research, Dr. Michael HAUSER
- BOKU Library, Mag. Martina HÖRL
- BOKU WAU Department Water-Atmosphere-Environment, Prof. Herwig WAIDBACHER
- BOKU IHG Institute of Hydrobiology and Aquatic Ecosystem Management, Prof. Stefan SCHMUTZ
- HYTECH Experimental Flow Research Station, Lunz am See, DI Bernhard ZEIRINGER
- WKL Wasser Cluster Lunz GmbH research station, Prof. Robert PTACNIK
- Fish Farm „Kleines Erlauftal“, Erich LANZENBERGER
- Wasserkraftschneke at the River Jessnitz, ALBRECHT Family

Visit of the „Buschenschank“ Walter, MBA Norbert WALTER (Director Vienna Farmers Association)

Visit of the “Jesuitenkirche” and St. Stephan’s Cathedral

Excursion to rivers in Lower Austria (Lunz am See)

- River Danube, Erlauf, Jessnitz, Lunzer Seebach, Ybbs
- Large sclae Hydro-Powerplant Ybbs Persenbeug at the Danube River
- Small scale Hydropower at the river Erlauf
- Small scale Hydropower at the river Ybbs in Lunz
- Nature like fish pass at the river Ybbs in Lunz
- Technical fish pass at the river Erlauf
- Boat trip on the Danube to Bratislava (optional)

## Web link

http://susfish.boku.ac.at/index.html

http://www.appear.at/

http://www.entwicklung.at/en/

http://www.oead.at/

http://www.boku.ac.at/home.html

http://www.wau.boku.ac.at/al.html

http://www.ird.fr/

http://www.g-eau.net/

http://institut-francais.at/vienne/

http://www.verbund.com/pp/de/laufkraftwerk/ybbs-persenbeug

http://www.seeterrasse.at/

http://www.wasserkluster-lunz.ac.at/

http://www.e-werk-schwaighofer.at/

http://hydropeaking.boku.ac.at/hytec.htm

http://www.innovative-services.at/wasserkraftschnecke/

http://www.lod.sk

http://weingut-walter-wien.at/

www.univ-bobo.bf

http://www.iucn.org/fr/propos/union/secretariat/bureaux/paco/paco_burkinafaso/

http://www.univ-ouaga.bf/

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