VII. MAIN ELEMENTS

SO1. The biodiversity of African threatened ecosystems is better conserved

Photo 1. *Going out gill net sampling with local fishermen on Lake George (FishBase Africa)* – J. Snoeks © RMCA

1. Contributions to strategic objective 1

A. FISHBASE AFRICA

FishBase for Africa: data dissemination, capacity building & fisheries

Expected outcome 1A: *Up-to-date scientific information about African freshwater and brackish water fish is freely available and ichtyological research capacity is strengthened, mainly for the benefit of developing countries, in order to achieve a correct identification of fishes and provide tools pertinent for studies on fisheries, aquaculture and conservation.*

Countries where the activities take place: Benin, Burundi, DRC, Mozambique, Rwanda, Uganda

Summary

The two major goals of FishBase Africa are the dissemination of existing data on African freshwater fish through various means, including the online database, and the training of qualified personnel through local training and training at the RMCA, and on MSc and PhD level to assure future qualitative studies. These will benefit African scientists involved in ichthyological research on a pan-African level.

FishBase Africa aims at keeping FishBase up-to-date for the African fresh and brackish water fishes, organising: two English and two French three-months training sessions for African scientists and a follow-up study visit for max. two trainees each year. A local training will be organised in Benin; 15 former FishBase trainees will participate in the PAFFA7 meeting. Publications include a field guide to the Clupeiformes, the freshwater fishes of Mozambique and an addendum to the guide on West African fishes. A Pan-African gap analysis will be done on missing data for sustainable fisheries management and Fact Sheets on the most economically important fishes will be produced. A local MSc programme and a PhD at the KU Leuven will be included to study the ecosystem services, fisheries and socio-economics of fishers of the Lake Edward basin. Collaboration with IUCN will be continued. In 2022, the FishBase consortium and the International Symposium will be organised.

Keywords: FishBase, Africa, training, fisheries, information transfer

DAC sector code & policy markers: 11430, 31181, 31382, 41030, 41082, BTR2

Partnerships:

- Université d'Abomey-Calavi, Cotonou, **Benin**
  Faculty of agronomic sciences, laboratoire d'Hydrobiologie et d'Aquaculture
- National Fisheries Resources Research Institute, Jinja, **Uganda**
  Fish Habitat Management Programme
- Official University of Bukavu, **DRC**
  Faculty of Sciences and Applied Sciences, Dept of Biology, Unit: Hydrobiology
- Museu de História Natural, Maputo, **Mozambique**
  Universidade Eduardo Mondlane

RMCA promoters: Jos SNOEKS (Vertebrates, Biology)

a) General context

Development problem that FishBase wants to tackle and its sectoral context

Worldwide, fisheries is in an alarming state with 58% of the stocks collapsed or overfished, another 33 % fully exploited, leaving less than 10% to be further developed. The situation of African inland fisheries is far from clear. But what is clear is that the importance of continental fish production (Africa accounts for about ¼ of world freshwater capture production) for the provision of a major share of animal proteins in most African countries cannot be overstressed. For example, for the Congo basin, Neiland & Béné (2008) mention a total estimated potential fisheries production of 520,000 t/yr with an estimated value of 208,000 million $/yr. However, the knowledge on the freshwater fishes of Africa including many of the parameters important for

their sustainable management, exploitation and conservation, remains poor, patchy and difficult to access. Whilst some of the commercial species have been studied quite intensively, for most the few existing data are often locally unavailable, only locally available in grey literature or only available as fishermen's knowledge; many species are simply understudied. Although some studies require a more developed infrastructure (e.g. aquaculture studies), much data already can be gathered using basic techniques and well-established methodologies, assuming well-trained local personnel is present. The integration of new knowledge in the existing pool of data requires access to these existing data and a means to spread the new knowledge, while access to existing data allows the recognition of priority and/or focus areas for future study, in turn substantially contributing to the knowledge of the subject.
The lack of sometimes even basic fisheries related data, either because it is unavailable to stakeholders or simply because non-existing, the lack of local experts who can produce these data, and the lack of a means to communicate the new insights, hampers the sustainable development and management of the fisheries sector and is a serious drawback on ecosystem conservation.

Capacity constraints and needs of the partner institutions

The two major goals are the dissemination of existing data on African freshwater fish through various means, including the online database, and the training of qualified personnel through local training and training at the RMCA, and on MSc and PhD level to assure future qualitative studies. These will benefit African scientists involved in ichthyological research on a pan-African level.

Based on several sources, including experiences with FishBase alumni, comments from African stakeholders and, importantly, the Joint Strategic Frameworks (used as a tool to identify strategic goals), FishBase Africa also contributes to the alleviation of certain educational and scientific research needs identified (relevant JSF text between quotation marks):

Benin (and West Africa at large): "improve access to knowledge, academic research quality and innovation by strengthening local capacity in order to contribute to development". FishBase will strengthen the position of the University of Abomey-Calavi as the leading institute in Benin and one of the leading institutes in West Africa in fish, fisheries and aquaculture studies by organising a local training in FishBase, with an emphasis on topics deemed important and relevant by the local scientific community and with practical and hands-on support/input from West-African FishBase alumni.

For West Africa at large, the valorisation of actual FishBase data is envisaged through the production of an update of the standard work on the Fresh and Brackish Water Fishes of West Africa, which will allow local scientists to correctly identify their fishes.

Mozambique: "promote scientific research in projects, including vulgarisation and valorisation". FishBase aims to collaborate with the Natural History Museum in Maputo to set a baseline for future research on fish diversity and conservation in Mozambique, by means of the production of a guide to the fishes of Mozambique summarising current knowledge. The Museum in Maputo is part of the Universidade Eduardo Mondlane and is the main museum in Mozambique with a mandate to study biodiversity of the country. The research on fishes is not well-developed, but one of the scientists, Erica Tovela, has been trained in ichthyology. We can capitalise on this training effort to strengthen the ichthyological research in the country and at the same time promote the Maputo Museum as the ichthyological hub of the country.

Uganda: topics related to environment ("ensure the conservation, restoration and sustainable management of the strategic ecosystems in Uganda and so increase resilience to climate change and improve the livelihood of the beneficiaries, especially women and youth") and education and research ("pursue inclusive and equitable quality education, promote lifelong learning and cultural opportunities for all, improve research and stimulate innovation"). These two directions have

been combined in a PhD scholarship for a study on the ecosystem services of the Lake Edward basin, including the development of an Ecopath with Ecosim (EwE) model with fisheries and socio-economic factors. Since this corresponds to the mandate of the Ugandan partner, National Fisheries Resources Research Institute (NaFIRRI), who will hence be reinforced in its mission.

DRC: environmental conservation and management ("garantir une préservation et gestion durable de l'environnement et des ressources naturelles afin de contribuer au bien-être humain, à la résilience des populations au changement climatique et aux catastrophes naturelles et à une plus grande équité sociale"), sustainable agriculture including fisheries and aquaculture ("favoriser une utilisation plus efficiente et plus durable de l'énorme potentiel qu'offre le Congo en matière de sylviculture, d'agriculture, d'élevage et de pêche, avec une attention particulière à l'agriculture familiale") and capacity building ("garantir et améliorer l'accès à la connaissance, améliorer la qualité de la recherche et stimuler l'innovation, afin de contribuer au développement). These strategic goals have been combined in a local MSc programme for a study on the ecosystem services of the Lake Edward basin in collaboration with the Université Officielle de Bukavu. This is linked within a south-south collaboration with NaFIRRI (Uganda). The UOB has experience in the study of the fishes of lakes Kivu and Edward and will be reinforced in its ichthyological research.

For Central Africa, especially the Uganda-Rwanda-DRC area, the production of Fisheries Fact Sheets is envisaged. This links with the goals of the DRC outlined above and also with those of Rwanda: education and research ("garantir et améliorer l'accès à la connaissance, améliorer la qualité de la recherche et stimuler l'innovation par le renforcement des capacités locales, afin de contribuer au développement").

In addition, and in answer to the need of data on the use of fishes, a pan African gap analysis on missing data for sustainable fisheries management will be performed, including an analysis of existing official data and the publication of a baseline report on the gaps and impediments for Africa to sustainable fisheries management.

b) *Background*

Partnership/ownership

The proposed intervention is a continuation of the existing FishBase for Africa project. However, several new topics are included, broadening the scope and in collaboration with alumni of the FishBase trainings, building on the network established over the years. Several of these new accents were developed following discussions with FishBase alumni and other African collaborators, so that these answer to concrete needs of African partners. Selection of the partners is thus based mainly on the geographical area and topic in combination with past (positive) experiences and collaborations with these partners.

Previous experiences between the partners

Here are the most important aspects of former collaboration with the FishBase Africa partners:
Benin partner: the RMCA team will work with a former FishBase trainee (Philippe Laleye) in collaboration with Djiman Lederoun, who did his PhD research in the Museum. They are currently working with the latter on a guide on the fishes of the Mono river. The RMCA is partner for the local master programme [Master Régional Professionnel en Monitoring des ressources Aquatiques et Aménagement des Pêches continentales' (MoRAP, 2015-2019), sponsored by l'Académie de Recherche et d'Enseignement supérieur (ARES) - Commission de la Coopération au Développement de Belgique]. The local training will capitalize on the expertise and the facilities of the research group. Other (West-African) FishBase alumni can/will be involved in the organisation of the local training.
Uganda-DRC: the RMCA team will work with the team of NaFIRRI, which includes several FishBase alumni; the RMCA is currently collaborating with NaFIRRI in a BELSPO Brain project

on the Human impacts on ecosystem health and resources of Lake Edward (HIPE). The planned activities will be complementary to the activities of the Museum in the HIPE project. The DRC partner is also a FishBase alumnus and involved in the HIPE project.
Mozambique: Erica Tovela is the only Mozambican FishBase alumnus. This collaboration is new.

c) *Theory of Change*

Sustainable inland fish production is crucial to address the needs for animal protein of the quickly growing African population. In order to achieve this, reliable scientific data should be the cornerstone of management plans. This then points to two prerequisites: data are available and scientists are trained to provide and analyse these data. Of course FishBase Africa cannot develop an intervention strategy to deal with this on a continent-wide scale and across all disciplines involved. Therefore, it seems logic to concentrate on these regions and scientific domains where expertise is present or can be attained in an efficient and valuable way. That is basically the FishBase Africa's logic in a nutshell. Because of the large range in geographic coverage, going from a continental scale (e.g. the database itself) to regional (many results), range in activities in outreach and capacity building (from presentations to organisation of scientific meetings and from dedicated training activities to PhD-level supervision), and range of disciplines (biodiversity, ecology, conservation, fisheries, socio-economics, …), the different intervention strategies are also very diverse and with different premises and focusses. Therefore, it is impossible to document in detail all change processes envisaged by the divergent results envisaged.

As basic information and an understanding of the current knowledge and state-of-affairs of a particular research topic is a main prerequisite for continued research, FishBase Africa offers a powerful tool to assist local scientists as well as other stakeholders in identifying important research topics, working out proposals and methodologies and attaining realistic goals.
The FishBase database is in essence an online library/encyclopaedia providing free and direct access to all available and up-to-date information related to the fish species of the world. In change process terms, the **African (and other) scientific community are capable of accessing better and updated information of African fishes**. To further improve data accessibility and summarize current knowledge, also in a physical form, fish guides will be developed. The stakeholders hence have access to synthetized regional information or information relevant to a certain group of fishes. As an aid to identify key research areas, a gap analysis of missing fisheries-related data will be performed, and the existing data on commercial fisheries species will be brought together in Fisheries Fact Sheets. Donors, decision makers and scientists get insight in gaps of knowledge and have access to the most important data of the economically most important species. As to the development of an ecosystem model and fisheries management plan, stakeholders within the Lake Edward basin will be able to use this information for sustainable management plans; outside the region other scientists can use the methodology as a baseline for other areas. Specifically for the conservation part of the FishBase Africa logic, ad hoc contributions will be made to the IUCN red list database. Scientists, conservationists and other stakeholders have access to freely available (as are those of FishBase) that set the global benchmark for the conservation status of the various species.

Trained staff is another prerequisite for qualitative research, especially in Africa. FishBase Africa therefore offers several trainings, including basic training locally and intensive training at the RMCA. Alumni will be encouraged to spread their newly acquired skills locally and will be offered follow-up training on a competitive basis. In addition, a MSc and a PhD student will be supervised in their research activities. Along these various processes**, trained scientists benefit from their training, gain knowledge, develop better research skills, start or improve their network and become better equipped to tackle the challenges within their home institute and country.**

All this will contribute to a **better understanding of the fish communities and will aid in the sustainable development and management and conservation of local ecosystems.**

d) Expected results

The training component (yearly FishBase and Fish taxonomy training, local training), the MSc and PhD training and the conferences are in line with SO4, SO5 and SO1. The updating of the database and the output through scientific collaboration link mainly to SO1. Activities under FishBase for Africa lead to all 5 results levels envisioned under the program (see logframe for detailed information):

R1: Strengthening scientific research capacity
R2: Strengthening physical and virtual diffusion of scientific research results to the larger scientific community
R3: Awareness raising towards the general public
R4: Support to good governance, based on the scientific results
R5: Development of synergies and complementary activities among partners through multi-partner governance and coordination

e) Methodology

Data dissemination:

- The FishBase website will be updated based on scientific publications.
- Contribution to IUCN red list database with mutual synergies with FishBase: ad hoc, according to needs and without compromising other parts of the activities.
- Promotion of FishBase for Africa in courses, presentations to student group visits, in scientific meetings, …
- Presentations by the FishBase team and former trainees at next PAFFA meeting (2023).
- Participation in yearly FishBase consortium meeting and International symposium and organisation of them (2022).
- Addendum to the West Africa ichthyofaunal guide: In 2003, the second edition of the standard work on the Fresh and Brackish Water Fishes of West Africa has been published in co-production with the RMCA. This is one of the most consulted books on African fishes. In the meantime, a lot has changed, warranting an update for which the team has already entered the preparatory phase. This will be a publication covering the latest scientific insights and based on the relevant information from FishBase and discussing the changes since the 2003 volumes in such a way that the combination of the books and the addendum provides the full and up-to-date overview of the fishes in the region.
- Production of a field guide to the fresh and brackish water fishes of Mozambique: a large part of Mozambique has never been subject of a study on its fishes; some fieldwork for the Mozambican partner is included, as well as a study visit to the SAIAB collections in South Africa (south-south collaboration), and a workshop with local stakeholders that can contribute relevant information to the book.
- Production of Fact Sheets for the commercial fish species of Central Africa, mainly DRC, Rwanda and Burundi: by analogy with the FAO Aquaculture and Fisheries Fact Sheets, standardized overview sheets that contain the most important scientific information (identification, distribution, biology) and the data linked to their economic relevance (fisheries statistics, catch data, pricing, trends) will be produced. FAO fact sheets are currently available globally for the most important aquaculture and fisheries species, the latter group containing mainly marine species, but only five African species are currently included.

Remark: no real policy briefs are foreseen. However, a number of tools will be produced (publications, reports, on-line documents). In addition, the results will be presented and discussed

at scientific meetings with the most important one being the conference of the Pan African Fish and Fisheries Association (PAFFA) to which the RMCA and the Fishbase trainees contribute a lot. This five-yearly conference can be considered as the best high profile vehicle for knowledge transfer on all aspects of African fishes to the large community of interested persons

Education:

- Organisation of a regional training session of two-three weeks in Benin in 2021 for about 20-25 trainees from the region (West Africa; south-south collaboration). Some key persons from the FB-alumni network will be engaged to actively contribute to the training.
- Training at the RMCA: based on the well-received past experiences but with updates to the program in function of comments from participants and new scientific insights and developments. Possibility for a follow-up training for a limited number of alumni is foreseen.
- MSc and PhD level training (see below).

Research:

- Development of an ecosystem model and fisheries management plan, including socio-economic aspects (traditional fishing, demography of fishers) for the Lake Edward system. This will be the subject of a PhD study for a Ugandan scientist (KU Leuven) and a MSc study for a Congolese scientist (Université Officiele de Bukavu) (south-south collaboration). Fisheries catch statistics will be analysed for the two countries; relevant biological data on the commercially important fishes and on ecosystem functioning will be gathered and the socio-economic and value-chain situation evaluated in order to develop an Ecopath with Ecosim (EwE) model, which is the most used model in fisheries and ecosystem functioning. The software is freely available and has been developed by partners in the FishBase Consortium. The parameters collected during the study will be entered into FishBase and can also be used to obtain better estimates of other relevant parameters.
- Pan African gap analysis on missing data for sustainable fisheries management on a twofold level. First, an analysis of existing official data is made. Secondly, it is clear that many biological data are lacking, with published parameters largely skewed towards marine fisheries and fish production in developed regions. A plea for further information to resolve the African fisheries paradox was the major output of a FAO audit (2012). Yet little has happened up to very recently with a mainly technical new FAO report (2018) on the world inland fisheries, again highlighting the challenge of collecting reliable catch statistics. With a baseline report on the gaps and impediments for Africa to sustainable fisheries management, FishBase Africa wants to contribute to a solution for this issue.

f) Developmental relevance of FishBase Africa

The ca. 3600 described African fresh and brackish water fishes constitute in many regions the single most important source of animal protein. FishBase centralises the scientific information on these fishes and includes some important tools for their study. Hence FishBase for Africa is an important tool for the transfer of information on African fishes to stakeholders in Africa and elsewhere. In addition, the intervention will include an important educational component through annual training sessions and follow-up visits, a regional training session, and the formation of a MSc and a PhD student.

The specific activities proposed are explicitly aimed at alleviating local needs as expressed in the Joint Strategic Framework (JSF, or CSC in French) of the countries involved (e.g. Benin cible 3J, 4G, 5B, 6I & 7B & F; DRC cible 2D-F, 3D-E, 5, 9; Mozambique cible 2B-D, Uganda: 1A, D, 5B,

E, 6H, 7A-C, E). With this scheme a mainly user-driven, bottom-up approach is taken and will be applied in collaboration with local partners.

This intervention has a clear link to the D4D objective in which digitisation is considered as an important lever for development. With the increasing performance of internet in Africa, it is sure that consultation of FishBase will keep on increasing as well.

It also contributes to several UN strategic development goals (SDG 2, 3, 4, 12, 14 &17).
All partner institutes are active in the domain of ichthyology or inland fish production, and hence develop activities directly linked to the developmental problem of the intervention. Some are oriented mainly to the study of the biodiversity of fishes (Mozambican and Benin partner), others more to the study of the biology of fishes and fisheries related matters (DRC, Uganda, Benin), and aquaculture (Benin). The Benin partner can be regarded as a key regional partner within West Africa. The Ugandan partner is an important partner for the East African region. The partner in the Mozambique and DRC are important on the country level or local scale. Embeddedness is promoted through south-south collaborations; Mozambican partner with the South African Institute for Aquatic Biodiversity (SAIAB, Grahamstown, South Africa) for fish collections, DRC and Uganda for study on Lake Edward, Benin partner with interested West African partners for local training. In addition, five African scientists will work together during the three months training and build regional networks.

g) Long term impact of FishBase Africa

Unlocking and transferring scientific information is a crucial factor for future research by African scientists. This is, in combination with passing on expertise in qualitative high training activities, a necessary condition for long-term human capacity building. It is envisaged that this human capital will be necessary to cope with the ever increasing demand for local expertise to answer questions related to biodiversity, sustainable fisheries and aquaculture and conservation and at the same time to guarantee an enhanced quality (and quantity) of ichthyological studies, and capacity building within Africa.
In addition, the a on Lake Edward will create guidelines on how to collect data for commercially important African freshwater fish species, contributing directly to the sustainable management of these resources. The results will be integrated in FishBase. This will provide a roadmap to collect relevant information for the FishBase platform needed to bring data for African fishes to the same level as those from better-studied parts of the world.

h) Sustainability of FishBase Africa

Challenges for sustainability after DGD funding

FishBase exists since 1988 and successfully survived for more than 30 years as one of the few (only?) early developed databases. The continued existence of the database is guaranteed by the FishBase Consortium and as long as core funding can be found for the primary data entry and software maintenance and for the development team at Los Baños (Philippines). As with all databases, it will become obsolete when updating halts.

Sustainability of the research and training actions is directly related to the selection of good partners and partner institutes. Our decades-long experience in working with African stakeholders has helped in selecting reliable partners. Our Benin partner is the leading institute partner in fish, fisheries and aquaculture-related activities in the country and will continue to be so in the future. They are very active in collaborative projects with European donors.

Our Ugandan partner is the prime institute in Uganda charged with studies on fish and fisheries.

Many of our former trainees are still active in ichthyological research. Some got high positions and are not available any more for hands on research. However, they play an important role as

FishBase ambassadors, creating awareness and teaching students. There is no indication that this will change in the future.

Strategy to tackle those challenges

For the sustainability of the database part on African fresh and brackish water fishes, the RMCA needs to remain an important strategic partner within the International Fishbase Consortium. Because ultimately it is this consortium via all its partners that keeps FishBase relevant and growing.

Sustainability of the training efforts is obtained by a thorough selection process and careful attention not to devaluate the quality of the courses.

i) Key stakeholders

Southern Stakeholder	**Interest & influence**	**Stakeholder engagement strategy**
All stakeholders and individuals worldwide and specifically in Africa, interested in scientific information on African fish and fisheries. There is no limitation to which institution/country is a stakeholder.	Interest ranging from low to high (occasional user to high power user of information in FishBase); influence depending on interaction from user.	Stakeholders will have access to up to date information and will be able to interact with the FishBase team via the online platform and social media linked to FishBase. This includes species identification on photographs from Fishbase users, project scientists or consultants, fish-related questions in the fish forum, full text pdf inquiries,…
Governments of the DRC and Uganda	Interest should be high; influence on project needed to support of scientific activities and the absorption of results in management plans.	Will profit from the ecosystem model developed for the Lake Edward system. Will facilitate access through their government agencies.
Local fishing communities within the Lake Edward basin	High interest because the MSc and PhD studies include a model for ecosystem functioning and fisheries, and hence will provide baseline data to a more sustainable fisheries. Influence via data provision for surveys.	Will profit from ecosystem model and the management actions resulting from this. Will contribute data to the socio-economic surveys.
Western African institutions dealing with fish, aquaculture and fisheries	Interest in the local training. Influence (Benin partner) via organisation of local training and (West Africa) by sending delegates to training.	Involved in local training by experts in the region. Training of non-experts.
Institutions, NGOs and fisheries departments from	Interest in the fact sheets of the economically important fish species.	Involved in the development of research projects and management plans, will profit from the fact sheets.

DRC, Rwanda, Burundi.		
Mozambican institutions, NGOs and fisheries department	Interest in the field guide of fresh and brackish water fishes. Influence by providing data for the guide.	Involved in production of guide through network of the partner; involved in the local workshop. South-south cooperation with SAIAB (South Africa, see below).
The South African Institute for Aquatic Biodiversity (SAIAB), Grahamstown	Interest via valorisation of collections from Mozambique; minor influence via provision of access.	South-south contribution with Mozambican partner. Access to collections for and valorisation of collections by Mozambican partner.

Northern Stakeholder	**Interest & influence**	**Stakeholder engagement strategy**
All stakeholders and individuals worldwide interested in scientific information on African fishes and fisheries. No limitation to which institution/country is a stakeholder.	Interest ranging from low to high (occasional user to high power user of information in FishBase); influence depending on interaction from user.	Stakeholders will have access to up to date information and will be able to interact with the FishBase team via the online platform and social media linked to FishBase. This includes species identification on photographs from Fishbase users, project scientists or consultants, fish-related questions in the fish forum, full text pdf inquiries,…
KU Leuven	Interest in the good evolution of the PhD study. Influence by directing and evaluating the PhD study and providing lab facilities.	Will host PhD student; will provide access to library, facilities, labspace and network of scientists.

B. MBISA CONGO II

Science, Culture & Fish diversity Preservation

Expected outcome 1B: *The research capacity on fish diversity and the sustainable conservation of fish in the Congo basin is strengthened through sustainable North-South-South partnerships.*

Countries where the activities take place: Burundi, Republic of the Congo, DRC, South Africa.

Summary

The major objective of Mbisa Congo II is sustainable, long term, collaborative N-S & S-S capacity building in fish diversity & conservation research. Mbisa Congo II builds further on the collaborative work undertaken within Mbisa Congo I and envisions the further study of the ichthyofauna of 10 protected areas in the Congo basin. It foresees the continued collaboration with six local Congo Basin partners, i.e. one in Burundi, one in the RCongo and four in the DR Congo, to enable a persisting growth of skills and knowledge transfer over the generations. These existing collaborations will be extended to include the South African Institute for Aquatic Biodiversity (SAIAB, Grahamstown, South Africa) one of the leading centres in fish diversity research on the African continent. Although studies on the overall fish fauna of the selected protected areas and their conservation implications remain central, an integrative morphogenetic approach will be applied especially to fish groups previously known and identified for their high species diversity.

Keywords: Fish diversity, research, preservation guidelines (policy briefs), capacity building, network, sustainability

DAC sector code & policy markers: 410: General Environment protection and 313 Fishing

Partnerships:

- Université du Burundi (UB), Bujumbura, **Burundi**
  Faculty of Sciences, Biology Department
- Université Marien Ngouabi (UMNG), Brazzaville, **Republic of Congo**
  Ecole Nationale Supérieure d'Agronomie et de Foresterie; Département des Masters
- Université de Lubumbashi (UNILU), **DRC**
  Unité de recherche en Biodiversité et Exploitation durable des Zones Humides(BEZHU)
- Centre de Recherche en Hydrobiologie (CRH), Uvira, **DRC**
- Institut Supérieur Pédagogique de Mbanza-Ngungu (ISP Mb-Ng), **DRC**
  Section des Sciences Exactes, Département de Biologie, Laboratoire de Biologie
- Université de Kisangani (UNIKIS), **DRC**
  Faculté des Sciences, Département d'Ecologie et Gestion des Ressources Animales et d'Hydrobiologie
- South African Institute for Aquatic Biodiversity (SAIAB), Grahamstown, **South Africa**

Other partner:

- Zoologische Staatssammlung München (ZSM), Munich, **Germany**

RMCA promoters: Emmanuel VREVEN (Zoology, Invertebrates, Ichthyology)

a) General context

Development problem that Mbisa Congo II wants to tackle and its sectoral context

The development problem tackled through Mbisa Congo II can be divided into three major sub-problems.

The first one is a **knowledge and data gap problem with regard to the fish diversity of the Congo basin**. However, this knowledge and these data are critical for: (i) fish protection/conservation, (ii) sustainable harvesting and (iii) education/awareness raising. This problem is intrinsically related to the fact that fish: (i) are less visible due to their live medium, water; (ii) are too often viewed as "nutrition only"; and likewise (iii) are less appealing in the

general public's perception than, e.g., mammals. Without doubt, this has resulted in the often poor or at least insufficient attention given to them in the past, and consequently comparatively little data on fishes. However, in this "Anthropocene" age, where humans have become, omnipresent and of global ecological impact, especially with regard to valuable freshwater ecosystems and their inhabitants such as fishes, this data-based knowledge has more than ever become critical for the survival of these highly vulnerable ecosystems and their inhabitants.
The second problem – although already tackled during Mbisa Congo I – is an extant **lack in well-trained local scholars in the field of fish diversity studies,** and even more critical on the long term is the **lack of well-established local research groups which can ensure the integration and thus the continuation of the obtained local expertise over the generations. This problem is still on the agenda considering, a.o., the vastness of the giant aquatic landscape that is the Congo basin.** This problem is only symptomatic for a more fundamental post-colonially related education issue which, a.o., resulted in the absence of well-trained local academics to ensure the continuation of the university level education in this field.
Both previous sub-problems are undoubtedly linked to the third problem of the **lack of national research funds** and thus to the chronical lack of local means, i.e. equipment & opportunities, which enable, for instance, first step and first hand contact with up-to-date genetic research.
As such, Mbisa Congo II is to be situated into the fields of:

(i) fish biodiversity research;
(ii) fish protection/conservation research;
(iii) long term capacity building of key research groups in the field of fish biodiversity research and
(iv) general protection/conservation, education and awareness raising.

Country analysis:

For the DRCongo the **law N°14/003 of 11 February 2014** with regard to **"the conservation of nature"** clearly stipulates that the state should create the conditions to promote and encourage research activities that contribute to the conservation of the biodiversity and its sustainable use. It should encourage, in particular, the creation of national capacities and develop scientific research with regard to genetic resources and access and transfer of technologies adjusted to the needs for national development (article 6) Further, the species protection especially targets, next to others, fishes threatened by extinction or susceptible of being so (article 13).
The **law N°15/026 of 13 December 2015** with regard to **"water"** clearly stipulates with regard to the protection of the aquatic ecosystems (Title VI) that all faunal and floral aquatic species living in the wild are protected (Article 98) and that any action susceptible to cause harm to the equilibrium of aquatic ecosystems or affect their biodiversity in wetlands or protected areas is prohibited or, if necessary, should clearly be regulated.
The **politic and directive research plan of the "Institut congolais pour la conservation de la nature" ICCN (2011)** clearly stipulates as one of its objectives the need to increase the knowledge of the natural resources in the protected area's (objective 1) and this by conducting taxonomic studies (Activity 1.1.7.) (see also law N°75/023 of 22 July 1975 regarding the status of the Zairean institute for the conservation of nature, i.e. the predecessor of the ICCN). Another objective is the contribution to the valorisation of the natural resources (objective 3) for which the study of wild fish species for their exploitation in aquaculture (Activity 3.1.5) and studies with regard to the ichthyological potential of lakes and rivers around protected areas (activity 3.1.6) are listed as activities. Of course all the objectives can only be obtained based on a sound knowledge of the fish diversity of the protected areas and their surroundings.

For Burundi also, a pregnant need for capacity building in the field of taxonomy has been identified in the past by the **"Institut National pour l'environnement et la conservation de la nature"** (INECN, 2003) with (i) some insufficiencies identified (2.3) such as: (a) the lack of

research and capacity building programs, and material for an in-depth knowledge (taxonomy) in conservation of its biodiversity; (b) the lack of taxonomists and skilled people for fieldwork and the description, identification and conservation of its biodiversity; (c) the lack of a centralised information on Burundi's biodiversity. As a results, (ii) some special needs (n°3) were explicitly formulated as well: (a) the need for a better knowledge of Burundi's biodiversity and its protection/conservation; (b) technicians and researchers able to and with the means to undertake inventory studies; and (c) the need for a better, more efficient, national and international exchange of biodiversity related information. The explicit need to build and maintain reference collections was also expressed as these are currently lacking although they would enable subsequent verification of identifications.
Further, a more recent evaluation of the efficiency of the management of the Protected Areas (PA's) of Burundi (UICN, 2011) stipulates, a.o., in his recommendations: (i) the need for a national inventarisation programme highlighting the priorities of the biodiversity studies that need implementation; and (ii) the need to install a framework of transborder collaborations for which these PA's for which this is not yet so (a.o. Malagarazi & Rusizi). Some sites of important conservation value have already been identified for species conservation but are not yet recognised as PA (a.o. the swamps of the Malagarazi for its aquatic fauna). Finally, the need for the diffusion of research data has also been noted.

For Congo Brazzaville and the Lésio-Louna Gorilla Reserve in particular the decree with regard to its creation (Decree n°2009-203; 20 July 2009: Article 2) clearly stipulates the need to organize and stimulate education, training, awareness and research with regard to the biodiversity of the sanctuary.

Capacity constraints and needs of the partner institutions

Mbisa Congo II will enable the fish biodiversity research groups of the partner institutions, and implicitly the involved third parties (i.e. in the DRC: the University of Kolwezi, l'Institut Congolais pour la Conservation de la Nature (ICCN), Wildlife Conservation Society (WCS), etc.), to further:

(i) enhance their capacity building in terms of integrating new experienced scholars;
(ii) enhance their capacity building in terms of taxonomic research skills;
(iii) continue the fish research undertaken, which would otherwise quickly come to a halt due to the chronical lack of national funding for research;
(iv) extend their research expertise, if not practically at least on a theoretical level, to the field of genetics and thus enable a more integrative approach to the fish diversity questions raised;
(v) install themselves, at least, as national centres of excellence in fish biodiversity research able to respond to the increasing demand for, a.o., aquatic impact studies, for which fish can be used as key species;
(vi) extend their S-S network over the Congo basin borders by including SAIAB (South Africa) a continental key player in fish biodiversity research and conservation.

b) *Background*

Partnership/ownership

Mbisa Congo II, emerged from different past and present observations made by the local partners:

(i) the critical need for further capacity building to ensure a next generation of well-trained local researchers in the field of fish taxonomy and conservation;
(ii) the critical lack, as for other research fields, of local/national financial support for fish diversity and protection/conservation research;

(iii) the critical lack of opportunities for first hands on experience in the field of genetics resulting in the widening of the North-South knowledge gap in this crucial field for fish taxonomy research considering the desirability for an integrative approach to tackle such complex biodiversity problems; and related with it;

(iv) the dependence and excessive time consuming efforts during study visits in the North to prepare high quality DNA extracts, which, if performed already in the home country, would enable independent up-to-date genetics facilities to be used globally and safe time for guided analysis of genetic data while being in the North.

Exchange with the local partners further led to the clarification of their needs in capacity building and consolidation to enable the much needed research in fish diversity and protection/conservation.

The involvement of the local partners grew out of past collaboration and opportunities for collaboration (see below for some details) with each of the local promotors and the desire to further consolidate and extend, over the generations, these past opportunities to capacity building. Collaboration with Dr. Albert Chakona & Emeritus Prof. Paul Skelton from the SAIAB in South Africa also grew out of past joined research and publication opportunities and was envisioned based on several observations: (i) the fact that SAIAB is one of the key African institutes in, a.o., African fresh and brackish water studies; (ii) the opportunity to not only consolidate North-South but also South-South partnership through this extension of partners involved; (iii) the critical issue of doing so considering the important past exchanges between the fish faunas of the Congo and the Zambezi basin (Southern Africa) resulting in partially shared fish fauna and thus the need and reciprocal benefit for envisioning expertise sharing; (iv) the recent discovery of high endemism and resulting undescribed species diversity in need of taxonomic attention and description on some highland plateaus in particular but also more general on both sides of this hydrographic divide; and (v) the explicit request from Albert Chakona (SAIAB) to indeed share expertise on some taxonomic groups obtained by the Congo basin partners to tackle the unknown species diversity discovered in several groups. Since expertise in fish morphology research for some key fish groups, i.e. *Amphilius* (Amphiliidae), *Enteromius* (Cyprinidae), *Nannocharax* (Distichodontidae), is now available among our African Congo basin partners resulting, a.o., from the expertise built over the years by the three KU Leuven PhD students of Mbisa Congo I, this will enable a future South-South win-win endeavour.

Colleagues from the Bavarian Natural History Collections (SNSB-ZSM) have also further been integrated as partners considering their extensive genetic and Cichlid taxonomic expertise and the very positive complementary capacity enhancing collaboration worked out during Mbisa Congo I. Further, collaboration with the world renowned elephant fish (family: Mormyridae) specialists (Prof. Carl Hopkins, Dr. John Sullivan and Dr. Sébastien Lavoué) was discussed during the PAFFA6 meeting in Malawi (Mangochi) in Sept 2018. In addition, Prof. Eric Parmentier (U Liège) will be involved in this elephant fish work as well.

Previous experiences between the partners

Mbisa Congo II is a continuation of Mbisa Congo I (2013-2018) which itself has built further especially on the PhD research undertaken by Armel Ibala Zamba (UMNG), the PhD research undertaken by Gaspard Banyankimbona (UB), the PhD research undertaken by Soleil Wamuini (ISP Mb-Ng) and extensive fieldwork undertaken with Auguste Chocha Manda (UNILU) within the framework of the PRODEPAK project (2008-2013) of ENABEL which opened the collaboration with this last university.

Mbisa Congo I envisioned the study of the fish fauna of 10 protected areas in the Congo basin. Within this context: (i) an introductory chapter to each of the protected areas has been compiled; (ii) a checklist chapter has been compiled and is being further updated; (iii) a diversity chapter is also in the making; (iv) data analysis of the ecological studies is on its way; and (iv) conservation proposals, i.e. policy briefs, are in the making for each of these selected protected areas and also

an integrative synthesis of these is in the making based on: (1) the newly generated fish diversity and distribution data; and (2) the first hand anthropogenic impact observations made in the field. In addition, to date, 4 papers have been published in a peer reviewed journal with IF (impact factor) and for three of them with one of the South partners as first author; two more have been submitted to a similar journal, both with a South partner as first author, and are currently under review. Several more are in the pipeline. Finally, the different contributing partners presented a total of more than 20 oral presentations at the PAFFA6 meeting in Malawi (Mangochi) in Sept 2018 testifying to the growing research and results generating potential of the collaborators. Five DEA's and three KU Leuven PhD's are being finalised all with good perspectives on the quality of the generated results which for each of the DEA students will result in at least one publication and for each of the PhD students will, without doubt, result in several more.
With regard to the lessons learned the following insights can be highlighted: (i) the importance of explaining well the baselines of skills, the use of equipment, research objectives etc.; (ii) the need for a close following up of the DEA students, PhD students and partners to allow for a most efficient progress of the research work; (iii) the importance of study visits to Belgium this to: (a) enable partners to free themselves from duties related to their local academic and other responsibilities, (b) obtain, extend and/or update their skills, literature knowledge, etc…; and (c) enable the indispensable comparison with type specimens to settle some taxonomic questions in need of attention; (iv) the importance of joined progress meetings to exchange obtained expertise between partners, exchange ideas, clarify the goals set and consolidate the network; (v) the regular communication problems partly due to technical telephone & internet contact restrictions; (vi) the great human potential, desire & capacity but sometimes the likewise lack of incentive of their local environments to tap this potential; and (vii) the urgent need for further capacity building in these research areas if one is to try to make a significant and lasting difference with regard to the protection of this group of often overlooked animals.

Mbisa Congo II is a prolongation of a long term former collaboration with the six above mentioned partners, all located in the Congo basin. However, one new partner, SAIAB, has been integrated formally to the existing network.
The following reasons can be formulated as to the necessity and desirability for a prolongation: (i) the high fish biodiversity of most of the protected areas and their catchment areas under study and the persistent knowledge gap which in this "Anthropocene" age urgently needs continued research attention to allow for a better protection/conservation, sustainable harvesting and stewardship of these highly unique faunas; (ii) the need for further financial support of the research groups in the partner institutions as financial support for research is effectively lacking completely in their home countries; (iii) the continued need to consolidate the scientific skills and knowledge transfer and exchange to enable the young generation of locally fully integrated research groups to take up and integrate into the local and national research, protection/conservation, sustainable harvesting, and education issues; and (iv) the continued long term need for reference collection access, as for the RMCA collections, of the different partners in order to allow for comparison/verification with type specimens, i.e. those used in the original description of species, as a requisite for the generation of high quality taxonomic results. As such, Mbisa Congo II continues and thus consolidates the efforts undertaken during Mbisa Congo I and thus perpetuates past and present efforts by linking different generations of fish diversity researchers with the next generations.
The added value of Mbisa Congo II lies in:

(i) enabling an integrative and modern approach to fish diversity research by further opening ways to collaborative genetic research;
(ii) integrating SAIAB, as an African centre of excellence in African fish diversity research, into the network of North-South & South-South partners; and
(iii) guarantee the continuation of previous capacity building and research efforts as the best way of making a difference which will have a lasting impact on the capacities of

local research groups in Central Africa and even beyond with regard to local fish biodiversity research, conservation & education.

As a summary, a short description of each previous partnership:

UMNG: The past collaboration with enabled for knowledge (follow up support to Prof. Armel Ibala Zamba and Prof. Victor Mamonekene + fieldwork and DEA opportunities for local students: Mbisa I), capacity building and material support and the present collaboration will enable to further do so (1 PhD + fieldwork and DEA opportunities for local students: Mbisa II).

ISP Mb-Ng: The past collaboration enabled for knowledge (1 local PhD + fieldwork and DEA opportunities for local students: Mbisa I), capacity building and material support and the present collaboration will enable to further do so (1 DEA and finalization of the local PhD + fieldwork and DEA opportunities for local students: Mbisa II).

UNIKIS: The past collaboration enabled for knowledge (2 local DEA's + fieldwork and DEA opportunities for local students: Mbisa I), capacity building and material support and the present collaboration will enable to further do so (1 local DEA at 1 local PhD + fieldwork and DEA opportunities for local students: Mbisa II).

CRH-Uvira: The past collaboration enabled for knowledge (1 DEA & 1 KU Leuven PhD + fieldwork and DEA opportunities for local students: Mbisa I), capacity building and material support and the present collaboration will enable to further do so (1 DEA at the ISP Bukavu & 1 Masters Degree in collaboration with UB, Burundi + fieldwork and DEA opportunities for local students: Mbisa II).

UB: The past collaboration enabled for knowledge (follow up support to Prof./Rector Gaspard Banyankimbona + fieldwork and DEA opportunities for local students: Mbisa I), capacity building and material support and the present collaboration will enable to further do so (1 DEA + fieldwork and DEA opportunities for local students: Mbisa II). Considering the past & present occupations of the local promotor as the rector and presently as a minister it is important to educate a new generation of researchers. It is within that framework that this support is essential. In addition, the collaboration with CRH-Uvira (ISP Bukavu) will be further built on as there is a verbal agreement that PhD student Kisekelwa Tchalondawa could lecture at UB which will support Gaspard Banyankimbona's effort in local capacity building in Ichthyology.

UNILU: The past collaboration with the institute enabled for knowledge (2 DEA's & 2 KU Leuven PhD's + fieldwork and DEA opportunities for local students: Mbisa I), capacity building and material support and the present collaboration will enable to further do so (finalization of 2 DEA's in collaboration with the ZSM + fieldwork and DEA opportunities for local students: Mbisa II).

SAIAB: Explicit request for capacity building in genetics + local ichthyologists expert network building, this within the framework of the need for a better knowledge to also enable a better protection/conservation of the regions ichthyofauna.

c) Theory of Change

Freshwater fish diversity and distribution within the Congo basin at large remains largely unexplored and this even in protected areas. As a result, contrary to more enigmatic animal groups such as large mammals, they most often remain completely absent in management plans even until the present day. However, freshwater diversity is severely under threat and this even the more since terrestrial wildlife has heavily been depleted as a food source.

As such, the major change that Mbisa Congo II envisions, in continuation with Mbisa Congo I, is that the research groups of the partner institutions involved acquire sustainable, long term, collaborative and excellence capacity in fish diversity research and conservation, and this as an

incentive to freshwater ecosystem research and protection at large scales. Within this large-scale framework of change, which should enable the consolidation of independent research groups/units integrated in a strong international continental and trans-continental network, the main target is a growth in expertise, in particular in the following domains:

(i) Fieldwork and collection;
   a. acquisition;
   b. management;
(ii) Research capacity building and student supervision;
(iii) Scientific output in terms of
   a. manuscript publications in peer reviewed journals and;
   b. oral presentations at scientific meetings;
(iv) Grant proposal writing (a.o. IFS);
(v) The elaboration of propositions in policy brief format in regard to
   a. protection/conservation;
   b. sustainable harvesting;
   c. education/awareness raising.

Sphere of interest: Development cooperation partner countries : (i) Burundi, (ii) Congo Brazzaville, and (iii) Democratic Republic of the Congo.

Ultimate Change Envisioned: « live in a just and sustainable world »

Immediate Changes: (i) awareness raising on fish biodiversity of the Congo basin and the need for its protection through its description in scientific papers etc., the identification of flagship species, and the development of the policy briefs; **(ii) knowledge acquisition** with regard to the fish biodiversity of the Congo basin through scientific research on the DEA, Master and PhD level; **(iii) acquisition of technical et pedagogical skills** through fieldwork participation, laboratory work and national and international oral presentations (a.o. PAFFA 7: 2023).

Intermediate Changes engendered through capacity building on the level of: (i) governance this through the formulation of policy briefs which will then be made available to the DFAP and the DGE (Congo Brazzaville), the ICCN (DR Congo) and the OBPE (Burundi) as implementation tools; **(ii)** pedagogical skills in oral presentations; **(iii) knowledge diffusion** through the capacity building over the generations in the partner institutions; **(iv) technical skills** in fieldwork, collection management, laboratory work, power point preparations for oral presentations, student supervision and local/international grant proposal writing; **(v) quality of performances** by providing the partners opportunities to get in contact with high quality sources of information [reference (type) collections and scientific peer reviewed publications] and by capacity building through study visits at the RMCA; **(vi) scientific production** in terms of data acquisition through morphological and genetic study of the existing and newly made collections and manuscript writing; **(vi) capacity to work in a network, of collaborations, of internal and external communications, of notoriety, and of national and international recognition** through (a) the further acquisition of expertise in fieldwork, (b) the organisation of a start-up meeting further bringing partners together in a close network, (c) the writing of papers in peer reviewed journals, and (d) the further establishment and organisation of local fish reference collections; and **(vii) quality of services provided to society at large** through the acquisition of all the above mentioned skills and expertise to establish themselves as centres of excellence in their field, i.e. first of all the field of fish biodiversity studies for the Congo basin.

Sphere of control
Capacitator: RMCA

Financial Co-capacitators: ENABEL
Institutional Co-capacitators: WCS, MAB, WWF / DFAP (Congo Brazzaville), DGE (Congo Brazzaville), ICCN (DR Congo) and OBPE (Burundi)
Scientific Co-capacitators: All partner institutions

External Risk Assessment: (i) technological, accessibility is limited due to regular electricity cuts; and **(ii) political,** instable political situation in the home countries of the partners institutions.

d) Expected results

R1: Strengthening scientific research capacity
It is impossible, within the current context, to protect what is unknown and, as such, the capacity building encompassed within Mbisa Congo II will provide the means to generate this knowledge.
Regarding the cultural contribution, the new fieldwork undertaken will provide the further means to collect the local fish names and link them to their scientific names.
Mbisa Congo II foresees: 1 MSc (Burundi); 5 DEA's (1 in Kinshasa, 1 Kisangani, 1 Bukavu; 2 Lubumbashi); 3 local PhD's (1 in Kinshasa, and 2 or 1 Kisangani and 1 Lubumbashi); and two sandwich PhD's (1 from Lubumbashi; 1 from Rep Congo Brazzaville).

R2: Strengthening physical and virtual diffusion of scientific research results to the larger scientific community
Published and shared knowledge are also the ways to create the awareness needed for a more effective protection of a still too often "forgotten" fauna.
Furthermore, the local fish names will be incorporated especially in the overall diversity publications thus ensuring their long term preservation.
Mbisa Congo II foresees: scientific publications (peer reviewed papers and books); study visits to the RMCA; a locally organised course in collection management; and participation to PAFFA (International conference of the Pan African Fish & Fisheries Association) 2023.

R4: Support to good governance, based on the scientific results
The "policy briefs" and other means foreseen will provide the tools to envision and implement a better fish and aquatic biodiversity protection.
Furthermore, the local fish names are the best appellation that can be used to communicate the message of protection/conservation and sustainable harvesting to the local inhabitants as well as to some staff members, such as some of the eco-guards, of the protected areas.
Mbisa Congo II foresees: the sharing of fish diversity knowledge with the different governance institutions (a.o. ICCN for the DR Congo); and the formulation of "policy briefs", i.e. guidelines to fish preservation, conservation and sustainable harvesting in the selected protected areas.

R5: development of synergies and complementary activities among partners through multi-partner governance and coordination
A strong network of fish biodiversity specialists will be one of the best societal tissues to ensure an effective/affective "stewardship" of an often overlooked fauna.

Mbisa Congo II foresees: one yearly co-ordination, follow-up and network meeting (i.e. in Lubumbashi).

Mbisa Congo II also links with the strategic objectives 5: *Natural resources have an improved contribution to sustainable development* (See SO5).

e) Methodology

Mbisa Congo II builds on the collaborative work already undertaken within MbiSa Congo (I) (2013-2018); which has been positively evaluated last year by two external reviewers (2017).

As such, Mbisa Congo II will further strengthen the skills needed by the partners to generate high quality publication and communication output this by targeting:

(i) the finalisation of papers prepared within the framework of the DEA's and PhD's of Mbisa Congo I;
(ii) the elaboration and completion of the "policy briefs", i.e. propositions, with regard to effective fish conservation and sustainable harvesting in the protected areas under study;
(iii) the drafting and ideally finalisation of the manuscripts of the fish biodiversity (electronic) books of these protected areas; and
(iv) the improvement and completion of an (electronic) book on the fish families & genera of the Congo basin which will be a unique, updated tool for local fish diversity education at the university level and a general tool for first level fish diversity identification by park authorities and others involved in fish diversity conservation in the region.

Furthermore, as an innovative approach to the fish diversity studies undertaken, high quality DNA-extraction facilities allowing for provision of DNA-samples not only for "simple" DNA-barcoding but also for so called NextGeneration Sequencing studies (i.e. for mitogenomic mDNA and ddRAD nDNA approaches), will be installed/supported in some key institutions and this with the following major objectives in mind:
(i) provide hands-on introduction in genetic lab work, instead of the usual ex cathedra introductions;
(ii) enable local tissue processing for this DNA research as outsourcing of the sequencing process is nowadays often the most cost efficient approach;
(iii) save transcontinental visit time and thus enhance quality research time for critical data analysis rather than data generating time at the Northern partners institutions;
(iv) enable the full integration into modern cutting edge genetic research by the partners;
(v) further allow for multidisciplinary approaches to the topic of fish diversity studies in the basin; and
(vi) also locally open the field of genetic research for diversity studies on other animal groups.

The local fish faunas targeted are those of the following 10 protected areas that have already been studied in the past: (1) - Mangrove National Park (MNP, DRC); (2) - Luki Biosphere Reserve (LBR, DRC); (3) - Lésio-Louna/Léfini Reserve [(L-L/LR, Republic of the Congo (Congo-Brazzaville)]; (4) - Yangambi Biosphere Reserve (YBR, DRC); (5) - Okapi Wildlife Reserve (RFO: Ituri) (OWR, DRC); (6) - Ruzizi National Park (RNP, Burundi/DRC); (7) - Malagarazi Reserve (MR, Burundi); (8) - Kahuzi-Biega National Park (KBNP, DRC); (9) – Upemba National Park (PNU, DRC); and (10) - Kundelungu National Park (KNP, DRC). Considering the budgetary constraints, the study of two new protected areas as initially proposed has been suspended. Instead, additional sampling will be undertaken: (i) in the upstream part of the Léfini River, i.e. above the Kouembali George, where the occurrence of a rather different, Lower Guinea related, fish fauna is to be expected but has not been explored in the past due to insecurity issues that have settled since; and (ii) in the KBNP as large parts of the hydrographic network of this park have remained unexplored due to insecurity issues that have partially settled as well. Although studies on the overall fish fauna of these areas remains central, an integrative morpho-genetic approach will be applied to fish groups previously known for their high species diversity or which revealed to be species rich within the framework of Mbisa Congo I. Recording of the local fish names will also be continued to:
(i) enable the use of local names, rather than scientific ones, when discussing conservation issues with the local human populations;
(ii) compare both locally and scientifically recognised species diversity and, where needed, complement the documented local languages in order to enable conservation communication on unrecognised species diversity.

Mbsia Congo II will, as currently foreseen, further strengthen and sustain local research capacity in African ichthyology through: a PhD (sandwich grant) for Mukweze Mulelenu (Lubumbashi; DR Congo) in Mormyridae systematics a highly diverse group of Congo fishes desperately in need of a young specialist; a PhD (sandwich grant) for Exaucée Fleur Clauchanty Guimbi (Brazzaville; Congo-Brazzaville) on the fishes of upstream part of the Lefini River basin to strengthen the latter research group by enhancing its critical personnel capacity; one DEA for Kosi Zola Darrel at ISP Mbanza-Ngungu; further support for the finalisation of the local PhD of Paul N'Lemvo on the fish diversity of the MNP at ERAIFT (Kinshasa); further support for the DEA's of Pacifique Kiwele Mutambala and Lewis Ngoy Kalumba at UNILU on the documentation of unexpected species diversity in two Shellear (Kneriidae) genera; one Master degree for Anatole Bigirimani assistant researcher and Master student at UB; one DEA for Wilson Mayo Ilodiri at UNIKIS; a local PhD for Taylor Mambo at UNIKIS; and one DEA for Kubota Musombwa Espérance at ISP Bukavu. In addition, as during Mbisa Congo I, Mbisa Congo II will also provide numerous opportunities for other licentiate, DEA and Master students under supervision of the partner institutions involved.

Moreover, capacity building in efficient and high quality collection development and management will be made possible through a local meeting under supervision of Dr. Didier van den Spiegel (RMCA) and associated staff (RMCA) for collection database development and for the hands-on issues of fish collection management, all of whom have years of experience in field sampling techniques and/or data management. Further, a start & closure local meeting at Lubumbashi will be organised to share results, obtained expertise, enhance the existing network and evaluate the overall progress towards achieving the goals, objectives and the overall vision. Both a mid-term local meeting and a second edition of the workshop on electric signals in elephant snout fishes (Mormyridae) (part II: with special attention on data analyses) which were also to be held in Lubumbashi have been omitted due to imposed budget restraints. However, alternative sources for funding will be searched. Finally, participation to the PAFFA 2023, the international congress *par excellence* on African ichthyology, has been planned as it will enable the partners to share their latest research results on an eminent international forum.

Extensive fieldwork will be undertaken continued in the ten previously selected protected areas with special attention to "type locality sampling" in and around the protected areas targeted. Type locality sampling has two major objectives in mind: (i) making freshly available comparative specimens available which can partly be housed at the partner institution and will enable the further installation of a critical reference collection for which further means will be provided; and (ii) collect tissue samples for genetic biodiversity studies indispensable for high quality evaluation of species diversity in the protected areas selected and their surroundings. As such, partners will get introduced in DNA work during their study visits in the North. Moreover, Mbisa Congo II foresees the installation of high quality DNA extraction facilities (see above). As such, with the currently attributed funding, the existing facilities already available at SAIAB will be updated where needed to meet the need for high quality DNA extraction. Later on, the installation of such facilities, depending on additional funding opportunities, is to be envisioned for UNILU at Lubumbashi, where the partners with the needed expertise are readily available, and also this depending on (i) additional funding and (ii) enhanced local capacity in genetic expertise, for the UB at Bujumbura (and possibly for the UMNG at Brazzaville). Further, this/these facilities will also be made available to other disciplines [a.o. the fish parasitology work undertaken by University Hasselt (Belgium) and thus facilitate the transfer of skills and expand opportunities for collaboration among the southern partners.

Feasibility of the foreseen activities is enhanced by: (i) the experience built up during the previous years; (ii) the local workshop on collection management; (iii) the (two) annual local progress meetings; (iv) the RMCA study visits; and (iv) the consolidation, at SAIAB, and the installation, first, at UNILU, of the genetic facilities which will enable us to further build on the obtained expertise to possibly install these facilities at other localities.

f) Developmental relevance of Mbisa Congo II

First, Mbisa Congo II is integrated in the Sustainable Development Goals (SDGs) and contributes to the following aims: (i) it contributes and integrates both the **Life below the water** (SDG14) and **Life on Land** (SDG15) objectives in innovative ways by highlighting freshwater fish diversity and the pressing need for its preservation and conservation as well as its importance as a major source of animal protein since the further extirpation of mammalian wildlife; (ii) it strengthens long term South-South and North-South **partnerships** (n°17); (iii) it fully supports local universities **quality education** (SDG4); and (iv) pays attention to **gender equality** and **reduced inequalities** (SDG5 and SDG10).

Study of the protected areas will be undertaken by the collaborators of six Congo Basin partner institutions, i.e. four from the DR Congo, one from Burundi and one from Congo Brazzaville (see above). In addition, Mbisa Congo II will consolidate the longstanding but rather loose collaboration with SAIAB (South-Africa), one of the leading centres in fish diversity on the African continent, and this through a collaboration with Dr. Albert Chakona, the first black African ichthyologist appointed at the institute, and emeritus Prof. Paul Skelton the leading authority on the systematics and taxonomy of southern African freshwater fishes, thus also enabling knowledge transfer and continuation over the generations. This collaboration should further enhance South-South and North-South trans-watershed research as the Congo and the Zambezi basin share an important part of their fish fauna due to faunal exchanges that were facilitated by past geological and climatic events.

A further extension of the collaboration network to other partners countries, such as Benin, for which a long-term collaboration already exists with the University of d'Abomey-Calavi, might also be envisioned.

g) Long term impact of Mbisa Congo II

The long term impact of Mbisa Congo II includes:

(i) the local integration of the needed scientific knowledge on fish biodiversity & conservation research;
(ii) the international recognition of the existence of locally based fish biodiversity research in Central Africa;
(iii) a solid South-South network of African researchers in ichthyology in Central Africa and beyond;
(iv) an integrated North-South transcontinental network; and
(v) the established importance of fish biodiversity, and thus freshwater ecosystems, in biodiversity conservation in Central African protected areas and beyond.

h) Sustainability of Mbisa Congo II

Challenges for sustainability after DGD funding

Sustainability of the interventions supported will be enhanced by:

(i) **enabling the local research groups to obtain a "critical personnel capacity"**, this a.o. by sustaining the North.-South. and South.-South capacity building of subsequent generations of researchers and the consolidation of the Congo basin network to further establish and empower the much needed network of researchers in fish biodiversity that is to serve as an umbrella for freshwater ecosystem conservation science as a whole;
(ii) **ensuring that the propositions for the protection/conservation and sustainable harvesting of the fish fauna's of the protected areas selected in particular and of the fish fauna of the Congo basin in general** and the protection/conservation

"policy briefs" **reach the national actors (a.o. ICCN for the DRC), NGOs and the general public.**

Strategy to tackle those challenges

Several major challenges can be identified with regard to the sustainability of the results after DGD funding:
First, there is the **chronical need for research funds** due to the almost entire lack of national funds for scientific research. This issue can only be, partially, tackled through: **(I) capacity building in grant proposal application of the collaborators involved,** which has already been initiated within the framework of Mbisa Congo I; and **(II) sustained financial DGD support to the research groups**, i.e. these groups of people with specific fish biodiversity related expertise, as the human capacity building undertaken in the past, present and future will otherwise fade away due to the lack of effective further research means to sustain and further extend it into the future. This also underscores the importance to work on both the level of continuity and innovation alike without neglecting or ostracising the first as an indispensable element for sustainability of past efforts.
Secondly, there is the **need for the effective implementation of the protection/conservation propositions** formulated. Although beyond the level of the direct impact of Mbisa Congo II, attention to making fish projection/conservation further visible as an important issue will be possible through our sustained contacts with the **(I) national** (a.o. ICCN for the DRC) and **(II) NGO conservation actors** (a.o. WWF, WCS etc…) in the countries involved.

i) Key stakeholders

Southern Stakeholder	**Interest & influence**	**Stakeholder engagement strategy**
UB, UMNG, UNILU, CRH Uvira, ISP Mb-Ng, UNIKIS (partner institutions)	Interest: Human capacity building; logistic support; network building. Influence: further acquired research capacity & exchange.	Involved as partner institution.
SAIAB (South Africa)	Interest: Human capacity building; logistic support; network building. Influence: further acquired research capacity and exchange.	Involved as partner institution.
DFAP(1), DGE(2) (Rep. Congo); ICCN (DRC); OBPE(3) (Burundi)	Interest: Fish Biodiversity data; human capacity building; and network building. Influence: Implementation of conservation/protection, sustainable harvesting and education/awareness raising propositions as elaborated upon in a.o. policy briefs.	Involved as partner institution.
MAB, WCS, WWF	Interest: Fish Biodiversity data; human capacity building; and network building. Influence: Implementation of conservation/protection,	Involved as partner institution.

	sustainable harvesting and education/awareness raising propositions as elaborated upon in a.o. policy briefs.	

(1) Direction de la Faune et des Aires protégées (Rep. Congo)
(2) Direction Générale de l'Environnement (Rep. Congo)
(3) Office Burundais pour la Protection de l'Environnement (Burundi)

Northern Stakeholder	**Interest & influence**	**Stakeholder engagement strategy**
RMCA	Interest: fish taxonomy (ichthyology), collecting and database development and management tools (collection management and ICT), specialised local biodiversity language (linguistics). Influence: Expertise sharing.	As North partner, coordinator, ICT support, collection management support and as specialised collecting support.
ZSM (Germany)	Interest: genetics and mainly cichlid taxonomy. Influence: Expertise sharing.	As partner institution specialised in genetics and cichlid taxonomy.
ULg (Belgium)	Interest: electric signals in fishes. Influence: Expertise sharing.	As partner institution specialised in electric signals in fishes which is explicitly relevant within the framework of biodiversity studies on elephant fishes, i.e. Mormyridae.
UHasselt (Belgium)	Interest: fish diversity as host for diverse and impacting parasite fauna's. Influence: extending the fish collecting effort beyond fish diversity issues and integrating the issues of fish parasites, thus opening the research groups to a more "holistic" view on fish diversity issues.	As partner institution the UH will be involved in joined field expeditions enabling for the study of the parasite fauna's of some key fish groups collected.

C. BICS

Biodiversity Information for Collections in the South

Expected outcome 1C: *African research partners in MBISA and FISHBASE networks are supported in digital management and preservation of their collection data and field data.*

Countries where the activities take place: Belgium

Summary

BICS aims to enhance the long-term preservation of the collection data and field data produced by the African researchers trained within the framework of the DGD-RMCA multiannual program 2019-2023. It is structured around 3 axes:

1) Managing and technically maintaining a modern database system to preserve, and publish on the web the collections of RMCA African partners. The technical backbone of this activity will be the *DaRWIN* system used at RBINS and RMCA;
2) Providing the African partners of the RMCA with a software workflow enabling them to document easily their field data;
3) Developing an e-learning platform with training material on state-or-art technologies in the fields of GIS and information system for environmental sciences. The focus will be put on the building and teaching of an ecological model, to identify watersheds and tributaries and estimate their richness in term of fish distributions. This task will be carried out in collaboration with staff and trainees of FishBase Africa and Mbisa Congo II.

Keywords: Collection data, collection management system (CMS), data quality, data publishing, biodiversity, capacity building, Modelling, fish diversity, long-term preservation of data

DAC sector code & policy markers: **22013** Information services + **140** General Environment Protection

Partnerships:

- Université du Burundi, Bujumbura, **Burundi**
  Biology department
- Université Marien Ngouabi (UMNG), Brazzaville, **Republic of Congo**
  Ecole Nationale Supérieure d'Agronomie et de Foresterie; Département des Masters
- Université de Lubumbashi (UNILU), **DRC**
  Facultés des Sciences Agronomiques
  Unité de recherche en Biodiversité et Exploitation durable des Zones Humides(BEZHU)
- Centre de Recherche en Hydrobiologie (CRH), Uvira, **DRC**
- Institut Supérieur Pédagogique de Mbanza-Ngungu (ISP Mb-Ng), **DRC**
  Section des Sciences Exactes, Département de Biologie, Laboratoire de Biologie
- Université de Kisangani (UNIKIS), **DRC**
  Faculté des Sciences
  Département d'Ecologie et Gestion des Ressources Animales et d'Hydrobiologie
- Centre de Recherches Géologiques et Minières (CRGM), Kinshasa, **DRC**

RMCA promoters: Franck THEETEN (ICT), Larissa SMIRNOVA (BIOCOL)

a) General context

Development problem that BICS wants to tackle and its sectoral context

The BICS team has been active in capacity-building project activities with African partners (most notably the Democratic Republic of Congo, but also Tanzania) in the field of environmental information systems and GIS since 2009.

One of the long-term aims of these previous projects was the enhancement of the technical capacity and work methods of scientists from the South; so that they could position themselves as valuable partners of international research programs. This implied, as a medium-term

objective, to enable them to get a sound enough technical knowledge, so that they make headway from the basic usage of data and software to the conception relevant ecological models. This expertise will be directly applicable in their academic curricula; and enable them to identify environmental problems (loss of habitat for example).

The second axis of activity, transfer of service, consisted in the setting up of data centers in Central Africa, and in on the job trainings in Africa for local IT engineers. A special emphasis was given to increase the collaboration of African scientists with international scientific networks, such as the Global Biodiversity Information Facility (GBIF).

By implementing those two axes of activities, the scientific level and technical skills of our partners from the South was noticeably improving over the years. Their ability to assess their own need, their capacity to work in an autonomous way with complex software, the increasing quality of the data they manage and the diffusion of knowledge at local level (for instance during practical work session at their University) was improving, and often matching at the end of the project, at individual level, the technical knowledge and expertise of researchers from the North.

However, the **reinforcement of the technical capacities of the partner institutions was perfectible**, and not benefiting from the gain of knowledge of the individual scientists, for several reasons related both to the local realities (lack of equipment at Universities and research centers, remoteness of the most ecologically sensitive areas) and to the fragmentation of the cooperation in the offered activities and in the target group. The two above-mentioned activities targeted different groups of people (**scientists and IT engineers**), and the **setting of a common working environment in each institution was difficult to reach**. Even if the technical level of the trained scientists was quite good during training activities gathering both kinds of profile, it was difficult to develop a multidisciplinary service gathering both promising scientists and skilled technicians in the local institution. This issue is also related to an unintentional brain-drain phenomena, as the most proficient African scientists in environmental sciences are often engaged in long-term training schemes involving long academic missions.

Capacity constraints and needs of the partner institutions

In some cases the previous CABIN trainings, although useful and relevant, could have negative side-effects, both for technical and institutional reasons. The world of open-source and GIS software is evolving rapidly. Quantum GIS has now technical workflow that tends to simplify the usage of the tool and integration of scientific libraries like SAGA or GRASS, enabling the user to more easily access the advanced scientific modeling features of the tools. By training African scientists on old version of these tools, in a context where it is difficult to access the Internet and literature, we may tend to entrench African partners in methods and tools that are progressively being considered as obsolete and tedious in the North, and that may actually slow down the acquisition of a more advanced knowledge of these scientific tools on the long run.

Therefore, BICS will update the material, tools and documentation developed within the CABIN project, making the current state-of-the-art in GIS and databases available, and focussing on the e-learning and data-mobilisation activities. As BICS is mostly related on applied skills for environmental scientists in Africa, the target group are scientists or institutions that are already involved in scientific research project with RMCA (and eventually RBINS). BICS thus reinforces their training activities in the field of database management and GIS, rather than organizing separate training activities.

The aim of BICS is to provide scientists of Central Africa with access services (software and database) that help out to bridge the gap between their own data and their field research, and improve their contribution in scientific articles.

b) *Background*

Partnership/ownership

BICS is an update of the CABIN activities in the previous RMCA-DGD multi annual program supported by DGD. It will benefit from the lessons learned to provide capacity building in a more targeted way. It still retains the links with international networks like GBIF, although it will be a secondary objective, compared to the integration of the data of the scientists inside of a database that can be used at the RMCA and in Central Africa. There was also a demand from Mbisa Congo II team to link the development cooperation with Central Africa on ichtyological research with a database system (such as *DaRWIN*) that could also be used on the field ; and to develop a scientific workflow that encompasses a quality check aspect on the field data produced and studied by its local partner. A third requirement was to link external authority resources like FishBase and Eschemyer Catalogue of Fishes with the collections of the RMCA and of its African partner institutions, which could be technically tackled by BICS.

Previous experiences between the partners

BICS is a continuation of previous RMCA activities benefiting from the experience gathered during CABIN and previous DGD trainings in RMCA, Congo (Kinshasa) and Dar es Salaam (Tanzania).
On a technical point of view, synergies will be sought with the NaturalHeritage (in collaboration with RBINS and APM) and the Geology department at RMCA, as in their projects part of the required software and hardware is present.
A substantial amount of training material is already available on a Wiki website and after updating and structuring could be re-used to create a more user-friendly e-learning platform.

The datasets of visitors and partners of the RMCA in Central Africa, are currently valorised by publishing their data on 1) an online database for collection management (*DaRWIN*); 2) tools for distribution checklists (GBIF IPT) and 3) taxonomic keys (Lucid). These systems are already existing and maintained at the RMCA facilities. Scientists from the South can use it to convert their data into different formats (Excel, GIS layers, IPT view), manage their own collection and compare their data with reference web services (*Catalogue of Life, GBIF, WORMS, OpenStreetMap, FishBase*).

c) *Theory of Change*

Even if the individual and technical level of the attendees to previous training projects (such as CABIN) was satisfactory, the data they used during these training activities and produced afterwards remained scattered and difficult to reach on the Internet. The lack of material infrastructure in Central Africa increases the difficulty for a searcher to combine 1) research and fieldwork, 2) publishing effort and 3) the technical management of data and collection. There is actually a risk that the data used by Central African researchers during their MSc, PhD training and scientific article become lost, while they are the most scientifically relevant data they own, directly related to environmental problems. The aim of BICS is to train African researchers on GIS and database management, by using both:
1) offline GIS and database tools in Africa (that can be used by local researchers during field work and in a situation with limited Internet Access and without intranet)
2) on-line tools to store the data at RMCA and on a local technical node.
This will improve the cost efficiency, as the on-line tools (namely Darwin) already exist at the RMCA and RBINS as systems for physical collections. This will limit concurrence between training activities in the field of database on the one hand and academic activities on ecology on the other hand.

Target groups and impact on each group:

The major impact of BICS will be the conservation of the data belonging to each partner institution in a database system that can guarantee long-term preservation. Scientists will be trained on a workflow that enables them to link their field work with on-line systems, which can be more integrated, both the data produced during their academic training in Europe and those of their affiliation institution.
They will also benefit from a training scheme in GIS that will be based on their actual field data, and that can lead to the conception of real ecological models, allowing a more precise analysis of watershed and rivers.

d) Expected results

R1: *Strengthening scientific research capacity*

R2: *Strengthening physical and virtual diffusion of scientific research results to the largest scientific community*

R5: *Development of synergies and complementarity among partners through multi-partner governance and coordination*

BICS has established a set of five broad categories of activities to fulfil these three results (one activity may overlap with several results):

1) A model based on QGIS, distribution data and elevation model will be set up to identify hotspots and endangered areas in freshwater biodiversity (Result 1) ;
2) the IT and data management knowledge of the scientific and technical partners will be reinforced by the usage of DaRWIN as collection management system and the organisation of trainings (Result 2) ;
3) the quality of the field and collection data of the stakeholders will be improved. Several web tools allowing the partners to check geographical data, complete inaccurate taxonomic references (FishBase), and solve taxonomic conflicts will be developed and, integrated in the training schemes (Result 1 and Result 2) ;
4) The visibility of their partner institutions on the Internet and in scientific data networks will be improved. Data will be put online on the RMC Darwin website, on one (or several) regional mirrors, and published to the GBIF (this concerns Result 2 and Result 5)
5) the on-site technical capacities of the stakeholder will be reinforced. A local and simplified copy of Darwin will be distributed to the partners. One or several regional center could be set up to host an on-line version of DaRWIN and/or the web services for quality checks (e.g FishBase checker). This concerns results 1 and 2.

See *Annex I - Logic framework and Operational plan – SO1* for further details.

e) Methodology

An e-learning platform will be set up during the first year. The training content from the former CABIN project financed by DGD in the field of 1) GIS 2) Database modeling for taxonomic and ecological data 3) data quality; will be updated.
The Darwin system will be used to store environmental data of African scientists participating in Mbisa Congo II and FishBase.
A copy of DaRWIN is installed (which is both a collection management system and a website) at the data center of the CRGM (although this is not a scientific partner, it has the technical capacity to store complex Internet system and web of science resource in Central Africa) and do a yearly (or biannual) mission to update the hardware, the data, and train the local technical staff. *DaRWIN* data of BICS and of Mbisa Congo II (and eventually of RMCA collections) could therefore be integrated in a common GIS infrastructure, with other geographical resources (geological layers used in GECO or PROMINES).
Finally, the third and last axis of BICS will be the development of a simple offline database system that can be used by individual scientists in Africa, or by faculty departments or Natural

Sciences museums having limited infrastructure. This system will be compliant with the DaRWIN data model (for input and output) and is linked to tools and devices allowing management of a physical collection (for instance label printers for alcohol jars). A biannual mission supports the installation of this system and on-the-job training of technicians.

Detail of the activities to be implemented:

Training on GIS: an on-line training material will be elaborated, to guide African MSc and PhD scientists in the management of QuantumGIS 3+, GRASS and SAGA. The aim is to enable them to make in an autonomous way complex ecological maps. This will not only encompass the production of distribution maps, but the mastering of elevation models and the development of models that can identify and analyse ecologically relevant units, like watershed basins or remote tributaries. These features meet a demand expressed by African PhD trainees and staff involved in FishBase Africa and Mbisa Congo II. The methodology to access these models will be available on an e-learning platform, and could also be explained as contribution to training (1 to 2 days).

Another aim of is to provide access to the powerful *DaRWIN* collection management tool (presently used at the RBINS and RMCA) to African partner scientists. *DaRWIN* is now (2017-2019) being extended within the framework of the NaturalHeritage project (a BELSPO project). BICS enriches DaRWIN with several services and tools that increase its scientific relevance.

These tools will be provided allowing the scientific partner to :
- automatically and easily compare the taxonomical hierarchy they use in their research and collection data with the hierarchies *of Catalog of Life, GBIF, WORMS* (a noted on-line resource on marine species, developed by the VLIZ), *IUCN*. This tool (a prototype is already existing :http://**naturalheritage.africamuseum.be/natural_heritage_webservice/taxonomy/**) will be extended within BICS with Fishbase and the "Catalog of Fishes" (https://www.calacademy.org/scientists/projects/catalog-of-fishes) bibliographical references, as these resources are considered as the most valid authorities by the scientists working in Fishbase and Mbisa Congo II. By using these tools, and following a methodology for taxonomic reconciliation developed by BICS, RMCA African partners would improve the quality of their scientific data (both for field works and collections), get the required skills to clean them on a regular basis, increase their scientific value and get more opportunities to valorise their data in scientific articles and grants.
- index their samples in scientific publications. The NaturalHeritage project is indeed implementing the CETAF stable identifier mechanism (https://cetaf.org/cetaf-stable-identifiers), and (for geological sample) the IGSN (International GeoSample Number http://www.igsn.org/). This initiative aims to create central repositories of specimens (or rock samples), that links back to the original website of the collection, and that is stable and authoritative enough so it can be used as a reference in a scientific paper. BICS will offer to our African partner the possibility to link their collection to these international scientific services for collection samples.

Technical support:
BICS plans to provide its scientific partners with the capacity to maintain on the long-term the data collected on the field and/or their collection data, via *DaRWIN*. It will provide a tailor-made work-flow, based on simple and easy –to-use Excel and/or Word templates. This would ease and speed up the recording of data, by allowing the importation of several specimens in a single operation. Eventually, *DaRWIN* (or a simplified to be developed MySQL or Access version) could be installed locally in the South in datacentre (like the CEDESURK/CRGM) or faculties that have the technical capacity to host such software.

Increased visibility:
DaRWIN and the above-mentioned IGSN and CETAF protocols are on-line systems, linked to Reinforcement public search portals, twill make the data of our partner visible and searchable on

the Internet both for the wide public (or school public) and researchers. These systems could also be used to publish the collection data of the researchers from the South to the GBIF if they wish to.

f) Developmental relevance of BICS

BICS fully integrates the D4D (Digital Resources for Development) initiatives fostered by the RMCA strategic plan 2019-2028 and provides a link between digital resources and African taxonomists and ecology researchers.
The aim of BICS is also to train the scientists in FishBase and Mbisa Congo II using GIS systems by starting directly from their actual field data (and not a standard dataset) and to train them to do advanced ecological model (specially for fish distribution). The scientific goal of BICS is to apply the methodology for the identification of watershed basins developed and taught in the North (http://www.geoinformations.developpement-durable.gouv.fr/qgis-2-2-grass-determination-des-bassins-versants-a3502.html) in the context of development projects, for the local partner and by the local partner, with their own data.

g) Long term impact of BICS

- The ecological data (and eventually sample specimens) of the partner institution are better preserved and made available for the future generation. They can be reused by African MSc and PhD students over the years.
- The knowledge in GIS by the partner institutions increases. Individual researchers can develop and test ecological model that can be ultimately used in peer-reviewed papers, increasing their scientific notoriety. This knowledge becomes part of the specific culture of their universities, which are more competitive while applying to research grant and therefore attract more students. The transmission of this technical knowledge exists at regional level in Central Africa, and the surveyed area gradually extends from a local level to a regional or national levels. Ultimately an accurate scientific knowledge can be used in national strategic plans and policy notes for nature conservation.

h) Sustainability of BICS

Challenges for sustainability after DGD funding

Promising African scientists who return to their home institution after having finished a PhD degree are often required by administrative and organisational tasks, due to the need to develop their institution, therefore losing touch with the research. Political instability could also displace academic staff in other region. It is therefore important to preserve their research data (especially primary ecological data) so that they remain available for them and their successors. Political instability has also a prejudicial effect on the integration of researchers into the international community, by hampering their mobility for international and national reasons.

Strategy to tackle those challenges

By seeking synergies with existing initiatives at the RMCA already dealing with the reinforcement of technical capacity at institutional level (Mirror at the *CRGM*, but also ongoing activities with Burundi and Rwanda). Data will also be published online via *DaRWIN* and GBIF (it the user agrees to the IPR terms), to make them more accessible and indirectly archived. Existing collaboration with international capacity building initiatives (like BID GBIF) will enhance the sustainability of the planned training activities by sharing experience, training materials and networking and allowing redundancy of the data. The aim of the e-learning trainings in GIS and quality-checking is to develop a training material that fits with the needs and actual hardware resources of the African universities and research centres, and that can be integrated and transmitted in their own training scheme at Msc and PhD level than training on complex on-line

GIS and databases. Putting in contact BICS participant to GBIF resource and network could also help them to secure additional funding to preserve and develop their data. The side effects of political instability (in term of mobility and economic costs) could be (very partly) tackled by the focus on **e-learning** resources. Regarding of gender balance, the accession of woman scientist to a teaching position could act as an example for other women and men. Increasing their technical skills (in database management, GIS or collection management) could represent a gradual way to increase their influence in their university where they have difficulty to get permanent research position. The publication of on-line interviews where the participants describe their background and report their experience on a dedicated section of the *e-learning* platform could also be a way to tackle the gender dimension and to make the participation of women to the research in Central Africa more visible.

i) Key stakeholders

Southern Stakeholder	**Interest & influence**	**Stakeholder engagement strategy**
MBISA partners : UNILU, CRH-Uvira, UNIKIS, ISP- Mb-Ng, UB (DRC) ; UMNG (Rep. Congo) This list is non-limitative. BICS could collaborate with other stakeholders (especially for the call for data mobilization), but they have to come from an institution already involved in the DGD-RMCA multiannual program 2019-2023. Other possible partners from DRC : Université Pédagogique Nationale, CRGM, Institut supérieur pédagogique de Bu kavu, Université Officielle de Bukavu, C.R.S.N Lwiro, UNIKIN, ERAIFT(1), UPN(2) Kinshasa + other universities and research centers in Central Africa.	Already involved in FishBase and Mbisa Congo II. PhD students expressed to BICS staff the need to improve their knowledge of GIS and develop a model to identify watersheds, tributaries of rivers and assess their ecological richness. The identified partner institutions have a regional influence in Central-Africa, are relatively well present in international cooperation and have the critical size to attract a sizable group of young students on an annual basis	Two targets groups will be trained: 1 - MSc PhD and post-doc student or field workers that need to keep and store data from their field work and produce distribution maps in scientific article. This group will follow the e-learning on GIS and taxonomy, and will be trained in Europe while attending a training session within the multiannual program 2 - Academic or technical staff managing a collection of biological objects or geological samples, trained during the mission in Africa of RMCA staff (on the job learning rather than training session).
Northern Stakeholder	**Interest & influence**	**Stakeholder engagement strategy**
RMCA	Interest : improved assessments of the partner needs, cross-disciplinary approach between departments Influence: Technical know-how, sharing of scientific expertise	Coordinator, and holder of relevant physical collections

RBINS	Interest : cross-disciplinary approach between department Influence: Technical know-how, sharing of scientific expertise	Some of the technical needs of BICS (simpler template to import data in Darwin, link to outputs like labels for collection management) matches ongoing developments at RBINS. BICS staff is also involved in the BELSPO NaturalHeritage project
KUL	Interest : Ichtyological research Influence: sharing of scientific expertise; academic control	Most of the PhD visitors in ichtyology at RMCA are doing their research both at their local university and the KUL
GBIF(3)	Interest : assessment of needs of South scientists, link between policy making and faculties Influence: global audience , awareness on environmental threats, centralisation of geographically and historically diverse data.	The data will be published by GBIF and get a global visibility. The participating scientists and institution will become known to the global scientific community. A link will be established on the GBIF node in DRC and eventually Burundi and Rwanda and field-workers

(1) Ecole Régionale Postuniversitaire d'Aménagement et de Gestion Intégrés des Forêts et Territoires Tropicaux
(2) Université pédagogique nationale
(3) Global Biodiversity Information Facility

D. DIPoDIP

Diversity of Pollinating Diptera in South African biodiversity hotspots

Expected outcome 1D: *The diversity of pollinating Diptera in South African biodiversity hotspots is better known.*

Countries where the activities take place: South Africa

Summary

DIPoDIP – The Diversity of Pollinating Diptera in South African (SA) biodiversity hotspots – will study the biodiversity of selected true fly families (Bombyliidae, Nemestrinidae, Syrphidae, Tabanidae) in several Biodiversity Hotspots of SA. It will improve the taxonomy and resolve phylogenetic relationships of these families and provide basic data on their distribution, pollination ecology in order to study plant-pollinator co-evolution. This will be achieved through training of PhD, MSc and BSc students and joint fieldwork and research. The research will deliver data for Red List assessments and improved conservation strategies for these Biodiversity Hotspots and a workshop with local partners, conservationists, Red List assessors and stakeholders will be organized to translate the results for policy making. Results will be presented to the larger public to raise awareness of the importance of these fly families in pollination, food security and nature conservation.

Keywords: Biodiversity, South Africa, Diptera, Bomybiliidae, Nemestrinidae, Syrphidae, Tabanidae, pollination

Partnerships:

- Stellenbosch University, Stellenbosch, **South Africa**
  Faculty of Science, Botany and Zoology Department, Biological Interactions Group

- University of KwaZulu Natal, Pietermaritzburg, **South Africa**
  School of Life Sciences
- KwaZulu Natal Museum (Natural Sciences), Pietermaritzburg, **South Africa**
- South African National Biodiversity Institute (SANBI), Silverton, **South Africa**
  Biosystematics & Research Collections Division

RMCA promoters: Kurt JORDAENS, Marc DE MEYER (Biology)

a) General context

Development problem that DIPoDIP wants to tackle and its sectoral context

Main context

Species rich ecosystems provide ecosystem services (*e.g.*, food security) and act as a resource base for the sustainable development and sectors such as tourism, agriculture and forestry. A healthy environmental resource base provides critical eco-system services that are a foundation for economic and social development. Biodiversity richness is one of South Africa's (SA) important natural assets as it provides goods and services which are vital for human well-being. Biodiversity of a number of plant and animals groups, however, is decreasing due to a growing human population and their increasing demands on the environment. Insects are no exception to this and the focus of the biodiversity and conservation programmes in South Africa is on the regulation and management of all biodiversity, heritage and conservation matters in a manner that ensures equitable and sustainable use, conservation and resource base management as well as to mitigate threats to them as a basis for sustainable and inclusive socio-economic development. Diptera biodiversity is largely neglected in conservation programs because of a lack of taxonomic expertise and an insufficient knowledge on the ecology of most of the true fly families. This is very alarming since many fly families are very diverse and constitute important components of plant-pollinator networks which shape the species rich biodiversity hotspots of South Africa. DIPoDIP therefore directly underpins sustainable development objectives ODD15, more specifically, parts 15.1 and 15.5.

Problem analysis

Biodiversity hotspots of South Africa

Several SA biomes are characterized by a great taxonomic diversity and profuse flowering of nectar-bearing plants. In some of these areas there is a mass-flowering of most plant species and these events are a major tourist attraction. Little is known about the pollinators which maintain these rich plant communities. In order to conserve these areas, knowledge on the pollinator community needs to be incorporated in conservation programs. DIPoDIP will focus on three biodiversity hotspots in SA where the relevance of Diptera pollinators is acknowledged but poorly understood. The succulent Karoo biome occurs in north-west SA and harbours a botanical diversity that is unparalleled by any other arid region on Earth (> 5,000 higher plant species, 18 % of which are threatened). In the montane environment of the Drakensberg escarpment in the east of SA, another rich grassland flora is present where many nectar-feeding flies occur. The Maputaland-Pondoland-Albany biodiversity hotspot is a meeting point of six of SAs eight major vegetation types and the region boasts an unusually high number of unique species and ecosystems. These areas are either within the mountainous or dry zone within SA and their biodiversity requires special attention following ODD15, part 15.1 of UNO.

Afrotropical and South African Diptera

The Diptera ("true flies" or "two-winged flies") constitute one of the largest orders of insects in the biosphere. SA has the most diverse and distinctive Diptera fauna in the Afrotropics. Recently, the role of true flies in pollination has received increasing attention in Africa and the few studies conducted indicate that some families of true flies may be far more significant in pollination biology than previously considered. The importance of true flies in plant-pollinator networks in

SA's biodiversity hotspots has been poorly studied. Yet, this information is highly relevant since indigenous pollinators not only play a pivotal role in the pollination of wild plants, but also may act as source populations for the pollination of crops in adjacent cultivated areas and thus may provide essential ecosystem services related to food security. The study areas harbour a highly diverse insect community with many local endemics which are threatened by human activities and hence require special conservation strategies. DIPoDIP therefore aligns with ODD 15, part 15.5 of UN.

Problems related to the research: biodiversity of plant-pollinator networks

There is substantial interest in the robustness of plant-pollinator networks to species loss and collapse, especially due to anthropogenic factors such as habitat destruction. Models specifically focused on the effects of habitat loss have shown that specialist species tend to go extinct first. The species richness of flowering plant species has been well-studied in the biodiversity hotspots of SA. In contrast, very little is known on the taxonomy and ecology of the many pollinating true flies that pollinate, and maintain, the high species diversities in these areas, such as the Bombyliidae (bee flies), Nemestrinidae (tangle-veined flies), Tabanidae (horse flies) and Syrphidae (hover flies) and there is no critical assessment available on the role of true flies in pollination. This is because there is insufficient knowledge on species taxonomy, species distributions and ecological knowledge. Some efforts are being made to disentangle the co-evolutionary relationships between long-tubed flowers and fly pollinators with a long proboscis.

Problems related to conservation

There are several major challenges facing fly conservation. Targeted conservation of this group can only take place once the taxonomy has been clarified. Thereafter there is a strong biological challenge, which refers to insufficient knowledge on the ecology, inter-relationships and general ecology of the various focal species to be able to make informed and sound conservation management decisions. Finally, there is a perception challenge that relates to the fact that certain types of species do not muster public sympathy. Bombyliidae, Nemestrinidae, and especially Syrphidae, often mimic bees and wasps. It thus takes a great deal of persuasion to convince many influential sectors, especially the public one, that flies are worth conserving. One means to increase public awareness is for specialists to publish popular articles on the plights of endangered fly species (including photographs, etc).

Capacity constraints and needs of the partner institutions

Stellenbosch University (SU) and the University of KwaZulu-Natal (UKZN) have a strong expertise in co-evolutionary processes between flowering plants and their pollinators. However, most focus is on the plants because of a lack of taxonomic Diptera expertise. This impedes studies on the evolution of plant and insect diversity in the SA biodiversity hotspots. It is known that the taxonomy of the most important true fly pollinators is very complex and the co-evolutionary processes which drive biodiversity can only be understood in a phylogenetic context. SU and UKZN thus need support in Diptera taxonomy, molecular phylogenetics and data/specimen collection and management. The KwaZulu-Natal Museum (KZNM) has a very strong expertise in collection management and good expertise in Diptera identification. These skills have typically been applied narrowly, focussing on Diptera taxonomy. Including KZNM in will allow the in-house skills to be applied in a broader, ecological sense. This complements the lack of skills at SU and UKZN, increasing the chance of success of DIPoDIP and allowing for skills transfer between partners. The South African National Biodiversity Institute (SANBI) is a state institution which has a legal mandate for a wide range of outputs related to the conservation and sustainable use of biodiversity, included co-ordinating and promoting taxonomy, dissemination of biodiversity data, co-ordination of red listing of species, policy advice and for capacity development in the biodiversity sector. SANBI has very limited capacity in zoological systematics and operates through a network of partner institutions and experts. There is declining expertise in insect taxonomy in South Africa, and very limited capacity for training of postgraduate students and young scientists in this field. Partnerships are therefore a critical aspect

for addressing the capacity constraints. The South African Department of Science & Technology has initiated the establishment of a Natural Science Collection Facility, which is a network of institutions holding natural science collections. The objectives of this initiative include increasing research on the collections, especially where such research can contribute to addressing national challenges. International partnerships are important for contributing to the capacity needed for achieving this objective.

b) *Background*

Partnership/ownership

Kurt Jordaens (KJ) has developed a strong collaboration with the KZNM (John Midgley, JM) and has visited the museum several times. KJ and JM perform joint fieldwork in SA. KJ visited Timo van der Niet (TvdN) of UKZN to discuss potential collaboration on tangle-veined flies. As a result, one of the PhD students working on tangle-veined flies followed the Kenya 2017 training course on Diptera pollinators. A few years ago, Alan Ellis (AE) (SU) contacted KJ with respect to a call of the Foundation Biodiversity Information Program (FBIP) and the need for AE to have taxonomic and DNA barcoding expertise on bee flies. TvdN is also a collaborator and he has worked with AE on a book chapter on speciation process in the Greater Cape Floristic Region. DIPoDIP is the first to group all this expertise whereby botanical expertise (SU, UKZN) is linked to Diptera taxonomic expertise (KZNM, RMCA). Initial ideas were developed during visits of KJ to UKZN and KZNM.

Previous experiences between the partners

JM (KZNM) and MH (SANBI) are partners in the JRS Biodiversity project "The Pollinator Information Network of two-winged Insects (Diptera): 2017-2019" of which KJ is the promotor. KJ and JM have applied for a Belspo Network proposal entitled: DIPtera Museum collections as a source for TAxonomic research and TEACHing activities and a FBIP project entitled: A taxonomic revision of, and new identification keys to, the South African hoverfly species of the genera *Eristalinus* and *Syritta* (Diptera: Syrphidae). KJ has received a travel grant from SANBI to study the collections of the KZNM in November 2018. KJ is a collaborator in the FBIP project entitled Diversity and life-cycle requirements of keystone fly pollinators in the Succulent Karoo biodiversity hotspot of AE (SU). TvdN (UKZN) is currently supervising a PhD (Genevieve Theron), who already interacted with Kurt Jordaens at a fly identification course in Nairobi. He also works with Prof Steve Johnson, the holder of the South African Research Chair in Evolutionary Biology, to investigate micro- and macroevolutionary patterns and processes of fly-plant interactions. There is an established collaboration of RMCA with SU for several years on a different group of Diptera, *i.e.*, the team has been working together with SA on Tephritidae since 2013. MH (SANBI) is the manager of the FBIP and the Natural Science Collections Facility, and is responsible for ensuring that the outputs from projects funded through these projects flow into long term national and global archives and are available for activities such as red listing, environmental assessments, the compilation of species pages for a national e-fauna, and for building the DNA barcode reference library. This is an important link for ensuring that the outputs of DIPoDIP are taken up into policy-related activities and have a long-term impact.

c) *Theory of Change*

The overall desired change envisaged is two-fold: 1) to increase the appreciation of true flies in the ongoing biodiversity and ecological research in South African biodiversity hotspots and 2) to convince influential sectors, especially the public one and the policy makers, that flies are worth conserving. This change is desirable because many insects are important pollinators and thus contribute to sustainable food security and a better health for South African citizens. The areas in which the study will take place are also important for the ecotourism industry, which provide jobs

and revenue for the country, and fly pollinators are important in the ecosystems that form the basis of this industry. A better protection of biodiversity hotspots will also contribute to a lower loss of biodiversity, less ecological damage and thus a healthier environment.

As such, DIPoDIP is considered important for the researchers, policy makers, agricultural sector and tourism involved in the management and exploitation of the biodiversity hotspots of South Africa but also for the larger public living in and around the hotspots.

Given the existing expertise of partners, their research emphasis and the funding and time limitations, only a number of factors listed in the problem analysis can be tackled directly. The following domains of change are selected as being of high priority in order to contribute substantially to the desired overall change:

- ✓ *Problems related to the taxonomy of Afrotropical Diptera:* Have a better understanding of the taxonomy and systematics of the families Bombyliidae, Nemestrinidae, Syrphidae and Tabanidae
- ✓ *Problems related to the plant-pollinator networks in SA biodiversity hotspots:* Have a better understanding of the diversity of the target families in some of South Africa's biodiversity hotspots and to better understand the value and role of the target families in plant-pollinator networks in these areas.
- ✓ *Problems related to the conservation of the SA biodiversity hotspots:* Providing policy makers with scientific data that will allow them to integrate the Diptera of the target families into conservation programs and to provide the general public with means to appreciate Diptera as important components on biodiversity.
- ✓ *Problems related to research capacity in SA:* Develop the technical and scientific support to enable partner institutions to gain the necessary expertise with regard to taxonomy of Diptera and molecular phylogenetic research.

Focusing on these domains, the pathway of change involves two groups of stakeholders/actors: the conservation researchers and policy makers and the researchers affiliated with the local institutions.
Regarding conservation researchers and policy makers the following phases have to be followed:
Initial phase: what kind of data do conservation biologists and policy makers need to incorporate Diptera into conservation programs ? How can Diptera enhance existing conservation programs or how can the result in new conservation programs ? How can we increase appreciation of Diptera in conservation programs ? What guidelines need to be followed when including new taxonomic groups in new or existing conservation programs ?
Second phase: how to tackle the problem ? What kind of information do we need to increase appreciation of Diptera for conservation purposes? Can we use information on other groups used in conservation programs to increase the appreciation of Diptera ?
Information in these two initial phases will be obtained through discussions with stake holders and policy makers. The South African National Biodiversity Institute (SANBI) is a partner in DIPoDIP. SANBI contributes to South Africa's sustainable development by facilitating access to biodiversity data, generating information and knowledge, building capacity and providing policy advice. SANBI will highlight the priority data information needed and advise on policy briefs.

The perception of the conservation biologists and policy makers will need to be supplemented with information from the field. What is the biodiversity of the target Diptera families in the DIPoDIP biodiversity hotspots ? What is the distribution of the species of the different target families? With what other species (groups) and flowering plant species do they co-exist? Which fly species is a potential pollinator for the different flowering plant species? How do plants and pollinators interact ? How do they co-evolve and how does this drive diversity of plants and pollinators ?

After acquiring of these baseline data, data will need to be made available for conservation planners and policy makers in order for them to carry out Red List assessments, to identify

priority areas and management activities and to improve/develop conservation programs. Therefore, all biodiversity data will be made available in online repositories such as GBIF. In order to increase the relevance of pollinating true flies on the long term, we will develop identification keys and picture databases that will be made freely available through at least two websites. Collected flies will be vouchered and housed in the collaborating institutes with an emphasis on the KZNM which as a state-of-the-art Diptera collection of South Africa and is the major reference collection of Diptera of southern Africa. Concurrently, the larger audience will be informed on the use of true flies in conservation programs and management in South Africa though an information panel and guided tours for students at the KZNM. In addition, the distribution of information brochures, the organisation of public talks and the publication of a booklet on the role of Diptera in plant-pollinator and biodiversity research in South Africa will raise awareness to the larger pubic.

The resulting data and the development of repositories of pictures, distributional, taxonomic and ecological data will simultaneously enable the local partners to enhance their training programs and re-inforce their research capacity, including the use of new molecular techniques. As such it will increase the local expertise and regional recognition of the collaborating institutes as centres of excellence on plant-pollinator networks research.

The expected changes, ranked according to the different spheres are the following:

Sphere of control

Local partners in DIPoDIP have trained students and researchers and obtained expertise and research infrastructure to study aspects related to true fly taxonomy, biology and biodiversity studies and to understand plant-pollinator networks in SA biodiversity hotspots.
Information on pollinating true flies (taxonomy, identification methods, distribution, ecology) is deposited in online free-access depositories and has been disseminated to conservation biologists, to biodiversity institutes and to policy makers. Research results are presented to the scientific community and to the larger public.

Sphere of influence

A first target group include researchers at local institutions, and technicians, who will have gained additional expertise regarding true fly taxonomy and plant-pollinator networks and will be in a better position to provide advice on matters regarding Diptera taxonomy and plant-pollinator network research. They will also have gained technical expertise in (molecular) taxonomic and systematic techniques and the publications of such data and results. This target group is (or are associated with) the KwaZulu-Natal Museum, the University of Stellenbosch and the University of KwaZulu-Natal. The RMCA will benefit from an increased collection and a gain in expertise in plant-pollinator networks and collection management. DIPoDIP will thus lead to a strengthening of the expertise of the partners from the north and south.
A second target group will constitute the (partner at the) KwaZulu-Natal Museum who will have been assisted in the development of expositions in entomology, and the role of insects in agriculture and tourism, and biodiversity research. As such, (especially young) students will be targeted for education.
A third, final target group will constitute conservation biologists and policy makers, including (the partner at) the South African National Biodiversity Institute (SANBI), who acknowledge the importance of true flies in biodiversity conservation and the role of true-flies in plant-pollinator networks. They also acknowledge that true flies are relevant study groups to assess local biodiversity and that this information can be incorporated into existing or new conservation plans for South Africa's biodiversity hotspots.

Sphere of interest

The ultimate beneficiaries will constitute conservationists who use the taxonomic and ecological data obtained to produce Red Lists and to develop conservation programs for the different groups of true flies within South Africa's biodiversity hotspots. Moreover, local partners will be able to continue their research on the conservation of biodiversity of true flies in South Africa's biodiversity hotspots. As such, better protected biodiversity hotspots will attribute to rural development through increased tourism and an increased food security (protection of sink populations of pollinators, protection of potentially new food items or natural strains of cultivated crops) and will contribute to the general welfare of South Africa. Educational beneficiaries will constitute young and emerging South African entomologists and local school children who are educated in conservation biology and the sustainable development of agriculture, tourism and biodiversity.

d) *Expected results*

R1: Strengthening scientific research capacity

Research on the biodiversity and role of Bombyliidae, Nemestrinidae, Syrphidae and Tabanidae in SA biodiversity hotspots.

Three MSc and three PhD researchers are trained in aspects related to true fly taxonomy and ecology, and plant-pollinator networks.

R2: Strengthening physical and virtual diffusion of scientific research results to the larger scientific community

Research results are published in international peer reviewed journals and presented at dedicated international conferences. Existing websites on pollinators and biodiversity in SA are enhanced.

R3: Awareness raising towards the general public

Museum visits for school children are organized. Educational tools on true fly identification and ecology are developed. Public talks on the role of true flies in plant-pollinator networks and the conservation of biodiversity hotspots are organized.

R4: Support to good governance, based on the scientific results

Policy brief on the value of true flies in conservation programs of South African biodiversity hotspots is composed and disseminated through policy makers.

R5: Development of synergies and complementary activities among partners through multi-partner governance and coordination

Meetings with other partners involved in biodiversity conservation research in Africa are organized.

e) *Methodology*

R1. Research capacity

R1.1. Biodiversity survey and improved taxonomy of keystone fly pollinators with a focus on Mariobezzinae (Bombyliidae) and Rhigioglossa (Tabanidae) (Y1-4)

Study of the biodiversity of both taxa in the Succulent Karoo biome, taxonomic revision of both groups, description of plant-pollinator interactions. Student assignment: 2 MSc: Y1-2.

R1.2. Evolutionary diversification of keystone fly pollinators (Bombyliidae, Nemestrinidae, Tabanidae) (Y2-4)

Study of the phylogenetic relationships and co-evolution (and of its dynamics) of pollinators and plants in SA biodiversity hotspots, identification and description of biogeographic patterns of species diversity and endemism, explore drives of insect diversification across SA diversity hotspots. Student assignment: 2 PhD: Y2-4.

R1.3. Diversity and feeding ecology of hoverflies (Syrphidae) (Y2-4) in the Maputaland-Pondoland-Albany and Drakensberg escarpment biodiversity hotspots (Y2-4)

Study of the biodiversity and biogeography of hoverflies in this biodiversity hotspot, describe basic plant-pollinator relationships, improve identification keys and draw distribution maps,

provide information on pollination importance and conservation priorities. Student assignment: 1 MSC: Y1-2; 1 PhD: Y2-4.

R.1.4. Supporting PhD and MSc researchers

Support of 3 PhD and 3 MSc students (cf. R1.1-1.3).

Thesis topics for several BSc Honours students (cf. R1.1-1.3).

R2. Diffusion to scientific community

R.2.1. Participation at international conferences (Y1, Y3-Y5)

Participation at five international scientific conferences of SU/UKZN/KZNM/RMCA members of staff and students linked to DIPoDIP, to present the results and interact with fellow researchers:

Y1: 11th International Symposium on Syrphidae (Greece, 2019)

Y1: Entomological Society of Southern Africa meeting (Durban, South Africa, 2019)

Y3: 12th International Symposium on Syrphidae (2021)

Y4: 10th International Congress of Dipterology (2022)

Y5: 13th International Symposium on Syrphidae (2023)

R2.2. Publication of research results, to disseminate the results to the larger scientific community (Y1-Y5)

Three to five public access publications (peer review journals, conference book of abstracts and proceedings, chapters in books, etc.) each during Y2 tot Y5 with DIPoDIP results.

Two popular scientific talks / year to local communities, associations, etc.

R2.3. Enhancement of existing websites on fruit fly pests and pollinators (Y2-5)

Extension of existing factsheets for Syrphidae (http://fruitflykeys.africamuseum.be/;)

Publishing of specimen factsheets on SANBI's National Biodiversity Information System which is being developed and to use the data to compile species pages for the national "e-fauna".

Additional images digit03 website.

Additional information pollinators (https://www.pindip.org).

R3. Awareness raising

R3.1. Development of a booklet on Diptera pollinators in South Africa (Y4,Y5)

Y4-5: Publication and distribution of a booklet with general taxonomic (identification) and ecological (pollination) information on pollinating Diptera in South Africa (all DIPoDIP members)

R3.2. Demonstration session (morning session, talk on pollination, other ecological and conservation talks, tour of museum focussing in invertebrate gallery (Y2,3,4)

Y2: Production of a panel display at the KZNM invertebrate display emphasizing the link between research and society (*e.g.* ‚impact of pollinators on food production and sustainability) (KZNM).

Y3-4: Guided tour and talks with respect to biodiversity of Diptera research in South Africa and the role of true flies in plant-pollinator networks.

R4. Support to good governance

R4.1. Development of policy brief on the value of true flies in biodiversity research and the conservation of biodiversity hotspots in South Africa, to be distributed to policy makers and other stakeholders (Y5)

Y5: development of policy brief in collaboration with CEBios unit at Royal Belgian Institute of Natural Sciences.

(50-100 copies Afrikaans, 50-100 copies Zulu and/or Sotho and/or Xhosa, 50 copies English) (joint KZNM/RMCA team)

Y5 : meeting with all DIPoDIP partners and policy makers to disseminate policy brief (cf. R4.1)

R5. Development of synergies

R5.1. Interaction with policy makers involved in biodiversity research in South Africa (Y1-Y5)

Y5: two-day workshop at SANBI with 20 participants for interaction with other entities working on biodiversity conservation.

Y1, Y3-5: participation at international congresses (cf. R2.1).

f) Developmental relevance of DIPoDIP

With increasing globalization, the effects of climate change and the improvement or maintaining human well-being and livelihoods, there have never been as many challenges in and opportunities for science to inform, contribute to and support decision-making. These contributions have impacted fields such as conservation, yet, barriers still exist that prevent the ready integration of research into policy.

Therefore, South Africa has started some notable initiatives that try to actively engage across the divide, such as the Program to Support Pro-poor Policy Development but such initiatives remain few. South Africa has also played a leading international role in integrating science-based biodiversity planning into policy, for example in the Cape Action Plan for People and the Environment (CAPE). CAPE has subsequently underpinned many national and regional biodiversity plans and forms of legislation.

Such programs define methodological frameworks of best practice within a well-networked community who meet annually at the National Biodiversity Planning Forum, hosted by SANBI, one of the partners in DIPoDIP. The Forum is intended primarily for those involved in the technical aspects of biodiversity planning and the production and use of biodiversity planning products, including people from conservation agencies, provincial environmental and conservation departments, conservation NGOs, universities and research institutes, and independent biodiversity planning consultants. The focus in the sessions are on the technical aspects of biodiversity planning and its implementation. These meetings have highlighted the continued need for the inclusion of South African researchers in high-level activities. DIPoDIP should be seen in the light of these recommendations.

g) Long term impact

In the long term DIPoDIP will a) consolidate the expertise on plant-pollinator networks of the local partners in the study areas as well as that of RMCA; b) contribute to an improved protection of the biodiversity hotspots of South Africa; and c) contribute to an increased appreciation of true flies in conservation programs and education. Moreover, DIPoDIP will highlight pitfalls and provide guidelines to translate raw, scientific data in policy making recommendations. These guidelines and recommendations will be applicable to other animal groups and conservation programs.

h) Sustainability of DIPoDIP

Challenges for sustainability after DGD funding

The local partners have been capable of attracting funding independently (*e.g.*, through FBIP). Through the novel expertise that they will acquire from DIPoDIP, they will have an even stronger position to be part of research consortia, and to request for funding (*e.g.*, the team has applied for BELSPO network project). The partners will also have gained expertise in the development of policy briefs and the dissemination of these briefs – expertise on both can be translated to other Diptera groups and will facilitate the incorporation of data on other Diptera into conservation programs and policy making.

Strategy to tackle those challenges

In order to ensure continuation of the research, SU, UKZN and KZNM institutions will develop a strategy of looking for alternative funding during the second half of the DIPoDIP project's lifetime, and to set-up a research network in SA with partners related to their research topics. The

three institutions have a track record of being able to attract funding for research opportunities in their field of expertise. To further improve the applied aspects the three institutes will work out a strategy with SANBI.
A meeting with policy makers will be organized so that adjustments to data acquisition and dissemination of data and policy briefs is optimised and take into account to needs put forward by the policy makers. As such, DIPoDIP will contribute to an integrated vision of science (UKZN, SU, RMCA) – politics (SANBI)– society (KZNM, RMCA) among, and within, the different partners.

i) Key stakeholders

Southern stakeholders

- **Young African researchers and students (emphasis on female participants)**
  Interest & influence: *Critical*

Young researchers and students will be given the opportunity to be directly involved in DIPoDIP and obtain expertise and knowledge. Their involvement is critical for proper execution of all activities.

- **Researchers in Conservation Biology**
  Interest & influence: *Critical to high*

Involvement of conservation biologists and nature protection agencies (e.g., Cape Nature, South African National Parks, KwaZulu-Natal Nature Conservation Services) is critical in that they need to provide essential information on the field study areas, provide access to the field areas and allow research conducted in the areas. The local nature protection agencies will also benefit directly from the knowledge gathered.

- **Governmental institutes involved in conservation**
  Interest & influence: *high*

National Government officials/organisations (e.g., SANBI, Department of Environmental Affairs, Conservation South Africa) and international organisations involved in the conservation of biodiversity (e.g., Conservation International, IUCN) will be informed and involved in processes where appropriate.

- **Other research institutions (ministry, international) and local NGO's**
  Interest & influence: *medium to low*

Local or regional research institutions and NGO's will be kept informed on DIPoDIP results. Where applicable collaboration can be envisaged.

Northern stakeholders

- **BBIF (Belgium)**
  Interest & influence: *medium*

The Belgium Biodiversity Information Facility (BBIF) is the Belgian branch of the Global Biodiversity Information Facility (GBIF). GBIF's is an international network and research infrastructure funded by the world's governments and aimed at providing anyone, anywhere, open access to data about all types of life on Earth.

BBIF will be consulted for guidance in making the distributional records obtained from DIPoDIP available to the scientific (and non-scientific) community and to make all data online accessible for free.

E. CONFERENCE BIODIVERSITY OF THE CONGO BASIN

Expected outcome 1F: *The knowledge base on biodiversity by the local scientific community and other stakeholders is increased in order to reinforce their involvement in the sustainable exploitation and conservation of the natural resources of the Congo Basin*

Countries where the activities take place: DRC

Summary:

In June 2018 the RBINS, together with the RMCA, has been invited to become a member of the CBFP (http://pfbc-cbfp.org/home.html), in the context of the Belgian Facilitation of the organisation (2018-2019).

The CEBioS-program of the RBINS, supported by the Belgian Development Cooperation and Belgian Science Policy, proposes to submit an extra activity to the CBFP's calendar for 2019. The considerable investments of the Belgian Development cooperation in recent years (scientific expedition on the Congo River in 2010, the construction and creation of the Centre de Surveillance de la Biodiversité in Kisangani, the VLIR-UOS institutional capacity building program with the University of Kisangani, Universitic, the Flegt program, REFORCO, the organisation of the 1st International Conference on Biodiversity in the Congo Basin (http://congobiodiversityconference20l 4.africamuseum.be/l_in 2014), have contributed to the CBFP' s roadmap.

The first conference in 2014 was an initiative of the Consortium Congo 2010 (the University of Kisangani, the Royal Museum for Central Africa, the Royal Belgian Institute of Natural Sciences and the National Botanic Garden of Belgium) and the ' Centre de Surveillance de la Biodiversite' in Kisangani to facilitate interactions and collaborations among Congolese, Belgian and international teams and experts involved in various fields of biodiversity-related research in the Congo Basin.

The conference was attended by well over 200 academics and researchers of the DRC and of 20 different African countries, in addition to researches from several European, Asian and South-American countries and the USA and enjoyed a wide media coverage. Many representatives of the DRC government and civil society from all eleven former provinces of the DRC also attended the conference.

Through the involvement of the scientific community, policy makers and other stakeholders of the Congo Basin , which are usually not represented at international conferences on the Congo Basin, the conference led to a strengthened Congolese network of researchers , stakeholders and decision makers with an increased awareness of the importance of the conservation of biodiversity and the sustainable exploitation of natural resources in that region.

Besides the traditional output of a scientific conference (an abstract book), the conference resulted in the publication of the P1 edition of the 'Etat des lieux de la Biodiversite dan la RD Congo' (by the CSB and its satellites across the DRC) : state of the art of the knowledge available in the Congolese scientific community about their natural resources, and to the joint publication of a Participants Statement addressing recommendations for improved scientific research conditions in the Congo Basin and enhanced implementation of scientific findings in the management of the natural resources

The output of the 1st conference and the subsequent activities have raised the interest of various international stakeholders to repeat this initiative, to the extent that they may be willing to assist in seeking funding.

The current context allows to include themes not addressed during the 1st conference, such as public health (Ebola and other zoonotic diseases) , food security, sustainable agriculture, primarily oriented at supra-national and interregional collaboration for scientific research, conservation, sustainable exploitation of natural resources and policy making. This would call for

an audience larger than the 1st conference in 2014, leading to the reinforcement and extension of the already existing network.
The need to update the 'Etat des lieux de la biodiversité dans la RD Congo' to assess the increase of the knowledge base on biodiversity by the local scientific community and other stakeholders and to reinforce their involvement in the sustainable exploitation and conservation of the natural resources.
The proposed venue is situated in the secluded heart of the Congo Basin, combining beautiful forests with the challenges emblematic of this region.

Partnerships: CEBioS (RBINS), with support from the RMCA and the National Botanic Garden of Belgium, University of Kisangani.

2. Synergies and complementarities

With CEBioS-RBINS in general
Given the expertise in biodiversity research present in both RMCA and RBINS, for all SO1 activities close collaboration with CEBioS is envisaged.
Synergetic activities under SO1 with CEBioS include:

- Organisation of joint seminaries or workshops in North and South, using added value of reciprocal expertise, such as expertise on policy briefs, Nagoya protocol, expertise in forestry, fisheries, entomology
- Joint management of the Publication Service Unit and joint publications
- Exchange of jury members
- Exchange of reports and best practices
- Information exchange about five year program and annual planning
- Information sharing about alumni.

A. Fishbase Africa

With other Belgian actors
RMCA is partner in the ARES-project "Appui à la mise en place d'un Master Régional Professionnel en Monitoring des Ressources Aquatiques et Aménagement des Pêches continentales" (MoRAP), with the Université d'Abomey-Calavi (Bénin), with Université de Namur and coordinated in Belgium by the ULiège. RMCA complements the regional and Belgian expertise with a one week course on FishBase and Fish Taxonomy. This project will end in 2019 and the planned local training in 2022 should allow to capitalise on the logistics and expertise created by the ARES project.
With other actors
The RMCA is member of the renowned international FishBase Consortium. This consortium coordinates the activities involved in keeping the database running and updated and decides on future approaches. Members of the consortium are leading experts in the development of ecosystem models (EwE). Collaboration is initiated with UBC Vancouver for the study on the ecosystem services of the Lake Edward system. FAO has shown interest and invited the RMCA coordinator to meet with the FAO staff members working on African Inland Fisheries.
South African Institute for Aquatic Biodiversity (SAIAB) is the strongholder of ichthyological research in southern Africa. RMCA will call upon their expertise and collections for the development of the Mozambican field guide, through a visit of the Mozambican partner to SAIAB (South-south collaboration).

B. Mbisa Congo II

With other Belgian actors
RMCA foresees collaboration with CEBios for the development of policy briefs.

With other actors

(i) The **"Exploiting the Genomic Record of Living Biota to Reconstruct the Landscape Evolution of South Central Africa" project (2015-2019)** led by Dr. U. Schliewen of the SNSB-Bavarian State Collection of Zoology, Munich(SNSB-ZSM). This project aims at understanding the relationships between fish and the evolution of their aquatic environment, i.e. the rivers that harbour them, and this towards the Congo-Zambezi watershed in Southern Congo. As such it is a multidisciplinary project integrating the expertise in both the field of African ichthyology and African geology. For the fish diversity component morphometrics as well as a strong genetic, next generation, component to identify lineages and species will be used. The strong genetic component of the project and its interest in the fish fauna of the Southern part of the Congo basin both underscore its synergy and its complementarity with Mbisa Congo II.

(ii) The **IFS grant application**

C. BICS

With other Belgian actors

BICS will collaborate extensively with Mbisa Congo II (also applying to the same call) and target the same community of users. It handles technical aspects that cannot be tackled by the research focus of MBISA, in order to increase the GIS skills of MBISA trainees and ease the technical access to FishBase data from within Africa. It will ensure a long-term preservation of research data generated by other activities (primarily DGD funded RMCA activities, but potentially also from Enabel, ARES and VLIR-UOS).

RBINS is involved as creator of the *DaRWIN* system. The BELSPO NaturalHeritage (2017-2019) project aims at better integrating *DaRWIN* in international scientific web portal on one side, and to mainstream the link between *DaRWIN* and technicians who work on physical collection on the other one. A substantial part of the technical developments made within the framework of the NaturalHeritage project can be used as a basis for BICS.

With other actors

BICS will collaborate with the national GBIF node in DRC. This node would be linked by BICS with recent and accurate research data of Central African research. In return, the node could do outreach activities at national level for BICS or link BICS to communication activities targeting Congolese policy makers.

D. DIPoDIP

With other Belgian actors

RMCA foresees collaboration with CEBios for the development of a policy brief on biodiversity conservation in SA near the end of the program period (2023).

With other actors

The South African National Biodiversity Institute (SANBI) is South Africa's major biodiversity research institute and is a partner in the ongoing JRS Biodiversity project PINDIP (under RMCA promotor Kurt Jordaens). SANBI plays a leading role in generating, coordinating and interpreting the knowledge and evidence required to support policies and decisions relating to all aspects of biodiversity. SANBI will also help in the dissemination of the policy brief and will form the pivotal link between the other DIPoDIP partners and the policy makers, in order to translate 'raw' scientific data into 'policy adapted' recommendations.

The JRS Biodiversity Foundation has a Pollinator Biodiversity Program. The main goal of this program is to increase the accessibility and quality of pollinator biodiversity data through a long-term investment in collecting baseline data, developing technologies and methods to do so, and creating data sharing platforms relevant at regional and local levels. JRS is developing grant making initiatives in Pollinator Biodiversity Knowledge and in Applied Pollinator Biodiversity Informatics and seeks to support partnerships that advance pollinator data collection methods, shared data platforms, and plant-pollinator data standards. DIPoDIP is in line with the goals of

JRS and the JRS project (PINDIP): the Pollinator Information Network for two-winged insects (Diptera) with partners SANBI and KZNM involved.
RMCA and KZNM have received a BELSPO Network project to perform complementary research and research dissemination and will substantially contribute to the development of the research network and capacity of DIPoDIP.

E. Conference Biodiversity of the Congo Basin

This conference is organised by CEBioS (RBINS), with support from the RMCA on behalf of the Consortium Congo 2010 (the University of Kisangani, the Royal Museum for Central Africa, the Royal Belgian Institute of Natural Sciences and the National Botanic Garden of Belgium).

SO2. Culture and heritage are respected, protected and documented as a source for empowerment and sustainable development

Photo 2. *Des étudiants de l'institut supérieure de Pédagogie participent à une journée d'information sur l'atelier 'L'évolution des espèces' au Musée National de Lubumbashi (MNL)*, B. Cornet © RMCA

1. Contributions to the strategic objective 2

A. RWANDA ARCHIVES

Expected outcome 2A: *An increased digital accessibility and discoverability of a series of key Rwanda archives present in Belgium*

Countries where the activities take place: Rwanda, Belgium

Summary

The RMCA manages a significant collection of Rwandese objects, archives, photos and other collections. Although they reside mainly in Tervuren and are legally part of the Belgian patrimony, the objects themselves morally belong to the global community, as part of a heritage shared between Belgium and Rwanda. Part of the RMCA's mission is to make these objects and archives available and known to scholars, enthusiasts, … worldwide. Over the last few years, important efforts have been made to open up these collections. Notable projects include the digitization of the Rwandese ethnographical objects and musical instruments, the close collaboration with the Belgian State Archives resulting in the publication of an archival overview of all colonial archives and the digitization of the sound archives and the accompanying field photography.

Nevertheless, significant improvements can still be made to increase the discoverability, usability and accessibility of these digital resources, not least for the Rwandese community. To name a few problems and constraints:

- Foreign Affairs and the State Archives have large volumes of historical archives from Rwanda that could be made more easy accessible by digitization.
- Most of the partners' collections and knowledge about these collections is isolated in local "silos".
- The discoverability of the collections is weak and often Euro-centric. The information used to describe and open up the archives dates mostly from the 1960s – 1970s.
- Most of the results of the abovementioned projects are currently only accessible from within the premises of Foreign Affairs, Archives and museums, forcing remote scholars to carefully plan an expensive study visit to Tervuren or Brussels.

The objective of this project is to digitize as many as possible of historical archives of Rwanda currently held in Belgium at Foreign Affairs, State Archives and RMCA. The digitized copy of these archives will be handed over to Rwanda authorities.

By giving Rwandese scholars and officials access to Rwanda historical archives in Belgium, historical research in the country will be greatly facilitated.

Belgium would be the first European country to return to a former colony from Africa a copy of to its historical archives.

Duration: 2 years (and continued collaboration in SHARE – see hereunder)

Partnership: Institute of National Museum of Rwanda (INMR), Rwanda Archives and Library Services Authority (RALSA)

RMCA promoters: Dieter Van Hassel, Patricia Van Schuylenbergh

a) General context

Development problem that RWANDA ARCHIVES wants to tackle and its sectoral context

In the framework of the SDGs, Target 11.4 calls for strengthening efforts to protect and safe-guard the world's cultural and natural heritage.

The Rwanda archives present in Belgium are part of Rwanda´s historical heritage but are currently not easily accessible for the Rwandese community.

The RMCA aims to facilitate the access to digitized key Rwandan archives.

Capacity constraints and needs of the partner institutions

The RWANDA ARCHIVES project is initiated based on the question of Rwandese authorities for an improved access to Rwandan archives in Belgium. A training on the use of these archives is also foreseen.

b) *Background*

Partnership/ownership

Given the vast amount of "Rwandan" archives and taking into consideration the relatively short timing of the digitisation activities, prioritisation is needed.

The first selection will be based on archives that are accessible and consultable, eg archives still in need of declassification or "mixed archives" (archives covering Rwanda, Burundi, DR Congo in the same files) will not be taken into consideration at the first stage.

Priority will be given to the archives indicated by the Rwandan experts as most susceptible for digitisation. A delegation of 4 Rwandan experts will be invited to visit the State Archives, the Archives of Foreign Affairs and the archives preserved in Tervuren during the month of May 2019. An extensive list of archives held in these repositories will be communicated to the Rwandan experts prior their visit. The visit of the delegation should result in a conclusive and final list of archives with the highest priority of digitisation.

Meanwhile, the Belgian partners will start the preparatory activities to the digitisation. This includes cleansing and thorough inventorisation of the archives involved.

Comprehensive list of Rwandan archives:

1. *Archives preserved at Foreign Affairs / State Archives in Belgium*
    a. "Archives allemandes" (1901-1959, 10 linear meter)
    b. "Archives du Service des Territoires du Ruanda et de l'Urundi" (1916 – 1934, 15 linear meter)
    c. "Archives du Ruanda-Urundi (RWABU)" (1916-1962, 25 linear meter)
    d. "Archives du Ruanda" (1916-1961, 20 meter)
    e. "Archives relatives à l'emancipation du Ruanda-Urundi" (1959-1962, 5 linear meter)
2. *Archives and collections preserved in RMCA, Tervuren*
    a. Archives from private persons, companies and organisations (+/- 40 linear meter)
    b. Archives from research institutes such as Institut national d'études pour le développement du Bas-Congo (INGA), Commision pour la Protection des arts et metiers indigènes (COPAMI), Institut des parcs nationaux du Congo belge et du Ruanda-Urundi (IPNCB), Institut pour la recherche scientifique en Afrique centrale (IRSAC) (105 linear meter)
    c. Acquisition files of around 2300 etnographical objects (wickerwork, wooden pots, baskets, metal objects, music instruments, …)
    d. Photographs and films on Rwanda (+/- 4000 items)
    e. Sound recordings and music instruments

c) *Theory of change*

The changes envisaged can be situated on different levels.

1. **Rwandese cultural heritage institutions** will have a better insight on key Rwanda archives in Belgium.

2. The **Rwandese broader research community** (scholars, students, …), civil servants and general public, will benefit from a better accessibility and discoverability of the key archives.
Facilitating access to the archives in a broad sense will unlock the (research) data contained in the archives and help as such its users to achieve their (research) goals. It will greatly facilitate in particular **historical research** in Rwanda.

d) *Expected results*

Result 1: Strengthening scientific research capacity through insight in archives

Result 2: Strengthening physical and virtual diffusion of archives to the larger scientific community

Result 3: Strengthening physical and virtual diffusion of archives to the larger public

The spotlight is on facilitating access to research communities and enthusiasts worldwide, with a strong focus on local, Rwandese partners.

Target groups will have a clear overview of existing and accessible archives held by the RMCA and the State Archives of Belgium. A significant amount of those archives will be accessible online. A digital copy of the digitized archives is returned to Rwanda.

e) *Methodology*

The RMCA starts a collaboration with the Rwandan authorities and the Institute of National Museums of Rwanda in order to achieve the following steps:

- Organise a visit of Rwandan representatives in order to prioritize which archives of Rwanda in Belgium are most interesting to Rwanda (2019)
- Provide a better insight on the Rwanda archives in Belgium
- Produce a guide with digital archive inventories of the most important Rwanda archives in Belgium (2020)
- Improve accessibility to key Rwanda archives in the RMCA
- Digitize as many as possible of historical archives of Rwanda currently held in Belgium at Foreign Affairs, State Archives and RMCA
- Provide a digitized copy of these archives to Rwandan authorities (2020)
- Train Rwandese scientists and archivists.

Recent developments in information technology and heritage practice make it possible to open up collections for a global and diverse public. Technologies such as Linked Open (Usable) Data and the International Image Interoperability Framework (IIIF) facilitate remote access and allow the collections to be embedded into a wider web of knowledge, leading to an increased use and relevance.

f) *Developmental relevance of RWANDA ARCHIVES*

Rwanda developed a National Culture Heritage Policy in 2015, which is built on 10 key intervention areas one of which is the dissemination of the Rwandan History. Research and promotion of the history of Rwanda is a key element on the Rwandese cultural agenda.

g) Key stakeholders for RWANDA ARCHIVES

Southern Stakeholder	Interest & influence	Stakeholder engagement strategy
Institute of National Museum of Rwanda (INMR) and Rwanda Archives and Library Services Authority (RALSA)	Very high interest for access to Rwandan archives abroad	Involved as direct partners
Rwandese scientists and archivists	High interest	Receiving training on key Rwandan archives; better access to historical heritage is of high interest for Rwandese historical scientists
Rwandan authorities	Interaction needed in order to identify priority archives	

B. SHARE

Shared heritage, shared knowledge

Expected outcome 2B: *Contribute to shared heritage and strengthened conservation and management capacity of collections with museums in Rwanda, DRC and Senegal*

Countries where the activities take place: DRC, Rwanda, Senegal, Belgium

Summary

The main goal of SHARE is to enrich and to increase the usability of and accessibility to the human heritage preserved in the partners' collections. The key element to realize this is the concept of "**shared heritage, shared knowledge**".
Although a significant amount of objects and archives, originating from the partners' regions of interest, are (physically) located in Tervuren, the study and dissemination of these collections can't be solely done in Tervuren. There's a growing demand from both the RMCA and the local partners to collaborate on the enrichment of metadata, the creation and curation of databases and datasets, etcetera to make both the combined collections in Tervuren and in their counterparts in the partners' institutions available to the interested researchers and public at large (scholars, state agents, students, enthusiasts, …).
By combining the knowledge that is currently held in "silos" into a larger shared web-of-knowledge, the heritage in collections of the different partners can be shared.

The global objective of this project is to share heritage and strengthen conservation and management capacity of collections with museums and research institutes in Rwanda, DRC and Senegal. The main partners are both collection holding institutions and research institutes.

The specific objectives of SHARE are:

- An increased digital accessibility and discoverability of a series of key (shared) collections of the partners, tailored to the needs of the partners and their clients,
- An increased user awareness and user engagement around the partners' collections and archives as a whole,
- A framework with guidelines, best practices and recommendations for museums and research institutes, guiding them through the process of collaboratively opening up their collections, regardless of physical location,

- Creation of a network of expertise on conservation and restoration where the different parties can exchange knowledge.

Duration: 2019-2023
Partnerships:

- National Museum of Rwanda (INMR), Rwanda Archives and Library Services Authority (RALSA), Rwanda
- Rwanda Académie Langues et Cultures rwandaise (RALC), Rwanda
- Institut des Musées Nationaux du Congo (IMNC), Kinshasa, DRC and Musée National de Lubumbashi (MNL), Lubumbashi, DRC, Académie de beaux arts (ABA), UNIKIN & CEDESURK, Kinshasa, RDC
- Musée des Civilisations Noires (MCN) – Dakar, Senegal

RMCA promoters:
Guido Gryseels, Patricia Van Schuylenbergh, Dieter Van Hassel, Jacky Maniacky, Rémy Jadinon

a) General context

Development problem that SHARE wants to tackle and its sectoral context

In the framework of the SDGs, culture has a crucial role to play in SDG 11: Make cities and human settlements inclusive, safe, resilient and sustainable. Target 11.4 calls for strengthening efforts to protect and safeguard the world's cultural and natural heritage.

The safeguarding and promotion of culture is a goal in itself, and at the same time it is linked to and contributes to many other SDGs — safe and sustainable cities, decent work and economic growth, reduced inequalities, the environment, promoting gender equality and peaceful and inclusive societies.

UNESCO is convinced that no development can be sustainable without a strong culture component and as such states that "*Only a human-centred approach to development based on mutual respect and open dialogue among cultures can lead to lasting, inclusive and equitable results. Yet until recently, culture has been missing from the development equation. To ensure that culture takes it rightful place in development strategies and processes, UNESCO has adopted a three-pronged approach: it spearheads worldwide advocacy for culture and development, while engaging with the international community to set clear policies and legal frameworks and working on the ground to support governments and local stakeholders to safeguard heritage, strengthen creative industries and encourage cultural pluralism.*" (https://en.unesco.org/themes/protecting-our-heritage-and-fostering-creativity).

In today's complex and interconnected world, the power of culture to transform societies is clear. Heritage constitutes a source of identity and cohesion for communities disrupted by change and economic instability. The access to heritage and life long learning possibilities can lay the foundations for innovative and prosperous knowledge societies.

The UNESCO international treaties aim for protection of the world's cultural and natural heritage **including museum collections, oral traditions and other forms of heritage**.

Through SHARE, the RMCA follows the UNESCO guidelines by strengthening African museums and research institutes in their role for sustainable development.

b) *Background*

Partnership/ownership

Since many years but especially in the period leading up to the reopening of the renovated RMCA, more and more African musea and research institutes have been expressing the wish and need for collaboration on collections and heritage with the RMCA. These regular requests for collaboration include questions for capacity strengthening support in (field) research or conservation and restauration techniques but also for facilitated access to collections and support in digitizing collections.

The museums and research institutes from Rwanda, RDC and Senegal are chosen based on the explicit demand for specific support the RMCA received from them and on the geographical focus of this program.

Preparatory discussions were held with invited representatives of ABA, IMNC, MNL, CEDESURK and UNIKIN in the period of the reopening of the RMCA (December 2018) and during a 2017 visit of the Director of the RMCA to the MCN (Senegal). The focus of a future collaboration with these institutions on restoration and management of collections, inventory, digitization and provenance research of collections, and public activities was discussed. The interest in historical archives digitisation and management is also clear from the activities under RWANDA ARCHIVES with INMR and RALSA and further collaboration on collections is envisaged under SHARE. RALC questions for collaboration on language and music were directly posed to RMCA scientists at the end of 2018. A needs analysis of the partners questions led to the development of the SHARE project.

Previous experiences between the partners

RMCA has a long-standing collaboration with the MNL in Lubumbashi. Since 2004, an intense RMCA-MNL collaboration supports the awareness raising activities of MNL and ateliers for disadvantaged schools and teachers by disseminating knowledge of past and present cultural, social, economic and ecological specificities in Central Africa, from the permanent collections of the MNL and the temporary exhibition "Congo. Nature & Culture" (transferred from the RMCA to the MNL in 2007).

More recently, the MCN requested the RMCA for collaboration and expert advice on the new exhibition that MCN was creating early 2018. MCN financed the visit of Alexandre Smith (RMCA Scientist) for this task.

c) *Theory of change*

The impact of SHARE can be situated on different levels.

1. All **direct partners** will:
   - have a better overview of the mutual heritage, shared by the different partners.
   - benefit from a better understanding of and an increased knowledge about their individual collections.
   - have a better insight in what the other partners & their clients need to make full use of their collections.
   - see an increased user awareness and user engagement with their collections.

2. **Clients of the partners**: the broader research community (scholars, students, …), civil servants and interested enthusiasts, will benefit from a better accessibility and discoverability of the collections and archives. Life long learning is envisaged in this way.
3. The **archives & museum sector at large** will benefit from the lessons learned and the resulting guidelines and best practices. SHARE wants to professionalize the museum, archival

and heritage sector in the South (Rwanda, DRC and Senegal). By reaching out to policy makers the guidelines and recommendations should find their way into daily practice in the museum sector.

The added value for the local partners will be:

- The local partners will have a better insight in the collections held in Tervuren and their own collections.
- The local partners will benefit from a better accessibility of the collections in the RMCA, tailored to their needs.
- The resulting framework, guidelines and best practices of SHARE will help the partners to make their own collections more accessible.
- The local partners are supported to build a sustainable network of local and global museum and heritage professionals.

d) Expected results

Result 1: Strengthening scientific research capacity:
Facilitating physical and digital access to (remote) collections has a significant impact on research capacity as research can be conducted more efficiently (eg. shorter, more productive research trips, with content discoverable and accessible online, etc).

SHARE aims at realizing:

- a regional network for conservation and restauration of collections and develop an action program for inventorying
- fine-tuning and enriching existing databases & inventories
- training of local researchers and curators, (for example with particular attention to sound registration techniques)
- implementing joint provenance research on collections (from RDC) in RDC and Tervuren with art historians and anthropologists from RDC and RMCA
- facilitation of field work, in order to collect additional information (in particular for the sound archives of the RALC).

Result 2: Strengthening physical and virtual diffusion of scientific results to the larger scientific community
As one of the three main outcomes of this project, spotlight is on enriching existing databases and making the contents more available to the research communities around the world. At the projects' end, both local and international researchers will benefit from more accessible inventories and collections, with search capabilities tailored to the needs of the different user groups. This will be done by:

- facilitating the (print and online) publication of research instruments and digital content
- finalisation and publication (digital and paper) of kinyarwanda dictionary in 2019
- organizing conferences and workshops to present the intermediary results and make the joint databases and initiatives known to the scholarly community, with a significant participation of all partners
- creating and improving (joint) databases, collections catalogs and (crowdsourcing)portals to open up the (shared) collections of the partners
- digitization of additional (parts of) collections within the scope
- developing a 'Scientist in residence' program from 2020 onwards whereby African scientists will have the opportunity to study collections in Tervuren in the context of provenance research or restitution.

Result 3: Awareness raising towards the general public
Awareness raising and engaging users is a key component : without an aware public (academic or enthusiast), all invested efforts in databases, portals, ... are void.
To increase awareness and user engagement, the following results are expected:

- Organization of thematic workshops for target groups (participants in the crowdsourcing platforms, teachers, …) to make them familiar with the tools and databases
- Investments in an active social media campaign
- Publications of by-monthly SHARE newsletters
- Support the educational activities for disadvantaged schools and public oriented (life long learning) activities of the Musée National de Lubumbashi in 2019-2020
- Organisation and support for the transport of the « Exposition Première Guerre mondiale en Afrique centrale » of the RMCA to Rwanda in 2019
- Collaborate with, organise and support the visit of a "Wikimedian in residence", who writes about shared collections on Wikipedia.

Result 4: Good governance
SHARE aims at sustainable, reusable results. The key recommendations and best practices and guidelines should find their way to institutional or governmental policies and become embodied in the day-to-day practice of the museum partners.

Result 5: Development of synergies and complementary activities among partners through multi-partner governance and coordination.
The SHARE goals can only be reached as the result of a profound synergy between the partners involved. Therefore, regular coordination, steering committee and follow-up meetings will be organized.

e) Methodology

In 2019, the **UNESCO local conference** for national museums of 17 countries of Central Africa will be supported. This conference should result in an **action program for strengthening the capacity of local museums.**

The RMCA will develop a **scientist in residence** program starting in 2020 in order to give at least one African scientist per year the opportunity to study collections during an extended study period in Tervuren in the context of provenance research or restitution.

In DRC, the RMCA aims to build **a regional network of expertise** with IMNC, ABA, CEDESURK and UNIKIN on the conservation and inventorying of collections and archives. Local training is also provided. MNL is presently know as a well performing museum in RDC specifically in its educational activities. MNL has built regular contacts with other institutions and museums in Africa. The RMCA will continue its effort to support the educational activities for disadvantaged schools and public oriented activities of the MNL in 2019-2020. From 2021 onwards, the recommendations of the external evaluation on the MNL-RMCA activities for the period 2013-2017 will be implemented.
In Rwanda, the same objective is supported in partnership with INMR, RALSA and RALC.
In Senegal, RMCA works together with MCN towards improved conservation and restauration of the MCN collections and strengthened public-oriented activities.

f) Developmental relevance of SHARE

Culture is noted specifically in SDG 4 -Target 4.7, which calls for education to **promote an appreciation of cultural diversity, and of culture's contribution to sustainable development.**

By building a network of strengthened African musea and research institutes (strengthened in African collections management, in awareness raising capacities, in strengthened language and sound research) SHARE wants to contribute to sustainable development.

SHARE will promote **life long learning** (SDG 4) for visitors of African musea through the support for specific activities for families, teachers and the general public.

SHARE provides **at least 4 scholarships for African scientists on RMCA collections**, thereby supporting SDG 4 Target 4.b (By 2020, substantially expand globally the number of scholarships available to developing countries, in particular least developed countries, small island developing States and African countries, for enrolment in higher education, including vocational training and information and communications technology, technical, engineering and scientific programmes, in developed countries and other developing countries).

g) Sustainability

SHARE aims at sustainable, reusable guidelines and recommendations for the museum sector in Africa, also reusable by other interested partners after the project ends.

As a regional network of expertise on conservation and inventorying of collections ad archives is envisaged through SHARE, the projects aims for long lasting South-South-North interaction between the partners.

h) Key stakeholders

Southern Stakeholder	**Interest & influence**	**Stakeholder engagement strategy**
African musea and research institutes (INMR, RALSA, RALC, IMNC, MNL, CEDESURK, UNIKN, MNC) and their visitors	Very high interest for collection management, collection sharing, restoration and inventorying of collections; influence on visitors through life-long learning is envisaged	Involved as direct partners
African scientists	High interest	Receiving training in field research or a scholarship in the "Scientist in residence" program to study collections in RMCA
Cultural authorities of the DRC, Rwanda and Senegal	Interest should be high; influence needed in order to absorb the recommendations and guidelines in management plans.	Can profit from the support to musea; Can facilitate networking activities and South-South networking specifically.

C. FORMARCH

Formation en archivistique

Expected outcome 2.C: *Archives are better managed and conserved in Burundi, DRC and Rwanda through an archival training for professional archivists.*

Countries where the activities take place: Benin with participants from Rwanda, Burundi, DRC

Summary

FormArch offre un perfectionnement professionnel à l'attention de bibliothécaires, documentalistes, archivistes ayant sous leur responsabilité des archives (anciennes ou contemporaines), au sein d'une institution publique (universités, centres d'archives, cours des comptes, etc.). Le premier volet de 6 semaines offre un rattrapage intensif théorique et méthodologique avec travaux pratiques à l'Ecole du Patrimoine africain (EPA, Bénin). Le MRAC et les Archives générales du Royaume accueilleront ensuite les 4 meilleurs d'entre eux qui effectueront un inventaire complet (avec guide / outil d'orientation) d'un fonds proche de ceux dont ils ont la charge, sous la direction d'un conservateur. Enfin, à leur retour au pays, on attend des participants qu'ils développent leur projet de transfert de connaissances en direction de leurs pairs et de leur hiérarchie (séminaires de rétrocession / publication de guide / recommandation interne) et, si possible, du grand public (outil d'orientation, humanités numériques).

Keywords: Archives, bonne gouvernance, traitement / accès à l'information, numérisation, séminaire intensif, 'train the trainer', développement de compétence, égalité des genres dans la fonction publique, formation des formateurs

Duration: 6 semaines à l'Ecole du Patrimoine Africain (EPA, Bénin), puis 12 semaines au MRAC (Tervuren) par session.

DAC sector code & policy markers: 11130 ; 11420; GG; D02

Partnerships:

- Ecole du Patrimoine Africain (EPA), Porto-Novo, **Benin**
  Pôle musées et patrimoine

RMCA promoters: Mathilde LEDUC-GRIMALDI, Patricia VAN SCHUYLENBERGH (Dept. Cultural Anthropology & History, Service HistPol)

Involvement of other Belgian institutes: Archives générales du Royaume (AGR-Histoire contemporaine)

a) General context

Development problem that FormArch wants to tackle and its sectoral context

Problèmes de développement concernés :

- Amélioration de la bonne gouvernance, en conservant les données nécessaires à l'exercice d'une paix civile et à la responsabilisation des pouvoirs en exercice. En effet, les archives, parce qu'elles sont la mémoire des gouvernements et des sociétés civiles participent aux efforts de bonne gouvernance, en particulier pour ce qui est des processus « paix et réconciliation », des données et du respect des libertés civiles, de la responsabilité des pouvoirs publics lors des réformes qui contribuent au maintien de la démocratie;
- Accès à l'information / mise à disposition des informations pour les membres de la société civile, échange des informations, pour soutenir les droits qu'ils ont à faire valoir (faire valoir ses droits à la retraite / constitution de dossiers de carrière ; faire valoir ses droits cadastraux, etc.) ;
- Renforcement des capacités administratives pour assurer une meilleure gestion et une bonne transparence ;
- Réactualisation des connaissances et diffusion des bonnes pratiques vers les collègues documentalistes / archivistes et bibliothécaires des pays d'origine ;

- Affirmation de l'égalité des chances pour les femmes et leur représentation dans tous les secteurs d'activités, ce que doit faciliter l'exigence de la parité hommes / femmes parmi les participants à la formation ;
- En renforçant les capacités des archivistes, et à travers eux, en maximisant l'impact des archives, cette formation met la société civile à même d'obtenir les informations nécessaires à l'exercice quotidien d'un état de droit et à rendre les décisions des instances politiques plus conformes à ce qui est attendu d'un état de droit. La transparence est renforcée localement, il devient moins aisé pour les administrations de ne pas se plier à la gestion correcte des dossiers.

Capacity constraints and needs of the partner institutions

Valeur ajoutée pour le partenaire local:

- Développement de capacité managériale et de 'project management' en formation continue et en éducation professionnelle de 2e cycle ciblé (niveau licence / master), grâce à la tenue de formations de courte durée intensive (que l'EPA n'a pas été en mesure de développer jusqu'alors sans l'appui du MRAC) ;
- Renforcement des capacités, connaissances, compétences et network de l'acteur local, soutenu par les apports du MRAC ;
- Renforcement de la présence féminine de haut niveau, grâce aux coordinatrices scientifiques et à des enseignantes adjointes internationales ;
- Renforcement d'un pôle panafricain du sud vers qui les participants peuvent également se tourner pour envisager des solutions à des problèmes spécifiques similaires en local sud-sud (et pas seulement nord-sud).

b) *Background*

Partnership/ownership

FormArch s'est tenu pour la première fois en 2012, suite à la conférence « Afrique Europe Archives » organisée au MRAC en 2010. Le MRAC avait alors reçu de nombreuses demandes de formation en archivistique et de demandes de stages pratiques émanant des institutions publiques africaines, principalement d'Afrique centrale. Ces demandes faisaient remonter les besoins clés suivants :

- Revaloriser les connaissances professionnelles actuelles sur la manière de tenir / prendre / soin / gérer des archives ;
- Développer les capacités, compétences, connaissances des institutions à travers le développement de leurs agents en charge des archives, et pas forcément formés aux archives ;
- Développer auprès de leur public les capacités de recherches, compréhension et impact des archives, en particulier en terme de droits à faire valoir, de transparence, ou de bonne gouvernance ;
- Besoin d'augmenter l'efficacité à mettre en œuvre des outils associés à la gestion d'archives, leur connaissance, leur accessibilité et leur conservation (plan de classement, plan de versement, plan de conservation préventive et de stockage, répertoire, inventaires, etc.
- Participer à la valorisation locale du statut d'archiviste dans le pays d'origine ;
- Garantir, grâce à leur inscription dans une institution ou un réseau local, la transmission des connaissances et pratiques nouvellement acquises auprès de leurs collègues ;
- Faciliter l'accès aux ressources et aux méthodes actuellement en usage en Europe à de jeunes archivistes des régions précitées, via le MRAC et les AGR ;

- Créer un « remote support group » en faisant bénéficier les participants de l'expérience du Musée et en contribuant aux échanges entre participants et avec le Musée sur le long terme ;
- Encourager la diffusion d'archives et sensibiliser à l'importance des archives la société civile via des outils en ligne

C'est donc à une demande venue de la base et en local que FormArch a répondu par une programmation biennale, initialement développée sur 6 + 12 semaines. Dès le début du programme pluriannuel précédent en 2012, il a été décidé de confier la partie de la formation théorique à une institution réputée au sein pays tiers, ceci afin de faire bénéficier les participants d'Afrique centrale des compétences développées en locale pour la bonne gestion des archives, par les pays d'Afrique de l'ouest. Après étude par le MRAC, l'Ecole du Patrimoine Africain a été sélectionnée, car elle pouvait offrir :

- la meilleure flexibilité pour prendre en charge des périodes courtes,
- des réseaux d'enseignants de niveau international,
- des compétences spécifiques sud-sud,
- un espace de travail accessible et répondant aux attentes du MRAC

Previous experiences between the partners

Le projet actuel est la continuité de FormArch, tel que réadapté en fonction des attentes budgétaires communiquées au sein du MRAC et des nouvelles attentes que la base (participants récents, candidats, leurs hiérarchies locales) a fait remonter depuis l'Afrique centrale vers les coordinatrices. Les valeurs ajoutées de ce cycle 2019-2023 sont les suivants :

- Renforcement de la présence et participation féminine
- Augmentation du nombre de participants formés, et à travers eux, du nombre d'équipes actives dans les archives (effet boule de neige via un 'train the trainer')
- Prise en compte / augmentation des compétences digitales pour maximiser l'accès à et la localisation de l'information, la transparence, les humanités numériques, via des études de cas, les enjeux de la conservation préventive, des coups de pouce pour une activité numérique partagée par les participants.

c) *Theory of Change*

Pour créer et soutenir les effets du changement au sein d'une institution, l'approche de FormArch est construite sur 3 éléments :
- 1) l'effet de répétition régulière des activités sur le long terme ;
- 2) l'effet boule de neige « train the trainer » ;
- 3) la maximisation des institutions d'où proviennent les participants.

1) L'effet de répétition permet d'augmenter et d'assurer, via la formation, que les participants bénéficient d'un rattrapage des connaissances les plus récentes (et telles que défendues par le Conseil international des Archives), mais aussi d'un accès aux mêmes approches professionnelles, aux mêmes compétences, aux mêmes capacités que celles développées dans les centres de formations de prestige (EPA, école des Chartes, universités européennes ou américaines, etc.) En assurant une continuité par capillarité d'une année à l'autre, les participants et leurs collègues restés sur place sont assurés de porter attention aux spécificités et contenus théoriques ramenés par les participants, et de les mettre en application au jour le jour.

2) Les participants ont une obligation de rétrocession des acquis à leurs collègues au sein de leur institution d'origine ainsi qu'auprès de leurs pairs (branche de leur association professionnelle locale) via des séminaires. Certains sont également enseignants, et donc peuvent également rétrocéder leurs connaissances auprès des jeunes étudiants en 1er cycle universitaire, et via toute autre initiative qui peut être développée à distance.

3) La maximisation des institutions de provenance représentée à travers la sélection des participants suscite des débats formateurs sur les différentes solutions adoptées d'un centre d'archives à l'autre et favorise des moments de partage créatif, face à des enjeux souvent similaires.
Enfin, le fait que les activités du programme pluriannuel précédent aient, dès le début en 2012, imposé une parité des genres a provoqué dans les institutions sur place (en particulier les universités à travers les bibliothécaires qui ont participé aux activités précédentes) un courant reconnaissant l'intérêt de l'apport féminin par le corps professoral et une revalorisation du statut d'archiviste et des archives. Cela incite les jeunes étudiantes à ne pas limiter leur ambition et à participer pleinement à la force de travail. L'aura, le prestige et le soutien que le MRAC représente a permis aux anciennes participantes de monter en grade et en salaire.

d) Expected results

R1: Renforcement des capacités de recherches à travers la formation de collègues en charge de collections patrimoniales et publiques (les archives)

R2: Renforcement des capacités de recherche à travers l'émergence d'outils nécessaires à la recherche et à l'accès à l'information (inventaire, plan de sauvetage, etc.)

R3: partage et soutien de la prise de conscience tournée vers le grand public (formation à la diffusion en ligne des inventaires ou outils d'accès à l'information en ligne, formation en humanités numériques et histoire publique) pour favoriser une approche des archives éthique, responsable et utile au plus grand nombre.

R3: bénéfice d'information touchant une large communauté : chercheurs, enseignants, mais aussi acteurs d'ONG, membre individuel de la société civile cherchant à faire valoir leurs droits

R5: Développement de synergies et de complémentarités entre MRAC et les partenaires locaux

e) Other transversal objective

En imposant une parité de genre, l'ensemble des candidats prend conscience de la représentativité et de l'apport des femmes et de la nécessité de continuer l'effort de promotion féminine pour un développement durable et humain.

f) Methodology

La formation s'effectue en « blended learning », avec une partie via un cycle (12 semaines) de formation intensive à l'EPA in-situ avec des enseignants à disposition sur place, des moments de lectures au rythme de chacun, des travaux dirigés (TD) de mise en pratique, des moments de réalisation d'inventaire et de recherche prosopographique et des archives du MRAC, et le soutien, le cas échéant d'un enseignement en ligne (en différé via vidéos, ou bien via webinars à des moments donnés). Ce mixte de type d'approche permet à la fois le suivi des participants, tout en donnant à chacun une chance de trouver son rythme d'apprentissage.
La diffusion des résultats de chaque participant est encouragée sous format classique (réalisation d'inventaires, d'outils de conservations, de plans de sauvegarde et de classement ; contribution à des colloques/conférences, publications d'articles), mais les participants sont également poussés à expérimenter de nouvelles manières de diffuser leurs activités et les archives vers des groupes niches ou cibles (chercheurs universitaires) et grand public (y compris via le digital).

g) Developmental relevance of FormArch

Si l'on reprend les objectifs de la coopération au développement (suite au rapport UN 18/07/2017), la formation FormArch assure :

- le développement des connaissances des collègues archivistes, bibliothécaires, documentalistes de Rw, Bu et RDC acceptés dans FormArch, destiné à garantir la conservation, la diffusion des informations, la transparence et la bonne gestion des archives et de l'information selon les normes internationales en vigueur, afin de permettre l'analyse des problèmes socio-politiques actuels, ou pour faire valoir les droits de chacun
- via cette formation, de renforcer les liens du MRAC avec ses collègues et alter égo locaux (autres centres d'archives, universités, ministères, etc.)
- de renforcer les capacités des centres d'archives locaux, qui doivent en même temps faire face à une augmentation de la masse d'information à traiter, une augmentation des demandes de la part des administrés / chercheurs / société civile, sans nécessairement avoir accès avec facilité aux informations ou outils de recyclage des connaissances disponibles pour les archivistes des pays du nord
- en imposant une parité de genre, la formation pousse la présence féminine dans une administration encore essentiellement masculine au niveau cadre et niveau B et valorise leurs travaux, leur présence et leur impact. Les résultats obtenus lors de la session précédente du programme pluriannuel ont permis de voir que grâce à la participation à ces activités, les femmes, bloquées dans leur carrière, se sont enfin vu offrir des compensations ou des postes de niveau similaire à ceux de leurs collègues masculins.

h) Long term impact of FormArch

- Mise à disposition d'archives peu / pas inventoriées au MRAC et dans les institutions d'origine ;
- Création de nouveaux outils (en salle ou numériques) pour sensibiliser chercheurs et grand public à l'importance des archives et le besoin de les gérer, conserver et communiquer sur le long terme ;
- Réactualisation des connaissances et diffusion des bonnes pratiques au sein des collègues documentalistes / archivistes et bibliothécaires des pays d'origine;
- Amélioration de la bonne gouvernance, en conservant les données nécessaires à l'exercice d'une paix civile et à la responsabilisation des pouvoirs en exercice. En effet, les archives, parce qu'elles sont la mémoire des gouvernements et des sociétés civiles doivent participer aux efforts de bonne gouvernance, en particulier pour ce qui est des processus « paix et réconciliation », des données et du respect des libertés civiles, de la responsabilité des pouvoirs publics lors des réformes qui contribuent au maintien de la démocratie;
- Affirmation de l'égalité des chances pour les femmes et leur représentation dans tous les secteurs d'activités qui devraient être facilitées en assurant une parité Hommes / femmes parmi les participants à la formation.

i) Sustainability of FormArch

Challenges for sustainability after DGD funding

- Risque de fuite des cerveaux ayant validé cette formation, hors des centres d'archives ou des institutions d'état dont FormArch vise les membres ;
- Risque de rétention d'informations et de capacités acquises si les participants, contrairement à leur engagement sur l'honneur, refusent de rétrocéder les connaissances et données nouvellement acquises (ou font le choix de ne les rétrocéder que partiellement, ou mal ;
- Risque de retour au « business as usual », avec des participants ne faisant pas l'effort de mettre en application ce qu'ils ont appris en terme de bonne gestion des archives, de publicisation, ou de conservation préventives au sein de leurs institutions / centre d'archives.

Strategy to tackle those challenges

Prévoir à terme, tous les 10 ou 15 ans, un « séminaire de recyclage » regroupant tous les participants des activités FormArch, et proposant un suivi ponctuel pour ceux ayant fait l'effort

continu de rester dans les centres d'archives publiques, échangeant pro activement les informations et diffusant régulièrement leurs travaux.

j) Key stakeholders

Southern Stakeholder	**Interest & influence**	**Stakeholder engagement strategy**
EPA	Continuer de s'affirmer comme un acteur phare de la formation en histoire, patrimoine, art etc. au niveau panafricain. S'ancrer plus spécifiquement dans la région des Grands Lacs et en Afrique centrale. Bénéficier du réseau et des apports du MRAC	Association au niveau du choix des enseignants, sujets des cours, valorisation des TD, et partage des informations recouvrées en local
Participants archivistes/ bibliothécaires/ documentalistes (Rw, Bu, RDC)	Recyclage des connaissances, besoin de se former aux techniques, disciplines, approches, théorie, pratique de l'archivistique pour augmenter les capacités, connaissances, et capacités locales ; volonté d'obtenir une bourse de prestige auprès de centres reconnus internationalement (MRAC/EPA)	Participation proactive lors des différents stades des activités de formation ; renversement des rôles et passage de 'trainee' à 'trainer' lors des moments de rétrocessions, laissés à la seule initiative des participants pour en maximiser l'autonomie, l'adaptabilité et le résultat ; augmentation de l'efficacité en terme de traitement des archives et mise à disposition du public

Northern Stakeholder	**Interest & influence**	**Stakeholder engagement strategy**
MRAC	Bénéficier et continuer de faire grandir en local un réseau de collègues formés aux mêmes techniques, compétences, capacités ; augmenter le partage des informations et le retour local sur les archives conservées au MRAC, et vice-versa	Soutien financier, organisationnel, de réseaux, et d'enseignement ponctuel à distance, en fonction des demandes et lacunes observées par l'EPA ou par les participants
Archives générales du Royaume (AGR)		

D. IMMARCH

Immersion en Archives et formation des Doctorants à la recherche en histoire

Expected outcome 2.D: *Research skills in history for PhD students in human sciences in Burundi, DRC and Rwanda are strengthened through training on research methodology and analysis in history.*

Countries where the activities take place: Benin (with participants from Rwanda, Burundi, DRC)

Summary

ImmArch a pour but de former aux méthodes de recherches et d'analyse en histoire des doctorants en provenance des sciences humaines, tout en incluant aussi les sciences politiques et le droit. Le MRAC accueille les meilleurs d'entre eux pour leur permettre de consulter les archives et d'ainsi avancer dans leur recherche doctorale. Un premier volet (2 semaines) intitulé « Séminaire intensif pour pré-doctorants et doctorants du Burundi, de la République Démocratique du Congo et du Rwanda - formation en consultation d'archives et méthodologie de l'histoire » se tient à l'EPA à Porto Novo, Bénin. Il s'agit d'offrir une formation théorique et un soutien méthodologique à de jeunes doctorants de tous les départements des sciences humaines, sciences politiques et du droit (16 participants). A la fin de ce séminaire intensif et après évaluation des compétences, quatre doctorants sont présélectionnés pour bénéficier d'une résidence de 12 semaines au MRAC où ils effectueront leurs recherches.

Key words: Séminaire intensif doctoral, méthodologie et archives historiques, 'train the trainer', histoire, sciences humaines, développement de compétence, égalité des genres en université, formation des formateurs

Duration: 2 semaines à l'Ecole du Patrimoine Africain (EPA, Bénin), puis 12 semaines au MRAC (Tervuren) par session.

DAC sector code & policy markers: 11130 ; 11420; GG; D02

Partnerships:

- Ecole du Patrimoine Africain (EPA), Porto-Novo, **Benin**
  Pôle musées et patrimoine

RMCA promoters: Mathilde LEDUC-GRIMALDI, Patricia VAN SCHUYLENBERGH (Dept. Cultural Anthropology & History, Service HistPol)

a) General context

Development problem that ImmArch wants to tackle and its sectoral context

Problèmes de développement concernés :

1. Echange des informations historiques et archivistiques, pour soutenir la transparence, la bonne gouvernance et sur le long terme, la responsabilisation historique des agences et institutions ayant mené aux situations spécifiques actuelles au niveau local (gestions minières, gestions sanitaires, etc. pouvant trouver leurs sources à l'époque coloniale) ;
2. Renforcement des capacités universitaires : l'âge moyen de la majeure partie du corps enseignant universitaire en Histoire et disciplines associées dépasse 60 ans. Cet ensemble d'activités permet d'accélérer la formation des bases théoriques des jeunes assistants qui doivent rétrocéder ces acquis aux étudiants de 1er et 2e cycles universitaire. Cela permet également de réduire le temps en thèse des participants, et donc d'accélérer la formation et l'accès à un poste en chaire professorale ;
3. Affirmation de l'égalité des chances pour les femmes et leur représentation dans tous les secteurs d'activités que doit faciliter l'exigence de la parité hommes / femmes parmi les participants à la formation.

Capacity constraints and needs of the partner institutions

Valeur ajoutée pour le partenaire local:

- Développement de capacité managériale et de project management en éducation de 3e cycle ciblé, grâce à la tenue de formation de courte durée (que l'EPA n'a pas été en mesure de développer jusqu'alors sans l'appui du MRAC) ;
- Renforcement des capacités, connaissances, compétences et network de l'acteur local, soutenu par les apports du MRAC ;
- Renforcement de la présence féminine de haut niveau, au sein des coordinatrices scientifiques et grâce au recours à des enseignantes adjointes internationales ;
- Renforcement d'un pôle panafricain du sud vers qui les participants peuvent également se tourner pour envisager des solutions à des problèmes spécifiques similaires en local sud-sud (et pas seulement nord-sud).

b) *Background*

Partnership/ownership

ImmArch s'est tenu pour la 1ere fois en 2006, suite à une demande répétée des enseignants en histoire des universités de UNIKIN, UNIKIS, UNILU faisant remonter 3 besoins clés :

- besoin pour les doctorants locaux d'avoir accès à des archives conservées au MRAC
- besoin d'accélérer la mise à niveau des doctorants pour une soutenance de thèse rapide (compte tenu des besoins dans le corps enseignant).
- besoin de formations des doctorants de sciences humaines en histoire,

C'est donc à une demande venue de la base et en local qu'ImmArch a répondu par un ensemble d'activités sur une période biennale, initialement développé sur 4 semaines, avec un suivi de 3 mois au MRAC pour les participants les plus avancés. A partir de 2012, il a été décidé de confier la partie de la formation théorique à un pays tiers, ceci afin de faire bénéficier les participants d'Afrique centrale des compétences développées en histoire et patrimoine par les pays d'Afrique de l'ouest. Après étude par le MRAC, l'Ecole du Patrimoine Africain a été sélectionnée, qui pouvait offrir :

- la meilleure flexibilité pour prendre en charge des activités sur des périodes courtes,
- des réseaux d'enseignants de niveau international,
- des compétences spécifiques sud-sud,
- un espace de travail accessible aux étudiants d'Afrique centrale et répondant aux attentes du MRAC

Previous experiences between the partners

Le projet actuel est la continuité d'ImmArch, tel que réadapté en fonction des attentes budgétaires communiqués au sein du MRAC et des nouvelles attentes que la base (participants récents, candidats, enseignants locaux) ont fait remonter depuis l'Afrique centrale vers les coordinatrices.

Les valeurs ajoutées de ce cycle 2019-2023 sont les suivants :

- renforcement de la présence et participation féminine ;
- augmentation du nombre de participants formés, et à travers eux, du nombre d'étudiants universitaires (effet boule de neige via un 'train the trainer') ;
- prise en compte / augmentation des compétences digitales pour maximiser l'effet d' « histoire publique » et « humanités numériques», via des études de cas, les enjeux de diffusion des recherches, des coups de pouce pour une activité partagée digitale des participants.

c) *Theory of Change*

En terme de théorie du changement, l'approche du projet est construite sur 2 éléments :

- l'effet de répétition régulière des activités sur le long terme
- l'effet boule de neige « train the trainer »

d) *Expected results*

Result 1: renforcement des capacités de recherches à travers la formation de participants en cours de doctorat / prédoctorat

Result 2: renforcement de la diffusion des résultats de recherche (physique et digitale), bénéficiant à une large communauté de chercheurs, à travers la formation d'enseignants, le soutien à la diffusion de résultats (publication d'article de recherche / avancement de la thèse / participation à un colloque d'étude, partage des connaissances en ligne, etc.)

Result 3: partage et soutien de la prise de conscience tourné vers le grand public (formation à la diffusion des résultats en ligne, formation en humanités numériques et histoire publique) pour favoriser une approche des travaux scientifiques éthique et responsable à destination du grand public

Result 5: développement de synergies et de complémentarités entre la coordination du MRAC et les partenaires locaux

Transversal objective : en imposant une parité de genre, l'ensemble des candidats prend conscience de la représentativité et de l'apport des femmes et de la nécessité de continuer l'effort de promotion féminine pour un développement durable et humain.

e) *Methodology*

La formation s'effectue en « blended learning », avec une partie via un cycle court de formation intensive à l'EPA in-situ avec des enseignants à disposition sur place, des moments de lectures au rythme de chacun, un moment de recherche intensif et plus long au sein des archives du MRAC, et le soutien, le cas échéant d'un enseignements en ligne (en différé via vidéos, ou bien via webinars à des moments donnés). Ce mixte de type d'approche permet à la fois le suivi des participants, tout en donnant à chacun une chance de trouver son rythme d'apprentissage.
La diffusion des résultats de chaque participant est encouragé sous format classique (rédaction du mémoire / thèse ; contribution à des colloques/conférences, publications d'articles), mais les participants sont également poussés à expérimenter de nouvelles manières de diffuser leurs recherches vers des groupes niches ou cibles et grand public (y compris via le digital).

f) *Developmental relevance of ImmArch*

Si l'on reprend les objectifs de la coopération au développement, tels que décrits sur le site diplomatie.belgium.be (suite au rapport UN 18/07/2017), la formation ImmArch permet :

- en renforçant les capacités des doctorants de Rw, Bu et RDC acceptés dans ImmArch, de développer leur connaissance des archives du MRAC et les méthodologies de l'histoire nécessaires à l'analyse des problèmes socio-politiques actuels
- de renforcer les liens du MRAC avec les universités locales, via une formation offerte à leur futurs enseignants
- de renforcer les capacités des universités locales, qui doivent en même temps faire face à une augmentation substantielle du nombre d'étudiants inscrits et à des enseignants de 3e cycle et des professeurs en chaire dont la majorité ont dépassé l'âge de la pension. En raccourcissant le temps imparti à la thèse, l'ensemble des activités permet aux participants d'entrer plus vite dans l'activité professorale, de reprendre les cours des anciens, ou de

créer de nouvelles classes pour les étudiants. En imposant une parité de genre, la formation pousse la présence féminine dans un corps professoral essentiellement masculin et valorise leurs travaux. Les résultats obtenus lors de la session précédente du programme pluriannuel ont permis de voir que grâce à la participation à ces activités, les femmes, bloquées dans leur carrière, se sont enfin vu offrir des compensations ou des postes de niveau similaire à ceux de leurs collègues masculins.

g) Long term impact of ImmArch

- Renforcement des connaissances sur des archives laissées en friche ou non encore exploitées, en particulier par des chercheurs externes belges ou européens ;
- Accélération de l'autonomisation des jeunes chercheurs et des femmes chercheuses, en leur permettant de limiter le temps nécessaire à la préparation / écriture / soutien de la thèse, et donc en accélérant le moment de la soutenance ;
- Réactualisation des connaissances et diffusion des bonnes pratiques de recherches en sciences humaines auprès des participants et, via leurs intermédiaires, auprès d'autres groupes présents dans les pays d'origine;
- Re-contextualisation et approche « fact-based » et historiques des problématiques de recherches à incidences actuelles
- Affirmation de l'égalité des chances pour les femmes et leur représentation dans tous les secteurs d'activités, en assurant une parité hommes / femmes parmi les participants à la formation.

h) Sustainability of ImmArch

Challenges for sustainability after DGD funding

- risque de fuite des cerveaux formés à l'extérieur des universités d'état dont ImmArch vise les participants ;
- risque de rétention d'informations et de capacités acquises si les participants, contrairement à leur engagement sur l'honneur, refusent de rétrocéder les connaissances et données nouvellement acquises (ou font le choix de ne les rétrocéder que partiellement ou mal) ;
- risque de retour au « business as usual », avec des participants ne faisant pas l'effort de publier leurs résultats ou de réaliser un projet en histoire publique par ex.

Strategy to tackle those challenges

Prévoir à terme, tous les 10 ou 15 ans, un « séminaire de recyclage » regroupant tous les participants des activités ImmArch, et permettant un suivi ponctuel pour ceux ayant fait l'effort continu de rester dans les universités publiques et diffusant régulièrement leurs travaux.

i) Key stakeholders

Southern Stakeholder	**Interest & influence**	**Stakeholder engagement strategy**
EPA	Continuer de s'affirmer comme un acteur phare de la formation en histoire, patrimoine, art etc. au niveau panafricain. Bénéficier du réseau et des apports du MRAC	Association au niveau du choix des enseignants, sujets des cours, et partage des informations recouvrées en local
Participants universitaires (Rw, Bu,	Besoin de se former aux techniques, disciplines, approches et théorie de l'histoire pour augmenter les capacités,	Participation proactive lors des différents stades des activités de formation ; renversement des rôles et

RDC)	connaissances, et approches multidisciplinaires ; volonté d'obtenir une bourse de prestige auprès de centres reconnus internationalement (MRAC/EPA)	passage de 'trainee' à 'trainers' lors des moments de rétrocessions, laissé à la seule initiative des participants pour en maximiser l'autonomie, l'adaptabilité et le résultat

Northern Stakeholder	**Interest & influence**	**Stakeholder engagement strategy**
MRAC	Bénéficier et continuer de faire grandir un réseau en local de (futurs) collègues formés aux techniques et approches de l'histoire ; augmenter le partage des informations et le retour local sur les archives conservées au MRAC	Soutien financier, organisationnel, de réseaux, et d'enseignement ponctuel à distance, en fonction des demandes et lacunes observée par l'EPA

2. Synergies and complementarities

There are several synergies and complementarities between **RWANDA ARCHIVES, SHARE, FormArch and ImmArch**. Several activities under SO2 are intertwined since a network of strengthening for the same partners is envisaged.

With other Belgian stakeholders, the following collaborations are important:

- Collaboration with State Archives: increasing the accessibility and digitizing the Rwandese archives
- Collaboration with the Royal Museums for Art & History (RMAH, MIM): increasing the accessibility and discoverability of musical instruments collections.

SO3. The incidence of natural hazards and the associated risks have been significantly reduced

Photo 3. *Observation de zones soumises à de l'érosion intense et aux glissements de terrain dans la ville de Bujumbura (Burundi) et analyse de la situation par les collègues du service Risques Naturels du MRAC, de la Vrije Universiteit Brussel, de l'Université de Liège et de l'Université du Burundi* – © RMCA

1. Contribution to strategic objective 3

A. HARISSA

Natural hazards, risks and society in Africa: developing knowledge and capacities

Expected outcome 3A: *The incidence of natural hazards and the associated risks have been significantly reduced in Central Africa and in particular in the West Branch of the East African Rift, in DRC, Uganda, Rwanda and Burundi as a result of academic training, mapping and hazard data collection, improving awareness and risk preparedness.*

Countries where the activities take place: DRC, Uganda, Burundi

Summary

Experience in recent years has taught us that natural hazards in Central Africa, although still poorly studied, have a significant negative impact on development. HARISSA's long-term overall objective is to contribute to reducing the incidence of natural hazards and associated risks in Central Africa and in particular in the West Branch of the East African Rift, in DRC, Uganda, Rwanda and Burundi. HARISSA aims to develop knowledge, expertise, awareness and support for local, national and regional initiatives by following four specific objectives: 1/ academic training, 2/ mapping and hazard data collection, 3/ improving awareness and risk preparedness, and 4/ consolidating previous achievements. The achievement of these objectives is based on the strengthening of key institutions in these domains with a strong link to citizen-based science. The project aims to target the wide range of stakeholders involved and/or concerned by natural risks and disasters, from academic or research groups to citizens and policy makers. The project will also look at the impact of citizen-science on development.

Key words: Natural hazards and disasters, PhD and master programmes, digital- and citizen-based knowledge, awareness raising, partner and stakeholder interactions/collaborations, data sharing, development impact self-assessment

DAC sector code & policy markers: 470; Rio marker 1

Partnerships:

- Centre de Recherche en Sciences Naturelles (CRSN), Lwiro/Bukavu, **DRC**
  Département de Biologie, Unité de Recherche sur les Mammifères, Laboratoire de Mammalogie
- Mbarara University of Science and Technology (MUST), Mbarara, **Uganda**
  Department of Environment and Livelihood Support Systems
- Institut Géographique du Congo (IGC), Kinshasa, **DRC**
- Goma Volcano Observatory (GVO), **DRC**
- Protection Civile – Sud Kivu (PC-SK), **DRC**
- Université Officielle de Bukavu (UOB), **DRC**
  Facultés des Sciences et Sciences Appliquées, Département de Géologie
- Protection Civile – Nord Kivu (PC-NK), Goma, **DRC**
- Université de Goma (UNIGOM), **DRC**
- Université du Burundi (UB), **Burundi**
  Faculté des Lettres et Sciences Humaines, Département de géographie
- Institut Géographique du Congo (IGC) – Nord Kivu, Goma, **DRC**

RMCA promoters: François KERVYN (Earth Sciences), Olivier DEWITTE (Earth Sciences), Tine HUYSE (Biology)

Involvement of other Belgian Institutes: KU Leuven, VUB, ULiège, UMons, UGent, ULB

a) *General context*

Development problem that HARISSA wants to tackle and its sectoral context

Central Africa is the scene of a wide range of **natural disasters**. Floods, earthquakes, volcanic eruptions, toxic gas emissions, landslides, soil erosion are all **hazards** (the phenomenon that causes danger) that can have dramatic consequences. Depending on the **vulnerability** (propensity for damage) and **resilience** (ability to cope) of populations, these situations can lead to economic damage, loss of life, population displacement or even epidemics. They can also exacerbate inter-community and intra-community tensions (e.g. land conflicts) and lead to security crises.

However, the extent of the phenomena is often poorly known, partly because of the lack of expertise available to understand them, and partly because of the lack of reliable and up-to-date data. The assessment of natural hazards is of paramount importance for their consideration in development strategies.

In 2015, the UN-organized Sendai Conference adopted a new disaster risk reduction (DRR) framework for action for the period 2015-2030. It pursues the following four priorities:

1. Understanding disaster risks
2. Strengthening disaster risk governance to better manage disaster risks
3. Investing in disaster risk reduction to strengthen resilience
4. Improve preparedness for effective intervention and "do and rebuild better".

Each priority is subdivided into several objectives to be achieved at local, national and regional level. Since 2006, MRAC-GeoRiskA* has been active in the field of risk assessment in Central Africa, in densely populated areas, with a high level of vulnerability and a low response capacity. RMCA-GeoRiskA also focused on characterizing the impact of these hazards on society. Its actions are based on scientific research and knowledge sharing with partner institutions in the DRC, Rwanda, Burundi and Uganda. HARISSA builds on this experience and aims to capitalize on its results by developing and applying methodologies, partnership networks and tools already in place.

** RMCA-GeoRiskA is the name used by the RMCA's Natural Risks Unit and stands for "Georisk Study in Africa"; it comes from the name of the GeoRisCA project which has become a reference name in the Kivu region for all institutions aware of our work.*

Capacity constraints and needs of the partner institutions

HARISSA relies on a partnership that has been operational through several other projects.

In DRC:

GVO: Under the authority of the Ministry of Research, the Goma Volcano Observatory is an institution which acquired autonomy from the CRSN in 2009. It is in charge of the monitoring of the active volcanoes of the Virunga. Settled in Goma, GeoRiskA has promoted the development of ground-based monitoring networks and the setup of methodologies based on the extended use of field and satellite data. Despite intense scientific collaboration since more than 13 years, the GVO stills suffers from a lack of experienced skill to process the collected monitoring data. The institution receives little support from the State and the major recurring needs it meets concern its 1/ ability to maintain the tools developed with its partners in the framework of research projects, 2/ the strengthening of the expertise of scientific staff up to the doctoral level required to fully carry out its mission of advising political decision-makers, 3/ its ability to ensure awareness of volcanic risks among the general public. Following the eruption in 2002, GVO received a strong support from the international community: USAID, UE, UN have provided funding to support operations whereas foreign scientists came to install modern monitoring tools. After a few years, the objective of having a fully operational observatory was still not attained: the operation means were finished and the foreign scientific support progressively decreased with absence of results.

GeoRiskA and its partners have chosen a different approach based on a long-term vision: the GVO staff was associated in every technical development and training was organized when possible (RGL-GEORISK, RESIST). As a result, the monitoring performance has improved but the need of academic training (especially at PhD level) remains in order to capitalize on scientific results and warrant the progressive takeover.

UOB: the Université Officielle de Bukavu has been working with GeoRiskA since 2012 to improve its expertise in the field of natural hazards. This collaboration with UOB began at GeoRiskA's invitation to study natural hazards in Bukavu. Subsequently, UOB understood the need to develop this expertise and pushed several assistants to train in this field. The Department of Earth Sciences lacks professors and currently uses foreign visiting professors.

The initial collaboration between RMCA and UOB was initially supported by the former dean of faculty who saw the opportunity for the geology department to open an eye on the natural hazards problem and its link with the society. Progressively, the commitment of the members of the staff increased and was boosted during the RGL-GEORISK project focused on training: several assistants were performing well and were selected for a master program in Belgium. Today, the geology department has changed its name into "Earth sciences" in order to formalize its interest for disciplines like natural hazards that are not restricted to geology alone.

CRSN: the Centre de Recherche en Sciences Naturelles de Lwiro is a research center located 30 Km north of Bukavu. Formerly IRSAC, this renowned center used to control regional offices in the DRC, Burundi and Rwanda. Today, greatly weakened by a lack of resources, the CRSN, which is the mother-institution of the GVO, remains a reference for its archives but also for the presence of scientists concerned with the study of natural hazards. In collaboration with GeoRiskA since 2013, the partnership boosted two years later with the launch of the RESIST project. The staff of the Department of Geophysics has been since then associated to the regional seismic, geodetic, and rain gauge networks and to their maintenance.

Later, recognizing the value of the CRSN archives, the GeoKivu project (http://geocatalogue.africamuseum.be) was initiated and promoted the scanning and cataloguing of the available geoinformation; some information being key in the study of natural hazards and their impacts. Strengthening the capacities of researchers is a priority that would allow the appropriation of the tools and methods developed within the framework of these scientific projects.

UNIGOM: The Department of Geology at the University of Goma is young and still suffers from a lack of leadership. As in Bukavu, Earth sciences attract several dozen students per academic level, which underlines the regional importance of this discipline. UNIGOM has never collaborated with GeoRiskA but contacts exist, established within the framework of various projects. Here too, visiting professors provide the teaching, supported by young assistants. The priority for this partner is to develop skills in the field of volcanology and volcanic risk assessment.

Although the creation of the Department of Geology at UNIGOM was initially motivated by the mineral potential of the Kivu, the awareness on natural hazards raised by successive projects lead by RMCA motivated a growing interest for that problematic. Moreover, despite the presence of the Nyiragongo volcano at a few kilometers from the city center, there is so far no development of academic research in volcanology. With HARISSA, there is an opportunity to start the development of that discipline at UNIGOM.

IGC: The support to the Geographic Institute of Congo has long since been abandoned by the Congolese State, which has thus deprived itself of a structure in charge of mapping the country, although very large. Located in Kinshasa, the IGC has difficulty in preserving some unique archives that are urgently needed, specifically in the context of understanding the human-induced changes of the environment in relation to DRR strategies. Some regional offices exist, more or

less dynamic and, in 2016, the Goma office started a fruitful collaboration with GeoRiskA focused on mapping this city. The success of this collaboration with RMCA did not go unnoticed and has motivated the IGC in Kinshasa to propose collaboration to strengthen its capacity in various areas. Its priority is to train young people in modern mapping techniques and to protect its archives from being damaged.

RMCA is achieving important mapping activities focused on DRC based on archives and field data. But, in opposition to most actors active in that field, RMCA seeks for a long term approach based on the reinforcement of the institution in charge whose mandate is official. That approach would contribute to limit the flourishing in a frequent haphazard way of a variety of maps that do not follow (national) standards and whose access/visibility is very often restricted if not not available. IGC and RMCA will work together on that by including all relevant actors.

PC-NK & PC-SK: the Civil Protection in Goma (PC-NK) and Bukavu (PC-SK) are both under the authority of the respective provincial government and coordinated by the national office in Kinshasa. These two units are responsible for disaster monitoring and response coordination. Their mandate therefore go beyond natural hazards. However, despite the diversity of their actions, natural disasters occupy a large part of their attention due to the frequent occurrence of floods, landslides, earthquakes and the risk associated with volcanic eruptions. But for natural hazards, the two civil protection units are expecting HARISSA to provide the necessary expertise support that should enable them to improve preparedness and response mechanisms.

In Burundi:

UB: The University of Burundi is the amongst the one having the longest history in that region of the Rift (Burundi; Rwanda, Uganda, North and South Kivu) and has a strong and renowned academic culture. Close to the political authorities present in the capital city, it has felt the growing importance of the issue of natural hazards and their associated risks in the context of the Disaster Risk Reduction global agenda and its needs to develop expertise an teaching in this topic to support various development sectors. The Departments of Geology and Geography started more than 10 years ago to pay attention to the problems related to natural hazards. The city of Bujumbura and its surrounding are indeed highly prone to landslides, erosion and floods. An on top of that comes the problem of seismicity. These problems, which were previously of little concern, have become a priority. The growth of population, the associated urbanization and land degradation, are largely responsible for this. It does not come as a surprise that interests for collaboration between UB and RMCA emerged. First through the GeoRisCA project, the collaboration reinforced via GEORISK and RESIST (a seismic station is hosted in the premises). One key consequence is that this collaboration was an opportunity to bring these two departments at a same table, which made them realized the importance of merging synergies and led to the creation of a common research structure framed around the topic of natural hazards (called "Groupe Géorisques). The ageing departments' staff has among its priorities the training of young researchers at the doctoral level who can ensure the continuity of the departments. This initiative is fully supported by their University's authorities which now holds its own doctoral school (supported by an ARES project).

In Uganda:

MUST: Mbarara University of Science and Technology is a new partner of GEORISKA. MUST interest for natural hazards and environmental changes studies and citizen-science started a few years ago. This provided the basics for the Department of Environment and Livelihood Support Systems to set up a project together with KU Leuven on land degradation issues in that region of Uganda. The KU Leuven partner (Department of Geography) is a close partner of GEORISKA team (through the PAStECA project a. o.). In the meantime, GEORISKA research in Uganda had been running for a few years (through the AfReSlide project and a subsequent VLIR project) and the development of a successful proof of concept on participatory sensing of disasters was

established in the Rwenzori Mountains. This sparked interest among MUST that started to consider initiatives in citizen science and disaster risk reduction as a priority. However, despite their will to progress towards that direction, they lack young skilled researcher as well as observation networks. MUST already collaborates with RMCA Department of Biology.

The HARISSA activities are primarily based on the capacity, needs and interest of the partner institutions and attempt to address each of the issues identified:

- The extent of the problem of natural hazards and associated risks is poorly understood
  - ⇨ Strengthening expertise with doctorates (UOB, UB, GVO, UNIGOM, CRSN, MUST) and the establishment of a master's degree in partnership with universities (UOB, UB).
- Few reliable data, no information collection standard to document and understand the environment and its changes
  - ⇨ Development of a methodology for collecting reliable baseline data for change and risk analysis (CRSN, MUST, Civil Protection).
- Data are rarely available
  - ⇨ Development of a distribution platform (WebGIS) (RMCA)
- Robust monitoring tools and methods exist but are struggling to reach the operational level due to a lack of expertise
  - ⇨ Capacity building for maintaining hazard monitoring networks and interpreting the data collected (GVO, CRSN, UB)
- Collaboration between scientific institutions, authorities and countries concerned is necessary
  - ⇨ Promote these collaborations and synergies through the various actions (UOB, UB, GVO, CRSN, MUST, Civil Protection).
- Lack of accurate and validated maps and reference data
  - ⇨ Strengthening the cartographic capacities of the IGC, enhancement of relevant archives (IGC)
- Little information available on natural hazards within communities
  - ⇨ Dissemination of information and awareness through appropriate communication tools (GVO)
- Need for capacity building, networking of stakeholders, effective communication, coordination of initiatives, data sharing, and active citizen participation (UOB, UB, GVO, CRSN, MUST, Civil Protection)
  - ⇨ HARISSA

b) Background

Partnership / ownership

RMCA-GeoRiskA has been active in the region for more than 12 years, through hazard studies and natural risk assessment, in a changing society characterized by low capacities and reliable data. This has led RMCA-GeoRiskA to establish partnerships with key regional actors in the field of natural hazards and to work with many local actors directly concerned by these issues. Such action has enabled RMCA-GeoRiskA to identify the capacities, needs and interests of local institutions.

The development of the HARISSA project is based on this expertise and on the many exchanges and projects already developed with local institutions. More precisely, the actions developed in HARISSA were identified on the basis of the results of previous projects and following close consultation (during field missions) with potential partners.

HARISSA aims to develop original activities in line with previous actions. The selected Southern partners are institutions with which we have already worked successfully; we have always had trusting relationships and effective collaborations. Mbarara University of Science and Technology (MUST, Uganda) is a new partner. But MUST already collaborates with RMCA Biology Dept. and with colleagues involved in the PAStECA and AfReSlide projects. UNIGOM is also a new partner, but through our activities in the region, we have been in contact with them for several years and opportunities for collaboration have been discussed since then.
In the North, several Belgian universities will be involved in HARISSA, through the supervision of doctoral theses. RMCA Biology Dept. will collaborate with HARISSA through citizen observers and a joint PhD. RMCA-GRM unit will contribute to the supervision of a doctorate and the Master's programme that will be developed in a partner university. Close interactions with the RMCA Human Sciences Dept. are planned (population, vulnerability).

Previous experiences between the partners

Since 2005, RMCA-GeoRiskA has been leading projects with complementary themes in the field of natural hazards and risks (Fig. 2). Consideration should be given to research projects (RP) in which expertise and knowledge are developed, and scientific cooperation projects (SCP) with institutions in the region. However, some hybrid projects have developed these aspects in parallel (HP).

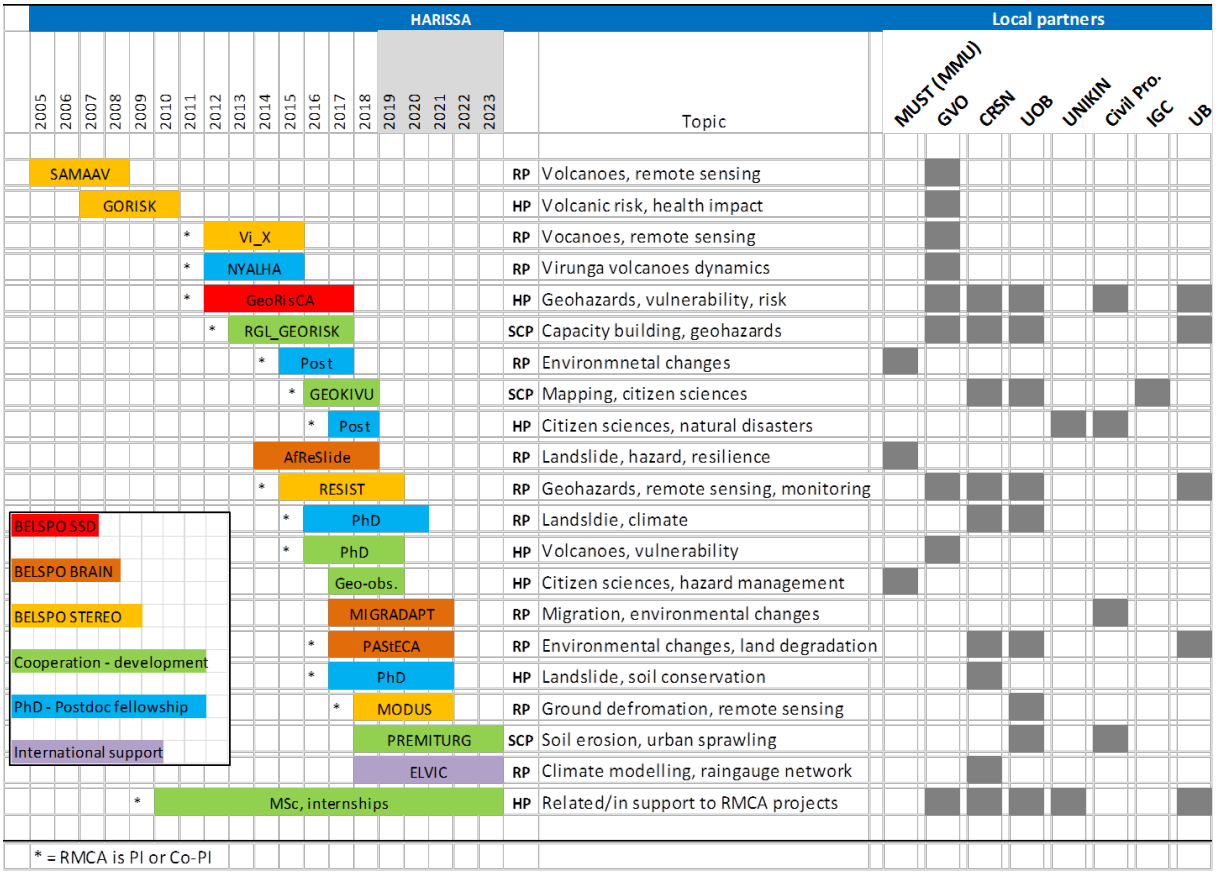

Fig. 2. *Projects related to HARISSA with involvement of the Natural Hazard Service.*

For each project the main funding source is highlighted (colour scale). For the individual PhD and postdoc fellowships, several funding sources: BELSPO, EU Marie-Curie, National Research Fund (FNR) Luxembourg, UCL, DGD, F.R.S-FNRS, BAEF. For the other project, the main funding support is highlighted. For the cooperation projects; besides DGD, ARES and VLIR-UOS are key partners. For the research-based projects, extra support were also found via FNR (Luxembourg), ESA, DLR, and CEOS

All these projects have been developed with complementary themes in order to respond to new questions raised while developing the expertise of local partners. HARISSA is therefore not the

continuation of one of these projects, but it builds on the achievements and will also benefit from simultaneous actions in the region. HARISSA will fill some of the gaps identified and will be a major step towards integrating sustainability into development strategies.

How HARISSA creates added value compared to the previous project:

Partnership with UOB: RGL-GeoRisk (training activities, successful experience; the capacities of the geology department are significantly strengthened); GeoRisCA (involvement of research assistants in field work; capacity building); RESIST (provision of new data to the institution, methodological developments). HARISSA contributes to strengthening the expertise and autonomy of the UOB with the supervision of new doctoral research and the development of a master's programme.

Partnership with GVO (Office Volcanologique de Goma): GeoRisCA (involvement of research assistants in field work; capacity building); RESIST (provision of new data to the institution, capacity building). HARISSA should enable GVO to near scientific autonomy in key areas and facilitates the carrying out of its mandate (monitoring and awareness raising of volcanic risks).

c) *Theory of Change*

Experience in recent years has taught us that natural hazards in Central Africa, although still poorly studied, have a significant negative impact on development. HARISSA's long-term objective is to contribute to **reducing the incidence of natural hazards and associated risks** in Central Africa and in particular in the West Branch of the East African Rift, in DRC, Uganda, Rwanda and Burundi.

The project aims to develop knowledge, expertise, awareness and support for local, national and regional initiatives by following **four specific objectives**: 1/ academic training, 2/ mapping and hazard data collection, 3/ improving awareness and risk preparedness, and 4/ consolidating previous achievements (Fig. 3).

The achievement of these objectives will be based on the strengthening of key institutions in these domains. The project aims to target the wide range of stakeholders involved and/or concerned by natural risks and disasters, from academic or research groups to citizens and policy makers.

The orientation of political decisions requires that the study and understanding of natural phenomena be developed at university level (master's degree programme, doctoral research). These require that the data necessary for these studies and for assessing the extent of the problems be collected by exploiting existing archives (in particular in the RMCA), by appropriating locally the tools developed within the framework of previous scientific projects, and also by involving citizens who become aware actors (observers-citizens). Moreover, in an introspective approach, HARISSA will also look at the impact of this type of innovative approach on development.

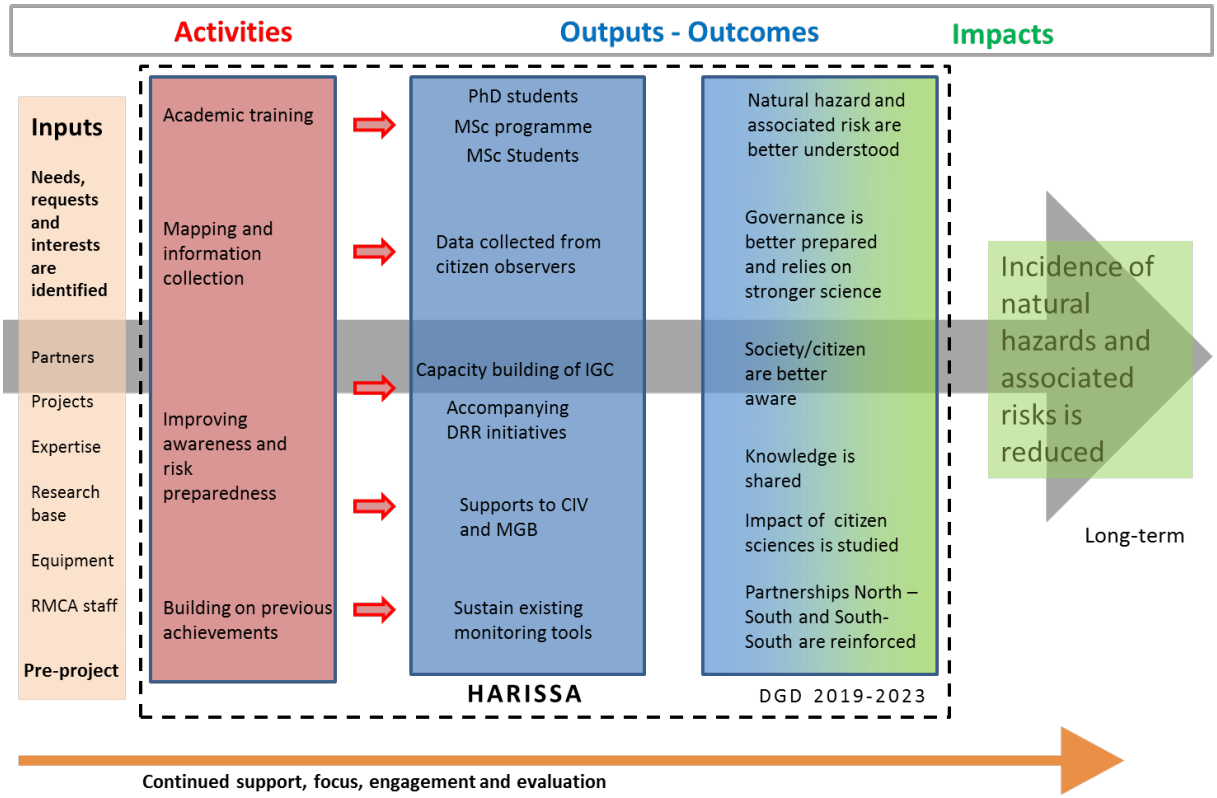

Fig. 3. *HARISSA layout and pathway of change*

d) *Expected results*

R1: Strengthening scientific research capacity (including MSc/PhD training programmes)

- Setup of a regional panel of experts through the training of 6 South PhD in key areas;
- Implementation of an inter-university UOB-UB master's programme focused on the problem of on geohazards and risks. Through this programme, new MSc students are trained;
- Setup of networks of citizen observers for the collection of hazard and disaster data (in collaboration with research institutes, local partners) ;
- Securing, maintenance and appropriation of scientific tools developed within the frame-work of scientific projects by local research institutions (transition from experimental to operational);
- Study visit for PhD students (4 stays each of 4 to 5 months/ academic year in Belgium) ;
- Training organized by RMCA scientists in partner institutions ;
- The scientific capacity of the IGC is significantly increased.
- Impact assessment of citizen-science actions at community and governance level

R2: Strengthening physical and virtual diffusion of scientific research results to the larger scientific community (i.e. publications, conferences, databases, websites, training sessions, study visits, etc.)

- Dissemination of PhD research results through publications and conferences;
- Dissemination of results and recommendations to policy makers;
- Dissemination of scientific information to civil society to improve awareness;
- Involvement of PhD students in teaching activities / integration of research results into courses taught / adoption of new research and teaching methods / development of new research activities on the topics;
- Setting up a project website that may include a WebGIS for data sharing;
- Feeding the geocatalogue developed as part of GeoKivu;
- Dissemination of hazard and disaster data through networks of citizen observers;

- Dissemination of new original maps produced by the IGC and RMCA.
- Impact assessment of citizen-science actions at community and governance level

R3: Awareness raising towards the general public (i.e. education activities, exhibits, etc.)

- Strengthening and spreading awareness through the implementation of an inter-university UOB-UB master's programme focused on geohazards and risks;
- Increased awareness of geohazards at the community level through networks of citizen observers of hazard and disaster data;
- Increased awareness through the establishment of a project website;
- Impact assessment of citizen-science actions at community and governance level

R4: Support to good governance, based on the scientific results (i.e. reports for the local government, manuals for ministries, etc.)

- Capacity building of IGC;
- Setup of networks of citizen-observers;
- Strengthening dialogue with authorities and sharing risk management recommendations;
- Sharing information through a website;
- Pilot actions to raise awareness and prepare for volcanic hazards and landslides disasters;
- Organization of two workshops (years 2 and 4) involving project partners, civil society and local, regional and national stakeholders;
- Thematic maps, essential to decision-making processes, are produced with the IGC and the RMCA and will fill some gaps;
- Impact assessment of citizen-science actions at community and governance level;
- Policy briefs based on the research outputs of the projects

R5: Development of synergies and complementary activities among partners through multi-partner governance and coordination (i.e. co-ordination meetings, follow-up meetings, etc.). Increase interactions and synergies between the various actors and stakeholders involved with this problem

- Implementation of an inter-university master's programme;
- PhD students have their research stays in Belgium at the same time where they develop relationships with each other and with the Belgian academic world;
- PhD research focuses on topics that foster synergies and collaboration with project partners or other projects and/or themes present in the region;
- Organization of two workshops (see details in R4);
- Setup of networks of citizen-observers of hazard and disaster data;
- Data from citizen-observer networks are directly linked to IGC mapping activities.
- Impact assessment of citizen-science actions at community and governance level

e) Other strategic objective

See SO6: *Target groups have acquired the knowledge and skills necessary to promote and contribute to a fair, inclusive, sustainable and equitable world.*

f) Methodology

A. EDUCATION / FORMATION

A.1. Phd training

Objectives: *strengthening of partner scientific institutions with 6 PhD ideally distributed among them UOB, UNIGOM, OVG, CRSN (DR Congo), UB (Burundi), MUST (Uganda).*

Methodology :

- Selection of candidates with partner institutions, ensuring diversity of research topics and complementarity of disciplines (see Table 1 in section "project management").

- The selection of candidates will be carried out in an open and transparent manner. For equivalent quality, priority will be given to candidates from the permanent staff of these institutions who will do their best to keep the researcher in the institution at the end of his/her PhD, and thus benefit from the new expertise;
- The PhD will last 4 years. The selection of candidates will take place during the first semester of 2019. Research is scheduled to begin in October 2019.
- The scholarships will be of *sandwich* type and will provide for stays of 5, 5, 4 and 5 months in Belgium against 4, 7, 8, 10 months respectively in their country. This ensures the preservation of the link with their institutions and the original context, and the fieldwork for the collection of the necessary data. At the end of the PhD, the researcher spends 5 months in Belgium in order to finalize their research, write and defend their manuscript within the prescribed deadlines. Within the current HARISSA budget, a total 19 months of research scholarship in Belgium can be supported for each PhD. Ideally, an extra 6 months would be needed in the last two years. We will seek additional financial support from Belgian Universities partners; a practice that we have already successfully done at several occasions.
- The requirements and constraints will be based on the ARES and VLIR programmes (documentary analysis, additional courses, thesis committee, conference, publications, etc.);
- Supervision is provided by the promoter(s) of the RMCA in collaboration with the academic promoters in the Belgian university, and when possible, a promoter from the partner institution;
- Future doctors will be involved in the implementation and monitoring of the master's programme (see A.2).

A.2. Setting up of a new master's program (UOB-UB)

Objective : *Create an inter-university master's programme dedicated to teaching disciplines related to the study of natural hazards and risks from physical processes to societal issues. This idea has already been discussed and received with enthusiasm by the academic authorities.*

Methodology :

- A preparation period (years 1 to 3) for all necessary arrangements between the UOB, UB and the Ministry of Scientific Research and for the preparation of the programme, the identification of trainers (from the region, the RMCA, and others)
- The master 's programme will be implemented at UOB. Management and monitoring is done by UOB.
- Two-year degree implemented over two academic years (2021-2013). The target groups is of 15 students (5 from UB) supported by the project. In the new term of 2022-2023, a second group of 15 students is enrolled. First year focused on courses and lectures, second year and MSc thesis (with supervisions form both RMCA and UOB-UB members). Three professors from UB and 5 from UOB will be involved.

B. MAPPING AND DOCUMENTING OF HAZARDS AND DISASTERS

In Africa, the scarcity of data leads to significant underestimation of the occurrence of hazards and disasters. For the few data available, their relevance and quality is often questionable. However, information collection is essential for (1) assessing natural hazards and their impacts, (2) anticipating disasters, and (3) implementing awareness and protection measures.

B.1. Data collection and citizen observers

Objective: *setting up two networks of citizen observers (CO) to collect relevant information (natural hazard events). Crowdsourcing based on the experience gained in Uganda ("Geo-observers" in the project AfreSlide http://afreslide.africamuseum.be/).*

Methodology:

- Identify COs within communities. They collect all relevant information relating to hazards and disasters occurring in their community areas and transmit it to the network focal point (at Civil-protection-CRSN and MUST), which shares it after validation;
- COs are selected based on their interest and active participation in the life of their community. They are trained at the beginning of the project during a seminar;
- Data transmission is organized by SMS (remote rural areas), or where possible, by Internet and smartphone (e. g. www.kobotoolbox.org);
- Two networks of a few dozen people each: one in Uganda (in partnership with MUST (and MMU), one in the DRC (in partnership with the Civil Protection and CRSN);
- For each network, a local coordinator is trained to compile the data (one at Civil protection, one at MUST);
- Quality control (cross-referencing of information) and operation are carried out by the local coordinator and the scientists involved in the project under the supervision of the RMCA expert. MUST and CRSN PhD students are involved.

This methodology is shared with the ATRAP team promoted by Tine Huyse (RMCA) (SO4) which aims to deploy a citizen observer network for snail-borne diseases in Uganda (also with MUST as local partner).

C. GOVERNANCE SUPPORT

C.1. Capacity building of the Institut Géographique du Congo (IGC)

Objective: *strengthening support for the IGC initiated in GEOKIVU. This now greatly weakened institution still has its place and should play its essential role in the Congolese institutional landscape. The action will be carried out in three parts: (1) valorisation of archives, (2) training in modern mapping tools, (3) interactions with mapping actors in the DRC.*

Methodology:

- In Kinshasa: Inventory and arrangement of map collections and aerial photographs. Collections are sometimes highly damaged, an inventory is essential to identify possible unique elements, many of which are of inestimable value.
  The digitization of DRC administrative boundaries is a priority. HARISSA will take advantage of the archives already digitized by the RMCA and will contribute to valorise those probably available at the IGC (maps, legal texts, etc.). The GIS team is strengthened at the IGC;
- In the provinces: Building on the experience of the Goma IGC antenna (GEOKIVU project), some other provincial antenna are being strengthened and are giving priority to mapping areas with high population density or those most exposed to natural hazards. In the field, the use of connected tablets allows for quick and efficient tracking;
- All work is monitored weekly with the achievements sent to the RMCA experts who correct and/or comment (archive inventories, maps, etc.)

C.2. Support to disaster risk reduction (DRR) initiatives

Objective: *HARISSA will contribute to local and regional initiatives to ensure the integration and alignment of the different tasks with DRR initiatives.*

Methodology:

- HARISSA will maintain the important network of contacts setup under the GeoRisCA project involving scientists, decision-makers (provincial governments, Civil Protection, etc.).
- Organization of 2 workshops (years 2 and 4) to promote exchanges and synergies between the various project partners and local, national and regional authorities.
- Contacts will also be established with the various regional institutions active in the field of DRR: BAD, AU, IGAD, ECCAS, ECOWAS, SADC, ACP...

C.3. Development of awareness-raising actions

Objective: *HARISSA supports awareness and preparedness for natural hazards.*

Methodology:

- In Goma: revitalization of the Centre d'Information des Volcans (CIV), which aims to disseminate scientific information to the general public;
- HARISSA will approach ICCN to discuss an information programme for park visitors: information panels on the volcano, activities at the CIV, etc;
- In Bukavu: creation of a public awareness space on natural hazards in the premises of Musée Géologique de Bukavu (MGB): in particular landslides and earthquakes;
- In general, through its various actions, HARISSA's activities will increase the awareness of authorities and the population (e. g. citizen observers).

D. REINFORCEMENT OF THE ACHIEVEMENTS OF PREVIOUS ACTIONS

D.1. Securing, maintenance and appropriation of scientific tools

Objective: *Ensure the transition to the appropriation of experimental techniques and tools developed within the framework of ongoing/previous scientific projects (GeoRisCA, RESIST, AfReSlide, VLIR-TEAM Geo-Obs.) for the study and monitoring of risks in the Kivu region (seismic network, geodesics network, rain gauge network, and remote sensing network) and the Rwenzori Region (rain gauge network).*

Methodology:

- With the Luxembourg team (ECGS/ NMNH) that designed the tools and contributed to their deployment, ensure the maintenance of existing instruments and data transmission (seismic, geodetic, ground-based remote sensing);
- Continue the training of young researchers from these institutions (see A.1 and A.2) for greater autonomy in the maintenance, processing, and interpretation of measurements.
- Rain gauge networks (DRC and Uganda) are maintained in parallel to the citizen observer networks (Civil-Protection-CRSN and MUST respectively)

D.2. Making scientific data available online

Objective: the scientific data acquired by HARISSA are put online

Methodology :

- Creation of an exchange platform or a WebGIS.

E. A SELF-EVALUATION OF THE PROJECT IMPACTS

Objective: Citizen science is at the heart of both HARISSA as well as ATRAP (on aquatic snail-borne diseases in Uganda) led by Tine Huyse from the Department of Biology. An evaluation of these innovative citizen approaches and their impacts (perception) both at the community and policy level, but also at the management level will be the subject of a specific study shared with ATRAP. The outcome will also provide the necessary feedback in order to streamline and possibly re-adjust the research strategy wherever needed. It is also anticipated that the design of our communication/awareness actions can be improved.

Methodology: this self-evaluation will be done through a joint RMCA-based PhD research.

g) Developmental relevance of HARISSA

Relevance for development cooperation

- Strengthens expertise by combining high-level education and research in a sustainable university programme;
- Increases awareness of natural hazards and associated risks;
- Increases stakeholder awareness of environmental issues;
- Provides a tool for the collection, sharing and dissemination of hazard data;

- Fosters collaborations and synergies between partner institutions;
- In accordance with the sustainable development goals (SDG): 4, 9, 11, 11, 13, 15, 16, 17;
- In accordance with the Sendai Framework for Action;
- Strengthens the IGC and responds to the need for up-to-date mapping skills.

Embeddedness in the region/country

- Most partners and stakeholders are known for their previous activities (cooperation and research). The framework is therefore well established;
- The actions respond to the needs expressed by the respective partners;
- A pool of potential PhD candidates has already been identified and their skills have already been assessed in previous projects;
- RMCA-GeoRiskA is in close contact with various institutions in the regions studied;
- HARISSA's activities are spread over several countries and partners, which reduces risks related to the local security or political context or diplomatic relations (inaccessibility);
- Through the collaborations of the RMCA-GeoRiskA, HARISSA will also contribute to the strengthening of collaborations between partners from the North and the South;
- Field missions are always conducted with partner institutions.

Link with country strategies or strategic notes

With a focus on natural hazards and the associated risks within a context of DRR, HARISSA lines up with many strategic notes. For example, for the three targeted countries, the **strategy note of the Belgian Development Cooperation on the Environment** clearly specifies, among others, the prevention of natural disasters (section 4.1.5), education(section 1.1.1), sustainable land and soil use (section 4.2.2), and policy coherence for development (section 4.3.2). HARISSA lines up also with the Strategic Policy Note 'Digital for Development' (D4D) for the Belgian development cooperation".

For Uganda, HARISSA is well in line of the National Policy for Disaster Preparedness and Management (https://www.ifrc.org/docs/IDRL/Disaster%20Policy%20for%20Uganda.pdf) whose overall policy goal is to promote national vulnerability assessment, risk mitigation, disaster prevention, preparedness, effective response and recovery in a manner that integrates disaster risk management with development planning and programming.

For DRC, it is in line with the "Rapport national de suivi sur la mise en œuvre du Cadre d'action de Hyogo" that has the objectives to integrate DRR in sustainable development policies, develop and strengthen institutions, mechanisms and capacities for increase resilience to natural hazards, and systematically consider risk reduction in implementation emergency preparedness, response and recovery programs.

(https://www.preventionweb.net/files/41890_COD_NationalHFAprogress_2013-15.pdf)

In Burundi, HARISSA is in line with initiatives from Global Facility for Disaster Reduction and Recovery (GFDRR) and the ACP-EU Natural Disaster Risk Reduction Program that focus on e.g. flood and landslide preparedness to improve community resilience (https://www.gfdrr.org/index.php/en/burundi-flood-and-landslide-preparedness-improve-community-resilience).

h) Long term impact of HARISSA

- With the introduction of a master's degree in natural hazards, university teaching is being expanded in an area of importance for society and development;
- The critical mass of experts is increasing through doctoral and master's degrees;
- Knowledge and expertise is improved by setting up a mechanism for collecting and sharing new hazard data;

- Capacity building at the IGC will benefit to all development sectors;
- Interactions between research/education and other stakeholders and civil society actors are strengthened and awareness has increased;
- Measures for the sustainable management of the environment and strategies for the mitigation of natural and related risks are taken;
- The impact of natural disasters is reduced and populations are less vulnerable and more resilient.

i) Sustainability of HARISSA

Challenges for sustainability after DGD funding

HARISSA is an initiative focused on sustainability:
- PhD training will give 6 doctors in complementary fields;
- Implementation of a master's programme is a sustainable action and trains experts;
- Implementation of a methodology for collecting data on hazards will make it possible to improve knowledge and, above all, the scale of the phenomena and their impacts;
- Strengthening of the IGC's capacities should contribute to the structuring and homogenization of cartographic information in DRC, which is currently lacking;
- Appropriation of monitoring tools and methods by the GVO will contribute to its autonomy.

Strategy to tackle those challenges

With HARISSA, we can anticipate an intensification of future collaborations with partners.
With the development of expertise in natural hazards, we can expect partner institutions (UOB, CRSN, OVG, UNIGOM, UB, MUST) to be integrated into national or international programs and projects (multiplicative effects). Similarly, with the strengthening of the IGC, it is expected that this institution will gradually regain its position as a reference in the DRC, which will necessarily imply that it will be better supported.

j) Key stakeholders

Southern stakeholders

- **UOB and UB**
  Interest & influence: *Interested in raising their notoriety*

Their engagement is high as they have to validate institutional and bilateral decisions

- **Civil Protection**
  Interest & influence:
  -They recognize the lack and need of expertise in natural hazards
  -They recognize the lack and need of relevant data

Their engagement is high as they will be directly involved in the consultations for strategic decisions as well as for data and information gathering

- **Province and urban authorities**
  Interest & influence: *Interested in improved natural risk knowledge for their decisions*

Their engagement is critical for the facilitation of the field operations, but also for results appropriation.

- **Map users at (inter)national level(s)**
  Interest & influence: *Developing IGC capacity and making archive accessible*

Users are motivates the action of support to IGC and can also share their own data

- **Civil society**
  Interest & influence: *Strongly concerned by DRR initiatives and prevention initiatives.*

Civil society engagement is critical for hazard data collection by the Citizen Observers

- **MONUSCO**

Interest & influence: *Strong and marked interest for better volcanic risk assessment, for high quality maps*

MONUSCO has strong logistical facilities that they share for e.g. acquiring aerial photos or to access difficult sites.

- **Private sector**

  Interest & influence:

  -Need reliable risk maps to prevent loss of assets

  -Need quality maps

Presence in the field as well as our dissemination activities will be an opportunity to raise the interest of the sector.

Northern stakeholders

- **Cooperation agencies and actors**

  Interest & influence:

  -Interested in having relevant risk information to orient their actions at best

  -Interested in having maps of both present and past times

Multiplicative effect can be expected thanks to the HARISSA framework

- **DRR regional / sub-regional institutions**

  Interest & influence*: Interest in the reinforcement of the expertise in Central Africa*

They can facilitate and relay the bottom-up / top-down information streams.

- **Private sector**

  Interest & influence*:*

  -Need reliable risk maps to prevent loss of assets

  -Need quality maps

Through our research activities/publications/partnerships/conference, we expect that the interest of the sector be raised

2. Synergies and complementarities

With other Belgian actors

The RMCA HARISSA team will benefit from an existing framework including multiple collaborations:

- Various ARES initiatives underway in Burundi (doctoral school), in DRC in Kinshasa and Bukavu (doctoral thesis on urban erosion), master's program in disaster management at ULiège;
- Ongoing VLIR project in the Rwenzori region of Uganda on landslides (VUB/KU Leuven);
- VLIR project proposal submitted by VUB/INES (Musanze) in Rwanda with RMCA-GeoRiskA as partner;
- Synergies with the UCL (thesis of a CRSN-Lwiro researcher).
- Although collaboration with the RBINS-IRSNB-KBIN would be welcome if relevant, our respective interests, expertise, and geographic areas limit the potential of such collaboration

With other actors

- Recently in DRC: setup of a national platform for disaster risk reduction (DRR). This is a first step to overcome the problem of coordinating joint actions instead of generally isolated actions;
- In Bukavu, UOB has been working with us since 2012 to develop an interest in the issue of natural hazards as part of the curriculum at the undergraduate level. With HARISSA this teaching will be significantly reinforced;

- DRC Civil Protection, which has to deal with disaster management, tries to develop preventive actions to raise awareness but also to collect information;
- The NGO sector is also interested in the issue of natural risks. The results are often limited by the lack of expertise that HARISSA will increase;
- Concerning donors and cooperation agencies such as the EU, UNDP, the World Bank, the African Development Bank..., they sometimes invest massively in support programmes that also struggle to achieve the objectives because of the lack of local appropriation capacity linked to expertise;
- The DRC Disaster Risk Reduction Action Plan (2017-2023) gives priority to the assessment of disasters and associated vulnerabilities (priority axis 4).