EVAMAB

Economic valuation of ecosystem services in Man and Biosphere reserves: testing effective rapid assessment methods in selected African MABs

Anne-Julie Rochette (Royal Belgian Institute of Natural Sciences), Luc Janssens de Bisthoven (Royal Belgian Institute of Natural Sciences), Bruno Verbist (Katholieke Universiteit Leuven), Koen Vanderhaegen (Katholieke Univeristeit Leuven), Jean Hugé (Université Libre de Bruxelles), Hossein Azadi (Universiteit Antwerpen), Steven Van Passel (Universiteit Antwerpen)

Memorandum of Understanding between BELSPO and the MAB programme of UNESCO

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Economic valuation of ecosystem services in Man and Biosphere reserves: testing effective rapid assessment methods in selected African MABs

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PROMOTORS: Luc Janssens de Bisthoven (Royal Belgian Institute of Natural Sciences)
Bruno Verbist (Katholieke Universiteit Leuven)
Jean Hugé (Université Libre de Bruxelles)
Steven Van Passel (Universiteit Antwerpen)

AUTHORS: Anne-Julie Rochette (Royal Belgian Institute of Natural Sciences)
Luc Janssens de Bisthoven (Royal Belgian Institute of Natural Sciences)
Bruno Verbist (Katholieke Universiteit Leuven)
Koen Vanderhaegen (Katholieke Univeristeit Leuven)
Jean Hugé (Université Libre de Bruxelles)
Hossein Azadi (Universiteit Antwerpen)
Steven Van Passel (Universiteit Antwerpen)

STEERING COMMITTEE: Brigitte Decadt (Belspo)
Noëline Raondry Rakotoarisoa (UNESCO-MAB)
Meine van Noordwijk (ICRAF)
Honore Tabuna (CEEAC)
Gert van Hecken (Universiteit Antwerpen)

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ABSTRACT

Context

The idea of documenting ecosystem services for Man and Biosphere (MAB) Reserves came from a need expressed by the AfriMAB network back in 2013. During a general assembly about “Green Economy and ecosystem services”, the concept of ecosystem services (ES) was quite new for the participants. They needed to know more and be capacitated in these ES issues for a better management of the MAB sites.

Objectives

The EVAMAB project was launched to address this need. EVAMAB stands for “Economic valuation of ecosystem services in Man and Biosphere reserves: testing effective rapid assessment methods in selected African MABs”. It addresses the evaluation of the economic value of ecosystem services in UNESCO-MAB sites from a regional perspective (Africa) and focuses on Biosphere reserves (BR) from 4 countries: Benin, Ethiopia, Tanzania, Uganda.

General objective

The general objective was to further test and develop existing methods and tools for rapid assessment of ecosystem services (ES) and to perform evaluation of the (economic) value of ecosystem services in African Biosphere Reserves for a better appreciation of the potential for management and socio-economic integration, in order to better protect and sustainably manage Biosphere Reserves for their biodiversity for future generations.

Specific objectives

The specific objectives were

- to test and adapt rapid assessment tools for a bundle of ecosystem services provided by UNESCO-MAB sites
- to formulate pertinent stakeholder engagement and policy advice for managers and decision-makers, including other stakeholders such as private sector, community leaders, and MAB Council, concerning the valuation of ecosystem services, reward mechanisms and opportunities and limitations of socio-economic valuation in conservation.

Conclusions

The project had the opportunity to involve many MAB stakeholders, test good practices, and study cases related to ES assessment and valuation. These were summarized in a manual intended for African MAB managers. In particular, tools that are most suited for ES assessment, valuation methods, and ways to involve stakeholders, are the core of the projects recommendations.

Keywords

Ecosystem services, Biosphere Reserves, Africa, UNESCO-MAB

1. INTRODUCTION

The loss of biodiversity alters the functioning of ecosystems and decreases their ability to provide society with essential goods and services (Cardinale *et al*., 2012; Costanza *et al.*, 2017). While the concept of ecosystem services which links biodiversity to human wellbeing, is by now well-known, its translation into actual management decisions is still uneven. Moving from scientific knowledge and societal awareness about ecosystem services to effective real-world decision-making and impact remains challenging.

The wellbeing of people is directly dependent on ecosystem services (Suich *et al*., 2015) and access to the benefits provided by a steady flow of the ecosystem services contributes to poverty alleviation (Fisher *et al*., 2014). The challenge of biodiversity loss is particularly acute in developing countries, where economies and a large part of their population depends on goods and services provided by local ecosystems (IPBES, 2018). These countries, often rich with and highly dependent on natural resources, would benefit from the inclusion of the concept of ecosystem services in their policy-making processes. Although their economies and a large share of their population is directly dependent on goods and services provided by local ecosystems (IPBES, 2018), until now, these are often not sufficiently recognized, understood and managed sustainably. Africa in particular, has a high proportion of Least Developed Countries (UN CDP, 2018), contains multiple biodiversity hotspots (Myers *et al*., 2000) and shows a particularly high direct dependency on ecosystem services (*e.g*. 62 percent of its rural population depends directly of ecosystem services for its survival (IPBES, 2018)).

The linkages between the conservation of biodiversity and human development is provided by the concept of ecosystem services, and lies at the roots of UNESCO's Man and Biosphere (MAB) programme (Cuong *et al*., 2017). Managers hence need to identify the ecosystem services delivered by the Biosphere Reserve and need to ensure the long-term provision of these services. A better knowledge and a better integration of ecosystem services in their management plans is a key priority for African Biosphere Reserves, as these reserves are facing high anthropogenic pressures such as the rapid population growth, its strong dependence on natural resources for its livelihoods, weak institutions and competing stakeholder interests in challenging governance conditions (German Federal Agency of Nature Conservation, 2011).

To ensure that ecosystem services contribute to improved decision-making, the assessment of these services -and their contributions to human wellbeing needs to become systematic, quantifiable, robust and credible (Bagstad *et al*., 2013). Solid methods to assess and map ecosystem services exist, but remain insufficiently known, used and communicated (Maes *et al.,* 2013; Martinez-Harms *et al*., 2016; Ruckelshaus *et al*., 2015).
(Extracts from Hugé et al. 2020).

The EVAMAB project aimed to further explore the potential of ecosystem services for the management of Biosphere Reserves. In particular the following approaches were chosen:

- A selection of the most suitable existing tools for assessing Ecosystem Services in African Biosphere Reserves (Work package A)
- An assessment of priority ecosystem services in four selected Biosphere Reserves and possible reward mechanisms (Work package B)
- Strengthening the science-policy interface around ecosystem services in the selected Biosphere Reserves (WP C) and inside the AfriMAB network
- The economic valuation of ecosystem services and guidelines for reward mechanisms (Work package D)

2. STATE OF THE ART AND OBJECTIVES

The concept of nature conservation has evolved from a rather nature-centred towards a more anthropocentric approach, with several gradations in between (Mace, 2014). In that sense, the MAB concept in the seventies was ahead of its time. Nature conservation however keeps evolving, the latest being an 'evocentric' approach (Sarrazin & Lecomte, 2016), where conservation is considered as a stewardship for long term evolutionary trajectories for both humans and non-humans.

Meanwhile, the concept of 'ecosystem services' emerged and was especially popularized in the Millennium Ecosystem Assessment of the early 2000s (Millennium Ecosystem Assessment, 2005). This concept grouped ecosystem services into four broad categories: provisioning, such as the production of food and water; regulating, such as the control of climate and disease; supporting, such as nutrient cycles and crop pollination; and cultural, such as spiritual and recreational benefits. This framework was also largely used in the TEEB manuals, 'The Economics of Ecosystems and Biodiversity' developed by UNEP since 2008 (TEEB, 2010). TEEB suggests a tiered approach to analysing problems and ascertaining policy responses. Value can be recognized in a monetary, intrinsic, spiritual or social way. TEEB focuses on instruments that capture value by rewarding and supporting good conservation – through measures such as payment for ecosystem services (PES) (TEEB, 2010). To help inform decision-makers, many ecosystem services are being assigned economic values.

The general objective of the project was to further test and develop existing methods and tools for rapid assessment of ecosystem services (ES) and to perform evaluation of the (economic[1]) value of ecosystem services in selected African UNESCO-MAB sites for a better appreciation of the potential for management and socio-economic integration, in order to better protect UNESCO-MAB sites for their biodiversity for future generations.

The specific objectives were

- to test and adapt rapid assessment tools for a bundle of ecosystem services provided by UNESCO-MAB sites;
- to formulate pertinent stakeholder engagement and policy advice for managers and decision-makers, including other stakeholders such as private sector, community leaders, and MAB Council, concerning the valuation of ecosystem services, reward mechanisms and opportunities and limitations of socio-economic valuation in conservation.

[1] We put 'economic' in brackets, as the Evamab project focuses on the valuation beyond the purely economic approach. Therefore the inclusion of 'economic' in the title is too restrictive.

2.1. Work package A: literature survey of rapid assessment methods and tools for ecosystem services related to MAB sites

Insight in the state and flux of ecosystem services and their use, and in the risks that ecosystem services are facing, is key for sustainable management (Maron *et al*., 2017). An assessment of the social and economic value of ecosystem services can provide important leverage to safeguard and manage Biosphere Reserves and their ecosystem services in a plural way, acknowledging the interests of a wide range of stakeholders.

Solid methods to assess and map ecosystem services exist, but remain insufficiently known, used and communicated (Maes *et al.,* 2013; Martinez-Harms *et al*., 2016; Ruckelshaus *et al*., 2015). Many decision-support tools have been developed in recent years, yet their applicability and user-friendliness are often context-, site- and user-specific. Moreover, their application is often limited due to high demands of data, skills, time and resources. In order to structure and understand the diversity of these tools, some authors performed reviews attempting to classify these methods and analyse their trade-offs. Bagstad *et al.* (2013) evaluated ecosystem services assessment tools based on their suitability to be mainstreamed in environmental decision-making processes in the most resource-efficient way. Pandeya *et al.* (2016) reviewed tools that contribute to better policy making and are locally applicable in data-scarce areas. Grêt-Regamey *et al*. (2017) reviewed tools that have been operationalized into decision-support for a range of sectors such as water, soil, forest, agriculture and transport; while IUCN (2018) reviewed tools to model and value ecosystem services in among others World Heritage Sites and Key Biodiversity Areas. Despite these valuable efforts, a review of widely applicable, rapid and affordable tools to assess multiple ecosystem services in the specific context of African Biosphere Reserves, building on the expectations of the prospective users of such tools, was still lacking.

Objectives: To address this gap, the objective of this work package was to provide a selection of rapid assessment tools that are most suitable for the context of African Biosphere Reserves, and in particular to:

- Provide insight into the evolving landscape of ecosystem services assessment tools and their applicability in the context of African Biosphere Reserves;
- Identify the perspective of prospective users of ecosystem services assessment tools (e.g. Biosphere Reserve managers) on management challenges and preferences regarding tool format and objectives;
- Evaluate the characteristics of ecosystem services assessment tools to facilitate an informed selection process when choosing which tool to apply;
- Critically reflect on the design and the use of current and future ecosystem services assessment tools in African Biosphere Reserves. (Extracts from Hugé *et al.* 2020)

2.2. WP B: assessment of ES in 4 selected MAB sites

In order to validate the selection of tools resulting from WP A and further document their applicability, the *objective* of Work package B was to test the application of selected tools in four selected Biosphere Reserves.

More specifically the *objectives*, for each site, were to

- Understand what ecosystem services are priority, for whom, and why;
- Whenever feasible, assign a value (economic or not) to the priority services;
- Document existing and potential Payment for Ecosystem Services (PES) schemes, as well as associated stakeholders (potential suppliers, buyers of ES and intermediaries).

The study sites

These four sites were chosen as a function of their representativeness for different ecosystems, biomes and relative weights of ecosystem services and stakeholders, as well as based on the track record of the consortium members to optimally capitalise on their expertise and existing networks and projects concerning these sites. It concerns Lake Manyara (Tanzania), Mount Elgon (Uganda), Pendjari National Park (Bénin) and Lake Tana (Ethiopia).

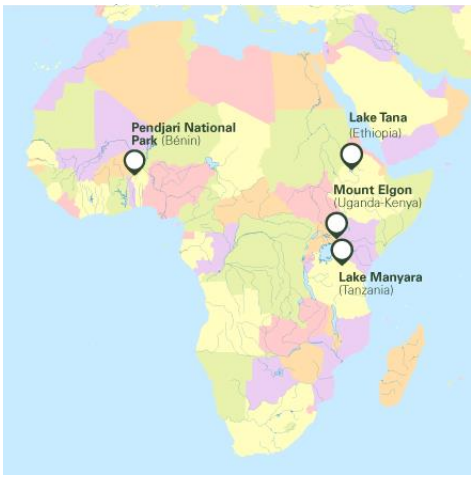


FIGURE 1: MAP OF AFRICA SHOWING THE FOUR EVAMAB STUDY SITES

a) **Pendjari Biosphere Reserve**

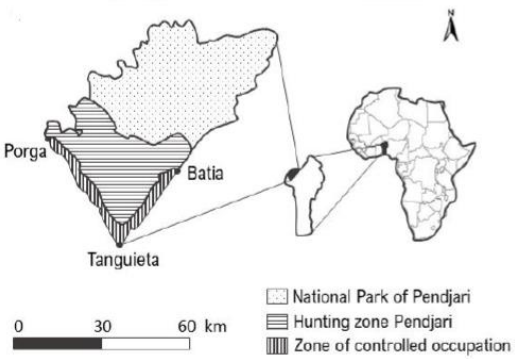


FIGURE 2: THE LOCATION OF THE PENDJARI NATIONAL PARK WITH ITS THREE FUNCTIONALLY DIFFERENT ZONES IN BENIN, WEST AFRICA. PICTURES TAKEN INSIDE THE BIOSPHERE RESERVE (MAP: JANSSENS, 2019; PICTURES: L. JANSSENS DE BISTHOVEN)

- Area (hectare): 575,000
- Year designated as MAB: 1986
- Administrative authority: African Parks Network

Pendjari National Park is a gazetted national park lying in the Sudano-Sahelian zone in West Africa, bordering the transfrontier Park of W, hence being a reference as a last stronghold of relatively well preserved biodiversity in semi-arid West-Africa. The land is dominated by grass and park savannahs, although gallery forests occur along rivers and dry forests in areas protected from fire (Floquet, 2011).

After being classified as Partial Wildlife Reserve and National Park in respectively 1956 and 1961, Pendjari National Park and its adjacent reserves joined the list of Biosphere Reserves of the UNESCO Program on MAN and the Biosphere in 1986. It is part of the W-Arly-Pendjari (WAP) complex, which is a continuation of protected areas shared between the Republic of Niger, Burkina Faso and the Republic of Benin. (De Ryck, 2018)

Currently, the PNP consists of three zones with different functions (Fig. 1c): in the Zone of controlled occupation (ZOC), settlements and all agricultural activities are allowed. In the Hunting Zone, regulated harvesting of non-timber products and religious activities are allowed as well as trophy hunting by tourists. In the core zone of the park, no other activities but research and low-impact tourism such as safaris are allowed. (Janssens, 2019)

The Centre National de Gestion des Réserves de Faune (CENAGREF) was in charge of the conservation and management of the protected area in collaboration with the Association Villageoise de Gestion des Réserves de Faune (AVIGREF) (Vodouhê et al., 2010) until 2017. Recently, the management of Pendjari Biosphere Reserve has been taken over by African Parks Network (De Ryck, 2018) by presidential decree.

Over 28,000 people live in and around PNP spread across 24 settlements. The population's main source of livelihood is agriculture, small-scale animal husbandry and tourism.
Several transhumance routes run through the park during the dry season, when cattle herders from the Sahel zone trek to the south of Benin in the search of water. (Janssens, 2019)

b) Lake Manyara Biosphere Reserve

FIGURE 3: SCENERY IN LAKE MANYARA NATIONAL PARK (PICTURES: A-J. ROCHETTE).

- Area (hectare): 2,833,000
- Year designated as MAB: 1981
- Administrative authority (core area): Tanzania National Parks (TANAPA), Lake Manyara National Park
- Main economic activities: Agriculture, pastoralism, tourism

Lake Manyara (LM) basin (also called 'Manyara' in the text) in the Northern Tanzanian Rift Valley is a biodiversity hotspot. Lake Manyara, a shallow soda lake, is the epicentre of Lake Manyara National Park (LMNP) which has since 1981, been one of the seven Tanzanian UNESCO Man and Biosphere reserves (UNESCO, 2015, Pool-Stanvliet and Clüsener-Godt, 2013). LMNP is an Important Bird Area (IBA) (BirdLife, 2018) and it is part of the famous 'Northern safari circuit' for tourists. With the other iconic protected areas in Northern Tanzania, LMNP generates much-needed direct (tourist visits) and indirect (the service sector and trade) tourism revenues (DTIS, 2016). Besides for conservation, the wider LM catchment is also important for regional food security and pastoral- and agricultural livelihoods (Ngana et al., 2003). This contributes to poverty reduction but also drives strong immigration of people seeking new economic opportunities in the region (Njole, 2011). It further exacerbates an already tense demographic situation compared with the limited carrying capacity of the semi-arid ecosystem (Loibooki, 2008). Currently, multiple social and economic drivers, which are rooted in historical disruptions of the social-ecological system (SES), are pushing communities towards the unsustainable use of natural resources (Blake 2018; Wynants et al. 2019). This

complex social-ecological system (sensu Ostrom, 2009) provides an interesting case of intermingled social-economic and environmental threats and opportunities (Loibooki, 2008, Kideghesho et al., 2015, UNESCO, 2015).

Despite, but also because of these economic and ecological assets, the multiple use and management of ecosystem services is prone to environmental degradation and even to serious conflicts among stakeholders with different priorities. Lake Manyara itself is threatened by (1) episodic droughts and declining water levels due to excessive water capture by agriculture and possibly less rainfall due to climate change and (2) sedimentation because of erosion in the catchment basin (Kiwango, 2009a), which itself is exacerbated by deforestation, overgrazing and violent downpours and floods (Blake et al. 2018). A 30-year (1988-2016) land cover reconstruction by Wynants et al. (2018) found a net conversion of natural or semi-natural land cover towards agricultural uses in the Lake Manyara catchment. The biggest net declining land cover types are 'bushland', 'seasonal grassland' and 'permanent savannah', which were reduced by 8.7, 6.1 and 3.5% respectively. Moreover, the conversion has often occurred in areas that are naturally vulnerable due to topography, soil type and rainfall patterns, thereby seriously increasing runoff and soil erosion risk. While the environmental effects of land cover change are relatively well understood, the social-economic causes and effects are not (Blake et al. 2018). This has not only impacted the foraging of ca 1 million Lesser Flamingos (TANAPA, 2005), which potentially threatens tourism, but also on other aquatic biodiversity, threatening fisheries and the associated value chain extending well beyond the Manyara area (Nonga et al., 2010). (Janssens de Bisthoven *et al.* 2020)

c) **Mount Elgon Biosphere Reserve**

FIGURE 4: LEFT: MAP OF THE MT. ELGON UNESCO MAN AND BIOSPHERE RESERVE. RIGHT: UNESCO MAB SIGN AT THE KAPKWAI GATE OF THE MT. ELGON NATIONAL PARK. (PICTURES: K.VANDERHAEGEN)

Mount Elgon is a 4,320 m high, extinct volcano on the boundary between Uganda and Kenya, situated just north of the equator. Its foot slopes are separated from the lowland at about 1,200 m altitude by a series of volcanic cliffs and a change in soils and climate. Mount Elgon is a key biodiversity area in the Eastern Afromontane hotspot. As an isolated mountain surrounded by the lowlands of the rift valley it harbours high numbers of endemic species and relict populations of Afromontane fauna and flora. Besides its biodiversity conservation value, the Mt. Elgon is also a vital "water tower" for the region, has important cultural significance and adds to the livelihoods of thousands of local people by its provision of ecosystem goods such as firewood, timber, herbs, fodder and medicines.

Average annual rainfall is ca. 2,100 mm. The local landscape mosaic consists of croplands, tree plantations, pastures and coffee- gardens where Arabica coffee, as the main local cash crop, is intercropped mainly with bananas, yams, maize or beans. Economic activities are thus smallholder agriculture, resource harvesting and tourism.

The smallholder agriculture system reaches up to about 1,900 m altitude, where the Mount Elgon National Park starts. The transboundary national park covers the buffer and core zone

of the UNESCO Man and Biosphere Reserve and stretches up to the top of Mt. Elgon. A 10 km wide belt of densely inhabited and intensively used agricultural land adjacent to the Mt. Elgon National Park forms the UNESCO MAB transition zone. The total area encompassed by the Ugandan Mt. Elgon MAB reserve is 215 147 hectares (Buffer zone: 32 742ha, Core zone: 79 375ha, Transition zone 103 030ha). It was designated in 2005. The core and buffer areas are managed by the Ugandan Wildlife Authority (UWA). An Ecosystem Management Committee was set up by the Ugandan UNESCO MAB committee for the Mt. Elgon MAB reserve, drawing membership from all local stakeholders, to steer the implementation of an overall management plan. Community Conservation Teams and Community Action Plan Committees ensure community mobilisation, awareness creation and implementation of alternative income-generating activities such as sale of farm produce for hotels and agroforestry. The UWA plays a prominent role in this committee regarding the buffer and core zones while other organizations including the IUCN, ICRAF and WWF provide support for projects in the transition zone.

d) **Lake Tana Biosphere Reserve**

FIGURE 5: LAKE TANA: PHOTO (LEFT): AMAZING SUNSET CRUISE; PHOTO (RIGHT): MORE THAN 217 DIFFERENT BIRD SPECIES HAVE BEEN RECORDED.

- Area (terrestrial and lacustrine/aquatic): 695,885 ha
- Year designated as MAB: 2014
- Administrative authority (core area): ANRS Bureau of Culture, Tourism and Parks Development, under the authority of the Ethiopian Ministry of Science and Technology
- Main economic activities: agriculture, fishing, tourism, sand mining

The Lake Tana Biosphere Reserve is located in the Amhara National Regional State 563 km northwest of Addis Ababa in the north-western part of Ethiopia. The biosphere reserve comprises Lake Tana, the largest lake in Ethiopia, which provides important ecosystem services. It offers a wide array of ecosystem services. Being the source of the Blue Nile river (Anteneh et al., 2015), the quality and supply of water of Lake Tana influences all downstream areas, contributing to the ecosystem services provided there as well. First of all, Lake Tana and its fertile wetlands provide important agricultural value not only to people inhabiting the shores, more remote areas also depend on the irrigation services of the lake (Worku, 2017). Crop production and communal grazing lands are the dominant agricultural activities (Wondie, 2018). the islands on Lake Tana have significant spiritual value with their Christian Orthodox monasteries and churches. These commercial and cultural values contribute to the relevance of transportation services provided by Lake Tana. Thirdly, there are approximately 5000 fisherfolk around Lake Tana, directly contributing to the livelihood of many (Amare et al., 2018). Fourthly, the water from Lake Tana forms an inlet for several hydroelectric power plants (Tesfaye et al., 2016). Finally, the importance of tourism to the region is increasing, with Lake Tana as one of the main attractions (Anteneh et al., 2015). Apart from the ecological value of the Lake Tana Biosphere Reserve, the abovementioned ecosystem services contribute to the significant economic, social and cultural added value of Lake Tana. (Extract from Van Oijstaeijen et al., 2018)

The biosphere reserve has been established to protect the immensely valuable biological and cultural diversity of the area around Lake Tana, while at the same time promoting sustainable economic development and land use. Local communities will benefit from new environmentally-friendly sources of income and an improved living standard. The rich cultural heritage and unique biodiversity will be conserved for future generations to enjoy. The German Nature and Biodiversity Union (NABU) has supported the Government of Ethiopia and Amhara National Regional State during the establishment of the Lake Tana Biosphere Reserve. In 2015, the Lake Tana Biosphere Reserve was accepted into the worldwide network of UNESCO biosphere reserves and officially inaugurated.

2.3. WP C: science-policy interface

Based on results and lessons learned from WP A and B, the project aimed to present and validate the results with concerned stakeholders, and to formulate a set of recommendations, so that stakeholders are more aware of the conservation potential of their MAB site and of effective actions to consider in decision-making processes.

More specifically, the *objectives* were to

- Share and validate results of WP B through multi-stakeholder workshops, thereby stimulating the uptake of results by key stakeholders
- Provide recommendations for managers, decision- and policy makers and community leaders
- Share methodologies and results with the MAB and scientific communities

Involving key stakeholders, including local governance actors of the BR, end users, decision makers, is indeed key in order to (1) scope as much diversity of opinion as possible, (3) inform in a capacity building mode as much target groups as possible and (3) raise awareness, ownership and active involvement of the process with key players, creating a ‘critical mass’ of informed stakeholders which add motivation to national authorities and international donors to take action in specific management and governance decisions of MAB areas.

2.4. WP D: economic valuation of Ecosystem Services and guidelines for reward mechanisms

The valuation of non-market services such as ecosystem services is challenging and complex. Environmental Economists rely mainly on revealed preference methods (e.g. travel cost method) and stated preference methods (e.g. contingent valuation). Benefit transfer methods use a unit-value of non-market services, estimated in an original study to estimate the value of similar services in the region without a valuation study available. This can be considered as a rapid assessment measurement of the economic value reducing the cost and time compared to original studies of non-market values.

The objectives were to:

- Use rapid assessment methods to value the ecosystem services (of work package B) in the different UNESCO-MAB case studies;
- Execute a more detailed valuation exercise will be made by using a contingent valuation approach at least in one MAB site (Lake Tana);
- Formulate recommendations considering the valuation of ecosystem services and the design of reward mechanisms, specifically targeted to African MABs.

3. METHODOLOGY AND SCIENTIFIC RESULTS

AS THIS SECTION CONTAINS MANY UNPUBLISHED DATA, IT HAS BEEN REMOVED FOR THE ONLINE VERSION

Methodologies and results for each work package are presented in this section. Moreover, Table I summarizes the main methodologies and expected results per study site, thereby referring to different Work packages and giving an overall picture of the methodologies used.

The methodology was different in each site; it was developed on the basis of

- previous existing studies
- the local context
- the expertise of the leading partner
- co-funding opportunities
- the availability of Belgian and local BSc and MSc students to conduct field work
- the availability, expertise and motivation of the local partner(s)

TABLE I: OVERVIEW OF MAIN METHODOLOGIES APPLIED AND EXPECTED RESULTS FOR EACH STUDY SITE. THE LAST COLUMN REFERS TO THE RELATED SECTION OF THE REPORT.

SITE	PERIOD	METHODOLOGY	EXPECTED RESULTS	REPORT SECTION
ALL	2017-2019	Literature review	Selection of ecosystem services assessment tools	**Error! Reference source not found.**
		Delphi technique	Identification of user-generated criteria to evaluate ES assessment tools	**Error! Reference source not found.**
		Classification against criteria	Evaluation and classification of ES assessment tools and guidance	**Error! Reference source not found.**
PENDJARI BR	Aug-Oct 2017	Interviews with local experts	Identification and general documentation of priority ES and existing/potential PES schemes	**Error! Reference source not found. Error! Reference source not found.**
		Focus groups based on TESSA/PA-BAT tools	Identification and general documentation of priority ES	**Error! Reference source not found. Error! Reference source not found.**
		TESSA-inspired surveys, documents analysis,	More in depth assessment of 4 priority ES (carbon, water, tourism, agriculture)	**Error! Reference source not found. Error! Reference source not found.**
		Interviews, surveys and documents analysis	Documenting and evaluation of an existing PES scheme (improved cooking stoves)	**Error! Reference source not found. Error! Reference source not found.**
	2017	Remote sensing supervised classif.	Land use changes in and around Pendjari NP	3.2.2 **Error! Reference source not found.**
	2018	Systematic review of ES research	ES bibliography	3.2.2 **Error! Reference source not found.**
	Aug-Oct 2018	Q methodology	Mapping stakeholder perceptions on the Park management	3.2.2 **Error! Reference source not found.**
		TESSA-inspired Nominal Group Technique	- Threats to priority ecosystem service provision - Temporal trends of service provision in the area	3.2.2 **Error! Reference source not found.**

			- Impact of the management shift on local communities	
		Contingent valuation	Economic value of 5 NFTP	
	Sept 2018	Stakeholders workshop – Multi-criteria decision analysis	Priority management options	**Error! Reference source not found. Error! Reference source not found.**
	Feb 2019	Logistic regression analysis	Park dependency and its effect on park management attitudes	3.2.2 - **Error! Reference source not found.**
		Contingent valuation	Factors influencing the compensation for reduced access to the Park	3.2.2 - **Error! Reference source not found.**
LAKE MANYARA BR	2018-2019	Integrated literature review	List of drivers of environmental conflict and list of responses per thematic clusters	**Error! Reference source not found.**
	Dec 2015 and 2016	Focus groups	Participatory maps, problem tree & priority ecosystem services & their dynamics	**Error! Reference source not found.**
	June 2017	Key informants interviews	Identification of environmental drivers, pressures, state, impact, response (DPSIR)	**Error! Reference source not found.**
MOUNT ELGON BR	2016	Remote sensing-supervised classification	Land use changes in and around Mt Elgon NP	**Error! Reference source not found.**
	Aug-Oct 2017	Interviews with local experts	Identification and general documentation of priority ES and existing/potential PES schemes	**Error! Reference source not found.**
		Focus groups based on TESSA/PA-BAT tools	Identification and general documentation of priority ES	**Error! Reference source not found.**
		TESSA-inspired surveys, documents analysis,	More in depth assessment of 4 priority ES (carbon, water, tourism, agriculture)	**Error! Reference source not found.**
		Interviews, surveys and documents analysis	Documenting and evaluation of an existing PES scheme (improved cooking stoves)	**Error! Reference source not found.**
	2017-2018	Systematic review of ES research in Elgon area	ES bibliography	**Error! Reference source not found.**
		TESSA-inspired Nominal Group Technique	- Threats to priority ecosystem service provision - Temporal trends of service provision in the area - Impact of the management shift on local communities	**Error! Reference source not found.**
	Sept 2018	Stakeholders workshop in Mbale	Presentation of results	3.3.1. **Error! Reference source not found.**
LAKE TANA	Jan-Sept 2018	TESSA-inspired surveys, documents analysis	Identification and general documentation of priority ES and existing/potential PES schemes	**Error! Reference source not found. Error! Reference source not found.**

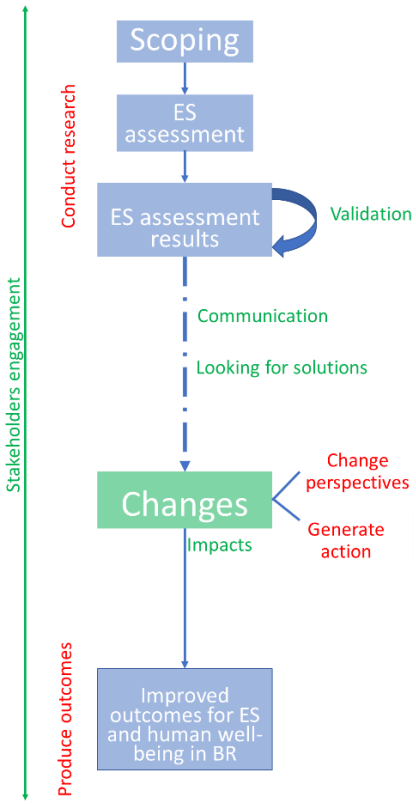
	Oct 2018	TESSA Stakeholders workshop	Identification, Characterization and Ranking of Ecosystem Services in Lake Tana basin	**Error! Reference source not found. Error! Reference source not found.**
	Oct-Nov 2017	Valuation study	The economic impact of water hyacinth infestation on farmers: Case of Lake Tana in Ethiopia	3.2.5 **Error! Reference source not found.**
	Nov 2018	Valuation study	Willingness to contribute for the protection and restoration of papyrus wetlands around Lake Tana, Ethiopia: a contingent valuation study	3.2.5 **Error! Reference source not found.**
	Sept 2019	Valuation study	A contingent valuation of non-market ecosystem services of agricultural land in Bahir Dar, Ethiopia	3.2.5 **Error! Reference source not found.**

4. RECOMMENDATIONS

4.1. Recommendations to MAB managers

Recommendations to MAB managers are listed in the EVAMAB Manual and based on both our EVAMAB insights and literature and prior knowledge. A summary is presented here.

4.1.1. *How to achieve real change?*



Information gathered through ES assessment ideally needs to be used to inform decisions that will impact ecosystem services and their management. ES assessment is only a means to an end, and should be part of a whole process engaging stakeholders from the beginning to the end, with the final objective of producing an outcome, which could be synthesised for the sustainable management of Biosphere Reserves as "Improved outcomes for ecosystem services and human well-being in the Biosphere Reserve'.

This outcome will only be reached if changes (of behavior, of management, of governance etc) occur, as a consequence of the ES assessment. Key elements to induce changes are scoping, continuous stakeholders engagement and communication.

FIGURE 6: THE PROCESS OF ACHIEVING OUTCOMES ON THE BASIS OF ECOSYSTEM SERVICE ASSESSMENT.

4.1.2. *Stakeholders involvement*

One of our core messages is that ecosystem service assessments are an opportunity to involve key stakeholders of Biosphere Reserves, including local communities, at all stages of the assessment (from scoping to real changes), which is the core of the MAB philosophy. Conservation effectiveness is heavily influenced by local support, ownership and collaboration, which first requires trust to be installed. This trust can be gained through culturally adapted communication and by giving back stewardship to the locals. (Janssens 2018, Janssens de Bisthoven et al., 2020).

Stakeholders: how and when to engage them?

Conservation does not work without people. The people having a "stake" in and around a protected area locally or from a distance, are the relevant stakeholders, the players who will conceive and implement this dual purpose of conservation and sustainable development, embodied in the MAB philosophy. Therefore, stakeholders should be the "owners" of the conservation schemes and should be the actors in any conservation effort. Many stakeholders are involved in the different functions of a Biosphere Reserve.

"People can't make decisions, but when it comes to receiving money, they can air their opinion" (participant at EVAMAB Ethiopia workshop, May 2019)

With this somewhat provocative quote we would like to emphasise that BR management and decision-makers need to create a safe context or safe space where "the people" can air their opinions about the area where they live or which they depend on, or which they decide upon for management decisions such as water allocation, hunting quotas, community co-management etc...

"The people" is of course a vague term. In the context of conservation and management of PA, "stakeholders", people having a stake into something, can be defined according to several criteria, such as e.g. their interest in the topic (e.g. water, conservation, integrated management), but also their potential or real influence into the processes under consideration.

This "mapping of stakeholders" or "stakeholder analysis" is an important step before any other assessment, because at the end of the day, any ecosystem services assessment will refer to possible changes and actions at the level of the stakeholders.

So, why is involving stakeholders that important?

There are two important reasons:

1- Involving stakeholders impacts the relationships between the stakeholders in many ways. The mere fact of interacting and getting to know each other, is a key first step in order to move towards effective, socially robust conservation. Involving stakeholders on a specific topic, such as e.g. mapping the ES in an area, or playing a game to illustrate power balances or benefits of ES, has direct and indirect impacts on the stakeholders and their mutual relations.

Features amongst stakeholders being influenced with such collective exercise include:

- Awareness
- Acceptance
- Trust
- Ownership
- Continuous learning process
- Build societal support
- Mutual understanding

2- Involving stakeholders allows us to collect a whole range of useful knowledge, information, traditional beliefs and knowledge, scientific facts and figures etc, leading to:

- new insights into the power balances (political economy)
- identified knowledge gaps, pointing at priorities for further scientific research
- identified conflicts
- identified possible solutions (which can be discussed and voted upon in a multicriteria decision analysis for instance).

However, when engaging with stakeholders, it is essential

- to be clear about the objective of the venue, event, seminar, workshop, focus group
- to explain these objectives in a clear and transparent way
- to be sure not to create false or unrealistic expectations ('after the workshop you will all have a better life')
- to acknowledge complexity and conflicts and analyse them without prior judgement
- to be well aware of the prevailing governance structure or to map it in a stakeholder analysis
- to avoid polarisation but promote common understanding on 'neutral grounds or language' such as the DPSIR framework or the concept of Ecosystem Services.
- to do the moderation by a 'third party' which is accepted as sufficiently neutral and objective
- To disseminate the workshop report to all involved
- To do a follow-up in order to avoid 'one shot actions'. A following workshop
    - to deepen the subject
    - finetune the results,
    - add some stakeholders
    - work out a timeline with milestones to achieve clear goals
    - involve the stakeholders with decision and management power to commit themselves
    - devise a strategy to find resources to achieve the more ambitious changes

Which stakeholders should be involved?

- Most of the important stakeholders will be 'local', but in a slightly wider circle than those who have been directly involved, and can be grouped under community leaders (including women, youth, religious, customary), local government, NGO's and entrepreneurs.
- At national governance level there usually is a long list of Ministries and Departments to consider, sometimes collectively reachable through the national MAB Committee
- as well as members of Parliament, journalists, MGO's (Major Groups and other Stakeholders) business platforms.
- Depending on the context regional bodies can be interested and supportive, as well as global organizations (international, NGO) and potential bi- or multi-lateral donors and investors.

It is important for all of these that communication is not an afterthought, but that efforts have been made throughout the process (see Figure 7) to understand who all might have a stake in the area of focus (positively or negatively), and what approach may work best to engage them.

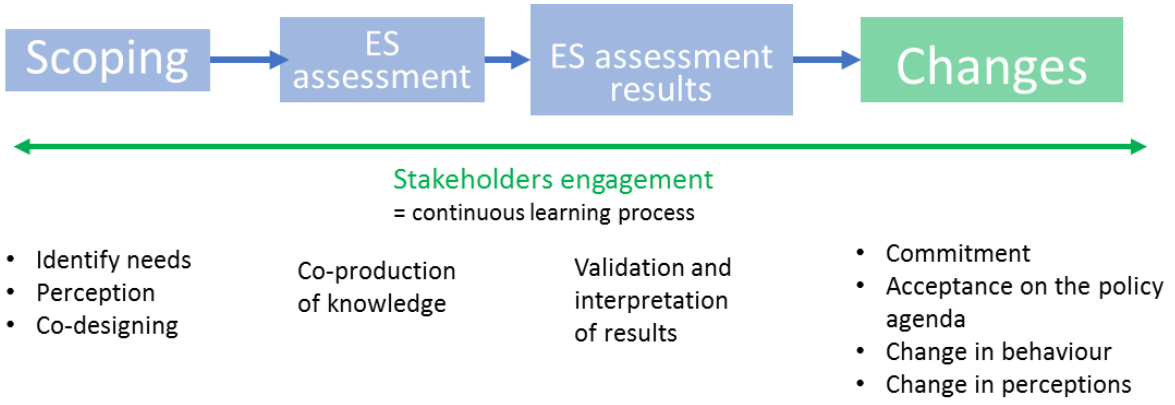


FIGURE 7: ILLUSTRATION OF HOW STAKEHOLDERS ENGAGEMENT SHOULD HAPPEN THROUGHOUT THE WHOLE PROCESS OF ECOSYSTEM SERVICE ASSESSMENT

4.1.3. *Communication*

How and to whom to communicate?

Communicating key results and conclusions of ecosystem services assessments is key to achieve real change and impacts. Whether it targets decision-makers so that they consider ES in plans and policies, or local communities to raise awareness or suggest alternative

management options, communication means should be carefully selected to effectively reach the target public.

To whom to communicate will depend on the results of your stakeholders analysis. How to communicate will depend on the profile of the stakeholders and their interest in the issue at stake (see Table XIX).

TABLE II: COMMUNICATION METHODS BEST SUITED FOR DIFFERENT TARGET AUDIENCES (ADAPTED FROM PABON-ZAMORA ET AL. 2008)

TARGET AUDIENCE	INTEREST IN ES PROVIDED BY THE BIOSPHERE RESERVE	USE OF THE ES ASSESSMENT STUDY	COMMUNICATION TOOLS
Local community	Extractive use, recreational use, harvesting, derived economic benefit (e.g., tourism)	Increase in knowledge about the value of ES. Demonstrate need for sustainable use of natural resources	Local outreach – e.g., community education campaign, community meetings, local news story, local radio
Decision-makers	Possibly very low interest. Lack of awareness of uses and services provided and associated economic benefits	Increase awareness of the economic use of the ecosystem. Describe national and local economic benefits associated with protecting ecosystems and potential costs if ecosystem degrades	Presentation, maps, policy brief, poll results, individual meetings, short film, story placement in high profile media
NGO's	Conservation. Poverty reduction. Social and economic development	Provides all parties with the same data on which to come to a consensus about the economic benefits of protected areas.	Policy brief and full report, presentation, side event at regional or international conservation meeting
Multilateral /bilateral donors	Possibly low, focused on development agenda	Increase in awareness of the link between protected areas, poverty reduction and social and economic development	Policy brief, presentations at high level international meetings, individual meetings, international high profile media, conferences

Short versus medium/long term

Journalists and politicians are triggered by immediate issues that are starting to get traction, but for the longer term the 'slow variables' of education, trust building, respect, recognition and partnerships are key to success. It is important that short-term issues are in support of the change needed for the longer term.

4.2. To UNESCO MAB

The EVAMAB manual is a good basis for sharing knowledge and experience about the consideration of Ecosystem Services for sustainably managing Biosphere Reserves. However, a manual alone will hardly make any concrete change on the field. We believe training sessions (and train the trainer) or workshops are needed in order to explain and apply it, and in order to bring different MAB managers together, which seems extremely relevant for exchanging best practices, lessons learned and success stories.

4.3. About Ecosystem Services Assessment tools (scientist, managers)

The diverse and dynamic landscape of ecosystem services assessment tools reflects the diversity of representations of the relationship between people and nature. Ecosystem services assessment tools typically start from a range of assumptions about what is important, what is measurable and what is urgent to address – and these assumptions differ between the teams developing the tools. This situation creates a rich landscape of tools in which potential tool users may find it difficult to navigate. The difficult trade-off between simple and complex approaches to ecosystem services assessment should not lead to inaction, as the diversity of tools and their respective strengths and coverage offer opportunities for users with different expectations to find the most suitable tool, while also providing inspiration for users aiming at developing new tools.

In order to choose the most suited tool in a particular context, we proposed two 'tools to select tools': a Table and a series of visualizations which highlight the main components of a range of ecosystem services assessment tools (see Annex 2). In the EVAMAB manual, we also present decision tree. There is no one-size-fits-all approach to ecosystem services assessment tools, and the resource -constrained context of African Biosphere Reserves creates extra challenges that will influence the tool selection process. Tools are not applied in a governance vacuum. Hence the impact of the application of such tools should not only be measured based on their technical quality, but also on their short- and long-term impact on actual decision-making – *i.e.* on the governance and management of Biosphere Reserves.

While most tools reviewed in this study have been extensively applied in the field, not all have been applied in Biosphere Reserves, and not all applications have been subject to scientific scrutiny. The INVEST tool applications have been reviewed by Ruckelshaus et al. (2015) and have had impact at different decision-making levels. The TESSA tool application for the Shivapuri-Nagarjun National Park in Nepal yielded estimates of avoided monetary loss thanks to conservation (Peh et al., 2016). In order to evaluate the range of impacts ecosystem services assessment tools can have on decision-making on the short- and the long-term, a more comprehensive model of tool effectiveness needs to be kept in mind, focusing on their substantial impact on well-defined decisions, as well as on their less directly measurable normative impact (e.g. tools fostering –social- learning and changing mind-sets) (Hugé et al., 2015). An increased awareness of the diversity of existing tools and guidance for prospective tool users will increase the number of applications of such tools and will consequently increase our understanding of their impact. (Hugé et al. 2020)

As part of the EVAMAB project, (parts of) TESSA tool was applied in different sites and adapted in different manners (focus groups, nominal group techniques, stakeholders workshops, …). Many adaptations were required to create a fit between method and environment. We believe that the preliminary scoping appraisal of TESSA provides outstanding guidance and inspiration on how to structure and adapt the methodologies. Forthcoming researchers looking to use this technique in the field of ecology and conservation are urged to examine the TESSA's Preliminary Scoping Appraisal. TESSA provides non-experts with a methodological framework to identify and evaluate the services that an area provides. This yields a more comprehensive understanding of services, which facilitates ES inclusion in policy and decision making. Stakeholder engagement is stressed throughout the framework's methodology. TESSA enables the collection of fine resolution data through a myriad of templates which users adapt to site-specific conditions, which is suitable with the fine-scale at which natural resource management decisions take place. Moreover, TESSA has proven successful as a tool to generate locally-relevant data on ecosystem services. Locally-relevant data can contribute to the sustainable management of natural resource as local knowledge, traditional beliefs, values and practices, "often provide a better foundation for protected area management than plans advised and administered solely by outsiders" (Stevens and De Lacy, 1997 pp9). (Goad 2018)

4.4. About the economic valuation of Ecosystem Services

The concept of ecosystem services has proved itself to be very useful to concretize nature's value and benefits to human well-being. Putting a monetary value on ecosystem services makes it easier to point out the importance of these services to decision-makers. This is a direct way to communicate about something abstract like nature's contribution to people, but it is also quite reductionist and anthropocentric. It takes away from the intrinsic or relational value of nature and puts nature in a purely instrumental perspective (McCauley, 2006). Some values are quantifiable, but invaluable ecosystems and their biodiversity are in fact priceless. The invaluable aspect is very important but still more difficult to assess.

Economic valuation seeks to produce, in monetary terms, public expectations for environmental changes. Therefore, the primary objective is to provide adequate evidence of these assumptions in the cost-benefit analysis. Ecosystems and their related services have economic value for society as people gain value from their actual or potential use as well as resource value for non-use purposes such as altruistic motivations, legacies, and stewardship. The overall objective of the policy evaluation would be to measure as many of the impacts on ES as possible (in monetary terms) against all the other costs and benefits of the policy evaluation (Azadi et al., 2020). It is worth noting that changes in ES may involve both costs and benefits, and both need to be covered by the assessment. Some environmental impacts can be evaluated relatively easily, such as the impact of air quality on the yield of agricultural products, and this change in yield can be evaluated at market prices (Defra, 2007; Muthee et al., 2017; Wangai et al., 2016). As shown in table below, a range of techniques were used to measure the economic, social, and ecological benefits of biodiversity and related ES. These methods are widely classifiable into two concepts: biophysical methods and preference-based methods. Choosing a valuation approach mainly relies on the form of service, resources existence, time, and the information for the research along with its aim. Precise use values are likely to be the simplest approach as they are usually a section of established markets

TABLE III: ECONOMIC VALUATION APPROACHES (ADAPTED FROM GIZ, 2012).

Way	Procedure	Use
Market cost (marketed goods)	Market values	The amount of money that is considered for ecosystem goods and services that are conducted in commercial markets such as timber and fish.
	Changes in productivity	Value is derived from the revisions in nature and/or the amount of an advertised good that is derived from an ecosystem change like fisheries benefits followed by enhancements in water quality.
Revealed preference (uses market-based information to infer a non-marketed value)	Travel cost	It is thought that the value of a station is mirrored in the number of individuals who are likely to pay for visiting the station. Included costs are travel expenses, entrance fees, and time value.
	Hedonic price	Hedonic prices measure economic values for the ecosystem services that precisely have an effect on market prices. It generally refers to changes in accommodation or land prices that mirror the value of regional environmental features.
Cost based	Refrained harms expenses	Value is grounded on the price of decisions made to prevent losses if a particular ecosystem service was not available, like the expenses to safeguard a belonging from flooding if neighboring wetlands are disgraced.
	Replacement/ substitute costs	Value is grounded on the price of changing the ecosystem, service (application), or supplying alternatives like formerly clean water that currently needs to be purified in a site.
	Costs of human capital	Health expenses (misery and death) due to alterations in ecosystem services like air and water contamination.
Stated preference (questionnaire surveys; these procedures can be utilized to measure non-use	Contingent valuation	Covers precisely questioning people how far they would be likely to pay to avoid the damage or improve an ecosystem service, like the tendency to maintain a regional forest unharmed.
	Choice modeling	Every one selects from a list of choices with varying degrees of ecosystem services and varying expenses in a place where a group of likely actions may end in various shocks on ecosystems.

Way	Procedure	Use
values.)		
Transfer of values	Benefits transfer (not a valuation method in itself)	Relocating a value from researches already done in another place and/or situation like assessing the value of a forest by applying the measured economic value of another forest of the same size and type.

In the manual, Chapter 5 focuses on monetary values. Methods presented use an anthropocentric instrumental approach and should not be used exclusively without considering the relational and intrinsic values of nature, as they have a crucial influence on the reasons why people want to maintain it.

4.5. About Payments for Ecosystem Services (PES)

From the four case studies it became clear that PES does not offer a magic bullet that right away leads to better management of natural resources.

A crucial condition is to find a market with willing buyers. In some cases (**carbon**) that can be international, while for ecosystem services like **water** a local market needs to be found. The size of the market is a constraint in both cases, although the voluntary carbon market has shown a rather consistent and stable increase over the years.

In the case of the Elgon area it is unlikely the local market for water services would pay a premium for the water they get. For carbon it was clear that it was an interesting add-on on top of other in-kind rewards (value of wood, provision of shade, …) helping to speed up a "re-treeing" of the landscape.

Landscape beauty and ecotourism are now ecosystem services that are on the radar of the management of most Biosphere reserves.

Biodiversity is probably the ecosystem service that is hardest to sell. It needs to 'piggy-back' on other ecosystem services that are being rewarded.

The bundling of ecosystem services for payments is something that deserves more attention. The link with other promising PES is however until now hardly something the MAB-managers have been looking for. The difficulties encountered in the buffer zone in the Elgon area probably had a very demotivating effect. It was a bit surprising to learn that MAB- managers and local officials were hardly aware of the successes of the 'Trees for Global Benefits' programs outside the buffer zone that could present promising results.

The quality of both the ecosystem service and the accompanying process is primordial. In the case of Benin the cookstoves were cheap enough, but the lifetime short. The project duration was too short to build local capacity to produce cookstoves in a sustainable way.

In the four cases it became clear that PES holds potential, but it is not a quick fix.

4.6. To Belspo, about the added value of working with UNESCO-MAB

The EVAMAB team listed the added-value of working for and with UNESCO-MAB, in order to encourage Belspo continuing their collaboration.

a) Meeting the needs from MAB managers in the field, or the concept of 'living labs'

"Man and biosphere" approach: combining conservation of ecosystems with sustainable use of natural resources for the benefit of local communities – the objective of the MAB programme, is a huge current issue addressed in global strategies such as CBD, SDGs, etc: how to reconcile biodiversity conservation and sustainable development? MAB reserves are excellent study sites ('living labs') to:

1. Draw lessons learnt and share success stories from sites that were sometimes already designated as such 40 years ago,
2. Compare different management types sharing similar conservation and development objectives,
3. Study the interactions between people and nature: benefits (ecosystem services), perceptions, use, impacts, value, threats, … and
4. Develop management options based on research results.

There was and is a high interest among the "frontrunners " within UNESCO – MAB and MAB reserve managers to aim for a more modern management of the MAB reserves. This largely

boils down to more attention for the M of Man in MAB as in most, if not all, UNESCO-MAB sites, human pressure on ecosystems increased. Past (often violent) solutions to address these pressures top-down proved unsustainable (e.g. Mt. Elgon, Lake Manyara, Pendjari). The local MAB – managers realize that other pathways need to be explored and welcomed the fact that also UNESCO-MAB-HQ (Paris) was supporting that new pathway.

b) Positive feedback from MAB to EVAMAB and asking for more!

The EVAMAB project largely responded to the needs of UNESCO-MAB and was well appreciated by UNESCO headquarters and all stakeholders. EVAMAB scientists were invited to high level AFRIMAB meetings. The manual developed by the EVAMAB project should now be tested out by UNESCO-MAB members.
Other MAB reserves and their managers showed interest as well (e.g. Cogelsberg in South Africa, Lamto and Come in Ivory Coast, Luki and Yangambi in DRC, etc…). EVAMAB created a high level of anticipation for more.

c) EVAMAB: value for money and putting Belgian expertise in the global picture

A relatively small project like EVAMAB succeeded in creating momentum within UNESCO-MAB. The fact that EVAMAB – (Belgian) scientists looked for additional funding and pooled resources (links with past and present VLIR-UOS projects and CEBioS institutional partners) made that EVAMAB could box above its weight category.
The momentum – and further demand by UNESCO-MAB - is there. It is surprising that a small country like Belgium could have such an impact. It would be a relatively small investment to continue support for this project, because the doors at UNESCO-MAB are still wide open.

d) The multi-and trans-disciplinarity in EVAMAB is key to its success

The implementation of the MAB approach requests to address different complementary fields in order to reflect on both “M-man” and “B-biosphere” components. The combination of very complementary expertises present at the 4 institutes of the EVAMAB consortium with a real deep cooperation in the field was key to its success. Some examples amongst others:

- At AfriMAb – the Delphi (data collection) method was used, coming from the field of social-ecological-systems science
- Several semi-open or structured survey techniques were used in the different research components
- MAB manual: a diversity of topics was addressed in the different sites: economics – social sciences – natural sciences
- Workshops: multidisciplinarity opportunities, exchange of lessons learnt at the cross fertilizing workshop
- The use of Multi Criteria Decision Analysis in Benin to develop management options, at the same time diminishing existing tensions between stakeholders by creating a space for dialogue and information and perception exchange, as was also the case in Manyara NP.
- The strong Payment for Ecosystem Services (PES) approaches in Uganda and Ethiopia, playing with the local context and existing problems: Uganda: existing PES schemes on carbon and water with Belgian NGOs, Ethiopia: the invasive water hyacinth problem
- The science-policy interface in action through the workshops (scoping of information and restitution to stakeholders) and through the production of Policy Briefs.
- The high availability of students from KU Leuven, UA and VUB-ULB, due to the strong thematic link of EVAMAB with existing Master programs at these universities (e.g. Oceans and Lakes, Tropimundo, ICP Master of Science in Sustainable Development,

...). Therefore, research is a natural trigger, motivation and component in this productive consortium.

e) Extensive networks

Extensive network: the UNESCO-MAB programme offers an extensive network of actors (~700 MAB reserves!) across the world. It is a huge opportunity, including through network meetings such as AfriMAb meetings, to engage stakeholders at different stages of the research:

1. design (better understanding needs and field realities),
2. data collection (e.g. involving them in social science methods, knowledge collection, mapping perceptions),
3. facilitate validation and outreach (Validating and sharing research findings directly with people working on the field).

Diversity of the network: The Mab programme is the custodian of around 700 protected areas across the world, each having a particular ecosystem, protection status and management type. It offers an outstanding opportunity to compare sites with different or similar assets.

It has several advantages:

- Access to expertise of the UNESCO-MAB improves research and feedback can be taken into account to make research policy-relevant.
- Project work (including master theses) linked to UNESCO-MAB is also more appealing as it was easier to motivate students (and researchers) to collaborate in a famous and well-established international context and concept.
- Working at the MABs had the advantage that the system boundaries are (more or less) clear and there is already a general framework. Moreover, it helped to learn and do comparative analysis between MAB sites.

f) Outputs and outcomes to be proud of

- The 4 national workshops and the international workshop in Ethiopia proved to have a strong rallying and dynamising effect on the MAB community internally and between the MAB community and experts.
- The high visibility at AFRIMAB in Ibadan and Abidjan valorised this impact even more and strongly anchors Evamab in the lines of implementation of the Lima declaration.
- The manual for MAB managers meets high expectations and will be printed, disseminated and explained (provided earmarked funding available) in 2020.
- The project resulted in quite a few A1-papers and more are on the way.
- Evamab was presented in many international conferences and is planned to be prominently present at the next IUCN World Conference and the CBD COP15 in Kunming (side event), both in 2020, hence ensuring the visibility at the highest policy levels.

g) A bright future?

A follow-up of Evamab was recommended by the steering committee, especially for developing

- a dissemination strategy and implementation of the manual
- capacity building to train the MAB managers to use the manual adequately and in concrete situations
- continue research in domains such as green economy, PES, multi-stakeholder approaches, conflict mitigation, cultural values, etc...
- a promising new theme could be linking and adapting MAB – reserve management to climate change …. From EVAMAB to “CLIMAB”

5. DISSEMINATION AND VALORISATION

Figure 8 summarizes the outputs that were generated through the projects. Some (in yellow) are still in progress as they concern the valorisation of project results in scientific papers and a manual for MAB managers that still needs to go through the reading committee in 2020.

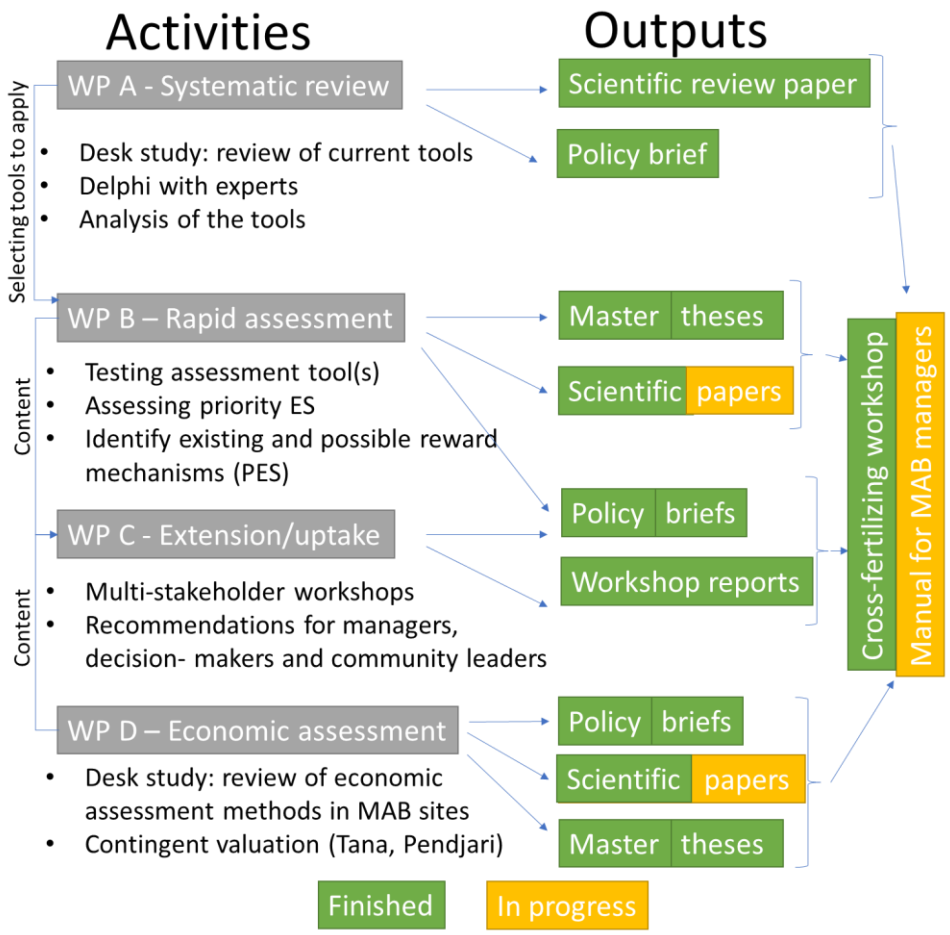


FIGURE 8: OVERVIEW OF OUTPUTS GENERATED BY THE PROJECT, RELATED TO PROJECT ACTIVITIES.

Results were also disseminated through various conferences and events.

5.1. Publications

5.1.1. *Peer reviewed publications*

Accepted:

- Geussens, K., G. Van den Broeck, K. Vanderhaegen, B. Verbist, and M. Maertens. 2019. "Farmers' Perspectives on Payments for Ecosystem Services in Uganda." *Land Use Policy* 84 (May): 316–27. https://doi.org/10.1016/J.LANDUSEPOL.2019.03.020. *(Annex 1)*
- Hugé J., Rochette A.-J., Parra Paitan C., de Béthune S., Vanderhaegen K., Vandervelden T., Van Passel S., Vanhove M., Verbist M., Waas T., Janssens I., Janssens de Bisthoven L., 2020. Ecosystem services assessment tools for African Biosphere Reserves: a user-informed classification. Accepted in the Journal Ecosystem Services on February 5th 2020. *(Annex 2)*
- Conservation News : Janssens de Bisthoven L., Rochette A., Verheyen E., Akpona T., Verbist B., Vanderhaegen K., Naturinda Z., Steven Van Passel S., Daregot Berihun D., Munishi L., Hugé, J. (2019). Conserving African biosphere reserves: A workshop on the valuation of ecosystem services in Man and the Biosphere Reserves. *Oryx, 53*(4), 609-609. doi:10.1017/S003060531900070X *(Annex 3)*

Submitted:

- Janssens de Bisthoven, L., Vanhove, M.P.M., Rochette, A.-J., Hugé, J., Verbesselt, S., Machunda, R., Munishi, L. d, Wynants, M., Steensels, A., Malan-Meerkotter, M., Henok, S., Nhiwatiwa, T., Casier, B., Kiwango, Y.A., Kaitila, R., Komakech, H., Brendonck, L. 2020. Social-ecological assessment of Lake Manyara basin, Tanzania: a mixed method approach. Re-submitted, after revision with major changes to Journal of Environmental Management on January 10th 2020. *(Annex 4)*

5.1.2. *Working papers (or peer-reviewed papers in preparation):*

- Azadi, H., Van Passel, S., Cools, J. Rapid Economic Valuation of Ecosystem Services in Man and Biosphere Reserves in Africa: A Review. Working paper. *(Annex 5)*
- DevCo & Carbon payments to realise a bundle of ecosystem services case Mt. Elgon
- Ejigu Tefera, N., Cools, J., Van Passel, S., Berihun, D. Identification, Characterization and Ranking of Ecosystem Services in Lake Tana basin: An application of toolkit for ecosystem services site-based assessment (TESSA). Working paper. *(Annex 6)*
- Gbedomon R.C., Akpona T.J.D.., Rochette A.-J.., Janssens de Bisthoven L., Hugé J., Vanhove M., Glele Kakaï R, 2020. A systematic review of ecosystem services research on the Pendjari Biosphere Reserve: current state and the road ahead. In prep. *(Annex 7)*
- Hugé J., Rochette A-J, Janssens I., Vanderhaeghen K., Verbist B., Janssens de Bisthoven L., 2020. Assessing ecosystem services: experiences from applying and adapting the TESSA tool in Africa and beyond. In preparation.
- Multiple-Criteria Decision analysis to select management options for ecosystem services in Pendjari Biosphere Reserves
- Van Oijstaeijen, W., Van Passel, S., Cools, J., Janssens, L., Hugé, J., Berihun, D., Ejigu, N., Nyssen, J. Farmers' preferences towards water hyacinth control in Lake Tana: a contingent valuation study. Working paper. Submitted to 'Environment, Development & Sustainability' in January 2020. To be re-submitted to other journal after revision. *(Annex 8)*

5.1.3. *Others*

a) **Policy briefs**

Two policy briefs were produced: one for Pendjari BR, that was distributed to the local partners and spread during the 2018 Stakeholders workshop, and one for Lake Tana BR, that was spread at the Closing workshop and distributed to the partners. The objective of such documents is to convey a simple message and to present results in a synthetic and visual way.

- Rochette A.J., Hugé J., Akpona T.J.D., Gbedomon R.C., Glèlè Kakaï R., Vanderhaegen K., Verbist B., de Ryck A., Janssens I., Goad D., Janssens de Bisthoven L.. Les services écosystémiques dans la Réserve de Biosphère de la Pendjari (Bénin). Policy brief. 2018. *(Annex 9)*
- Van Oijstaeijen W., Azadi H., Van Passel S.; Janssens de Bisthoven L.; Hugé J. The economic impact of water hyacinth infestation on farmers: Case of Lake Tana in Ethiopia. Policy brief. 2019.*(Annex 10)*

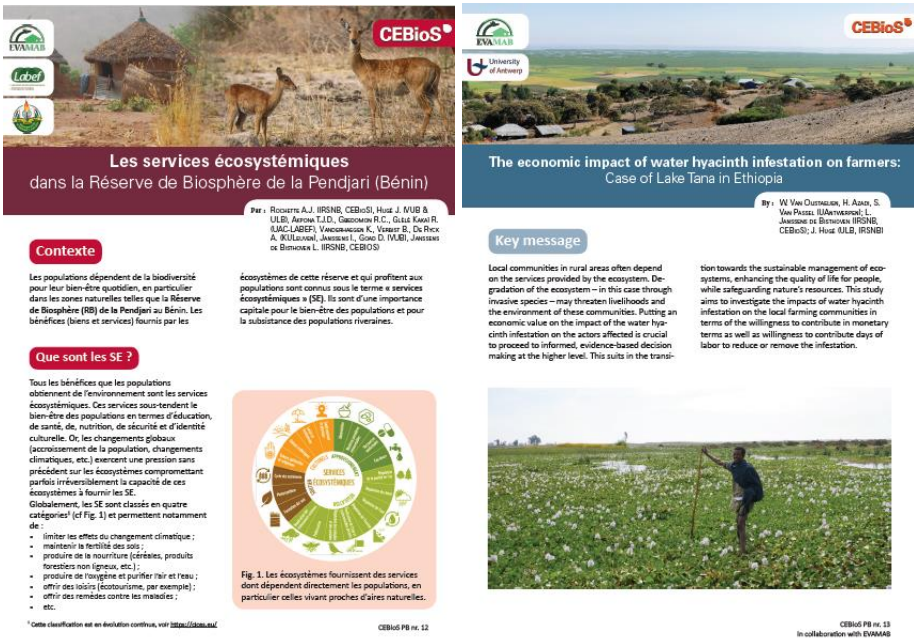


FIGURE 9: FIRST PAGES OF THE TWO POLICY BRIEFS CREATED FOR PENDJARI BR AND LAKE TANA BR

b) Posters

- Baeten S., Vanderhaege K., Maertens M., Verbist B. Trees for Global Benefits: the Analysis of a Smallholder PES project. Poster *(Annex 11)*
- Hugé J., Rochette A-J. Critical evaluation of rapid ecosystem services assessment tools in African Man & Biosphere Reserves. Poster presented at the 2018 Communities, Conservation & Livelihoods Conference (CCL) in Halifax, Canada. *(Annex 12)*

c) Master theses

- Amorgaste, A., Van Passel, S. Willingness to contribute for the protection and restoration of papyrus wetlands around Lake Tana, Ethiopia: a contingent valuation study. Master Thesis. Academic year 2018-2019. *(Annex 13)*
- Baeten, S. 2018. Trees for Global Benefits: the Analysis of a Smallholder PES Project in Uganda. Master thesis, Katholieke Universiteit Leuven, 100 pp. *(Annex 14)*
- Chaffa T.K. 2019. Evaluation économique de cinq Produits Forestiers Non Ligneux d'importance: Vitellaria paradoxa, Parkia biglobosa, Adansonia digitata, Diospyros mespiliformis et Tamarindus indica dans la Réserve de Biosphère de la Pendjari. Mémoire de Master, Université d'Abomey-Calavi, 81pp. *(Annex 15)*
- Claessens, H., Van Passel, S. A contingent valuation of non-market ecosystem services of agricultural land in Bahir Dar, Ethiopia. Master Thesis. Academic year 2019-2020. *(Annex 16)*
- De Ryck A., 2018. Payments for ecosystem services: an assessment of existing and possible reward mechanisms for ecosystem services in the Pendjari Biosphere Reserve, Benin. Master thesis, Katholieke Universiteit Leuven, 134 pp. *(Annex 17)*
- Fabri, Ch., Van Passel, S. Park dependency and its effect on park management attitudes: a case study of Pendjari Biosphere Reserve, Benin. Master Thesis. Academic year 2018-2019. *(Annex 18)*
- Geussens, K, 2018. Farmers' preferences for watershed conservation incentives in the Mt. Elgon region, Uganda. Master thesis, Katholieke Universiteit Leuven, 81 pp. *(Annex 19)*
- Goad D. 2019. Rapid ecosystem service assessment & conceptualization of conservation effectiveness in Pendjari National Park, Benin. Master thesis, VUB. 61 pp. *(Annex 20)*
- Hasaers, L., Van Passel, S. Factors influencing the compensation for reduced access to Pendjari Biosphere Reserve, Benin: a contingent valuation study. Master Thesis. Academic year 2018-2019. *(Annex 21)*
- Janssens I. 2019. Conservation conflict following a management shift in Pendjari National Park (Benin):a Q methodological study. Master thesis, VUB. 28pp. *(Annex 22)*
- Zerubabeeli N. 2018.Economic value of Mt. Elgon forest ecosystem services; A case of Bududa and Kapchorwa districts, Uganda. Master thesis, Busitema University, 142 pp. *(Annex 23)*

5.2. Workshops

Stakeholders workshops were conducted in each BR Reserve:

- **Pendjari BR**, see 3.3.1.**Error! Reference source not found. Error! Reference source not found.**
- **Lake Manyara BR**, see **Error! Reference source not found. Error! Reference source not found.** (Janssens de Bisthoven et al. 2020 – Annex 4)
- **Mount Elgon BR**, see 3.3.1 **Error! Reference source not found. Error! Reference source not found.**
- **Lake Tana BR**, see 3.2.5. **Error! Reference source not found. Error! Reference source not found.**

Cross-fertilizing workshop in Ethiopia (Annexes 3 (conservation news) and 26 (full report))

Near the end of the project, about 35 scientists and African Biosphere Reserves managers gathered in Bahir Dar (Ethiopia), between May 13 and May 17 2019, to present the results of the EVAMAB project (coordinated by CEBioS) and discuss ecosystem services in African Biosphere Reserves (BR). Participants came from Africa (Benin, Ethiopia, Ghana, Madagascar, Tanzania, Uganda), Europe (Belgium, France), Indonesia and Canada.

FIGURE 10: GROUP PICTURE WITH THE PARTICIPANTS OF THE CROSS-FERTILIZING WORKSHOP IN ETHIOPIA (13-17 MAY 2019)

Objectives

Key results of the EVAMAB project were presented to introduce the subject of ecosystem services (ES) in African Biosphere Reserves (BRs). A participatory approach gave the opportunity to all participants to draft recommendations about the assessment of ecosystem services, their economic value, and their incorporation in the management of African BR.

These are summarized in a manual aiming to support the management of African BR in favour of both Nature and People – using the ecosystem services approach. The workshop was also summarized in a Conservation News in Oryx (Annex 3).

Main outcomes

Key initiatives and results of the EVAMAB project were presented, such as payment for ecosystem services-initiatives in Uganda, community-based workshops held in Benin, Uganda, Tanzania and willingness-to-pay studies conducted among communities surrounding Lake Tana. They demonstrated the opportunity of using ecosystem services as a tool for clear communication, buy-in of conservation and development policies and international comparability.

The general format of the manual to be produced was agreed to be concise, easy to use, but not too general at the same time, enabling to take into account the specificity of the different MAB sites. It should also be useful to other stakeholders but MAB managers are the target audience of the manual. A policy brief should accompany such a manual, and training about using it would be highly desirable.

The participatory approach enabled to gather different points of views and information:

- Reasons for (not) using rapid ES assessment tools, such as the opportunity to involve stakeholders, the constraints of time, skills and budget, the legitimacy of results, etc.
- Possible entry points to feed the results of such tools into MAB Reserve management and ways to trigger change: communicating results to the stakeholders, co-designed action plans, mainstreaming of results in local by-laws, adapted communication channels,…
- Other ecosystem services-based approaches to complement the use of rapid ecosystem services assessment tools, such as the co-production of knowledge & dialogue (serious games, scenarios, etc), communication media (local media, goodwill ambassadors, local 'brands', sports contests, traditional events etc), traditional knowledge (sacred sites, importance of traditional leaders, etc).
- Main advantages and risks of the economic valuation of ecosystem services in support of the sustainable management of African BRs. Advantages cited include helping to diversify between economic activities, attracting funds and investments, designing compensation schemes, supporting appreciation and awareness of ES, etc. Risks cited include imbalance between existing methodologies for different ES, volatility in price of ES, potential underestimation, increasing the gap between suppliers and beneficiaries, etc.
- Most impactful stakeholders and how to reach them, which includes actors at the local, regional and national level, and is to be adapted to each context.
- Best practices, success stories, regarding the economic valuation of ecosystem services in African MAB Reserves and/or beyond.
- Success stories of research impacting decision making and conditions for research to be taken up by decision-makers.

5.3. The EVAMAB Manual

The project involved many MAB stakeholders, observed good practices, study cases related to ES and inspired the donor (BELSPO) and the benefiting programme (UNESCO-MAB). It became logical and a strong wish by UNESCO-MAB to summarize its findings in a user-friendly manual that would inspire and support MAB managers and other stakeholders to address ES in their MAB Reserves. It is entitled "African Man and Biosphere Reserves: guidance to assess ecosystem services". This manual intends to primarily reach the managers and administrators but also decision makers of African Biosphere Reserves, as they are on the field and need to take day to day decisions, defuse conflicts, be in dialogue with many stakeholders, and promote the protection of biodiversity.

It is one of the main outputs of EVAMAB and its content was produced based on EVAMAB activities:

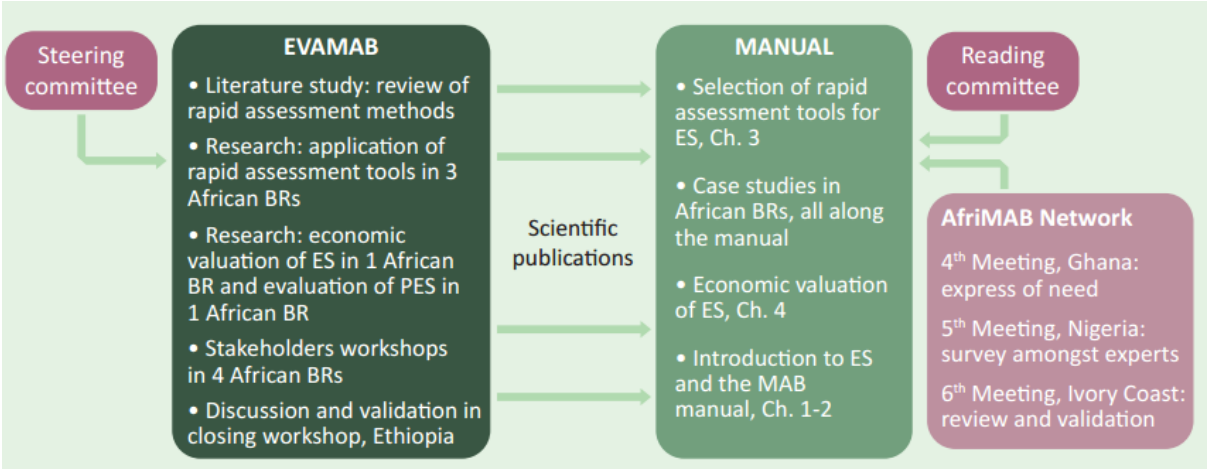


FIGURE 11: LINK BETWEEN EVAMAB ACTIVITIES AND THE MANUAL CONTENT.

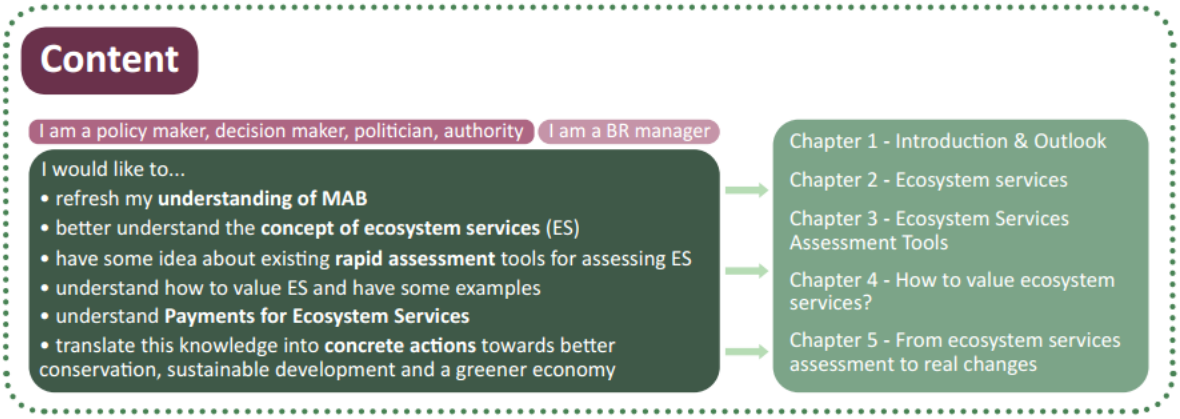


FIGURE 12:CONTENT OF THE MANUAL

The objectives are

- To outline the significance of ecosystem services for the management of African BRs ;
- To increase the awareness, knowledge and use of ecosystem services among stakeholders involved with African BRs ;
- To serve as a support & background document for the AfriMAB network and beyond ;
- To serve as a transfer mechanism for key principles and approaches of ES in BRs ;
- To maintain sustainably ecosystems and their services in BRs and support the management of BRs in favour of both Nature and People ;
- To be a milestone in a process of continuous learning.

Steps for the development of the manual:

- Closing workshop in Ethiopia: About 35 scientists and African BRs managers gathered in Ethiopia discuss priorities for this manual: its format and content.
- The draft manual was presented at the AfriMAB meeting in Abidjan (October 2019), with representatives of the AfriMAB network.
- A reading committee will still have the opportunity to review and validate the content of the manual. We hope to have the final manual ready in 2020, and present it during a side event at the CBD COP 15.
- CEBioS intends to present EVAMAB at the IUCN World Congress in Marseille in June 2020 (postponed to 2021 due to coronavirus).

5.4. Videos

Interviews of participants were filmed during the Closing Workshop in Ethiopia. They were used to create short video clips, which are now published on the CEBioS Youtube channel : https://www.youtube.com/channel/UCp9IYI9IsQjYugUFddS9O4Q. They are showed during presentations about EVAMAB, and disseminated through the EVAMAB and CEBioS website, as well as through the CEBioS Facebook page.

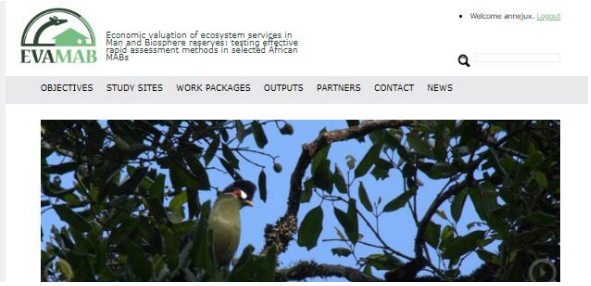
5.5. Events

The project and its key results were presented during different conferences and meetings:

- AfriMAB meeting, September 2017 (Nigeria). Koen Vanderhaegen presented the EVAMAB project and organized the Delphi survey of WP A among the participants.
- Ecosystem Services Partnership (ESP) regional conference - Africa 2019 *(Togo, June 2019), entitled "Management of ES for Nature Conservation and Human Wellbeing in Africa".* Session hosted by our Beninese partner T.J.D. Akpona about "Rapid ecosystem services assessment tools in Africa: where are we now and where are we heading?" with presentations of EVAMAB results:
    - Rapid ecosystem services assessment tools in African Man & Biosphere reserves
    - Willingness to contribute for water hyacinth control in villages around Lake Tana, Ethiopia: a contingent valuation study
    - Lake Manyara basin, assessment of a complex socio-ecological system through a multistakeholder approach
    - A systematic review of ecosystem services research on the Pendjari Biosphere Reserve: current state and the way forward.
- AfriMAB meeting (Ivory Coast, 2019). Presentation of the project and the manual, as well as participatory session to discuss manual content (L. Janssens de Bisthoven and K. Vanderhaegen).*(Annoucement of the manual distributed – see Annex 25)*
    - EVAMAB: présentation du projet et du manuel pour l'évaluation des services écosystémiques dans les RBs africaines
    - EVAMAB - Interaction avec les participants sur le manuel EVAMAB
- ESP World Conference 10 (Hanover, 21-25 October 2019), with two presentations:
    - Selecting and applying ecosystem services assessment tools in African Man and Biosphere Reserves (Jean Hugé)
    - Rapid ecosystem services assessment in practice: Applying the TESSA tool in African Biosphere Reserves (Iliana Janssens)

5.6. Website

News and publications are regularly added to the EVAMAB website: http://www.biodiv.be/evamab/ and communicated through CEBioS Facebook page https://www.facebook.com/RBINS.CEBioS/



6. WERE OBJECTIVES MET?

Here we copied the objectives as they were in the EVAMAB proposal and detailed their level of achievement.

Expected research results	**Achieved ?**
A review of ecosystem services rapid valuation metrics related to selected representative UNESCO-MAB sites;	A literature review for each site was conducted but no specific reviews of the metrics because it did not seem relevant.
A recommendation for a set of rapid assessment method and tools of ES linked to biodiversity, hydrology and carbon for four African UNESCO-MAB sites;	The tools review recommends tools for all African BRs, not specifically for the 4 study sites.
A recommendation for the most appropriate reward mechanisms for at least one UNESCO-MAB site, Lake Tana in Ethiopia;	A specific topic was further investigated in Lake Tana: water hyacinths removal. The principles of Payments for Ecosystem Services are simple: the ecosystem service providers should be rewarded by the ecosystem service users. A payment – which has to be more than the additional benefits of the alternative land use – by the beneficiaries can convince landowners to conserve the forest. At the same time, it must be less than the value of the benefit to the downstream population, otherwise they would not be willing to pay for it.
A more general upscaling for a regional and global approach to BRs worldwide, but with special emphasis on AfriMAB based on the local and regional lessons learned and best practices.	The EVAMAB manual used a regional approach for African BRs and consider reward mechanism in its chapter 5.
In total at least 4 A1 scientific papers are expected: 1. a review paper with an assessment of the tested decision support tools; 2.an economic paper with an assessment of the valuation methods. For at least 2 sites 2 more detailed papers will be produced that compare rapid and slower methods allowing an assessment of the quality of rapid approaches.	See list of publications, more than 4 scientific papers will be published.
For each MAB - site a policy brief will be produced based on the research results.	We produced policy briefs for 2 over 4 sites, due to timing reasons and dissemination possibilities.
The recommendations from the research and the multi-stakeholder workshops will be summarized in several international fora and media, such as side events at SBSTTA, COP and IUCN World Congress, best practices in OECD-DAC manuals and of course through all UNESCO-MAB relevant events/meetings (International coordinating Council, MAB networks meetings...)	Projects results were disseminated in different conferences, mainly related to Ecosystem Services Research and to the AfriMAB network. COP 15 in October 2020 is seriously envisaged for presenting the main project output (the manual). Idem for the IUCN World Congress in Marseille, June 2020.
The multidisciplinary character of the EVAMAB approach might lead to new scientific insights concerning both the stakeholder engagement methodology and the valuation of ecosystem services, or a combination of both.	In particular in Pendjari BR, multidisciplinarity was experienced as social, biological and economic methods were combined and relied on each others' results.
Expected impacts of the research	
It will make UNESCO-MAB better aware of tools and methods to realise the local potential of PES in UNESCO-MAB sites in Africa to capitalise on ecosystem services for a better socio-economic	The EVAMAB manual that is intended for UNESCO MAB in Africa presents in a user friendly way the tools and economic

integration of conservation and a better conservation of biodiversity, based on state-of-the-art stakeholders' engagement.	valuation methods that can help contribute to the sustainable management of BRs.
UNESCO has some guidelines for a more appropriate use of rapid assessment tools of ES in other UNESCO-MAB sites in Africa and globally.	The EVAMAB manual has a specific chapter for choosing the best suited tool among rapid assessment tools that are suitable for African BRs.
The best practices and lessons learned from the RUPES project in Southeast Asia and the PRESA project in East Africa are transferred to the 4 selected MAB sites.	Major results from both RUPES and PRESA were that in many – if not most - cases a 'full' market mechanism was hard to develop. Nevertheless, the joint exploration on who are ecosystem service providers and beneficiaries helped to get a mutual understanding between different groups. Depending on the location – and the level and phase of conflicts the proposed PES approaches helped to resolve conflicts and obtain a more sustainable ecosystem resource use.
In four UNESCO-MAB sites where the multi-stakeholders engagement, validation and uptake took place, stakeholders are more aware of the conservation potential of their MAB site and effective actions to consider in decision-making processes.	Results were presented and discussed in all 4 study sites together with local stakeholders and managers. In particular in Pendjari management options were collectively selected with the presence of MAB managers. In the Elgon area it became clear during the stakeholder workshop that there was a large communication gap between stakeholders and that there were interesting lessons to be learnt from each other. The MAB managers learnt and took inspiration from positive actions taken just outside their judiciary area.
The perspectives of sellers, buyers and intermediaries in typical UNESCO-MAB sites are better understood and also better linked to possible gender differences.	Perspectives of sellers, buyers and intermediaries were especially documented for the carbon market and tourism in Pendjari, carbon market and water in Mount Elgon, and for Water hyacinth removal in Lake Tana.
For biodiversity, hydrology and carbon, monetary value of ecosystem services is better understood and estimated for 4 UNESCO-MAB sites in Africa.	The different valuation cases in Lake Tana and Pendjari clearly showed the possibilities and limitations of the economic valuation of ecosystem services in African MABs. An important lesson was that in some cases (Elgon) the demand prices to change management practices were too high for what a local market could provide. It is clear that in those cases other measures than PES are needed and that we saw the limit of PES.
The recommendation of a most appropriate reward mechanism for Lake Tana will incite local and national authorities to design sustainable PES schemes in the area and can serve as a basis for extrapolation to other MAB sites.	With the support of the Rewarding Upland Poor for Environmental Services (RUPES) program, the private company provided incentives for the local population to conserve the protected forests. In this way, both water flow to the dam and the sustainable livelihood of the local population is ensured. The amount of payment made is based on the turbidity reduction which is a consequence of the conservation actions, but also nonmonetary compensations are included in the PES scheme.

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8. REFERENCES

- Amare, D., Endalew, M., Debas, T., Demissew, A., & Temesgen, K. (2018). Fishing Condition and Fishers Income: The case of Lake Tana, Ethiopia. *Int J Aquac Fish Sci, 4*(1), 006-009.
- Amorgaste, A., Vvan Passel, S. Willingness to contribute for the protection and restoration of papyrus wetlands around Lake Tana, Ethiopia: a contingent valuation study. Master Thesis. Academic year 2018-2019.
- Anteneh, W., Miwuyelet, M., Ayalew, W., Dereje, T., Woldegebrael, W., Addisalem, A., & Wondie, E. (2014). *Water hyacinth coverage survey report on Lake Tana*. Retrieved from http://www.bdu.edu.et/sites/default/files/publication/Water_Hyacinth_Lake%20Tana_Report%20Series%201.pdf
- Azadi, H., Van Passel, S., Cools, J. Rapid Economic Valuation of Ecosystem Services in Man and Biosphere Reserves in Africa: A Review. Working paper.
- Bagstad, K.J., Semmens, D.J., Waage, S., Winthrop, R., 2013. A comparative assessment of decision-support tools for ecosystem services quantification and valuation. Ecosystem Services 5, 27–39. doi:10.1016/j.ecoser.2013.07.004
- Baeten S., Vanderhaege K., Maertens M., Verbist B. Trees for Global Benefits: the Analysis of a Smallholder PES project. Poster
- Baeten, S. 2018. Trees for Global Benefits: the Analysis of a Smallholder PES Project in Uganda. Master thesis, Katholieke Universiteit Leuven, 100 pp.
- Ball, I.R., H.P. Possingham, and M. Watts. 2009. Marxan and relatives: Software for spatial conservation prioritisation. Chapter 14: Pages 185-195 in Spatial conservation prioritisation: Quantitative methods and computational tools. Eds Moilanen, A., K.A. Wilson, and H.P. Possingham. Oxford University Press, Oxford, UK.
- Bayliss, J., Schaafsma, M., Balmford, A., Burgess, N.D., Green, J.M.H., Madoffe, S., Okayasu, S., Peh, K., Platts, P., Yu, D. (2014). The current and future value of nature-based tourism in the Eastern Arc Mountains of Tanzania.Ecosyst. Serv. 8: 75–83.
- Benitez-Capistros, F.B., Hugé J., Koedam N. (2014). Environmental impacts on the Galapagos Islands: identification of interactions, perceptions and steps ahead. Ecological Indicators 38, 113-123.
- Birdlife International (2018). Important Bird Areas factsheet: Lake Manyara. http://datazone.birdlife.org/site/factsheet/lake-Manyara-iba-tanzania. Accessed on Oct 4, 2018.
- Blake W.H., Rabinovich A., Wynants M., Kelly C., Nasseri M., Ngondya I., Patrick A., Mtei K., Munishi L., Boeckx P., Navas A., Smith H., Gilvear D., Wilson G., Roberts, N., Ndakidemi P. (2018). Soil erosion in East Africa: an interdisciplinary approach to realising pastoral land management change. Environ. Res. Lett. 13 (12).
- Bogner A., Littig B, Menz W. (2009). *Interviewing experts*. Palgrave McMillan. NYC, USA & Houndmills, UK.
- Boumans, R., Roman, J., Altman, I., Kaufman, L., 2015. The Multiscale Integrated Model of Ecosystem Services (MIMES): Simulating the interactions of coupled human and natural systems. Ecosystem Services 12, 30–41. https://doi.org/10.1016/j.ecoser.2015.01.004
- Cardinale, B.D., Duffy, E., Gonzalez, A., Hooper, D.U., Perrings, C., Venail, P., Narwani, A., Mace, G.M., Tilman, D., Wardle, D.A., Kinzig, A.P., Daily, G.C., Loreau, M., Grace, J.B., Larigauderie, A., Srivastava, D.S., Naeem, S., 2012. Biodiversity loss and its impact on humanity. Nature 486, 49–57.
- Cavan, G., Lindley, S., Jalayer, F., Yeshitela, K., Pauleit, S., Renner, F., Gill, S., Capuano, P., Nebebe, A., Woldegerima, T., Kibassa, D., Shemdoe, R. (2014). Urban morphological determinants of temperature regulating ecosystem services in two African cities.Ecol. Ind. 42: 43–57.
- CENAGREF, 2005. Plan d'Aménagement Participatif et de Gestion de la Réserve de Biosphère de la Pendjari, 83p.
- CENAGREF. (2009). *Plan d 'Aménagement Participatif et de Gestion de la Réserve de Biosphère de la Pendjari 2004 – 2013*. Retrieved from www.pendjari.net/IMG/pdf/pag_pendjari_2009.pdf
- CENAGREF, 2016. Plan d'Aménagement et de Gestion Participatif de la Réserve de Biosphère de la Pendjari. Programme d'Appui aux Parcs de l'Entente, Composante 2. Cotonou, Bénin, 158 p.
- Chaffa T.K. 2019. Evaluation économique de cinq Produits Forestiers Non Ligneux d'importance: Vitellaria paradoxa, Parkia biglobosa, Adansonia digitata, Diospyros mespiliformis et Tamarindus

indica dans la Réserve de Biosphère de la Pendjari. Mémoire de Master, Université d'Abomey-Calavi, 81pp.

- Claessens, H., Van Passel, S. A contingent valuation of non-market ecosystem services of agricultural land in Bahir Dar, Ethiopia. Master Thesis. Academic year 2019-2020.
- Cordeiro, N.J., 1990. A provisional annotated checklist of the butterflies in Lake Manyara National Park, Arusha region, Tanzania. Journal of the East Africa Natural History Society and National Museum, 80 (196), 25-41.
- Costanza, R., de Groot, R., Braat, L., Kubiszewski, I., Fioramonti, L., Sutton, P., Farber, S., Grasso, M., 2017. Twenty years of ecosystem services: how far have we come and how far do we still need to go? Ecosyst. Serv. 28, 1–16.
- Co$ting Nature, 2018 http://www.policysupport.org/costingnature
- Cuong, C.V., Dart, P., Hockings, M., 2017. Biosphere reserves: attributes for success. J. Environ. Manage. 188, 9–17.
- Davenport, N.A., Shackleton, C.M., Gambiza, J. (2012). The direct use value of municipal commonage goods and services to urban house-holds in the Eastern Cape, South Africa. Land Use Policy 29 (3): 548–557.
- Defra (2007). An introductory guide to valuing ecosystem services. PB12852.
- De Ryck A., 2018. Payments for ecosystem services: an assessment of existing and possible reward mechanisms for ecosystem services in the Pendjari Biosphere Reserve, Benin. Master thesis, Katholieke Universiteit Leuven, 134 pp.
- De Wit, M., van Zyl, H., Crookes, D., Blignaut, J., Jayiya, T., Goiset, V., Mahumani, B. (2012). Including the economic value of well-functioning urban ecosystems in financial decisions: evidence from a process in Cape Town.Ecosyst. Serv. 2: 38–44.
- DPNP. (2016). Rapport synthèse de l'analyse des fiches de suggestion des visiteurs du Parc National de la Pendjari.
- Drakou, E.G., Crossman, N.D., Willemen, L., Burkkhard, B., Palomo, I., Maes, J., Peedell, S. 2015. A visualization and data-sharing tool for ecosystem service maps: Lessons learnt, challenges and the way forward. Ecosystem Services 13 (2015) 134-140.
- DTIS, 2016. Tourism draft report for the DTIS, pp. 31.
- Dudley, N. & Stolton, S. (2009): The Protected Areas Benefits Assessment Tool. A methodology, WWF – World Wide Fund for Nature, Gland.
- Duku, C., Rathjens, H., Zwart, S.J. & Hein, L. 2015. Towards ecosystem accounting: a comprehensive approach to modelling multiple hydrological ecosystem services. Hydrology and Earth System Sciences, 19, 4377–4396.
- Ejigu Tefera, N., Cools, J., Van Passel, S., Berihun, D. Identification, Characterization and Ranking of Ecosystem Services in Lake Tana basin: An application of toolkit for ecosystem services site-based assessment (TESSA). Working paper.
- Elisa, M., Gara, J.I., Wolanski, E. (2011). A review of the water crisis in Tanzania's protected areas, with emphasis on the Katuma River-Lake Rukwa ecosystem. Ecohydrol.Hydrobiol. 10 (2): 153–166.
- Estoque, R.C. & Murayama, Y. 2012. Examining the potential impact of land use/cover changes on the ecosystem services of Baguio city, the Philippines: A scenario-based analysis. Applied Geography, 35, 316–326.
- Fabri, Ch., Van Passel, S. Park dependency and its effect on park management attitudes: a case study of Pendjari Biosphere Reserve, Benin. Master Thesis. Academic year 2018-2019.
- Fegraus, E.H., Zaslavsky, I., Whitenack, T., Dempewolf, J., Ahumada, J.A., Lin, K. & Andelman, S.J. 2012. Interdisciplinary Decision Support Dashboard: A New Framework for a Tanzanian Agricultural and Ecosystem Service Monitoring System Pilot. IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, 5(6), 1700–1708.
- Fisher, J.A., Patenaude, G., Giri, K., Lewis, K., Meir, P., Pinho, P., Rounsevell, M.D.A., Williams, M., 2014. Understanding the relationships between ecosystem services and poverty alleviation: a conceptual framework. Ecosyst. Serv. 7, 34–45.
- Floquet, A. (2011). Contributions of the Existence of Protected Areas in Benin. In C. R. Heredia (Ed.), The Contributions of Protected Areas to the Economic and Social Development in Bhutan, Costa Rica and Benin (pp. 299–350). Program of South-South Cooperation.
- Gaillard J. and Knoops J. 2018. Land use changes in and around Pendjari National Park (North-Benin). Report of the Land Cover and Land Use Monitoring (2017-2018) Assignment 2, Katholieke Universiteit Leuven, 19pp.

- German Federal Agency of Nature Conservation, 2011. Report of the International Expert Workshop on 'Managing Challenges of Biosphere Reserves in Africa'. Available at: https://www.bfn.de/fileadmin/MDB/documents/themen/internationalernaturschutz/2011_AfriBR_DiscussionResults.pdf. Last accessed March 9, 2018.
- Geussens, K, 2018. Farmers' preferences for watershed conservation incentives in the Mt. Elgon region, Uganda. Master thesis, Katholieke Universiteit Leuven, 81 pp.
- Geussens, K., G. Van den Broeck, K. Vanderhaegen, B. Verbist, and M. Maertens. 2019. "Farmers' Perspectives on Payments for Ecosystem Services in Uganda." Land Use Policy 84 (May): 316–27. https://doi.org/10.1016/J.LANDUSEPOL.2019.03.020.
- GIZ. 2012. Economic Valuation of Ecosystem Services. Federal Ministry for Economic Cooperation and Development (BMZ). https://www.giz.de/expertise/downloads/giz2013-en-biodiv-economic-valuation-ecosystem-services.pdf
- Goad D. 2019. Rapid ecosystem service assessment & conceptualization of conservation effectiveness in Pendjari National Park, Benin. Master thesis, VUB. 61 pp.
- Grêt-Regamey, A., Sirén, E., Brunner, S.H., Weibel, B., n.d. Review of decision support tools to operationalize the ecosystem services concept. Ecosystem Services. doi:10.1016/j.ecoser.2016.10.012
- Hanson, C., J. Ranganathan, C. Iceland, and J. Finisdore. 2012. The Corporate Ecosystem Services Review: Guidelines for Identifying Business Risks and Opportunities Arising from Ecosystem Change. Version 2.0. Washington, DC: World Resources Institute.
- Harrison, P.A., Holman, I.P. & Berry, P.M. 2015. Assessing cross-sectoral climate change impacts, vulnerability and adaptation: an introduction to the CLIMSAVE project. Climatic Change, 128, 153–167.
- Harvey, N., Holmes, C.A., 2012. Nominal group technique: An effective method for obtaining group consensus. Int. J. Nurs. Pract. 18, 188–194. https://doi.org/10.1111/j.1440-172X.2012.02017.x
- Hasaers, L., Van Passel, S. Factors influencing the compensation for reduced access to Pendjari Biosphere Reserve, Benin: a contingent valuation study. Master Thesis. Academic year 2018-2019.
- Helmholtz Centre for Environmental Research-UF, Leipzig, 2018. SITE, accessed 20/07/2018 - (online: www.ufz.de/index.php?en=19080)
- Hicks, C.C., Graham, N.a., Cinner, J.E. (2013). Synergies and tradeoffs in how managers, scientists, and fishers value coral reef ecosystem services. Global Environ. Change 23 (6): 1444–1453.
- Huge, J., Van Puyvelde, K., Munga, C., Dahdouh-Guebas, F., Koedam, N., 2018. Exploring coastal development scenarios for Zanzibar: a local microcosm-inspired Delphi study. Ocean Coast. Manag. 158, 83–92.
- Hugé J., Mukherjee N. (2018). The nominal group technique in ecology & conservation: application and challenges. Methods Ecol. Evol., 9 (2018), pp. 33-41. https://doi.org/10.1111/2041-210X.12831.
- Hugé J., Rochette A., de Béthune S., Parra Paitan C., Vanderhaegen K., Vandervelden T., Van Passel S., Vanhove M.P.M., Verbist B., Verheyen D., Waas T., Janssens I., Janssens de Bisthoven L. (2020). Ecosystem services assessment tools for African Biosphere Reserves: A review and user-informed classification. Ecosystem Services 42. https://www.sciencedirect.com/science/article/abs/pii/S2212041620300218
- IPBES, 2018. Summary for Policymakers of the Regional Assessment on Biodiversity and Ecosystem Services for Africa of the Intergovernmental Science-Policy Platform on Biodiversity & Ecosystem Services. IPBES Secretariat, Bonn, Germany.
- IUCN, 2018. Tools for measuring, modelling and valuing ecosystem services. Guidance for Key Biodiversity Areas, natural World Heritage Sites, and protected areas. Best Practices Protected Areas Guidelines N° 28. Gland, Switzerland.
- Jahn T., Bergmann N., Keil F. (2012). Transdisciplinarity: between mainstreaming and marginalization. Ecological Economics 79, 1- 10.
- Janssens I. 2019. Conservation conflict following a management shift in Pendjari National Park (Benin):a Q methodological study. Master thesis, VUB. 28pp.
- Janssens de Bisthoven L., Rochette A., Verheyen E., Akpona T., Verbist B., Vanderhaegen K., Naturinda Z., Steven Van Passel S., Daregot Berihun D., Munishi L., Hugé, J. (2019). Conserving African biosphere reserves: A workshop on the valuation of ecosystem services in Man and the Biosphere Reserves. Oryx, 53(4), 609-609. doi:10.1017/S003060531900070X

- Janssens de Bisthoven, L., Vanhove, M.P.M., Rochette, A.-J., Hugé, J., Verbesselt, S., Machunda, R., Munishi, L. d, Wynants, M., Steensels, A., Malan-Meerkotter, M., Henok, S., Nhiwatiwa, T., Casier, B., Kiwango, Y.A., Kaitila, R., Komakech, H., Brendonck, L. 2020. Social-ecological assessment of Lake Manyara basin, Tanzania: a mixed method approach. Re-submitted to Journal of Environmental Management on January 10th 2020.
- Kideghesho J.R., Rija A.A., Mwamende K.A., Selemani I.S. (2013). Emerging issues and challenges in conservation of biodiversity in the rangelands of Tanzania. Nature Conservation 6, 1–29.
- Kiwango, Y. (2009). Hot springs of Lake Manyara National Park. In TANAPA Today, May 2009 Issue 004. TANAPA, Tanzania.
- Kohtala, C. 2015. Addressing sustainability in research on distributed production: an integrated literature review. Journal of Cleaner Production 106: 654-668.
- Landsberg, F., S. Ozment, M. Stickler, N. Henninger, J. Treweek, O. Venn, and G. Mock (2011): Ecosystem Services Review for Impact Assessment: Introduction and Guide to Scoping. WRI Working Paper. World Resources Institute, Washington DC.
- Landsberg, F., Treweek, J., Stickler, M.M., Henninger, N. & Venn, O. 2014. Weaving ecosystem services into impact assessment. A step-by-step method. World Resources Institute.
- Lind, B. M., Friedline, C. J., Wegrzyn, J. L., Maloney, P. E., Vogler, D. R., Neale, D. B., & Eckert, A. J. (2017). Water availability drives signatures of local adaptation in whitebark pine (Pinus albicaulis Engelm.) across fine spatial scales of the Lake Tahoe Basin, USA. *Mol Ecol, 26*(12), 3168-3185. doi:10.1111/mec.14106
- Loibooki, B (2008), Report presented to the Parliament Committee on Natural Resources and Environment on a visit to Lake Manyara National Park on 27Th August 2008.
- Loth, P.E. and H.T Prins, 1986. Spatial patterns of the landscape and vegetation of Lake manyara National Park. ITC Journal 2, 115-130.
- Mace, G.M., 2014. Whose conservation? Science 345, 1558–1560.
- MacKenzie, C. A. Filtered meaning: appreciating linguistic skill, social position and subjectivity of interpreters in cross-language research. *Qual. Res.***16,** 167-182 (2016).
- Maes, J., Hauck, J., Paracchine, M., Ratamaki, L.O., Hutchins, M., Termansen, M., Furman, E., Perez-Soba, M., Braat, L., Bidoglio, G., 2013. Mainstreaming ecosystem services into EU policy. Curr. Opinion Environ. Sustain. 5, 128–134.
- Martinez-Harms, M.J., Quijas, S., Merenlender, A., Balvanera, P., 2016. Enhancing ecosystem services maps combining field and environmental data. Ecosyst. Serv. 22, 32–40.
- McCauley, D. J. (2006). Selling out on nature. *Nature*, *443*(7107), 27.
- Millenium Ecosystem Assessment, 2005. Ecosystem and human well-being: biodiversity synthesis. World resources Institute, Washington DC, pp. 86.
- Mukherjee, N., Huge, J., Sutherland, W., McNeill, J., Van Opstal, M., Dahdouh-Guebas, F., Koedam, N., 2015. The Delphi technique in ecology and biological conservation: applications and guidelines. Methods Ecol. Evol. 6, 1097–1109.
- Müller F., Burkhard B. (2012). The indicator side of ecosystem services. Ecosystem Services 1 (2012) 26–30.
- Muthee, K. W., Mbow, Ch., Macharia, G. M., eal-Filho, W. 2017. Ecosystem services in adaptationprojects in West Africa. International Journal of Climate Change Strategies and Management. DOI 10.1108/IJCCSM-06-2017-0140
- Myers, M., Mittermeier, R.E., Mittermeier, C.G., da Fonseca, G.A.V.B., Kent, J., 2000. Biodiversity hotspots for conservation priorities. Nature 403, 853–858.
- Namaalwa, S., Van dam, A.A., Funk, A., Ajie, G.S., Kaggwa, R.C. (2013). A characterization of the drivers, pressures, ecosystem functions and services of Namatala wetland, Uganda. Environ. Sci. Policy 34: 44–57.
- Natural Economy Northwest, CABE, Natural England, Yorkshire Forward, The Northern Way, Design for London, Defra, Tees Valley Unlimited, Pleasington Consulting Ltd, and Genecon LLP (2010). Building natural value for sustainable economic development: Green Infrastructure Valuation Toolkit. Version 1.4. http://bit.ly/givaluationtoolkit
- Ness, B., Anderberg, S., & Olsson, L. (2010). Structuring problems in sustainability science: The multi-level DPSIR framework. *Geoforum*, *41*(3), 479–488. https://doi.org/10.1016/j.geoforum.2009.12.005
- Ngana J.O., Mwalyosi R.B.B., Yanda P., Madulu N.F. (2004). Strategic development plan for integrated water resources management in Lake Manyara sub-basin, North-Eastern Tanzania. Physics and Chemistry of the Earth 29, 1219–1224.

- Njole M. (2011). Tourism for sustainable local livelihood and nature conservation. A *Case of Lake Manyara* National Park. Master thesis, Wageningen University, pp. 151.
- Nonga, H.E., Mdegela, R.H., Lie, E., Sandvik, M., and Skaare, J. U., 2010. Socio-economic values of wetland resources around lake Manyara, tanzania: assessment of environmental threats and local community awareness on environmental degradation and their effects. Journal of Wetlands Ecology, (2010) Vol. 4, pp 83-101.
- Oosterbroek, B., de Kraker, J., Huynen, M.M.T.E., Martens, P., 2016. Assessing ecosystem impacts on health: A tool review. Ecosystem Services 17, 237–254. doi:10.1016/j.ecoser.2015.12.008
- Ostrom E. (2009). A general framework for analyzing the sustainability of social-ecological systems. Science 325, Issue 5939, 419-422. DOI: 10.1126/science.1172133.
- Pabon-Zamora, L., J. Bezaury, F. Leon, L. Gill, S. Stolton, A. Grover, S. Mitchell and N. Dudley. 2008. “Nature’s Value: Assessing protected area benefits.” Quick Guide Series, ed. J. Ervin. Arlington, VA: The Nature Conservancy. 34 pp.
- Palomo I., Martin-Lopez B., Potschin M., Haines-Young R., Montes C. (2013). National parks, buffer zones and surrounding lands: mapping ecosystem service flows. Ecosystem services 4, 104-116.
- Pandeya, B., Buytaert, W., Zulkafli, Z., Karpouzoglou, T., Mao, F., Hannah, D.M., 2016. A comparative analysis of ecosystem services valuation approaches for application at the local scale and in data scarce regions. Ecosystem Services, Integrated valuation of ecosystem services: challenges and solutions 22, Part B, 250–259. doi:10.1016/j.ecoser.2016.10.015
- Parra, C. 2017. Tools for the rapid assessment of ecosystem services. Professional internship report, Vrije Universiteit Brussel, 33pp.
- Peh, K.S.-H., Balmford, A., Bradbury, R.B., Brown, C., Butchart, S.H.M., Hughes, F.M.R., Stattersfield, A., Thomas, D.H.L., Walpole, M., Bayliss, J., Gowing, D., Jones, J.P.G., Lewis, S.L., Mulligan, M., Pandeya, B., Stratford, C., Thompson, J.R., Turner, K., Vira, B., Willcock, S., Birch, J.C., 2013. TESSA: A toolkit for rapid assessment of ecosystem services at sites of biodiversity conservation importance. Ecosystem Services 5, 51–57. doi:10.1016/j.ecoser.2013.06.003
- Pool-Stanvliet R., Clüsener-Godt M. (eds), (2013). AfriMAB. Biosphere Reserves in Sub-Saharan Africa: Showcasing Sustainable Development, pp. 333.
- Reyers, B., Cowling, R., Egoh, B., Le Maitre, D., Vlok, J. (2009). Ecosystem services, land-cover change, and stakeholders: finding a sustainable foothold for a semiarid biodiversity hotspot. Ecol. Soc. 14(1): 38.
- Rochette A.J., Hugé J., Akpona T.J.D., Gbedomon R.C., Glèlè Kakaï R., Vanderhaegen K., Verbist B., de Ryck A., Janssens I., Goad D., Janssens de Bisthoven L.. Les services écosystémiques dans la Réserve de Biosphère de la Pendjari (Bénin). Policy brief. 2018.
- Rose D. C., Brotherton P. N., Owens S., Pryke T. (2016). Honest advocacy for nature: presenting a persuasive narrative for conservation. Biodiversity and Conservation, 1-21.
- Ruckelshaus, M., McKenzie, E., Tallis, H., Guerry, A., Daily, G., Kareiva, P., 2015. Notes from the field: lessons learned from using ecosystem services approaches to inform real-world decisions. Ecol. Econ. 115, 11–21.
- Sarrazin, F. & Lecomte, J. 2016. Evolution in the Anthropocene. Taking account of the evolutionary effects of human actions is crucial for humans and non-humans. Science, vol. 351, issue 6276.
- Schaffler, A., Swilling, M., 2013. Valuing green infrastructure in an urban environment under pressure – the Johannesburg case. Ecol. Econ. 86: 246–257.
- Sherrouse, B.C., and Semmens, D.J., 2015. Social values for ecosystem services, version 3.0 (SolVES 3.0)—Documentation and user manual: U.S. Geological Survey Open-File Report 2015–1008, 65 p., http://dx.doi.org/10.3133/ofr20151008.
- Silvestri, S., Zaibet, L., Said, M.Y., Kifugo, S.C. (2013). Valuing ecosystem services for conservation and development purposes: a case study from Kenya. Environ. Sci. Policy 31: 23–33.
- Stave, K., Goshu, G., & Aynalem, S. (2017). *Social and Ecological System Dynamics*: Springer.
- Stevens, S., De Lacy, T., 1997. Conservation through cultural survival : indigenous peoples and protected areas. Island Press. Washington D.C.
- Suich, H., Howe, C., Mace, G., 2015. Ecosystem services and poverty alleviation: a review of the empirical links. Ecosyst. Serv. 12, 137–147.
- Svarstad H., Petersen L.K., Rothman D., Siepel H., Wätzold F. (2008). Discursive biases of the environmental research framework DPSIR. Land Use Policy, 25 (1) (2008), pp. 116-125
- Swallow, B.M., Sang, J.K., Nyabenge, M., Bundotich, D.K., Duraiappah, A.K., Yatich, T.B. (2009).

Tradeoffs, synergies and traps among ecosystem services in the Lake Victoria basin of East Africa. Environ. Sci. Policy 12 (4): 504–519.

- Tallis H. et al.2013: InVEST tip User's Guide: Integrated Valuation of Environmental Services and Trade-offs. A modeling suite developed by the Natural Capital Project. www.naturalcapitalproject.org
- TANAPA (2005) Ecological and Health Studies of Lesser Flamingos in Soda Lakes of Northern Tanzania*.* A Research Agenda to Establish the Current Deaths of Flamingos.
- Tanzania (URT), 2014. Fifth National report on the implementation of the convention on Biological Diversity, pp. 64.
- TEEB, 2010. The economics of ecosystems and biodiversity for local and regional policy makers, Progress press, Malta, pp. 207.
- Turner, K.G., Anderson, S., Gonzales-Chang, M., Costanza, R., Courville, S., Dalgaard, T., Dominati, E., Kubiszewski, I., Ogilvy, S., Porfirio, L., Ratna, N., Sandhu, H., Sutton, P.C., Svenning, J.-C., Turner, G.M., Varennes, Y.-D., Voinov, A., Wratten, S., 2016. A review of methods, data, and models to assess changes in the value of ecosystem services from land degradation and restoration. Ecological Modelling, 40th Anniversary of Ecological Modelling Journal 319, 190–207. doi:10.1016/j.ecolmodel.2015.07.017
- UN CDP, 2018. List of Least Developed Countries (as of December 2018). Last accessed January 5, 2020. https://www.un.org/development/desa/dpad/wpcontent/uploads/sites/45/publication/ldc_list.pdf.
- UNESCO (2015). Man and the Biosphere (MAB) Programme - Biosphere reserve periodic review, pp. 68.
- USDA. (2015). i-TreeEco. Retrieved August, 2015, from http://www.itreetools.org/eco/
- Van Mens, L., 2016. Unravelling the hydrological dynamics of Lake Manyara in Tanzania. Ms. Thesis, Universiteit Utrecht, pp. 35.
- Van Oijstaeijen W., Azadi H., Van Passel S.; Janssens de Bisthoven L.; Hugé J. The economic impact of water hyacinth infestation on farmers: Case of Lake Tana in Ethiopia. Policy brief. 2019.
- Van Oijstaeijen, W., Van Passel, S., Cools, J., Janssens, L., Hugé, J., Berihun, D., Ejigu, N., Nyssen, J. Farmers' preferences towards water hyacinth control in Lake Tana: a contingent valuation study. Working paper.
- Vice President's Office, Division of environment, The United Republic of Tanzania, 2015. National Biodiversity Strategy and Action Plan (NBSAP) 2015-2020, pp. 137
- Vigerstol, K.L., Aukema, J.E., 2011. A comparison of tools for modeling freshwater ecosystem services. J. Environ. Manage. 92, 2403–2409. doi:10.1016/j.jenvman.2011.06.040
- Villa, F., Ceroni, M., Bagstad, K., Johnson, G., Krivov, S., 2009. ARIES (ARtificial Intelligence for Ecosystem Services): a new tool for ecosystem services assessment, planning, and valuation. 11.
- Vodouhê, F. G., Coulibaly, O., Adégbidi, A., & Sinsin, B. (2010). Community perception of biodiversity conservation within protected areas in Benin. *Forest Policy and Economics*, *12*(7), 505–512. https://doi.org/10.1016/j.forpol.2010.06.008
- Von der Gracht, H.A., 2012. Consensus measurement in Delphi studies. Technol. Forecast. Soc. Chang. 79, 1525–1536.
- Wangai, P.W., Burkhard, B., Muller, F. (2016). A review of studies on ecosystem services in Africa. International Journal of Sustainable Built Environment 5: 225–245.
- Watts, S., & Stenner, P. (2012). *Doing Q Methodological Research: Theory, Method and Interpretation.* London, Thousand Oaks CA, New Delhi, Singapore: Sage Publications.
- Watts, M.E. 2016. marxan.io: A web app for systematic conservation planning. Revision 46."
- Willemen, L., Drakou, E.G., Dunbar, M.B., Mayaux, P., Egoh, B.N. (2013). Safeguarding ecosystem services and livelihoods: understanding the impact of conservation strategies on benefit flows to society. Ecosyst. Serv. 4: 95–103.
- Wondie, A. (2018). Ecological conditions and ecosystem services of wetlands in the Lake Tana Area, Ethiopia. *Ecohydrology & Hydrobiology, 18*(2), 231-244. doi:https://doi.org/10.1016/j.ecohyd.2018.02.002
- Worku, M. (2017). Lake Tana as Biosphere Reserve: Review. *J Tourism Hospit, 6*(310), 2167-0269.1000310.
- Wynants M., Solomon H., Ndakidemi P., Blake W.H. (2018). Pinpointing areas of increased soil erosion risk following land cover change in the Lake Manyara catchment, Tanzania. International

Journal of Applied Earth Observation and Geoinformation 71, 1-8. https://doi.org/10.1016/j.jag.2018.05.008.

- Wynants M., Kelly C., Mtei K., Munishi L., Patrick A., Rabinovich A., Nasseri M., Gilvear D., Roberts N., Boeckx P., Wilson G., Blake, W.H., Ndakidemi, P. (2019). Drivers of increased soil erosion in East Africa's agro-pastoral systems: changing interactions between the social, economic and natural domains. Regional Environmental Change. In press.
- Young J.C., Rose D.C., Mumby H.S., Benitez-Capistros F., Derrick C.J., Finch T., Garcia C., Home C., Marwaha E., Morgans C., Parkinson S., Shah J., Wilson K.A., Mukherjee N. (2018). A methodological guide to using and reporting on interviews in conservation science research. Methods in Ecology and Evolution. In: Special Feature: Qualitative methods for eliciting judgements for decision making. Volume 9, Issue1 Pages 10-19.
- Zabala, A., Sandbrook, C. & Mukherjee, N. When and how to use Q methodology to understand perspectives in conservation research. *Conserv. Biol.* **32,** 1185-1194 (2018).
- Zerubabeeli N. 2018.Economic value of Mt. Elgon forest ecosystem services; A case of Bududa and Kapchorwa districts, Uganda. Master thesis, Busitema University, 142 pp.

9. ANNEXES

Accepted Peer reviewed publications:

1. Geussens, K., G. Van den Broeck, K. Vanderhaegen, B. Verbist, and M. Maertens. 2019. “Farmers’ Perspectives on Payments for Ecosystem Services in Uganda.” *Land Use Policy* 84 (May): 316–27. https://doi.org/10.1016/J.LANDUSEPOL.2019.03.020.
2. Hugé J., Rochette A., de Béthune S., Parra Paitan C., Vanderhaegen K., Vandervelden T., Van Passel S., Vanhove M.P.M., Verbist B., Verheyen D., Waas T., Janssens I., Janssens de Bisthoven L. (2020). Ecosystem services assessment tools for African Biosphere Reserves: A review and user-informed classification. Ecosystem Services 42. https://www.sciencedirect.com/science/article/abs/pii/S2212041620300218
3. Conservation News : Janssens de Bisthoven L., Rochette A., Verheyen E., Akpona T., Verbist B., Vanderhaegen K., Naturinda Z., Steven Van Passel S., Daregot Berihun D., Munishi L., Hugé, J. (2019). Conserving African biosphere reserves: A workshop on the valuation of ecosystem services in Man and the Biosphere Reserves. *Oryx, 53*(4), 609-609. doi:10.1017/S003060531900070X

Submitted Peer reviewed publications:

4. Janssens de Bisthoven, L., Vanhove, M.P.M., Rochette, A.-J., Hugé, J., Verbesselt, S., Machunda, R., Munishi, L. d, Wynants, M., Steensels, A., Malan-Meerkotter, M., Henok, S., Nhiwatiwa, T., Casier, B., Kiwango, Y.A., Kaitila, R., Komakech, H., Brendonck, L. 2020. Social-ecological assessment of Lake Manyara basin, Tanzania: a mixed method approach. Re-submitted, after revision with major changes to Journal of Environmental Management on January 10th 2020.

Working papers (or peer-reviewed papers in preparation):

5. Azadi, H., Van Passel, S., Cools, J. Rapid Economic Valuation of Ecosystem Services in Man and Biosphere Reserves in Africa: A Review. Working paper.
6. Ejigu Tefera, N., Cools, J., Van Passel, S., Berihun, D. Identification, Characterization and Ranking of Ecosystem Services in Lake Tana basin: An application of toolkit for ecosystem services site-based assessment (TESSA). Working paper.
7. Gbedomon R.C., Akpona T.J.D.., Rochette A.-J.., Janssens de Bisthoven L., Hugé J., Vanhove M., Glele Kakaï R, 2020. A systematic review of ecosystem services research on the Pendjari Biosphere Reserve: current state and the road ahead. In prep.
8. Van Oijstaeijen, W., Van Passel, S., Cools, J., Janssens, L., Hugé, J., Berihun, D., Ejigu, N., Nyssen, J. Farmers’ preferences towards water hyacinth control in Lake Tana: a contingent valuation study. Working paper. Submitted to ‘Environment, Development & Sustainability’ in January 2020. To be re-submitted to other journal after revision.

Policy briefs

9. Rochette A.J., Hugé J., Akpona T.J.D., Gbedomon R.C., Glèlè Kakaï R., Vanderhaegen K., Verbist B., de Ryck A., Janssens I., Goad D., Janssens de Bisthoven L.. Les services écosystémiques dans la Réserve de Biosphère de la Pendjari (Bénin). Policy brief. 2018.
10. Van Oijstaeijen W., Azadi H., Van Passel S.; Janssens de Bisthoven L.; Hugé J. The economic impact of water hyacinth infestation on farmers: Case of Lake Tana in Ethiopia. Policy brief. 2019.

Posters

11. Baeten S., Vanderhaege K., Maertens M., Verbist B. Trees for Global Benefits: the Analysis of a Smallholder PES project. Poster
12. Hugé J., Rochette A-J. Critical evaluation of rapid ecosystem services assessment tools in African Man & Biosphere Reserves. Poster presented at the 2018 Communities, Conservation & Livelihoods Conference (CCL) in Halifax, Canada.

Master theses

13. Amorgaste, A., Van Passel, S. Willingness to contribute for the protection and restoration of papyrus wetlands around Lake Tana, Ethiopia: a contingent valuation study. Master Thesis. Academic year 2018-2019.
14. Baeten, S. 2018. Trees for Global Benefits: the Analysis of a Smallholder PES Project in Uganda. Master thesis, Katholieke Universiteit Leuven, 100 pp.
15. Chaffa T.K. 2019. Evaluation économique de cinq Produits Forestiers Non Ligneux d'importance: Vitellaria paradoxa, Parkia biglobosa, Adansonia digitata, Diospyros mespiliformis et Tamarindus indica dans la Réserve de Biosphère de la Pendjari. Mémoire de Master, Université d'Abomey-Calavi, 81pp.
16. Claessens, H., Van Passel, S. A contingent valuation of non-market ecosystem services of agricultural land in Bahir Dar, Ethiopia. Master Thesis. Academic year 2019-2020.
17. De Ryck A., 2018. Payments for ecosystem services: an assessment of existing and possible reward mechanisms for ecosystem services in the Pendjari Biosphere Reserve, Benin. Master thesis, Katholieke Universiteit Leuven, 134 pp.
18. Fabri, Ch., Van Passel, S. Park dependency and its effect on park management attitudes: a case study of Pendjari Biosphere Reserve, Benin. Master Thesis. Academic year 2018-2019.
19. Geussens, K, 2018. Farmers' preferences for watershed conservation incentives in the Mt. Elgon region, Uganda. Master thesis, Katholieke Universiteit Leuven, 81 pp.
20. Goad D. 2019. Rapid ecosystem service assessment & conceptualization of conservation effectiveness in Pendjari National Park, Benin. Master thesis, VUB. 61 pp.
21. Hasaers, L., Van Passel, S. Factors influencing the compensation for reduced access to Pendjari Biosphere Reserve, Benin: a contingent valuation study. Master Thesis. Academic year 2018-2019.
22. Janssens I. 2019. Conservation conflict following a management shift in Pendjari National Park (Benin):a Q methodological study. Master thesis, VUB. 28pp.
23. Zerubabeeli N. 2018.Economic value of Mt. Elgon forest ecosystem services; A case of Bududa and Kapchorwa districts, Uganda. Master thesis, Busitema University, 142 pp.

Others

24. Gaillard J. and Knoops J. 2018. Land use changes in and around Pendjari National Park (North-Benin). Report of the Land Cover and Land Use Monitoring (2017-2018) Assignment 2, Katholieke Universiteit Leuven, 19pp.
25. Full detailed report of the EVAMAB closing workshop (Bahir Dar, 13-17 May 2019), 31pp.
26. Announcement: new manual. African Man and Biosphere Reserves: guidance to assess ecosystem services. Folder distributed during AfriMAB meeting 2019, Abidjan.
27. Janssens 2019. Conservation conflict after a management shift in Pendjari National Park (Benin) : English summary for policy makers. 2 pp
28. Janssens 2019. Les perceptions sur la conservation de la biodiversité au parc de la Pendjari (Benin) : un résumé en français. 2pp