

# Final Technical Report

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## Economic assessment of Lower Barowetland ecosystem services as an input for the development of wetland management plan

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**Prepared for: Nile Basin Initiative (NBI)**

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## Executive Summary

The key objective of this call by Nile Basin Initiative (NBI) is to conduct economic assessment of wetland ecosystem services as an input green infrastructure planning and development for the lower Baro Wetlands:

- To review documents to identify study finding and recommendations from BAS and TEEB related studies in the Lower Baro wetland system,
- To develop a preliminary Lower Barowetland system map and recent period land use land cover (ecosystem account) map,
- To conduct a preliminary assessment of the ecosystem status and valuationof ecosystem services of the Lower Baro wetland system,
- To present the findings of the Lower Baro wetland system preliminary ecosystem services assessment and mappingof ecosystem accounts to NBI stakeholders.

To achieve the stated objectives, the consultant applied standard economic valuation analysis using the Economics of Ecosystems and Biodiversity (TEEB) as a major methodological approach that has been used in developing the Nile basin TEEB wetland synthesis report(NBI 2020b), as well as to conduct theeconomic valuation of biodiversity and ecosystem services of Machar Marshes(NBI 2020a) and Sudd (NBI 2020c)wetlands in South Sudan to inform green infrastructure planning and development in the face of in situ and ex-situ development interventions.

This study was motivated by the unavailability of previous attempts to estimate the total economic value of the Lower Baro wetlands systems which can guide policy makers for development decision making. Hence the broad aim of the study was to conduct economic valuation of biodiversity and ecosystem services of the Lower Baro wetlands systemto inform the preparation of wetland management plan and development in the face of in situ and ex-situ development interventions. To this end, different sources of information have been consulted and the results have been based on value transfer approach as well as available literature.

Considering 2020 as a base year, the total economic value of the wetland ecosystem services was estimated at above \$425 million annually. However, about 35 percent of these benefit emanate from the regulatingand biodiversity protection services. The total value of the provisioningecosystem services from the wetland is the third highest. Unless a mechanism is set to increase the benefits from the provisioning services, the status quo may not be sustainable. Because, both the regulating and biodiversity services have a public good character which may not be the immediate reasons for the protection of the wetlands. Both the government of South Sudan and Ethiopia as well as other development partners should also seek how the local community would be compensated from the regulating and biodiversity of the wetland.

## 1. Background and justification to the study

The proposed assessment and evaluation of wetlands in Nile Basin, particularly the Lower Baro wetland system, will address the links between ecosystem services and human wellbeing, specifically interventions to restore and conserve ecosystems, and to enhance poverty and equity in a rapidly developing country. The concept of ecosystem services has become of considerable interest to both environment and development policy communities at local, national, regional and international levels, especially since 2005 following the publication of the Millennium Ecosystem Assessment (MA, 2005). The Millennium Ecosystem Assessment (MA) gave great relevance for better understanding of classification and the economic valuation of Ecosystem Services (ES). According to the Wetland International<sup>1</sup> report, about 131 million hectares of the African continent is covered by wetlands and about 18.3 million hectares is located in the Nile Basin. Wetlands in the Nile basin have a significant role in the hydrology of the Nile River and to sustain the livelihood of million households (McCartney & Rebelo 2018; NBI 2020b). Although the Nile basin has a productive ecosystem, the Nile's land, ecosystems and water are degraded at an alarming rate. The wetlands in Nile Basin covers 5%, vulnerable to various degrading problems and are one of the most degraded ecosystems(Lisa-Maria & Matthew 2012).

Currently, the importance of wetlands is reflected by the growing number of valuation studies (Skourtos *et al.* 2003; Schuyt 2005; Agimass & Mekonnen 2011; Mulatu *et al.* 2014; Mulatu *et al.* 2018). Numerous economic valuation studies of wetlands around the world have been carried out; however, most of these studies have focused on wetlands in developed countries and are very limited in developing countries. On those studies carried out for developing countries, African wetlands are clearly underrepresented. At the same time, African wetlands are facing serious threats, but the importance of their protection for the survival of local people is increasingly recognized (Schuyt 2005). Therefore, conducting economic valuation of biodiversity and ecosystem services to inform green infrastructure planning and development in the face of in-situ and ex-situ development interventions is vital for better understanding of sustainable wetlands management in Nile basin.

One of the recent developments and initiation in Nile basin is that a “TEEB-inspired study”, focusing on wetland ecosystems. The Nile Basin Wetlands TEEB, coordinated by the Nile Basin Initiative (NBI), focusing on raising awareness about the importance of wetland ecosystem services to regional, national, sectoral and local-level development processes. To enhance this initiative, site specific case studies were proposed to conduct TEEB synthesis report, and five selected wetlandsites were identified and comprehensive study has been conducted as well as, for the first time, the Nile Basin wetland TEEB synthesis report is developed(NBI 2020b). In addition to the TEEB study, The NBI has commissioned a project ‘Nile Basin wetlands of transboundary significance: Inventory, Baseline Study and Framework Management Plan with a nested case study on the Sudd wetland to do an economic valuation of biodiversity and ecosystem services of the Machar Marshes wetland in South Sudan(NBI 2020c).

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<sup>1</sup> <http://www.africa.archive.wetlands.org>

Both studies are implemented in parallel, utilizing synergies with this overarching basin wide study and making use of its approaches and results regarding data collection, remote sensing data analysis, wetland modelling, biodiversity assessment, ecosystem services analysis and environmental flow assessment work. The development of the Machar Marshes will specifically benefit from the lessons learned with regards to wetland modelling and will make use of the collected datasets with regards to biodiversity and ecosystem aspects(NBI 2020a). A key feature of the hydrology of the Baro-Akobo-Sobat sub-basin is that its rivers (especially the lower reaches) flow over flat surface with meandering patterns creating complex interactions with surrounding floodplains. Particularly, the spill from the Baro river into the Machar Marshes (in the White Nile Sub-basin) is one of the naturally occurring transfer of water into a neighbouring catchment<sup>2</sup>. Even if the economic value of the Machar Marshes wetland is conducted, to get a complete picture of the wetland systems in the basin, since the Baro river spills into the Machar Marshes wetland, it is necessary to evaluate and assess the lower Baro wetland. Hence, this study initiated based on this motive and hence, in a sense, is a continuation of the previous studies conducted both in South Sudan and other countries in the Nile basin.

The key objective of this study is to conduct economic assessment of wetland ecosystem services as an input green infrastructure planning and development for the Lower Baro Wetlands. The following activities were performed towards achieving the following objectives:

- Review documents to identify study finding and recommendations from BAS and TEEB related studies in the Lower Baro wetlands system,
- Develop a preliminary Lower Baro wetlands system map and recent period land use land cover (ecosystem account) map,
- Conduct a preliminary assessment of the ecosystem status and valuation of ecosystem services of the Lower Baro wetlands system,
- Present the findings of the Lower Baro wetlands system preliminary ecosystem services assessment and mapping of ecosystem accounts to NBI stakeholders.

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<sup>2</sup><https://atlas.nilebasin.org/treatise/the-baro-akobo-sobat-nile-sub-basin/>.

## 2. Brief overview natural resources and environment related policies and strategies in South Sudan

At the country's formation in 2011, formal governing institutions were created, but given the years of conflict and the breakdown of former structures, they commenced from a generally low foundation. The new government's capacity to formulate policy and implement programs is still limited, but is developing and evolving. It should be further strengthened. South Sudan is signatory to the Montreal Protocol to the Vienna Convention on Substances that Deplete the Ozone Layer, the United Nations Framework Convention on Climate Change (UNFCCC), the Kyoto Protocol to the UNFCCC, the International Plant Protection Convention (IPPC), the Convention on Biological Diversity (CBD), and the UN Convention to Combat Desertification. The institutional frameworks to accomplish environmental and climate-change commitments, however, are still at the nascent stage due to the low priority given to them in the context of the ongoing situation of conflict, as well as the lack of technical capacity and financial resources. Being a young Government, the Government of Republic of South Sudan (GRSS) is still in the process of enacting various legislations, and among the pieces of legislation that are yet to be developed is a comprehensive Environmental Act. For this reason, only pieces of legislation that are relevant to the environment have been enacted and reviewed in this report. The table below summarizes the bulk on information discusses under this chapter.

Table 1: Summary of the different Environmental and Wetland Policies, Laws, Regulations and Plans<sup>3</sup>

<b>Policy, law, regulation, and plan</b>	<b>Relevant provision (theme)</b>
Post 2015 SDGs	The 15 <sup>th</sup> Goal states “protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forest, combat desertification and halt and reserve land degradation and halt biodiversity loss. This goal is directly linked to wetland conservation and intervention related to improving land health.
Intended Nationally Determined Contributions	South Sudan prioritizes three sectors for low carbon development and puts forward several options per sector: Energy generation and use, reforestation and deforestation, and transport sectors.
The Interim National Constitution (ICSS), 2005	Part three, article 44 of the Interim Constitution of Southern Sudan (The Environment) has guaranteed every person or community the right to have a clean and healthy environment.
The Transitional Constitution (TCRSS), 2011	Under Article 14 – every person or community shall have the right to clean healthy environment, the obligation to protect the environment, the right to have the environment protected through appropriate legislative action and other measures.
The National Development Strategy (2018-2021)	conducting a baseline survey on the status and sources of environmental pollution as well as developing legislation, regulation, standards and guidelines on environmental pollution management among others.
South Sudan Development Plan (SSDP), 2011-2016	Sustainable development through enforcing environmental and social impact assessments; accede to and ratify applicable and beneficial multilateral environmental treaties, conventions and agreements; and promote inclusive participation, access to information and good governance.

<sup>3</sup> The policy and strategic reviews of South Sudan referred the previous review that has been undertaken during the development of Machar Marshes and Sudd wetland ecosystem services valuation studies.

NAPA to Climate Change 2016	Promotion of reforestation and agroforestry; sustainable management and conservation of wetlands; promotion of climate-smart agriculture; improved drought and flood early warning systems; and strengthening institutional capacity
The environmental Protection Bill 2013	Aims to protect the Environment and to promote ecologically sustainable development that improves the quality of life.
The Wildlife Conservation and Protected Areas Bill 2015	Covers all matters concerned with Wildlife Conservation, the establishment and management of protected areas and the sustainable management and conservation of South Sudan's natural heritage and wildlife for the benefit of its citizens.
The Draft Wildlife Bill 2013	Coordination with other relevant authorities of all issues affecting wildlife management including issues of security, infrastructure, private investment and land use planning.
The Forests Bill 2009	Is meant to operationalize the Forestry Policy covering all matters concerned with all forests and woodlands and all forest reserves in the country.
The Water Bill 2013	Aims to conserve available water resources, to manage water quality and to prevent pollution of ground and surface waters; manage floods and droughts and mitigate water-related disasters, and; establish appropriate management structures including mechanisms for inter-sectoral coordination and stakeholder participation.
Draft National Environment Policy 2013	Aims to maintaining the balance between the environment and development needs through sustainable use of the natural resource base; creating public awareness of the importance of protecting the environment; and providing the basis for formulation of biodiversity and ecosystem protection and management policies, laws and guidelines.
The South Sudan Wildlife Conservation and Protected Area Policy 2012	Envisions an effective and professional Wildlife Service that will guide the sustainable management and utilization of natural resources, including land, water, fauna and flora for the benefit and enjoyment of the people.
The Environmental Policy and the Environmental Protection Bill 2010	Emphasizes the importance of carrying out Environmental Impact Assessments (EIAs) in relation to any activity that may affect the environment.
The Water Policy	States that the right to water shall be given the highest priority in the development of water resources; rural communities shall participate in the development and management of water schemes; and the involvement of NGOs and the private sector in water projects shall be encouraged.
The Forestry Policy 2014	Proposes the ratification of the UNFCCC so that the country can benefit from the Clean Development Mechanism (CDM); emphasizes the need for measures "so that South Sudan can access financing under Reduced Emission from Deforestation and Forest Degradation (REDD)."
Minerals Law and Policy	The Mining Act 2012 - provides a framework for the management of the mining sector consistent with international standards; and provides for Community Development Agreements for Mining Licenses and environment and social provisions.  The Petroleum Act 2012 - emphasizes maximum petroleum recovery within a framework that seeks to ensure the safety, security and protection of the environment, and requires transparency, accountability and ethical behavior on the part of both licensees and the government; requires conducting SEIA.
Fisheries Policy	Decentralization and co-management; embeds the FAO Code of Conduct for Responsible Fisheries; integration into sector wide and national planning; facilitates monitoring and progress

Source: (NBI 2020a)

## **Post 2015 Sustainable Development Goals (SDGs)**

The SDGs framework addresses key systemic barriers to sustainable development such as inequality, sustainable consumption patterns, weak institutional capacity, and environmental degradation that the MDGs neglected (ISSC, 2015). It has seventeen (17) Goals (SDGs) and one hundred sixty-nine (169) targets (UNDG 2015). The 15<sup>th</sup> Goal states “protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forest, combat desertification and halt and reverse land degradation and halt biodiversity loss” is essential for fulfilling the environmental, socio-cultural and economic needs of present and future generations and, therefore, plays a vital role in the international agenda for achieving a better life for all human societies. This goal is directly linked to wetland conservation and intervention related to improving land health. Furthermore, Goal 13 of the SDGs highlights the importance of taking urgent action to combat climate change and its impacts which could have direct implication for wetlands such as the lower Baro.

## **Intended Nationally Determined Contributions (INDC)**

South Sudan submitted its Intended Nationally Determined Contributions (INDC) in September 2015, but has not submitted its First NDC to the UNFCCC. Taking into consideration the 50 years of conflict that destroyed the little infrastructure and governance structure that existed prior to the conflict, in its INDC South Sudan presents itself as being highly vulnerable to the negative effects of climate change, mainly due to the dependence of its population on climate-sensitive natural resources for their livelihoods, limited institutional and technical capacity, appropriate technologies and financial resources to support the implementation of for climate adaptation interventions. The INDC notes that in South Sudan climate change is already occurring – particularly unpredictable rain patterns, recurrent droughts, flash flooding and excessive heat that result in food insecurity and famine. Implementation costs of adaptation and mitigation actions up to 2030, is estimated at over USD 50 billion and is conditional upon international support.

In its INDC the country commits to undertake a national GHG-inventory to allow assessment for mitigation potential and to quantify emission reductions. South Sudan prioritizes three sectors for low carbon development and puts forward several options per sector: Energy generation and use, reforestation and deforestation, and transport sectors. For adaptation, a sectoral approach was adopted for the INDC with priority actions based on observed adverse effects of climate change on the sectors: agriculture and livestock; health; adapting vulnerable communities to climate change; forests, biodiversity and ecosystem; infrastructure; and institutional and policy options. The country’s objective in this regard includes prioritizing the enhancement of climate resilience in the agricultural sector through the promotion of climate-smart agriculture, livestock improvement, enhancement of fisheries productivity and soil erosion control. In the Capacity building and transfer of technology component of the INDC, the areas identified which would benefit mitigation and adaptation include renewable energy technologies, climate information systems, water technologies (e.g., water savings, recycling, harvesting and irrigation), methods and tools to assess



climate impacts, vulnerability and adaptation, and transportation technologies that are climate resilient.

### **The Interim National Constitution of Southern Sudan, 2005 (ICSS)**

The ICSS was the supreme law of Southern Sudan which stipulates the legal aspects for the protection and management of the environment and natural resources. The environmental record of South Sudan dates back to its ICSS where there were clear provisions on environmental issues of relevance for the country at large and its people in particular. Part three, article 44 of the Interim Constitution of Southern Sudan (The Environment) has guaranteed every person or community the right to have a clean and healthy environment. The Constitution further commits all levels of government in Southern Sudan to sustainable development in order to ensure that the environment is protected for the benefit of present and future generations, through reasonable legislative action and other measures that prevent pollution and ecological degradation, promote conservation and secure ecologically sustainable development and use of natural resources while promoting rational economic and social development so as to protect genetic stability and bio-diversity of Southern Sudan. And also, all levels of government in Southern Sudan shall promote energy policies that will ensure that the basic needs of the people are met while protecting and preserving the environment.

The Interim Constitution also specifies land issues that are under National powers (Federal level) and those under the control of states as well as joint powers (concurrent powers) shared by the Federal and States institutions. The states manage issues related to State lands that are not under National control. These include: management, lease and utilization of lands belonging to States, town and rural planning and agricultural lands within the state boundaries. The concurrent powers include matters related to urban development, planning and housing, electricity generation, waste management, consumer safety and protection, water resources other than inter – state waters and regulation of land tenure and the rights on land. Articles of the Constitution have also provisions on the right to expropriate land and compensation to the owners, protection of cultural heritage and religious sites, as well as issues related to the safety and protection of the inhabitants, beside penalties incurred for environmental damage and pollution as well as respect of the International Environmental Agreements, ratified by the Government of the Republic of South Sudan.

### **The Transitional Constitution of the Republic of South Sudan, 2011 (TCRSS)**

In 2011, the Government of South Sudan adopted an amendment to the 2005 Interim Constitution renaming it the “Transitional Constitution of the Republic of South Sudan”. Under Article 14 “The Environment” the Transitional Constitution states in part (1) that every person or community shall have the right to a clean and healthy environment. While in part (2) states that every person shall have the obligation to protect the environment for the benefit of present and future generations. And, in part (3) every person shall have the right to have the environment protected for the benefit of present and future generations, through appropriate legislative action and other measures that: (a) prevent pollution and ecological degradation; (b) promote conservation; and (c) secure

ecologically sustainable development and use of natural resources while promoting rational economic and social development so as to protect genetic stability and bio-diversity. Also, in Part (4) that all levels of government shall develop energy policies that will ensure that the basic needs of the people are met while protecting and preserving the environment.

### **The National Development Strategy of South Sudan (2018-2021)**

In the Nation Development Strategy (NDS) several issues are considered to be critical to deliver the NDS objectives for the people of South Sudan. Four cross-cutting issues specifically are identified as important: environment, women and youth, capacity-building and Local Service Support (LSS). The broad nature of these issues means that they cannot be categorized into any of the other clusters. The NDS aims to mainstream these important cross-cutting issues across all clusters through integrating initiatives into sectoral action programs during implementation. Facilitating access and participation by women and youth in governance, peacebuilding and economic opportunities must be clearly reflected in implementation of cluster strategic priority actions. Environmental concerns must be seriously considered for the sustainability of potential gains in economic development and service delivery. The ultimate aim of the NDS is to improve the standard of living of the people of South Sudan.

Among the issues identified to be priority strategic actions in this regard are conducting a baseline survey on the status and sources of environmental pollution as well as developing legislation, regulation, standards and guidelines on environmental pollution management among others. Under the natural resources sector the following activities are highlighted to be performed: a) to review and update policies and strategies for development of the agricultural sector, b) to develop priority infrastructure for wildlife conservation tourism c) to improve the productive capacity of livestock and fisheries resources, and d) to conduct baseline.

### **The South Sudan Development Plan (SSDP) (2011 – 2013 and later extended to 2016)**

The main guiding document for the development of the country was the South Sudan Development Plan (SSDP) which addresses conflict management, poverty reduction and economic development. One of the goals of the document was to strive for less dependence on oil. The Government's role was not to undertake economic activities itself, but to create an enabling environment for economic development by assuring peace, security, rule of law, macroeconomic stability, basic infrastructure and effective tax administration (GOSS, 2011).

The SSDP was structured through four 'Pillars', namely: (1) governance, (2) economic development, (3) social and human development, and (4) conflict prevention and security. Within these pillars, cross cutting issues are defined as (1) anti-corruption, (2) capacity development, (3) environment, (4) gender, (5) HIV and AIDS, (6) youth, and (7) human rights. Under the Governance Pillar, the Government's role is to:

- a) ensure that development is sustainable through enforcing environmental and social impact assessments for all development programmes and projects, b) accede to and ratify applicable

and beneficial multilateral environmental treaties, conventions and agreements, and c) promote inclusive participation, access to information and good governance in sustainable natural resources management and environmental protection.

The Economic Development Pillar covers the following priority programme areas: (a) agriculture and forestry, (b) roads and road transport development, (c) development of energy, mineral and mining sectors (including oil), (d) animal resources and fisheries, and (e) Water resources management, development, utilization and provision of sanitation services. Environmental sustainability of economic development and related activities including oil extraction, logging and charcoal production is to be ensured. The use of environmental impact assessments (EIAs) is required for infrastructure and power supply development.

The Social and Human Development Pillar envisages environmental awareness-raising of children, and improved health and sanitation facilities focusing particularly on the youth. A national early warning system will be developed to reduce risks of disasters. The Conflict Prevention and Security Pillar will ensure environmental awareness-raising of disarmament, demobilization and reintegration (DDR) participants as well as the requirement of EIAs for all major construction projects.

#### **The Republic of South Sudan National Adaptation Programs of Action (NAPA) to Climate Change 2016**

National Adaptation Programmes of Action (NAPAs) serve as simplified, rapid and direct channels for Least Developed Countries to identify and communicate priority activities to address their urgent and immediate adaptation needs. NAPAs emerged from the multilateral discussions on adaptation measures within the UN Framework Convention on Climate Change (UNFCCC). South Sudan's NAPA therefore specifies five priority activities (referred to as Priority Adaptation Projects) for effective climate change adaptation across the five-identified priority thematic areas, namely: i) Environment: Promotion of reforestation and agroforestry to reduce vulnerability to droughts and floods; ii) Water Resources: Sustainable management and conservation of wetlands in South Sudan; iii) Agriculture: Promotion of climate-smart agricultural techniques to improve livelihoods and food security under changing climatic patterns; iv) Disaster Risk Reduction: Establish improved drought and flood Early Warning Systems in South Sudan through an improved hydro-meteorological monitoring network; and v) Policy and Institutional Framework: Strengthening the institutional capacity of the Government of South Sudan to integrate climate change into national policies and planning processes. These five Priority Adaptation Projects therefore represent the most urgent and immediate adaptation needs in the country.

However, it is also noted that the other Adaptation Project Options identified through the NAPA process remain important and that ideas/activities/elements can be blended across projects and thematic areas when designing final project concepts for implementation in the country. The NAPA process also identified other guiding principles for adaptation projects in South Sudan, including that:

- Adaptation projects should promote conflict resolution and peace-building.

- Gender equality should be considered in the design of adaptation projects.
- Adaptation projects should target those groups most vulnerable to climate change impacts.
- Adaptation projects should contribute to the further development of legislative and regulatory frameworks in South Sudan.
- Adaptation projects should promote livelihood diversification.
- Capacity building – of human, institutional, technical and financial resources – should be included in the design of adaptation projects.
- Adaptation projects should promote long-term research on climate change adaptation, including the collection of baseline information.
- Indigenous knowledge should be included in the design of adaptation projects.
- Land tenure must be considered when deciding the location for adaptation projects.

### **The National Biodiversity Legislation**

Many of the key national legislations for biodiversity management in South Sudan are still in the form of Bills before the National Legislative Assembly. The Bills include: The National Environmental Protection Bill 2013; The Draft Wildlife Bill 2013 and the Wildlife Conservation and Protected Areas Bill 2015; The Water Bill 2013; and the Forests Bill 2009. The Draft Policies include: The Draft National Environment Policy 2013; and the South Sudan Wildlife Conservation and Protected Area Policy (Draft of June 2012). The inclusion of these draft bills is due to the fact that there is no adequate information on the current status of the drafts; i.e., whether they are still at draft stage or they have been ratified. In addition, the inclusion of such drafts shows at least the intention and desire in terms of managing the resources stipulated in each draft which mainly address the ecosystem services considered in this study.

### **The Environmental Protection Bill 2013**

This bill is a key pending legislation that aims to protect the Environment in South Sudan and to promote ecologically sustainable development that improves the quality of life. It grants the right to a decent environment to every person and the concomitant right to bring an action to enforce that right if it is threatened as a result of an activity or an omission. The Bill if enacted into law will empower the Ministry of Environment and Forestry to supervise and co-ordinate all matters relating to the environment and to be the principal instrument of government in the implementation of all policies relating to the environment including biodiversity. This will include stock taking of the natural resources in the country and their utilization and conservation; examining land use patterns to determine their impact on the quality and quantity of natural resources, and; carrying out surveys which will assist in the proper management and conservation of the environment. That means establishing an Environmental Information Centre that will undertake an inventory of South Sudan's biological diversity and ecosystems as a priority for the Ministry.

### **The Wildlife Conservation and Protected Areas Bill 2015**

The Bill covers all matters concerned with Wildlife Conservation, the establishment and management of protected areas and the sustainable management and conservation of South Sudan's natural heritage and wildlife for the benefit of its citizens.

### **The Draft Wildlife Bill 2013**

The Bill establishes an autonomous South Sudan Wildlife Service (SSWS) as proposed by the Constitution with a board of trustees and headed by a Director-General both appointed by the President. One of its key functions will be coordination with other relevant authorities of all issues affecting wildlife management including issues of security, infrastructure, private investment and land use planning. This will be done by ensuring the enforcement and implementation of the law with respect to the use of wildlife, the management of protected areas and other uses of natural resources.

### **The Forests Bill 2009**

The Forest Bill is meant to operationalize the Forestry Policy covering all matters concerned with all forests and woodlands and all forest reserves in the country. The Bill provides for a governance structure for all the forests in the country, national sustainable forest management standards, certification systems and schemes, and private and voluntary standards; procedures and decision-making processes, and; complaint and appeal mechanisms.

### **The Water Bill 2013**

This bill provides protection of water sources from pollution, erosion or any other adverse effects by creating Protected Zones within a catchment draining to, or above any water facility forming part of a water supply or any catchment, lake, reservoir, aquifer, wetland, spring, or any other source of water (section 34). The Bill aims to develop procedures for prioritizing allocation of water resources for different social, economic and environmental uses, efficiency, system reliability and environmental sustainability principles. It also aims to conserve available water resources, to manage water quality and to prevent pollution of ground and surface waters; manage floods and droughts and mitigate water-related disasters, and; establish appropriate management structures including mechanisms for inter-sectoral coordination and stakeholder participation.

### **Draft National Environment Policy 2013**

The aim of the drafted Bill is to ensure the protection, conservation and sustainable use of the natural resources of South Sudan without compromising the tenets of inter-generational equity. This includes maintaining the balance between the environment and development needs through sustainable use of the natural resource base; creating public awareness of the importance of protecting the environment; and providing the basis for formulation of biodiversity and ecosystem protection and management policies, laws and guidelines.

### **The South Sudan Wildlife Conservation and Protected Area Policy (Draft of June 2012)**

It envisions an effective and professional Wildlife Service that will guide the sustainable management and utilization of natural resources, including land, water, fauna and flora for the benefit and enjoyment of the people of South Sudan. It provides for the formulation of legal frameworks for rationalizing the protected area system and wildlife utilization and benefit sharing.

### **The Environmental Policy and the Environmental Protection Bill (Draft January 2010)**

The South Sudan National Environmental Policy has been drafted to achieve sustainable development in light of the following factors (draft January 2010): 1) The upcoming huge investment and development activities following the attainment of comprehensive peace in the country; 2) Emerging environmental management challenges pertaining to diversion of land use systems, urban sprawl, oil exploration in the Sudd wetlands, loss of biodiversity, waste management and others; 3) Ineffective environmental governance due to inadequate institutional capacity and limited government budgetary allocation for environment; 4) The need to harmonize the environmental legal frameworks with sectoral legislation and guidelines; 5) The need to decentralize and devolve management of the environment to the lowest levels of government within the framework of the federal system of rule; 6) The current state of environmental degradation as manifested in widespread pollution by the oil industry, increasing loss of biodiversity due to over-exploitation of forests, inadequate environmental sanitation associated with urban sprawl, and desert encroachment southwards; 7) Lack of reliable information and data on the environment and limited research capacity.

The policy is based on the following principles: good governance, sustainable development, prevention, subsidiarity, the precautionary principle, scientific knowledge, skills and expertise, and 'The Polluter Pays'. The policy gives guidance to all relevant sectors: agriculture, biodiversity, energy, fisheries, forestry, health, human settlements, industry, livestock, mining, oil, roads, tourism, transportation, water and sanitation. It emphasizes the importance of carrying out Environmental Impact Assessments (EIAs) in relation to any activity that may affect the environment.

### **Current Policies and Legislation**

As stated above, no adequate information is available, at least for now, whether those bills are still at draft stage. Hence, we assume the following are the policies and legislations that are in use for the different environmental and resource issues. Like the draft bills, these also cover a range of issues that have direct implications for this study. The land policy has direct implication for the ownership and governance of land and resources while the water, forestry, and fisheries policies stipulate on the use and management of these resources and the resultant ecosystem services.

### **The Land Policy**

The Transitional Constitution of 2011 states that all land in South Sudan is owned by the people of South Sudan, and charges the government with regulating land tenure, land use and exercise of rights to land. The constitution classifies land as public, community or private land, and requires the Government of Republic of South Africa (GRSS) to recognize customary land rights when exercising the government's rights to land and other natural resources. The constitution does not clarify the extent to which customary rights can limit government's rights, but does require that all levels of government incorporate customary rights and practices into their policies and strategies. As a result, the Land Act (2009), the Local Government Act (2009) and the Investment Promotion Act (2009) were developed to establish the institutions and mechanisms of governance that would address pressure points and fill vacuums created by conflict, uneven development and lack of transparency and accountability in resource governance (GRSS, 2011).

The three laws mentioned above established the fundamental framework for the fair and transparent administration of land rights in South Sudan. For example, the Land Act regulates land tenure and equally recognizes rights to customary, public and private tenure. Only South Sudanese citizens can own land, but foreigners can lease land. The document defines rights and restrictions of land users and owners. The Land Commission supervises the application of the Land Act and its institutional set-up at the different administrative levels is elaborated in the Act. The Act prescribes EIA for investment projects, but there are no elaborate provisions for land use planning such as land use categories or planning and allocation procedures. The Local Government Act defines primary responsibilities of local government and traditional government authorities in the regulation and management of land, which includes charging customary institutions with particular responsibilities for administering community land rights. On the other hand; the Investment Promotion Act establishes procedures for facilitating access to land for private investment, including by foreign investors, in ways that balance the interests of both current right holders and investors. Although a framework has been developed, government officials have a poor understanding of the laws and lack the capacity to interpret and carry them out. There is also a lack of awareness by the population as a whole, which further impedes progress (GRSS, 2011).

### **The Water Policy**

In December 2007, the GRSS adopted the South Sudan Water Policy, which states that access to sufficient water of an acceptable quality and quantity to meet basic human needs is a human right. The policy provides that: the right to water shall be given the highest priority in the development of water resources; rural communities shall participate in the development and management of water schemes; and the involvement of NGOs and the private sector in water projects shall be encouraged. Apart from customary laws governing access to grazing and fishing grounds for communal use at a local level, currently there is no formal system for allocating water resources for different social and economic purposes in the country.

### **The Forestry policy 2014**

Recognizes the critical role played by forests in providing "critical environmental services, water catchment and in mitigating climate change." The forestry policy proposes the ratification of the

UNFCCC so that the country can benefit from the Clean Development Mechanism (CDM). It also proposes establishing a designated national authority “to facilitate the flow of climate change benefits to South Sudan.” The policy also emphasizes the need for measures “so that South Sudan can access financing under Reduced Emission from Deforestation and Forest Degradation (REDD).” It calls for delineation and gazettelement of forests to attain a national forest cover of 20 per cent of land area.

### **Minerals law and policy**

The Interim constitution of South Sudan states that all levels of government will protect and ensure the sustainable management and utilization of minerals, including oil. The Mining Act of 2012: provides a framework for the management of the mining sector consistent with international standards, including licensing, environmental protection guidelines and the use of technology to ensure as much mineral resources as possible are recovered from the ground. It also provides for Community Development Agreements for Mining Licenses and environment and social provisions.

The Petroleum Act 2012: The Act states that ownership of petroleum is vested in the people and to be managed by the government for their benefit. The Act also emphasizes maximum petroleum recovery within a framework that seeks to ensure the safety, security and protection of the environment, and requires transparency, accountability and ethical behavior on the part of both licensees and the government (SSIS, 2012). The Petroleum Act is relevant because of the increasing adverse environmental impacts associated with petroleum development in the country on the one hand, and the potential to use funds generated from petroleum sales and taxes for biodiversity management: Oil exploration is carried out mainly in the central flood plains of Jonglei, Lakes and Upper Nile States which are also endowed with vast natural resources including forests, livestock, wildlife and aquatic resources. The Petroleum Act provides that a SEIA to be undertaken by that the oil contractor or licensee in compliance with international standards to determine any present environmental and social damage, establish the costs of repair and compensation and determine any other areas of concern. Whereas the petroleum industry in the country has express a desire for environmental compliance, the Ministry of Petroleum and Mining is still developing policies and measures to safeguards the environment and govern the oil and mining sector to include EIA, environmental sensitivity atlas, multi-institutional monitoring, hazardous waste management, conservation of drilling and campsites, and oil spill contingency plans.

### **Fisheries policy**

The 2006-2011 Fisheries Policy also placed inadequate emphasis on co-management as the key to management of capture fisheries and aquaculture, and failed to place the private sector squarely as the main engine for growth in the sector. A new Fisheries Policy is required with a different emphasis. This new policy:- a) is consistent with the aims and ideals of the transitional constitution, including decentralization of powers and co-management as a guiding theme through the whole sector b) embeds the principles contained in the FAO Code of Conduct for Responsible Fisheries in all activities and sub sectors c) places the private sector as the engine for growth in the sector d) provides a coherent and participatory roadmap to the sector objectives, which can be seen and



understood by all stakeholders from all sectors e) provides a sound basis for integration into sector wide and national planning f) facilitates the capture of funds to address the priority policy areas g) facilitates monitoring of progress towards achieving the stated objectives h) is realistic and implementable.

### **Concluding Remark on the Enabling Environment for Wetlands in South Sudan**

South Sudan, the newest nation among the comity of nations, getting its independence in July 2011, is endowed with vast and rich natural resources. Its natural capital includes arable land, grasslands, tropical forests, rivers, wetlands, lakes, biodiversity, minerals, oil, etc. One of the top priorities of the Government of South Sudan is to develop and implement sustainable management plans in the sub-sectors of the environment sector, so that the exploitation of natural resources does not adversely impact the environment. Hence, different attempts have been made, albeit insufficient, towards these goals in collaboration with different international organization. In the above paragraphs an attempt has been made to highlight the different formulation of environmental policies, standards and guidelines, and enforcement of these instruments with some bearing to wetlands in particular and environmental issues in general.

Though a new nation, there has been some strives to formulate different rules and regulations that have direct bearing on the environment. Starting from the ICSS, environmental issues have been clearly stated. Article 44 of the ICSS and Article 14 of the TCRSS give provisions for environmental issues. Both the national development strategy of the country (DSSS) and the South Sudan Development Strategy (SSDP) considers environmental issue in cross cutting category as it has implications on different sectors of the economy. In its INDC, South Sudan has considered reforestation and deforestation activities among the proposals for low carbon development while in its adaptation strategies agriculture and livestock, forests, biodiversity and ecosystem were put forward as areas for priority actions. The five priorities thematic areas (environment, water resources, agriculture, disaster risk reduction, and the policy and institutional framework) identified in the NAPA of South Sudan have direct implications for wetland management. All these measures show that environmental issues have been given some consideration which can be considered as a good enabling condition for wetland management in the country.

Though the legislative initiatives towards national biodiversity are many, this is the area where most of the initiatives remained at draft level. These initiatives have direct implication for the lower Baro and other wetlands system and hence finalizing these draft bills into legislation could be important in partially protecting wetlands of ecosystem importance such as the lower Baro wetlands system. The continued conflict and war in the country has not only hampered the completion of such legislative initiatives but also the protection of natural resources of high importance and the lower Baro wetland system is one of them. This latter condition could further exacerbate the conflict in the means of forced migration and competition for resources. Sustainable and equitable management of resources, such as forests, oil, wetland, water and minerals, will contribute to peace and economic prosperity and one way to ensure this is to establish mechanisms for protecting and sustainably using natural resources. Hence such legislative initiatives should be given high priority as they set the rules of the game.

All the above discussion set the rules of the game both for the use, ownership and management of the lower Baro and other wetlands and the ecosystem services that are derived from them. They all are important for this study because they have direct bearings to one or more of the ecosystem services considered in this study. Namely: provisioning (crops, timber, grazing, fuel wood, fishing, etc.) cultural (transport, education, tourism), and regulating services (carbons sequestration, water purification and attenuation, and soil erosion). Also, one of the efforts of this study, for example, is to propose conservation options for the wetland and such proposal is incomplete without thoroughly understanding the rules of the game and the organizations involved in managing the ecosystem services and the resources that generate such services. More than anything else, the lower Barowetlands system is one of the important ecosystems in the country and since it is geographically located in Southern Sudan, it falls under the jurisdiction of the Government of Southern Sudan (GOSS) in terms of policy and its management.

### **3. Brief overview natural resources and environment related policies and strategies in Ethiopia**

As the Lower Baro initiates in Ethiopia, we have also reviewed the Policy and strategy documents in Ethiopia related to wetland, forest, and land escape restoration. In Ethiopia, the number of policies, strategies, proclamations, programs and plans has been developed since the 1990s to maintain the natural environment and to implement nature-based solutions. The Ethiopian Forestry Action Program (EFAP, 1994), the Environmental Policy of Ethiopia (FDRE, 1997), the Forest Development, Conservation and Utilization Policy (2007), the Climate Resilient Green Economy Strategy (CRGE, 2011), the Growth Transformation Plan (GTP), Sustainable Land management Program (SLM), Agriculture Growth Program (AGP), Climate Change National Adaptation Programme of Action (NAPA) of Ethiopia, Post 2015, Sustainable development Goals (SDGs), the National Forest Sector Development Program (NFSDP) (2016), the Home Grown Economic Reform (HGER), the Ten-Year Development Plan (10YDP), and the Enhanced Nationally Determined Contribution (ENDC) and etc. , are documents which directly or indirectly address the conservation and development of wetland, forest resources and landscape restoration interventions. Some of these documents are briefly reviewed below. The purpose here in this section is not to list and discuss all policies, strategies or programs related to wetland, forestry and landscape but to highlight a general idea and to focus on some of the leading ones that facilitate settings to conduct wetland, forest and landscape restoration interventions in Ethiopia.

#### **Forest Development, Conservation and Utilization Policy (2007)**

Forest Development, Conservation and Utilization Policy (FDCUP), is the first forest policy and strategy document which was formulated in 2007. The main aim of this policy is to meet the public demand in forest products and foster the contribution of forests in enhancing the economy of the country through appropriately conserving and developing forest resources. The following specific objectives are clearly stated under this policy document.

- To encourage sustainable forest development by rendering professional and technical assistance to farmers, pastoralists, investors and institutions engaged in forest resource development;
- To adequately meet the forest and forest product demands of the public through sustainably enhancing the production of forest resources in areas that are suitable for forest and forest resource development;
- To foster the contribution of forest resources to food security and industrial development through the identification, rejuvenation, multiplication and distribution of tree species that are suitable for our country and capable of giving diverse benefits;
- To lay the foundation wherein forest resources deliver all-embracing services to the country in a sustainable manner, through the prevention of threats as well as the conservation and development of forest resources;
- To ensure maintenance of the natural ecological balance through adequately conserving and developing the forest resources of the country.

Fostering private forest development and conservation schemes; expansion of forest development technology; expanding market development for forests; administration and management of state forests; protecting forest resources from threats; and establishing modern information systems on forest development, conservation and utilization are the main policies and strategies outlined. Specific strategies and procedures at individual, community, organizational and government level are clearly stated in this policy document.

### **The Environmental Policy (1997)**

The Environmental Policy of Ethiopia (1997) is the overarching policy for the environment and natural resource management in Ethiopia. It was developed to address an identified gap in the policy framework. The importance of sustainable development was recognized in national policy and laws however there was no overall comprehensive policy formulation to address the cross-sectoral and sectoral issues that concern the environment and natural resource management. This policy is setting out specific policy directives for different sectors concerning the environment and natural resource management. The policy has sections that contain specific policies relevant to the forestry sector and REDD+ such as encouraging tree planting and policies on the management of forests, trees and woodland resources. Here, sustainable forest management and participatory approaches involving state, private companies and communities are promoted.

### **Climate-Resilient Green Economy (CRGE) strategy**

The Ethiopian government acknowledged that climate change is of critical strategic importance to Ethiopia. Given the dominance of the agricultural sector in Ethiopian economy and with its rain-fed nature, climate change has the potential to hold back economic progress, or reverse the gains made in Ethiopia's development and could exacerbate social and economic problems. Ethiopia aims to build a green economy and to follow a green growth path that fosters sustainable development. Through the development of its Climate-Resilient Green Economy (CRGE) strategy that is based on carbon-neutral growth, it envisions to attaining middle-income status by 2025 (FDRE 2012). The CRGE strategy identified the forest sector as one of its four pillars together with agriculture, energy and transport sectors. The CRGE initiative has prioritized three strategies that could help to develop sustainable forestry and reduce fuel wood demand:

- Reduce demand for fuel wood via the dissemination and usage of fuel-efficient stoves and/or alternative-fuel cooking and baking techniques leading to reduced forest degradation,
- Increase afforestation (2 million ha), reforestation (1 million ha), and forest management (2 million ha of forests and 2 million ha of woodlands) to increase carbon sequestration in forests and woodlands.
- Promoting area closure via rehabilitation of degraded pastureland and farmland, to enhance soil fertility and thereby ensuring additional carbon sequestration.

Among the various recommended adaptation options under CRGE strategy in relation to the forest sector, developing a national monitoring system for forests; ensuring the resilience of forest and forest species to climate change; supporting and encouraging forest growing; removing incentives for deforestation, and creating integrated land use planning are recommended.

### **The Growth and Transformation Plan (GTP-I and GTP-II)**

During GTP I, the Climate Resilient Green Economy (CRGE) strategy was formulated to embark on building green economy. To implement the CRGE, new institutions and organizational structures have been put in place since then. The establishment of the Ministry of Forest Environment and Climate Change to oversee and coordinate the implementation of the CRGE strategy is key among them. It was indicated that formulating and effectively implementing environmental strategies and laws are essential to accelerate the process of building a climate resilient green economy. In this context, the government planned to prepare 14 environmental conservation systems and 15 were prepared by the end of the plan period. Leadership commitments, new organizational arrangements, active participation of communities; conducive policies, strategies, action-plans; strong working relationship with relevant stakeholders, communities and implementing agencies were opportunities witnessed during the plan period. However, limited implementation capacity as well as inadequate adaptation and promotion of Green Technology Packages have remained challenges in the course of implementation.

Under GTP II, the government of Ethiopia has given major emphasis to building a climate resilient green economy in the context of sustainable development and realizing the vision of becoming a lower middle-income country by 2025. Accordingly, the government promised enhanced efforts in reducing greenhouse gas emission through following four pillars

- Enhanced crop and livestock production that improve food security and income of farmers and pastoralists;
- Natural resource development, forest protection and reforestation programs, that enhance economic and ecological advantages of forests;
- Expanding electricity power generation from renewable sources of energy for domestic and regional markets and;
- Leapfrogging to modern and energy efficient technologies in transport, industry and constructions are the basic strategies of building climate resilient green economy.

Furthermore, additional efforts are promised to be exerted in improving or creating forest products marketing chains and enhancing their economic contribution in terms of value addition and employment generation. Among the goals in GTP-II, reduce natural resource degradation and improve its productivity; and increase conservation of national biodiversity, promote its sustainable utilization and ensure fair and equitable benefit sharing of the country and its communities are the major activities to improve the natural resources of the country and mitigate the impacts of climate change.

## **The National Forest Sector Development Program (NFSDP) (2016)**

The National Forest Sector Development Program (NFSDP) was initiated by Ethiopia's Ministry of Environment, Forest and Climate Change (MoEFCC) to serve as the main guiding document for coordinating strategic policy interventions and sector-wide investments for a period of 10 years since 2016. The Government of Ethiopia has demonstrated a strong commitment to increase the forest cover and strengthen the forest contribution to green economic growth. Ethiopia's diverse forest resources including high forests, woodlands, and trees in farms, have among the highest biodiversity in the world and provide a wealth of goods and services to ensure a green economic growth pathway while maintaining rapid infrastructure development and urbanization. The goal of the NFSDP is to provide the master plan that serves as the roadmap for forestry actions while considering the mandate of National Regional States for natural resources management.

Additionally, the NFSDP serves for mobilizing funding and coordinating support. Given the strong reliance of forest sector development on the collaboration between many sectors and institutions, as stated under NFSDP, the MEFCC will serve as the lead forestry institution that provides the inter-sectoral coordination required to realize successful NFSDP implementation. The NFSDP is comprised of a series of transformational actions that together can achieve the forest sector's ambitious development and green growth goals. The proposed actions with the most transformative potential include attracting private investment in commercial forestry and establishing industrial clusters for manufacturing timber and other industrial wood products for domestic consumption and export.

The main pillars around which the NFSDP is built are listed as follow;

- Enabling environment and institutional development
- Sustainable forest production and value chains
- Forest environmental services
- Forests and rural livelihoods
- Urban greening and urban forests, and
- Implementation framework

Generally, NFSDP's overall vision is to see sustainable management of Ethiopia's forests and tree resources by 2025 that contributes to self-sufficiency in forest products and enhanced environmental services.

## **Sustainable Land Management Program(FDRE 2013)**

**Sustainable Land Management Project (SLMP-I)-2008-2013:** The prime objective of Sustainable Land Management Project (SLMP-I) has been set to reduce land degradation in agricultural landscapes and to improve the agricultural productivity of smallholder farmers. The main components of this program are watershed management (scaling up best practices), land

certification (strengthening land tenure) and project management (knowledge management), which are directly linked to forest and landscape restoration.

**Sustainable Land Management Project (SLMP-II)-2013-2019:** The SLMP-II planned to build on the results of SLMP-I and to introduce measures to address climate change/variability related risks and to maximize Green House Gas (GHG) emission reductions so as to meet the GTP and the CRGE goals.

### **The Agriculture Growth Program (AGP)(FDRE n.d)**

The Agriculture Growth Program (AGP) is a multifaceted investment program supporting agricultural productivity and commercialization focusing on high agricultural potential areas. It is a program approach viewed by the Government as the key investment mechanism for development partners and government to collaborate. The program closely aligns with the objectives set for agriculture sector in the GTP-I and GTP-II. Agricultural water development and rehabilitation of degraded land and ecosystem are the major components of AGP to improve smallholders' livelihood and income in Ethiopia. Irrigation is also one of the components that can help farmers to increase their crop production and variety, and lengthen their agricultural seasons. AGP has two phases, i.e., AGP-I and AGP-II. The development objective of the Agricultural Growth Program (AGP) is to increase agricultural productivity and market access for key crop and livestock products. (<http://ethioagp.org/objective/>)

### **Climate Change National Adaptation Program of Action (NAPA) of Ethiopia (NAPA 2007; WSP 2011)**

These lists are selected actions to implement climate change national adaptation program of action greatly interconnected with conservation measures:

- Conduct water resources assessment studies (inventory of water quality and quantity, surface and underground water in time and space to develop proper use of available water resources
- Introduce improved methods of water conservation, storage and rational use
- Construction of small check dams and rainwater harvesting schemes to meet water supply for domestic and irrigation use
- Undertake soil conservation measures that help to reduce soil erosion & siltation and also protect the pollution of water sources
- Implement watershed management and water conservation programs & projects that promote local community participation
- Introduce methods to tackle & prevent flood protection, disaster prevention actions; and maintenance of flood control structures
- Manage and tackle droughts as well as the associated slow on-set diseases

### **Post 2015, Sustainable development Goals (SDGs)**

The SDG framework addresses key systemic barriers to sustainable development such as inequality, sustainable consumption patterns, weak institutional capacity, and environmental degradation that the MDGs neglected (ISSC 2015 ). It has 17 Sustainable Development Goals (SDGs) and the 169 targets. The 15<sup>th</sup> goal which states “protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forest, combat desertification and halt and reverse land degradation and halt biodiversity loss” is essential for fulfilling the environmental, socio-cultural and economic needs of present and future generations and, therefore, plays a vital role in the international agenda for achieving a better life for all human societies. This goal is directly linked to forest restoration and intervention related to improving land health.

### **The Ethiopian Forestry Action Program (EFAP, 1994)**

EFAP was produced in 1994 under the Ministry of Natural Resource Development and Environmental Protection which was established in 1991(EFAP 1994). EFAP came up with four primary and four supporting development programs. The primary programs were developed to directly address forestry development objectives include: Tree and Forest Production Program; Forest Resource and Ecosystems Management Program; Forest Industries Development Program; and Wood-fuel Energy Efficiency Development Program. The supportive development programs were developed to back up the primary programs. However, there were low success of implementing of these programs due to limited funding and restructure of the Ministry. The above brief review of policy and strategies in Ethiopia revealed that there are conducive policy settings at different institutional and ecological scales in order to promote and support intervention to restore the degraded wetlands, forest and landscape areas.

### **Home Grown Economic Reform (HGER).**

Ethiopia has started implementing its HGER in the year 2019 and the 10YDP by mid-2021. The overall vision of the HGER and 10YDP is to sustain the fast economic growth that was achieved while the country was implementing the GTP I and II while improving on the shortcomings of the previous strategies. The country’s fast-paced development has impressed and has garnered strong international support from bilateral and multi-lateral partners. The HGER and 10YDP is planned to commit to correct the lopsided sectoral focus of the previous strategies in favor of balanced sector-focused growth in a manner that the inter sectoral heterogeneities and the sector-embedded advantages can be capitalized on. The HGER and 10YDP also pay due attention to exit poverty in green way to making in a manner that ensures the continuation of focus on the CRGE strategy.

From the national prosperity vision, development objectives and strategic pillars, a set of overarching priority areas are identified as follows for the efficient allocation of resources, as well as the effectiveness of reforms, policy initiatives and implementation actions. The priorities are set for the medium-term to provide substantial milestones for the long-term development plan against which progress will be measured. These key priority areas are the basis for the homegrown economic reforms and policy direction at the macroeconomic and sectoral levels. Enhance the tourism sector as major foreign exchange earnings through effective management of protected



areas, wetlands, national parks and through implementation of nature-based solutions are the key reform agenda of this policy. The following key priority areas are major interventions:

- i. Multi-sectoral and Diversified Sources of Growth and Job Opportunities,
- ii. Sustainable and Inclusive Financial Sector Development,
- iii. Harnessing the Demographic Dividend,
- iv. Quality and Efficient Infrastructure Development,
- v. Sustainable Urban Development, and
- vi. Peace, Justice, and Inclusive Institutions

### **Ethiopia's Ten-Year Development Plan (10YDP)**

The 10YDP represents the Government's long-term vision for development as the country moves towards middle-income status. Eight broad priority areas have been identified: macroeconomic reform, structural transformation, industry, infrastructure, energy, human development, urban development and housing, and population. The overall development goal of the 10YDP is to achieve improved welfare of the society by improving the standard of living and quality of life that are captured in the broader national prosperity vision by taking CRGE as one of the strategic pillars of the plan. These development vision and objectives will be achieved through the following key strategic pillars which are primarily focused on addressing the deep-rooted macroeconomic, sectoral, and structural bottlenecks of economic, social, administrative, and institutional development of the country. Some of the key strategic pillars are interlinked, yet for the reform and policy intervention emphasis, some of the central pillars are recognized on their own. The key strategic pillars of the ten-year development plan are:

1. Quality Economic Growth and Shared Prosperity,
2. Economic Productivity and Competitiveness,
3. Technological Capability and Digital Economy,
4. Sustainable Development Financing,
5. Private Sector-led Economic Growth,
6. Resilient Green Economy,
7. Institutional Transformation,
8. Gender and Social Inclusion,
9. Access to Justice and Efficient Civil Services, and
10. Regional Peace Building and Economic Integration.

## **Ethiopia's Enhanced Nationally Determined Contribution (NDC, 2020)**

The Government of Ethiopia has undertaken economy-wide analysis and comprehensive stakeholder engagement to update its Nationally Determined Contribution (NDC). Ethiopia originally submitted its Intended Nationally Determined Contribution (INDC) to the United Nations Framework Convention of Climate Change (UNFCCC) on 10<sup>th</sup> June 2015 which later converted to Ethiopia's 1<sup>st</sup> NDC after it ratified the Paris Agreement (PA) on 9<sup>th</sup> March 2017. A preliminary update of the first NDC has already been submitted to UNFCCC at the end of 2020. The final update of Ethiopia's NDC is submitted in July 2021, to allow the international community to consider Ethiopia's new targets well ahead of COP 26 which has been re-scheduled to take place in November 2021 in Glasgow. Ethiopia has developed an ambitious NDC. It has maintained its impressive level of ambition in Mitigation of its GHG emissions from its first NDC and enhanced the robustness of its baselines, projections and targets. Adaptation has been made more central to this enhanced NDC, with very clear baselines, targets, and indicators. In terms of resources required to implement the activities set out in this NDC a high-level breakdown has been prepared providing guidance of the magnitude of resources required and a clear demarcation between conditional and unconditional financing. Implementing such an impressive and ambitious programme of work will be challenging.

#### 4. The Lower Baro Basin Wetlands System<sup>4</sup>

Wetlands occur extensively across the Nile Basin and support the livelihoods of millions of people. The Baro-Akobo-Sobat (BAS) system (see figure 4.1) is one of them and is a vast and complex area containing numerous wetlands stretching over a wide expanse of plains. The basin includes an extensive network of wetlands crisscrossed by watercourses generally draining into the White Nile through the lower Sobat system. The Sobat River is the final tributary of the White Nile and contributes about half its flow (Sutcliff 2009). The Sobat has two major tributaries: East, the Baro River, which drains an area of the Ethiopian mountains, east of Gambela, and to the south, the Pibor, which receives the flow of the Gilo and the Akobo Rivers origination in Ethiopia South of the Baro Basin. This southern system also drains a wide area of the plains east of the Bahr el Jebel.

The Baro river is the main rivers within the Baro-Akobo basin. The rivers rise from the southwestern Ethiopian highlands (about 1,500 to 3,100 m asl) and flow in westerly direction, first along deep incised valleys over steep gradients then open across the Gambela Lowland plains at about 500 masl where they meander through a vast plain stretching all the way to the border with South Sudan. Though the Baro supplies 75% of the Sobat flow (ENTRO 2007b), little is known about the extent of the wetland, ecology and hydrology in the lower Baro. Below Gambela it flows towards the Pibor junction, but about 100 km above this junction it splits into the Adura and Baro which rejoin downstream; these rivers receive tributaries but also lose water through several spill channels leading towards the Machar marshes. In addition, the river overtops its banks at high flows and inundates wide areas. The Machar marshes area wetland to the north of the Baro, whose extent is little known except from satellite imagery. Outflow from these marshes sometimes reaches the White Nile (Sutcliffe, 2009).

Flow in the Baro Akobo Sobat Sub-basin is characterized by high seasonality with a distinct high flow season occurring between July and October. This sub-basin is one of the least monitored Sub-basins and yet has very complex hydrology. A key feature of this sub-basin is high interconnection between floodplains and the river network with braided and bifurcating streams. Downstream of Gambella station, Baro River overflows into the Machar marshes, which are in the White Nile sub-basin<sup>5</sup>. Nile Basin wetlands are vulnerable to a range of threats: water resource infrastructure, agricultural land expansion, population growth, over exploitation of resources, expansion of invasive species, extraction of non-renewable resources (like minerals and oil) and climate change. These challenges are also common to the Lower Baro wetland system and deepen the situation due to its location remoteness to assess the main wetland indicators (Rebelo and McCartney, 2012).

The main problem in the sub-basin is underdevelopment and under exploitation of the water and natural resources to improve livelihoods of the population in the sub-basin in particular, and the rest of the population in the EN countries in general. The South Sudanese part of the sub-basin has

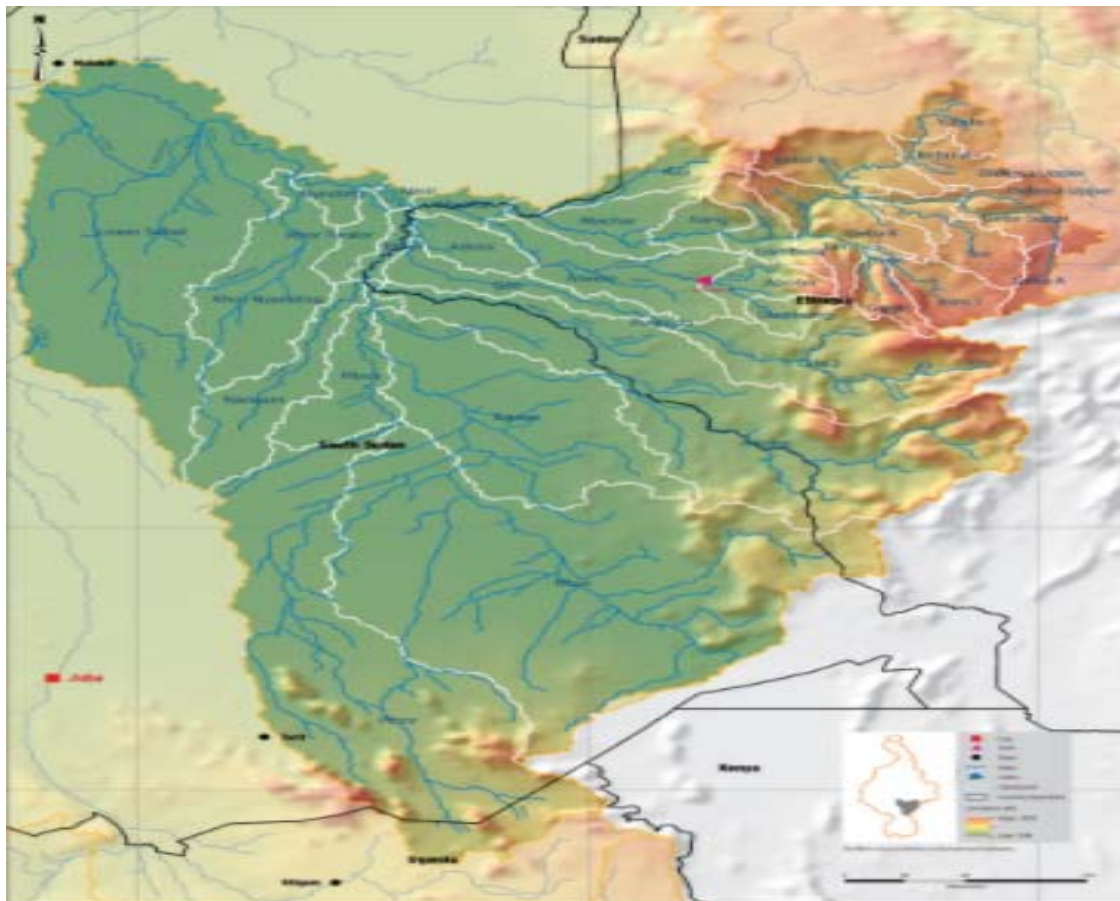
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<sup>4</sup> We expect the map of the Lower Baro basin Systems along its coordinates to be provided by NBI/ENTRO which is missing in the ToR.

<sup>5</sup> <https://atlas.nilebasin.org/treatise/baro-akobo-sobat-sub-basin/>

recently emerged from a long period of civil conflict and is in greater need for development. The Ethiopian part of the sub-basin is also relatively underdeveloped in comparison with the rest of Ethiopia (ADB, 2012). Competition for grazing land and water sources is not uncommon in the area (Mohamed, 2016). The sub-basin experiences frequent flooding and droughts, which worsens the vulnerability of communities as well as their livestock. Hydrological and climate variability are high and are likely to be more affected by climate change. Population pressure (Ethiopia and South Sudan both have annual growth rates exceeding 2.6%) is exacerbating deforestation and together with poor land use practices, it leads to significant land degradation. Furthermore, the sub-basin has very important wetlands (the Machar Marshes) that are of international importance. The wetlands have very significant effects on the hydrology of the sub-basin; and they are important habitat for wildlife as well as livestock. The Baro-Akobo-Sobat sub-basin is a highly sensitive environmental zone (ADB, 2012).

Figure 4.1: The Baro-Akobo-Sobat sub-basin



Source: <https://atlas.nilebasin.org/treatise/the-baro-akobo-sobat-sub-basin/>

Despite the importance of wetlands in Nile Basin including the BAS sub-basin, there are big gaps in the knowledge about the current status of these ecosystems, and how populations in the respective

sub-basin uses them. A better understanding is needed on the ecosystem services provided by the different types of wetlands in the Nile basin, and how these contribute to local livelihoods. While many of the Nile's wetlands are inextricably linked to agricultural production systems and other ecosystem services, the basis for making decisions on the extent to which, and how, wetlands can be sustainably used is weak. Moreover, the Nile's land and water resources are not well utilized or managed and are degrading rapidly. While water development interventions and agricultural activities should be undertaken with caution within wetlands, to ensure the maintenance of ecosystem services, they offer a vast livelihood resource and development potential for agriculture and fisheries in particular (Rebelo and McCartney, 2012).

Regional plans for water resources development have been started by the Eastern Nile Technical Regional Office (ENTRO) but limited with wetlands assessment. This includes storage dams upstream on the Ethiopian side of the Baro River (Mohamed, 2016). The strong dependency of communities on the area's natural resources requires critical assessment of the impacts of future interventions in the BAS basin wetland systems.

## 5. Methodology

### 5.1. Sources of Data and Data Collection

- Explore documentations and records; and conducting desk review (reports, annual plan, policy and strategy documents, etc.)
- Explore secondary data (both socio economic and biophysical)
- Explore available TEEB reports and valuation studies including Machar Marshes and Sudd wetlands in South Sudan
- Conduct virtual interviews with experts at Nile Basin Initiative (mainly NBI secretariate and ENTRO)
- Conduct inception and validation workshops (this may be virtual)

For the successful accomplishment of the stated objectives, secondary data are considered. Secondary data for better understanding of this particular issue and enabling policy environment were explored. In view of this, desk review was conducted on different documents focusing on wetland valuation, ecosystem services, valuation and cost and benefit analysis. Policies, strategic documents, plans, progress reports of different potential stakeholder, review the national and regional proclamations related to wetlands and ecosystems, and other records and reports from federal/regional/local level environmental offices, research findings conducted on similar issues, and review of best practice at international arena will be explored. We also applied a statistical application tool to analyze the collected data, the land use and land cover (LULC) or ecosystem accounts mapping analysis were carried out using Geographical Information System (GIS) and available remote sensing data to develop the ecosystem accounts (land use land cover) map of the Lower Baro wetlands system using the available Lower Baro Sub-basin delineated area.

### 5.2. Method of Analysis

#### 5.2.1. Monetizing values of ecosystem services and trade-offs associated with alternative wetland land use, resource use, management or investment scenarios:

We applied benefit transfer method (“value transfer”) to estimate economic values for wetland ecosystem services by transferring available information from relevant documents, empirical works and studies. We defined the environmental unit that help us to define in more detail the components of the environment (ecosystem) and the economy (socioeconomic conditions) about which data can be compiled or from which data were collected. Note that value transfer is the primary approach in this case to value wetland ecosystem services since field measurement and primary data collection were not possible as a result of the current circumstances in the ground.

To compute the value of the wetlands ecosystem services, different approaches were applied depending on the availability of information pertinent to each ecosystem service. While the specific method of analysis for the respective ecosystem service are indicated in each of the ecosystem services to be considered for the economic valuation, generally the market price method and value/benefit transfer approach (Troy & Wilson 2006) were utilized to estimate the economic value of the wetland. In value transfer, the adjusted unit value transfer is preferred to a simple unit value

transfer approach because the former allows the possibility of capturing the differences in income and price between the policy and the study sites.

Considering the approach that has been applied for the development of both Machar Marshes (NBI 2020a) and Sudd (NBI 2020c) wetlands ecosystem services valuation report, benefit transfer is a plausible approach. Moreover, the preparation of the Nile basin TEEB of Wetland synthesis report, it not only helps in understanding the wetlands considered in the basin, but also helped to review and consider similar experiences around the globe that are consistent with the approach applied here in this analysis (NBI 2020b). The TEEB global database is also considered as a good input for the value transfer exercise and in further broadening the global experience in applying benefit transfer approach (Rudolf *et al.* 2020). Based on Troy & Wilson (2006), the following core steps have been applied as a decision framework for mapping and valuing ecosystem services:

1. **Study area delineation:** Spatial designation of the study extent. It will have a significant impact on the final results when estimating the economic value of ecosystem services.
2. **Typology development:** establishment of a land use and land cover (LULC) or ecosystem account typology. This step starts with a preliminary survey of available GIS data at the site/study area to determine the current LULC.
3. **Meta-analysis of peer-reviewed valuation literature to link per unit (area) coefficients to available LULC types:** Preliminary review of economic valuation studies to determine whether the ecosystem service coefficients value will be documented for the LULC types in a relatively similar context and available global and regional database.
4. **Mapping:** Map creation involves GIS overlay analysis and geo-processing will be conducted to combine input layers from diverse sources to derive the LULC map of the wetland.
5. **Ecosystem Services Valuation:** Calculation of the Ecosystem Services Values (ESVs) and break down by LULC types will be analyzed.
6. **Geographic summaries:** Tabulation and summary of ESVs by relevant management geographies (spatial scales) will be developed.
7. **Scenario or historic change analysis:** This analysis can be conducted by changing the inputs in step 4 and 5.

#### 5.2.2. Assessing and mapping of the ecosystem accounts (LULC)

We combined available remote-sense data and GIS approach, and available ecosystem account (land use land cover) models to be considered as analytical methods to map the Lower Baro wetland system. As well, available natural resource and biodiversity inventories, indicators of ecosystem conditions, and socioeconomic data as data sources were considered. Table 5.1 shows the potential required information, data sources and analytical approaches for assessing ecosystem condition and trends in the selected site (MA 2005). Since the literature suggests the seasonal nature of the Lower Baro wetland system, an attempt was made to assess the wetland considering this fact. Hence, the valuation exercise was based on plausible scenarios depending on the season of the year and thereby by the water flow in the system.

At the end, the proposed methods above enabled us to conduct the ecosystem services status and trend; to assess the socio-economic contribution of the wetland ecosystem services; to assess associated wetland conservation efforts; and to analyse trade-off and synergies in wetland management for alternative wetland and other natural resource use in the Lower Baro wetland system.

Table: 5.1. Required information, data source and analytical method to assess ecosystems condition and trends

Type of information required	Data sources or analytical models						
	GIS	Natural resource and biodiversity inventories	Socioeconomic data	Ecosystem models	Indicators of ecosystem condition	Indigenous and traditional knowledge	Case studies of ecosystem response drivers
Current spatial extent and condition of ecosystem	x	x			x		
Quality, quantity and spatial distributions of services provided by system		x		x			
Human populations residing in and deriving livelihoods from system			x			x	x
Trends in ecosystem conditions and services	x	x		x	x	x	x
Response of ecosystem condition and services to drivers				x	x	x	x

Source: MA (2005)



## 6. Results and Discussion

### 6.1. Introduction

In earlier studies conducted for Sudd and Machar wetlands, a stakeholder consultation was conducted to solicit the stakeholders of the wetlands and other relevant information for the studies. We noticed that there is a significant similarity not only on the ecosystem services provided by the two wetlands but also on the type and nature of stakeholders. Despite the fact that the Lower Baro wetlands system also includes areas in Ethiopia, we believe that there still is significant resemblance regarding the stakeholders of the Lower Baro wetlands system and the previous two studies (NBI 2020b)). Believing that it will enrich the content and findings of the study, we adopted the stakeholder analysis that was conducted for Machar and Sudd wetlands. For example, the Nuer and Anuak are the dominant groups in the wetlands despite using the wetland differently. Similar communities were among the beneficiaries of the Machar Marshes wetlands. Hence, there is huge resemblance in terms of culture, religion, ecosystem services consumed, and other activities between the different communities in the wetlands. With regard to development, even if there could be a bit difference between the Ethiopian and the South Sudan part, generally they can be regarded as less developed by respective country's standard.

### 6.2. Land Use and Land Cover of the Lower Baro Wetlands System

The extent of the lower Baro region had been a challenge to get since there are very limited studies conducted for the region in addition extracting out only lower Baro among the entire Baro Akobo basin was also a difficult due to the scarcity of Data. Therefore, we have explored what are the available existing data sources which can at least serve as a general guideline of the area representativeness. Hence the first data sources identified and possibly can fit our demand is the wetland data from the Eastern Nile Technical Regional Office (ENTRO). The ENTRO of NBI had done a project called Baro-Akobo Sobot (BAS) back in 2016. Hence BAS area wetland had been mapped and identified for the entire BAS region which is mostly located in Ethiopia and South Sudan. Therefore, the only wetland estimated in the BAS document were covering the lower parts of the BARO were clipped out consequently for better visualization of the area post processing of the data had been done. In the meantime, the land cover data of the Lower Baro had been collected from FAO WaPOR. Table 6.1 revises the area data sources and the land cover classification of the lower Baro region.

Table 6.1: Reviews of Data Sources

	<b>Items</b>	<b>Data Source</b>
1	Lower Baro Wetland	NBI, ENTRO
2	Land cover classification	FAO, WaPOR

## Land cover Classification of Lower Baro Wetland

The land cover mapping and analysis of Lower Baro wetland was carried out using land cover data of FAO WaPOR. The FAO WaPOR land cover Classification makes use of the decadal reflectance time series and seasonal phenology information from the Crop Calendar. The land cover products were derived from the the Global Land Service of Copernicus, the Earth Observation Programme of the European Commission. This product was generated from MODIS data, using the Copernicus training data and operational workflow, modified to account for differences in spatial resolution and the delivered land cover classes. The classification applied is based on the Land Cover Classification System (LCCS) that was developed by FAO. The main land use classes identified in the area includes cropland or under water management, tree/forest cover, grassland, shrub land, built up areas, and water bodies. The data can be downloaded from <https://wapor.apps.fao.org/home/1>, Figure 6.1 showed the land cover classification of lower Baro wetland region.

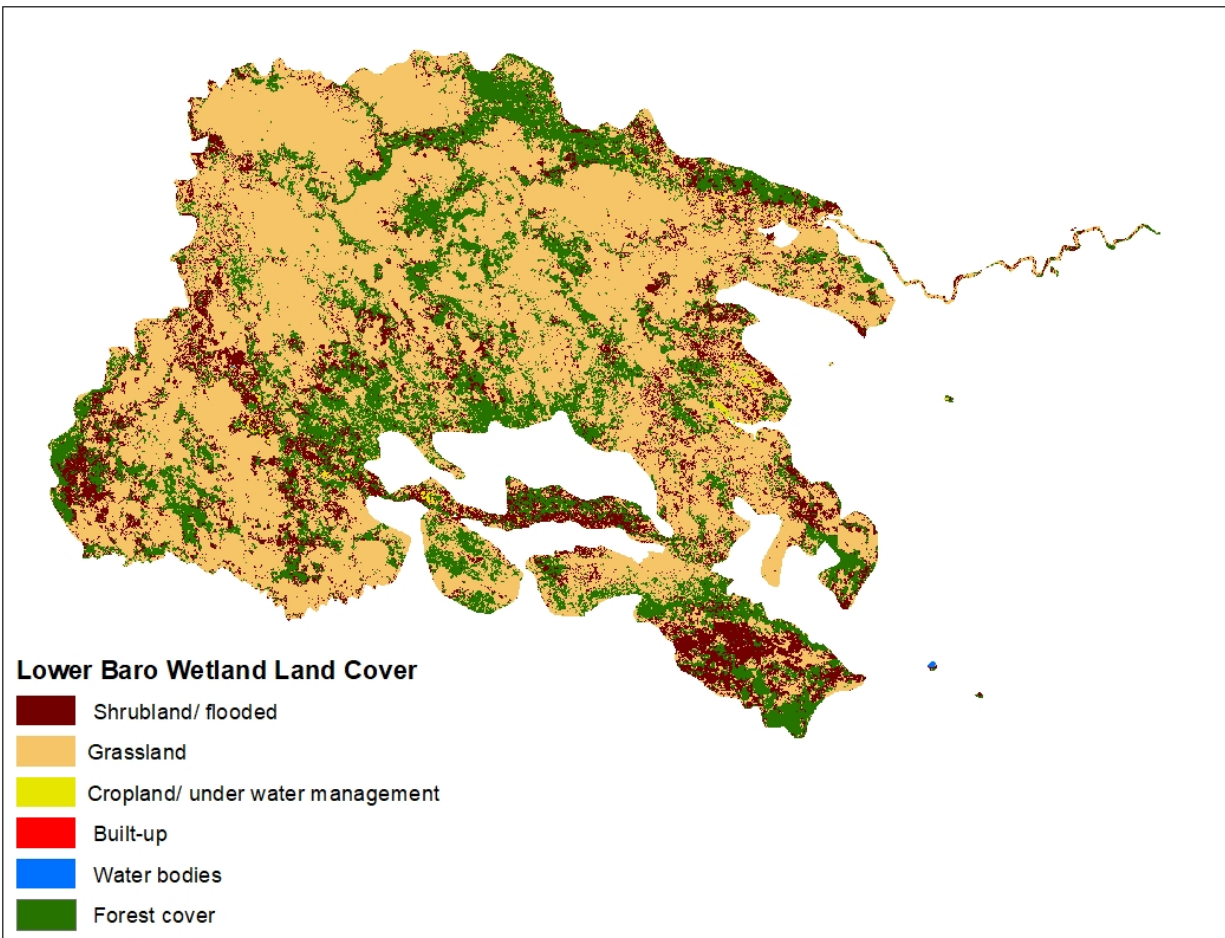


Figure 6.1: land cover classification of lower Baro wetland region

As it is represented in the above figure 6.1, the lower Baro region have a significant amount glass land coverage which accounts about 62% of the area. Hence Table 2 and the bar chart below

indicate the total areas of each land use land cover classification in hectare and percentage of each land use and land cover classification.

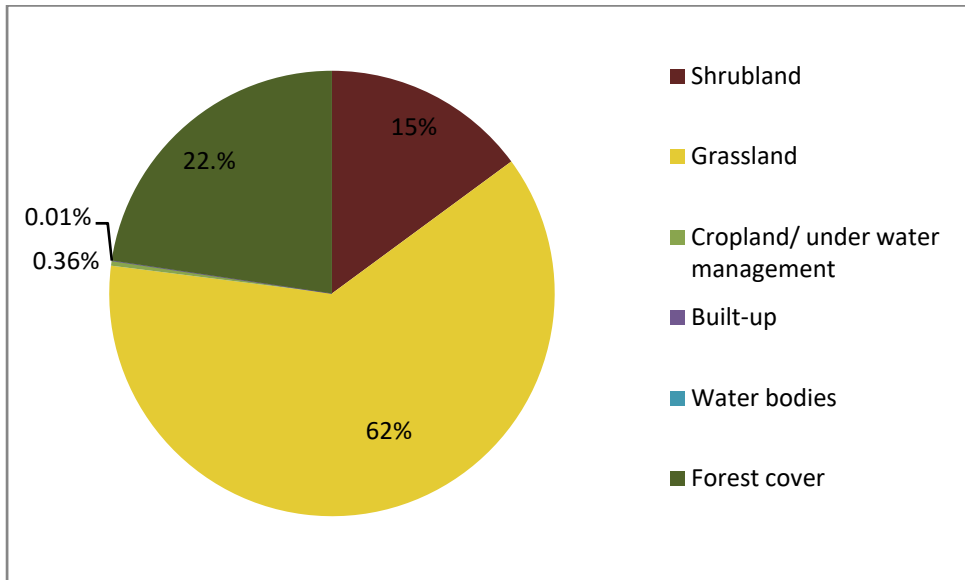


Table 6.2: Area of Land Use and Land Cover (LULC) Classification

No	Land Cover Classes	Area (Ha)
1	Shrub land	88624
2	Grassland	369049
3	Cropland/ under water management	2157
4	Built-up	6
5	Water bodies	74
6	Forest cover	134541
	<b>Total</b>	<b>594451</b>

### 6.3. Stakeholder Analysis and Mapping

In this section, the following major themes are addressed: What are the likely impacts of the conservation interventions on individual, local (community), regional, national and global level? Who are the stakeholders that will be impacted most (identifying the stakeholders)? What are the indicators to measure the impacts? What are the costs and benefits of undertaking the conservation intervention (opportunity costs, transaction costs, implementation costs)?

Based on the predetermined stakeholder groups and identification, that were carried out at different levels in the form of focus group discussion and key informant interview to identify key stakeholders for Machar Marshes and Sudd wetland provide highlight to identify stakeholders for

the Lower Barowetland system as well. The stakeholders categorized in to four groups; 1) local community (upstream and downstream village residents), 2) government institutions (national, state and local governmental organizations) and 3) researchers (NBI, research centers and universities) 4) NGOs (non-governmental organizations involved in wetland conservation programs and other humanitarian activities).

Table 6. 3: Key Stakeholders Involved in Lower Baro Wetlands System

Stakeholders		Proposed intervention	
Local community		Take responsibilities to conserve the wetlands, sources of labor and endogenous knowledge on how to preserve the wetland sustainably.	
External stakeholders	Governmental organizations	Local municipality	Administrative budget and enforced laws which written by the national government. <ul style="list-style-type: none"> <li>✓ Promote Community base wetland conservation.</li> <li>✓ Helps to assimilate information on how to utilize and conservation of the wetland,</li> </ul>
		National government	✓ Draw policy and strategies for sustainable preservation of the wetland
		Ministry of Animal Resources and Fishery	✓ By collaborating with Ministry of Environment, it will conserve the wetland so as to achieve the ministry's goal of creating harmony habitat for wild lives.
		Ministry of Agriculture (MoA)	✓ MOA collaborated with MOE on the conservation of foothill wetland by planting agroforestry plantations
		Ministry of finance (MoF)	✓ Allocate, execute and manage budget for the wetland conservation.
		Ministry of water resource and irrigation	✓ drafting and overseeing the implementation of policy, guidelines, master plans and regulations for water resource development; ✓ Implementing water bill to protect water sources from pollution, erosion or any other adverse effects.
		Ministry of environment and forest	✓ Developing policy and regulatory frameworks on wetland conservation. ✓ Implement environmental bill policy to prevent the wetland from overexploitation. ✓ Advocate community level forestry and agroforestry on the foothill of the wetland so as to promote forestation. ✓ find fund for the restoration programs by linkages with donors, non-governmental organizations, and community- based organizations
	Non-governmental organizations	wildlife conservation society	✓ Give training for the local communities on wetland resource management, land-use planning, on how people and wildlife live together in harmony. ✓ Work on conservation to reduce conflict and catalyze economic development
		Non- Government Organizations (NGOs)	✓ Create awareness on the advantage of wetland conservation for the local community and way of wetland restoration ✓ Source of funds
		United Nation Environment program	✓ source of finance ✓ Support technically interventions to improve wetlands
		Wetland International	✓ Support technically interventions to improve wetlands
Researchers	NBI	✓ Source of information on how to utilize wetland resource efficiently ✓ Undertake researches on the impact of upstream development on wetland wellbeing. ✓ Undertake research on which conservation option is more visible for South Sudan wetlands', specifically the Lower Baro wetlands system.	
	Universities and research institutes	✓ Source of research base information regarding causes of wetland degradation and alternative ways of intervention. ✓ Create awareness for the local community about the negative impact of wetland degradation and on alternative ways of wetland restoration.	

Stakeholders were categorized based on their interest and influence/power on the wetland resource use and conservation efforts. The stakeholder mapping has been done based on stakeholder mapping of Machar Marshes (NBI 2020a); Sudd wetland (NBI 2020c) as well as the synthesis report developed to analyze the Nile Basin wetland TEEB studies(NBI 2020b). The

influence and relative importance/interest of stakeholders are presented in Figure 6.2. Stakeholders in box A are different NGOs with high interest on the Lower

Table 6. 4: Identified Stakeholders of Lower BaroWetlands System

S.N	Stakeholders	Brief description
1	Local community	Different local communities live in and around the Lower Baro Wetlands system. Their livelihood mainly depends on fishing, subsistence farming, cattle rearing, mat making, honey production and wild fruit collection.
2	Government administrative	Government administrators at national, state and local level that are directly and indirectly involved on the political administration of the wetland resource
3	Researchers	From universities, research institutes and international initiatives working on wetland conservation and restoration
4	NGOs	Domestic and international non-governmental organizations that are working on welfare and humanitarian improvement

Baro wetlands system conservation and restoration but have less power to influence interventions to conserve the wetland.

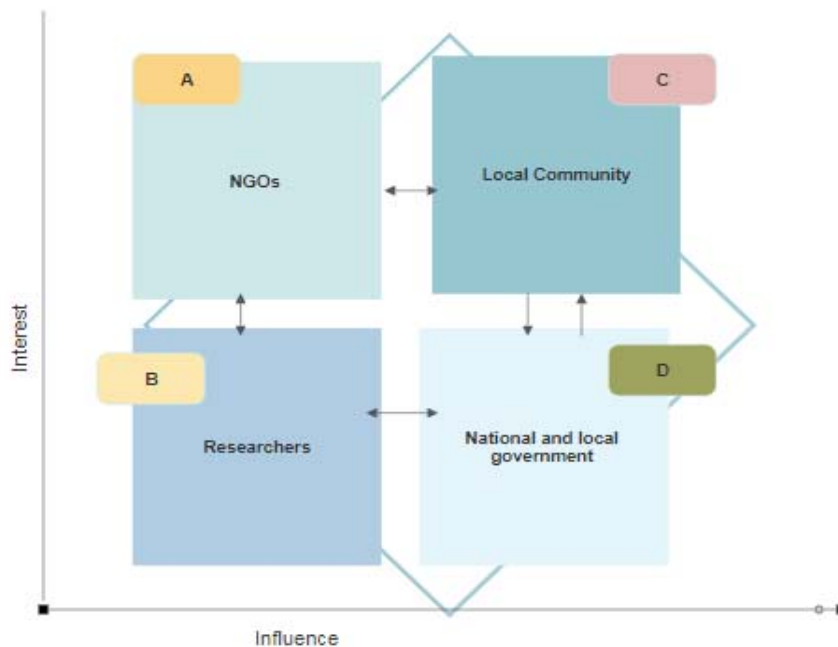


Figure 6. 2: Interest-Influence Matrix of Stakeholders in Lower Baro Wetlands System Conservation, (Note that this is based on the consultation on Machar Marshes and Sudd Wetlands stakeholders (NBI 2020c))

While in box B, researchers are involved on knowledge transfer and data repository of the wetlands' socioeconomic and ecological functions (like conservation, biophysical measures, and socioeconomic assessment and restoration efforts) and have little interest in the process to influence. A group of stakeholders categorized in box C are local communities which are the most important/key players of the entire process of the Lower Baro wetlands resource utilization, management, conservation and restoration. National and local government presented in box D of Figure 2 has a political power to oversee and settle issues related with the wetland entire activity, particularly the states have significant influence in the process of implementation.

The relationship between the stakeholders can mainly categorize in three ways; one stakeholder could influence the other decision (i.e. has power on the other); two stakeholders communicate each other but not influence each other (has balanced power) and one stakeholder could influence other's decision but the influenced stakeholder could give feedback.: In the Lower Baro wetlands system, the government administration at different levels can influence the decision of the local community but the local community has a power to give feedback on the government action. On the other hand, NGOs' and researchers communicate with the local community and government structure but not influenced each other (Figure 6.2). Key stakeholders involved in the Lower Baro Wetlands' resource use, knowledge development and wetland conservation efforts are presented in Table 6.2.

#### 6.4. The Benefits for Stakeholders from the Lower Baro Wetlands System

The Lower Baro wetlands system provides multidimensional benefit for different stakeholders. The local community who resides in states that the wetlands are found are the foremost stakeholders that significantly benefited from the wetland system mainly in the form of regulating and provisioning service. The main ecosystem services obtained from wetlands is summarized in Figure 6.3. Especially, for the downstream community regulation service (such as flood attenuation) obtained from the wetland play very crucial role for their survival. The Ethiopian and South Sudanese governments also benefit from the wetlands. For instance, the wetlands provisioning ecosystem services for the poorest surrounding community decrease the governments' spending for food aid; the wetland flood attenuation service decreases the governments' costs to support peoples' evacuation during flood disaster and infrastructure maintenance and development costs. The wetlands water purification services also contribute to avoid costs of the government which could spend to purify drinking water for domestic consumption. The wetlands' sediment retention services avoid the costs related to sediment removal. The wetlands also support the nation to preserve the environment by sinking a higher amount of carbon. Moreover, NGOs and researcher receive enormous benefits from the wetlands and these stakeholders give due emphasis for the wetland regulation and supporting service (Figure 6.3).

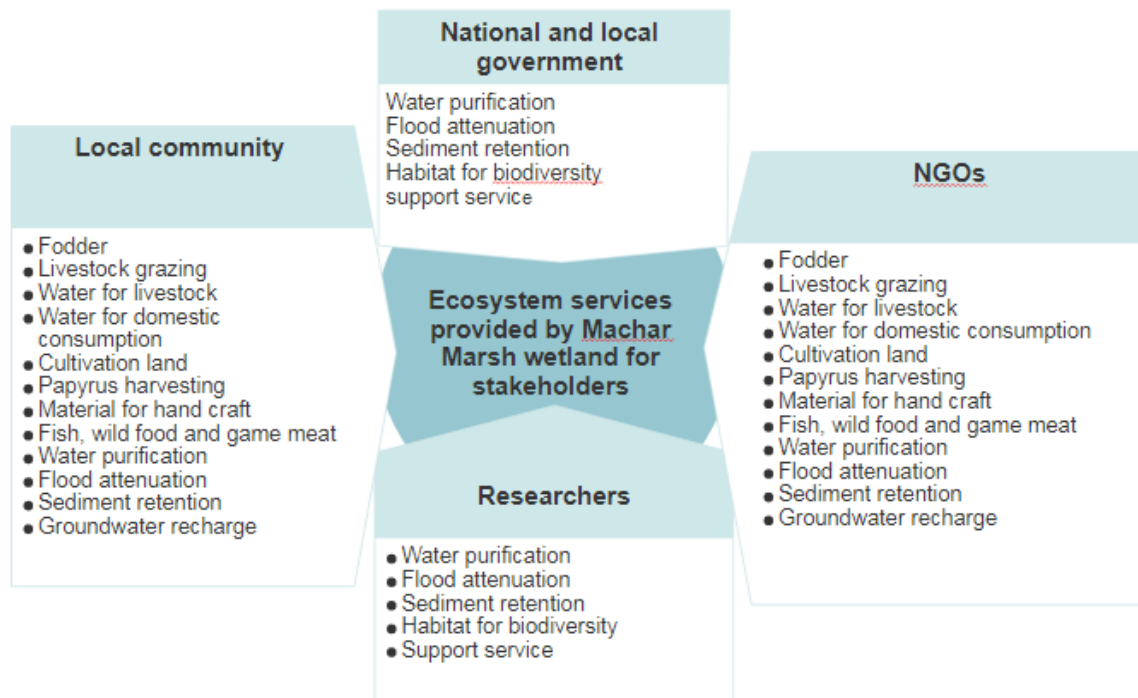


Figure 6. 3: Mapping the Lower Baro wetlands system ecosystem services and their relevance for different stakeholders (Note that this is based on the Machar Marshes wetland stakeholders consultations(NBI 2020a)).

### 6.5. Total Economic Value of the Lower Baro Wetlands System

We applied the value transfer approach to estimate the total economic value of the wetlands. We also used the information obtained (for Machar Marshes and Sudd wetlands study) for triangulation and to complement the discussion of the results obtained using the value transfer approach. There are two approaches for the application of value transfer to value resources. They are the unit value transfer, the value function transfer and meta-analytic transfer approach. The unit value transfer is an approach where a constant value per unit of ecosystem service is applied to estimates of supply (or a constant value per unit area of ecosystem is applied to the area of ecosystem as a proxy of supply). The unit value approach has been the predominant methodology used for valuing ecosystem services within the value-mapping literature (Senet *al.*, 2013). In the value function transfer instead of transferring the point value estimates from the original study site, transfers the whole benefit function estimated in the study site. Then the average characteristics of the policy site are plugged into the benefit function to obtaining the new values to be transferred. Meta-analysis summarizes information from several valuation studies averaging their values expecting that this procedure will provide more accuracy than simple unit value transfer. The function is estimated from the results of multiple primary valuation studies, which increases the



scope for including additional spatial variables that might not be feasible within a single primary valuation study (e.g., crowdedness, accessibility, fragmentation, scarcity).

We have reviewed different studies to select the best policy site that can be used for the application of the unit value transfer. However, we couldn't find any valuation study in South Sudan (other than Sudd and Machar wetlands whose study was based on value transfer) and limited wetland valuation studies in Ethiopia as well that can help us in such exercise. Hence, we opted to depend on the ecosystem services valuation database (ESVD) version released on June, 2020. The main reason we selected ESVD is that it is a follow-up to the Economics of Ecosystem and Biodiversity (TEEB) databased which contained over 1300 data points from 267 case studies. The updated version of ESVD contains 4042 value records obtained from 693 studies. Moreover, the value estimates are standardized in to international \$/ha/year for all relevant beneficiaries at 2020 price levels. Under its guide, it has been clearly stated that the data contained in the ESVD can be used for value (benefit) transfer and other forms of data analysis requirements. The other reason is that the use of such database for value transfer allows the possibility to increase the scope for including additional spatial variables that might not be feasible within a single primary valuation study. In addition, single primary studies may not be exactly the same in all aspects of the ecosystem services to be evaluated and hence may require to consider values from different single primary studies.

Moreover, due to lack of data it was necessary to make various assumptions about the levels of use and sustainability for the various ecosystem services provided by the wetland. And that the exact biophysical relationships between wetland extent and quality, and regulating services, are not yet fully understood or proven. In calculating the different scenarios as well, only changes in land use were considered again due to lack of appropriate data for the exercise. However, this in no way undermines the importance or credibility of the report's findings, it just underlines that there remain many data gaps at the present time.

The basis for computing the economic value of the ecosystem services from the wetland is the 2020 land use land cover (LULC) distribution of the Lower Baro wetland system. The LULC distribution for the year shows that more than half of the wetland system is covered by grassland (62 percent) followed by forest cover and shrublands. The cropland is very small (0.4 percent) while the water bodies and built-up areas are almost non-existent compared to other land uses and entire size of the wetland.

The first activity in applying the value transfer was to identify the unit value of the different ecosystem services from the wetland in the ESVD. Such effort has yielded the information in Table 6.5. Since the ESVD followed the TEEB (2010) classification of ecosystem services, for the sake of consistency, we applied the same classification of ecosystem services to that of TEEB (2010). The main ecosystem services from the wetland are provisioning, regulating and cultural services and each service in turn has different sub-services which is shown in the computation of each service in detail. Furthermore, the table shows that which ecosystem service is obtained from which LULC and how much. The tables developed subsequently mainly base the per unit values and the size of the LULC and both are captured in Table 6.5.

Table 6.5: The per hectare values of different ecosystem services from different LULC of the wetland

Land use and land cover of the Lower Baro Wetlands system		Unit values of ecosystem services: US\$/ha (2020 values) ( <a href="https://www.es-partnership.org/esvd/">https://www.es-partnership.org/esvd/</a> ) <sup>6</sup>										
		Provisioning services				Regulating services				Cultural services		Biodiversity Protection
Land Cover Type	Area (Ha)	Food	Water	Raw material	Medicinal resources	Climate regulation	Regulation of water flows	Erosion prevention	Maintenance of soil fertility	Spiritual experience	Inspiration for culture, art & design	Biodiversity services
Shrubland	88,624	8		1	1	89	71				214	
Grassland	369,049		313	637		73	43				284	
Cropland/ under water management	2,157	510	604	6		10	17	173	34		16	
Built-up	6											
Water bodies	74	2,288	9,198	92		251	4,221			76	310	17,987
Forest cover	134,541	4		33		481	68	6	117		196	7
<b>Total</b>	<b>594,451</b>											

Source: Authors' computation from the LULC distribution of the wetland and ESVD

<sup>6</sup> The standardized USD per hectare value of each ecosystem service for the year 2020 has been taken from (<https://www.es-partnership.org/esvd/>) and the detail is presented in the Annex.

### 6.5.1. Provisioning Ecosystem Services

The provisioning ecosystem services provided by the wetlands system are food, water, raw materials, and medicinal resources. The food items listed in the ESVD database are fish, meat, plants and vegetables, non-timber forest products and other unspecified food items. The food items are obtained from the shrubland, cropland, water bodies and the forest cover of the wetland. The Anuak live on the high levees along the main rivers, especially the Baro, and practice flood retreat cultivation of sorghum and maize in the adjoining wetlands. They also engage in fishing. An estimated 25 percent of the population is reported to be dependent for cultivation around the wetland (Wood et al. 2018). The specific US\$ per hectare values and the size of each LULC is shown in Table 6.5. Adding the value of the food sources from the different LULC results the food value from the wetland to be about US\$2.5 per annum. This is small in value compared to other provisioning services such as water and raw material. Part of the explanation could be the low productivity in the areas the wetland covers both in the Ethiopian part and the South Sudan part. If we consider the South Sudan part, for example, a WB (2012) estimates show that South Sudan's average value is less than half of the value in Uganda (\$665) and about a third of the value in Ethiopia (\$917). Another explanation could be the low proportion of croplands from the entire wetland LULC which is less than a percent.

Water from the wetland can be used for drinking, industrial use, irrigation purpose, and other unspecified uses. The water services cover grasslands, croplands, and the water bodies. Springs around wetland edges are sources of drinking water. An estimated 50 to 100 percent of the population in the wetland region is dependent in the wetlands for domestic water use while 30 of the population uses the wetland for livestock watering (Wood et al. 2018). We applied similar procedure to compute the value of water to that we used for computing food services. Accordingly, the wetland provides an estimated US\$117 million per annum. The huge livestock population in and around the wetland could be part of the explanation for the high value of water services from the wetland. Both Ethiopia and South Sudan are known to have huge livestock population. While Ethiopia is the first in African in its livestock population, South Sudan is among countries in the world where its livestock population is greater than its human population. The participants of the consultative meeting in Juba for studies of Sudd and Machar Marshes wetlands, confirm such fact. In that they stated, livestock grazing is among the top services of the wetlands and the Lower Baro case seems to comply to such iteration.

Raw material and medicine services are among the provision services of the wetland. The Nuer are agropastoralists who are based on limited higher areas in the west of the lowlands away from the tsetse belt. They graze their cattle extensively across the seasonal wetlands, migrating between the drier uplands in the rains and the seasonally flooded grassland in the dry season. The wetlands provide sedges which are used for thatching, craft work, and floor covering on holidays (Wood et al. 2018). The same authors also reported that 100 of the population depends for medicinal plants, 30 percent for dry season grazing, 5 percent for craft materials, and 85 percent for thatching reeds. Following similar procedure, the estimated per annum values of raw material and medicinal resources are about US\$5 million and US\$88 thousand, respectively. The raw material

services are used in the form of fibers, timber, fuel wood, charcoal, fodder, sand, rock, gravel, biomass fuels, fertilizer, and other unspecified uses. Given the multitude of uses and the relative less development indicators in the wetland areas, the high value of the raw material services are not surprising. This rather confirms that there is huge dependence from the community in the wetland resources. In the consultative meetings held in Juba for the studies of Sudd and Machar Marshe wetlands, the participants iterated the huge dependence of the local communities in wetland resources to fulfil their different needs. The Lower Baro case won't be an exception in this regard. The wetlands in the Lower Baro region play an important role in rural livelihoods, and the sound management of the wetlands is an important element in the development of an ecologically sensitive and sustainable use regime for this basin (Wood et al. 2018).

Table 6.6: Economic value of the provisioning services from the wetland

<b>Provisioning Services</b>	<b>Economic Value</b>
Food	2,516,538
Water	117,495,817
Raw material	4,917,913
Medicinal resources	88,624
<b>Total provisioning services</b>	<b>125,018,892</b>

Source: Authors' computation

### 6.5.2. Regulating Services of the Wetland System

Among the regulating services provided by the wetland are the climate regulation, regulation of water flows, erosion prevention, and maintenance of soil fertility (see Table 6.5). The climate regulation again includes services such as carbon sequestration and microclimate regulation. The per annum value of the climate regulation services are estimated at about US\$100 million which is the highest among the regulating services. This could be partly attributed due to the high value of the carbon sequestration services from the forest covers and the high size of forest covers from the LULC of the wetland (see Table 6.5). The water flow regulation services from the wetland include river discharge, natural irrigation, and drainage services among others. The wetlands provide hydrological regulation which attenuates the flow of the rivers and moderates and maintains the flood regime in the lowlands and further downstream (Wood et al. 2018). An estimated per annum value of above US\$31 million worth of regulation of water flows services are derived from the wetland. This value stood as the second highest among the regulating services of the wetland. The items that will be damaged due to flooding are such as livestock, crops, and infrastructure. The local communities in the Lower Baro area are more of pastoralists that are moving from place to place depending on the season. Agriculture is not the dominant practice in the wetland while the available infrastructure is not that developed. Even so, the water flow regulation is a very important aspect of the wetland for doing uninterrupted day to day business of the local communities. The erosion prevention services of the wetland stood as the least from the regulating services with an estimated per annum value of US\$1.2 million. The maintenance of soil structure, deposition of

nutrients, soil formation, and nutrient cycling services of the wetland are categorized generally as maintenance of soil fertility service. The per annum value of this service is estimated to be about US\$16 million.

Table 6.7: Economic value of regulating services from the wetland

<b>Regulating Services</b>	<b>Economic Value</b>
Climate regulation	99,582,478
Regulation of water flows	31,659,222
Erosion prevention	1,180,407
Maintenance of soil fertility	15,814,635
<b>Total regulating services</b>	<b>148,236,742</b>

Source: Authors' computation

### 6.5.3. Cultural Services from the Lower Baro Wetlands System

The wetlands are also known for their provision of cultural services. Even if cultural services include a multitude of services provided by wetlands and despite the discrepancy of the services included under cultural services from study to study, in this study services such as spiritual experience and inspiration for culture, art and design are considered. Wood et al. (2015) study reported that 100 percent of the population (including urban dwellers) uses sedges found from the wetlands for social and ceremonial purposes. Almost all the cultural service values come from the inspiration for culture, art and design which further includes artistic inspiration and other cultural uses with an estimated per annum value of about US\$150 million. The spiritual/religious experience has an estimated per annum value of about US\$5.6 thousand.

Table 6.8: Economic value of cultural services from the wetland

<b>Cultural Services</b>	<b>Economic Value</b>
Spiritual experience	5,624
Inspiration for culture, art & design	150,202,940
<b>Total cultural services</b>	<b>150,208,564</b>

Source: Authors' computation

### 6.5.4. Biodiversity Protection Services from the Wetland

The wetlands are known to be a habitat for different flora and fauna species and there are many reserved parks and game reserves which have significant importance for conservation of biodiversity. Including several diverse aquatic habitats like swamps, lakes, channels and floodplains. The wetlands are both permanent and seasonal in nature, being fed by overspill from the Baro and Akobo rivers and their tributaries. Three types of swamp are found in these lowlands:

(a) *Cyperus papyrus* swamp, (b) *Typha domingensis* swamp, and (c) *Vosiacuspidata* swamp. The seasonally flooded areas are dominated by (a) *Oryza longistaminata* dominant and (b) *Echinochloa pyramidalis* (Sutcliffe 2006b). The major concentration of wetlands is in the western part of the lowlands. Their complex ecological conditions make for rich and varied patterns of habitats, and they support very distinctive flora and fauna (Woube 1999). As a result, a large part of this area is covered by the Gambella National Park (5061 km<sup>2</sup>). This Park was proposed because of the numerous large wildlife species, particularly Nile lechwe *Kobus megaceros*, white-eared kob *K. kob*, and whale-headed stork *Balaeniceps rex*. The white-eared kob migrates every year between the Sudd in South Sudan and the Gambela marshes. Some 43 species of mammals are found in the park and an IBA team recorded 230 species of birds (EWNHS/Bird Life International 1996). The Park is not legally gazetted and no management plan has been prepared. There have been major incursions into the park by the government's Akobo large-scale farm in the 1980s/1990s and by foreign investment for irrigation development after 2000 (Wood et al. 2018). The biodiversity services of the wetland is estimated at about US\$2.3 million per annum.

Table 6.9: Economic value of biodiversity protection services of the wetland

<b>Biodiversity Protection Services</b>	<b>Economic Value</b>
Biodiversity Service	<b>2,272,825</b>

Source: Authors' computation

### 6.5.5. Total Economic Value of the Wetlands

In the previous section, the economic value of the different ecosystem services are estimated and presented. Table 6.10 shows the total economic value of the wetland while figure 6.3 shows the percentage share of the respective ecosystem service from the total value. Hence, the annual total economic value of the wetland is estimated to be above US\$425 million. The regulating and cultural services contribute more or less similar value to the total economic value contributing about 35 percent each. The provisioning services, constituting about 29 percent of the total value stood third in value terms. The least contribution comes from the biodiversity services contributing only half percentage of the total value (see figure 6.4).

Table 6.10: Total economic value of ecosystem services from the wetlands

<b>Ecosystem services</b>	<b>Economic Value</b>	<b>Percentage Share</b>
Provisioning services	125,018,892	29.4
Regulating services	148,236,742	34.8
Cultural services	150,208,564	35.3
Biodiversity protection services	2,272,825	0.5
<b>Total economic value</b>	<b>425,737,023</b>	<b>100.0</b>

Source: Authors' computation

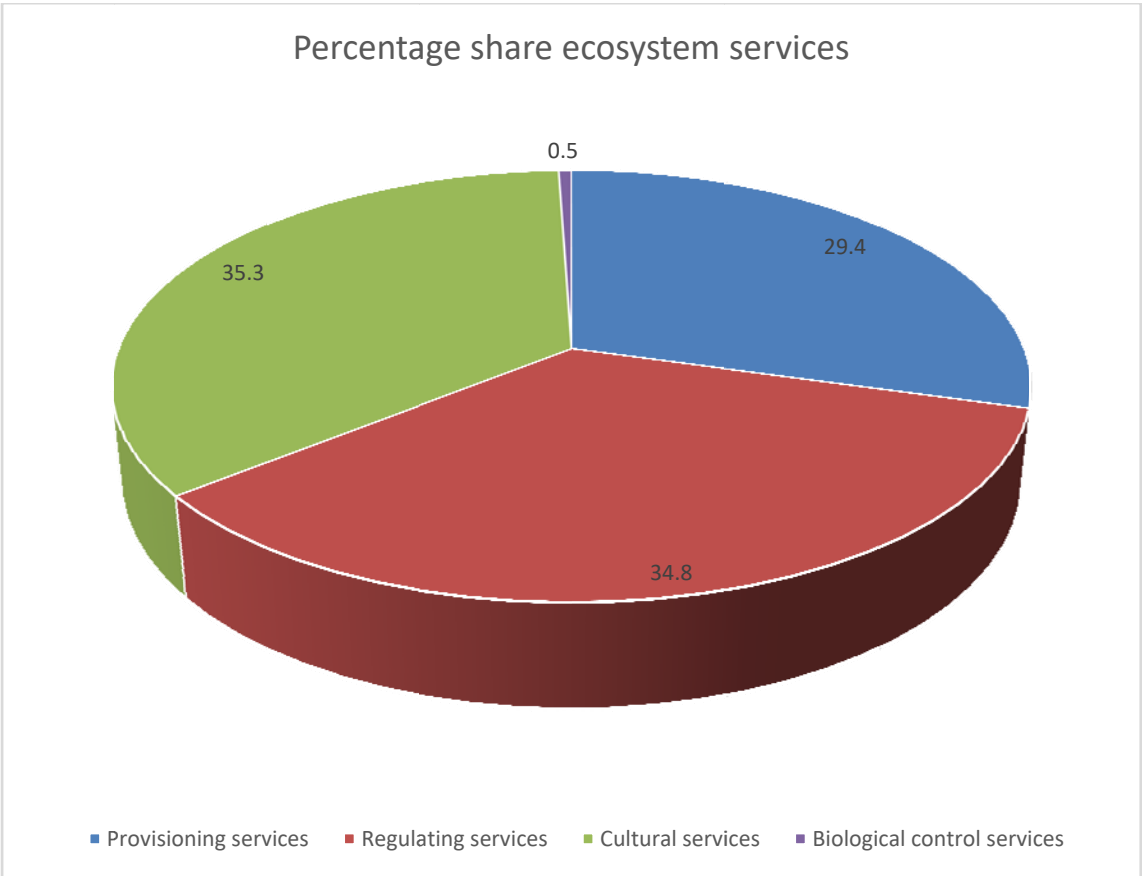


Figure 6.4: Percentage share of the ecosystem services from the total economic value

## 7. Conclusions and Recommendations

### 7.1. Conclusions

This study was motivated by the unavailability of previous attempts and limited research and knowledge output to estimate the economic value of the Lower Baro wetlands systems which can guide policy makers for development decision making. Hence the broad aim of the study was to conduct economic valuation of biodiversity and ecosystem services of the Lower Baro wetlands system to inform the preparation of wetland management plan and development in the face of in situ and ex-situ development interventions. To this end, different sources of information have been consulted and the results have been based on a value transfer approach using the June 2020 version of the ESVD as well as available literature. The land use and land cover map and distribution for the year 2020 was extracted for conducting the valuation process.

The Lower Baro wetlands system is one of the wetlands systems in Ethiopia and South Sudan and as a result it affects different stakeholders; from local to global actors. Local communities are both the immediate beneficiaries as well as conservation actors of the wetlands. It serves them as a means of livelihood and source of income while they also contribute their labor and knowledge in the conservation and protection of the wetland. The state and federal governments in addition to formulating policies, laws and regulations and enforcing them they also allocate budget for the law enforcement and conservation of the wetland. Regional and global actors also allocate some funding for capacity building and conservation of the wetlands. However, it has been noticed that, even if there have been some attempts to legislate different policies and legislations, many of them are yet to be approved especially in the South African case.

According to the LULC map of the wetland, the Lower Baro wetlands system covers an area of more than 425 hectare for the year 2020. Considering such LULC, the total economic value of the wetland was estimated at above \$425 million per annum. However, most of this benefit emanates from the regulating and cultural services and provisioning services stood third in value terms. Unless a mechanism is set to increase the benefits from the provisioning services, the status quo may not be sustainable. Because, especially the regulating services have a public good character which may not be the immediate reasons for the protection of the wetlands. The implication of such findings is that calls for local governments as well as other international actors have to step-in to compensate for some of the regulating and biodiversity services that have benefits beyond the location of the wetland.

One of the contributions of such studies is to help the preparation of wetland management plans and in case of the Lower Baro wetlands system understanding the economic values of the wetlands has to be the first step in proposing feasible investment plans. The preparation of wetland management plan has to consider this fact and use the valuation results as an input so as to bring results that can address some of the challenges highlighted in the valuation exercise. It should propose alternative approaches aimed at changing the status quo approach and thereby increase the overall wellbeing of the wetland and the wetland community. The wise management and utilization of the wetland can be considered as an alternative scenario to the status quo. Under this



scenario, wise use of the wetland requires the development of integrated land use planning, landscape restoration and rehabilitation, species and habitat conservation, ecosystem-based adaptation, and sustainable livestock production. The sustainable and climate resilient local livelihood, another component of this scenario, proposes the provision of support for agroforestry and tree-based businesses, developing sustainable fish farming and capture fisheries, enhancing beekeeping technique and markets, practicing climate-smart agriculture, promoting energy saving practices and technologies, addressing local vulnerabilities to climate change and disaster risk among others. The last component in the first approach is the community water, sanitation and hygiene emphasize the importance of the wetland on water provision and sanitation and hygiene services and vice versa. Another scenario to consider is the green development approach where the countries have to balance between their development aspirations and their natural resources in general and that of Lower Baro wetlands system in particular. Specially building institutions and their capacity as well as awareness creation on conservation practices is crucial for the sustainable development of the countries. Given the countries are among of the top in the list of least developed in terms of infrastructure and other development indicators, it is necessary for the countries to follow the green infrastructure path than the business-as-usual approach. The Jongeli canal and the oil refiners should be areas in the South Sudan part to watch while the promotion of tourism could yield tremendous benefits. In the Ethiopia part there is water extraction and diversion in the lowlands. There is also a considerable potential for hydropower development along the escarpment which would further impact on the downstream hydrological system and wetlands but also need functioning catchments and wetlands for water storage in the highlands. Hence, it is important such and other interventions be guided based on the scenarios proposed above.

## 7.2. Recommendations

The Lower Baro wetlands system is one of the wetlands in Ethiopia and South Sudan. It provides different ecosystem services to the local communities and beyond. Especially, the regulating and biodiversity services of the wetland are big while the provisioning services are very promising. The study has proposed development options that has to be included in the preparation of wetland management and investment plans for the wetlands each with different sub-activities to be performed. The first is the wise management and utilization of the wetland while the second is the green development path which demands a balance between the development needs of the country and the protection of its ecosystem and biodiversity. Based on the findings of this study, the following recommendations are forwarded:

- ✚ Strong institutions are very crucial in efficiently conserving and managing the wetlands and implementation of wetland management plans. Hence, in addition to the establishing institutions with such mandates, the parliament need to approve the different pending legislations with the aim of protecting the natural resources of the country. This is the least commitment the governments can prove their greater ambition for protection and conservation of the countries' resources. Enhance the capacity of the different workers in different institutions through formal education and informal on the job trainings.

- ✚ Aim for green development and the construction of green infrastructure in wetland areas. It has been shown that the wetland has serious challenges which could significantly jeopardize the livelihood of the local community and hence the country at large. It is also understandable that the countries have serious demands for development. However, care should be taken to balance the development needs of the countries with the protection and conservation of their ecosystem. The best approach is to follow green the development path where economic growth is should not be against the resource endowment of the country.
- ✚ Promote tourism using the Lower Baro wetlands system. It is a wetland of international importance and rich in flora and fauna which can be regarded as good potential for tourism. Currently, tourism is almost non-existent and this trend should not continue.
- ✚ Securing additional source of financing from local and international actors is vital; say in the form of climate financing. From wetland reforestation measures, the local community could benefit additional source of income. Since the wetlands have tremendous contribution to regulating and biodiversity services, this can be used as a justification to demand additional funding from international actors.

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Annex 1: Detail ES valuation Exercise and note that this annex also presented to NBI in excel format to support the database

		Unit values of ecosystem services: US\$/ha (2020 values) ( <a href="https://www.es-partnership.org/esvd/">https://www.es-partnership.org/esvd/</a> )											
Land use and land cover of the Lower Baro Wetlands system		Provisioning services				Regulating services				Cultural services		Biodiversity Protection	
Land Cover Type	Area(Ha)	Food	Water	Raw material	Medicinal resources	Climate regulation	Regulation of water flows	Erosion prevention	Maintenance of soil fertility	Spiritual experience	Inspiration for culture, art & design	Biodiversity services	%share of LULC
Shrubland	88,624	8		1	1	89	71				214		14.9
Grassland	369,049		313	637		73	43				284		62.1
Cropland/ under water management	2,157	510	604	6		10	17	173	34		16		0.4
Built-up	6												0.0
Water bodies	74	2,288	9,198	92		251	4,221			76	310	17987	0.0
Forest cover	134,541	4		33		481	68	6	117		196	7	22.6
<b>Total</b>	<b>594,451</b>												100.0
<b>Provisioning Services</b>		<b>Economic Value</b>											
Food		2,516,538											
Water		117,495,817											
Raw material		4,917,913											
Medicinal resources		88,624											
<b>Total provisioning services</b>		<b>125,018,892</b>											
<b>Regulating Services</b>		<b>Economic Value</b>											
Climate regulation		99,582,478											
Regulation of water flows		31,659,222											
Erosion prevention		1,180,407											
Maintenance of soil fertility		15,814,635											
<b>Total regulating services</b>		<b>148,236,742</b>											
<b>Cultural Services</b>		<b>Economic Value</b>											
Spiritual experience		5,624											
Inspiration for culture, art & design		150,202,940											
<b>Total cultural services</b>		<b>150,208,564</b>											
<b>Biological Control Services</b>		<b>Economic Value</b>											
Biodiveristy Service		2,272,825											
<b>Ecosystem services</b>		<b>Economic Value</b>											<b>Percentage share</b>
Provisioning services		125,018,892											29.4
Regulating services		148,236,742											34.8
Cultural services		150,208,564											35.3
Biological control services		2,272,825											0.5
<b>Total economic value</b>		<b>425,737,023</b>											<b>100.0</b>