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**Machar Marshes Wetland Economic Valuation of Biodiversity and
Ecosystem Services for Green Infrastructure Planning and
Development**

**NBDF Economic Valuation of Wetland Ecosystem Services Webinar, March
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Introduction

- Under The Economics of Ecosystem and Biodiversity (TEEB), there are more than 200 published documents on ecosystem services valuation which cover all riparian countries.
- Although most of the studies cover a wide range of wetland types, species diversity, economic valuation and geographical distribution, studies are still limited in South Sudan wetlands, except (Mohamed 2019, El Tahir & Vishwanath (2015), Ibnaof et al.(2013), Nile-Eco-VWU (2015), Nile-Eco-VWU (undated)) specifically on the economic valuation wetland ecosystem services in Machar Marshes wetland.

Introduction



- The key objective of this report is to conduct economic valuation of biodiversity and ecosystem services
- The specific objectives include:
 - To investigate economic, social and cultural beneficiaries of the Machar Marshes wetland
 - To determine the current value of the Machar Marshes wetland ecosystem services
 - To determine the economic impacts of the Machar Marshes wetland degradation and loss
 - To determine the value-added or costs avoided in investing on the Machar Marshes wetland conservation and wise-use of available resources for integrated development decision making

Methodology

Sources of Data

- Primary and secondary data that include
 - South Sudan national statistics office
 - Population data of the wetland area,
 - States and national level,
 - Agricultural production data,
 - Consumer price index (CPI),
 - Statistical bulletins
 - **ENTRO -Eastern Nile Technical Regional Office**
 - Consult experts to validate available data and reports from ENTRO data base and reports.
 - LULC
 - ESA- CCI LC
 - USGS- MODIS
 - Benefit transfer and Market price approach
 - Regulating
 - Biodiversity ecosystem services of the wetland
 - A few provision services prices
 - Published and unpublished reports (e.g. TEEB)

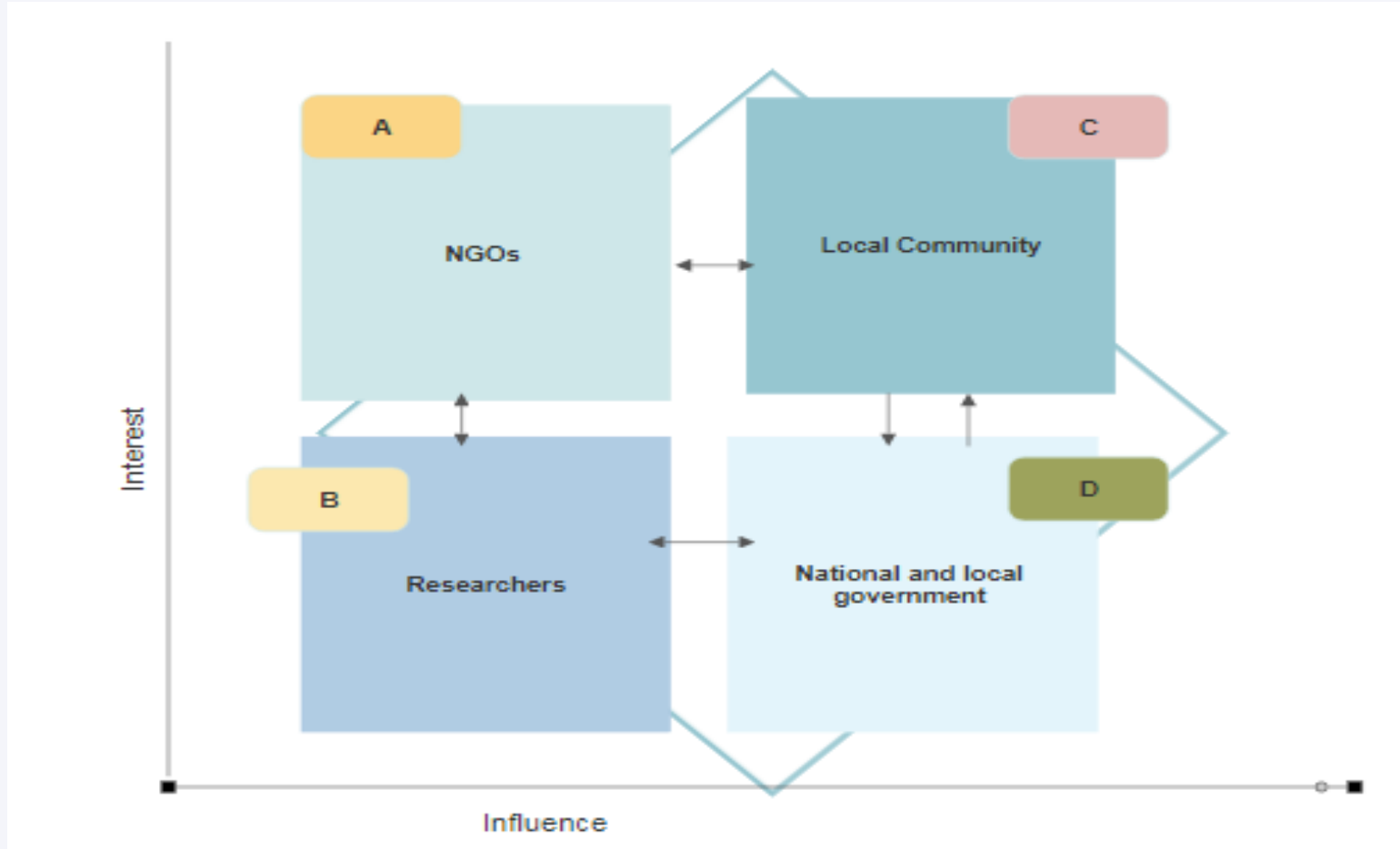
Data collection methods

- Key informant interview
- Focus group discussions
- Document review
- Technical Team Review meetings & consultations



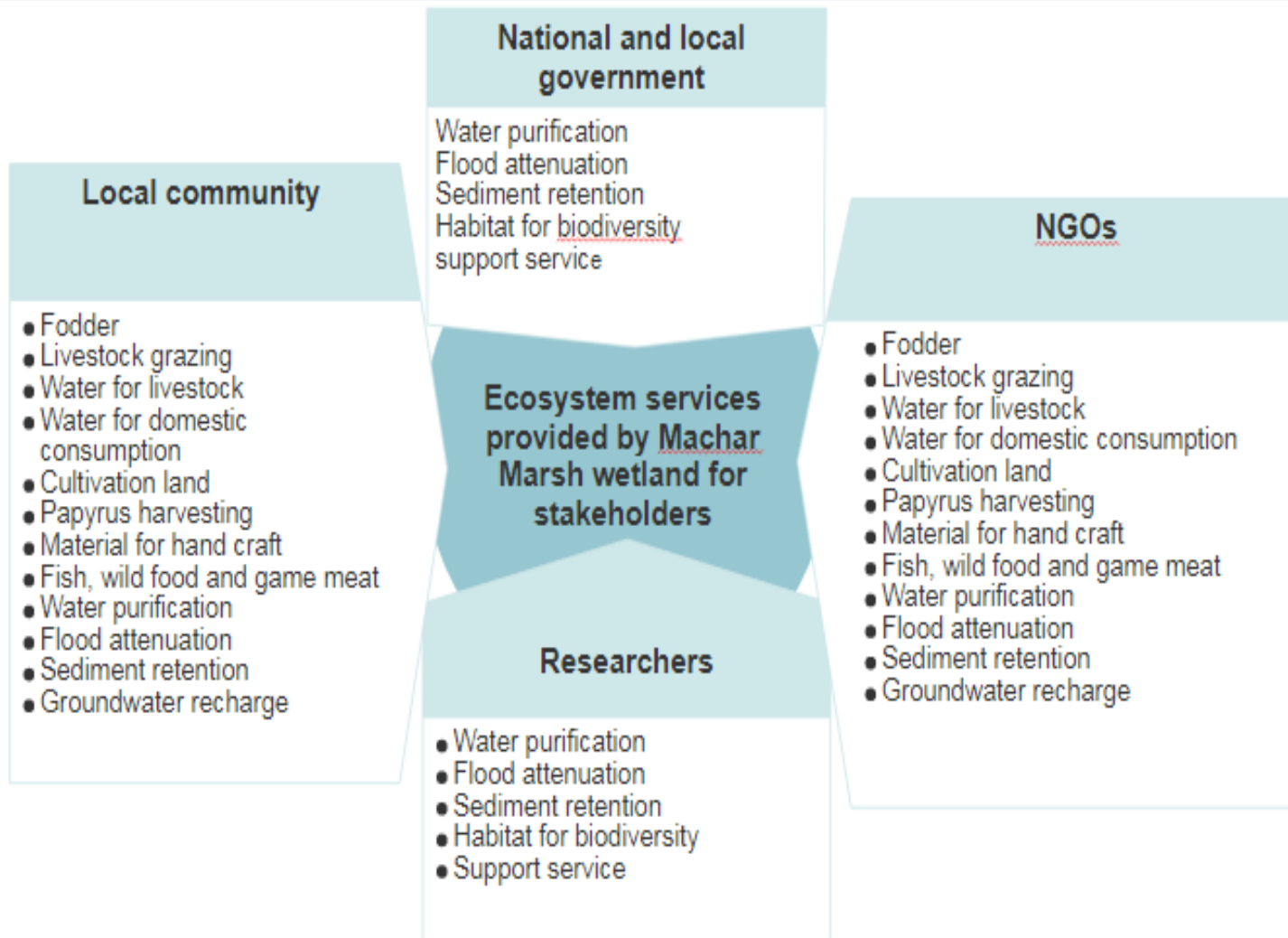
Result and discussion

The role, interest, influence and power of stakeholders on the Machar wetland varies

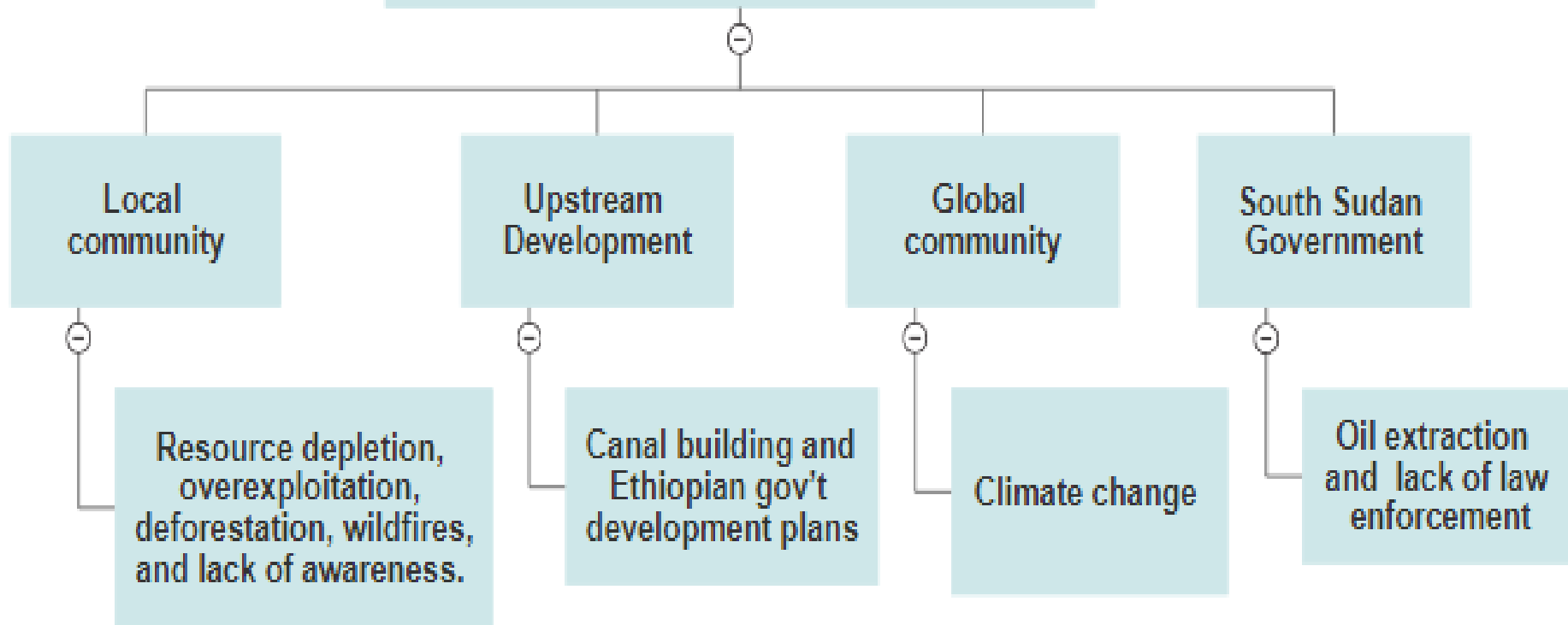


Machar marshes wetland LULC and the ecosystem service it provides

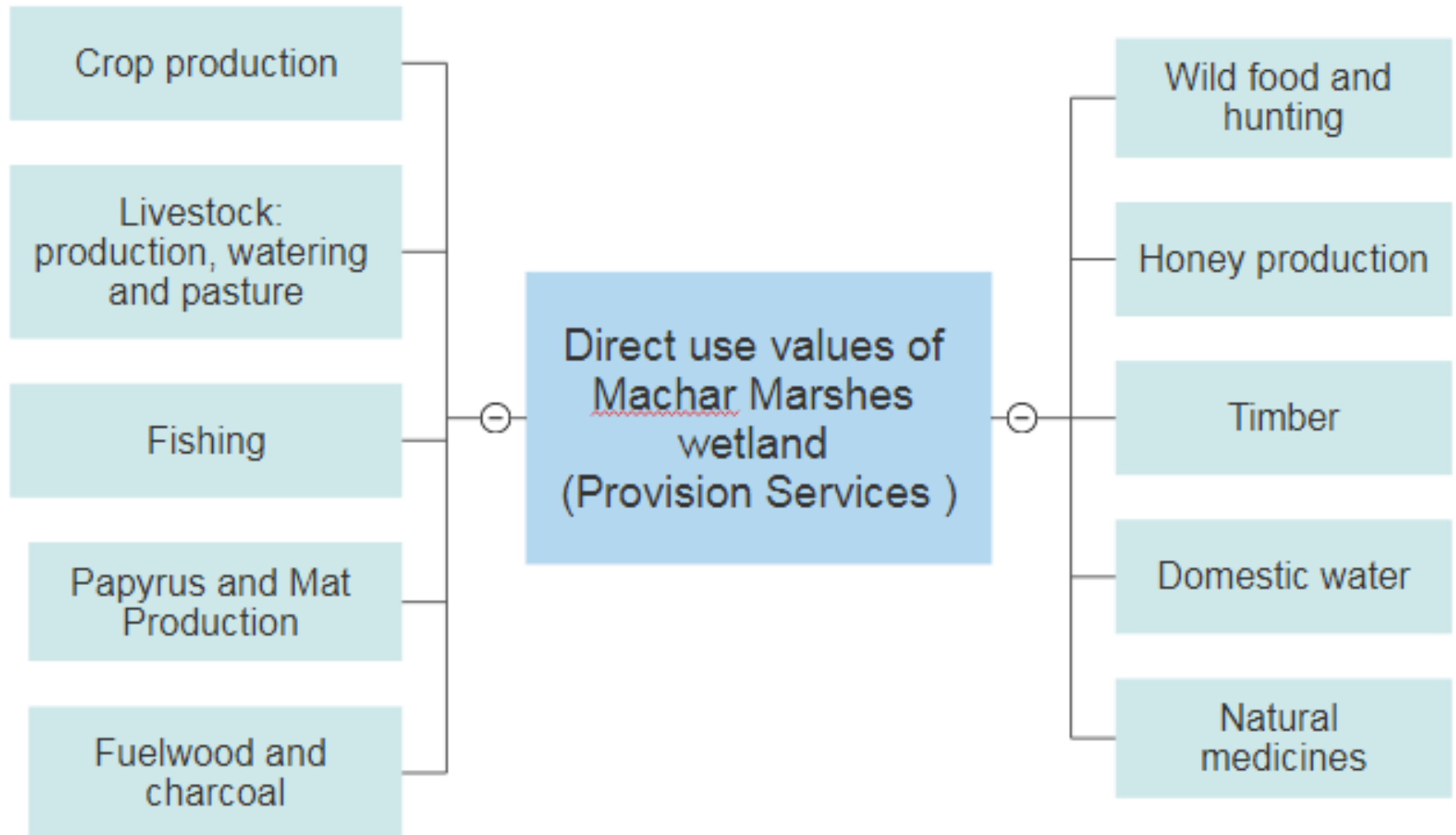




Sources of Machar Marshe wetland degradation

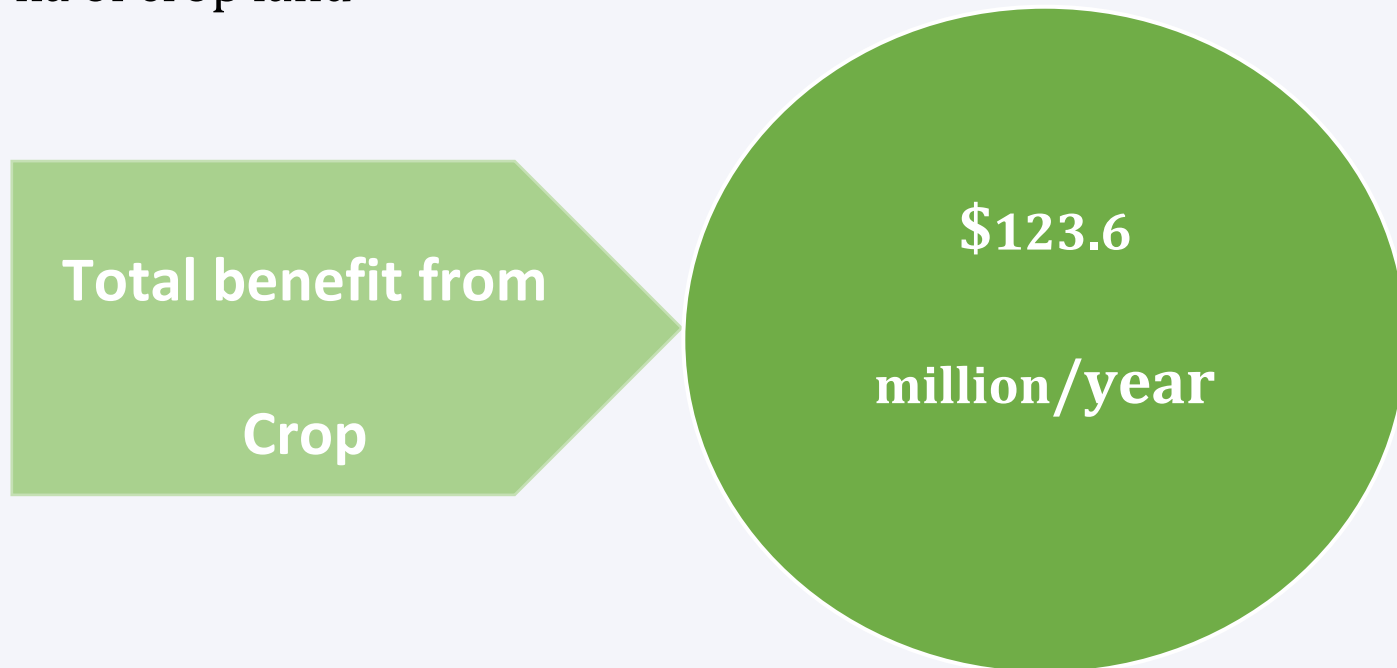


Provisioning Ecosystem Services Of Machar Marshes Wetland



Crop Farming

- Local communities from Nuer, Dinka, Koma and Anyuak
- A total of 12,312 households
- 41,616 ha of crop land



Livestock watering and pasture

- 61,559 pastorals from Nure, Shai, Dinka, Anyuak, Murle and Baggari ethnic group are engaged on livestock rearing.
- 206,838 livestock population is estimated around the wetland.
- 174,406 of the livestock population use the wetland as watering point and pasture annually (ENTRO, 2016).
- Annually the livestock's used 158,709 mcm of water.

Watering

\$0.47 million/year

Pasturing

27.4 million/year

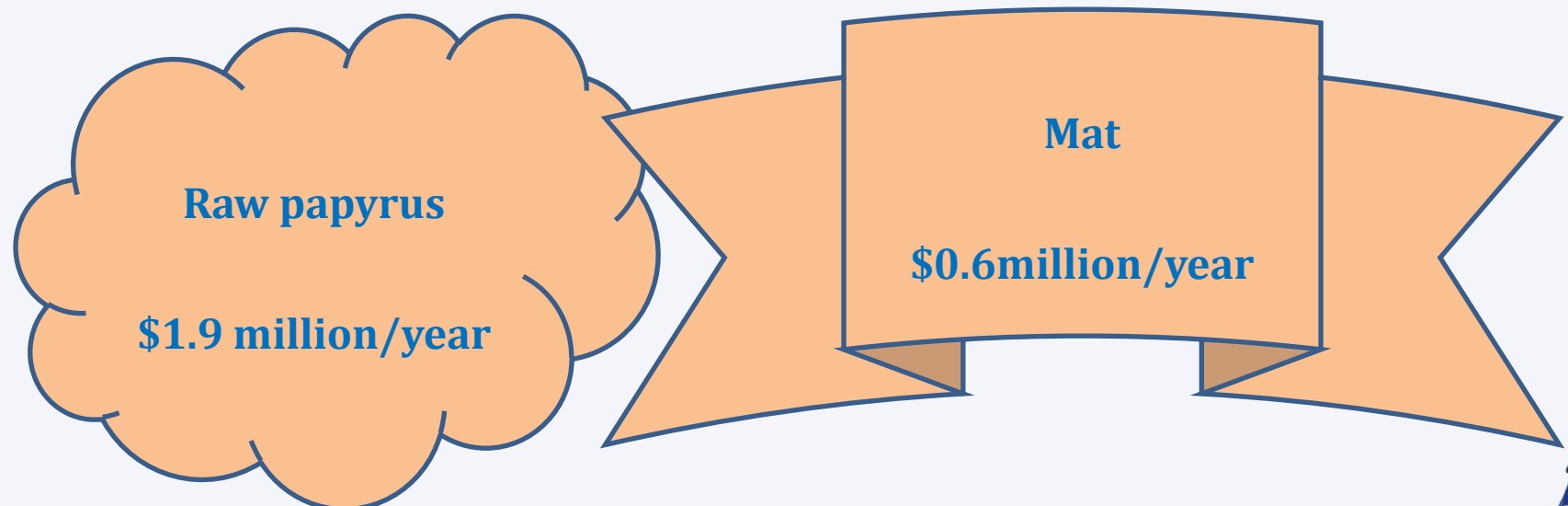
Fishing

- 8% (about 9,849 households) of the local community are engaged in fishing activities
- The main fishing season is from October to December ([USAID 2018](#)).



Papyrus and mat production

- 95% of the local community in Machar Marshes wetland engaged in papyrus harvesting
- 5% of the local community from Nure, Shai and Anwak communities earn income by making mat and craft



Wild Food

The most common wetland wild food include

- *Balanites aegyptica* (Lalop) fruits and nuts,
- *Tamarindus indica* fruits (Koat) and
- wild vegetables (Neet and *Balanites aegyptica* (Lalop) leaves (NPA and ROSS 2016).

Wild food

\$4.2 million/year

Traditional medicine

- 2000 patients are visited by traditional healer per year

Traditional medicine

\$0.011 million/year

Bust meat

- Local communities got 75.5 ton of bust meat/year from the wetland

Bust meat

\$0.13 million/year



Honey Production

- 400 beehives that produce about 3500kg of honey during honey harvesting seasons in Machar Marshes.

Honey production

\$0.018 million/year

Fuel Wood and Charcoal Production

- 98% of rural community used firewood as primary source of energy for domestic uses([UNDP 2013](#))

Fuel wood

\$23.9 million/year

Charcoal production

2% of population uses charcoal for their domestic energy consumption(UNDP 2013)

Charcoal \$1.6 million/year

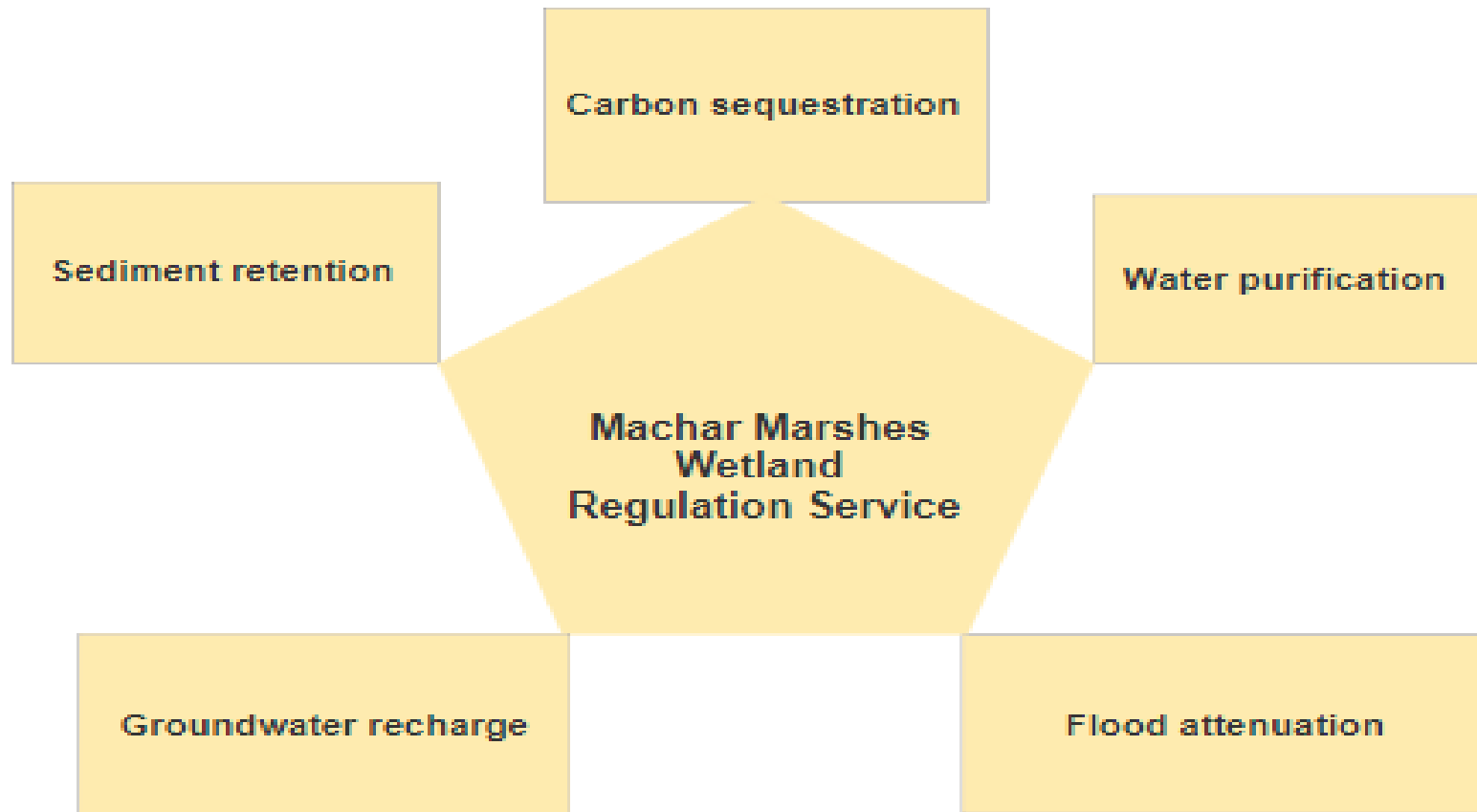
Domestic Water

- 35% of population uses wetland's water for drinking, laundry, cooking, bathing and washing of utensils and irrigation of crops and trees.

Domestic water

\$156.8 million/year

Regulating Ecosystem Service of Machar Marshes Wetland



Carbon Sequestration

Carbon Sequestration
\$45.6 million/year

Flood Attenuation

Flood Attenuation
\$79 million/year

Sediment Retention

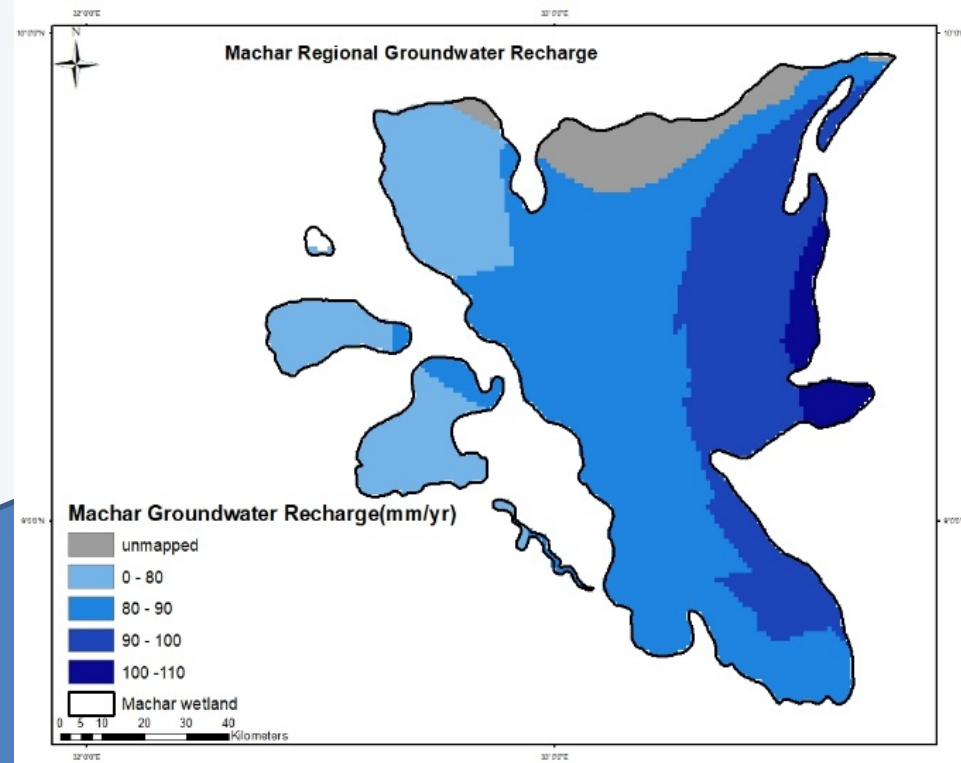
Sediment Retention
\$4.7 million/year

Water Purification

Water purification
\$6.91 million/year

Groundwater recharge

Groundwater recharge
\$126.6 million/year



The Biodiversity

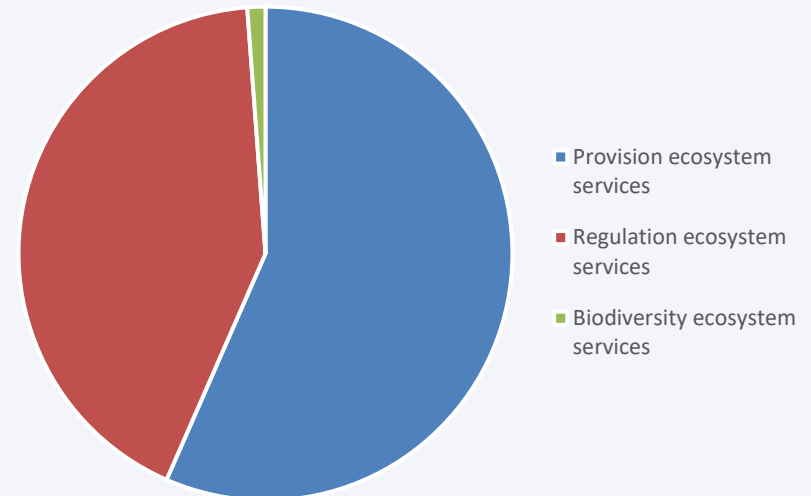
- The wetland is habitat for about 400 different bird species and more than 100 mammal species ([Smakhtin 2012](#)).
- The wetland is internationally recognized wild heaven for waterfowl birds.
- These unique habitats also support many species not seen or in large numbers outside of Sudan, such as Nile lechwe, the Shoebill Stork Balaeniceps Rex and White-Eared Kob (The Higher Council for Environment and Natural Resources (HCENR) 2009).
- The Machar Marshes wetland is internationally recognized habitat close to 92 different fish species (ENTRO 2007b).

Biodiversity

\$7.35 million/year

Estimated Economic Values of Machar Marshes Wetland Ecosystem Services

- The total economic value of the wetland for provisioning ecosystem services is \$ 351.8 million/year.
- The total economic value of the wetland for regulating ecosystem services is \$262.8 million/year.
- The biodiversity ecosystem service estimated about \$7.35 million/year.
- In total Machar Marshes wetland is \$622 million/year.
- Comparing the wetland ecosystem services economic value with GDP share, it is equivalent to almost 4.26% South Sudan the total GDP (Ministry of Finance and Economic Planning 2016).



Conclusion

- The key stakeholders that are influenced and impacted by Machar Marshes wetland ecosystem services include:
 - local community (i.e. upstream and downstream)
 - government institutions from national up to local level
 - researchers and academia
 - non-governmental organization
- Slight tradeoff has observed across the land uses of the wetland; for instance,
 - Decreasing trend: grass land cover, herbaceous cover, grass land and tree cover
 - Increasing trend: crop land, shrub land, herbaceous cover flooded and tree cover flooded
- The estimated total economic value of the wetland is **\$622 m/year** from provisioning, regulation and biodiversity ecosystem services.
- The wetland's provisioning service provide the highest monetary value compared with other ecosystem services.

Policy implication

- Even though, the wetland provides huge economic value for the livelihood of the local community and the natural ecosystem, the wetland doesn't get protective authority for its sustainable provision.
- So far, there is no institutional arrangement to manage and ensure sustainability of the wetland ecosystem service.
- Some ecosystem services (particularly those related with tree cover) of the Machar Marshes wetland shows decreasing tendency.
- By considering the trend of LULC & the prospective economic values of the wetland ecosystem services, we strongly recommend four potential conservation options to maintain and restore Machar Marshes wetland.

Four potential conservation options

- **Conserving the foothill part of the Wetland**
- **Conserving the Flooded Plain of the Wetland**
- **Permanent Wetland Restoration**
- **Intervention to maintain the water inflow of the Machar Wetland**

Acknowledgments

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THANK YOU!