



Ecosystem Services Accounts (2015/2021)

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Outline

- Introduction
- Purpose and Rationale
- Ecosystem Services Accounts Development
- Results & Findings
- Key Messages (Policy Implications & Applications)
- Conclusion



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Introduction

- **Ecosystem assets** are contiguous spaces of a specific ecosystem type characterized by a distinct set of biotic and abiotic components and interactions.
- **Ecosystem Services Account (ESA)** are part of the SEEA EA. They are directly related to ecosystem extent accounts as shown the Figure below.
- ESA account for the **supply of ecosystem services** by ecosystem assets and use of those services by economic units, including households e.g., water provisioning, air filtration, climate regulation and recreation, etc.

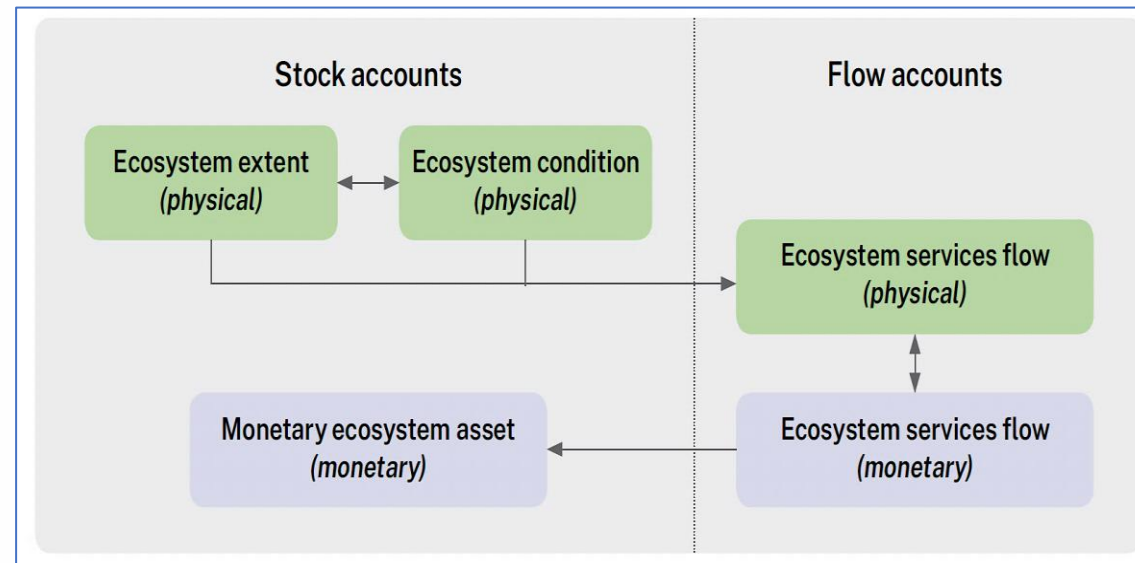


Figure 1: Connections between the SEEA Ecosystem Accounts (Physical & Monetary)



Introduction



- The ESA is built on the land cover and ecosystem extent accounts.
- Ecosystem services are the contributions of ecosystems to the benefits that are used in economic and other human activity.
- Ecosystem services are structured into **three (3)** broad categories: **provisioning services; regulating and maintenance services and cultural services.**
- Ecosystem Services Account (ESA) serve as the bridge between ecosystem assets, production and consumption activity of businesses, households and governments.

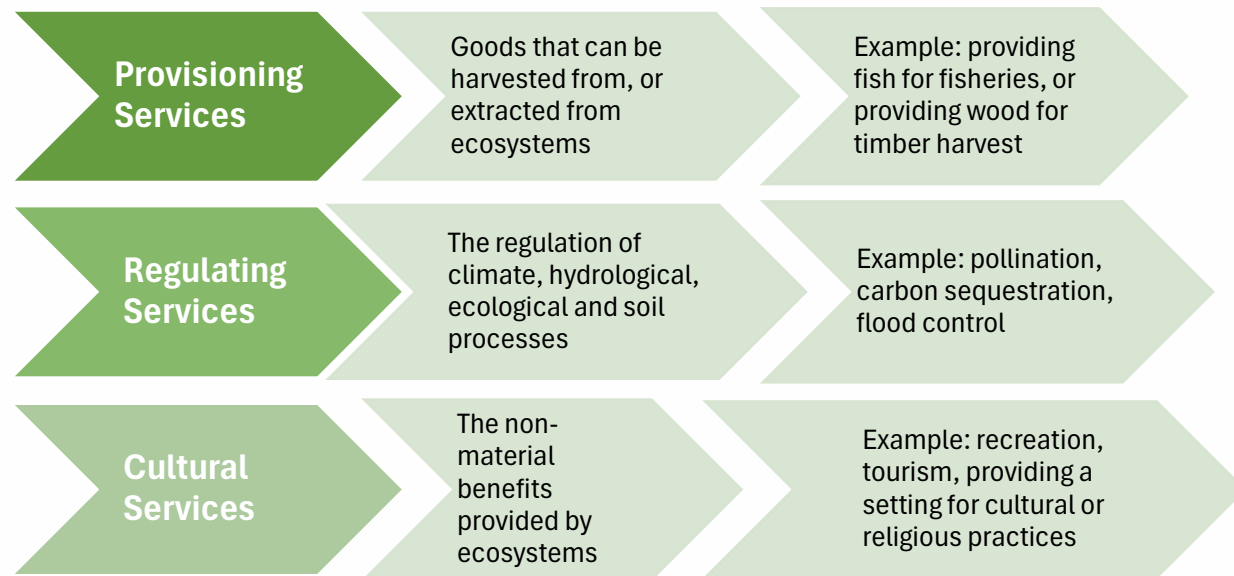


Figure 2: Broad Categories of Ecosystem Services based CICES



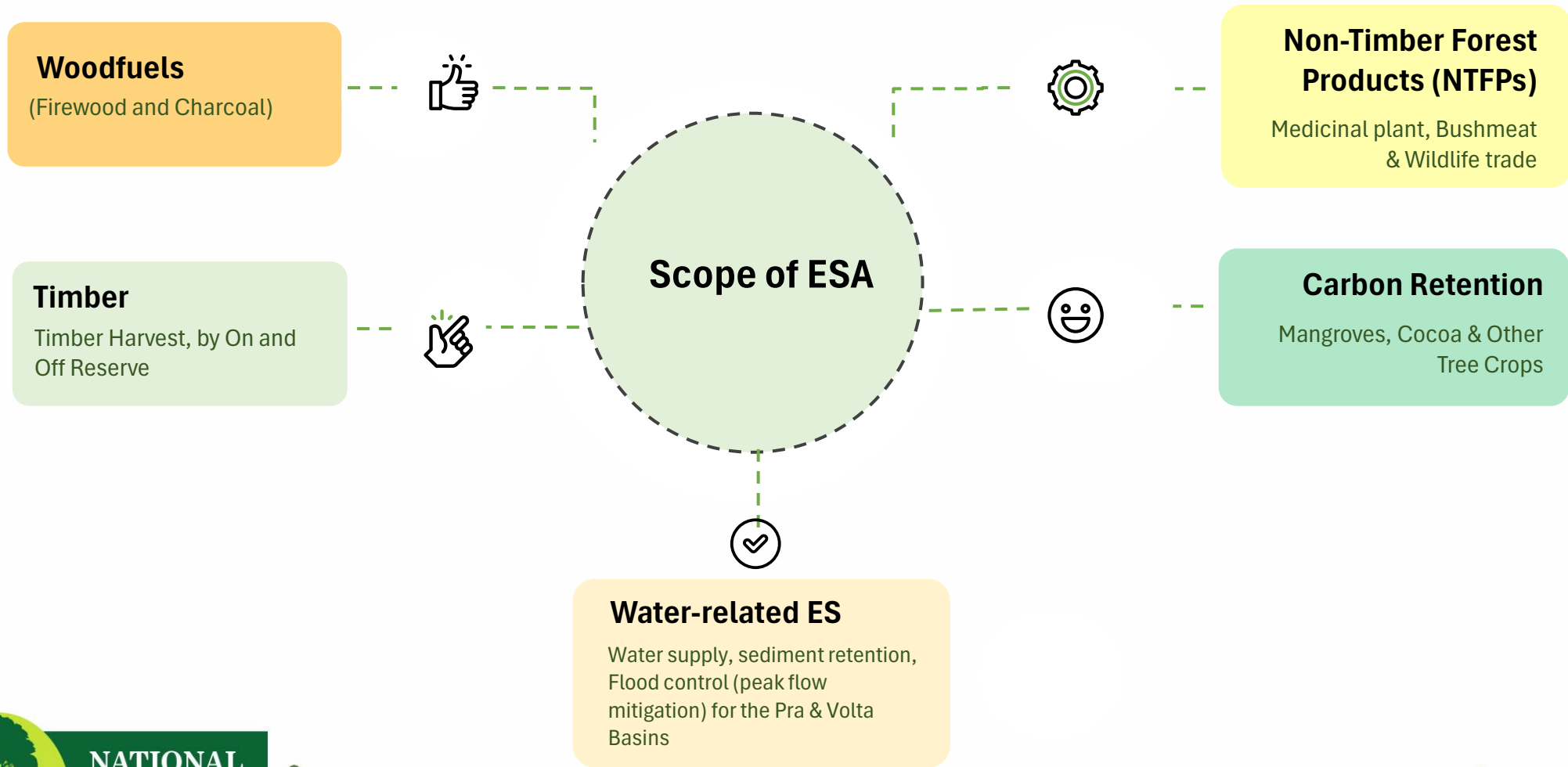


Purpose & Rationale

- The main purpose and rationale for compiling the ecosystem services account include:
 - Inform Sustainable Resource Management:** Provide data to guide policy, planning, and decision-making in sectors like water, forestry, agriculture, etc.
 - Support Biodiversity and Livelihoods:** Highlight the value of ecosystem services (e.g., NTFPs, woodfuels, cocoa) essential for local communities and biodiversity conservation.
 - Enhance Climate and Environmental Resilience:** Services like carbon retention (mangroves) and flood control (Volta & Pra Basins) contribute to climate mitigation and disaster risk reduction.
 - Integrate ES into National Accounting:** Promote the institutionalization of natural capital in national accounts, supporting sustainable development and international commitments.

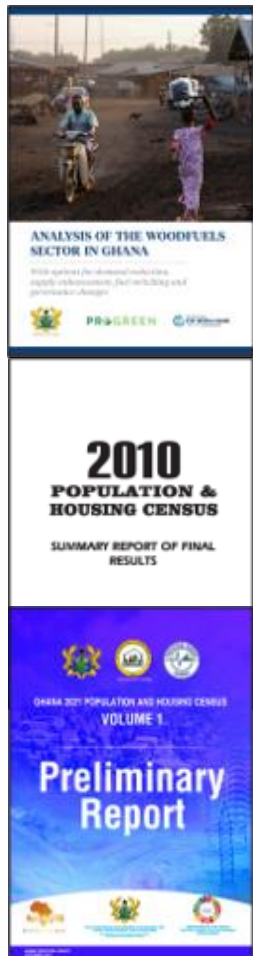


Ecosystem Services Accounts (ESA) Development





Ecosystem Services Estimation Matrix



Ecosystem Service	Data Sources	Estimation Methods	Methodology Description
Woodfuels (Firewood & Charcoal)	World Bank (2022) GLRSSMP; Ghana Population and Housing Census (2010, 2021); GSS StatsBank	Modelled supply and demand; back-casting for 2015; valuation using market prices (replacement cost method)	Used supply-demand modelling from national census and survey data; estimated back in time using trends; valued using replacement cost approach.
Timber (On & Off Reserve)	Forestry Commission – Resource Management Support Centre (RMSC); ICT, Production and Plantation Report (2022)	Volume harvested by reserve type; market prices from Forestry Commission (London Office & TIDD)	Compiled harvest volume by reserve type and year; monetized using official market rates; spatial distribution inferred from forest types.
Non-Timber Forest Products (Medicinal Plants)	Van Andel et al. (2012); Scopus literature search; World Bank WDI; GSS CPI	Scaled estimates from market surveys; adjusted using rural population and poverty rates; valued using adjusted market prices	Market survey data scaled using rural population and poverty rates; price adjusted using consumer price index; estimated physical supply and value.
Non-Timber Forest Products - Bushmeat	Literature (e.g. ALU, 2020; Ntiemoa-Baidu, 1998); Various Scopus references; News articles	Literature review provided volume and value ranges; data not sufficient for inclusion in final estimates	Synthesized national bushmeat estimates from literature; values not used due to outdated or inconsistent data.
Non-Timber Forest Products - Wildlife Trade	Wildlife Division of the Forestry Commission; CITES Trade Database	Export records reviewed; national data used due to re-export uncertainty; no spatial attribution possible	Reviewed export data from national and CITES sources; selected national data due to reliability; limitations in spatial linkage noted.





Ecosystem Services Estimation Matrix

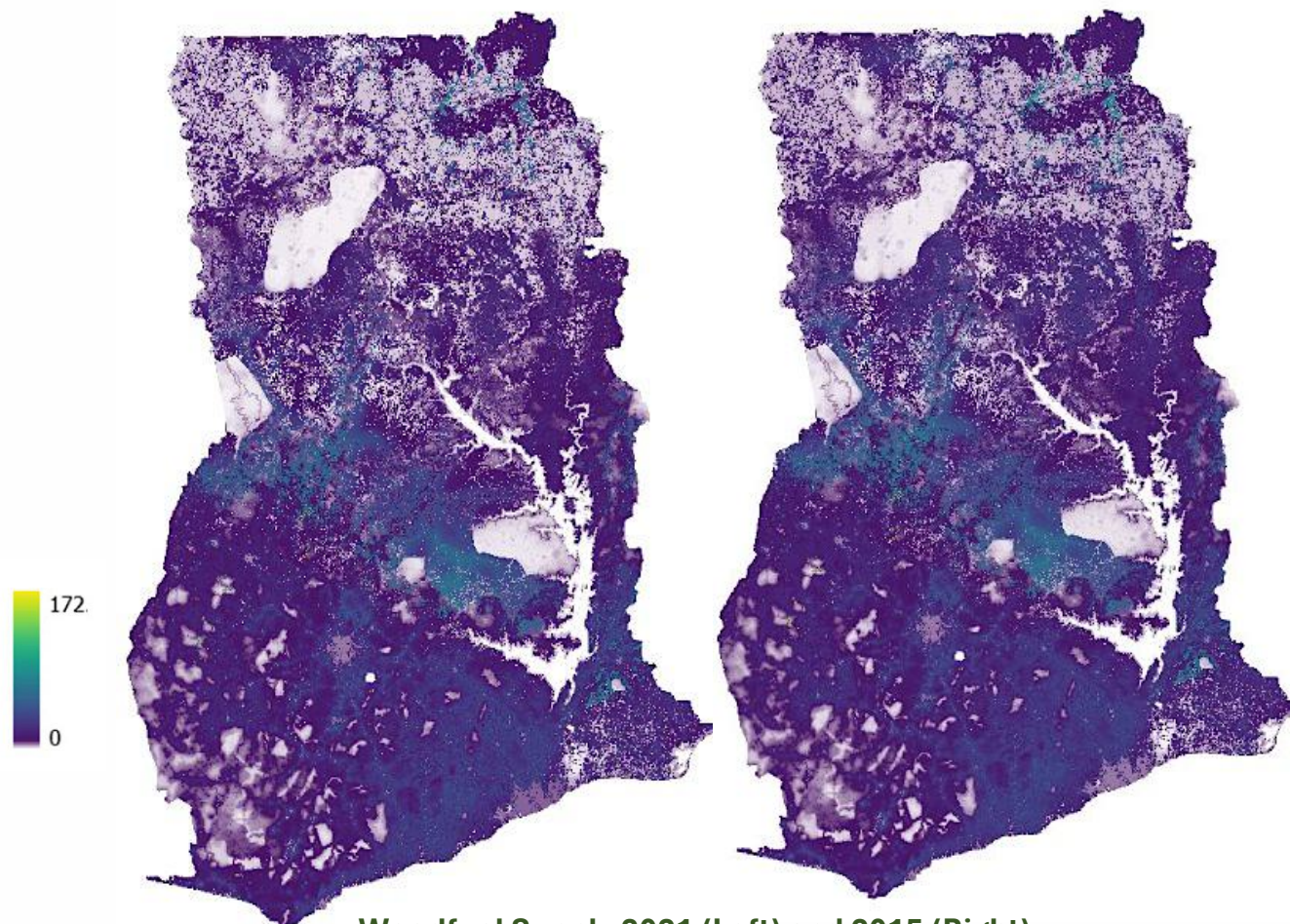


Ecosystem Service	Data Sources	Estimation Methods	Methodology Description
Carbon Retention (incl. Mangroves)	National land use and cover data; SEEA EA guidelines; Market/social cost of carbon prices	Carbon stocks estimated using biomass data; valuation based on social cost of carbon; annuitized value	Carbon stock volumes derived from biomass data; converted to monetary terms using social cost of carbon; results expressed as annual flows.
Water-related ES - Water Supply	Hydrological models (e.g. HEC-RAS); WRC and CSIR-WRI data	Physical flows modelled for Pra and Volta Basins; not monetarily valued	Modelled ecosystem contributions to household and industrial water needs using hydrological data from Pra and Volta Basins; not monetized.
Water-related ES - Sediment Retention	WRC and CSIR-WRI reports; land cover and vegetation data; Pra and Volta Basin models	Modelled vegetation impact on sediment retention in basins; no monetary valuation applied	Estimated vegetation's role in controlling erosion using basin-scale models; sediment retention valued qualitatively due to data gaps.
Water-related ES - Flood Control	WRC flood maps; riparian vegetation data; ecosystem modelling in Pra & Volta Basins	Ecosystem modeling of peak flow mitigation and flood control; valued qualitatively	Used hydrological and ecological models to assess vegetation's role in mitigating flood peaks; results expressed in physical terms only.



Results & Findings: Woodfuel

- **Increase in woodfuels consumption of 5.8 %** between 2015 and 2021.
- The monetary value of **woodfuel provisioning service** was **USD173 million in 2015** and **USD282 in 2021** (in current prices).
- At the **regional level**, most regions experienced **declines or modest increases in woodfuel demand**.
- **Significant reductions** in regions like **Savannah (-442,296 tons)** and **Northern (-334,188 tons)**.
- **Greater Accra** showed an **increase of ~28,965 tons**.
- The variation **reflects changing population patterns, urbanization, and possibly adoption of alternative energy sources**.



Woodfuel Supply 2021 (Left) and 2015 (Right)



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Results & Findings: Woodfuel



Key Messages

- Woodfuel remains a **critical energy source**, particularly for **households and small-scale industries** .
- The **modest growth in demand** underscores the **importance of sustainable woodfuel management**, especially in regions facing resource pressure.
- **Increasing valuation** also indicates the **growing economic importance of this provisioning service**.

Region	AREA (KM ²)	WOODFUEL DEMAND (TONS PER YEAR WOOD-EQUIVALENT) 2021	ESTIMATED WOODFUEL DEMAND (TONS PER YEAR WOOD-EQUIVALENT) 2015	NET CHANGE 2015 TO 2021	RATIO 2015 TO 2021
AHAFO	5,191	332,354	307,897	-24,457	92.6%
ASHANTI	24,379	1,971,067	1,978,289	7,222	100.4%
BONO	11,916	903,080	820,448	-82,632	90.9%
BONO EAST	22,877	1,790,062	1,570,512	-219,550	87.7%
CENTRAL	9,665	879,054	849,378	-29,675	96.6%
EASTERN	18,987	1,559,401	1,562,476	3,075	100.2%
GREATER ACCRA	3,704	185,283	214,248	28,965	115.8%
NORTH EAST	9,084	484,022	377,958	-106,064	78.1%
NORTHERN	24,886	1,296,507	962,319	-334,188	74.2%
OTI	11,070	606,435	547,744	-58,691	90.3%
SAVANNAH	35,847	1,913,385	1,471,089	-442,296	76.9%
UPPER EAST	8,652	423,023	353,258	-69,766	83.5%
UPPER WEST	18,779	616,579	507,597	-108,982	82.3%
VOLTA	9,840	800,549	808,962	8,413	101.0%
WESTERN	14,220	645,609	623,651	-21,958	96.6%
WESTERN NORTH	10,066	458,139	408,770	-49,368	89.2%
Total	4,041,373	4,537,618	4,041,373	4,537,618	4,289,496

Woodfuel Demand (2015 & 2021)

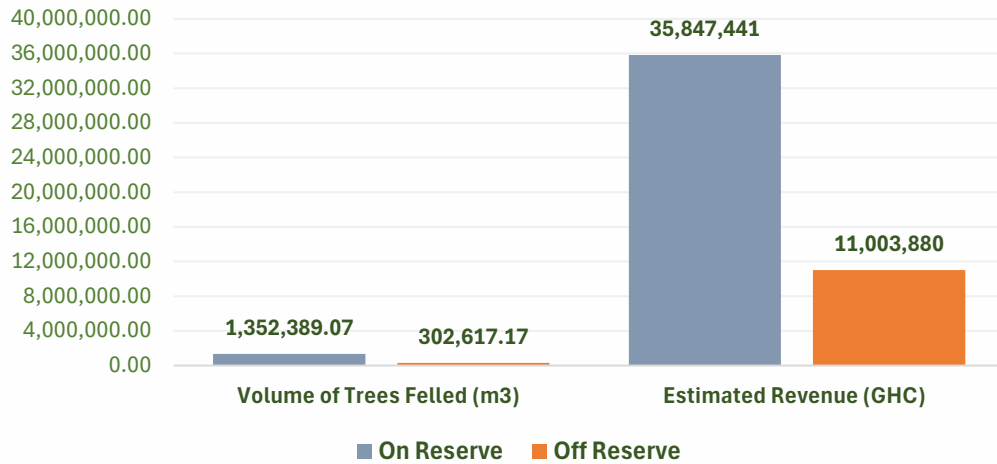




Results & Findings: Timber



Timber Harvest: Volume & Revenue By Reserve Type (2021)



- **Volume of Timber Felled:** On Reserve areas accounted for **1,352,389 m³ (82%)** of timber harvested.
- **Revenue from Timber Harvest:** On Reserve timber harvest generated **GHS 35.8 million (76%)** of the total estimated revenue.

Key Messages

- **Need for Sustainable Management of On Reserve Areas:**

The **high dependency** on On Reserve forests suggests potential **pressure and risk of overharvesting** if not properly regulated.

Long-term sustainability may require **rotation schemes, reforestation, and enforcement of yield limits.**
- **Off Reserve Forest Potential:**

While Off Reserve areas contribute less in terms of volume and revenue, they could be **strategically managed and possibly enhanced** through **community-based forestry, agroforestry**, or incentives for sustainable use to **diversify pressure** away from protected reserves.





Results & Findings: Non-Timber Forest Product (NTFPs)



1. Medicinal (Herbal) Plants

2015



903,770

Quantity (kg/year)



3.12

Price (\$/kg)



2.82

Total Value (\$mil)



13,255,803

Rural Population (People)

2021



899,969

Quantity (kg/year)



5.75

Price (\$/kg)



5.17

Total Value (\$mil)



13,794,798

Rural Population (People)



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Results & Findings: Non-Timber Forest Product (NTFPs)



2. Bushmeat

1. High Consumption Volume & Economic Value:

- Estimates suggest that **around 380,000 tons** of bushmeat are consumed annually in Ghana.
- The bushmeat economy was valued at approximately **USD 350 million (2020)**, rivaling or exceeding revenue from other sectors.

2. Unavailability of Updated & Comprehensive Data:

- Most figures cited originate from **older reports**, including a 2008 article and a 1998 estimate by Ntiamao-Baidu.
- No **recent, nationally representative studies** provide updated volumes or value, making current accounting and policy-making difficult.

Key Messages

1. Critical Ecosystem Service with Underreported Value:

Bushmeat harvesting is an important **provisioning ecosystem service**, yet its **contribution to livelihoods and the economy is underrepresented** in national accounts due to poor data.

2. Need for Data and Regulation:

The absence of recent and reliable data highlights a **major gap in wildlife monitoring**.

Enhanced **data collection, species tracking, and regulatory enforcement** are needed to manage this service sustainably.

3. Potential for Community-Based Conservation:

With the right incentives, **community-led wildlife management** could help balance livelihood needs and conservation goals, particularly in off-reserve areas.

4. Sustainability Concerns:

There's a **risk of ecological imbalance** if harvesting **exceeds natural regeneration** because of overexploitation and biodiversity loss.

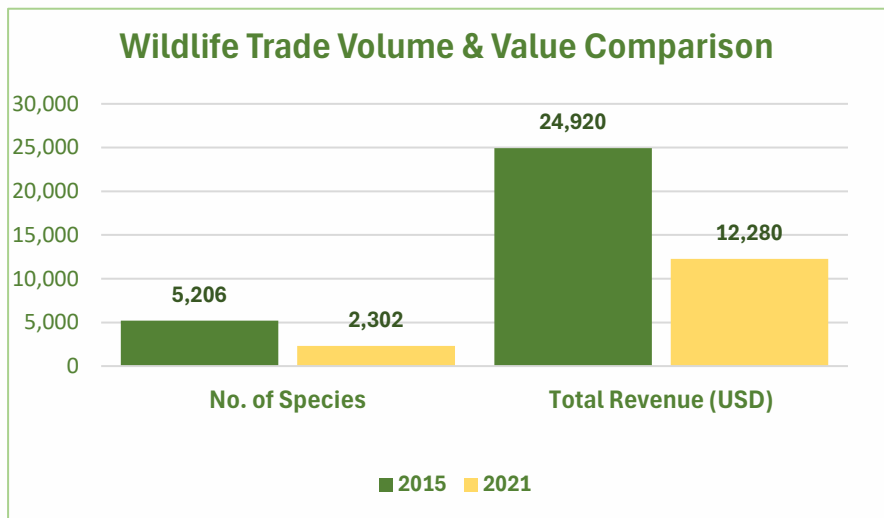




Results & Findings: Non-Timber Forest Product (NTFPs)



3. Wildlife Trade



- **Unit prices remained low and relatively stable**, ranging between **USD 4 to 30**, indicating a **low market value per species**.
- **10 species (2015); 3 species (2021)** suggesting reduced species diversity in trade attributed to the COVID-19 Pandemic to some extent.
- The **most traded species in 2015** were the Graceful chameleon (**1,505 units**), Royal python (**1,400 units**) and **Savannah monitor lizard (1,750 units)**.
- **Most traded in 2021** was **Savannah monitor lizard (2,251 units)**.

Key Messages

1. **Dependence on a Few Species:** Trade is heavily concentrated in a few species (especially the **Savannah monitor lizard**), posing **risks of overexploitation, biodiversity loss** and the need for species-specific monitoring.
2. **Data and Regulatory Gaps:** The limited scope of species and lack of continuity in some entries **suggest potential gaps in reporting, monitoring, or enforcement**.

- **Volume of trade** decreased by over **55%** from 2015 to 2021.
- **Revenue** also dropped by more than **50%**, suggesting a general decline in export trade activity for live wildlife.





Results & Findings: Carbon Retention



- **The ESA focused on Carbon Retention, not Sequestration**

Carbon retention (i.e., avoiding carbon emissions through conservation of existing biomass) due to **ongoing deforestation** in Ghana.

Carbon sequestration (removal from the atmosphere) was not quantified due to data limitations.

- **Carbon Stock Estimation**

The physical volume of carbon stocks was estimated in **tonnes**, based on **above-ground** and **below-ground biomass** from **land cover data**.

- **Decline in Carbon Stocks (2015–2021)**

Carbon stocks declined over the period, reflecting **continued deforestation and degradation**, especially in **off-reserve areas and savannah ecosystems**.

There was a **loss of about 2.6 % of total carbon stocks** between 2015 and 2021.

- **Economic Contribution**

The monetary value of **carbon retention in 2021** was estimated at **USD 1.15 billion (1.5 % of current GDP in 2021)**, making it the **most valuable ecosystem service** accounted for although it is a **decline (16.7%)** from **USD 1.38 billion (2.8 % of current GDP in 2015)** in 2015.



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Results & Findings: Carbon Retention



Key Messages

1. High Potential for Climate Finance

The **high monetary value of carbon retention** (especially in forests and mangroves) presents significant opportunities for Ghana to **access carbon markets, e.g., REDD+, voluntary markets.**

2. Urgency to Halt Deforestation

Declining carbon stocks highlight an **urgent need to scale up forest conservation, reforestation,** and sustainable land-use planning.

3. Mangroves as Strategic Assets

Mangroves, though spatially limited are **carbon-rich ecosystems** and **deserve priority protection** under coastal resilience and climate adaptation efforts.

4. Data and Monitoring Needs

Improved and frequent biomass and SOC data are needed to enhance accuracy in carbon accounting and **unlock international climate finance opportunities.**

5. Integration into Policy

Embedding carbon retention values in national planning, especially in **climate, forestry, and land-use policies** aligns with **SDG 13 (Climate Action)** and Nationally Determined Contributions (**NDC**) targets.



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Results & Findings: Water-related ES



- Water-related ecosystem services were estimated for the **Pra and Volta (part within Ghana) Basins**.
- The Pra and Volta Basins were selected because of their **strategic importance** to the economy.
- The Pra Basin is entirely within the nation.
- The Volta Basin spans several countries so estimates were only made for the portions of the basin occurring within Ghana.
- The **three (3) water-related ecosystem services** estimated were **water supply, sediment retention** (erosion control) and **flood mitigation**.

Definitions of the water-ecosystem services

Ecosystem Service	Definition
Water supply (Water yield)	Water available at abstraction points/dams/reservoir locations (modelled in SWAT). The higher the number the better.
Sediment retention	Tonnage of sediment trapped by Land Use and Land Cover (LULC) types and prevented from filling reservoirs/dams in the basins, i.e., volume of dams not filled with sediment. The higher the number the better.
Flood control (Peak flow mitigation)	Area and number of people not flooded by having LULC types in place as opposed to the Barren in the Basins. The higher the number the better.



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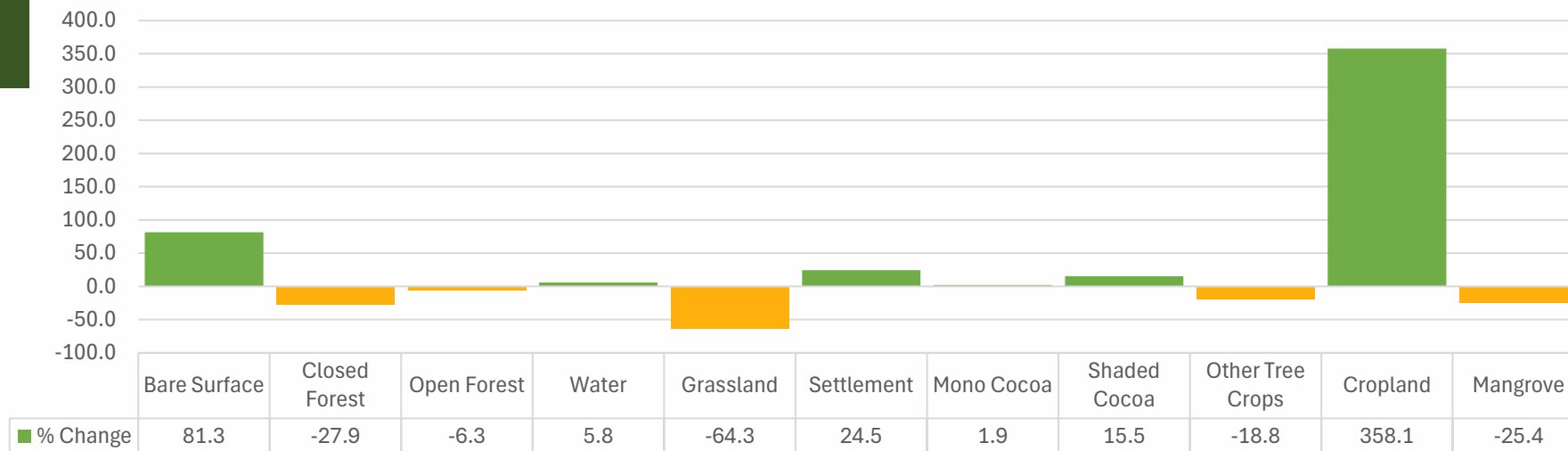


Results & Findings: Water-related ES



Pra Basin

Percentage Change in Land Cover Types in the Pra Basin (2015-2021)



- The Pra Basin experienced notable changes in both land cover and ecosystem service between 2015 and 2021.
- **Closed forests (-27.9%) and grasslands (-64.3%)** decreased in area, while **cropland (358.1%), shaded cocoa (15.5%) and settlements (24.5%)** increased.



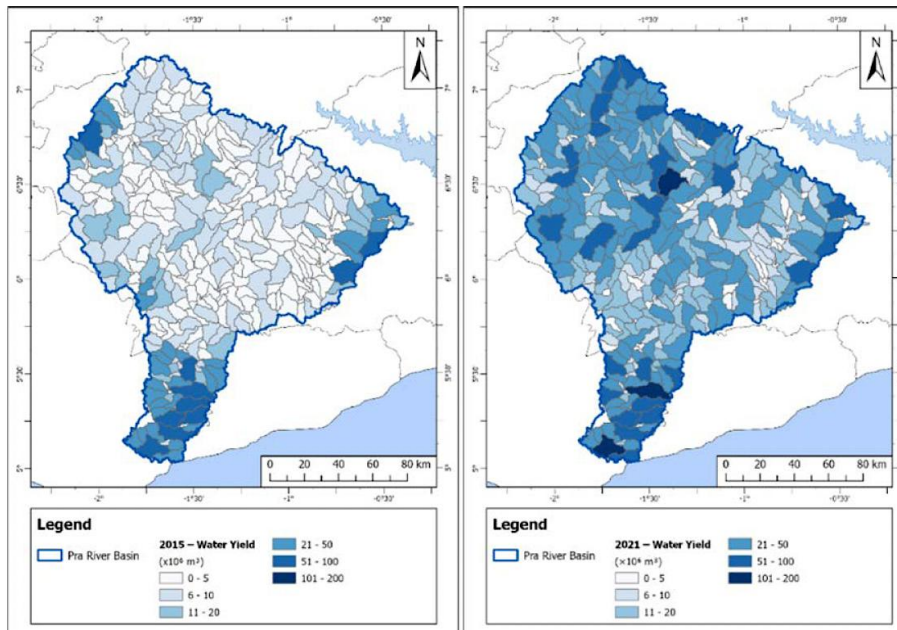


Results & Findings: Water-related ES

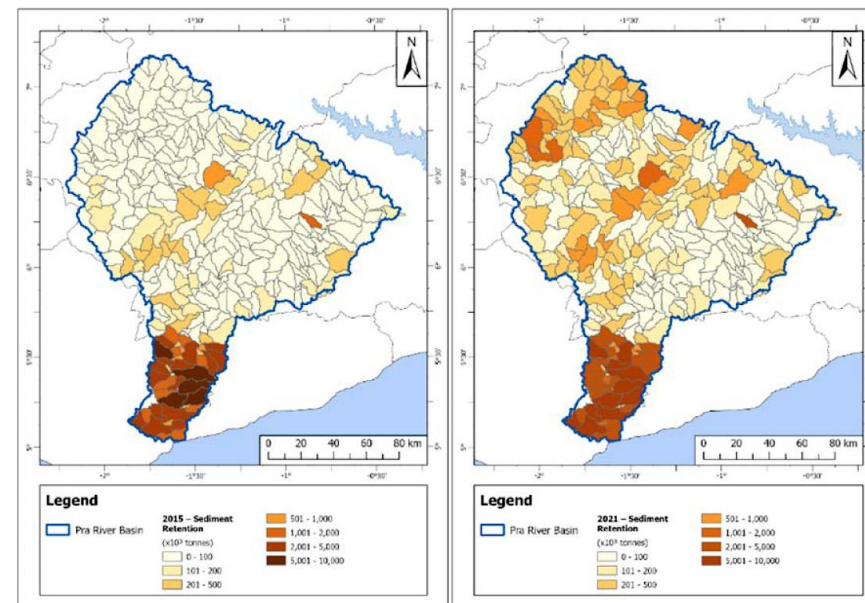


Pra Basin

Water Yield in 2015 (Left) and 2021 (Right) in the Pra Basin



Sediment Retention Services in 2015 (Left) and 2021 (Right) in the Pra Basin



3.04 (2015)

Total Water Yield (billion m³)



113.41 (2015)

Total Sediment Retention (million tonnes)



6.45 (2021)

Total Water Yield (billion m³)



192.66 (2021)

Total Sediment Retention (million tonnes)



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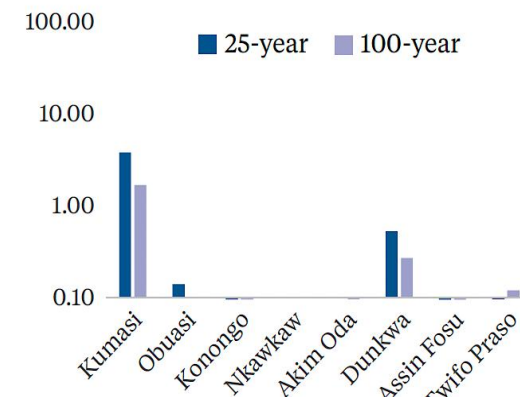
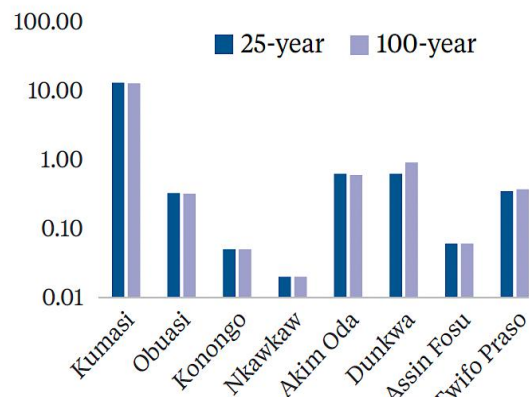


Results & Findings: Water-related ES

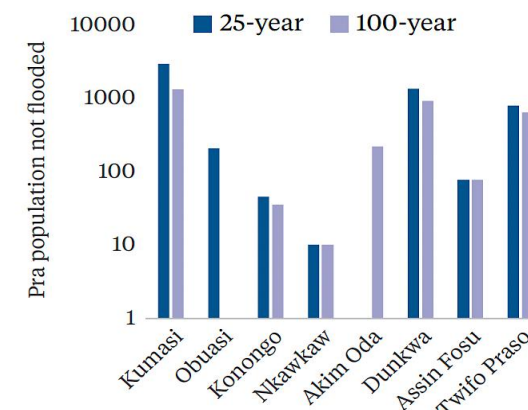
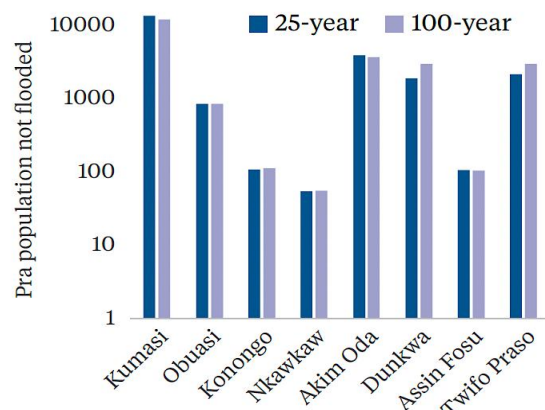


Pra Basin

- Flood control services were estimated for urban areas in the Pra Basin. The metrics used were **area not flooded**, and **population not flooded by 25- or 100-year floods**.
- Both the **area not flooded** and the **number of people not flooded by 25- or 100-year floods** declined from around **22,500** in 2015 to just under **6,000** in 2021, a significant reduction.
- The change was due to a **smaller area and number of people protected in Kumasi**, which **declined** from around **13 to 4 km²** and from over **13,000** in 2015 to more than **3,000** in 2021, respectively.
- Kumasi** has the **highest population** and hence a **potential higher service use** than other **urban centres** in the basin.
- The flood control services **depend on local factors**, including **population, roads and other structures and local riparian vegetation**.



Flood Control Services, Area not Inundated in Urban Settlement in the Pra Basin for 2015 (Left) and 2021 (Right) by the 25- and 100-year floods



Flood Control Services, Population not Flooded in Urban Settlement in the Pra Basin for 2015 (Left) and 2021 (Right) by the 25- and 100-year floods



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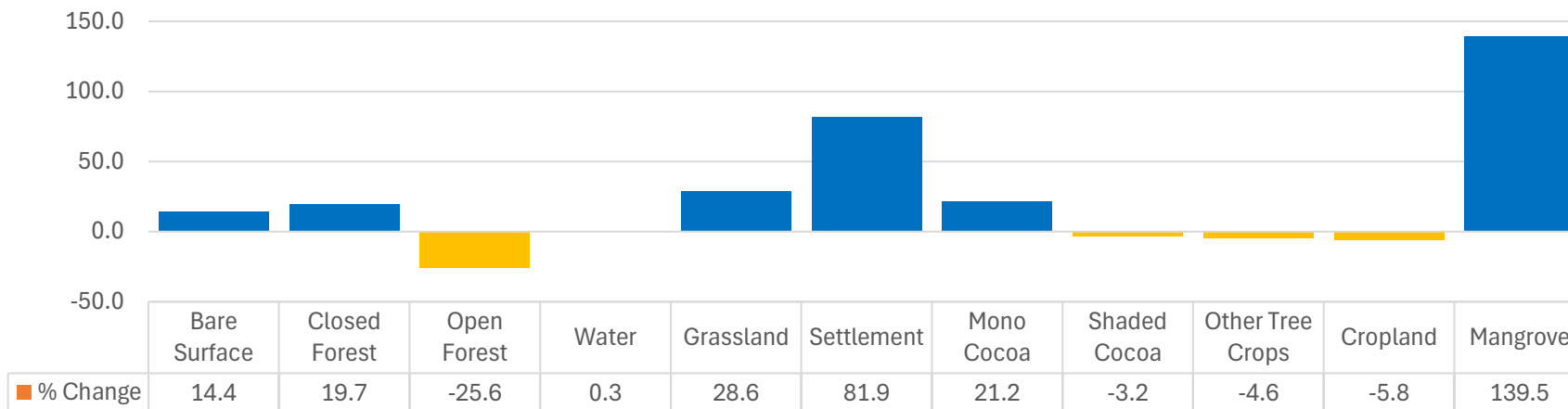


Results & Findings: Water-related ES



Volta Basin

Percentage Change in Land Cover Types in the Volta Basin (2015-2021)



- The Volta Basin experienced changes in both land cover and ecosystem service between 2015 and 2021.
- **Open forests (-25.6%) decreased in area, while grasslands (28.6%), settlements (81.9%) and mangrove (139.5%) increased.**



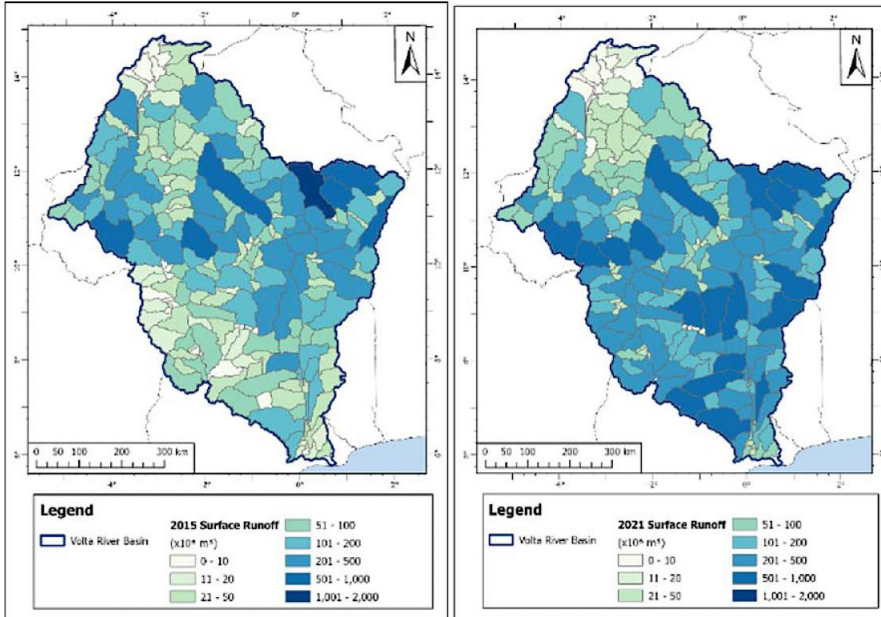


Results & Findings: Water-related ES



Volta Basin

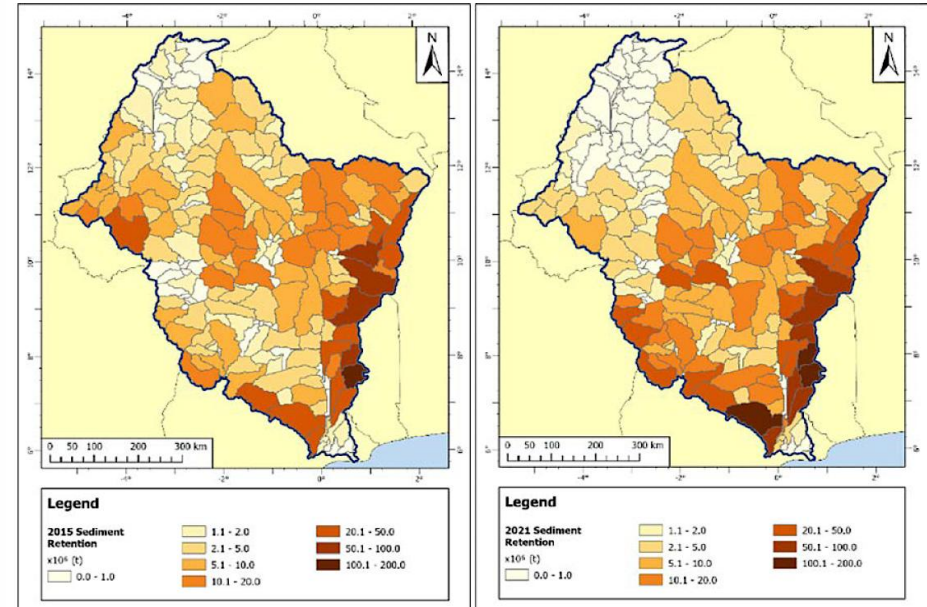
Water Yield in 2015 (Left) and 2021 (Right) in the Volta Basin



49.37 (2015)
Total Water Yield (billion m³)



Sediment Retention Services in 2015 (Left) and 2021 (Right) in the Volta Basin



1.49 (2015)
Total Sediment Retention (billion tonnes)



78.27 (2021)
Total Water Yield (billion m³)



2.04 (2021)
Total Sediment Retention (billion tonnes)



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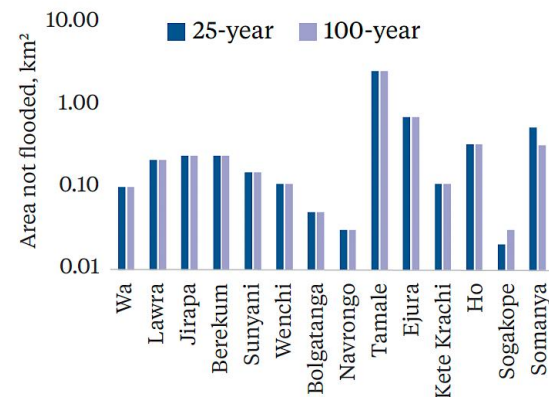
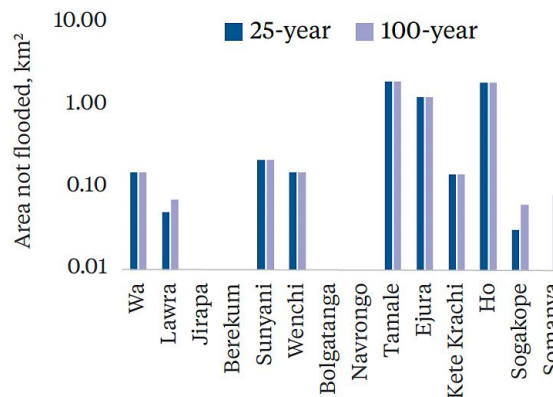


Results & Findings: Water-related ES

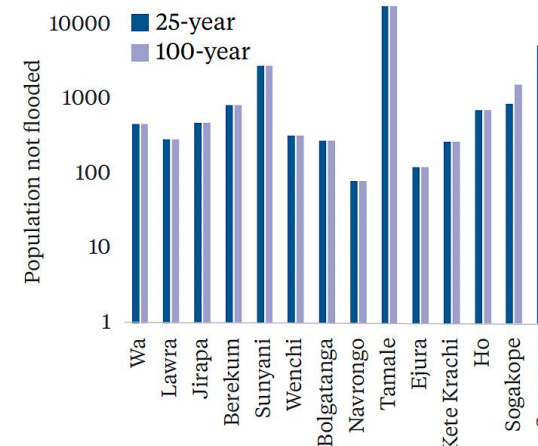
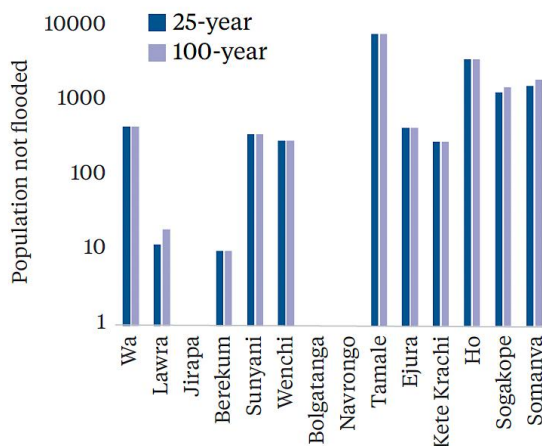


Pra Basin

- Flood control services covered an area between 5 - 6 km², affecting approximately 15,558 to 22,606 people in the Volta Basin.
- In terms of population “not flooded the flood” control services increased across the area.
- However, the change was driven by an increase in the number of people living in flood prone areas, not by an increase in natural capital (i.e. the ecosystems providing the service).
- This is inferred from the fact that the area that would have flooded changed very little (<1 km²) compared to the increased number of people (around 7,000 people).



Flood Control Services, Area not Inundated in Urban Settlement in the Volta Basin for 2015 (Left) and 2021 (Right) by the 25- and 100-year floods



Flood Control Services, Population not Flooded in Urban Settlement in the Volta Basin for 2015 (Left) and 2021 (Right) by the 25- and 100-year floods



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Conclusion



- **Strengthening the link to national accounts** will increase **their relevance of ES to macroeconomic planning** and how they can be used to **address national priorities** (e.g., reducing poverty).
- There is **potential to include additional ecosystem services** in future iterations such as biomass provisioning, global climate regulation (carbon sequestration), cultural and recreational services (e.g., “ecotourism”) and other water-related ecosystem services.
- **Placing ESA into a broader system** will link environmental protection and resource management activity and evaluate ecosystem condition and service flows.
- **Support for Target 2 of the Global Biodiversity Framework**, link to energy accounts, climate mitigation and adaptation, among others.



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