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METHODOLOGICAL WORK SEEA-EEA
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Accounting for Ecosystem and Biodiversity Related Themes in Uganda

Introduction

Calls for more evidence-based approaches to policy have increased the need for integrated environmental-economic information which the SEEA can provide. The World Bank (2017) policy forum identified three specific policy areas where this information can support decision making: Sustainable development (including achieving SDGs); Green growth; and, Climate change.

Uganda provides an interesting case study for applying the SEEA and the EEA extension to inform decisions on ecosystem and biodiversity management. It is one of the most biodiverse countries on earth, yet species and habitat loss remains a national concern (as identified in Uganda's National Biodiversity Strategy and Action Plan II[1]).

Uganda has quite an extensive collection of spatial data on ecosystems and species, however it is piecemeal in its presentation and application, which is common in a number of country settings. The data are amenable to producing a preliminary set of environmental-economic accounts. Most importantly, there are clear policy entry points that these accounts can speak to.[2]

This paper describes the outcomes of an attempt to rapidly compile a set of such policy relevant ecosystem and biodiversity related natural capital accounts using the SEEA framework in Uganda.[3] These accounts provide a solid spatial data infrastructure for calculating wider ecosystem accounting modules going forward. Based on the work presented in this paper, we would appreciate feedback from the London Group on the potential for expansion and wider application of the approach.

Approach

The SEEA CF starts from the perspective of the economy, from this perspective land is defined as an environmental asset in which economic activities and environmental processes take place[4]. The SEEA-CF proposes two approaches to account for land as an environmental asset, firstly based on land-use (reflecting activities and institutional arrangements) and secondly based on Land Cover (the observed physical and biological cover of the Earth's surface). The SEEA-EEA starts from the

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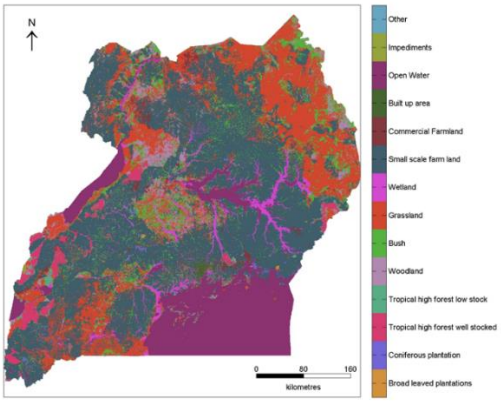
[1] NEMA, 2016. National Biodiversity Strategy and Action Plan II (2015-2025), Kampala, Uganda: https://www.cbd.int/doc/world/ug/ug-nbsap-v2-en.pdf

[2] The National Development Plan II (NDP II) for Uganda sets out objectives for Environmental and Natural Resources (ENR) in pursuit of sectoral growth and socio-economic development, with tourism identified as a key development sector. The second National Biodiversity Strategy and Action Plan for Uganda (NBSAP II) further recognises the importance of biodiversity to Uganda's economy and livelihoods of Ugandans and provides national targets aligned with the ambitions of the NDP (II) and the CBD Aichi Biodiversity targets. Both plans explicit recognise the role that natural capital accounting can play in informing decision-making towards achieving their objectives.

[3] UNEP-WCMC & IDEEA (2017) Experimental Ecosystem Accounting in Uganda: www.wcmc.io/0524

[4] Land is a unique environmental asset that delineates the space in which economic activities and environmental processes take place and within which environmental assets and economic assets are located (SEEA-CF, 5.239)

perspective of ecosystems and applies the definition of ecosystems from the Convention on Biological Diversity[5]. Accordingly Land-use and land cover are not ecologically meaningful representations of ecosystems – although they may align in some cases [6]. As such, we present an approach integrating both land based accounts from the SEEA-CF and spatial ecological data on ecosystem distribution in Uganda to develop a set of Experimental Ecosystem Accounts for Uganda[7]. The approach draws on similar work undertaken by SANBI in South Africa with respect to ecosystem accounting[8] and existing work to associate natural ecosystems with species derived benefits in Uganda coordinated by Makerere University[9]. We extend the analytical power of these accounts by integrating expert knowledge in order to communicate the implications of changes in the configuration of land cover and ecosystem extent on selected species, as an ecosystem accounting theme of policy relevance. We term these constructs 'Species Accounts', which provide structural statistics (i.e., statistical indicators that can be used for making comparisons over time and themes) that can inform key policy objectives relevant to ecosystems and biodiversity in Uganda. Below we summarise our approach.



produced using EnSym **Extent of NBS Land Cover Classes**

Land Cover Accounts: The first stage in the process was to construct accounts of the extent of land cover classes for 1990, 2005, 2010 and 2015 using land cover maps produced for Uganda. These land cover maps are based on the FAO LCCS and derived from LandSat imagery.

[5] Ecosystems are a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit (CBD, 2003, Article 2, Use of Terms).
[6] Driver et al. (2015) - http://www.statssa.gov.za/wp-content/uploads/2016/08/Land-and-Ecosystem-Accounting-in-KZN-Discussion-Document-FINAL.pdf
[7] The approach and results are described in detail in UNEP-WCMC & IDEEA (2017) Experimental Ecosystem Accounting in Uganda: www.wcmc.io/0524
[8] Driver et al. (2015) - http://www.statssa.gov.za/wp-content/uploads/2016/08/Land-and-Ecosystem-Accounting-in-KZN-Discussion-Document-FINAL.pdf
[9] Pomeroy et al. (2002) – http://pdf.usaid.gov/pdf_docs/pnacy477.pdf

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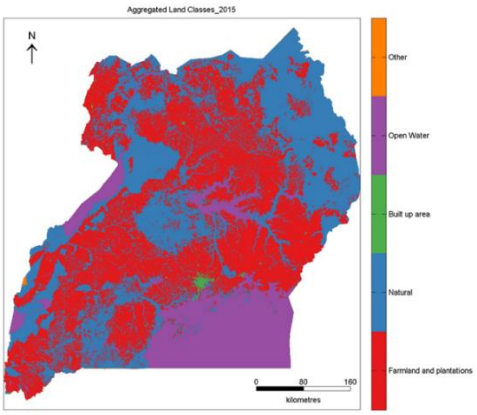
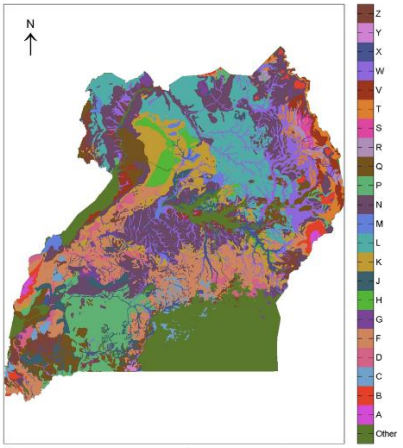
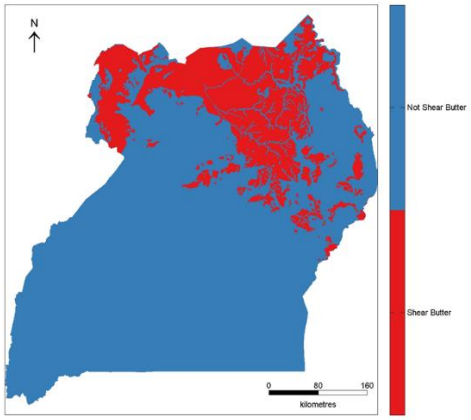
 produced using EnSym **Natural Land Cover / Use in Blue (aggregated NBS Classes)**	**Aggregated Land Cover Accounts:** Using this information, accounts have then been created for 1990, 2005, 2010 and 2015 for the extent of: • natural land cover • open water • farmland and plantation • built-up areas These were based on based on aggregations of relevant land cover classes.
 produced using EnSym **Langdale Brown - Original extent of ecosystems in Uganda**	**Ecosystem Accounts:** By intersecting the extent of natural land cover with a map of the original distribution of vegetation classes (i.e., before anthropogenic change) accounts have been created for 1990, 2005, 2010 and 2015 for the extent of these vegetation classes. These are our 'natural ecosystem' accounts and are based on 22 vegetation classes that aggregate to 4 Biomes. First mapped by Langdale-Brown et al., in the 1950s/1960s
 produced using EnSym **Original extent of Shea butter nut tree suitable habitat**	**Species Accounts**: Accounts of the extent of suitable habitat for individual species were calculated for 1990, 2005, 2010 and 2015 using expert knowledge to link species to the remaining extents of preferred natural ecosystem types or land cover classes within species ranges: • Shea butter nut trees (linked to natural ecosystems) • Gum Arabic (linked to natural ecosystems) • *Prunus Africana* (linked to natural ecosystems) • Chimpanzees (linked to IUCN ranges and land cover classes)

	• Elephants (linked to IUCN ranges and land cover classes)

Selected Results

The accounts reveal substantial ongoing reductions in the extent of natural ecosystems in Uganda at the national scale. This is shown in Table 1, where vegetation classes have been aggregated to biomes ('Aggregated Other' is all non-natural land cover and open water).

Table 1: Ecosystem extent account

Classifications >>	Dry Savannas	Forest	Moist Savanna	Aggregated Other	Wetlands	TOTALS
Opening Stock	4,831,858	1,179,006	2,275,929	14,099,137	1,759,468	24,145,398
Additions to stock						-
Total additions to stock	462,669	141,505	281,798	1,957,614	157,879	3,001,465
Reductions in stock						-
Total reductions in stock	(758,013)	(254,815)	(777,002)	(1,043,851)	(167,784)	(3,001,465)
Net change in stock	(295,344)	(113,310)	(495,204)	913,763	(9,905)	-
Closing stock	4,536,514	1,065,696	1,780,725	15,012,900	1,749,563	24,145,398

The accounts also identify large areas with the potential to support Shea butter nut tree harvesting (> 1 million ha), mainly in sub-regions in the north and west of the country (see Table 2). In particular, Karamoja is identified as retaining a substantial extent of natural ecosystems that could support Shea butter nut tree harvesting, which is not in conflict with the protected area estate (see green ovals, Table 2). Conversely Teso has lost a large extent of its original extent of natural ecosystems for supporting Shea butter nut tree harvesting.

Table 2: Shea butter nut tree account

	ACHOLI	ELGON	KARAMOJA	LANGO	TESO	WEST NILE	Uganda
Original Extent	1,698,092	84,296	831,487	481,236	605,551	986,801	4,687,463
1990	1,021,071	25,823	742,697	132,093	187,845	596,956	2,706,485
% Original Extent	60%	31%	89%	27%	31%	60%	58%
% 1990 extent in Uganda	38%	1%	27%	5%	7%	22%	100%
2015	788,723	15,042	702,678	83,443	91,280	419,758	2,100,924
% Original Extent	46%	18%	85%	17%	15%	43%	45%
% 2015 extent in Uganda	38%	1%	33%	4%	4%	20%	100%
Regionally Protected 2015	72,230	50	302,280	5,689	2,410	59,807	442,466
Regional % Protected	9%	0.33%	43%	7%	3%	14%	21%

Policy applications

Below we present some key policy relevant applications that can be supported by the accounts.

- **SDG 1 (End poverty in all its forms everywhere):** The species accounts presented can help inform where tourism and Non-Timber Forest Product (NTFP) production possibilities can contribute to local economic development and address poverty.

- **SDG 12 (Ensure sustainable consumption and production patterns):** The land, ecosystem extent and NTFP species accounts can inform about sustainable production by tracking the degree of habitat conversion and degradation associated with different economic sectors and potential implications on NTFP harvests and the tourism sector.

- **SDG 15 (Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss)**: The land, ecosystem extent and species accounts can track whether ecosystems are being sustainable managed by identifying.

- **NBSAP (II) target 3.2, by 2020 ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15% of degraded ecosystems (corresponds to Aichi Target 15):** In combination, the land cover and ecosystem extent accounts can identify areas that have been degraded and are characterised by high ecosystem diversity potential.

- **NBSAP (II) target 3.1, by 2020 the extinction of known threatened species plants and animals inside and outside of protected areas has been prevented and their conservation status improved (corresponds to Aichi Target 12)**: The flagship species, Shea butter nut tree and *Prunus africana* accounts can inform progress towards protecting the range and conservation status of these species.

- **NBSAP (II) target 3.1, b7 2020 at least 17% of terrestrial and inland water ecosystems in Uganda are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas for socio-economic benefit of the population (corresponds to Aichi Target 11**): The flagship species and ecosystem extent accounts can reveal progress towards protecting an ecologically representative set of areas with high biodiversity importance in Uganda.

Discussion

There are key benefits that this approach has provided:

- The rapid development of the accounts using existing data allows insights to be quickly disseminated. This will assist in retaining the support of key users of the accounts and foster ownership through elicited feedback to direct future iterations.
- This work establishes a spatial data infrastructure for ecosystem accounting, for natural ecosystems at least, that can support wider ecosystem accounting.
- The staged approach is also likely to prove more efficient, as investments to fill data gaps (e.g., condition ground-truthing) and calculate additional modules can then be targeted to policy and user priorities.

The London Group exam question(s)!

- What are the links to other global datasets that can provide the ecological information for other countries for producing these types of ecosystem extent accounts?
- Are these 'Species Accounts' useful constructs for considering the habitat services of ecosystems, as well as identifying distributions of opportunities for ecosystem service dependent on particular species and functional traits (e.g., provisioning services, cultural services / tourism and regulating services including pollination)? Perhaps a useful interim measure in the absence of ecosystem service accounts.
- How should this approach be integrated with accounting for managed ecosystems? Farmland in areas of former forest is likely to be different to that in drained wetlands.