Applying natural capital accounting at an estate scale

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Introduction

Natural Capital Accounting (NCA) can inform decision-makers of the benefits of investing in nature and sustainable management of natural resources. This is done by quantifying and monitoring natural assets and their ecosystem service outputs over time.

The aim of this study was to apply NCA to the MacRobert Trust Estate in Aberdeenshire by adding a valuation element to an existing biophysical account by Langan (2016). In particular it seeks to evaluate the issues of applying benefit transfer in NCA applications. The Estate consists of tenanted mixed farming and both productive and conservation woodland.

Fig.1 The estate, West Aberdeenshire, Scotland

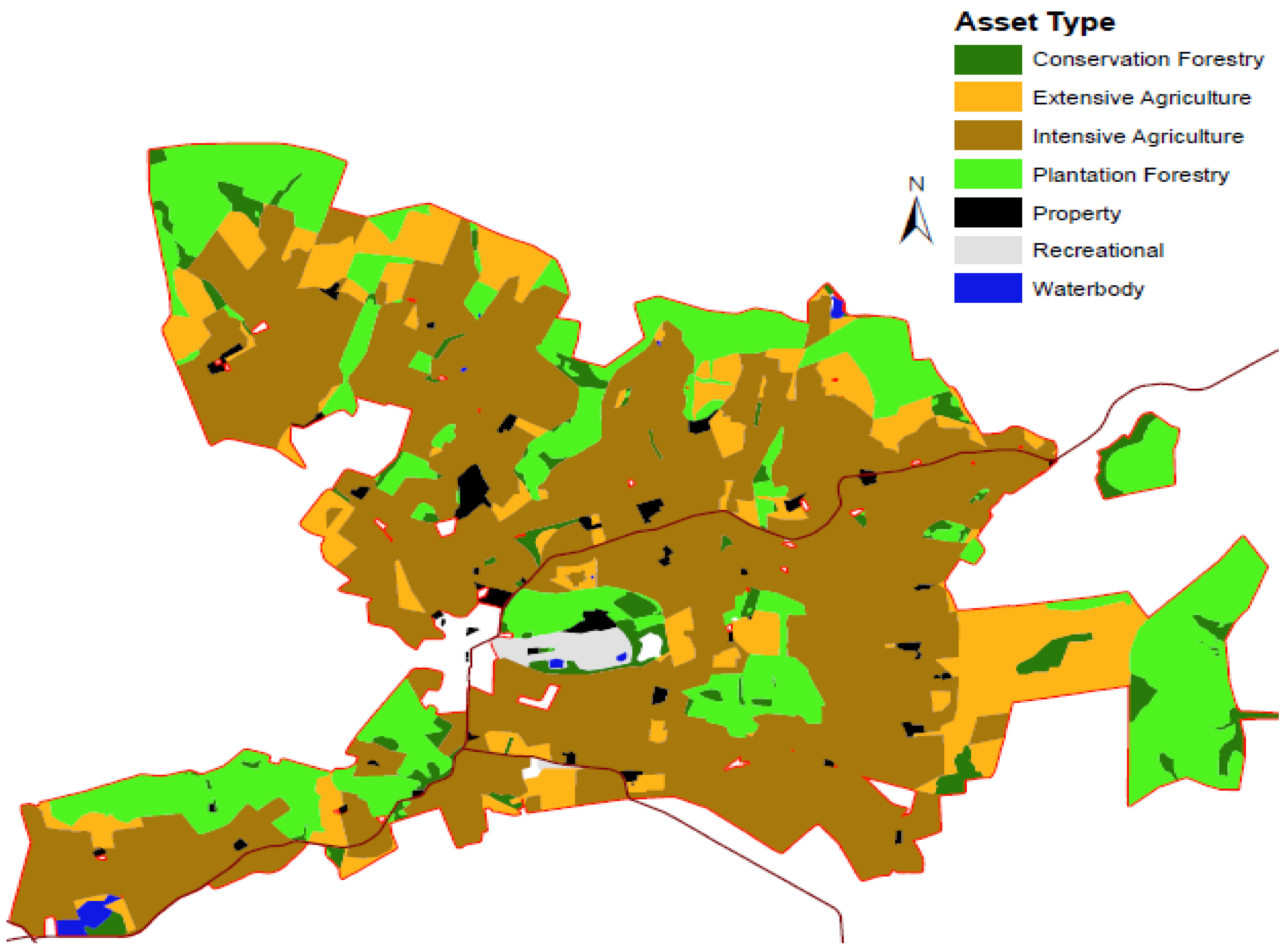

Fig. 2 Estate natural capital assets.

Methods

In order to evaluate the usefulness of the framework on the MacRobert Trust Estate the following steps were undertaken.

1. Using land class maps, the ecosystem assets were assessed in bio-physical terms to create an asset registry.
2. A biophysical flow account was created. Ecosystem services were identified and quantitative indicators used to show the flow of services provided by the assets.
3. Benefit transfers were used to monetize the quantity values found in the biophysical flow account.

The valuation numbers depend on many assumptions and constraints. Therefore, a robustness framework was developed to assess the validity of the valuation results.

Results

The assessment showed a variety of values for the ecosystem services on the estate. However, local data constraints impacted the precision of estimating biophysical indicators on the estate. Additionally, in making the monetary flow account, it was assessed that there was a limited transferability of economic values and furthermore scientific knowledge gaps on ecosystem valuation. This lead to the construction of a consistency scoring framework as shown in Figure 3.

This scoring was then applied to the estimated NCA values (Figure 4)

	Grading	Air quality	Flood forest	Flood rip. buffer	Total flood prot.	WQ rip buff	Soil erosion	Climate reg.	prov. service	Biodiv	Cultural forest	Cultural hedonic	Aesthetic
A. Value transfer completeness (40%)*													
No value	0	0	0	2	0	0	0	0	0	0	0	0	0
Unit benefit transfer	5	0	5	0	5	0	0	0	5	0	5	5	0
Adjusted benefit transfer	8	8	0	0	0	0	8	8	0	8	0	0	0
Meta-analysis	10	0	0	0	0	0	0	0	0	0	0	0	10
B. Valuation approach (20%)*													
cost-based	8	8	8	8	8	0	8	8	0	0	0	0	0
revealed/stated preference	9	0	0	0	0	9	0	0	0	9	9	9	9
Price based	10	0	0	0	0	0	0	0	10	0	0	0	0
C. Biophysical evidence (40%)*													
Biophysical evidence	1-10	7	3.5	1	4	6	8	7.5	7.5	2	8	4	1
Final grade													
*Weight totals to a 100% up to a grade of 10	10.0	7.6	5.0	2.8	5.2	4.2	8.0	7.8	7.0	5.8	7.0	5.4	6.2

Fig. 3 Methodological consistency framework.

Ecosystem service	Sub-category	Valuation basis	Monetary flows annually	Methodological consistency (1-10)
Ambient air quality	SO_2 absorption	Avoided damage costs	£4	7.6
	PM_{10} absorption	Avoided damage costs	£6,340	7.6
Flood protection	Forest flood protection	Avoided damage costs	£5,967	5.0
	Riparian buffer protection	Avoided damage cost	£6,855	2.8
	Total flood protection potential	Avoided damage costs	£141,000	5.2
Chemical condition of fresh water	Total water purification potential	Stated preference (CE)	£34,899 (upper bound)	4.2
Soil erosion prevention	Erosion prevention due to land-cover and management	Replacement costs	£4,996	8.0
Climate regulation	Carbon sequestration	Marginal abatement costs, shadow pricing & carbon market	£377,745	7.8
Provision of cultivated crops	Winter wheat	Total gross margin	£20,787	7.0
	Feed barley	Total gross margin	£115,237	7.0
	Malting barley	Total gross margin	£191,853	7.0
Provision of livestock products	Beef production	Gross margin per animal	£193 - £390	6.0
	Sheep production	Gross margin per 100 animals	£1,140 - £1,369	6.0
Biodiversity (Existence value)	Red squirrel	Stated preference (CVM)	£8,514	5.8
	Water Vole	Stated preference (CVM)	£23,545	5.8
Cultural services	Recreation in forest	Stated preference (CE)	£52,939	7.0
	1% increase in fresh water wetlands	Revealed preference (HP) per ha	£645 (upper bound)	5.4
	1% increase in coniferous woodland	Revealed preference (HP) per ha	£168 (upper bound)	5.4
	1% increase in broadleaved woodland	Revealed preference (HP) per ha	£449 (upper bound)	5.4
	1% increase in inland bare ground	Revealed preference (HP) per ha	-£1509 (upper bound)	5.4
	Footpath	Stated preference (CVM) per visitor	£3.5	6.2
	Semi-natural grasslands and enclosed farmlands recreation	Stated preference (CVM and CE) per visitor	£2 - £ 6	6.2
	Fresh water, wetlands and floodplains recreation	Stated preference (CVM) per visitor	£4	6.2
	Woodland recreation	Meta-analysis – per visitor	£10	6.2
	Cultural heritage	Meta-analytical transfer	£1,725,624	6.2

Fig. 4 Estimated NCA values and consistency scores

Conclusions

The NCA provides an order of magnitude for each ecosystem service value rather than a precise estimate. Additionally, numerous knowledge gaps persist. Despite these limitations, there are still benefits in developing an NCA to monitor changes in quality and quantity of ecosystems:

- To some extent, through identification of potential beneficiaries and the valuation efforts, externalities were made clear on the Estate and its surroundings.
- Because ecosystem services are often not owned by any party, a case is built for providing property rights of ecosystem services.
- NCA can signal sustainability of management practices to land managers, help them deal with the effects of market failures and use NCA to build a case for payment for ecosystem service schemes.

References

Langan, C. (2016). Natural capital accounting for land managers. University of Aberdeen, Valuing Nature Programme.

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