Natural capital accounting for farms

Briefing Note for the RSA Food, Farming and Countryside Commission

by economics for the environment consultancy (eftec)

1.1 Why Natural Capital for Farming?

The reliance of our economy on the natural environment is gaining increasing attention due to concerns about climate change and loss of wildlife. This is reflected in the Government's adoption of the idea of public goods as a basis for payments to farmers:

> *The government's proposals will see … a new system of paying farmers "public money for public goods" - principally their work to enhance the environment and invest in sustainable food production*[1].

Public goods are benefits to wider society that everyone benefits from, but which are difficult, or impossible, to charge for directly. They include soil health, water quality, reducing greenhouse gas emissions, and enhancements to natural habitats and wildlife. However, the concept is not universally understood and measuring public goods and using this evidence in policy remain a work in progress.

Farming already provides such public goods, whether paid for through CAP Pillar II or not. Going forward, the new Environmental Land Management scheme aims to link payments more closely to public good provision. Therefore, farmers need to look more closely at which public goods their land does provide, which it could provide, and what value these have.

The natural capital approach provides a way to measure and value public and private goods from land. A natural capital account organises data to do this in a systematic and repeatable manner. This briefing note aims to provide practical descriptions of natural capital approach and accounting that can integrate into farm decision making.

[1] https://www.gov.uk/government/news/once-in-a-generation-opportunity-to-shape-future-farming-policy *accessed 05/06/19.*

1.2 What is Natural Capital?

Natural capital is the stock of renewable and non-renewable resources (such as plants, animals, air, water, soils, minerals) that combine to provide a flow of benefits to people[2]. Wildlife is an essential component of natural capital stocks and an indicator of their condition and resilience. The spatial arrangement of natural capital is also referred to as green or blue infrastructure.

Farming relies on natural capital in a very direct way and to a greater extent than most other businesses. Recent advances in natural sciences and economic valuation organised within a natural capital approach can help farmers:

- Understand the link between natural capital and farm productivity;
- Assess the long run sustainability of farming practices;
- Quantify the current private benefits to the farm and public benefits to others from well managed farmland, and
- Highlight potential future benefits of looking after natural assets (and the risks of not doing so).

1.3 What is the natural capital approach?

The natural capital approach integrates the concept of natural capital into decision-making. It helps to identify how different parts of nature benefit people in different ways. As illustrated in Figure 1, it is based on the relationships between the stock of natural assets owned/managed; the services (including, but not limited to ecosystem services) these assets produce; and the benefits that these services give to people. 'Economic benefits' is used in the broadest sense and includes anything that contributes positively to wellbeing: market (financial), social, cultural and environmental benefits.

Figure 1: Natural Capital Approach

The distinction between stocks of assets and the benefits they provide is one of the key features of the natural capital approach, which are listed in Table 1.

It is not a requirement of the natural capital approach to apply all the features in Table 1. However, it is good practice to consider their relevance, and all natural capital assessments must link to natural capital stocks. When natural capital assessments are used for compiling accounts and undertaking comparisons over time, these are referred to as natural capital accounting.

The natural capital approach is now being applied all over the world, by businesses, financial institutions and local and national governments.

[2] https://naturalcapitalcoalition.org/natural-capital-protocol/ and see: https://naturalcapitalcoalition.org/natural-capital-2/

Table 1: Key features of a Natural Capital Approach[3]

Focuses on (quality and quantity of the) **stocks** of natural capital assets, as well as **flows** of benefits
Incorporates both **biotic and abiotic** natural resources
Assesses how both stocks and flows are likely to change in the **future**
Considers both **dependencies** of an economic activity on natural capital and its **impacts** on natural capital
Uses **valuation*** of impacts and dependencies
Makes the links between all of the above, to support **systems-based thinking**

* Valuation is the process of estimating the relative importance, worth, or usefulness of natural capital to people (or to a business), in a particular context. Valuation involves qualitative, quantitative, or monetary approaches, or a combination of these.

1.4 What is natural capital accounting?

Natural capital accounts organise the information relating to stocks of natural capital assets, and the benefits they provide in a systematic and transparent manner. Much like financial accounts, this facilitates the information being comparable across time for a given organisation or across organisations.

The Corporate Natural Capital Accounting framework developed by eftec and partners (2015) for the Natural Capital Committee creates a balance sheet for natural capital assets and is suitable for application to farming. Such accounts seek to answer the following questions:

I. What assets do we have?
II. What benefits do they produce?
III. What are these benefits worth?
IV. What does it cost to maintain the assets?
V. How do costs compare to benefits over time?

Annex 1 describes these questions in greater detail. The answer to each question helps inform the next one. For example, understanding which natural capital assets there are (such as grazing or arable land, peat soils, public footpaths) helps identify what benefits they produce (such as meat or crops, carbon storage, recreation).

A key aim of the accounts is to ensure that they include the information that is material to the business and sustaining the flow of benefits. The process of compiling the accounts is a structured way of selecting the important elements to consider. Combining all this data within an account makes it easier to identify future changes in the extent and condition of the assets, and management practices and how these will affect benefits.

[3] https://naturalcapitalcoalition.org/wp-content/uploads/2019/06/NCC-WhatIs-NaturalCapitalApproach-FINAL.pdf

1.5 Natural capital accounting for farms

The key natural capital asset that a farm should maintain is its soil, as healthy soil is important to both food production and to public goods such as wildlife, carbon storage and avoiding water pollution. Good management can address pressures such as erosion and compaction and restore soils. Natural capital accounts can reflect the implications of different soil management practices on private and public (external) benefits.

Table 2 shows the natural capital balance sheet format to present the value of the benefits provided by natural capital assets to the farm business (private benefits) and to the rest of the society (external benefits, many of which are public goods). It also shows costs of maintaining the assets and benefits. This format has developed through several tests of the original eftec et al (2015) framework.

The key benefits are food and timber products; water quantity and quality; climate regulation (emissions and sequestration) and wildlife (even if this is often impossible to express in monetary terms, other than the weak proxies of subsidies and other payments for wildlife management). There can be trade-offs between maximum farm production and maintaining public goods. Therefore, it is important that natural capital accounts cover both. Annex 2 illustrates the kind of data needed to complete Table 2. The roman heading numbers in Tables 2 and 3 relate to the steps of natural capital accounting listed in Section 1.4.

Table 2. Natural Balance Sheet for a Farm and examples of how it can be populated

II Benefits	**Physical output (examples)**	**Annual Value £**		
		Private benefits & costs (A)	**External benefits & costs (B)**	**TOTAL (A + B)**
Food production	Livestock Arable/Other			
Timber	Timber			
Other financial income from natural capital	Accommodation (long term leases & holiday) Renewable Energy			
Water quality / quantity	Nitrate loading Flood risk management			
Climate regulation	Livestock emissions Emissions from operations Sequestration into habitats			
Wildlife	Pollinator strips Species recorded			
Recreation	Public / Permissive footpaths			
Other cultural benefits	Historic features Rare breeds Protected landscapes			
	III Total Value			
IV Maintenance Costs	**Physical output (examples)**			
Statutory & other spending	Tillage, drainage; hedgerow management			
V Net Natural Capital (III – IV)				

The scope of any balance sheet has to be clear (and the same for calculations of maintenance costs and benefits). The answer to the first accounting question ('What assets do we have?) is the main determinant of this scope. The answer can be organised in an asset register, as shown in Table 3.

Table 3. Asset register and example indicators used to populate it

I Assets	Land use types	Extent	Condition
List assets identified	Land uses and habitats	Area	Quality indicators – presence / absence of species etc.
	Linear features	Length	

1.6 Social Benefits

External values from natural capital include public goods like recreation and flood risk reduction which are closely linked to social outcomes (such as healthier more resilient communities). Benefits to wider society are sometimes referred to as social value. Social metrics that are linked to natural capital assets include:

- Maintenance of ways of living and landscape that have cultural and social value beyond the financial and environmental benefits;
- Public access – including footpaths and school visits to farms;
- Using farm equipment for social purposes (e.g. clearing snow, flood relief), and
- Contribution to rural employment, which is also an economic indicator, directly and indirectly through:
    - Farm employment;
    - Suppliers and purchasers,
    - The leisure and tourism sector through maintaining landscapes and traditions, and through accommodation in farming communities where the quality of the environment attracts visitors who spend money with local businesses.

Just as natural capital (the stock) is distinct from environmental benefits, so there is a distinction between rural social capital (i.e. the strength and capacity of communities) and social benefits. In addition to these social metrics linked to natural capital, there are a wider range of other social benefits that farmers contribute to rural communities (e.g. hosting school visits, maintain traditions). However, these are beyond the scope of this briefing.

1.7 Using Natural Capital Accounts

Accounts can support decision making in several ways:

- Keep a record of the state of natural capital assets and benefits at a given time;
- Track changes over time to reflect how the stocks of assets and flows of benefit change – especially when data in accounts is updated annually as part of individual farm's annual business cycles and management activity (see Annex 2).
- Contribute to the understanding of what changes over time mean for farm management:

  - Farming practices: different types of farming; changing soil, crop or herd management; choices about which inputs (feed, pesticides, fertilizers) to buy, not buy or produce on farm;
  - Food and other markets: Prices for agricultural outputs may change. This is currently highly uncertain due to Brexit;
  - Environmental factors: climate change may mean the current agricultural systems will not be technically or economically feasible under certain conditions, and new land uses need to develop;
- Allow scenario analysis to compare current practice and potential scenarios that test how different ways of managing an asset change the type and quantity of benefits provided; or how different farms compare in terms of the private and public benefits they provide. The latter is illustrated in Annex 3.

1.8 Conclusion

Farming is changing: to better recognise public benefits farmers already provide, there will be new opportunities for public payments, and new markets may emerge. Farmers who want to be ready for changes to land use subsidies need to understand the concepts of natural capital and public goods. They can provide evidence on the public goods their farm provides in a logical and consistent way, using natural capital accounting. Accounts can be started with existing farm data.

As well as producing food and fibre, farmers that can deliver public goods, and prove that they do, will have more control over the direction their business takes, and will be better prepared for policy changes.

Annex 1: Natural capital accounting framework

Table Error**! No text of specified style in document.**.1 expands on the key questions natural capital accounts can answer. Each answer is an interesting output in its own right, as well as in combination.

Table Error! No text of specified style in document.**.1: Stages of Natural Capital Accounting and Key Questions Answered**

	Answer these key questions…	…to generate these natural capital accounting outputs
1	What natural capital assets are owned, managed, or depended on?	**Natural Capital Asset Register:** Registry of all natural capital assets owned/ managed / dependent on
2	What flows of benefits do the assets produce?	**A statement of physical flows:** Benefits, both for the farm and for wider society, in biophysical metrics
3	What is the value of the benefits and to whom do they accrue?	**A Monetary flow statement:** Benefits in monetary terms: data from markets (and financial accounts of the business) and the literature, and where monetary data lacks, in other indicators and qualitative narratives
4	What does it cost to maintain the natural capital assets?	**A schedule of maintenance costs:** Relevant activities and their costs
5	What's the net impact of the business on natural capital?	**A natural capital balance sheet (Corporate Natural Capital Account):** Sum of natural capital benefits over time minus the cost of maintaining the natural capital assets in a condition that generates the benefits.

Natural capital account (balance sheet) organises information in the following tables:

- **Natural Capital Asset Register** – which records the stock of natural capital assets in terms of their extent, condition and spatial configuration (e.g. size and status of designated sites). These indicators help determine the health of natural capital assets and their capacity to provide benefits.
- **Physical Flow Statement** – which quantifies the benefits that the assets deliver in physical terms. The changes in the quantity / quality of the assets and their benefit provision over time are also considered. The provision can change due to maintenance activities or external factors outside the control of the organisation.
- **Monetary Flow Statement** – which estimates the economic value of the benefits in monetary terms and discounts the projected future flow of these benefits to provide the present value (PV) for the assets. This uses data from actual markets and other (non-market) values.
- **Natural Capital Maintenance Cost Account** – which details the costs of activities required to sustain the capacity of the natural capital assets to provide benefits over the long term, including management actions for the habitats identified in the asset register.
- **Natural Capital Balance Sheet** – which compares the present value of the assets' benefits to the present value of the maintenance costs. The present value of an asset is the discounted sum of future benefit flows from it. The present value of maintenance costs is the discounted sum of future management costs. Where possible, costs and benefits over time should reflect expected future changes. A key question is whether spending is sufficient to maintain the assets in a healthy and productive state.

Annex 2: Data

This annex lists the types of data that have been used to answer the five questions to populate a natural capital balance sheet. There are many external data sources that can be useful, but the starting point for any natural capital work, and to building an account, should be the information that a farmer already has.

Much of the data (such as yields, prices and management costs) can be updated annually. Some data may be harder to gather (for example arranging a volunteer to survey farmland birds), or more stable over time (for example, if condition of a habitat is maintained, carbon sequestration rates can be assumed not to change). This data can be updated less regularly (e.g. 3 or 5 years) or when changes occur.

I. What natural capital assets do we have?

- Types of land cover (grassland, arable, moorland, woodland, river/streams, ponds, wetlands)
  - Areas under farming systems (e.g. livestock, arable)
  - Length of linear features (e.g. hedgerows)
- Soil type and/or condition and land grades
- Areas and type of land under different management agreements (e.g. agri-environment) and with special features of the land (e.g. special or designated habitats, species or landscapes) and areas of public access (e.g. footpaths, common land)

Some key sources of data within Table A2 are:

1. Soils: farmers can self-assess soil quality (e.g. structure and earthworm populations) annually, and also test soil in fields (e.g. for PK, Ph, OM and soil depth) periodically – such as every 3 years. These data can be useful as part of whole farm plans and are in line with good soil management practice[4].
2. Agri-environment payments: these are recorded as an external cost, as they are paid to farmers from taxpayers. However, they are also a reflection of the value of public goods the farm is providing. An agri-environment agreement usually requires certain management actions, the costs of those can be recorded as private costs to the farmer.
3. Accounting can make use of farm survey data: Surveys of wildlife (e.g. by a volunteer), or of the presence of special features (e.g. archaeological remains, ancient hedgerows or trees) can provide information about features on the farm that provide public goods. While estimating a monetary value for these may require knowledge about economic value literature, simply recording the presence of the features is a good first step to recognise the value they provide. Wildlife value can also be scored using the Defra biodiversity metric (Natural England, 2018) as well as proxied by agri-environment payments or values from the economic literature.

The practicality of obtaining this data may vary between farms, but data that should be easier to obtain (where relevant to a farm) is underlined.

[4] *For a simple guide, see: https://archive.leafuk.org/eblock/services/resources.ashx/000/595/601/LEAF-Simply_Sustainable_Soils_2016.pdf*

Table 2A. Data Sources for a Farm Natural Balance Sheet

II. Impacts	Physical output (examples)	Data Sources	
		Private Benefits and Costs	External Benefits and Costs
Food production	Livestock Arable/Other	Net margin on market produce (e.g. wheat, milk, meat)	
Timber/ Fibre	Timber	Net margin on market produce (e.g. timber, wool)	
Other financial income from natural capital	Accommodation (long term, tourism)	Rents Tourism income	
	Renewable Energy	Market price of energy	Value of carbon emissions saved (see climate)
Water quality / quantity	Nitrate loading Flood risk management		Emissions of nutrients to soil, water– can be hard to measure and value Value of flood risk damage avoided downstream
Climate change	Livestock emissions Emissions from farm operations Sequestration into habitats		Emissions or sequestration of carbon[5]
Wildlife	Presence of wildlife species (e.g. nesting birds) and condition habitats (e.g. hedgerows, wet grassland)		Protected features (e.g. survey data on breeding birds).
Recreation	Public rights of way/ permissive footpaths		Numbers of visitors to the farm (e.g. walkers)
Other cultural benefits	Historic features Rare breeds Protected landscapes		Designated features (values from the literature or proxied by payments received)

III. Maintenance Costs	Physical output (examples)		
Soil management	Tillage, drainage	Cost of any soil management actions Soil testing	
Actions to reduce emissions to air	Costs of actions (e.g. covered slurry stores)		
Maintaining wildlife	Habitat management	Costs of undertaking agri-environment measures	Agri-environment payments
Other environmental management	Protecting natural capital	Silt/runoff traps	
	Any other actions to maintain features in Table 3 or provide impacts listed in this table (e.g. Hedgerow management, Costs of maintaining/ providing paths)		

An example of a balance sheet for an organic farm, which has a well-developed environmental monitoring system, is shown in Annex 3.

[5] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/48184/3136-guide-carbon-valuation-methodology.pdf

Annex 3: Example Balance Sheet

Natural Capital Balance Sheet for Cholderton Estate & comparison to a typical farm (£'m; present value over 50 years)

	Assumptions	Cholderton	Typical Farm	Difference
Asset Values – benefits from natural capital (monetised)				
Food	Net income from farming (including the Basic Payment Scheme (Pillar I) but not higher-level schemes, see wildlife below)	(1.3)	1.7	(3.0)
Water	Net income of Cholderton & District water co (Typical farm increases costs of nitrate removal for C&D water co.)	0.2	(0.1)	0.3
	Water treatment costs to Wessex Water	-	(0.6)	0.6
Greenhouse gas flow	Artificial fertiliser use	-	(1. 8)	1.8
	Soil carbon sequestration	3.7	-	3.7
	Livestock emissions	(4.9)	(8.0)	3.1
	Tree Planting	0.5	-	0.5
Wildlife/habitat	Higher Level Scheme (Pillar II) payments indicative of value	3.0	-	3.0
Total Gross Asset Value (monetised)		**1.2**	**(8.8)**	**10.0**
Natural capital maintenance	Costs of sowing leguminous seed and sainfoin	(0.7)	-	(0.7)
Total Net Asset Value (monetised)		**0.5**	**(8.8)**	**9.3**
Asset Values – benefits from natural capital (non-monetised)				
Biodiversity units	Indicative use of the Defra Bio-diversity offsetting metric	18,000	4,000	14,000
Qualitative wildlife metrics	Insect species abundance*	18 bee species 40 butterflies 740 moths	Few species of butterflies/bees,	Many times more species
	Wild birds	137 species	Low species count (low tens)	Many times more species
	Number of wild flowers in grasslands	+100	Few	Nearly 100 more
Rare Breeds	Conservation of Cleveland Bays and Hampshire Down sheep	2 rare breeds	None	2 rare breeds

Note: Brackets and red represent net costs or losses**.** Non-bracket and black represent benefits or net-gains. Asset values are net of production costs.

*: There are 25 species of bumble bee in Britain, plus 224 solitary species and 1 honey bee (https://researchbriefings.parliament.uk/ResearchBriefing/Summary/CDP-2017-0226) 18 at Cholderton are bumble bee species. There are 59 resident or migrant species in UK (http://www.ukbms.org/specieslist.aspx). There are around 2,500 moth species in UK (Butterfly conservation (2013) The State of Britain's Larger Moths https://butterfly-conservation.org/files/1.state-of-britains-larger-moths-2013-report.pdf). British bird species list as maintained by British Ornithologists Union (BOU) and currently stands at 574 species. Read more at https://ww2.rspb.org.uk/birds-and-wildlife/bird-and-wildlife-guides/ask-an-expert/previous/ukbirds.aspx#KclwFk5rIz7Oqzxd.99

Reading down the column for Cholderton Estate, **the natural capital bottom line for Cholderton is a benefit of £0.5 million in present value terms over 50 years**:

- The Estate makes a financial loss from food production despite CAP Pillar 1 payment (£1.3 million in present value terms over 50 years), but
- The public goods it provides are almost twice as valuable (including CAP Pillar 2 payment), leaving a positive asset value of £1.2 million over 50 years, and
- The natural capital liability of the Estate is £0.7 million over 50 years spent on specific activities that maintain soil quality and biodiversity. The cost of food production is taken into account when estimating the net value of the food production in the asset values.

We also compare the figures for Cholderton with 'a typical (intensive) farm'. For simplicity, a typical farm is defined as one which also has 1,000 hectares for dairy, but which uses artificial fertilisers, has higher stocking densities and does not invest in soil quality and biodiversity.

The natural capital bottom line for a typical farm is a loss of £8.8 million in present value terms over 50 years:

- The typical farm makes financial profit from food production including CAP Pillar 1 payment (£1.7 million in present value terms over 50 years), but
- Its impacts on water quality and greenhouse gas emissions alone mean degradation of public good ('public bad' if you like) which results in a significantly higher cost of £8.8 million over 50 years; and
- We assume the typical farm makes no additional investment in maintaining natural capital assets.

The significantly lower greenhouse gas profile of Cholderton farming practice arises from avoiding inorganic fertiliser, lower stocking rates, and better soil management practices that improve carbon sequestration in soil. The avoidance of inorganic fertiliser has water quality benefits in terms of avoided nitrate removal costs. The Estate supports an outstanding range of wildflowers, grasses, insects and birds. The value of these has not been possible to express in monetary terms, but they are included in the balance sheet.

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