Chapter 4: The Natural Capital Accounts

Natural Capital Accounting

Natural Capital is "the stock of renewable and non-renewable natural resources (e.g., plants, animals, air, water, soils, minerals) that combine to yield a flow of benefits to people"[16].

A natural capital approach can be defined as distinguishing between the natural capital stocks and the flows of benefits they provide; projecting benefits into the future and linking them to the extent and condition of assets. The intention is to ensure that decisions prioritise maintaining the assets to sustain a range of benefits, and not to maximise one of the benefits at the expense of others or the natural capital asset itself.

This approach is reflected in the structure of natural capital accounts, shown in Figure 57. The accounts link together different types of physical and monetary assets and flow data. This study has developed natural capital accounts to understand the extent, condition and benefits of Natural Capital in Derbyshire. The results for Derbyshire as a whole are reported in this chapter, and sub-accounts for local government boundaries, landscape character areas and the Peak District National Park of Derbyshire are reported in Appendix 6.

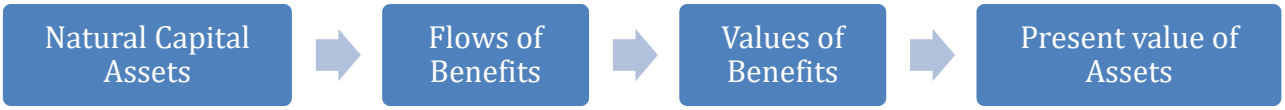

Figure 57: The structure of natural capital accounts

Accounting differs from one-off assessments by generating systematic and consistent evidence, enabling repeated updates. Accounting offers comparability across space and time, bringing rigour to the presentation of data on natural capital assets, the services they provide, the benefits and hence the value of those services, and the distribution of those benefits across society and into the future.

The approach to developing the Derbyshire baseline natural capital accounts is based on the Corporate Natural Capital Account (CNCA) framework for the Natural Capital Committee in 2015[17]. This framework is also the basis of BSI:8632 on Natural Capital Accounting for Organizations[18]. Natural capital accounting involves producing a natural capital balance sheet and a natural capital income statement mirroring traditional

[16] Source: Natural Capital Protocol *https://naturalcapitalcoalition.org/natural-capital-protocol/*
[17] eftec, RSPB and PWC (2015) Developing Corporate Natural Capital Accounts for the Natural Capital Committee. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/516968/ncc-research-cnca-final-report.pdf
[18] Available at: *https://shop.bsigroup.com/products/natural-capital-accounting-for-organizations-specification?pid=000000000030401243*

financial accounting. The intention is to present information to decision makers in a format they are familiar with so that the organisation's impacts and dependencies on natural capital are considered more explicitly and in conjunction with other forms of capital.

The natural capital balance sheet has two parts:

1. Asset Values (of the benefits natural capital produces for business and the wider society)
2. Liabilities (of spending to maintain natural capital).

This project considers the asset values. It was not possible to consider liabilities within this project's resources. The report presents a Natural Capital Asset Register, Physical Flows Accounts and Monetary Flow Accounts, which come together to form a Natural Capital Asset Account.

The natural capital balance sheet and its supporting schedules answer five key questions, those which the Natural Capital Asset Account can address are the first three of these (shown in bold):

- What assets do we own and/or manage?
- What benefits do they provide and to whom?
- What are these benefits worth?
- What does it cost to maintain the assets?
- How do costs compare to benefits over time?

Three supporting schedules hold the information gathered for the Derbyshire account:

- 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[19].
- Physical Flow Accounts – which quantify the benefits that the assets deliver in physical terms. Changes in the quantity / quality of the assets and their benefit provision over time are also shown.
- Monetary Value Accounts – which estimate the economic value of the benefits in monetary terms and discounts the projected future flow of these benefits to provide the present value for the assets. This uses data from actual markets and other (non-market) values. The value of the benefit should be the net of the cost of producing the benefit.

The monetary flow and cost accounts distinguish private values to business from external values to the rest of society. Where understanding and evidence allow, calculation of

[19] The natural capital asset register is also the basis for scoping the natural capital risk register, and for a materiality assessment to determine the content of the flow and liabilities accounts.

asset values can take account of expected changes to future costs and benefits of management, and external factors such as population growth or climate change.

This part of the project was executed through three main tasks:

Task 1 - Data collection: established data requirements, including discussions with Derbyshire County Council, Peak District National Park Authority and Derby City Council to identify relevant stakeholders to contact for data inputs to help produce the account. eftec developed a data collection spreadsheet to gather this data.

Task 2 – Support to build the natural capital accounts: The development of the asset register was undertaken by project lead partners Environment Systems. Data was provided on both the extent and condition of natural capital assets with the County level and sub-regional level. eftec used this data to complete the calculation processes for quantifying benefits and expressing the values in monetary terms.

Task 3 – Review of results: initial draft results were presented to stakeholders on the 8th June 2022, the results have since been updated are summarised in this report.

The natural capital approach and overall method for producing natural capital accounts for Derbyshire are described in Chapter 2. A more specific description of the methods used to evaluate the benefits included in the accounts is provided in Appendix 7. The distribution of benefits between private benefits to business sectors and benefits to wider society, is also noted in the reporting.

Scope of the account

The scoping stage defined the spatial and temporal boundary of the account, the data sources available and the types of benefits from natural capital covered; these are summarised in

Table 2. The list of potential benefits to assess reflects the list of individual benefits included in Defra's (2020) 'Enabling a Natural Capital Approach' (ENCA), shown in Table 3.

Table 2: Natural Capital Asset Account parameters

Parameter	Description
Spatial	The spatial boundary for the account is Derbyshire county– the results have been broken down into the eight district and borough councils within Derbyshire, Derby City and the Peak District National Park (see Appendix 6).
Temporal	The baseline year for the analysis is 2021 and all values are reported in 2021 prices using HM Treasury (2022b) GDP deflators. The results are provided in annual terms and present value over a 60-year time period for both catchments, as recommended by the HM Treasury (2022a) Green Book. A discount rate of 3.5% is applied in the present value calculations for all benefits. Where possible, future values take into account expected trends in the quantity and/or value of the benefit. Where this information is not available, renewable benefits are assumed to be constant over time.
Data sources	National and regional datasets are the initial source for evidence and assumptions, with local level information sources drawn on where feasible. Sources used are in line with Defra's Enabling a Natural Capital Approach (ENCA) guidance (Defra, 2020).

Table 3: Potential benefits to assess

- Agricultural output
- Fishing (commercial)
- Timber
- Water supply
- Renewable energy
- Minerals
- Carbon sequestration
- Air quality regulation
- Flood risk management
- Noise reduction
- Temperature regulation
- Recreation
- Physical health
- Mental health
- Education
- Volunteering
- Amenity
- Biodiversity
- Soil
- Water quality
- Landscape
- Non-use values

Materiality assessment

A materiality[20] assessment is used to determine which of the benefits listed above should be included in the account, given the natural capital assets in scope. All the individual benefits in Defra's ENCA guidance (2020), listed above, were considered for inclusion in

[20] This is defined in the Natural Capital Protocol as "an impact or dependency on natural capital is material if considering it, as part of the set of information used for decision making, has the potential to alter that decision" (p. 43, Capitals Coalition, 2016).

the account[21]. The assessment has been undertaken using a service-asset attribute matrix which aims to show:

- Which ecosystem services are material for each asset within the Derbyshire account boundary;
- Of these material ecosystem services, which benefits have been assessed and how; and
- Which have not been possible to measure in biophysical units or value in monetary terms and why.

The materiality assessment for the Derbyshire account is shown in Table 4.

The following benefits are considered material but have not been measured in these accounts:

- Flood risk management – It is difficult to quantify the benefit provision without more detailed modelling (e.g. identifying flood risk areas and natural capital assets providing flood risk benefits)
- Mental health benefits of engagement with nature – Following current ENCA guidance (Defra, 2020a), only physical health benefits are valued in this report as there is currently insufficient evidence to value mental health benefits in general terms. While the evidence for mental health benefits from green space is strong, it is context dependent and not readily quantifiable for the purposes of accounting and policy analysis.

[21] Defra's ENCA (2020) also reflects 'bundled' benefits which include amenity, soil, landscape and non-use values. These are not considered for this account to avoid double-counting with the individual benefits already included (e.g., recreation).

Table 4. Materiality assessment, 2021

Private & Public Benefits **At September, 2022**	**Natural Capital Assets**						
	Arable	Freshwater	Grassland	Mountain, moorland and heath	Woodland	Urban	Other
Agricultural output	●		●				
Fishing (commercial)							
Timber					●		
Water supply		●	●	●	●		
Renewable energy	○	●	○	○			●
Minerals							●
Carbon sequestration	●		●	●	●		
Air quality regulation					●		
Flood risk management	○	○	○	○	○	○	○
Noise reduction						○	
Temperature regulation						○	
Recreation	●	●	●	●	●	●	●
Physical health	●	●	●	●	●	●	●
Mental health	○	○	○	○	○	○	○
Tourism	●	●	●	●	●	●	●
Education[1]	●	●	●	●	●	●	●
Volunteering	●	●	●	●	●	●	●
Water quality		●					
Biodiversity	◖	◖	◖	◖	◖	◖	◖

Legend

Material service provision	
No material service provision	
Benefit estimated in quantitative and monetary terms	●
Benefit estimated in non-monetary terms	◖
Not assessed	○

[1]Education estimates only reflects South Derbyshire and volunteering only reflects Lowland Derbyshire due to data limitations in the other areas.

Outputs

Asset Register

Figure 58 and Table 5 summarise the asset extent account for Derbyshire by UK broad habitat.

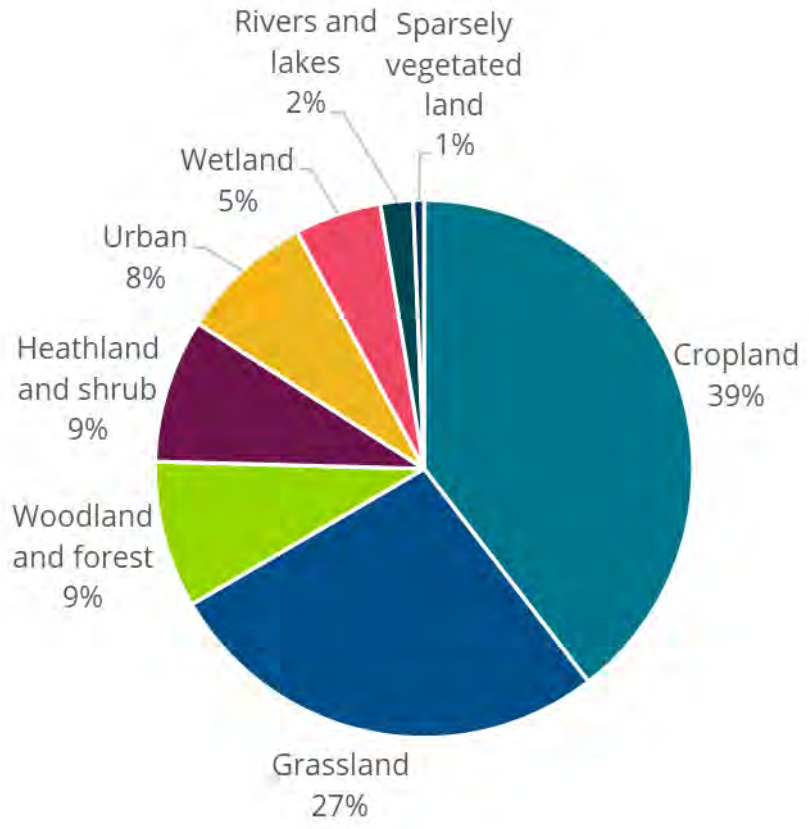

Figure 58. Asset extent Derbyshire, 2021 (produced at September 2022)

Table 5 Asset extent Derbyshire (ha), 2021 (produced at September 2022)

Habitat	Area (ha)
Cropland	104,000
Grassland	71,200
Woodland and forest	23,300
Heathland and shrub	22,800
Urban	21,200
Wetland	13,700
Rivers and lakes	5,200
Sparsely vegetated land	1,700
Total	263,100

Data reflecting the condition of natural capital assets is shown in Table 6 which presents the coverage of terrestrial designations, flood risk zones and habitat connectivity within

Derbyshire, and Table 7 which shows the condition data on the water environment including Water Framework Directive status.

Table 6 Terrestrial designations in Derbyshire, 2021 (produced in September 2022)

Indicator		
Designated SSSIs	Area (hectares)	% of total SSSI area
Favourable condition	4,600	16%
Unfavourable recovering condition	23,000	81%
Unfavourable declining condition	270	1%
Unfavourable no change	520	2%
Part destroyed	1	0.004%
Destroyed	5	0.02%
Total	28,330	100%
Other designated areas	Areas (hectares)	% of total area
Country Parks	1,600	1%
Local Nature Reserves	670	0.3%
National Nature Reserves	1,800	1%
Special Areas of Conservation	27,000	10%
Special Protection Areas	25,000	10%
Ancient Woodland	7,700	3%
Green Belt	240	0.1%
Parks and Gardens	3,000	1%
Flood risk	Areas (hectares)	
Flood zone 2	19,000	
Flood zone 3	15,000	
Accessibility		
Area of greenspace (ha)	14,000	
Length of footpaths (m)	3,800,000	
Habitat connectivity	**Areas (hectares)**	**% of total habitat area**
Grassland		
Core network	12,000	5%
Stepping stone	200	0.1%
Remaining network	110,000	42%
Outside network	140,000	54%
Heathland		
Core network	11,000	5%
Stepping stone	50	0.02%
Remaining network	42,000	18%
Outside network	180,000	77%
Wetland		
Core network	15,000	6%
Stepping stone	1,100	0.4%
Remaining network	90,000	34%
Outside network	160,000	60%
Woodland		
Core network	14,000	5%
Stepping stone	4,600	2%
Remaining network	130,000	48%
Outside network	120,000	45%

Source: Day, B. H., and G. Smith (2018), Habitat Asset Register, Natural England data

Table 7. Water Framework Directive waterbodies in Derbyshire, 2021 (produced at September 2022)

Water Framework Directive status[22]		
Rivers	Length (kilometres)	% of total length
High	320	45%
Good	250	35%
Moderate	87	12%
Poor	51	7%
Total	708	100%
Lakes	Area (hectares)	% of total area
High	1,500	18%
Good	3,000	35%
Moderate	3,700	44%
Poor	300	4%
Total	8,500	100%

Source: *Day, B. H., and G. Smith (2018)*

Physical and Monetary Flow Account

The estimated annual physical and monetary values for each benefit are summarised in Table 9. The physical and monetary estimates in Table 9 are given a confidence rating, which is described in Error! Not a valid bookmark self-reference..

Table 8. Assessing data quality

Level of confidence	Symbol	Description
Low	L	Evidence is partial and significant assumptions are made so that the data provides only order of magnitude estimates of value to inform decisions and spending choices.
Medium	M	Science-based assumptions and published data are used but there is some uncertainty in combining them, resulting in reasonable confidence in using the data to guide decisions and spending choices.
High	H	Evidence is peer reviewed or based on published guidance so there is good confidence in using the data to support specific decisions and spending choices.
No colour	●	Not valued

The accounts identify a wide range of benefits from the natural capital within Derbyshire. Table 9 shows significant values for provisioning (e.g. water supply and minerals), regulating (e.g. air quality regulation) and cultural (e.g. recreation) services, as well as significant physical health benefits in relation to physical activity. Overall, there is medium to high confidence for most benefits, except for the

[22] *Source: Environmental Agency (2021) Catchment Data Explorer. Available at: https://environment.data.gov.uk/catchment-planning/*

estimated tourism expenditure, education and volunteering attributed to nature, which are low confidence.

The total annual net value of ecosystem benefits and services produced within Derbyshire is £2.6 billion in 2021 prices. Key benefit values include carbon sequestration by habitats (£2 billion, 77% of total benefits), mineral production (£298 million, 11% of total benefits) and recreation (£181 million, 7% of total benefits). The carbon sequestration benefits provided by habitats outweigh the GHG emissions produced by habitats (-£95 million) and livestock (-£249 million). Note that wherever red values in parentheses appear, this indicates that the value is negative and represents negative environmental impacts.

Table 9. Derbyshire Physical and Monetary Flow Account (annual values , 2021

At September, 2022						
Agricultural output	Arable crop production (tonnes/yr)	241,979	H	Gross margin of arable crop production	24	H
	Livestock production (heads/yr)	460,488	H	Gross margin of livestock production	72	H
Timber	Volume of softwood removals (m3/yr)	25,402	M	Value of softwood removals	1	M
Water supply	Surface water abstraction for public water supply (m3/yr)	534,967,247	H	Resource rent value of surface water abstractions for public water supply	123	M
	Groundwater abstraction for public and private water supply, spray irrigation, agriculture and fish farming (m3/yr)	4,053,711	H	Ecosystem provision value of groundwater for public and private drinking water and agriculture benefits	9	M
Renewable energy	Electricity generated by renewable sources (MWh/yr)	85,895	M	Resource rent value of renewable energy	1	M
Minerals	Volume of minerals extracted (tonnes/yr)	22,557,750	H	Ex-works value of mineral production	298	M
Carbon sequestration	CO2e sequestered in habitats (tCO2e/yr)	8,028,901	M	Value of CO2e sequestered in habitats	1,966	M
	CO2e emitted by habitats (tCO2e/yr)	(387,305)	M	Value of CO2e emitted by habitats	(95)	M
	CO2e emitted by livestock (tCO2e/yr)	(1,017,527)	M	Value of CO2e emitted by livestock	(249)	M
Air quality regulation	PM2.5 removal by woodland (kg/yr)	158,226	H	Value of PM2.5 removal by woodland	20	H
Recreation	Adult recreation visits (under 3 hours) (visits/year)	49,708,989	M	Adult recreation welfare value (under 3 hours)	181	M
Physical health	Number of active visits (no. active visits/yr)	25,600,129	M	Avoided treatment medical costs	86	M
Tourism	Domestic day visits and overnight trips attributed to NC (visits/yr)	4,082,960	L	Domestic tourism expenditure attributed to natural capital	105	L
Education	Number of volunteer days (days/yr)	27,817	L	Value of volunteer days	1	L
Volunteering	Number of education visits (visits/yr)	5,110	L	Value of educational visits	0.02	L
Water quality	Length of WFD rivers (km)	702	H	Welfare of avoiding deterioration in rivers	9	M
	Area of WFD lakes (km2)	8,598	H	Welfare of avoiding deterioration in lakes	62	M
					2,619	M
Biodiversity	Total SSSI area (ha)	30,000	H		Not valued	•
Flood risk management						
Mental health						

Natural Capital Asset Account

Table 10 shows the benefits than can be provided by natural capital in Derbyshire if current annual benefits and quantified trends continue over 60 years. Overall, Derbyshire's natural capital assets have an asset value of £87 billion in present value terms. Within the account climate change is considered as a known but mostly unquantified trend.

Table 10 also reflects the distribution of benefits to businesses and wider society. Most of these benefits accrue to wider society through air quality regulation, carbon sequestration, water quality, recreation and physical health, equating to around £73 billion in present value terms. A further £14 billion accrues to businesses through agriculture, timber, water supply, renewable energy and minerals. In general, there is high to moderate confidence in both the Physical and Monetary Flow Account estimates, with present value estimates having greater uncertainty due to assumptions on future trends. Key gaps and uncertainties for the Derbyshire accounting boundary include:

- Partial estimates of the education and volunteering benefits throughout the Derbyshire, as data for each district and borough council was limited.
- There is insufficient data to represent some expected future changes (such as climate change risks) in the account, therefore the values may change due to costs and/or impacts of climate change or other trends. These future costs will partly depend on the actions taken to mitigate and adapt to climate change.
- The non-monetised and unquantified benefits listed in Table 10 are expected to be material. Further work could include undertaking a baseline biodiversity assessment for the region; however, this is expected to require support from other stakeholders.
- The maintenance costs associated with natural capital and their distribution (e.g., tree thinning, greenspace maintenance) should be included in order to understand the relationship over time between spending on assets and the benefits they provide.

Table 10. Derbyshire Natural Capital Asset Account, £m PV60, 2021

	Valuation metric	Value to businesses	Value to the rest of society	Total
Asset values (monetised)				
Agricultural output	Gross margin of cereal crop production	619	-	619
	Gross margin of livestock production	2,029	-	2,092
Timber	Value of softwood removals	22	-	22
Water supply	Resource rent value of Surface water abstractions for public water supply	3,226	-	3,226
	Ecosystem provision value of groundwater for public/private drinking water/agriculture benefits	235	-	235
Renewable energy	Resource rent value of renewable energy	37	-	37
Minerals	Ex-works value of mineral production	7,481	-	7,481
Carbon sequestration	Value of CO2e sequestered in habitats	-	72,066	72,066
	Value of CO2e emitted by habitats	-	(3,476)	(3,476)
	Value of CO2e emitted by livestock	-	(9,133)	(9,133)
Air quality regulation	Value of PM2.5 removal by woodland	-	532	532
Recreation	Adult recreation welfare value (under 3 hours)	-	4,736	4,742
Physical health	Avoided treatment medical costs	-	3,481	3,482
Tourism	Domestic tourism expenditure attributed to NC	-	2,744	2,744
Education	Value of volunteer days	-	18	18
Volunteering	Value of educational visits	-	0.5	0.5
Water quality	Welfare of avoiding deterioration in rivers	-	224	224
	Welfare of avoiding deterioration in lakes	-	1,631	1,631
Total gross asset value		13,691	72,824	86,515
Asset values (non-monetised)				
Biodiversity	Total SSSI area: 30,000 hectares			
Other material unquantified benefits				
Flood risk management				
Mental health				

Breakdown of results within Derbyshire

Sub-boundary accounts have been developed for the administrative areas and National Character Areas that fall within Derbyshire County, as well as for the Peak District National Park. Appendix 6 contains the reporting results for each sub-boundary area.

The sub boundary accounts are a sub-division of the Derbyshire account, applying the same methods where possible. The methodology for the benefit calculations is set out in Appendix 7.

Summary

Through working with Derbyshire County Council, Peak District National Park Authority, Derby City Council and stakeholders a Natural Capital Asset Account has been developed for the Derbyshire, the nine administrative areas, ten National Character Areas and the Peak District National Park. It provides an understanding of the overall scale and significance of benefits provided by

natural capital assets. It aligns with the Green Book (HM Treasury, 2022a) and Defra's Enabling the Natural Capital Accounting approach (ENCA) methods.

The account has been developed with a good coverage of data, including extensive habitat mapping (see Section 3) using the UKHab classification, and the measurement and valuation of 13 different benefits. The account provides a good baseline; however, it isn't able to capture everything in monetary terms due to data and methodological constraints.

The account can be used in different ways. Firstly, it provides data that can be used to make a business case to central government for support and funding to invest in natural capital. Secondly, it gives a consistent evidence base for different groups and decision-makers to refer to. For example, Biodiversity Net Gain, environmental land management schemes (ELMS[23]; where participating landowners receive payments for managing land in support of environmental objectives such as sustainable farming and nature recovery) design, and other policies can work from connected data. However, good communication is required to ensure the data is used properly.

Thirdly, the accounting structure also allows for comparison of the sub-regions using a consistent approach and data. Finally, while the account provides useful information to help manage natural capital it should be noted the positive values do not mean that the natural capital assets are being managed sustainably. To assess this, more understanding of future trends (e.g. climate change) and estimations of maintenance costs would need to be factored in.

[23] https://www.gov.uk/government/publications/environmental-land-management-schemes-overview