CASE STUDY – Peatland restoration

This case study applies the Natural Capital Protocol to a practical example.

FRAME STAGE: Why?

Step 01: Get started

Crown Estate Scotland maintains and enhances a diverse range of habitats on Glenlivet Estate and, in 2014, identified an opportunity to restore an area of degraded peatland at Glenmullie, with funding from Peatland ACTION managed by Scottish Natural Heritage (SNH). The key issues on the site included:

- Large areas of bare peat cut down to the mineral layer, the result of historic peat cutting
- Eroded gullies, peat hags and bare peat areas
- Drainage ditches
- Establishment of non-native confers

Crown Estate Scotland undertook a variety of measures to restore the peatland in order to reduce carbon loss, increase carbon sequestration, enhance peatland ecosystem functions and make the site more resilient to climate change.

SCOPE STAGE: What?

Step 02: Define the objective

The objective of this case study is to understand what impact Crown Estate Scotland activities to restore the peatland at Glenmullie have had on natural capital, as well as providing a high level cost/benefit analysis (incorporating financial costs and natural capital costs/benefits).

Step 03: Scope the assessment

This case study assesses the impacts of restoring peatland habitat to deliver the benefits outlined above, including:

- Blocking and re-profiling ditches
- Re-profiling, stabilising and re-vegetating areas of bare or badly eroded peat
- Removing non-native conifers

Step 04: Determine the impacts and/or dependencies

Peatland restoration has material impacts on climate regulation, water quality regulation, soil quality and erosion regulation, and wild species diversity. It should also have positive impacts on water supply (maintaining base flow in times of drought), flood regulation and education (given the use of a range of restoration techniques and the potential for demonstration). Upland livestock grazing and grouse shooting enterprises are dependent on the extent and condition of natural capital assets, including peatland and other upland habitats, so should also benefit.

MEASURE AND VALUE STAGE: How?

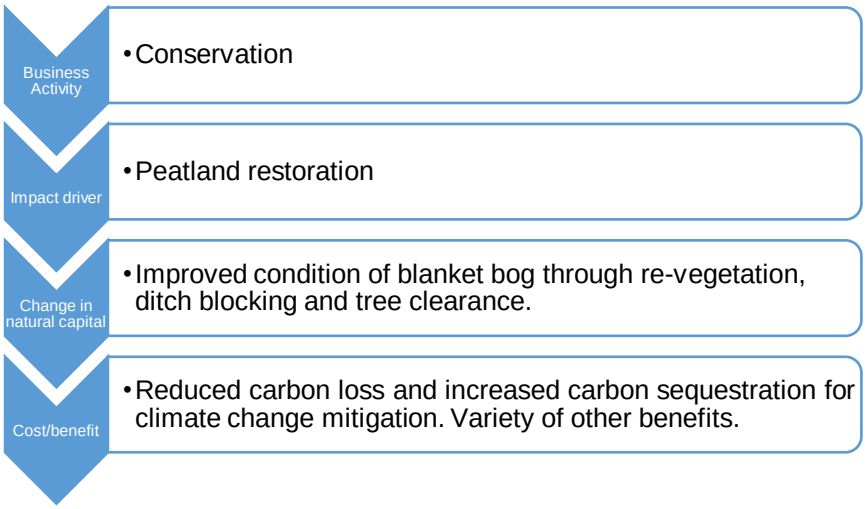
Step 05: Measure impact drivers

Climate regulation; the main impact driver for climate regulation is (peatland) habitat cover and condition, this in turn influences greenhouse gas emissions (GHGs). Degraded peat emits carbon dioxide and other GHGs, with carbon being lost through decay and shrinkage of peat as it dries. Restoration of peatland habitat and associated ecosystem functions maintains carbon stores, reduces carbon loss and encourages carbon sequestration over time. Habitat restoration practices include spreading heather brash and where necessary, re-profiling and stabilising with geotextile matting. Energy is required to operate the machinery involved in undertaking

the restoration work resulting in some additional GHG emissions. Estimates of changes in GHGs are set out in Step 07.

The impact pathway showing the 'logic chain' from business activity to impacts on natural capital and the costs and benefits associated with these impacts is shown below.

Climate regulation



Water quality regulation; habitat cover and changes in drainage, which influence the volume and type of water pollutants, are the impact drivers for water quality regulation. Eroding upland peatland can cause high levels of Dissolved Organic Carbon (DOC) and associated discoloration in watercourses. Water quality data was collected after the restoration work but no data is available yet on changes in water pollutants arising from the project.

Soil quality and erosion regulation; habitat cover and changes in drainage also influence soil quality and soil loss, and are therefore the impact drivers for soil quality and erosion regulation. There are linkages to both water quality and climate regulation. No data is available on changes in soil pollutants arising from peatland restoration at Glenmullie.

Wild species diversity; the restoration of peatland is beneficial for a range of flora and fauna associated with peatland habitat or habitat mosaic. The main impact driver for wild species diversity is therefore peatland habitat cover. It can also affect aquatic habitats and species affected by sedimentation resulting from eroding peatlands. Watercourses draining the area flow into the River Spey, designated SAC. No data is available on changes in wild species diversity arising from peatland restoration at Glenmullie.

Step 06: Measure changes in the state and trends of natural capital

Table A below sets out the asset register for this case study, detailing the interventions taken to restore peatland at Glenmullie and the resulting changes in the state of natural capital on this part of the Estate. It is important to note that there were a number of challenges experienced during the project including bad weather and time pressure, which affected the extent and quality of the restoration work. The restoration on the site is incomplete due to the failure of the mulch on the bare peat, the need to address water erosion in gullies and on the bare peat, and unsuccessful conifer removal work.

Table B sets out the impacts on natural capital assets. This reflects the information provided in the asset register, distilling it into a graded positive/negative (green or red scoring). The project has had a positive impact on the extent of blanket bog, which is included in both the 'moorland' and 'wetland' categories in this assessment.

Table C sets out the impact the project has had on ecosystem services. For example, the reduction in carbon emissions contributing to climate regulation. The project has had no (or negligible) negative natural capital or ecosystem service impacts.

Table A: Case study asset register

		2014		Management interventions	Current status 2017	
	Natural capital asset	**Hectares**	**Data source**	**Activities undertaken**	**Hectares**	**Data source**
Extent	Mountains, Moorlands and Heaths (Degraded upland blanket bog)	166	CNPA		0	CNPA
	Mountains, Moorlands and Heaths (Restored upland blanket bog)	0	CNPA	Peatland restoration through a variety of interventions (see below)	166	CNPA
Condition	**Condition Indicators**	**Status / Score**	**Data source**	**Activities undertaken**	**Status / Score**	**Data source**
	Peat depth	0.97m on average, but variable across site	CNPA	Various activities below will help increase peat depth in long term	0.97m on average, but variable across site	CNPA
	Bare peat area	4.75 ha	CNPA	Spreading heather brash and, where appropriate re-profiling and laying down geotextile matting	Bare peat partly re-vegetated.	CNPA
	Eroded gullies/haggs length	9,300m	CNPA	Re-profiling, laying down geotextile matting and spreading heather brah/turves	Eroded gullies/haggs partly restored.	CNPA
	Drainage ditches length	8,800m	CNPA	Re-profiling and blocking drainage ditches	0 m. Drainage ditches all blocked.	CNPA
	Invasive species coverage	45 ha	CNPA	Removal of non-native conifers	Conifers partly removed.	CNPA

Tables B & C: Key

Impact:	Positive	Negative
High		
Medium		
Low		
Mixed	+/-	
None		

Table B: Natural capital asset impacts

	Assets (habitat types)								
	Enclosed farmland:								
Activity	**Cropland (arable & horticultural)**	**Temporary pasture (temporary improved grassland)**	**Permanent pasture (permanent improved grassland)**	**Permanent unimproved pasture (semi-natural Grasslands)**	**Field margins**	**Hedgerows**	**Woodland (includes farm woodlands)**	**Mountains, Moorlands and Heaths**	**Water (Openwaters, Wetlands & Floodplains)**
Peatland restoration									

Table C: Ecosystem service impacts

	ECOSYSTEM SERVICES																		
	PROVISIONING SERVICES								REGULATING SERVICES							CULTURAL SERVICES			
Activity	**Crops**	**Livestock**	**Wild foods (game)**	**Wild foods (venison)**	**Wild foods (fish)**	**Water Supply**	**Timber**	**Fibre**	**Climate regulation**	**Flood regulation**	**Water quality regulation**	**Soil quality & erosion regulation**	**Air quality regulation**	**Disease & pest regulation**	**Pollination**	**Wild Species Diversity**	**Recreation**	**Education**	**Cultural heritage**
Peatland restoration																			

Step 07: Value impacts

The financial cost of the Glenmullie peatland restoration project was approximately **£120,000**. This was funded mainly from SNH's Peatland ACTION fund, with financial and in-kind contributions from CES.

The carbon emissions reduction of the project has been calculated using the methodology developed for the Peatland Code [1]and the Peatland Code Emissions Calculator[2], see Tables B and C. Based on the likely change in the different Assessment Units and an assumed project duration of 50 years, and no leakage (increased emissions on the Estate as a result of displacement of land management activities due to the restoration), then the project could result in a total cumulative saving of 8,919 tonnes of CO2 equivalents **(**tCO2e)[3].

Table B – Assessment units and pre- and post-restoration condition categories

Assessment Unit	Area (ha)	Pre-Restoration (Baseline) Condition Category	Post-Restoration Condition Category
AU1	4.75	Actively Eroding: Flat Bare	Drained: Re-Vegetated AE
AU2	1.86	Actively Eroding: Hagg/Gully	Drained: Re-Vegetated AE
AU3	52.80	Drained: Artificial	Modified
AU4	105.59	Modified	Modified
Total	**165.00**		

Table C – Cumulative emissions reduction over project duration (tCO2e)

Cumulative Emissions Reduction over project duration (tCo2e)					
Period (Year)	Gross Emissions Reduction (tCO2e)	Emissions Reduction less 10% model precision (tCO2e)	Net Emissions Reduction adjusted for Leakage (tCO2e)	Cumulative Risk Buffer Contribution (tCO2e)	Cumulative Claimable Emissions Reduction (tCO2e)
0-5	1166	1049	1049	157	**892**
5-10	2332	2099	2099	315	**1784**
10-15	3498	3148	3148	472	**2676**
15-20	4663	4197	4197	630	**3568**
20-25	5829	5246	5246	787	**4459**
25-30	6995	6296	6296	944	**5351**
30-35	8161	7345	7345	1102	**6243**
35-40	9327	8394	8394	1259	**7135**
40-45	10493	9444	9444	1417	**8027**
45-50	11659	10493	10493	1574	**8919**

The monetary value of the carbon emissions reduction can be estimated using non-traded carbon values which are calculated based on the abatement cost per tonne of carbon[4], with figures converted to £2014 using the latest HM Treasury GDP deflator series[5]. 8,919 tCO2e equates to a total value of £537,424; this averages out at £60.26/ tCO2e.

There is insufficient data available to measure and value other material impacts in terms of water quality regulation, soil quality and erosion regulation, and wild species diversity, nor other benefits relating to livestock production, wild food (game), flood regulation, recreation and education.

[1] http://www.iucn-uk-peatlandprogramme.org/peatland-code

[2] http://www.iucn-uk-peatlandprogramme.org/peatland-code/resources

[3] This figure could be higher depending on condition categories selected.

[4] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48184/3136-guide-carbon-valuation-methodology.pdf

[5] https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal

APPLY STAGE: So what?

Step 08: Interpret and test results

A one-off investment of around £120,000 in 2014 will yield a considerable return with a present value of £537,000, through reducing carbon emissions over a 50 year timescale; this represents an approximate benefit-cost ratio of 4.5:1 over 50 years. The return can be expected to continue to increase beyond the initial period. This is broadly in line with a similar assessment of the potential emissions savings at North Sanquhar Moor, carried out by the Crichton Carbon Centre[6] on behalf of Buccleuch Estates Ltd. In addition, the project will yield a wide range of other market and non-market benefits which it has not been possible to value at this stage.

Step 09: Take action

Lessons have been learned from the project and funding will be sought for remedial work to address the restoration issues identified above.

There is an opportunity to measure and value other impacts from the project to get a more complete picture of the net benefits. A better understanding of the before and after position in respect of water quality and other areas would help in this regard. This work would add value to Glenmullie as a site for education and demonstration. Future monitoring of peatland condition and its associated services would also be beneficial to track progress.

Peatland restoration could be extended to other areas on the Estate, subject to site suitability. Third party funding could potentially be sourced using Peatland Code verification.

[6] Crichton Carbon Centre (2017) North Sanquhar Moors Peatland Restoration – Restoration Potential and Carbon Savings