CASE STUDY – Woodland planting / wetland restoration

This case study applies the Protocol to a practical example, providing a more in-depth assessment including quantification and valuation of impacts.

FRAME STAGE: Why?

Step 01: Get started

At the bottom of field 8 (see second map in Appendix 3) there was an area of unimproved grassland with an old infilled millpond and stream. This is a habitat for mud snails that carry the liver fluke parasite, which has infected and caused sheep loss on the farm.

In 2014 Jim undertook works to fence off this area, clear out the millpond and plant approximately 3 ha of woodland. This has reduced the foraging area for sheep, whilst also requiring investment in trees, fencing and pond clearing. However, benefits include: reduced poaching in the wetland; increased shelter from the woodland; reduced incidence of liver fluke amongst livestock; and increased habitat for wildlife.

The new woodland comprises a mix of broadleaves (60%) and conifers (40%) with 0.28ha kept open for the stream and mill pond.

SCOPE STAGE: What?

Step 02: Define the objective

The objective is to understand what impact Jim's activities have had on natural capital and ecosystem service provision and to estimate the net benefits (expressed in monetary terms) associated with these activities.

Step 03: Scope the assessment

This case study assesses the natural capital impacts of the woodland planting and wetland restoration, including:

- Planting of 2.49 ha of broadleaves and conifers
- Clearing of millpond
- Fencing off area around woodland and wetland

The assessment:

- Considers direct impacts within the farm boundary and looks at value from the perspectives of both the business and society.
- Quantifies and values impacts as far as possible.
- Considers impacts over a three-year period (2014 – 2017). The impacts are assessed in relation to the 'business as usual' scenario (i.e. the absence of the intervention). Costs and benefits are projected over a 15-year and a 50-year period to reflect the lag between implementation (i.e. tree planting) and realisation of the full benefits (i.e. when the trees are mature).

Step 04: Determine the impacts

The woodland planting and wetland restoration aimed to reduce liver fluke contamination amongst livestock, provide a shelterbelt for livestock and to provide habitats and wildlife corridors to support Local and National Biodiversity Action Plan (BAP) species.

The following ecosystem services were assessed as being significantly impacted and are included in the assessment:

- Global climate regulation
- Local climate regulation
- Disease and pest regulation

In addition there are likely to be some moderate positive impacts on water quality regulation and wild species diversity services.

The financial cost of the project as set out in the Rural Development Contract is approximately £15,000 over 15 years – this includes a capital outlay and 15 years of management.

MEASURE AND VALUE STAGE: How?

Step 05: Measure impact drivers,

Step 06: Measure changes in the state of natural capital, &

Step 07: Value impacts

Table A sets out the asset register for this case study, detailing the interventions taken and the resulting changes in the natural capital assets. For example, prior to the project livestock had access to the pond and stream, resulting in erosion of the banks and siltation of the millpond. The 'water' asset is therefore classified as in 'degraded' condition in 2014. After fencing off the area and clearing the pond the waterways are now in a good condition.

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). For example, this project has had a negative impact on the extent of grassland habitat as it has converted grassland to woodland. This is reflected in the red score allocated to 'permanent unimproved pasture'.

Table C sets out the impact this project has had on ecosystem services. For example, the planting of woodland has greatly increased this area's provision of local climate regulation services, by providing shelter from the wind/rain/snow to livestock grazing in the adjacent field. This can be seen by the green scoring for this service.

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

Table A: Case study asset register

Natural capital asset (habitat types)	Unit of measure	Start of project 2014		Management interventions	Current status 2017		Data source	Trends (impact)
		Extent	Condition	Activities undertaken	Extent	Condition		
Enclosed farmland:								
Permanent unimproved pasture (degraded grassland)	ha	2.49	degraded	Grassland planted with trees	0	n/a	Rural Dev Contract/Jim Simmons	Decreased extent
Woodland (includes farm woodlands)	ha	0	n/a	Grassland planted with trees	2.49	good	Rural Dev Contract/Jim Simmons	Increased extent
Water (Openwaters, Wetlands & Floodplains)	ha	0.28	degraded	Millpond cleared of silt, stream and pond fenced off from livestock	0.28	good	Rural Dev Contract/Jim Simmons	No change in extent, improving condition

Table B: Natural capital asset impacts

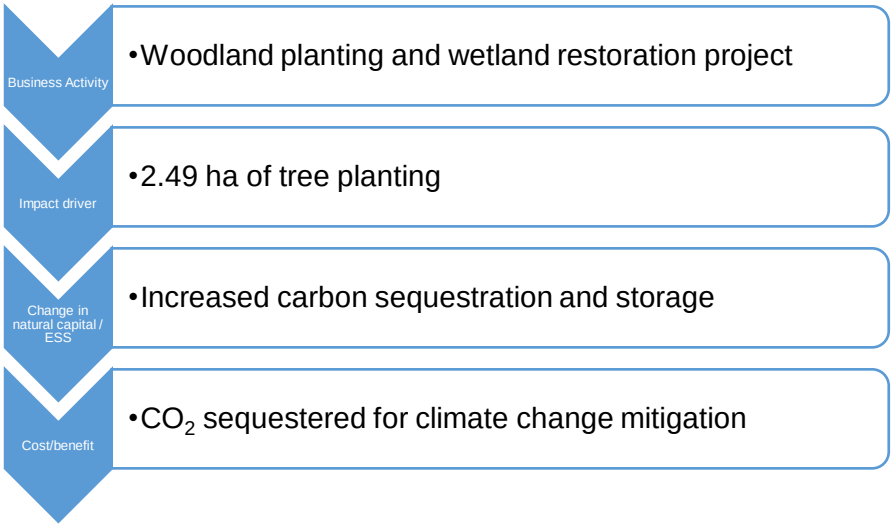
Activities	Assets (habitat types)							
	Enclosed farmland:						Mountains, Moorlands and Heaths	Water (Openwaters, Wetlands & Floodplains)
	Cropland (arable & horticultural)	Temporary pasture (temporary improved grassland)	Permanent pasture (permanent improved grassland)	Permanent unimproved pasture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

Table C: Ecosystem service impacts

Activities	Ecosystem Services															
	Provisioning			Regulating									Cultural			
	Crops	Livestock	Water supply	Global climate regulation	Local climate regulation	Flood regulation	Water quality regulation	Soil quality and erosion regulation	Air quality regulation	Disease & pest regulation	Pollination	Wild Species Diversity	Recreation	Education	Cultural heritage
Woodland planting & wetland restoration															

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

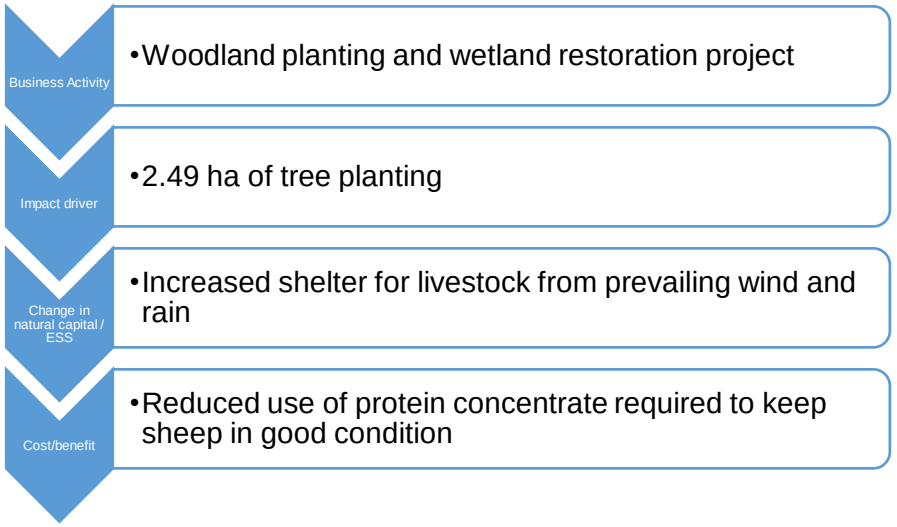
Global climate regulation



The carbon sequestration value associated with this mixed woodland is estimated to be approximately £16,500 over the 15-year appraisal period (lifespan of the Rural Development funding) and £64,800 over a 50-year period. This value relates to benefits delivered to broader society, rather than the farm business itself.

This value applies carbon sequestration rates reported in Christie et al. 2010[1] to the new mixed woodland and applies the UK Government non-traded central carbon prices[2]

Local climate regulation



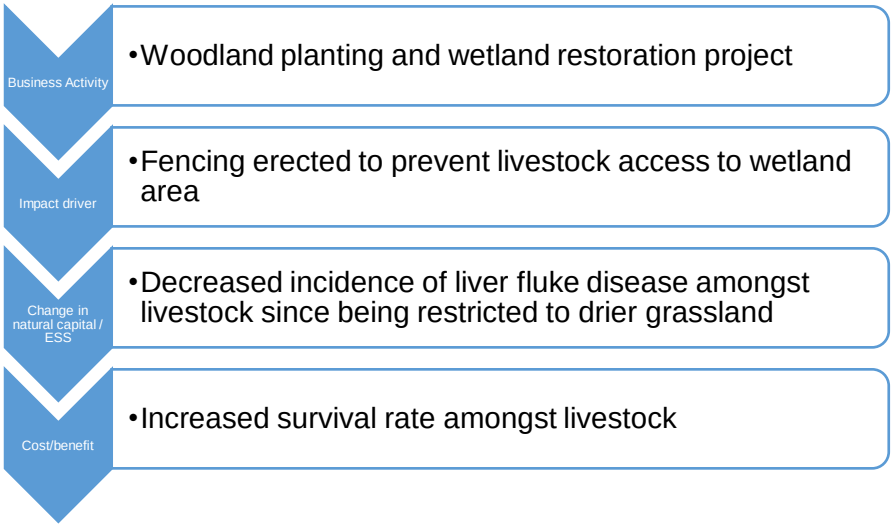
One of the main aims for planting this woodland was to provide shelter for livestock on the farm, particularly sheep, during the winter when driving wind and rain is common and can have a significant negative impact on sheep condition.

Based on an assumption that the shelterbelt improves the sheep condition by 1 condition score (say from score 2 to 3) this saves feed input that would otherwise be required to keep the sheep in good condition. Estimating the amount of protein concentrate saved gives a benefit value of approximately £88 per year. This is £1,051 based on a 15 year forecast, and £2,235 over a longer 50 year appraisal period. This longer 50 year time frame is provided for comparison against global climate regulation benefits – in practice it is very difficult to estimate benefits this far into the future as external factors may come into play. This value relates to benefits delivered to the farm business itself.

[1] Christie et al. 2010. Economic valuation of the benefits of ecosystem services delivered by the UK Biodiversity Action Plan

[2] DECC, 2015. Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal; Data tables 1-20

Disease and pest regulation



Reducing liver fluke contamination amongst livestock was a key driver for undertaking this project. While Jim routinely treats his livestock for the liver fluke parasite, it is becoming increasingly resistant to the treatments used. Preventing contamination is therefore an important way to regulate this pest and will likely become increasingly important in the immediate future, as resistance to treatment increases.

It is difficult, however, to measure and value the actual benefits delivered by this project as liver fluke treatment is still regularly used and there is no data to determine whether increased/maintained survival rates are due to veterinary treatment or reduced contamination.

Water quality regulation & wild species diversity

There are likely to be some positive impacts on wild species diversity and water quality regulation services.

Woodland planting and wetland restoration is expected to have a positive impact on biodiversity in the longer term. In particular, the actions could support UK BAP priority species and habitats[3] such as native woodlands, Northern Brown Argus (butterfly found only in the north of England and Scotland) and wood ants (which also feature on the IUCN red list – vulnerable and presumed declining). Other species such as hare and deer would also likely benefit.

Fencing off the wetland area has prevented livestock accessing the stream and breaking its banks, whilst clearing the millpond provides a natural silt trap, both of which should help to improve water quality downstream. As the rivers on and around Ruthven Farm are important spawning beds for salmon and habitat for freshwater pearl mussels there could be an increase in salmon and mussel numbers, however this is hard to gain data for and to attribute to a particular project, therefore it has not been possible to measure and value these benefits.

[3] These are those identified as being the most threatened and requiring conservation action under the UK Biodiversity Action Plan (UK BAP).

Step 08: Interpret and test results

Based on a 15 year forecast, the present value of the financial cost is approximately £14,000 and will yield returns with present values of approximately £17,000 (£16,000 relating to global climate regulation and £1,000 relating to local climate regulation). This represents an approximate benefit-cost ratio of 1.2:1 over 15 years.

When looking at a 50 year forecast the same £14,000 financial cost (costs end after 15 years) will yield returns with present values of approximately £67,000 (£65,000 and £2,000 relating to global and local climate regulation respectively). This represents an approximate benefit-cost ratio of 4.7:1 over 50 years.

In addition the project will yield benefits relating to water quality downstream, as well as disease and pest management on the farm. There may also be benefits relating to improved soil quality in the adjacent downhill field, once the woodland matures and assists in drying out the soil. There is also the possibility that the Sitka spruce trees could be used to fuel the on-farm biomass boiler, making the farm energy self-sufficient. However, these impacts have not been measured or valued in this assessment.

Step 09: Take action

This assessment could be used for education and demonstration purposes, perhaps as part of the farm's expansion into agri-tourism, focusing on the benefits it has been possible to value to date.

There may be scope to consider whether this approach could be extended to manage less productive wetland areas on other livestock/arable farms in Scotland.

It should also be noted that the actions in this case study were made possible by external funding. At a time when the future of agricultural and environmental support is particularly uncertain, it would be worth considering the resilience of various funding opportunities and how this might be managed to ensure that organisations on the wider estate have the means to access similar forms of beneficial funding in the future.