Ecosystem services in practice: experiences from three upland pilots

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Delivering Nature's Services

The ecosystem approach in practice

Three pilot areas:

Bassenthwaite Lake catchment, Cumbria

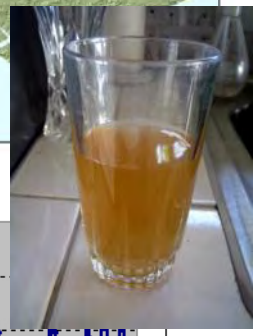
South Pennines National Character Area, Yorkshire

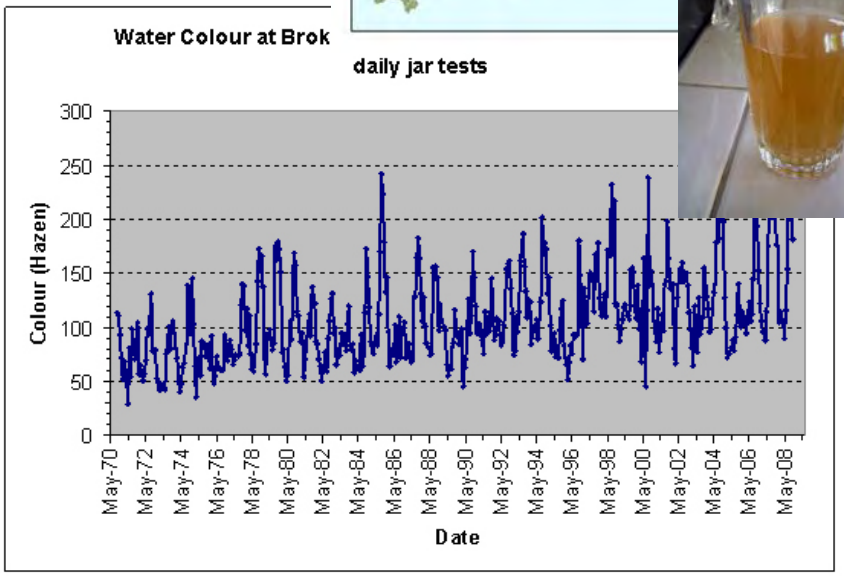
Dartmoor and Exmoor, South West

Links to water companies' AMP 5 programmes

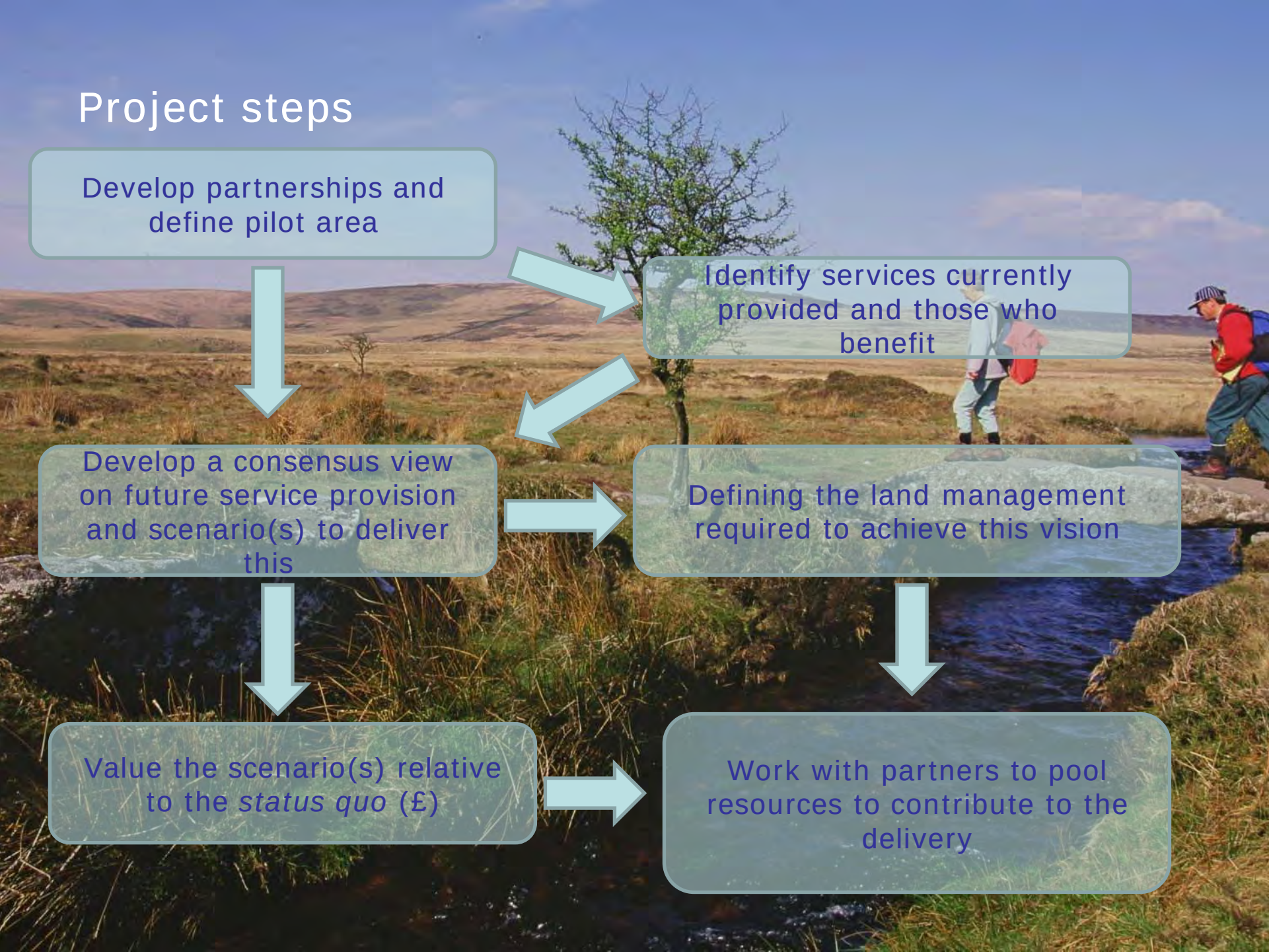
Catchment restoration to deal with deteriorating water colour

Combining public and private funds





Project steps



Building consensus

- Reaching a consensus: Bassenthwaite pilot has involved over 70 people (25+ organisations) in planning future land and water management

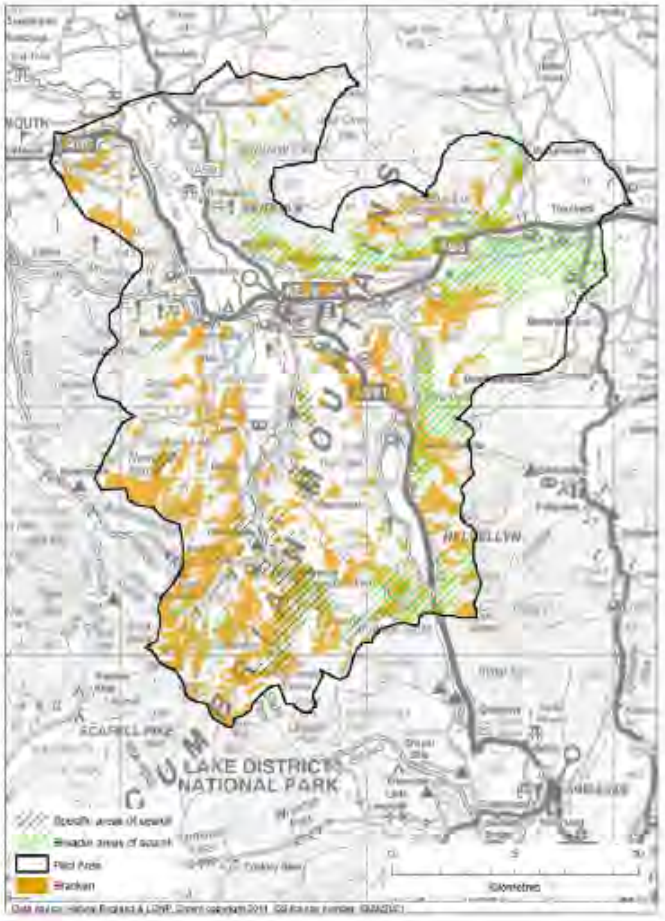
- Range of workshops – from regional economic benefits to the aspirations of farmers

- Integration with existing work – CSF, Catchment Flood Management Plan, WFD, SCaMP2, Nurture Lakeland tourism project, Carbon Landscapes project, ROWIP…

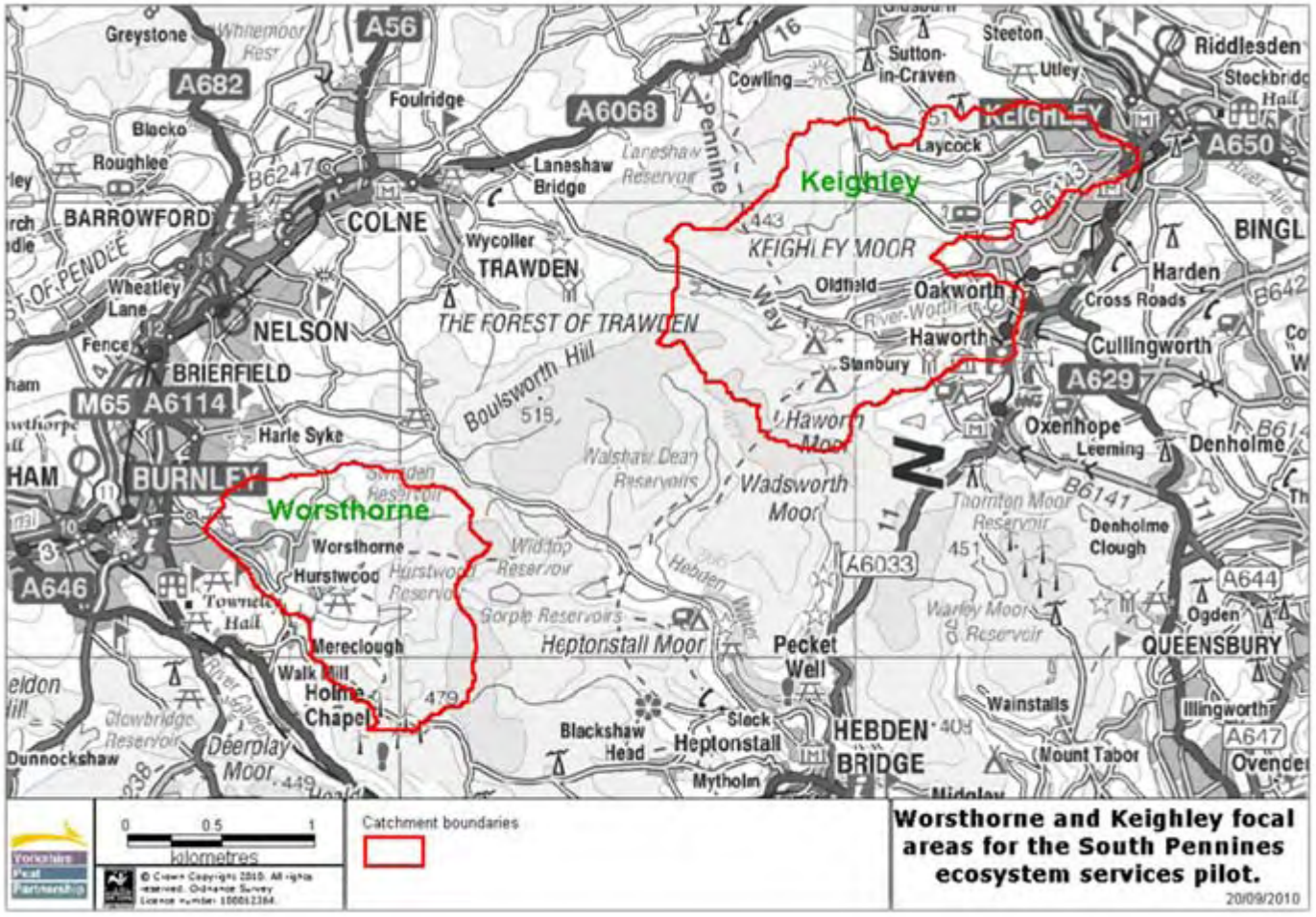
Shared delivery plan…

Action 1: Increase Woodland Cover
Target Area: 1140 ha, potential areas on bracken beds (600 ha), gills (100 ha), previous woodland sites and steep slopes with eroding soils. Specific and broader areas of search are shown on the map. The 1140 ha target for woodland creation could be achieved with 50% coverage in specific areas and 10% coverage on broader areas of search.
WHY? Native woodland creation is a single action that can deliver multiple benefits for the future supply of ecosystem services, particularly carbon storage, reduced soil erosion and gravel supply from gills, improved water quality and wildlife. To achieve multiple benefits, the proposals are for creation of native broad leaf woodland with species selection based on soil type, position and ground vegetation. Planting with wide spacing and random clusters creates a seed source that supplements natural regeneration.
Ecosystem Services: Water provision, timber, wood fuel, climate change regulation, flood regulation, erosion control, water quality, recreation (water based including angling), cultural heritage, sense of place, inspirational, spiritual and aesthetic values and biodiversity
WHERE? Woodland planting is aimed at the least agriculturally important areas, such as bracken beds, which were past woodland sites and often support remnant woodland ground flora. The potential areas are based on mapped data and local partner knowledge. Extensions to and connections between existing woodlands are included to develop woodlands adapted to climate change. Targeting avoids areas of deep peat (originally blanket bogs or lowland raised bogs) which are important for carbon storage and sequestration. Soil erosion risk maps target woodland which also contributes to improvements in water quality (sediment/nutrient load and colour). Gill woodlands are a priority to reduce coarse sediment transport and subsequent deposition on agricultural fields during floods. Hydrological modelling work being undertaken by Atkins, due for completion April 2011, will identify locations where reductions in flood flow, through woodland creation, could reduce downstream flood risk.
Map Information Sources: Bracken beds from Land Cover Map 2000, (Centre for Ecology and Hydrology), National Inventory of Woodlands and Trees, BAP habitat inventories, deep and shallow peat soils (BGS/Cranfield University), soils at high and medium risk of soil erosion (Lancaster University and Forest Research)
HOW? **Fitting in with farming:** Detailed design of individual woodland creation sites to fit with farming and other land management is essential. Successful creation of woodland in the pilot area in the last 3 years has been achieved through effective joint working with farmers and commoners. Future management of woodland could provide opportunities for production of timber and in particularly wood fuel as markets and the supply chain develop. **Partnership Delivery:** • Environmental Land Management Service (ELMS) • RSPB Futurescapes • Forestry Commission Carbon Task Force • BLRP Woodland Task Group • BLRP River Corridor Group – for riparian woodlands • Derwent Rivers Trust – for riparian woodlands • Catchment Sensitive Farming **Funding for Delivery:** • Higher Level Stewardship – for woodlands <3 ha and on common land • England Woodland Grant Scheme – for woodlands >3ha not on common land • SCaMP2 – within United Utilities land holding • Nurture Lakeland Visitor pay-back

ACTION 1: Increase Woodland Cover



Demonstrating value



Scenarios

Looking at marginal change over 25 years...

'Improvement scenario' –investments made to deliver a greater range of ecosystem services through habitat restoration and more sympathetic land management

'Decline scenario' –future decline in the catchment due to a general withdrawal of public investment in land management and environmental regulations

Both assessed against a counter-factual (or baseline) scenario, i.e. what might be expected to happen if management continued as at present.

Main habitat types and areas under different scenarios

Habitat type (ha)	Current	Counter-factual	Improved	Free market
Deep peat intact	43.4	43.4	1287	0.0
Degraded bog	1224.4	1219.6	0.0	1055.7
Bare peat (severe burn)	19.1	23.9	0.0	231.32
Flush & Mire	57.2	57.2	57.2	57.2
Upland heath (12 y burning)	281.8	281.8	0.0	140.5
Upland heath (16 y burning)	0.0	0.0	354.0	0.0
Acid Grassland	165.0	165.0	115.0	305.5
Bracken	44.4	44.4	22.0	65.6
New Woodland	0.0	0.0	131.2	0.0
Managed native woodland	108.4	108.4	108.4	87.4
Reservoirs	37.6	37.6	37.6	37.6
Improved grassland - low	1217.0	1217.0	1086	1217.0
Improved grassland - high	692.2	692.2	692.2	692.2
PMG & Rush	0.0	0.0	0.0	0.0
upland hay meadows	0.0	0.0	0.0	0.0
Urban	353.3	353.3	353.3	353.3
Total	**4243.8**	**4243.8**	**4347.0**	**4234.2**
Unaccounted for (ha)	**-104.5**	**-104.5**	**-104.5**	**-105.1**
Unaccounted for (%)	-2.4%	-2.4%	-2.4%	-2.4%

Two different valuation approaches

For biodiversity, carbon and other uses....

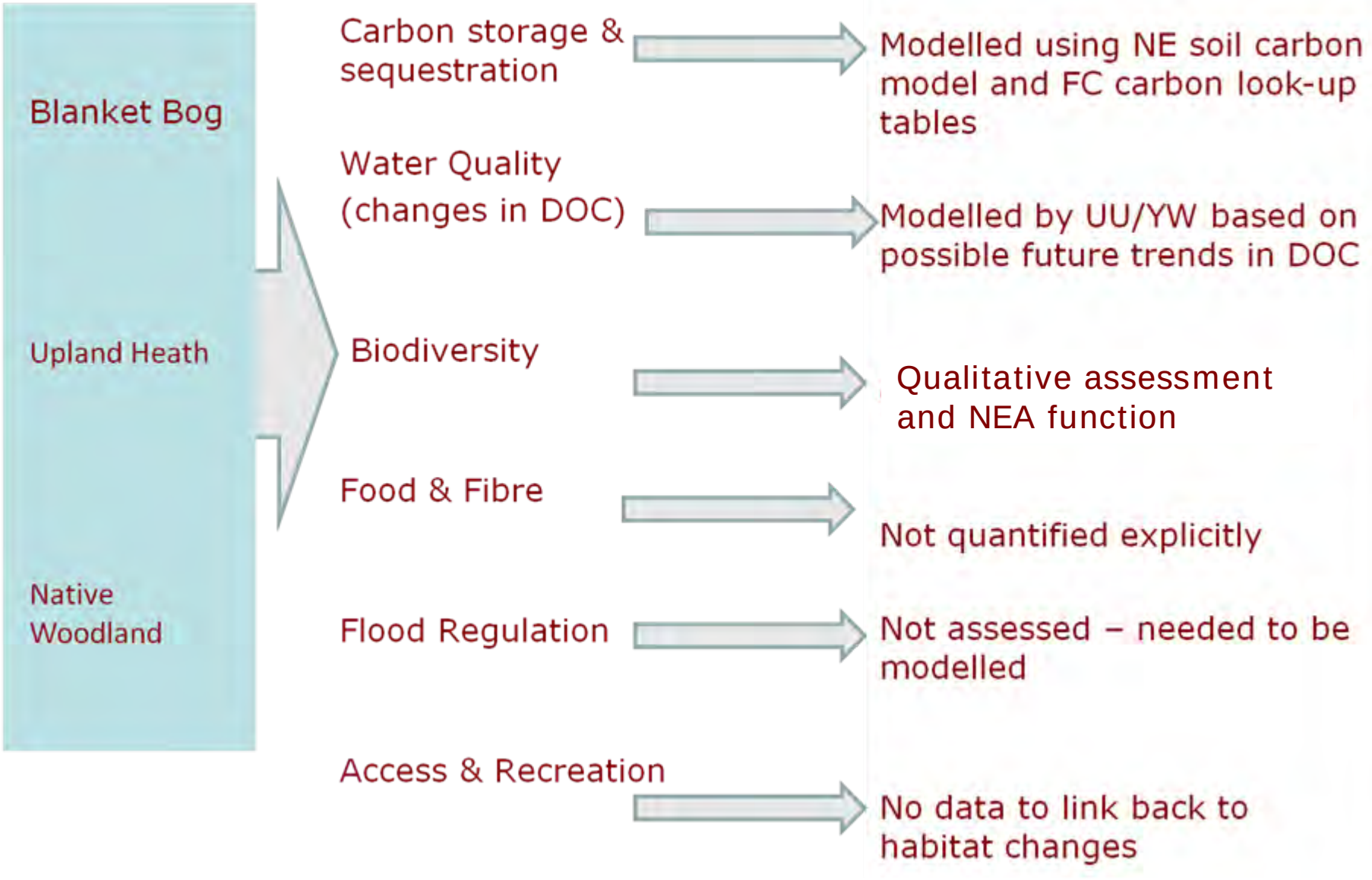
1) Values transferred from Christie et al., (2011) Economic Valuation of the Benefits of Ecosystem Services delivered by the UK Biodiversity Action Plan (Defra Project SFFSD 0702)

2) UK National Ecosystem Approach combined with direct 'measurement' of ecosystem service changes and using DECC carbon values – NEA/DECC

For water...

Yorkshire Water (and United Utilities) provided estimates of potential changes in water treatment costs stemming from possible changes in the level of dissolved organic carbon (DOC) and pesticides.

Ecosystem Service changes

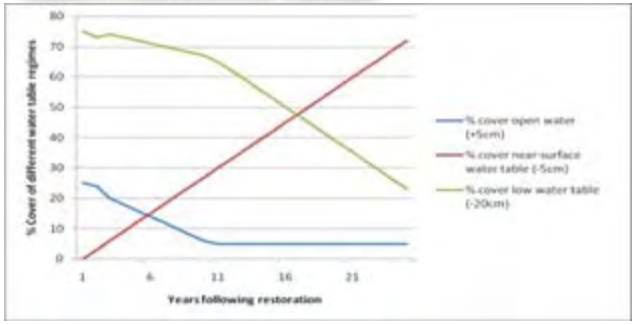


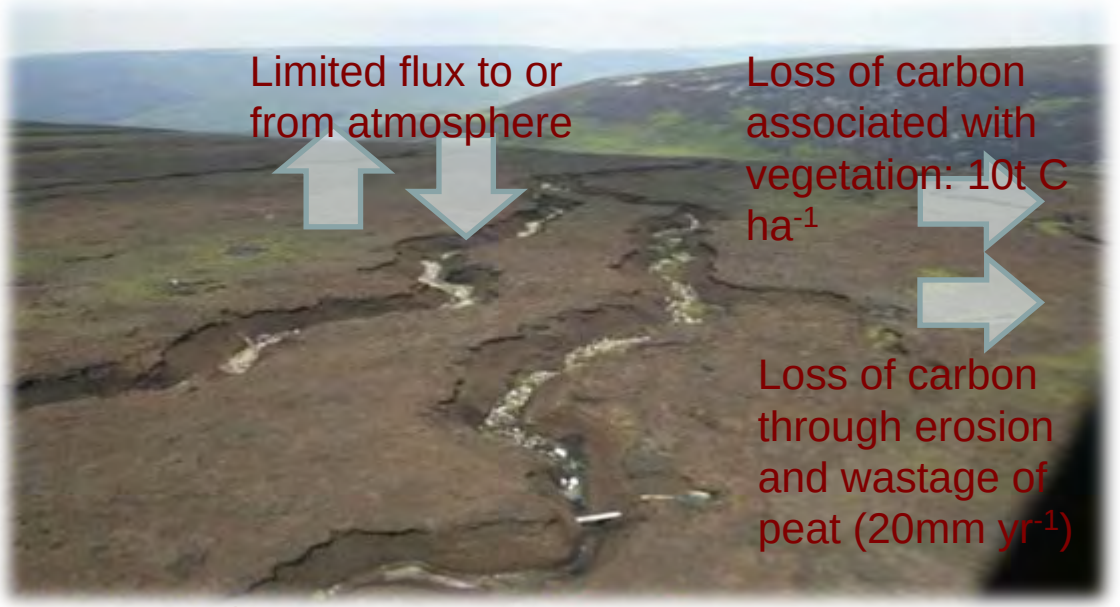
CO_2e flux with restoration and degradation

Restoration leads to methane release:

methane is more potent as GHG than CO_2 (25x)…

but peat forming *Sphagnum* colonises open water leading to CO_2 sequestration?



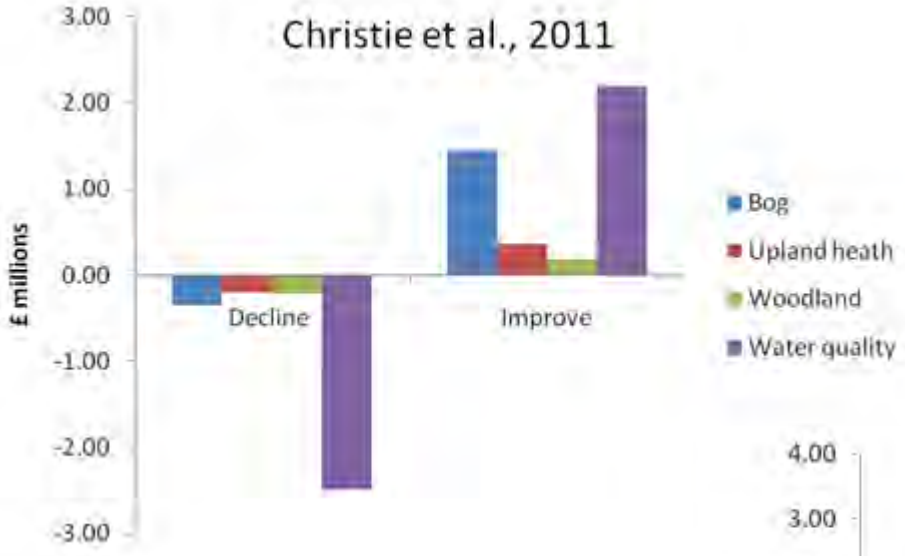


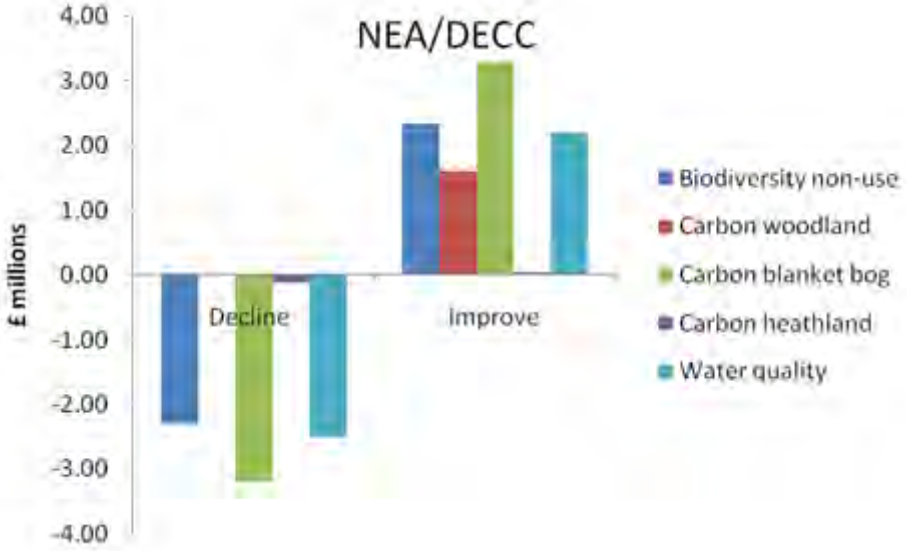
CO_2e flux from bare peat?

Biodiversity changes – improved

Biodiversity changes – free market?

Two different valuation approaches





Cost estimates

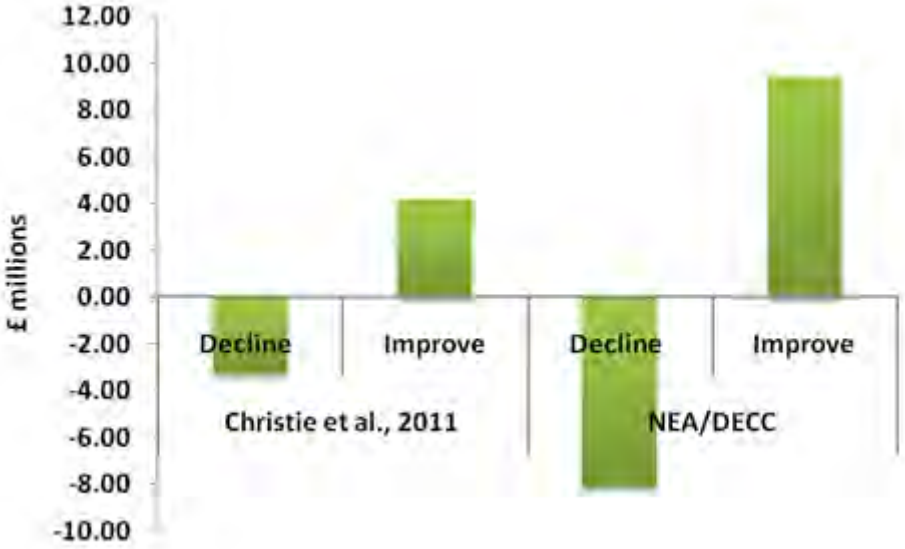
3 different approaches:

1)using national averages for Environmental Stewardship schemes;
2)using individual HLS option payment rates and then aggregating over the catchment;
3)using average HLS payment rates for the local area and extrapolating to the whole catchment.

(All costs have been assessed over 25 years, using standard HM Treasury discount rates (3.5%))

Improved Scenario			
Approach	**Capital cost**	**Annual cost**	**Total**
1. National average costs	-	-	£5,733,000
2. Option payment rates	£1,902,000	£1,302,000	£3,204,000
3. Catchment average costs	-	-	£4,276,000
Decline Scenario			
Current ES spend in catchment	-	-	£1,614,432

Keighley catchment net present value and benefit:cost ratios



Benefit cost ratios of : 1.31-2.96 (improved)
-2.03 to – 5.20 (decline)
(Christie et al and NEA/DECC respectively)

Improved scenario:
• for every £1 spent in the catchment, society benefits by £2.96;

Decline scenario:
• for every £1 not spent in the catchment, society stands to lose an estimated £5.20.

Conclusions

Outputs

- Natural Capital – delivery plan which will be implemented collectively
- Social Capital – through partnership and capacity building
- Economic Capital – through public private partnerships to incentivise the provision of services

Lessons

- Partnership and capacity building takes time but is well worth it
- Need simple decision support tools
- Valuation is valuable but relies on good ecological knowledge. Not all the piece of the jigsaw are there.
- It can take time to see changes in services.

Acknowledgements

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Matthew Shepherd (carbon modelling); Jane Lusardi; Mark Phillips

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Kate Snow

Supporting Material

Monetary valuation evidence

Carbon

DECC carbon valuation guidelines (DECC, 2009) provide detailed guidance on *values per tonne for CO2e for non-traded carbon*. Used to value the expected changes in carbon sequestration and GHG emissions (e.g. methane) under each scenario.

Water quality (colour)

A *treatment cost approach* has been adopted to value possible improvements in water quality. This analysis has been undertaken separately by Yorkshire Water and United Utilities for differing possible future trends in dissolved organic carbon (DOC).

Biodiversity

Non-use values could be quantified and valued in a number of ways e.g. estimates per household, per year are available from other studies which could then be aggregated to a relevant population (see eftec, 2010).

However, the approach adopted here is to use results generated by the National Ecosystem Assessment (NEA), which adapted a recent meta-analysis of wetland valuation (Brander *et al*., 2008) to UK wetlands.

Inland wetlands which afford good quality biodiversity habitat generate a value of £454 per hectare per year more than those of poor quality.

The £454 per ha per year value is the average of the biodiversity non-use value where currently present. The NEA goes on to develop marginal values – i.e. the value for an additional unit of new wetland with good quality biodiversity habitat. This is estimated at £304 for inland wetlands (which includes peatbogs).

Quantifying ES change – CO_2e blanket bog summary

Restoration

Model of water level (and associated CH_4 and CO_2) changes applied over 25 years

Assume works in years 1 & 2 therefore no benefit in these years

Deterioration of intact blanket bog

Difference in flux between intact and degraded systems from Natural England 'Peatlands' report (2010)

Deterioration spread over first five years

Deterioration of blanket bog to bare peat

Focus on erosion losses – average rate (20mm yr-1) from literature multiplied across area affected and assume carbon is 47kg per m^3 peat

Add carbon loss associated with vegetation (10 t C ha^{-1}) from Lindsay (2010)

Assume this happens over 10 years

Conversion of upland heath to acid grassland (and vice versa)

Draft Natural England report on carbon and land management gives values for different land use changes -used value of 1 tCO_2 ha^{-1} yr^{-1} for change from improved heath to grassland

Assume this happens over 10 years

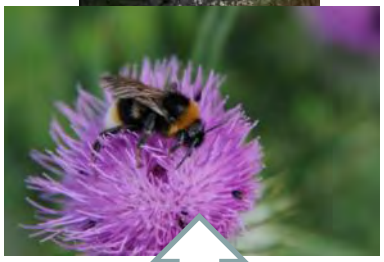
Summary Results

Scenario	PV benefits	PV costs	NPV	BC ratio
Improved (NEA/DECC Values)	£9,475,000	-£3,204,000	£6,271,000	2.96
Decline (NEA/DECC Values)	-£8,400,000	£1,614,432	-£6,786,000	-5.20
Improved (Christie *et al* Values)	£4,206,404	-£3,204,000	£1,002,404	1.31
Decline (Christie *et al* Values)	£3,207,860	£1,614,432	-£1,656,400	-2.03

Human health, wellbeing and prosperity

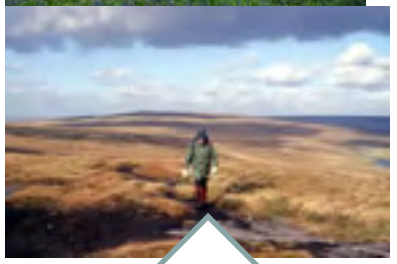
NATURAL ENGLAND

Regulating services



Provisioning services

Cultural services



Supporting Services

Underpinning biodiversity , geodiversity and ecosystem processes