

Bassenthwaite Ecosystems Services Pilot  
Aerial



**Bassenthwaite Vital Uplands  
DRAFT Baseline Assessment of Ecosystem  
Services**

## **Bassenthwaite Vital Uplands Baseline Assessment of Ecosystem Services**

Bassenthwaite Vital Uplands is one of three national ecosystem services pilot projects initiated by Natural England (NE). It aims to work with a broad range of partners to decide together how the catchment could look and what public benefits it could provide in future.

An integrated approach to land management is used to develop an action plan that encompasses new proposals as well as existing initiatives. A series of workshops with partners, farmers and other land managers have examined the existing range of benefits provided and explored how this could be further enhanced and funded. The pilot also seeks to develop new ways of paying for these benefits by linking together existing sources of funds and looking at whether new markets can be developed for those benefits or goods for which there is currently no way of paying.

This baseline assessment summarises the benefits or ecosystem services currently being provided within the project area. It is based upon readily available sources of information and represents an initial view of the benefits provided. Where possible, maps have been used to illustrate this assessment. These maps show “what we have got now” and the assessment aims to link these to the ecosystem services that are provided.

### **Summary of key ecosystem services, issues and opportunities identified by Bassenthwaite Vital Uplands partners:**

- Food
- Timber and wood fuel
- Water
- Climate change regulation
- Flood regulation
- Erosion control
- Water quality
- Wildlife-rich environment
- Recreation and tourism
- Cultural heritage
- Education and knowledge
- Health benefits, mental and physical
- Sense of place, inspiration and spiritual and aesthetic values

### **Key issues and opportunities:**

- Delivery of land management objectives at the catchment scale is well established through the Bassenthwaite Lake Restoration Programme.
- Expiry of large numbers of Environmentally Sensitive Area (ESA) schemes between 2012-14 provides an opportunity for replacement by Higher Level Stewardship (HLS) with a broader scope of objectives, management options and payments for providing ecosystem services.
- United Utilities' Sustainable Catchment Management Plan (SCaMP2) demonstrating how ecosystem services can be delivered through a combination of private and public funding.
- Nurture Lakeland visitor pay-back scheme working with 35 businesses in the Bassenthwaite catchment exploring how visitor pay-back can be expanded to pay for management actions for ecosystem services.
- Modelling work exploring the role of land management to reduce downstream flood risk.

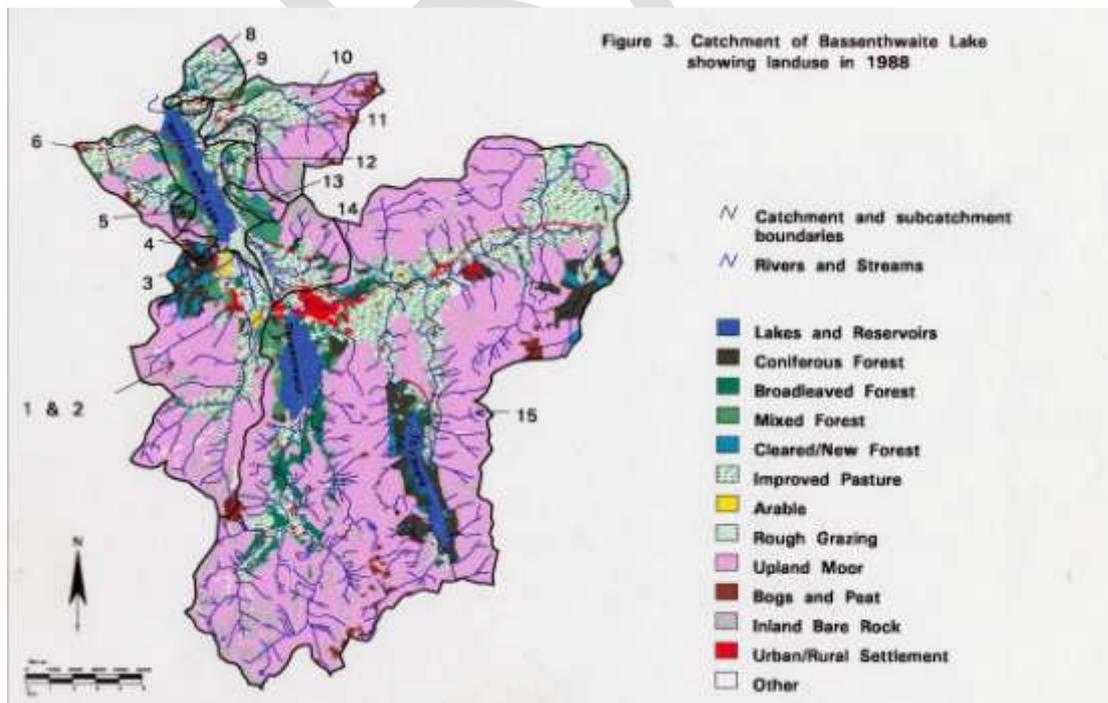
## 1. Where is the pilot area and what is it like?

The Bassenthwaite Vital Uplands ecosystem services pilot project covers the Bassenthwaite catchment in the north Lake District. The catchment, around a fifth of the Lake District National Park, has an area of 361.3km<sup>2</sup> and includes Bassenthwaite and Derwent Water lakes as well as Thirlmere reservoir. It is bounded by the Skiddaw massif to the north, Helvellyn to the east, the Borrowdale Fells to the south and the Buttermere Fells to the west. The fells are dissected by glacial- cut steep sided valleys. The valley floors provide a limited amount of flat terrain that supports the best agricultural land, known as “in-bye”. Large tracts of semi-natural habitat include blanket bog and heath on the fell tops, deciduous woodlands on the valley sides and the lakes, rivers and wetlands.

*Bassenthwaite catchment is located within the Cumbria High Fells National Character Area. The key characteristics of the Cumbria High Fells include:*

- *Spectacular and rugged mountain scenery of open fells with an expansive character, and a mosaic of high craggy peaks and screes, heaths, mires, peatland, heather moorland, acid grassland, bracken and remote valleys with fast flowing streams and tarns.*
- *A radiating pattern of deep glaciated valleys with extensive lakes, reed beds, carr woodlands, meadows and other lakeshore vegetation, rivers and semi-improved and improved grazing land.*
- *Farmland and sheltered valley landscapes at lower altitudes with woodland, dry stone walls, hedgerows, copses, pollarded trees and scrub vegetation.*
- *Extensive areas of ancient, semi-natural, broadleaved, mixed and conifer woodlands including in Borrowdale, Derwent Water, and the Thirlmere areas.*

**MAP 1** Land cover in the Bassenthwaite catchment (May et al., 1995). Land cover data for 1988 were supplied by the Lake District National Parks Authority.



The catchment is largely rural with 7000 residents (3500 dwellings), the majority living in the small market town of Keswick, situated at the confluence of the Rivers Greta and Derwent between Derwent Water and Bassenthwaite. Urban areas cover less than 1% of the catchment area. Keswick and the downstream towns of Cockermouth and Workington were badly damaged by extreme floods in November 2009. Farm land was also affected by the flooding, resulting in changes in the routes of water courses and deposition of large volumes of gravel onto in-bye land. Floods of this magnitude are predicted to become more common in the future as a result of climate change.

## **Tourism**

Tourism is a key driver of the local economy with around 3 million visitor days to the Bassenthwaite catchment recorded each year. Of these 2 million are day visitors with 1 million staying over-night in the 1071 tourism accommodation businesses. Tourism provides around 4000 full time equivalent jobs and generates around £306 million per year (2008 figures). 91% of visitors to the Lake District National Park say scenery and landscape is their primary motivation for visiting. Nurture Lakeland (formerly The Lake District Tourism and Conservation partnership) is the largest visitor pay-back scheme in England generating around a quarter of a million pounds for conservation schemes in Cumbria annually (about 80% for schemes in the Lake District). Breeding ospreys on Bassenthwaite Lake have been calculated as generating around 100k visitors annually spending £420k in the local area.

## **Farming**

There are 157 farms within the area, largely hill sheep farming with a limited amount of beef and less dairy, employing 8% of the population. Common land, covering 38% of the catchment (13,711 ha) is an important part of the farming system. This common land is actively managed for sheep production, with graziers working together via Commoners Associations.

Agri-environment schemes support around 146 farms (93% of farms in the catchment) with nearly £1.5M of financial support for sustainable land management. Many of these farms are within Environmentally Sensitive Area (ESA) schemes which are due to expire in 2013. Replacement of ESA schemes by Higher Level Environmental Stewardship (HLS) provides an opportunity to deliver multiple public benefits.

The pilot area is classified as Highly Disadvantaged Less favoured Area apart from the low lying land around Keswick and to the east of Bassenthwaite Lake which is classified as Disadvantaged. The inherent low productivity of farmland in the area means that agri environment payments are a major component of the profitability of many farm businesses.

A key challenge is to provide recognition, including within the farming community, of the wide range of public benefits than can be provided by farmers and other land managers within this upland catchment.

## **Water Supply**

Thirlmere Reservoir, (along with Haweswater in the Eden catchment to the east of the pilot area), provides the majority of the water supply for United Utilities' North West Integrated Supply Zone, including Greater Manchester. Thirlmere is at the south east of the pilot area and drains, via St John's Beck and the River Greta, into Bassenthwaite Lake. Bassenthwaite was in part chosen as one of the three national pilot areas for this ecosystem services project due to United Utilities Sustainable Catchment Management Plan project (SCaMP2). SCaMP2 aims to achieve improvements in drinking water quality, carbon storage and biodiversity through management of the Thirlmere and Haweswater reservoir catchments. The delivery of SCaMP2 is negotiated with United Utilities' tenant farmers through a combination of new Higher Level Environmental Stewardship schemes plus United Utilities funded capital works. The Bassenthwaite Vital Uplands Project includes the Haweswater SCaMP 2 area for the delivery aspect of the project.

### **Landscape and biodiversity**

Internationally renowned for its iconic cultural landscape, the Lake District National Park is a prospective World Heritage Site. The Bassenthwaite catchment has 28 Scheduled Monuments, including Castlerigg Stone Circle, as well as a high density of Historic Environment Records. The catchment is also of international importance for nature conservation with 30% (106,683ha) designated as Special Area of Conservation (SAC) (Borrowdale Woodland Complex, Lake District High Fells and River Derwent and Bassenthwaite Lake SAC) as well as 2200 ha of additional Sites of Special Scientific Interest.

### **Project partnership**

Bassenthwaite Vital Uplands is a new task group within the Bassenthwaite Lake Restoration Project (BLRP), a highly effective partnership project which has focussed on catchment management since its initiation by the Lake District Still Waters Partnership in 2002. The aims of the BLRP are to address sedimentation, nutrient enrichment and species issues within Bassenthwaite Lake.

Bassenthwaite Vital Uplands also links to other existing initiatives including:

- Catchment Flood Management Plan for River Derwent (EA)
- Water Framework Directive River Basin Management Plan (EA led)
- SCAMP 2 (United Utilities)
- River Restoration Strategy (EA/NE)
- Nurture Lakeland visitor pay-back scheme
- Catchment Sensitive Farming (NE/EA)
- Cumbria Rights of Way Improvement Plan (Lake District National Park Authority LDNPA)

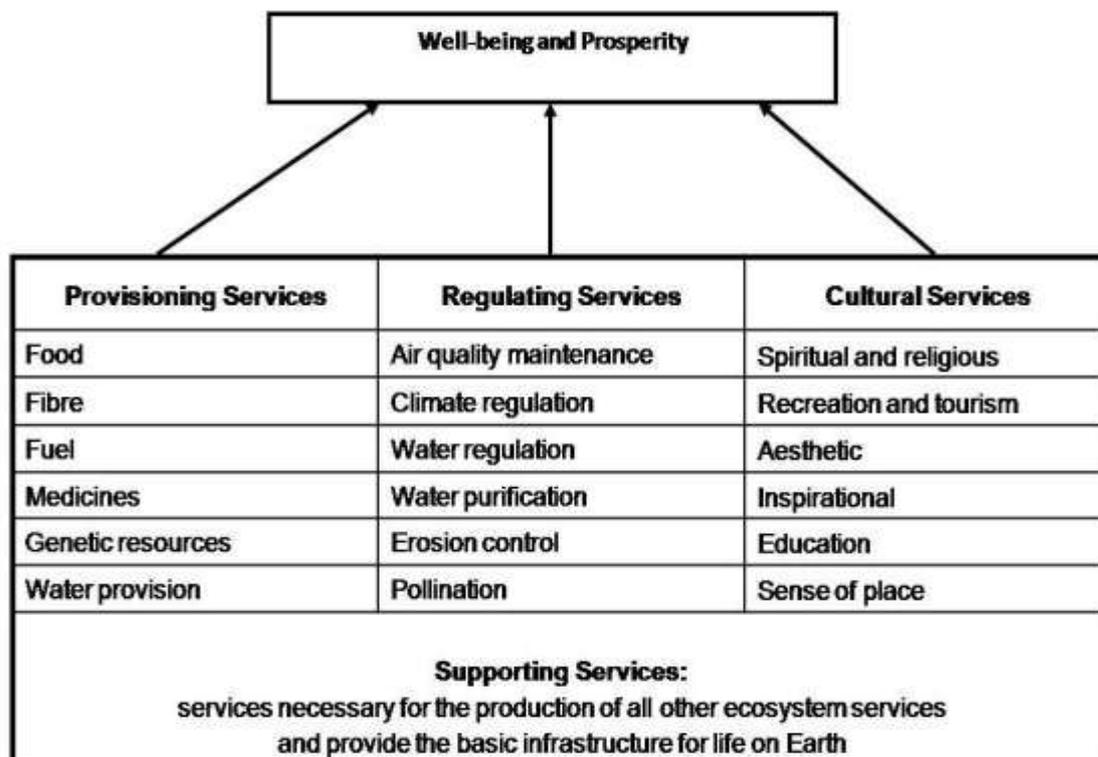
## Opportunities particular to the Bassenthwaite Vital Uplands pilot project:

- The expiry of the vast majority of ESA schemes in the period 2012-14 and replacement by HLS provides a key opportunity; HLS has a broader scope of objectives, management options and payments for providing ecosystem services.
- The delivery of SCaMP2 through a combination of new Higher Level Environmental Stewardship Schemes supplemented by SCaMP2 funded capital works demonstrating how ecosystem services can be delivered through a combination of private and public funding.
- Link to the Nurture Lakeland run visitor pay-back scheme (the largest in England) working with 35 businesses in the Bassenthwaite catchment to explore how visitor pay-back can be expanded to pay for management actions for ecosystem services.
- Following extreme flooding in November 2009, exploration of the role of integrated land and river management in developing a catchment that is more resilient to flooding.
- Delivery of land management objectives at the catchment scale is well established through the BLRP and the Defra/ NE/ EA Catchment Sensitive Farming Delivery Programme.

### 1. Approach to assessment of ecosystem service provision

This document sets out the ecosystem service provision of the Bassenthwaite catchment according to the Millennium Ecosystem Assessment (2005) classification which groups these services into four broad categories as follows (see Figure 1):

- **Supporting services** - services necessary for the production of all other ecosystem services and providing the basic infrastructure for life on Earth
- **Provisioning services** - the products obtained from ecosystems such as food, fibre, fuel, natural medicines and pharmaceuticals, and genetic resources.
- **Regulating services** - the benefits people obtain from the regulation of ecosystem processes, such as air quality maintenance and climate regulation.
- **Cultural services** - the non-material benefits that people obtain through things like recreation and learning, spiritual enrichment and cognitive development.



**Figure 1** The ecosystem services framework - linking nature and human well-being  
 The underpinning supporting services are a set of processes (e.g. photosynthesis, decomposition, nutrient cycling, soil formation, evapo-transpiration) that operate at the most fundamental level in the functioning of ecosystems. They ultimately control the level of all ecosystem services provided by the natural environment. Available evidence suggests that the rate and resilience of many of these processes are dependent upon levels of biodiversity. Biodiversity can also be considered as a cultural service, for the benefits that people obtain from a wildlife-rich environment. To prevent repetition in this baseline document, biodiversity is included in the cultural services section. However, it is important to remember the importance of biodiversity (including bacteria, fungi, protozoa and other less well known organisms) in supporting the full range of ecosystem services.

This assessment is based on a series of maps to demonstrate the current level of ecosystem services provided. It aims to assess the level of provision for a comprehensive range of ecosystem services, although some are not included either because they are not thought as important in the pilot area, or we have very limited information about them. Further, some services are more difficult to assess and not readily portrayed in a map format, notably the "cultural services" such as sense of place, health benefits, etc. For some environmental impacts the contribution from ecosystem services provided by the natural environment is only part of the picture. For example diffuse pollution has been identified as a major component of the nutrient loading to Bassenthwaite Lake. The terrestrial habitats, wetlands, rivers and lakes of the catchment provide a critical service in the disposal and purification (cleansing) of water with high phosphate loadings. However a significant proportion of pollution (22% of total phosphorus) can be attributed to point sources (e.g. waste water treatment works, septic tanks), and pollution reduction depends upon improvements to this infrastructure, which is out with the scope of this project. .

The baseline assessment is based on 3 main sources:

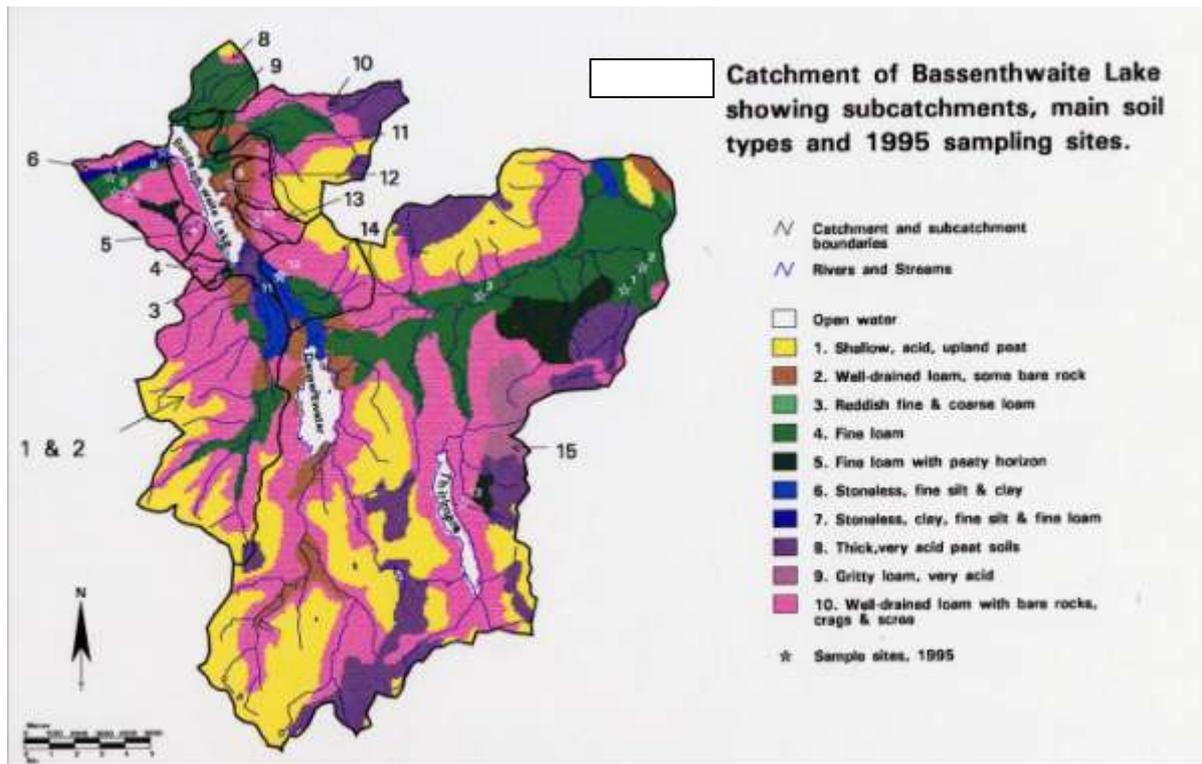
- A Bassenthwaite cut of the upland ecosystem services atlas “ Mapping Values: the vital nature of our uplands”
- Local data sets provided by NE, LDNPA, EA and other partners.
- Data from a report commissioned by the pilot project on the “The Ecosystem Economics Benefits of Ecosystem Services in the Bassenthwaite Catchment” (Rebanks Consulting 2010).

This has been supplemented by contributions from six partner and farmer workshops for the pilot project. The Lake District National Park Authority mapping unit produced large copies of maps for use in the workshops.

For many services metrics for the full service are not available, in which case partial data or surrogate data are presented. For example data about scheduled ancient monuments are presented relating to the historic environment, but many other non scheduled field monuments and other archaeological remains occur. Confidence in the assessment and surrogates for service provision are detailed under the comments on individual maps.

### **3. Supporting services:**

These are the underlying services which support all the other ecosystem services and provide the basic infrastructure for life on earth they include: nutrient cycling, soil formation, primary production and biodiversity. Supporting services are difficult to portray in map form and a map of the soils within the pilot area is included here as the best available data set. Biodiversity is a key supporting service which is covered under cultural services for the purpose of this assessment, solely to avoid repetition (see Maps 15-17).



**MAP 2** Soils in the Bassenthwaite catchment (May et al., 1996).

Reproduced from National Soil Resources Institute soils map. Map derived from soils data © Cranfield University (NSRI) and for the Controller of HMSO, 2011. For further information please visit [www.landis.org.uk](http://www.landis.org.uk)

The soil map reflects the underlying geology, glacial history and topography of the catchment. There are significant areas of higher altitude (over 300m) supporting acid peat of varying depths. Based on the Hydrology of Soil Types (HOST) classification of Boorman et al (1995), this map identifies 10 different soil types in the catchment including thick very acid peat soils (10.8%) and shallow acid upland peat (24%) as well as fine loam (16%) in the valley bottoms. The soil series is intimately linked to vegetation type and biodiversity. For example, blanket bog occurs on the thick very acid peat soils, although it should be noted that thick peat is not recorded here as being as extensive as on the peat soils map 9. It should be noted that map 2 does not assess soil condition in relation to factors such as compaction, erosion, water content or oxidation of peat soils.

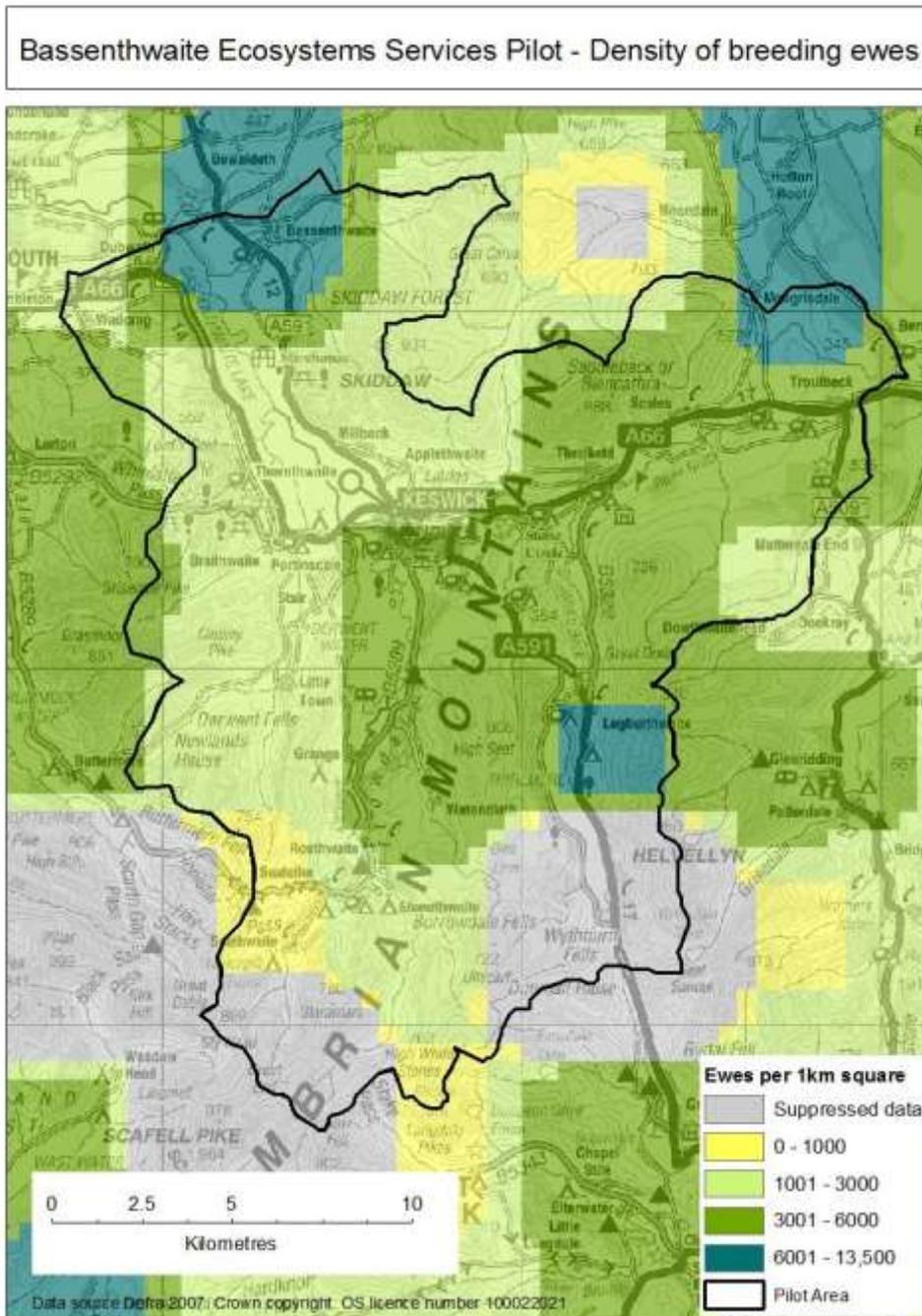
Soil is vital for agriculture and forestry, with prime agricultural land located on the fine loam alluvial soils of the valley bottoms. Soil and associated vegetation type underpin other services, notably the regulatory services of carbon storage/sequestration, erosion control and consequently water quality (including for drinking water provision). Soil type also influences flood regulation through water retention capacity of soils and again soil erosion, which exacerbates the impacts of flooding, due to sediment redeposition

Soil type is fundamental in influencing any future land management. Map 2 is of a suitable scale for targeting land management changes such as peatland management or woodland creation on loam with bare rocks crags and scree.

#### 4. Provisioning services

The provisioning services cover the products obtained from the natural environment including: food, wool, timber, fuel and fresh water. Genetic resources, biochemicals, natural medicines, pharmaceuticals and ornamental resources are also provisioning services although there is no readily available data on these for the Bassenthwaite catchment.

#### Food:



MAP 3

As the main farming type, sheep numbers provide an indication of the importance of the catchment for food production. Hardy fell ewes are also important as breeding stock for lowland UK sheep farming. Beef and a small amount of dairy also contribute to food production from the pilot area.

The density of breeding ewes, Map 3, is based on national Defra data from 2007. In national terms this catchment has a higher density of sheep than the lowlands and also compared with many other upland areas. Map 3 is effective at showing the overall density of sheep in the project area, although it does not take into account the movement of sheep between the in-bye and fell through the year. The high density of sheep shown on Map 3 shows generally highest numbers in areas with a high proportion of in-bye and reflects the importance of the in-bye land for sheep farming.

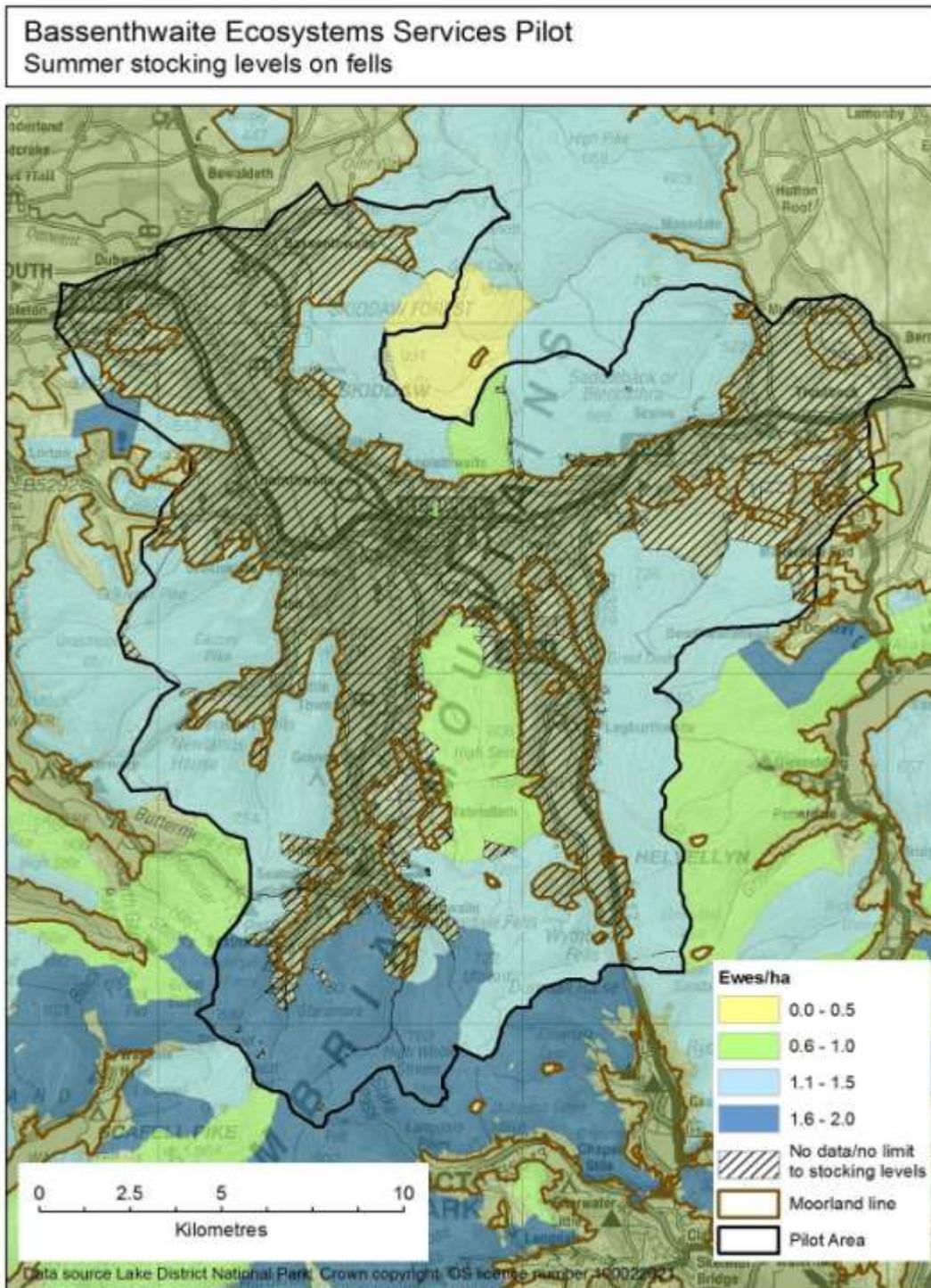
Although it provides an indication of sheep numbers, Map 3 does not highlight the importance of high quality local food produce. This issue was a focus of a project partnership workshop which identified the opportunities and constraints associated with the distribution, supply and marketing of local provenance food produce.

During the second half of the 20<sup>th</sup> century, government food policy and financial support led to a doubling of sheep numbers in the Lake District. This resulted in over grazing and poor habitat quality for wildlife, particularly on the fells, which include large areas of SSSI. Since 1995 a series of stepped negotiations between farmers and Natural England have achieved sustainable grazing levels through agri-environment schemes (ESA, HLS and Sheep Wildlife Enhancement Scheme SWES). The summer and winter sheep stocking density Maps 4 and 5 focus on the Lake District High Fells SAC but reflect these more sustainable grazing densities. As such they only cover the fell land and not the in-bye. Grazing levels have been tailored to individual fells according to the vegetation type present and the number of sheep this can support. For example blanket bog and montane heath support much lower levels of grazing. High levels of sheep grazing outside of the growing season can be particularly damaging to semi-natural vegetation and soils. SCaMP2 includes capital grant payments for off-wintering sheds for sheep (as well as lambing sheds to reduce risks to drinking water quality).

Farmer workshops for the pilot project highlighted the importance of achieving a balance between sustainable grazing levels and food production to maintain long-term viable farm businesses. Other services benefiting from reduced grazing levels, notably through an increase in vegetation as well as less soil compaction and erosion, include biodiversity, water quality, carbon storage/sequestration and flood regulation. The farmed landscape is an integral part of the cultural landscape including the dry-stone walls, barns and other farm buildings as well as the livestock themselves, especially the Lake District Herdwick sheep. The farmed landscape, local farm products and the experience of visiting a farm all contribute to the Lake District tourism experience.

Lowering of previously high grazing levels has allowed many habitats to recover, although in places further reductions in grazing levels would benefit other services such as carbon storage or soil erosion. Lower grazing levels can impact on the hill farming system including farm infrastructure and the “hefting” of flock grazing to particular fells. The challenge is to

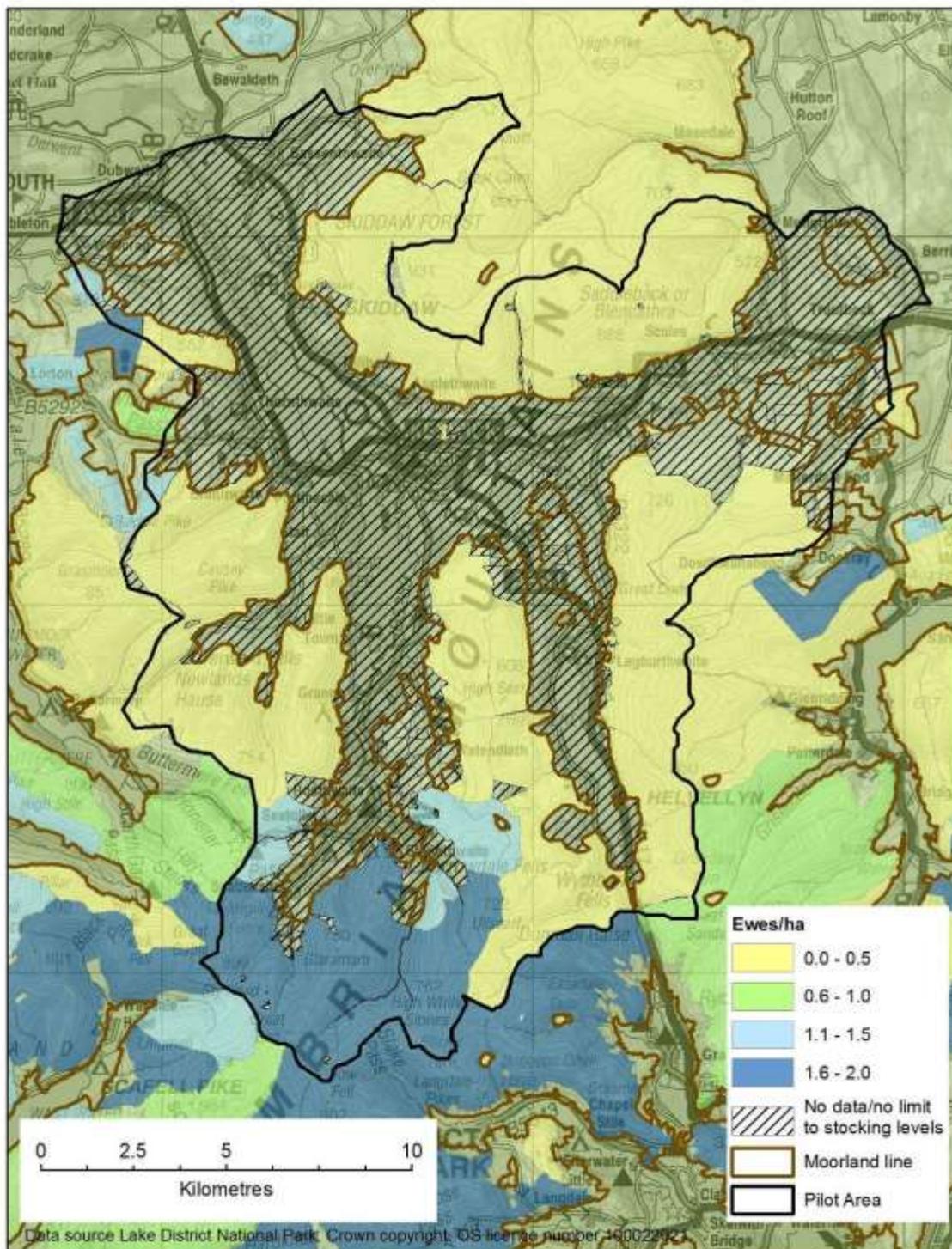
achieve the right balance for grazing levels that provide food and other public benefits as part of viable farm businesses.



**MAP 4**

*Note: Stocking densities are for ewes plus followers*

**Bassenthwaite Ecosystems Services Pilot**  
**Winter stocking levels on fells**

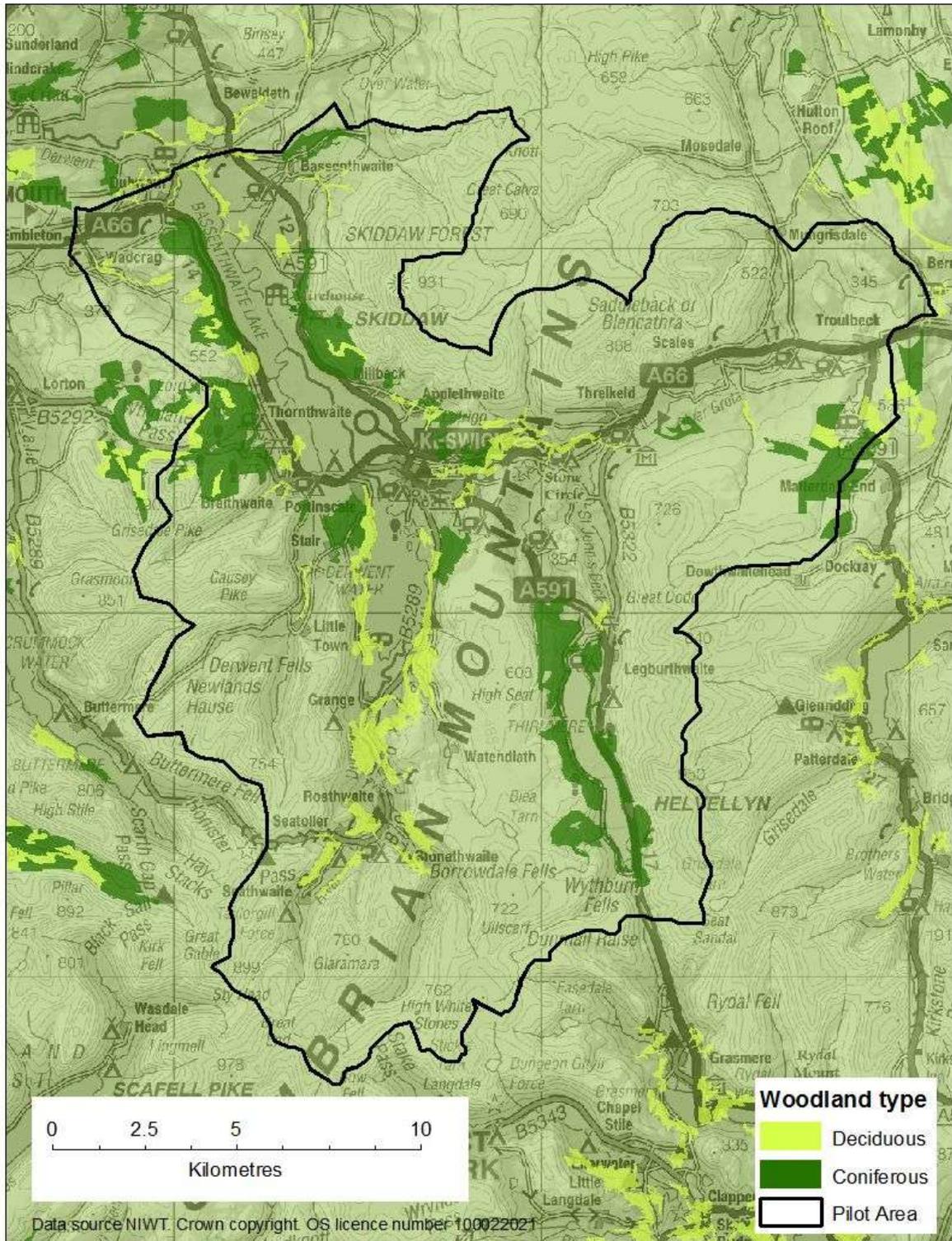


**MAP 5**

*Note: Stocking densities are for ewes plus followers*

# Timber:

## Bassenthwaite Ecosystems Services Pilot - Woodland over 10 ha



Map 6

Map 6, although showing the location of deciduous and conifer woodlands over 10 ha in the pilot area does not indicate current timber production. Bassenthwaite catchment has 1473ha of Forestry Commission owned land at Whinlatter, Dodd and Matterdale. A similar area of conifer woodland in the pilot area is in private ownership. Of the Forestry Commission land 991.2 ha is coniferous and 121.3ha broadleaved woodland, with additional areas of open land, felled areas, car parks etc. As an active partner in the BLRP, Forestry Commission manages about a third of these forests under a continuous cover management regime to reduce sediment run-off.

Forestry Commission felling periods for the productive conifers (reviewed every 5 years)

Felling year	Continuous cover	2007	2012	2017	2022	2027	2032	2037	2042	2047
		-11	-16	-21	-26	-31	-36	-41	-46	+
Area ha	342	49	85	111	59	30	73	44	32	166

The National Inventory of Woodland and Trees records 4016.92ha of woodland in the Bassenthwaite catchment (11% of the area). The majority of this is located in the valley bottoms and sides with only 171.58ha located above moorland line. Although over half of the catchment consists of unenclosed fell and fell allotments above the moorland line, less than 1% of this area currently supports woodland.

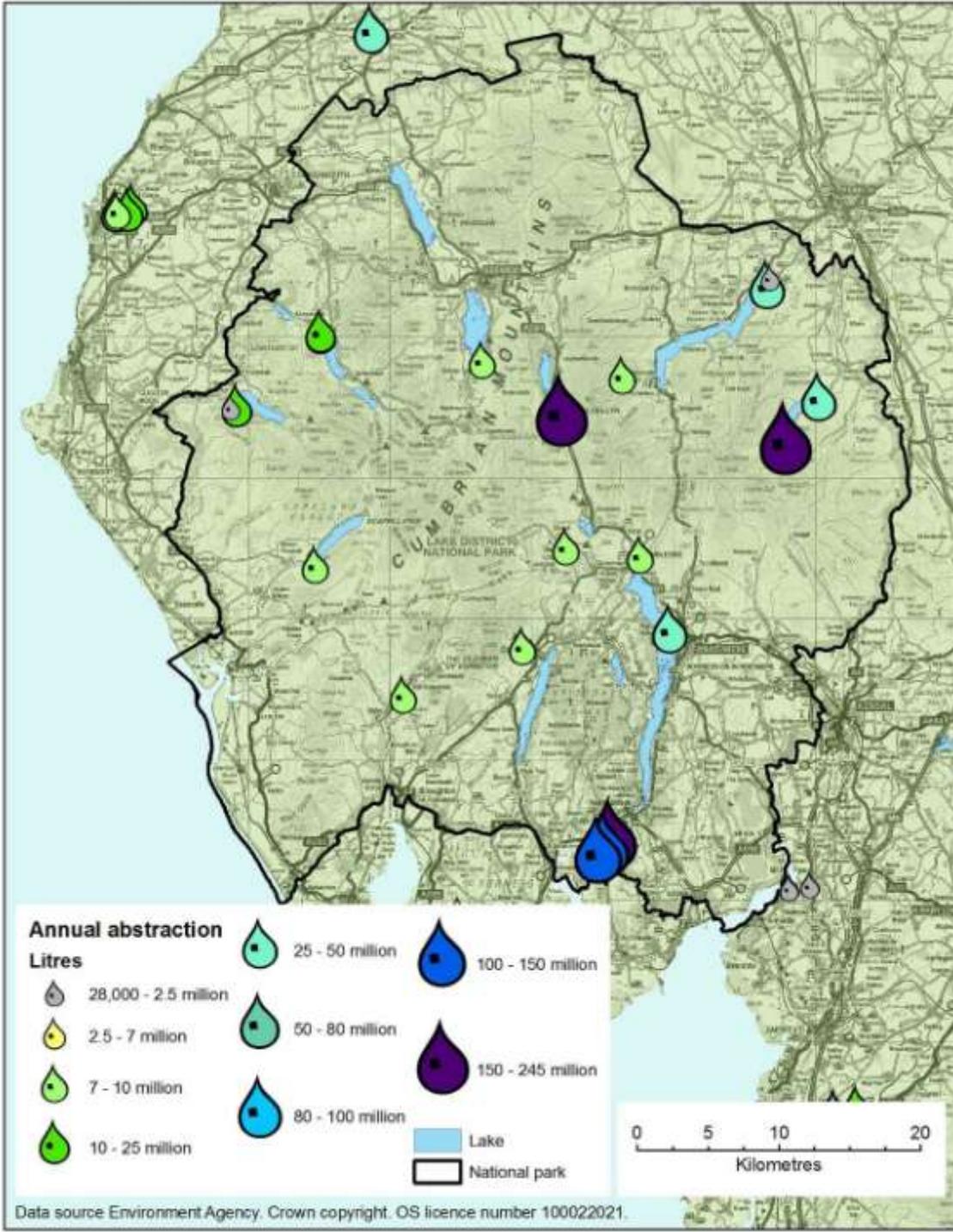
The large semi-natural woodlands of Borrowdale are one of the best and most extensive areas of Atlantic oak woodland in England. This prized woodland landscape can be appreciated from viewpoints such as the popular Surprise View. Map 6 does not identify potentially isolated small woodland fragments such as those in gills. It also does not show current management status or condition of woodland for timber, wood-fuel or nature conservation. Partner workshops identified the need to develop infrastructure and local markets for wood products, including wood-fuel. The importance of forestry skills for managing woodlands with poor accessibility was also raised.

In addition to timber and other wood products both coniferous and semi-natural woodlands provide a wide range of other public benefits. United Utilities owned conifer woodland around Thirlmere has recently been thinned to favour deciduous woodland and open habitats with landscape and biodiversity gains. Whinlatter has a visitor/education centre, including a web-cam for viewing the osprey, when on the nest, and popular mountain bike trails. New woodland creation provides major opportunities to deliver multiple benefits including reduced soil erosion, improvements to water quality and flood infiltration and resilience, carbon storage in trees and soils, biodiversity, habitat connectivity and cultural landscape. BLRP commissioned work by Forest Research and Lancaster University in 2005 to identify high, medium and low priority sites for woodland creation to address soil erosion (see *Soil Vulnerability under Regulating Services*).

Workshops for the pilot project identified that new woodland can potentially enhance a range of public benefits but needs to be carefully agreed with land managers and of a scale and location that works for an individual farm.

# Water

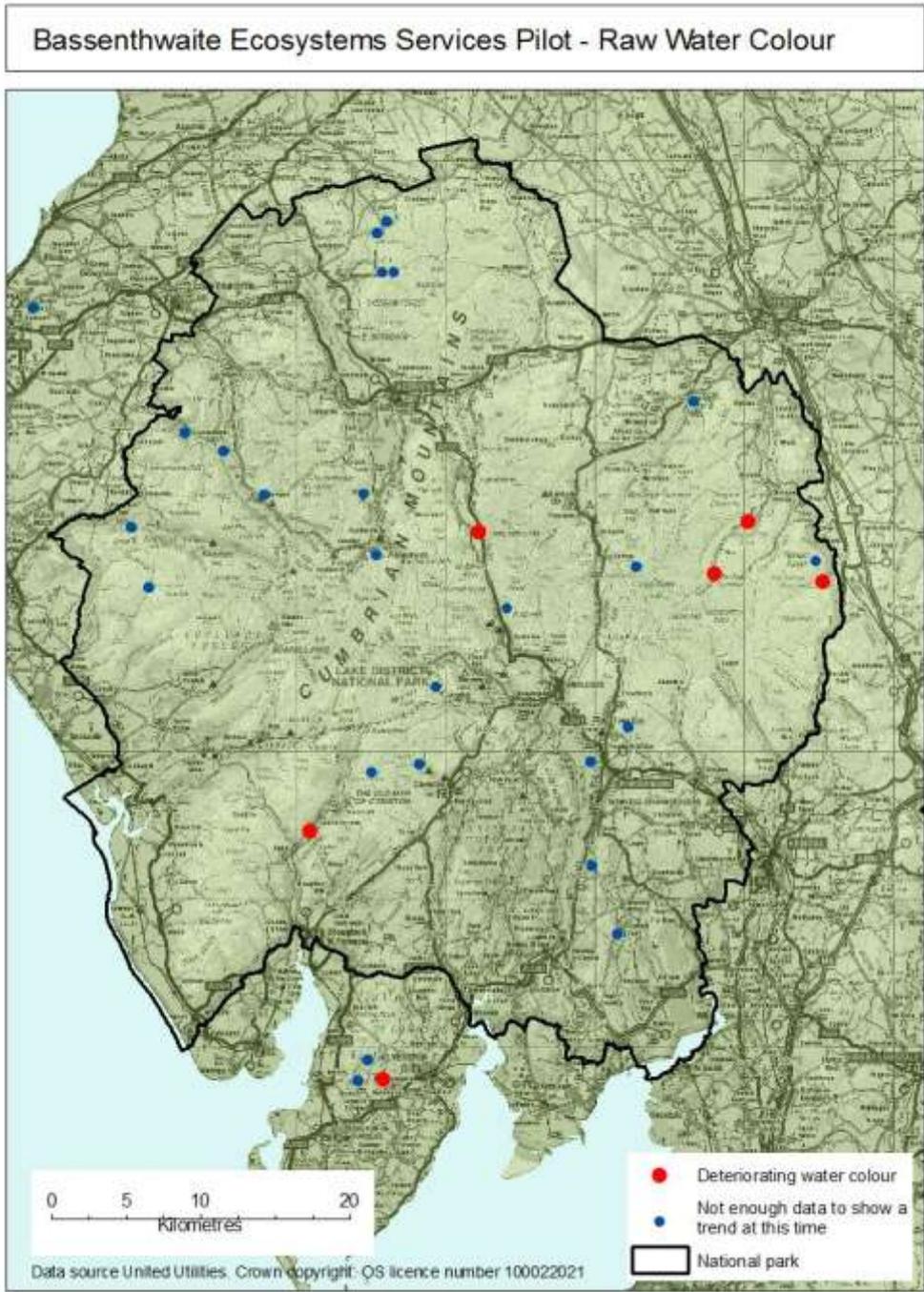
## Lake District National Park Ecosystems Services Pilot Water Abstraction



Map 7

The catchment is a major provider of drinking water for the region. Bassenthwaite Vital Uplands project area includes the entire SCaMP2 area of the United Utilities' owned

catchments of Thirlmere plus Haweswater (Eden catchment) for the delivery part of the project. Thirlmere and Haweswater reservoirs supply public drinking water to Greater Manchester as part of United Utilities Integrated Resource Zone covering South Cumbria, Lancashire, Greater Manchester, Merseyside and most of Cheshire. The Integrated Resource Zone provides 1800MI/day of water to 95% (6.5M people) of the region's population. A third of this is provided by Cumbrian sources, principally Thirlmere, Haweswater and Windermere.



Map 8

The quantity of water available is determined by rainfall and UU's management of the supply, in accordance with their Water Resources Management Plan. As recognised through SCaMP2, the management of the catchment is particularly important in its impact on water quality. The water abstraction map therefore needs to be considered in conjunction with the raw water colour map.

Upland catchments provide significant challenges for the provision of acceptable drinking water quality. Colour, due to particulate organic matter, is a critical factor for supplies originating from peatlands. Removal of colour from water is expensive and SCaMP therefore aims to reduce the amount of colour being produced by the catchment. This management also delivers the other key SCaMP objectives of enhancements to carbon storage and sequestration, as well as biodiversity. Therefore SCaMP is an excellent example of delivering multiple benefits through ecosystem/habitat management. This is being delivered in conjunction with food production and as part of farm management supported by agri-environment schemes.

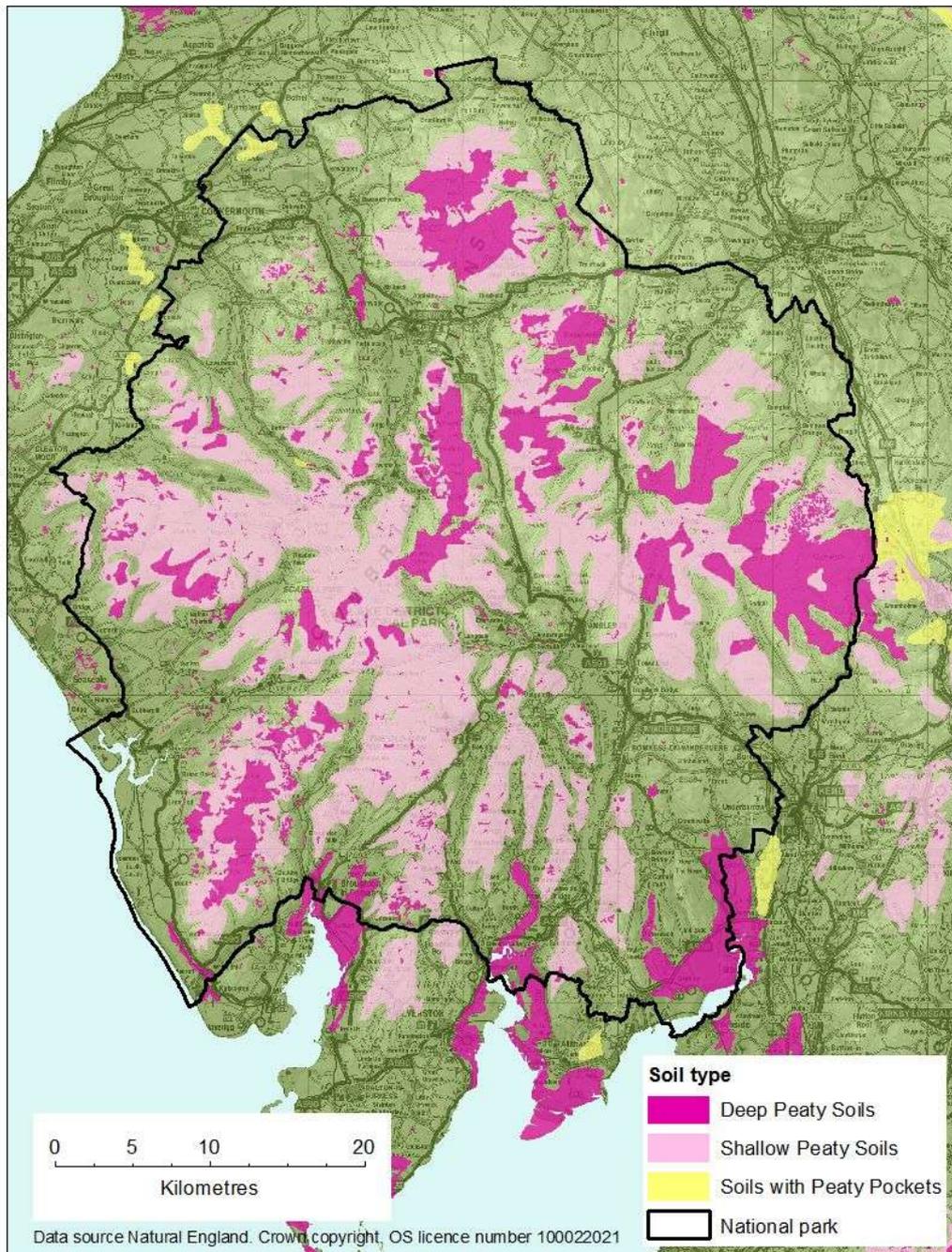
## **5. Regulating services**

Regulating services are the benefits that people obtain from the control of natural processes such as air quality regulation, climate regulation, flood regulation, erosion control, water purification and waste treatment, disease control, pest control, pollination and natural hazard regulation. Partners have identified the key regulating services for the Bassenthwaite pilot as climate regulation, flood regulation, erosion control and water quality (water purification and waste treatment).

### **Climate Regulation**

In recent decades levels of carbon dioxide and other green house gases, contributing to climate change, have risen. Soils and vegetation can help to store carbon and sequester further carbon dioxide from the atmosphere. Map 9 showing deep and shallow peat soils is a proxy indication of carbon storage in the catchment. This does not take into account carbon stored in trees, vegetation and other soils. Intact upland peat bogs with a high water table can sequester atmospheric carbon. It has been calculated that the peat soils of the Lake District National Park store 28 million tonnes of carbon. When viewed with Map10 for the Lake District as a whole, the comparatively large amount of deep and shallow peat soils in the pilot area is evident. Within the Bassenthwaite catchment, the large areas of peat soils on Armbboth Fell and the Skiddaw Massif are notable.

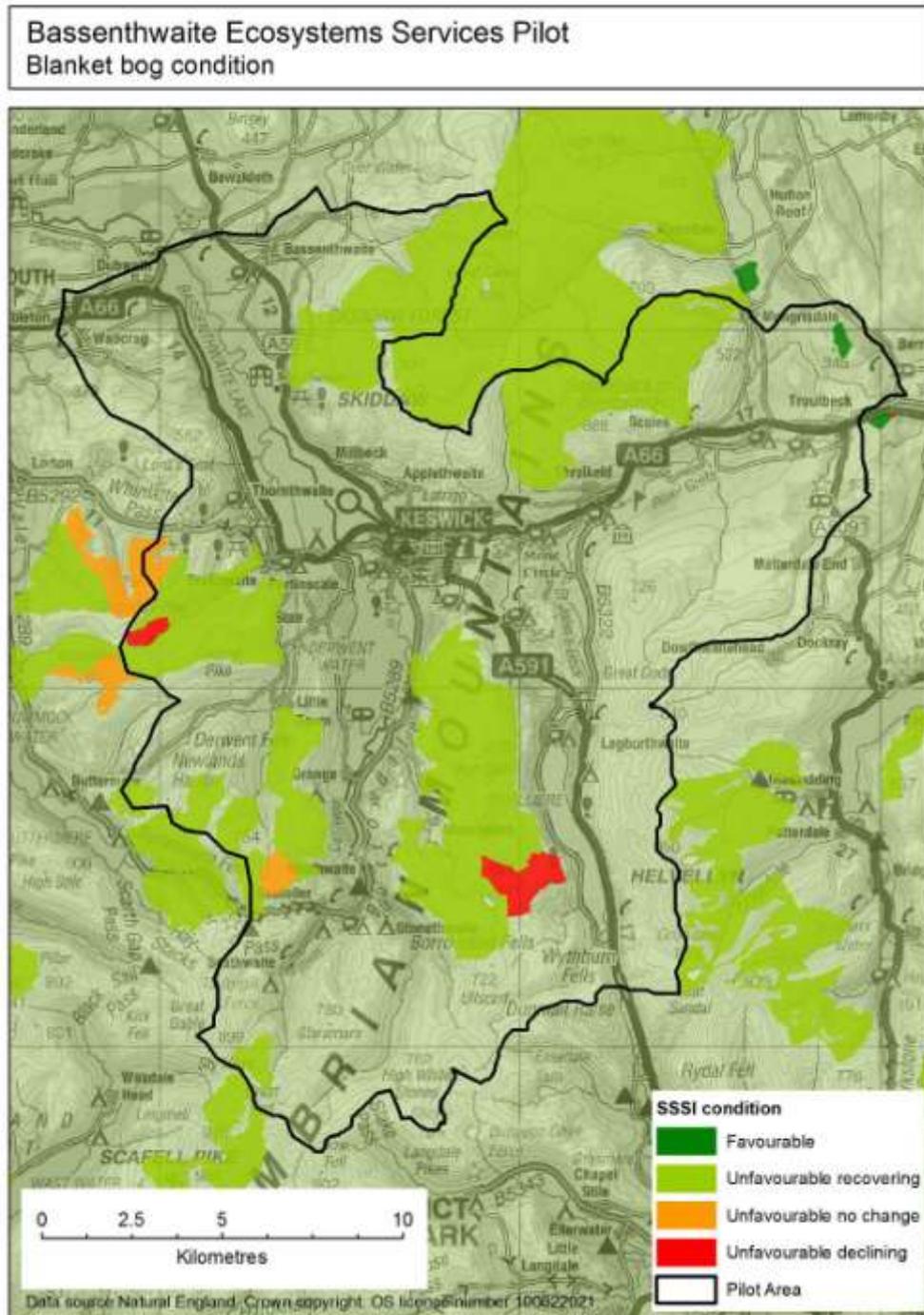
## Bassenthwaite Ecosystems Services Pilot - Peat soils



**Map 9**

The Peat Soils Maps 9 and 10 do not indicate condition of peat soils; drying and exposed peat soils release the carbon previously stored. The majority of the peatland SSSI units within the Bassenthwaite catchment are in unfavourable recovering condition due to past management, particularly heavy grazing. This indicates that they are currently likely to be losing carbon but management is in place to enable habitat recovery. Carbon loss should therefore cease over time as peat forming conditions re-establish and carbon is

sequestered. However it may take a long time and in places require further reductions in grazing, before peat habitats and soils fully recover.



**Map 10**

Compared to other areas in northern England a small proportion of the peat soils of the Bassenthwaite catchment have been drained by gripping. Drainage of bogs dries out the bog surface, resulting in decomposition and loss of carbon both to the atmosphere and water courses. Around 200 hectares of Skiddaw Forest spanning the watershed of Dash Beck (Bassenthwaite) and the River Caldew (Eden catchment) have been gripped on

Candleseaves Mire. Since 1995 a range of innovative techniques have been trialled in a continuous annual programme of grip blocking, the results of which are monitored by Durham University.

The peat soil and blanket bog condition maps are also linked to biodiversity as well as soil erosion, flood regulation, water quality (including water colour of drinking water) and consequently water based recreation, notably angling.

## Flood Regulation



Map 11

The flood risk map indicates the extent of a flood with a 1% (1 in 100) or greater chance of happening each year. This shows the limited amount of flat low lying ground in the valley bottoms. With high levels of rainfall (Borrowdale is the wettest place in England) and steep valley sides, water run-off from the fells is very rapid. Situated on the low lying ground between the two lakes, parts of Keswick are within the 1% flood risk zone as are a number of smaller settlements. The extreme floods of November 2009 were a 0.1% chance event that resulted in damage to houses, bridges, roads and farmland, through re-alignment of rivers and large deposits of sediment on fields.

Although this map shows the chance of flooding it does not show the role of the catchment for generating or ameliorating floods. The EA's Catchment Flood Management Plan identifies the preferred option for the River Derwent system upstream of Keswick as being to increase flooding of land, through re-establishment of the hydrological linkage between the river and flood plain, to alleviate flooding locally or elsewhere in the catchment. Hydrological modelling, commissioned by the pilot project with Cumbria Woodlands, Environment Agency and Forest Research, is assessing whether land management in the catchment (particularly woodland creation) could reduce the risk of downstream flooding.

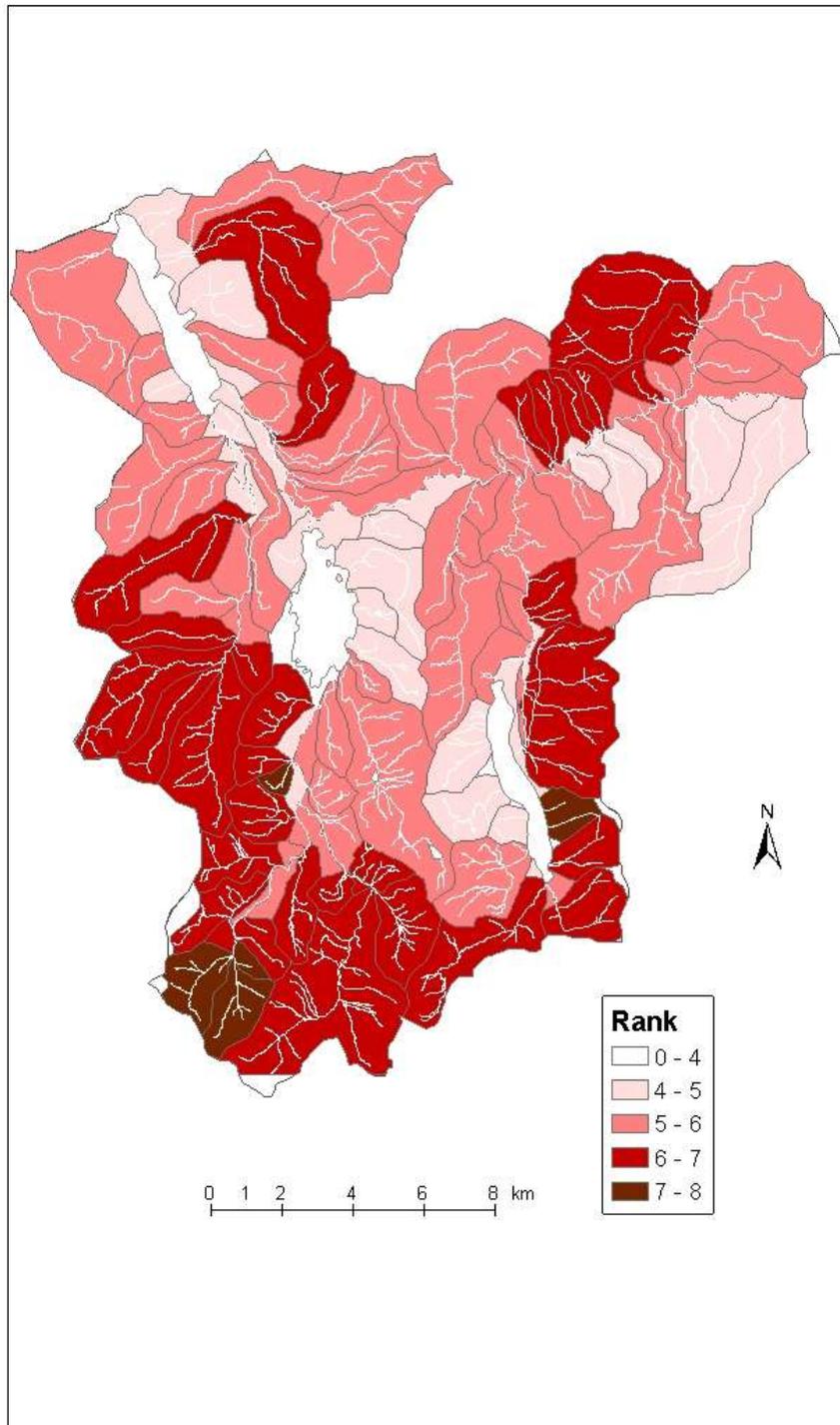
Partner workshops also identified the current opportunity to demonstrate the role of catchment management in increasing resilience to flood events and the need for an evaluation of this in relation to the costs of repairing flood damage. It is critical however to be realistic, with such high rainfall and steep valley sides, about the contribution catchment management can make in relation to the flood alleviation of places like Keswick. However catchment management may have a more significant role to play in the reduction of soil erosion, sediment transport and deposition during flood events.

The November 2009 floods showed the high risk of damage to inbye land through realignment of water courses and gravel deposition. Many of the water courses in the Bassenthwaite catchment have had their course modified in the past to maximise the availability of the prime agricultural land. A joint EA/NE River Restoration Strategy has been produced (April 2010) for the River Derwent and Tributaries SSSI, which includes the main tributaries of Bassenthwaite Lake. Linking to this initiative, workshops cited the need for a pilot site to demonstrate the potential multiple benefits of river restoration

Map 11 highlights that much of low lying land with 1% chance of flooding is prime agricultural land located on the fine loam soils of the flood-plain. It is critical that any management to make the catchment more resilient to flood events is a viable land management option for farmers in terms of cost, stock management, access and ongoing maintenance. The Borrowdale Whole Valley Planning Group of farmers, community and other key stake holders, has commissioned a gravel management plan to help plan how the impacts of flooding can be addressed in the short, medium and longer term.

In addition to links to food provision, catchment management to alleviate flood risk also potentially reduces soil erosion with improvements in water quality and consequent enhancement of freshwater habitat biodiversity and water based recreation, notably fishing.

## Erosion Control

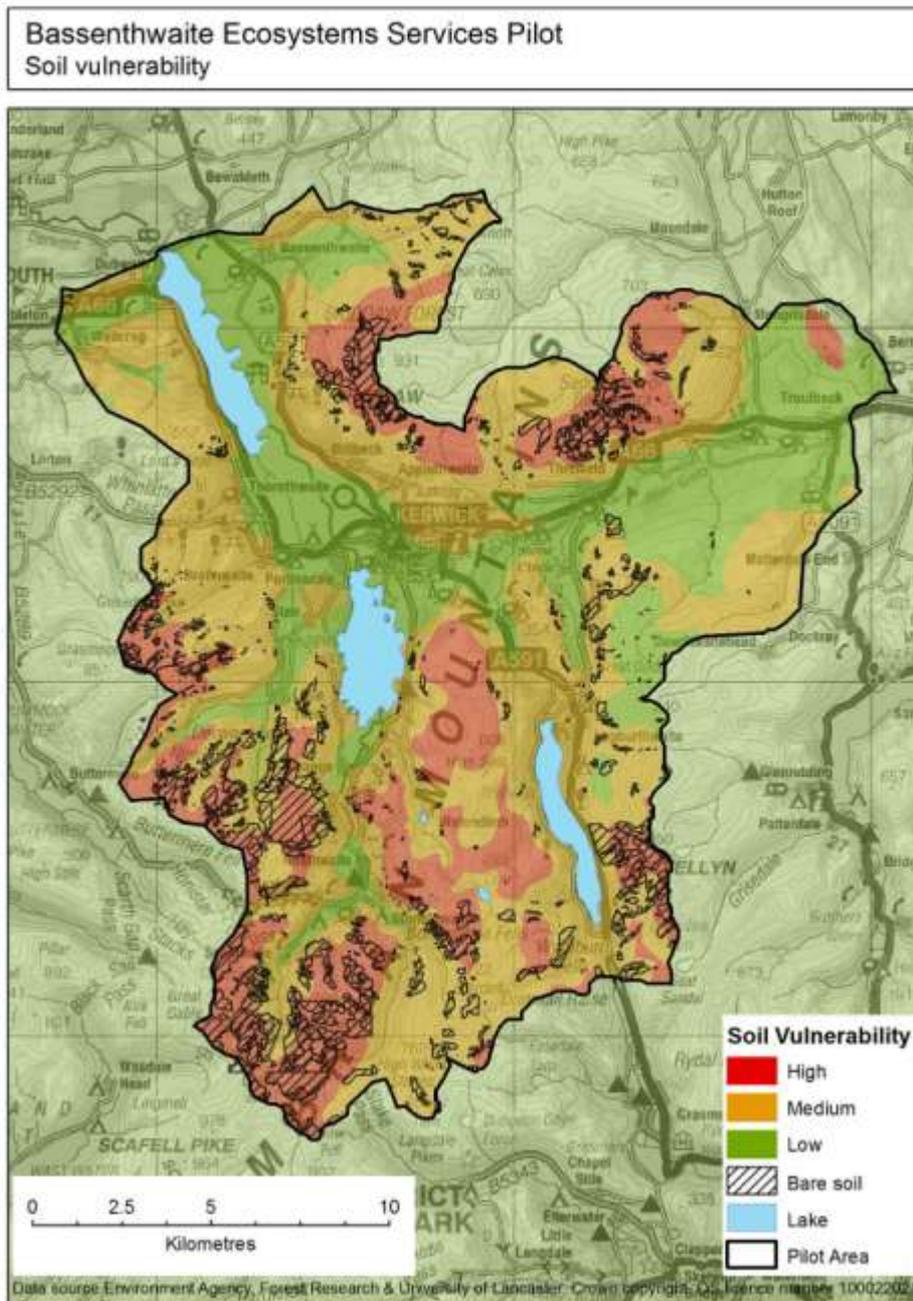


**Map 12** Sediment supply risk ratings for the Bassenthwaite sub catchments from Orr et al. 2004.

Rates of sedimentation in Bassenthwaite Lake have progressively increased since 1900 with current rates double those occurring at that time. This has multiple adverse effects in addition to loss of soil cover, including sedimentation and capacity loss in lakes and reservoirs, loss of soil carbon, damage to fish spawning sites and increased damage by

flood events. Sedimentation is largely due to erosion of mineral soils from the catchment. However sediment management in the catchment is complex and difficult due to occasional high input during extreme weather events.

The sediment source risk Map 13 shows areas of high potential for erosion identified using a modelled approach based on consideration of soil structure and hydrological properties. In combination with analysis of slope and vegetation cover, locations with potential to act as sources of sediment have been identified and ranked (with 8 as highest risk). The greatest potential sediment sources are patches of eroded ground on the high fells.



**Map 13** based on EA and Forestry Commission funded work undertaken by Forest Research and Lancaster University.

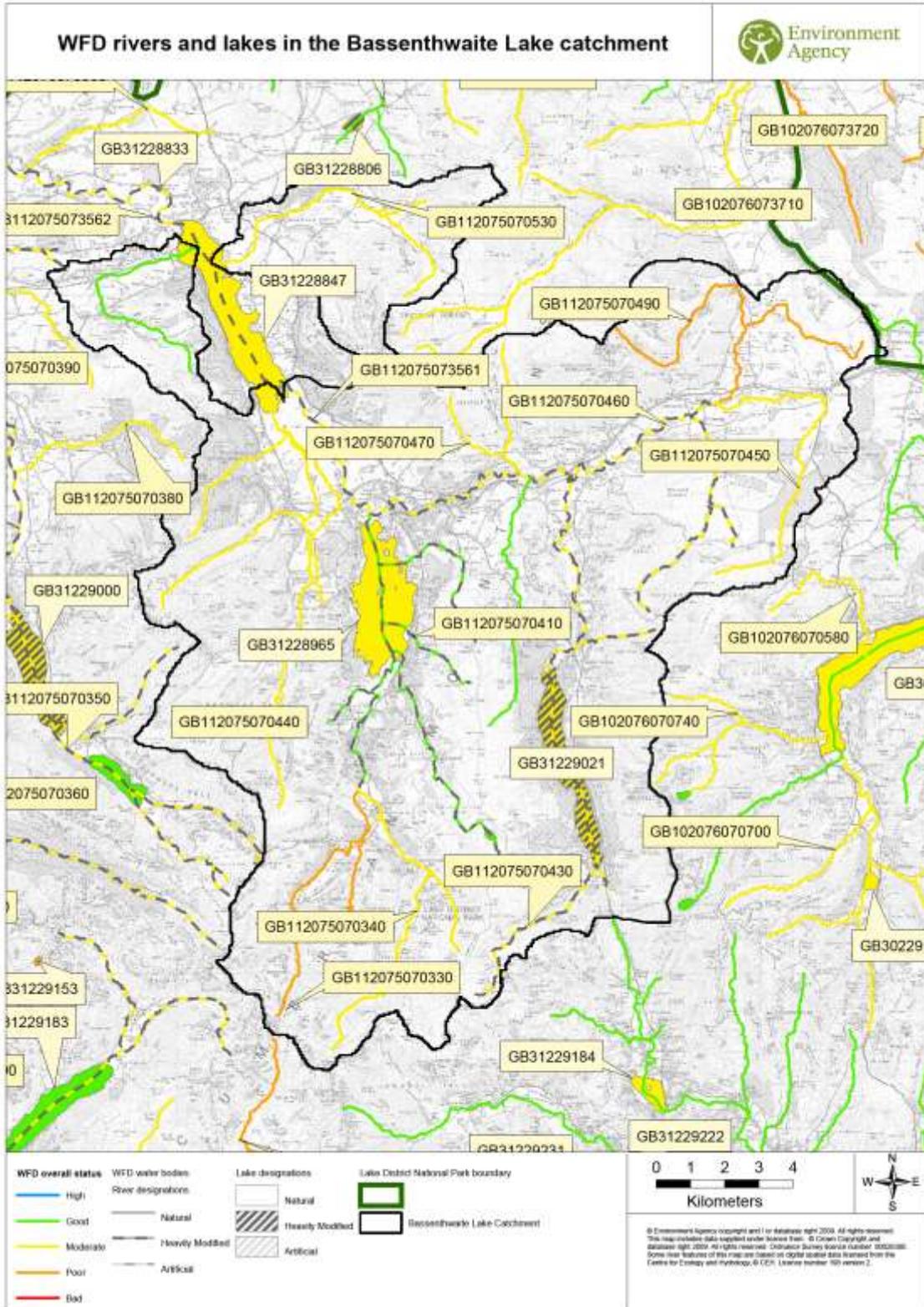
The Forest Research and Lancaster University 2005 map based project used aerial photos, National soil map, Lancaster University's fluvial audit and EA digital maps of predicted erosion vulnerability and sediment delivery to water courses for 1 in 10 flood chance, to identify where woodland planting could help to reduce soil erosion. The map shows that 20-25% of the catchment, notably the hill tops and upper slopes, support soils at high risk of eroding. An additional 40-50% of the catchment has been identified as being at moderate risk of soil erosion while in total 1224ha of bare ground were mapped. Two thirds of the bare ground is associated with two soil types, with the most vulnerable soils being the peaty rankers on the fell tops. This project identified the main pressures as being overgrazing and human trampling.

The areas with highest risk of soil erosion are located on the highest ground where woodland is scarce (less than 1% of land above the moorland line). A case therefore exists to expand woodland on the fells, particularly on previous woodland sites such as bracken beds and gills.

The Lancaster University geomorphological assessment of the catchment also produced maps of river bank erosion and riparian vulnerability. These have been used by the BLRP River Corridor Group to target river habitat improvement schemes. These maps are not included here due to significant changes in river bank erosion since the November 2009 flood event.

Erosion risk, and its link to water quality, affects drinking water supplies, carbon storage in soils, freshwater biodiversity and angling as well impacting on the cultural landscape through erosion scars. Siltation on spawning beds of the white fish vendace, previously only recorded in Bassenthwaite Lake and Derwent Water in England, has significantly contributed to the loss of this species from the lake. Through the work promoting alleviation of soil erosion risk through woodland planting, benefits can also be provided to biodiversity, habitat connectivity, timber and wood fuel, carbon storage in woodland, flood management and the cultural heritage of past woodland sites.

# Water Quality (water purification and waste treatment)



**Map 14** Water Framework Directive status of water bodies Copyright Environment Agency 2010

The Water Framework Directive map shows the status of water courses/bodies in the Bassenthwaite catchment. The Water Framework Directive (WFD) sets a target of aiming to achieve at least good status (both ecological and chemical) by 2015. However, provided certain conditions are satisfied, in some cases the achievement of good status may be delayed until 2021 or 2027. Those water bodies with moderate, poor or bad status currently fail to meet the requirements of the Directive. The WFD status is based on a series of ecological, chemical and physical attributes or “elements” and water bodies have been assessed by the EA according to standard WFD methodologies for each individual element. Failure on any individual element results in failure of that water body. See Appendix A for water bodies in the Bassenthwaite catchment with failing elements. The EA have a continuing process of validation and refinement of the monitoring data.

In the Bassenthwaite catchment, fish is the most frequent failing element for rivers and becks followed by specific pollutants and pH, although it should be noted that the fish data requires further refinement. Bassenthwaite Lake and Derwent Water are of moderate status due to dissolved oxygen, phytoplankton and total phosphorus, for Bassenthwaite and dissolved oxygen for Derwent Water.

The WFD map shows the status of water bodies but does not attribute cause of failure. The Environment Agency is currently working to collate a record of the reasons for failure for each water body. This will help the Environment Agency and co-deliverers to target remedial actions and identify further investigative needs. Failure due to point source pollution or mine discharges (likely to be the source of specific pollutants) are outside the scope of this project.

In many instances, including Bassenthwaite Lake, pollution is due to a combination of both point sources, both large and small (septic tanks etc.) and diffuse pollution from agriculture. The WFD River Basin Management Plan identifies that all the failing water courses are also at risk of sedimentation while the Rivers Greta and Glenderamackin are at risk from diffuse sources of phosphorus. The Phosphorus Soil Yield Characterisation in Catchment (PSYCHIC) model has been applied to the catchment several times. This shows a concentration of total phosphorus sources in the in by land of the floodplains.

Since 2005 Bassenthwaite Catchment has been included in the English Catchment Sensitive Farming Initiative to reduce diffuse pollution from agriculture. The CSF scheme has provided advice to over 90 farms including soil and manure analysis, infrastructure and slurry handling reports as well as nutrient and manure management plans. Grants have also been provided for capital items, such as roofs for slurry and muck stores, to address diffuse pollution from agriculture.

## 6. Cultural services

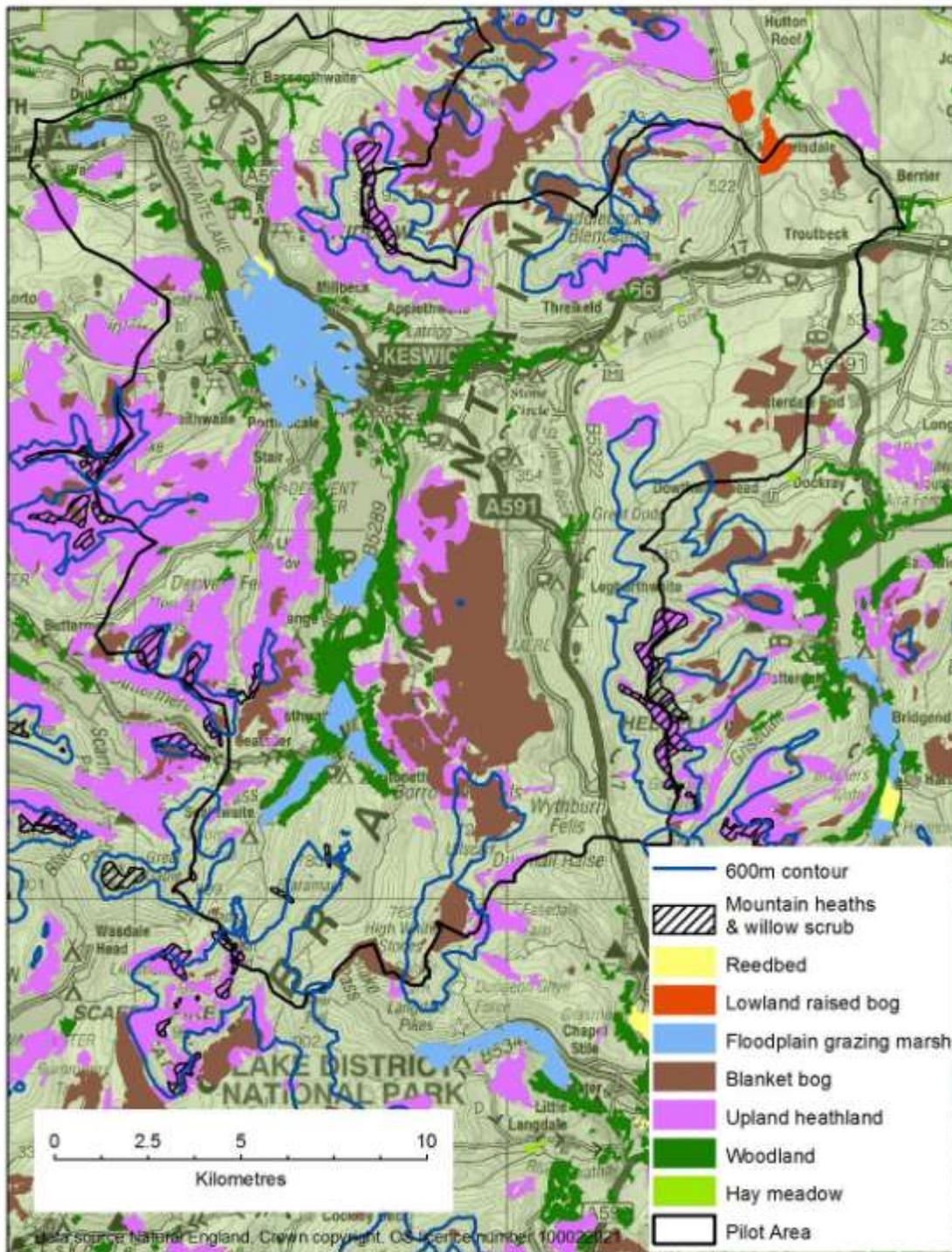
Cultural services are the non-material benefits that people gain from the natural environment. These include: a wildlife-rich environment, inspiration through contact with landscape, mental and physical health, recreation and tourism, knowledge (traditional and formal), education, spiritual and religious values, aesthetic values, social relations, sense of place and cultural heritage. However cultural benefits, especially to individuals are difficult to portray in map form. Maps are more useful where the importance of these benefits to society is recognised through the designation for example of Sites of Special Scientific Interest, Scheduled Monuments or national parks. More difficult is expression in map form of benefits such as inspiration, community development and sense of place. The maps included aim to capture a spread of the more tangible cultural services provided by the Bassenthwaite catchment.

### Wildlife-rich Environment

The Bassenthwaite catchment supports large tracts of remaining semi-natural habitats from the lakes, rivers and wetlands of the valleys to the fell tops. Centuries of human management by grazing, cutting, drainage and burning have altered the original vegetation of predominantly blanket bog and woodland to a mixture that includes grasslands and heath with residual amounts of semi-natural woodland. The majority of this woodland is located on valley sides and bottoms with a few isolated sites on the fells. The 600m contour on the map depicts the potential altitudinal tree line although this would vary locally with aspect and soil type. Woodland towards its altitudinal limit would consist of low growing scattered scrub. Above the limit of tree growth, montane areas support areas of mountain heath and willow scrub, which are naturally limited in their extent and particularly vulnerable to overgrazing and trampling, including by walkers. A scattering of small species rich grasslands, including hay meadows, remain in the valleys.

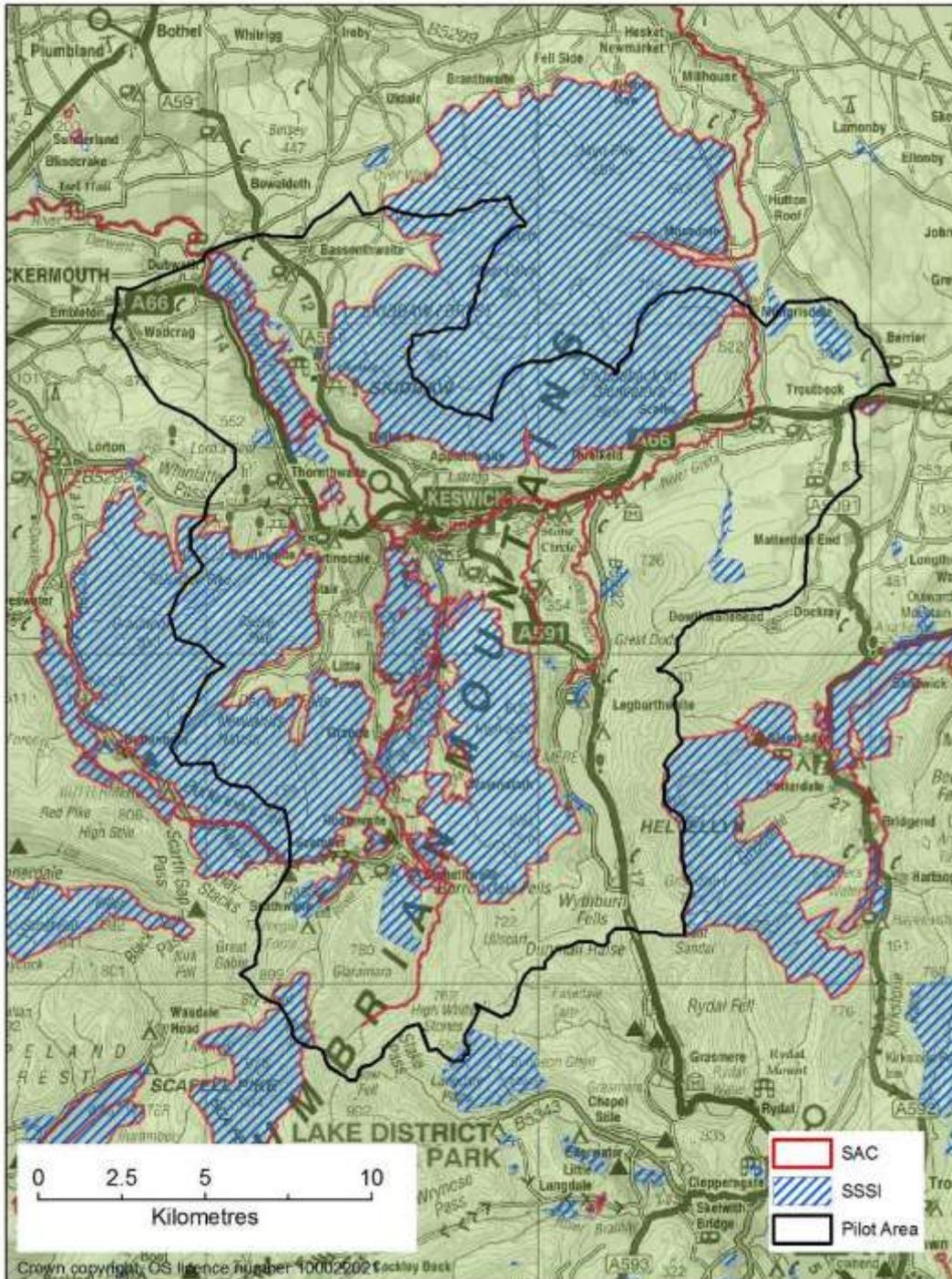
Although identifying locations of different habitat types, Map 15 does not consider habitat condition, or inform any management changes required. See Appendix B for a list of UK Biodiversity Action Plan (BAP) habitats and species in the Bassenthwaite catchment.

Bassenthwaite Ecosystems Services Pilot  
Biodiversity



Map 15 Biodiversity: Broad Habitats

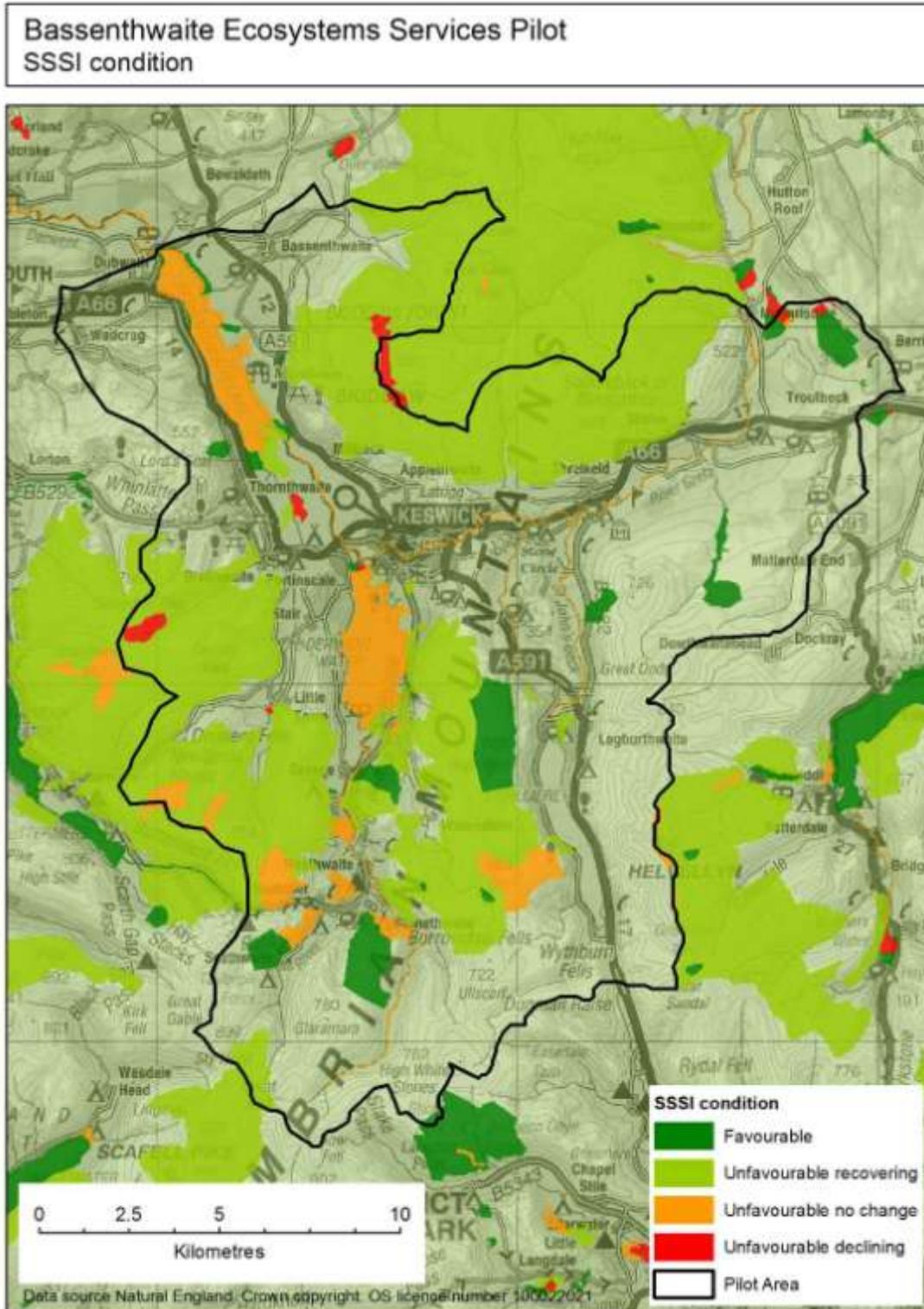
## Bassenthwaite Ecosystems Services Pilot - Designated Areas



**Map 16**

A high proportion (30% or 10,683 ha) of the Bassenthwaite catchment is recognised as being of international importance for nature conservation through its designation as Special Area of Conservation (SAC), with Borrowdale Woodland Complex, Lake District High Fells and River Derwent and Bassenthwaite Lake as the key sites. 560 ha of Bassenthwaite Lake and its surrounding wetlands are designated as a National Nature Reserve, managed by the

Lake District National Park Authority. Additional areas of Site of Special Scientific Interest (SSSI) not notified as SAC, constitute a further 6% (2200 ha) of the catchment. These include the lowland raised mire habitat of Mungrisdale Mires SSSI as well as geological sites such as Barf and Thornthwaite SSSI.



Map 17

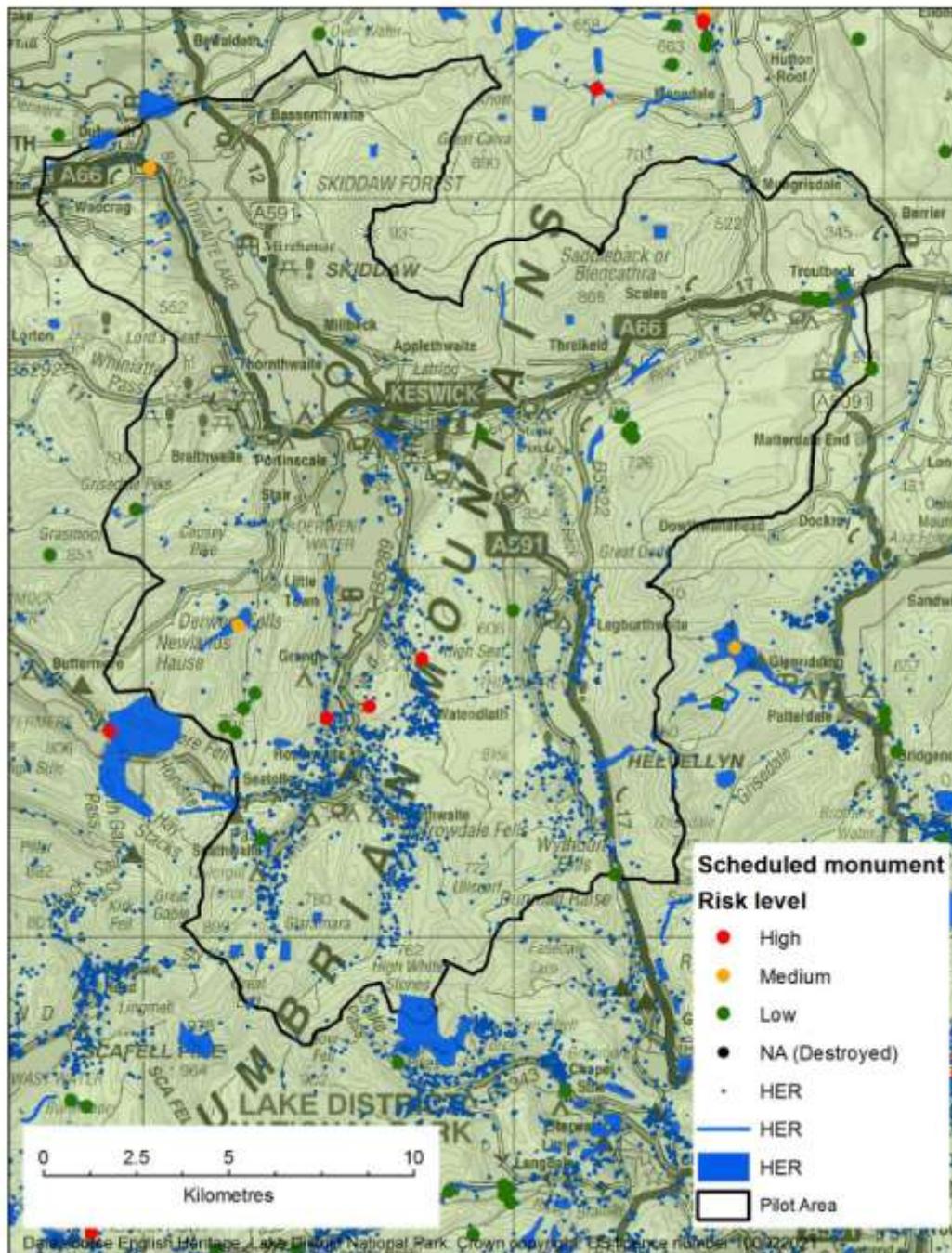
The SSSI condition map (Map 17) indicates the condition of those habitats notified as SSSI. A large proportion of sites are in *unfavourable recovering* condition where the unit is not yet in favourable condition but appropriate management is in place for the habitat to recover. Those sites in *unfavourable no change or declining* condition include the mountain heath and willow scrub communities of the popular summit plateaux and areas of blanket bog where trampling pressure and grazing levels are not sufficiently low for these sensitive communities to recover. Other units in unfavourable condition include some woodlands and the two main lakes where multiple pressures include the invasive aquatic species *Crassula helmsii* as well as nutrient and sediment levels in Bassenthwaite.

Biodiversity is included within the cultural services due to the benefits to people of a wildlife-rich landscape. Biodiversity and designated sites (as the best examples of the biodiversity occurring within the catchment) help to underpin the full suite of other ecosystem services (see figure 1).

Biodiversity is included within the cultural services due to the benefits to people of a wildlife-rich landscape. Biodiversity and designated sites (as the best examples of the biodiversity occurring within the catchment) help to underpin the full suite of other ecosystem services (see figure 1).

## Cultural Heritage

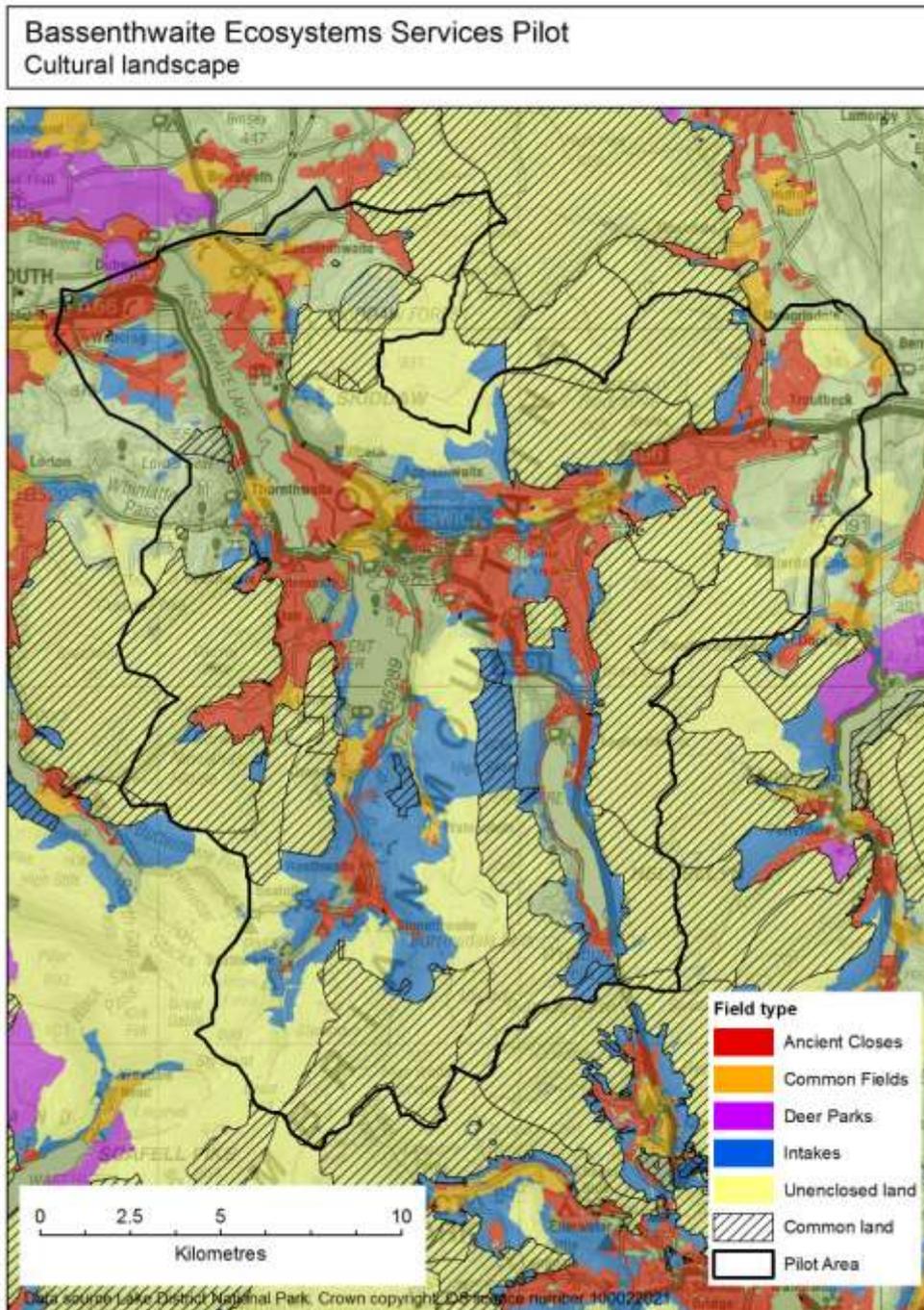
### Bassenthwaite Ecosystems Services Pilot Historic environment



Map 18

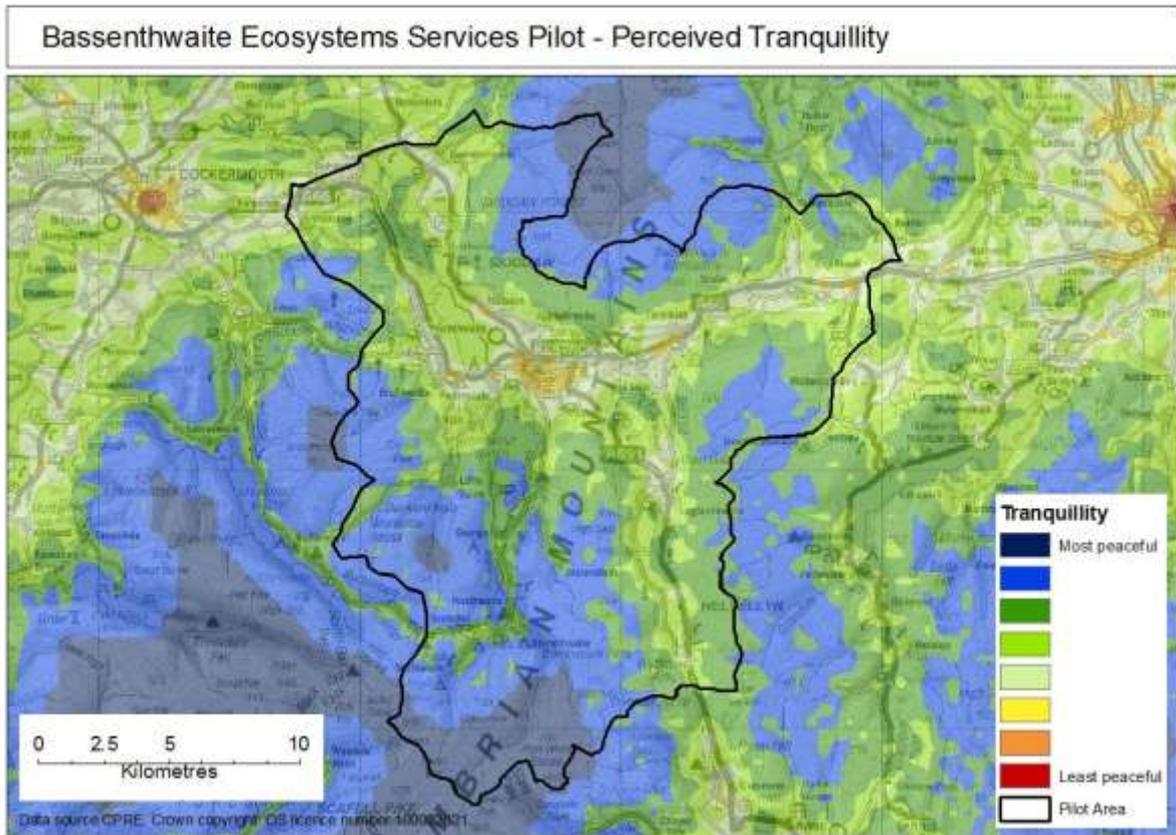
The historical environment is comparatively well preserved by the semi-natural habitats of the Bassenthwaite catchment. It supports a large number of Scheduled Monuments (28 see Appendix C) and a high density of Historic Environment Records. The risk level identifies the condition of the Scheduled Monuments, with the key risk in upland areas being

overgrazing and soil compaction but also undergrazing and scrub/bracken encroachment. The field pattern, shown in Map 19, provides a record of land enclosure and the changes in historical farming practices, which contribute to people’s “sense of place” of the Bassenthwaite catchment. The common fields are a remnant of medieval farming practices in the valley bottoms whilst the intakes are a legacy of the enclosure of fell edge land, largely during the 16<sup>th</sup> to 18<sup>th</sup> century. Cumbria is notable for its common grazing land remaining on the fells and the Bassenthwaite catchment has significantly large amounts (38%). The historical environment is a critical component of the cultural landscape in terms of the tourism industry, education and the less tangible benefits of inspiration and sense of place.



**Map 19 Cultural Services: Historic Landscapes**

## Tranquillity



**Map 20**

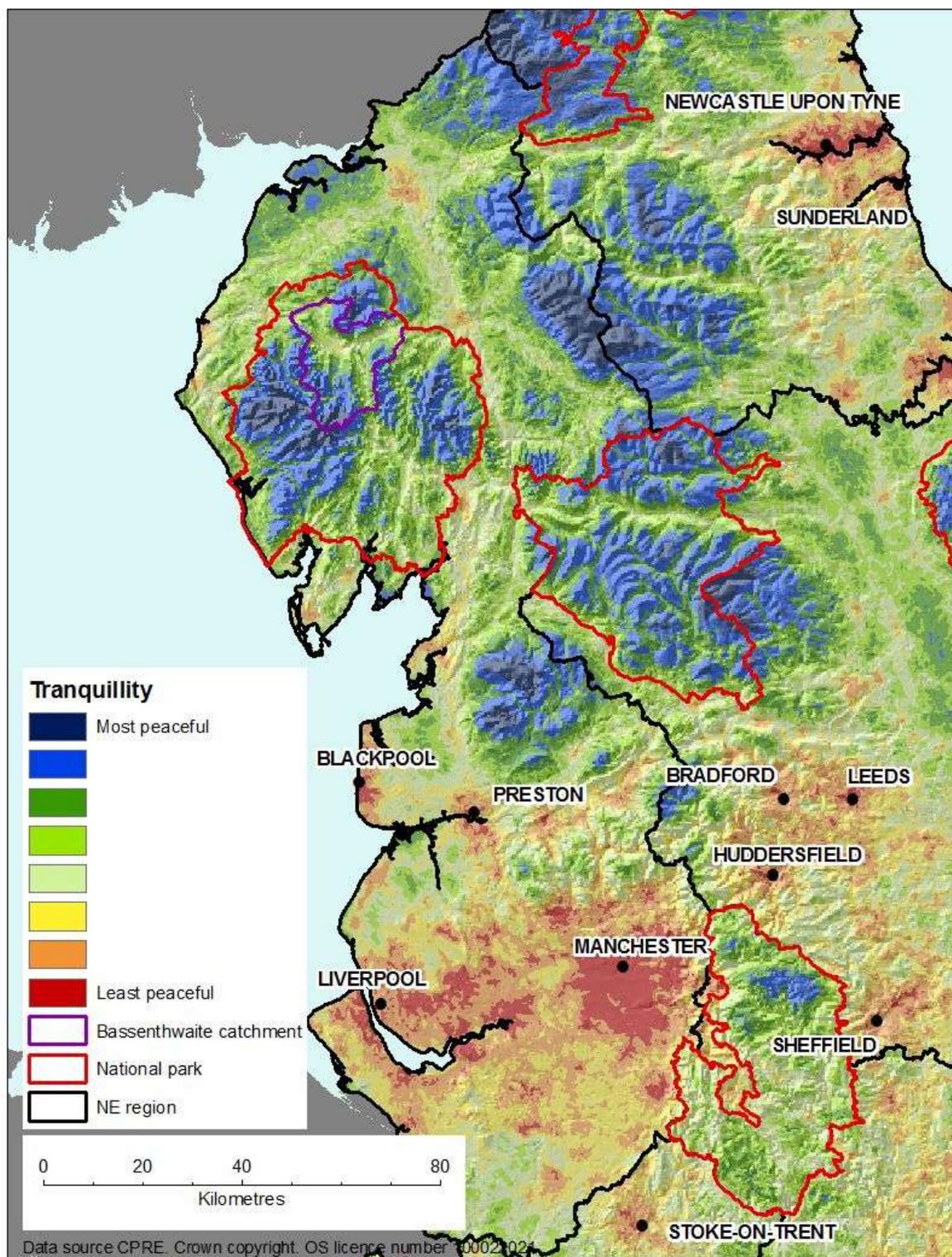
Both mental and physical health benefits are gained through visits to the quietest and most physically challenging areas. Map 20 shows the distribution of tranquillity within the pilot area based upon analysis of largely auditory and visual parameters. The Borrowdale, Skiddaw and Buttermere fells are amongst the most peaceful areas within the catchment and nationally. The tourism hub of Keswick and part of the A66 are the least peaceful parts.

Cultural services are comparatively difficult to portray on maps. Perceived tranquillity however is important for a number of cultural services including tourism and recreation, health, inspiration through contact with the landscape, aesthetic and spiritual values and sense of place.

Access to the natural environment has the potential to significantly benefit mental health including reducing levels of stress and anxiety, relieving symptoms of depression and dementia as well as improving self-esteem and mood.

The regional perceived tranquillity Map 21 shows the peaceful upland areas in relation to the conurbations of Liverpool, Manchester and the south of the region in general. It also depicts the comparatively less tranquil Cumbrian West Coast and its proximity to the Lake District.

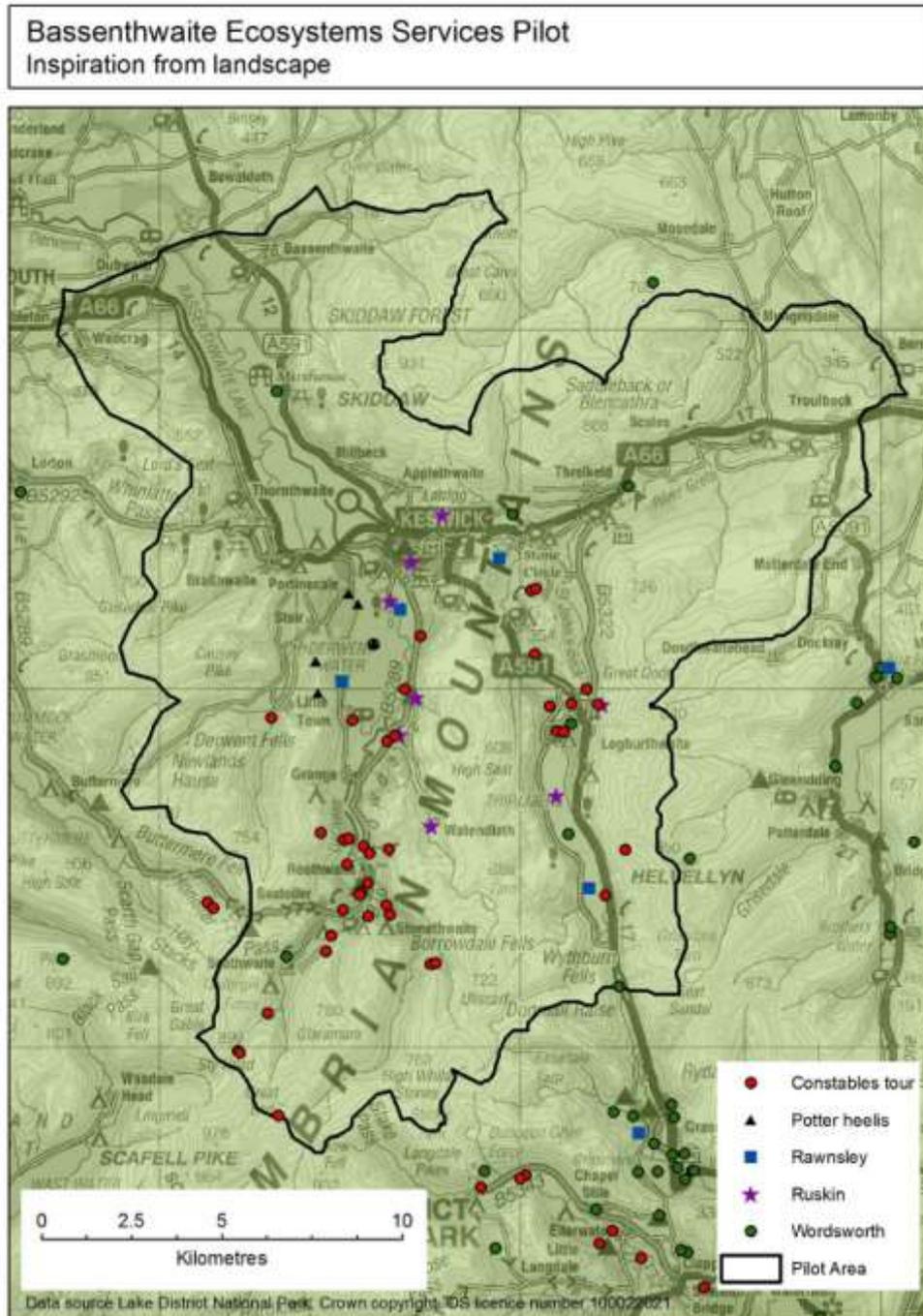
# Bassenthwaite Ecosystems Services Pilot - Perceived Tranquillity



Map 21

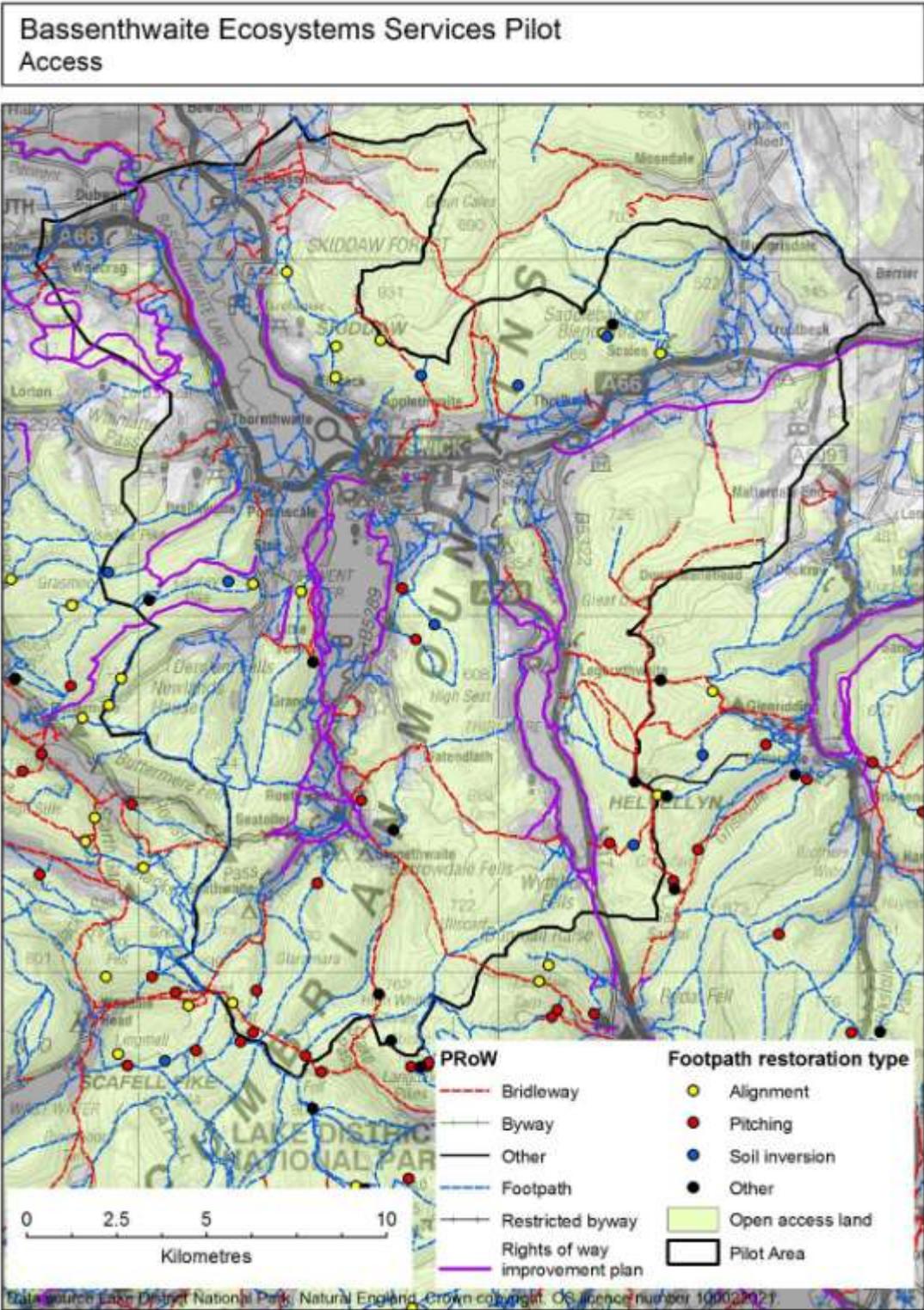
## Inspiration from Landscape

The inspiration that people received from contact with the landscape is difficult to portray in a map form. Map 22 shows the sites of inspirational importance to the romantic poets and other artists in the Lake District. These sites of artistic significance can also help to inspire other people as well as being the key attractions for cultural tourists to the Lake District.



Map 22

# Recreation and Tourism



Map 23

The access map, Map 23, shows not only rights of way but also Countryside and Rights of Way (CROW) open access areas. The Rights of Way Improvement Plan (ROWIP), produced by LDNPA, Cumbria County Council and the local access forum, identifies new routes which would enhance the current provision. Access is closely linked to a range of other ecosystem services including health benefits, both mental and physical, sense of place/inspiration and tourism. The location of access routes in relation to towns and villages is particularly important for health benefits and the ROWIP includes routes to link built-up areas to the natural environment.

42% of visitors to Cumbria engage in outdoor adventure with recreation having one of the highest economic growth rates 51% (or 6% per annum) for this tourism sub-sector for the period 2000-8. The access map can be linked to those recreation activities dependant on trails and open access such as walking, fell running, mountain biking and horse riding however it does not include any water based recreation such as sailing, canoeing, wind surfing or angling. There are 35 “activity provider” businesses within the catchment.

Access provision is also closely linked to both physical and mental health benefits. An accessible healthy environment close to where people live encourages increased physical activity. However there may be other perceived cultural barriers to access to the natural environment.

Access can adversely affect a range of services, particularly through soil loss from path erosion, with human trampling identified as one of the key pressures along with over-grazing. Soil erosion contributes to poor water quality, carbon loss from soils and unsightly erosion scars. Fix the Fells is a programme of repairs to paths and other areas undertaken by volunteers and supported by, among others the Nurture Lakeland visitor pay-back scheme. The location of Fix the Fells sites identifies those areas most affected by path erosion.

91% of visitors to the Lake District cite landscape and the environment as their primary motivation. The tourism sector supports 1171 businesses and 4115 jobs in the Bassenthwaite catchment, with 100 of these being non-accommodation including galleries, cafes, museums, visitor attractions and activity providers. Cumbria generally has one of the highest concentrations of retailers selling outdoor equipment in Europe. The concentration of tourism businesses is in Keswick with a scattering in the valleys.

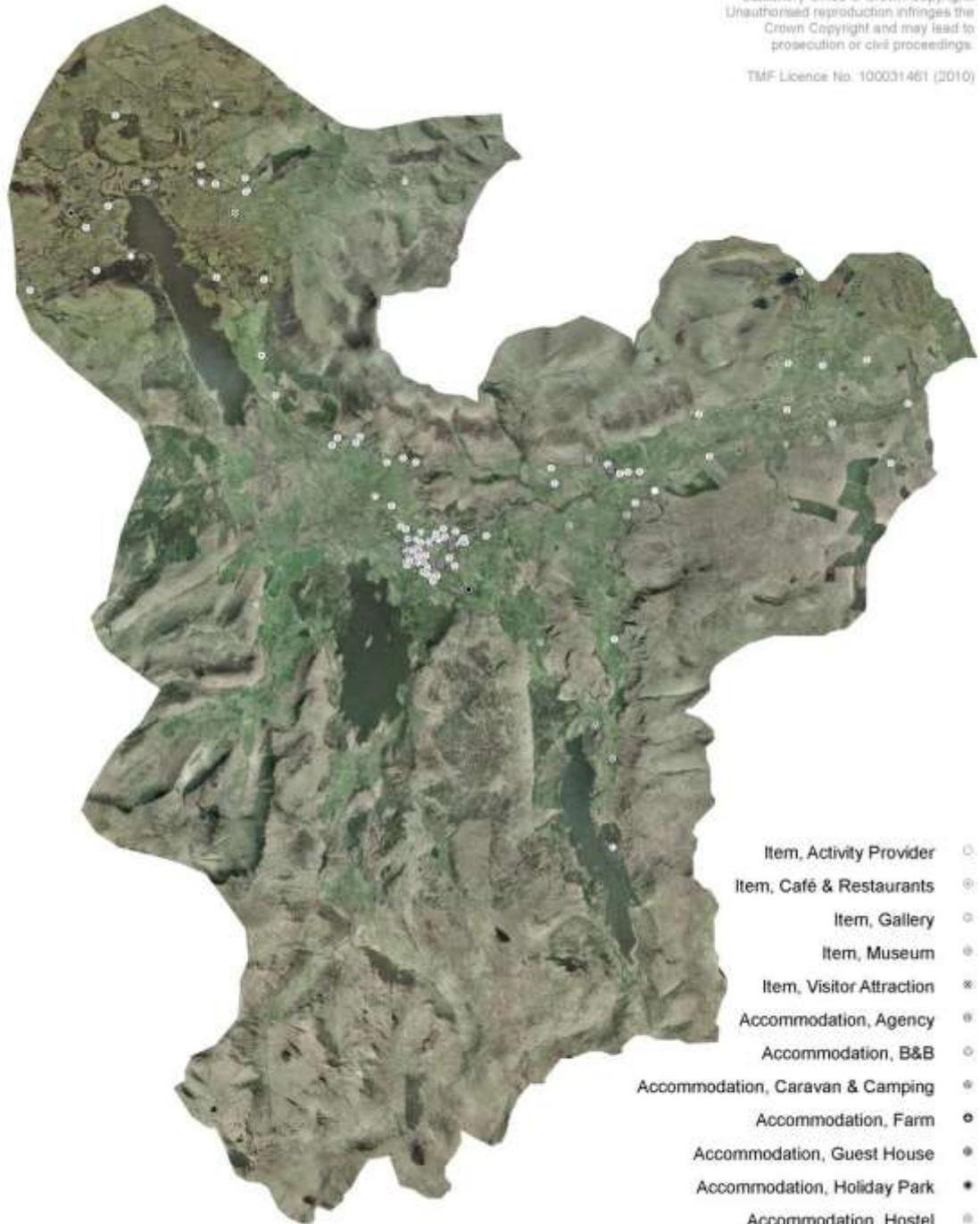
Map 24 identifies location and number of tourism businesses. This does not include assessment of the quality of tourism experience or sustainable tourism. Partner workshops identified the need to develop high quality low impact tourism, local provenance produce, sustainable transport and the existing visitor pay-back scheme.

The tourism experience is intricately linked to access and recreation, health benefits and the wildlife and culturally-rich landscape of the Bassenthwaite catchment.

# Tourism Businesses

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- Item, Activity Provider ○
- Item, Café & Restaurants ○
- Item, Gallery ○
- Item, Museum ○
- Item, Visitor Attraction \*
- Accommodation, Agency ○
- Accommodation, B&B ○
- Accommodation, Caravan & Camping ○
- Accommodation, Farm ●
- Accommodation, Guest House ●
- Accommodation, Holiday Park \*
- Accommodation, Hostel ○
- Accommodation, Hotel ○
- Accommodation, Inn ○
- Accommodation, Self-catering ○
- Accommodation, Activity Provider \*

**Map 24** from *Economics Benefits of Ecosystem Services in the Bassenthwaite Catchment report* – produced by Mersey Forest Green Infrastructure section (Natural Economy North West).

## 7. Initial assessment of service beneficiaries

Many of the people who benefit from the ecosystem services live outside of the Bassenthwaite catchment. Who actually benefits varies between services. The table below, based on findings of partner workshops, identifies where beneficiaries come from, ranging from local to global. It also considers whether beneficiaries pay for these ecosystem services and if so through what mechanism.

<b>Service/Benefit</b>	<b>Beneficiaries (description)</b>	<b>Location (Local, Cumbrian, Regional, National or Global)</b>	<b>Payment linkage (Direct Market, Indirect market, Institution, None)</b>
Food	Farmers	L	Direct market
	Livestock breeders	N	Indirect market through purchase of hardy draft animals - sheep stratification system
	Producers of local provenance food products	L	Direct market
Timber	Forestry Commission	N	Direct market
	Private foresters	L	Direct market
	Global community benefitting from lower carbon emissions through use of timber in construction	G	None (at present, though shadow carbon price)
Water	Water company customers	R	Indirect market/institution
	Individuals with private water supply e.g. wells, springs	L	None
Climate regulation	Global community benefitting from increased carbon storage (off-setting emissions)	G (national/regional – carbon budgets)	None (at present, though shadow carbon price)
Flood regulation	Farmers	L	None/institution (EA)
	Local residents i.e. those living within area	L	None/institution (EA)

	Downstream residents e.g. Cockermouth	C	None/institution (EA)
Erosion control	Farmers – benefiting from soil conservation	L	None
	Local residents – reduction of erosion scars	L	None
	Tourists – reduction of erosion scars	N, R, G	None
	Downstream residents through improved water quality	C	None
	Water-based recreation participants – particularly anglers	L, C, N, R, G	None. Direct market– Derwent Owners Association contribute 20% to river fencing schemes through BLRP River Corridor Group
	Water company customers	R	Indirect market/institution
	Global community benefitting from increased carbon storage in soils/vegetation	G	None (at present, though shadow carbon price)
	Global community benefitting from freshwater and other biodiversity gains	G	Institution
Water quality	Farmers – water for agriculture	L	None
	Local residents i.e. those living within area	L	None
	Tourists visiting area for day visits or overnight stays	R, N, G	None
	Downstream residents e.g. Cockermouth	C	None

	Water-based recreation participants	L, C, R, N, G	None. Direct market– Derwent Owners Association contribute 20% to river fencing schemes through BLRP River Corridor Group
	Water company customers	R	Indirect market/institution
	Global community benefitting from increased carbon storage in soils/vegetation	G	None (at present, though shadow carbon price)
	Global community benefitting from freshwater and other biodiversity gains	G	None/institution (NE/EA)
Biodiversity	Local residents i.e. those living within area	L	None/indirect market (through purchase of local goods and services from land managers)
	Tourists visiting area for day visits and overnight stays	R, N, G	None/indirect market (through purchase of local goods and services from land managers);  Direct market (through visitor pay-back scheme where this operates)
	Tourism businesses	L, N	None
	Global community benefitting from biodiversity gains	G	None/institution (NE)
Cultural heritage	Local residents i.e. those living within area	L	None/indirect market (through purchase of local goods and services from land managers)

	Tourists visiting area for day visits and overnight stays	R, N, G	None/indirect market (through purchase of local goods and services from land managers); Direct market (through visitor pay-back scheme where this operates)
	Tourism businesses	L, N	None
	Global community benefitting from cultural heritage	G	None/institution (LDNPA, English Heritage)
Sense of place	Local residents i.e. those living within area	L	None
	Residents of adjacent areas – day visitors	C, R	None
Mental and physical health	Local residents i.e. those living within area	L	None
	Residents of adjacent areas – day visitors	C, R	None
	Tourists visiting area for overnight stays	R, N, G	None
Education	School	L, C, R, N	None
	Field Study/ Outdoor Education Centres	L, C, R, N	None
	Universities including for research	L, C, R, N, G	None
Recreation and tourism	Local residents i.e. those living within area	L	None/indirect market (through purchase of local goods and services from land managers)
	Residents of adjacent areas – day visitors	C, R	None/indirect market (through purchase of local goods and services from land managers)

	Tourists visiting area for day visits and overnight stays	R, N, G	None/indirect market (through purchase of local goods and services from land managers); Direct market (through visitor pay-back scheme where this operates)
	Accommodation providers	L, N	None
	Outdoor retailers	L, N	None
	Other tourism businesses	L	None

## Beneficiaries Maps

Few maps are currently available to depict the range of beneficiaries indicated in the table above. The examples currently available are given below.

## Flood Risk

The flood risk map of Cumbria shows the areas at risk of flooding which are downstream of the Bassenthwaite catchment. The Derwent downstream of Bassenthwaite and particularly the urban areas of Workington and Cockermouth were amongst the worst affected by the extreme flood of October 2009. With such high rainfall and steep valley sides, the contribution catchment management can make in relation to the flood alleviation of downstream areas may be limited. However catchment management could potentially contribute to the reduction of soil erosion, sediment transport and deposition during flood events, reducing economic impacts on property. The role of land management in reducing flooding is being explored through modelling work commissioned through the pilot project with Cumbria Woodlands, Forest Research and the Environment Agency.

Bassenthwaite Ecosystems Services Pilot  
Flood risk



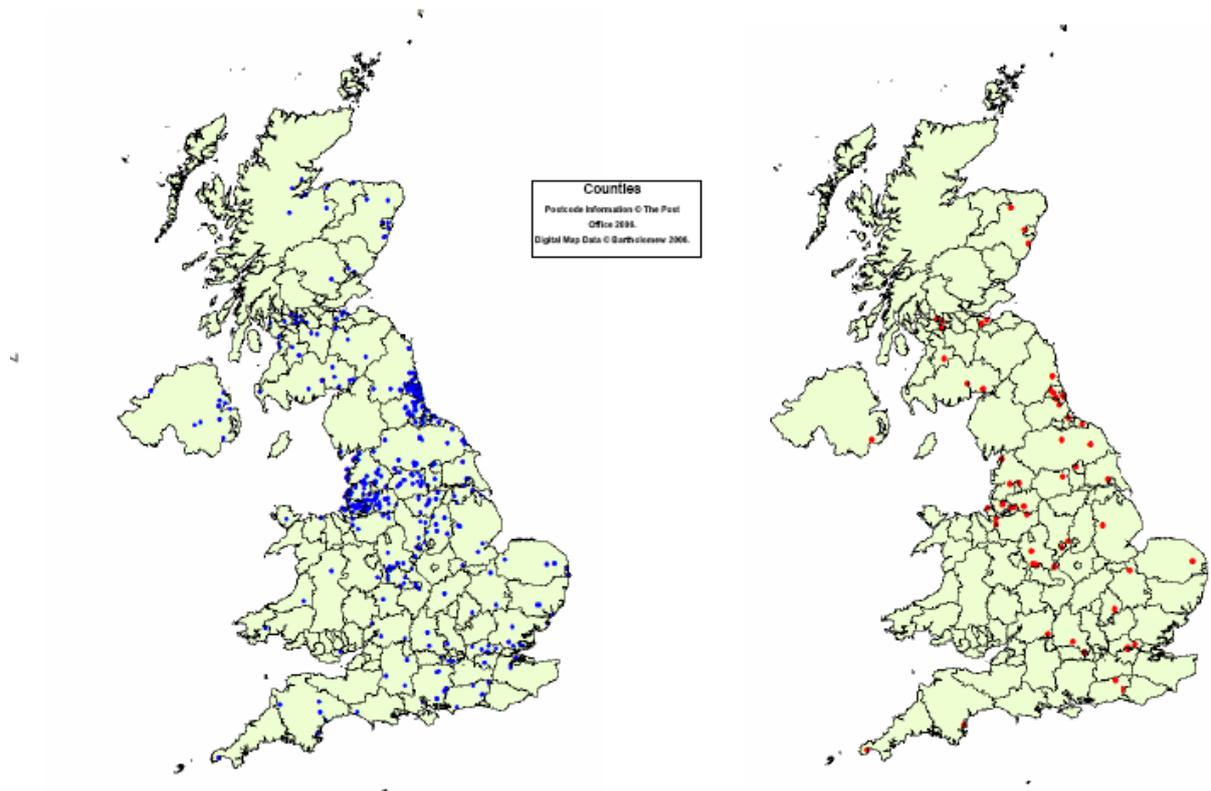
Map 25

## Visitor origin

The maps of visitor and staying visitor origin (for Penrith) indicate who benefits in terms of recreation, tourism, sense of place and health. Most visitors to the Lake District come from the North East and the Liverpool-Manchester area and to a lesser extent the Midlands, Glasgow and Edinburgh.

Figure A: UK Map of Visitor Origin by County

Figure B: UK Map of Staying Visitor Origin by County



## Maps 26 and 27

### 8. Gap analysis

The baseline assessment for the Bassenthwaite catchment clearly highlights the large area and diversity of comparatively high quality, semi-natural habitats present. As expected, this underpins the wide range of public benefits provided. The baseline assessment covers the key services identified by partners for the Bassenthwaite pilot area. It also generally provides a sufficient level of detail to target land management changes. However it does not extend to all potential ecosystem services, with notable omissions including:

- Primary production
- Nutrient cycling
- Fuel
- Medicines
- Genetic resources

- Air quality maintenance
- Pest control

Of the services addressed within the baseline assessment, it is the cultural services that are the least well understood, lack supporting data and are not readily depicted in map form. This includes more esoteric benefits such as spiritual, religious and aesthetic values as well as inspiration from the natural environment. The consideration of education and health benefits could be supported by maps and data on for example:

- Location, number and type of educational establishments in the catchment
- Educational visits to Field Study Centres, Outdoor Education Centres and Youth Hostels etc.
- Basic health statistics (including life expectancy, mental health and obesity figures)

For a number of the services, notably food, timber, and tourism, the maps do not indicate the “condition” of the asset on which the service is based or current level of service.

The complexity of regulating services is oversimplified in their representation on the maps. For example, water quality is a function of a combination of point sources, mine discharges and diffuse inputs, varying in their impact both temporally and spatially across the catchment. Although the chemical assessment of General Quality Assessment (GQA) is generally good to very good in the Lake District, only a small proportion of the catchment’s water courses achieve Good status under the WFD classification. While the failing elements are identified by the WFD map this does not attribute the cause of failure. Bassenthwaite Lake acts as a sediment trap for the rest of the catchment, other than the sub-catchments of Derwent Water and Thirlmere, where these water bodies act as sediment traps. However for diffuse pollution to the lake, although there is a map of sediment source risk, the distribution and level of agricultural inputs such as fertiliser, slurry and farm yard muck are not covered.

Flood regulation is similarly complex. In particular, the potential contribution that the catchment could make to addressing flood alleviation in Keswick and reducing the risk of other flood damage is not known. Modelling work is assessing whether land management could help to reduce downstream flood risk.

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## List of Acronyms:

BAP:	Biodiversity Action Plan
BLRP :	Bassenthwaite Lake Restoration Programme
CFMP:	Catchment Flood Management Plan
CROW:	Countryside and Rights of Way
CSF:	Catchment Sensitive Farming
EA:	Environment Agency
ESA:	Environmentally Sensitive Area
GQA:	General Quality Assessment
HLS:	Higher Level Stewardship
LDNPA:	Lake District National Park Authority
NE:	Natural England
ROWIP:	Rights of Way Improvement Plan (LDNPA)
SAC:	Special Area of Conservation
SCAMP 2:	Sustainable Catchment Management Plan
SSSI:	Site of Special Scientific Interest
UU:	United Utilities
WFD:	Water Framework Directive River Basin Management Plan

## Annex A: Water Framework Directive water courses with failing elements

Reference number	Name	Status	Failing elements			
GB112075070330	River Derwent	Poor	Fish	pH		
GB112075070340	Stonethwaite Beck	Moderate	pH			
GB112075070430	St John's Beck	Moderate	Mitigation Measures Assessment			
GB112075070440	Newlands Beck	Moderate	Specific pollutants			
GB112075070450	Trout Beck	Moderate	pH	Phytobenthos	Specific pollutants	
GB112075070460	Glenderamackin (Greta)	Moderate	Fish	Mitigation Measures Assessment	Phytobenthos	Specific pollutants
GB112075070470	Glenderamackin d/s Trout Beck	Moderate	Fish	Hydrology		
GB112075070490	Glenderamackin u/s Troutbeck	Poor	Fish			
GB112075070530	Dash Beck	Moderate	Fish	Hydrology		
GB112075073561	River Derwent US Bassenthwaite Lake	Moderate	Mitigation Measures Assessment	Specific pollutants		
GB31228847	Bassenthwaite Lake	Moderate	Dissolved Oxygen	Phytoplankton	Total Phosphorus	
GB31228965	Derwent Water	Moderate	Dissolved Oxygen			
GB31229021	Thirlmere	Moderate	Mitigation Measures Assessment			
GB112075070330	River Derwent	Poor	Fish	pH		

## Annex B UK BAP Habitats and Species in the Bassenthwaite Catchment

*Species and habitats in the UK that met agreed scientific criteria are included on the UK list of Priority Species and Habitats. These criteria include international threat, international responsibility/obligations, decline in UK and importance for key species (habitats only).*

- **Rivers**- River Derwent is the best example of a large upland oligotrophic river in England.
- **Oligotrophic and Dystrophic Lakes/Mesotrophic Lakes** – Bassenthwaite and Derwent Water, previously the only English site for the white-fish vendace, now extinct in Bassenthwaite.
- **Upland Oakwood** - Borrowdale some of the best examples in England. Young Wood and Keskadale Wood are the highest altitude oak woods in England.
- **Wet Woodlands** - much rarer than 'dry' woodlands and stands tend to be small and scattered. Examples around both Bassenthwaite Lake and Derwent Water.
- **Juniper**- in long term decline nationally. Most Lake District stands comprise old and moribund bushes requiring active restoration management. A number of stands, some large, in area.
- **Mountain Heaths and Willow Scrub** - fragile and naturally limited in extent - vulnerable to overgrazing and trampling. Only English sites North Pennines and Lake District. Important examples on the catchment boundary at Helvellyn, Skiddaw and the Derwent Fells.
- **Blanket Bog** - globally restricted peatland type. In the Lake District largely restricted to plateaux or gentle slopes, good examples on Armboth.
- **Lowland Raised Bog** - Nationally restricted habitat with some of the best examples on Cumbria's coastal areas. A small part of one example near Mungrisdale.
- **Upland Calcareous Grassland** - a rare habitat in England (10,000 ha) and very rare away from the carboniferous limestone. Occurring in small pockets on the Borrowdale volcanics.
- **Upland Hay Meadows and Lowland Hay Meadows** - less than 1Kha of upland hay meadow remaining in northern England. 5-10K ha of lowland hay meadow in England and Wales. These habitats have been recorded in the past in the catchment, current extent and condition not known.
- **Upland Heathland** - Extensive stands in the area but extent has declined in recent years with replacement by acid grassland and bracken in response to higher stocking rates.
- **Upland Flushes, Fens and Swamps** - extensive examples of the less restricted flush fen and swamp habitats on valley slopes and valley bottoms.
- **Lowland Fens** –Some of the best examples in England at the southern end of Bassenthwaite Lake. Also occurs at the southern end of Derwent Water.
- **Purple Moor Grass and Rush** - Good examples on low lying land close to the lakes, locally, supporting the rare marsh fritillary butterfly, a UK BAP species.
- **Reedbeds** - UK BAP habitat restricted to stands over 0.25 ha. Only a handful of small stands around the two lakes.

**continued**

**Mammals:**

Brown Hare  
Brown Long-eared Bat  
Soprano Pipistrelle  
Noctule  
European Otter  
Hedgehog

**Birds:**

Reed Bunting  
Yellowhammer  
Eurasian Tree Sparrow  
House Sparrow  
Spotted Flycatcher  
Wood Warbler  
Common Grasshopper Warbler  
Ring Ouzel  
Tree Pipit  
Common Cuckoo  
Curlew  
Lapwing  
Grey Partridge

**Herptiles:**

adder  
Common Lizard  
Slow-worm  
Common Toad

**Fish:**

Vendace

**Butterflies and moths:**

Crescent  
Rosy Rustic  
Dusky Brocade  
Knotgrass  
Grey Dagger  
Sallow  
Centre-Barred Sallow  
White Ermine  
Garden Tiger  
August Thorn  
Netted Carpet  
Small Phoenix  
Grey Mountain Moth  
Galium Carpet  
Shaded Broad-bar  
Oblique Carpet  
Forester  
Ghost Moth  
Large Heath  
Small Heath  
Mountain Ringlet  
Wall  
Marsh Fritillary  
Small Pearl-bordered  
Fritillary  
Dingy Skipper

**Other invertebrates:**

a leaf beetle - *Donacia  
aquatica*  
a crane fly - *Meloe  
violaceus*  
Oil Beetle - *Calosoma  
inquisitor*  
Caterpillar-Hunter

**Plants:**

Floating Water-Plantain  
Pillwort

**Fungi:**

a basidiomycete fungus -  
*Hygrocybe spadicea*

## Annex C Scheduled Monuments in the Bassenthwaite Catchment

Scheduled Monument Number	Monument Name	Grid Ref	Risk	Principal Risk Factor	Trend
32877	Force Crag Mines And Barytes Mill And A Prehistoric Cairnfield	NY19762156	Low	Deterioration as a result of neglect	Stable
32899	St Thomas' Work Elizabethan Copper Mine 320m North West Of Grey Buttress	NY23001661	Low	Localised/limited natural localised erosion	Stable
22565	Castlerigg Stone Circle And Two Bowl Barrows	NY29062359	Low	Moderate visitor erosion	Declining
23753	Roman Camp And Section Of Roman Road 700m South East Of Field Head Farm	NY38392729	Low	Other	Stable
23791	Prehistoric Stone Hut Circle Settlement, Irregular Aggregate Field System, Five Enclosures, a Well, a Cairnfield & Trackways On St John's & Threlkeld Commons	NY32892408	Low	Limited/localised vehicle damage/erosion	Stable
23789	Medieval Shieling 160m North West Of Clough Fold	NY33142362	Low	No known threat	Stable
23754	Roman Camp And Section Of Roman Road On Lofshaw Hill	NY38912758	Low	Localised/limited stock erosion	Stable
23752	Roman Camp South Of Field Head Farm	NY37932719	Low	Other	Improving
23799	Bowl Barrow On Brund Fell	NY26111625	High	Plant Growth	Declining
23755	Troutbeck Roman Fort And Annexe	NY38222727	Low	Plant Growth	Stable
23681	Reecastle Crag Hillfort	NY27511757	High	Plant Growth	Declining
23787	Two Medieval Shielings 25m North Of Clough Fold	NY33222351	Low	No known threat	Stable

23788	Two Medieval Shielings 210m North West Of Clough Fold	NY33112366	Low	No known threat	Stable
32900	Borrowdale Graphite Mines And Associated Grinding Mill, 660m North West Of Seathwaite	NY23161269	Low	No known threat	Stable
22556	Round Cairn On Dunmail Raise	NY32721171	Low	No known threat	Stable
23790	Two Medieval Shielings 240m North West Of Clough Fold	NY33072366	Low	No known threat	Stable
34954	Goldscope Copper And Lead Mines And Remains Of Associated Dressing Floors, Stamp Mill, Dressing Mill, Reservoir And Leats	NY22411854	Medium	Limited/ localised vehicle damage/erosion	Declining
23682	Shoulthwaite Gill Hillfort, Thirlmere	NY29991885	Low	Scrub / tree growth	Stable
23786	Two Medieval Shielings 60m North Of Clough Fold	NY33242354	Low	No known threat	Stable
23785	Medieval Shieling 300m North Of Clough Fold	NY33182379	Low	No known threat	Stable
23792	Castle How Hillfort	NY20173082	Medium	Scrub / tree growth	Declining
34952	Dale Head Copper Mine 300m North East Of Dale Head	NY22511553	Low	No known threat	Stable
23752	Roman Camp South Of Field Head Farm	NY37932719	Low	Other	Improving
23755	Troutbeck Roman Fort And Annexe	NY38222727	Low	Plant Growth	Stable
34951	Dale Head Copper Mine Dressing Floors And Associated Buildings 400m North Of Dale Head	NY22201570	Low	No known threat	Stable
23686	Bowl Barrow On Great	NY39672538	Low	No known threat	Stable

	Mell Fell				
23680	Slight Univallate Hillfort On Castle Crag	NY24951593	High	Plant Growth	Declining
34953	Long Work 16th And 17th Century Copper Mines, 400m North West Of Waterfall Buttress	NY22691620	Low	No known threat	Stable

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