Cairngorms National Park Partnership Plan, SEA scoping

Baseline information

Topic 4 – Soils and geodiversity

Contents

Questions for consultation authorities

1. Is there anything missing from the Topic baseline?

2. Are there any errors in what is presented?

3. Are there any new initiatives, research projects, plans, programmes or strategies or other things that will be reporting / implemented over the next 12-18 months that are relevant to the Topic, which may need to be included as the SEA progresses?

Context

Soils cover much of the surface of the earth, forming the foundation of all terrestrial ecosystems and services. They support key processes in biomass production, atmospheric and hydrological systems. Nearly all of the food, fuel and fibres used by humans are produced in soil. The functions provided by soil depend on a multitude of soil organisms, which makes soil an important part of our biodiversity. Soil is second only to the oceans as a carbon sink, with the potential to play an important role in the slowing of climate change.

Although soils are a continually evolving, living and dynamic medium responding to external pressures and management, their recovery from some damaging activities such as development or pollution may not take place within human timescales. This means soils are a finite and essentially non-renewable resource.

Land capability for agriculture

It is difficult to value the direct financial contribution that healthy soils make to our economy. However it is now widely acknowledged that the sustainable management of soils, and the protection of the ability of soil to deliver a wide range of environmental and ecological services, is essential to achieving sustainable economic growth.

Land Capability Classification for Agriculture mapping provides detailed information on soil, climate and topography for those involved in the management of land use and resources. The classification ranks land from 1 to 7 on the basis of its potential productivity and cropping flexibility determined by the extent to which its physical characteristics (soil, climate and topography) impose restrictions on its agricultural use. Land classified from 1 to 3.1 is considered to be prime agricultural land, while land classified as 3.2 to 7 is considered to be non-prime.

There are no areas of prime agricultural land within the Park, although there are areas of land in Strath Spey and Deeside within the 3.2 classification, around 1.2% of the total area of the Park (figure 1). This indicates non-prime land that is limited by moderate climatic factors, which may yield a moderate range of crops with average production, but potentially high yields of barley, oats and grass. However the majority (around 73%) of land within the Park is classified as 6 (rough grazing only) or 7 (very limited agricultural value).

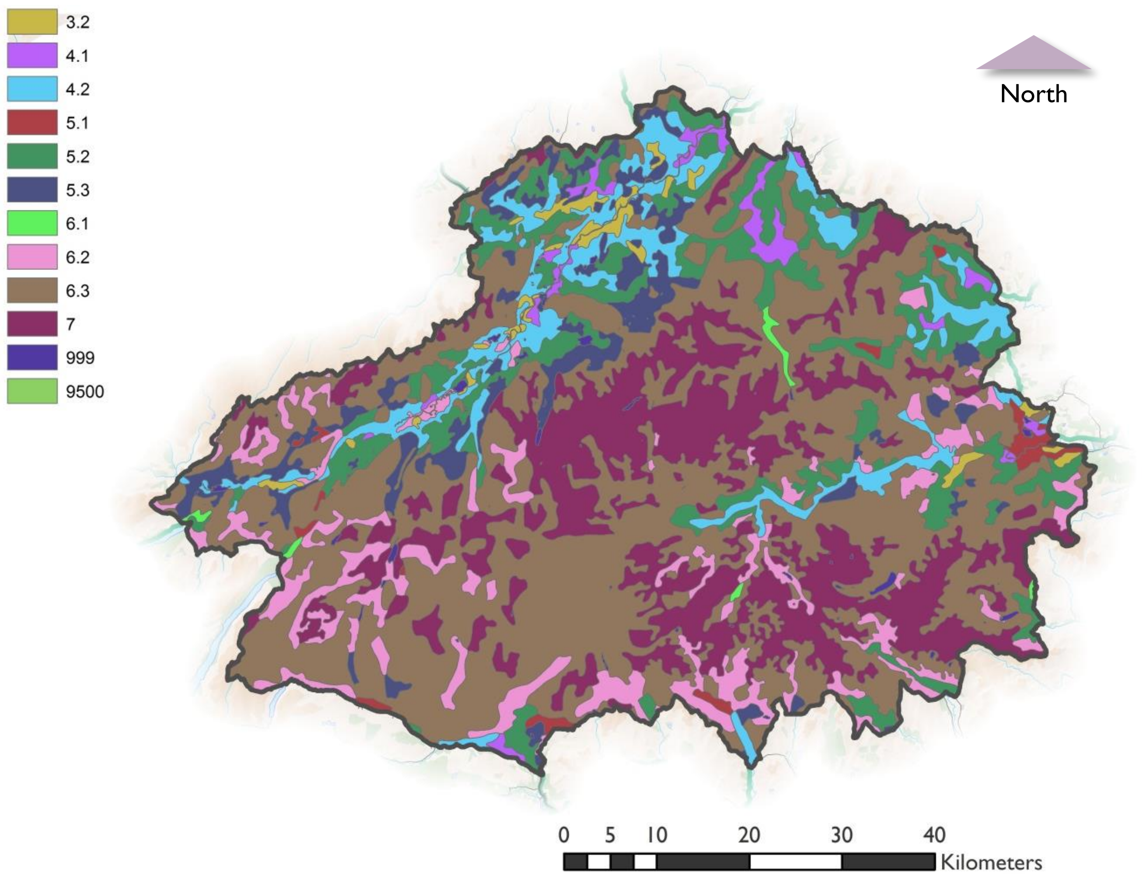


Figure 1 - land capability for agriculture classification for the Park (1:250K classification scale)

Carbon rich soils

Soil organic matter is plays a vital role in contributing to a range of soil functions. Organic carbon is the dominant component of soil organic matter (around 50%), so management of soil has important wider consequences in the context of greenhouse gas emissions and climate change. Soil organic matter also contains a wide range of nutrients such as nitrogen and phosphorus, as well as trace elements, all of which are essential for plant growth and health.

Carbon rich soils are important carbon sinks that if exposed, start to release carbon back into the atmosphere. Carbon dioxide (CO_2) release occurs via soil respiration or erosion causing degradation, but other greenhouse gases can also be emitted as a result of soil organic matter decomposition, for example methane (CH_4) and nitrous oxide (N_2O). Although most CO_2 is returned to soils as a consequence of the photosynthetic activity of plants, the difference between gains and losses of carbon from land surfaces may still be large. This is particularly the case for carbon rich soils such as those created by peatland habitats, which are very slow to regenerate due to the cool wet conditions stunting plant growth. The soils of the Park are particularly rich in soil organic matter because the cool, moist climate encourages the retention of decomposed organic materials. Peat, the most carbon rich soil, covers an extensive area of the Park (figure 2).

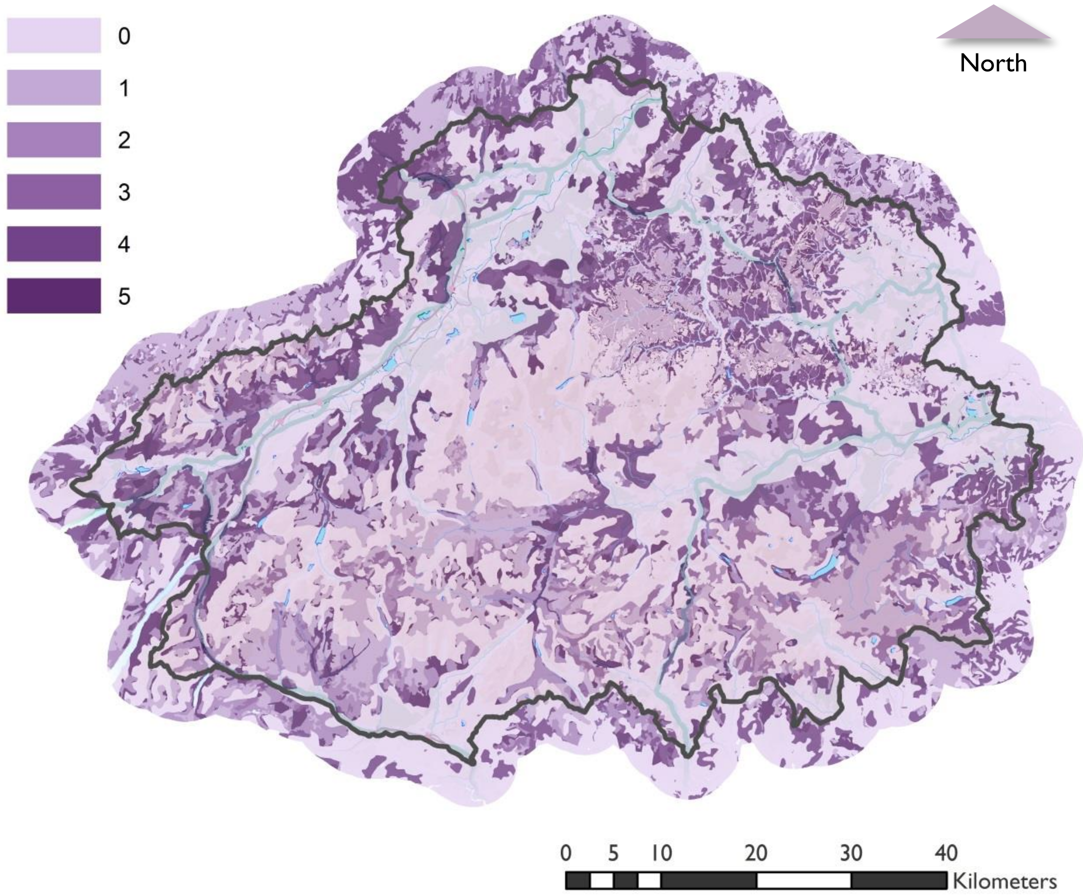


Figure 2 - SNH 2016 mapping of carbon rich soils in the Park (legend below)

- Class 5. Soil information takes precedence over vegetation data. No peatland recorded. May show signs of bare soil. All soils are carbon-rich soil and deep peat.
- Class 4. Area unlikely to be associated with peatland habitats or wet and acidic type. Area unlikely to include carbon-rich soils.
- Class 3. Dominant vegetation cover is not priority peatland habitat but is associated with wet acidic type. Occasional peatland habitats can be found. Most soils are carbon-rich soils, with some areas of deep peat.
- Class 2. All vegetation cover is dominated by priority peatland habitats. All soils are carbon-rich soil and deep peat.
- Class 1. All vegetation cover is by priority peatland habitats. All soils are carbon-rich soil and deep peat.
- Class 0. Mineral soils. Peatland habitats are not typically found on such soils.

Climate is important in determining the equilibrium of soil organic matter content. Temperature and rainfall influence both the input of organic matter via plant growth and its subsequent decomposition through microbial activity, as well as levels of erosion, with resultant release of greenhouse gases and dissolved organic carbon, along with nutrients and trace elements. Changes in climate, such as the increase in heavy rainfall events during winter identified in Topic 1 (climatic factors) are likely to disrupt the equilibrium.

Issues caused by climate change may be compounded by unsustainable land use activities, peat extraction and built development. Many of the most organic rich soils of the Park are located on its moorlands, large areas of which are managed for game. Deer can cause compaction and erosion by trampling, so it is necessary to manage the deer population towards a sustainable level. Grouse shooting requires management of the moorland habitat such that a balance of young heather is available for grouse to forage. This is normally done by burning (muirburn), typically in patches that are burnt every 10–20 years. Poorly managed burning can result in damage to the underlying carbon rich soils, resulting in greenhouse gas emissions.

Contamination

Soil contamination can come in many forms and sources. However, not all are of concern within the Park. While small amounts of contamination from metals, organic chemicals, radioactive substances and pathogens may occur within Park, due to the small scale of potential sources, they are not of an order that is likely to cause significant harm to the environment.

However, because of its potential effects on habitat and biodiversity, soil acidification is of significance. Typically, this pollution originates from gaseous emissions of sulphur dioxide and oxides of nitrogen that travel through the air before dissolving in rain to form sulphuric and nitric acids that are subsequently deposited on soil, causing soil acidification. Excess deposition of nitrogen can also lead to soil eutrophication (although fertiliser application in excess of crop requirements is more likely to be the cause of soil eutrophication in lower lying soils used for agricultural and forestry).

Due to the absence of major industrial sources within or in close proximity to the Park, the main sources of aerial acidification are likely to be far outwith the Park, although emissions from traffic within the Park will contribute to a lesser extent (see Topic 2, Air).

Acidification and eutrophication impacts are often greatest in upland areas as a result of high rainfall. They are exacerbated by predominantly poorly-buffered and nutrient-poor soils, with plants adapted to the local nutrient poor conditions being more sensitive to changes in soil conditions. However, lowland soils, especially those associated with ecosystems of high conservation value, may also be affected by acidification and eutrophication. Acidification can impact on soil nutrient cycling, causing critical load exceedance and a reduction in the ability of soils to filter contaminants. Contaminates may therefore more readily enter water bodies.

Soil erosion

Soil erosion by water or wind is the process where soil particles become detached and are transported within the landscape. Features of soil erosion can be found throughout the Park. For example, landslides and debris flows are a relatively common occurrence on many of the hill slopes shaped by ancient glaciers.

As well as weather events causing erosion, it can also be caused directly by human activity, such as construction, agricultural or forestry works, as well as indirectly through the effects of overgrazing causing trampling by livestock and deer.

One of the most important factors in the protection of soils from erosion is vegetation cover, as roots bind soil particles together and plants protect soil from direct raindrop impact, as well as disrupting overland flow. Where vegetation cover is sparse, or soils are bare, the incidence of landslides and soil erosion (by wind and water) is greater. The rate of soil loss via erosion and the incidence of landslides can be increased by removing the vegetation cover that protects the soil such as ploughing to grow crops or deforestation, as well as through engineering works.

In some upland areas of the Park, heavy grazing by sheep and deer has caused a decline in heather cover, which has then been replaced by tussock forming grasses with poorer soil binding abilities. However, there is difficulty in establishing links between soil erosion (in particular, the erosion of peat) and grazing as historic stocking densities, which are generally unknown, may have had more influence on the rate of erosion than current stocking densities.

Due to the popularity of the Park as a visitor and tourist destination, the effects of recreation are also a factor in erosion in the Park. As well as increasing rates of erosion on existing routes, recreation activity can lead to the expansion of desire lines away from existing routes. Where these go through sensitive environments, usually upland areas where natural regeneration of the vegetation is slow, the effects can be exaggerated.

Climatic factors such as extreme rainfall events play an important part in the erosion process, by exposing soil and increasing run off that carries soil from the land into watercourses. Climate change (see Topic 1, climatic factors) is therefore likely to lead to an increase in the frequency of landslides and in the intensity of soil erosion.

Geodiversity

Underpinning, and in some instances, part of, soils is geodiversity. Many of the issues affecting soils also affect geodiversity, for example acidification, erosion and unsympathetic land management. Geodiversity is the variety of rocks and soils laid down over millennia, which combine to create that landforms that are the basis for landscapes.

Large scale British Geological Society (BGS) mapping is available for Scotland and therefore the Park, however detailed geomorphological information is more limited. SNH along with the BGS have compiled a spatial inventory of the geomorphology of the Cairngorm Mountains core area (figure 3). However this offers only partial coverage, mostly for the mountainous centre of the Park. As geodiversity is part of the special qualities of the Park, the partial coverage is still a useful contribution to the baseline.

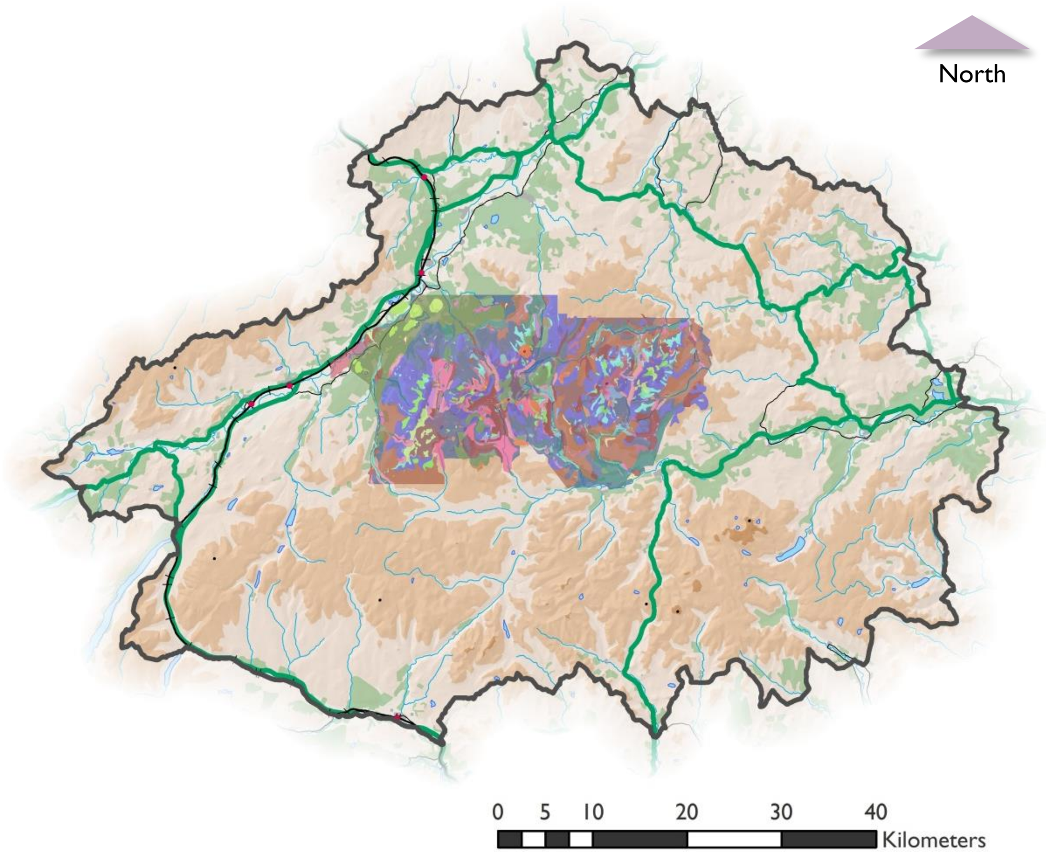
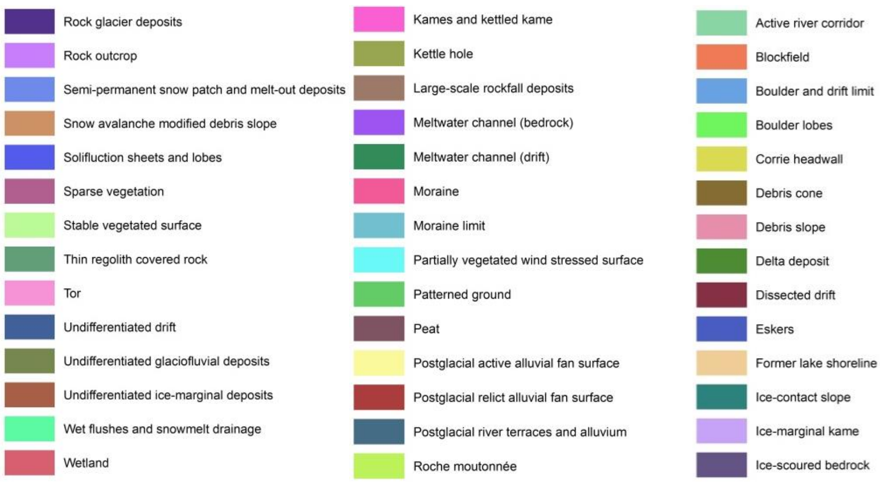


Figure 3 - BGS/SNH geomorphology of the Cairngorm Mountains (legend below)



More detailed information is available for Sites of Special Scientific Interest (SSSI) and Geological Conservation Review (GCR) sites (figure 4). These sites aim to safeguard wider geodiversity within the Park.

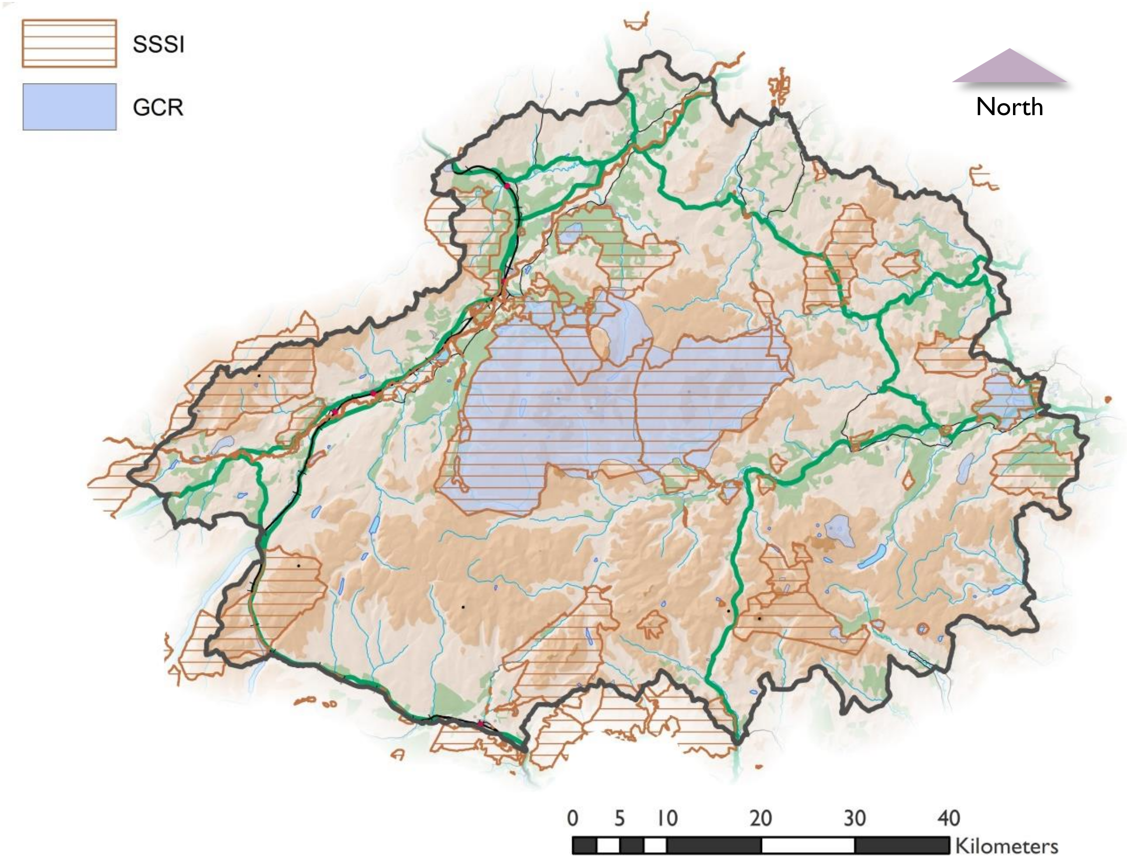


Figure 4 - map of geological SSSIs and GCR sites wholly or partially within the Park

There are 16 geological and mixed (geological and biological) SSSIs within the National Park, covering an area of some 680 km^2, around 15% of the Park area, with 39 GCR sites covering an area of around 592 km^2, the vast majority of which lies wholly within the National Park itself. The vast majority of this area (around 526 km^2) is attributed to a single GCR site, the Cairngorms Mountains (GCR site 2284), which is listed for its exceptional assemblage of pre-glacial, glacial, glacio-fluvial and periglacial features.

(Note that the use of geological materials as a resource is covered under Topic 5, Material assets.)

Proposed SEA objectives

SEA main objective	Sub-objectives
4a: Minimise contamination and safeguard and improve soil, peat quality and geodiversity	Will there be an effect on carbon rich soils, in particular peat?
	Will there be an effect on soil sealing, soil structure and soil loss?
	Will there be an effect on the levels of soil contamination?
	Will there be an effect on soil erosion and landslides?
	Will there be an effect on geodiversity interests (eg GCRs)?