

Cairngorms National Park Partnership Plan, SEA scoping

Baseline information

Topic I – Climatic factors

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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

Scotland has a temperate climate with cool summers and mild winters. As a whole it is influenced by predominantly westerly depressions alternating with less frequent settled periods. A range of factors, including topography, latitude and altitude, affect these weather systems at a more local level.

Rainfall is spread throughout the year but there are regional differences. For example, the easterly position of the Cairngorms massif results in a climate that is less oceanic, and therefore drier, than the west of Scotland. The mountains exert a noticeable rain shadow effect that reduced the amount of rainfall on the eastern side of the country.

Scotland is currently experiencing climate change, which owing to the global emission of greenhouse gasses, is likely to continue into the future. The predicted effects of climate change, currently supported by observed data, include hotter, drier summers; milder winters; increased frequency and intensity of extreme rainfall; reduced snowfall. The area within the Park boundary will be affected by climate change.

Historic climate trends

Historical climate data is provided by the Braemar weather station. It is recognised that using Braemar is a blunt proxy for the Park as a whole, however it is the only data source available for the Park. In addition it is some distance from large scale urbanisation so is likely to reflect the nature of the climate within the Park.

Records from the weather station indicate that the Park is experiencing a decrease in the number of days of air frost and an increase in annual rainfall (figures 1, 2 and 3).

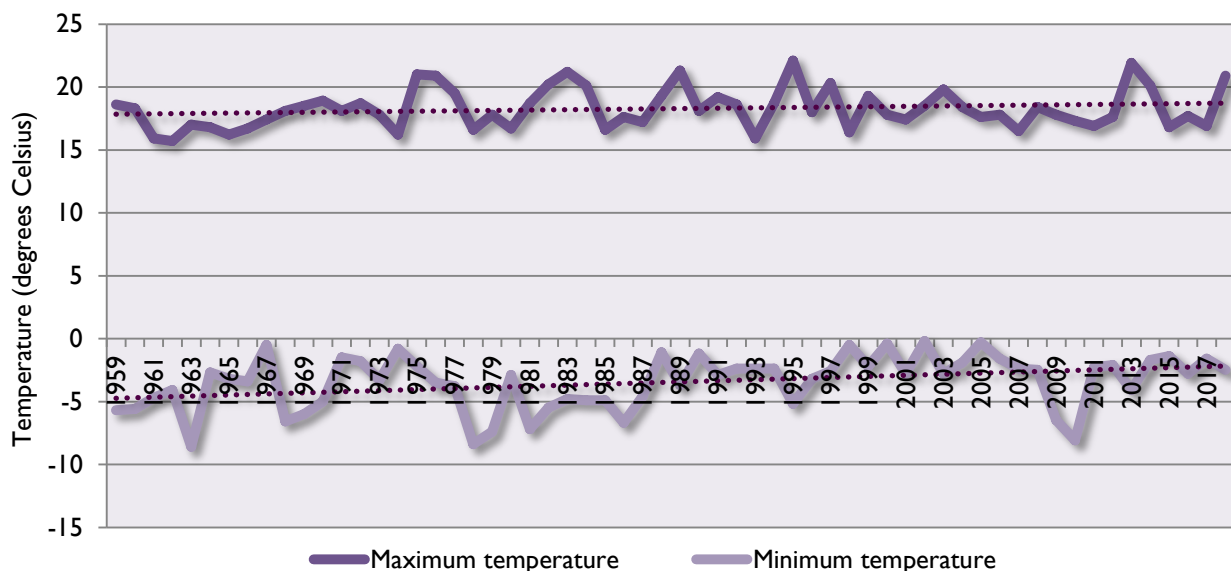


Figure 1 - Met Office maximum and minimum monthly average temperatures recorded at Braemar weather station during 1959 - 2018

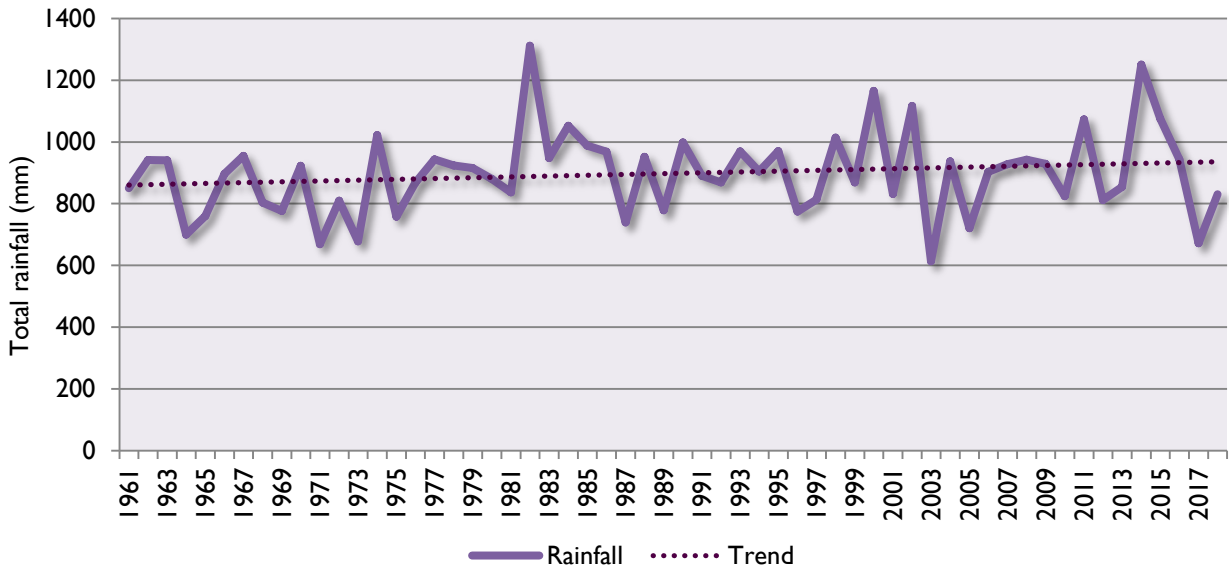


Figure 2 – Met Office rainfall recorded at Braemar weather station during 1959 - 2018

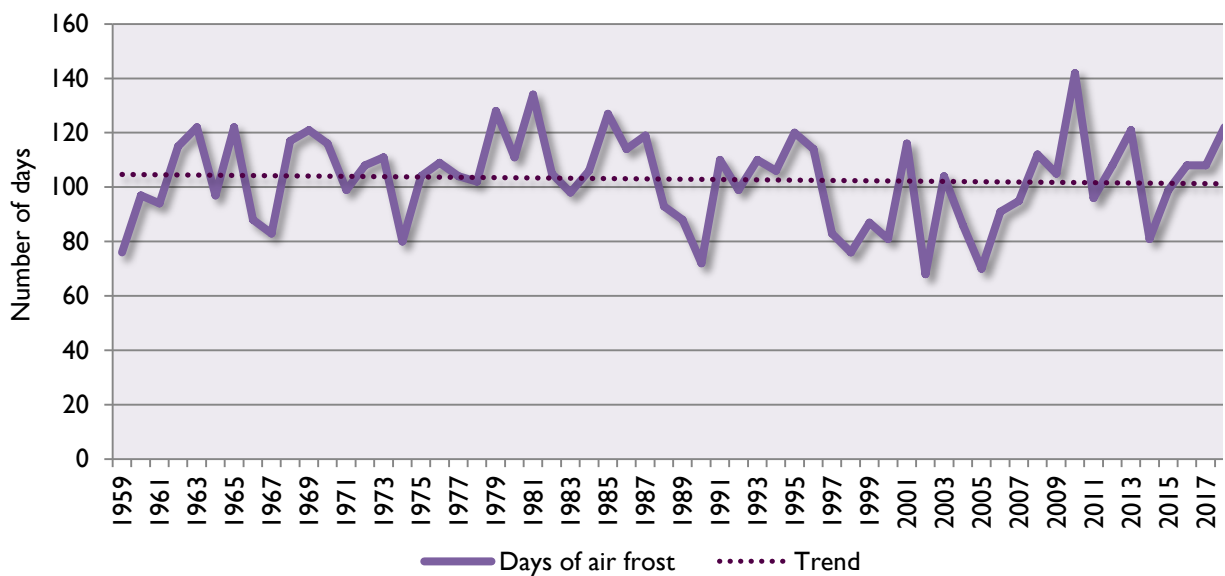


Figure 3 – Met Office days of frost at Braemar weather station during 1959 - 2018

This is consistent with broader trends across Scotland, where temperatures have risen by around 0.8 degrees since 1980, with increased heavy precipitation events contributing to an increase in winter rainfall versus decreases in summer rainfall.

Future climate projections

Probable projections available from the UK Climate Projections (UKCP18) website (<https://www.metoffice.gov.uk/research/approach/collaboration/ukcp/index>) are available for high, medium and low emission scenarios, with the latest projections down to a local resolution of 2.2 km². However the degree of uncertainty changes with the scale of resolution, so the data used for the scoping baseline is for the 25km² area including Braemar.

This is helpful as it increases the reliability of the projections and includes the Braemar weather station used to record the actual climatic changes shown since the 1960s, allowing comparisons to be made. The lack of clarity around the impact of feedback loops (such as the albedo effect due to a reduction in surface sea ice or methane release from thawing arctic tundra) also increases uncertainty.

From the baseline of 1981-2000, by 2050 under the medium emissions scenario the central estimate for Braemar is for a 1.2°C increase in mean annual temperature (figure 4). However, the 5th percentile estimate is for a minor decrease of -0.2°C & the 95th percentile estimates is for an increase of 2.7°C (figure 5), suggesting significant uncertainty. The medium emissions scenario also predicts an accelerated temperature increase after 2050.

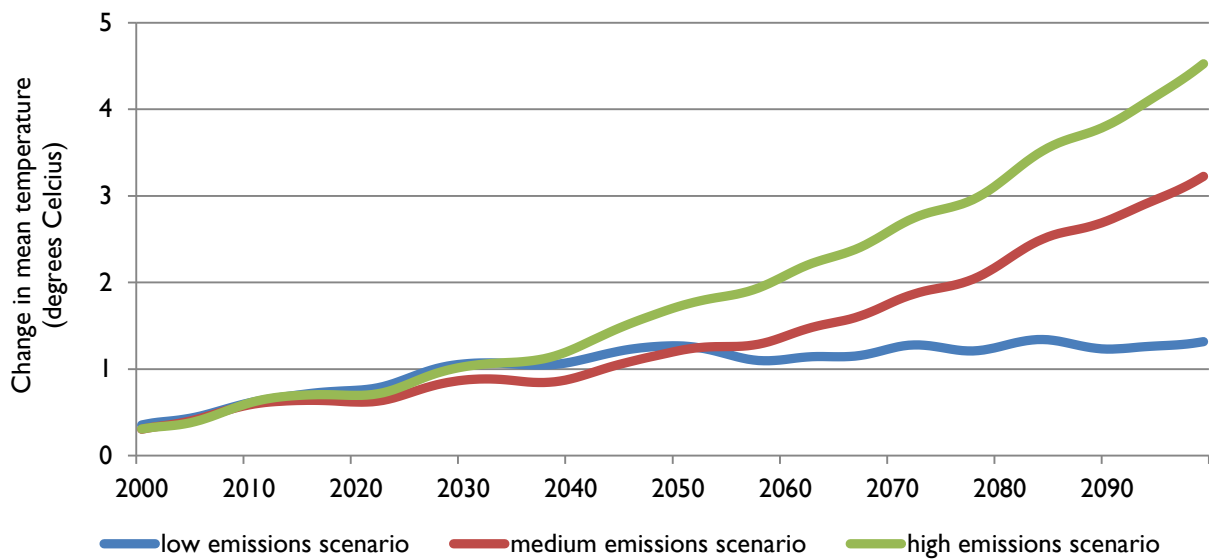


Figure 4 – UKCPI8 central estimates for mean change in annual temperature for grid box number 612, Braemar area

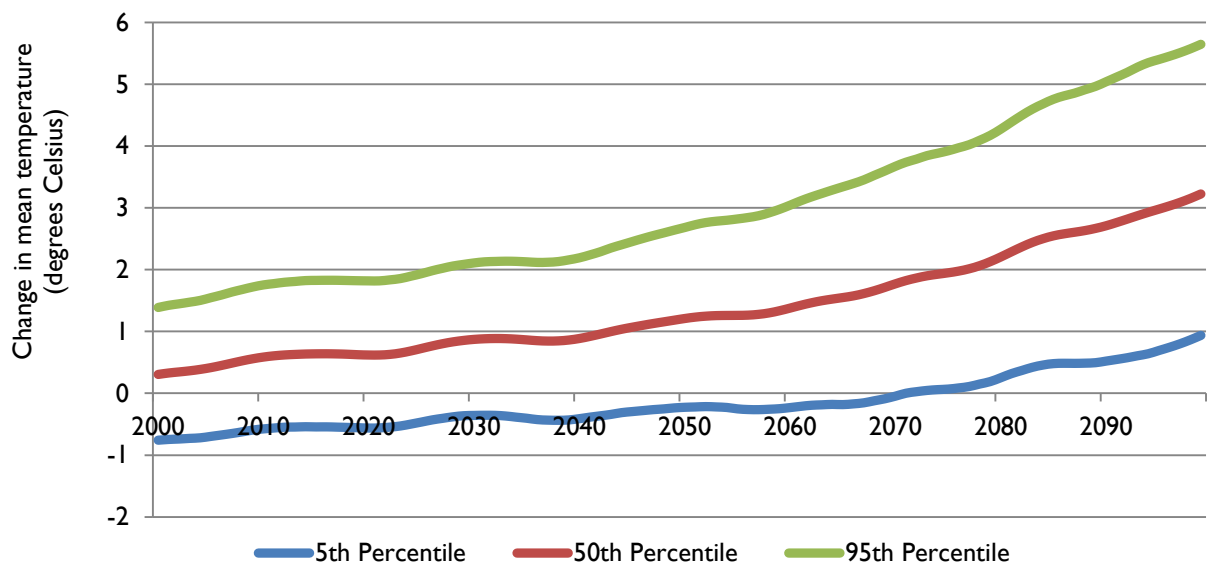


Figure 5 - UKCPI8 central, 5th and 95th percentile estimates for mean change in annual temperature for a medium emissions scenario (baseline 1981-2000, RCP 6.0) for 612, Braemar area

There is substantial uncertainty regarding average precipitation projections, with UKCPI8 considering that precipitation is less correlated to emission levels than temperature. However the number of extreme precipitation events is forecast to rise, with winters continuing the trend of being wetter and summers being drier (figure 6).

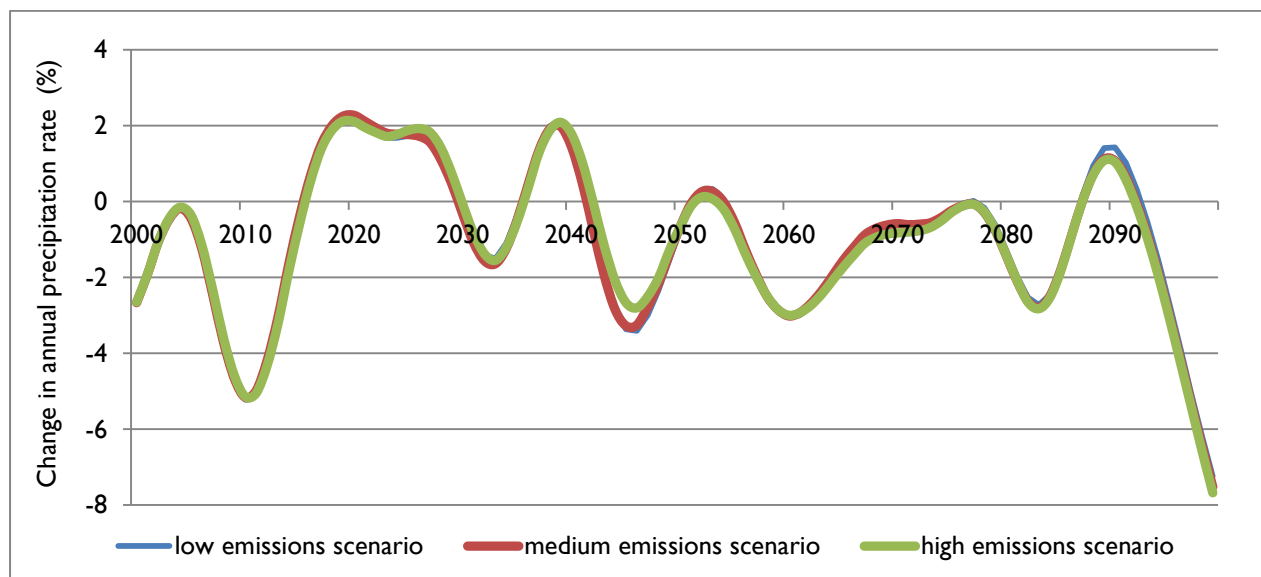


Figure 6 - UKCPI8 central estimate for mean change in precipitation for grid box number 612 (Braemar area) for 100 years from 2000

It should be noted that the use of the medium emissions scenario combined with the central probability projection represents a relatively conservative picture of the possible future climate for the Park. Adjusting these variables, particularly the emissions scenario, can lead to more significant projected changes. For example, the medium emissions scenario gives a central estimate temperature rise of 3.2°C by 2099, whilst the 95th probability percentile gives a temperature rise of 5.6°C. Given the experience of the approximate 1°C rise since the 1950s, increases of a further 3°C are likely to have a significant impact on life as currently experienced in the Park.

Greenhouse gas emissions

The causes of climate change are greater than local in scale and there is a strong global consensus that a reduction in greenhouse gas emissions is needed to avoid some significantly adverse effects. The Scottish Greenhouse Gas Emissions 2017 report (<https://www.gov.scot/binaries/content/documents/govscot/publications/statistics/2019/06/scottish-greenhouse-gas-emissions-2017/documents/scottish-greenhouse-gas-emissions-2017/scottish-greenhouse-gas-emissions-2017/govscot%3Adocument/scottish-greenhouse-gas-emissions-2017.pdf>) provides figures for sources of greenhouse gases (table 1 and figure 7)

Table I – amount and proportion of greenhouse gas emissions by source for Scotland in 2017

	MtCO ₂ e					% share by sector
	Carbon dioxide	Methane	Nitrous oxide	Fluorinated gases	TOTAL	
TOTAL	29.6	6.4	3.2	1.3	40.5	100.0%
Transport excluding international aviation and shipping	12.9	0.0	0.1	0.0	13.0	32.1%
International aviation and shipping	1.9	0.0	0.0	0.0	1.9	4.6%
Agriculture and related land use	2.8	4.3	2.6	0.0	9.7	23.9%
Business and industrial process	7.4	0.0	0.1	1.2	8.7	21.4%
Residential	5.8	0.1	0.0	0.1	6.0	14.9%
Energy supply	5.6	0.4	0.1	0.0	6.0	14.9%
Development	1.8	0.0	0.1	0.0	2.0	4.9%
Waste management	0.0	1.6	0.1	0.0	1.7	4.2%
Public sector buildings	1.1	0.0	0.0	0.0	1.1	2.7%
Forestry	-9.6	-0.0	-0.1	0.0	-9.5	-23.6%

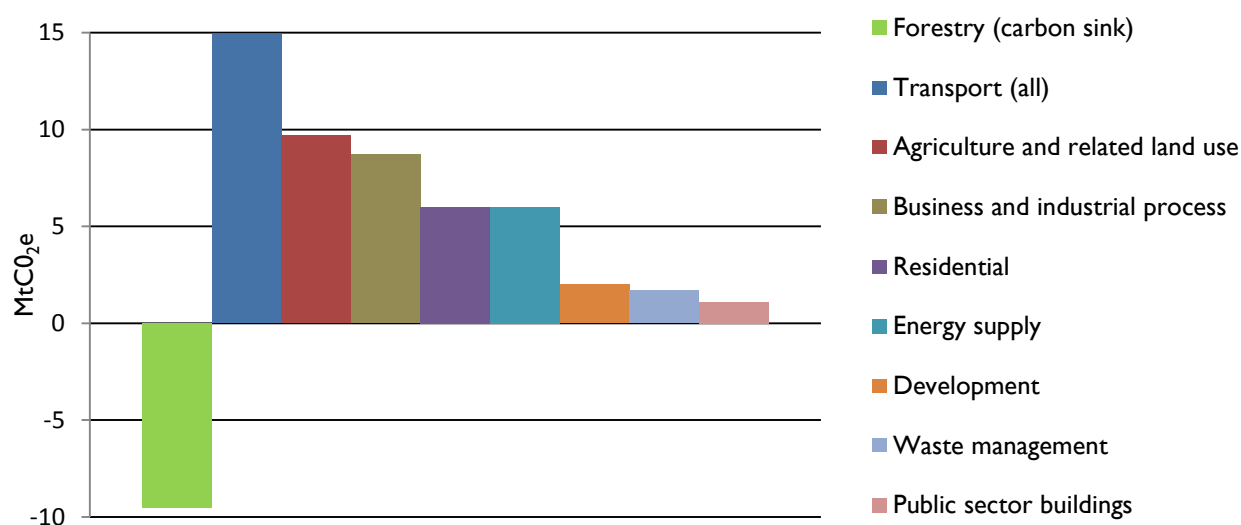
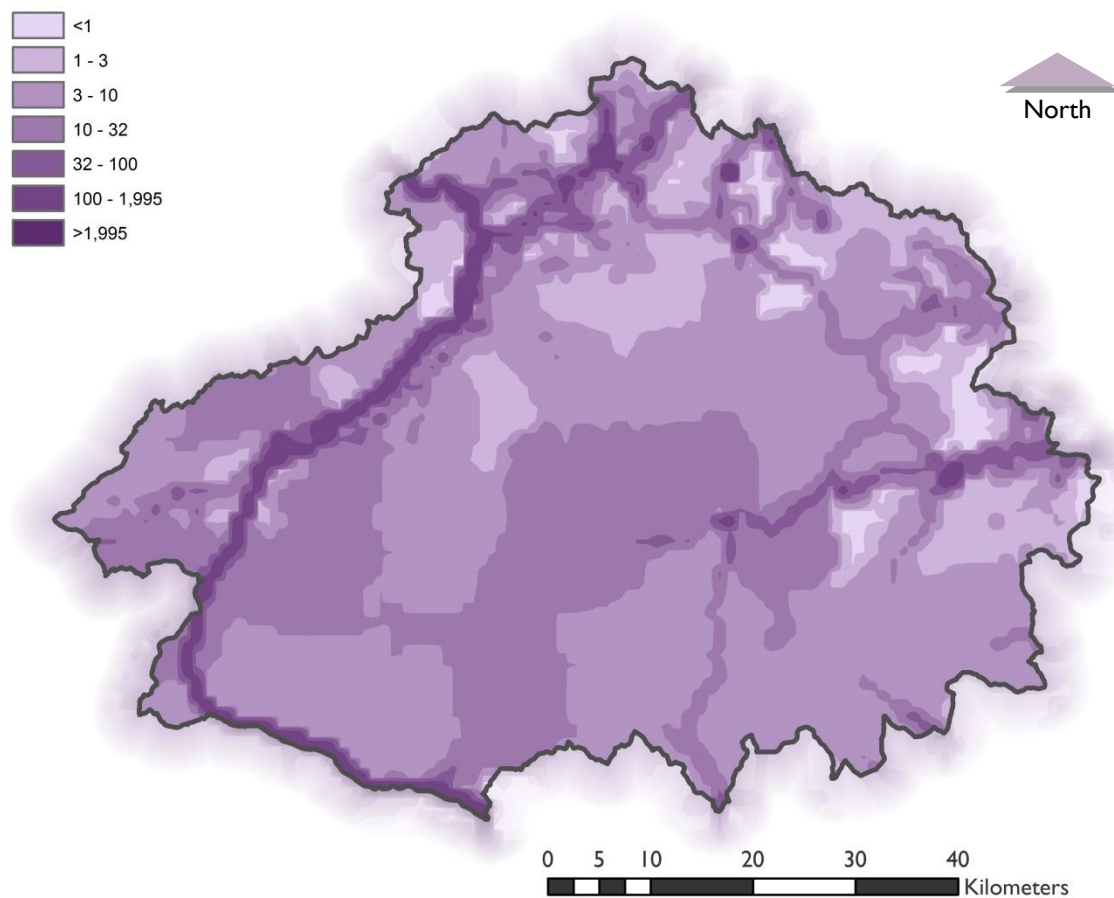


Figure 7 - greenhouse gas emissions by source for Scotland in 2017

The UK National Atmospheric Emissions Inventory maps greenhouse gas emissions. Figure 8 shows a subset of this data for the Park area. The most significant carbon dioxide emissions are associated with road transport corridors and settlements. Other emission sources are present in the Park, for example associated with agricultural practices and the Granish landfill site near Aviemore. Due to topography and climate, the Park has limited land suitable for the lowland agricultural practices compared to upland land uses, meaning that emissions from agriculture are also limited. Forestry has the capacity to be a significant carbon sink, although it is unclear whether the data considers emissions from planting, management and extraction processes or just sequestration from growing trees.



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Figure 8 - carbon dioxide (as carbon) emissions in tonnes for the Park in 2017 (km² data smoothed in map representation)

Annualised data for national parks is not available. To get an approximation of the contribution of the Park, further analysis of data from the 2019 Department of Business, Energy and Industry Strategy (<https://ukclimateprojections-ui.metoffice.gov.uk/>) has been required. Mid-year population estimates have been used as a proxy for proportionally attributing the emissions of the Local Authorities areas within the Park to the Park itself. It is recognised that this is a blunt means of estimation, particularly in terms of commercial and transport data.

In the absence of a detailed carbon-audit, figures 9 and 10 offer an alternative baseline. It should be noted that there are a number of other issues with emissions data for the Park:

- It has not been possible to include land use and forestry data. It is only being available at Local Authority scale rather than smaller datazones that could be aligned with the Park boundary, and the broad land uses of the wider Local Authority areas are unlikely to be representative of the land uses within the Park. This creates a high degree of uncertainty as to the accuracy of estimations for this data regarding the land uses in the Park which vary from the larger scale Local Authority areas. Instead, data on industrial/commercial, domestic and transport emissions has been used, as this data is available at a relevant scale.
- Information on EU Emissions Trading System industrial installations is not part of the available dataset. However as these tend to be power stations and high energy usage industrial plants, this should not significantly affect the data used due to the lack of such facilities in the Park.
- The emissions from gas, a fuel source that is only available via private supply in the Park, have been subsumed and estimated as a generalised emission source in the overall domestic, industry and commercial categories.
- The energy consumed by tourists and visitors to the Park has not been adjusted for, as data is unlikely to have been collected at a level that would provide meaningful results. (For example breaking down how tourists and visitors move through the Park, the energy efficiency of where they stay, how they use energy while on holiday, etc.)

Nonetheless, the data that is available provides an indication of the broad emissions source types and trends over time.

In the Park, the main source of emissions has been industrial and commercial, however in recent years this has reduced while transport emissions have increased, becoming the leading source of emissions in the Park. However, overall the trend has been for a combined reduction in emissions per person in the Park between 2005 - 2017. There is marked variation between the Local Authority areas within the Park (figure 11). This is likely a reflection of the different make up of the Local Authority areas for example the varying types of business/industrial activities and travel to work distances in each of the different Local Authority areas (see Topic 8, Population and human health).

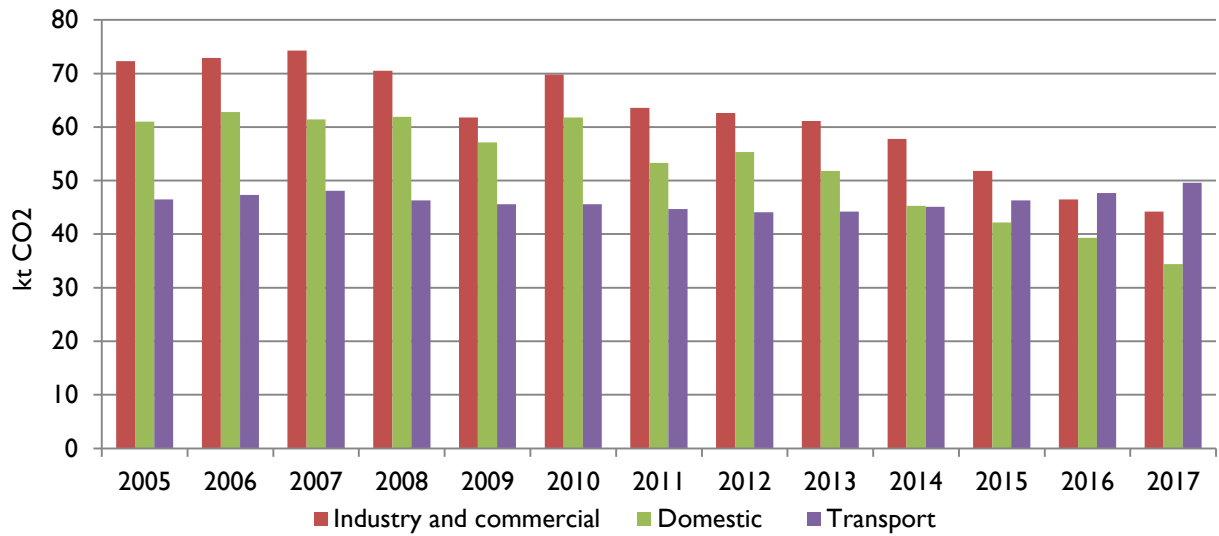


Figure 9 - estimated CO₂ emissions for the Park for the period 2005 to 2017 by source type

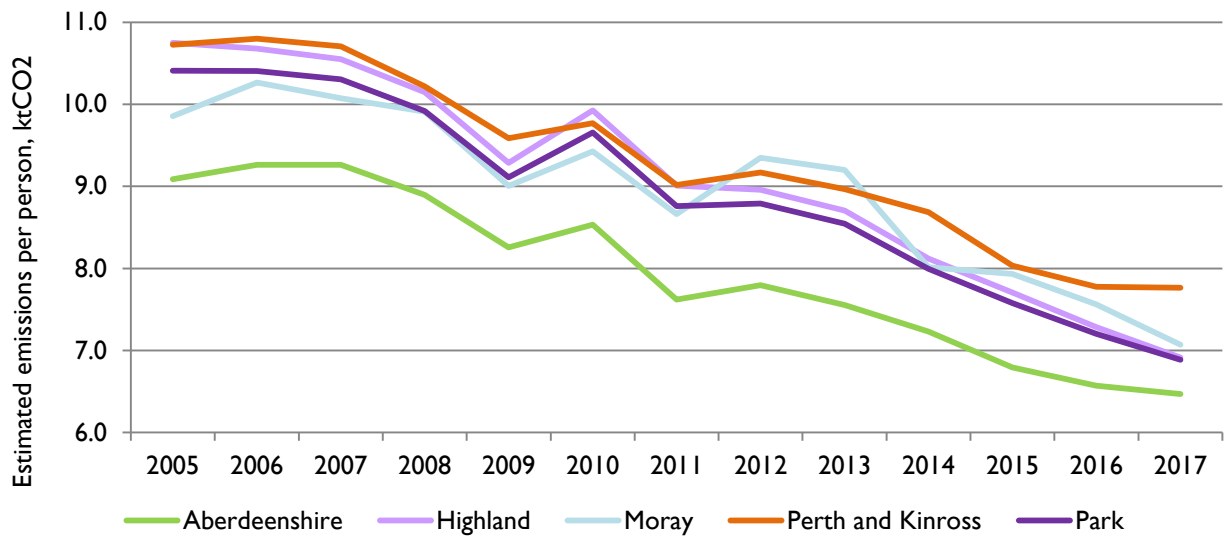


Figure 10 - estimated CO₂ emissions per person for the Park for the period 2005 to 2017



Figure 11 - estimated CO₂ emissions per person for the period 2005 to 2017, by Local Authority area, compared to emissions per person for the Park as a whole

With regard to methane, another greenhouse gas, the only facility within the Park that contributes towards the Scottish Pollutant Release Inventory is Granish landfill site, which is operated by the Highland Council. Estimates of the methane emissions for the site indicate a trend for sudden significant reductions in emissions which then plateau (Figure 12).

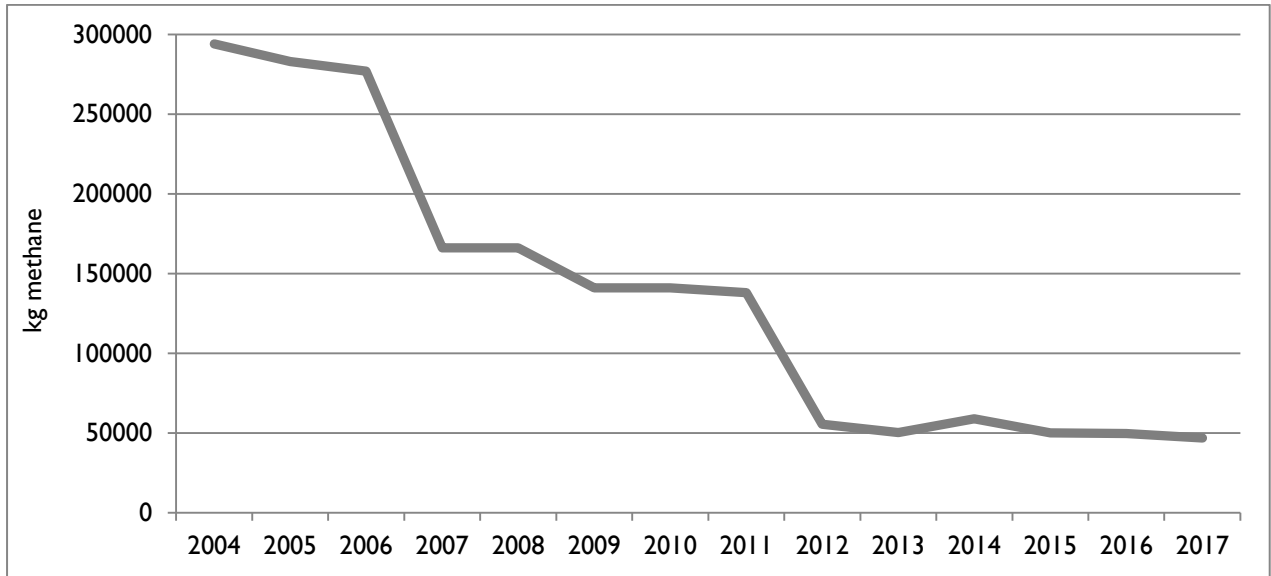


Figure 12 - estimated methane emissions from Granish landfill site, 2003 to 2017

Although the overall trend in greenhouse gas emissions is downward in the Park, it is likely that substantial further decreases will be required to meet the emissions targets of the Climate Change (Emissions Reduction Targets) (Scotland) Bill 2019.

Proposed SEA objectives

SEA main objective	Sub-objective
<p>Ia: Reduce the emissions of greenhouse gases with particular focus on emissions from buildings, transport, energy generation and industry (especially CO₂), but also from natural carbon sinks (such as woodlands and peatlands).</p>	Will there be an effect on energy conservation and efficiency in new development?
	Will there be an effect on the production of renewable energy of appropriate scale for the Park?
	Will there be an effect on local production and use of materials and food produce?
	Will there be an effect on carbon sinks (such as woodlands and peatlands)?
	Will there be an effect on travel that produces greenhouse gas emissions?
<p>Ib: Ensure existing and proposed infrastructure and buildings are located and designed to cope with future climate conditions.</p>	Considering future implications of climate change (eg increased severity of weather resulting in more flooding, periods of drought and extremes of temperature), will there be an effect on existing infrastructure and buildings?
	Considering future implications of climate change (eg increased severity of weather resulting in more flooding, periods of drought and extremes of temperature), will there be an effect on infrastructure and buildings proposed in the Local Development Plan?