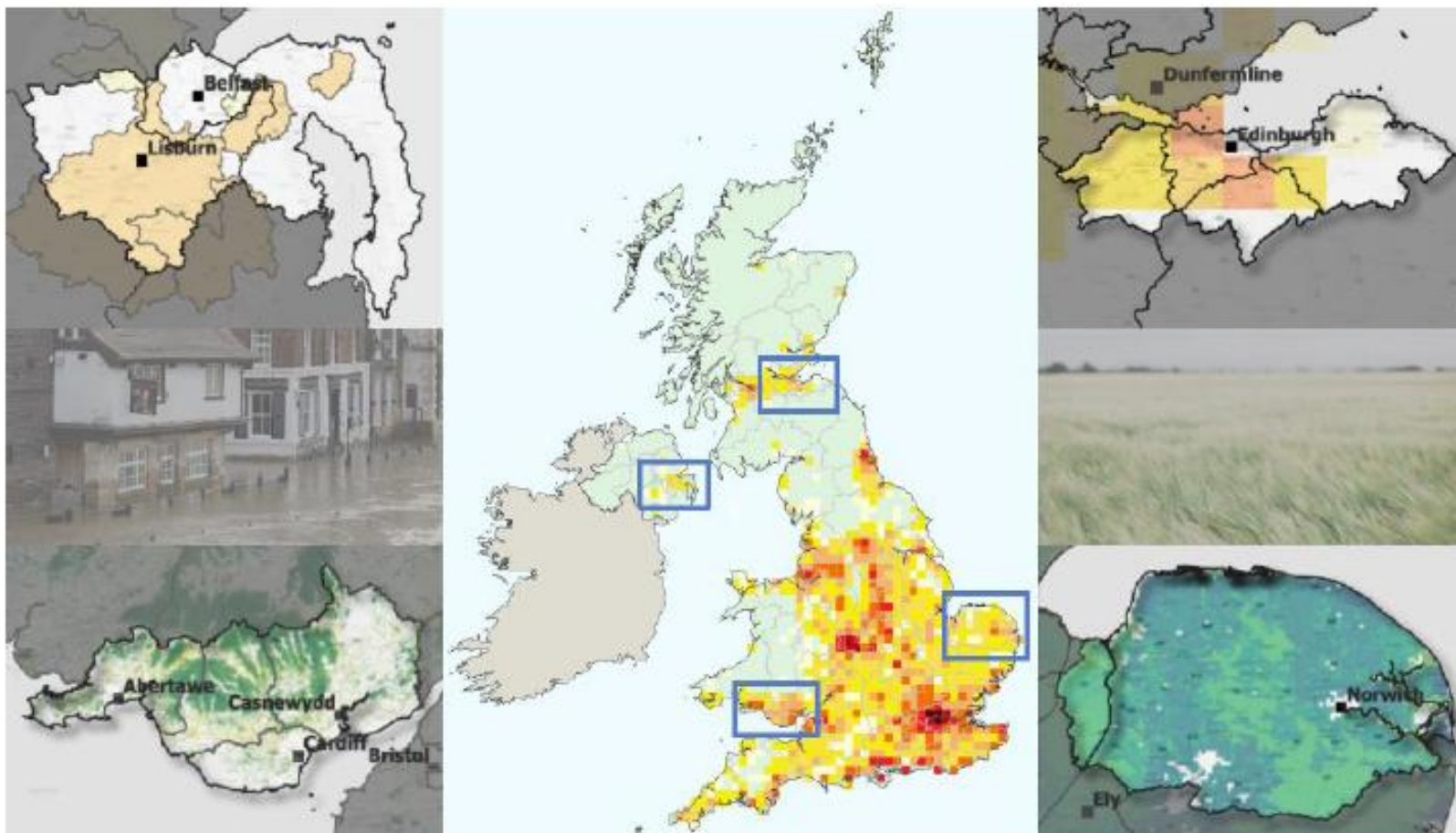


OpenCLIM Climate Risk Reports

Local insights from national analysis



Introduction

For further information visit openclim.science where you will find an overview of the OpenCLIM project, links to local climate risk reports for other regions, and a [user guide](#) outlining details of the project methodology, the risk sectors covered and specific metrics shown.

Agriculture

- Oil seed rape potential yield (units = tonnes per hectare)
- Grass potential yield (t/ha)
- Wheat potential yield (t/ha)

These metrics indicate areas where a crop is likely to increase/decrease in yield due to climate forced changes in temperature and water availability. 1 km grids.

Biodiversity

- Conservation potential (relative units)
- Restoration potential (relative units)
- Urban green space potential (relative units)

These metrics indicate the relative biodiversity impact in a location based on the richness of species remaining. Areas above 75 represent climate refugia under future warming levels. 100 m grids.

Heat Stress

- Heat related mortality (units = mean deaths, cumulative deaths)

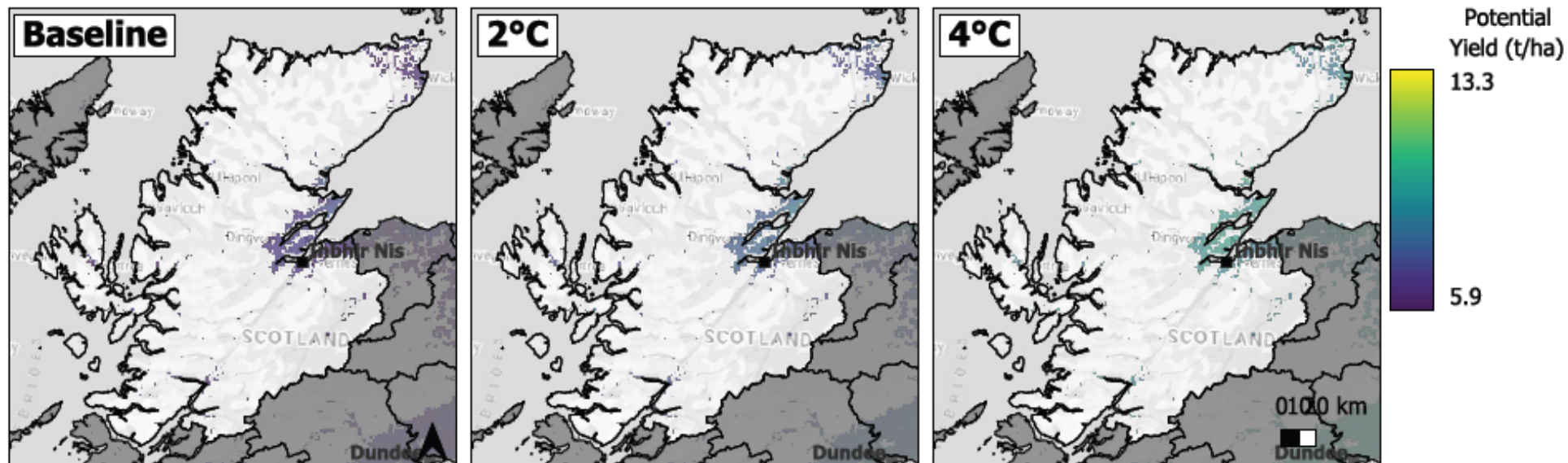
This metric projects the total number of heat related death that could occur in a warmer (2C or 4C) future, using future population (2050 and 2080), and UK Shared Socioeconomic Pathways (SSP2 and SSP4, see [user guide](#)). 12 km grid.

Hydrology

- Drought duration (units = cumulative months per 30 year period)
- 1-in-10-year return period flow (units = flow rate in m³/s, difference %)
- 1-in-100-year return period flow (units = flow rate in m³/s, difference %)

These river flow-rate metrics are shown as a proxy for drought or flooding and should be considered alongside national river, sea, and surface-water flood indicators from the Environment Agency and their devolved equivalents (SEPA, NRW, DAERA-NI). Tidally influenced and coastal catchments were not modelled. 1km grids for whole catchments.

Highland | Potential Yield | Oil Seed Rape



Key Points

Potential yield (tonnes per hectare) shows change in potential oil seed rape yield at 1km resolution, due to heat limitation and water limitation under baseline, 2°C, and 4°C warming scenarios.

Scenarios shown include the CO₂ fertilisation effect (enhanced plant productivity).

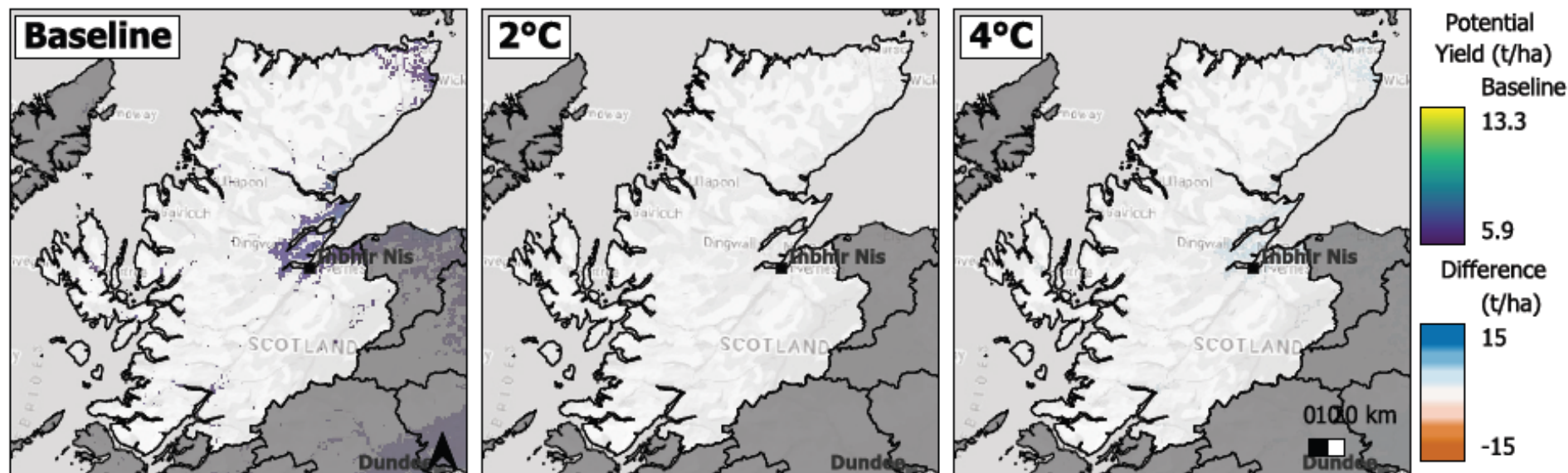
A modest increase in potential yield is projected at 2°C and 4°C for most of the Highland area.

Local Summary

Minimum, mean and maximum potential yield (t/ha) for the Highland region at baseline, 2°C and 4°C warming scenarios.

County	Mean			Minimum			Maximum		
	Baseline	2°C	4°C	Baseline	2°C	4°C	Baseline	2°C	4°C
Highland	6.8	8	9.5	5.6	6.7	7.9	8.7	10	11.6

Highland | Potential Yield - difference | Oil Seed Rape



Key Points

Potential yield (tonnes per hectare) shows change in potential oil seed rape yield at 1km resolution, due to heat limitation and water limitation under baseline scenarios with the difference from baseline at 2°C and 4°C warming level scenarios.

Scenarios shown include the CO₂ fertilisation effect (enhanced plant productivity).

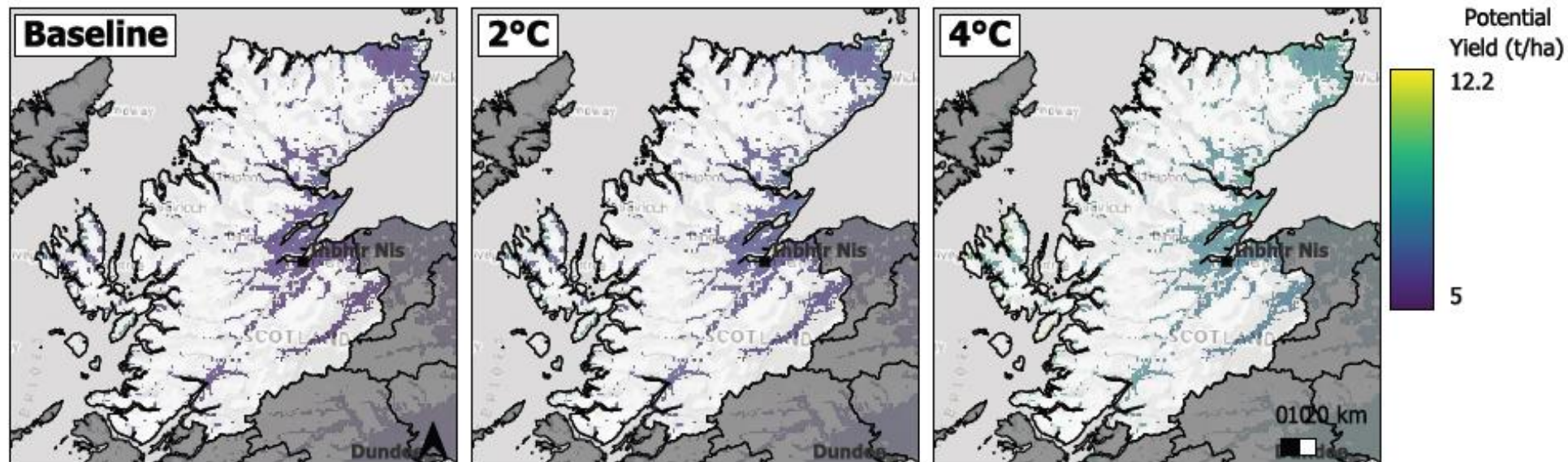
A modest increase in potential yield is projected at 2°C and 4°C for most of the Highland area.

Local Summary

Minimum, mean and maximum potential yield (t/ha) for the Highland region at baseline, 2°C and 4°C warming scenarios, with the difference from the baseline mean for 2°C and 4°C warming scenarios.

County	Mean			Minimum			Maximum			Difference	
	Baseline	2°C	4°C	Baseline	2°C	4°C	Baseline	2°C	4°C	2°C	4°C
Highland	6.8	8	9.5	5.6	6.7	7.9	8.7	10	11.6	1.3	2.7

Highland | Potential Yield | Grass



Key Points

Potential yield (tonnes per hectare) shows change in potential grass yield at 1km resolution, due to heat limitation and water limitation under baseline, 2°C, and 4°C warming scenarios.

Scenarios shown include the CO₂ fertilisation effect (enhanced plant productivity).

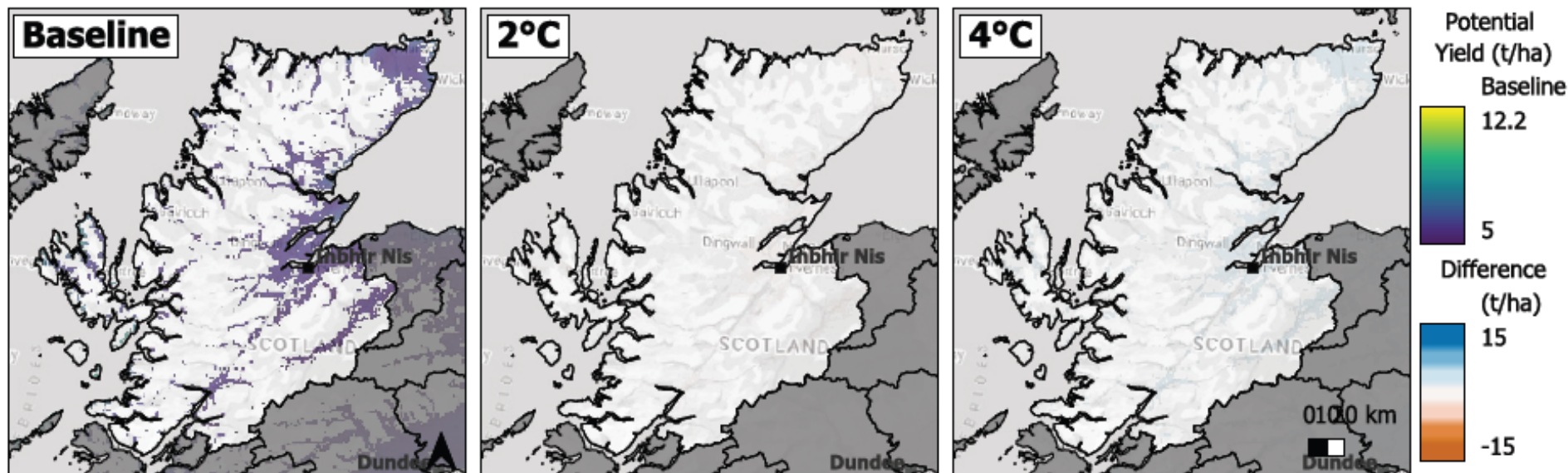
A modest increase in potential yield is projected at 2°C and 4°C for most of the Highland area.

Local Summary

Minimum, mean and maximum potential yield (t/ha) for the Highland region at baseline, 2°C and 4°C warming scenarios.

County	Mean			Minimum			Maximum		
	Baseline	2°C	4°C	Baseline	2°C	4°C	Baseline	2°C	4°C
Highland	6.1	6.6	8.5	5	5.4	7.1	9.3	9.9	12.2

Highland | Potential Yield - difference | Grass



Key Points

Potential yield (tonnes per hectare) shows change in potential grass yield at 1km resolution, due to heat limitation and water limitation under baseline scenarios with the difference from baseline at 2°C and 4°C warming level scenarios.

Scenarios shown include the CO₂ fertilisation effect (enhanced plant productivity).

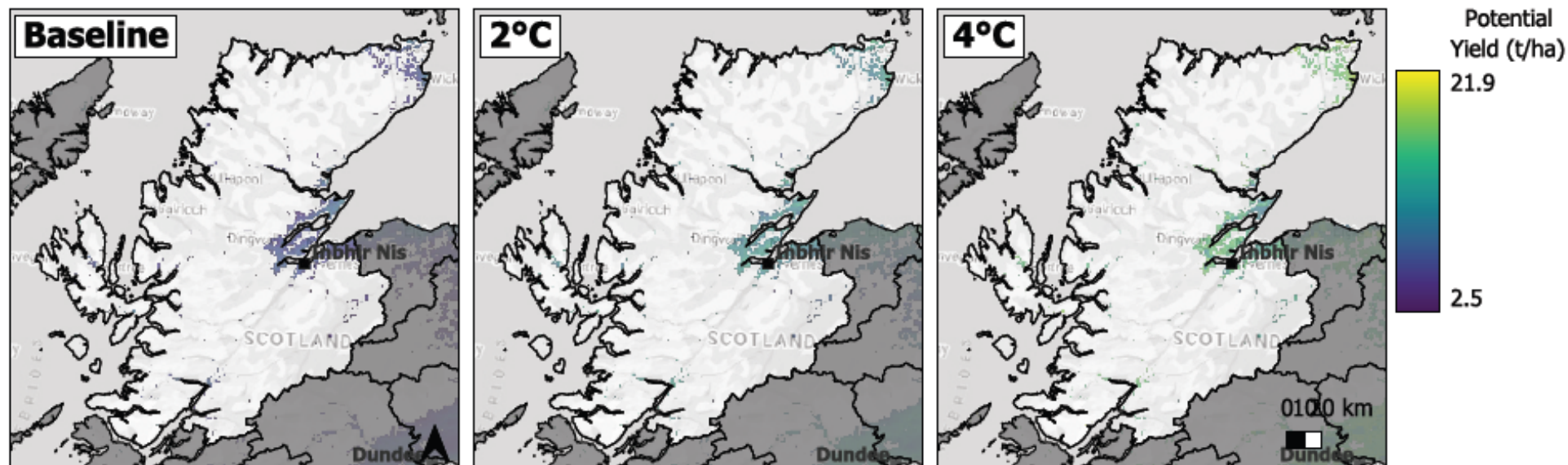
A modest increase in potential yield is projected at 2°C and 4°C for most of the Highland area.

Local Summary

Minimum, mean and maximum potential yield (t/ha) for the Highland region at baseline, 2°C and 4°C warming scenarios, with the difference from the baseline mean for 2°C and 4°C warming scenarios.

County	Mean			Minimum			Maximum			Difference	
	Baseline	2°C	4°C	Baseline	2°C	4°C	Baseline	2°C	4°C	2°C	4°C
Highland	6.1	6.6	8.5	5	5.4	7.1	9.3	9.9	12.2	0.6	2.4

Highland | Potential Yield | Wheat



Key Points

Potential yield (tonnes per hectare) shows change in potential wheat yield at 1km resolution, due to heat limitation and water limitation under baseline, 2°C, and 4°C warming scenarios.

Scenarios shown include the CO₂ fertilisation effect (enhanced plant productivity).

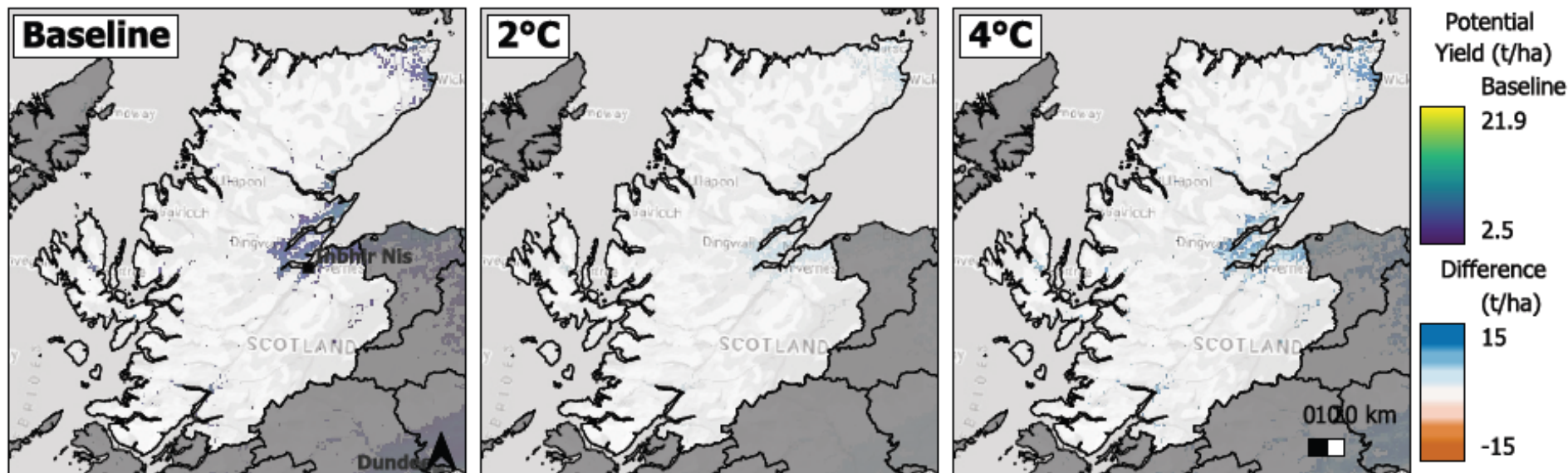
There is a slight increase in potential yield projected at 2°C and 4°C for most of the Highland area.

Local Summary

Minimum, mean and maximum potential yield (t/ha) for the Highland region at baseline, 2°C and 4°C warming scenarios.

County	Mean			Minimum			Maximum		
	Baseline	2°C	4°C	Baseline	2°C	4°C	Baseline	2°C	4°C
Highland	7.1	11.8	15.7	1.8	4.8	9	14.8	18.1	21.2

Highland | Potential Yield - difference | Wheat



Key Points

Potential yield (tonnes per hectare) shows change in potential wheat yield at 1km resolution, due to heat limitation and water limitation under baseline scenarios with the difference from baseline at 2°C and 4°C warming level scenarios.

Scenarios shown include the CO₂ fertilisation effect (enhanced plant productivity).

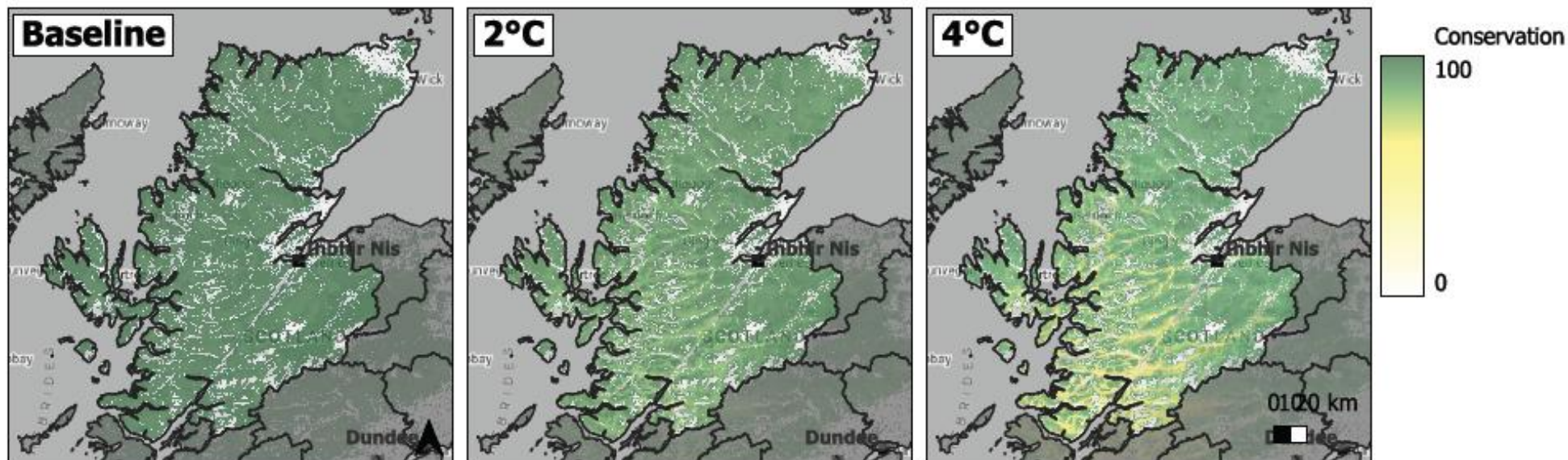
There is slight increase in potential yield projected at 2°C and 4°C for most of the Highland area.

Local Summary

Minimum, mean and maximum potential yield (t/ha) for the Highland region at baseline, 2°C and 4°C warming scenarios, with the difference from the baseline mean for 2°C and 4°C warming scenarios.

County	Mean			Minimum			Maximum			Difference	
	Baseline	2°C	4°C	Baseline	2°C	4°C	Baseline	2°C	4°C	2°C	4°C
Highland	7.1	11.8	15.7	1.8	4.8	9	14.8	18.1	21.2	4.7	8.6

Highland | Conservation | Warming Levels



Key Points

A relative scoring is shown for an area's suitability for Conservation, based on a metric of species richness remaining. Higher species remaining means better for conservation.

Under 2°C and 4°C warming scenarios, a decline in suitability is projected, with mean values shown in the Table (right).

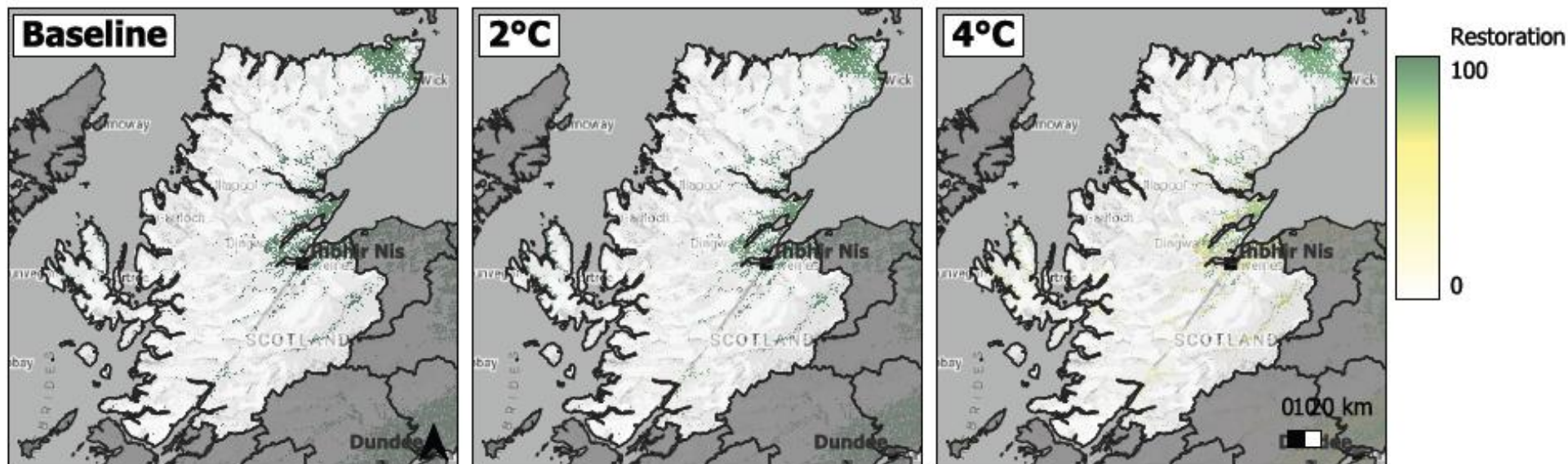
Under 4°C of warming, only one area is projected to retain a maximum suitability of 100 (range = 60 to 100), while the mean rarely exceeds 50, showing the importance of limiting warming to 2°C or less.

Local Summary

Mean, minimum and maximum conservation potential (%) for Highland at baseline, 2°C and 4°C warming scenarios.

County	Mean			Minimum			Maximum		
	Baseline	2°C	4°C	Baseline	2°C	4°C	Baseline	2°C	4°C
Highland	90.4	84.9	73.4	0	0	0	100	100	100

Highland | Restoration | Warming Levels



Key Points

A relative scoring is shown for an area's suitability for Restoration, based on a metric of species richness remaining. Lower species richness remaining requires greater restoration effort.

Under 2°C and 4°C warming scenarios, a decline in suitability is projected, with mean values shown in the Table (right).

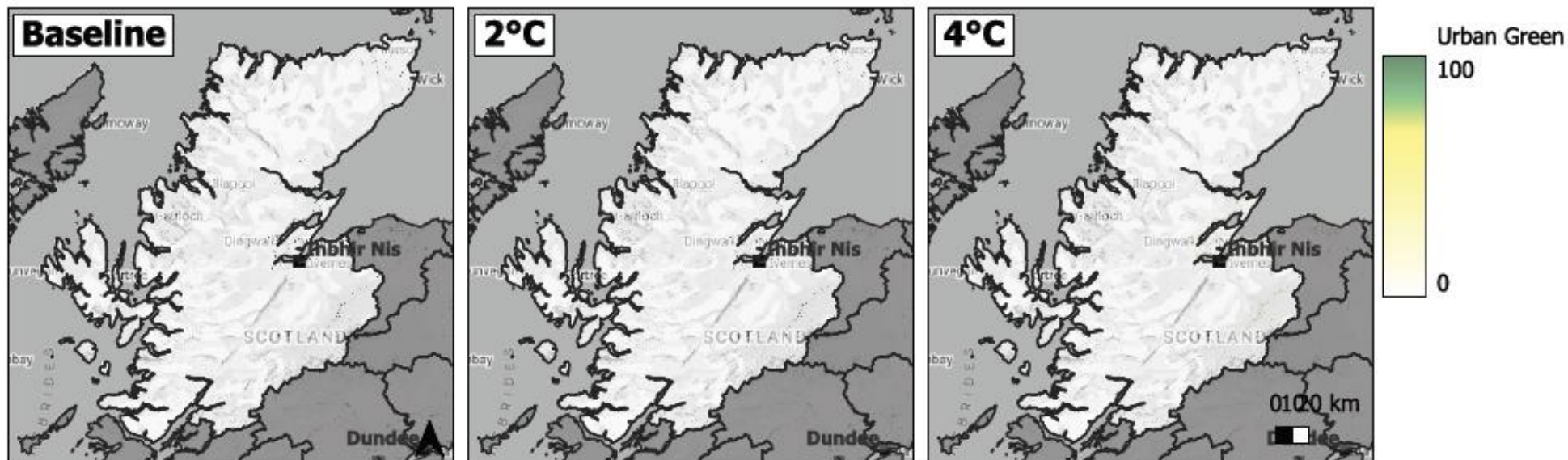
Under 4°C of warming no areas remain with a projected maximum suitability of 100 (range = 60 to 95), showing the importance of limiting warming to 2°C or less.

Local Summary

Mean, minimum and maximum restoration potential (%) for Highland at baseline, 2°C and 4°C warming scenarios.

County	Mean			Minimum			Maximum		
	Baseline	2°	4°	Baseline	2°	4°	Baseline	2°	4°
Highland	9.6	8.2	7	0	0	0	100	100	95

Highland | Urban Green | Warming Levels



Key Points

A relative scoring is shown for an area's suitability for Urban Green Space, based on a metric of species richness remaining. Higher species remaining has better urban green suitability.

Under 2°C and 4°C warming scenarios, a decline in suitability is projected, with mean values shown in the Table (right).

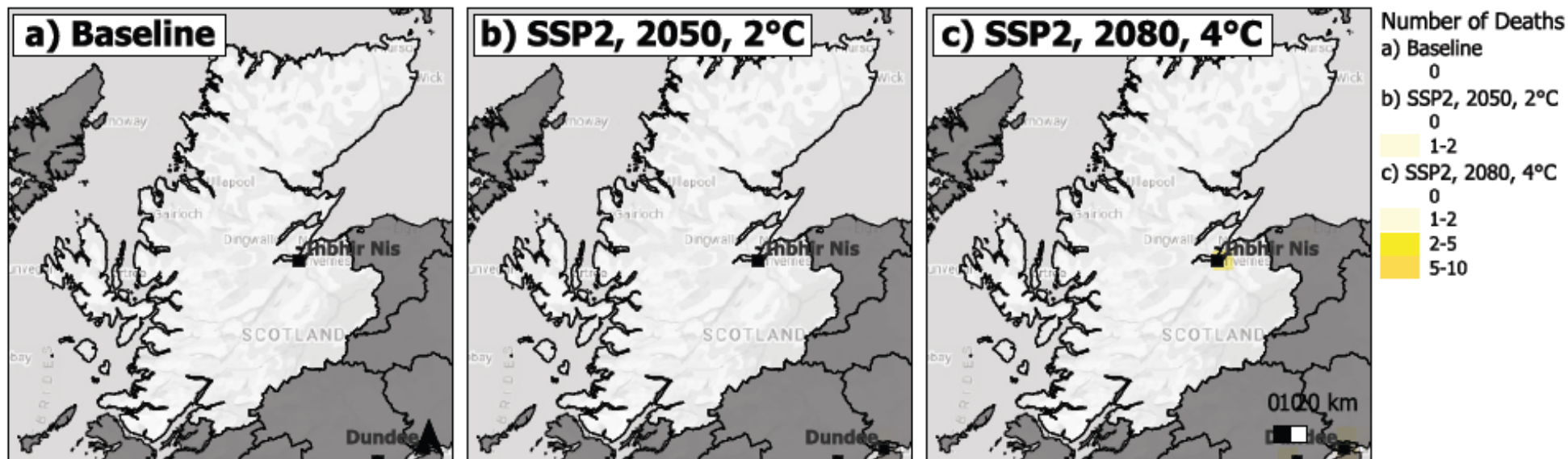
Under 4°C of warming there are no areas remaining with a maximum suitability of 100 (range = 60 to 95), showing the importance of limiting warming to 2°C or less.

Local Summary

Mean, minimum and maximum urban greenspace potential (%) for Highland at baseline, 2°C and 4°C warming scenarios.

County	Mean			Minimum			Maximum		
	Baseline	2°C	4°C	Baseline	2°C	4°C	Baseline	2°C	4°C
Highland	0.7	0.5	0.4	0	0	0	100	100	95

Highland | Heat Mortality | Combined Future Scenarios



Key Points

Heat mortality shows average deaths per year at 12km resolution, under future scenarios combining warming (2°C, 4°C), socioeconomics (SSP2, SSP4), and population (2050, 2080). [SSP information](#)

An increase in heat mortality is projected under 2°C and 4°C scenarios under SSP2. Additional population in 2050 and 2080 also increase mortality.

The climate model ensemble shows a range of outcomes, summarised by the 10th to 90th percentile range (bottom Table, right).

Local Summary

Mean deaths per year and cumulative deaths in Highland for baseline and future scenarios.

County	Baseline		SSP2 2050 2°C		SSP2 2080 4°C	
	Mean	Cumulative	Mean	Cumulative	Mean	Cumulative
Highland	0	0.6	0	2.7	0	9.8

For each region:

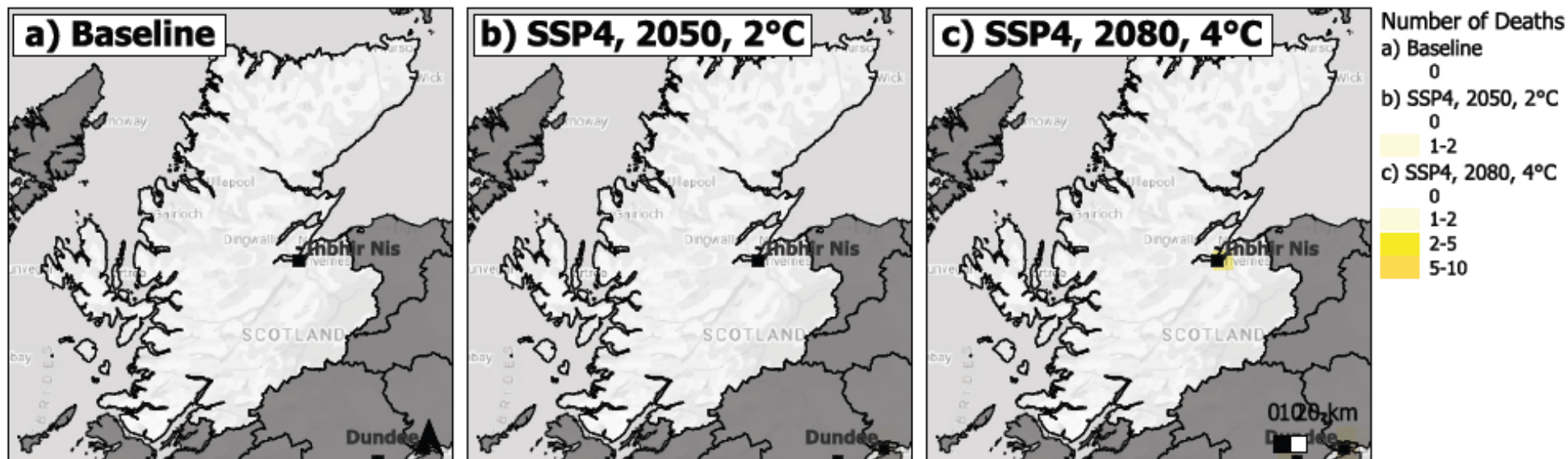
Mean = average of all grid squares.

Cumulative = sum of all grid squares.

Mean deaths per year for each future scenario and the climate model ensemble range between 10th and 90th percentile.

County	Baseline	10th - 90th	SSP2 2050	10th - 90th	SSP2 2080	10th - 90th
	Mean	percentile	2°C Mean	percentile	4°C Mean	percentile
Highland	0	0 - 0.3	0	0 - 1.2	0	0 - 4

Highland | Heat Mortality | Combined Future Scenarios



Key Points

Heat mortality shows average deaths per year at 12km resolution, under future scenarios combining warming (2°C, 4°C), socioeconomics (SSP2, SSP4), and population (2050, 2080). [SSP information](#)

An increase in heat mortality is projected under 2°C and 4°C scenarios under SSP4. Additional population in 2050 and 2080 also increase mortality.

The climate model ensemble shows a range of outcomes, summarised by the 10th to 90th percentile range (bottom Table, right).

Local Summary

Mean deaths per year and cumulative deaths in Highland for baseline and future scenarios.

County	Baseline		SSP4 2050 2°C		SSP4 2080 4°C	
	Mean	Cumulative	Mean	Cumulative	Mean	Cumulative
Highland	0	0.5	0	2.5	0	8.4

For each region:

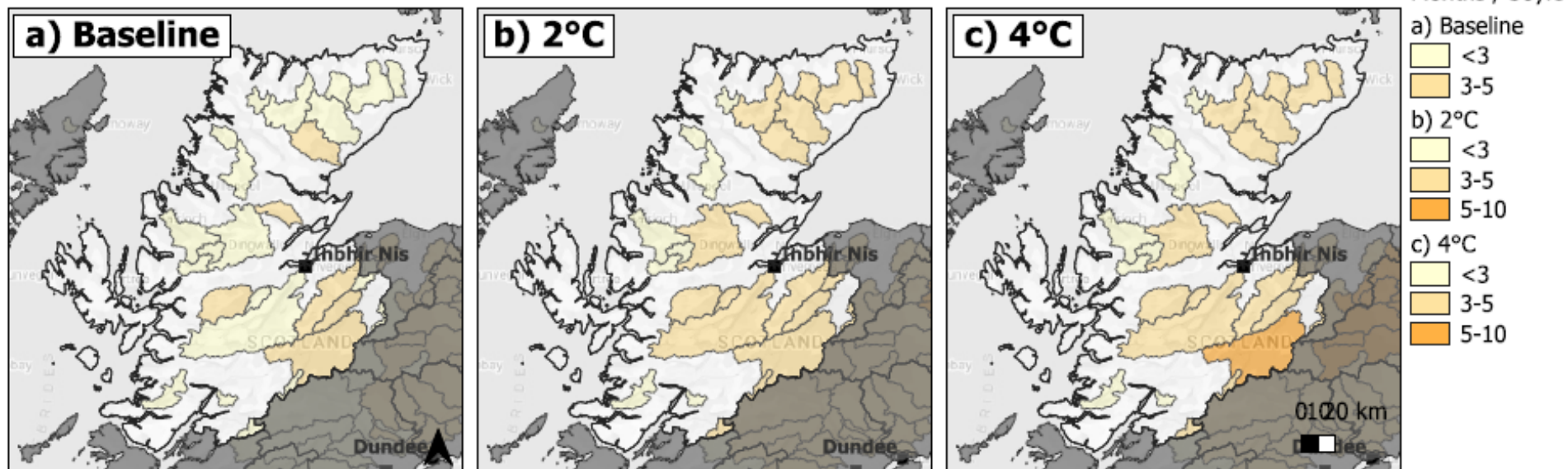
Mean = average of all grid squares.

Cumulative = sum of all grid squares.

Mean deaths per year for each future scenario and the climate model ensemble range between 10th and 90th percentile.

County	Baseline	10th - 90th	SSP4 2050	10th - 90th	SSP4 2080	10th - 90th
	Mean	percentile	2°C Mean	percentile	4°C Mean	percentile
Highland	0	0 - 1.1	0	0 - 1.1	0	0 - 3.4

Highland | Drought Duration | Warming Levels



Key Points

Drought duration is a low-flow metric representing the average cumulative duration of drought projected within a future 30-year period. Gridded 1km results are modelled at catchment scale. Coastal or tidally influenced catchments are not modelled.

Nationally for 2°C and 4°C warming scenarios, most catchments are projected to experience an increase in drought duration, particularly in southern and eastern areas.

The climate model ensemble shows a range of possible future outcomes, summarised by the 10th to 90th percentile range (bottom table).

Local Summary

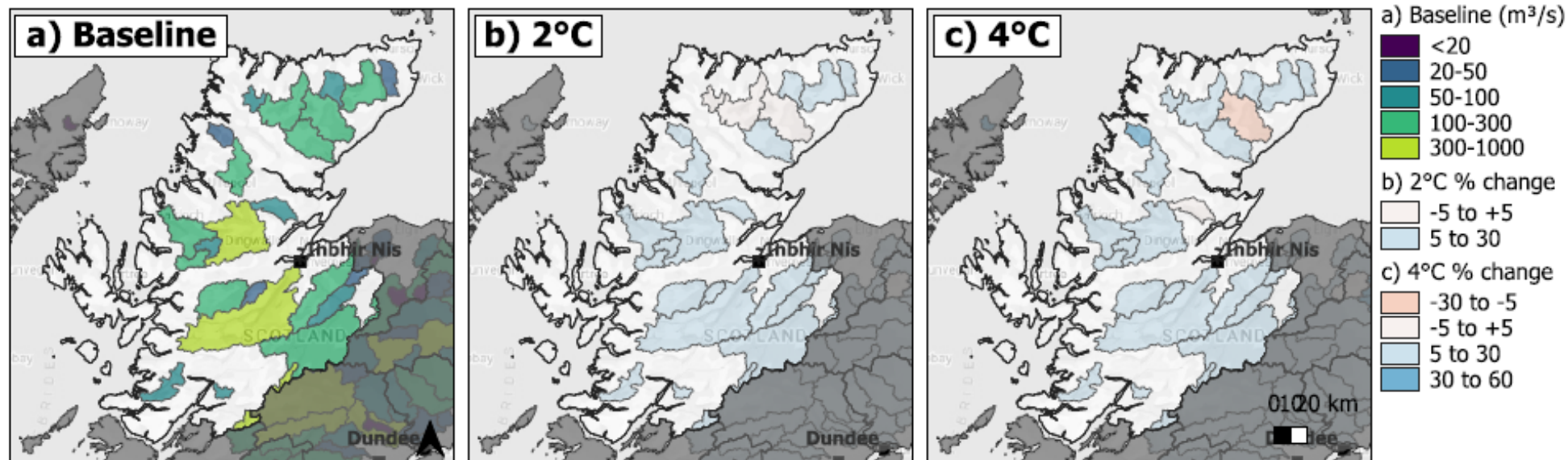
Median, minimum, and maximum drought duration (months/30-yr) for baseline scenario in Highland, and the percentage change from baseline for a 2°C and 4°C warming scenario.

County	Median			Minimum			Maximum		
	Baseline	2°C	4°C	Baseline	2°C	4°C	Baseline	2°C	4°C
Highland	2.8	3.4	3.6	2.2	2.5	2.4	3.3	4.8	5.6

Median drought duration (months/30-yr) for baseline scenario in Highland, the climate model ensemble range between 10th and 90th percentile, and the percentage change from baseline for a 2°C and 4°C warming scenario.

County	Baseline	2°C	4°C
	10th - 90th Median percentile	10th - 90th Median percentile	10th - 90th Median percentile
Highland	2.8	2 - 5.1	3.6
			2.1 - 10.7
			3.6
			2 - 14.2

Highland | 10 year Return Period Flow | Warming Levels



Key Points

The 1-in-10-year return period flow is a high-flow rate metric with a 10% annual probability of occurring. It is a proxy for a low probability, low magnitude flood event.

Nationally for 2°C of warming, most catchments are projected to experience 5% to 30% increase in flows, with little additional increase for most catchments at 4°C. Flow is projected to decrease for some central & eastern catchments.

The climate model ensemble shows a range of outcomes which is summarised by the 10th to 90th percentile range (bottom table).

Local Summary

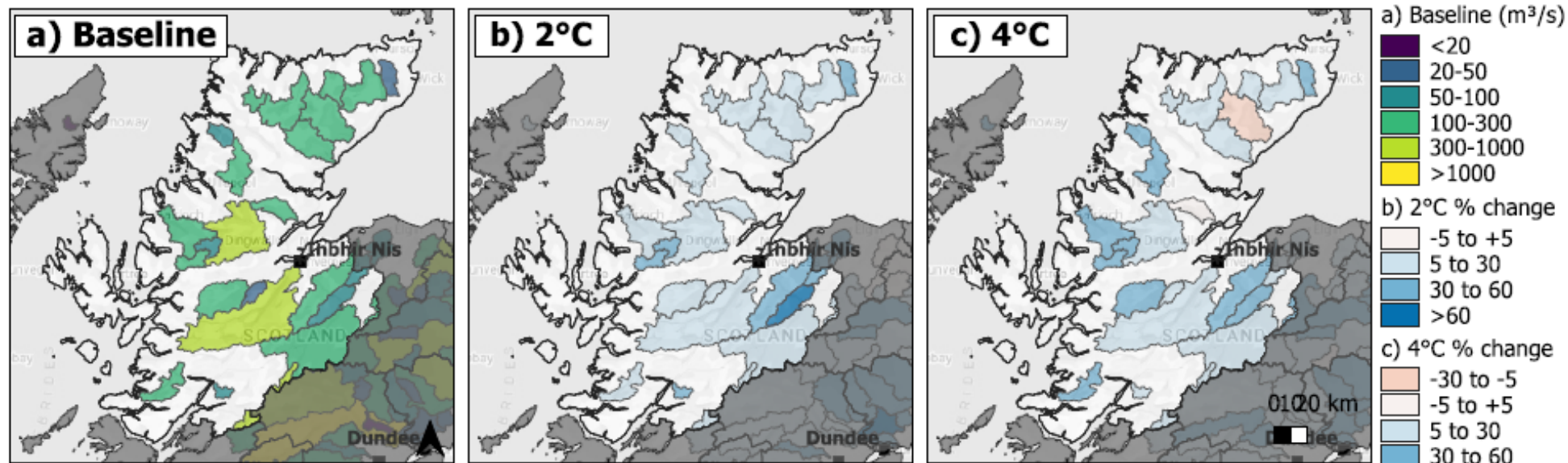
Median, minimum, and maximum flow rate (m³/s) for baseline scenario in Highland, and the percentage change from baseline for a 2°C and 4°C warming scenario.

County	Median		% change		Minimum			Maximum		
	Baseline	2°C	4°C	Baseline	2°C	4°C	Baseline	2°C	4°C	
Highland	106.8	11.4	15	29.3	-1.4	-9.4	909.7	24.3	43.2	

Median flow rate (m³/s) for baseline scenario in Highland, the climate model ensemble range between 10th and 90th percentile, and the percentage change from baseline for a 2°C and 4°C warming scenario.

County	Baseline Median	10th - 90th percentile	2°C % change	4°C % change
Highland	106.8	23.2 - 1115.9	11.4	15

Highland | 100 year Return Period Flow | Warming Levels



Key Points

The 1-in-100-year return period flow is a high-flow rate metric with a 1% annual probability of occurring. It is a proxy for a low probability, high magnitude flood event.

Nationally for 2°C warming, most catchments are projected to experience 5% to 30% increase in flows, while at 4°C more catchments are projected to increase flow >60%. Flow is projected to decrease for some catchments in the East.

The climate model ensemble shows a range of outcomes which is summarised by the 10th to 90th percentile range (bottom table).

Local Summary

Median, minimum, and maximum flow rate (m³/s) for baseline scenario in Highland, and the percentage change from baseline for a 2°C and 4°C warming scenario.

County	Median		% change		Minimum			Maximum		
	Baseline	2°C	4°C	Baseline	2°C	4°C	Baseline	2°C	4°C	
Highland	141.5	21.3	25.6	42.3	1.9	-7.7	1388	60.9	53.7	

Median flow rate (m³/s) for baseline scenario in Highland, the climate model ensemble range between 10th and 90th percentile, and the percentage change from baseline for a 2°C and 4°C warming scenario.

County	Baseline	10th - 90th percentile	2°C % change	4°C % change
Highland	141.5	32.3 - 1767.8	21.3	25.6

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Acknowledgements

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Patrick Fountain and Jasmin Evans provided GIS and other support to develop these reports. Front cover image credits: Don Lodge and Bruno Martins on [Unsplash.com](https://unsplash.com). Maps contain public sector information (administrative boundaries) licensed under the [Open Government Licence v3.0](#).