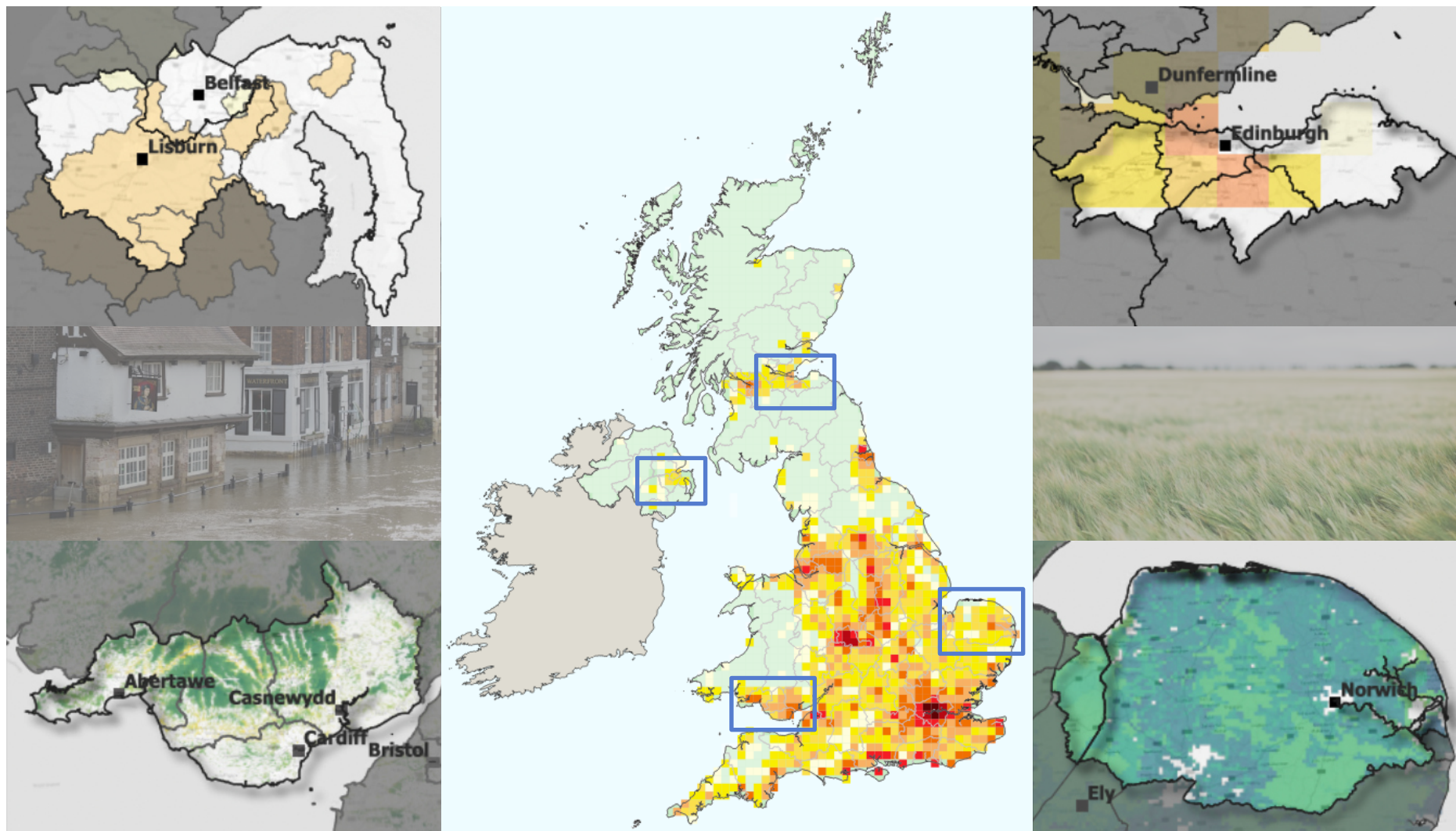


OpenCLIM Local Climate Risk Reports

Local insights from national analysis



Background

For further information visit openclim.science where you will find an outline of the OpenCLIM project, links to local climate risk reports for other counties, and a **user-guide** outlining the risk metrics shown and what they mean.

Agriculture

- Oil seed rape potential yield (units = tonnes per hectare, t/ha)
- 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. 100 m grids (resampled from 20 m original analysis).

Heat Stress

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

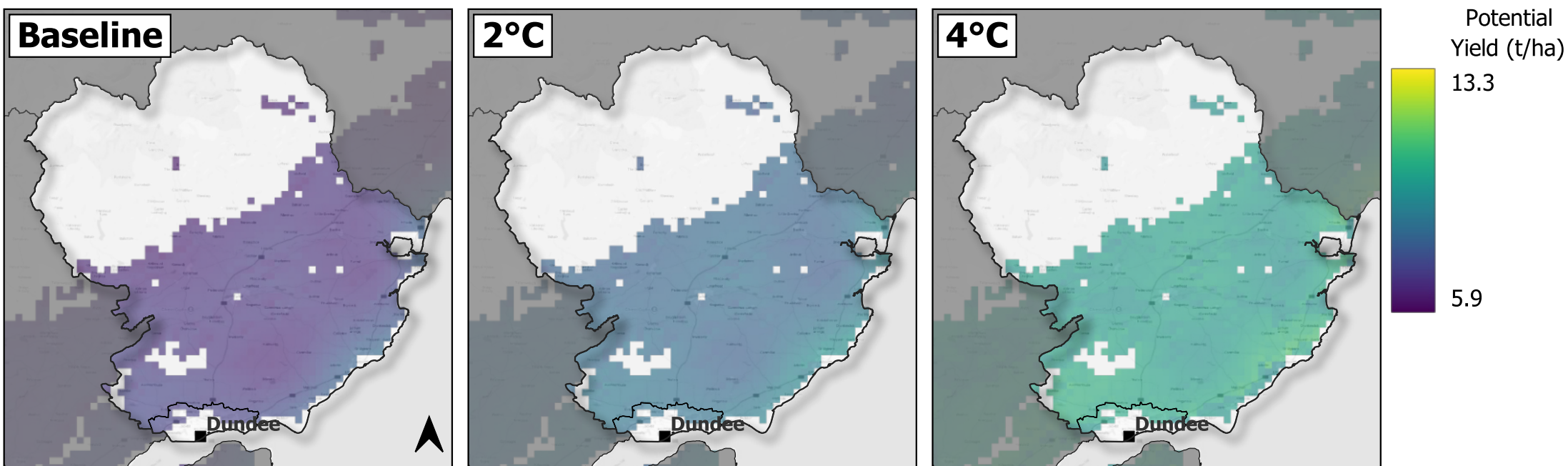
This metric projects the total number of heat-related deaths that could occur in a warmer future. 12 km grid (inherited from UKCP18 regional climate model).

Hydrology

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

These river flow-rate metrics are shown as a proxy for drought or flooding and should be used alongside e.g. Environment Agency flood indicators. Tidally-influenced and coastal catchments were not modelled. 1km grids for whole catchments.

Angus and Dundee | 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).

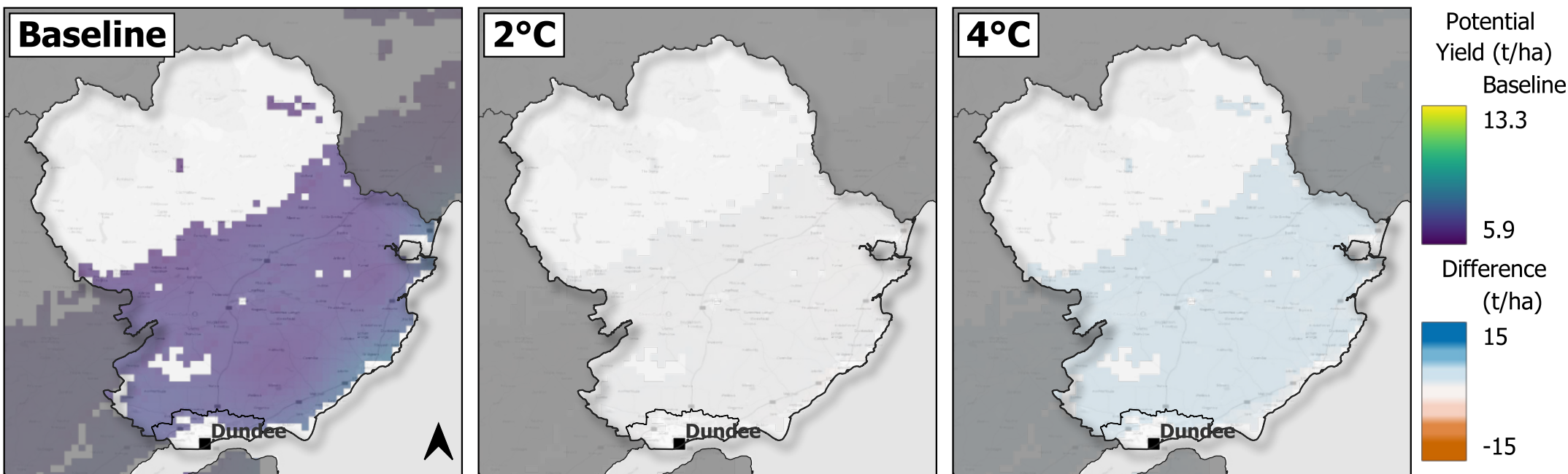
A modest increase in potential yield is projected at 2°C and 4°C for most of the Angus and Dundee area.

Local Summary

Minimum, mean and maximum potential yield (t/ha) for the Angus and Dundee 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
Angus	7	8.4	10.1	6.3	7.7	7.3	8.4	9.7	9.3
Dundee City	7.2	8.6	10.2	7.1	8.4	8.1	7.4	8.8	8.4

Angus and Dundee | 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).

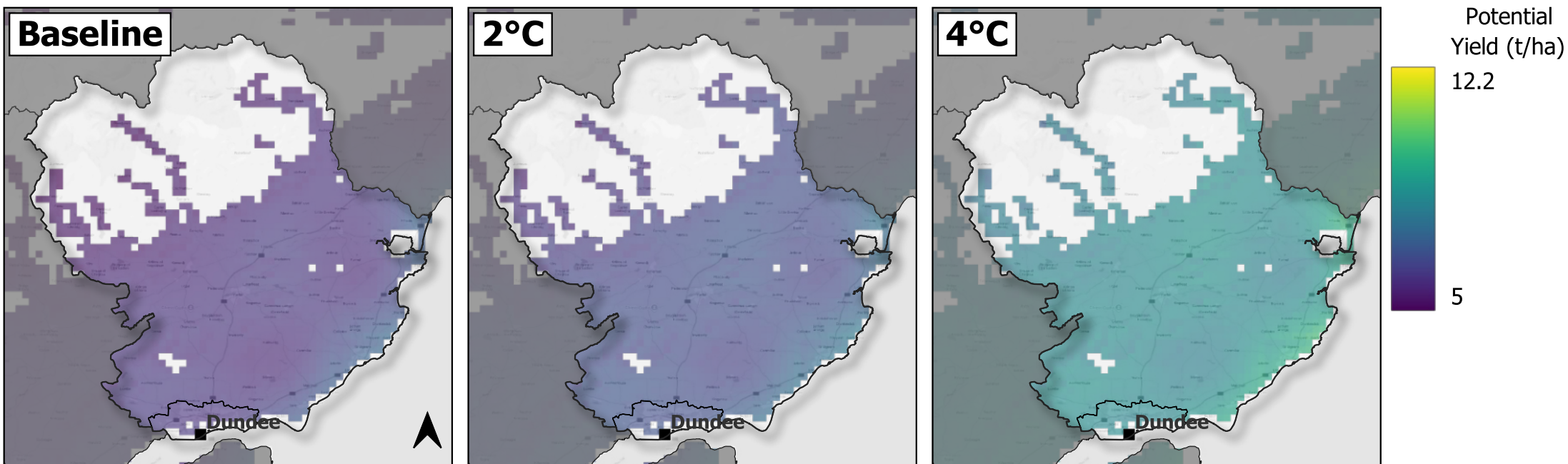
A modest increase in potential yield is projected at 2°C and 4°C for most of the Angus and Dundee area.

Local Summary

Minimum, mean and maximum potential yield (t/ha) for the Angus and Dundee 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
Angus	7	8.4	10.1	6.3	7.7	7.3	8.4	9.7	9.3	1.4	3.1
Dundee City	7.2	8.6	10.2	7.1	8.4	8.1	7.4	8.8	8.4	1.4	3

Angus and Dundee | 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).

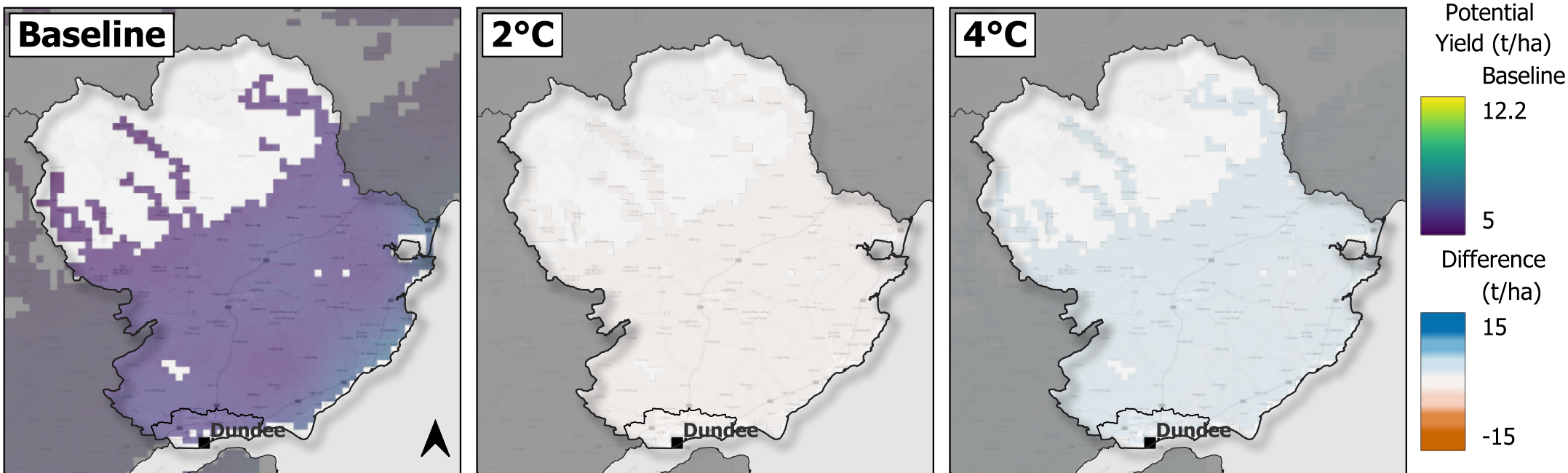
A modest increase in potential yield is projected at 2°C and 4°C for most of the Angus and Dundee area.

Local Summary

Minimum, mean and maximum potential yield (t/ha) for the Angus and Dundee 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
Angus	6	6.6	8.5	4.8	5.3	7.1	7.3	7.9	10
Dundee City	6.1	6.7	8.4	5.9	6.6	8.3	6.3	6.9	8.7

Angus and Dundee | 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).

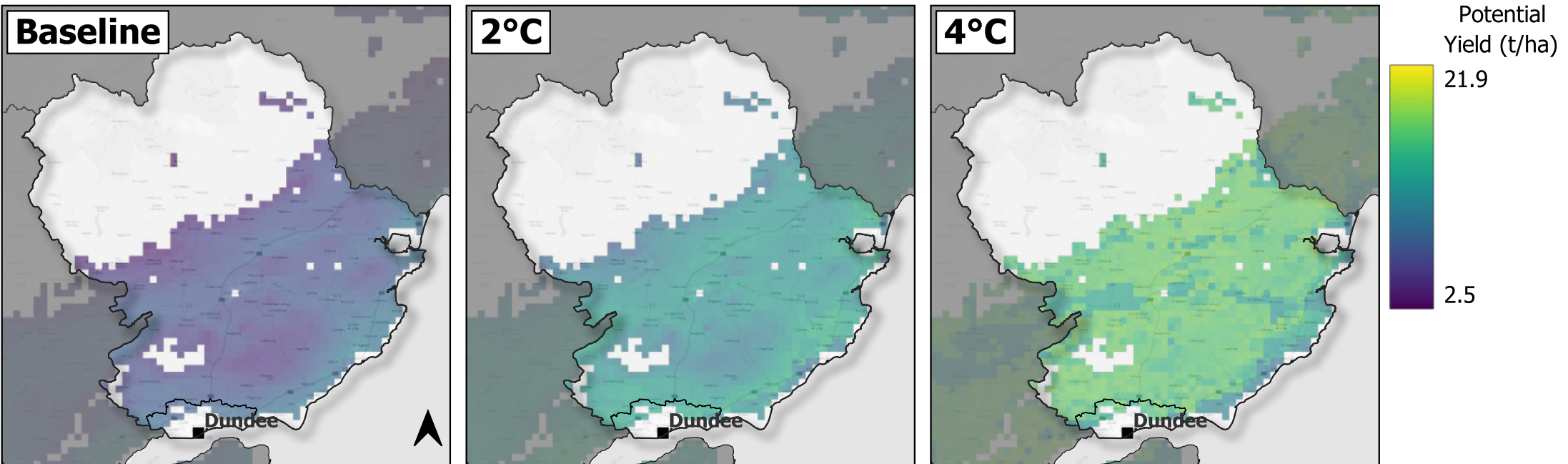
A modest increase in potential yield is projected at 2°C and 4°C for most of the Angus and Dundee area.

Local Summary

Minimum, mean and maximum potential yield (t/ha) for the Angus and Dundee 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
Angus	6	6.6	8.5	4.8	5.3	7.1	7.3	7.9	10	0.6	2.5
Dundee City	6.1	6.7	8.4	5.9	6.6	8.3	6.3	6.9	8.7	0.6	2.4

Angus and Dundee | 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).

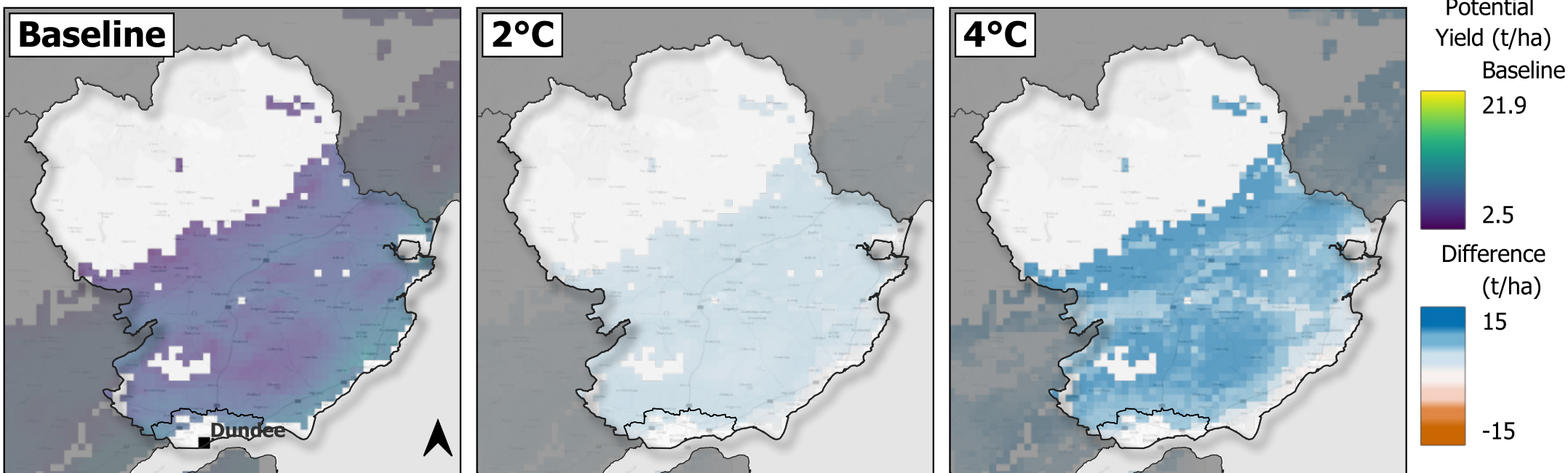
There is a slight increase in potential yield projected at 2°C and 4°C for most of the Angus and Dundee area.

Local Summary

Minimum, mean and maximum potential yield (t/ha) for the Angus and Dundee 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
Angus	10.2	12.1	16.1	3	7.3	9.4	11.2	15.5	19
Dundee City	11.8	13.5	15	7	11.9	11	9.5	14.6	17.9

Angus and Dundee | 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).

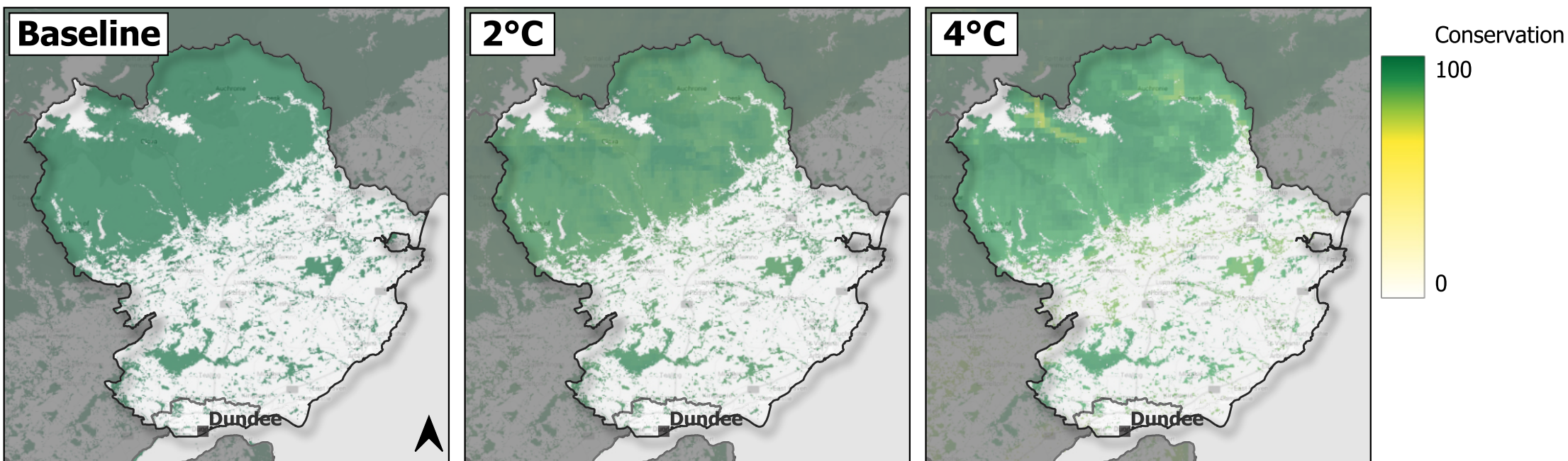
There is slight increase in potential yield projected at 2°C and 4°C for most of the Angus and Dundee area.

Local Summary

Minimum, mean and maximum potential yield (t/ha) for the Angus and Dundee 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
Angus	10.2	12.1	16.1	3	7.3	9.4	11.2	15.5	19	1.9	5.9
Dundee City	11.8	13.5	15	7	11.9	11	9.5	14.6	17.9	1.7	3.2

Angus and Dundee | 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.

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

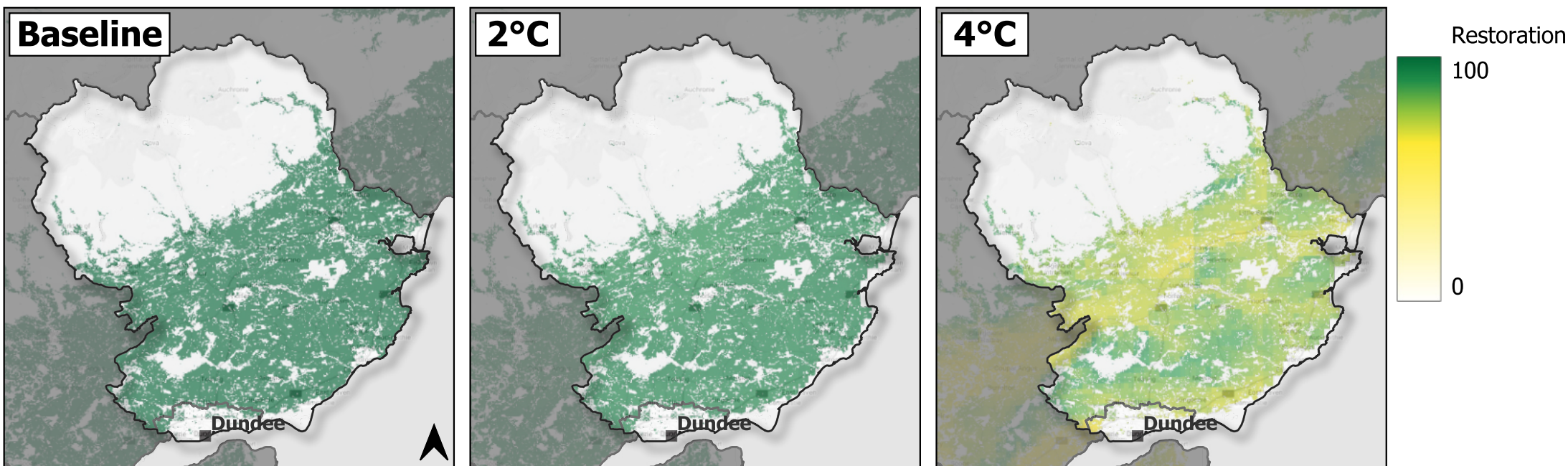
Under 4°C of warming, only one area is projected to retain a maximum suitability of 100 (range = 60 to 100), while the mean rarely exceeds 50, showing the importance of limiting warming to 2°C or less.

Local Summary

Minimum, mean and maximum conservation potential (%) for Angus and Dundee 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
Angus	52.7	50.4	45.5	0	0	0	100	100	95
Dundee City	32.3	29.4	23.9	0	0	0	100	96	80

Angus and Dundee | 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.

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

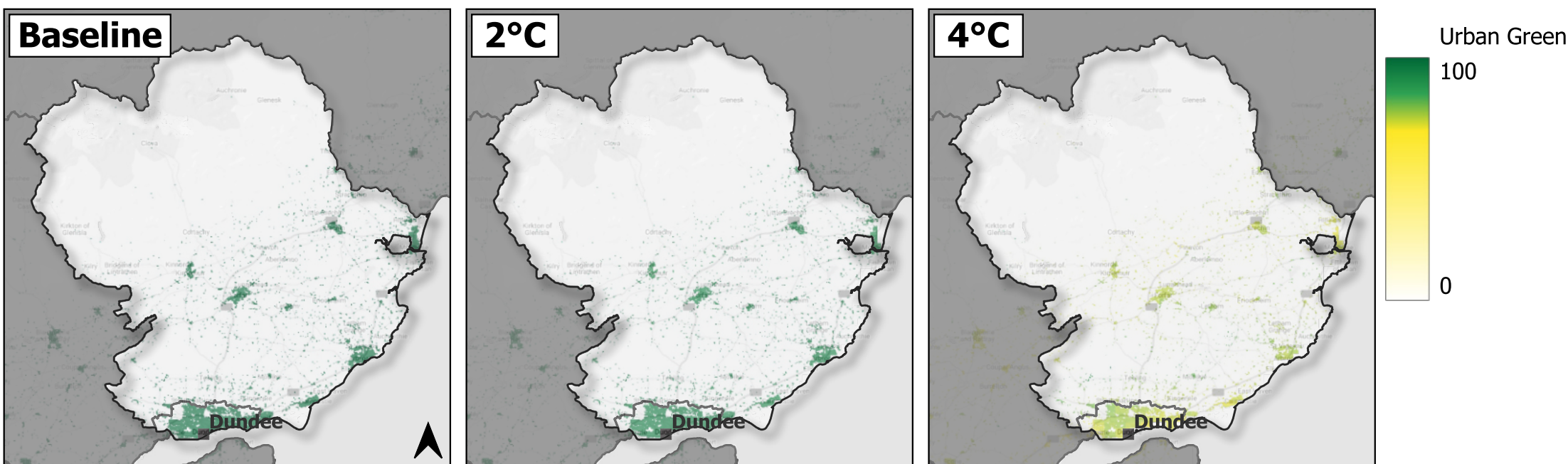
Under 4°C of warming no areas remain with a projected maximum suitability of 100 (range = 60 to 95), showing the importance of limiting warming to 2°C or less.

Local Summary

Minimum, mean and maximum restoration potential (%) for Angus and Dundee 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
Angus	47.3		36.7	0	0	0	100	99	93
Dundee City	67.7		51.3	0	0	0	100	96	80

Angus and Dundee | 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.

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

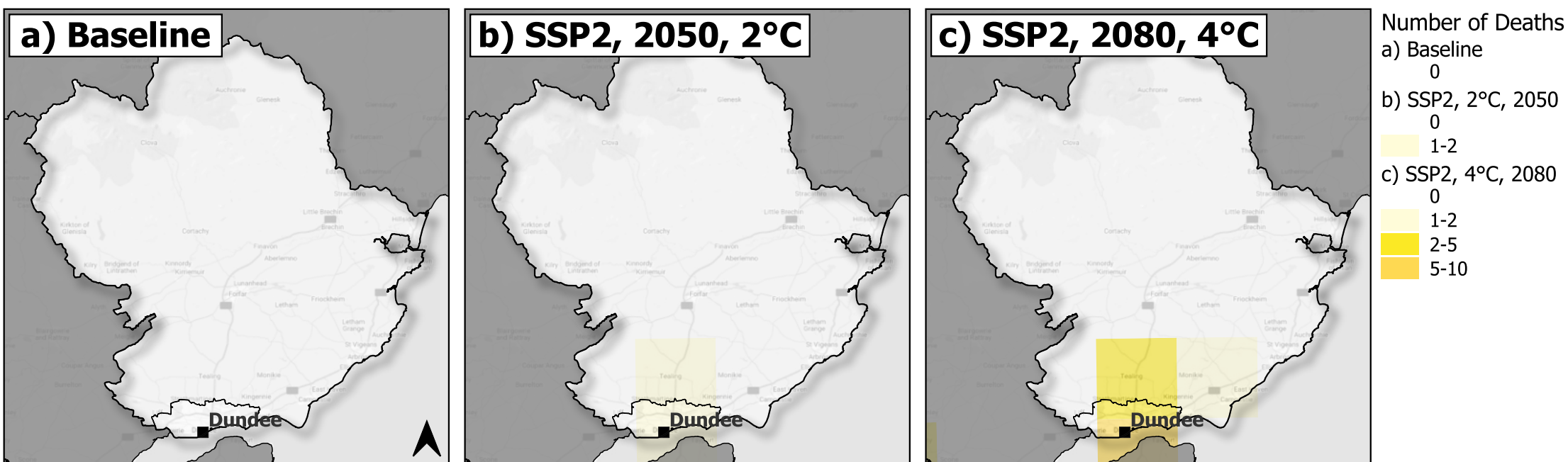
Under 4°C of warming there are no areas remaining with a maximum suitability of 100 (range = 60 to 95), showing the importance of limiting warming to 2°C or less.

Local Summary

Minimum, mean and maximum urban greenspace potential (%) for Angus and Dundee 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
Angus	3.1	2.8	2.2	0	0	0	100	98	92
Dundee City	68	64.5	49.2	0	0	0	100	96	80

Angus and Dundee | 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).

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

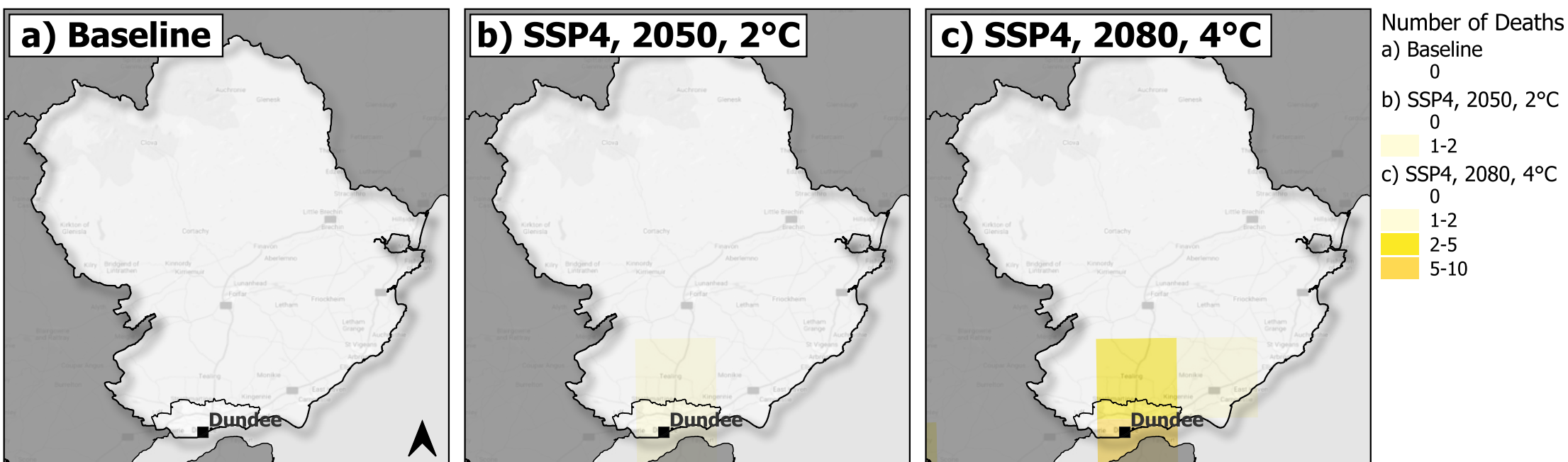
Mean deaths per year and cumulative deaths in Angus and Dundee for baseline and future scenarios.

County	Baseline		SSP2 2050 2°C			SSP2 2080 4°C		
	Mean	Cumulative	Mean	Cumulative	Difference	Mean	Cumulative	Difference
Angus	0	0.4	0.1	2.5	0.1	0.5	9.5	0.5
Dundee City	0.1	0.6	0.7	3.5	0.6	2.8	11.5	2.7

Mean deaths (death/yr) for each future scenario and the climate model ensemble range between 10th and 90th percentile.

County	Baseline Mean	10th - 90th percentile	SSP2 2050 2°C Mean	10th - 90th percentile	SSP2 2080 4°C Mean	10th - 90th percentile
Angus	0	0 - 0.3	0.1	0 - 1.6	0.5	0 - 5.3
Dundee City	0.1	0 - 0.4	0.8	0.1 - 2.3	2.8	0.3 - 7.4

Angus and Dundee | 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).

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

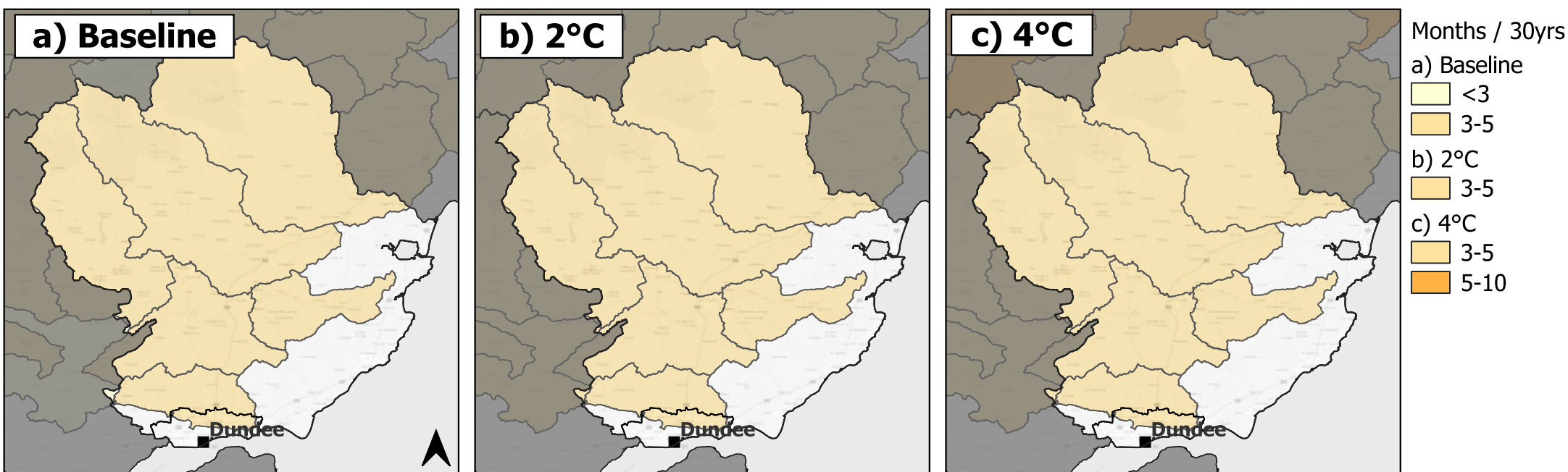
Mean deaths per year and cumulative deaths in Angus and Dundee for baseline and future scenarios.

County	Baseline		SSP4 2050 2°C			SSP4 2080 4°C		
	Mean	Cumulative	Mean	Cumulative	Difference	Mean	Cumulative	Difference
Angus	0	0.4	0.1	2.5	0.1	0.4	9.5	0.4
Dundee City	0.1	0.6	0.7	3.5	0.6	2.3	11.5	2.2

Mean deaths (death/yr) for each future scenario and the climate model ensemble range between 10th and 90th percentile.

County	Baseline Mean	10th - 90th percentile	SSP4 2050 2°C Mean	10th - 90th percentile	SSP4 2080 4°C Mean	10th - 90th percentile
Angus	0.1	0 - 1.4	0.1	0 - 1.5	0.4	0 - 4.3
Dundee City	0.7	0.1 - 2	0.7	0.1 - 2.1	2.3	0.3 - 6.1

Angus and Dundee | 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

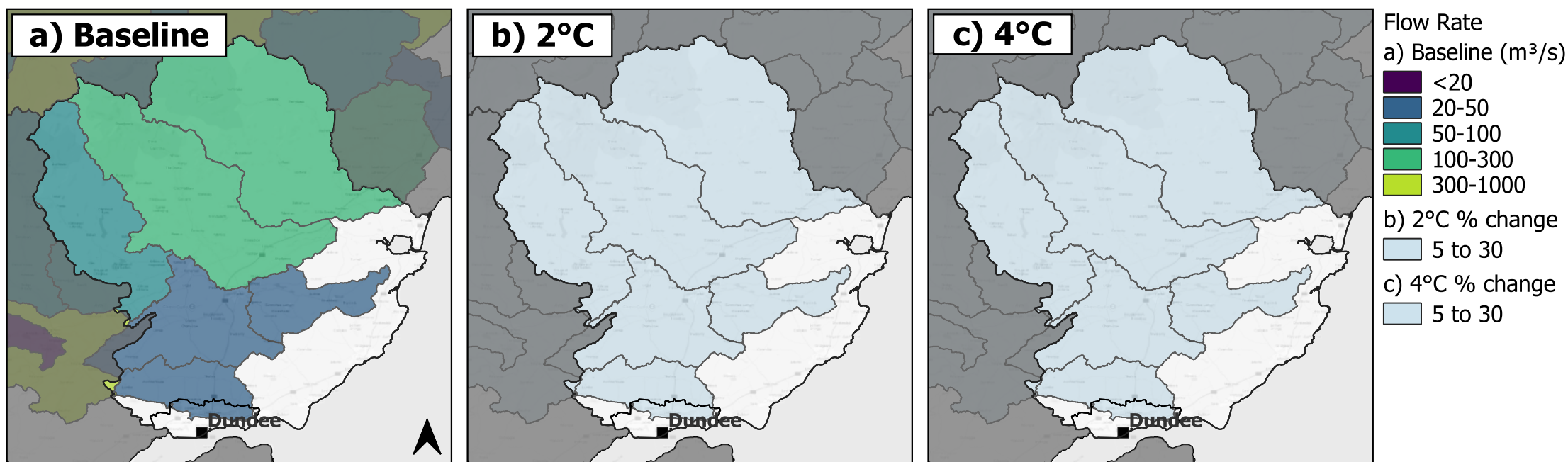
Median, minimum, and maximum drought duration (months/30-yr) for baseline scenario in Angus and Dundee, and the percentage change from baseline for a 2°C and 4°C warming scenario.

County	Median			Minimum			Maximum		
	Baseline	2°C	4°C	Baseline	2°C	4°C	Baseline	2°C	4°C
Angus	3.1	3.6	4.5	2.8	3.1	3.6	3.9	4.3	5.6
Dundee City	3.9	4.3	4.9	3.9	4.3	4.9	3.9	4.3	4.9

Median drought duration (months/30-yr) for baseline scenario in Angus and Dundee, 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 Median	10th - 90th percentile	4°C Median	10th - 90th percentile
Angus	3.1	2.1 - 5.3	3.6	2.3 - 6.8	4.5	2.8 - 10.1
Dundee City	3.9	3.4 - 5.3	4.3	3.1 - 5.7	4.9	4.3 - 7.4

Angus and Dundee | 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

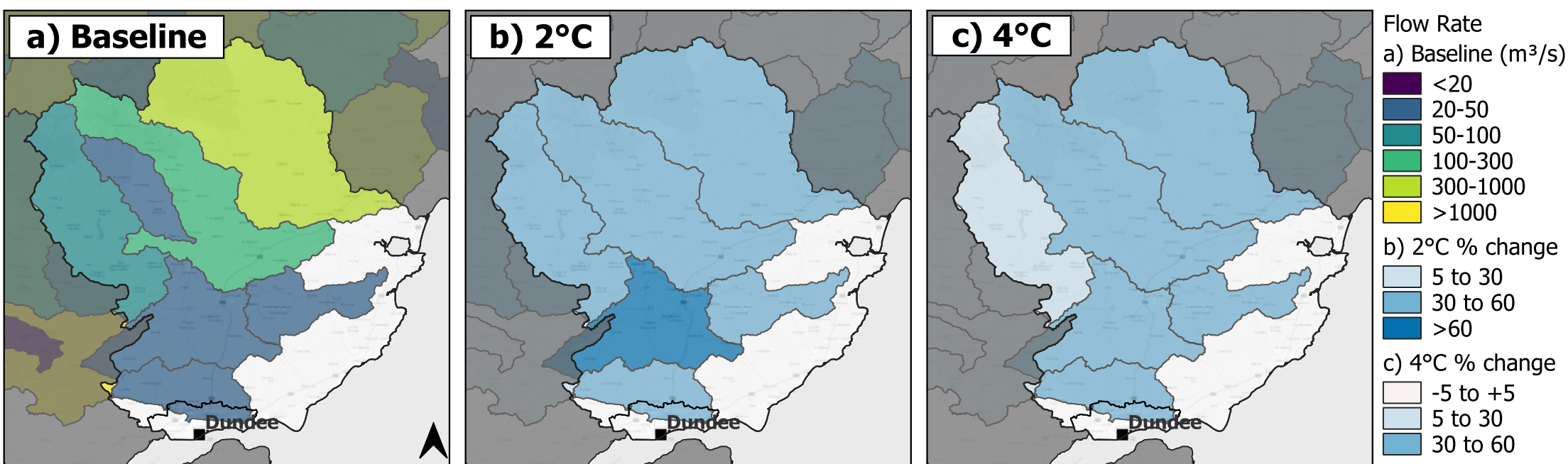
Median, minimum, and maximum flow rate (m³/s) for baseline scenario in Angus and Dundee, and the percentage change from baseline for a 2°C and 4°C warming scenario.

County	Median	% change		Minimum			Maximum		
	Baseline	2°C	4°C	Baseline	2°C	4°C	Baseline	2°C	4°C
Angus	76.9	17.9	19.8	19.4	8.9	11	909.7	28.7	26.7
Dundee City	20.2	15	15.5	20.2	15	15.5	20.2	15	15.5

Median flow rate (m³/s) for baseline scenario in Angus and Dundee, 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
Angus	76.9	15.8 - 1115.9	17.9	19.8
Dundee City	20.2	17.1 - 22.9	15	15.5

Angus and Dundee | 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 Angus and Dundee, 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
Angus	100.4	31.7	28.1	26.9	11.3	1.5	1388	73.1	47.9
Dundee City	29.9	32.2	47.9	26.9	32.2	47.9	26.9	32.2	47.9

Median flow rate (m³/s) for baseline scenario in Angus and Dundee, 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
Angus	100.4	18.9 - 1767.8	31.7	28.1
Dundee City	29.9	23.7 - 43.1	32.2	47.9

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