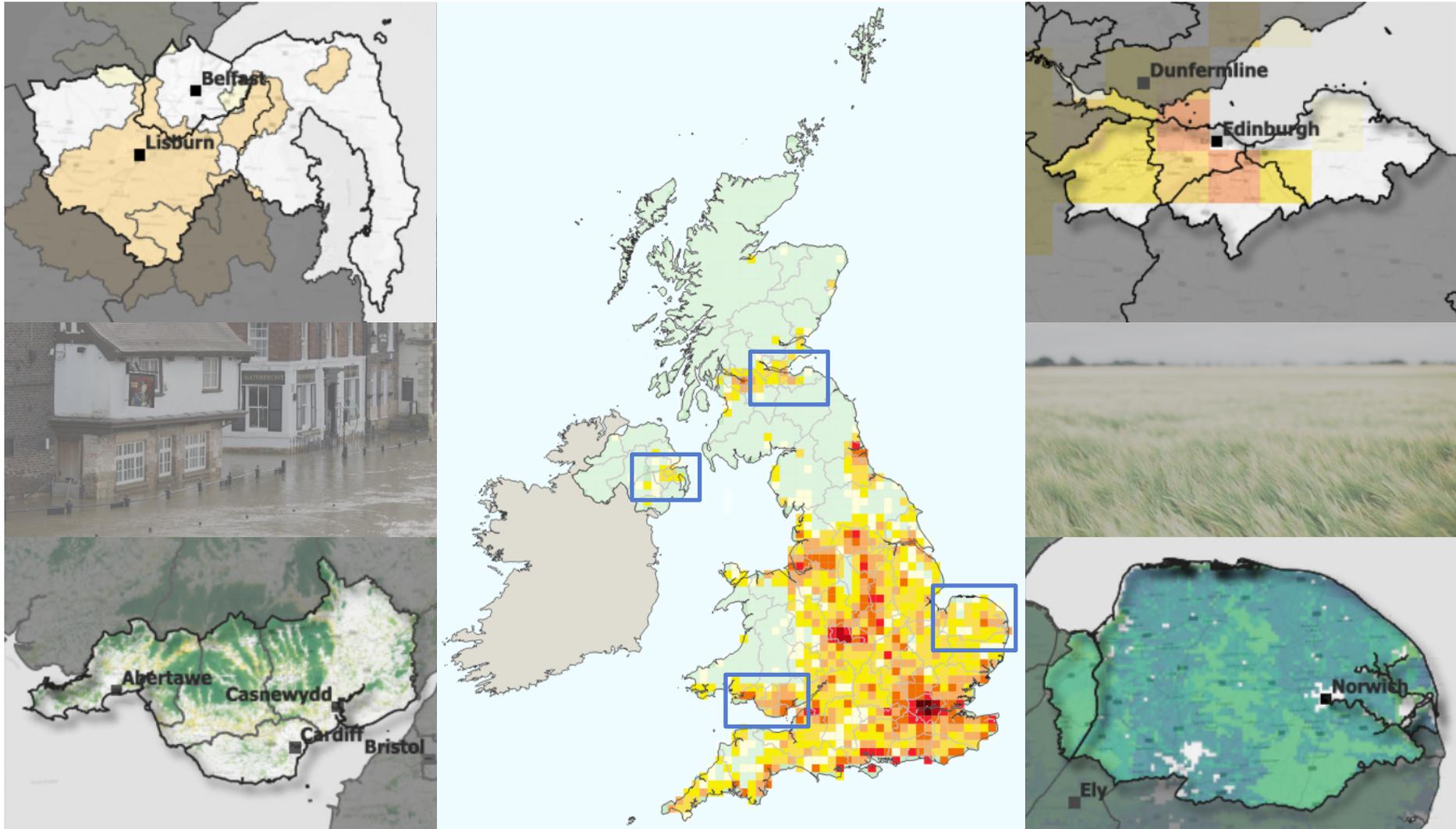


# OpenCLIM Local Climate Risk Reports

Local insights from national analysis



# Background

For further information visit [openclim.science](https://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)

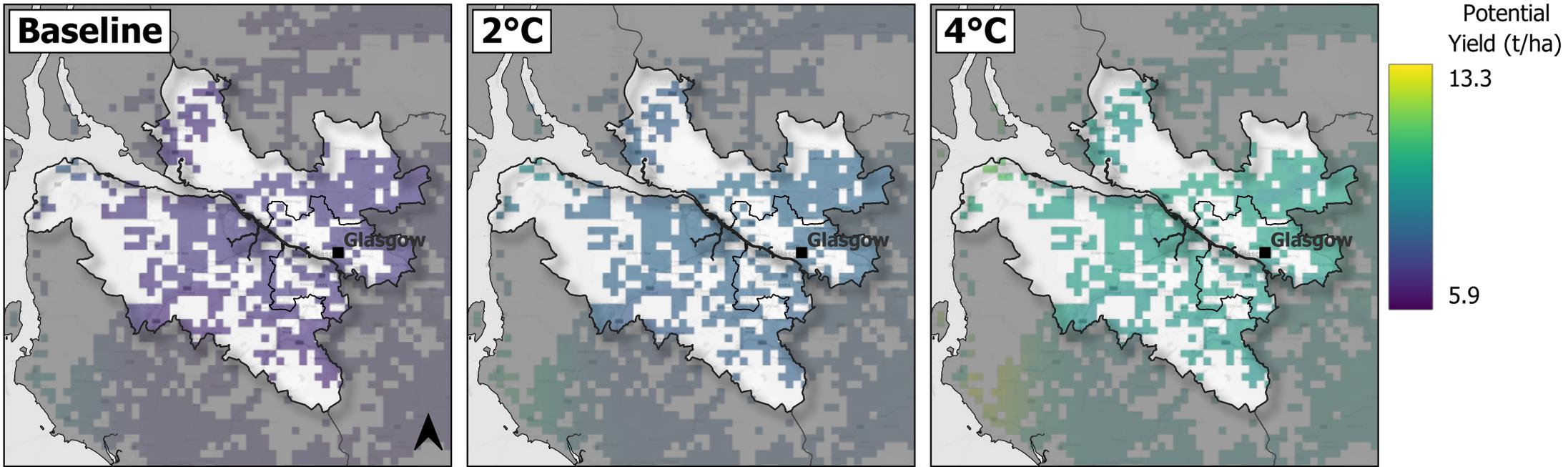
*This metric projects the total number of heat-related deaths that could occur in a warmer future. 12 km grid (inherited from UKCP18 regional climate model).*

## 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, m<sup>3</sup>/s; difference, %)
- 1-in-100-year return period flow (units = flow rate, m<sup>3</sup>/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.*

# Glasgow City | 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).

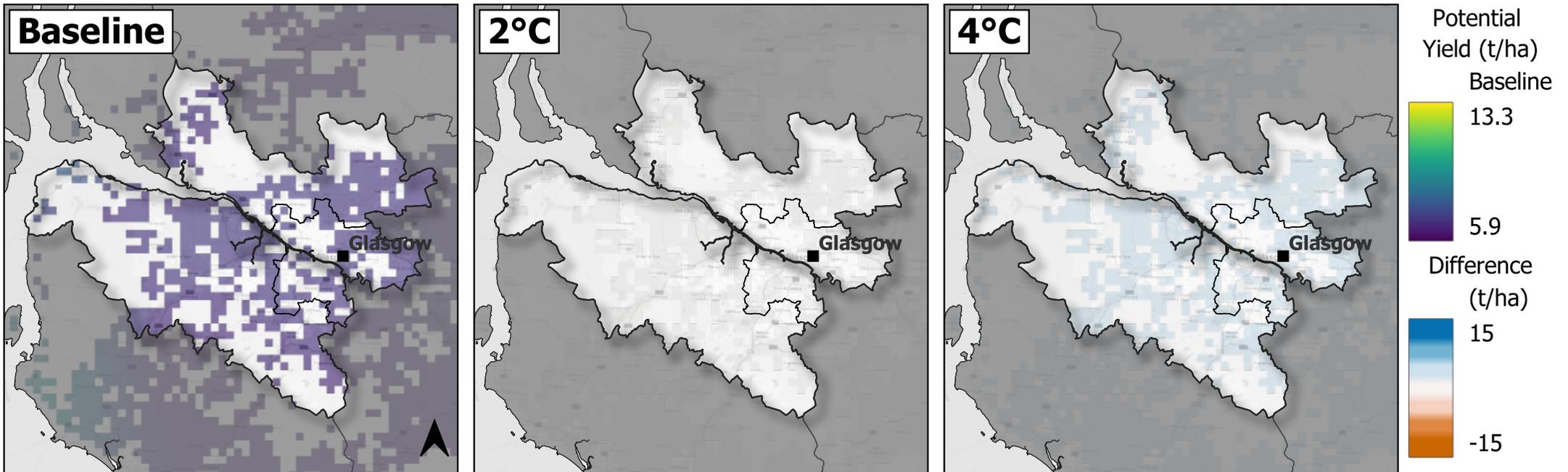
A modest increase in potential yield is projected at 2°C and 4°C for most of the Glasgow City area.

## Local Summary

Minimum, mean and maximum potential yield (t/ha) for the Glasgow City 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
Glasgow City	7	8.3	10	6.8	8.1	7.7	7.2	8.5	8.1
Renfrewshire	7	8.3	10	6.6	7.9	7.6	8.1	9.7	9.3
Dunbartonshire	7	8.3	10	6.7	7.9	7.6	7.2	8.6	8.2

# Glasgow City | 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).

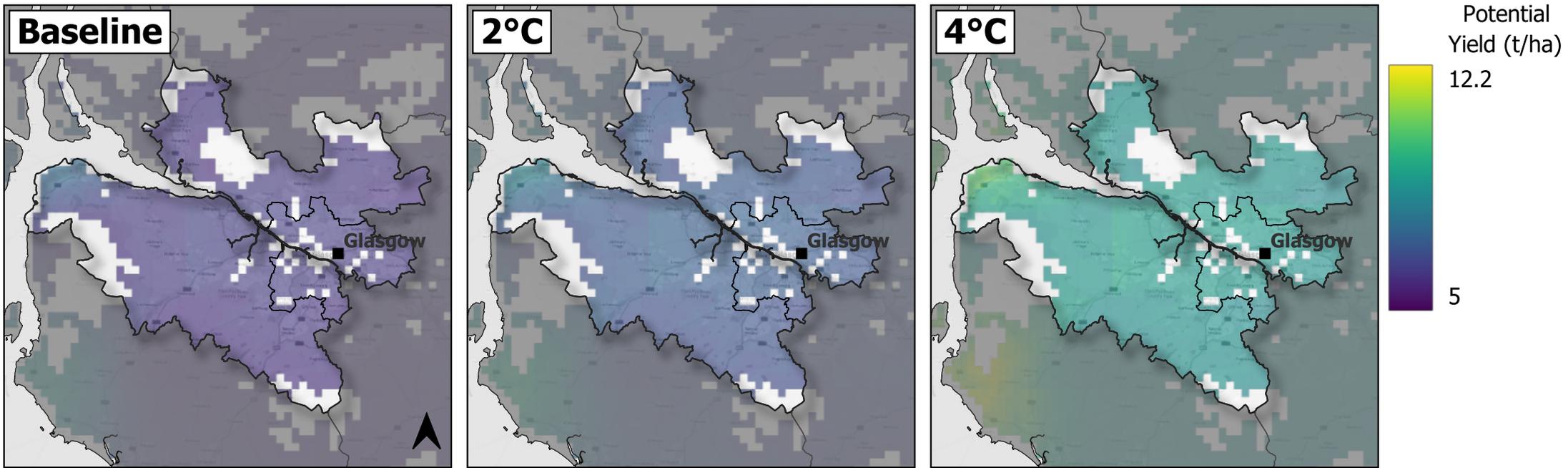
A modest increase in potential yield is projected at 2°C and 4°C for most of the Glasgow City area.

## Local Summary

Minimum, mean and maximum potential yield (t/ha) for the Glasgow City 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
Glasgow City	7	8.3	10	6.8	8.1	7.7	7.2	8.5	8.1	1.3	3
Renfrewshire	7	8.3	10	6.6	7.9	7.6	8.1	9.7	9.3	1.3	3
Dunbartonshire	7	8.3	10	6.7	7.9	7.6	7.2	8.6	8.2	1.3	3

# Glasgow City | 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).

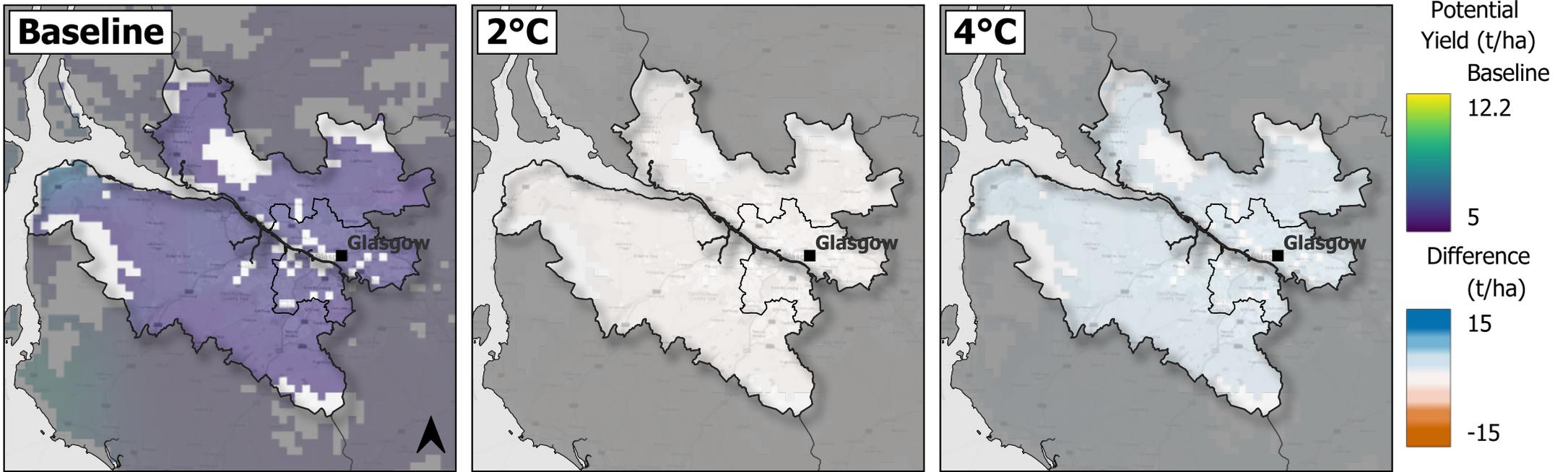
A modest increase in potential yield is projected at 2°C and 4°C for most of the Glasgow City area.

## Local Summary

Minimum, mean and maximum potential yield (t/ha) for the Glasgow City 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
Glasgow City	6.2	7	8.8	5.9	6.6	8.3	6.4	7.2	9.1
Renfrewshire	6.3	7	8.9	5.9	6.5	8.4	7.5	8.3	10.6
Dunbartonshire	6.2	6.9	8.7	5.8	6.5	8.3	6.4	7.2	9.1

# Glasgow City | 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).

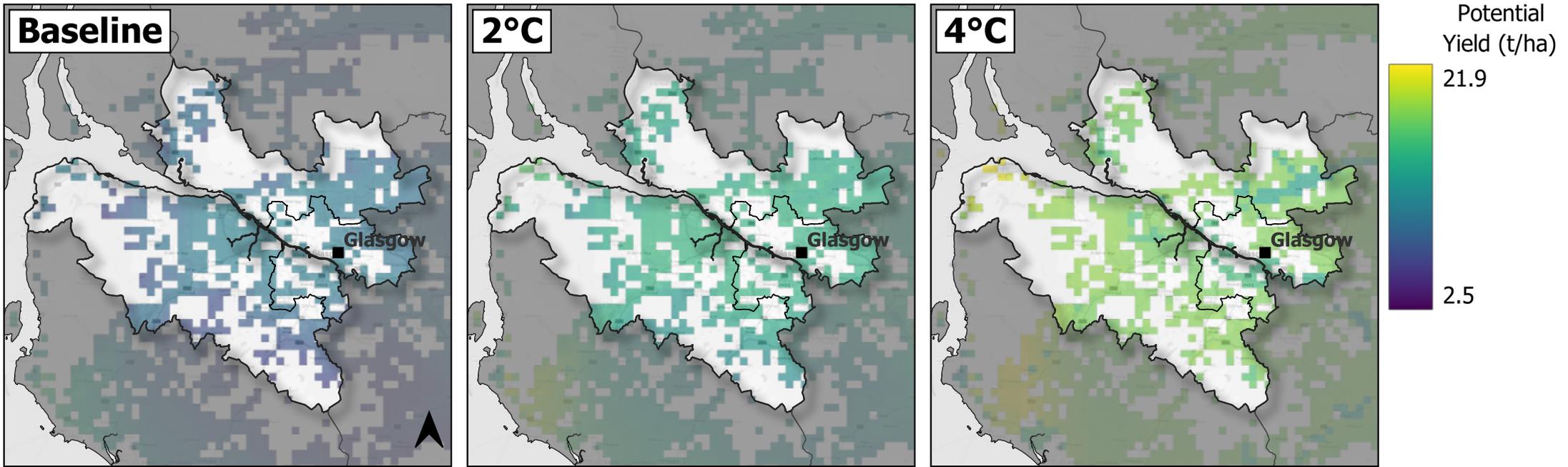
A modest increase in potential yield is projected at 2°C and 4°C for most of the Glasgow City area.

## Local Summary

Minimum, mean and maximum potential yield (t/ha) for the Glasgow City 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
Glasgow City	6.2	7	8.8	5.9	6.6	8.3	6.4	7.2	9.1	0.8	2.6
Renfrewshire	6.3	7	8.9	5.9	6.5	8.4	7.5	8.3	10.6	0.7	2.6
Dunbartonshire	6.2	6.9	8.7	5.8	6.5	8.3	6.4	7.2	9.1	0.7	2.6

# Glasgow City | 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).

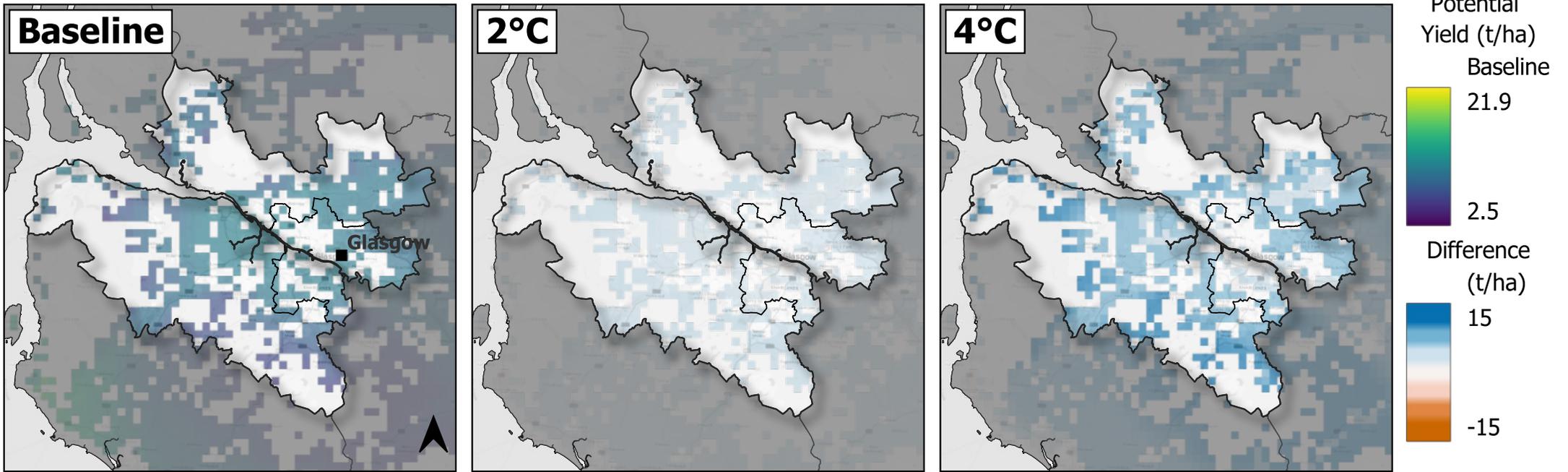
There is a slight increase in potential yield projected at 2°C and 4°C for most of the Glasgow City area.

## Local Summary

Minimum, mean and maximum potential yield (t/ha) for the Glasgow City 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
Glasgow City	13.5	14.8	17.3	7.6	13.2	13.9	11.1	15.3	18.4
Renfrewshire	12.7	14.2	18.2	5.8	11	15.7	11.9	17.6	21.6
Dunbartonshire	13.1	14.5	17.3	6.6	11.9	13.2	11.1	15.3	18.7

# Glasgow City | 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).

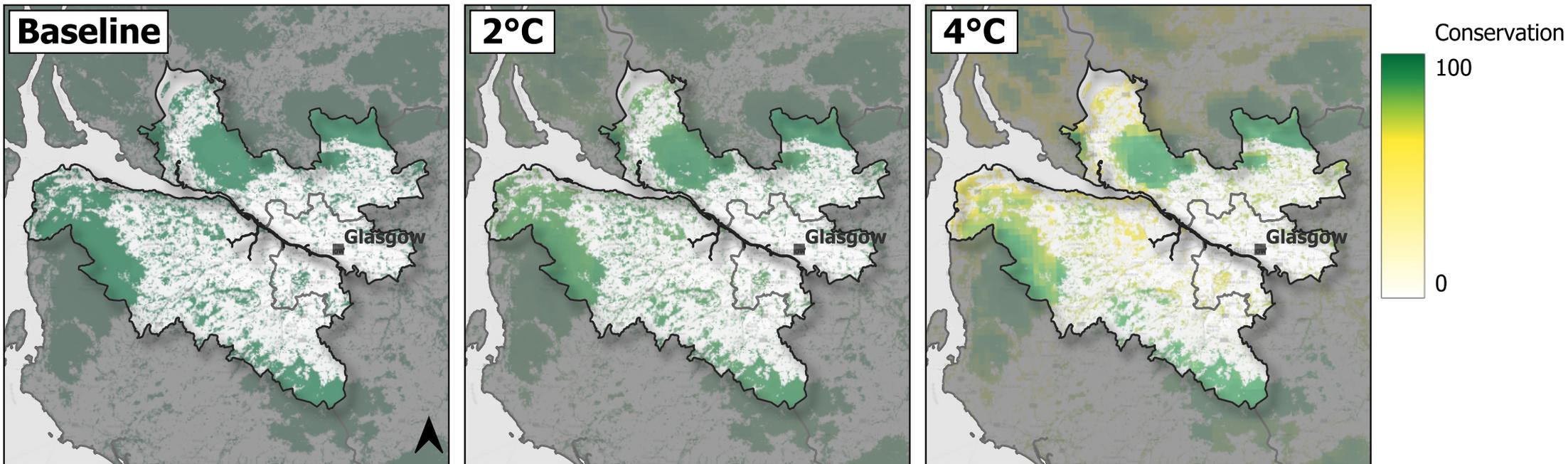
There is slight increase in potential yield projected at 2°C and 4°C for most of the Glasgow City area.

## Local Summary

Minimum, mean and maximum potential yield (t/ha) for the Glasgow City 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
Glasgow City	13.5	14.8	17.3	7.6	13.2	13.9	11.1	15.3	18.4	1.2	3.7
Renfrewshire	12.7	14.2	18.2	5.8	11	15.7	11.9	17.6	21.6	1.6	5.6
Dunbartonshire	13.1	14.5	17.3	6.6	11.9	13.2	11.1	15.3	18.7	1.4	4.2

## Glasgow City | 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).

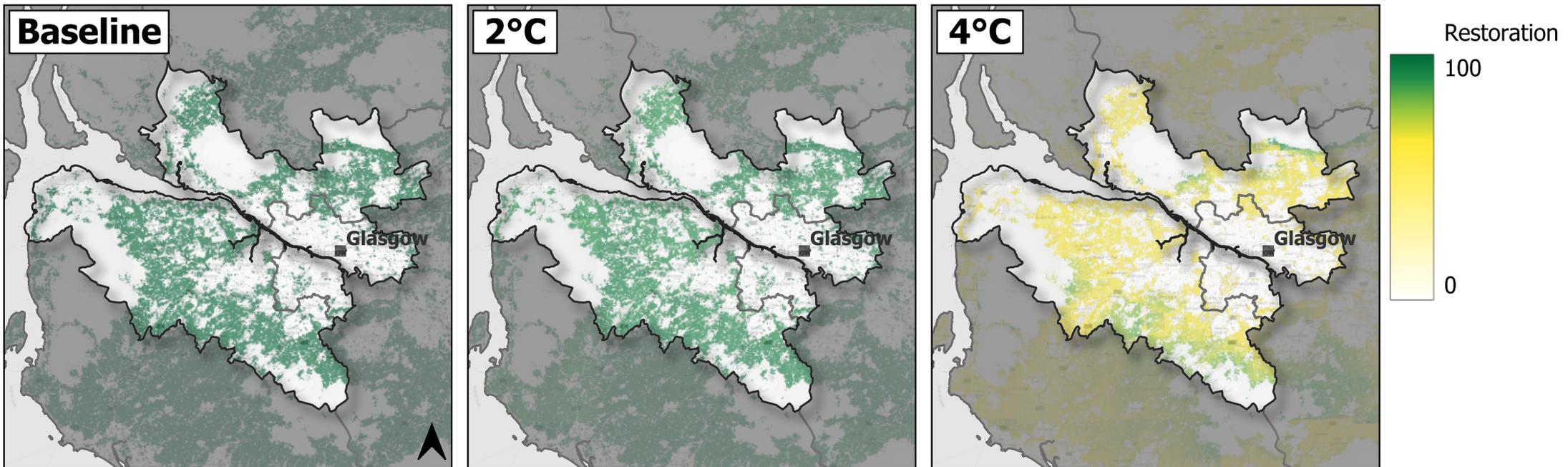
Under 4°C of warming, only one area is projected to retain a maximum suitability of 100 (range = 60 to 100), while the mean rarely exceeds 50, showing the importance of limiting warming to 2°C or less.

### Local Summary

Minimum, mean and maximum conservation potential (%) for Glasgow City 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
Glasgow City	47.6	43.8	31.7	0	0	0	100	94	75
Renfrewshire	48.9	45.2	35.1	0	0	0	100	99	89
Dunbartonshire	58.3	55.3	44.6	0	0	0	100	100	95

## Glasgow City | 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).

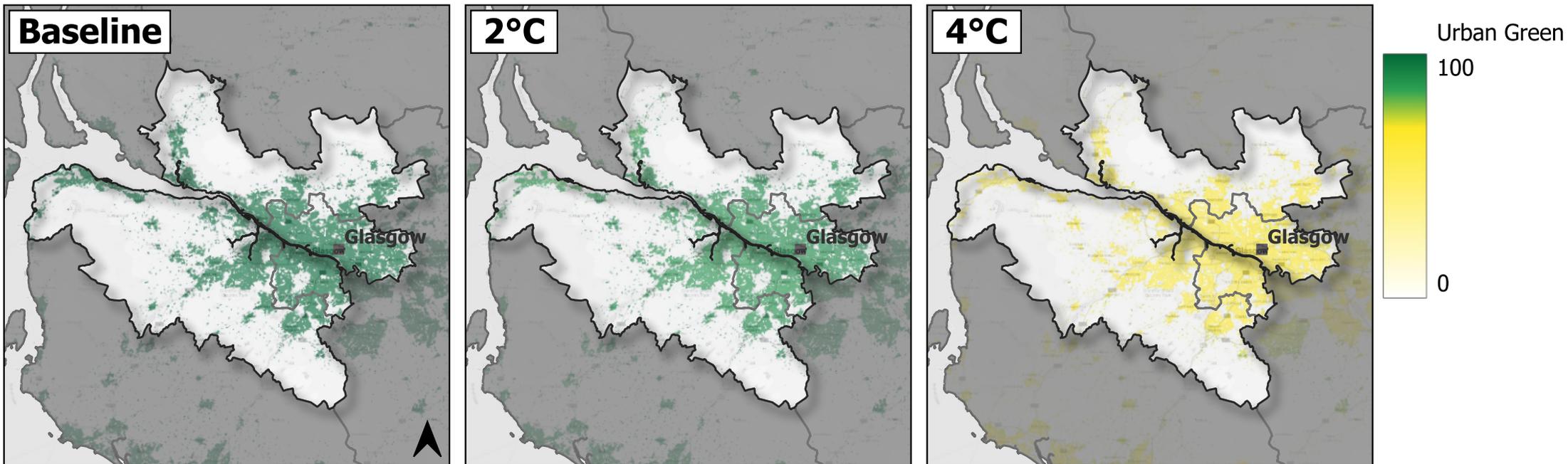
Under 4°C of warming no areas remain with a projected maximum suitability of 100 (range = 60 to 95), showing the importance of limiting warming to 2°C or less.

### Local Summary

Minimum, mean and maximum restoration potential (%) for Glasgow City 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
Glasgow City	52.4		35.4	0	0	0	100	94	75
Renfrewshire	51.1		35.4	0	0	0	100	97	85
Dunbartonshire	41.7		28.3	0	0	0	100	100	95

## Glasgow City | 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).

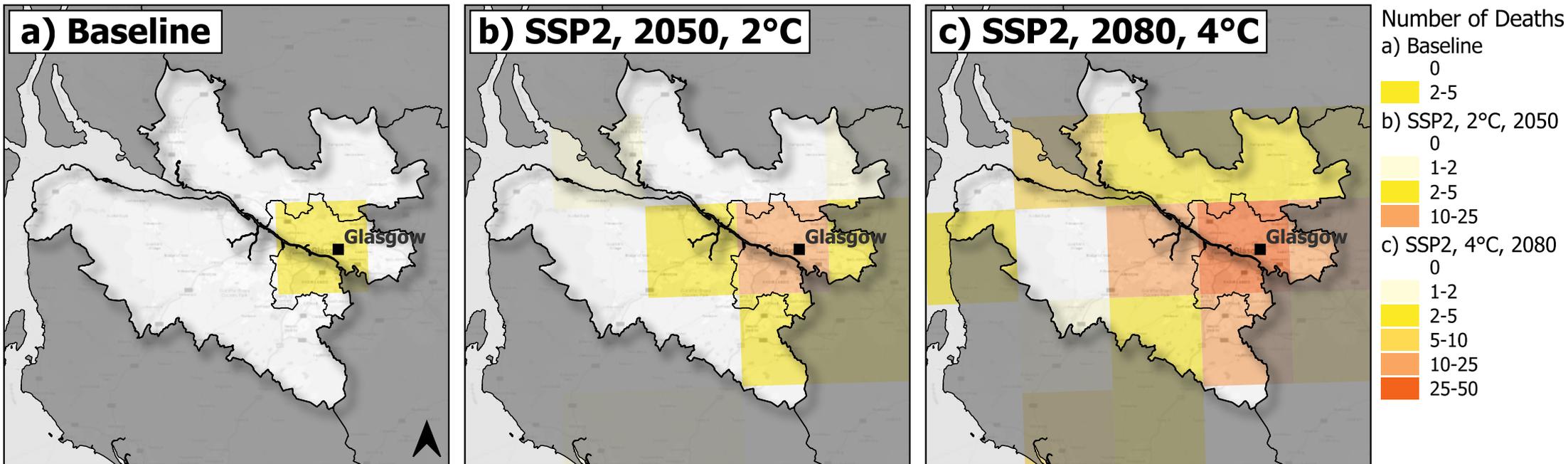
Under 4°C of warming there are no areas remaining with a maximum suitability of 100 (range = 60 to 95), showing the importance of limiting warming to 2°C or less.

### Local Summary

Minimum, mean and maximum urban greenspace potential (%) for Glasgow City 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
Glasgow City	70.4	64.6	46.2	0	0	0	100	94	73
Renfrewshire	18.6	16.3	11.4	0	0	0	100	96	83
Dunbartonshire	18.3	16.7	11.9	0	0	0	100	98	89

# Glasgow City | 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

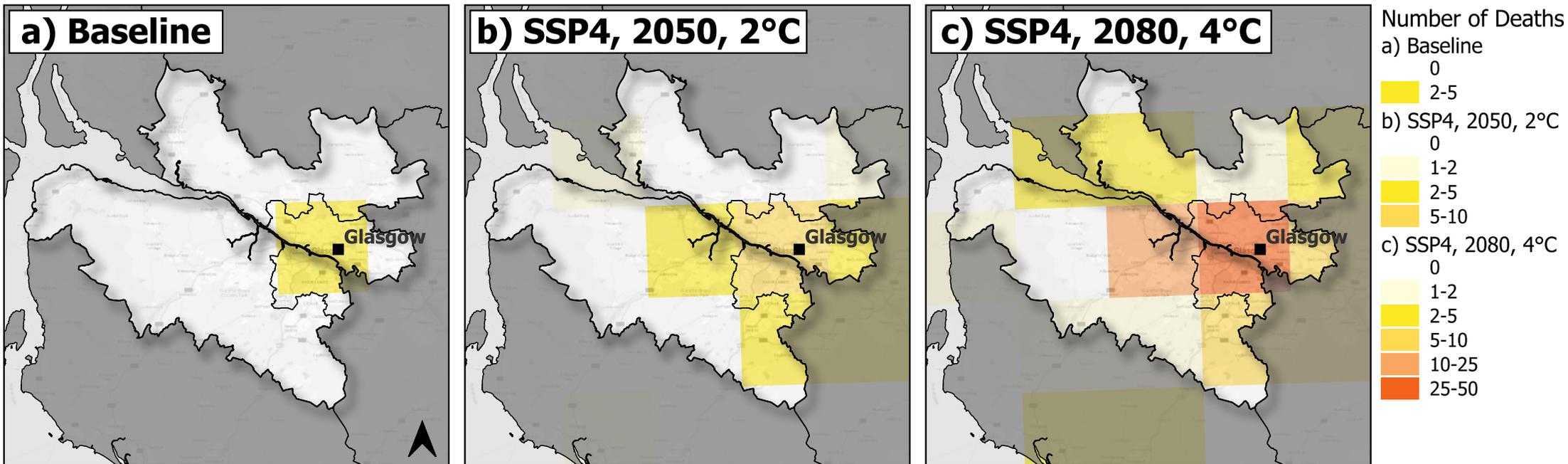
Mean deaths per year and cumulative deaths in Glasgow City for baseline and future scenarios.

County	Baseline		SSP2 2050 2°C			SSP2 2080 4°C		
	Mean	Cumulative	Mean	Cumulative	Difference	Mean	Cumulative	Difference
Glasgow City	0.7	4.6	3.1	21.4	2.4	10.9	62.6	10.3
Renfrewshire	0.4	4.8	1.9	21.4	1.5	7	62.8	6.5
Dunbartonshire	0.4	4.4	1.8	20.3	1.4	6.7	59.8	6.3

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
Glasgow City	0.7	0.1 - 2.8	3.3	0.5 - 13.1	10.9	1.5 - 39.4
Renfrewshire	0.4	0 - 2.8	2.1	0.1 - 13.1	7	0.3 - 39.4
Dunbartonshire	0.4	0 - 2.8	2	0 - 13.1	6.7	0 - 39.4

# Glasgow City | 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

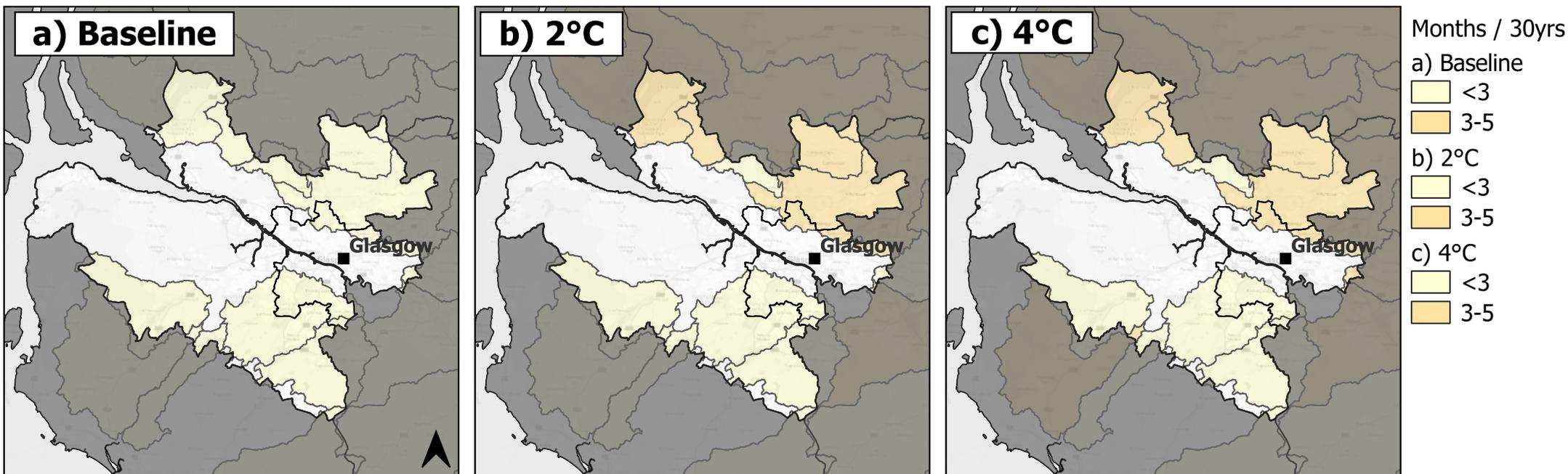
Mean deaths per year and cumulative deaths in Glasgow City for baseline and future scenarios.

County	Baseline		SSP4 2050 2°C			SSP4 2080 4°C		
	Mean	Cumulatiave	Mean	Cumulatiave	Difference	Mean	Cumulatiave	Difference
Glasgow City	0.7	4.6	3.1	21.4	2.4	8.9	62.6	8.3
Renfrewshire	0.4	4.8	1.9	21.4	1.5	5.7	62.8	5.3
Dunbartonshire	0.4	4.4	1.8	20.3	1.4	5.4	59.8	5

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
Glasgow City	2.9	0.4 - 11.2	3.1	0.5 - 12	8.9	1.3 - 31.8
Renfrewshire	1.9	0.1 - 11.2	1.9	0.1 - 12	5.7	0.3 - 31.8
Dunbartonshire	1.7	0 - 11.2	1.8	0 - 12	5.4	0 - 31.8

# Glasgow City | 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

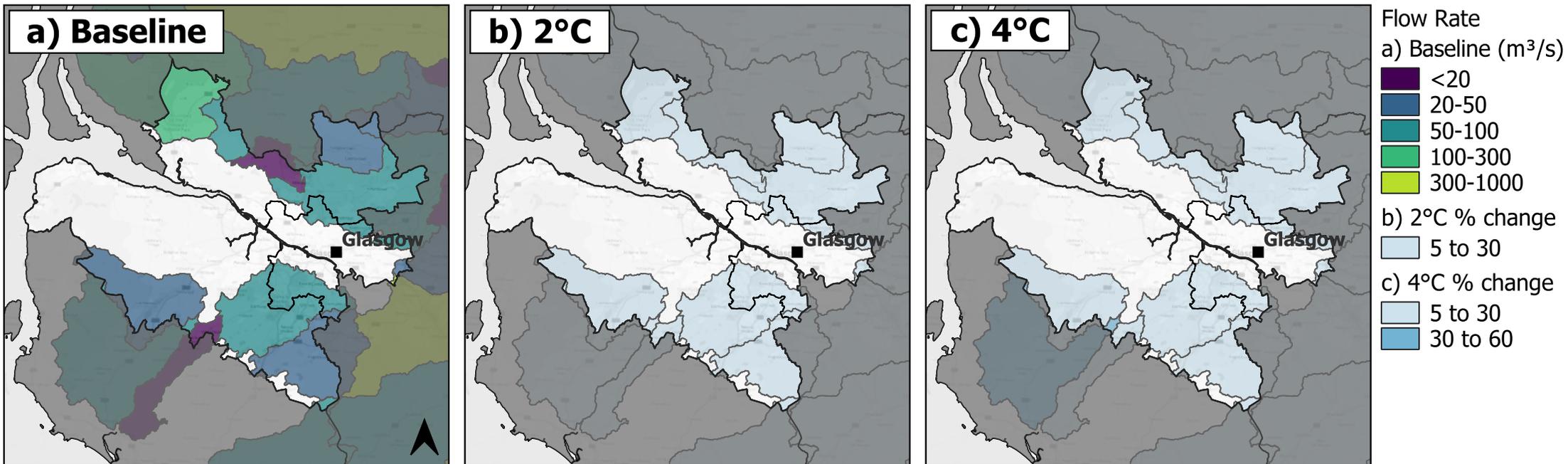
Median, minimum, and maximum drought duration (months/30-yr) for baseline scenario in Glasgow City, and the percentage change from baseline for a 2°C and 4°C warming scenario.

County	Median			Minimum			Maximum		
	Baseline	2°C	4°C	Baseline	2°C	4°C	Baseline	2°C	4°C
Glasgow City	2.5	3	3.3	2.3	2.8	2.7	2.9	3.4	3.8
Renfrewshire	2.5	2.8	2.8	2.3	2.6	2.7	2.6	3	3.2
Dunbartonshire	2.6	3	3.4	2.3	2.6	2.7	2.8	3.3	3.8

Median drought duration (months/30-yr) for baseline scenario in Glasgow City, 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
Glasgow City	2.5	2.1 - 3.4	3	2.4 - 4.2	3.3	2.5 - 5.6
Renfrewshire	2.5	2.1 - 3.3	2.8	2.4 - 3.5	2.8	2.3 - 4
Dunbartonshire	2.6	2.2 - 5.8	3	2.7 - 11	3.4	2.7 - 24.4

# Glasgow City | 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

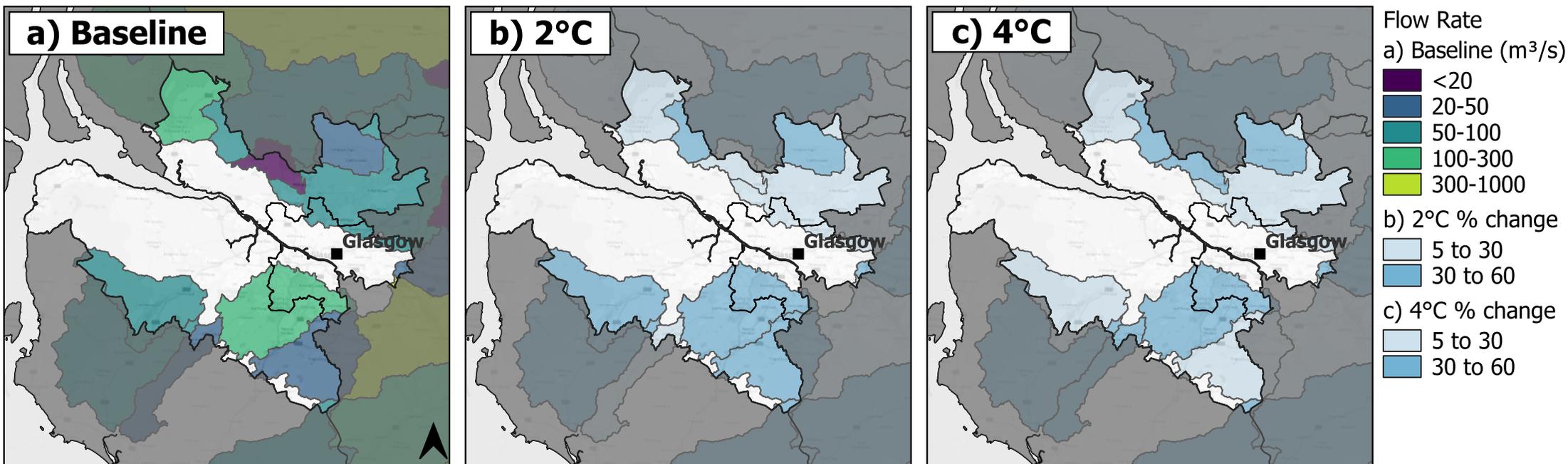
Median, minimum, and maximum flow rate (m<sup>3</sup>/s) for baseline scenario in Glasgow City, and the percentage change from baseline for a 2°C and 4°C warming scenario.

County	Median	% change		Minimum			Maximum		
	Baseline	2°C	4°C	Baseline	2°C	4°C	Baseline	2°C	4°C
Glasgow City	64.2	14.9	22.2	20.4	8.2	13.4	389.3	18.8	23.8
Renfrewshire	39.5	16.4	24.6	18.6	13.4	22.2	84.6	21.1	31.5
Dunbartonshire	57	9.2	19.4	12.1	7.8	13.4	150.8	10.4	25.8

Median flow rate (m<sup>3</sup>/s) for baseline scenario in Glasgow City, 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
Glasgow City	64.2	15.9 - 443.1	14.9	22.2
Renfrewshire	39.5	15.8 - 92.7	16.4	24.6
Dunbartonshire	57	9.9 - 166.4	9.2	19.4

# Glasgow City | 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 (m<sup>3</sup>/s) for baseline scenario in Glasgow City, 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
Glasgow City	81.2	30.7	28.6	40.8	25.5	25.6	577.8	53.5	52.2
Renfrewshire	54.3	31.5	35.8	26.6	23.2	26.2	113.8	53.5	52.2
Dunbartonshire	75.4	27.5	31.1	21.7	11.6	22.5	176.3	37.8	46.6

Median flow rate (m<sup>3</sup>/s) for baseline scenario in Glasgow City, 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
Glasgow City	81.2	20.6 - 705.2	30.7	28.6
Renfrewshire	54.3	18.2 - 165.9	31.5	35.8
Dunbartonshire	75.4	11.7 - 220.4	27.5	31.1

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## **Acknowledgements**

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