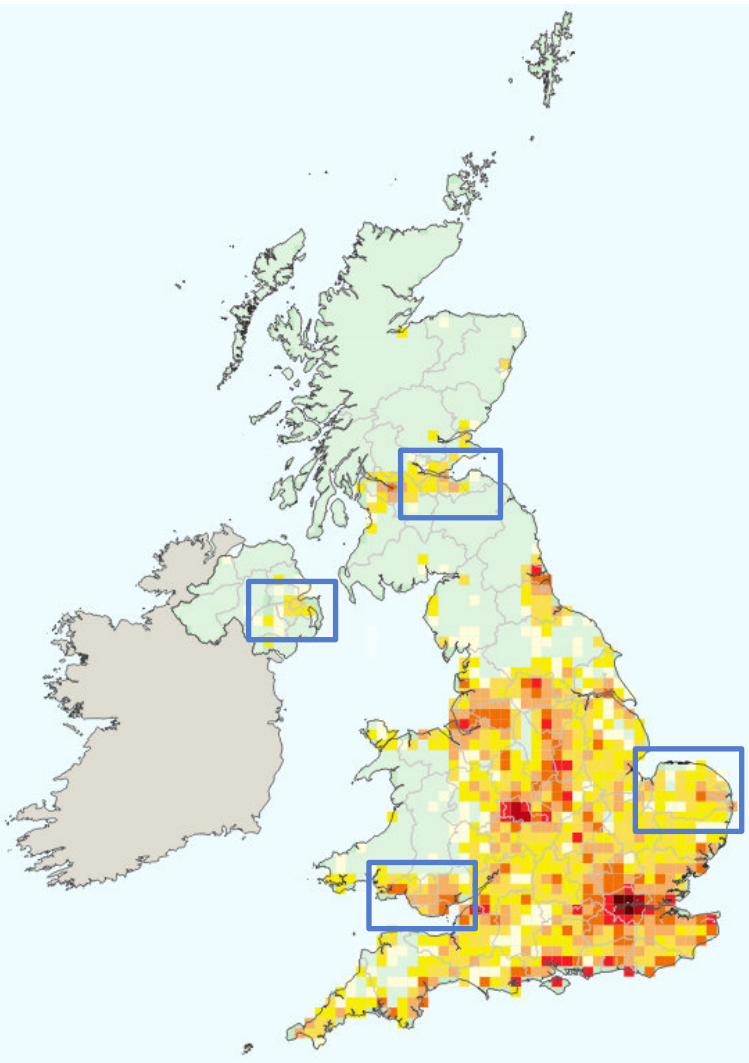
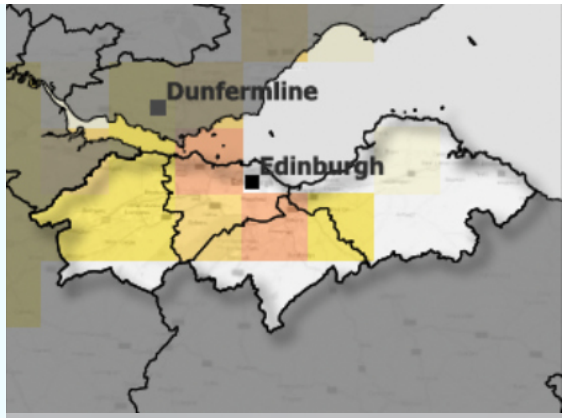
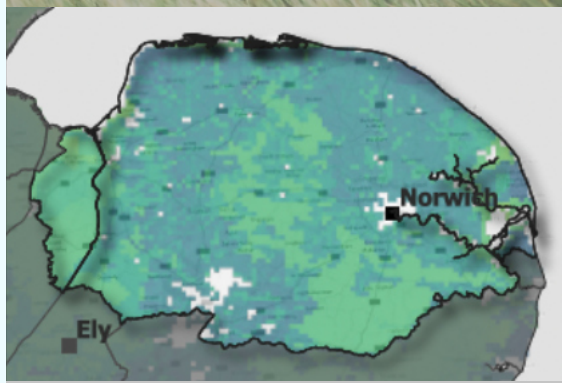
OpenCLIM Local Climate Risk Reports

Local insights from national analysis







Tyndall Centre for Climate Change Research

OPEN CLIMATE IMPACTS MODELLING FRAMEWORK

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)

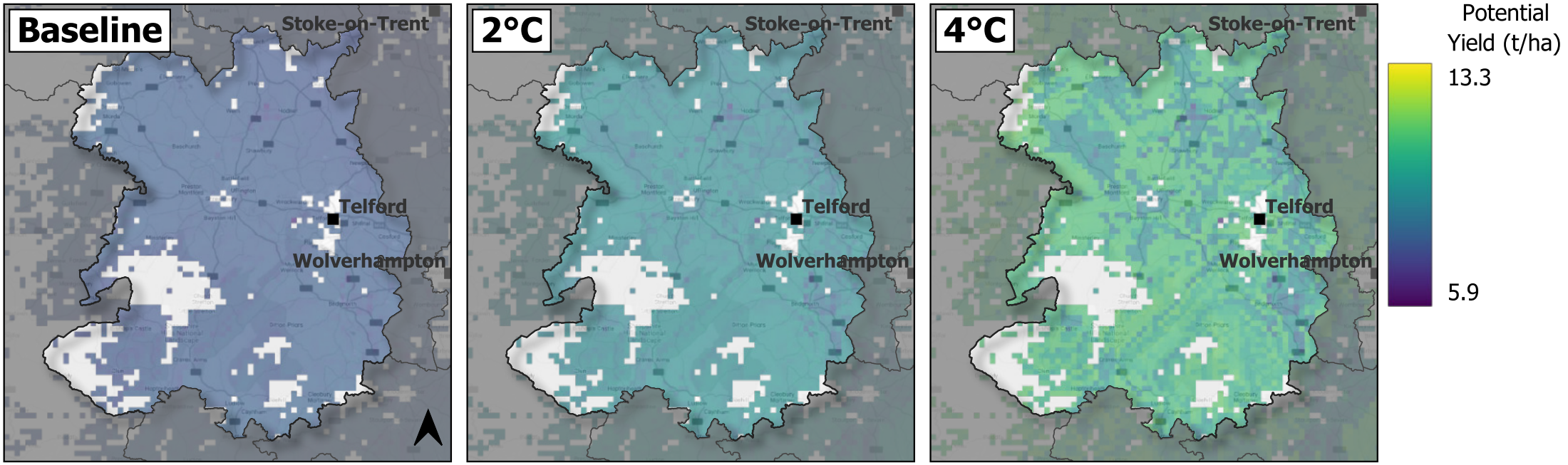
This metric projects the total number of heat-related deaths that could occur in a warmer future. 12 km grid (inherited from UKCP18 regional climate model).

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, m^3/s; difference, %)
- 1-in-100-year return period flow (units = flow rate , m^3/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.

Shropshire | 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 Shropshire area.

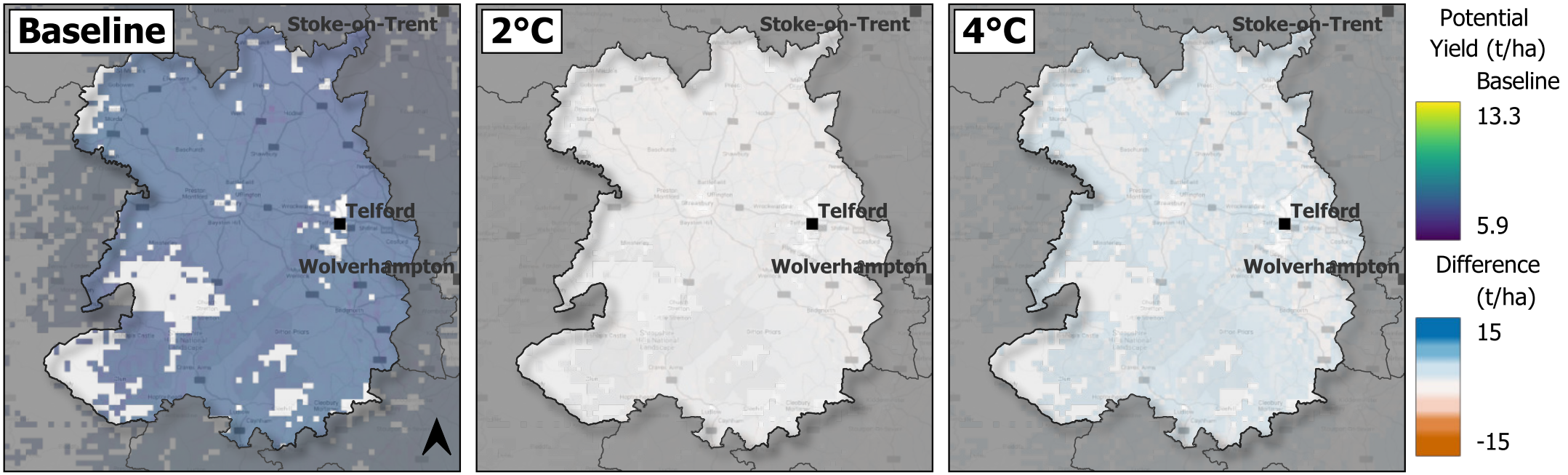
Local Summary

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

	Mean			Minimum			Maximum		
County	Baseline	2°C	4°C	Baseline	2°C	4°C	Baseline	2°C	4°C
Shropshire	7.9	9.2	10.4	6.7	6.9	6.7	8.2	9.8	9.3

The OpenCLIM project was funded by the UK Climate Resilience Program. For details visit openclim.science

Shropshire | 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 Shropshire area.

Local Summary

Minimum, mean and maximum potential yield (t/ha) for the Shropshire 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.

	Mean			Minimum			Maximum			Difference	
County	Baseline	2°C	4°C	Baseline	2°C	4°C	Baseline	2°C	4°C	2°C	4°C
Shropshire	7.9	9.2	10.4	6.7	6.9	6.7	8.2	9.8	9.3	1.3	2.5

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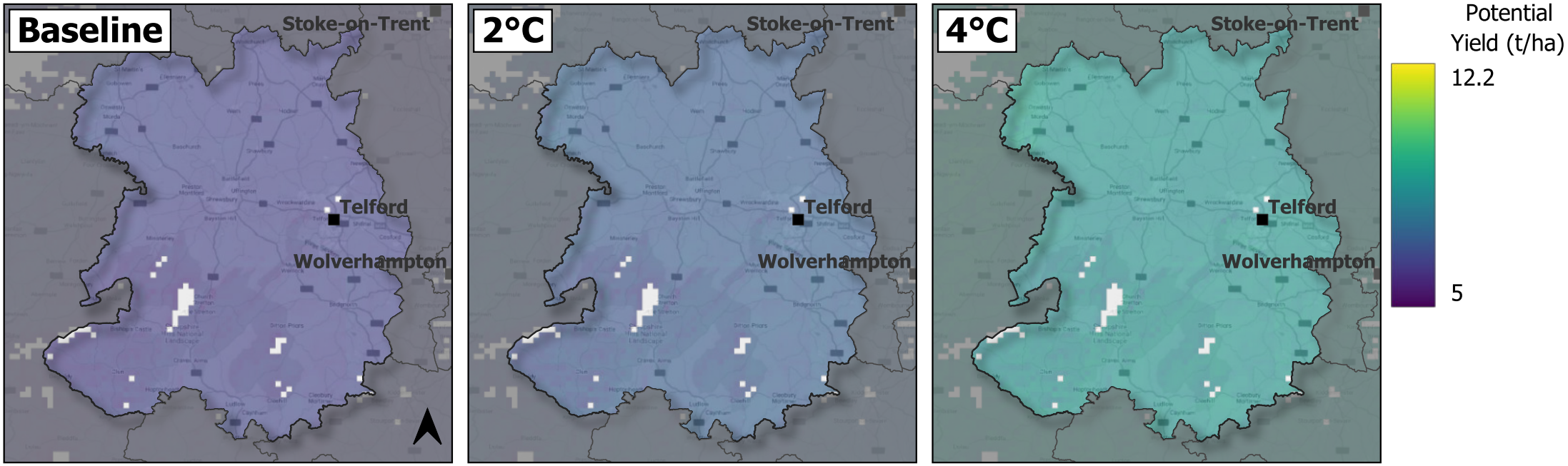
Shropshire | Potential Yield | Grass



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 Shropshire area.

Local Summary

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

	Mean			Minimum			Maximum		
County	Baseline	2°C	4°C	Baseline	2°C	4°C	Baseline	2°C	4°C
Shropshire	6.4	7	8.7	5.9	6.4	7.9	6.8	7.5	9.4

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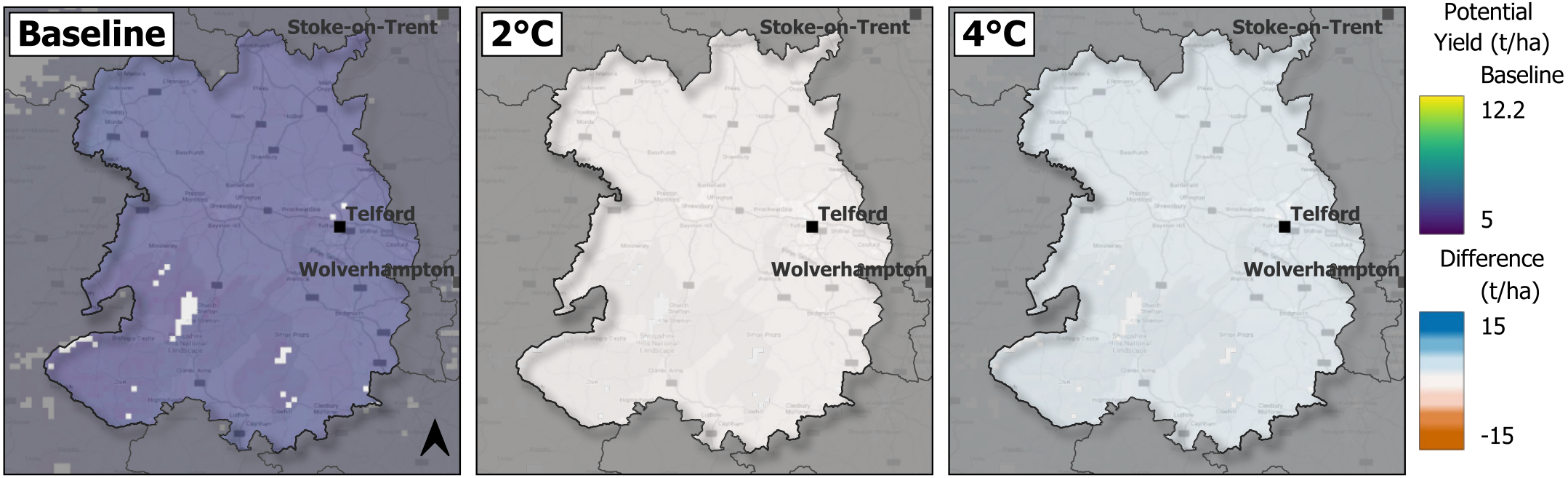
OPEN CLIMATE IMPACT FRAMEWORK

Shropshire | 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 Shropshire area.

Local Summary

Minimum, mean and maximum potential yield (t/ha) for the Shropshire 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.

	Mean			Minimum			Maximum			Difference	
County	Baseline	2°C	4°C	Baseline	2°C	4°C	Baseline	2°C	4°C	2°C	4°C
Shropshire	6.4	7	8.7	5.9	6.4	7.9	6.8	7.5	9.4	0.6	2.3

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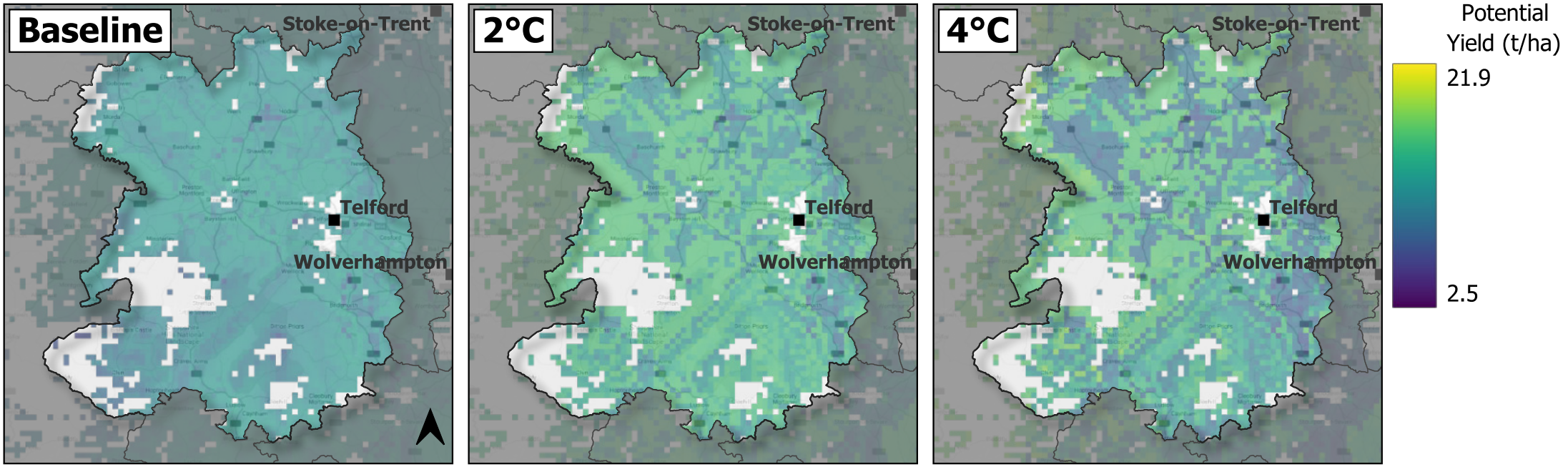
Shropshire | Potential Yield | Wheat



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 Shropshire area.

Local Summary

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

	Mean			Minimum			Maximum		
County	Baseline	2°C	4°C	Baseline	2°C	4°C	Baseline	2°C	4°C
Shropshire	13.7	14.3	13.3	6.3	7	6.1	13.6	16.8	18.9

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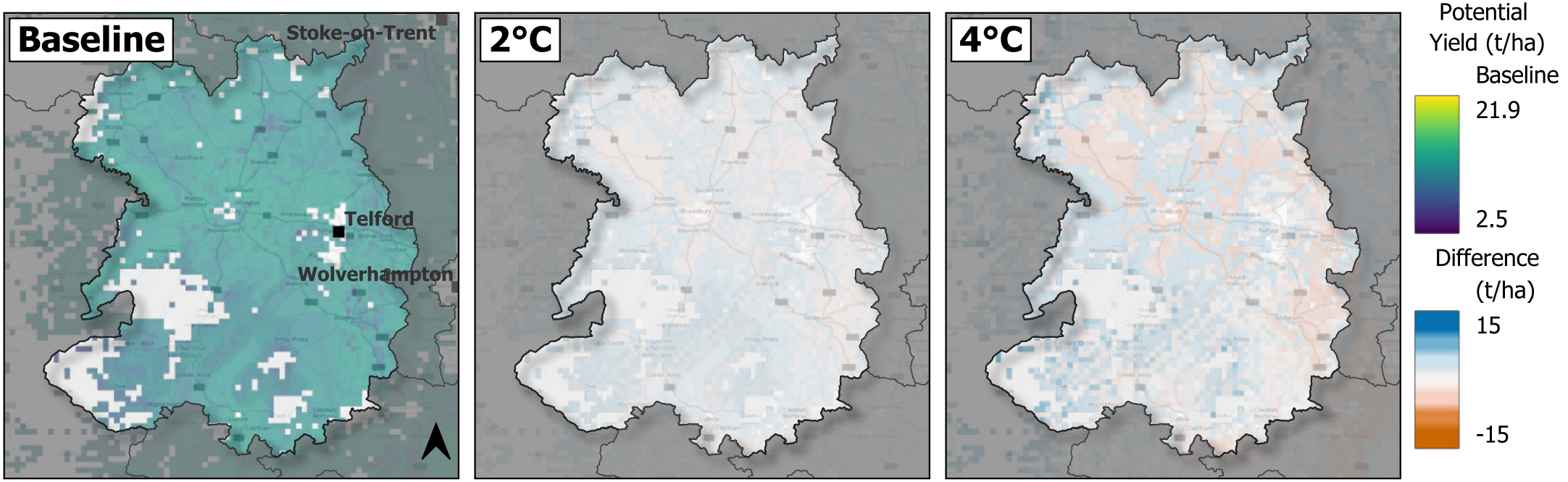
OPEN CLIMATE IMPACT FRAMEWORK

Shropshire | 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 Shropshire area.

Local Summary

Minimum, mean and maximum potential yield (t/ha) for the Shropshire 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.

	Mean			Minimum			Maximum			Difference	
County	Baseline	2°C	4°C	Baseline	2°C	4°C	Baseline	2°C	4°C	2°C	4°C
Shropshire	13.7	14.3	13.3	6.3	7	6.1	13.6	16.8	18.9	0.6	-0.4

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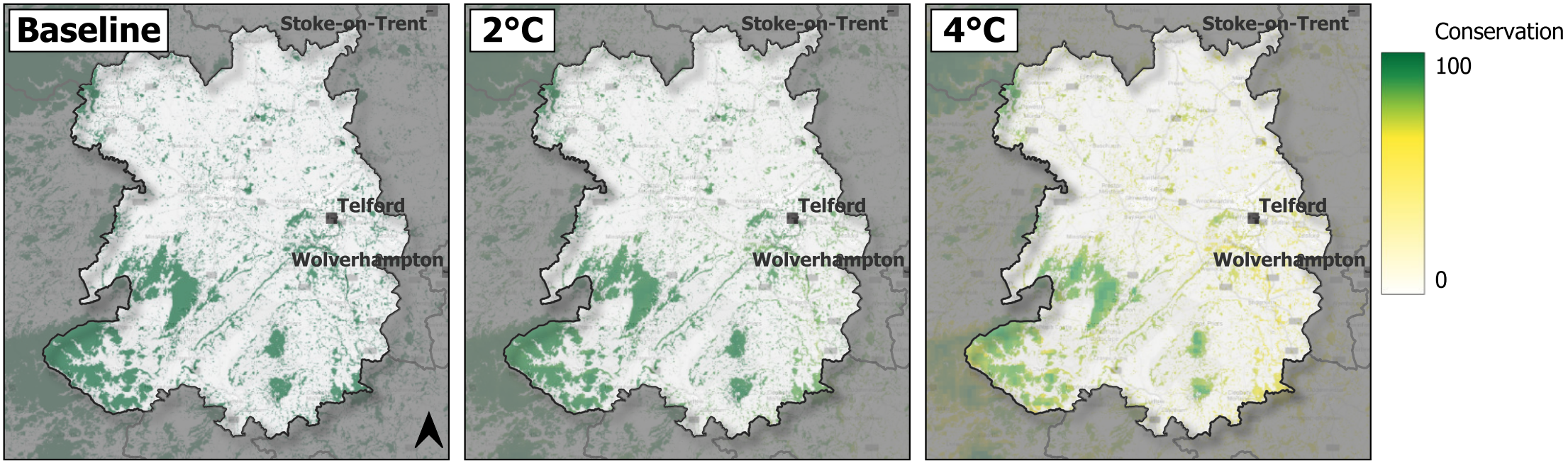
Shropshire | Conservation | Warming Levels



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 Shropshire at baseline, 2°C and 4°C warming scenarios.

	Mean			Minimum			Maximum		
County	Baseline	2°C	4°C	Baseline	2°C	4°C	Baseline	2°C	4°C
Shropshire	19.7	18.2	13.5	0	0	0	100	99	87

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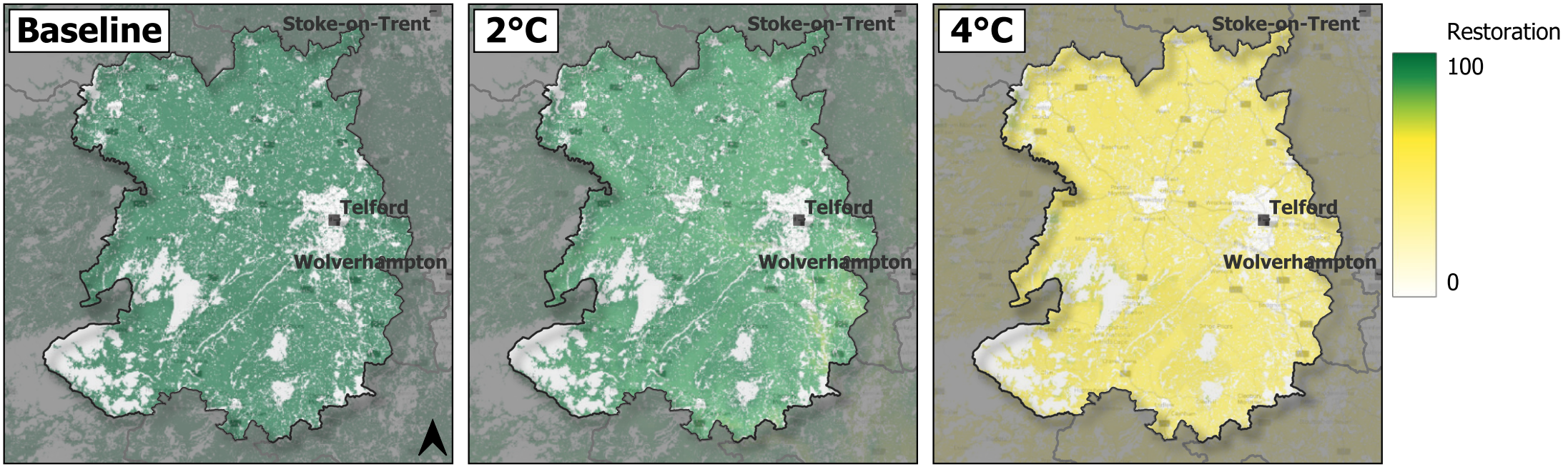
Shropshire | Restoration | Warming Levels



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 Shropshire at baseline, 2°C and 4°C warming scenarios.

	Mean			Minimum			Maximum		
County	Baseline	2°C	4°C	Baseline	2°C	4°C	Baseline	2°C	4°C
Shropshire	80.3		52.1	0	0	0	100	99	85

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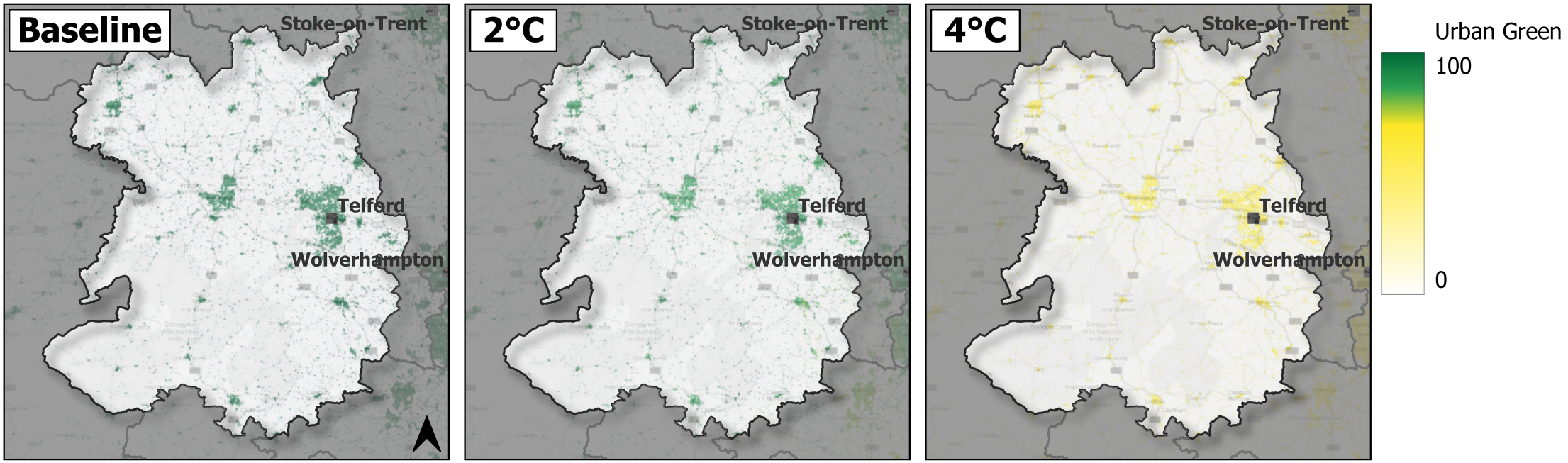
Shropshire | Urban Green | Warming Levels



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 Shropshire at baseline, 2°C and 4°C warming scenarios.

	Mean			Minimum			Maximum		
County	Baseline	2°C	4°C	Baseline	2°C	4°C	Baseline	2°C	4°C
Shropshire	6.1	5.5	3.9	0	0	0	100	99	82

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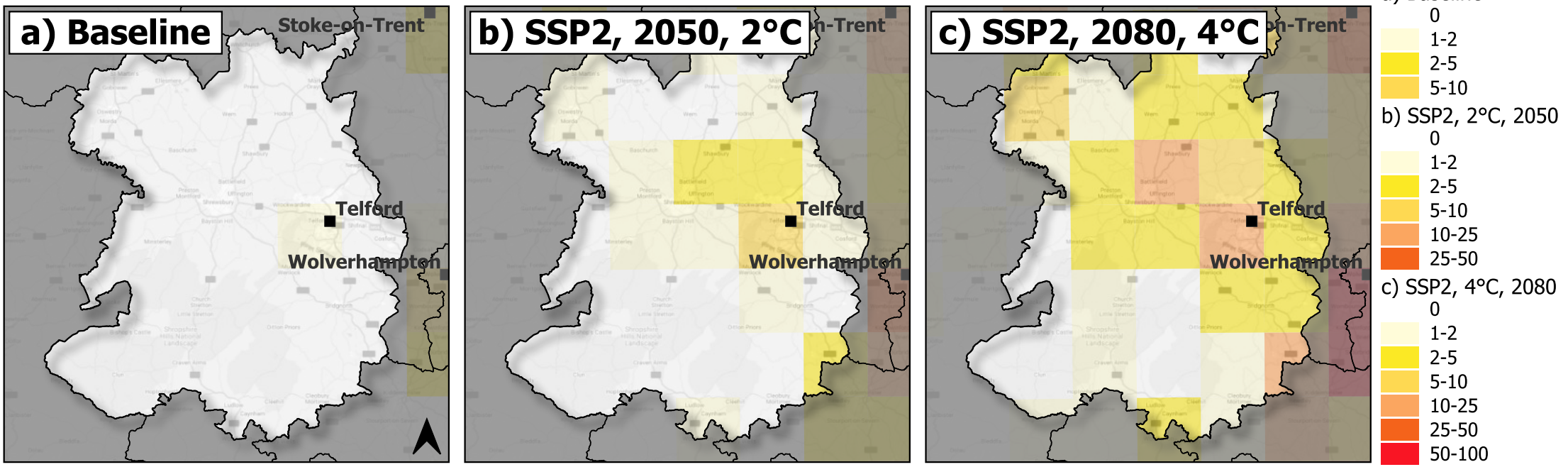
Shropshire | Heat Mortality | Combined Future Scenarios



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 Shropshire for baseline and future scenarios.

	Baseline		SSP2 2050 2°C			SSP2 2080 4°C		
County	Mean	Cumulatiave	Mean	Cumulatiave	Difference	Mean	Cumulatiave	Difference
Shropshire	0.2	9.9	1.2	49.5	1	4.1	140.9	3.8

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
Shropshire	0.2	0 - 2	1.3	0 - 10	4.1	0.1 - 28.8

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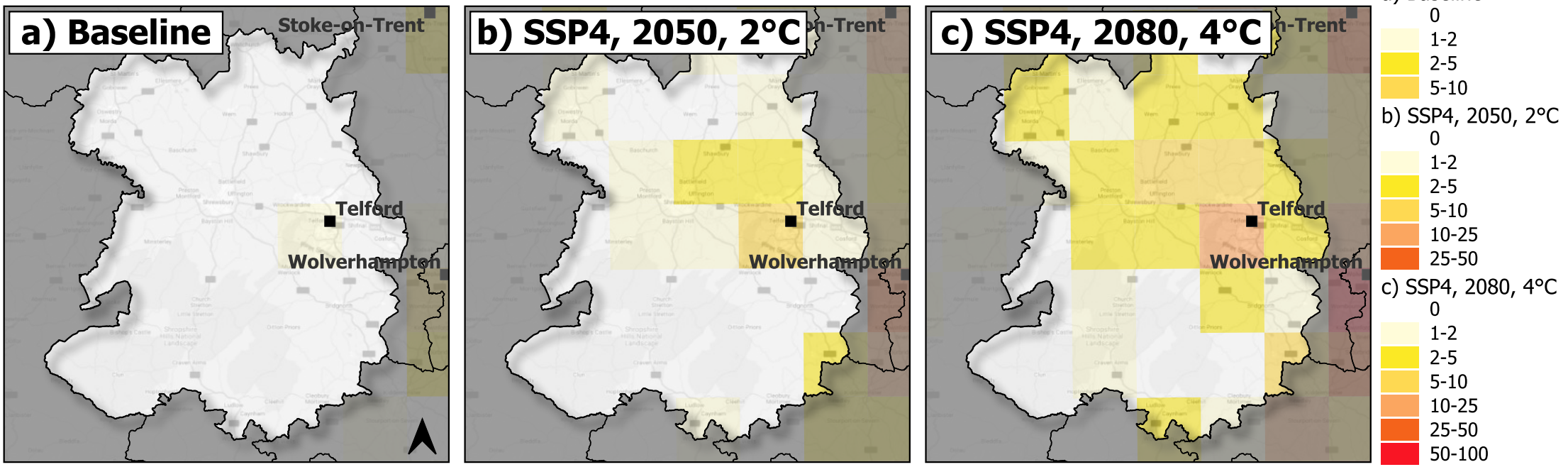
Shropshire | Heat Mortality | Combined Future Scenarios



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 Shropshire for baseline and future scenarios.

	Baseline		SSP4 2050 2°C			SSP4 2080 4°C		
County	Mean	Cumulatiave	Mean	Cumulatiave	Difference	Mean	Cumulatiave	Difference
Shropshire	0.2	9.9	1.2	49.5	1	3.5	140.9	3.3

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	SSP4 2050 2°C Mean	10th - 90th percentile	SSP4 2080 4°C Mean	10th - 90th percentile
Shropshire	1.2	0 - 8.8	1.2	0 - 9.1	3.5	0.1 - 23.3

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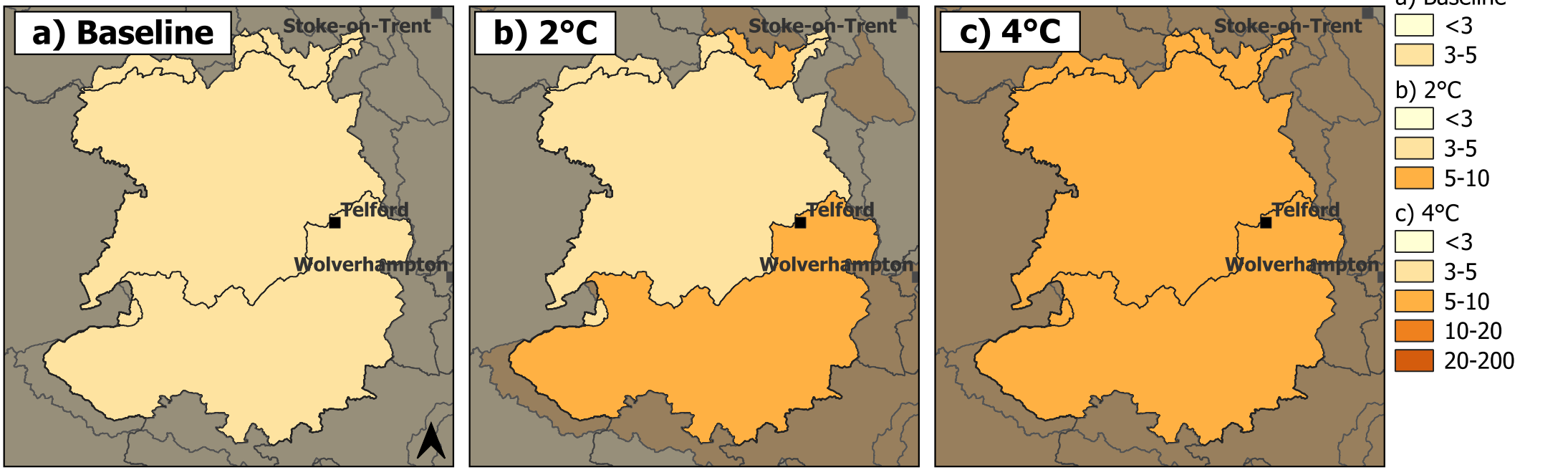
Shropshire | Drought Duration | Warming Levels



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 Shropshire, and the percentage change from baseline for a 2°C and 4°C warming scenario.

	Median			Minimum			Maximum		
County	**Baseline**	**2°C**	**4°C**	**Baseline**	**2°C**	**4°C**	**Baseline**	**2°C**	**4°C**
Shropshire	3.6	4.9	6.8	2.6	3.3	4.4	4.6	10	24.8

Median drought duration (months/30-yr) for baseline scenario in Shropshire, 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**
Shropshire	3.6	2.1 - 7.5	4.9	2.4 - 18.6	6.8	2.7 - 54.3

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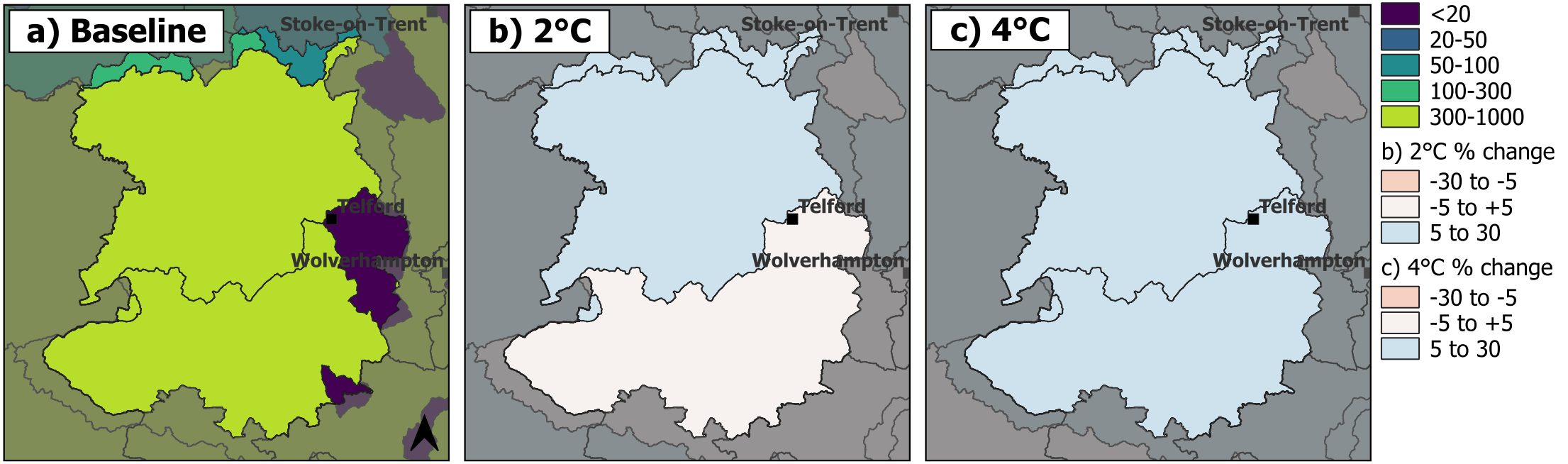
OPEN CLIMATE IMPACT FRAMEWORK

Shropshire | 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 Shropshire, and the percentage change from baseline for a 2°C and 4°C warming scenario.

	Median	% change		Minimum			Maximum		
County	**Baseline**	**2°C**	**4°C**	**Baseline**	**2°C**	**4°C**	**Baseline**	**2°C**	**4°C**
Shropshire	72.5	10.5	13.8	2	-9.6	-21.9	692.2	19.7	22.9

Median flow rate (m3/s) for baseline scenario in Shropshire, 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
Shropshire	72.5	1.8 - 804	10.5	13.8

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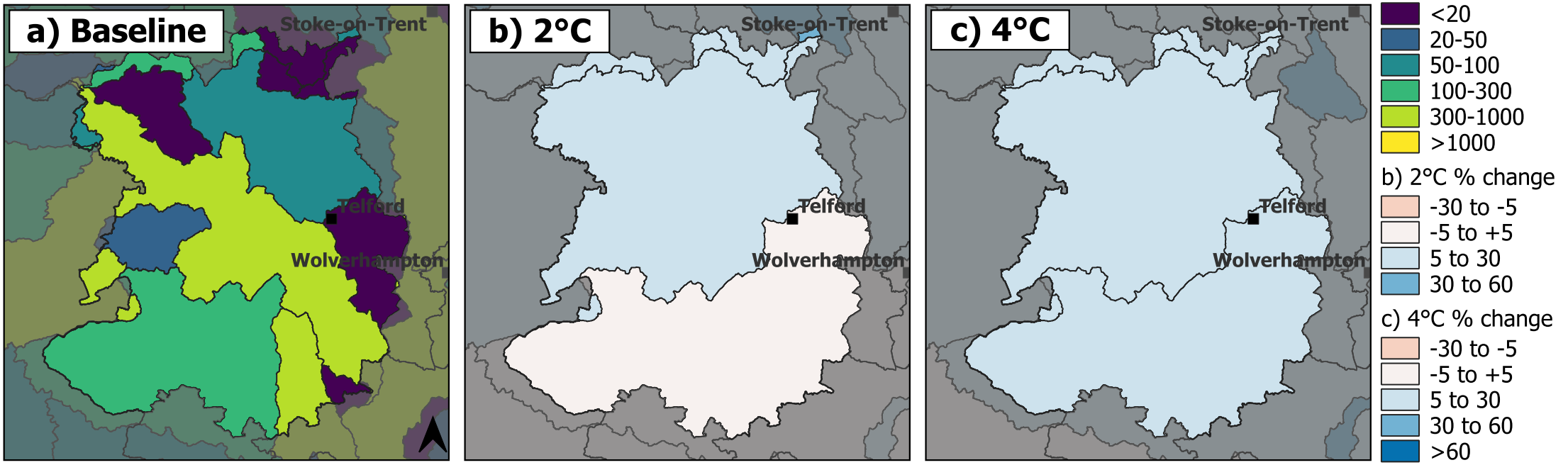
Shropshire | 100 year Return Period Flow | Warming Levels



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 Shropshire, and the percentage change from baseline for a 2°C and 4°C warming scenario.

	Median	% change		Minimum			Maximum		
County	**Baseline**	**2°C**	**4°C**	**Baseline**	**2°C**	**4°C**	**Baseline**	**2°C**	**4°C**
Shropshire	95.7	19	15.8	6.2	-7.5	-15.5	1256.6	42.9	65

Median flow rate (m3/s) for baseline scenario in Shropshire, 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
Shropshire	95.7	2 - 1412.9	19	15.8

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Sharing and re-use

Acknowledgements

These reports are based on the OpenCLIM project, a collaboration led by the Tyndall Centre for Climate Change Research at the University of East Anglia (UEA), with partners from Newcastle University, the University of Bristol, the UK Centre for Ecology and Hydrology (UKCEH), the Data and Analytics Facility for National Infrastructure (DAFNI), and Sayers and Partners. For further information visit openclim.science.

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. Maps contain public sector information (administrative boundaries) licensed under the Open Government Licence v3.0.

University of East Anglia

Tyndall Centre for Climate Change Research

Open Climate Impacts Modelling Framework