



Climate change risk maps for the Greensand Ridge

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Report prepared for and funded by:

The Greensand Country Landscape Partnership, funded by the
National Lottery Heritage Fund

April 2021



Introduction

Climate change is likely to exacerbate many of the existing pressures on the natural environment. It will also lead to additional environmental challenges. Climate change adaptation is, therefore, a priority if sustainable environmental management is to be achieved. However, to successfully adapt, it is necessary to understand the associated risks. Here, some of the future risks that climate change poses to the natural environment and people within the Greensand Country are mapped. This will help The Greensand Country Landscape Partnership create strategies for adapting to the impacts of climate change.

Location

This assessment focusses on the Greensand Country; a distinctive area of sand and sandstone that forms a ridge between the clay vales of lowland Bedfordshire, to the south of Bedford (Figure 1). Greensand Country stretches for 45 km, the vast majority in Bedfordshire, but reaching onto Cambridgeshire at the eastern end and Buckinghamshire and Milton Keynes at the western end. This study area is similar to the Greensand Ridge National Character Area (NCA 90), which was also the basis for the Greensand Nature Improvement Area (NIA). However, as the Greensand Country has a slightly different boundary and occupies some areas just outside of the Greensand Ridge NCA, we have produced maps and analyses for the Greensand Ridge plus a 1 km buffer (Figure 1).

Approach

We assessed climate change risk using spatial data provided by Natural England and Climate Just. First, we used Natural England's 'National biodiversity climate change vulnerability model'¹ to calculate the Overall Vulnerability of habitats within Greensand Country to future climate change. For a detailed explanation of how Overall Vulnerability is calculated, please see the Natural England report entitled 'National biodiversity climate change vulnerability model (NERR054)'². Overall Vulnerability is an index between 0 (low) and 3 (high).

Second, we downloaded a range of spatial datasets provided within the 'Map tool' on the Climate Just website³, including the Neighbourhood Flood Vulnerability Index (NFVI) and the Social Flood Risk Index (SFRI). NFVI *"provides insight into the social vulnerability of a neighbourhood should a flood occur. It estimates how far individuals may experience a loss in well-being if exposed to a flood as well as their ability to prepare, respond and recover from a flood (without significant emergency support from the authorities)"*⁴. Neighbourhoods are based on those used during the census. Each neighbourhood is given one of the following NFVI scores: Slight, Very low, Relatively low, UK average, Relatively high, Very high and Acute. NFVI is calculated for the present day rather than under future warming scenarios.

¹ Spatial data for the National Biodiversity Climate Change Vulnerability Assessment (England):

<https://data.gov.uk/dataset/4754c2ba-ec60-4356-98ae-cbfaaa30a43e/national-biodiversity-climate-change-vulnerability-assessment-england>

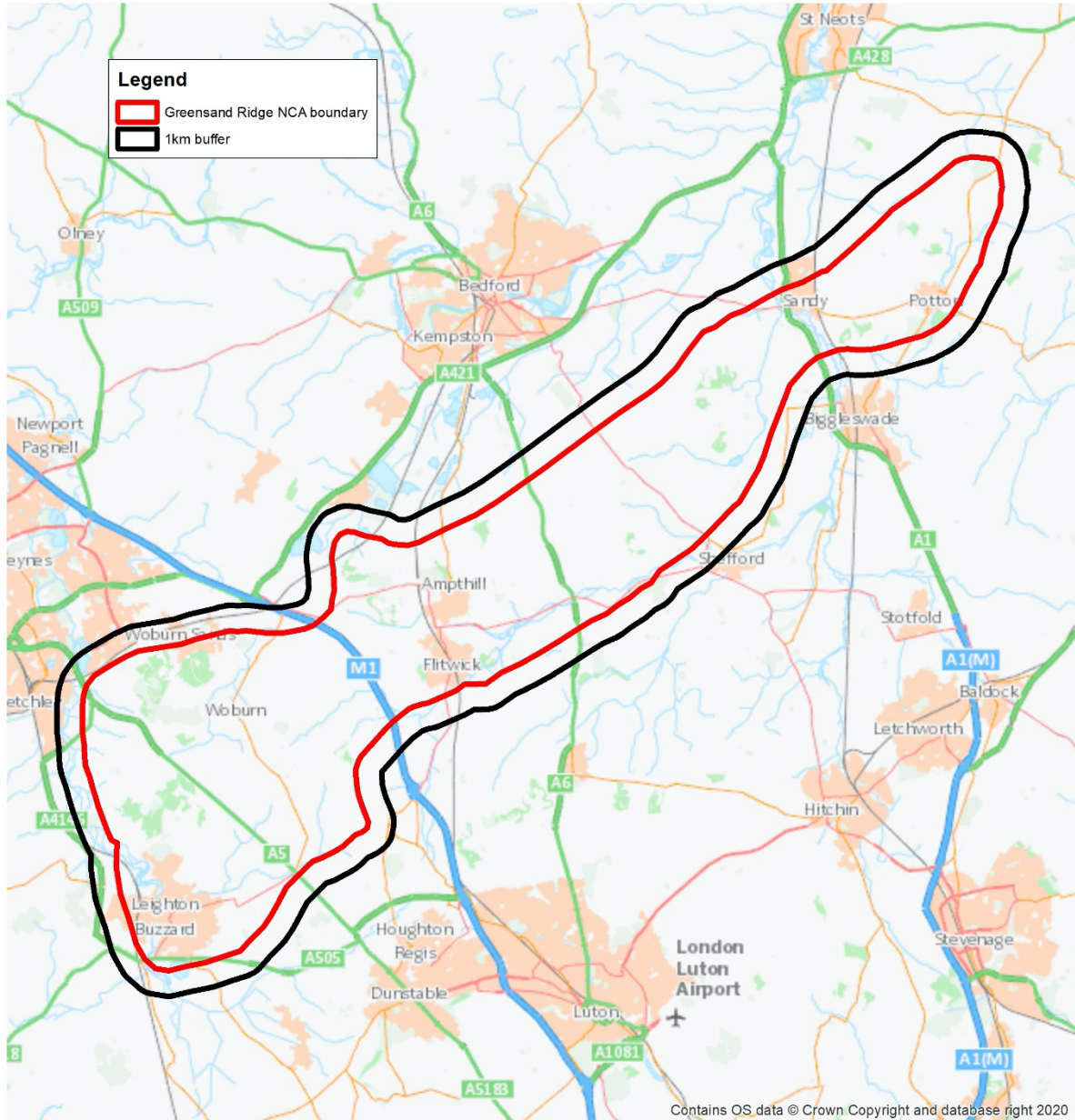
² Natural England (2014). National biodiversity climate change vulnerability model (NERR054). Natural England, York, UK <http://publications.naturalengland.org.uk/publication/5069081749225472>

³ <https://www.climatejust.org.uk/map>

⁴ Climate Just (2018). Technical User Guide. Climate Just, UK

https://www.climatejust.org.uk/sites/default/files/Technical_User_Guide_March2018_Final_Draft-05152+MP.pdf

The Greensand Country study area



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0 10 km

1:200,000
(at A4 paper size)



Figure 1: The Greensand Country study area.

SFRI “provides insight into the flood disadvantage of a neighbourhood should a flood occur. It is a measure of where social vulnerability and exposure to flooding coincide”⁵. As with NFVI, SFRI neighbourhoods are based on those used during the census. Each neighbourhood is given one of the following SFRI scores: Exposed (but NFVI below the UK mean), Low, Moderate, High, Very high, Acute, Extreme and No exposed population. Unlike NFVI, SFRI can be calculated using three different scenarios and two flood themes. The three scenarios include the present day, 2050s with a two degree rise in Global Mean Temperature (GMT), and 2050s with a four degree rise in GMT. The two flood themes include surface water flooding, and river and coastal flooding.

For more information about how NFVI and SFRI are calculated, refer to the Climate Just ‘Technical User Guide’⁴.

Results

Figure 2 displays the Overall Vulnerability to climate change scores for the habitats found within Greensand Country. There is a distinct difference between the centre and periphery of the study area: overall, priority habitats in the centre of the Greensand Ridge NCA have a low vulnerability to climate change, but those close to or outside the NCA boundary have a moderate or high vulnerability to climate change (Figure 2). The only exception to this pattern is a band of habitats running the length of the River Ivel, between Sandy and Biggleswade (Figure 1 and 2).

Figure 3 indicates that the majority of Greensand Country has an NFVI at or below the UK average. There are only a few small areas that have an NFVI above the UK average, but these areas only score an NFVI of ‘Relatively’ high (Figure 3). Figure 4 displays the SFRI scores for the study area under the present day scenario in relation to river and coastal flooding. It suggests that the neighbourhoods of Greensands Country currently have a low SFRI when considering riverine and coastal flooding.

Figure 5 suggests that this pattern is broadly the same when considering present day SFRI scores for surface water flooding. However, unlike the present day riverine and coastal flooding SFRI scores, there are several discrete areas in which surface water SFRI is currently Very high to Extreme (Figure 5). Figures 6 and 7 suggest that SFRI severity increases within these areas by the 2050s under both a two and four degree rise in GMT, with the increase in SFRI severity being slightly higher under a four degree rise in GMT. The areas of High to extreme surface water SFRI include several areas in Leighton Buzzard, an area on the Eastern edge of Bletchley, parts of Flitwick, Wilstead and an area on the North-western edge of Sandy.

⁵ Climate Just (2018). Technical User Guide. Climate Just, UK
https://www.climatejust.org.uk/sites/default/files/Technical_User_Guide_March2018_Final_Draft-05152+MP.pdf

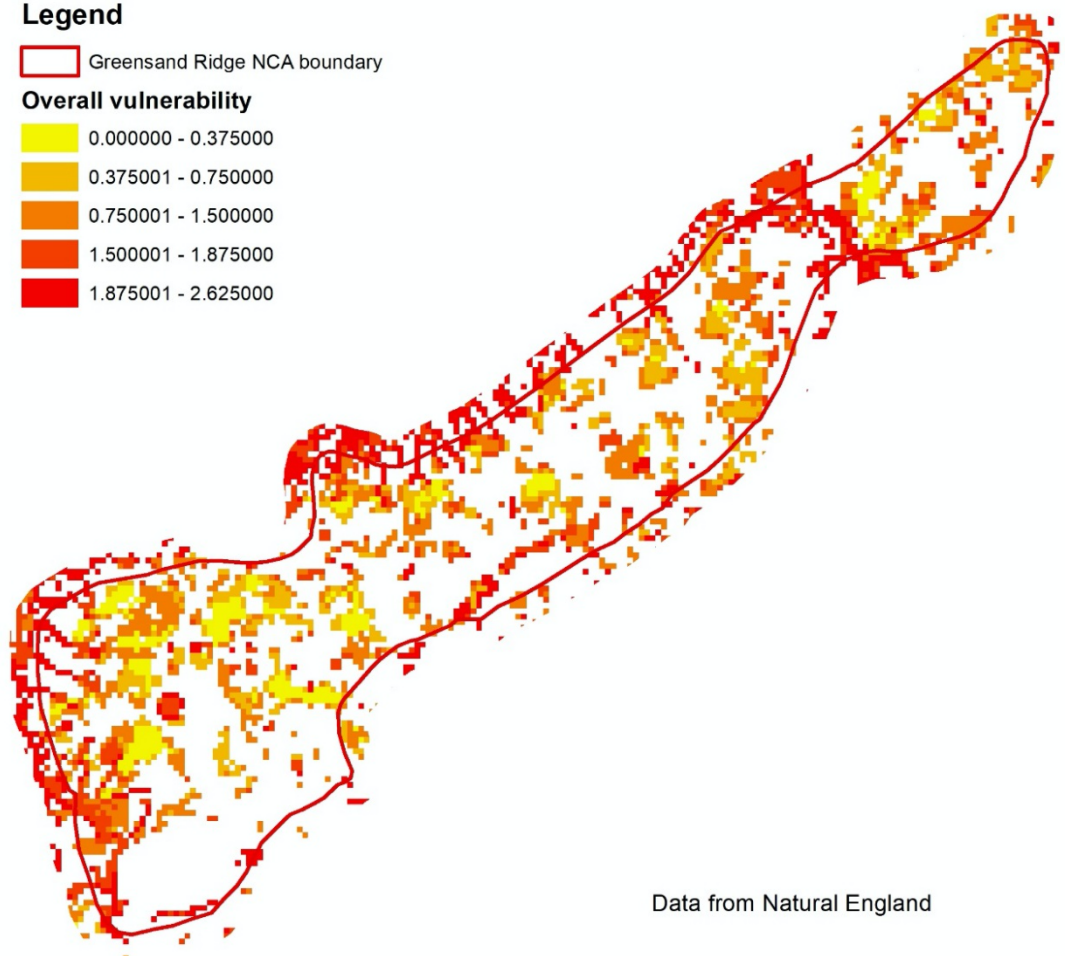
National biodiversity climate change vulnerability model

Legend

 Greensand Ridge NCA boundary

Overall vulnerability

 0.000000 - 0.375000
 0.375001 - 0.750000
 0.750001 - 1.500000
 1.500001 - 1.875000
 1.875001 - 2.625000



Data from Natural England

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0 5 10 km 1:200,000
 (at A4 paper size)



Figure 2: The Overall Vulnerability to climate change of habitats within Greensand Country. Spatial data taken from Natural England's 'National biodiversity climate change vulnerability model'.

Neighbourhood Flood Vulnerability Index (NFVI)

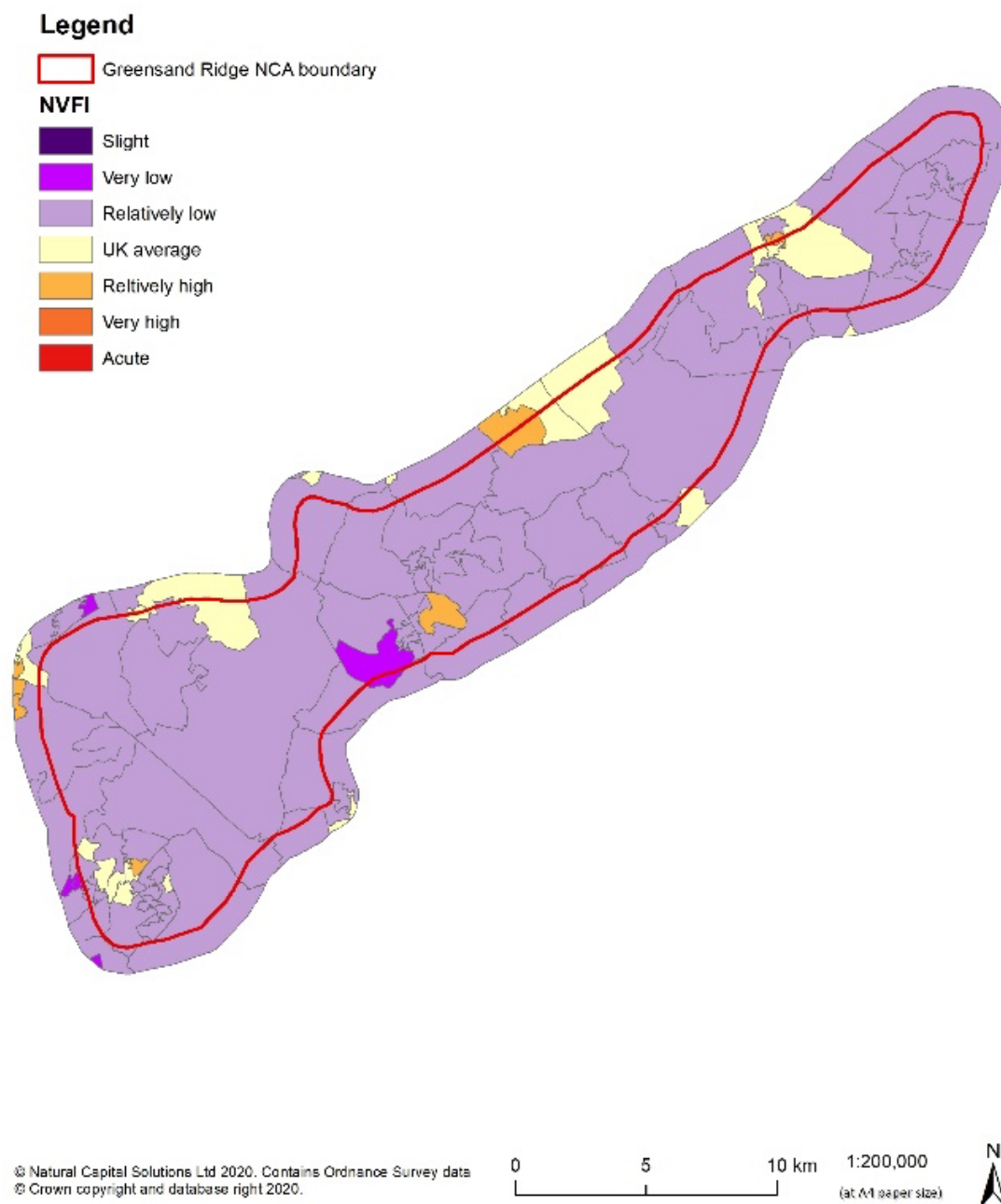


Figure 3: The Neighbourhood Flood Vulnerability Index (NFVI) of Greensands Country. Spatial data produced and provided by Climate Just.

Social Flood Risk Index (SFRI) - River & coastal present day

Legend

 Greensand Ridge NCA boundary

SFRCPPCG

 Exposed, NFVI below the UK mean

 Low

 Moderate

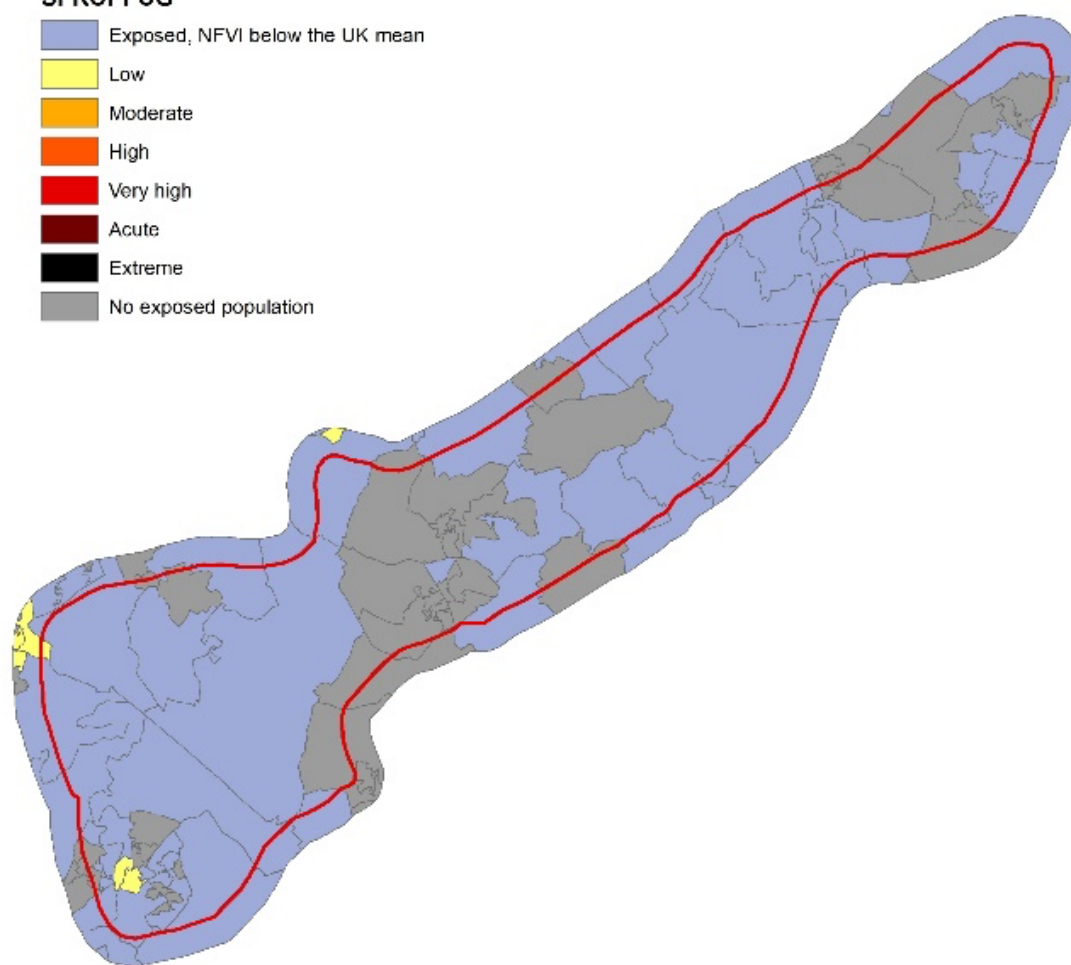
 High

 Very high

 Acute

 Extreme

 No exposed population



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0 5 10 km 1:200,000
(at A1 paper size)



Figure 4: The present day river and coastal Social Flood Risk Index (SFRI) of Greensands Country. Spatial data produced and provided by Climate Just.

Social Flood Risk Index (SFRI) - Surface water present day

Legend

 Greensand Ridge NCA boundary

SFRCPCG

 Exposed, NFVI below the UK mean

 Low

 Moderate

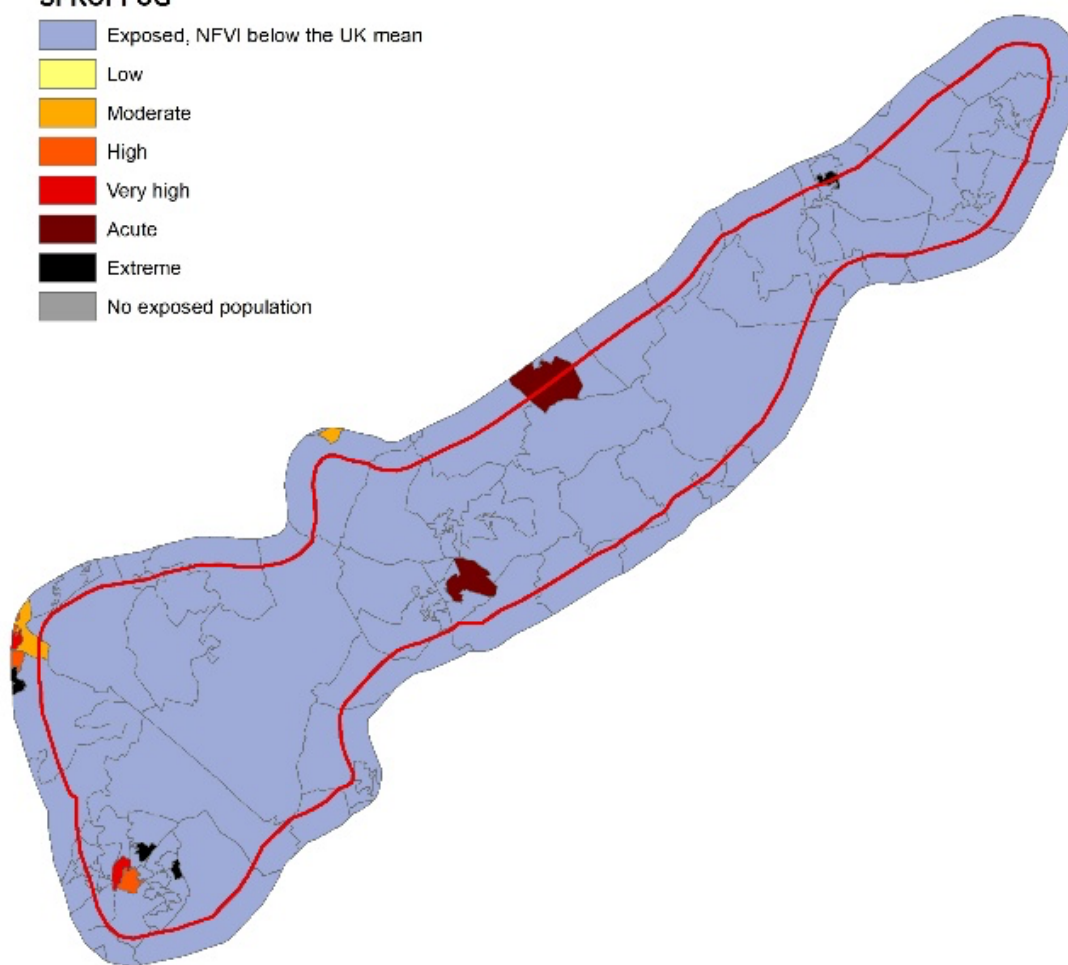
 High

 Very high

 Acute

 Extreme

 No exposed population



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0 5 10 km 1:200,000
(at A1 paper size)



Figure 5: The present day surface water Social Flood Risk Index (SFRI) of Greensands Country. Spatial data produced and provided by Climate Just.

Social Flood Risk Index (SFRI) - Surface water 2050s 2C warming

Legend

 Greensand Ridge NCA boundary

SFRCPCG

 Exposed, NFVI below the UK mean

 Low

 Moderate

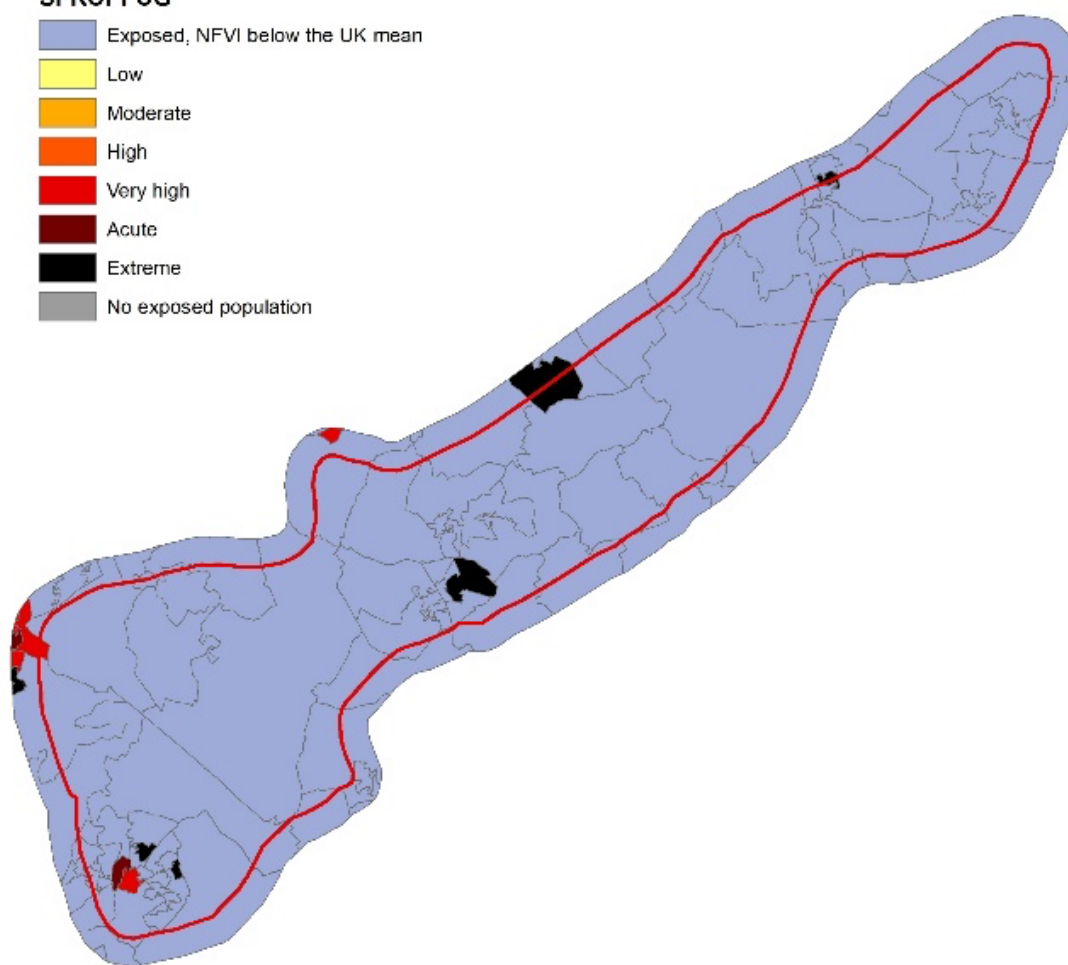
 High

 Very high

 Acute

 Extreme

 No exposed population



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(at A1 paper size)



Figure 6: The surface water Social Flood Risk Index (SFRI) of Greensands Country in the 2050s under a 2°C warming scenario. Spatial data produced and provided by Climate Just.

Social Flood Risk Index (SFRI) - Surface water 2050s 4C warming

Legend

 Greensand Ridge NCA boundary

SFRCPCG

 Exposed, NFVI below the UK mean

 Low

 Moderate

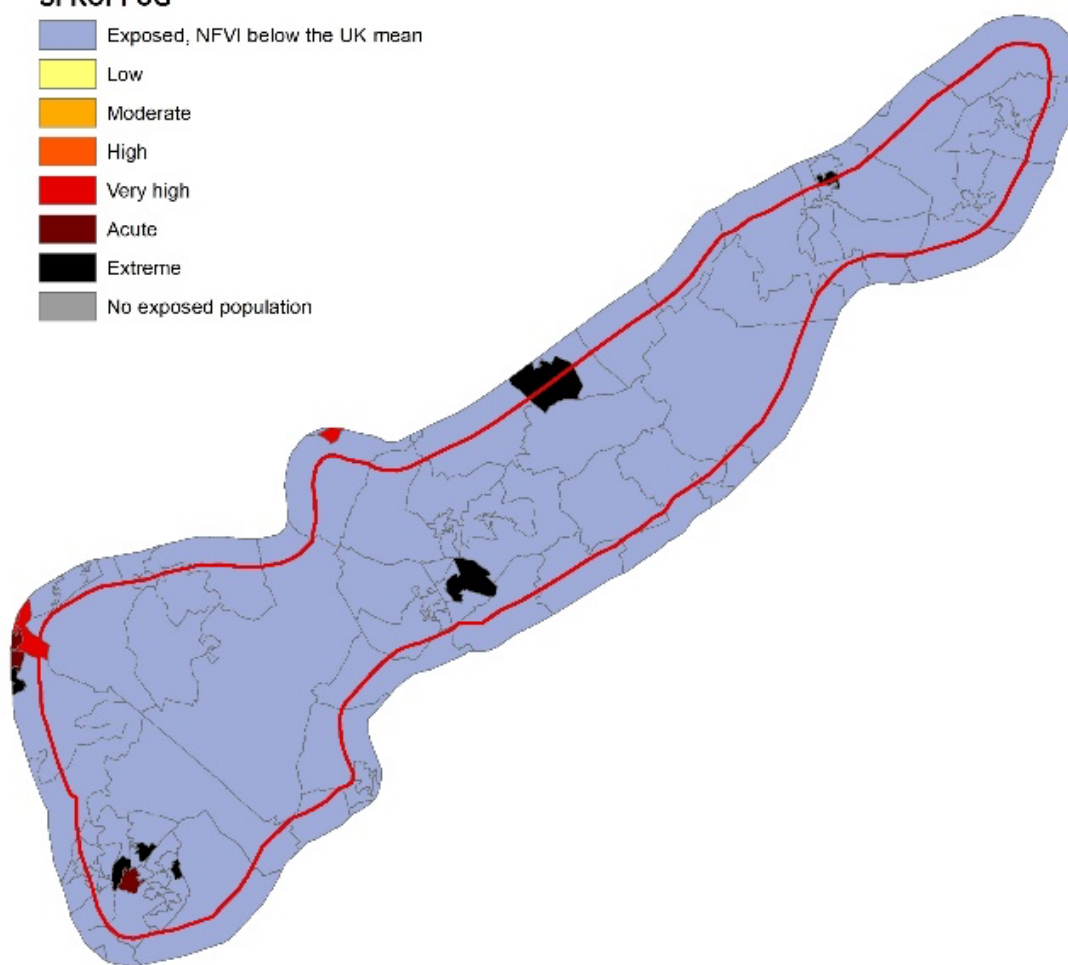
 High

 Very high

 Acute

 Extreme

 No exposed population



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0 5 10 km 1:200,000
(at A1 paper size)



Figure 6: The surface water Social Flood Risk Index (SFRI) of Greensands Country in the 2050s under a 4°C warming scenario. Spatial data produced and provided by Climate Just.

Conclusion

We have presented a series of climate change vulnerability maps for Greensand Country. The maps suggest that the habitats in the centre of the study area have a low vulnerability to climate change, whereas those at the periphery are much more vulnerable. Furthermore, neighbourhoods within the study area are generally not that vulnerable to the social and economic costs of flooding, and are currently at low risk from the social and economic costs associated with the impacts of riverine and coastal flooding, as well as surface water flooding. Nevertheless, there are a few discrete areas that are currently at high to extreme risk from the social and economic costs of surface water flooding. These areas include several areas in Leighton Buzzard, an area on the Eastern edge of Bletchley, parts of Flitwick, an area centred on Wilstead and an area on the north-western edge of Sandy. Under future two and four degree increases in GMT, these areas, but no others, will be at even greater risks from the social and economic costs of surface water flooding. The maps provided within this report will help The Greensand Country Landscape Partnership better adapt to the impacts caused by future climate change.