Achieving Net Zero: Understanding the Potential Hydrological Impacts of Changing Climate and Land Cover in the UK

Marcus Buechel Supervisors:

Professor Simon Dadson and Dr Louise Slater marcus.buechel@ouce.ox.ac.uk



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JULES remote Open Science Meeting

9th September 2020

Understanding the Potential Hydrological Impacts of Changing Climate and Land Cover in the UK **Marcus Buechel**

Supervisors: Professor Simon Dadson and Dr Louise Slater marcus.buechel@chch.ox.ac.uk

Net Zero

ommittee on Climate Change

The UK's contribution to stopping global warming

1.Broad Background and Achieving Net Zero

- 2. Questions and Outline
- 3.Methodology
 4.Initial Results
- 5.Conclusions







marcus.buechel@chch.ox.ac.uk

Professor Simon Dadson and Dr Louise Slater

Supervisors:

1. Background: A changing world

- Flood magnitude and frequency have risen in many regions across the globe (Winsemius et al., 2016)
- Climate change is set to increase rainfall intensity and flooding (IPCC, 2019)
- Land use and land cover are changing
- How can we predict future streamflow in a nonstationary climate and landscape?



Flood rich (blue) and poor (red) periods in England and Wales (Dadson et al., 2017)





1. Background: A changing world



1. Background: A changing world





https://metro.co.uk/2020/02/28/storm-jorge-raging-towards-britain-bringing-even-flooding-12318975/



- Gauging locations with their highest peak in the last 10 years, but not in autumn / winter 2019/20
- Gauging locations with their highest peak in autumn / winter 2019/20
- All gauging locations

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Map showing gauges recording record breaking flood events in the last decade across a series of temporal ranges.

Supervisors: Professor Simon Dadson and Dr Louise Slater marcus.buechel@chch.ox.ac.uk

1. Achieving Net Zero

- Climate models suggest limiting CO₂ can reduce the amount of negative effects on communities across the world (CCC, 2019a, IPCC, 2018)
- One of the ways that the UK government proposes to reach
 Net Zero by 2050 is to increase
 the amount of afforestation (CCC, 2019b)
- Potential for Natural Flood
 Management?

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2. Outline and Aims

- Marcus Buechel Supervisors: Professor Simon Dadson and Dr Louise Slater marcus.buechel@chch.ox.ac.uk
- 1. To what extent does afforestation influence UK streamflow?
- 2. How does afforestation location influence catchment streamflow dynamics?
 - 3. Where can afforestation locations reduce high flows?



3. Methodology: Land Cover Generation



3. Methodology: Land Cover Generation



3. Methodology: Land Cover Generation

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Drainage Basin Planting Location



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3. Methodology: Land Cover Generation

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River Tamar Planting Locations

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3. Methodology: Land Cover Generation



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4. Initial Results: High and Low Flows

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5. Initial Results: River Thames

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4. Initial Results: River Dynamics





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4. Initial Results: River Dynamics

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4. Initial Results: Planting Location



4. Initial Results: Planting Location



- Afforestation location has a significant impact on catchment hydrology increasing flow regime variability and dampening catchment response to rainfall.
- Care must be taken on afforestation location as it can lead to unintended changes in streamflow e.g. increase extremes.
- Plan to use ensemble weather forecasts to test future climate impacts on streamflow.





Supervisors: Professor Simon Dadson and Dr Louise Slater marcus.buechel@chch.ox.ac.uk

Questions?

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River Culm Flooding on 28th December 1979. Environment Agency