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Renewing coexistence with beavers in Britain: maximising nature-based solutions benefits

Beavers Across Britain: May 2026

Richard Brazier, Alan Puttock and Roger Auster

r.e.brazier@exeter.ac.uk a.k.puttock@exeter.ac.uk r.e.auster@exeter.ac.uk

The Return of the Beaver

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A tale of human destruction but then a proactive conservation success story!

In the late 19th century
An estimated 1,200 beavers remained

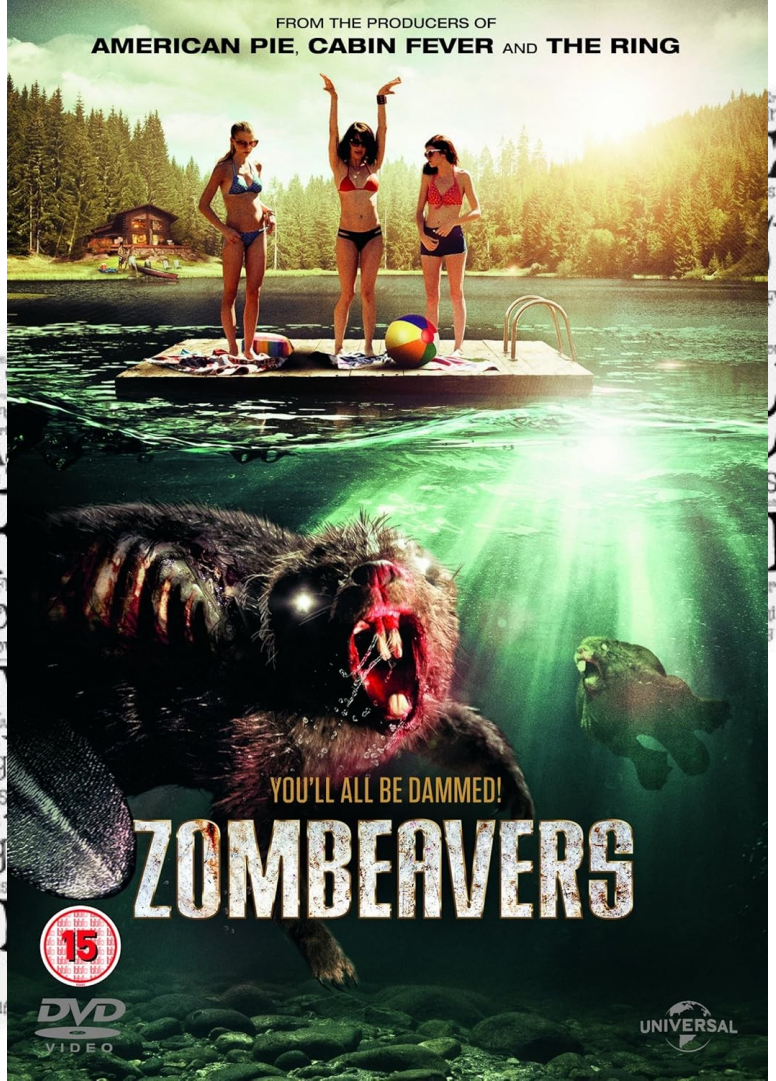
Today
There are an estimated 1.5 million beavers!

Halley et al., 2021: https://onlinelibrary.wiley.com/doi/10.1111/mam.12216

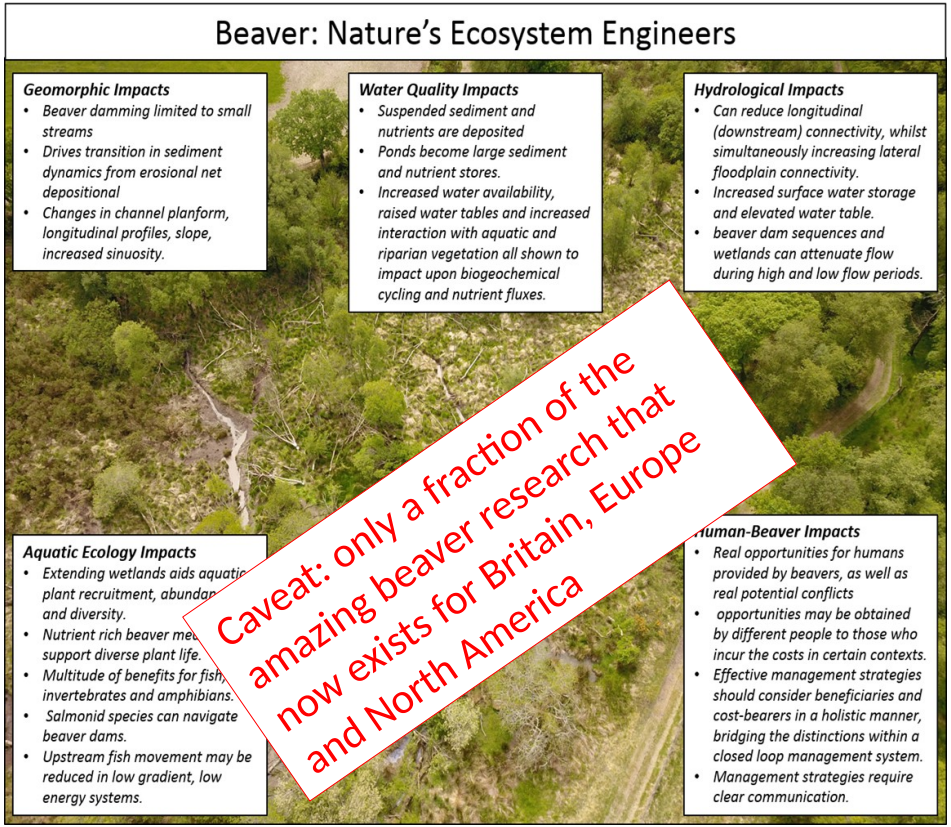
Impacts of Beaver reintroduction

are both positive…

and negative…



Since 2013 undertaking a national suite of applied research to understand the return of the beaver to Britian



Hydrology, and Geomorphology

Puttock et al., 2017: DOI:10.1139/juvs-2015-0005
Puttock et al., 2018: DOI:10.1002/esp.4398
Puttock et al., 2021. DOI:10.1002/hyp.14017
Graham et al., 2022: DOI:10.1002/hyp.14735
Bradbury et al., 2026; DOI: 10.1002/esp.70256

Geospatial/Surveys/Mapping/Modelling

Graham et al., 2020: DOI:10.1007/S10344-020-01379-W
Graham et al 2022: DOI:10.1002/2688-8319.12168
Bradbury et al., 2023: DOI:pdf/10.1002/rra.4082
Campbell-Palmer et al., 2020: DOI:10.1002/rra.3755
Puttock et al., 2015: DOI:10.1139/juvs-2015-0005

Ecology

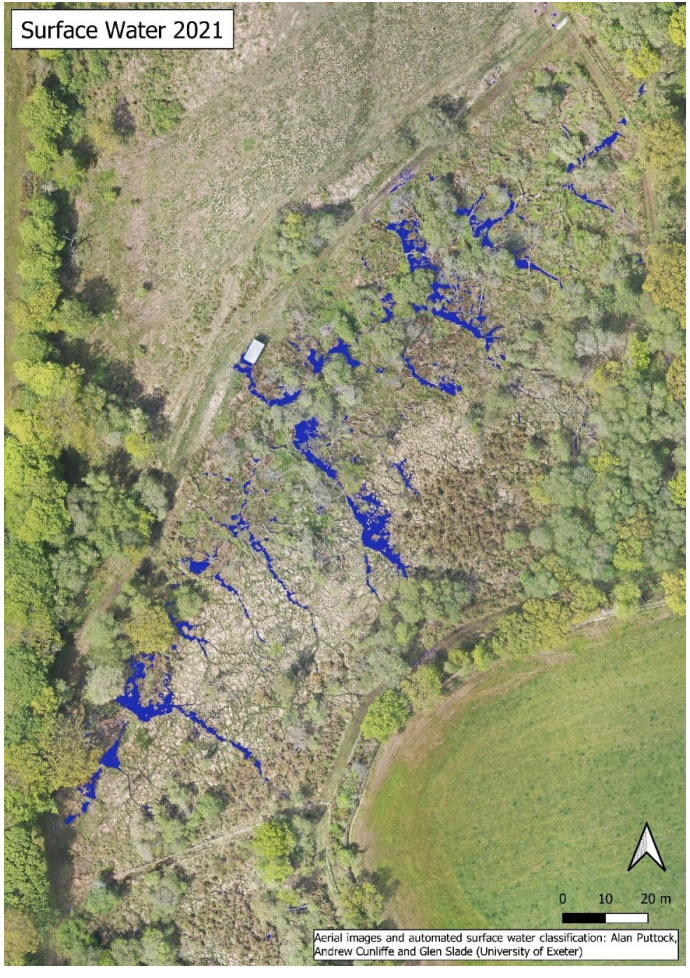
Puttock et al., 2023: DOI:10.59922/GONL2514

Social Science/Human Dimensions

Auster et al., 2019: DOI:10.1111/area.12576
Auster et al., 2020: DOI: 10.1080/09640568.2020.1837089
Auster et al., 2023: DOI:10.1111/jfr3.12789
Auster et al., 2023: DOI:10.1111/rec.13899
Auster et al., 2023: DOI:10.1002/pan3.10503
Puttock et al., 2025: DOI: 10.1016/j.nbsj.2025.100249
Auster et al., 2026: DOI:10.1111/cobi.70195

Brazier et al., 2020. Beaver: Nature's Ecosystem Engineers. WIRES. DOI: 10.1002/wat2.1494

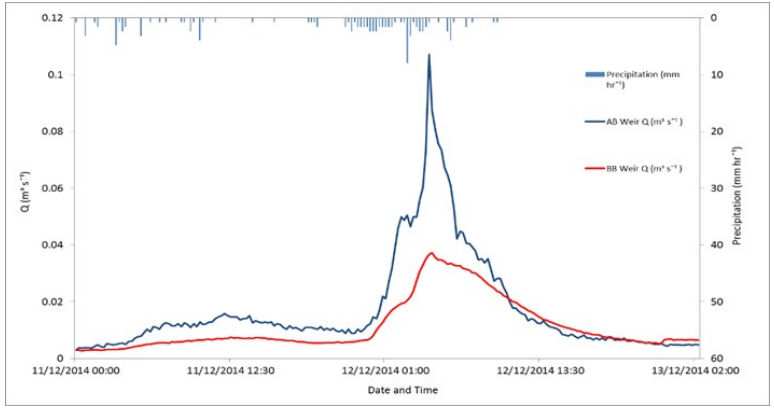
Hydrological Impacts



Initial proof of concept research (working with Devon Wildlife Trust) demonstrated:

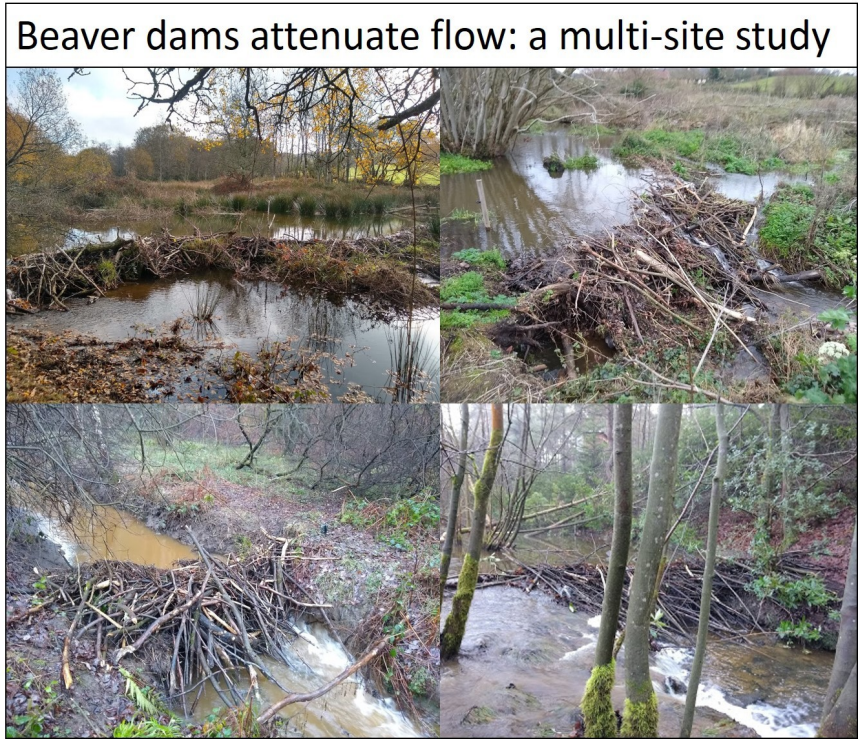
Total storm flow and peak flows reduced by ca 30 % below beaver site

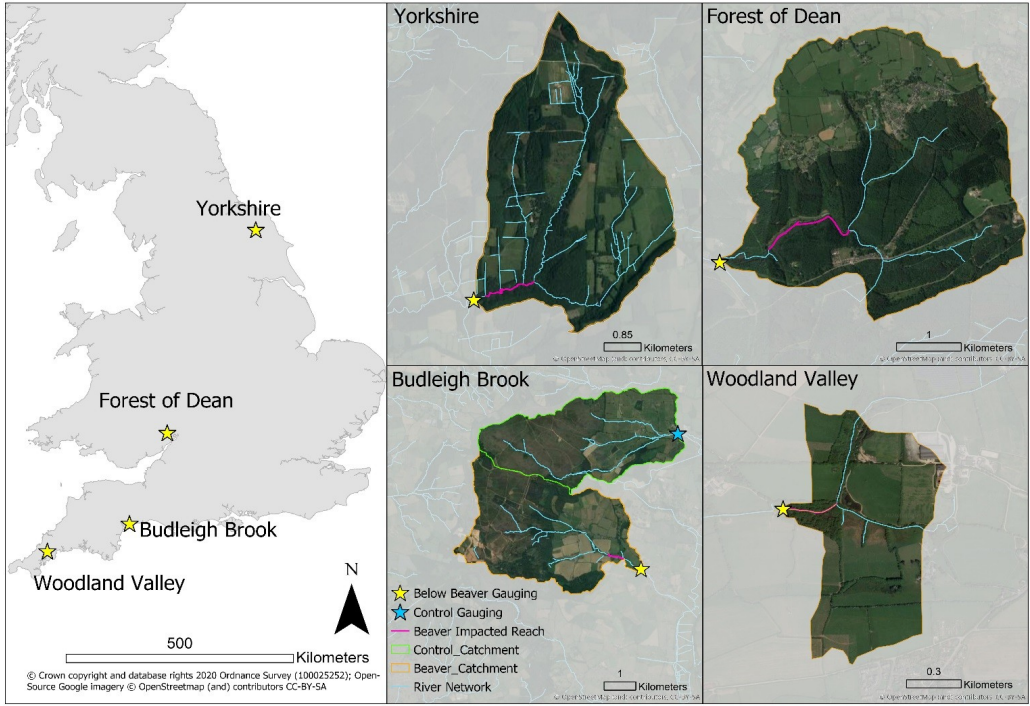
- Lag times (peak rainfall to peak flow) shorter above beaver site than below (29 %).
- Significant surface water storage (up to ~ 1000 m^3 in ponds
- Ponds storing over 100 t of sediment, estimated as over 70 % trapped from upstream catchment.
- Lower suspended sediment and associated nutrients released during storm events.
- Increase in wide range of biodiversity and habitat heterogeneity metrics.



Puttock et al., 2017. Eurasian beaver activity increases water storage, attenuates flow and mitigates diffuse pollution from intensively-managed grasslands. Science of The Total Environment. DOI:10.1139/juvs-2015-0005

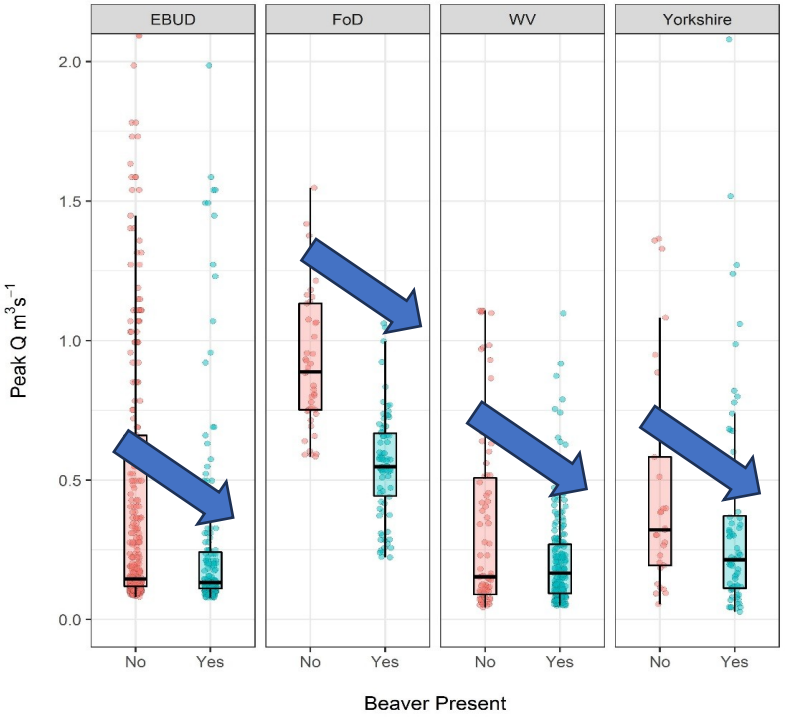
Focus upon storm flow: now have multi-site, multi-scale understanding:
- Monitoring across 12 beaver sites nationally



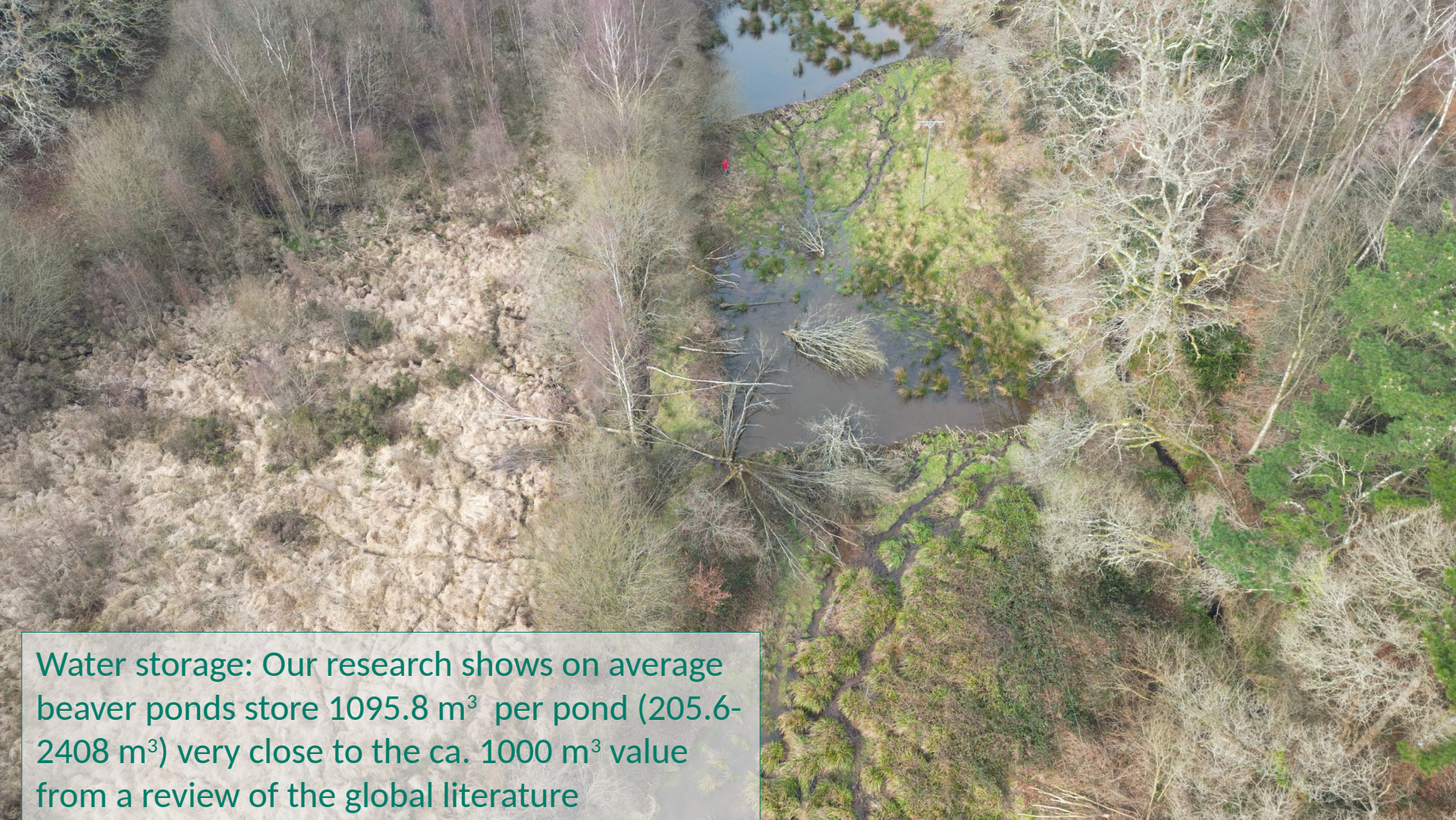


Puttock et al., 2021. Beaver dams attenuate flow: a multi-site study, Hydrological Processes.
https://doi.org/10.1002/hyp.14017

We see an overall trend of reduction in peak flows, lag times and overall ‘flashiness’



Puttock et al., 2021. Beaver dams attenuate flow: a multi-site study, Hydrological Processes. **https://doi.org/10.1002/hyp.14017**



Water storage: Our research shows on average beaver ponds store 1095.8 m^3 per pond (205.6-2408 m^3) very close to the ca. 1000 m^3 value from a review of the global literature

Water Quality Impacts

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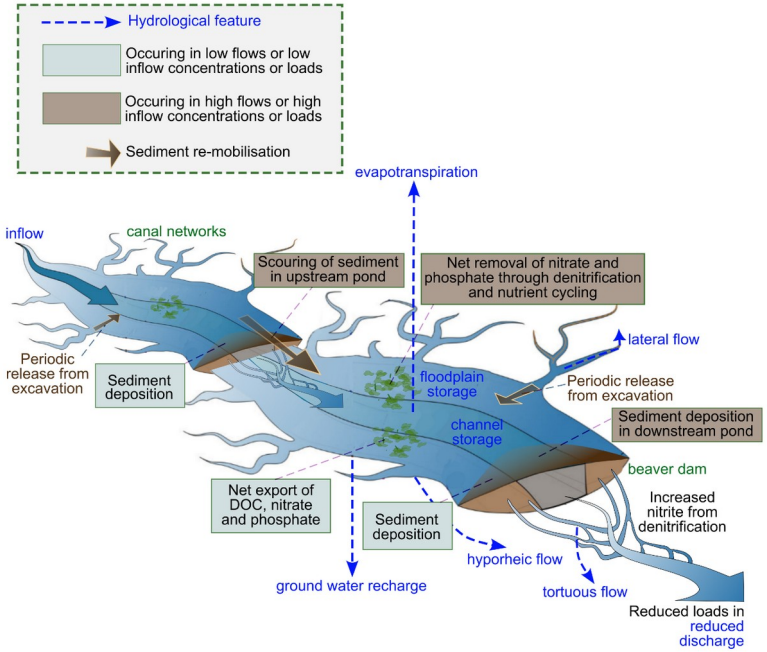
Beaver wetlands mediate diffuse water pollution in agriculturally dominated catchments

Gareth Bradbury[1] , Alan Puttock[1] , Gemma Coxon[2], Stewart Clarke[3], Richard E Brazier[1]
[1] University of Exeter, [2] University of Bristol, [3] National Trust

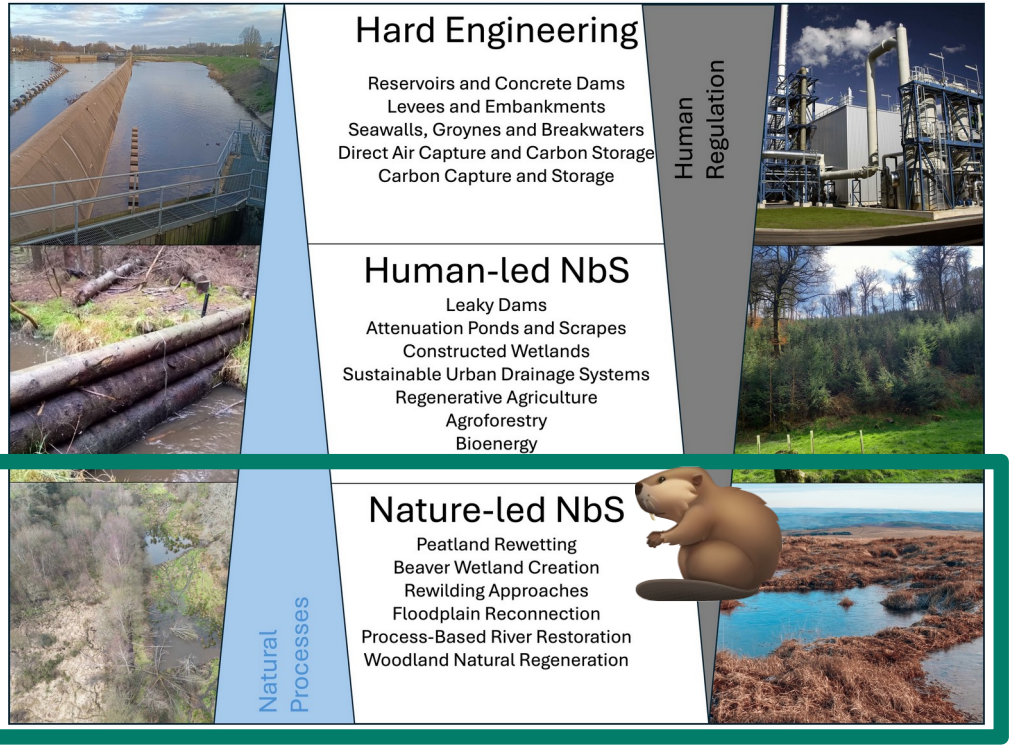


Ecological Impacts

Between 2016 and 2021

- Water vole sign increase 9 to 101 (1022 % increase)
- Surface water increase by 387 % and critically also a 366 % increase in wetted perimeter
- Zones of water vole activity expanded from 5 (0.2ha) to 11 much larger areas (1.2ha)
- 10 of 11 zones show overlap with beaver impact (91 %)

Making space for ‘nature-led’ NbS



A spectrum of solutions required

- Propose four key factors influence uptake:

1. Need for certainty
2. Balancing co-benefits + risks
3. Governance and policy structures
4. Societal perceptions.

How do we make space for nature-led NBS?

Puttock and Auster et al., 2025. Human, or nature led? A spectrum of nature-based solutions: https://doi.org/10.1016/j.nbsj.2025.100249

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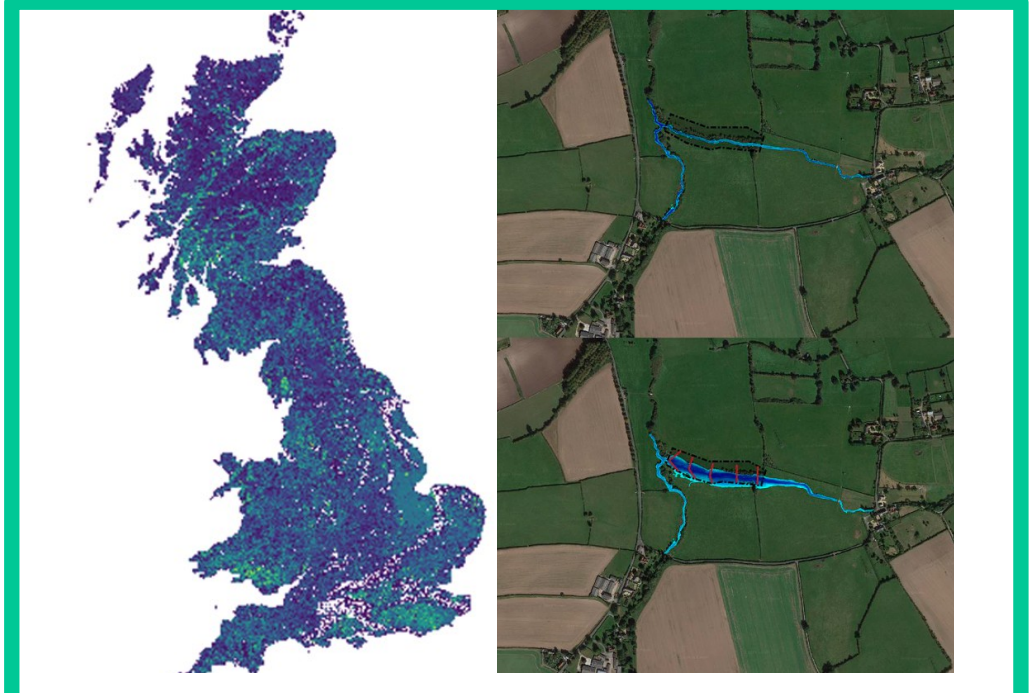
Part 2: Monitoring - Geospatial - Modelling



Alan Puttock: a.k.puttock@Exeter.ac.uk

Why? *'Making beavers boring?!'*

(or informing reintroduction management and policy…)

© Roisin Cau[illegible] Palmer

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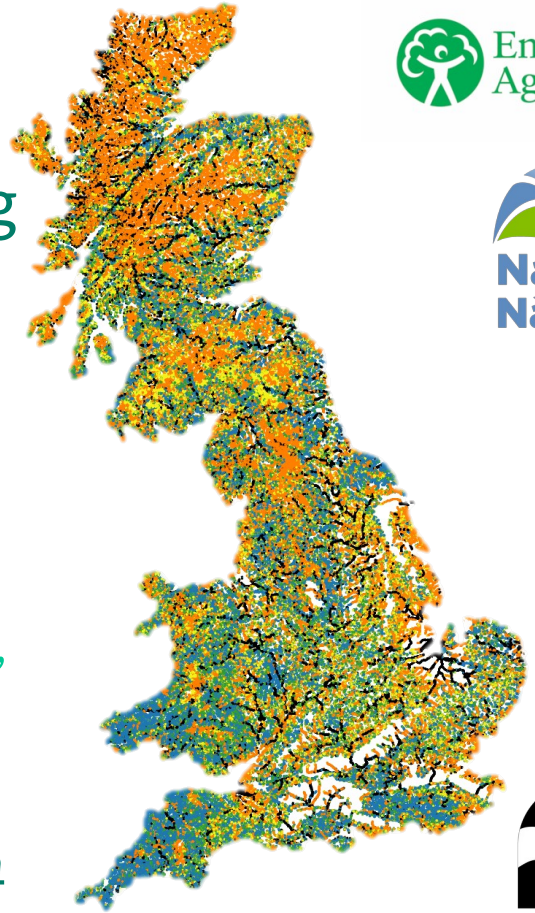
Environment Agency

Need for Geospatial Understanding

Beaver habitat and dam capacity models



NatureScot NàdarAlba

Cyfoeth Naturiol Cymru Natural Resources Wales

NATURAL ENGLAND

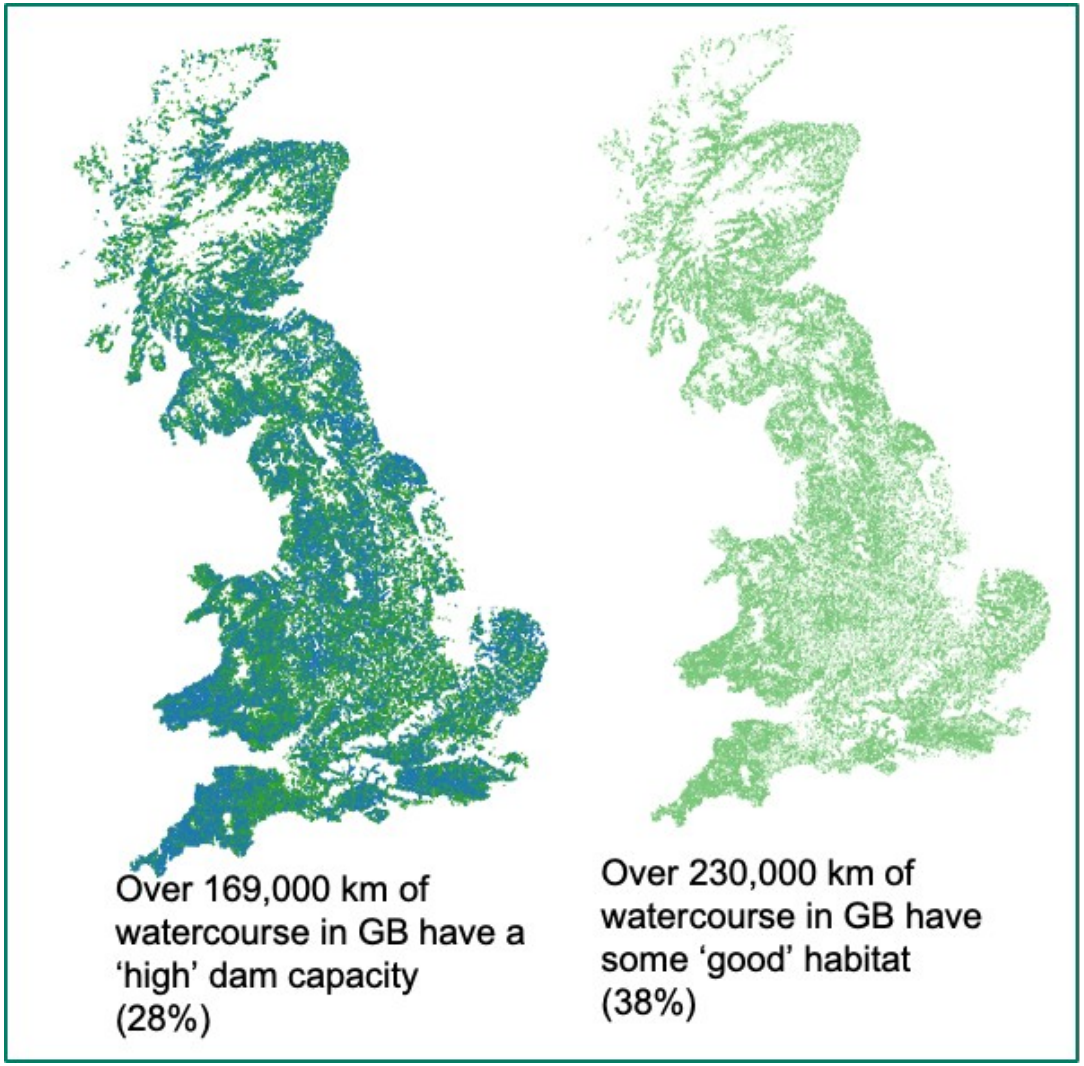
The Wildlife Trusts

"a tool for 'imaging' what is possible"

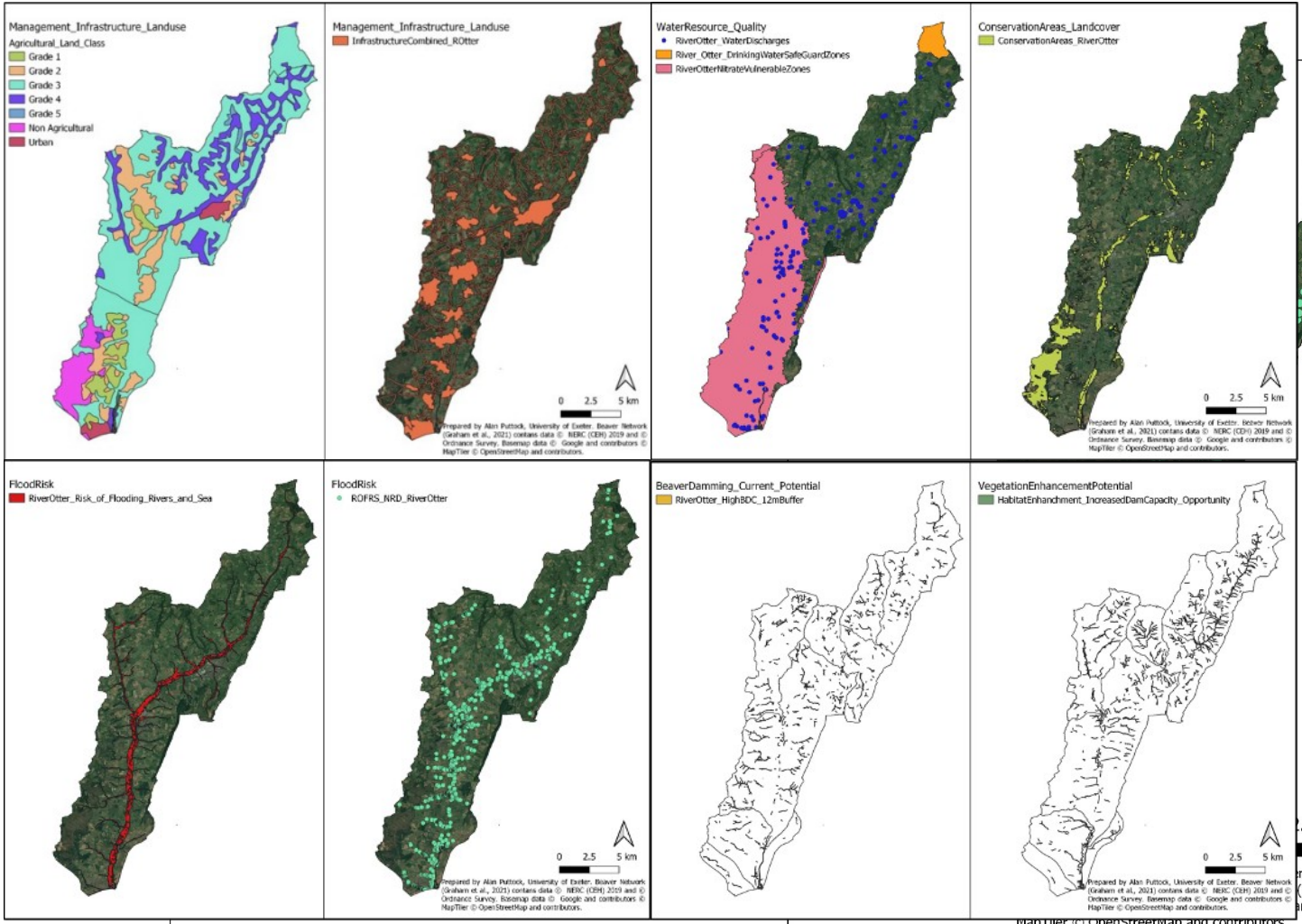
"Although BRAT's primary value is technical, it is, too, an achievement of the imagination, a method for visualizing".

Ben Goldfarb:
Eager, The Surprising, Secret Life of Beavers and Why They Matter

Graham, H. A., Puttock, A., et al.,(2020). Modelling Eurasian beaver foraging habitat and dam suitability, for predicting the location and number of dams throughout catchments in Great Britain. *European Journal of Wildlife Research*, *66*(3). https://doi.org/10.1007/S10344-020-01379-W

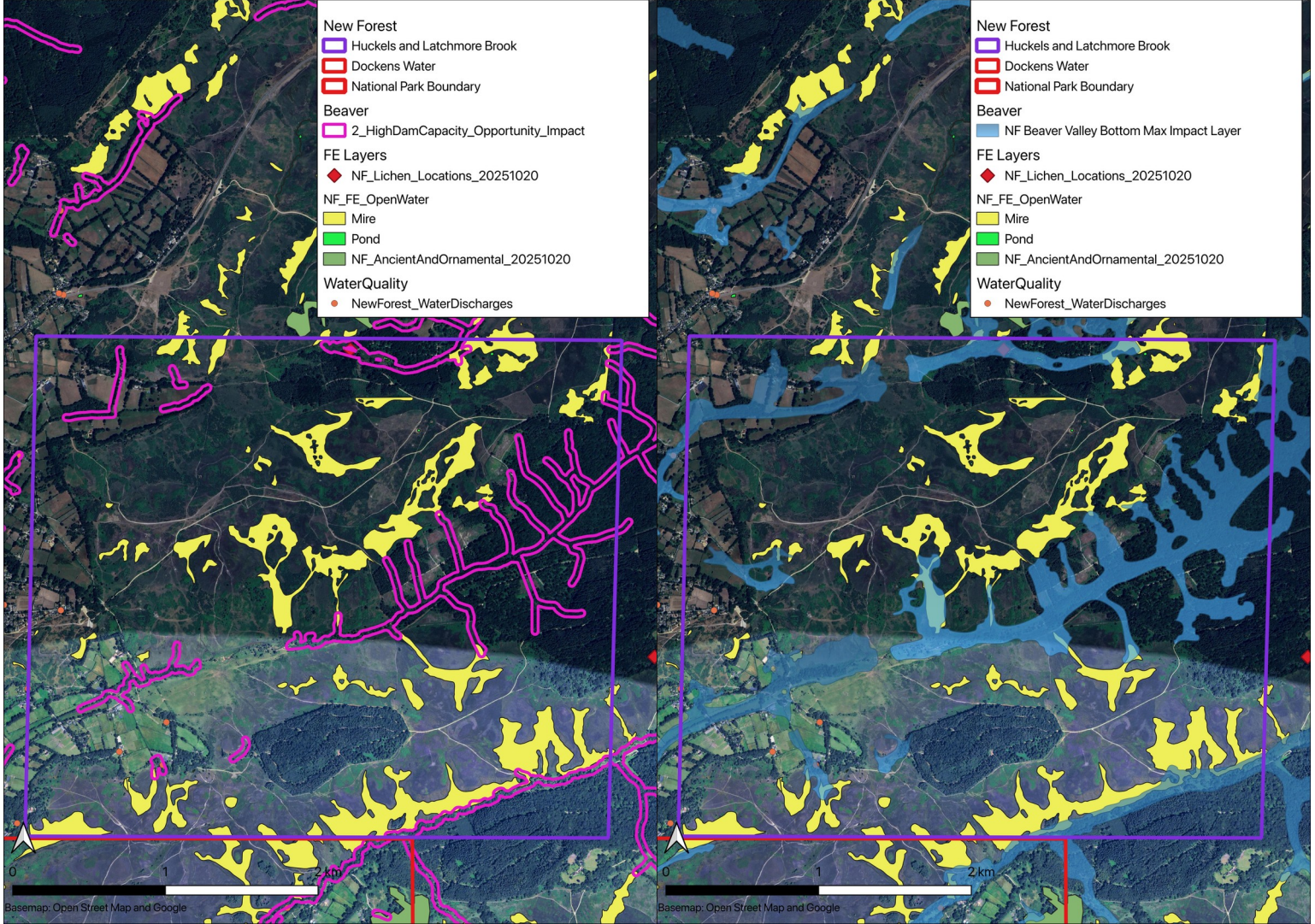


- Beaver Network gives us detailed high resolution understanding of beaver habitat and dam capacity.
- Inform management and strategy as beaver populations expand
- Visualise future possibilities
- Where will beavers have potential to impact via damming and wetlands creation? Inc both impacts perceived as positive and negative.
- Provides geospatial foundation for a range of other work: opportunity-risk mapping , population dynamics, hydrological modelling



Opportunity- Risk Mapping

- Identification of existing opportunity areas where beaver activity can be supported
- Identification of zones where habitat enhancement could provide future opportunity i.e. ‘making beaver ready’


New Forest
Huckels and Latchmore Brook
Dockens Water
National Park Boundary
Beaver
2_HighDamCapacity_Opportunity_Impact
FE Layers
NF_Lichen_Locations_20251020
NF_FE_OpenWater
Mire
Pond
NF_AncientAndOrnamental_20251020
WaterQuality
NewForest_WaterDischarges
0
1
2 km
Basemap: Open Street Map and Google
New Forest
Huckels and Latchmore Brook
Dockens Water
National Park Boundary
Beaver
NF Beaver Valley Bottom Max Impact Layer
FE Layers
NF_Lichen_Locations_20251020
NF_FE_OpenWater
Mire
Pond
NF_AncientAndOrnamental_20251020
WaterQuality
NewForest_WaterDischarges
0
1
2 km
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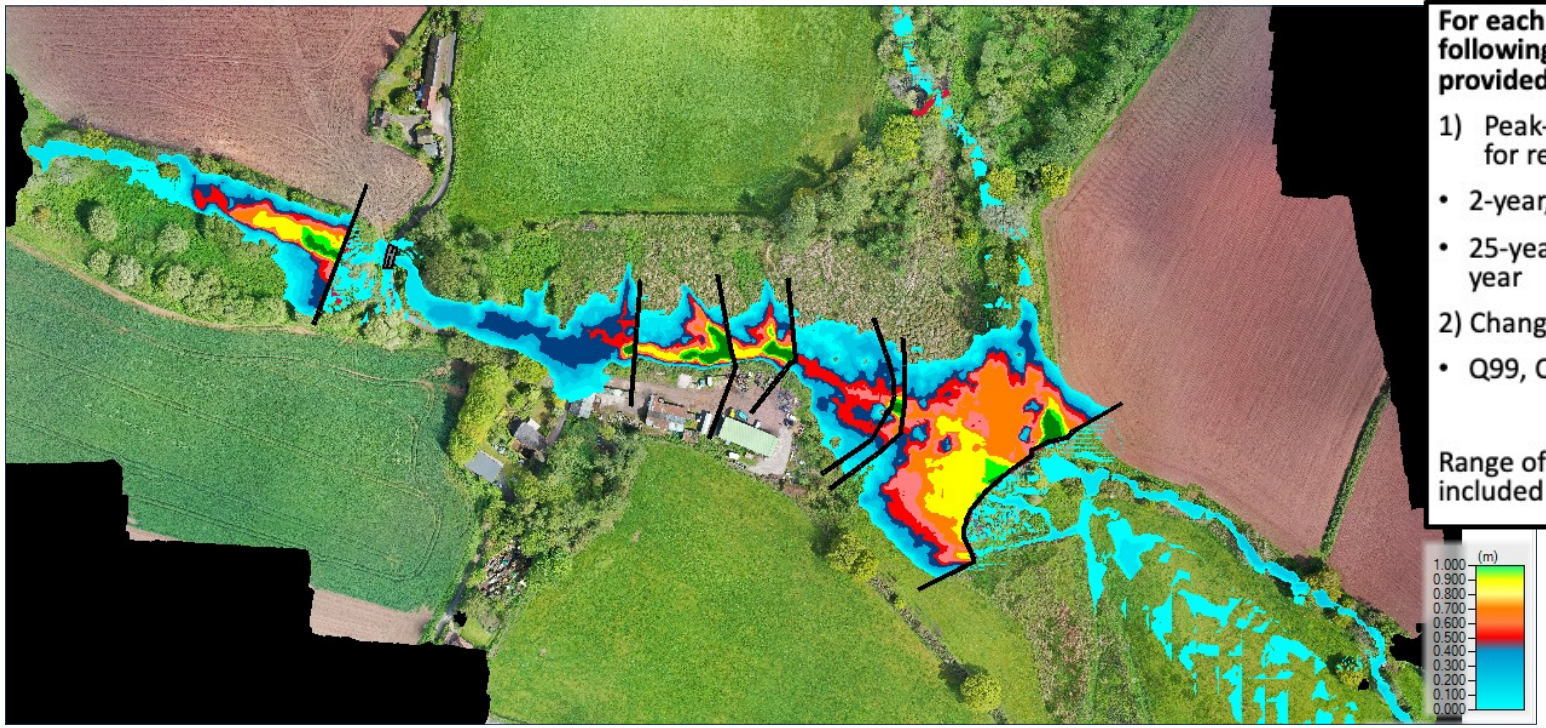
Beaver hydraulic modelling



For each reach, the following statistics are provided

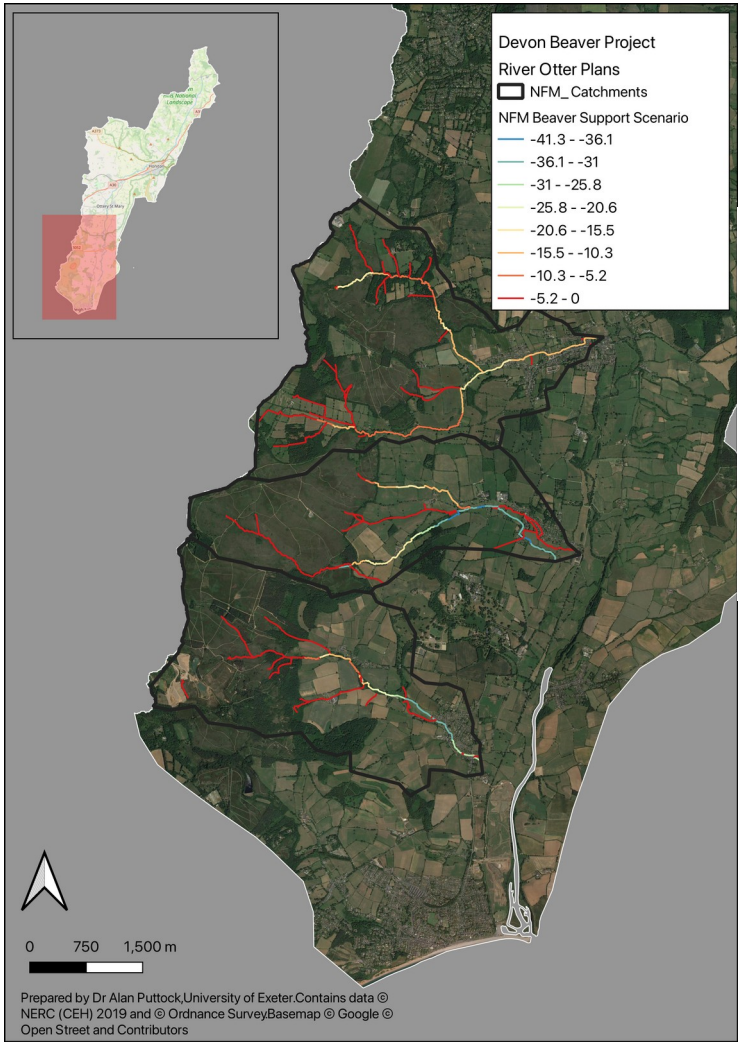
1) Peak-flow reduction for return periods:
- 2-year, 5-year, 10-year,
- 25-year, 50-year, 100-year

2) Changes to low-flows:
- Q99, Q95, Q90, Q50

Range of uncertainty included

Can model local inundation, surface water storage as well as downstream impacts on flow regimes – wider management uses.

Jackson et al., *in Prep*



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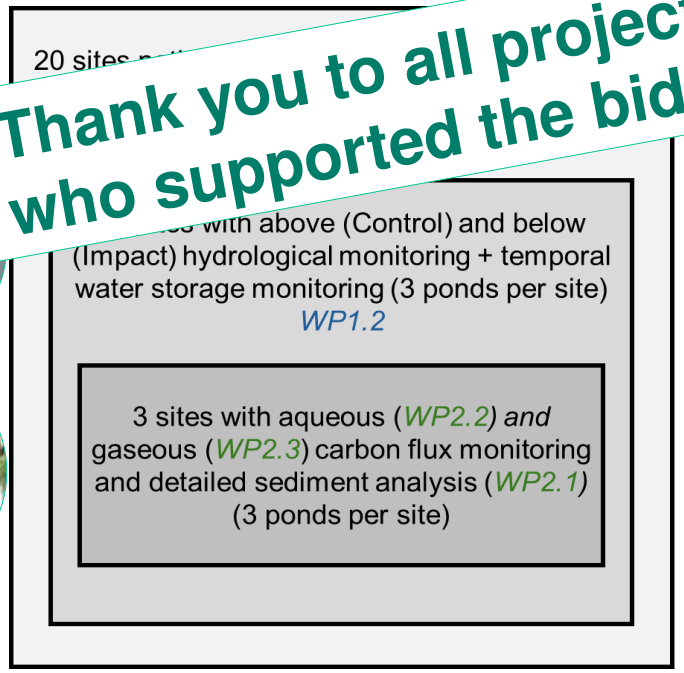
Modelling flow statistics helps prioritise sites where the ecosystem service benefits of beavers may be of greatest benefit, least risk and where direct opportunities exist.

Scenario Exploration: Modelled downstream reductions in peak flows (10year/10 % AEP storm) under targeted beaver+ intervention plans

Where next?

NERC: Return of the Beaver: adapting and mitigating climate-induced hydrological extremes

Thank you to all project partners who supported the bid!



Hydrology + Carbon Monitoring – Hydrological Modelling – Geospatial Upscaling and Tools

Part 3: Unlocking Sustainable Outcomes

Recap: Human-Wildlife Interactions

CONFLICT

Between humans AND wildlife
('Human-wildlife conflict')

or

between humans ABOUT wildlife
(Human-human conflict about wildlife or wildlife management)

COEXISTENCE

Sustainable but dynamic state of humans and wildlife living together, including active governance as humans and wildlife co-adapt to live together
(Carter & Linnell, 2016)

Includes potential benefits (e.g. Ecosystem Services)

Renewed Coexistence

Received: 10 June 2025 | Revised: 15 September 2025 | Accepted: 22 September 2025

DOI: 10.1111/cobi.70195

Conservation Biology

ESSAY

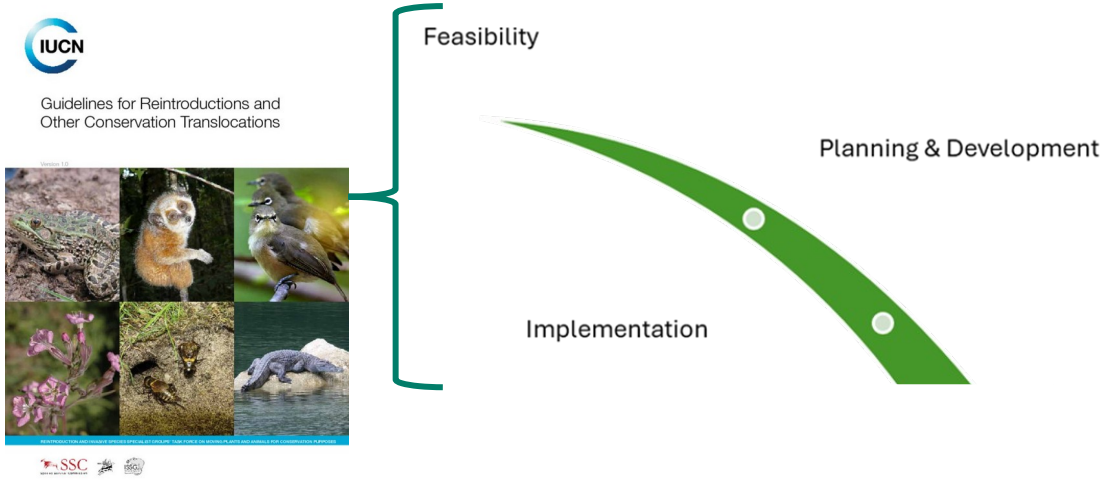
Renewed coexistence as a conceptual reframing of animal reintroductions to foster sustainable human–wildlife coexistence

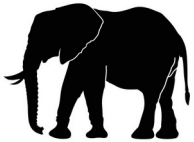
Roger Edward Auster[1] | Alan Puttock[1] | Stewart Barr[2] | Richard Brazier[1]

- Shifting baseline Syndrome
- ‘Extinction of experience’ (Whitehead & Hare, 2025)

“…coexistence that is specifically associated with a reintroduced species, thereby one which was present in the landscape historically, but which will likely be a ‘new’ presence for the humans living in the locality post-release.” (Auster et al, 2021a)

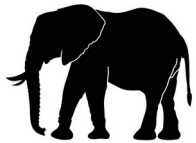
Renewed Coexistence

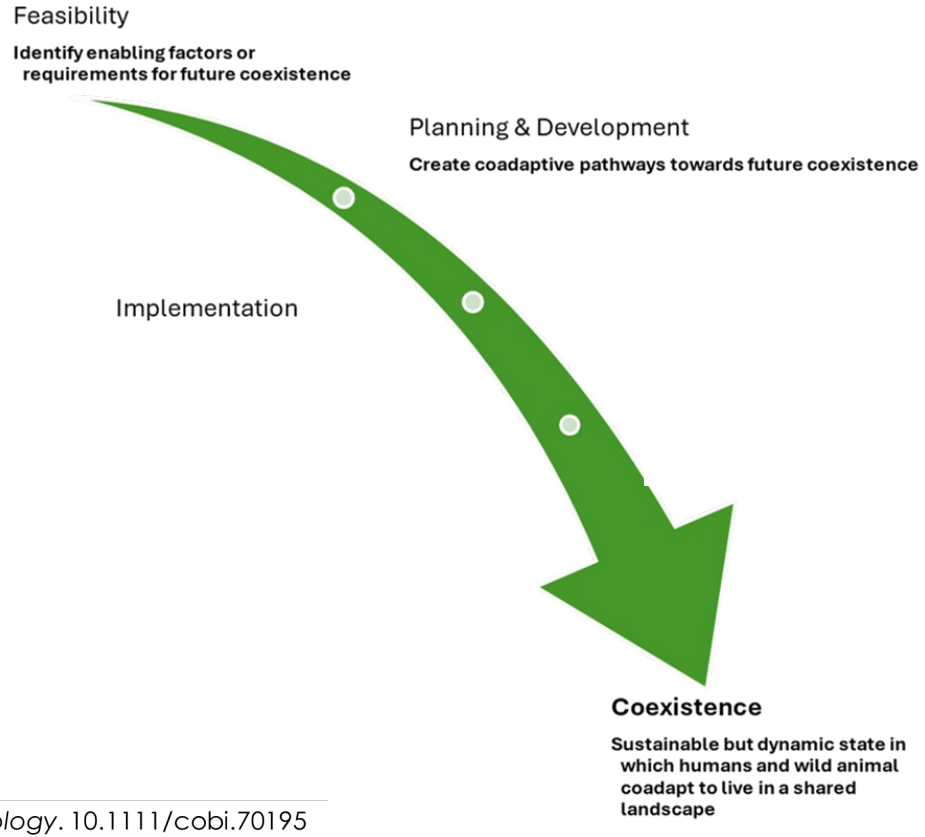




Auster et al., 2026. *Conservation Biology*. 10.1111/cobi.70195

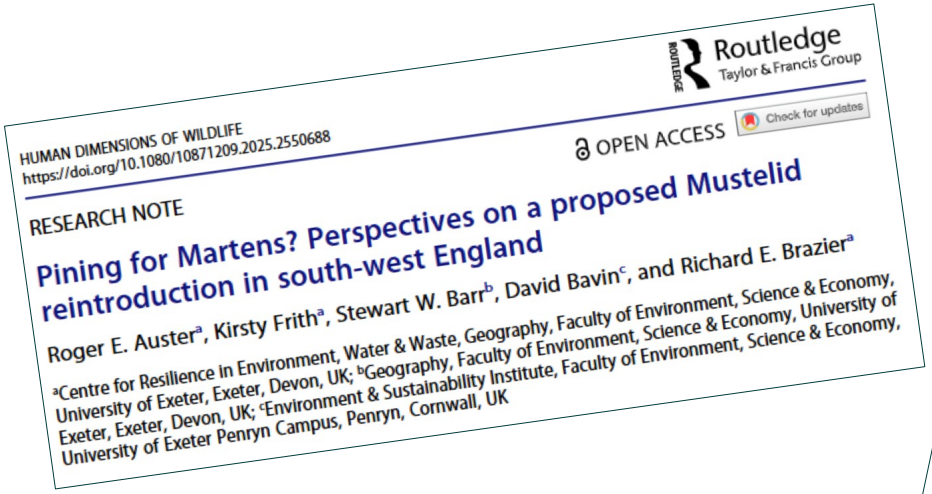
Renewed Coexistence





Auster et al., 2026. *Conservation Biology*. 10.1111/cobi.70195

Feasibility *then* Development



HUMAN DIMENSIONS OF WILDLIFE
https://doi.org/10.1080/10871209.2025.2550688

Routledge
Taylor & Francis Group

OPEN ACCESS Check for updates

RESEARCH NOTE

Pining for Martens? Perspectives on a proposed Mustelid reintroduction in south-west England

Roger E. Auster[a], Kirsty Frith[a], Stewart W. Barr[b], David Bavin[c], and Richard E. Brazier[a]

[a]Centre for Resilience in Environment, Water & Waste, Geography, Faculty of Environment, Science & Economy, University of Exeter, Exeter, Devon, UK; [b]Geography, Faculty of Environment, Science & Economy, University of Exeter, Exeter, Devon, UK; [c]Environment & Sustainability Institute, Faculty of Environment, Science & Economy, University of Exeter Penryn Campus, Penryn, Cornwall, UK

University of Exeter

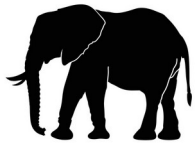
Wildcat Reintroduction in South-West England:
A Social Feasibility Study

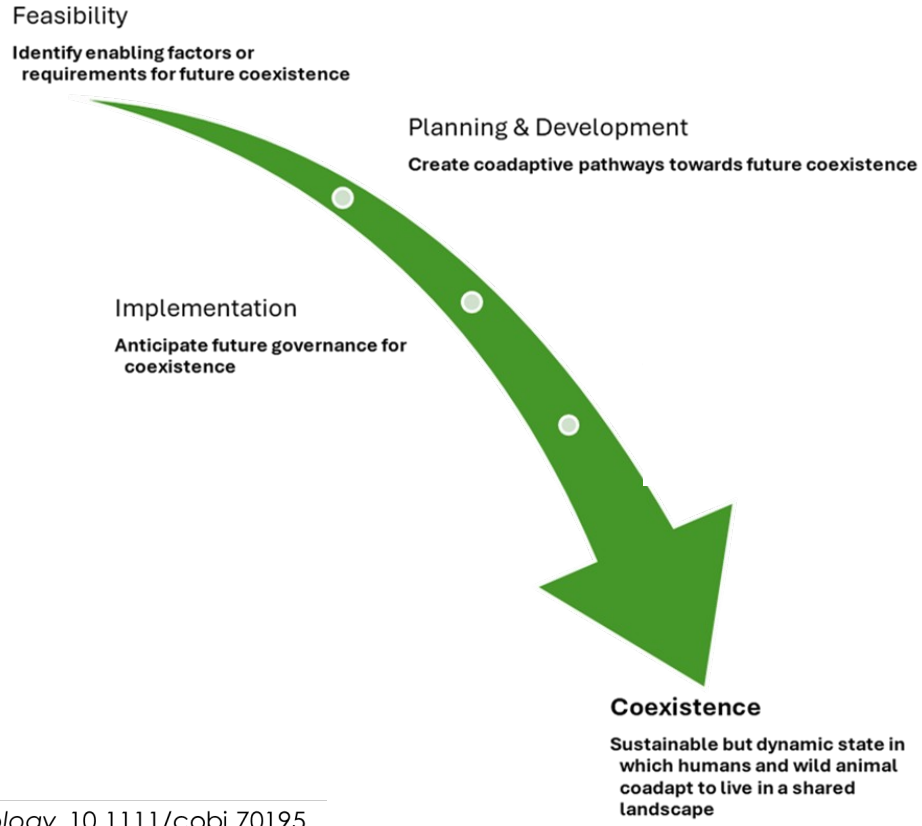
Report for Submission to the South West Wildcat Project

Dr. Roger E. Auster, Sian Moody, Dr. Sarah L. Crowley,
Dr. Thomas Dando, Prof. Stewart Barr, & Prof. Richard Brazier

July 2024

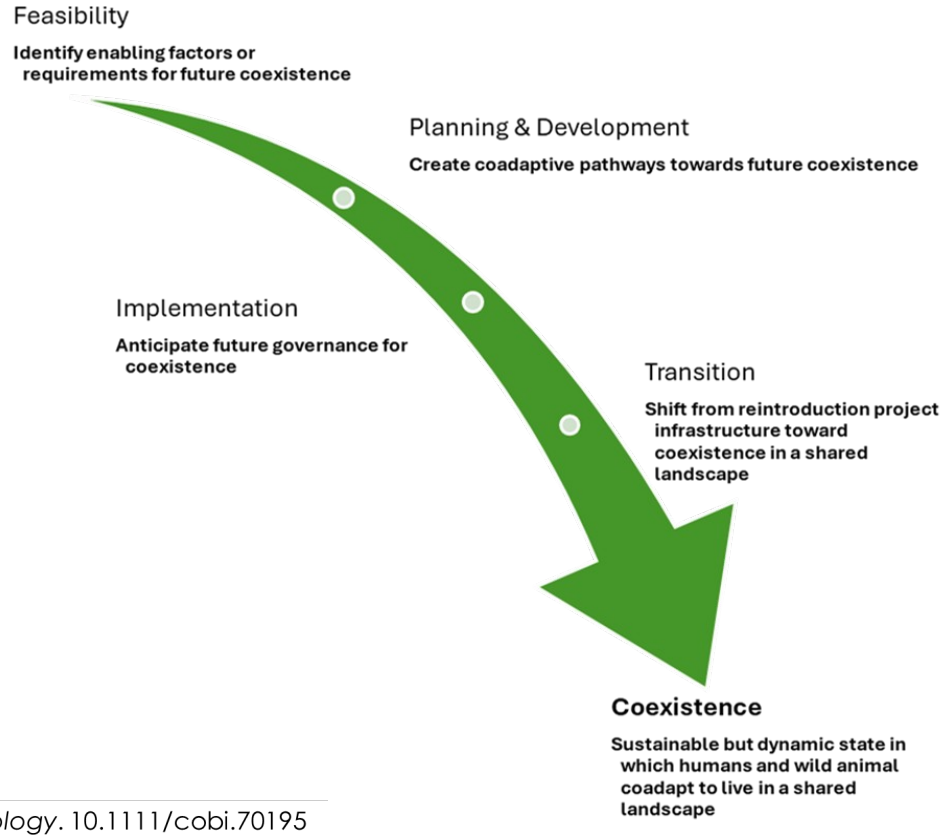
Renewed Coexistence

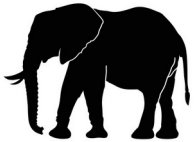




Auster et al., 2026. *Conservation Biology*. 10.1111/cobi.70195

Renewed Coexistence





Auster et al., 2026. *Conservation Biology*. 10.1111/cobi.70195

Transition

RESTORATION ECOLOGY
The Journal of the Society for Ecological Restoration
SER

POLICY ARTICLE | Open Access

Learning to live with reintroduced species: beaver management groups are an adaptive *process*

Roger E. Auster, Alan K. Puttock, Stewart W. Barr, Richard E. Brazier

First published: 10 March 2023 | https://doi.org/10.1111/rec.13899 | VIEW METRICS

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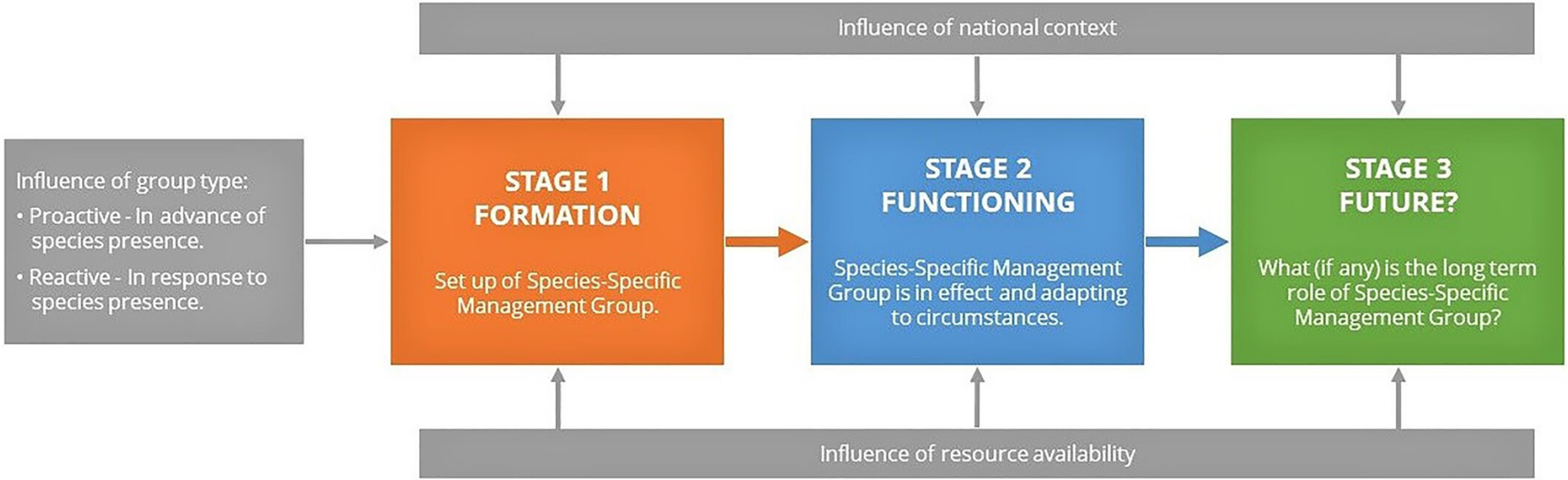
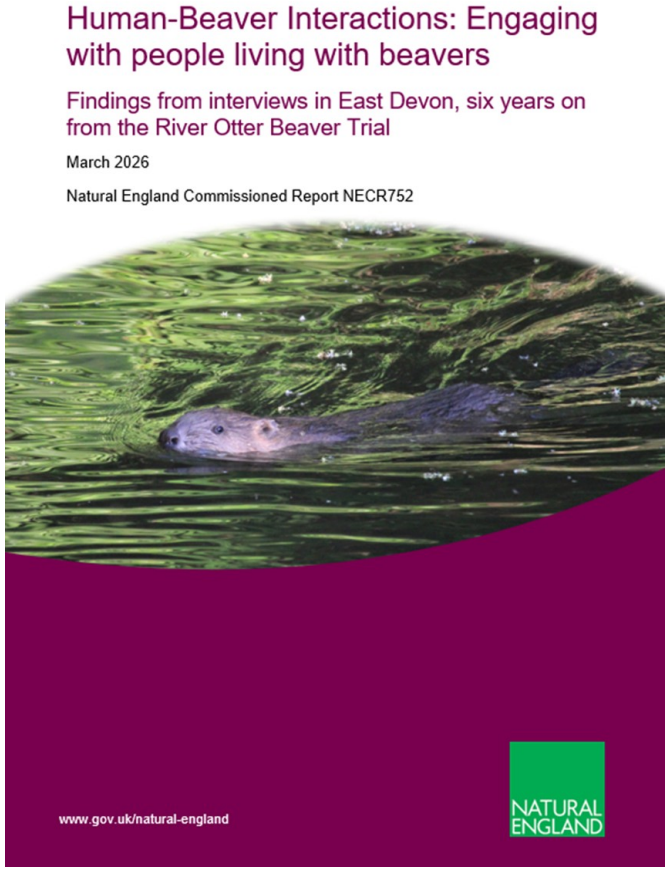


Transition

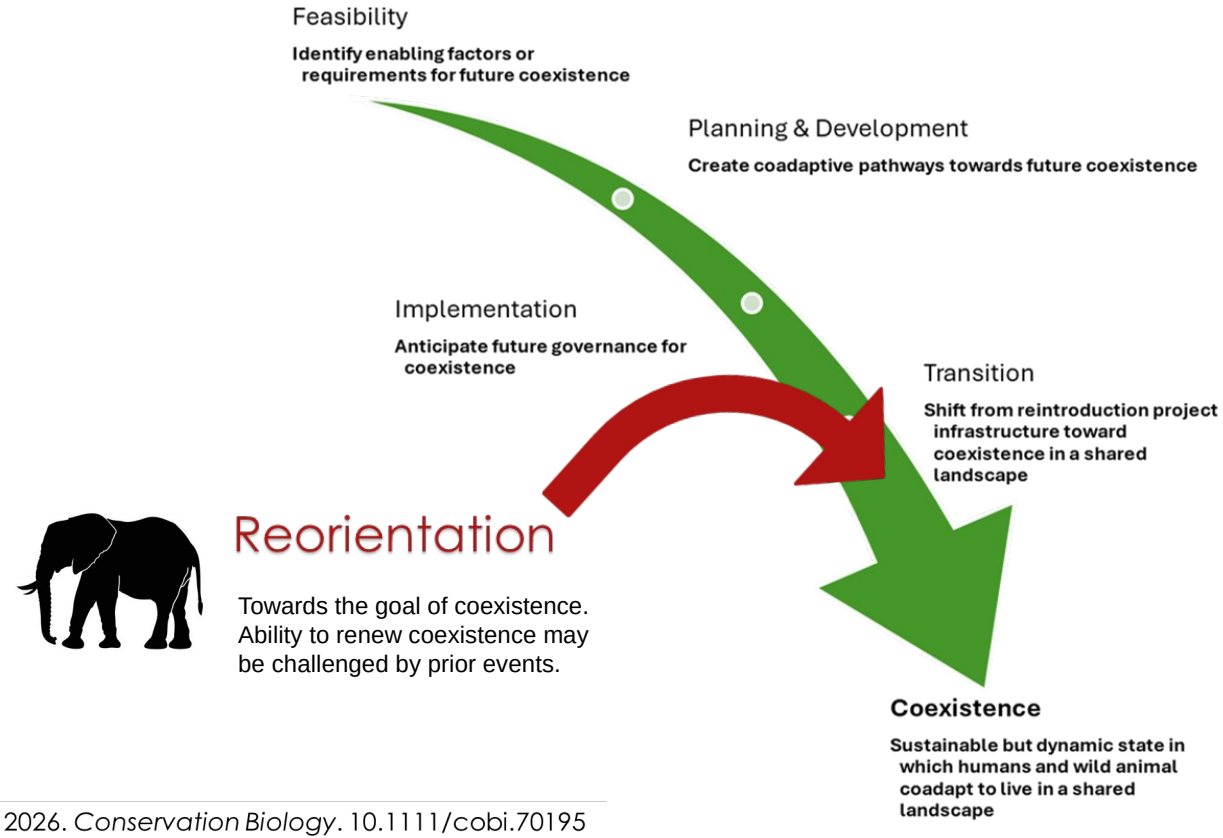
Coming Soon!

NE Report NECR752



Introduced in Workshop 2:
Beavers in your neighbourhood: what community engagement is needed as beavers are restored in Britain?

Renewed Coexistence



Auster et al., 2026. *Conservation Biology*. 10.1111/cobi.70195

Beavers at all stages!

Feasibility

Identify enabling factors or requirements for future coexistence

Planning & Development

Create coadaptive pathways towards future coexistence

Implementation

Anticipate future governance for coexistence

Transition

Shift from reintroduction project infrastructure toward coexistence in a shared landscape

Reorientation

Towards the goal of coexistence. Ability to renew coexistence may be challenged by prior events.

Coexistence

Sustainable but dynamic state in which humans and wild animal coadapt to live in a shared landscape

Auster et al., 2026. *Conservation Biology*. 10.1111/cobi.70195

Renewed Coexistence

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Renewed Coexistence with Beaver

University of Exeter

r.e.brazier@exeter.ac.uk | a.k.puttock@exeter.ac.uk | r.e.auster@exeter.ac.uk