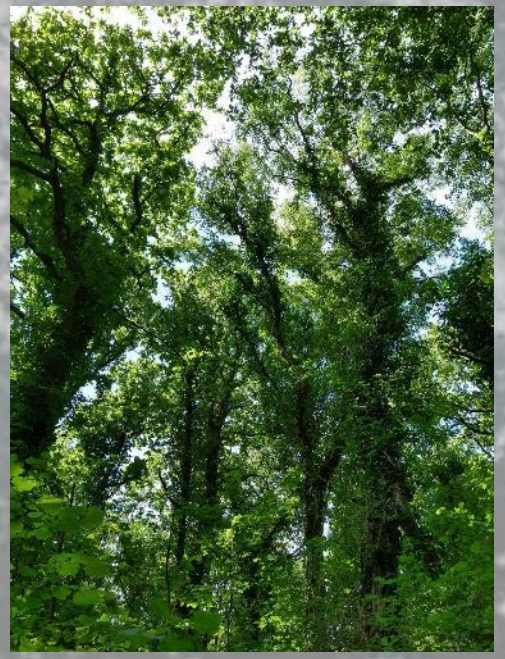
Ecologically-based temperate rainforest restoration: effectiveness for biodiversity recovery, carbon sequestration and resilience

PRIFYSGOL BANGOR UNIVERSITY

Ymddiriedolaeth Natur De a Gorllewin Cymru
Wildlife Trust of South & West Wales



The Project Team

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Natura 2000 Sustainable Management Advisor, Natural Resources Wales, 2022-present

MRes Soil ecology/organic matter in Alpine system, University of York

BSc Applied Terrestrial and Marine Ecology, Bangor

Adam Dawson, Conservation Officer, Wildlife Trust of South and West Wales

Prof John Healey, Bangor University, Expertise in forest restoration, biodiversity and resilience

Dr Marielle Smith, Lecturer in Forest Science, Bangor University, Expertise in forest structure, resilience and carbon

Dr Bid Webb, Lecturer, Bangor University, Expertise in soils-water-trees, 14 years' experience with NRW

Objectives = targeted evidence gaps

1. Rainforest ecosystem establishment

Provide robust experimental evidence of the most effective, ecologically-based restoration methods for environmentally-adverse sites (dense bracken, poor soil/hydrology, browsing pressure)

1.1 Compare spectrum of methods:

- Passive natural colonization - direct seeding - active sapling planting,
- Site preparation/management: pre-/post-planting bracken control
- Tree/shrub species choice (in situ or planted) – competitors versus facilitators – mixtures/combinations
- Sapling size

1.2 Monitored impacts/effectiveness:

- Capital and management costs
- Soil/litter/tree carbon stock changes
- Resilience of biodiversity recovery

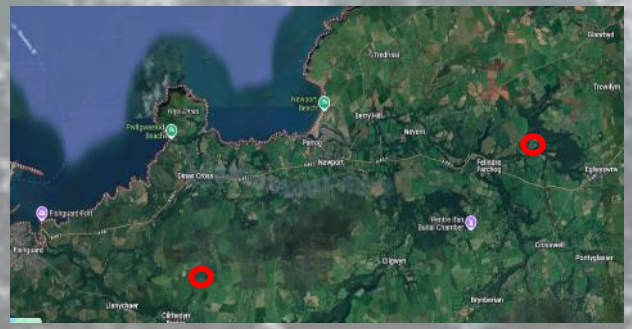
Methods

1. Rainforest ecosystem establishment

Provide robust experimental evidence of the most effective, ecologically-based restoration methods for environmentally-adverse sites

1.1 Randomized Control Trial experiment, using before-after-control-impact (BACI) design, at Trellwyn Fach upland site in Pembrokeshire, established in winter 2025/6

1.2 Supplementary testing of most promising treatments in at least one contrasting site (e.g. Pengelli Forest lowland site)



Objectives = targeted evidence gaps

2. Longer-term resilience of restored rainforest ecosystems

Determine longer-term restoration trajectory through woodland-site "chronosequence" set (successive stages of passive or active restoration)

2.1 Improved basis for estimating restoration project carbon credits:

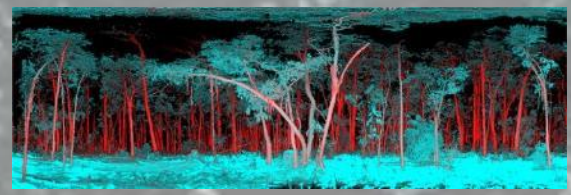
- Yield class → above-ground carbon stock growth rates of key non-commercial rainforest tree species

2.2 Longer-term successional trajectory / resilience of:

- whole ecosystem (above- & below-ground) carbon stock recovery
- forest structure linked to biodiversity
- key implications for species selection, establishment method, phasing

2.3 Determine most cost-effective methods for monitoring temperate rainforest restoration success:

- develop and test application of mobile laser scanning



Collaboration/co-delivery

- Core project partnership: Bangor University – Wildlife Trust S & W Wales
- Committed collaborators: Woodland Trust
- Links being established with: other Wildlife Trusts; Forest Research; Stump Up for Trees; other projects in this Aviva research programme
- Key stakeholder groups: Alliance for Wales' Rainforests
- MSc research projects, e.g. in 2025:
  - Spatial variation in temperate rainforest plant communities linked to canopy tree species composition, disease and storm impacts
- Major match-funding from Bangor University: staff time and no overheads
- Application for supplementary match funding under negotiation

Methods

2. Longer-term resilience of restored rainforest ecosystems

2.1 In collaboration with breadth of partner / collaborator organizations identify candidate temperate rainforest sites, from which to:

- select at least one set of sites matched in environmental conditions (substrate, altitude, rainfall) and management history
- that represent different ages since start of passive or active restoration – a "chronosequence"
- intend to have at least two sets to enable broad geographical spread across Wales and England
- visit candidate sites to score against criteria to carefully select final matched sets

2.2 Inventory trees, vegetation, soils using conventional methods and mobile laser scanning for structure, biomass, carbon stock and biodiversity

Deliverables

- Embedded in project through co-delivery with Wildlife Trusts (primarily WTSWW) – opportunities for members' voluntary participation (e.g. citizen science monitoring), open day events, blogs, news items etc.
- Partnership with Alliance for Wales' Rainforests, Woodland Trust etc.
- Engagement with community woodland organisations
- Forestry/conservation/ecological bodies, e.g. Royal Forestry Society, British Ecological Society
- Peer-reviewed scientific outputs providing robust evidence base for technical recommendations
- Formal analysis of stakeholder/practitioner needs for new guidance on temperate rainforest restoration and monitoring to identify key content and preferred formats