Can natural processes help to scale-up woodland creation?

TreE_PlaNat team:

Elisa Fuentes-Montemayor

Laura Braunholtz

Bianca Ambrose-Oji

Rachel Orchard

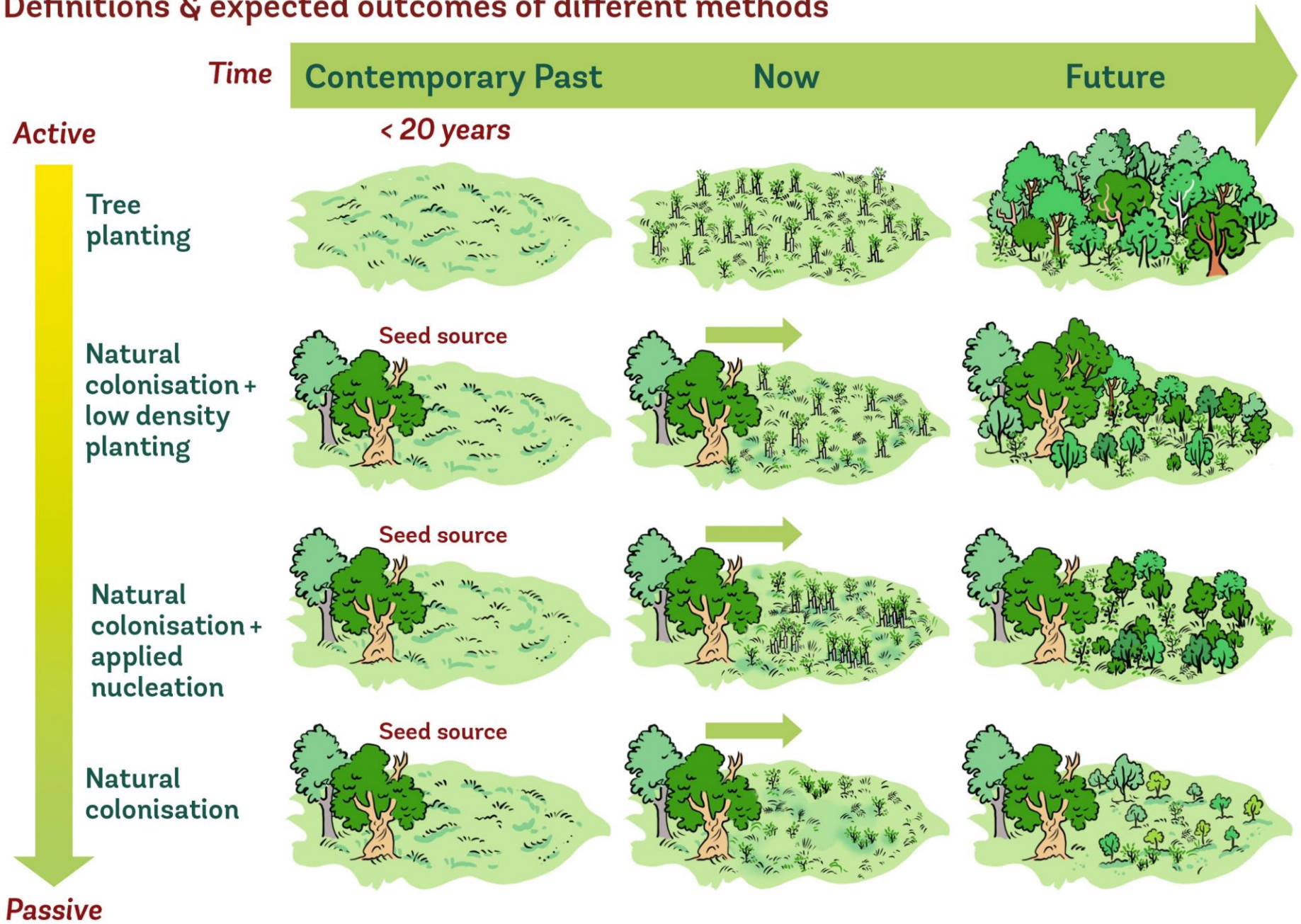
Susannah Fleiss

EFLN, 6th Nov 2024

Woodland creation – challenges & need for evidence

- Landscape-scale restoration to mitigate the ecological crisis
- Ambitious woodland expansion targets in UK (mainly through tree planting)
- But challenges of scaling up tree planting (e.g. nursery stock required)
- Potential of using natural processes to complement tree planting
- Very different approaches:
  likely different outcomes / used by different kinds of land managers / for different objectives
- Need for evidence to understand when / where / how / for whom natural colonisation can be used

Definitions & expected outcomes of different methods



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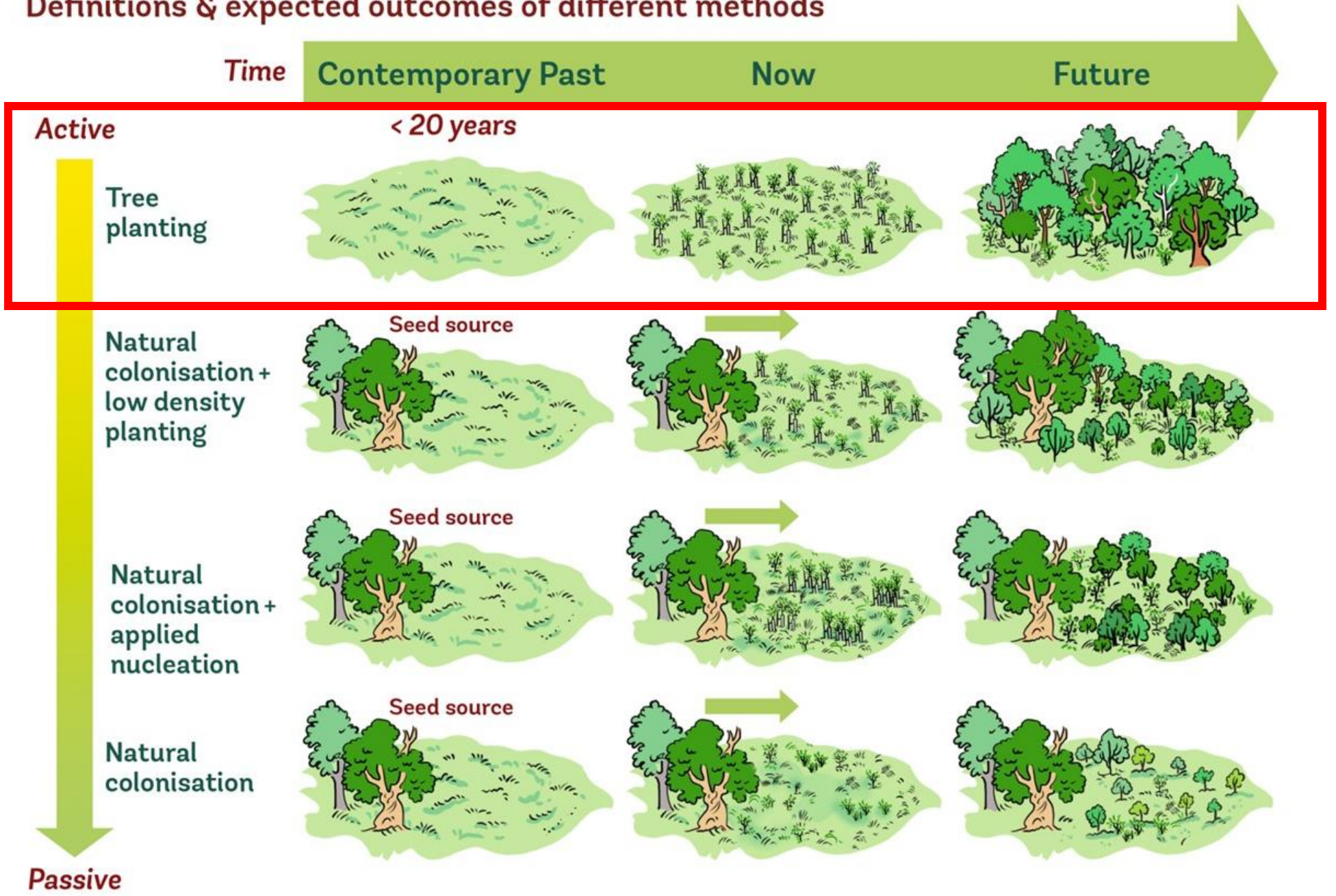


Woodland creation through tree planting

- Decision making of certain kinds of land managers: how & why they do / don't engage with woodland creation through tree planting

- Habitat development, soil quality, biodiversity responses: **structural complexity benefits biodiversity**

Conservation Biology

Contributed Paper

Bird-community responses to habitat creation in a long-term, large-scale natural experiment

Robin C. Whytock, Elisa Fuentes-Montemayor, Kevin Watts, Patanjaly Barbosa De Andrade, Rory T. Whytock, Paul French, Nicholas A. Macgregor, † and Kirsty J. Park

RESEARCH ARTICLE

Larger and structurally complex woodland creation sites provide greater benefits for woodland plants

Emily H. Waddell | Elisa Fuentes-Montemayor | Kirsty J. Park | Peter Carey | Matt Guy | Nicholas A. Macgregor | Kevin Watts

RESEARCH ARTICLE

Diversity and Distributions WILEY

Moth community responses to woodland creation: The influence of woodland age, patch characteristics and landscape attributes

Elisa Fuentes-Montemayor | Kevin Watts | Philip Sansum | Will Scott | Kirsty J. Park

ECOLOGICAL APPLICATIONS
ECOLOGICAL SOCIETY OF AMERICA

Article Open Access

Small mammal responses to long-term large-scale woodland creation: the influence of local and landscape-level attributes

Natasha Hambly, Stephen Brennan, Ruth Coxon, Holly Langridge, and Kirsty J. Park
Elisa Fuentes-Montemayor, Mark Ferryman, Kevin Watts, Nicholas A. Macgregor, Natasha Hambly, Stephen Brennan, Ruth Coxon, Holly Langridge, Kirsty J. Park

Forestry An International Journal of Forest Research

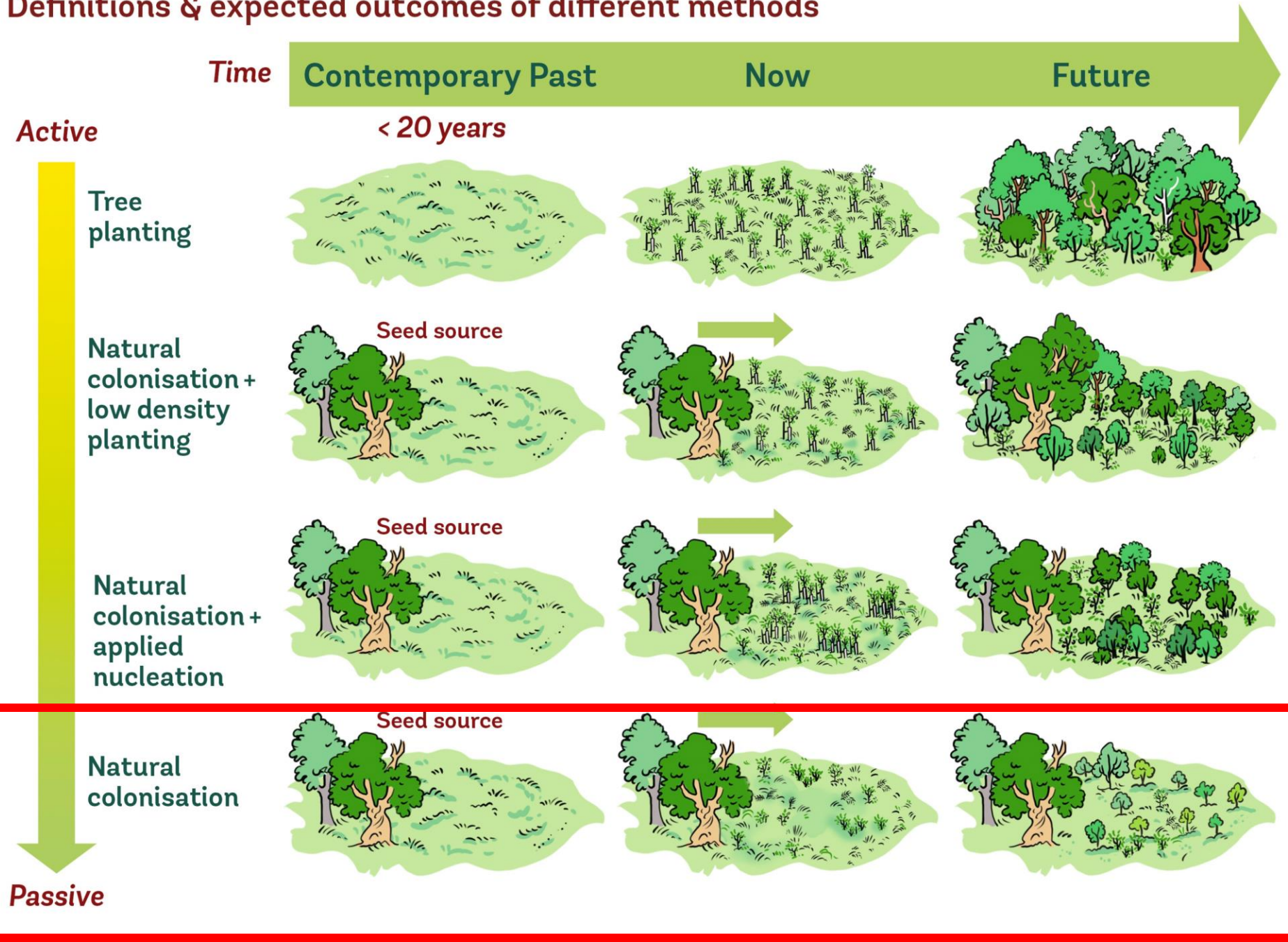
Institute of Chartered Foresters

Forestry 2021; 1–10, doi:10.1093/forestry/cpab027

The long-term development of temperate woodland creation sites: from tree saplings to mature woodlands

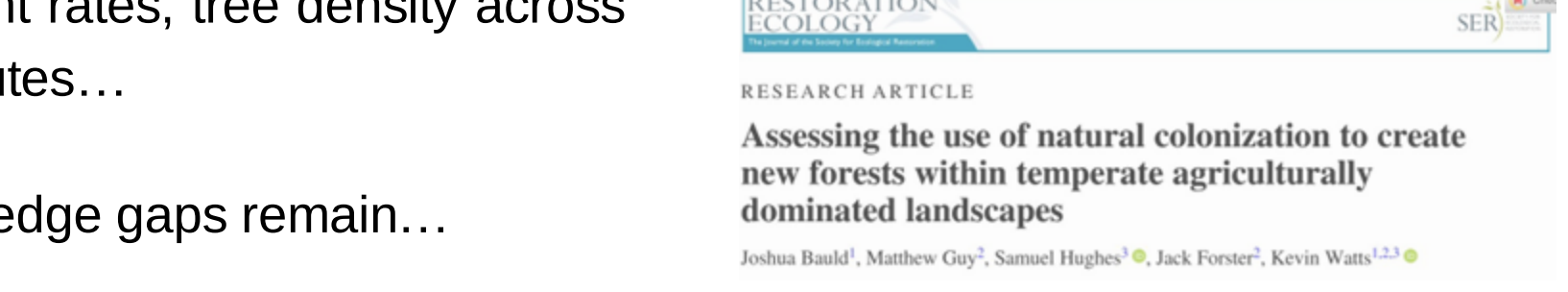
Elisa Fuentes-Montemayor[1,2,*], Kirsty J. Park[2], Kypfer Cordts[2] and Kevin Watts[1,2]

Definitions & expected outcomes of different methods



Increasing interest in using natural processes to create woodlands

- Factors influencing establishment rates, tree density across space and time, structural attributes…
- Limited set of sites, many knowledge gaps remain…



Predicted benefits & potential challenges of planting & natural processes

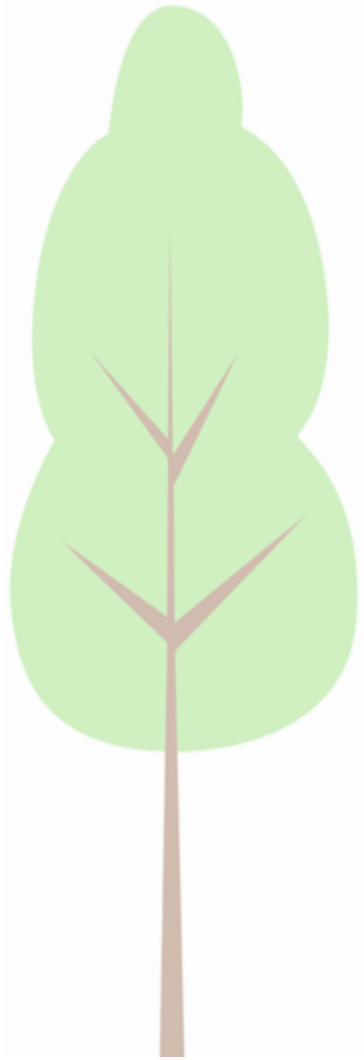
Tree planting

Quicker & reliable method, more control on outcome (e.g. tree density & species present)

Nursery stock required (& risk importing P&D)

May not be genetically diverse or locally adapted, potentially low resilience

Creates uniform habitat structure (likely lower biodiversity value)



Natural colonisation

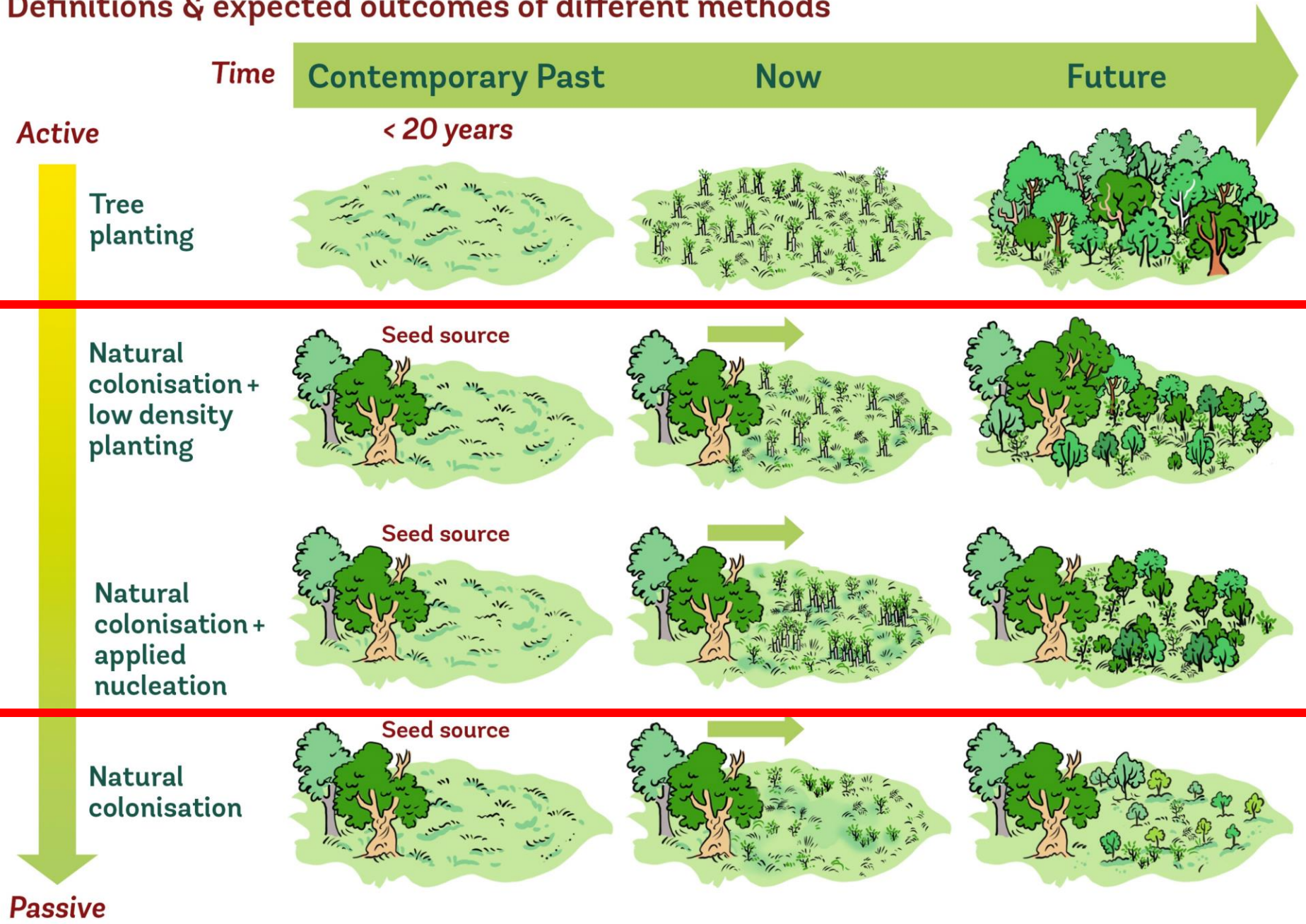
Outcomes highly context dependent (e.g. on proximity to seed sources, site conditions, herbivory pressure)

No reliance on planting stock (cheaper, fewer P&D risks)

Natural selection (locally adapted, robust survivors, high genetic diversity & resilience)

Patchy, structurally diverse woodland (likely high biodiversity value)

Definitions & expected outcomes of different methods



TreE_PlaNat project

Treescape Expansion through Planting & Natural Colonisation

Addressing key knowledge gaps:

- Stakeholder perceptions of woodland expansion approaches incorporating natural colonisation
- Ecological consequences of woodland expansion approaches spanning the planting to natural colonisation continuum
- Knowledge synthesis & demonstration of how tree planting and natural colonisation can be used in combination / complementary ways to scale-up woodland expansion for a range of objectives

Landscape context

WP1: Understanding perceptions & objectives of a diverse range of 'agricultural' land managers

Income (e.g. timber, Carbon payments)

Well-being (e.g. recreational use)

Biodiversity

Ecological function (e.g. rewilding)

Resilience

??

Woodland creation method: 'planting' to 'natural colonisation' continuum

WP1: Understanding perceptions & objectives of a diverse range of 'agricultural' land managers






Income (e.g. timber, Carbon payments) | **Well-being** (e.g. recreational use) | **Biodiversity** | **Ecological function** (e.g. rewilding) | **Resilience** | **??**

Landscape context






WP2: Assessing socio-ecological outcomes of woodland creation

Woodland creation method: 'planting' to 'natural colonisation' continuum

WP1: Understanding perceptions & objectives of a diverse range of 'agricultural' land managers






Income (e.g. timber, Carbon payments) | **Well-being** (e.g. recreational use) | **Biodiversity** | **Ecological function** (e.g. rewilding) | **Resilience** | **??**






WP2: Assessing socio-ecological outcomes of woodland creation

Landscape context

WP3: Integrating socio-ecological knowledge to inform woodland expansion strategies
(knowledge production, dissemination & impact)

Woodland creation method: 'planting' to 'natural colonisation' continuum

Forest Research

Land managers: Perceptions and Tradeoffs

Dr Bianca Ambrose-Oji, Forest Research
Rachel Orchard, Forest Research
Dr Maddy Pearson, Forest Research
Elsa Galbraith, University of Edinburgh

Research overview

May/ June 2023

Expert interviews

What do experts think are the key **trade-offs** and **knowledge needs** for land managers when choosing tree expansion methods?

Nov ’23- Feb ‘24

National survey

Which tree expansion method would land managers choose to meet different **objectives**?

May – August 2024

Follow-up interviews

Present and discuss findings from national survey to land managers to gain more in-depth views on **why** choose different tree expansion methods?

Expert interviews

They suggested:

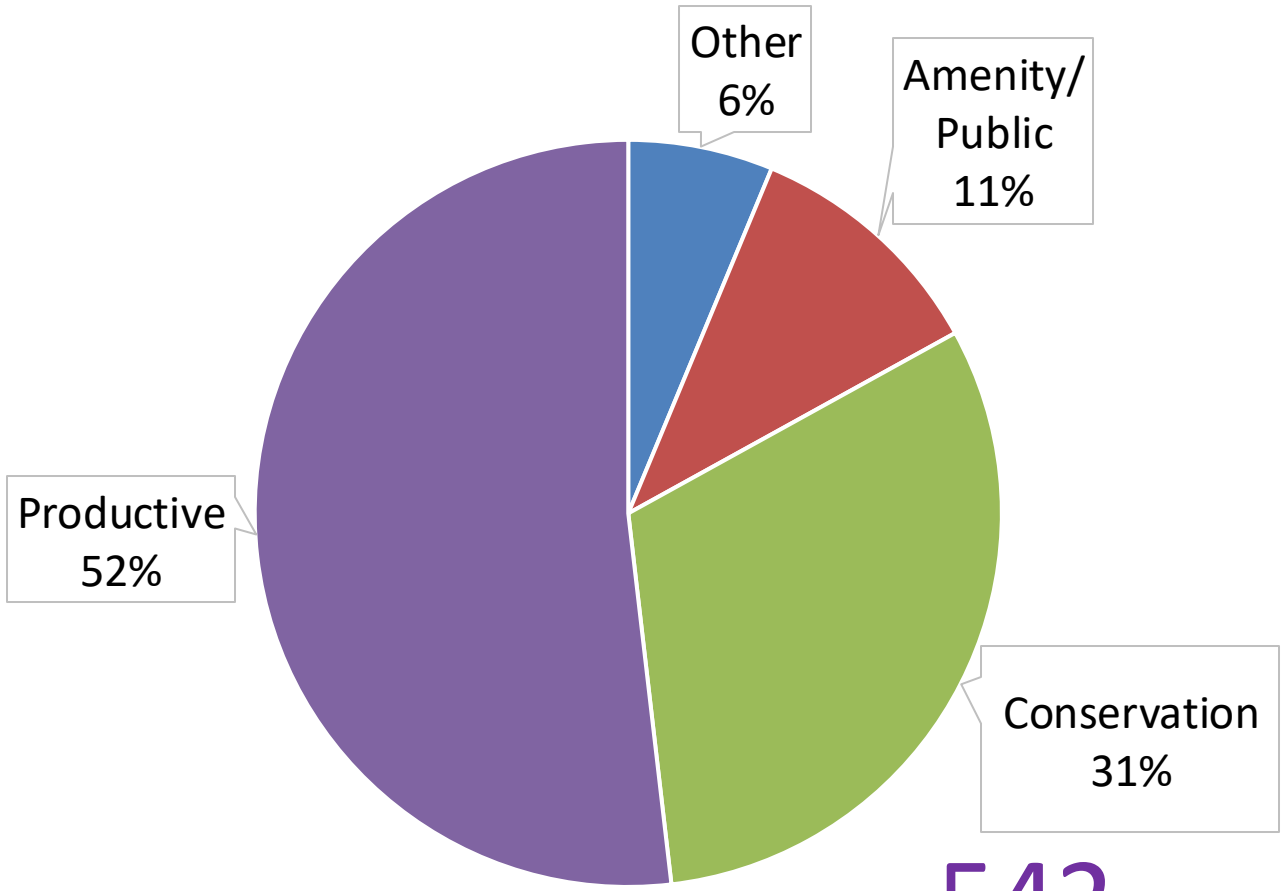
- Uncover more detail about the trade-offs being made

- We used the characterisation they helped to refine to:
  i. sample
  ii. analyse

Conservation	Productive	Public/ amenity
eNGOs	Forest managers	Local authorities
Small woodland owners	Estate managers	Utilities
Community woodland groups	Productive farmers	Other public bodies e.g. MOD
	Regenerative farmers	

National Survey

- **How do different land managers perceive the trade-offs between tree planting, natural colonisation and hybridity?**
- 17 quantitative and 3 open ended questions – mixed format
- Purposive quota sampling for land manager types to reflect community segment size
- Survey open between Nov 2023 - Feb 2024
- England 375 (69%), Scotland 122 (23%), Wales 45 (8%)



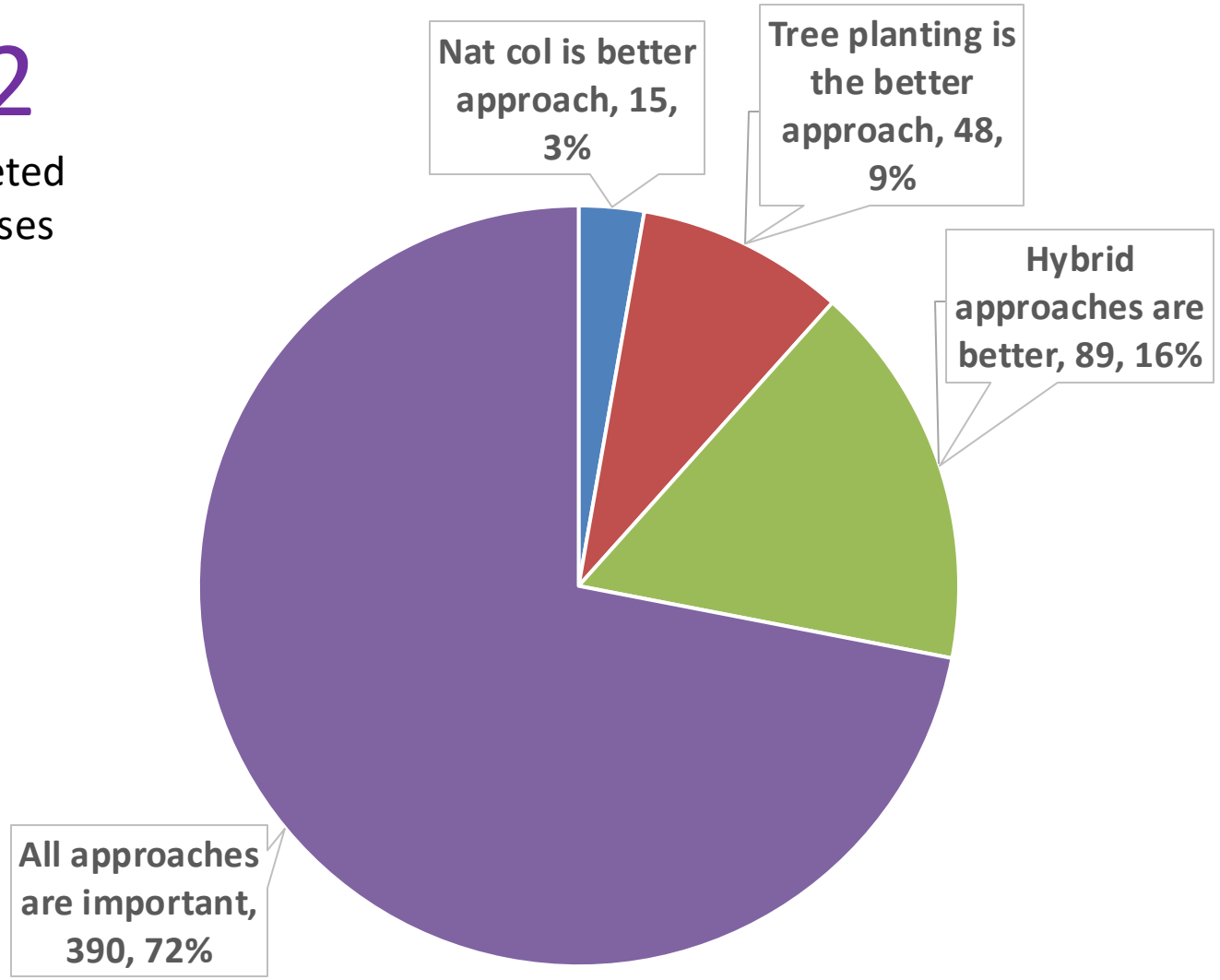
542

completed responses

Preferred approaches

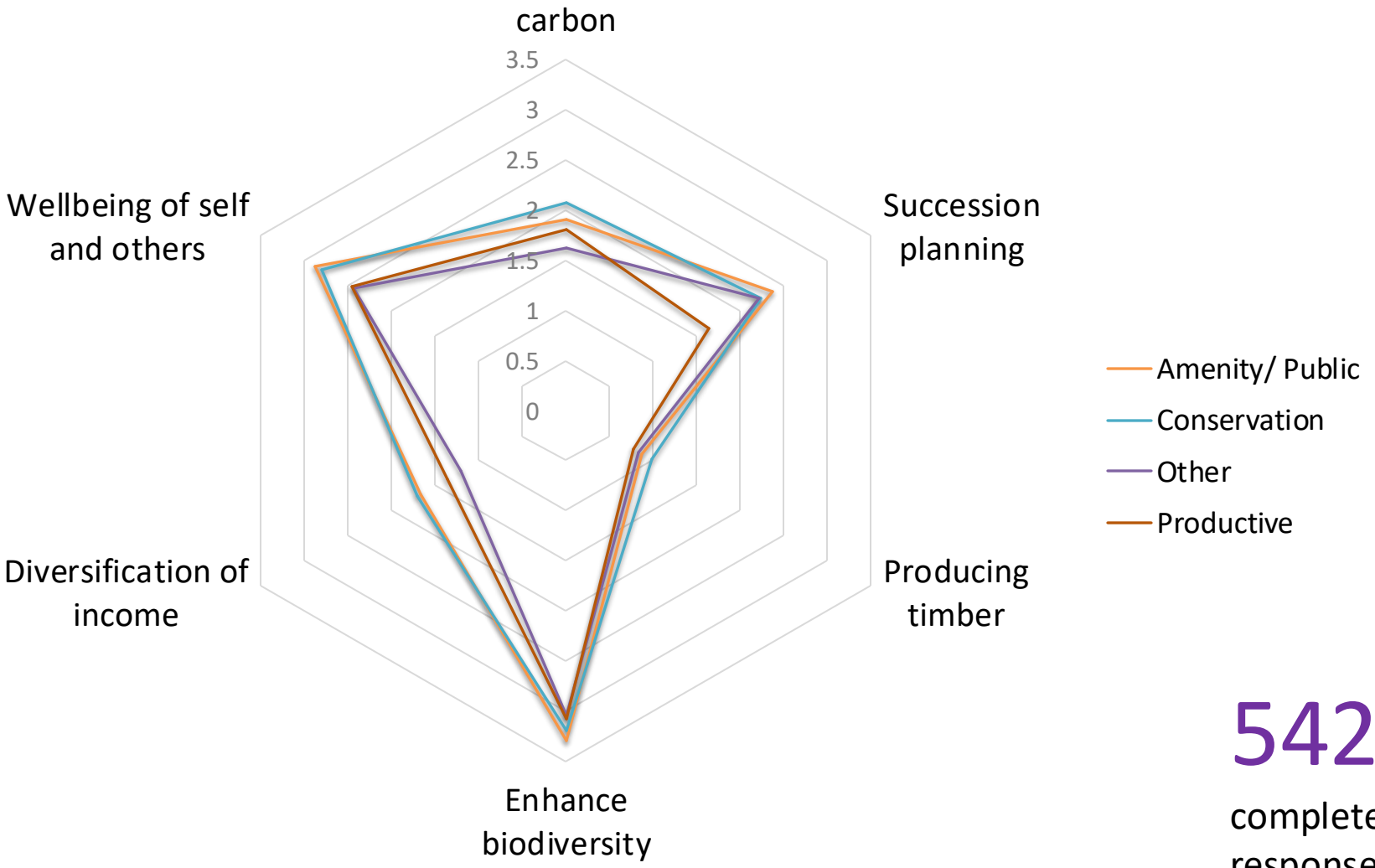
542

completed responses



- It's not either/or
- A mix of tree planting, hybrid approaches and natural colonisation were **all important**
- Hybrid approaches were considered better than either tree planting or natural colonisation alone

Multi-criteria trade-offs



542

completed responses

Scale: closer to 0 = tree planting; 2.5 = hybrid; closer to 5 = only natural colonisation

Trade-offs for benefits

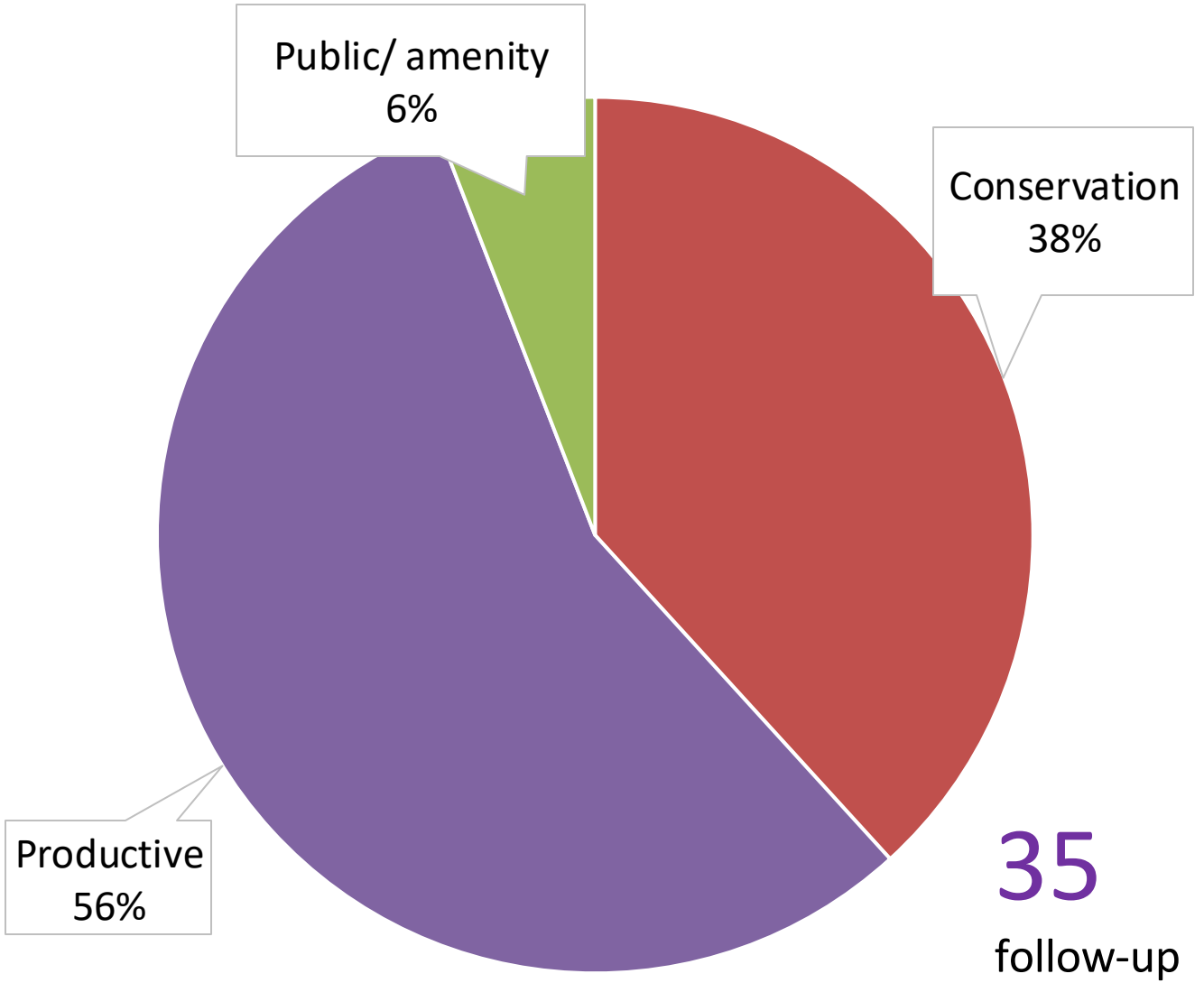
Benefits	Tree planting	Natural colonisation	Hybrid approaches
Biodiversity	😐	🙂	🙂
Carbon	🙂	😐	😐
Resilience	😐	🙂	🙂
Visual impact	☹	😐	😐
Income generation	🙂	☹	🙂
Time to establish	🙂	☹	😐

Follow-up interviews

- **How do different land managers perceive the trade-offs between tree planting, natural colonisation and hybridity? → why?**

- Present initial findings from survey and ask:
  - What do you think of this result?
  - Reflects your experience?

- Interviews carried out May – Aug 2024
- England 7, Scotland 20, Wales 8



35
follow-up interviews

Follow-up interviews

Approach

Objectives

Stand density & species mixture

Resilience

Certainty of biodiversity

Wellbeing of land managers & others

Difficult to work land

→ **Why?**

Participant quotes

*tree planting because [schemes] are judged by the **density and quality** of the tree crop.*
(Scotland, productive)

*[hybrid] much **broader array of species** to try and give **resilience***
(Scotland, productive)

*I think **initially you'd have less biodiversity** [with nat col]*
(Scotland, productive)

*I think you get a greater **connection to the land** and to the outcome*
(England, conservation)

*All the craggy **inaccessible** areas are **full of birch***
(England, public/amenity)

Follow-up interviews

Survey finding:

- **All approaches are important** to meeting targets
- Respondents were **split** on their opinion about **natural colonisation** being more likely to meet **public approval**.
- Respondents told us they had **little information** about natural colonisation and even less about hybrid approaches.

→ Why?

*I think they've all got a role to play. As I said earlier, it **depends on the location** and **what you want to achieve**.*
(Wales, conservation)

*I think a lot of people think natural regeneration is just… **rewilding** areas*
(Scotland, productive)

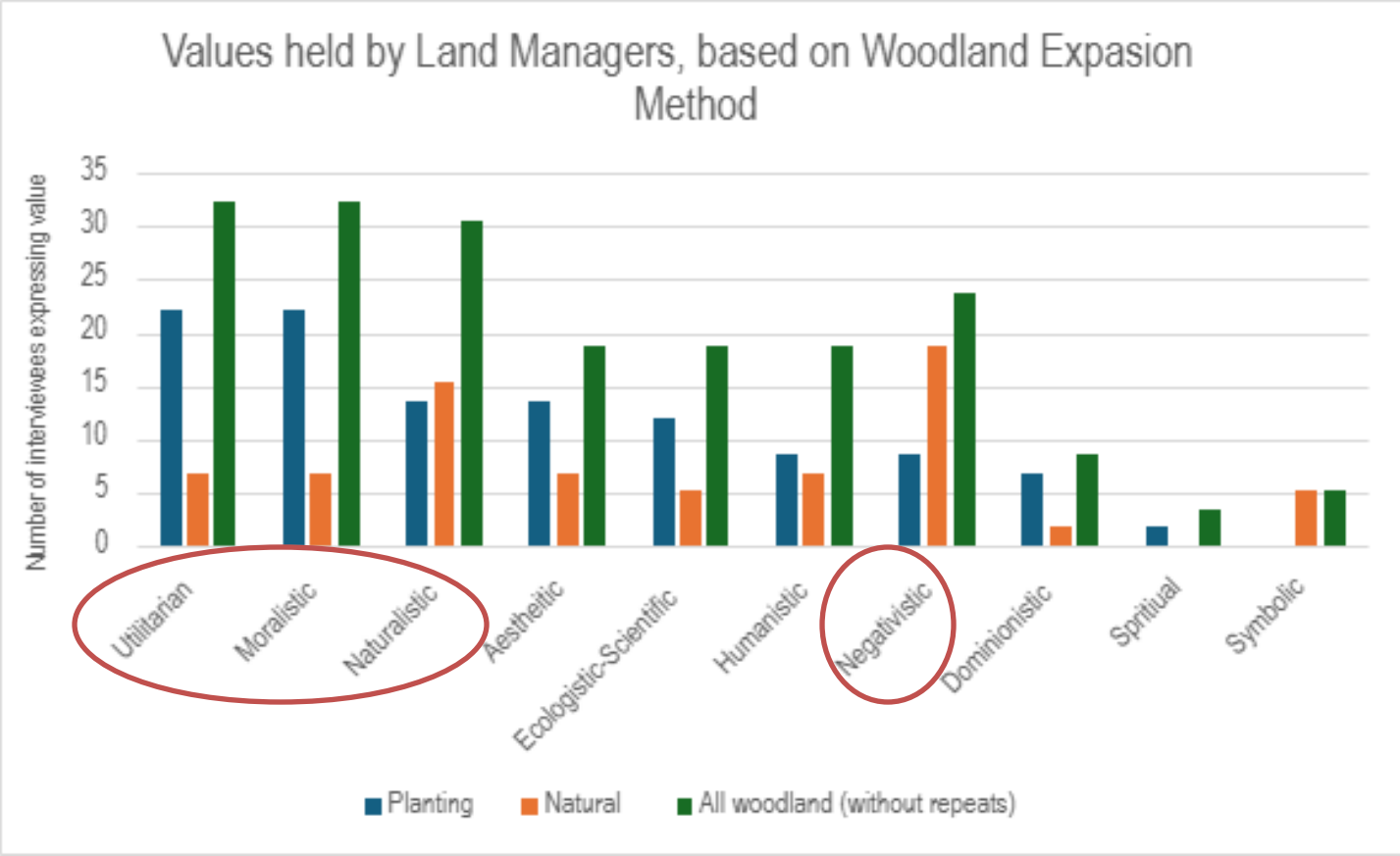
*I think the public hate regen because it looks **scrappy and messy***
(Wales, conservation)

*if the government is serious about, you know, colonisation, it needs to **invest in skills and knowledge**.*
(Scotland, productive)

Land managers' values

Land manager values behind choice of woodland approaches:
Elsa Galbraith, Bachelor dissertation

- How do environmental values affect the attitude and behaviours of land managers towards woodland creation methods?



Ecological outcomes of treescape expansion through planting and natural colonisation

Dr Laura Braunholtz, UoS
Dr Elisa Fuentes-Montemayor, UoS
Prof. Kirsty Park, UoS
Dr Thiago Silva, UoS
Prof. Kevin Watts, FR
Dr Matt Guy, FR
Dr Sam Hughes, FR
Prof. Julia Koricheva, RHL

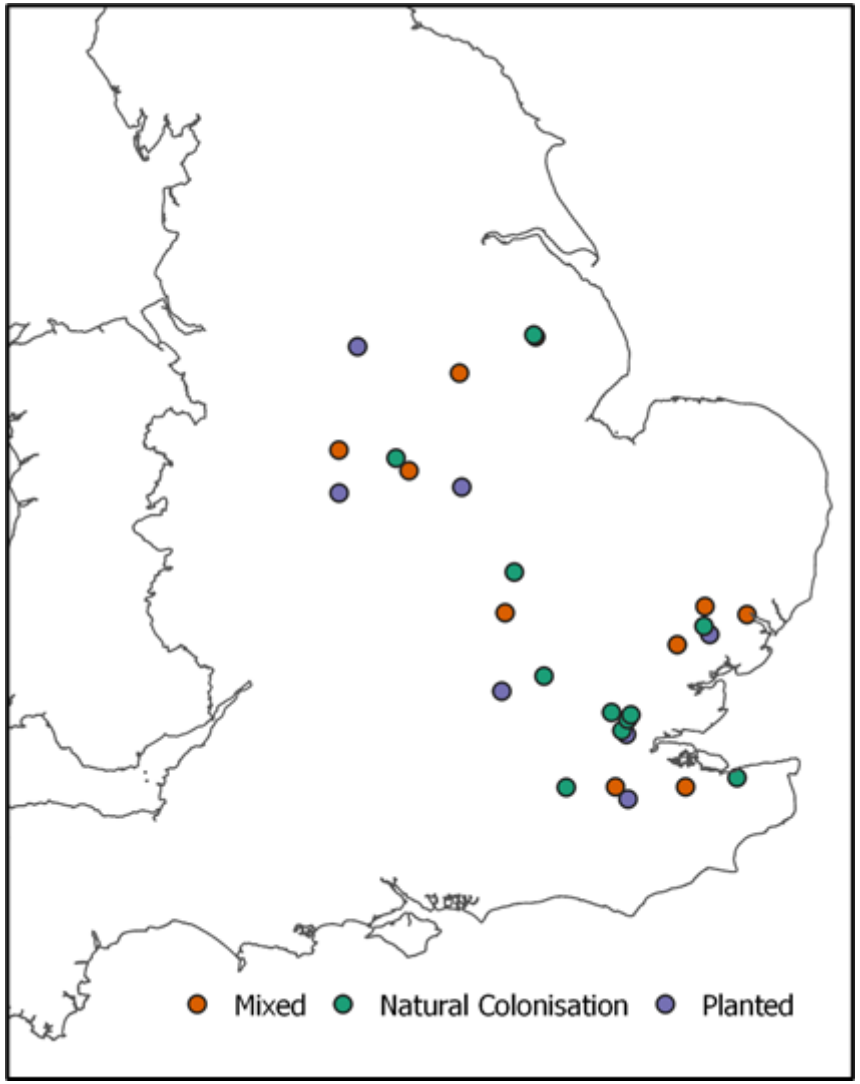
Thanks to Megan Layton and Billy Dykes for fieldwork efforts

How does the method of establishment influence a woodland's

- Structure
- Biodiversity
- Ecological function

Woodland sites

- 28 broadleaf/mixed broadleaf woodland sites
- Young: mean age of 22 years (range 13-43 years)
- Range of sizes 1 - 18ha (mean 5.7ha)
- Prior land use: arable/improved grassland
- Adjacent to established woodland



Methods

Habitat structure

- Circular plots and subplots – tree species identification, counts and measurements
- LiDAR drone surveys

Biodiversity

- Ground flora surveys
- Moth trapping
- Acoustic recording – audible and ultrasound
- Camera traps

Ecosystem function

- Caterpillar predation experiment
- Leaf damage by insects
- Herbivore browsing damage

Woodland sites

Planted

Mixed/hybrid

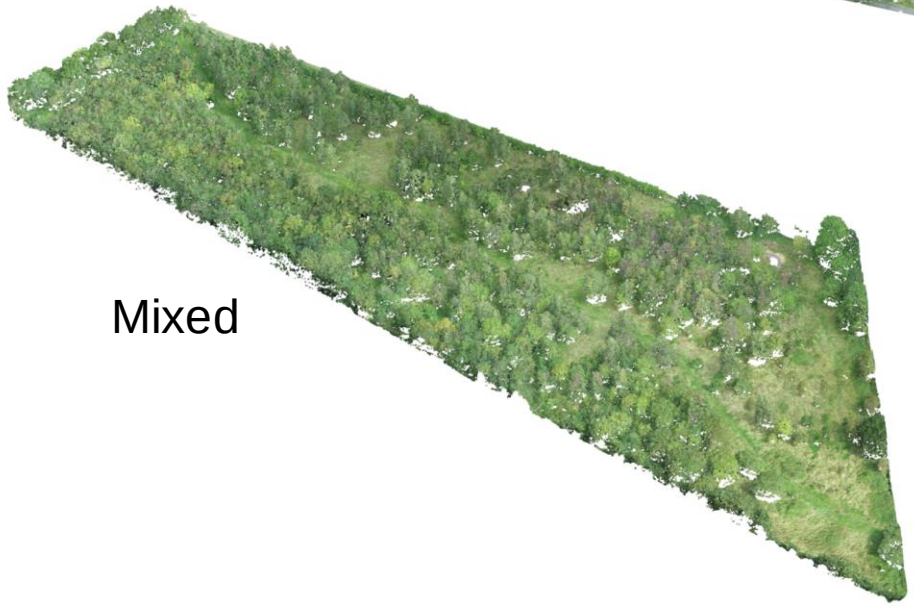
Natural colonisation

Woodland sites

Planted

Natural colonisation

Mixed



Similar tree species richness across woodland creation methods

- **25 tree species** recorded across all sites
- Tree species richness **similar** across woodland creation methods (average ~7 species) - slightly higher in planted & lower in natural colonisation sites
- Variation in dominance of species **between** and **within** woodland creation method

Preliminary figure removed

Habitat structure largely similar across woodland creation methods

- Stem density, basal area and standard deviation of DBH **similar** across woodland creation methods

- Mean stem DBH higher in **planted** sites

Preliminary figure removed

Habitat structure at site level varies within woodland creation methods

- Greater variation in mean foliage height diversity in **mixed** woodland sites
- **Natural colonisation** sites highly variable in gap frequency

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Higher ground flora species richness in mixed sites

- 129 ground flora species in total
- 21 woodland specialists, 46 woodland generalists, 62 non-woodland species
- Woodland creation method influences ground flora species richness - **highest in mixed sites**

Image credit: Getty Images

Preliminary figure removed

Higher moth species richness in mixed sites

- 6202 individuals captured from 393 species
- 260 woodland generalists, 98 woodland specialists, 35 non-woodland species
- Woodland creation method influences moth species richness - **highest in mixed sites**

Image credit: Megan Layton

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Bird species richness not influenced by woodland creation method

- 32 species of bird detected
- 8 woodland generalists, 3 woodland specialists
- Woodland creation method does not influence bird species richness

Image credit: Francis C. Franklin

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What does this mean for woodland ecological function?

Caterpillar predation

- Woodland creation method does not influence probability of caterpillar predation

Preliminary figure removed

What does this mean for woodland ecological function?

Insect herbivory

- Woodland creation method influences probability of leaf damage by insects
    - Higher in **planted** and **natural colonisation** sites

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What does this mean for woodland ecological function?

Seedling and sapling herbivory

- 23 species of seedlings and saplings across all sites
- Mammal herbivory low overall – 15 sites with no evidence, only 8% plots had evidence of herbivory
- Higher detection rate of herbivores at planted sites
- Proportion of stems browsed **not** significantly different between woodland creation methods

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TreE_PlaNat ecological outcomes preliminary findings

- No striking differences between habitat structure variables across woodland establishment method, except…
- Larger trees (mean DBH), that increase in size more rapidly with woodland age, in planted sites
- Woodland creation method influences ground flora and moth species richness (higher in mixed sites), but not bird species richness
- Some ecological functions (mammal herbivory, predation of caterpillars) similar across woodland creation, while insect herbivory lower in mixed sites

Knowledge exchange, synthesis & impact

Knowledge exchange, synthesis & impact

Susannah Fleiss and Marc Metzger, University of Edinburgh;
Vanessa Burton, Woodland Trust; Heather Gilbert, National Forest Company

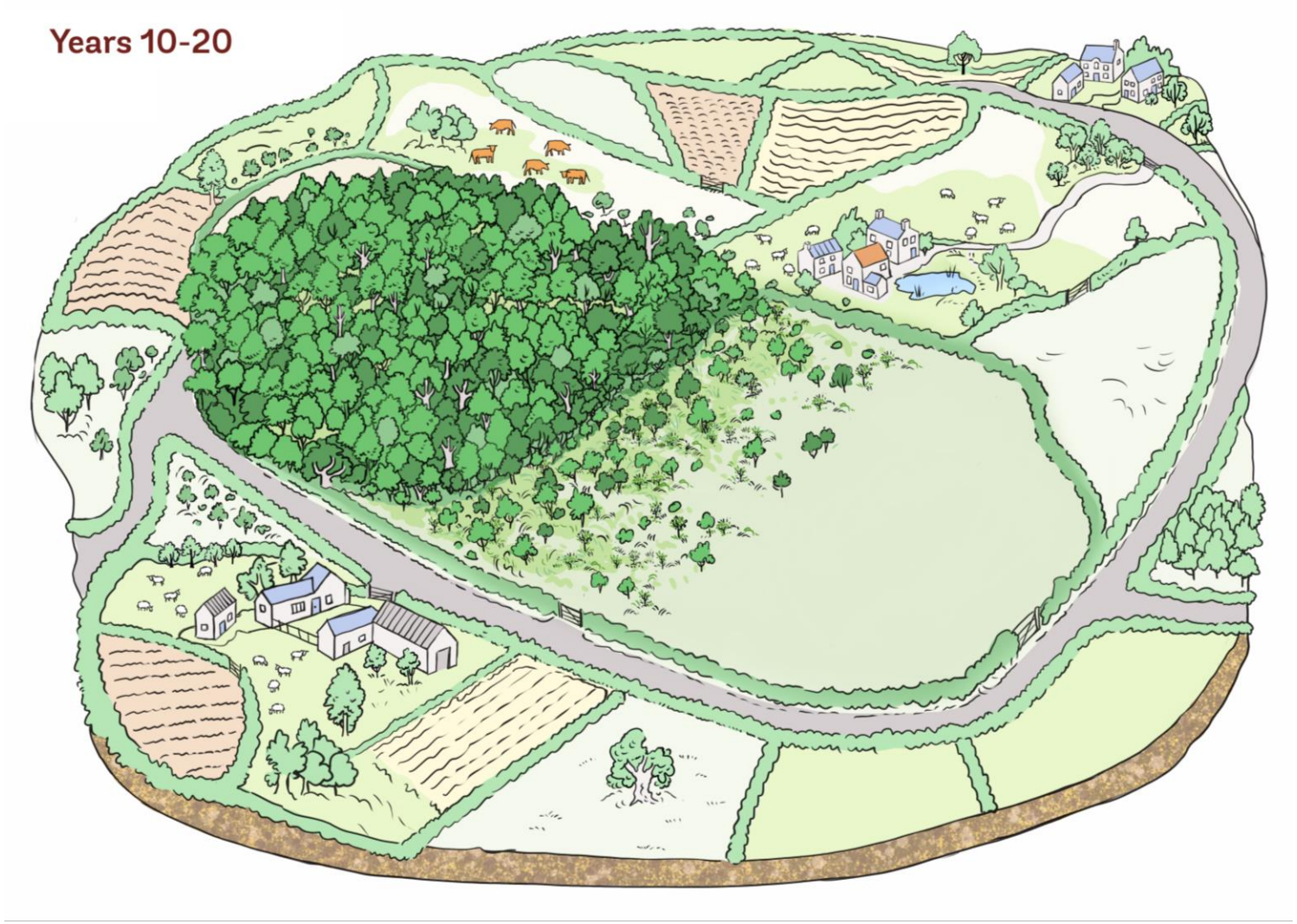
Ongoing knowledge exchange activities:

- Regular (~3-monthly) **blog posts** and **webinars** covering project activities, and research findings, addressing knowledge needs raised by the Knowledge User Board where possible
- Regular (3-monthly) meetings with the project's '**Knowledge User Board**' of land managers, policymakers and other environmental professionals to:
    1. Establish and understand knowledge needs
    2. Support research interpretation
    3. Support research impact

Knowledge exchange, synthesis & impact

Knowledge exchange outputs (written into project proposal):

- Demonstration site in National Forest, with launch event (spring 2024)
- Training event for land managers, run by Woodland Trust (summer 2024), which made use of newly-commissioned illustrations
- Articles in practitioner journals/magazines (upcoming)
- Dissemination video (upcoming)



Knowledge exchange, synthesis & impact

Working with the 'Knowledge User Board'

Who? 18 active members, usually around 10 attending each meeting:

- Government and public sector organisations (GB-wide)
- National environmental NGOs
- Regional NGOs/orgs. for woodland cover expansion
- Land agents and forestry consultants
- Farming networks and farmers

They are a fantastic group!

Knowledge exchange, synthesis & impact

Discussions with KUB

Lots of knowledge gaps identified, and ways to address these (unforeseen project outputs):

(1) What to expect from natural colonisation? A strong need for case studies

- 15 case studies collated from across GB, including both ‘successful’ and ‘unsuccessful’ sites

Factsheet: Case studies of woodland creation through natural colonisation

Natural colonisation: what to expect?

Natural colonisation has the potential to create biodiverse, locally-adapted woodlands, and help expand woodland cover across the UK, but the outcomes of the resulting woodland habitat are usually uncertain. These six case studies provide an overview of the timescales and outcomes of creating woodland through natural colonisation (in some cases, still at a grassy/scrub stage) in a range of habitats. In some sites, naturally-colonised woodland can resemble mature woodland after 50 years (Monks Wood, Case Study 4), but in others, areas can have very low tree cover after 30 years (Noddle Hill, Case Study 5).

Map of case studies (numbered green dots)

Key aim: restoring biodiversity

Biodiversity restoration was a key aim of woodland creation in all of the case studies, which were sometimes located on sites of previous woodland that had been lost. Other aims were habitat connectivity, water management, carbon sequestration and creating a recreation area.

Combining natural colonisation and tree planting within projects

All projects used natural colonisation as part of a wider biodiversity project, and four out of seven sites had some areas of tree planting too.

Variation in timescale and species mix of the developing woodland

The time to develop closed-canopy woodland varied among sites, and in some examples has still not taken place after ~30 years. The species that colonise successfully are difficult to predict, and are usually only a subset of those that are present as nearby mature trees.

Knowledge exchange, synthesis & impact

(2) Questions on the ecological process of natural colonisation and management

- **Set of FAQs on natural colonisation**, co-produced during joint workshop with Knowledge User Board and PAG (Spring 2024)
- Hosted **webinar 'The ecology of naturally colonised woodlands'** with 10 experts (GB-wide)

↓

- **Set of case studies expanded to cover 15 examples from across GB**

↓

- **'Practitioners' perspective' paper**

Knowledge exchange, synthesis & impact

(2) Questions on the ecological process of natural colonisation and management

e.g. When does it successfully create woodland; what are the key determinants of success?

- **Development of a monitoring protocol for naturally colonised woodland sites**

e.g. What are the best management practices; when should natural colonisation be combined with tree planting?

- **Woodland Trust training on woodland creation commissioned on repeat**

Knowledge exchange, synthesis & impact

Reflections

- Strong value of continuous engagement with non-academic knowledge holders
- A timely project? Practitioners have lots of questions – our knowledge exchange has provided the opportunity to synthesise these and begin to answer some of them

www.wren-project.com/tree-planat

Upcoming:

- Social research lunchtime webinar (9th December)
- Final project wrap-up webinar (20th January)
- Final resources and outputs: FAQs, monitoring protocol, case studies, video and final blog posts

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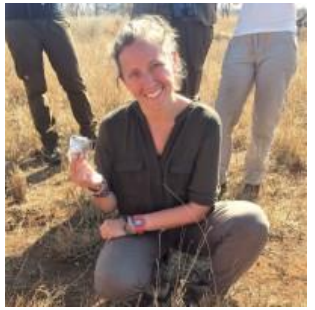

Dr Heather Gilbert

Dr Vanessa Burton

Rachel Orchard