Increasing tree cover at a farm level: Understanding farmer preferences and using LCA to assess the environmental impacts

Farm Woodland Forum Annual Meeting 2024

Sally Westaway[1], Ian Grange[1], Jo Smith[2], Laurence Smith[3]
1. Royal Agricultural University, 2. MV Agroecology Research Centre, 3. University of Reading

Afforestation targets have changed over time, with the focus moving from timber to climate change emission abatement

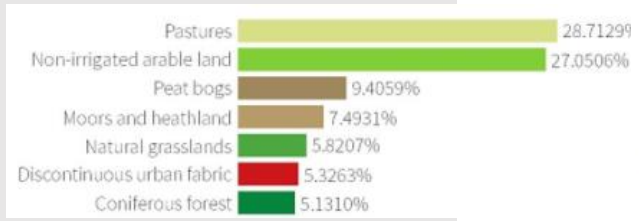
In England the most recent target is to increase tree canopy cover from **14.5 % to 16.5 % by 2050 (an increase of around 250,000 ha)**

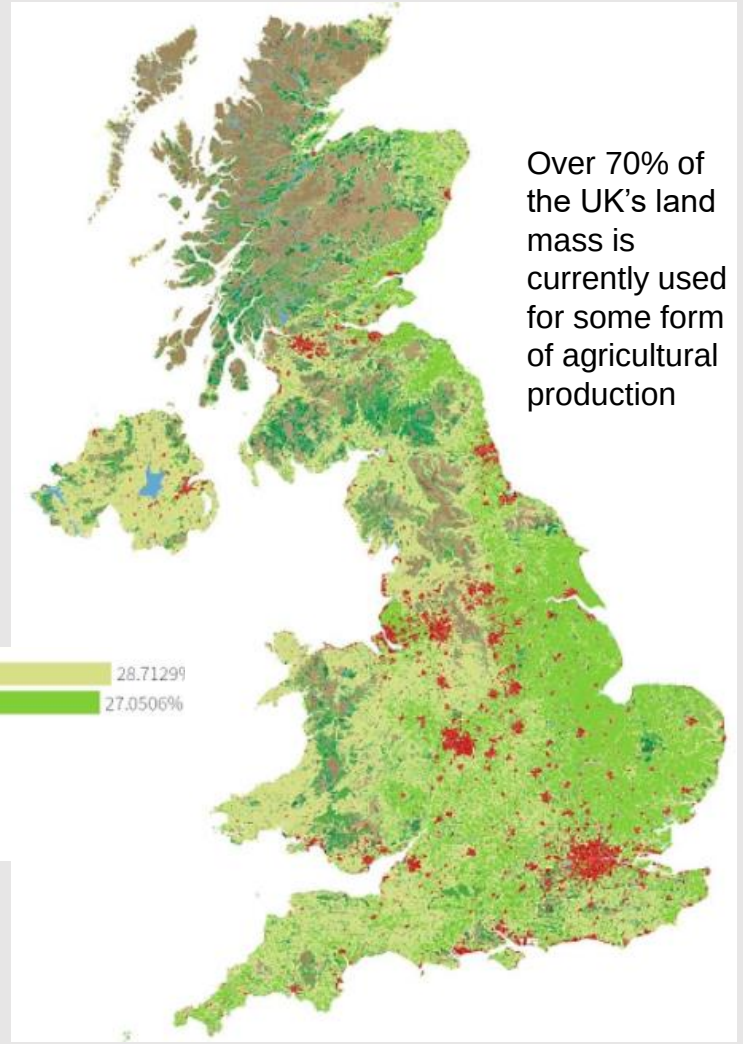
Is **Agroforestry** part of the solution?

Committee on Climate Change

Land use: Policies for a Net Zero UK (2020)

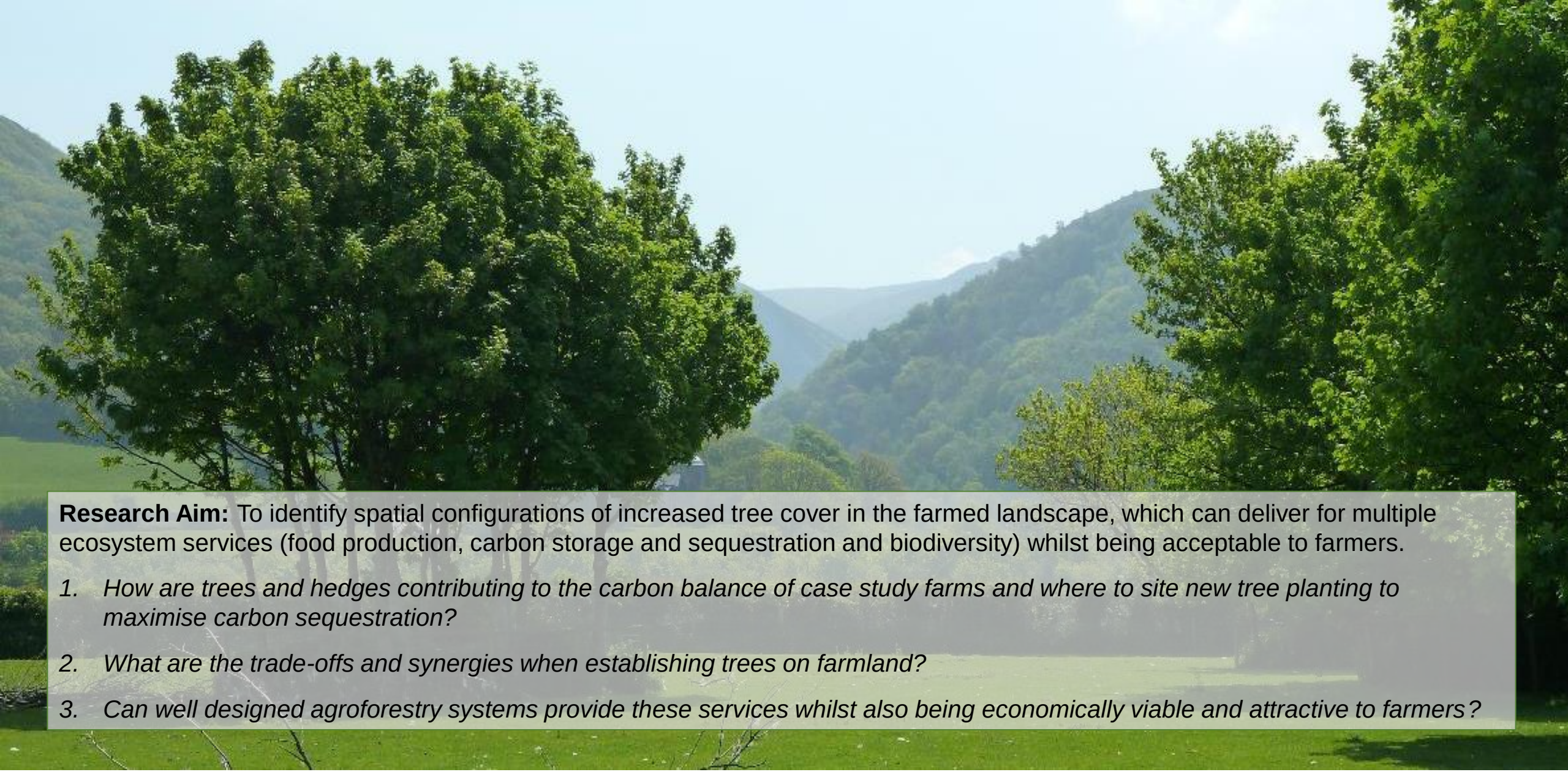
Use **10%** of farmland for agro-forestry.





Over 70% of the UK's land mass is currently used for some form of agricultural production

Land Cover Atlas of the United Kingdom (Rae, 2017)



Research Aim: To identify spatial configurations of increased tree cover in the farmed landscape, which can deliver for multiple ecosystem services (food production, carbon storage and sequestration and biodiversity) whilst being acceptable to farmers.

1. *How are trees and hedges contributing to the carbon balance of case study farms and where to site new tree planting to maximise carbon sequestration?*
2. *What are the trade-offs and synergies when establishing trees on farmland?*
3. *Can well designed agroforestry systems provide these services whilst also being economically viable and attractive to farmers?*

Literature Review

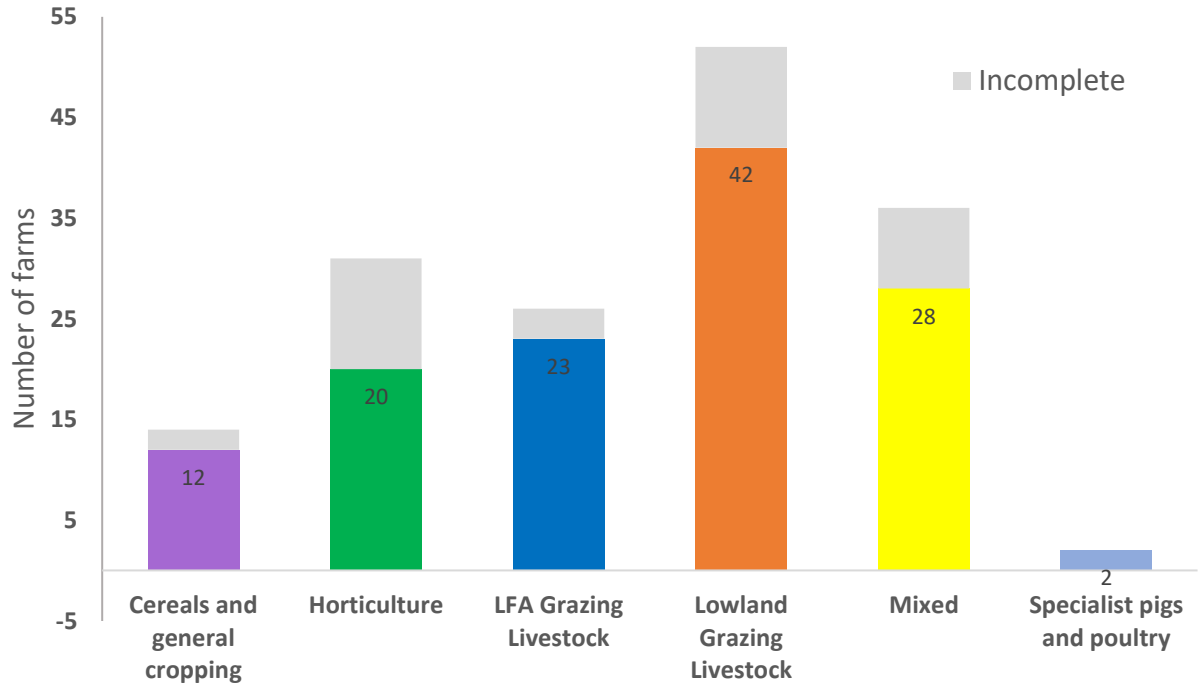
Westaway et. al. (2023) Meeting tree planting targets on the UK's path to net-zero: A review of lessons learnt from 100 years of land use policies. ***Land Use Policy 125*** *doi: 10.1016/j.landusepol.2022.106502*

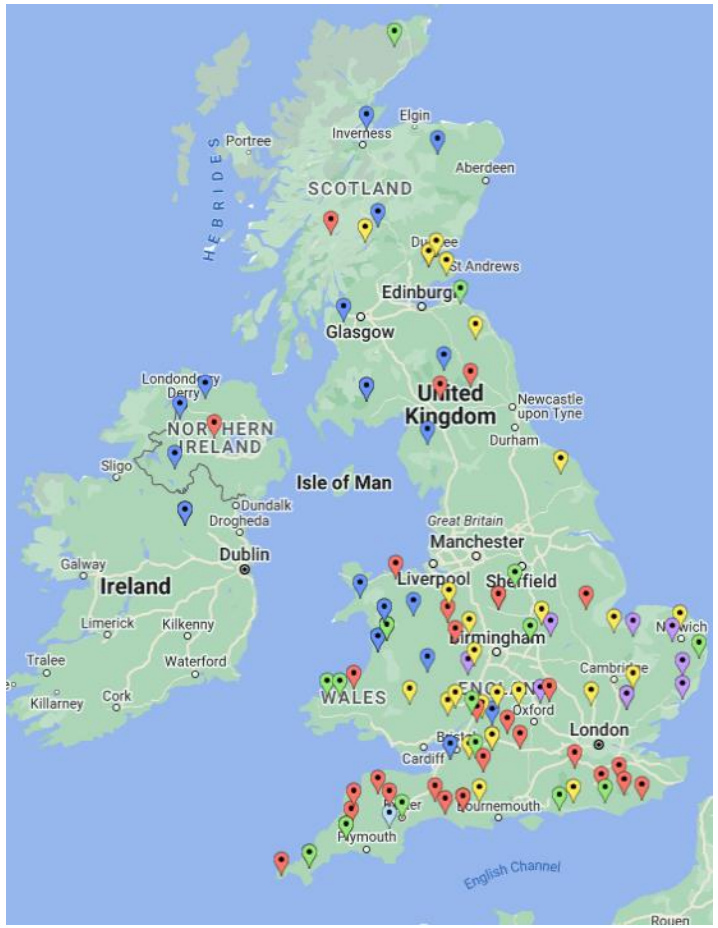
Understanding farmer preferences

Given that all farmers are being incentivised to plant more trees. What might the future of trees on farms in the UK look like?

- **Initial online survey** launched at the Agroforestry Show September 2023
- Circulated widely via farmer networks and contacts
- Filter so that only those that identify as farmers can complete – questions tailored to farm sector
- Deliberately short and simple **185 responses**

No. of complete responses by enterprise type





‘What is your vision for tree planting on your farm by 2050?’

What is your vision for tree planting on your farm by 2050
Habitat connectivity at scale
I have planted approx 10,000 trees in the past 3 years, native woodland and silvoarable. I may pla
Maintain existing agroforestry
More trees in hedge lines, reinstatement of previous hedgerows removed in 1960's, possibly nev
Natural regeneration in areas of ancient woodland; gapping up hedgerows, laying them, and enc
New hedges
Not to take out arable land but manage the well established extensive woodland already present
ORCHARD, horticulture , nut production every 27 m in wild flowers then 24m commercial croppin
Probably not plant a lot more, otherwise we risk becoming unprofitable.
Small scale, 16ha of woodland on the farm already
To increase tree cover by planting an alley cropping system
To increase tree planting in marginal areas for environmental and amenity enhancement whilst r
2.5acres of new woodland established 2018, 1.25 acres managed established woodland (less thar
70% tree/shrub with perennials in-between. So far I have planted the majority of these trees. St
actually have planted lots in the last 20 years. would think about doing more agroforestry
Am planning on planting 3-4 x 60m rows of fruit/coppice/wildlife tree on new 1ha field between

Farm visions categorised – using **Thematic Content Analysis** (Braun and Clarke, 2022)

Visions used to generate a set of statements that participants will then rank how much they agree/ disagree in stage 2 of consultation

Thinking about what you would like to see on your farm, please choose your preferred images (up to three) for trees on your farm?


woodland/ copse


hedge short


riparian buffer

Images categorised:

- Integrated/ separate
- Low density/ high density
- ‘no tree’ option


in-field trees sparse

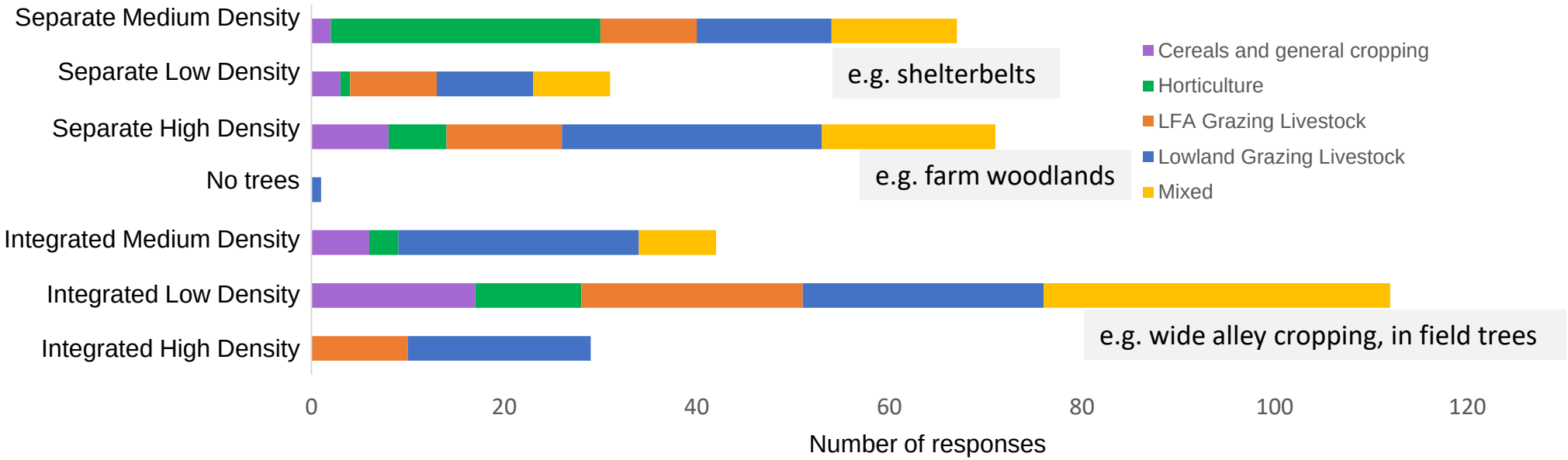

in-field trees dense


shelterbelt/ hedge

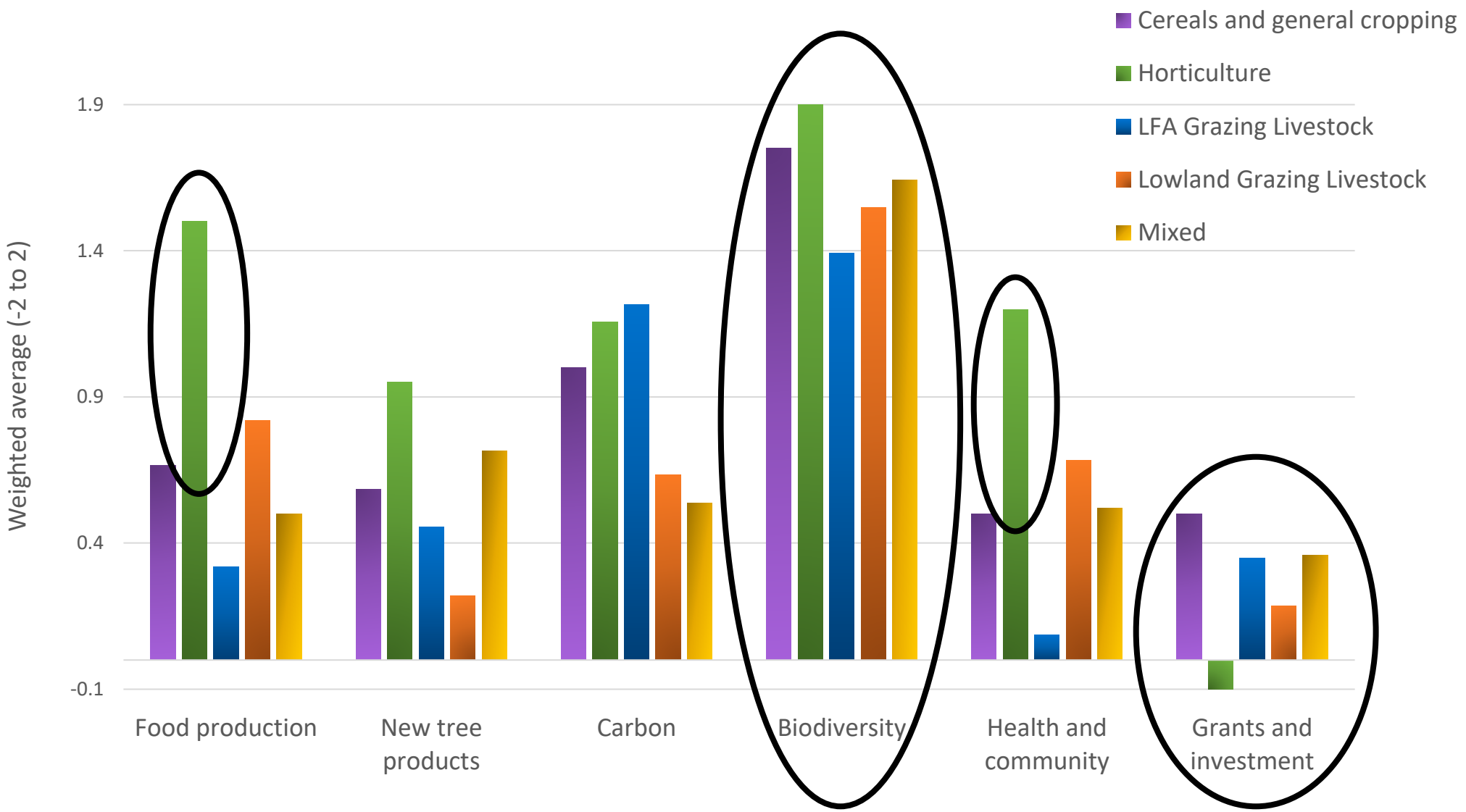

woodland/ hedge


woodland grazing


sparse/ no trees



What do you want your trees to do for you? Please score the following from low priority (1) to High priority (5)



WHAT NEXT? Stage 2 of stakeholder consultation

AIM: to identify the preferred (sector specific) increased tree cover scenarios and understand the drivers/ barriers to achieving these

1. Online workshop with a group of experts/ farmers

- Present online survey findings to participants – 82 emails
- Develop and present some initial sector specific increased tree cover scenarios with live online voting (**Discrete Choice Experiments**) Include species choice and the influence of costs/ grant availability
- **Q method** to find shared perspectives based on farmer visions with additional 'farmer reasons for tree planting' from relevant literature and 'top down' policy visions. Allows ID of different types of farmers grouped by shared perspectives

2. Farmer interviews (Case Study Farms)

- Mapping used as a visual communication tool to test farmer acceptability of different increased tree cover scenarios.

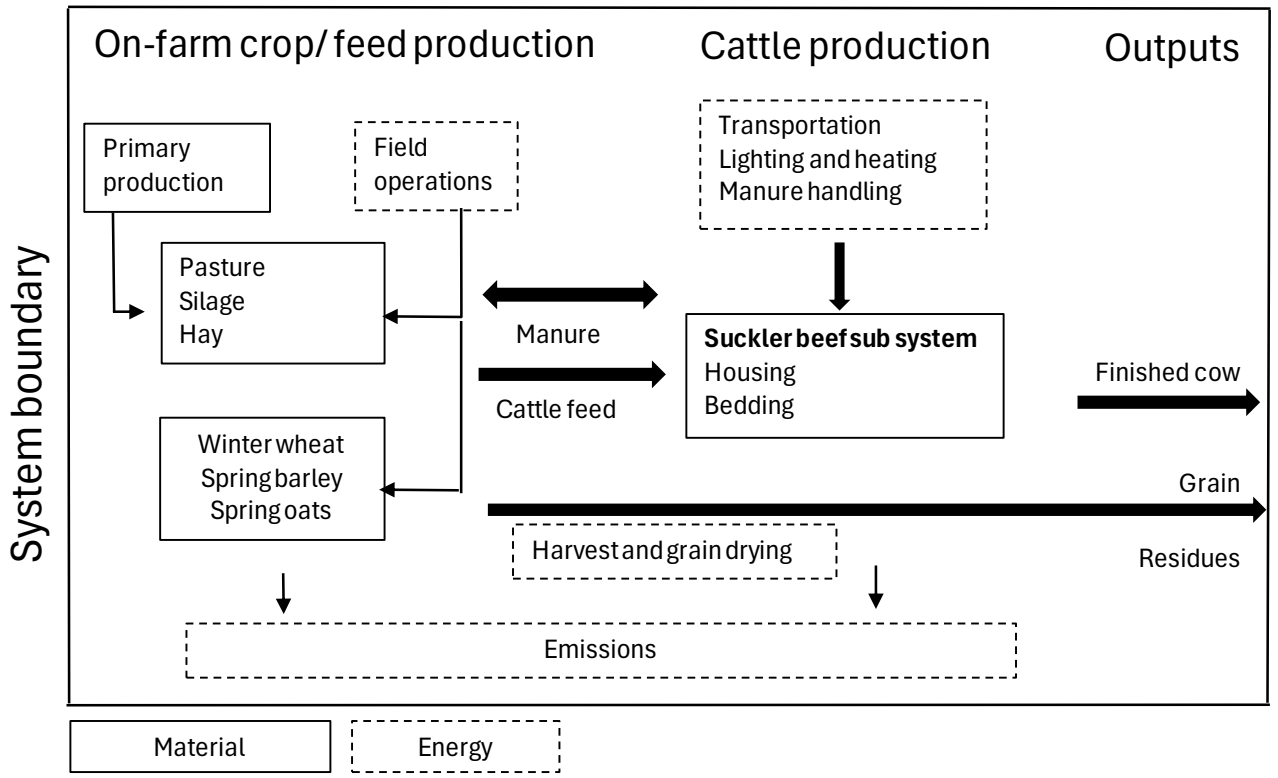
How to capture opinions/ preferences?

Using LCA to assess environmental impacts of increased tree cover scenarios

Why LCA?

- Standardized methodology
- Allows inclusion of upstream impacts
- Knowledge gap for agroforestry systems
- Consequential LCA can be used to assess impacts due to displaced food production

Goal: To assess the net changes in environmental impact associated with the current (baseline) situation compared to different increased tree cover scenarios on one case study farm.



- **Initial LCA** for current situation – use economic allocation to account for multifunctionality
- Modelled over 6-year rotation (3 crop outputs, plus beef)
- Current tree output limited
- Partial LCA focussing on climate change impact
- Include above and below ground carbon sequestration (and other ES?)

Functional Unit: Impacts (1) per hectare and (2) per £ income from one hectare averaged over one year of production

System boundary: Cradle to farm gate

Modelling increased tree cover scenarios using LCA

Increase tree cover by 10% based on farmer priorities:

Expanding fruit and nut tree alley cropping

SRC for woodchip production for bedding (to replace purchased chip)

Shelter and woodland grazing

Will this lead to net-zero at a farm level?

Use whole farm carbon accounting as well as LCA modelling

What is the impact on food production and farm incomes?

Economic modelling to include different financial incentives (gross margin calculations, Farm-SAFE)

Scenario	Income	Costs
1. Baseline	Income from production plus existing grants	Production costs
2. Fruit and nut alley cropping	a) SFI payments to extend and maintain agroforestry b) SFI plus carbon credits	Tree establishment, protection and management Reduced crop production/ grazing area Additional time to manage crops in alleys
3. SRC block planting for woodchip	a) Replacement for purchased woodchip b) Carbon credits	SRC harvesting, chipping Fencing Reduced crop production/ grazing area
4. Shelter and woodland grazing	a) SFI payments b) SFI plus carbon credits	Tree establishment, protection and management Reduced crop production/ grazing area


Thanks for listening
Any Questions?