

2. Agroforestry –research results

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Research into agroforestry

- There is a huge body of research into the theory and practice of agroforestry worldwide
- A substantial and fast-growing body of research into agroforestry in temperate climates and the EU
- But-a very small research base for agroforestry research relevant to or on the island of Ireland
- The research programme in Northern Ireland started in 1989 and is gradually being extended across the island



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The European Agricultural
Fund for Rural Development:
Europe investing in rural areas



The evidence base...

30 years ago our driver was to : Make grasslands in Northern Ireland more sustainable by increasing tree cover to improve biodiversity, nutrient capture and water quality & soil health.

Considerable investment went into establishing a replicated trial comparing grassland, silvopastoral and woodland systems at the Department's research station at Loughgall, Co Armagh.



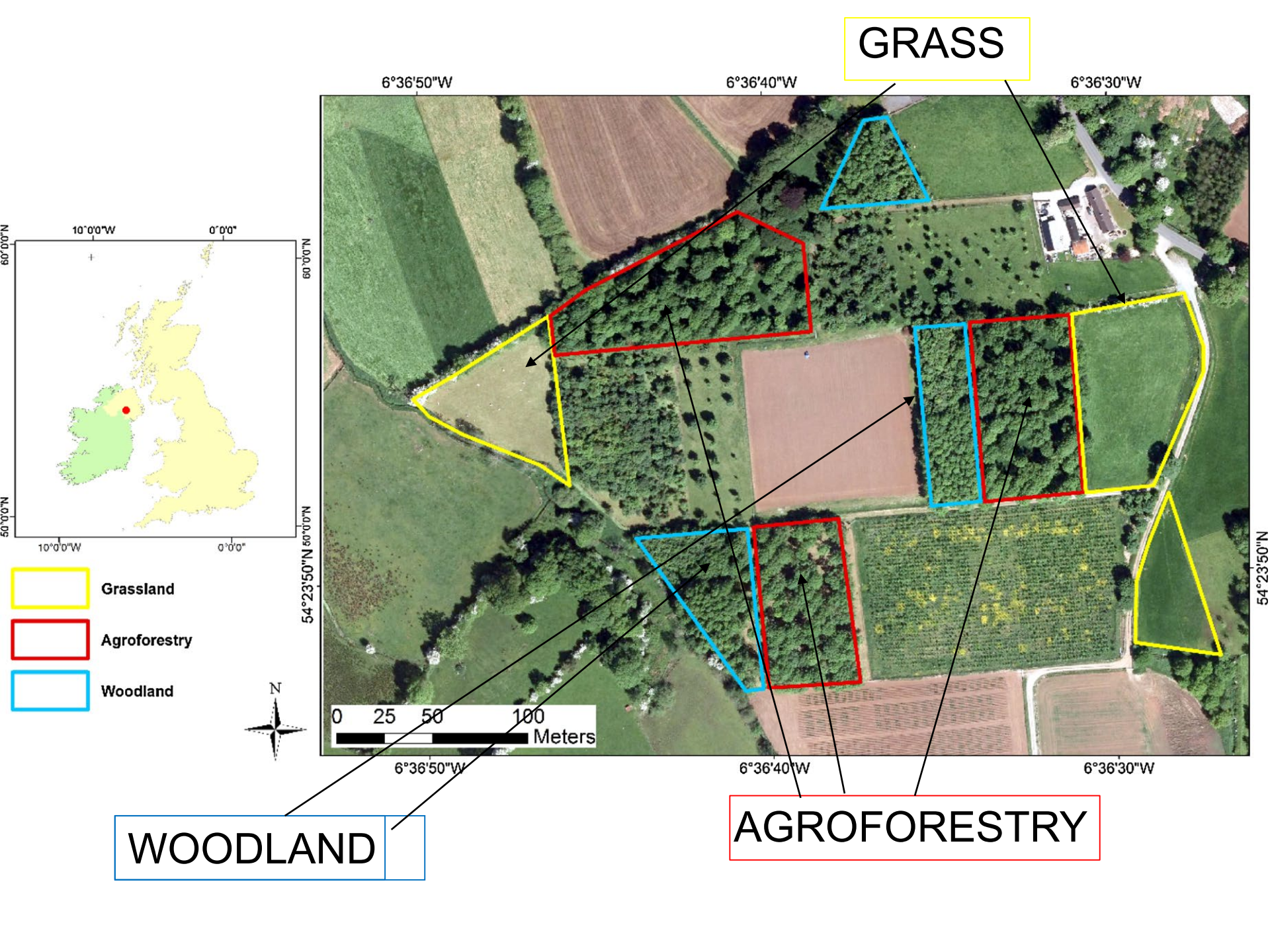
Pasture with perennial ryegrass(*Lolium perenne*)



Silvopastoral system planted with ash (*Fraxinus*) trees (400 stems ha-1)



Woodland planted with ash trees (2500 stems ha-1)



Establishing silvopasture

3 yr old



8 yr old



8 yr old



16 yr old



19 yr old



8 yr old



26 yr old



Ecosystem Services

Scenery

Pollination

Renewable Energy

Flood Control

Biodiversity

Crops

Fodder

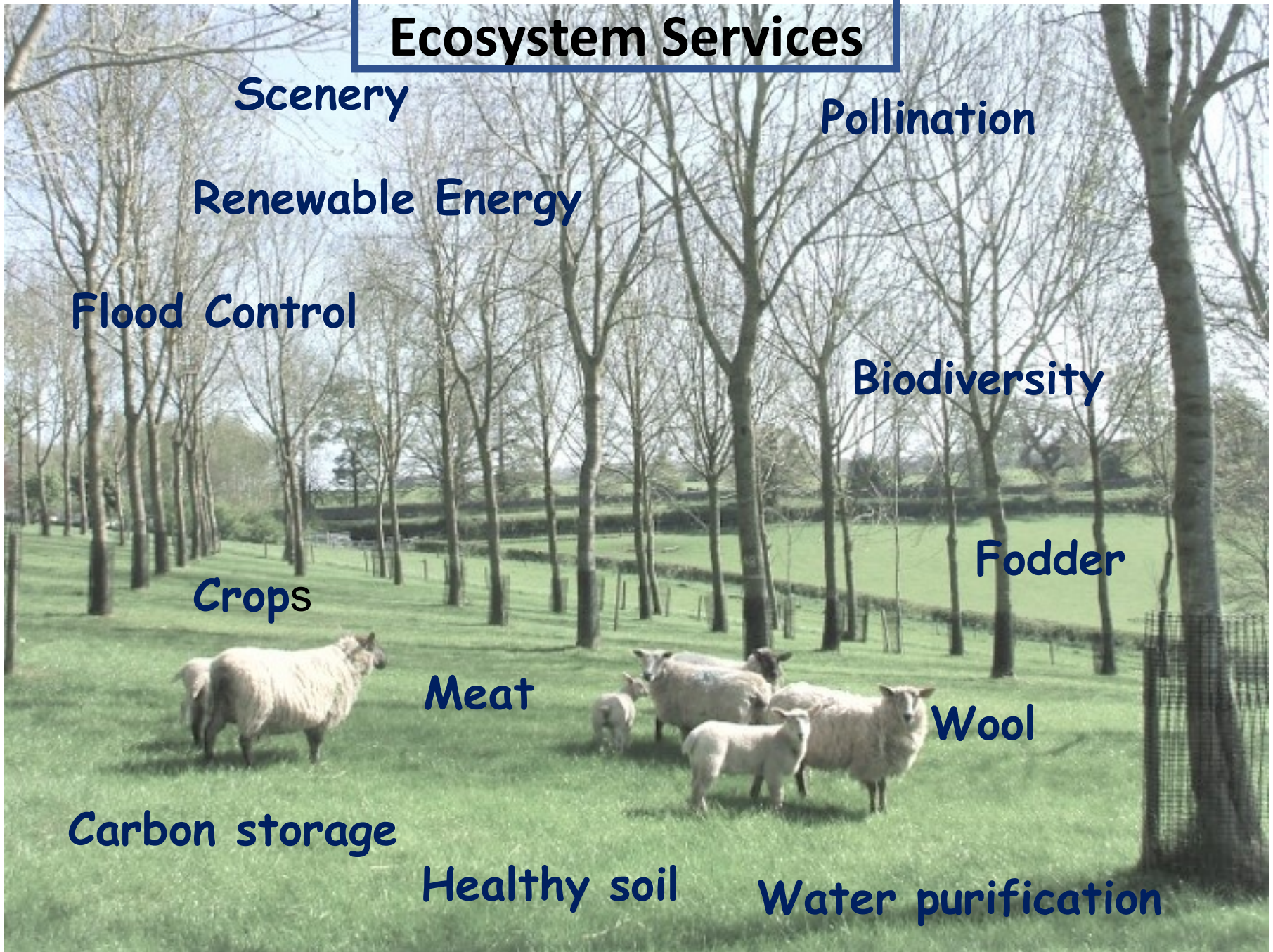
Meat

Wool

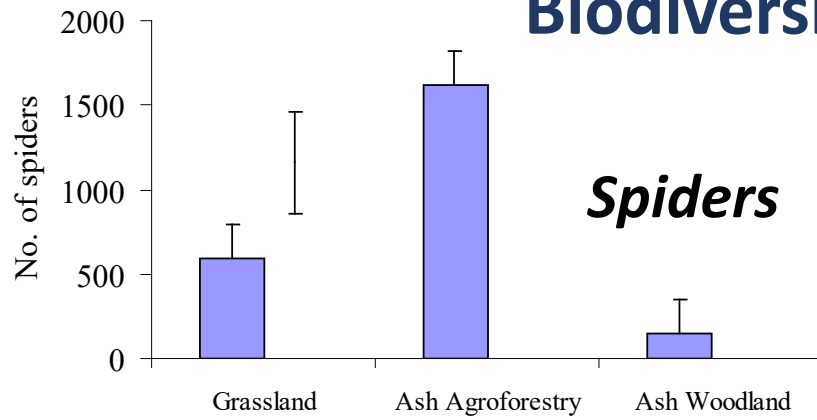
Carbon storage

Healthy soil

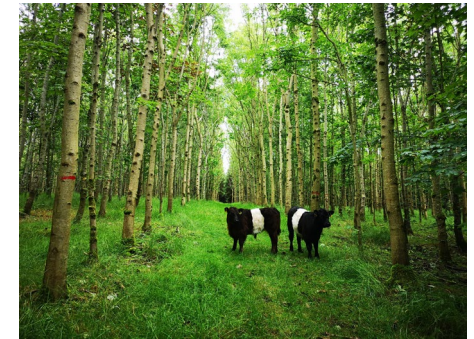
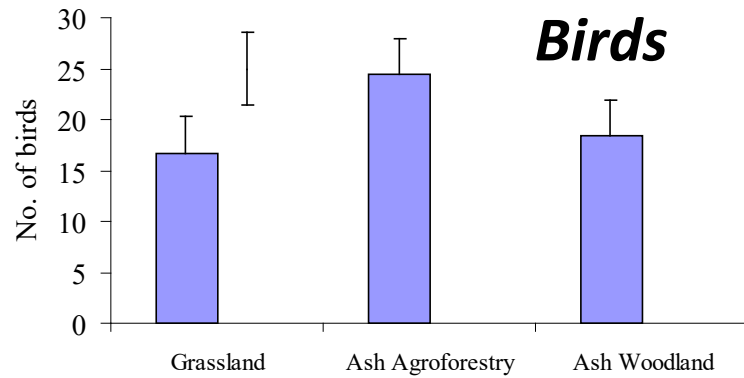
Water purification



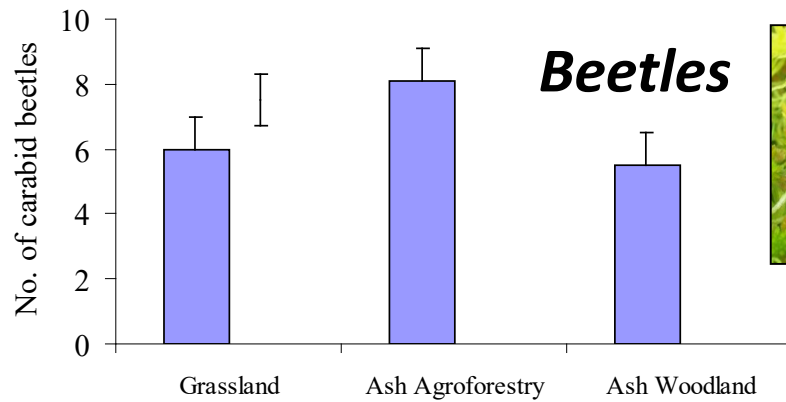
Biodiversity benefits



Earthworms

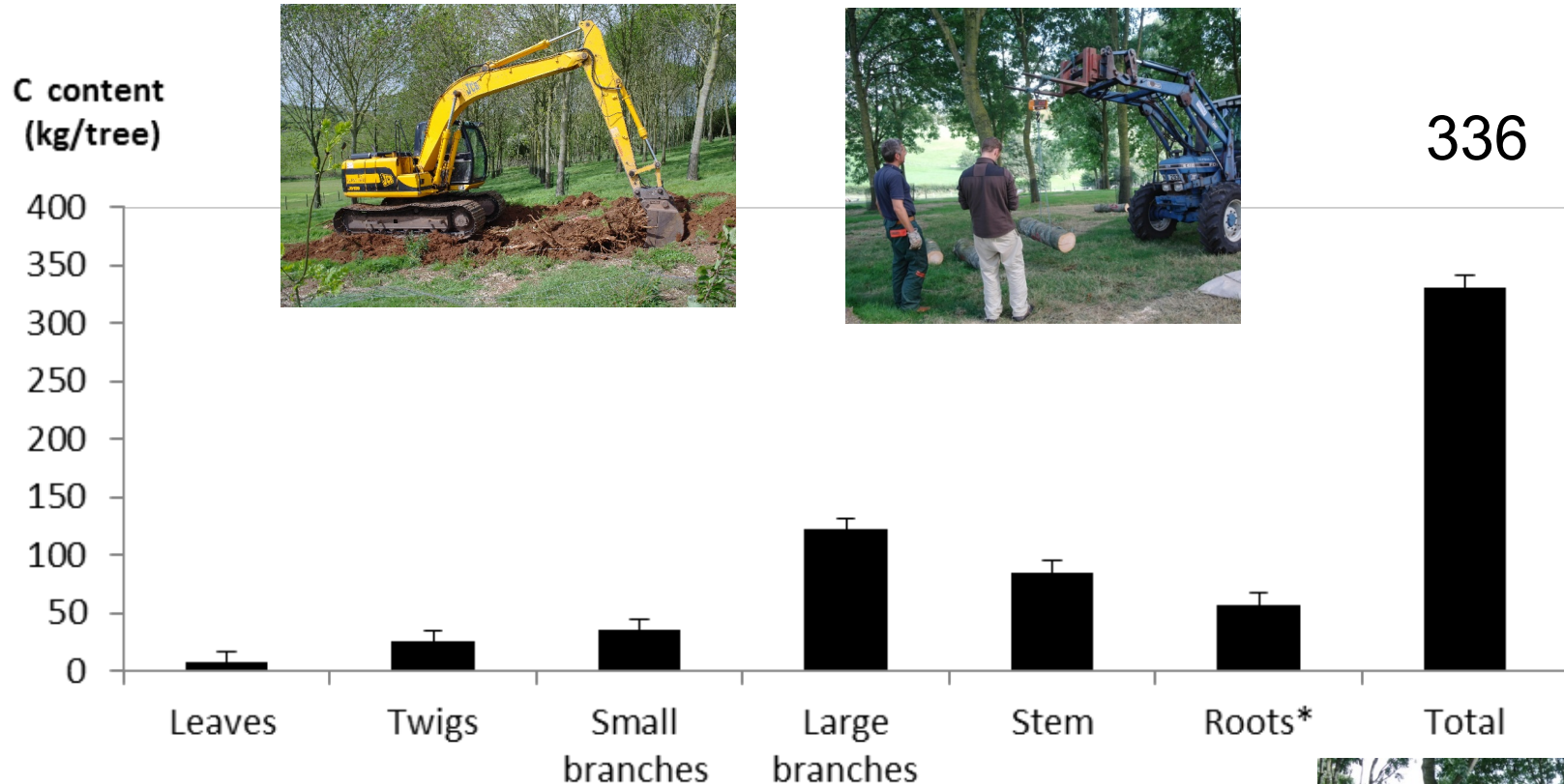


Flora



Pollinators

Carbon stored in ash trees (dry weight) growing in agroforestry (21 years old)



Tree components of ash trees

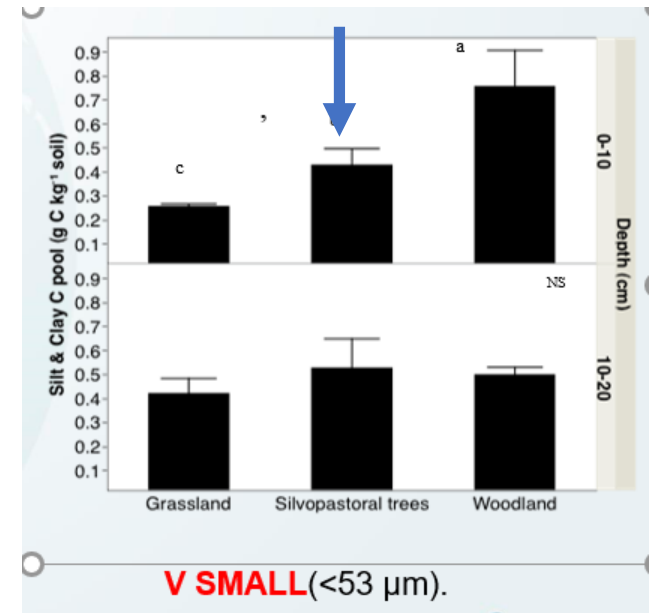
Total C in woody biomass- **77.28 t/ha**

Source: Olave, R., Higgins, A., Sherry, E., Fornara, D., McAdam, J (2016). Agroforestry as a land use option to sequester carbon in a cool temperate climate. World Congress Silvopastoral Systems 2016. University of Évora, Portugal. 27-30 September 2016. 32-33.



Soil carbon

There is more 'stable' carbon stored in the ash silvopasture than the grassland.



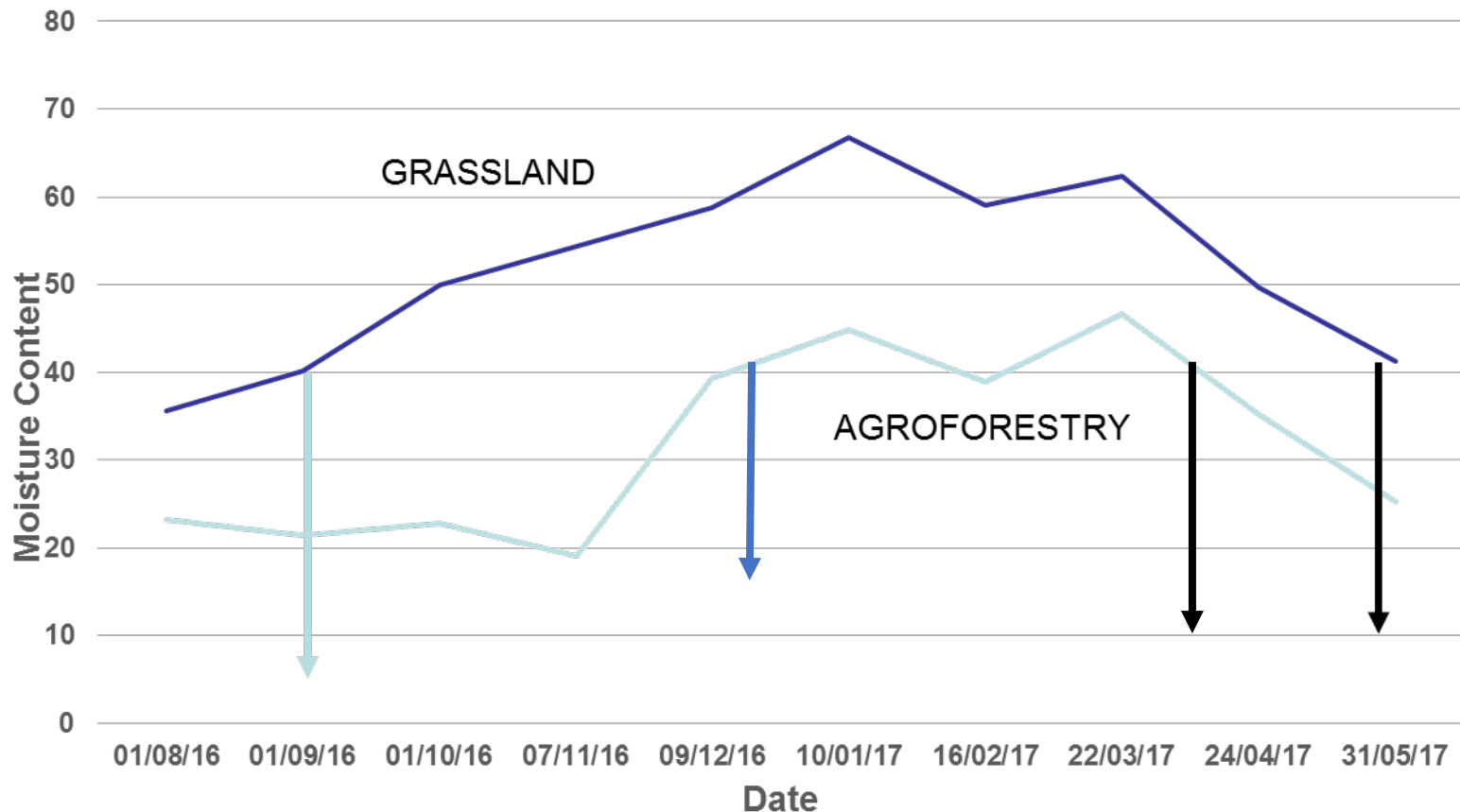
- When the carbon stored in the wood is added in, these systems have the potential to store "long term" and "short term" carbon

Carbon sequestration

Land Use Practice	Species	tC/ha/yr
Silvopasture	Ash /Mixed Species	2.4
Pasture	Perennial ryegrass	0.6-1.0
Forest plantation	Sitka Spruce	3.8

Ability to sustain grazing-soil trafficability

Extended grazing season under agroforestry

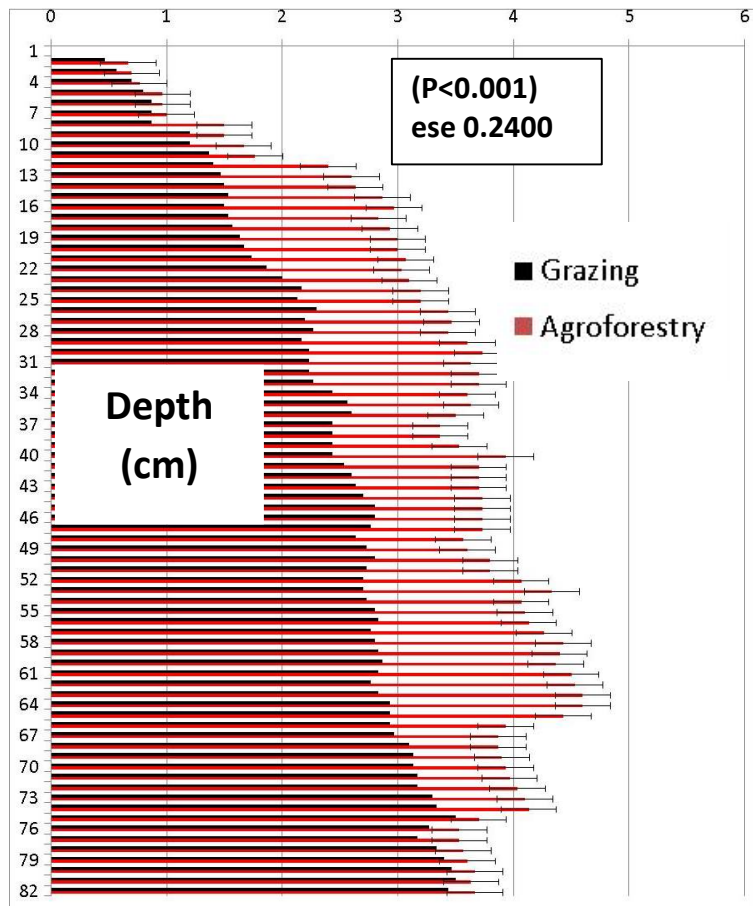


Assume 40% soil moisture content as a cut off, we have 17 weeks longer “season” under agroforestry-5 in spring, 12 in autumn.

Resilience to extremes of weather

- Silvopasture increases soil permeability
- **infiltration potential was greater in the silvopasture than the grassland treatment down to 76cm (Sept-Nov)**

Results in-



- Extended grazing season under agroforestry (we measured 13-17 weeks)
- Greater levels of grass utilisation
- Reduced ammonia emissions from livestock
- Reduced N₂O emissions
- Improved animal health
- Increased resilience to flash flooding
- Improved biological soil health

Proven benefits from silvopasture

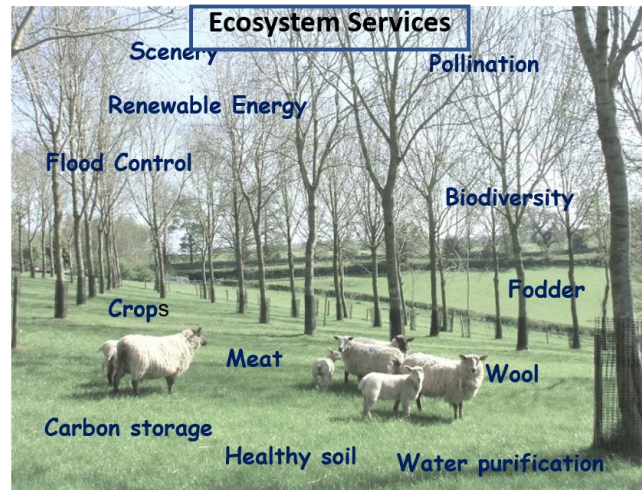
Silvopasture was found to:-

- extend grazing seasonhigher grass utilisation
- resilience to grazing during extreme rainfall & drought : reduced ammonia emissions
- increase biodiversity
- carbon sequestration
- reduce water run off
- provide renewable fuel
- 'mine' P from greater volume of soil.

There have been other trial sites in NI



Research challenges



- We know that the system actually works and can deliver a range of ecosystem services
- The evidence base is largely from one site with one tree species -need to widen the scope
- Need more research on the relevance of silvopasture to cattle - based farms
- How can we better present agroforestry as a viable, sustainable, climate - resilient system?
- **What are the factors limiting uptake- now underway**

Two very positive moves..

Walsh Fellowship Project-Rachel Irwin



Woodland Support Project-Irish Agroforestry Forum



An Roinn Talmhaíochta,
Bia agus Mara
Department of Agriculture,
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