Making the most of trees & hedges on farms
soils, agroforestry and productivity

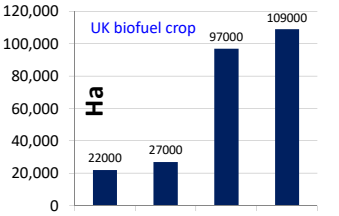
Stephen Briggs

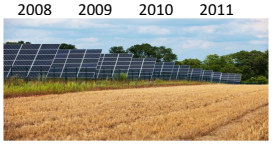
INNOVATION *for* AGRICULTURE

NUFFIELD FARMING SCHOLARSHIPS TRUST

ABACUS AGRICULTURE

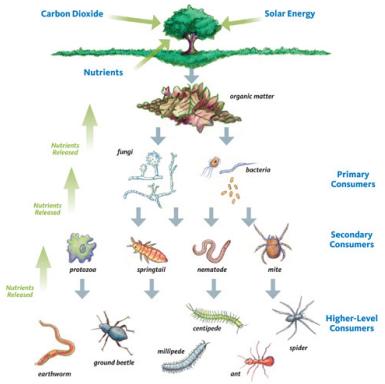
Competition for land





Is agriculture still emptying the soil carbon account?

Soil food web



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Agricultural challenges ahead…..

High input monoculture
- is it yesterdays approach?

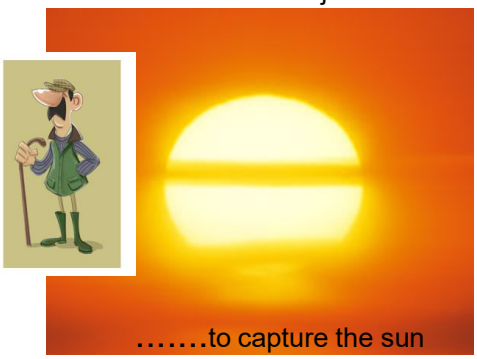
Inputs more expensive & less available ?

Increase productivity ?

Better resource use ?

Protect & enhance biodiversity ?

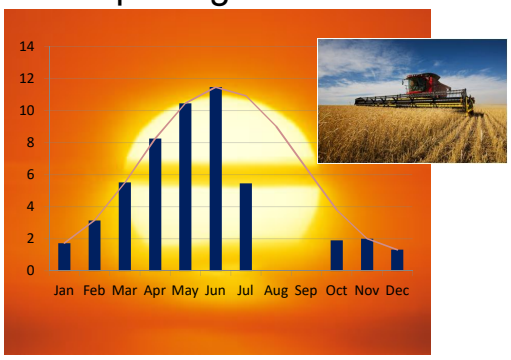
What is a farmers job.....



…….to capture the sun

& turn it into carbon (*crops, animal feed etc*)

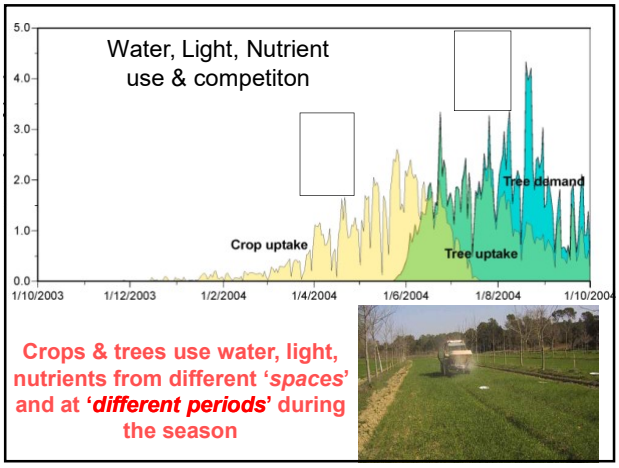
Capturing the sun

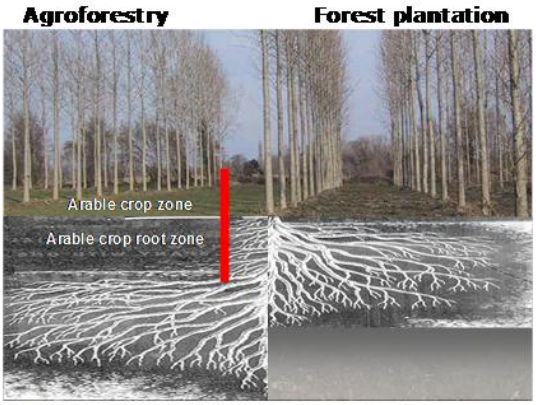


Potential daily sun utilisation by combinable crops

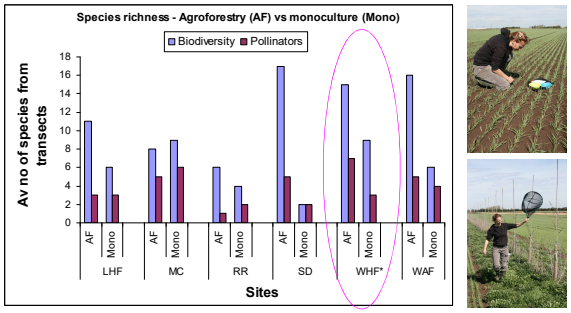
What is agroforestry

- Land use where trees are combined with crops and/or livestock on the same unit of land and where there is **significant ecological or economic interaction** between the tree and the agricultural components
- ***Silvopasture*** **-** Trees in grazed pasture in regular of varied pattern
- ***Silvoarable*** – tree and crop combinations



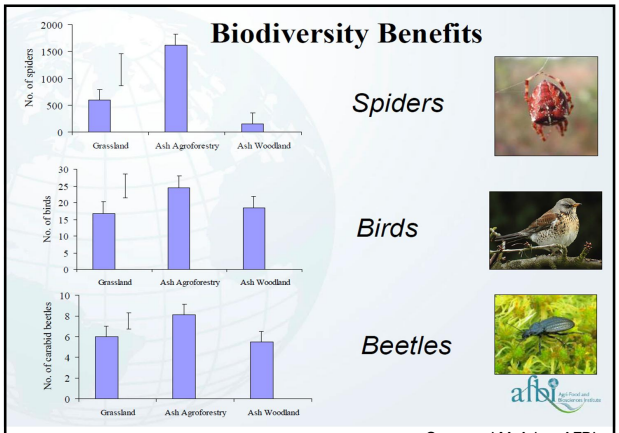


Biodiversity & Ecosystems services research



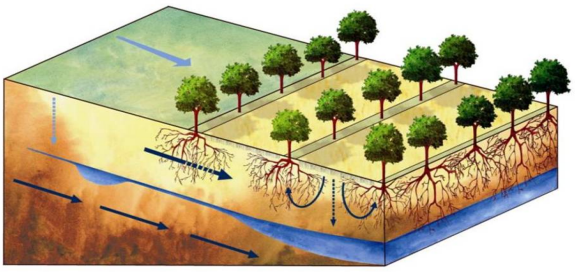
Comparison of species richness between agroforestry (AF) and monoculture (mono) at 6 farms in England 2009-2011.

Source : A Varah Reading University



Source : J McAdam AFBI

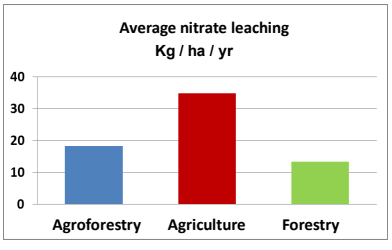
- Improved soil & water quality protection
- Wind speeds reduced
- Reduced evaporation and water loss from crops
- Microclimate modified

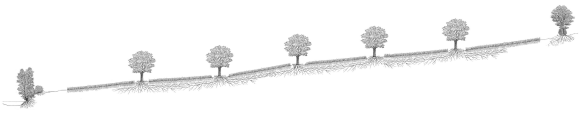


Reduced Nitrogen leaching

Up to 50% less N lost under Agroforestry than arable

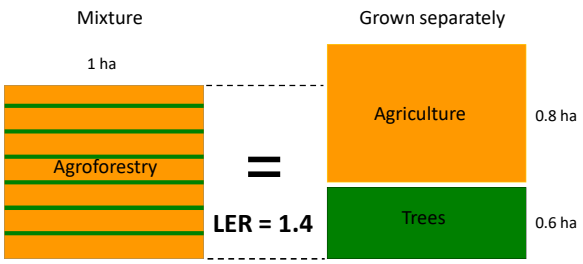
Trees capture N not used by crops





Source : Research by INRA Restinclières, France

Land equivalent ratio of productivity

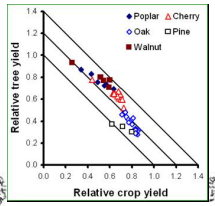


An LER of 1.4 means 100 ha of agroforestry produces as much crop & tree products as 140 ha farmland where trees and crops are separated

Land Equivalent Ratio (LER) (Mead and Willey, 1980)

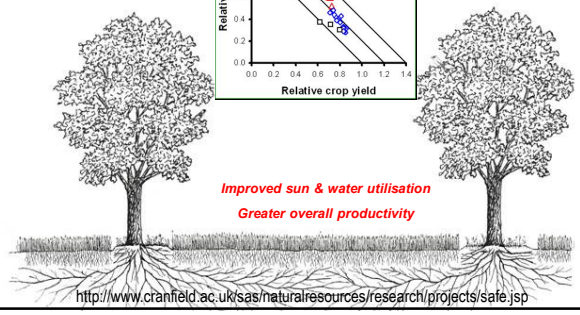
Balancing productivity with environment management

Tree and crop yields for 42 tree-crop combinations



LER's

1.1 to 1.4



Improved sun & water utilisation

Greater overall productivity

http://www.cranfield.ac.uk/sas/naturalresources/research/projects/safe.jsp

Examples of agroforestry

Silvo-pastoral: trees and livestock

Tree forage – increasing interest

- Trace minerals
- Protein rich leaves
- Medicinal benefits
- Diet supplementation
- Willow & poplar browse?

Palatability classes

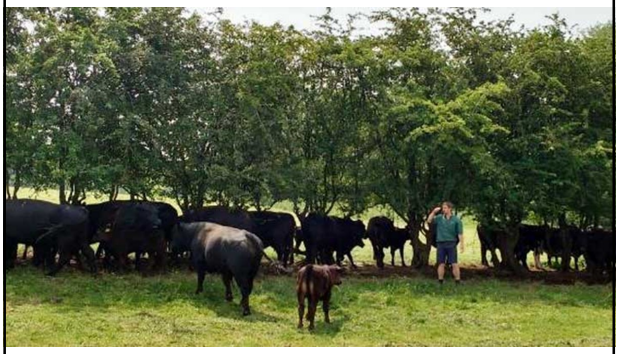
1. Aspen, Willow
2. Ash, Rowan
3. Hazel, Oak
4. Scots pine, Juniper, Holly
5. Birch, Hawthorn
6. Beech
7. Alder

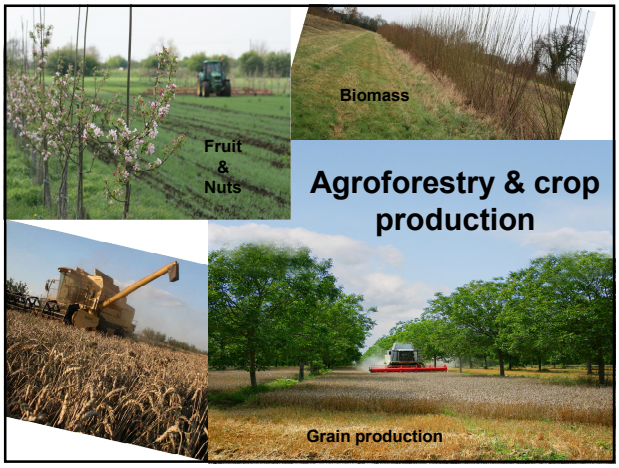
- *Lowland woodland - aspen may be class 3*
- *Scots pine, juniper, holly good as winter food as evergreen*
- *Ongoing debate as to holly/hawthorn further up list – often browsed but prob only when other species are removed first or not present*

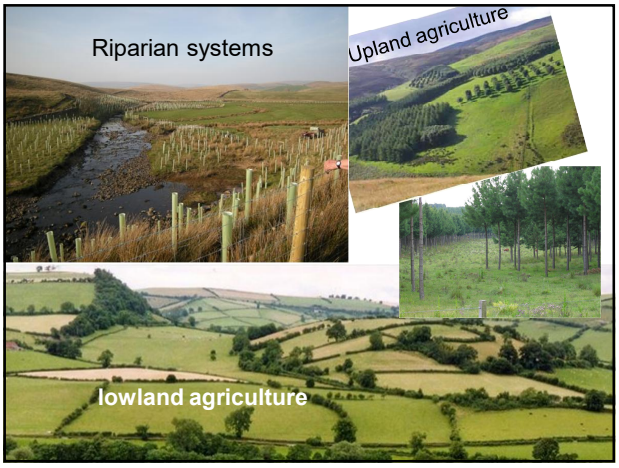
Leaf nutrition in tree species compared to hay and red clover (%)

Tree species	moisture	Ash	Fat	Sugar	Protein	Fibre
Wych elm	12.6	9.9	2.9	49.2	13.2	12.3
Rowan	11.9	5.9	6.5	50.4	9.9	15.4
Goat willow	11.5	6.1	3.8	50.3	11.6	16.7
Aspen	10.8	8.5	6	43.5	13.3	20.9
Ash	11.6	6.3	3	50.4	12	16.7
Grey alder	11.9	3.9	5.9	43.6	17.6	17.4
Birch	11.7	3.9	7	49.2	12	16.2
meadow hay	*14.96*	*5.42*	*2.2*	*44.43*	*8.51*	*24.56*
red clover	*15.65*	*5.17*	*1.88*	*36.76*	*10.98*	*28.56*

Birks et al 1989

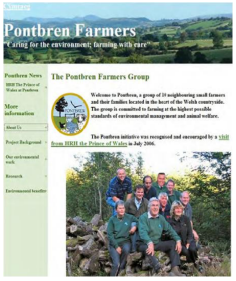






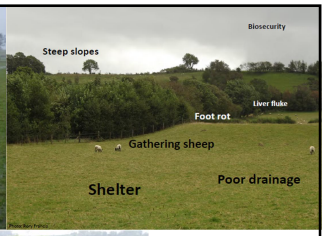
Catchment scale

Pontbren example



During the 19th and 20th centuries landscapes had become simplified

Overland flow was a significant runoff path



Intensive monitoring between 2004 - 2011

'Woodland' increased from 1.5% to 5%

Water infiltration in shelter belts was 60 times that of neighbouring grassland

Livestock excluded from streams

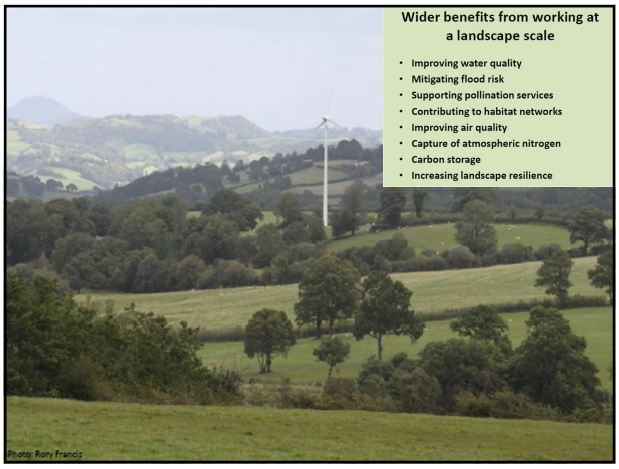
- Vegetation has recovered
- Bank erosion has been reduced
- Stream morphology has recovered
- Riffles and pools important for spawning fish and other wildlife have reformed

Wider implication for water

- Peak stream flows reduced by 40%
- The 2007 floods cost around £3 billion in insurance
- Welsh government expect to spend £135m pa on flood defenses by 2035
- Agroforestry represents a costs effective way to reduce risk.

Business benefits

- Increase in farm net income
- Improved efficiency of livestock enterprises
- Future proofing
- Reducing the risk of water pollution and biosecurity



Converting woodlands to woodland grazing ?

Opportunities for improved land and economic output ?

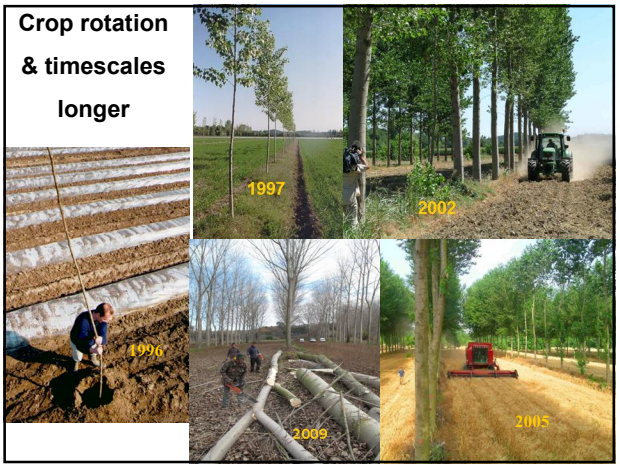
Upland systems

Agroforestry plots at Glensaugh

Poultry

Silvo-arable : crops & trees

Crop rotation & timescales longer



Markets

Policy

EU policy

- Agroforestry eligible under new CAP
  - Greening measures
  - Ecological Focus Area (EFA) option
- Article 23 Pillar II funding (*5yr plant & Maintenance*)

UK structural & policy challenges

- Land tenure – in England
  - Ownership (68%) vs Tenancy (32%)
  - New shared ownership models may be needed
- Separate Forest & Agriculture policies

Forestry Commission

defra
Department for Environment Food and Rural Affairs

Forestry Commission	**England**	defra
Cyfoeth Naturiol Cymru Natural Resources Wales	**Wales**	Llywodraeth Cymru Welsh Government
Forestry Commission Scotland	**Scotland**	The Scottish Government Riaghaltas na h-Alba
FOREST SERVICE	**Northern Ireland**	Department of Agriculture and Rural Development

UK structural & policy challenges

- Environmental schemes

NATURAL ENGLAND Glastir The Scottish Government Riaghaltas na h-Alba Department of Agriculture and Rural Development

Conservatives Labour

EURAF European Agroforestry Federation

- EURAF www.agroforestry.eu/
- AGFORWARD www.agforward.eu/
- AGROFE www.agrofe.eu

Agroforestry = 'Ecological' intensification

Summary ;

- Use what is already there better…….
- Improved resource capture and use
- Profitability equal to or greater than monoculture
- Soil and environment protection
- Enhanced biodiversity
- Crops/animals maintain annual income -Trees provide long term income & capital asset Improved resource use
- Policy developments required

For construction….

There was a '*breakthrough*' moment

I believe that agroforestry is a '*climate smart*' *breakthrough* for agriculture

Farmers should adopt agroforestry on at least 20% of their land

Agroforestry is one of the few options with the potential to help reduce greenhouse gas emissions, help protect natural resources whilst at the <u>same time</u> producing more food and biomass

Trees will grow in most places !