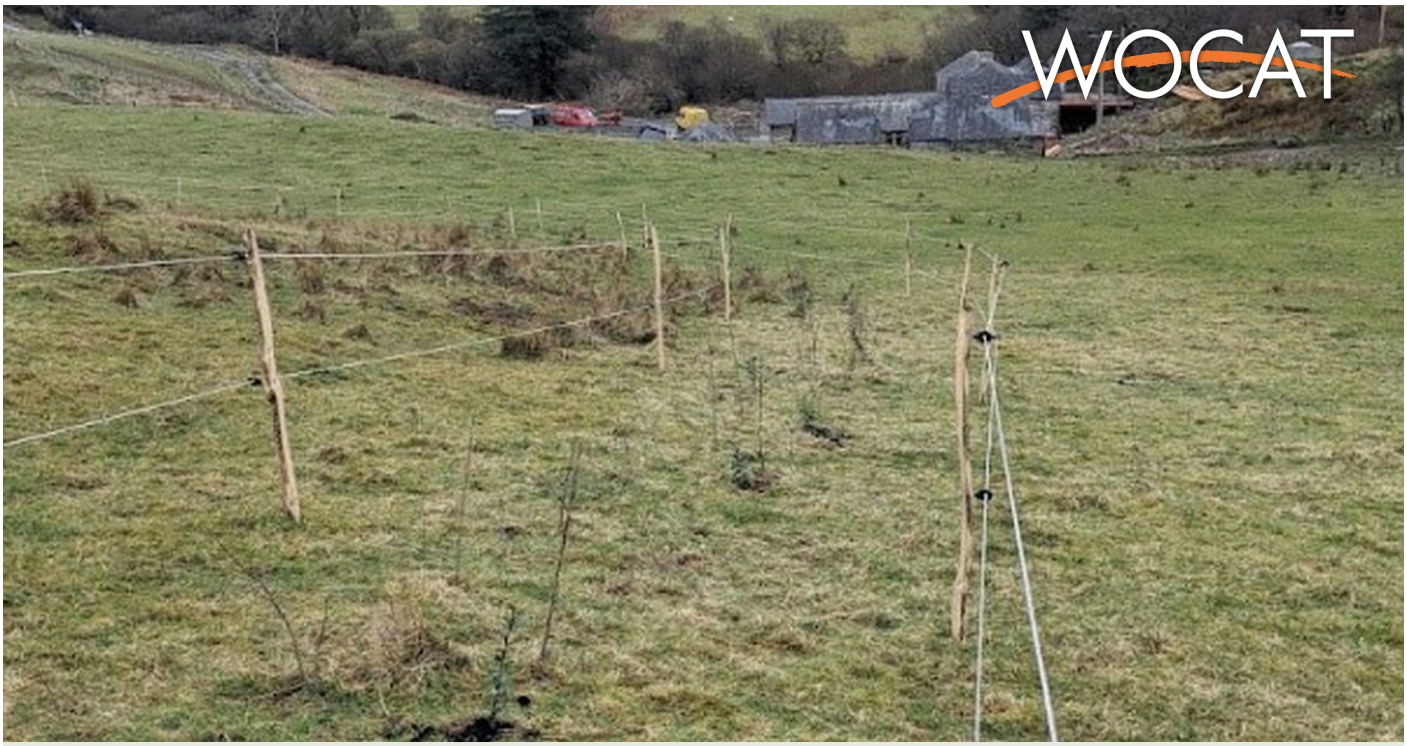


Year 1 – Newly planted trees (Joe Hope)

Silvopastoral Agroforestry with Cattle (United Kingdom)

DESCRIPTION

A mixture of silvopastoral agroforestry approaches, including extensive and rotational cattle grazing around trees, provide benefits for biodiversity as well as leaf fodder for cattle, edible fruits and nuts, and wood fuel.

A first generation farmer with a mixed 36 hectare farm has been exploring the establishment of a regenerative silvopastoral agroforestry system.

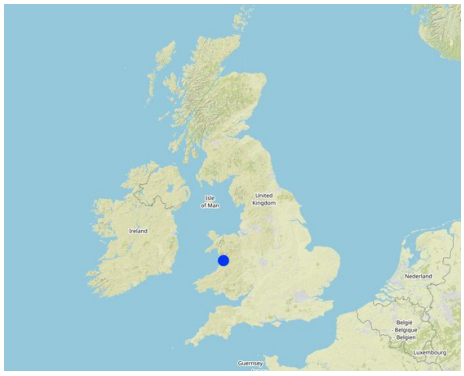
Under this system the farm has been divided into four zones:
1. Cae mawr- 4.3 ha field. Formerly semi-improved permanent pasture with occasional scattered trees. The field has been divided with hedges into 8 rotational grazing units for Highland and Welsh White cattle. Hedges are of mixed edible fruit and nut varieties. The more distant hedges are composed of mixed native species.
2. Cae Ceirch – 5.4 ha field. Semi-improved permanent pasture with scattered trees and gorse bush. New planting of native species amongst the gorse, creating enclosures by planting native trees at a variety of densities. Electric fences have installed for protection and will be removed once the trees are large enough to withstand browsing. Additionally, field trees are being planted and protected with "cactus tree guards" (tubular sleeves of wire mesh with outer spikes).
3. Lower slopes - 3 ha area. Old pasture which has been grazed exceptionally lightly for a number of years. Allowing native trees, mostly birch, willow and hazel to naturally regenerate. Bracken and bramble have been controlled by pigs with the aim of rehabilitating towards a silvopastoral system. Some thinning of trees will be undertaken in places to achieve that end.
4. Riparian woodland - 1 ha area. Occasionally grazed by cattle on an "as needed" (ad hoc) basis.

The system aims to produce high quality nutrient-dense food, with the highest animal welfare, whilst simultaneously providing maximum biodiversity benefits.

New tree planting is protected by electric fencing comprising chestnut posts with ring insulators and poly wire, with cactus tree guards for individual trees.

The benefits include shelter and shade for animals, with increased diversity of forage. In time there will be a harvest of edible products for human consumption (fruits and nuts etc). And the system provides a variety of biodiversity benefits as well as a visual - aesthetic - improvement to the landscape.

LOCATION



Location: Machynlleth, Wales, United Kingdom

No. of Technology sites analysed: single site

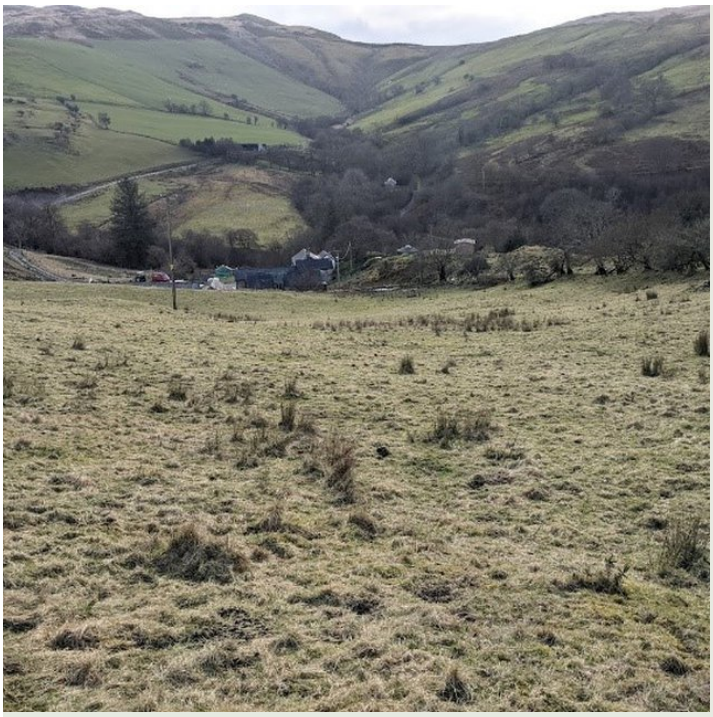
Geo-reference of selected sites
- -3.86207, 52.56096

Spread of the Technology: applied at specific points/ concentrated on a small area

In a permanently protected area?: No

Date of implementation: 2018

Type of introduction
- [x] through land users' innovation
- [ ] as part of a traditional system (> 50 years)
- [ ] during experiments/ research
- [ ] through projects/ external interventions



Field before planting (Joe Hope)

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- [x] improve production
- [ ] reduce, prevent, restore land degradation
- [x] conserve ecosystem
- [ ] protect a watershed/ downstream areas – in combination with other Technologies
- [x] preserve/ improve biodiversity
- [ ] reduce risk of disasters
- [x] adapt to climate change/ extremes and its impacts
- [ ] mitigate climate change and its impacts
- [ ] create beneficial economic impact
- [ ] create beneficial social impact
- [x] Improve animal welfare

Land use

Land use mixed within the same land unit: Yes - Agro-silvopastoralism

Grazing land

- Improved pastures

Animal type: cattle - non-dairy beef
Is integrated crop-livestock management practiced? No
Products and services: meat

Species	Count
cattle - non-dairy beef	15
swine	5

Forest/ woodlands

- Tree plantation, afforestation: temperate continental forest plantation. Varieties: Mixed varieties

Tree types (deciduous): n.a.
Products and services: Fuelwood, Fruits and nuts, Grazing/ browsing, Nature conservation/ protection, Recreation/ tourism

Water supply

- [x] rainfed
- [ ] mixed rainfed-irrigated
- [ ] full irrigation

Purpose related to land degradation

- [ ] prevent land degradation
- [ ] reduce land degradation
- [x] restore/ rehabilitate severely degraded land
- [ ] adapt to land degradation
- [ ] not applicable

Degradation addressed

soil erosion by water - Wt: loss of topsoil/ surface erosion

biological degradation - Bc: reduction of vegetation cover, Bh: loss of habitats

SLM group

- agroforestry
- windbreak/ shelterbelt
- pastoralism and grazing land management

SLM measures

vegetative measures - V1: Tree and shrub cover

management measures - M1: Change of land use type, M2: Change of management/ intensity level

TECHNICAL DRAWING

Technical specifications

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated: per Technology area (size and area unit: **40 hectares**; conversion factor to one hectare: **1 ha = 1 ha = 2.47 acres**)
- Currency used for cost calculation: **£GBP**
- Exchange rate (to USD): 1 USD = 0.85 £GBP
- Average wage cost of hired labour per day: £150

Most important factors affecting the costs

The cost of trees, establishment (i.e. planting & replacing trees) and fencing

Establishment activities

1. Ground preparation – marking out planting lines (Timing/ frequency: Winter)
2. Planting trees (Timing/ frequency: Winter)
3. Erecting electric fencing (Timing/ frequency: Winter)

Total establishment costs (estimation)

8000.0

Maintenance activities

1. Checking trees visually (Timing/ frequency: Ongoing - monthly)
2. Vegetation maintaince via mowing (Timing/ frequency: Once a year in late summer)
3. Management of rotational mob grazing (Timing/ frequency: Ongoing during grazing season - daily)
4. Checking electric fences (Timing/ frequency: Ongoing - weekly)

Maintenance inputs and costs (per 40 hectares)

Specify input	Unit	Quantity	Costs per Unit (£GBP)	Total costs per input (£GBP)	% of costs borne by land users
Labour					
Checking trees & electric fences	Hours	24.0	10.0	240.0	100.0
Vegetation maintance	Hours	30.0	10.0	300.0	100.0
Management of rotational grazing pastures	Hours	100.0	10.0	1000.0	100.0
Equipment					
Flail mower attachment to tractor / strimmer	unit	1.0			100.0
Total costs for maintenance of the Technology				**1'540.0**	
Total costs for maintenance of the Technology in USD				*1'811.76*	

NATURAL ENVIRONMENT

Average annual rainfall

- ☐ < 250 mm
- ☐ 251-500 mm
- ☐ 501-750 mm
- ☐ 751-1,000 mm
- ☑ 1,001-1,500 mm
- ☐ 1,501-2,000 mm
- ☐ 2,001-3,000 mm
- ☐ 3,001-4,000 mm
- ☐ > 4,000 mm

Agro-climatic zone

- ☑ humid
- ☐ sub-humid
- ☐ semi-arid
- ☐ arid

Specifications on climate

n.a.

Slope

- ☐ flat (0-2%)
- ☐ gentle (3-5%)
- ☐ moderate (6-10%)
- ☐ rolling (11-15%)
- ☑ hilly (16-30%)
- ☐ steep (31-60%)
- ☐ very steep (>60%)

Landforms

- ☐ plateau/plains
- ☐ ridges
- ☐ mountain slopes
- ☑ hill slopes
- ☐ footslopes
- ☐ valley floors

Altitude

- ☐ 0-100 m a.s.l.
- ☑ 101-500 m a.s.l.
- ☐ 501-1,000 m a.s.l.
- ☐ 1,001-1,500 m a.s.l.
- ☐ 1,501-2,000 m a.s.l.
- ☐ 2,001-2,500 m a.s.l.
- ☐ 2,501-3,000 m a.s.l.
- ☐ 3,001-4,000 m a.s.l.
- ☐ > 4,000 m a.s.l.

Technology is applied in

- ☐ convex situations
- ☐ concave situations
- ☑ not relevant

Soil depth

- ☑ very shallow (0-20 cm)
- ☑ shallow (21-50 cm)
- ☐ moderately deep (51-80 cm)
- ☐ deep (81-120 cm)
- ☐ very deep (> 120 cm)

Soil texture (topsoil)

- ☐ coarse/ light (sandy)
- ☑ medium (loamy, silty)
- ☐ fine/ heavy (clay)

Soil texture (> 20 cm below surface)

- ☐ coarse/ light (sandy)
- ☑ medium (loamy, silty)
- ☐ fine/ heavy (clay)

Topsoil organic matter content

- ☑ high (>3%)
- ☐ medium (1-3%)
- ☐ low (<1%)

Groundwater table

- ☐ on surface
- ☑ < 5 m
- ☐ 5-50 m
- ☐ > 50 m

Availability of surface water

- ☐ excess
- ☑ good
- ☐ medium
- ☐ poor/ none

Water quality (untreated)

- ☐ good drinking water
- ☑ poor drinking water (treatment required)
- ☐ for agricultural use only (irrigation)
- ☐ unusable

Water quality refers to: ground water

Is salinity a problem?

- ☐ Yes
- ☑ No

Occurrence of flooding

- ☐ Yes
- ☑ No

Species diversity
- [ ] high
- [x] medium
- [ ] low

Habitat diversity
- [ ] high
- [x] medium
- [ ] low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
- [ ] subsistence (self-supply)
- [x] mixed (subsistence/ commercial)
- [ ] commercial/ market

Off-farm income
- [ ] less than 10% of all income
- [ ] 10-50% of all income
- [x] > 50% of all income

Relative level of wealth
- [ ] very poor
- [ ] poor
- [x] average
- [ ] rich
- [ ] very rich

Level of mechanization
- [ ] manual work
- [ ] animal traction
- [x] mechanized/ motorized

Sedentary or nomadic
- [x] Sedentary
- [ ] Semi-nomadic
- [ ] Nomadic

Individuals or groups
- [x] individual/ household
- [ ] groups/ community
- [ ] cooperative
- [ ] employee (company, government)

Gender
- [ ] women
- [x] men

Age
- [ ] children
- [ ] youth
- [x] middle-aged
- [ ] elderly

Area used per household
- [ ] < 0.5 ha
- [ ] 0.5-1 ha
- [ ] 1-2 ha
- [ ] 2-5 ha
- [ ] 5-15 ha
- [x] 15-50 ha
- [ ] 50-100 ha
- [ ] 100-500 ha
- [ ] 500-1,000 ha
- [ ] 1,000-10,000 ha
- [ ] > 10,000 ha

Scale
- [x] small-scale
- [ ] medium-scale
- [ ] large-scale

Land ownership
- [ ] state
- [ ] company
- [ ] communal/ village
- [ ] group
- [x] individual, not titled
- [ ] individual, titled

Land use rights
- [ ] open access (unorganized)
- [ ] communal (organized)
- [ ] leased
- [x] individual

Water use rights
- [ ] open access (unorganized)
- [ ] communal (organized)
- [ ] leased
- [x] individual

Access to services and infrastructure

health	poor	good
education	poor	good
technical assistance	poor	good
employment (e.g. off-farm)	poor	good
markets	poor	good
energy	poor	good
roads and transport	poor	good
drinking water and sanitation	poor	good
financial services	poor	good

IMPACTS

Socio-economic impacts

fodder production	decreased / increased	Increased diversity with new tree forage available
animal production	decreased / increased	Improved welfare for cattle as trees provide shelter.
forest/ woodland quality	decreased / increased	Increased forest areas, diversity and connectivity
product diversity	decreased / increased	Trees provide wood fuel, fruit and nuts, alongside possible future option for recreation and tourism opportunities
diversity of income sources	decreased / increased	Trees provide wood fuel, fruit and nuts, alongside possible future option for recreation and tourism opportunities
workload	increased / decreased	Time for installation and management is higher than previous

Socio-cultural impacts

Aesthetic appeal of landscape - i.e. landscape looks better	decreased / increased	More trees in the fields and flowering hedgerows etc

Ecological impacts

soil organic matter/ below ground C	decreased / increased	Trees as stores of carbon and improved soil health

biomass/ above ground C — decreased — increased — Addition of above ground biomass in trees and hedgerows

plant diversity — decreased — increased — More diversity of productive and native trees and hedges

habitat diversity — decreased — increased — More space for biodiversity

Off-site impacts

COST-BENEFIT ANALYSIS

Benefits compared with establishment costs

Short-term returns — very negative — very positive

Long-term returns — very negative — very positive

Benefits compared with maintenance costs

Short-term returns — very negative — very positive

Long-term returns — very negative — very positive

CLIMATE CHANGE

Gradual climate change

annual temperature increase — not well at all — very well

ADOPTION AND ADAPTATION

Percentage of land users in the area who have adopted the Technology

- [x] single cases/ experimental
- [ ] 1-10%
- [ ] 11-50%
- [ ] > 50%

Of all those who have adopted the Technology, how many have done so without receiving material incentives?

- [ ] 0-10%
- [ ] 11-50%
- [ ] 51-90%
- [x] 91-100%

Has the Technology been modified recently to adapt to changing conditions?

- [ ] Yes
- [x] No

To which changing conditions?

- [ ] climatic change/ extremes
- [ ] changing markets
- [ ] labour availability (e.g. due to migration)

CONCLUSIONS AND LESSONS LEARNT

Strengths: land user's view

- Offers the opportunity to radically increase the biodiversity potential of the farm
- Shelter belts improve animal welfare
- Productivity increases with diversification of products and co-benefits.

Strengths: compiler's or other key resource person's view

- A whole system approach promotes co-benefits of the farm improving animal welfare, biodiversity and diversification and thus resilience of the farm business.

Weaknesses/ disadvantages/ risks: land user's viewhow to overcome

- High set up costs Careful choice of tree protection mechanism and seeking grant assistance

Weaknesses/ disadvantages/ risks: compiler's or other key resource person's viewhow to overcome

- The system can be expensive to implement for little return in short-term Grant assistance
- Approach takes time to implement (i.e. trees to grow) before full benefits are seen, and management during this time in particular is higher than traditional methods Long-term farm planning and seek guidance for the most effective implementation techniques to ensure best chance of success

REFERENCES

Compiler
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Editors

Reviewer
William Critchley
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Resource persons
Karen Fisher - co-compiler
Joe Hope - land user

Full description in the WOCAT database
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6347/

Linked SLM data
n.a.

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