Cows with young Perry pear trees. (Ben Raskin)

Silvopastoral Agroforestry – Perry pears and timber with mob grazed young dairy stock (United Kingdom)

Silvopastoral Agroforestry – Perry pears and timber with mob grazed young dairy stock

DESCRIPTION

Silvopastoral Agroforestry in a natural farmed environment – This is an alley cropping system with rows of Perry pears and timber trees inter-planted with coppiced willow and alder. The pasture in between the rows is mob grazed with young dairy stock.

Background: The agroforestry system is part of a mixed farm of 630 hectares. 550 hectares are rented on a three generation tenancy. The farmer is the second generation. The trees are planted on the 80 hectares owned by the farmer. The annual rainfall for the region is approximatly 630mm per year with a typical temperate UK climate. The soil is heavy clay on a flat landscape.

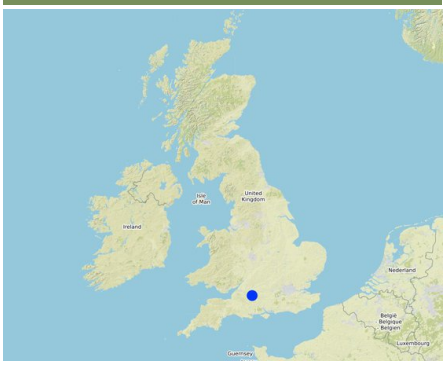
The system: The field is 19 hectares. The trees are planted in rows which are 27 m apart. There is a main species in each row, planted at 10 m spacing. These are inter-planted with smaller trees, or species that will be coppiced/pollarded to maintain a small form. The main species are: Perry pear (a small pear that is a cross between Pyrus communis and its wild subsp. pyraster – used to make the alcoholic drink "Perry"). We have also some species planted for timber Quercus robur, Sorbus torminalis, Carpinus betula, Prunus avium. The inter-plant species are Salix various sp., Alnus glutinosa. These will be used either for animal fodder or for chipping and used as a mulch or for spreading on the land as soil health improver. There are also some Hippophae rhamnoides for human consumption. The alleys between the rows of trees are grazed by young dairy stock on a mob grazing rotational basis.

Aims: The aim is to improve soil and drainage in the field which is heavy clay. We hope to improve productivity but also have designed the system that we can grow crops in the future if we wanted to. The trees will also provide benefit to the cows through shelter and shade, and the inter-plants of willow and alder grow through diverse forage.

Tree protection: Fencing was our major challenge. There needed to be protection from the livestock but also from wildlife (in particular deer and hares). Our initial trial used individual guards and stakes but we have since fenced each side of each row with a single strand of electric fencing. This is working well.

Benefits: This is newly planted but already we are seeing improvement in the grass ley through our rotational grazing. Water quality into the nearby stream and infiltration improved and flooding should also improve. We have seen an immediate increase in wildlife with greater numbers of hares, raptors (including kestrels, red kites and buzzards), and butterflies. The farm manager likes the ability to mob graze, although the system was complicated to set up. It is too early to comment on further benefits at this stage.

LOCATION



Location: Wiltshire, South West, United Kingdom

No. of Technology sites analysed: single site

Geo-reference of selected sites
- -1.97754, 51.31708
- -1.97754, 51.31708

Spread of the Technology: evenly spread over an area (0.19 km²)

In a permanently protected area?: No

Date of implementation: 2017

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. (Ben Raskin)

Year 1 with trees before grazing. (Ben Raskin)

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

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

Land use

Land use mixed within the same land unit: Yes - Silvo-pastoralism

Grazing land

- Improved pastures

Animal type: cattle - dairy and beef (e.g. zebu)
Is integrated crop-livestock management practiced? Yes
Products and services: meat, milk

Species	Count
cattle - dairy and beef (e.g. zebu)	100

Forest/ woodlands

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

Tree types (deciduous): n.a.
Products and services: Timber, Fruits and nuts

Water supply

- ✓ rainfed
- mixed rainfed-irrigated
- full irrigation

Purpose related to land degradation

- prevent land degradation
- ✓ reduce land degradation
- restore/ rehabilitate severely degraded land
- adapt to land degradation
- not applicable

Degradation addressed

chemical soil deterioration - Cn: fertility decline and reduced organic matter content (not caused by erosion

physical soil deterioration - Pw: waterlogging

SLM group

- agroforestry
- integrated crop-livestock management

SLM measures

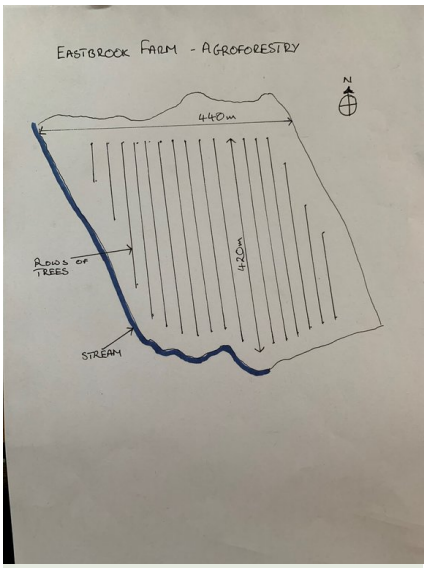
vegetative measures - V1: Tree and shrub cover

management measures - M2: Change of management/ intensity level

TECHNICAL DRAWING

Technical specifications

The field has an area of 19 hectares with north to south rows of trees of up to 420m length and across a 440m field. The field is adjacent to stream and has no slope. The trees are planted in rows with a within row spacing of 10 m and between row spacing of 27 m . The main species planted is perry pear



Author: Ben Raskin

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs
- Costs are calculated: per Technology area (size and area unit: **19 hectares**; conversion factor to one hectare: **1 ha = 1 ha = 2.47 acres**)
- Currency used for cost calculation: **British pound**
- Exchange rate (to USD): 1 USD = 0.73 British pound
- Average wage cost of hired labour per day: Approx. £150

Most important factors affecting the costs
Type of tree, type of fencing and weather related impacts.

Establishment activities
1. Trench dug with tillage machinery to plant each row of trees (Timing/ frequency: Autumn)
2. Tree standards (bought from tree nursery) planted by hand in trench spaces 2m apart (Timing/ frequency: Winter)
3. Fencing installed by hand as single strand electric along either side of each row of trees (Timing/ frequency: Spring)
4. Mulch added to base of trees using tractor to surpress weeds, provide fertiliser and keep moisture in soil (Timing/ frequency: Spring)

Total establishment costs (estimation)
14500.0

Maintenance activities
1. Mulching each year at base of trees (Timing/ frequency: Yearly (first 3 years))
2. Strimming grass and weeds between trees where livestock are exluded from area by fencing (Timing/ frequency: Yearly (first 5 years))
3. Light pruning or training by hand where required (Timing/ frequency: Yearly (first 5 years))

Total maintenance costs (estimation)
1500.0

NATURAL ENVIRONMENT

Average annual rainfall
- [ ] < 250 mm
- [ ] 251-500 mm
- [x] 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
- [x] semi-arid
- [ ] arid

Specifications on climate
n.a.

Slope
- [x] 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
- [x] valley floors

Altitude
- [x] 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
- [x] not relevant

Soil depth
- [ ] very shallow (0-20 cm)

Soil texture (topsoil)
- [ ] coarse/ light (sandy)

Soil texture (> 20 cm below surface)

Topsoil organic matter content
- [x] high (>3%)

- [ ] shallow (21-50 cm)
- [ ] moderately deep (51-80 cm)
- [x] deep (81-120 cm)
- [ ] very deep (> 120 cm)

- [ ] medium (loamy, silty)
- [x] fine/ heavy (clay)

- [ ] coarse/ light (sandy)
- [ ] medium (loamy, silty)
- [x] fine/ heavy (clay)

- [ ] medium (1-3%)
- [ ] low (<1%)

Groundwater table
- [ ] on surface
- [x] < 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
- [x] No

Occurrence of flooding
- [x] 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
- [x] less than 10% of all income
- [ ] 10-50% of all income
- [ ] > 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
- [x] 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
- [ ] 15-50 ha
- [ ] 50-100 ha
- [ ] 100-500 ha
- [x] 500-1,000 ha
- [ ] 1,000-10,000 ha
- [ ] > 10,000 ha

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

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

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

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

product diversity — decreased ✓ increased

Slight improvement in productivity of grassland due to rotational grazing between the trees.

Currently still too early for full pear harvest, yet in time the return with product diversification will be of great benefit to farm diversification and sustainability.

Socio-cultural impacts

recreational opportunities — reduced ✓ improved

Visitors coming to learn about Agroforestry has provided an opportunity to engage the interested general public and share knowledge.

Ecological impacts

flood impacts — increased ✓ decreased

Slight reduction in standing water during periods of high rainfall

Off-site impacts

COST-BENEFIT ANALYSIS

Benefits compared with establishment costs
Short-term returns: very negative ✓ very positive

Benefits compared with maintenance costs
Short-term returns: very negative ✓ very positive

Technology very recently implemented so cost-benefit is still unknown. Currnetly not viewed negitivly, yet benefits are still to be understood.

CLIMATE CHANGE

Gradual climate change
seasonal temperature increase: not well at all ✓ very well — Season: summer
seasonal rainfall increase: not well at all ✓ very well — Season: summer

ADOPTION AND ADAPTATION

Percentage of land users in the area who have adopted the Technology
- ✓ 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%
- ✓ 91-100%

Has the Technology been modified recently to adapt to changing conditions?
- Yes
- ✓ 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
- Change in grazing regime from large pasture to rotational grazing between tree lines has additional benefits for improved pasture and animal wealfare with less requirement to worm using antibiotics.
- Initial observations of improved water infiltration due to better infiltration by trees rooting system

Strengths: compiler's or other key resource person's view
- Future opportunity of land and business diversification
- Increase in biodiversity evident already and would expect further improvements.

Weaknesses/ disadvantages/ risks: land user's view → how to overcome
- Tree loss due to weather extremes (i.e. loss of young tree stock in 2018 summer drought) → Mulching, irrigation, earlier planting, improved placement of tree stock on edge of sub-soil slot where less soil drying occurs compared to centre of slot.
- Perenial weed control poor using just wood chip mulch → Increased strimming management of the growth around trees where livestock cannot reach due to fencing.
- Time investment against other commitments (i.e. priority of broader farm systems when attention to new technology is required) → Forward planning and improved communcation between the farm team is vital to ensure a sufficient amount of time is provided for attending to and learning about a new technology.

Weaknesses/ disadvantages/ risks: compiler's or other key resource person's view → how to overcome
- Overall costs against short-term return → Secure funding to enable longer-term return.

REFERENCES

Compiler
Alan Radbourne

Reviewer
Rima Mekdaschi Studer
Ursula Gaemperli

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Resource persons
Ben Raskin - SLM specialist
Helen Browning - land user

Full description in the WOCAT database
https://qcat.wocat.net/en/wocat/technologies/view/technologies_5186/

Linked SLM data
n.a.

Documentation was faciliated by
Institution
- n.a.

Project
- European Interreg project FABulous Farmers