

Trees and woodland in the farmed landscape

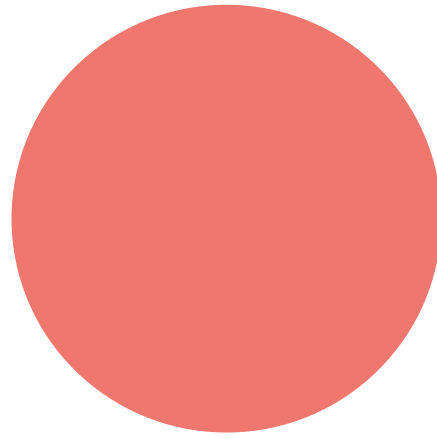
Modelling an agroforestry & farm woodland economy

Clive Thomas

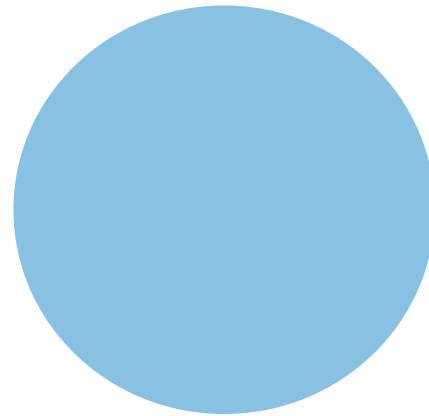
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The context



**Beyond the public policy case
– what is the macroeconomic
case?**



**Building on the principles of
whole system and integration
in our Regenerative forestry
report – where we scope in
the integration of trees and
woodlands into farming
systems as regenerative
forestry systems**



**Regenerative
forestry**

Forestry and forests for the future

Main report and country summaries

Woodland and trees in
the farmed landscape:
Towards a diverse, resilient and
vibrant farm woodland and
agroforestry economy for the UK
Report for
Soil Association
April 2022

Cumulus



Trees and woodland in the farmed landscape:

A farmer led approach towards a diverse,
resilient and vibrant agroforestry and
farm woodland economy for England



Trees and woodland in the farmed landscape:

A farmer-led approach towards a diverse,
resilient and vibrant agroforestry and
farm woodland economy for Scotland



Wales
next...



The case for an agroforestry and integrated farm woodland economy – Stage 1

Co-benefits -
climate -
nature -
health

Opportunities -
Performance,
diversification
& resilience

Barriers –
evidence,
knowledge,
cultural

Viability &
achievability



The model – Stage 2 – core components

- The Evidence base
- Land use change assumptions
- Financial data
- Agroforestry & farm woodland systems
- Optional parameters



The Evidence base

Current performance for the 6 farm types used in the model from the various Agricultural Surveys and Farm Business Surveys that are undertaken across England, Scotland, Wales, and Northern Ireland.

- Poultry (free range)
- Horticulture
- Cereals
- Dairy
- Lowland grazing
- LFA grazing

The performance impact of AFW on agricultural performance included in the model is based on peer reviewed literature.

Where possible, data was extracted from studies that took place within the UK and focused on a specific farm type. Where this was not possible, studies from areas with similar climatic conditions were used and the performance impacts were applied to the UK context.





Land use change assumptions

- Land use change in the model relates to a change in area of any type of AFW rather than a change in canopy cover or number of trees.
- This is so that we can make direct comparisons between the land use changes.
- This means that actual tree numbers for each scenario will differ. e.g. coniferous farm woodland comprises the highest density tree planting, whilst silvopastoral planting has a far lower density.

Financial Data

- Income & expenditure budgets are included for each system with a 25 year timeframe.
- Fixed costs were excluded from these budgets and therefore the model. This is because these costs remain largely unchanged for each system and farm type.
- Capital expenditure required to establish each of the AFW systems was included in the budgets. It was divided over the 25-year period that was modelled. Including this cost helps to predict the investment necessary to transition to increased AFW planting across the farm types.
- Income from production (timber etc.) was based on standard rotations and then divided over the 25-year period
- Basic Payment Scheme and agri-environment scheme payments (incl. income foregone) have been excluded from the baseline scenario.





Agroforestry & Farm woodland systems

The systems that have been modelled have been defined based on the reviewed literature and case studies for the UK context. Although well validated, they are generalised depictions of how the various forms of AFW would be integrated into UK farm types.

1. Silvopasture/Silvoarable orchards (fruit)
2. Silvopasture /Silvoarable (timber)
3. Silvopasture (shelter/shade only)
4. Shelterbelts
5. Farm woodland
 - Conifer
 - Broadleaved
 - Mixed

Optional model parameters

- Existing policy payments – if selected the model will draw from the best attempt to include the current public payment for the different systems - in the different administrations
- Income foregone – this option can be selected
- Private payments - carbon – yield models are used to provide an indicate figure for tonnes CO² sequestered. A carbon payment/tonne can be included as a variable.

Also the yield models are used to provide indicative figures for biomass for SA/SP timber and farm woodland systems .



The Model – High-level dashboard

Select the scenario that you wish to model

Creating the Custom scenario

Select the type of RPI you wish to apply to each farm type

Select the X of Change in net income per ha with policy

Select the X of Change in net income per ha with policy

Create:

Horizontal: 100X

Diagonal: 100X

LFA grazing: 100X

Lowland grazing: 100X

Pooling: 100X

Select the level of payment for public goods and performance impact of RPI

SRP Orchard: No support

SRP Timber production: No support

Silvopastoral: No support

Skilled skills: No support

Farm woodland: No support

Carbon prior 6/10/20: 60

Impact of agriculture and farm woodland on agricultural performance: Moderate

High level table presenting findings here

Scenario	Net income	Additional income generated by trees (€CS)	Additional net income generated by trees (€CS)
Baseline	6596,252,326		
SRP Orchard	6548,428,558		425,288
SRP Timber production	6555,581,478	2,357,385	768,258
Silvopastoral	6542,611,188	21,685	265,258
Skilled skills	6538,945,855		378,455.58
Farm woodland (unified)	6492,432,914	7,372,588	3,589,228
Farm woodland (unified)	6598,845,535	5,185,888	5,515,888
Custom	6519,153,247	688,858	587,478

Composition and performance of the UK agricultural sector

RPI Scenario			All Farm Types				Cereals				Horticultural				Dairy				LFA grazing				Lowland grazing				Pooling			
			Total Area of Agriculture	Area RPI	X change in RPI	Net Income	Area of cropping cereal	Area RPI	X change in net income per ha	Net Income	Area of horticultural	Area RPI	X change in net income per ha	Net Income	Area of dairy	Area RPI	X change in net income per ha	Net Income	Area of LFA grazing	Area RPI	X change in net income per ha	Net Income	Area of lowland grazing	Area RPI	X change in net income per ha	Net Income	Area of pooling	Area RPI	X change in net income per ha	Net Income
1	Baseline	Click to view baseline	4,375,228	551,588		6596,252,326	463,188	58,114	8X	6554,438,432	-	-	BDIV/81	68	184,722	15,187	8X	642,362,834	3,152,872	341,887	8X	6389,335,398	1,283,335	123,132	8X	632,363,838	-	-	BDIV/81	68
1	Silvopastoral and silvopastoral orchards	Click to view scenario 1	4,375,228	1,862,888	100X	6548,428,558	463,188	188,227	14X	6448,554,353	-	-	BDIV/81	68	184,722	22,375	14X	643,287,378	3,152,872	582,815	14X	6398,539,883	1,283,335	258,385	14X	626,845,553	-	-	BDIV/81	68
2	Silvopastoral and silvopastoral timber production	Click to view scenario 2	4,375,228	1,862,888	100X	6555,581,478	463,188	188,227	14X	6498,568,147	-	-	BDIV/81	68	184,722	22,375	14X	643,587,852	3,152,872	582,815	14X	6344,343,345	1,283,335	258,385	14X	628,476,925	-	-	BDIV/81	68
3	Silvopastoral	Click to view scenario 3	4,375,228	1,862,888	100X	6542,611,188	463,188	58,114	8X	6454,438,432	-	-	BDIV/81	68	184,722	23,533	12X	644,353,338	3,152,872	747,513	12X	6322,257,522	1,283,335	274,834	12X	624,569,757	-	-	BDIV/81	68
4	Skilled skills	Click to view scenario 4	4,375,228	737,258	58X	6538,945,855	463,188	75,478	5X	6452,838,788	-	-	BDIV/81	68	184,722	16,781	5X	643,565,882	3,152,872	511,518	5X	6362,838,334	1,283,335	193,783	5X	633,188,883	-	-	BDIV/81	68
5A	Farm woodland unified	Click to view scenario 5A	4,375,228	1,862,888	100X	6492,432,914	463,188	188,227	14X	638,859,886	-	-	BDIV/81	68	184,722	22,375	14X	625,374,742	3,152,872	582,815	14X	6335,538,582	1,283,335	258,385	14X	-622,272,486	-	-	BDIV/81	68
5B	Farm woodland broadleaf	Click to view scenario 5B	4,375,228	1,862,888	100X	6398,845,535	463,188	188,227	14X	639,269,579	-	-	BDIV/81	68	184,722	22,375	14X	629,282,927	3,152,872	582,815	14X	6278,324,376	1,283,335	258,385	14X	-654,388,444	-	-	BDIV/81	68
5C	Farm woodland mixed	Click to view scenario 5C	4,375,228	1,862,888	100X	6345,829,328	463,188	188,227	14X	637,859,332	-	-	BDIV/81	68	184,722	22,375	14X	622,346,837	3,152,872	582,815	14X	6268,688,364	1,283,335	258,385	14X	-655,829,666	-	-	BDIV/81	68
6	Custom		4,375,228	1,862,888	100X	6519,153,247	463,188	58,114	8X	6454,438,432	-	-	1X	68	184,722	24,468	18X	649,472,364	3,152,872	573,424	28X	6289,466,782	1,283,335	258,126	18X	628,763,818	-	-	4X	68



Scenario	Change in net income compared to baseline	X change in net income	Scenario	Change in net income compared to baseline	X change in net income	Scenario	Change in net income compared to baseline	X change in net income	Scenario	Change in net income compared to baseline	X change in net income	Scenario	Change in net income compared to baseline	X change in net income	Scenario	Change in net income compared to baseline	X change in net income	Scenario	Change in net income compared to baseline	X change in net income	Scenario	Change in net income compared to baseline	X change in net income	Scenario	Change in net income compared to baseline	X change in net income	Scenario	Change in net income compared to baseline	X change in net income
Silvopastoral and silvopastoral orchards	-648,329,645	-8.45	Silvopastoral and silvopastoral orchards	-648,828,573	-7.32	Silvopastoral and silvopastoral orchards	6395,284	8.82	Silvopastoral and silvopastoral orchards	-638,852,187	-8.45	Silvopastoral and silvopastoral orchards	-66,518,274	-24.83	Silvopastoral and silvopastoral orchards			Silvopastoral and silvopastoral orchards			Silvopastoral and silvopastoral orchards			Silvopastoral and silvopastoral orchards			Silvopastoral and silvopastoral orchards		
Silvopastoral and silvopastoral timber production	-645,581,855	-5.33	Silvopastoral and silvopastoral timber production	-642,852,345	-8.53	Silvopastoral and silvopastoral timber production	6545,258	5.33	Silvopastoral and silvopastoral timber production	-624,445,555	-5.33	Silvopastoral and silvopastoral timber production	-64,487,785	-19.52	Silvopastoral and silvopastoral timber production			Silvopastoral and silvopastoral timber production			Silvopastoral and silvopastoral timber production			Silvopastoral and silvopastoral timber production			Silvopastoral and silvopastoral timber production		
Silvopastoral	-654,145,228	-5.12	Silvopastoral	-654,145,228	-5.12	Silvopastoral	65,352,258	3.32	Silvopastoral	-647,138,338	-10.82	Silvopastoral	-68,488,873	-25.52	Silvopastoral			Silvopastoral			Silvopastoral			Silvopastoral			Silvopastoral		
Skilled skills	-655,885,464	-1.82	Skilled skills	-655,885,464	-1.82	Skilled skills	6582,558	5.42	Skilled skills	-67,236,375	-2.82	Skilled skills		8.27	Skilled skills			Skilled skills			Skilled skills			Skilled skills			Skilled skills		
Farm woodland unified	-6164,255,412	-27.33	Farm woodland unified	-6164,255,412	-27.33	Farm woodland unified	-617,538,332	-48.33	Farm woodland unified	-639,855,488	-3.23	Farm woodland unified		-182.73	Farm woodland unified			Farm woodland unified			Farm woodland unified			Farm woodland unified			Farm woodland unified		
Farm woodland broadleaf	-6165,188,787	-14.32	Farm woodland broadleaf	-6165,188,787	-14.32	Farm woodland broadleaf	-619,229,367	-45.32	Farm woodland broadleaf			Farm woodland broadleaf		-26.33	Farm woodland broadleaf			Farm woodland broadleaf			Farm woodland broadleaf			Farm woodland broadleaf			Farm woodland broadleaf		

The Model – Options 1

Select the country that you wish to model:

Scotland

Creating the Custom scenario

	Select the type of AFW you wish to apply to each farm type	of this farm type that you wish to apply it to	Change in net income per ha with policy payments
Cereals:	SA SP timber production	0%	-£257
	SA SP Orchards	1%	-£99
Horticultural:			
Dairy:	SA SP timber production	10%	£49
LFA grazing:	Silvopastoral	20%	-£125
Lowland grazing:	SA SP timber production	10%	-£35
		4%	-£138
Poultry:	Silvopastoral		

The Model – Options 2

Select the level of payment for public goods and performance impact of AFW

	SA SP Orchard	SA SP timber production	Silvopastoral	Shelterbelts	Farm woodland
Agri-env. payment	No support	No support	No support	No support	No support
Carbon price £/tCO ₂	£0	£0	£0	£0	£0
Impact of agroforestry and farm woodland on agricultural performance	Moderate	Moderate	Moderate	Moderate	Moderate


The Model – Outputs

High level table presenting findings here

Scenario	Net income	Additional biomass produced (cu m)	Additional carbon sequestered by trees (tCO2)
Baseline	£596,752,326		
SA SP Orchards	£548,428,660		425,200
SA SP timber production	£555,501,470	2,357,309	760,258
Silvopastoral	£542,611,100	21,685	265,750
Shelterbelts	£590,945,865		370,455.50
Farm woodland (conifer)	£432,492,914	7,972,500	9,503,220
Farm woodland (broadleaf)	£330,843,539	3,189,000	5,315,000
Custom	£513,133,247	608,858	507,170

A mixed agroforestry and farm woodland scenario for England

Farm Type	Total Farm type area (ha.) in England	Area of agroforestry or farm woodland based on %age allocation by farm type					Total farm type allocation (ha.)	Total change in farm type net annual income (£)
		Orchards	Silvoarable/ Silvopasture	Silvopasture (shelter only)	Shelterbelts	Mixed Farm Woodland		
Poultry – free range	11,314			@ 50% = 5657ha.			5,657ha.	+£16,971
Cereals	2,629,637	@1% = 26,296ha.	@1% = 26,296ha.		@1% = 26,296ha.		78,888ha.	-£9,782,112
Dairy	983,542		@5% = 49,177ha.	@10% = 98,354ha.	@1% = 9,835ha.		157,366ha.	+£16,434,905
LFA grazing	1,190,402			@5% = 59,520ha.	@1% = 11,904ha.	@10% = 119,040ha.	190,464ha.	-£53,139,456
Lowland grazing	1,208,771		@5% = 60,438ha.	@5% = 60,438ha.	@1% = 12,087ha.	5% = 60,438ha.	193,401ha.	-£43,853,805
Total	6,023,666 ha.						625,776 ha.	-£90,323,497
Overall woodland and canopy cover area		Total in-field agroforestry canopy area ² = 115,851ha.			Total farm woodland area ³ = 239,600ha.			




A modelled scenario for England

1. Implementation across following farm types: poultry, cereals, dairy, LFA and lowland grazing.
2. Modest allocation of agroforestry and farm woodland systems over next 30 years – mostly 1-5% with 50% silvopasture for free range poultry and 10% mixed woodland for LFA grazing and 10% silvopasture for dairy.
3. In-field agroforestry systems at 30% canopy cover would total 115,000ha. by 2050.
4. Shelterbelts and mixed farm woodland would total 240,000ha. by 2050.
5. The reduction in net farm income from this scale of delivery is modelled at £90 million per annum (capital costs included)

A mixed agroforestry and farm woodland scenario for Scotland

Farm Type	Total Farm type area (ha.) in Scotland	Area of agroforestry or farm woodland based on %age allocation by farm type				Total farm type footprint (ha.)	Total net cost/farm type (£)
		Silvoarable/ Silvopasture	Silvopasture (shelter only)	Shelterbelts	Mixed Farm Woodland		
Cereals	469,100	@1% = 4,691ha.		@1% = 4,691ha.		9,382ha.	
		@ -£1,346,317		@+£126,657			-£1,219,660
Dairy	104,722		@5% =5,236ha.	@1% = 1,047ha.		6,283ha.	
			@+£591,668	@+£113,076			+£704,744
LFA grazing	3,192,072		@5%= 159,603ha.	@1%= 31,920ha.	@5%= 159,603ha.	351,126ha.	
			@-£1,995,045	@-£1,372,560	@-£50,913,357		-£54,280,962
Lowland grazing	1,209,375	@1%= 12,093ha.	@5%= 60,468ha.	@1%= 12,093ha.	5%= 60,468ha.	145,122ha.	
		@-£423,255	@-£3,567,612	@+£36,279	@-£41,481,048		-£45,435,636
Overall woodland and canopy cover area		@30% = 5,035ha.	@30% = 67,592ha.	@100% = 49,751ha.	@100% = 220,071ha.		Total net cost = - £100,023,151
		Total in-field agroforestry canopy area = 72,627ha.		Total farm woodland area ³ = 269,822ha.			



A modelled scenario for Scotland

1. Implementation across following farm types: cereals, dairy, LFA and lowland grazing.
2. Modest allocation of agroforestry and farm woodland systems over next 30 years – just 1% for cereals and 1% or 5% for different systems applied to dairy, lowland grazing and LFA grazing.
3. In-field agroforestry systems at 30% canopy cover would total 72,000ha. by 2050.
4. Shelterbelts and mixed farm woodland would total 270,000ha. by 2050.
5. The change in net farm income from this scale of delivery is modelled at £100 million per annum.



Report recommendations - What else needs to change?

- An integrated approach to farm support and regulation
- Confidence building for farmers
- Innovation that helps to make farm forestry viable

In summary - Key benefits of agroforestry & integrated farm woodland

- Benefit 1: Possibilities for maintained and enhanced food production
- Benefit 2: Increased farm enterprise resilience and diversification opportunities, including natural capital control
- Benefit 3: Co-benefits for climate, nature and people
- Benefit 4: Achievable tree planting in crowded, contested landscapes





Thank you for listening

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