Agroforestry: A land-use system with potential on Irish farms

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Definition

- Agroforestry
  - A dynamic, ecologically based, natural resources management system that, through the integration of trees on farms and in the agricultural landscape, diversifies and sustains production for increased social, economic and environmental benefits for land users at all levels

    (ICRAF, 2002)

- Agroforestry is a new name for old practices

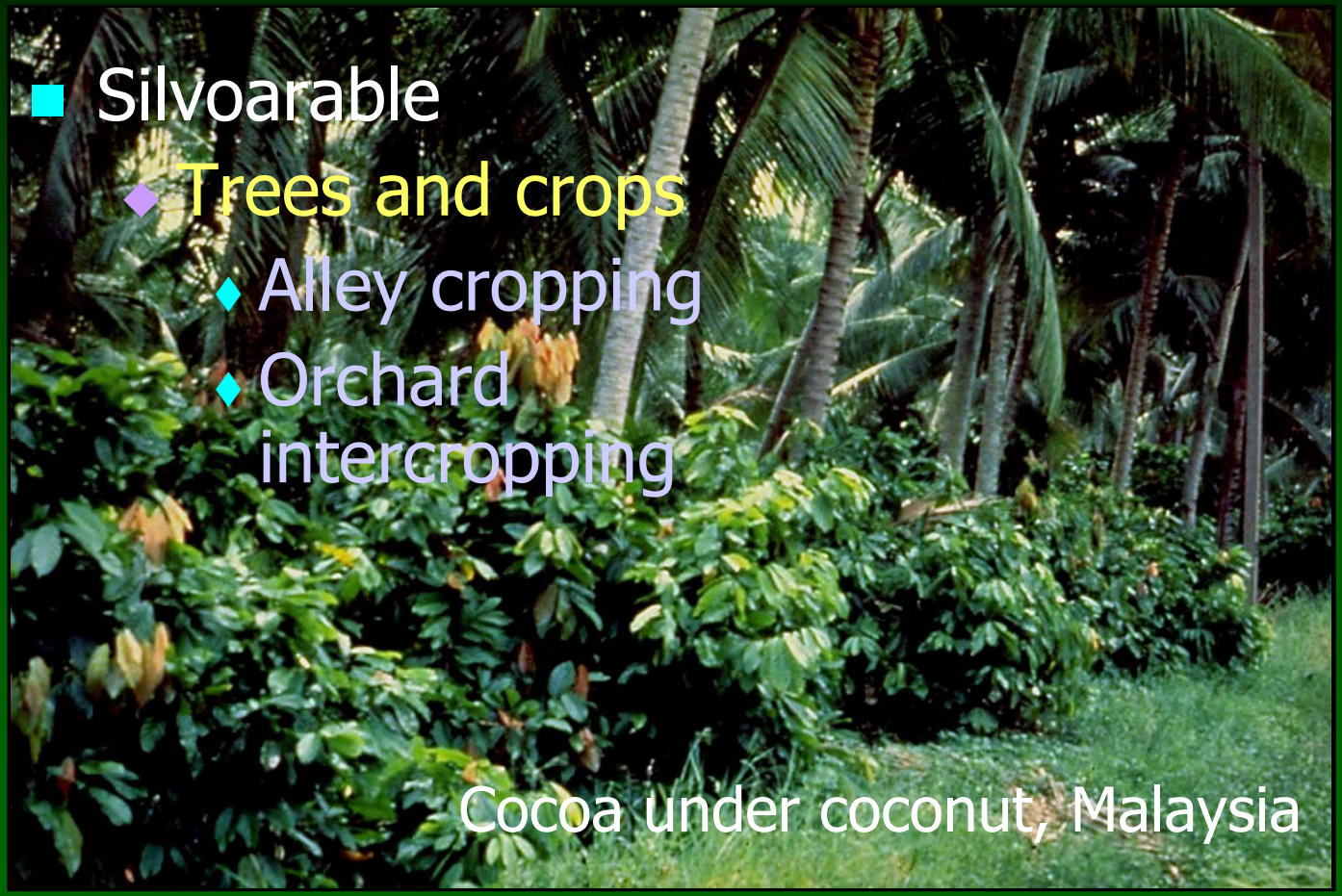
ICRAF (2002). What Is Agroforestry? *http://www.worldagroforestrycentre.org.* ICRAF. Accessed 30/10/02

History

- First defined in 1978 in the context of the Tropics
- Agroforestry as a land-use system is ancient
- Majority of research based in the Tropics
- Interest increased in Temperate regions

Types of agroforestry

- Silvoarable
  - Trees and crops
    - Alley cropping
    - Orchard intercropping



Cocoa under coconut, Malaysia

Types of agroforestry

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Arable crops and poplar, Uni. Leeds experiment

Types of agroforestry

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Intercropping with strawberries in an immature peach orchard, Ontario

Types of agroforestry

- Silvopastoral
  - Trees and livestock
    - Forest grazing
    - Pannage

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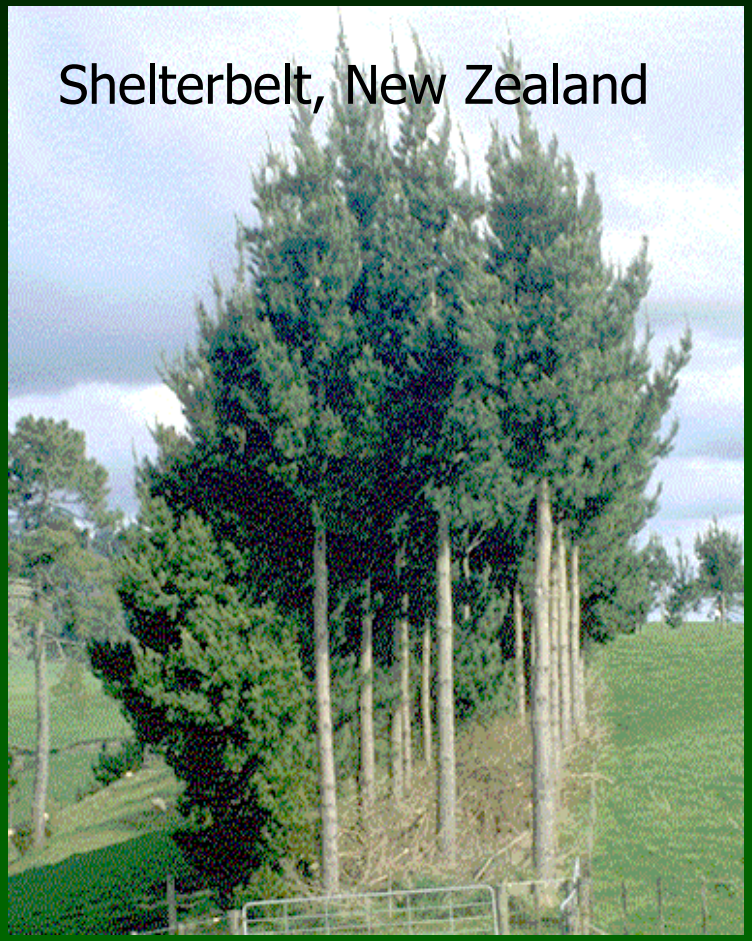
Types of agroforestry



- Agrisilvopastoral
  - Trees with crops and livestock
- Others
  - Shelterbelt
  - Riparian zones
  - Fodder banks
  - Home gardens

Arrangement of components

- Spatial arrangement
- Temporal arrangement

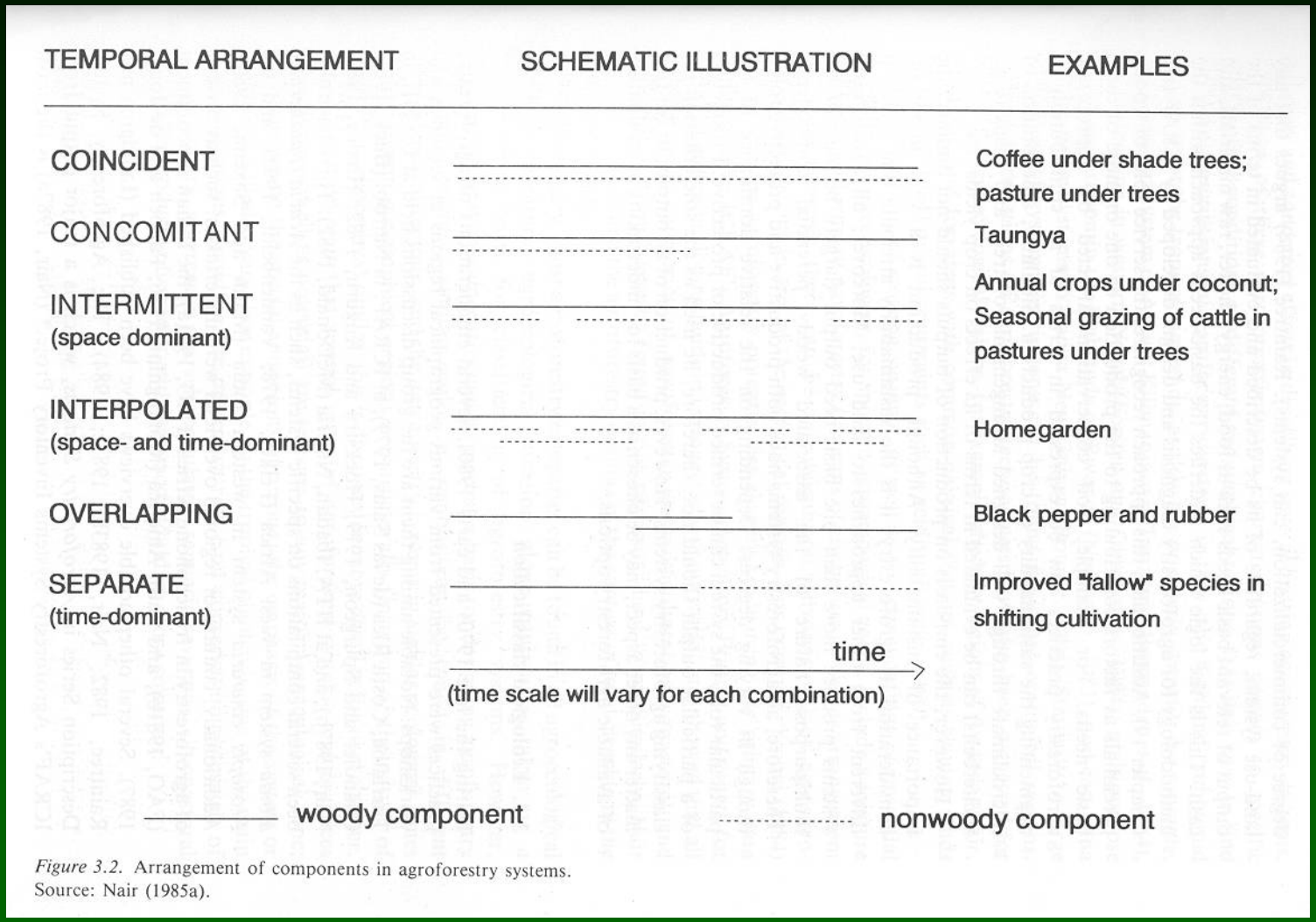
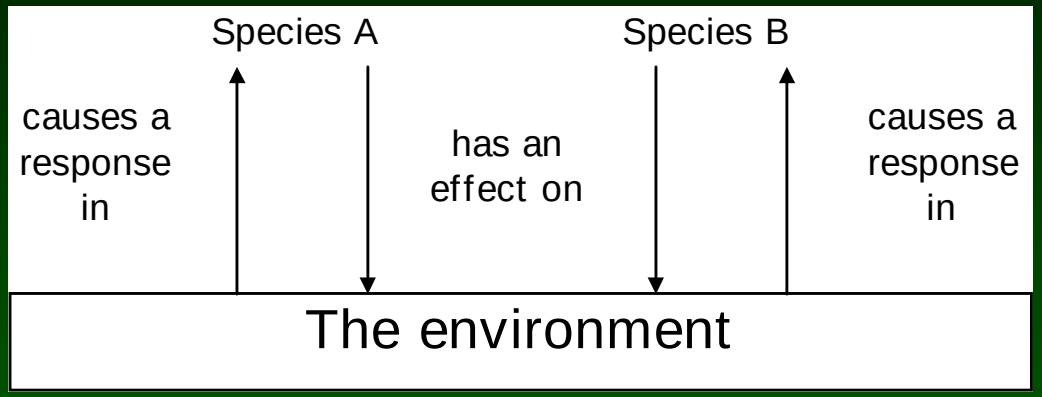


Figure 3.2. Arrangement of components in agroforestry systems.
Source: Nair (1985a).

Component interactions

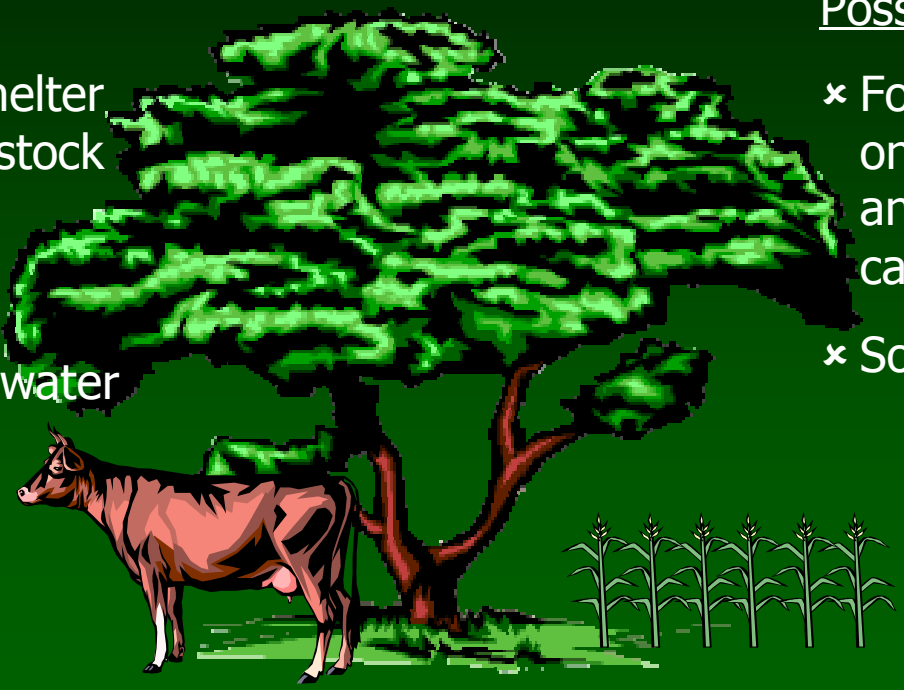


- Micro-climate
- Resources

Shared above-ground space

Possible facilitation

- ✓ +ve shade and shelter for crops and livestock
- ✓ Litter and mulch effects
- ✓ Improved topsoil water status
- ✓ Fodder



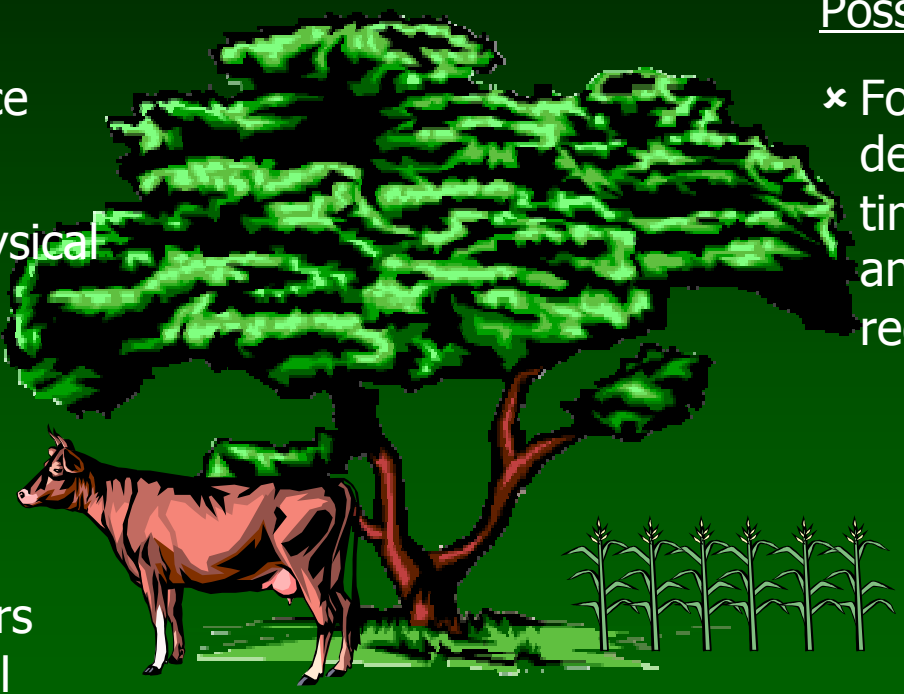
Possible competition

- × For light, depending on canopy structure and relative times of canopy activity
- × Soil compaction

Shared rooting zone

Possible facilitation

- ✓Improved resource capture
- ✓Improved soil physical and chemical properties
- ✓Mycorrhizas
- ✓N-fixation
- ✓Enhanced numbers and activity of soil biota



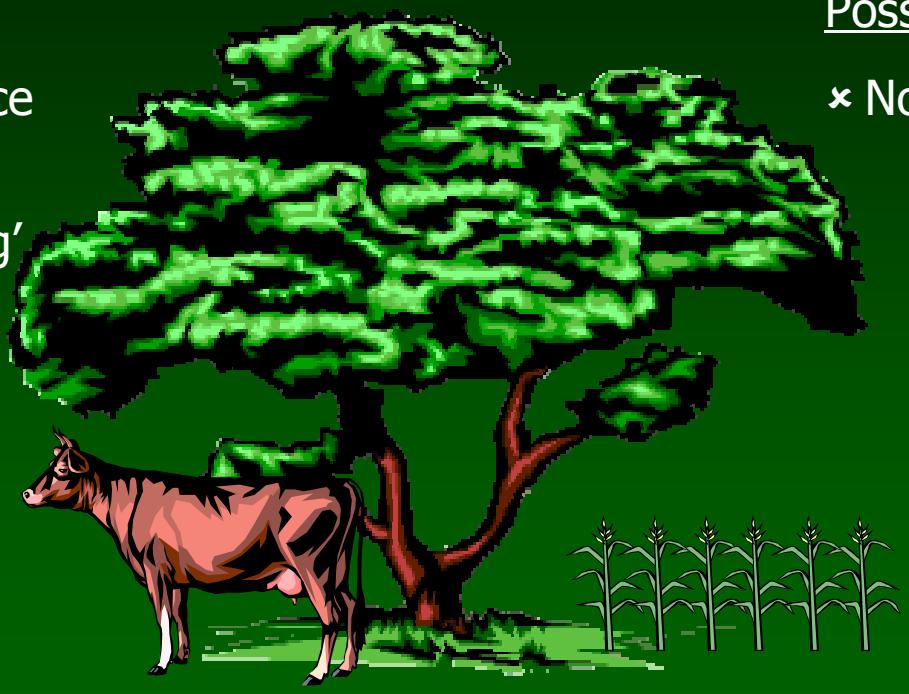
Possible competition

- × For nutrients, depending relative times of root activity and niche requirements

Deep rooting zone occupied by one plant component

Possible facilitation

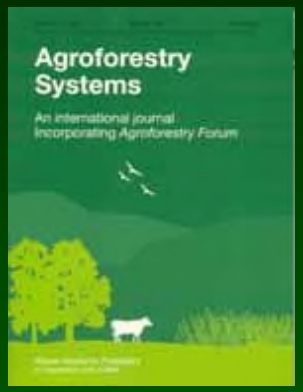
- ✓Improved resource capture
- ✓Nutrient 'pumping'

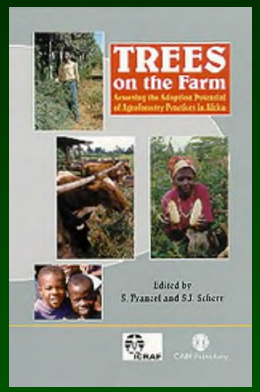


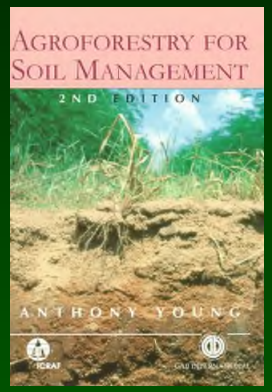
Possible competition

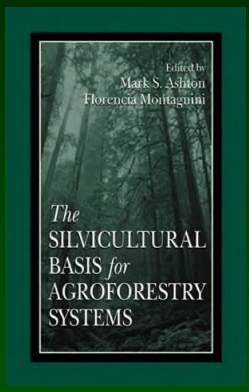
- × None apparent

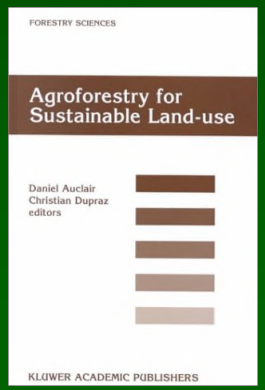
Publications

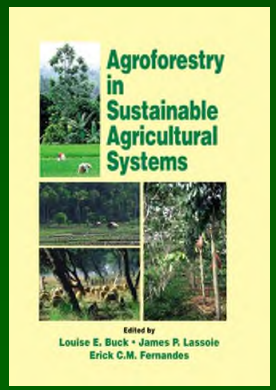


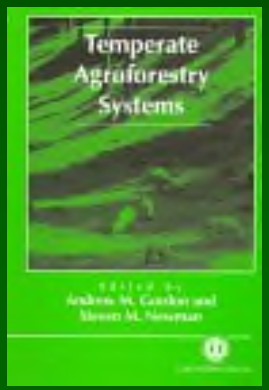




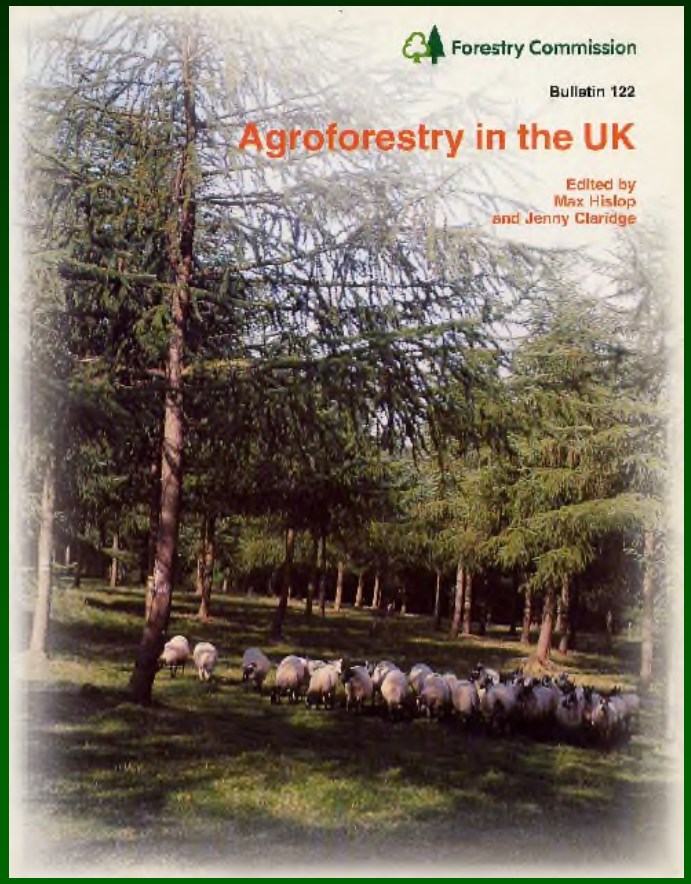








European Extension



Context

- EU agricultural policy
  - Sustainability
  - Environment
  - Decoupling

Context

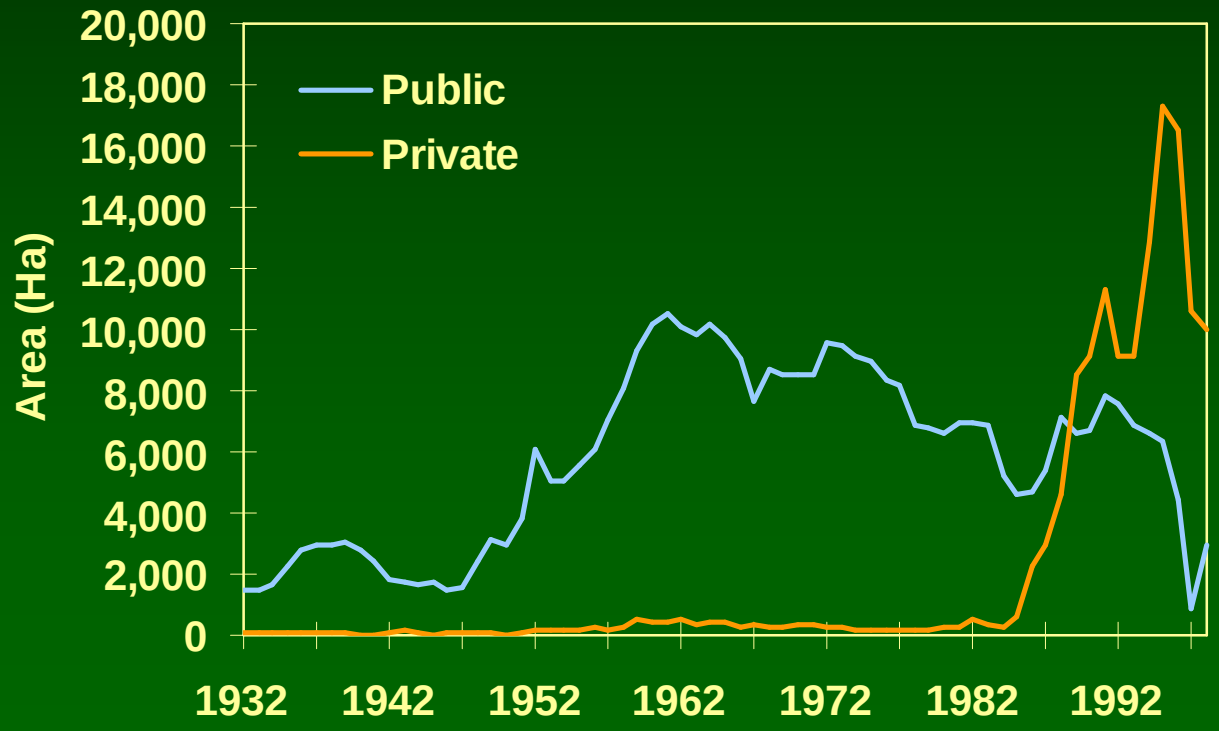
- Commission Regulation (EC) No 796/2004 of 21 April 2004
  - Article 8
    - A parcel that contains trees shall be considered an agricultural parcel for the purposes of the area-related aid schemes provided that the agricultural activities … or the production envisaged can be carried out in a similar way as on parcels without trees in the same area.

Context

- EU agricultural policy
  - Sustainability
  - Environment
  - Decoupling
- Government forest strategy
  - 9%-17% land area by 2030
- Kyoto agreement

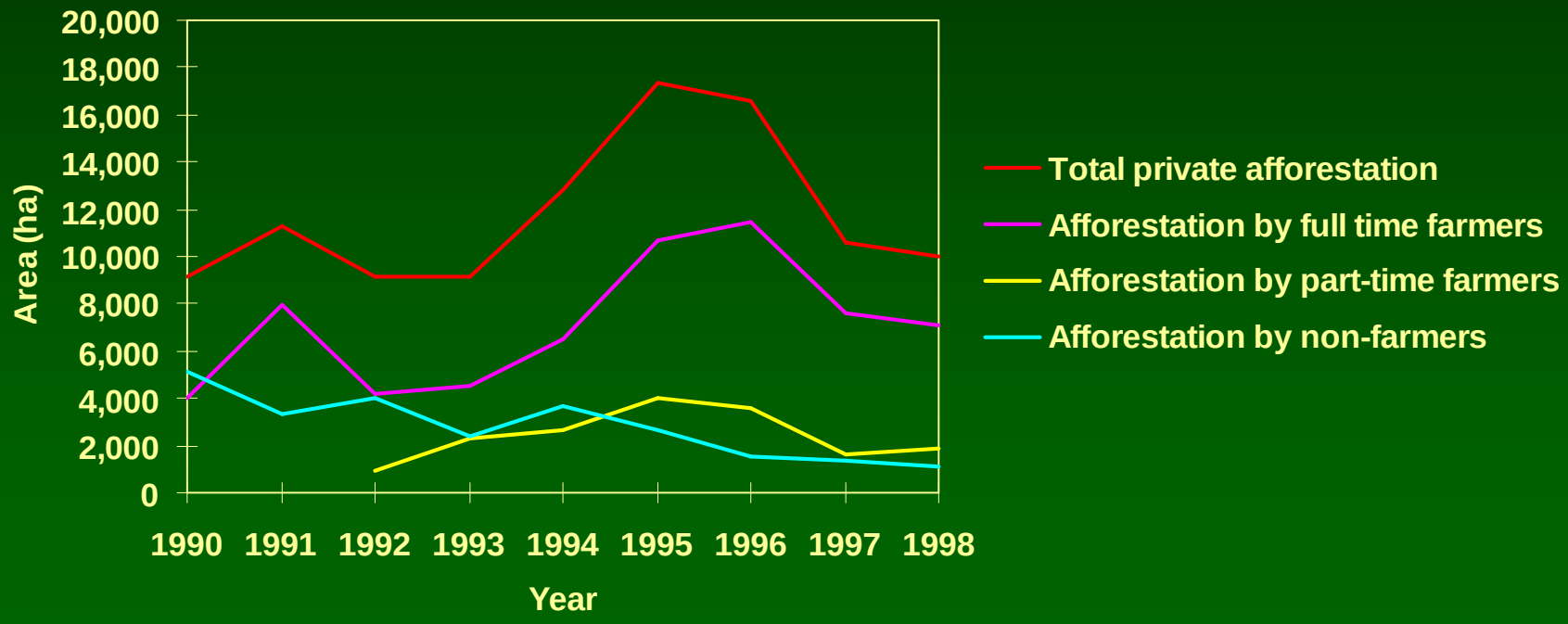
Afforestation

- Private > Public since introduction of Annual Premia (1987)



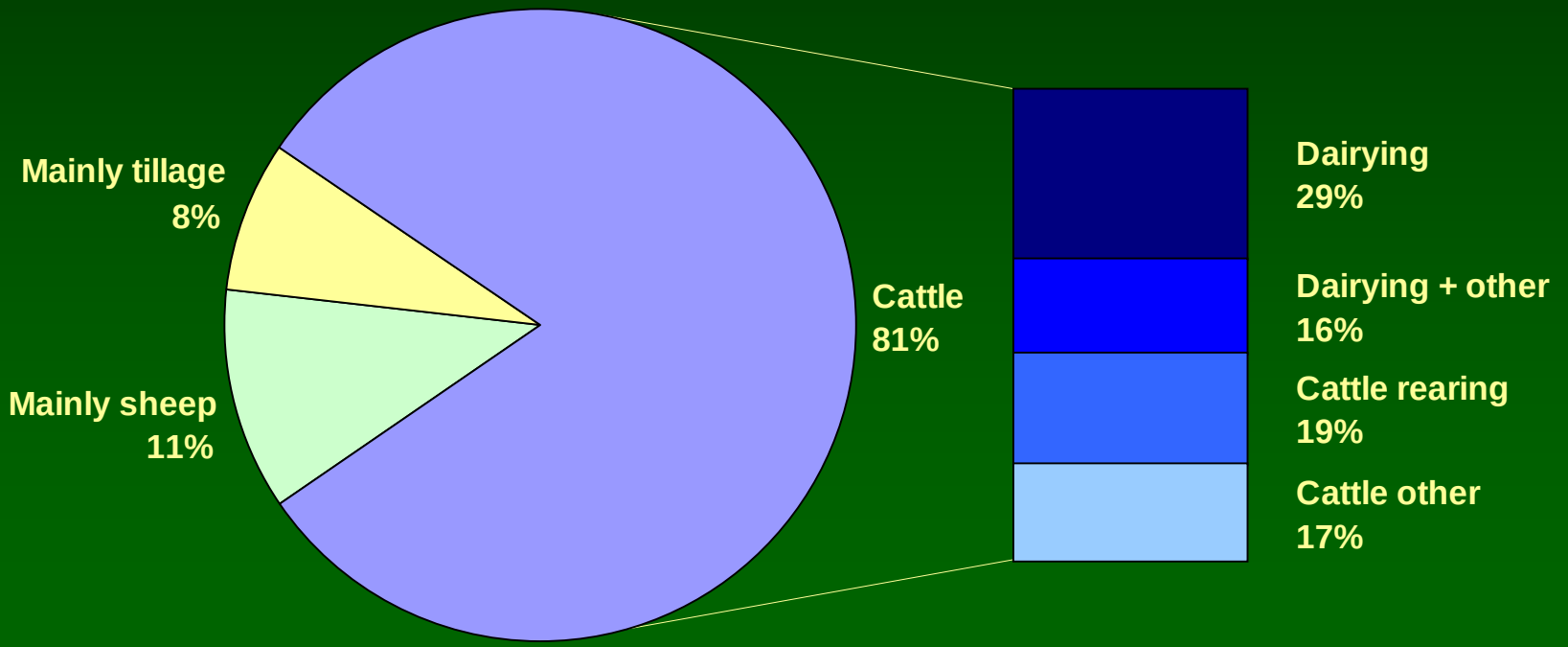
Private afforestation

- Majority by farmers



Farming systems

- Majority of Irish farms have cattle



Model

Inputs

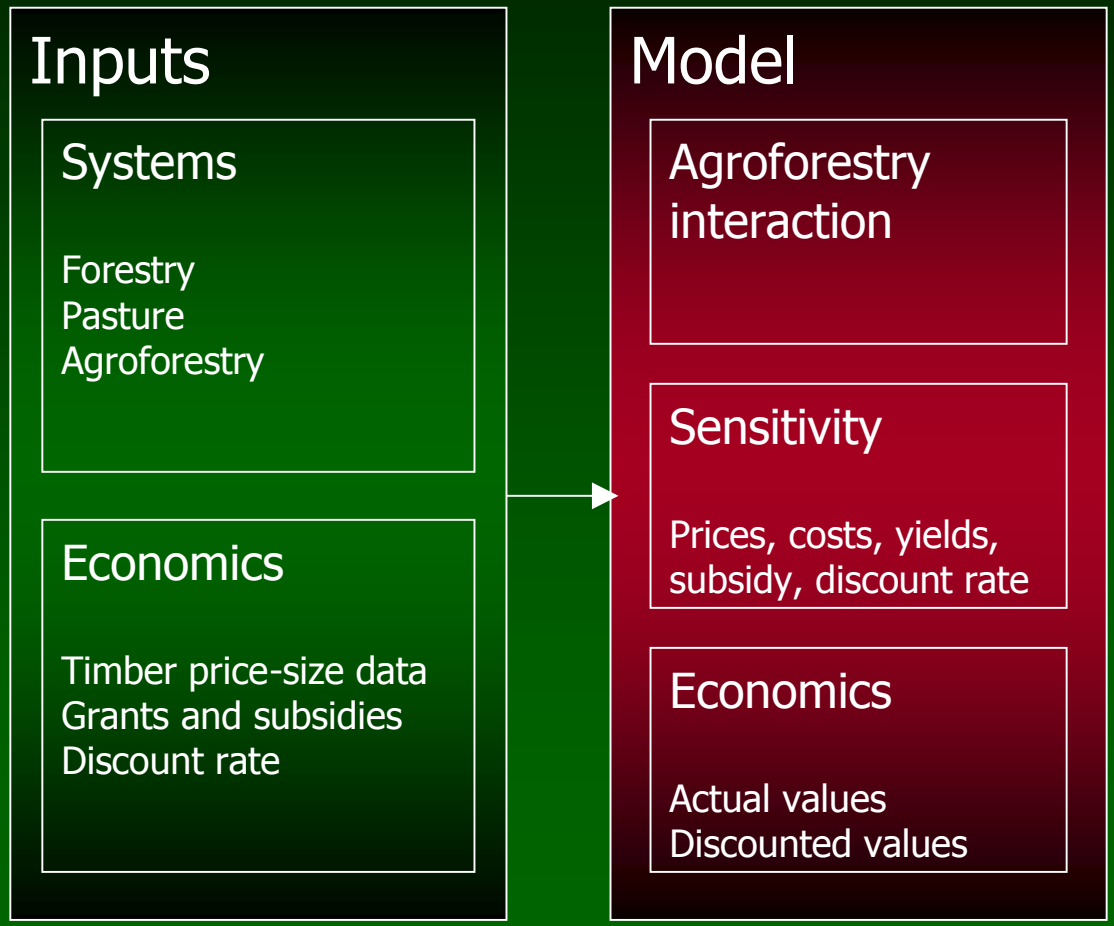
Systems

Forestry
Pasture
Agroforestry

Economics

Timber price-size data
Grants and subsidies
Discount rate

Model


Inputs
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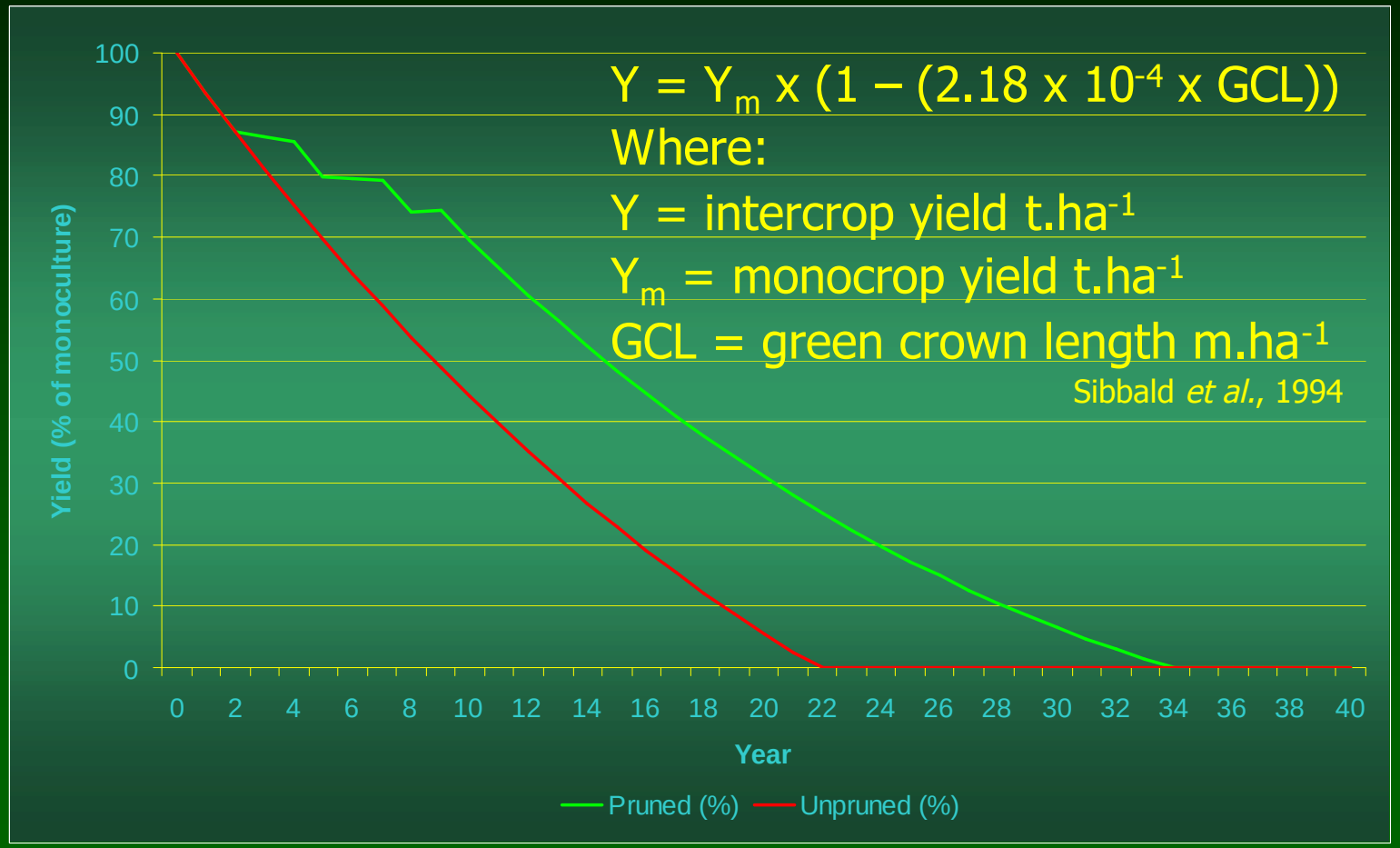
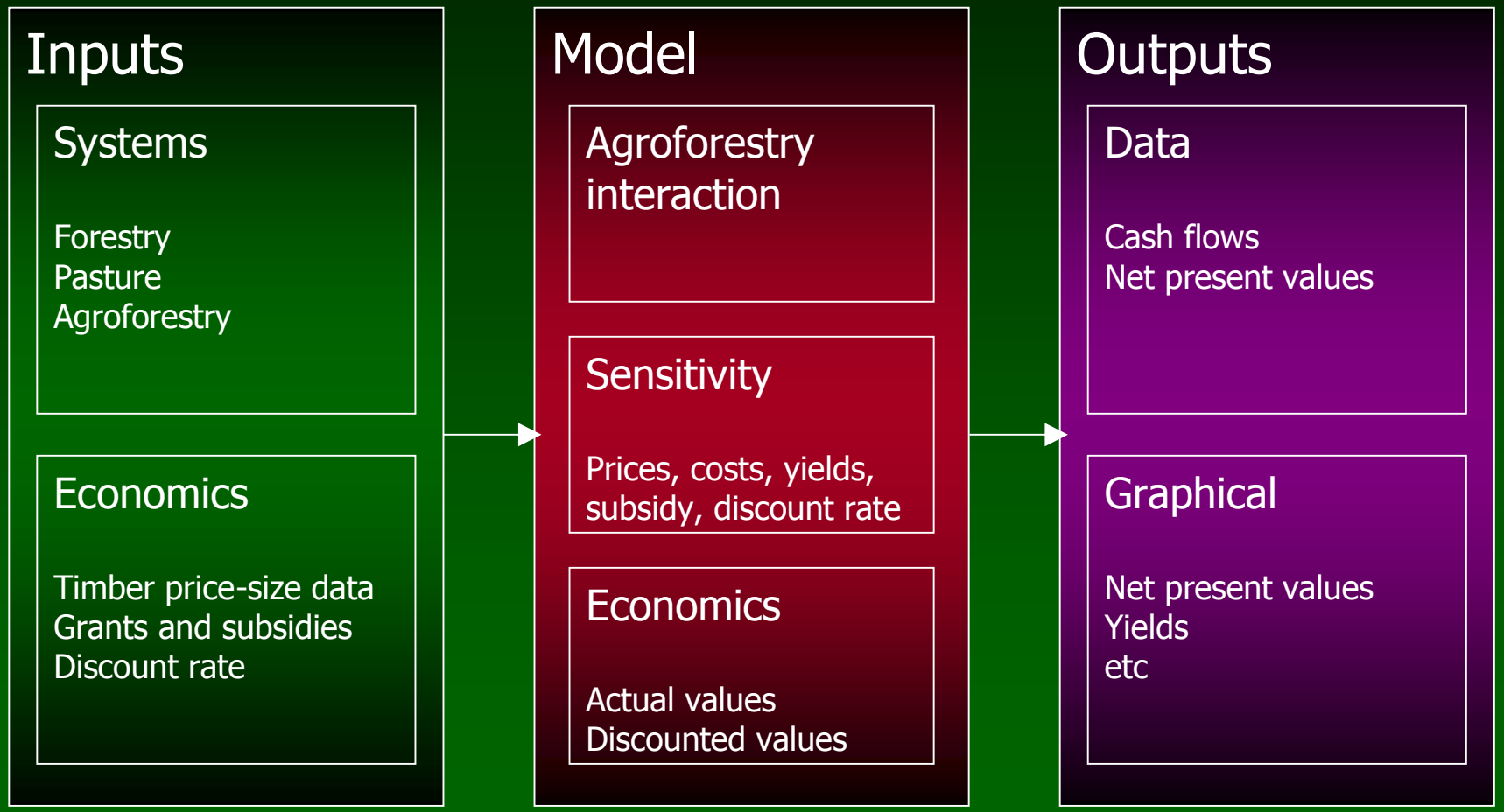
Pasture
Agroforestry
Economics
Timber price-size data
Grants and subsidies
Discount rate
Model
Agroforestry interaction
Sensitivity
Prices, costs, yields, subsidy, discount rate
Economics
Actual values
Discounted values

Model - Agroforestry interaction



Model


Inputs
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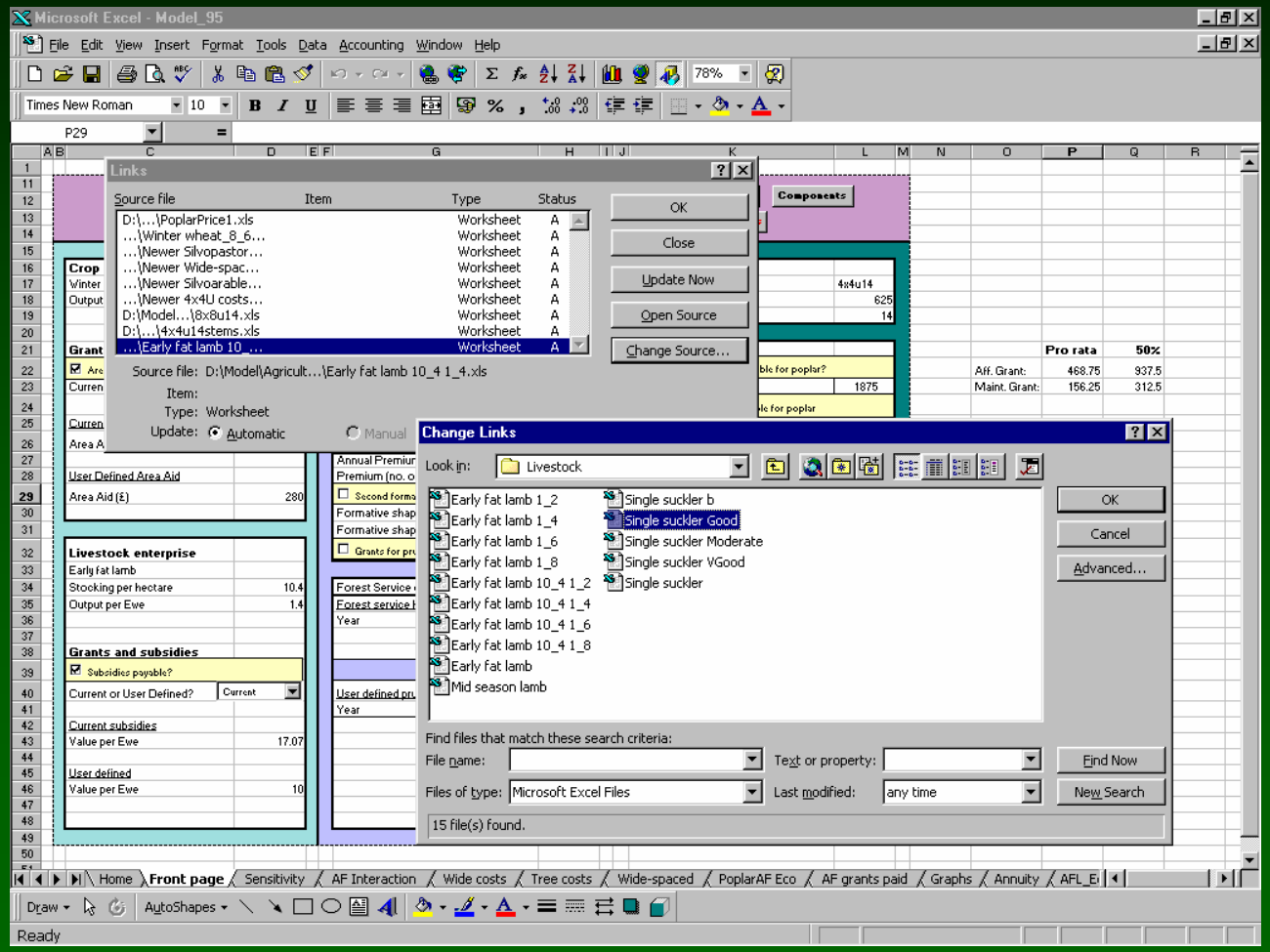
Prices, costs, yields, subsidy, discount rate
Economics
Actual values
Discounted values
Outputs
Data
Cash flows
Net present values
Graphical
Net present values
Yields
etc

Bio-economic model



Bio-economic model

Discount rate	5.0%

Homepage | Sensitivity | Components | Graphs | Comparisons

Crop enterprise	
Winter wheat (Feed Wheat)	
Output (tonnes/hectare)	8.6
Grants and subsidies	
☑ Area Aid payable?	
Current or User defined?	Current
Current Area Aid	
Area Aid (£)	290
User Defined Area Aid	
Area Aid (£)	280

Livestock enterprise	
Early fat lamb	
Stocking per hectare	10.4
Output per Ewe	1.4
Grants and subsidies	
☑ Subsidies payable?	
Current or User Defined?	Current
Current subsidies	
Value per Ewe	17.07
User defined	
Value per Ewe	10

Poplar agroforestry file	
File:	8x8u14
Stems/ha	156
Yield class	14

Grants	
☐ Afforestation Grant payable for agroforestry?	
Afforestation grant (£)	937.50
☐ Maintenance payable for agroforestry?	
Maintenance grant (£)	312.50
☐ Premium payable for agroforestry?	
Annual Premium (£)	86.86
Premium (no. of years)	12
☐ Second formative shaping grant payable?	
Formative shaping (£)	200
Formative shaping (year)	3
☐ Grants for pruning available for agroforestry?	

Forest Service or User Defined?	Forest Service
Forest service high pruning grants	
Year	Value (£)
4	171.6
6	202.8
User defined pruning grants	
Year	Value (£)
5	125
7	138

Poplar plantation	
File:	4x4u14
Stems/ha	625
Yield class	14

Grants	
☑ Afforestation grant payable for poplar?	
Afforestation grant (£)	1875
☑ Maintenance grant payable for poplar	
Maintenance grant (£)	625
☑ Premium payable?	
Annual Premium (£)	348
Premium (no. of years)	12
☐ Second formative shaping grant payable?	
Formative shaping (£)	200
Formative shaping (year)	3
☐ Grants for pruning available for poplar?	

Forest Service or User Defined?	Forest Service
Forest Service high pruning grants	
Year	Value (£)
4	550
6	650
User defined pruning grants	
Year	Value (£)
5	125
7	138

Bio-economic model - sensitivity

	Sensitivity		
Discount rate	0.0%	New discount rate:	5.0%

Homepage | Graphs | Front page | Components | Comparisons

Agricultural costs and revenues	
Factor	Sensitivity
Agricultural subsidies (total)	0.0%
Annual or total agri-costs change? (a/t)	t
Agricultural costs (annual)	0.00%
Agricultural costs (total)	0.0%
Annual or total crop price change? (a/t)	t
Crop price (annual)	0.00%
Crop price (total)	0.0%
Annual or total livestock price change? (a/t)	t
Livestock price change (annual)	0.00%
Livestock price change (total)	0.0%

Poplar agroforestry costs and revenues	
Factor	Sensitivity
Poplar agroforestry subsidies (total)	0.0%

Silvoarable Tree/Crop interaction	
Crop yield (total)	0.00%
Width of tree row (m)	2.0

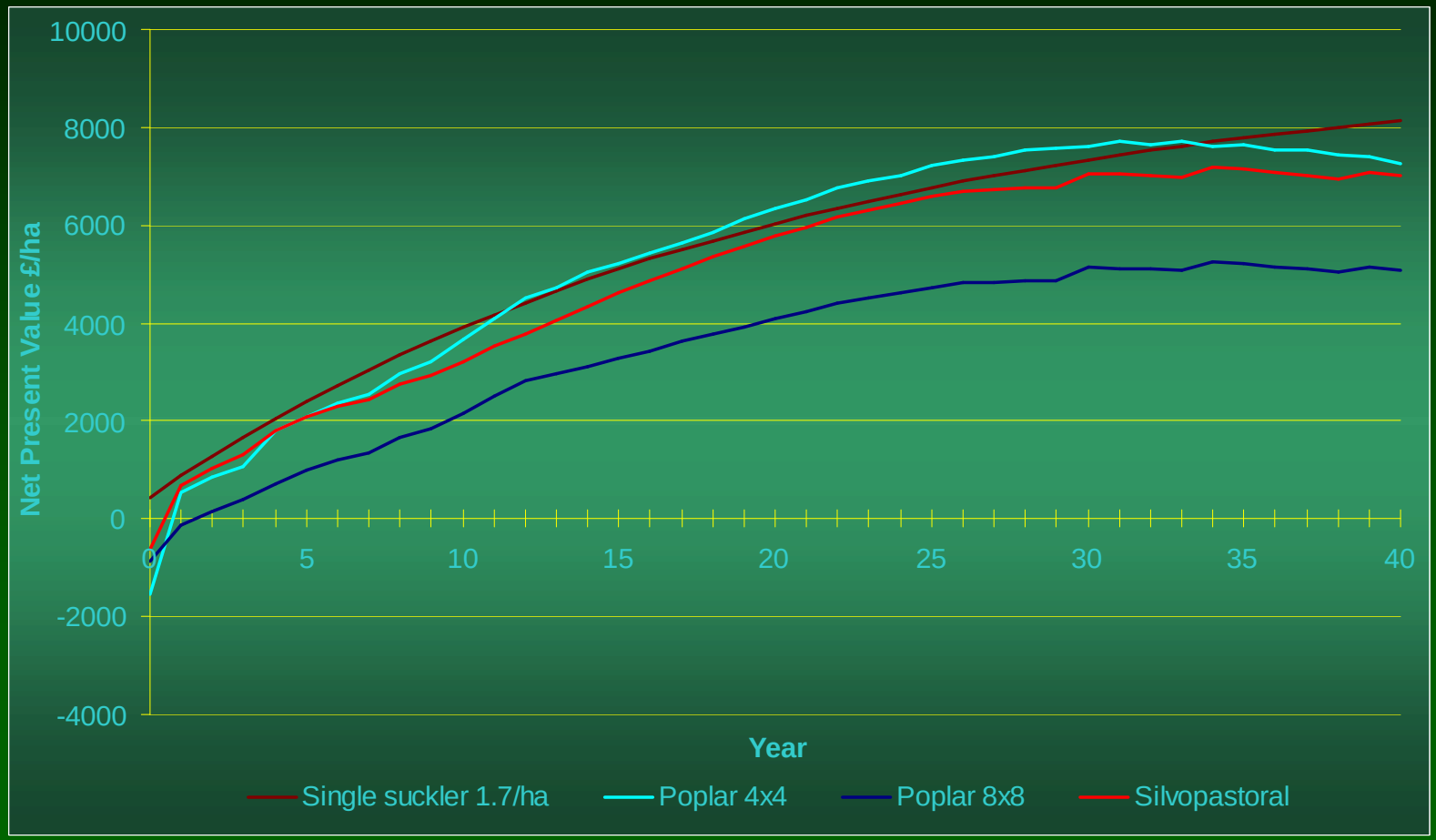
Silvopastoral Tree/Livestock interaction	
Yield change (total)	0.00%

Agrisilvopastoral	
Earliest year of livestock introduction	7
Cost of pasture establishment (£/ha)	100

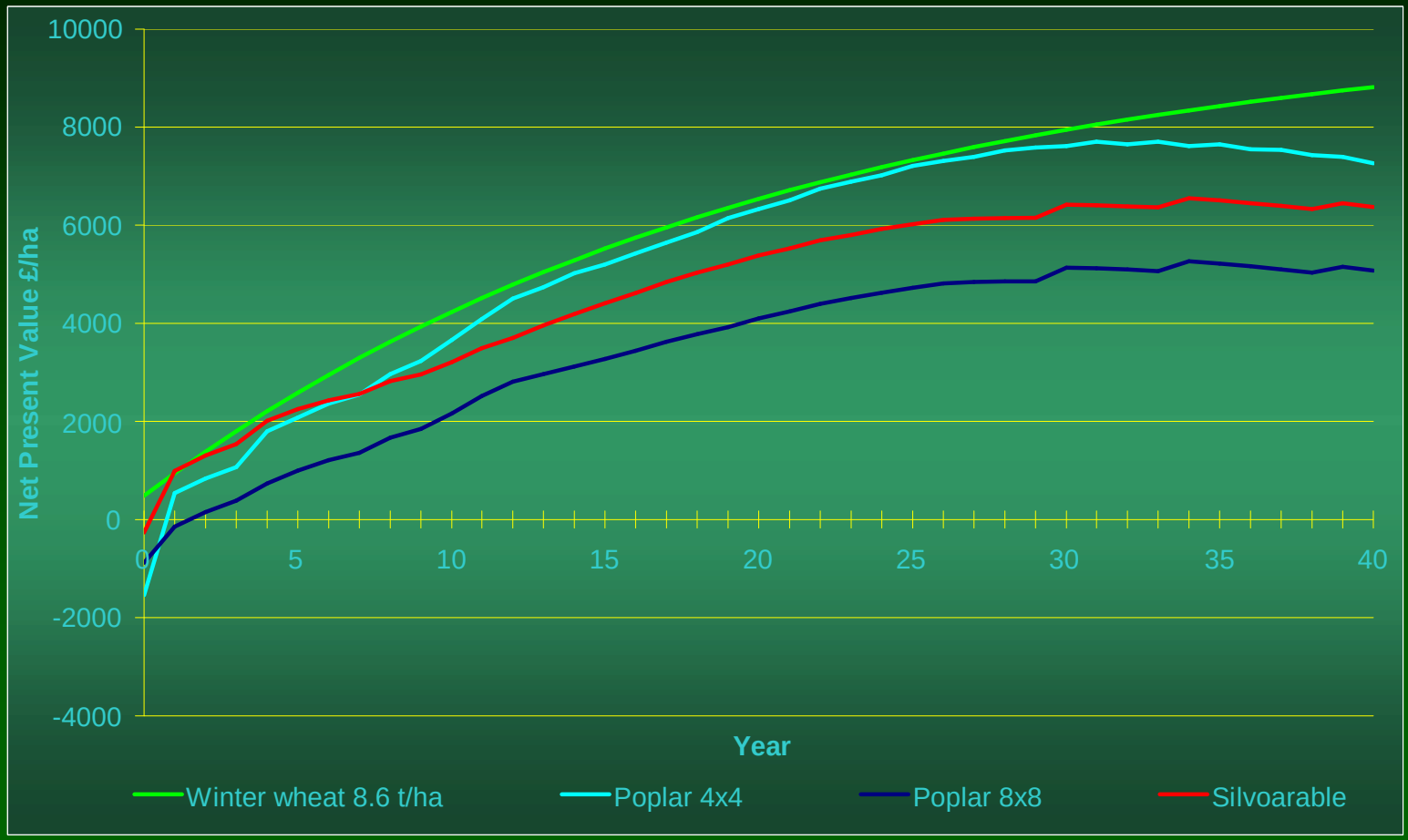
Poplar plantation costs and revenues	
Factor	Sensitivity
Poplar subsidies (total)	0.0%

Poplar yield and price	
Factor	Sensitivity
Poplar yield (total)	0.0%
Poplar price (total)	0.0%
Poplar costs	
Annual or total poplar cost change? (a/t)	t
Poplar costs change (annual)	0.00%
Poplar costs change (total)	0.0%

Results - livestock



Results – Winter wheat



Results – Sensitivity to product price

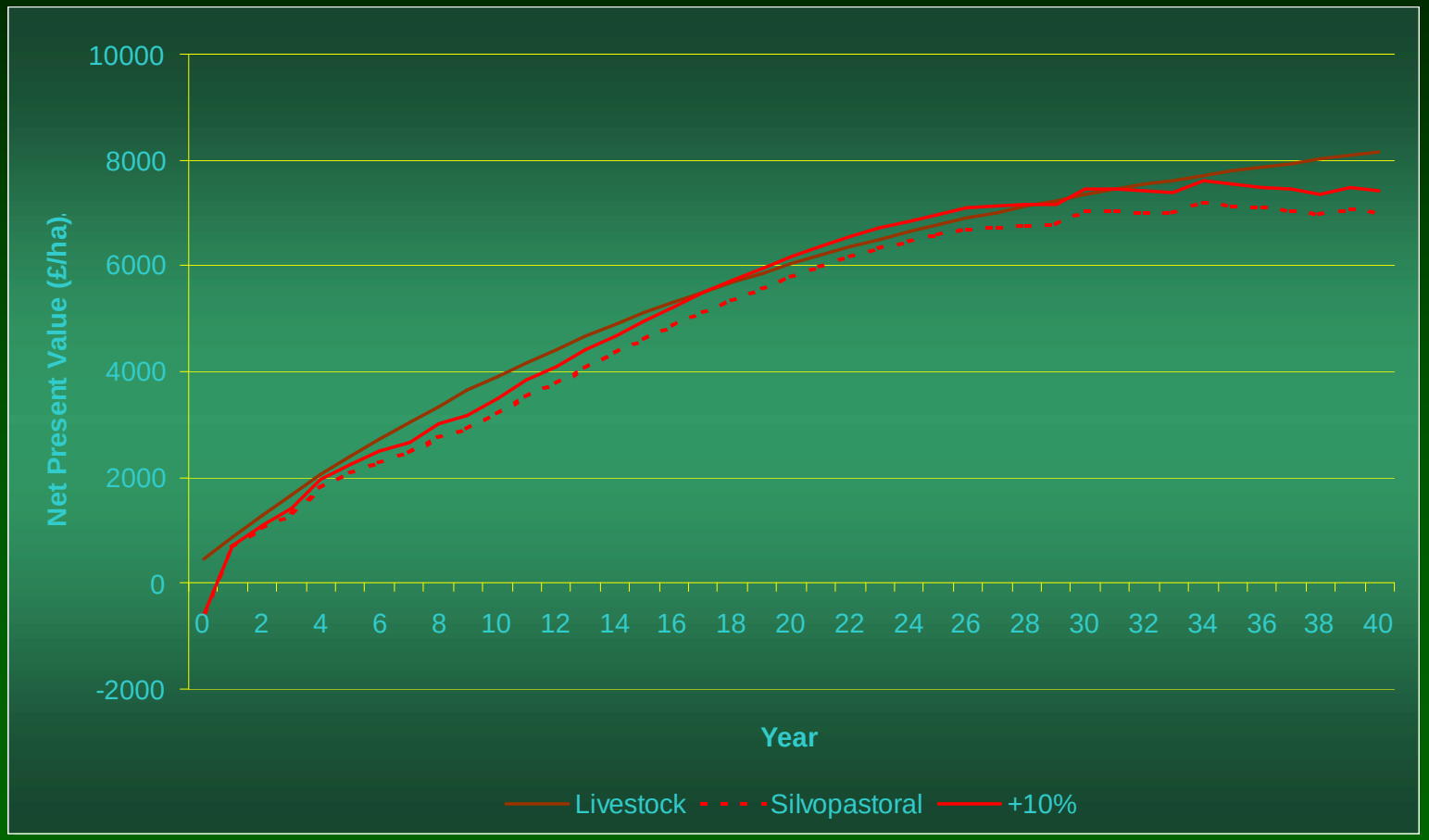
% change in product price	Cattle	Silvopasture
+ 20	+ 27.1	+ 20.9
- 20	- 27.2	- 20.9

% change in product price	Winter wheat	Silvoarable
+ 20	+ 30.4	+ 25.2
- 20	- 30.4	- 24.5

Results – Sensitivity to input costs

% change	Winter wheat	Cattle	Silvoarable	Silvopastoral
+ 20	- 22.4	- 22.0	- 23.2	- 17.0
- 20	+ 22.4	+ 22.0	+ 26.7	+ 17.0

Results – Sensitivity to interaction equation



Results – Sensitivity

- The silvopastoral system is less sensitive to price changes than the monocultural system
- The interaction equation can have an affect on conclusions derived from the model

Conclusions

- Silvopastoral system shows economic potential
- Model verification is required
- Real data required for model improvements
  - Experiments
  - Field trials