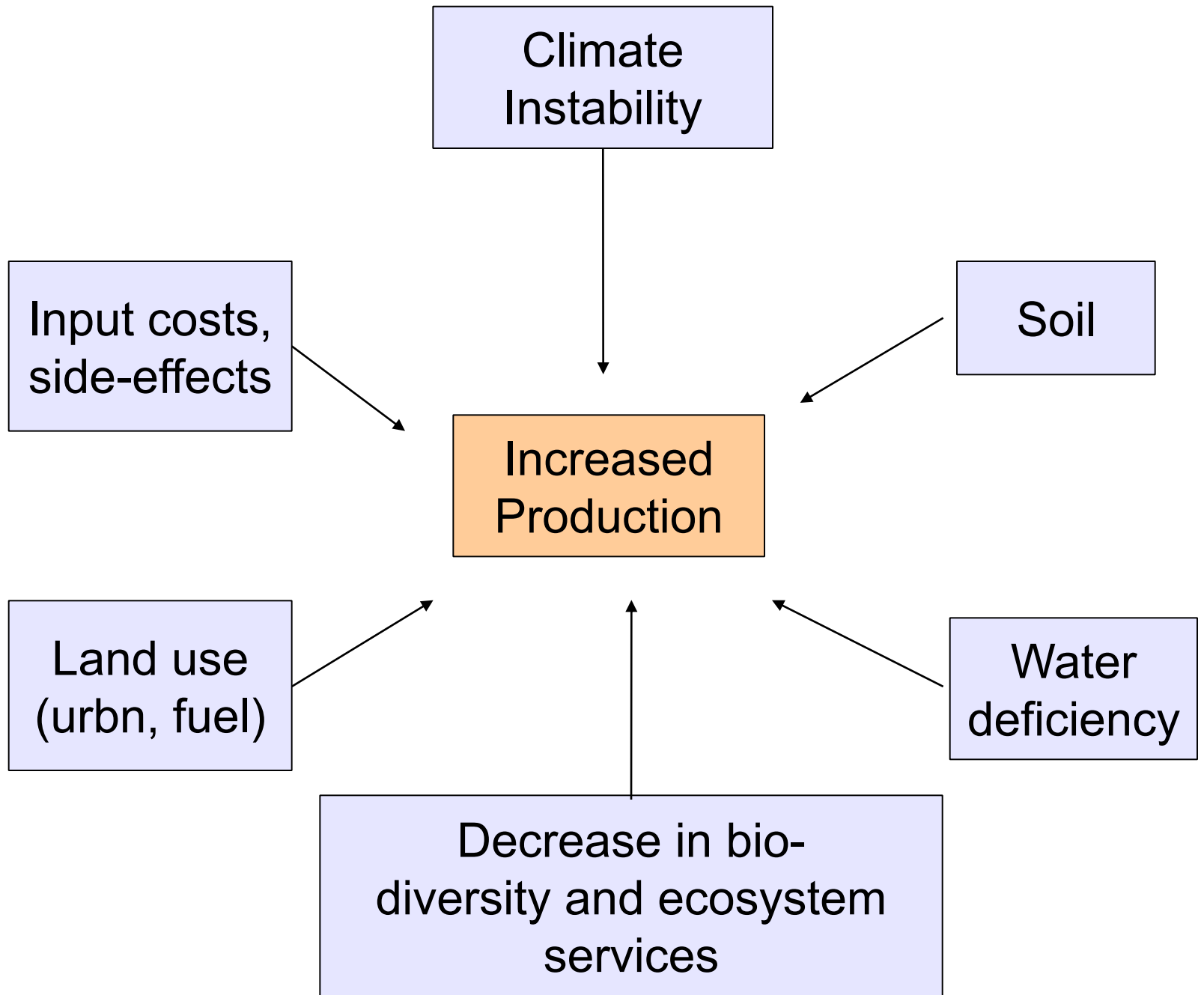
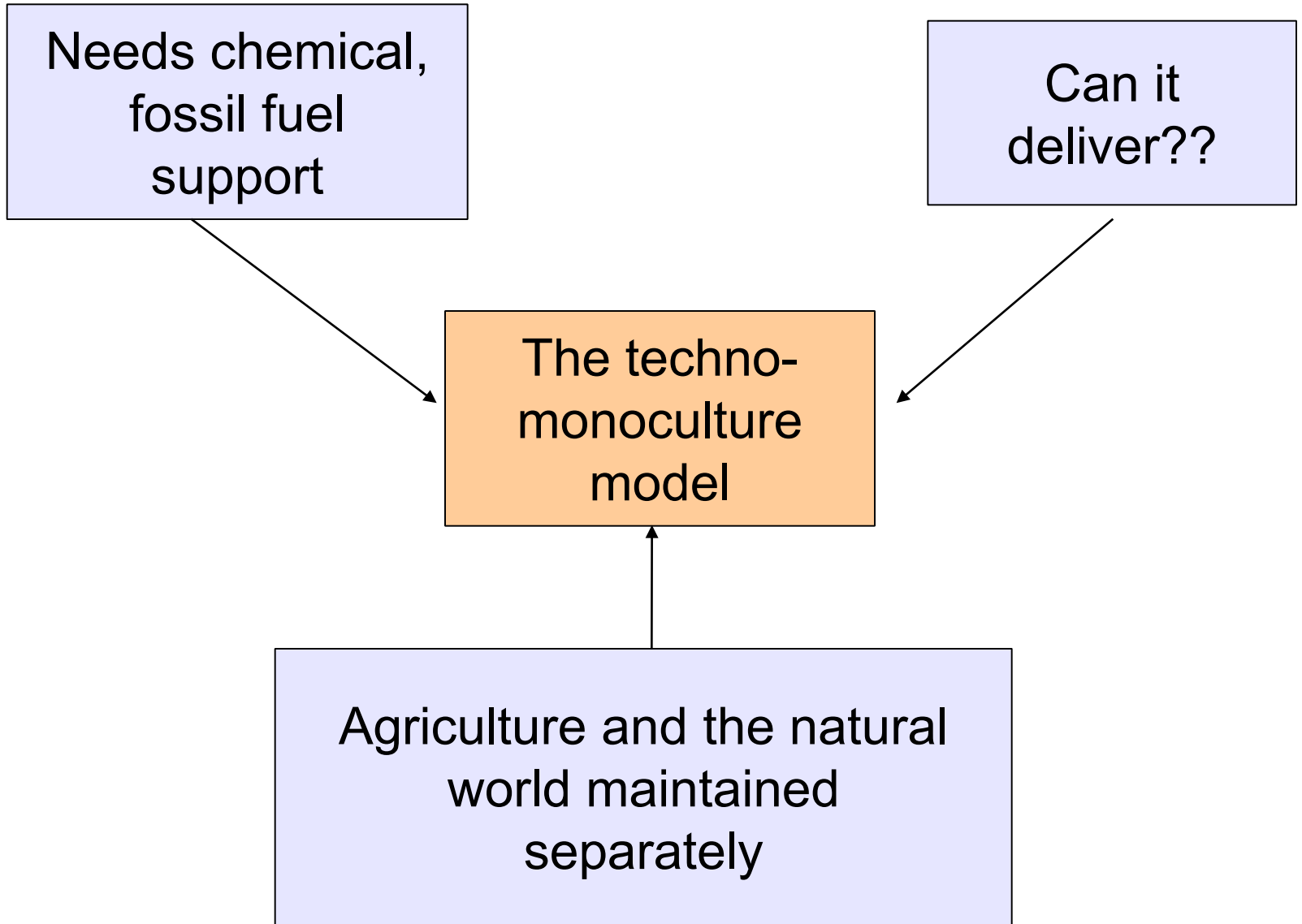


Organic Agroforestry: eco-functional intensification

Martin Wolfe

The Organic Research Centre and
Wakelyns Agroforestry, Suffolk





- *this is what we survive by - the natural world – or,
as it is now frequently termed -*

Ecosystem Services

Provisioning (food and water, materials, energy);

Regulating (carbon sequestration, climate regulation, decomposition and detoxification, purification of water and air, pests and diseases, pollination);

Supporting (nutrient dispersal and cycling, seed dispersal, primary production);

Cultural (spiritual, health and recreational benefits)

Unifying concepts in ecology (Loreau 2010)

There are positive correlations between:

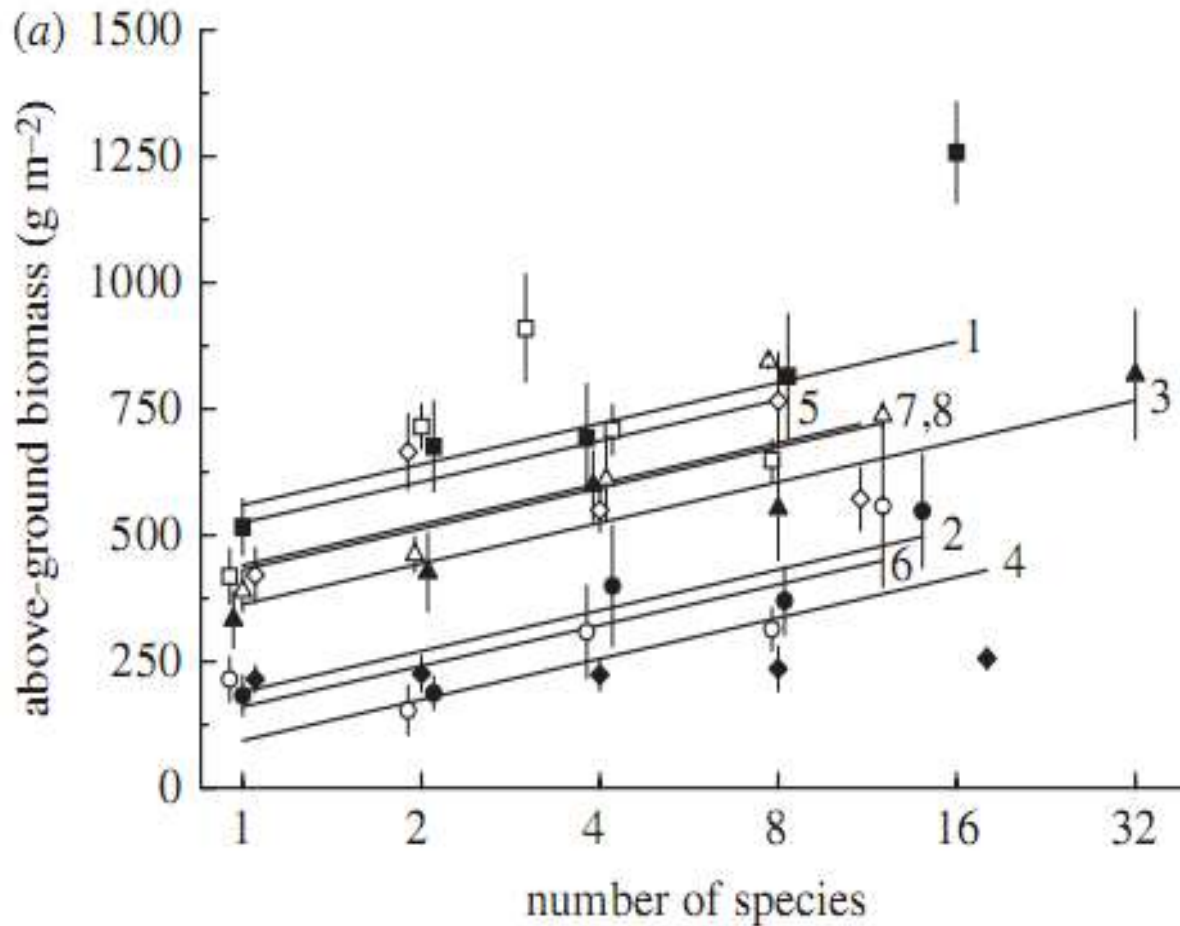
A) DIVERSITY AND STABILITY

(e.g. wheat populations)

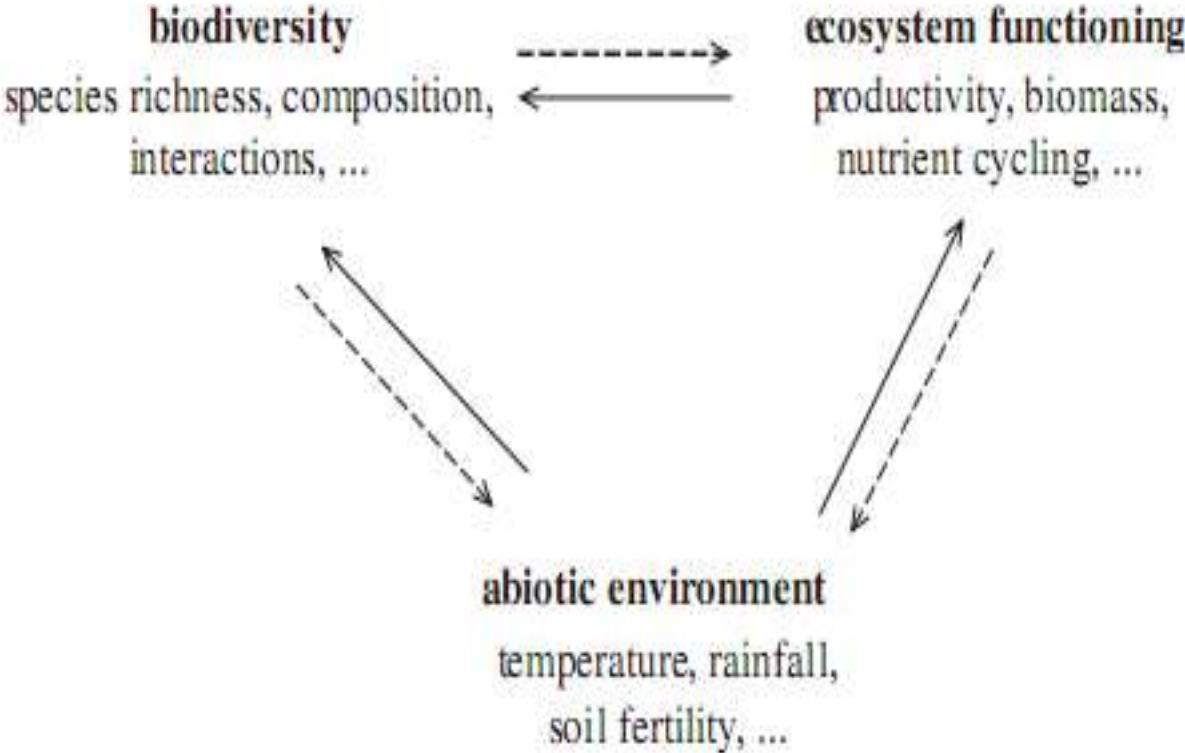
B) DIVERSITY AND PRODUCTIVITY

(e.g. large-scale natural grassland projects)

BIODEPTH project: biomass and diversity at eight European sites



Feed-back systems



Loreau 2010



Ecological activity....

..... is at a maximum in woodland edge

So, why not farm just
WOODLAND EDGE???

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The Wakelyns Systems

HARDWOODS

- a) ash, hornbeam, Italian alder, oak, small-leaved lime, sycamore, wild cherry
- b) as above with dispersed apple

FRUIT AND NUT

- a) range of topfruit, some under-storey fruit bushes
- b) walnut and plum varieties

COPPICE SYSTEMS

- a) mixture of willow varieties
- b) outcross hazel population

Winter wheat and hazel in 2006



Clover ley in 2008



Potato crop in 2009



Advantages of tree integration

- Achieves ecosystem intimacy
- Carbon capture and storage
- Ammonia abatement
- Nutrient cycling
- Produces food, fuel and fibre
- Biodiversity
- Crop and animal protection and nutrition
- Also protects soil, water and air
- Employment opportunities; pension scheme

Inputs needed:

- Soil, sun, air, water – and some labour



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Some willow data.....

Five component mixture – planted as pairs of rows:

75 cm between rows

90 cm within rows

44 t fresh wt/ha/2years

Equals: 11 t dry wt/ha/year

- which gives an LER of about 1.4
- ***but an FER of about 2.2 (using heating oil price equivalents)***

The birds and the bees.....



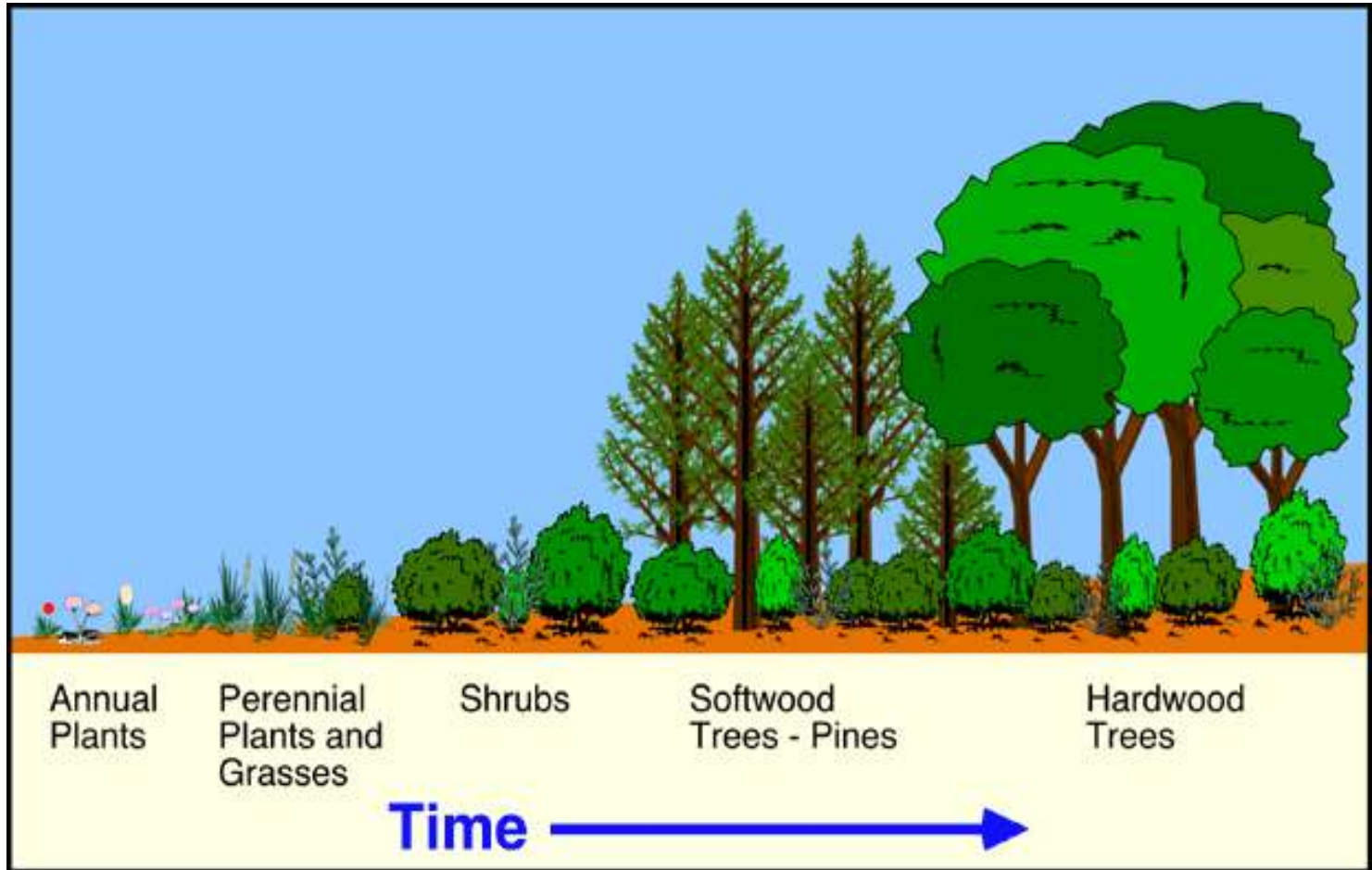
BIRDS: on 22ha, 45-50 species

BEEES: 40,000/ha on legume leys



NB selection of farmland AND woodland types

Plant succession to climax vegetation



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Within-crop diversity: wheat populations

POSITIVE

Capacity: more phenotypic and genotypic variation

Complementation: different genotypes complement each other

Compensation: if some fail, others take their place

Change: evolutionary shifts in response to selection

NEGATIVE

Competition: may work against the four 'Cs' above.

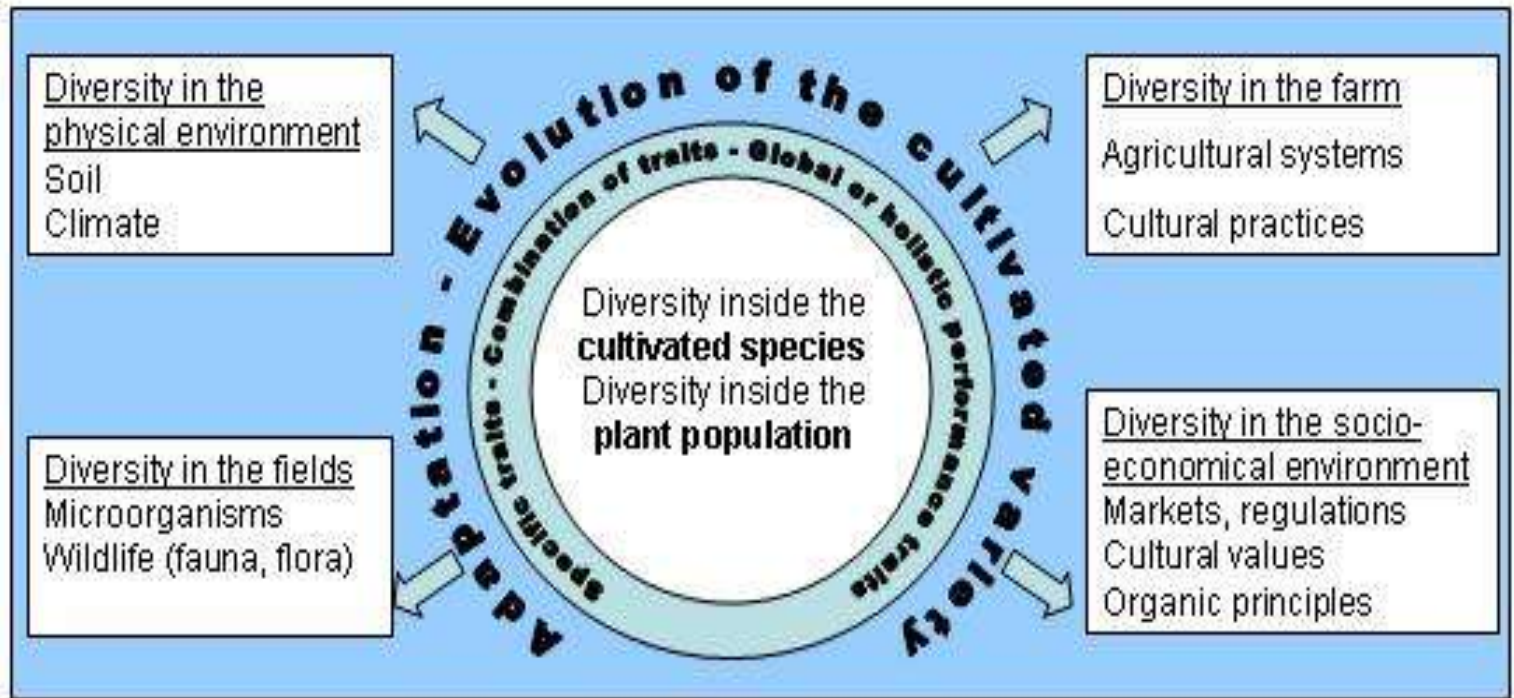




Project 3: SOLIBAM



The SOLIBAM diagram (Strategies for Organic and Low-input Integrated Breeding and Management) – an EU project started in March 2010:



Wheat populations and diverse hardwood trees



**- and the importance of
perenniality**



Advantages of long-term perennial grassland versus annual wheat

A. Above Ground

- Higher N yield, no inputs
- Perennials dominant, high diversity
- Pollinators, herbivores, detritivores more, more diverse

B. Below Ground

- Roots longer, deeper
- Food webs more diverse and structured
- Soil: more C and N, better structure, less leaching
- Better water quality (reduced NO₃-N load)

(Glover et al., 2010)

Root biomass below native perennial prairie versus crop land in Kansas (Culman et al. 2010)

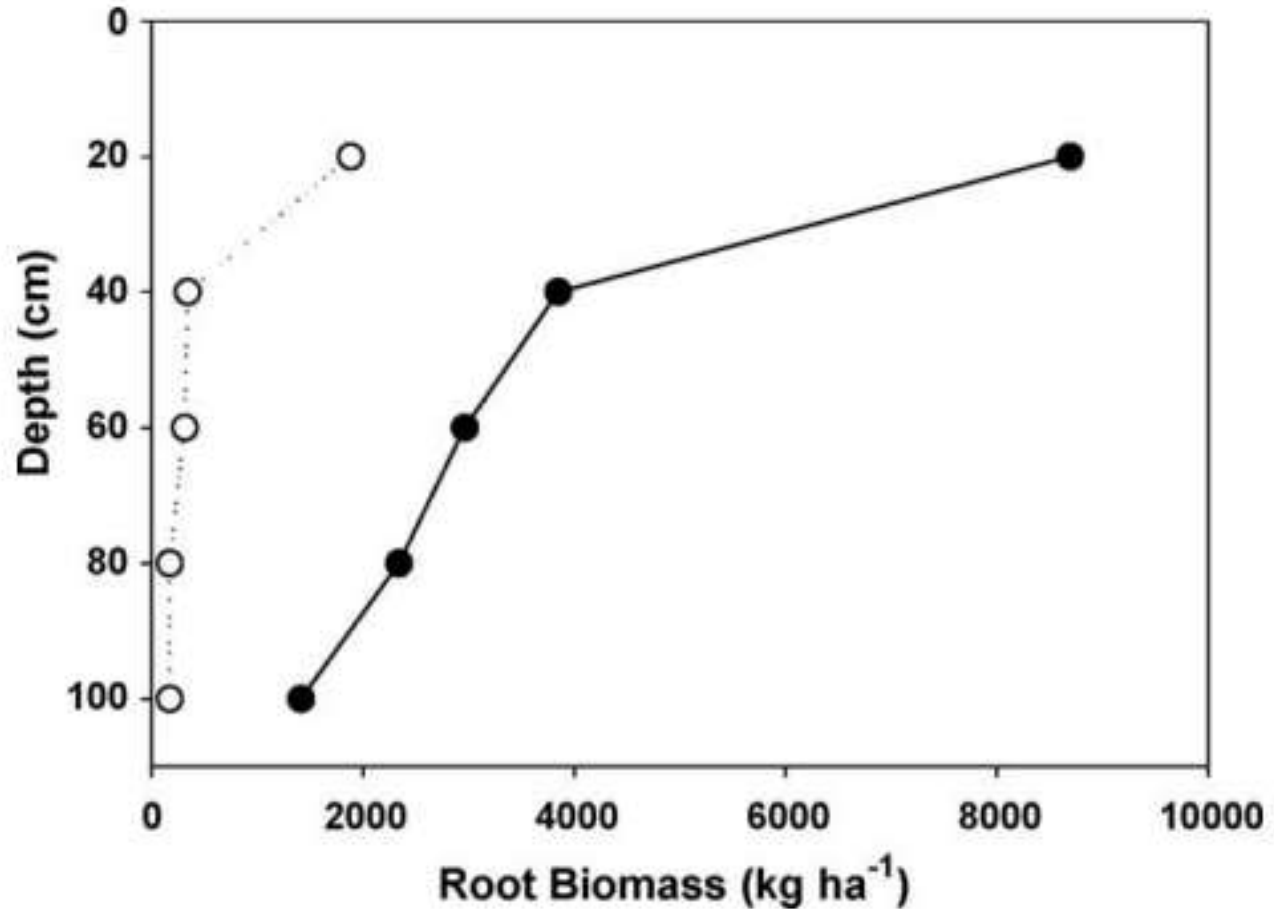


Fig. 1. Root biomass in the Niles grassland (closed circles) and cropland (open circles) site at 0–20 cm, 20–40 cm, 4–60 cm, 60–80 cm, and 80–100 cm.