DESIGNING TEMPERATE AGROFORESTRY SYSTEMS

Jo Smith (ORC)

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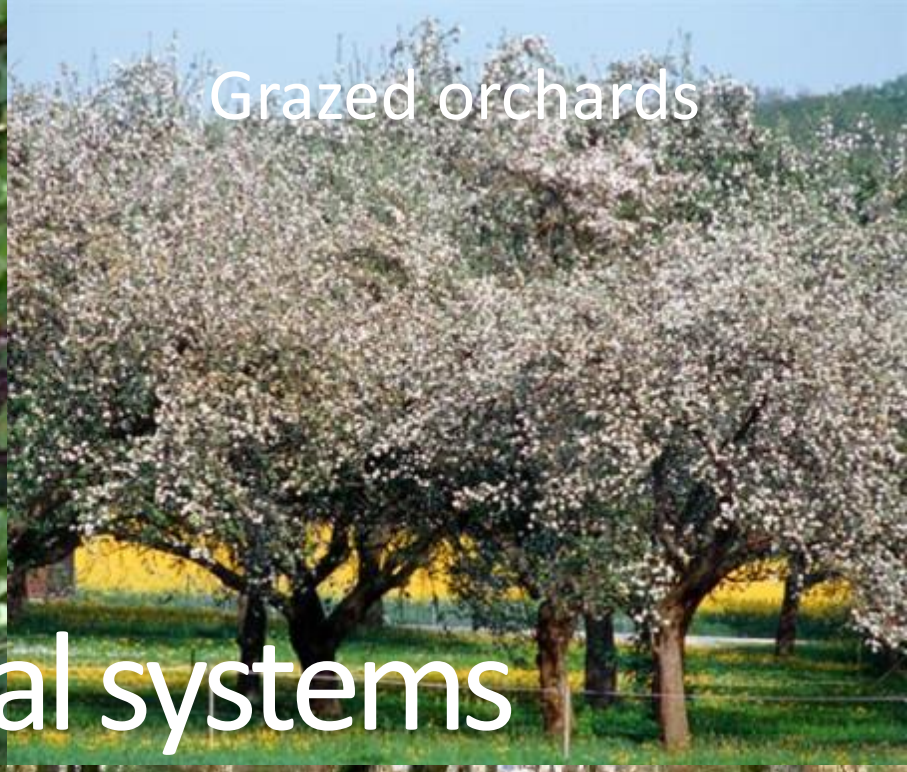

Traditional systems

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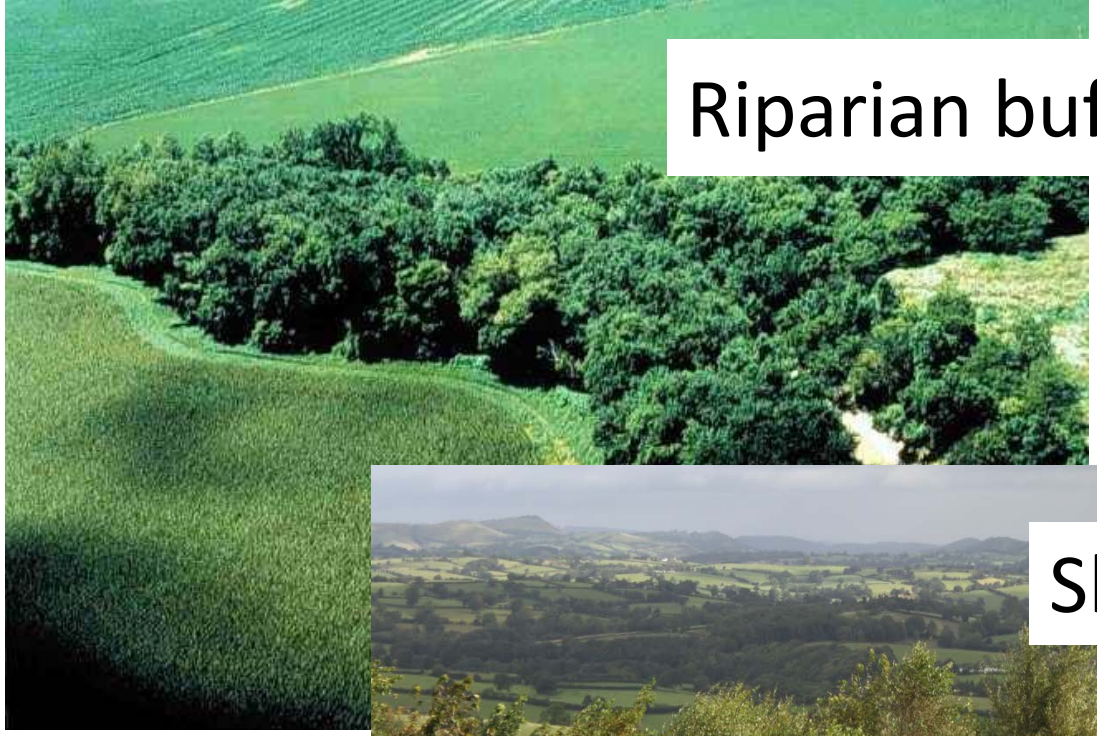

Riparian buffers

Shelter belts

Contour planting

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Silvoarable = trees and crops

Silvopastoral = trees and livestock

Productivity: Managing Interactions

Positive **interactions**

- Shelter
- Microclimate
- Soil OM
- Nutrients
- N fixation
- Pest & disease control
- Pollination

PRODUCTIVITY

Negative **interactions**

Competition for:

- Light
- Water
- Nutrients
- Space
- Labour

Varies spatially & temporally (season/yr/rotation)

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Design Considerations: drivers

What are the key drivers?

- Food/fuel/fibre security?
- Increased productivity?
- Environmental protection?
- Cultural resource?

Are there any conflicts between the key drivers?

e.g. Productivity vs. env protection

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Design Considerations: constraints

What are the key constraints?

- Land resources
- Financial resources
- Afforestation legislation (or felling restrictions)
- Management skills and time
- Site characteristics and location

Agroforestry Design

1. Site characteristics
2. Species selection: trees, crops, livestock
3. Spatial arrangement
4. Temporal arrangement

Aim is to maximise niche differentiation between components (therefore minimise competition for resources)

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1. Site characteristics

- Soil characteristics (water availability and nutrient supply)
- Topography (mechanical access, effect on water supply and nutrients)
- Exposure and aspect
- Climate (precipitation, temperature, humidity)
- Area size
- Location – access, distances for processing and end use (optimal logistic chain)

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2. Species selection: products

Food

Fuel

Fodder and forage

Timber

Fibre

Gums and resins

Thatching and hedging

Gardening materials

Medicinal products

Craft products

Recreation

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2. Species selection: characteristics

Trees

- Deciduous/evergreen
- Native/exotic
- Canopy structure
- Canopy density & timing
- Root structure
- Growth periods
- Harvest timings
- N fixation
- Allelopathic

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2. Species selection: characteristics

Crops

- Shade tolerance: C3 vs C4 plants
- Growth periods
- Harvesting timings
- Susceptibility to allelopathic chemicals

Livestock

- Breed suitability for agroforestry – ranging behaviour
- Browsing/foraging impact
- Utilisation of woody browse

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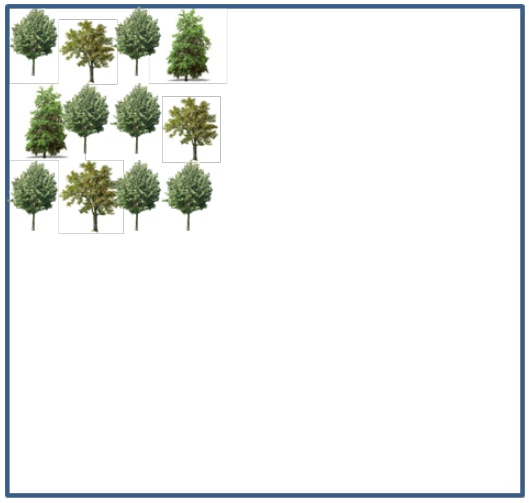
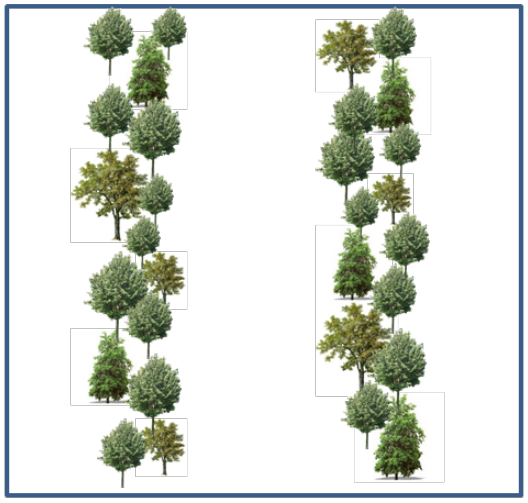
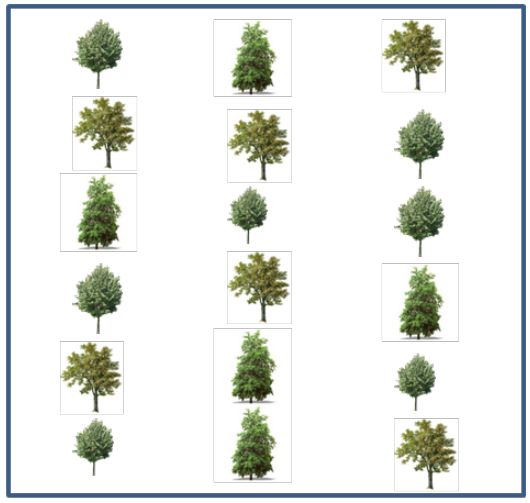
3. Spatial arrangement



Farm woodland

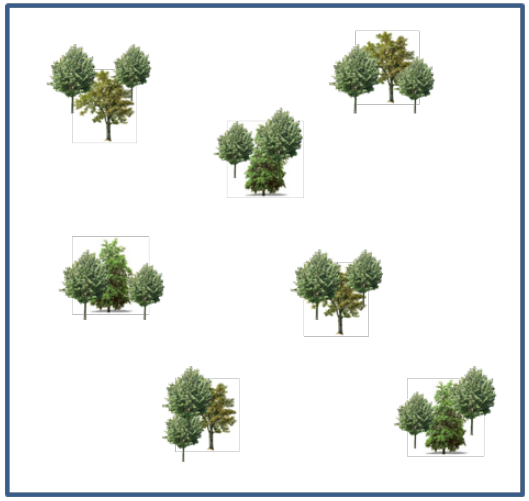


Shelterbelts



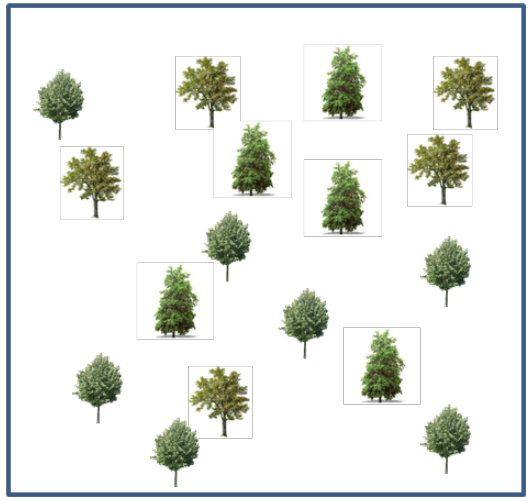
Tree rows

Clumps



Single trees (regular)

Single trees (irregular)



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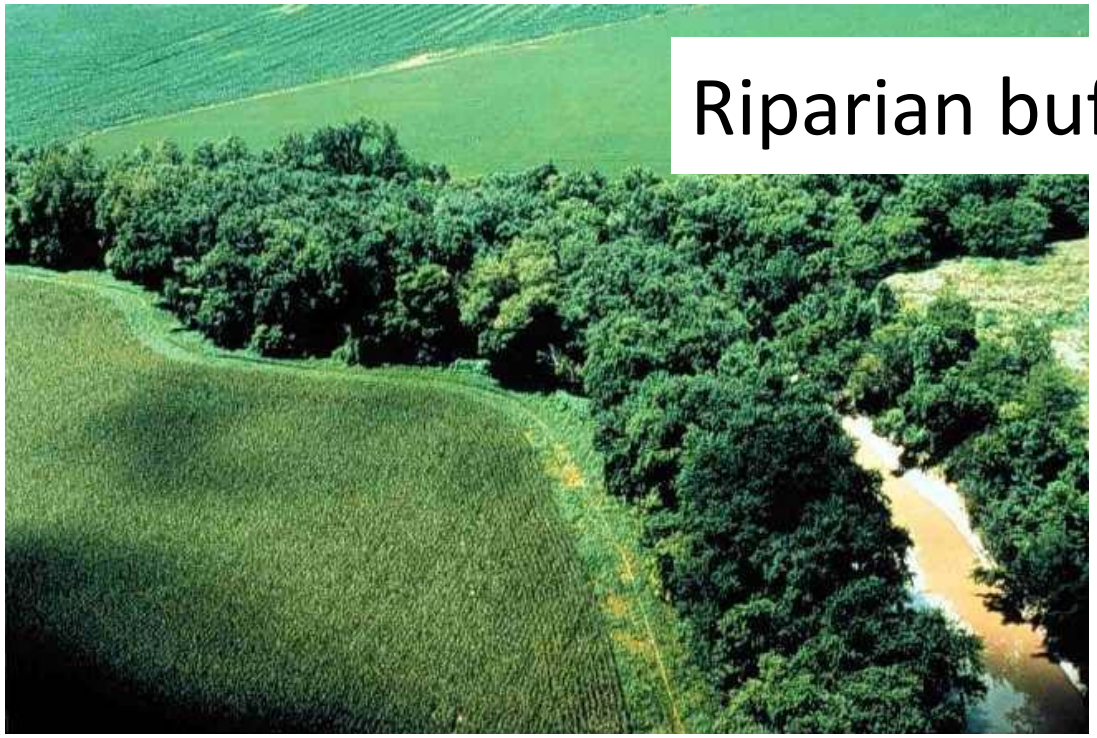

Riparian buffers

Contour planting

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3. Spatial arrangement

Tree Orientation

- Rows north/south to reduce shading on crops
- Shelterbelts orientated against prevailing winds
- Contour planting to reduce soil erosion
- Riparian buffers
- Odour or GHG buffers surrounding livestock housing

Tree density

- Trade-off between high volume wood production and greater competition with neighbouring crops at high densities
- Management of widely-spaced trees.
- Alley width determined by machinery size

4. Temporal arrangement

ROTATIONAL VS PERMANENT AGROFORESTRY

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5. Management

- Thinning and pruning – above and below ground
- Weed control in early years
- Pest control
- Protection from animals in early years and during regeneration
- Harvesting – trees and crops
- Tree stump and root removal after harvest

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Design Workshop

1. Divide into groups
2. Overview of case study farm
3. Identify drivers and constraints
4. Design one (or more!) agroforestry system for the farm…..could be one field or the whole farm!
5. Report back at 3.30pm

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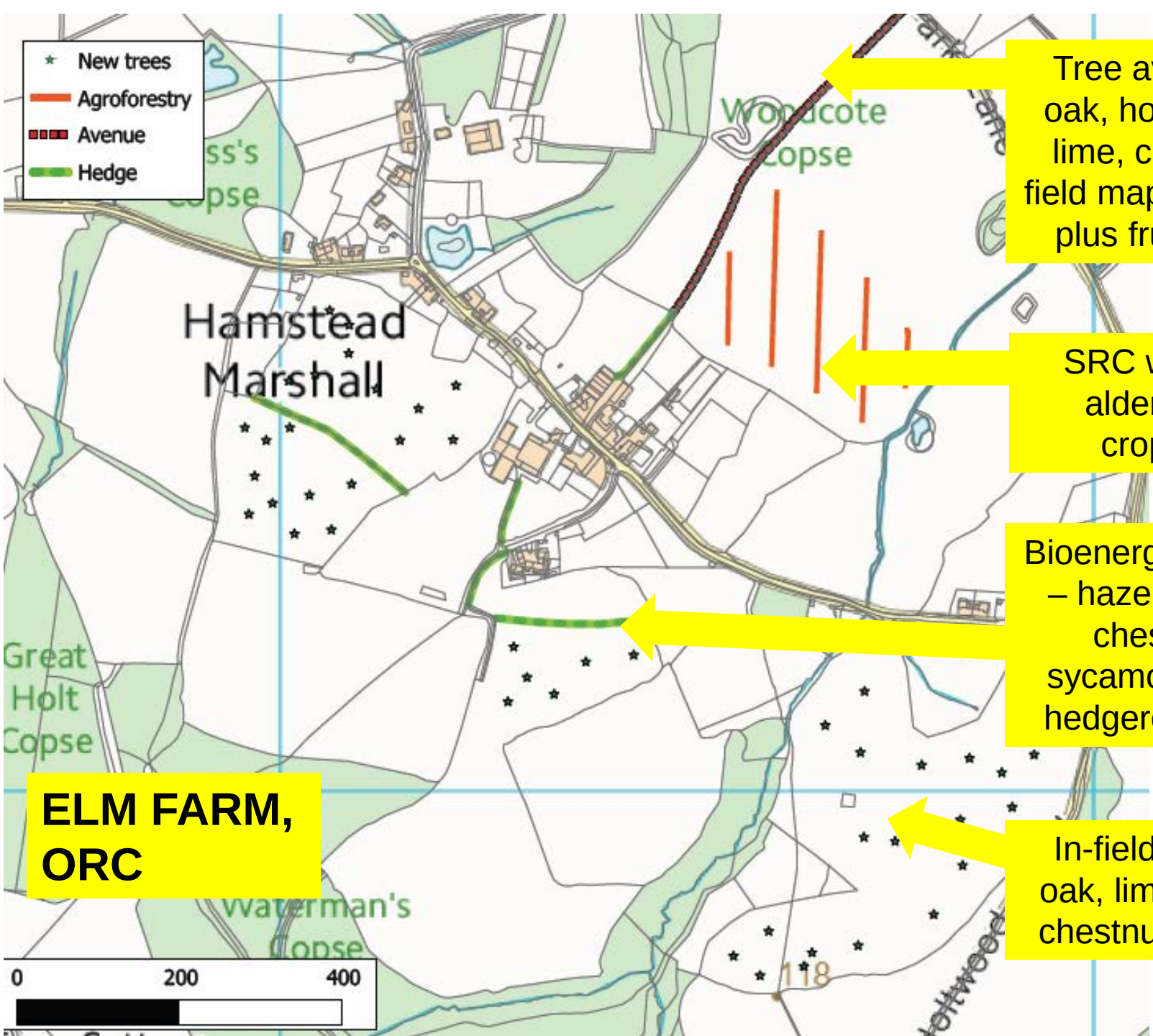
Design workshop

4 case study farms

- Dairy: Longnor, Shropshire
- Horticultural: Shillingford Organics, Devon
- Lowland livestock: Elm Farm, Berkshire
- Arable: Red House Farm, Cambs

Design Factors					
Species Selection			Spatial Arrangement		
Site characteristics	*Outputs/ products*	*Species properties*	*Tree distribution*	*Tree Orientation*	*Tree density*
Rainfall Drainage Soil Type Aspect	*Trees* Top fruit/nuts Fodder Timber Woodfuel *Crops* Arable Horticultural *Livestock* Dairy Meat Eggs Fibre	*Trees* Canopy structure Canopy density & timing Root structure Growth periods Harvest timings Allelopathic *Crops* Shade tolerance Growth periods Harvest timings *Livestock* Breed suitability for agroforestry Browsing impact	Scattered Rows and alleys Shelterbelts Small clumps Farm woodlands	Rows north/south to reduce shading on crops Shelterbelts orientated against prevailing winds Contour planting to reduce soil erosion Riparian buffers Odour or GHG buffers surrounding livestock housing	Trade-off between high volume wood production and greater competition with neighbouring crops at high densities Alley width determined by machinery size



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Tree avenue – oak, hornbeam, lime, chestnut, field maple, rowan plus fruit trees

SRC willow & alder, alley cropping

Bioenergy hedges – hazel, willow, chestnut, sycamore, plus hedgerow trees

In-field trees – oak, lime, sweet chestnut, walnut