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# FWF Annual Meeting 2012

# Integrating bioenergy and dairy production systems

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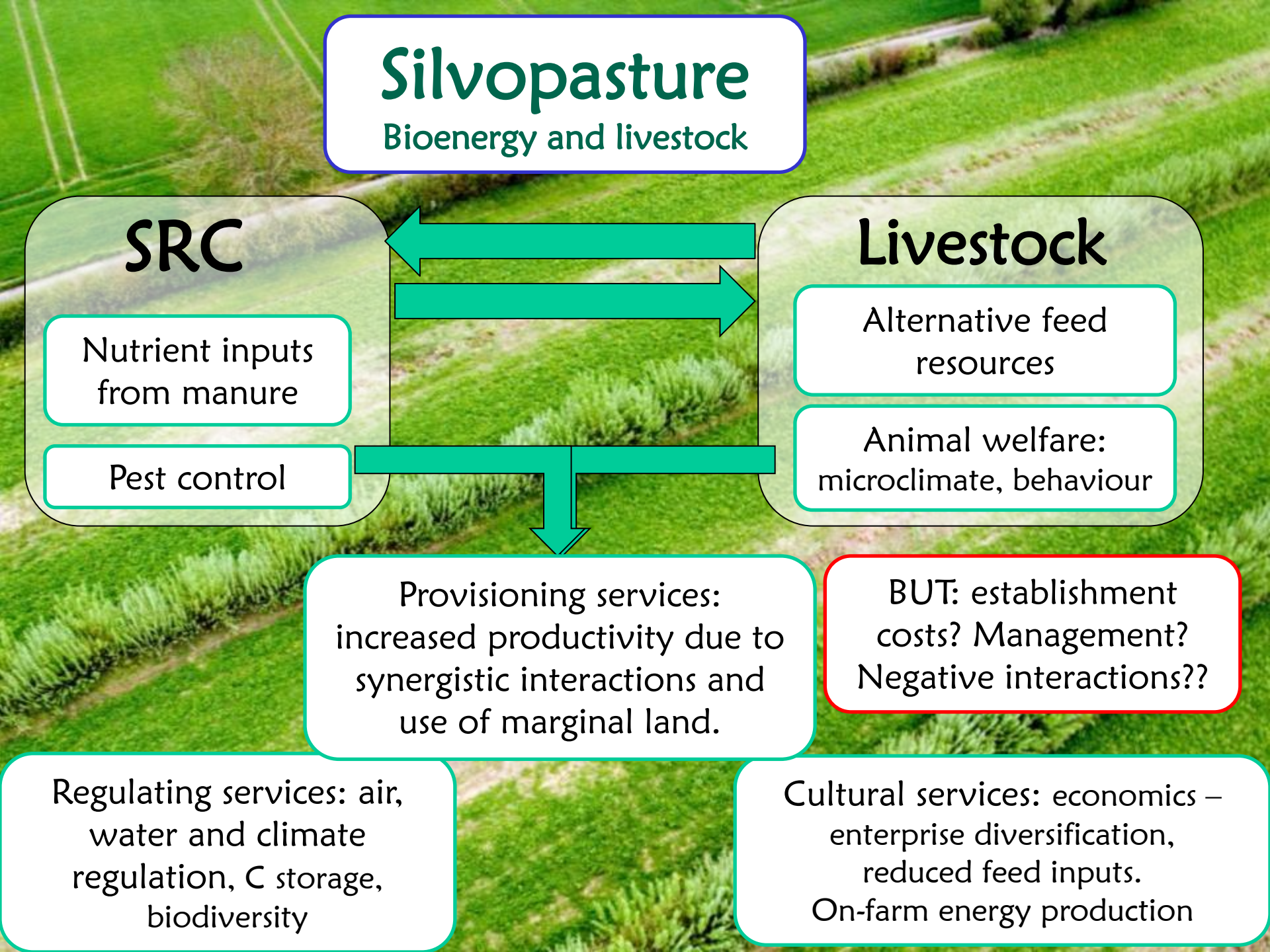
# Silvopasture

## Bioenergy and livestock



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SOLID | Sustainable Organic and Low Input Dairying

## FP7 Project: www.solidairy.eu

*To assess the viability and multifunctional potential of a novel integrated willow-based bio-energy/organic dairy production system*

(i) Establishing a new organic silvopastoral system to provide economic and environmental data – Elm Farm, Berkshire

(ii) Assessing an established willow bioenergy system – Wakelyns Agroforestry, Suffolk

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# (i) Establishing a new organic silvopastoral system to provide economic and environmental data – Elm Farm, Berkshire

| Willow | Alder |
|---|---|
| Well developed for SRC bioenergy production (infrastructure, varieties etc) | Coppices well, fast juvenile growth, similar yields to willow (Swedish studies) |
| Traditionally used as fodder | Less palatable to livestock and wildlife? Nutritional value lower? |
| 65-70% organic matter digestibility (similar to lucerne hay) | N-fixing through *Frankia alni*: 30-185kg N/ha/yr – transfer to pasture? |
| Crude protein: 17% in spring | Crude protein: 18-21% (black alder) |
| 1 – 6 tonnes $ha^{-1}$ $yr^{-1}$ of edible dry matter, the equivalent of 0.3-2.5 kg DM/tree (NZ study) | Productivity? |
| Contains salicyclic acid – internal parasites? | Medicinal properties of secondary compounds? |
| Also used for phytoremediation and biofiltration, craft materials | Can be used for charcoal, pallets, pulpwood |
| Biodiversity | |

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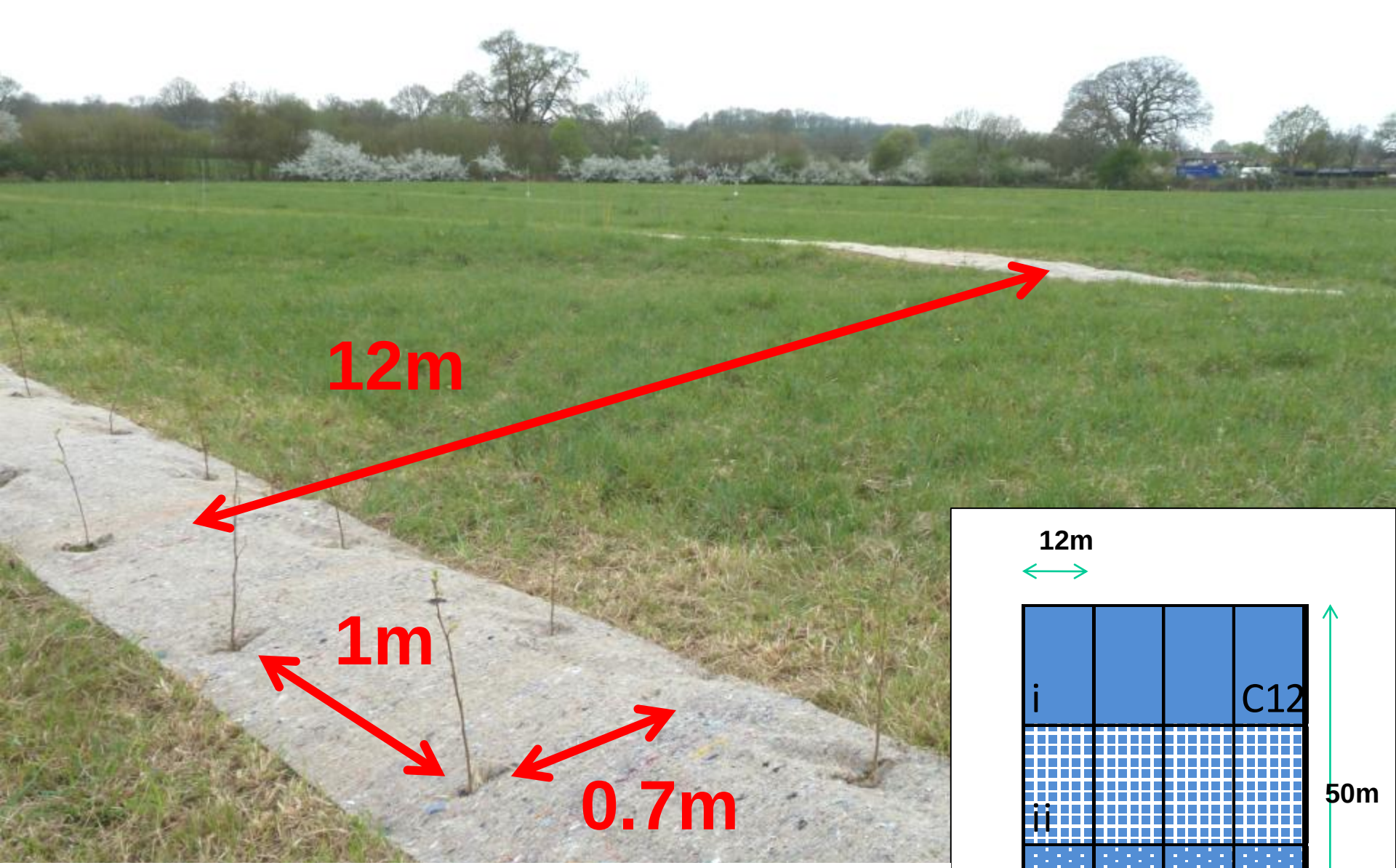






*Split plot design with 3 replicate blocks*

- **Main plot treatment:** species choice - willow, common alder, mix, pasture control
- **Sub-plot treatment:** weed management

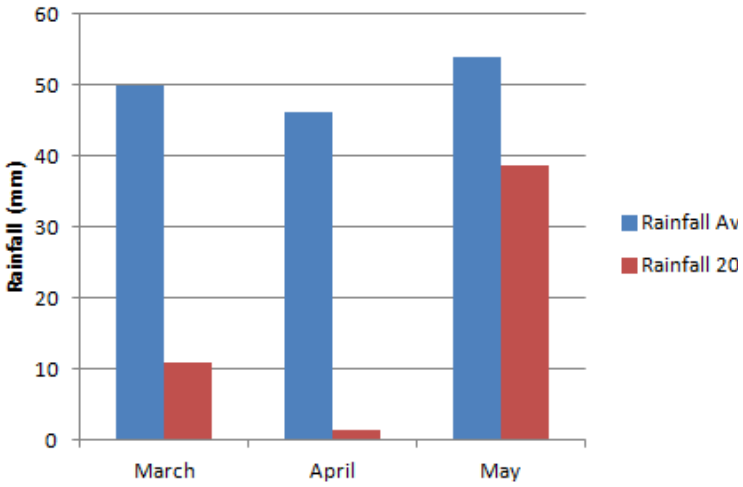


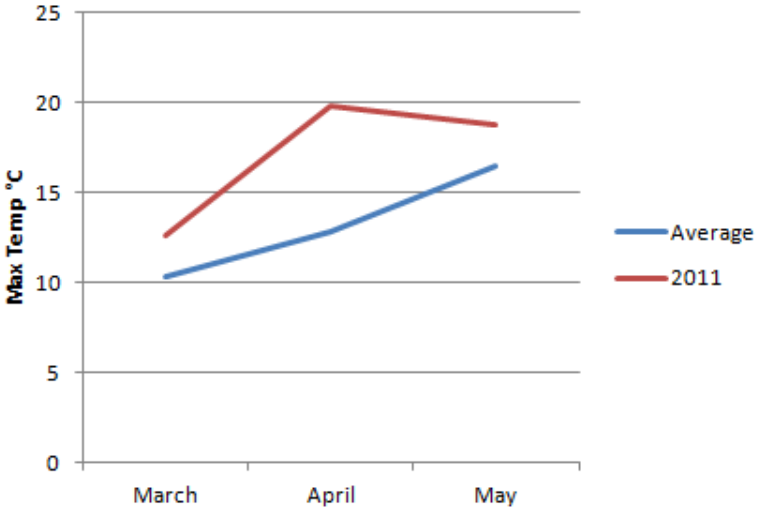


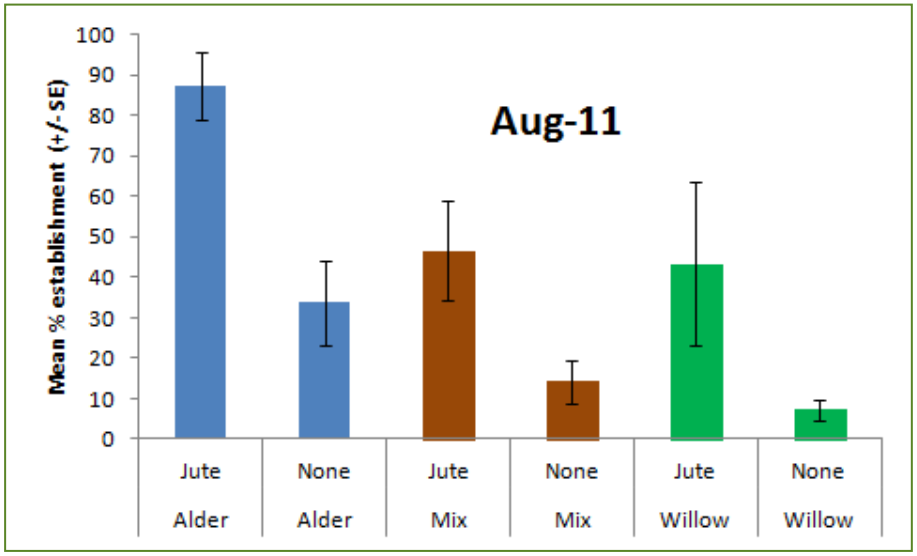




# Tree establishment (2011):

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# Parameters

- Economics of establishment and management
- Productivity – growth rates and biomass of SRC and pasture
- Microclimate effects (soil moisture & temp, air temp, humidity, shade, wind speed)
- Biodiversity (vegetation, soil inverts, epigeic inverts, pests and diseases)
- Soil and vegetation nutrients
- C storage (aboveground, soil and roots)

# Development

- Integration of livestock – management and impacts

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# Willow alley cropping at Wakelyns

4ha planted in 1998
20% willow
Harvested on a 2 yr rotation

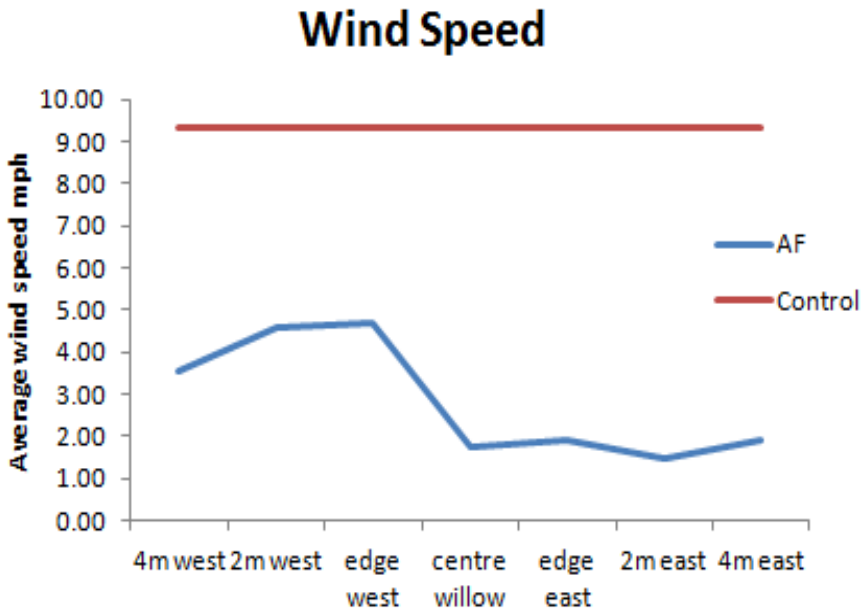
~ 6.7 t/ ha AF /year fresh weight

## Parameters

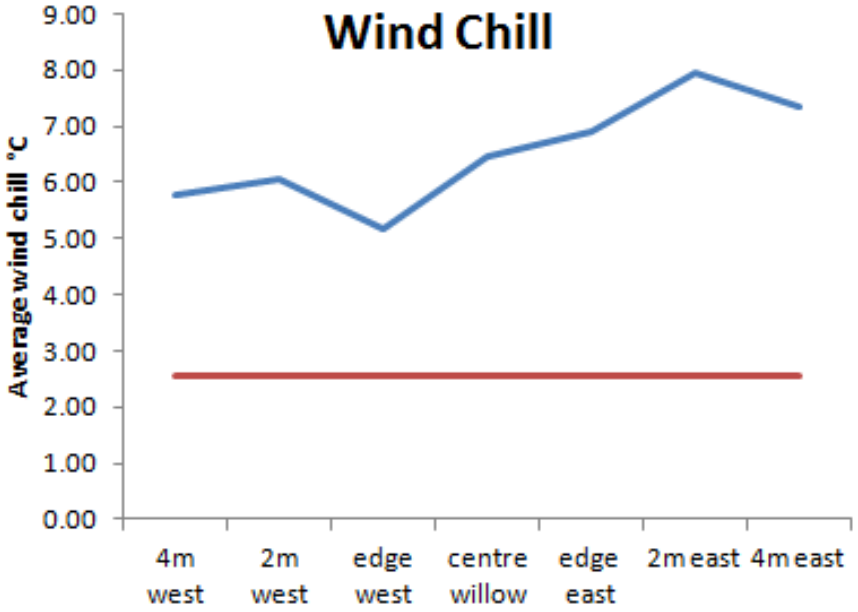
*Open pasture control under same ley mix*

- Microclimate effects: implications for animal welfare
- Feed value: quality (in vitro screening Task 3.1), quantity & availability
- Pilot study of ensiling willow
- Optimising productivity: trade offs between feed provision and bioenergy production

# Microclimate data: e.g. April 2012




Implications for animal welfare? *Animal Comfort Index; Temperature Humidity Index?*
Implications for pasture productivity?

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# Feed Value of Willow

## Treatments

- Age of re-growth; 1st year vs 2nd year
- Season: late spring vs late summer
- Leaves + stems <8mm diameter
- Analysis by MTT, Finland

# Feed value

| | Literature Range | First year | | Second year | | SEM | Statistical significance | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Early | Late | Early | Late | | Year | Season | Y*S |
| n | | 4 | 4 | 4 | 4 | | | | |
| Dry matter (DM; /kg) | | | | | | | | | |
| In DM (g/kg DM) | | | | | | | | | |
| Ash | 50-78 | 70.8 | 72.5 | 63.6 | 63.7 | 2.78 | <0.05 | 0.76 | 0.79 |
| Crude protein | 90-208 | 167 | 127 | 125 | 99 | 6.6 | <0.001 | <0.001 | 0.27 |
| NDF | 358-564 | 573 | 492 | 548 | 503 | 6.6 | 0.31 | <0.001 | 0.61 |
| ADF | 255-382 | 410 | 341 | 395 | 357 | 5.3 | 0.91 | <0.001 | <0.05 |
| Lignin | 82-142 | 184 | 136 | 168 | 135 | 4.5 | <0.1 | <0.001 | 0.11 |
| *In vitro* OM digest. | 0.43-0.91 | 0.405 | 0.383 | 0.399 | 0.369 | 0.0075 | 0.21 | <0.01 | 0.61 |

Crude protein higher in spring and 1st year

Lignin higher in spring and 1st year

Digestibility low (species/varieties/methods?)

**Conclude: Not high value feed! But may have role in providing fibre or as a buffer feed**