

Biomass Sustainability Research @ UKCEH

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Biomass Research in UKCEH

Climate mitigation, co-benefits and trade-offs

Focus on perennial biomass crops grown in UK

- What, where and how should we plant to maximise the environmental benefits?
- Air quality impacts of biomass production and use



Biomass crop suitability in the UK

Short rotation coppice (2-3 yr)



SRC Willow



SRC & SRF Poplar

Short rotation forestry (5-10 yr)



SRF Eucalyptus



SRF Alder



SRF Black Locust



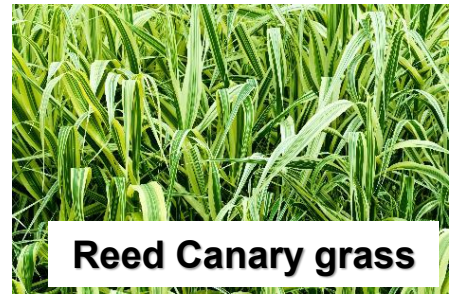
Perennial grasses (1 yr)



Miscanthus



Switchgrass



Reed Canary grass

Forbs (1 yr)



Sida

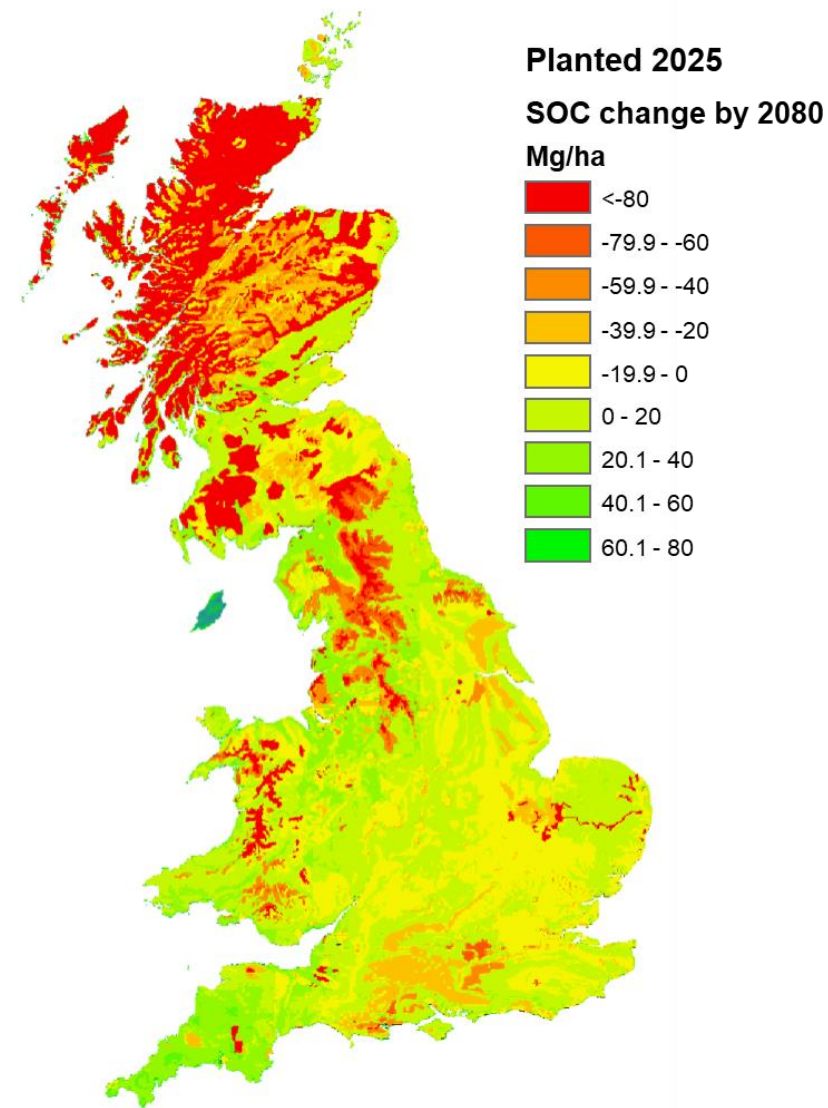


Silphium

Yield and soil carbon change across the UK

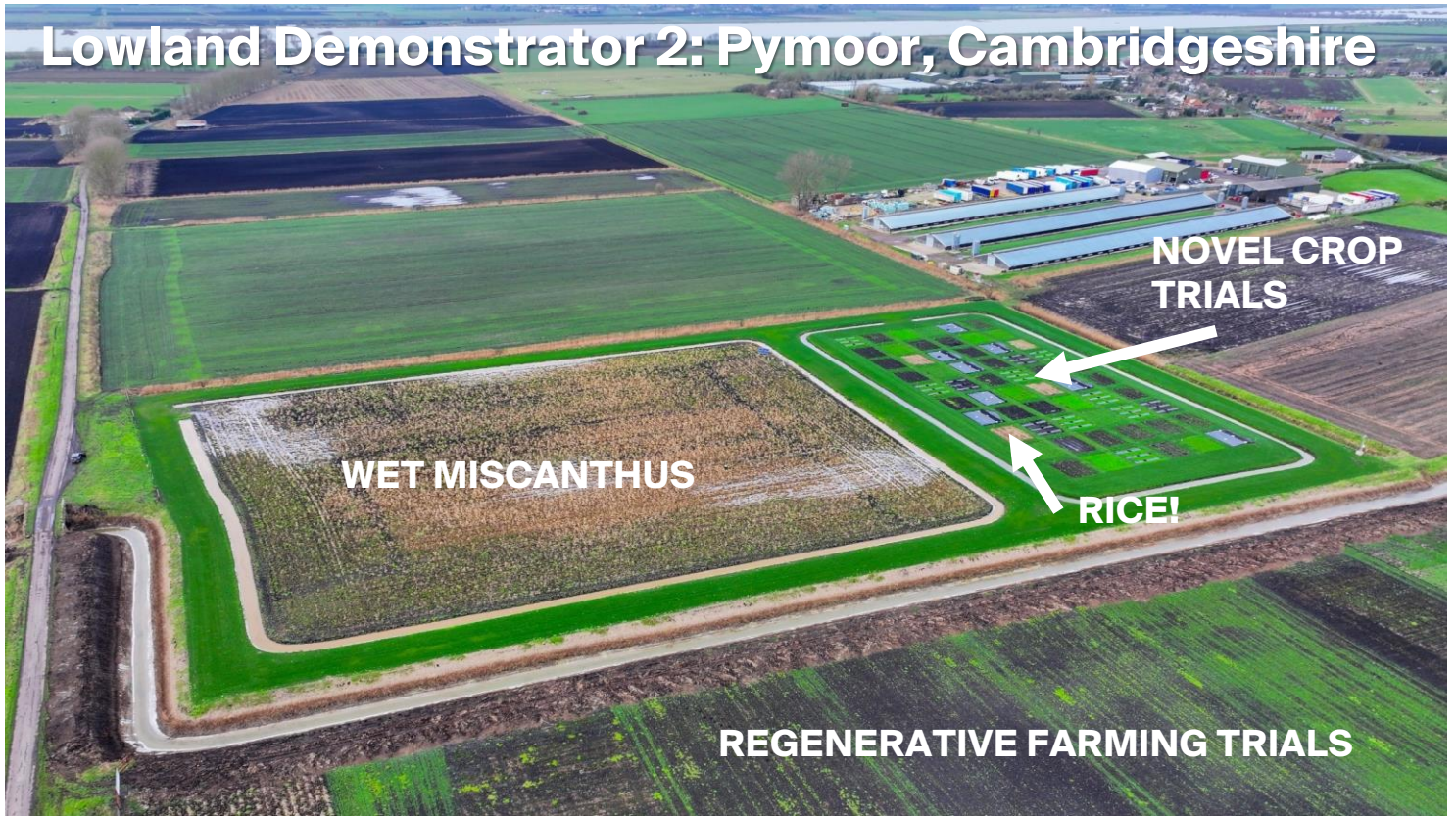
- Soil organic carbon (SOC) change is very important in carbon savings of biomass crop production
- SOC increases if initial SOC is less than 120 t/ha and decreases if over 120 t/ha this value
- Magnitude depends on yield which depends on growing environment
- Varies with climate scenarios

Astley Hastings and Anita Shepherd,
University of Aberdeen



Biomass and biochar from degraded peatlands

Peatlands are our largest terrestrial C store but are producing ~3% of total emissions

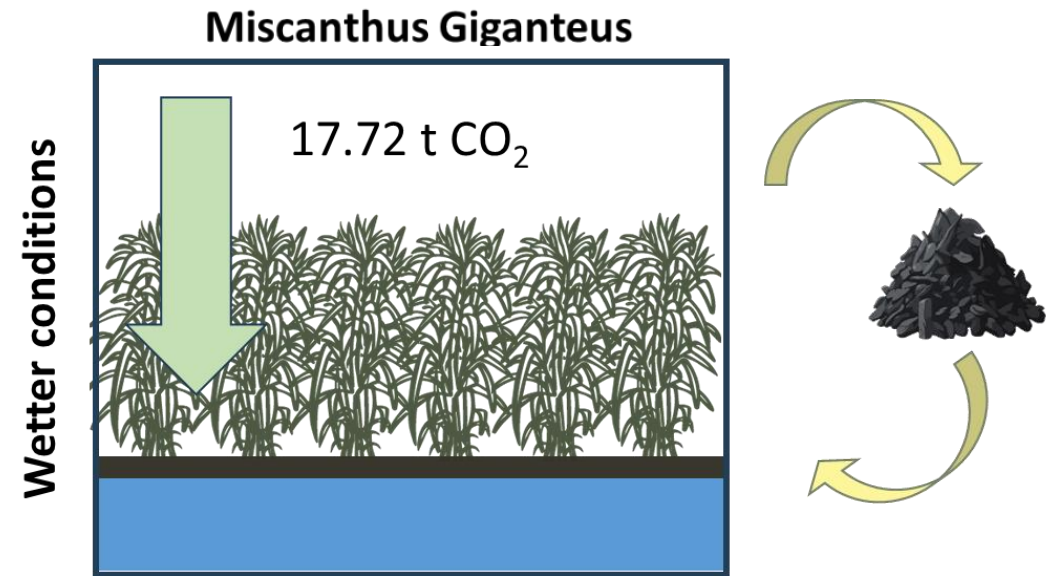


- Re-wet peatlands for carbon farming
- Grow biomass crops - paludiculture
- Make biochar from the biomass and deploy into the peat



What did we find? (selected highlights)

- We can shift lowland peat from a CO₂ source to a sink via biomass / biochar production
- Biomass crops grew well
- CO₂ sequestration greatly increased at higher water levels
- Biochar suppresses CH₄, N₂O and peat CO₂ emissions



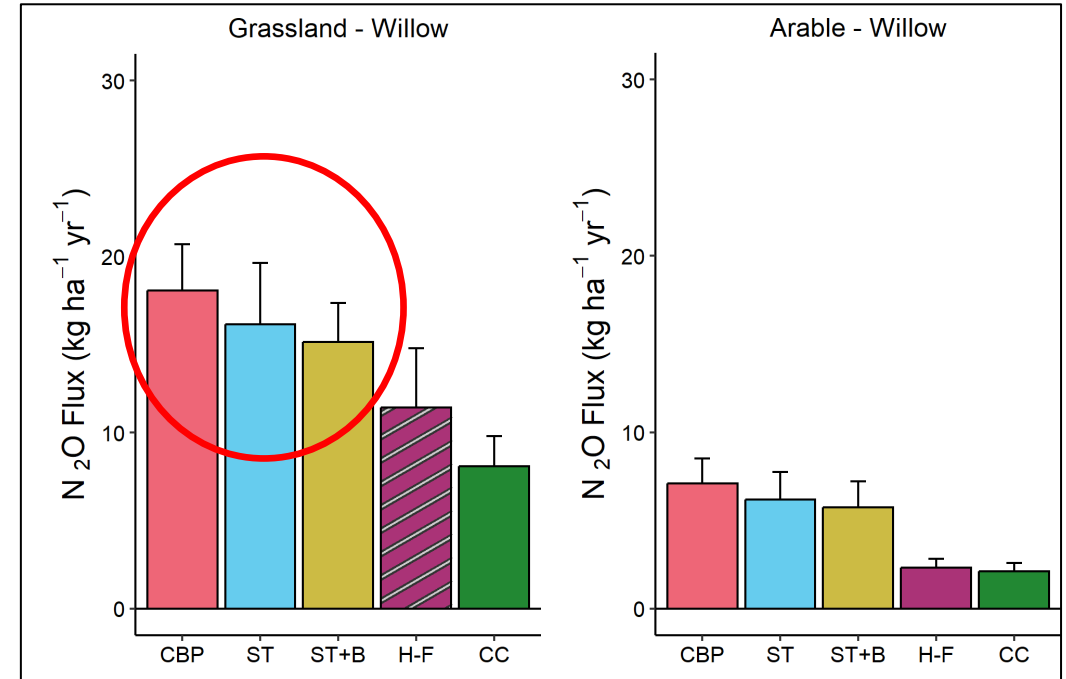
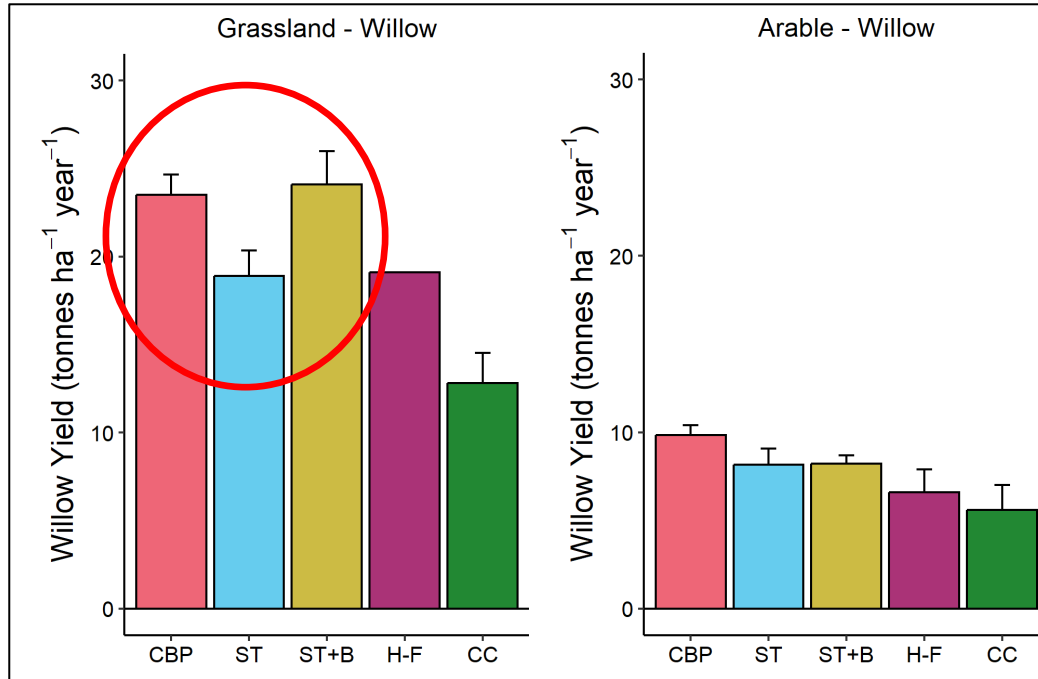
Can we maximize yield and minimize GHGs through planting and management?

- Two 80 plot trials of Miscanthus (3 types) and Willow (1 mix)
- Ex-arable (E. Yorks) and ex-grassland (Lancs)
- 5 crop establishment strategies for GGR and yield potential
 - Current best practice,
 - Strip till
 - Strip till+biochar
 - Herbicide free
 - Cover crop



Can we maximize yield and minimize GHGs?

SRC Willow



- Current best practice = best yield but largest N₂O
- Strip-till + biochar didn't impact yield in grassland
- Strip till +/- biochar didn't impact yield in arable
- Herbicide-free and cover crop were not as successful

Air quality and biomass research in UKCEH

Air quality impacts of domestic wood-burning

- In Scotland this is single largest source of $PM_{2.5}$

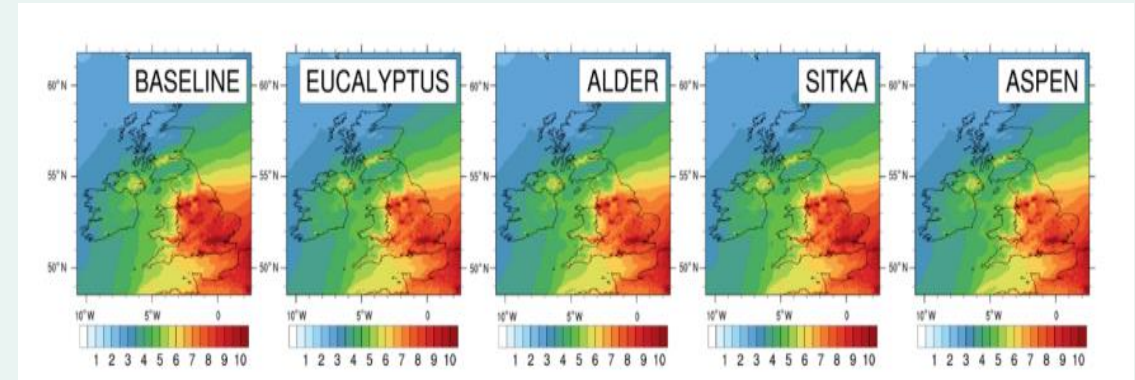
Direct NH_3 emissions from Anaerobic digestion

- More common in rural areas on-farm AD
- Increasing issue in urban areas due to expansion of food-waste AD



Air quality impacts of expanding biomass production in UK

- Trees emit Volatile Organic Compounds (VOCs)
- Precursors to ozone and other atmospheric pollutants
- We have emission factors for conventional forestry species
- But not for Short rotation forestry (fast-growing species) such as Poplar and Eucalyptus.



- Increased VOCs if forestry and SRF are significantly expanded across the UK
- This will result in increases in ozone and $PM_{2.5}$
- But forests also capture air pollutants ($PM_{2.5}$ and NH_3) – so potentially a net benefit
- Impacts likely to be localized but significant

Thank you.

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