Spatial Mapping and Evaluation of *Miscanthus* Crop Distribution in Great Britain to 2050

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UKERC project

Yields: variation and distribution

1) Miscanthus yields 2010-2050

2) Chalk soil water model

3) Constraints masked yield maps.

4) Energy yield and C mitigated

WP1: Bioclimatic envelope and yield

WP2: Environmental, Social and Economic Constraints

WP3: Economic assessment and spatial optimisation

WP4: Environmental, Social and Economic Impact Assessment

Spatial maps to 2050

1 = First iteration
2 = Second iteration
Convert meteo data from monthly to daily,

Calculate photosynthesis down-regulation

Calculate leaf Index

Calculate degree days & growing season

Calculate soil water deficit

Calculate evaporation down-regulation

Calculate solar energy absorbed

Calculate dry-matter production

Write files for grid-point, year & time-slice

mean and standard deviation each grid-point time-slice

Hastings et al. (2009a&b)
MiscanFor simulation

- Radiation calculated using cloud cover
- Potential Evapo-transpiration (PET) modified Thornthwaite
- Soil data from HWSD
- Field capacity and wilt point using modified Campbell 1985 with chalk modification
- Actual ET from SWAT method.
- 1 ha resolution for land use
Neutron Saturation profile
Sheepdrove experiment
2002-2006 to 4m depth.
(J. Finch)

New chalk soil water model match (red) to neutron saturation profile
Dry Matter Yield

Miscanthus

Mg ha$^{-1}$

High : 32

Low : 0

Campbell soil water

Chalk mod
Dry Matter Yield

**Miscanthus**

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<tr>
<th>Year</th>
<th>2010</th>
<th>2020</th>
<th>2030</th>
<th>2050</th>
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**Hi Scenario**
Prohibition Masks

- Roads, rivers, lakes Urban
- Slope>15%
- Monuments and heritage
- Designated areas
- Woodlands
- Peat soils
- Natural habitats
Miscanthus dry matter yields with constraint 1-9 (black mask)
1 ha resolution
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<tr>
<th>Yield Mg/ha</th>
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Mean Peak Yield 14.3 Mg ha\(^{-1}\)

2010 data
Peak yield change with time for UKCP-09

Hi scenario histogram

(NB Harvest yield is 66% of peak yield)
Using 100% non constrained land in 2010 for Mxg

928,475 boe/day  Gross energy production
874,943 boe/day  Nett energy production
65.9 Tg        C mitigated replacing coal
27.6 Tg        C mitigated replacing gas
**Miscanthus production energy cost**

**Crop cost v crop yield**

**Economic parameters**

- Exchange rate $1.6 to £
- Oil price $127 / bbl
- Wheat price £175 / ton, 8 tonne per ha yield
- Coal price $125 / tonne UK delivery

**Use Parameters**

- Rhizome propagation
- 20km transport
- Chopped fuel
- Replacing coal

**Subsidy per ton of Carbon mitigated required to match profit of growing wheat**
Conclusions

- 10% available land will give 93k boe/d
- C mitigated depends on fossil fuel replaced
- Costs will be reduced if seed propagated
- Subsidy required to maintain farm profit
- Need to compare to SRC willow etc.
Outputs so far

