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Rural Economy and
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Assessing the social, environmental and economic impacts of increasing rural land use under energy crops

A Rural Economy and Land Use Programme research project investigating the implications of increasing the area used for growing the perennial biomass crops miscanthus and short rotation coppice (SRC) willow in the UK.

Fields of miscanthus in the English landscape

Policy and Practice Notes

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The Rural Economy and Land Use Programme is a UK-wide research programme carrying out interdisciplinary research on the multiple challenges facing rural areas. It is funded by the Economic and Social Research Council, the Biotechnology and Biological Sciences Research Council and the Natural Environment Research Council, with additional funding from the Scottish Government and the Department for Environment, Food and Rural Affairs.

Concerns over climate change and future fuel security have resulted in the development of renewable energies as a substitute for fossil fuels. Willow grown as short rotation coppice (SRC) and miscanthus are biomass crops with potential for renewable energy production in the UK. Policies are encouraging farmers to grow more of these crops to help reduce CO_2 emissions. This would constitute a significant land use change. SRC willow and miscanthus are perennial, taller (3-5 m), deep-rooting and may attract different wildlife from conventional crops. This project aimed to identify the impacts of increasing land use under both crops, and to develop tools for assessing the potential effects of different expansion scenarios.

Why is the government encouraging farmers to grow perennial biomass crops?

SRC willow and miscanthus are already grown on over circa 17,000 ha in the UK to provide electricity and heat and research is progressing to produce transport fuels from biomass. Policies are encouraging up to around a million hectares because:

- Analysis of the whole chain from crop to fuel shows high carbon savings and greenhouse gas reductions are achievable
- SRC willow and miscanthus are fast-growing perennials and are not food crops
- Energy costs for cultivation are low
- They need far less nitrogen fertiliser and other chemicals than crops like wheat require

What effect do SRC willow and miscanthus have on farmland biodiversity?

Willow is native to the UK but miscanthus is an exotic grass originating from Asia. A survey of 24 sites across England revealed that:

- Compared to conventional crops, field margins of SRC willow and miscanthus crops had more butterflies of conservation interest and pest species of butterfly were less abundant
- There were more weeds and a greater range of invertebrates in SRC willow, compared with miscanthus
- SRC willow is likely to have a positive impact on the abundance of both farmland and woodland birds. There are, however, certain scarce, declining or otherwise important species that may be negatively affected
- The effects on bird populations from growing miscanthus are less clear

What effect do they have on water resources?

Measurements of water use at commercial field sites showed:

- The rooting depth of SRC willow and miscanthus is no greater than deeper rooting annual crops
- The water use of SRC willow is similar to that of a cereal crop, higher than permanent grass and lower than that of mature woodlands
- Water use of miscanthus approaches that of woodlands
- The net effect of converting land to biomass crops will depend on the previous land use, the soil type and climate

How will they affect the rural economy?

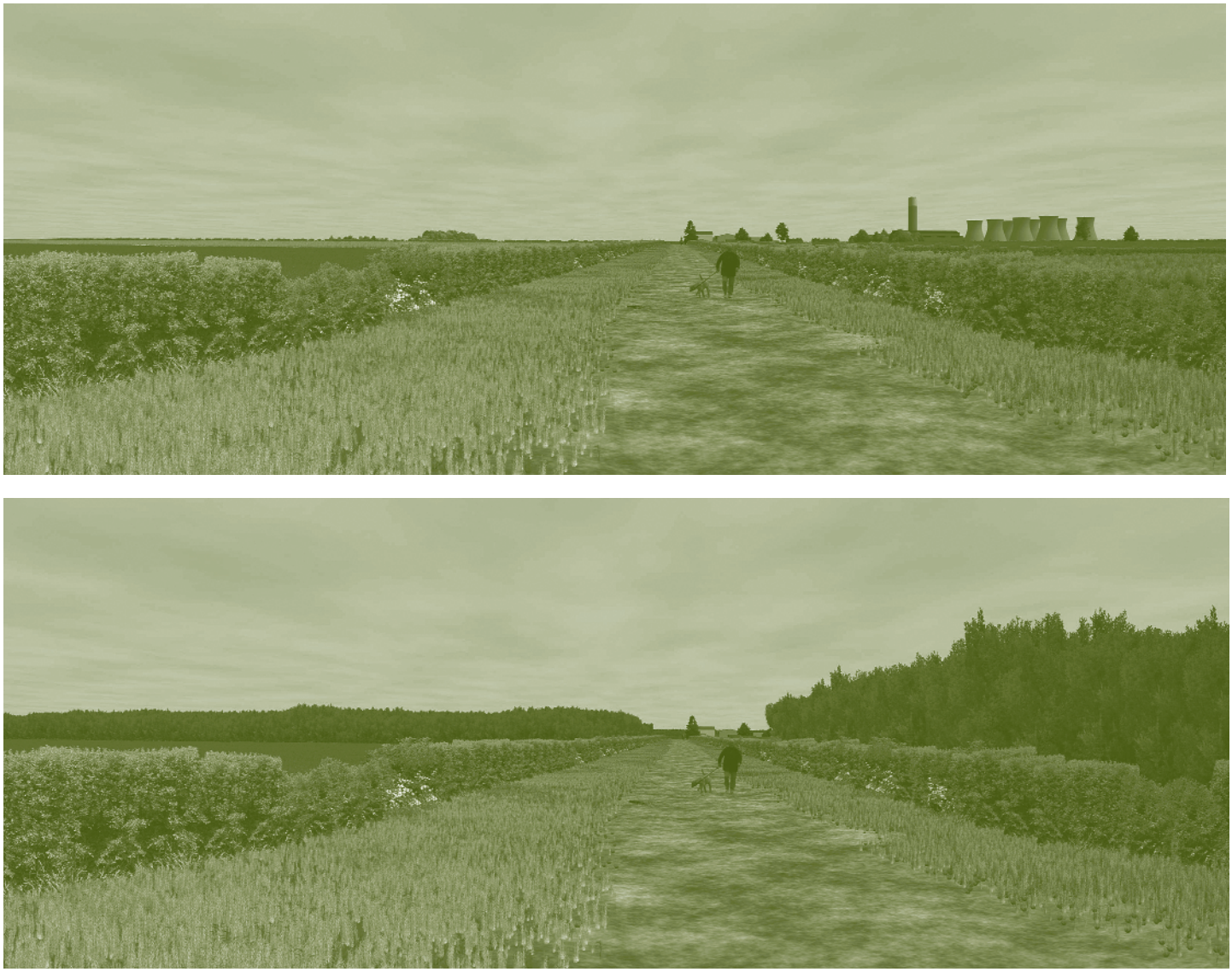
A wide variety of factors were found to affect farmers' decisions on whether to grow energy crops:

- Profitability was the most important factor
- Impacts of the crops on farmers' existing systems and their attitudes to risk management, market volatility and environmental issues were also important

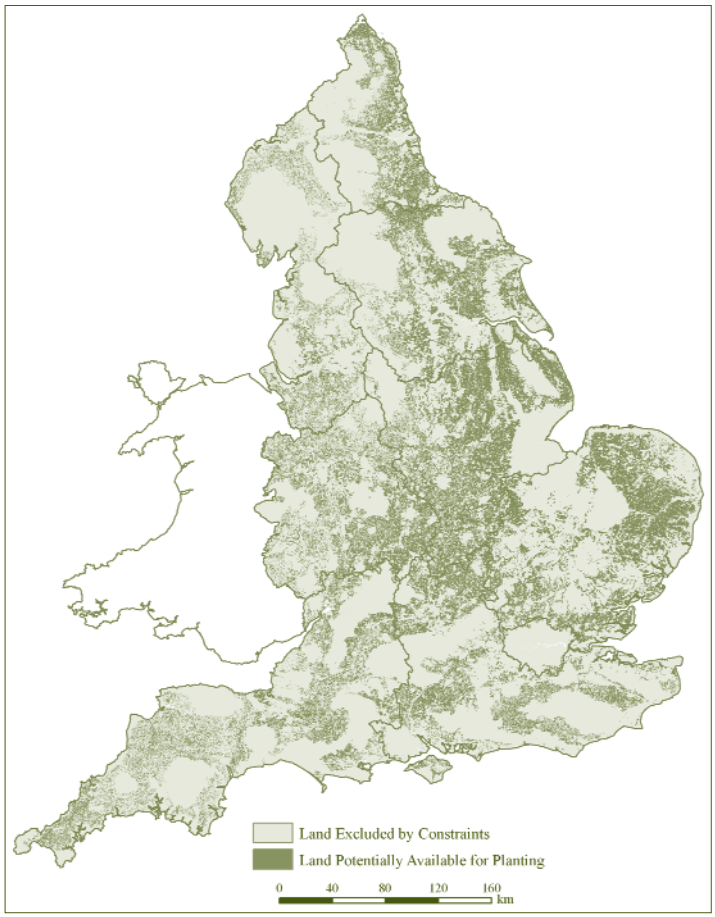
What is the public's attitude towards these crops?

Studies of public attitudes found that:

- Most members of the public were not particularly concerned about the appearance of these new crops and thought that they would fit in well with the current agricultural landscape
- People were more concerned with lorry movements and where biomass processing units and power stations would be built
- Wider margins, smaller, scattered fields (rather than large blocks of planting) and local small-scale end-uses were slightly more favoured than other planting options



Computer generated landscape view before (top) and after (below) SRC willow planting



Which areas would be best suited to growing biomass crops?

Suitability mapping was undertaken using miscanthus, as an example, to inform the land use change scenarios.

- GIS was used to map variations in miscanthus yield across England and, then to mask areas where the crop would not be grown due to constraints on land use (e.g. designated areas)
- Top grade land (classes 1 and 2) was excluded: most existing biomass crop planting is on agricultural land classes 3 and 4

How can the results be used in decision-making?

- There is real interest in growing biomass crops but the relative level of profitability and clear policy support would be essential elements in their large-scale adoption in the UK
- There is sufficient land available to meet production up to the UK government Biomass Strategy objective of 350,000 hectares for electricity without significantly impacting on food production. To meet an additional circa 750,000 ha for transport biofuels would place increased pressure on remaining land
- GIS-suitability mapping and sustainability appraisal have been used to integrate the evidence for decision making
- Widespread public opposition to planting of these crops on aesthetic grounds seems unlikely
- Both SRC willow and miscanthus crops are biodiverse, especially willow, but could benefit from plantation design and management protocols that are sympathetic to wildlife

Further information

The Research has been carried out at Rothamsted Research, the University of East Anglia, the Centre for Ecology and Hydrology, Wallingford, and the University of Exeter.
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Useful resources:

Finch, J W, Riche A B, (2008) Soil water deficits and evaporation rates associated with Miscanthus in England. Aspects of Applied Biology 90, Biomass and energy crops III, 295-302.

Haughton, Alison, Bond, Alan, Lovett, Andrew, Dockerty, Trudie, Sünnenberg, Gilla, Clark, Suzanne, Bohan, David, Sage, Rufus, Mallott, Mark, Mallott, Victoria, Cunningham, Mark, Riche, Andrew, Shield, Ian, Finch, Jon, Turner, Martin, Karp, Angela. (2009) A novel, integrated approach to assessing social, economic and environmental implications of changing rural land-use: a case study of perennial biomass crop. Journal of Applied Ecology 46, 315-222.

Lovett, Andrew A, Sünnenberg, Gisela M, Richter, Goetz M, Dailey, A Gordon, Riche, Andrew B and Karp, Angela. (2009) Land-use Implications of Increased Biomass Production Identified by GIS-Based Suitability and Yield Mapping for Miscanthus in England. Bioenergy Research. 2, 17-28.

Project Website:
www.relu-biomass.org.uk

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