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The National Assembly for Wales: Environment, Planning and Countryside Committee
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Biomass: Submission by the Countryside Council for Wales

The Countryside Council for Wales champions the environment and landscapes of Wales and its coastal waters as sources of natural and cultural riches, as a foundation for economic and social activity, and as a place for leisure and learning opportunities. We aim to make the environment a valued part of everyone's life in Wales.

Introduction

Following the discussion on biomass at the committee's meeting of 23 March 2006 in Haverfordwest, the Countryside Council for Wales was pleased to be asked to submit evidence on the biodiversity implications of biomass. We start by setting out briefly our general approach to energy and biodiversity policies, before considering the biodiversity impacts of biomass. We then briefly raise a number of other wider issues concerning biomass.

Summary

The key biodiversity and landscape issues concerning biomass cropping are:

- **Location and management**. Locational factors and the crop management regime are likely to be the most significant aspects in terms of the biodiversity impact of biomass planting. Targeting biomass planting, for example, near to watercourses as buffer strips to reduce diffuse pollution could be beneficial, though more work is needed to investigate the hydrological implications.
- **Protecting biodiversity**. Planting biomass on sites designated for nature conservation value, and other semi-natural habitats, must be avoided.
- **Scale of planting.** Particular care is needed to ensure that the scale of planting is appropriate to the character of the landscape, especially within designated landscapes or landscapes of historic importance.
- **Species likely to benefit** from an expansion in biomass cropping include birds, invertebrates and small mammals – however declining species dependent on more specialised habitats are unlikely to benefit.

We recommend that:

- further work is undertaken to expand the suite and coverage of best practice guides, to include landscape and biodiversity issues;
- planting proposals should be subject to some form of environmental assessment (such as a checklist) and any energy crop scheme should be compatible with agri-environment schemes;
- consideration is given to the development of a certification system for biomass crops.

UK and WAG Energy Policy

The UK Government's energy white paper "Our energy future: creating a low carbon economy" sets the target for UK CO_2 emissions to be reduced by 60% from current levels by 2050. CCW supports this long-term aim which, by implication, should be the major driver of policy

We have recently made a detailed submission in response to the UK Government's Energy Review Consultation Document *"Our Energy Challenge: securing clean, affordable energy for the long-term"*. This set out our views on a number of renewable energy (RE) technologies. In Wales, we have welcomed the WAG's Energy Route Map, and we look forward to playing a positive role in its implementation. In general, we suggest that to ensure the development of "the right RE technology in the right place" a strategic approach to planning for renewable technologies is required, which we hope that the forthcoming Energy Route Map will provide. CCW welcomes the strategic approach set out in TAN 8 in relation to terrestrial wind energy and would support a similar approach to the development of other renewable energy technologies. It is critical that the planning and delivery of energy policy in Wales fully reflects the following high-level strategies:

- The National Assembly for Wale's Scheme for Sustainable Development and the Welsh Assembly Government's Sustainable Development Action Plan;
- The Welsh Assembly Government's Spatial Plan, *People, Places, Futures;*
- The Welsh Assembly Government's emerging environment strategy;
- The Welsh Assembly Government's strategic framework for economic development.

CCW believes that the priorities for energy policy are to:

- Achieve greater energy efficiency and promote energy conservation. All the evidence suggests that large gains remain to be made in all sectors with regard to the efficiency with which energy is used.

- Develop a diverse mix of energy sources and electricity generation capacity, including a wide diversity of renewable energy technologies, with every source seeking to maximise generation efficiency and minimise greenhouse gas emissions. Such a framework should be based on clear sustainable development principles as laid out in the UK Government's shared framework for sustainable development.

The recent report by the *Biomass Task Force* (October 2005) to Defra and the Government's response published on the 27th of April[1] was produced in an England context, but much of the information it contains is applicable to Wales. The Environment, Food & Rural Affairs (EFRA) Select Committee in the House of Commons has also been taking evidence on the role of bioenergy in relation to climate change and consideration should be given to relevant evidence and impending recommendations applicable to Wales. Progress on the existing NAW Farm Woodland Development and Biomass Action Plan (2002) is currently being reviewed and the Assembly's current consultation on microgeneration (which ends on the 25th of June) refers to biomass. It is therefore timely to consider these issues and feed into the development and implementation of the new Energy Route Map.

UK Biodiversity Policy

At the European Council meeting in Gothenburg in June 2001, the EU committed itself to reversing the decline in biodiversity by 2010, by adopting the EU Sustainable Development Strategy. Noting that the loss of biodiversity in Europe has accelerated rapidly in recent decades, the Strategy established an objective *to protect and restore habitats and natural systems and halt the loss of biodiversity by 2010*.

The UK government is committed to the EU Habitats and Birds Directives, including the Natura 2000 network of special sites, which have a central role to play in the achievement of EU biodiversity policy. The UK Biodiversity Action Plan is a key mechanism for the increasing the populations of vulnerable species and improving condition and extent of semi-natural habitats through individual action plans.

Biomass

Biomass is generally accepted to be carbon-neutral, that is, carbon emitted in combustion is equal to that absorbed by the growing plant, though how biomass is utilised can influence the effectiveness of greenhouse gas (GHG) saving. The driver behind the adoption of biomass as an energy resource has been climate change and the need to reduce GHG emissions. Overall, biomass has the potential to contribute to WAG energy policy objectives.

Biomass energy can be drawn from a range of sources including wood (from existing woodlands and plantations), short rotation coppice, energy crops and waste (timber co-products, waste wood, animal manures/slurries, sewage sludge and food waste). CCW recommends that all sources of biomass, particularly those arising from 'wastes' are considered to ensure efficient use of materials and to maximise benefits.

Liquid biofuels for vehicles (bioethanol and biodiesel) are considered increasingly viable replacements for petrol and diesel. However aspects of biofuel production differ in some respects from biomass, and will not be discussed in this paper.

[1] The Government's Response to the Biomass Task Force Report, April 2006: http://www.dti.gov.uk/renewables/renew_responsetothebiomasstaskforce.htm

We share the concern of the Advisory Council on Releases to the Environment (ACRE)[2] that novel crops (non-GM) and agricultural practices can be introduced without assessment of their environmental impact. Biomass from plant sources, whether existing (woodlands and plantations) or newly established short rotation coppice or energy grasses, should comply with best practice to ensure that there are no negative environmental impacts. Further work is needed to expand the suite of best environmental practice guides[3] (for example, more comprehensive environmental guidance for Miscanthus and other energy grasses) and we consider it advisable that planting proposals are subject to an environmental assessment (perhaps based on a checklist, similar to the Tir Cynnal approach) to identify potential impacts on biodiversity and soil and water resources. A certification system (similar to the UK Woodland Assurance Scheme) is another option which would help to ensure that biomass production was sustainable.

Biomass: implications for biodiversity

There has been limited research into the implications of biodiversity of biomass planting, particularly of energy grasses (see the Annexe to this paper for a short literature review). However, based on available research we envisage a number of positive and negative implications. Positive aspects include:

- SRC and, to a lesser extent, grass energy crops, have the potential to support a wide range of species, some of which are priority species for nature conservation in the UK. However, benefits are very dependent on the location and management regime of crops.
- Energy crops could result in a reduction in diffuse pollution from fertilisers and herbicides due to lower intensity crop management relative to intensive grassland or arable production.
- Properly targeted, and with the right management regime, the planting of biomass crops as buffer strips or in fields adjacent to water courses could help achieve water quality objectives through reducing diffuse pollution. More experimental work is needed to investigate whether this is a potential benefit and to promote the development of the crop without the use of herbicides and other pesticides that could potentially add to water quality problems.

There are concerns that:

- Biomass crops could replace habitats of biodiversity value. Designated sites and semi-natural habitats are generally unsuitable for biomass planting. Even some more intensive land-uses (such as spring-sown cereals) are likely to have greater inherent biodiversity interest.
- Short rotation willow coppice (SRC) is known to have high water demand[4]. Energy grasses are thought to have a lower water demand than SRC, but

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[2] Consultation on the ACRE report on "Managing the Footprint of Agriculture: Towards a Comparative Assessment of Risks and Benefits for Novel Agricultural Systems" Letter from Christopher Pollack, 17 March 2006.

[3] Short Rotation Coppice for Energy Production Good Practice Guidelines. British Biogen/DTI (1999); Wood Fuel form Forestry and Arboriculture, Good Practice Guidelines. British Biogen/DTI (1999); Planting and Growing Miscanthus. Best Practice Guidelines for Applicant's to Defra's Energy Crops Scheme. Defra 2001.

[4] Hall, R.L., Allen, S.J., Rosier, P.T.W., Smith, D.M., Hodnett, M.G., Roberts, J.M., Hopkins, R., Davies, H., Kinniburgh, D.G. and Gooddy, D.C., 1996. *Hydrological effects of short rotation energy coppice.* ETSU B/W5/00275/REP, Report to ETSU for DTI by Institute of Hydrology & BGS, Wallingford.

more than for annual crops. Wetlands of biodiversity value may be vulnerable to nearby planting affecting the hydrological regime and site by site assessments of impacts may be necessary.

- The loss of small scale, low intensity arable cultivation or the replacement of spring sown arable crops could negatively affect specialist farmland birds (such as yellowhammer, skylark, lapwing and grey partridge) or areas used by wintering waders and wildfowl.
- The potential loss of hedgerows, and other traditional field boundaries, through neglect or removal as a result of the change in land use to biomass crop could be damaging. Hedges, walls banks and ditches often constitute a significant biodiversity resource in farmed areas.
- The scale of planting, either nationally or locally could lead to the problems associated with monocultures, including pests and disease, and lack of habitat diversity.
- Non-native strains of willow planted as a crop could hybridise with native willow species which would have genetic implications for the species involved. A separate issue is the possibility of fast-growing, competitive crops escaping into the wider countryside where they could invade semi-natural habitats and cause loss of native wildlife.

Priorities for further research are:

- Investigating the role of energy grasses in buffer strips to protect watercourses from diffuse pollution.
- The effects on local hydrology, water quality and temperature of both SRC and energy grasses when planted close to watercourses.
- Work to refine locational targeting to maximise benefits of biomass planting and minimise disbenefits.
- How the biodiversity in established Miscanthus stands compares with arable crops / grassland.

Biomass – landscape implications

The landscape implications of biomass crops depend on the character of the landscape in which the crop is to be grown and whether the crop would change that character. The key issue is the scale of the change – that is, one field might not be significant, a whole landscape of biomass might be very significant.

Changing landscape character isn’t necessarily a negative impact, but change needs to be viewed in terms of what it was about the existing landscape that was worthy of conserving, and whether such attributes would be lost through the changes the biomass cropping would make. It would be necessary to consider what new attributes the new biomass crops would bring to the landscape as benefits. For example a tall crop might provide shelter in a once exposed landscape. However, elsewhere, tall crops could block views and obscure traditional landscape features such as hedgerows and walls.

Short rotation coppice might bring some benefits if the environment created was akin to woodland. In landscape and access terms coppice areas could bring some of the benefits associated with woodland, to previously open areas.

The scale of biomass planting influences the likely impact. A patchwork landscape of small coppices, say between 1/3 and 2/3 of the total landscape wooded may have very positive impacts on the landscape. However extensive unbroken coppice with large scale 'industrial' mechanical harvesting may produce a landscape similar to forestry clearfell – but on a much more frequent cycle.

There may be particular landscapes that are valued for how they are at present, where particular care is needed to assess the potential landscape impact, especially if large scale planting is envisaged. Designated landscapes such as National Parks and AONB are obvious examples where the landscape would be very sensitive to biomass planting and special care would need to be taken to avoid adverse landscape impacts. Historic landscapes, such as open grazed landscapes with stone wall patterns could be obscured by coppice or tall energy grasses. Protection of archaeological sites, both above ground and buried should also be taken into consideration.

Biomass – wider issues

Change in farming systems as a result of CAP reform could result in an increase in the amount of locally grown biomass in Wales due to reductions in scale of livestock farming, though clear trends have yet to emerge. IGER have suggested[5] that 100,000ha of energy crops is a suitable target to aim for in Wales, representing 10% of arable and grassland. CCW estimates based on habitat survey data indicate that this represents approximately 10% of the area of improved grassland in Wales. Though technically possible, a change of land use of this magnitude would have potential impacts on biodiversity and landscape. Change on this scale would also imply a significant shift in the farming economy and wider considerations would need to be taken into account. At the local scale schemes could result in significant areas of land being taken up by energy crops and some form of impact assessment would be desirable.

Issues to consider at a strategic level include:

- **transport issues and scale:** Biomass energy is most efficient when the source is close to the end use, to reduce transport impacts. Biomass-fuelled heat is deemed to be more efficient than biomass-fuelled electricity production, though combined heat and power generation is efficient. These considerations suggest that it would be more effective to concentrate on smaller scale installations, such as schools or institutions, and small scale local heating / microgeneration than on large scale projects, such as co-firing power stations. A number of small-scale installations already exist and can act as exemplars and guide refinements in both technological and administrative aspects. Coed Cymru has developed a small scale wood pelleting process which supports the development of such initiatives, allowing pellets to be produced locally.
- **Utilisation of wastes**: The utilisation of waste needs to be accompanied by waste reduction, recycling and other sustainable consumption and production initiatives. There may be a need to align the waste regulations with use of waste as a renewable energy resource.

[5] EPC(2) 05-06(p5))

Biomass – funding issues

Evidence in the Biomass Task Force report suggests that biomass-fired heat has an 80% energy extraction efficiency and that the technology is available. Lack of confidence appears to be a major barrier to uptake. In Wales, the Centre for Alternative Land Use is researching and promoting biomass energy, and the Forestry Commission has secured funding from Objective 1 & 2 for the Wood Energy Business Scheme (WEBS). Opportunities for capital grants for equipment (boilers or anaerobic digesters and associated infrastructure) for community, farm scale and domestic use should be pursued. Such grant aid could be targeted geographically (perhaps guided by the forthcoming Energy Route Map). We support the recommendation of the Biomass Task Force that such policies need to be in place for the medium term, (5–7 years) to build confidence and to achieve a significant impact.

Short rotation coppice (SRC) can only be supported under Axis 2 of the EAFRD[6], whilst support for *Miscanthus* and bio-energy is possible under a combination of Axis 1 and the EU Energy Crops Scheme. The cost of delivering an energy crop scheme on 9000ha is estimated at c £9m pa (ie approximately £1000 / ha). Were this to be delivered via modulation applied to all Welsh farmers, the beneficiaries would be very limited. This is in contrast to the principle adopted by Tir Cynnal, which is substantially funded by modulation, but is widely available. Given the likely budget limitations on the RDP 2007-2013, using financial support for energy crops from Axis 2 would compete with other important environmental measures.

[6] European Agricultural Fund for Rural Development (EAFRD) under which the country Rural Development Plans for 2007 – 2013 will operate.

Annexe

Biodiversity impacts: summary of findings of a literature search

This literature review was undertaken in April 2006 using all available online literature databases and additional internet searches to collate both published research and any relevant grey literature. Biomass crops are still a relatively new land use and as such the literature available on their impacts is relatively sparse.

Short Rotation Coppice (SRC) willow is planted and harvested on a two to five year rotation (generally 3). During preparation and the first year after planting, weed control and fertilizer application is advocated to aid establishment (English Nature, 2003). After this initial establishment period, the impact of SRC crops on water quality is likely to be beneficial (Hall, 2003b). This is because current SRC management practises use far less fertilisers and pesticides than intensive arable or grassland management. There has, however, been recent evidence that yields can be increased with the addition of nitrogen fertiliser (Hall, 2003b). This raises concerns that future management practices could lead to water pollution from the application of fertilisers. Where fertiliser is used, sewage sludge (a common choice) may cause pollution problems. Sewage sludge contains high levels of nitrates and phosphates and is often contaminated with heavy metals.

Grasses currently grown for fuel include *Miscanthus*, reed canary grass and switch-grass. All are tall, woody, perennial grasses and apart from reed canary grass are not native to the UK. They grow rapidly and are harvested on an annual basis in winter. After establishment, the annual fertiliser demands of the grasses are low. Weed control in the establishment phase of the crop is essential, but once the crop is mature (from the third year), competition from weeds is effectively suppressed and herbicides are unlikely to be necessary (English Nature, 2003). Research has shown that *Miscanthus*, once established, can lead to low levels of nitrate leaching and improve groundwater quality; compared with growing arable crops (Hall, 2003a & Christian and Riche, 1998). There is also evidence that nitrate-rich groundwater can be ameliorated by continual cropping with reed canary grass (Geber, 2000).

Energy grasses and SRC could offer opportunities for improving water quality by planting buffer strips along watercourses and for remediation of waste waters. Their long lasting, extensive root systems provide efficient utilisation of nutrients from fertiliser runoff and waste products (Hall, 2003a & Hall, 2003b). The removal of nutrients from the growth system by harvests is limited, however, and any applied wastes would need to be carefully regulated, to avoid leaching of nutrients. There are also serious concerns (see below) over the effects of these crops on local hydrology that would need to be researched further before the use of biomass fuel crops could be recommended as buffer crops along watercourses.

Research, in the UK and on the continent, has shown that willow and poplar SRC use large quantities of water (Hall et al, 1996 & Stephens et al, 2001). In the UK, the water use from mature SRC during the summer months exceeds that from any other vegetation (Hall, 2003b). The impact on water tables could be significant, and this would have impacts on biodiversity, especially if large areas of plantations are sited close to wetland habitats.

The annual water use of energy grasses is expected to be less than SRC but more than for annual crops. The highest risk of water shortage will be during the summer on small, heavily planted catchments. Springs and ephemeral streams may dry up sooner and for longer than before the grasses were planted (Hall, 2003a). In these situations, there could be a detrimental effect on sensitive wetland habitats in the catchment. Negative impacts on biodiversity could be mitigated against by controlling the areas of crop planted within small catchments and ensuring that these crops are not planted close to sensitive wetland habitats.

Studies to assess the biodiversity supported by SRC willow plantations report conflicting results for vegetation. Britt *et al* (2002) showed that ground flora is often sparse due to regular herbicide use. They found that where extensive weed populations do occur they are generally dominated by a few species of low conservation value, for example common nettle and rosebay willowherb. Slater (per.com.) is currently surveying SRC willow plantations in Wales and has found extensive populations of arable weeds. The differences are undoubtedly due to differing management practices. Where regular cultivation between rows is used to suppress weeds, the crops can provide valuable open ground for annual plants. Where no weed control is practised, tall perennial vegetation will develop that has little botanical interest but will provide cover for invertebrates, birds and mammals.

SRC willow can support large earthworm populations, since the ground is not disturbed by ploughing after establishment. Provided pesticide use is low, large invertebrate populations can be present. Sites with a high density of ground cover may support higher populations of herbivorous invertebrates than those that have weed control (Britt *et al,* 2002).

SRC planted on farmland may provide new areas of suitable breeding habitat for some woodland, scrub and ruderal vegetation bird species, possibly resulting in local population increases (Reddersen and Petersen, 2004 & Anderson *et al*, 2004). Slater (per.com.) has found that mature willow plantations hold good populations of warblers and song birds. However, species characteristic of open farmland habitats, such as lapwing, skylark, and corn bunting, are unlikely to use SRC crops as a breeding habitat except perhaps in the year of crop establishment and the year following each cut. Newly planted SRC and plantations managed by regular cultivation can provide good winter foraging for species such as reed buntings, finches, yellowhammer and redpoll (Slater, per.com.). These species are attracted to crops where there are large numbers of seeds produced by annual weeds. Reddersen and Petersen (2004) and Christian *et al* (1998) reported that willow SRC supported lower numbers of birds than broadleaved natural woodland but higher densities than intensive arable or improved grassland.

There is little published information on mammal populations in SRC plantations, but various surveys in the UK have recorded a wide range of species, including rabbits, roe deer, brown hare, foxes, various rodents, and two species of bat. Both abundance and diversity of small mammals, such as wood mice, seem to be greater in weedy SRC plots (Britt *et al*, 2002) and higher than in surrounding intensive farmland (Christian *et al*, 1998).

Semere and Slater (2005) looked at the effects of young energy grass plantations on biodiversity. They found that young *Miscanthus* crops and to a lesser extent, reed canary grass crops can benefit native wildlife. *Miscanthus* fields were richer in weed vegetation than reed canary-grass or arable fields. This was attributed to the crop's initial slow growth and development early in the season, coupled with the agronomic practice of planting the crop in wide rows and at very low plant density leaving plenty of space for weeds to flourish with little competition during the crop's establishment years (years one to three). The field margins surrounding *Miscanthus* and reed canary-grass crop fields had a high diversity of plant species that would provided a habitat for invertebrates and a food resource for small-mammals and birds.

Ground beetles, butterflies, bumble bees, hoverflies and other invertebrates were more abundant and diverse in the more floristically diverse habitat of *Miscanthus* fields than in surrounding arable fields (Semere and Slater, 2005).

Semere and Slater (2005) found that bird use of the grass energy crops varied depending on crop species. There were considerably more open-ground bird species such as skylarks, meadow pipits and lapwings within *Miscanthus* than within reed canary-grass fields. Young biomass crop fields provide not only nesting habitat for ground-nesting species but also a winter foraging habitat for the wide range of species which exploit the crop fields for invertebrates and seeds as well as for cover. With the exception of the open-ground birds, most of the bird species were found more abundantly within the hedges and field-margins than in crop fields indicating the importance of retaining field structure when planting biomass crops.

A total of 37 species of birds during the breeding season and 35 species of overwintering birds were recorded in the Semere and Slater (2005) study sites. Most of the bird species were found more abundantly within the hedges than in crop fields, with the exception of skylarks (*Alauda arvensis*), lapwings (*Vanellus vanellus*) and meadow pipits (*Anthus pratensis*). Bird use of the crop fields was greater in the *Miscanthus* fields compared to the reed canary-grass. This was due to not only the presence of diverse weeds within the crop fields but also the presence of bare ground patches. Skylarks, meadow pipits and lapwings were found only or predominantly within the *Miscanthus* fields.

The most common species using the biomass crop fields during the breeding season include goldfinches (*Carduelis carduelis*), skylarks, stock doves (*Colomba oenas*) and
lapwings. During non-breeding season, the most common species using the biomass crop fields were linnets (*Acanthis cannabina*), meadow pipits (*Anthus pratensis*), skylarks, grey partridges (*Perdix perdix*) and pheasants (*Phasianus colchicus*).
Skylarks, grey partridges and lapwings were using the *Miscanthus* fields for breeding. Grey partridges and pheasants were using the biomass crop fields for breeding as well as for cover during the winter.
Energy grasses were also found to provide habitat for small mammals in the form of good ground cover and little land disturbance (Semere and Slater, 2005).

Miscanthus does not reach maximum canopy cover until year three or over. There is currently no research into how the relationship between crop architecture and wildlife changes as the crop ages and the canopy starts to close. Based on the studies from the current well-established and mature stands of reed canary-grass, it is likely that the biodiversity of *Miscanthus* crop fields will decrease as the crop achieves its maximum productivity. This is particularly true of the ground nesting bird species. Vegetation density is a key factor influencing foraging efficiency and habitat preferences in some ground-feeding birds (Henderson *et al*., 2000). In Semere and Slater's study the number of skylarks using the cropped area of *Miscanthus* decreased with time, as the ease of foraging and ground access declined with an increase in crop height and density of the crop itself. American studies (Murray and Best, 2003 & Murray *et al*, 2003) of bird use of mature switch grass crops have shown that grassland birds use the crop for nesting, although this research is not necessarily transferable to the UK situation.

Much of the wildlife value of energy grass crops is derived from unsprayed field margins (Semere and Slater, 2005). This suggests that the biodiversity benefit from these crops could be increased by the inclusion of rides and headlands.

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