dti

PROJECT SUMMARY NO 185

ARBRE Monitoring-Ecology of Short Rotation Coppice

OBJECTIVES

- To monitor appropriate flora and fauna within and around a suitable number of commercially managed Short Rotation Coppice (SRC) plantations established as a fuel source for Project ARBRE
- To use this information to assess the impact of the SRC plantations on wildlife in the area

SUMMARY

The project aim was to describe the ecological impact of planting commercially managed SRC plots on arable land. Four wildlife groups (birds, plants, butterflies and general invertebrates) were monitored over a four-year period. In order to properly quantify the ecological impact on these chosen groups arable control plots representing the previous land use were also monitored. Monitoring was carried out at various distances from the edge of the crops to determine the importance of edge habitat.

The data also provided information on weed and insect pest populations within commercially planted SRC plots contributing to the efficient management of SRC.

The results obtained show that commercially managed SRC plots contain a higher diversity of wildlife

Figure 1. Fieldfare within SRC (courtesy of The Game Conservancy Trust)

than the arable fields being replaced, although some species are also displaced.

CONTRACTOR

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COST

The total cost of the project, £91,393 was met by the Department of Trade and Industry (DTI).

DURATION

51 months – January 1st 2000 to March 31st 2004.

BACKGROUND

SRC is a crop grown to produce wood chips for subsequent conversion, to provide heating or power generation. The development of commercially planted SRC plots represents a significant step towards the UK Government's commitment to renewable energy production and the reduction of greenhouse gases. The ARBRE electricity generating plant was to have been the first commercial plant of its type in the UK using wood chips from forestry and purpose grown SRC plantations. It is anticipated that commercially planted SRC could become a widespread feature of the countryside, representing a major change in land use.

At present there is very little information on the impact of large-scale SRC plantations on the countryside and its wildlife. The planting of large scale SRC plots creates a new habitat that could potentially provide opportunities for colonisation by many species of plant and animals. Previous studies carried out on non-commercial SRC have already shown the crop to be beneficial to wildlife. However, these previous studies were carried out on SRC plots that tended to be smaller in size, with a more varied age structure and fewer agricultural inputs than the commercially planted plots used in this study.

Replacing existing arable land with SRC could also potentially be detrimental to some species preferring open habitats. Recent declines in bird species associated with farmland habitats have been of concern to conservation groups. In this study, paired arable control plots were also monitored in order to document both gains and losses in wildlife resulting from the change in land use associated with planting SRC.

In order to facilitate the objectives of the project a further four-year study began in May 2002 to determine the conservation value of SRC plots planted on grassland sites. This is also being funded by DTI. As SRC planted on grassland sites does not differ fundamentally from SRC planted on arable land the same wildlife groups are being monitored using the same methodology. This new study can be viewed as an extension of this project and on completion will provide even more information on the impact of commercial SRC on wildlife as well as allowing the effect of previous land use to be examined.

THE WORK PROGRAMME

A total of 12 sites were identified as suitable for use in the project along with 12 nearby arable fields as control plots. Four wildlife groups were monitored during the project; birds, plants, general insects and butterflies. Groups such as birds and butterflies were specifically

chosen due to their conspicuous nature making them easy to monitor. Many other groups such as small mammals were considered to require additional effort that could not be adequately undertaken within the broad constraints of the project.

The breeding birds of SRC

Breeding birds were monitored using a point count methodology on two separate occasions during the spring during each year of the project. This enabled the density of birds to be estimated both within SRC plots and arable control fields. Bird densities were estimated both at the edge and interior of the crop, as well as in the boundaries adjacent to the crop

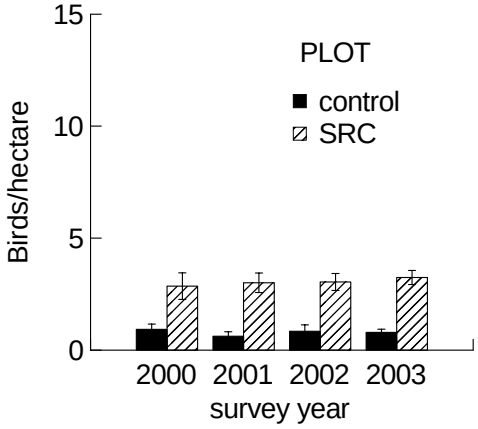

Figure 2. Density of birds within SRC and arable controls during each year of the project

Wintering farmland birds of SRC

In order to provide a more complete study of wildlife use in commercial SRC plots throughout the year wintering birds were also monitored by walking transects through the plots. Four visits were made to each site during the last three years of the project, to take account of the high mobility of birds during the winter in response to weather conditions and food supply.

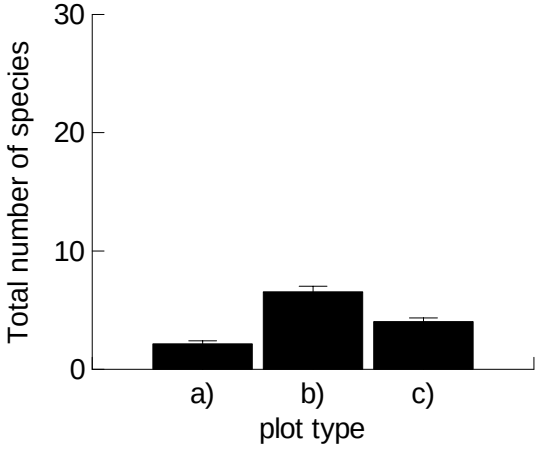

Figure 3. Total number of bird species recorded per visit wintering in a) arable control plots b) recently harvested or cut SRC c) established SRC

Vegetation within SRC and arable control plots

Vegetation was monitored annually throughout the study from a number of quadrats positioned at various distances from the crop edge along two transects in each SRC plantation and arable control field. Vegetation was also monitored from the surrounding headlands. Both percentage vegetation cover and the total number of species present and relative abundance were recorded. Plant species were separated into annuals, invasive perennials and long-lived perennials which enabled succession to be

documented within the SRC plantations.

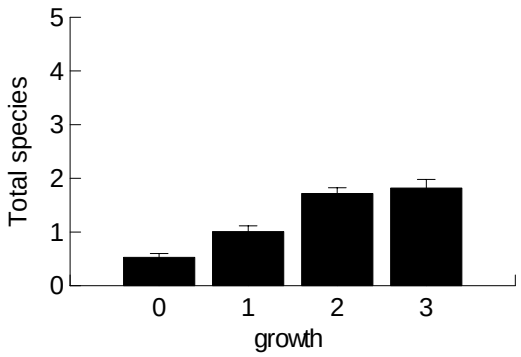

Figure 4. Total number of plant species recorded per 1x10 metre quadrat with a greater than 10% cover at various stages of willow growth (years) within SRC plots

Butterflies of SRC

Butterflies were monitored along transects around the edge of the SRC and arable plots using standard methodology involving timed counts. Monitoring was carried out three times during the summer to allow for seasonal variation between different species.

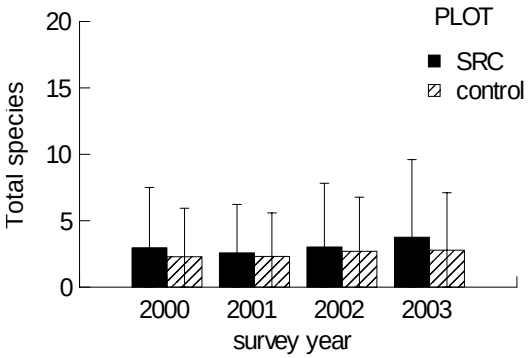

Figure 5. Mean number of butterfly species recorded per visit in SRC and arable control sites during each year of the study

General invertebrates of SRC

General invertebrates were sampled twice a year within the SRC only using standard beating techniques. Samples were taken at various distances from the crop edge

CONCLUSIONS

- Higher densities of birds were recorded during the summer in the SRC than the controls. The SRC plots also contained more bird species than the controls. Densities of migrant bird species, such as Warblers were as high in the edge of established SRC as they were in the surrounding hedgerows and adjacent boundaries. Resident bird species tended to prefer the hedgerows to the SRC. Bird density was higher at the edge than the interior of the plantations
- The bird community changed in response to increased willow growth. Densities of Tits, Finches and Warblers increased over the study. Thrushes reached a maximum density in two year-old SRC, Game birds in one-year old SRC and those species identified as preferring open habitat such as Skylarks and Wagtails declined as the willow became established.
- Recently planted and cut-back plots support higher numbers of Skylarks and

Lapwings than the arable fields.

- The density of birds in the commercially managed plots was lower than had previously been recorded in non-commercial SRC; perhaps reflecting the larger size, more uniform age structure and higher levels of agricultural inputs in commercially managed plots.
- In the winter there were on average more species of birds in the SRC plots than the arable controls. Recently planted SRC was especially attractive to Buntings, with several Yellowhammer and Reed Bunting flocks recorded. Many groups of birds preferred younger coppice, although tits were more abundant as the plots became more established. Both Snipe and Woodcock were regularly flushed from SRC in the winter, but were only rarely recorded from arable plots.
- The majority of plant species found both in arable fields and recently established SRC plots were annuals, characteristic of disturbed ground. There was a significant decrease in the proportion of annuals as the SRC became established and higher proportions of both invasive and long-lived perennials. The number of species present with a greater than 10% cover increased with each successive year's growth. The amount of vegetation cover varied between sites. In recently established plantations vegetation cover was higher at the edge of the plots. Vegetation cover increased for the first year after planting, but then remained fairly constant. Although vegetation height was not estimated it is predicted that the levels of vegetation cover recorded are generally not sufficiently high enough to significantly reduce yield.
- The butterfly community of both the SRC plantations and arable controls was dominated by relatively common species, with the Meadow Brown being the most abundant species. However, more butterflies were recorded in the relatively unmanaged and sheltered headlands of the SRC plantations than the arable control headlands. Both the number of individual butterflies and number of species increased over the four-year period of the study as the willow coppice became more established.
- The mean number of invertebrate orders also increased with subsequent growth of the willow coppice. There was a tendency for the edge of the plots to have higher numbers of invertebrates than the interior. The Blue

Willow Beetle *Phyllodecta vulgatissima* a pest species formed a high proportion of the total number of invertebrates recorded.

POTENTIAL FOR FUTURE DEVELOPMENT

The results of this study are able to provide guidance on the ecological impact of future commercial SRC developments.

Maximum conservation benefits can be obtained by continuing to retain hedgerows and open rides within the crop. Plots containing a variety of different growth stages are recommended.

The results of this study show recently planted SRC plots to be better for open species such as Skylark and Lapwing than arable plots. These are species of high conservation concern that have undergone declines in recent years. Further and more extensive research is probably needed to determine whether or not these species are able to successfully breed on recently established SRC plots before the rapid growth of the willow crop.

Vegetation within the established commercial plantations was a mixture of invasive perennials and long-lived perennials especially grasses. In contrast, vegetation in arable plots comprised mostly of annual species, characteristic of disturbed ground. The longer lived more stable plant communities are to be encouraged as they have lower transpiration rates and consequently are less likely to compete with the SRC crop for moisture.

The presence of long-lived perennial species on headlands and rides is of value not only in terms of conservation but also provides a nectar source for beneficial insects, such as parasitic wasps with the ability to control pest outbreaks.

Further research would be valuable in determining the best management strategies within commercial SRC to encourage more stable perennials rather than invasive weeds. High levels of fertiliser applications may encourage species such as Nettles to dominate.

Further renewable energy information from the DTI Technology Programme: New and Renewable Energy, and copies of publications, can be obtained from:
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