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CHANGES IN BIRD COMMUNITY COMPOSITION IN RESPONSE TO GROWTH CHANGES IN SHORT-ROTATION WOODY CROP PLANTINGS[1]

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ABSTRACT

Hybrid poplar established as intensively managed short-rotation woody crops (SRWC) on former agricultural lands can provide habitat for wildlife. Studies of bird use of SRWC for nesting and during fall migration have shown that the numbers and kinds of breeding birds using mature plantings of hybrid poplar are similar to natural-forested lands. In Minnesota, the number and species of breeding birds using habitat provided by clonal-trial plantings and young larger-scale plantings (12- 64 ha) of hybrid poplar were initially most similar to those using grasslands and row-crops. As the plantings approached canopy closure, successional species became predominant. In the Pacific Northwest, breeding bird composition and density were very similar for mature plantings and forested areas; however, fall migrants were found primarily in forested areas. In the Southeast, preliminary comparisons of breeding bird use of plantings of sweetgum and sycamore with naturally regenerating forests of different ages and sizes and vegetation structure are showing no size effect on use. As with hybrid poplar, species use of the more mature plantings of sweetgum and sycamore was most similar to that of natural forests.

Keywords: Breeding Birds, Diversity, Species Composition, Habitat, Woody Crops

INTRODUCTION

Both short-rotation woody crops (SRWC) and herbaceous crops show increasing promise as feedstocks for energy as well as fiber production. Over the last fifteen years, the Department of Energy's feedstock development research has moved from plot- to large-scale plantings of the most productive clones of hybrid poplar (Tolbert and Downing 1995). Large-scale production of energy from renewable feedstocks will require extensive land use conversion (Graham 1994). These land use changes could substantially alter the agricultural crop mixture and thus habitat for wildlife in production areas across the U.S. (Tolbert and Schiller 1996a, 1996b, Christian *et al.* 1994, Cook *et al.* 1991). Studies of the habitat value of hybrid poplar for wildlife have been limited by study site availability to a few studies primarily of clonal trials and more recently scale-up plantings of 20-150 hectares in the north central U.S. and a few commercial plantings

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DISCLAIMER

in Canada and Oregon (Christian *et al.* 1994, Hoffman *et al.* 1995). As biomass crop production increases, understanding how these land use changes affect habitat for wildlife will become increasingly important to answer public concerns and ensure producer and public acceptance of incorporating biomass crop production into the rural landscape (Cook *et al.* 1991). Understanding how energy crop plantings are used compared with grasslands, row crops, and natural forests and how bird use change with increasing age of the plantings can guide location and management of these crops to optimize benefits for wildlife.

This paper focuses on the results of research conducted in the upper Midwest, Pacific Northwest, Ontario, and most recently in the Southeast to determine how establishment of short-rotation woody crops within the existing landscape effects habitat availability. These studies have focused on habitat provided by hybrid poplar plantings of different sizes, ages, and landscape contexts. The U.S. Department of Energy through its Biofuels Feedstock Development Program (BFDP) is funding these ongoing studies. These (Christian *et al.* 1994, 1997,Hoffman, *et al.* 1995, Hanowski *et al.* 1997) are the only studies in the U.S., except for Verch (1986), to specifically address the potential of intensively cultured woody crops to enhance habitat for wildlife.

METHODS

Studies in the upper Midwest were to determine the species composition, abundance, and diversity of breeding birds and small mammals using agricultural lands, wildlands, grasslands, and SRWC plantings. Using both species groups facilitated comparisons of wildlife with restricted (small mammals) and broad-range (birds) movement patterns (Christian *et al.* 1994). The response of these species groups to planting age, size,and location with respect to the surrounding landscape were addressed (Christian *et al.* 1994, 1997, Hanowski *et al.* 1997). In 1992 and 1993, surveys were conducted on clonal trial plantings of 3-4 hectares (approximately 5 years of age) using the line transect technique. Beginning in 1994, studies in the upper Midwest were expanded to include newly established larger-scale demonstration plantings established in agricultural or mixed agricultural/forest landscapes.

From 1992 through 1994, Hoffman *et al.* (1995) compared breeding bird and fall migratory bird use of natural woodlands and a 3000 plus hectare complex of commercial hybrid poplar plantings in the Columbia River Basin. Surveys also included plantings (~ 10 hectares each) on former agricultural lands in Ontario. Hoffman used the circular plot method of Ralph and Scott (1986) to determine breeding bird use in both locations.

The results of the studies in the upper MidWest and Pacific Northwest are discussed from the perspective of how breeding birds and fall migrants use hybrid poplar plantings. Their influence on breeding bird surveys begun in 1996 on existing commercial plantings in the Southeast is also discussed. The southeastern study is comparing sycamore and sweetgum plantings and naturally regenerating forests of the same ages and acreage and the influence of vegetation cover and landscape context on abundance and diversity of breeding birds.

RESULTS AND DISCUSSION

Abundance and Species Richness

hay croplands (Fig. 1). Surveys in Ontario showed that use of plantings and adjacent forests was very similar; however, if species using the forest edges were included, the total abundance and richness of breeding birds were higher. In the Pacific Northwest, breeding bird abundance in plantings and natural forests were very similar; however, fall migrants used the natural forest almost exclusively (Hoffman *et al.* 1995). Hoffman concluded that the lack of territoriality by fall migrants allowed more individuals to clump together in preferred habitats - areas with the greatest food abundance. The abundance and species richness of breeding birds and fall migrants using hybrid poplar plantings were intermediate between forest/shrublands and agricultural land uses.

Species Composition

In the Midwest, forest associated and migratory bird species were more prevalent in forest/shrub habitats than in plantings, particularly younger plantings. The species composition of birds using the hybrid poplar plantings typically reflected a combination of more common species found elsewhere in the landscapebut occasionally included more rare species (Fig. 2). Both short- and long-distance migrants were more abundant in plantings than in non-hay croplands, but were less abundant in plantings than in either forests and non-wildlands (Hanowski and Niemi 1994). Individual properties of the plantings and their landscape contexts were most important in determining whether plantings of hybrid poplar provide a unique habitat that draws new species into areas where they are established. Forest species in the upper Midwest were not attracted to plantings established in agricultural area, probably because of the small size and/or young age of the plantings do not provide the appropriate habitat cover (Hanowski *et al.* 1997).

Species most common on poplar plantings in the upper Midwest were habitat generalists, those regionally abundant, widespread, or capable of using a wide variety of habitats for breeding (e.g., savannah and vesper sparrows, red-winged blackbirds, and common yellowthroat). Some grassland or open area species were found to use the edges and areas of more diverse vegetation within the poplar plantings while others used adjacent habitats but not the plantings.

Landscape Context

Studies of breeding and migratory bird use of hybrid poplar plantings have been limited by the availability of study sites of different sizes and ages. Most older plantings in the upper Midwest were smaller sites which had a higher proportion of "edge" habitat and tended to have a greater number of habitat generalists than would be expected in the interior of larger plantings. The larger plantings in the Midwest which are young (2-3 years of age) and have a vegetation structure that is more similar to that of a shrubland or successional habitat are dominated by more common, habitat generalists. Grassland species such as the horned lark and killdeer, which are associated with open fields, used the newly established scale-up plantings. These grassland species gave way to shrubland/successional species (57% species turnover) as the plantings changed from open land to more shrub like vegetation structure between years two and three. Between years two and three the turnover rate was 53% as the structure of the plantings changed from shrub to tree form. The high turnover rates on the younger sites paralleled results from the smaller older sites previously studied and indicate community instability (Hanowski *et al.*, in press).

Because of the fast growth rate of hybrid poplar in the Pacific Northwest, canopy closure occurs by the third year. Interior bird species were found to use these plantings; although the highest numbers of species observed were primarily in the planting edge. In Ontario, there was overlap in the bird community composition between young newly established

plantings and those of intermediate ages as well as between the intermediate aged and closed canopy stands (Hoffman *et al.* 1994). Across all regions where hybrid poplar studies have occurred, landscape context and vegetation diversity within the plantings have been the primary factors influencing the species composition, abundance, and richness of birds rather than differences in planting age (Christian *et al.* 1994, 1997).

In 1996 a study began in the Southeast, which draws upon the results to date from the above studies, to address in more detail and at a broader scale questions of habitat provided by short-rotation woody crops. This study is being conducted on a forest products industry's extensive land holdings and offers the opportunity to address simultaneously how planting acreage, tree crop species, planting age, and location within the existing landscape influence breeding bird diversity. Replicate plantings of sycamore and sweetgum, each of young (~5 years) or old (~20 years) ages, large (80 - 160 ha) or small (6 - 25 ha) acreage, and within different landscapes (agricultural, pine plantings, naturally regenerating hardwoods, bottomland hardwoods, or a combination thereof), are being compared with naturally regenerating hardwood sites with similar characteristics. The circular plot technique of Ralph and Scott (1986) is also being used in this study to determine breeding bird use of edge and interiors of the various site combinations and how these site characteristics influence diversity, abundance, and species composition.

Based on the first year's surveys, bird abundance and species richness were found to be similar in the SRWC and forest stands. Compared with the hybrid poplar plantings in the Pacific Northwest and the upper Midwest, which are virtually devoid of understory vegetation after crown closure, the vegetation surveys of the sycamore and sweetgum plantings showed assemblages of herbaceous, shrub, and understory not appreciably different from naturally regenerating forests of the same ages. As was true for plantings in the upper Midwest (Hanowski *et al.* 1997, and Christian *et al.* 1994), the presence of heterogeneous vegetation patches within individual planting increased habitat diversity and, consequently, breeding bird diversity (Lindberg 1997, Hoffman 1997). Comparison of species by habitat association revealed that for the young sites 79% of all detected birds were successional species (e.g., song sparrow, American goldfinch). In the older sites, the forest habitat associated birds (e.g., red-eyed vireo, Carolina chickadee) comprised 77% of the total species observed (Lindberg 1997). Also notable was the increase in forest interior birds (e.g., black-and-white warbler, scarlet tanager) from 10% in the young plantings to 27% in the older plantings (Lindberg 1997). The study will continue in 1997 with additional survey points located within the interior of the plantings to better discern potential differences in use of the SRWC compared with naturally regenerating sites. Efforts will also focus on determining the effect of surrounding land use on avia species presence, abundance, and composition in the sycamore and sweetgum plantings compared with the naturally regenerating forest sites. The data from these combined studies will provide a broader background from which to draw conclusions about the potential effects of woody crop production on wildlife and will provide a better understanding of how these crops can increase habitat for wildlife.

CONCLUSIONS

Studies in the Pacific Northwest and upper Midwest have shown that hybrid poplar plantings can provide habitat for both breeding birds and fall migrants. Bird species were found to use habitat provided by hybrid poplar plantings to a greater extent than agricultural crops but to a lesser extent than natural forests. Comparisons of avain species richness and composition in plantings versus forest and shrublands have shown that adjacent land uses and individual planting characteristics are the major influences on the use of hybrid poplar plantings by both breeding birds and migrants. Surveys of sycamore and sweetgum in the Southeast are also showing across a wider variety of site

characteristics than had been available to present that breeding bird diversity, abundance, and species composition are influenced primarily by site characteristics, particularly those associated with planting age. It is important, therefore, to integrate consideration of where to locate and how to establish, manage, and harvest plantings to provide wildlife habitat in combination with feedstocks for economic benefits for producers, rural communities, and industry. Identifying how SRWC plantings can be established and harvested on a rotational basis in a particular area can help maintain habitat availability while meeting feedstock requirements.

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