CHAINSAWS, CANEBRAKES, AND COTTON FIELDS: SOBER THOUGHTS ON SILVICULTURE FOR SONGBIRDS IN BOTTOMLAND FORESTS

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Abstract—Forested wetlands of the Mississippi Alluvial Valley (MAV) are the most productive of birds, including neotropical migratory birds, of all land uses there. Forest land uses are difficult to maintain in economic competition with annual crops. We compare perspectives of a bird biologist, a wildlife manager, a production forester, and an economic pragmatist to the issue: How can we manage bottomland forests for products, like birds, in addition to economically viable commodities? Our thesis assumes: (a) private lands are the major land ownership category, (b) economically successful timber production generally is prerequisite to existence of forest on private lands, and (c) traditional silvicultural tools can produce bird habitats. Principles for production of specific bird communities in bottomland hardwoods remain to be articulated. We assert that the future of neotropical migratory birds in bottomlands depends upon communication between avian biologists and silviculturists and the innovative capacity of land managers.

INTRODUCTION

The forested wetlands and seasonally inundated bottomland hardwood forests of the Lower Mississippi Alluvial Valley (MAV), growing as they do on soils deposited as erosional products of the major portion of the North American continent, are very productive as bird habitats. The soils here are also productive for a number of warm-season agricultural crops, from cotton to catfish, and forest products including short-rotation fiber and long-rotation high-quality wood products. Land use in the region is a competitive result of potential for cash production, constrained by hydrological uncertainties. For a century, public policy at the Federal, State, and local level has emphasized control of water flow (Barry 1997) which has produced outstanding opportunities for agriculture, seriously reduced forestry activities, and eliminated many wildlife species, including some song and other birds. Still, however, MAV forests are the primary contributors of certain birds to the nation's avifaunal estate (Hunter and others 1993).

In this paper, we address the question: How can we afford to manage bottomland forests for products, like birds, in addition to economically viable commodities? To explore this question, we review current knowledge and practice of silviculture for forest birds in MAV forests, we illustrate the intensity of potential conflicts over land use with several different management viewpoints, and we provide case histories of consequences of past and of potential land management actions. Our role is to highlight the difficulties involved in attempting to produce commodities, like neotropical migratory birds (NTMB), that have low direct economic return, in an environment where the burgeoning population of the nation has created a very great demand for food and fiber. We conclude by pointing out the importance of cooperation among people with differing interests in land use to the future persistence of the current avifauna. We contend that only by collaboration among the variety of viewpoints represented among land owners, land managers, and interested citizens can this rich environment succeed in producing the desired economic, ecological, and aesthetic commodities of which it is capable.

CURRENT ENVIRONMENT

For illustrative purposes, we use the lands of the MAV. The 2193 400 ha (5,417,700 ac) of the Delta, as it is called, were formerly primarily covered by forest (Hamel and Buckner 1998, MacDonald and others 1979), on which grew truly vast volumes of high-quality timber of a number of species. These forests and their history have been described thoroughly (Foti 2001, Rudis 2001, Tingle and others 2001). At the present time, < 30 percent of the landscape is forested (Faulkner and others 1995). The great majority of the remaining land in the Delta is devoted to cash crop production, primarily of cotton, soybeans, rice, corn, catfish, wheat, and other crops. The entire Delta is separated from the floodwaters of the Mississippi River by an extensive levee system, which extends from near Memphis, TN, in the north to the mouth of the Yazoo River near Vicksburg, MS, nearly 320 airline kilometers south.

Much of the forest land is located in the batture, the area between the levees and the Mississippi River. In this area, flooding usually occurs on at least an annual basis. Major remaining patches of forest on the protected side of levees in the Delta include the Delta National Forest in Sharkey and Issaquena Counties; Mahannah Wildlife Management Area in Issaquena County; as well as Yazoo, Panther Swamp, and Dahomey National Wildlife Refuges in Washington, Sharkey, Issaquena, and Bolivar Counties. The remaining forests primarily are confined to relatively low-lying sites, sites formerly flooded for extensive periods each growing season. Because of this, the full range of bottomland forest types currently is not represented in proportion to its past occurrence. Extent of flooding creates limits for forest production on sites; additionally, the use of revetments and dikes for water control limits the creation of new land and hence the sites for some species like eastern cottonwood (*Populus deltoides*). A reasonable correspondence exists

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between the bottomland hardwood zones of Wharton and others (1982) and the agricultural crop potential of sites (table 1). Drainage and flood protection make possible the cultivation of crops on relatively lower sites. Much of the remaining forest land is too low to support tree species typical of sites flooded only briefly each year, such as cherrybark oak (*Quercus falcata* var. *pagodaefolia*). Thus, the forest of the remaining landscape lies on a highly skewed subset of the original presettlement situation, as well as a relatively skewed subset of the forested lands before the most recent episode of land clearing during the soybean era subsequent to 1968. This lack of high sites restricts opportunities for silviculture, both for timber and for songbirds.

THE PEOPLE

Land use conflicts can be intense because individuals with a stake in decisions about land have separate, valid, seemingly non-overlapping views of the most appropriate uses of the land. The different perspectives lead to different sets of objectives in management. Until the advocates of different perspectives understand (Covey 1989) and respect the objectives of others, achievement of objectives of several different perspectives is not likely.

We here offer thoughts on four separate perspectives on the use of MAV lands—perspectives that represent a wide range, albeit not the full range, of potential views. We present them to stimulate the reader to identify not only with their particular favorite but also to appreciate the consistency of the others. We invite readers to see this situation as one in which a greater success will be achieved when proponents of different perspectives draw circles to include additional ideas rather than draw lines in the sand to separate themselves from their supposed opponents.

The perspectives we identify are those of a bird biologist, intended to reflect a strong protectionist position; a wildlife manager, intended to reflect an intense interest in successful hunting of game; a production forester, intended to reflect a focused attention on maximizing fiber production; and an economic pragmatist, intended to reflect a sincere concern with the bottom line of profit. To the bird biologist, any forest land use is preferable to agricultural cropland; those land management activities are gauged as profitable which increase the extent of bird habitat for species otherwise in limited supply. Often, the older the forest the better it is perceived to be. To the wildlife manager, any land use or practice that improves the quality of the hunting experience is useful; substantial manipulations are often necessary. The wildlife manager is interested in producing habitat that supports high populations of certain desirable species. To the production forester, maintenance of sufficient land in forest to assure a steady supply of top-quality wood of desired species is paramount. Foresters appreciate the change that occurs with time in any forest stand, and are prepared to groom the forest as it changes. To the economic pragmatist, any land use or practice is reasonable, as long as no other is available to produce a higher profit; this usually implies an agricultural or development land use. In this perspective lands that do not pay for themselves are of questionable use.

Each of these perspectives, as a sole determinant of objectives, leads to single-minded attachment to a particular set of objectives that may exclude the others, i.e., produces

Table 1—Correspondence between capacity of sites to support forest and agricultural crops

Hydrologic situation	Wharton zone	Forest type	Agricultural crop
Permanently inundated	I: Open water	None	None
Seasonal flooding			
>6 months per year	II	Baldcypress-water tupelo	Catfish, rice
3 to 6 months/year	III	Overcup oak-water hickory, Nuttall oak	Rice, soybeans (marginally)
1 to 2 months/year	IV	Mixed hardwoods: water oak, sweetgum, green ash	Soybeans, corn, cotton
<1 month/year	V	Mixed hardwoods: cherrybark oak, sweet pecan, swamp chestnut oak	Cotton primarily
Wet years only	VI	Mixed hardwoods: including upland species	Cotton primarily

conflict with them. Such conflict is unavoidable. The important issue is how the conflict is resolved, and whether resolution represents a loss of opportunity to achieve objectives of other perspectives in the aggregate. Relative costs and benefits of seeking to achieve different combinations of objectives have not frequently been evaluated on the broad scale of such varying perspectives. Unless such a broad approach can be pursued, however, the prognosis for the future of NTMBs in the MAV is grim. These birds are representative of the apparently most dispensable elements in the ecological and or economic puzzle. The cost of dispensing with them is unknown.

Two useful examples of approaches to bringing different perspectives into discussion with each other are the Black Bear Conservation Committee (BBCC) and the Southeast Management Working Group Partners in Flight. The experience of these two groups that began as ad hoc partnerships suggests that successful achievement of objectives to maintain populations of species like bears and migratory birds need not interfere with objectives to maintain productive forest management in the landscape. These two partnerships have constructively drawn a circle to include the views of the perspectives above. The BBCC, in particular, has usefully engaged all four of them in dialogue.

CURRENT SILVICULTURAL PRACTICE

Silviculture, the theory and practice of controlling forest establishment, composition, structure, and growth (Spurr 1979) provides forest managers with practical methods designed to manipulate current stand conditions in order to achieve desirable future stand conditions. Similarly, forest management is the process of making and executing decisions that direct the long-term development of forests on any particular tract of land. Ideally, both silviculture and management can be used to manipulate the forest to provide a particular vegetative structure at a specified time in the future. The following principles may be obvious but are nonetheless worthy of recognition:

1. “It ain’t management unless you do it on purpose.” Management requires the statement of objectives, indicated as desired future conditions or outputs.
2. Manipulation of survivorship of trees is the primary silvicultural activity currently used, i.e., the chainsaw is the primary management tool of silviculture; corollary to this is that cutting trees is a necessary part of managing forest lands.
3. Hydrological manipulations have profoundly affected the remaining patches of forest, such that site characteristics today may reflect the hydrological manipulations as much as or more than the historical development of the site.
4. Management options are limited by the site characteristics, which reflect history of hydroperiod and land use.
5. Management must be cost effective, or alternative land uses will take precedence.
6. Within the context created by the previous five principles, we can learn from old-growth stands about the productive capacities of sites.

In a useful, nontechnical review of silvicultural systems for ornithologists, Thompson and others (1995) identify the four regeneration methods commonly used in North America as selection, shelterwood, seed tree, and clearcutting. They compare the use of these methods in terms of the age-class distribution they produce in even-aged (shelterwood, seed tree, clearcutting) or uneven-aged silvicultural systems (selection). They identify silvicultural practices as regeneration practices or intermediate treatments. Regeneration practices include the method of establishing the new stand (natural or artificial) and the site preparation activities that may be employed to do so. Intermediate treatments include release cuttings of saplings, thinnings of older stands, and salvage and sanitation cuttings to remove dead or dying trees. Additional aspects of forest management operations, such as road building and maintenance, fire control and management, and use of pesticides and herbicides, as well as fuel wood harvest can have effects on stand structure and composition, and hence on the bird community that inhabits the stands. A more technical review of silvicultural systems for bottomland hardwoods is presented by Meadows and Stanturf (1997).

In MAV habitats where extensive conversion of forest to croplands has occurred, reforestation involving natural or artificial establishment of stands of trees on former agricultural lands is an important forest management technique. Often, stand establishment is difficult. Intercropping cottonwoods and oaks is a possible silvicultural manipulation to address the situation in which land use changes have reduced the rate of development of sites necessary for natural regeneration of cottonwood (Schweitzer and others 1997, Twedt and Portwood 1997).

GENERAL PRINCIPLES FOR MANAGEMENT OF NEOTROPICAL MIGRATORY BIRDS

The bird communities of the bottomland hardwood forests are quite diverse (Smith and others 1996), and include numerous species in both the spring and summer breeding season and in the winter nonbreeding season (Hamel 1992). Many of these birds are NTMB species whose declining populations make them of particular concern at the present time (Hunter and others 1993, Smith and others 1996).

Our thesis is that profitable silviculture is the primary hope for NTMB in the MAV. We believe this because most of the birds of interest in the MAV are forest birds, for which maintenance of forest cover in the landscape is critical. Competition among land uses, i.e., agriculture and forestry, is intense, and extensive set-asides of forest land, either through purchase or regulation, are unlikely to provide sufficient tracts to assure the persistence of all bird species. Furthermore, manipulation of forests will be necessary to assure the persistence of early successional habitats and the birds that require them.

Our thesis depends upon three premises:

1. private lands are the major land ownership category in the MAV,
2. economically successful timber production is generally a prerequisite for the existence of forest on private lands, and

3. traditional tools of silviculture can effectively be used to produce habitats for NTMB.

From these premises, we argue that the future of NTMB in bottomlands depends upon:

1. improved inventory of bird communities,
2. communication between avian biologists and silviculturists, and
3. the innovative capacity of land managers.

All of the management activities aimed at producing suitable habitat for birds assume that:

1. satisfactory bird habitat can be described in primarily structural terms;
2. production of woody vegetation cover is not only necessary but sufficient for production of insect foods as well as fruits of forest trees, and that this cover is sufficient to accord appropriate cover for roosting and breeding purposes of the birds;
3. corollary to the first two, if woody cover is produced, insect populations will follow, and they will in turn support bird populations, i.e. secondary consumers;
4. bird occurrence is synonymous with successful bird reproduction and survival.

These assumptions appear reasonable. However, they are not validated, particularly in bottomland systems (Wigley and Roberts 1994, 1997). They also oversimplify a complex reality, e.g., Hamel 1992, Sherry and Holmes 1995, Thompson and others 1995. They do form a starting place for adaptive management, in which as actions are taken, managers are enabled to learn from the consequences of their actions and improve the desirability of the consequences as time goes on. The work of Twedt and others (1999), Mueller and others (1999), and Loesch and others (1999) is illustrative of the process by which assumptions such as those above serve to structure management decision-making and lead to useful improvements. The process is similar to that advocated by Starfield (1997).

Our major theory of habitat utilization assumes that vegetation structure, rather than its species composition, is the driving force behind bird species occurrence. We assume that where appropriate structure occurs, the birds will be present. Especially do we see this as a question of choice on the part of the birds, where by some mechanism dispersing individuals locate and choose to settle in habitats of appropriate structure. We focus on structure because extensive theory exists that relates bird occurrence to vegetation structure, based upon the work of James (1971), Shugart (1984), DeGraaf (1987), and well illustrated by the works of Verner and others (1986), and Morrison and others (1992). Additional extensive theory assumes that the conditions of land use surrounding a particular patch, that is, the landscape position of the tract of appropriate vegetation, is a key feature limiting the occurrence of birds (Robbins and others 1989). A major, little-tested assumption embedded in the focus on structure is its linkage to appropriate foods and to appropriate sites for nesting, roosting, and escape cover.

Because we are not sure of the specific responses of individual bird species to particular manipulations, management activities have inherent risks of failure. Individual managers, as reasonable humans, exhibit a range of tolerance toward risk-taking in their management decisionmaking. Pukkala and Kangas (1996) note that measuring attitude toward risk is probably more difficult than measuring risk itself. They state, “In a situation involving risk, the optimum plan may be different for a risk-avoiding, a risk-neutral, and a risk-seeking decision-maker.” Uncertainties of outcomes in land management thus may be caused by deficiencies in the information base on which decisions are taken as well as on the decision style of the manager.

Specific considerations for the management of individual bird species are not likely to be developed soon (Martin and Finch 1995). Earlier workers (Dickson and others 1995, Hamel 1992, Pashley and Barrow 1993, Wigley and Roberts 1994,) have provided information on the occurrence of species in stands of different ages. We lack a long-term data set indicating how individual species respond to particular treatments applied to bottomland hardwood stands and followed over time. Wigley and Roberts (1997) and Hamel (1992) provide hypotheses of landscape-scale interactions of songbirds and forest management, but these too have not been subjected to sufficient experimental testing.

Several principles seem appropriate as guidelines for management of NTMBs in bottomland hardwood forests, however, they need to be tested (Dickson and others 1995, Wigley and Roberts 1997).

1. Bigger patches of forest are always better for forest birds than smaller ones. Pashley and Barrow (1993) recommend the optimal condition at the local scale to be a very large, forested tract managed under a natural disturbance regime. Large patches of forest buffer the effects of increased brood parasitism, predation, and other demographic consequences attendant on small populations inhabiting small tracts. The data of Robbins and others (1989) provide a strong rationale for maintenance of large tracts.
2. Reforestation will be a most important part of the future potential for birds in bottomland hardwoods. Particularly in the MAV where only a modest proportion of the landscape is forested, primarily in small, scattered patches, only specific reforestation activities will provide for the establishment of forests on lands far from seed sources (Mueller and others 1999).
3. We can learn from old-growth stands about the future composition and structure of stands left without intervention. The works by Devall and others (2001) and Smith and others (2001) as well as Hamel (1989) provide information on the use of old-growth stands as controls for comparison with second-growth bottomland forests.
4. Fragmentation of habitats has profound effects that local managers may be helpless to control, mitigate, or otherwise affect. Robinson and others (1995) provide a

chilling review of the effects of forces operating at the landscape scale on bird community dynamics within stands at the local scale. Readers uncertain of the consequences to local populations of such landscape-scale factors would do well to read that work.

Several recent papers provide some guidance to land managers concerning silviculture for songbirds in bottomland hardwoods (Dickson and others 1995; Hamel 1992; Pashley and Barrow 1993; Wigley and Roberts 1994, 1997). Hamel (1992) related individual species to particular layers of vegetation in the forest, assuming that manipulations which eliminate or favor particular layers of forest will similarly destroy or improve habitats for the species that use those layers. Pashley and Barrow (1993) provide a set of recommendations that involves local level management as well as regional scale management. Wigley and Roberts (1994) review results of 17 studies that indicate associations or dissociations between individual bird species and particular management treatments. Most of these studies involve descriptions of bird communities in stands of different ages, although some reflect experimental work. Few of the studies were long-term examinations of community changes in response to application of treatments. Dickson and others (1995) identify species that have been shown to increase or to decrease in response to particular treatments in bottomland hardwood forests. They note that little specific information on such effects has been developed in bottomland hardwood ecosystems. They recommend maintaining current forests and preventing further conversion to other uses, as well as reclamation of some previously converted land to forest. They suggest protection of existing old growth, existing corridors between existing stands, and the development of more old-growth stands. Wigley and Roberts (1997) review the modest literature on landscape correlates of species occurrence and abundance in bottomlands, noting that much of the theory is intuitively sound, but that it lacks empirical and experimental testing.

Among issues for which scant information currently exists are the role of fire and long-term annual variation in population levels of species. Unlike other southern ecosystems, very little is known about the utility of fire in wetlands as a management or ecological tool. Likewise, few long-term data sets are available to evaluate the variability of bird use of particular stands.

Management for NTMBs in bottomland hardwood forests is only part of the management picture, even of birds, for more than many other forests. Southern forests, particularly bottomland hardwood forests, are winter destinations for migrants from the north as well as summer destinations for migrants from the south, and stopover habitat for migrants in transit both spring and fall. Concentration on management of breeding habitats only will overlook the importance of these habitats in other seasons.

CASE STUDIES: SILVICULTURE FOR SEVERAL RARE BIRDS IN THE MAV

Two bird species, one a resident and the other a NTMB, have been effectively lost from the MAV fauna. One of them is probably extinct, the other possibly so; each was a regular, if not common, member of the MAV fauna. They provide an opportunity to review the possible silvicultural treatments that might have been employed to keep them from becoming so rare. A third species provides an example of an unintended benefit of silviculture designed strictly to produce fiber.

Ivory-billed woodpecker—In bottomland hardwoods, ivory-billed woodpeckers (*Campephilus principalis*) utilized stands of big, old trees. The apparent habitat requirements were for extensive stands with dying or senescent trees. An approach to producing this habitat silviculturally is the use of thinnings on moderate-to-good sites to accelerate the production of large trees with substantial crowns, eventually creating the conditions in which dead and dying limbs can supply the insect foods for the birds. Such senescent trees are not usually retained in stands managed for economic objectives. Unfortunately, needed information on the possible density of birds and their energetic requirements is unavailable, hindering the process of modeling how to do produces their habitat. Our point, nevertheless, is that active management possibly could produce the desired conditions faster than could passive.

Bachman's warbler—The Bachman's warbler (*Vermivora bachmanii*) was a species of openings in the canopy and areas with dense shrub cover interspersed with larger trees. They have long been associated with canebrakes (*Arundinaria gigantea*), and may have been obligate users of them (Remsen 1986). In the MAV, canebrakes likely occurred most prominently on relatively high ground, land now devoted to production of cotton. Serious gaps exist in our knowledge of the ecophysiology of cane: Does the species require full sunlight, partial sunlight, or full shade? Can canebrakes be developed on relatively wetter sites? Assuming that cane requires relatively open conditions, thinning a stand heavily would probably produce the light conditions in which woody understory vegetation, such as cane, could thrive in a forested environment, thereby producing habitat for the species (Platt and Brantley 1997). Such manipulative intervention may be a more direct method for creating habitat for the birds than passively waiting for a natural disturbance such as an ice storm, tornado, or hurricane. Unfortunately, the extreme rarity of the birds has prevented the implementation of such an experiment.

Warbling vireo—A third case involves another species rare in the MAV, the warbling vireo (*Vireo gilvus*). Its habitat is relatively long, narrow tracts of willows or other early successional trees growing along a watercourse or a slough. In such conditions, the species is exposed to potentially severe pressure from brown-headed cowbirds (*Molothrus ater*), birds that lay their eggs in other birds' nests. Reforestation treatments involving cottonwood plantations, with and without intercropping with other species, have produced habitats in which warbling vireos do very well.[2]

RESEARCH AND MANAGEMENT NEEDS

Virtually all authors commenting on land management for birds in bottomland hardwood forests note that information

[2] Personal observation. 1997. Paul Hamel, Research Wildlife Biologist, USDA Forest Service, Southern Research Station, P.O. Box 227, Stoneville, MS 38776.

on the basic biology and silviculture for birds is scanty, that landscape effects may be as or more profoundly influential on populations as stand-level vegetation structure, and that currently existing monitoring data, comprised mostly of relative abundance information, do not give as detailed a picture as will data on survivorship and reproductive success. These latter data are, however, expensive to gather; they may be virtually impossible to gather outside the research context for some forest canopy dwelling species like the cerulean warbler (*Dendroica cerulea*) (Hamel 2000, Mueller and others 1999).

CONCLUSIONS

Conflicts between different interests in the use of the land can and perhaps may produce serious potential problems in the future. We believe that such conflicts can best be avoided by active dialogue between perspectives. When the debate relates to objectives of management, rather than to a decision to manage or not to manage, each of the outlined perspectives will be able to contribute to a vision of a landscape containing a rich mix of chainsaws, canebrakes, and cotton fields. Where bird biologists and wildlife managers do not attempt to incorporate their objectives into production forestry, many opportunities will be missed. When production foresters fail to incorporate bird management objectives and wildlife habitat goals into their silvicultural practice, opportunities for improved silviculture will be foregone. In such cases, all dependents on the bottomland forest landscape may become losers, especially the NTMBs and other species that depend on forest habitats.

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