DNR Indiana Department of Natural Resources

To: Jack Seifert, Director DNR Division of Forestry

From: Glen Salmon, Director DNR Division of Fish and Wildlife

Date: September 1, 2005

Re: Attached recommendations for management of DNR Forest Properties

Director Seifert- Please find the attached recommendations from a team of fish and wildlife biologists concerning increasing wildlife diversity on forested lands managed by the Indiana DNR. The team was comprised of the following scientists from the Division of Fish and Wildlife:

Dr. John Castrale-Wildlife Diversity Section, nongame bird biologist
Steve Backs-Wildlife Section- grouse and turkey biologist
Thomas Flatt-Fisheries Section-aquatic habitat coordinator

The information and recommendations from the study team have been reviewed and approved by the upper level management team of the division of fish and wildlife.

Increasing Wildlife Habitat Diversity on Forested Lands managed by the Indiana Department of Natural Resources

John Castrale, Steve Backs, and Thomas Flatt, Indiana Division of Fish and Wildlife

Abstract: A more proactive approach is needed to increase wildlife diversity on forested areas managed by the Indiana Department of Natural Resources. Loss of early successional woodlands and low levels of internal disturbances have resulted in population declines of forest wildlife, especially birds, dependent on these forest components. We propose that timber management strategies be adjusted to increase timber harvest nearer to sustainable levels and rely on a wider variety of silvicultural treatments and cut sizes. We recommend that woodlands on IDNR properties utilize a combination of uncut and overmature areas (approximately 10% of forested area) with the remaining woodlands on an 80 to 100-year cutting rotation using a balance of uneven and even-aged systems. Strategies for individual areas should take into account the surrounding landscape and strive to minimize habitat fragmentation.

Introduction

Since the early 1900s, the amount of forestland in Indiana has increased dramatically, while woodlands have aged due to less timber cutting (Parker 1997, Schmidt et al. 2000). Lower rates of farmland abandonment, regrowth of previously cut forests, fire suppression, low timber harvest levels, and the reliance on uneven-aged cutting systems on public and private lands have resulted in two major trends detrimental to forest wildlife diversity. First, the loss of early successional habitat (0-20 years after disturbance) has caused declines in populations of wildlife species that use younger forests or require forest disturbances (Dessecker and McAuley 2001, Hunter et al. 2001). The current decline in the amount of early successional forest is expected to continue in the north-central United States (Trani et. al. 2001). Second, oak-hickory forests, which produce hard mast important to many wildlife species, will be replaced by more shade-tolerant species such as sugar maple in the absence of disturbance.

We propose changes in land management practices on IDNR lands to insure a broader diversity of sustainable wildlife populations. Forest wildlife managers face the challenge of providing habitat on both ends of the successional continuum, the early (0-20 years after cutting) and old-growth (>100 years) stages of forest succession. Hunter et al. (2001) contends that "the key forest bird management issue today lies in how best to protect, create, or restore an appropriate mix of frequently disturbed and infrequently disturbed forested conditions. Given that natural disturbance factors no longer function as they once did, more direct management intervention may be justified from an ecological restoration point of view (Askins 2000, Klaus et al. 2005). However,

restoration should not be at the expense of developing future old-growth conditions in many areas where mid-successional stands now dominate." Overall wildlife diversity is dependent on providing a balance of forest stages over the landscape. Two major considerations in devising a forest management strategy are the fragmentation of habitats and minimum area requirements of wildlife species.

Importance of Forests to Wildlife

Because of their complex structure and high plant diversity, Central Hardwood forests provide habitat for a large number of wildlife species compared to other, structurally simpler, ecological systems. Forests provide distinct layers of vegetation extending vertically from leaf litter, grasses and forbs, shrubs, tree seedlings and saplings, one or more sub-canopy strata to the outer canopies of the tall trees. Animal species fill these various niches and partition forests according to preferences for breeding, foraging, and security sites. Some of the forest resources that wildlife uses include burrows, leaf litter, downed woody debris, herbaceous plants, shrubs, tree cavities, and the outer tree canopy. Foods utilized by wildlife species in woodlands include fungi, buds, fruit, seeds, hard mast, herbaceous vegetation, woody browse, nectar from flowers, tree sap, insects, spiders, other invertebrates and other vertebrates.

Successional stages of forests differ in the structure and resources they provide for wildlife and, thus, the wildlife species present. Forested acreage with the full mix of distinct successional stages in adequate sizes will support the full gamut of forest wildlife species. Early successional stages offer grasses and herbaceous vegetation that are quickly replaced by fruit-producing shrubs and young trees. These early stages are ephemeral and bird species begin using them 1-5 years after disturbance (clear-cutting) and begin to decline after about 5-10 years (Thompson and DeGraaf 2001). Within 20 years, tree saplings form a dense canopy resulting in a woodland with simple vegetative structure (basically 1 horizontal layer) as ground vegetation is shaded out. Soft mast producers (brambles, flowering dogwoods) that thrive after disturbance are also replaced as other woody vegetation dominates. For the next 40 or more years, forests in this mid-successional stage host a reduced variety of wildlife species. Eventually, gaps occur in the forest with the death of trees, restoring some of these early successional attributes. Tree mortality also provides cavities and coarse ground material for a host of wildlife species such as woodpeckers and salamanders. Animal species diversity generally increases as forests age past mid-successional stages, vegetative structure becomes more complex, and disturbance factors once again provide habitat for ground-nesting and understory inhabitants.

Vegetative diversity in forests is caused by a variety of natural and man-made factors that affect different forest sizes, from thousands of acres due to fires and hurricanes to the death of isolated trees from other factors. Central Hardwood forests are relatively young (<100 years old) and have not had a chance (which may take centuries) to develop the tree-fall dynamics beneficial to gap-associated species (Hunter et al. 2001). Wildfire, storms, lightning, wind, ice, snow, flooding, beaver cutting, grazing, and insect outbreaks cause tree mortality and set back succession. Fire, primarily set by Native Americans, was the dominant disturbance factor in forests of the Midwest prior to European settlement (Lorimer 2001). Fire has become less common in recent times and rarely acts on large scales because of fire suppression. Prescribed fire, mowing,

herbicides, and timber cutting are man-made tools used to mimic natural disturbances and necessary to overcome habitat deficiencies not provided by natural disturbances (Klaus et al 2005).

Habitat associations of forest birds and response to timber cutting practices have been fairly well studied in the Central Hardwood region (Annand and Thompson 1993, Thompson and Dessecker 1997, Klaus et al. 2005). Even-aged silviculture, with rotations of at least 100 years in largely forested landscapes, appeared to have little affect on relative abundance of most bird species associated with mature forests in Missouri and some mature forest birds had higher population levels in areas with active timber management compared to wilderness areas (Thompson 1993, Annand and Thompson 1997). Shrublands and disturbed patches of forests are attractive to mature forest birds by providing protective cover and food for post-breeding adults, fledglings, and migrants (Anders et al. 1998, Vega Rivera et al. 1998, 1999, Pagen et al. 2000, Suthers et al. 2000, Lang et al. 2002, Marshall et al. 2003, Rodewald and Brittingham 2004).

Hunter et al. (2001) analyzed groups of birds associated with open habitats or dependent on disturbance in the eastern United States. Table 1 is a subset of these birds that breed in Indiana. Arguments could be made to add or delete species to this list in Indiana. About 70% of 40 bird species analyzed associated with shrub-scrub habitats in the eastern United States were undergoing declines (Hunter et al. 2001). A similar percentage of 21 species associated with open woodlands and savannas showed population decreases. Over 45% of 30 species associated with openings in woodlands were also declining. In contrast, only 15% of 60 bird species associated with eastern forests not obviously dependent on disturbances, showed declines. Although bird population trends are best studied, other vertebrate groups such as mammals (Litvaitis 2001) likely show similar patterns. The federally endangered Indiana bat requires a diversity of forest ages and tree sizes with oaks, hickories, and ash species favored (Appendix II, Forest Management Recommendations, of the 2005 draft of the Indiana Bat Recovery Plan).

In recent years, there has been much concern about the decline of oaks in the Central Hardwood region as they are replaced by more shade-tolerant trees in the absence of disturbance factors such as fire and even-aged timber management. Acorns and other hard mast provide a staple fall and winter food for many forest wildlife species (Martin et al. 1951, Thompson and Dessecker 1997, Dickson 2002). Birds foraged preferentially in oak trees compared to other species in Arkansas (Patterson and James 2002). Uneven-aged silvicultural practices are not conducive to regenerating oak forests.

Proposed Changes in Timber Management

We propose several steps to increase forest wildlife diversity on lands managed by the Indiana Department of Natural Resources: 1) designate approximately 10% of the land area on most properties that will be uncut or on a long rotation (>100 years) in order to allow old-growth characteristics to develop; 2) increase timber harvests on the remaining acreage closer to sustainable levels; 3) use a greater variety of even- and uneven-aged silvicultural methods to harvest timber.

Protected areas. Characteristics associated with old growth or over-mature forests may take centuries to develop. Although no wildlife species in the Midwest are known to require ancient forests, some may prosper in these situations. Few old-growth

or "virgin" forests are known to exist in Indiana and all are of small size and vary in quality. Many have been protected as designated Nature Preserves. Other forested lands have been protected from timber cutting (e.g., Deam Wilderness Area of the Hoosier National Forest) and will eventually exhibit old-growth characteristics. Even on state-managed lands, some areas should be protected from timber harvest in order to provide examples for scientific study and for the enjoyment of future generations. To this end, State Forests have designated "old forest areas" in recent years. A no-cut zone of at least 20 acres is recommended around openings of priority 1 and priority 2 Indiana bat hibernation caves with a minimum of 10% old-growth forest established within 5 miles of these locations (Appendix II, Forest Management Recommendations, of the 2005 draft of the Indiana Bat Recovery Plan).

About 10% of most public properties should be set aside in a combination of uncut and long (>100 years) rotations to provide areas of over-mature trees and for natural disturbance processes to develop. Target sizes of these protected tracts should be a minimum of 200 to >1,000 acres. Fewer, larger protected blocks are preferable over multiple, smaller tracts. Blocks should be round or square in general shape and not linear in order to minimize edge effects. To further minimize possible negative impacts of edge, these areas should be located away from the perimeters of the property and buffered by additional forest. Smaller, existing nature preserves can be used as the core of these sites. Adjacent public lands (state parks, federal forestland) can also be considered when considering the location and size of these areas.

Silvicultural practices. Currently, State Forests are managed almost exclusively under an uneven-aged system using single-tree selection and group selection (0.25-5 acres) along with improvement cutting and thinning (Indiana State Forests, Silvicultural Guidelines, 6 May 2002). Annual harvest targets are set well below annual growth rates. We recommend that public timberlands be managed more assertively on a rotational basis of approximately 80-100 years. A greater variety of timber harvest methods, including even-aged systems, should be used. Forests should still be sustainable (timber harvesting below level of annual tree growth). With 10% of the forests protected or in long rotations and the remainder under a 100-year rotation, this would require that 9% of the forest be cut every 10 years resulting in 18% in early (0-20 years) successional forest, 46% >60 years old and 28% in mature (>80 years) forest. With an 80-year rotation, these values would be 23%, 33%, and 10%, respectively.

Single-tree selection, group selection (0.25-5 acres), and clear-cutting up to 10-40 acres should all be used where possible since wildlife species respond to various sizes of disturbance from single tree removals to areas of 40 or more acres. Larger cuts may not be possible on smaller state properties. Because average woodland size has been declining on private lands, public and industrial lands are the only areas where larger cuts are feasible. In order to reduce potential negative edge effects and at the same time increase the value for species that require larger areas of habitat, a strategy should be devised to locate planned cuts adjacent to more recent harvests. Edges between cuts are less abrupt with this method. Given the same amount of timber to be harvested, large cuts concentrated in one area will have fewer detrimental edge effects than using single tree selection spread out over a much larger area. Using only one cutting method of similar sized areas will result in uniform patches of habitat across the landscape. Using multiple silvicultural techniques with a much wider range of cut sizes will create a more

desirable and heterogeneous landscape beneficial to wildlife. Thompson et al. (2001) suggested increasing spatial heterogeneity by allocating equal land area to different regeneration cut sizes. For example, if 100 acres of timber are to be harvested, these could be distributed as follows: 1 20-acre cut, 2 10-acre cuts, 4 5-acre cuts, 20 1-acre cuts, and 80 0.25-acre cuts.

Consideration of Indiana bats and their habitat has become of prime importance in recent years with respect to timber management on public lands. Although the potential presence of maternity roosts has restricted the timing of timber harvests, both even-aged and uneven aged silvicultural systems (as well as prescribed burning) can be used to create, maintain, and restore Indiana bat habitat (Appendix II, Forest Management Recommendations, of the 2005 draft of the Indiana Bat Recovery Plan). Emphasis is on creation and retention of snags, especially those of oaks, hickories, and ashes.

A widespread public perception about timber management is that once a wooded tract is logged, the forest has been irreversibly destroyed and it no longer functions as a forest or wildlife habitat. Educational efforts are needed to convey the fact that timbered areas, although unsightly to some, revegetate quickly, provide immediate habitat for a new suite of wildlife species, and gradually return to a stage similar to the pre-cut condition. The greatest threat to forest-dependent wildlife species is not timber cutting, but the permanent conversion of woodland to other land uses (housing, business development, row-crop agriculture). In the Great Lakes states, developmental pressure for urban space, housing, and recreation is the largest risk to forest land-use (Trani et al. 2001).

Aquatic habitat considerations. There are many and varied aquatic habitat types (i.e. streams, lakes, ponds, rivers and wetlands) on forestland that provides homes to a variety of fish, amphibians and other water dependent wildlife. These habitats need to be identified and considered during any forest disturbance activity. The primary areas of concern are potential water quality degradation from sediments where soil has been exposed and shading and wildlife habitat issues that may develop when too many trees are removed in riparian areas.

The Division of Forestry developed a manual "Logging and Forestry Best Management Practices, Field Guide for Water Quality in Indiana " (1998) in cooperation with many agencies including the Division of Fish and Wildlife. That manual details the steps needed to protect water quality during forest management activities. Continuing to follow these guidelines will result in negligible adverse impacts on forest aquatic habitats.

Landscape considerations. Management plans for specific forests should consider the surrounding landscape. The relative amount of forest in a region is negatively correlated with nest parasitism rates by brown-headed cowbirds, and, to a lesser extent, nest predation rates of many migratory songbirds (Robinson et al. 1995). Small, isolated forests in predominately agricultural areas, such as the Till Plain of central Indiana, are likely population sinks for many forest birds, because of the abundance of brown-headed cowbirds and nest predators (snakes, mice, raccoons, opossums, skunks, foxes, coyotes, mice, blue jays, American crows). Small woodlots in agricultural areas are surrounded by hostile habitat, are too small to attract many area-sensitive species, and those birds that do nest are susceptible to cowbird parasitism or nest predators that can easily penetrate the forest interior. Although of dubious value to

breeding birds, these areas are valuable as migratory stopover sites for songbirds, as they rest and refuel. Timber management in areas where 25% or less of the landscape is timbered will likely have little additional detrimental impacts of breeding bird populations.

At the other forested extreme (>70% forest), populations of brown-headed cowbirds and open land predators are low. Brown-headed cowbirds are likely limited on a large scale by feeding areas (cropfields, livestock operations) and will travel only about 4-5 miles from feeding areas to find hosts to deposit eggs. Timber management in areas near feeding sources for cowbirds will have little affect on overall parasitism, but rather just influence where parasitism occurs. Presence of horses on or adjacent to state lands may have a greater negative impact than vegetation management. Internal edges (trails, forest openings, timber cuts) will have little negative impact. Hostile environments (farms, housing) should be restricted to the peripheries of these landscapes, if possible.

Landscape considerations are of most importance in areas of moderate forest cover (25-70%) and forest management has the greatest potential impact to wildlife populations that are area sensitive or edge sensitive. Area sensitive species are those that occur more frequently or at greater densities in larger habitat patches. Even though most songbird territories are less than 10 acres in size, those that are area sensitive may not be frequently found in habitat patches unless they are hundreds or thousands of acres in size. Edge sensitive species or forest interior species avoid settling near the periphery of a forested tract or exhibit lower reproductive success near habitat edges. Conservation steps for area sensitive species would be to reduce fragmentation by securing and reforesting inholdings, and encouraging consolidation of woodlands. Timber cutting strategies would be to locate areas to be timbered near recently cut areas, use single tree selection in more heavily wooded blocks and restrict even-aged silviculture to more peripheral and open areas. Edge specialists are those that require several distinct habitat types in close proximity to each other in order to fulfill basic life requirements. These species are favored by smaller blocks of distinctively different habitats, thus responding to smaller cut sizes spread more evenly over the landscape.

Literature Cited

Anders, A.D., J. Faaborg, and F.R. Thompson III. 1998. Postfledging dispersal, habitat use, and home-range size of juvenile wood thrushes. Auk 115:349-358.

Annand, E.M., and F.R. Thompson III. 1993. Forest bird response to regeneration practices in central hardwood forests. Journal of Wildlife Management 61:159-171.

Askins, R.A. 2000. Restoring North America's birds: lessons from landscape ecology. Yale University, New Haven, Connecticut. 320pp.

Crawford, H.S., R.G. Hooper, and R.W. Titterington. 1981. Songbird population response to silvicultural practices in central Appalachian hardwoods. Journal of Wildlife Managmenet 45:680-692.

Dessecker, D.R., and D.G. McAuley. 2001. Importance of early successional habitat to ruffed grouse and American woodcock. Wildlife Society Bulletin 29:456-465.

Dickson, J.G. 2002. Wildlife and upland oak forests. Pages 106-115 *in* M.A. Spetich, editor. Upland oak ecology symposium: history, current conditions, and

sustainability. U.S. Forest Service, Southern Research Station, General Technical Report SRS-73.

Hunter, W.C., D.A. Buehler, R.A. Canterbury, J.L. Confer, and P.B. Hamel. 2001. Conservation of disturbance-dependent birds in eastern North America. Wildlife Society Bulletin 29:440-455.

Klaus, N.A., D.A. Buehler, and A.M. Saxton 2005. Forest management alternatives and songbird breeding habitat on the Cherokee National Forest, Tennessee. Journal of Willdife Management. 69:222-234

Lang, J.D., L.A. Powell, D.G. Krementz, and M.J. Conroy. 2002. Wood trush movements and habitat use: effects of forest management for red-cockaded woodpeckers. Auk:119:109-124.

Litvaitis, J.A. 2001. Importance of early successional habitats to mammals in eastern forests. Wildlife Society Bulletin 29:466-473.

Lorimer, C.G. 2001. Historical and ecological roles of disturbance in eastern North American forests: 9,000 years of change. Wildlife Society Bulletin 29:425-439.

Marshall, M.R., J.A. DeCesso, A.B. Williams, G.A. Gale, and R.J. Cooper. 2003. Use of regenerating clearcuts by late-successional bird species and their young during the post-fledging period. Forest Ecology and Management 183:127-135.

Martin, A.C., H.S. Zim, and A.L. Nelson. 1951. American wildlife and plants: a guide to wildlife food habits. Dover Publications, Inc., New York. 500pp.

Pagen, R.W., F.R. Thompson III, and D.E. Burhans. 2000. Breeding and post-breeding habitat use by forest migrant songbirds in the Missouri Ozarks. Condor 102:738-747.

Parker, G.R. 1997. The wave of settlement. Pages 369-381 *in* M.T. Jackson, ed. The natural heritage of Indiana. Indiana University Press, Bloomington.

Patterson, C.J., and D.A. James. 2002. Use of tree species by summer birds in Ozark upland oak-hickory forest. Pages 120-122 *in* M.A. Spetich, editor. Upland oak ecology symposium: history, current conditions, and sustainability. U.S. Forest Service, Southern Research Station, General Technical Report SRS-73

Robinson, S.K., F.R. Thompson III, T.M. Donovan, D.R. Whitehead, and J. Faaborg. 1995. Regional forest fragmentation and the nesting success of migratory birds. Science 267:1987-1990.

Rodewald, P.G., and M.C. Brittingham. 2004. Stopover habitats for landbirds during fall: use of edge-dominated and early-successional forests. Auk 121:1040-1055.

Schmidt, T.L., M.H. Hansen, and J.A. Solomakos. 2000. Indiana's forests in 1998. U.S. Forest Service, North Central Research Station, Resource Bulletin NC-196. 139pp.

Suthers, H.B., J.M. Bickal, and P.G. Rodewald. 2000. Use of successional habitat and fruit resources by songbirds during autumn migration in central New Jersey. Wilson Bulletin 112:249-260.

Thompson, F.R. III. 1993. Simulated responses of a forest-interior bird population to forest management options in central hardwood forests of the United States. Conservation Biology 7:325-333.

Thompson, F.R. III, and R.M. DeGraaf. 2001. Conservation approaches for woody, early successional communities in the eastern United States. Wildlife Society Bulletin 29:483-494.

Thompson, F.R. III, and D.R. Dessecker. 1997. Management of early-successional communities in central hardwood forests with emphasis on the ecology and management of oaks, ruffed grouse, and forest songbirds. North Central Forest Experiment Station General Technical Report NC-195. 33pp.

Thompson, F.R., III, W.D. Dijak, T.G. Kulowiec, and D.A. Hamilton. 1992. Breeding bird populations in Missouri Ozark Forests with and without clearcutting. Journal of Wildlife Management 56:23-30.

Trani, M..K., R.T. Brooks, T.L. Schmidt, V.A. Rudis, and C.M. Gabbard. 2001. Patterns and trends of early successional forests in the eastern United States. Wildlife Society Bulletin 29:413-424.

Vega Rivera, J.H., J.H. Rappole, W.J. McShea, and C.A. Haas. 1998. Wood thrush postfledging movements and habitat use in northern Virginia. Condor 100:69-78.

Vega Rivera, J.H., W.J. McShea, J.H. Rappole, and C.A. Haas. 1999. Postbreeding movements and habitat use of adult wood thrushes in northern Virginia. Auk 116:458-466.

30 August 2005

Habitat Associations		
Large (>5 ha) patches of shrub-scrub, early successional and forest ecotones	Disturbance-maintained woodlands	Small (<4 ha), disturbed patches within forests
Ruffed grouse	Mississippi kite (SC)*	White-eyed vireo
Wild turkey	American kestrel	Blue-gray gnatcatcher
American woodcock	Yellow-billed cuckoo	Wood thrush
Mourning dove	Barn owl (E)**	Gray catbird
Black-billed cuckoo	Chuck-will's-widow	Brown thrasher
Whip-poor-will	Red-headed woodpecker	Cerulean warbler (SC)
Alder flycatcher	Northern flicker	Black-and-white warbler (SC)
Willow flycatcher	Eastern wood-pewee	American redstart
Least flycatcher	Eastern kingbird	Worm-eating warbler (SC)
Bell's vireo	Loggerhead shrike (E)	Kentucky warbler
Warbling vireo	Eastern bluebird	Hooded warbler (SC)
Veery	Summer tanager	Eastern towhee
Blue-winged warbler	Baltimore oriole	Rose-breasted grosbeak
Yellow warbler	American goldfinch	Indigo bunting
Chestnut-sided warbler		
Prairie warbler		
Yellow-breasted chat		
Field sparrow		
Swamp sparrow		
Blue grosbeak		
Orchard oriole		

*Special concern in Indiana.

**Endangered in Indiana.