

I. Project Title: Effects of Changes in the Forest Ecosystem on the Biodiversity of Minnesota's Northern Forest Birds

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A. M.L. 91 Chpt. 254, Art. 1, Sec. 14, Subd. 9.o. Appropriation: \$300,000
Balance: \$ 0

Changes in Ecosystem on Biodiversity of Forest Birds: This appropriation is from the Minnesota environment and natural resources trust fund to the commissioner of natural resources to monitor forest songbird populations and to develop geographic information system tools to correlate forest bird populations with dynamics of the forest landscape. This appropriation must be matched by \$200,000 from a combination of non-state funds and the state nongame wildlife program.

B. Compatible Data: During the biennium ending June 30, 1993, the data collected by projects funded under this section that have common value for natural resource planning and management must conform to information architecture as defined in guidelines and standards adopted by the Information Policy Office. In addition, the data must be provided to and integrated with the Minnesota Land Management Information Center's geographic data bases with the integration costs borne by the activity receiving funding under this section.

C. Match Requirement: \$200,000
Funds Raised to Date: \$200,000

Appropriations that must be matched and for which the match has not been committed by January 1, 1992, must be canceled. Amounts canceled to the Minnesota future resources fund are appropriated to the contingent account created in subdivision 15.

II. Narrative

The state's large public land base and the recent increase in forest management activities provide an unparalleled opportunity to develop an integrated resource management policy that provides a sustainable resource base for industry and maintains the biological diversity of the forest ecosystem. This project contributes to the development of such a policy by:

1) designing and implementing a long term research and monitoring program to investigate the response of forest bird diversity to regional land use patterns, and 2) analyzing field inventory data using Geographic Information System (GIS) techniques to develop forest landscape management tools. Forest birds, which comprise nearly 70% of all forest vertebrates, will be the primary focus of the project. Projects will be designed to help guide the management of Minnesota's forests in a direction that accommodates all future needs.

III. Objectives

A. Assess historical forest bird population trends and develop a program to monitor and predict future trends.

A.1. Narrative: Predicting the response of forest birds to changes across the northern forest landscape begins by assimilating information at a smaller scale (e.g. a forest stand) on the presence, abundance and habitat requirements of each species. The focus of this objective is to compile and analyze existing bird data and to use it to help develop a monitoring program comprehensive and sensitive enough to detect population changes that are a response to changes across the landscape.

A.2. Procedures: Forest bird population trends across the northern forest region will be analyzed using data collected since 1966 from standardized U.S. Fish and Wildlife Service Breeding Bird Survey (BBS) routes. Population trends in Minnesota will be compared with population trends throughout the Great Lakes states. Past changes in vegetative cover along the Minnesota routes (approximately 20 in the northern forest region) will also be assessed using aerial imagery to examine possible correlations between bird population changes and major changes in forest cover. Using data from these analyses, a comprehensive monitoring program will be developed that incorporates the existing BBS routes (designed to monitor trends at the national level) and extensively augments them with additional data collection points and/or plots to more effectively monitor population levels in the birds of Minnesota's northern forests and their habitat relationships.

Statewide or regional models for this effort are not available. Review and advice from statisticians at NRRI will be integral to the monitoring program's design. All major cooperators (NRRI, UM-St. Paul, MDNR) will participate in this objective.

A.3. Budget:

	LCMR Funds	Matching Funds
a. Amount Budgeted:	\$ 180,000	\$ 120,000
b. Balance:	\$ 0	\$ 15,700

A.4. Timeline for Products:

	7/91	1/92	6/92	1/93	6/93
Analyze BBS data	*****				
Analyze vegetation changes along routes			*****		
Final report of analysis			*****		
Design monitoring program			*****		
Implement monitoring program			*****		
Conduct complementary field studies to address specific habitat selection issues			*****		

A.5. Status:

1. Breeding Bird Survey (BBS) Analysis

■ Population Trends: All Species

In the mid-1960s the U.S. Fish and Wildlife Service initiated a nationwide roadside count of birds to establish a baseline for bird population trends. The BBS in Minnesota consists of 52 roadside count routes, censused once each June. A preliminary analysis of population trends using just the BBS data for northern Minnesota indicated no significant population trends. The data analysis was hampered, however, due to the small number of routes that had been consistently surveyed between 1966 and 1990. As a result, subsequent analyses pooled data from all of the forested BBS routes. Eleven of the 52 routes run in Minnesota, which had little forest area and were located primarily in the southwestern and western portions of the state, were eliminated.

Using two significance criteria, the results indicated that nine species show a consistent decline over the past 25 years. These species include the Franklin's gull, American bittern, ruffed grouse, northern flicker, least flycatcher, brown-headed cowbird, western meadowlark, pine siskin, and grasshopper sparrow. In contrast, populations of 17 species have shown a consistent increase over the past 25 years. These species include the double-crested cormorant, Canada goose, great egret, red-tailed hawk, hairy woodpecker, downy woodpecker, eastern phoebe, alder flycatcher, blue jay, orchard oriole, Brewer's blackbird, LeConte's sparrow, swamp sparrow, northern cardinal, tree swallow, solitary vireo, and eastern bluebird. The significance of these results, and important factors that need to be considered in their interpretation, are discussed in detail in the project's final report, Section 1.A.1. (Trends in the Minnesota Breeding Bird Survey: 1966-1990).

■ Population Trends: Area Sensitive Species

The analyses also included an investigation of statewide population trends for 17 forest birds classified by studies in the eastern deciduous forest as 'area sensitive' or 'forest interior' species. All 52 routes were used for this analysis. Only one of the 17 species, the Northern Waterthrush, met the two significance criteria and demonstrated a significant population increase statewide. The only species to demonstrate a population decrease was the American Redstart; it met one of two significance criteria. Six other species, restricted primarily to southeastern and east-central Minnesota, were too infrequently reported on the BBS routes to conduct any statistical analysis.

■ Other Analyses

Population trends across the Great Lakes Region

Data for all the BBS analyses were provided by biologists at the Patuxent Wildlife Research Center of the U.S. Fish and Wildlife Service in Laurel, Maryland. They have developed a complex statistical software package which allows a number of adjustments to be made to the survey data. Unfortunately, the lack of the software's availability restricts our ability to compare trends in Minnesota with trends in other parts of the Great Lakes region. We are continuing to discuss opportunities for further analysis with biologists at Patuxent; however, the center is understaffed and likely will not be able to complete additional work until the fall of 1993.

Analysis of vegetation changes along northern forest BBS routes

Initial plans under this work objective called for analyzing past changes in vegetative cover along the Minnesota BBS routes in northern Minnesota and examining possible correlations between changes in bird populations and major changes in forest cover. When examination of the data revealed that individual routes were inconsistently covered over the years this work was dropped and replaced instead with the LUDA/BBS analysis described under Objective B. Only 6 northern forest routes have been consistently covered since 1966, a number too low for analyzing any significant correlations.

Assessment of BBS as a monitoring tool

An overall evaluation of the strengths and weaknesses of the Breeding Bird Survey is presented in the project's final report (Section 1.A.2.). Generally, the BBS is an outstanding national monitoring program for detecting large scale trends in the relative abundance of birds. To address specific land management issues at a smaller scale, the BBS is best utilized in combination with other, more intensive data collection efforts.

2. Monitoring Program

■ Overall Design

A monitoring program designed to augment the BBS program effort in Minnesota was developed for implementation during the 1992 breeding season. Three primary study areas were identified for intensive field work: 1) the Superior National Forest; 2) the Chippewa National Forest; and 3) the St. Croix River Valley. The areas were selected to represent variations in landscape parameters that are known to affect forest bird distribution including intensity of agricultural conversion, habitat composition, land ownership, and intensity of forest management activities. Twelve hundred survey points were distributed among the study areas as follows: 400 points in the Chippewa National Forest; 600 points in the Superior National Forest; and 200 points in the St. Croix River Valley. Many point counts on the Chippewa National Forest have been located to correspond with releve plot locations for development of the forest's Ecological Classification System. This collaborative work will provide forest managers with the capability of directly

incorporating forest birds into their management decisions.

Within each study area, habitats were sampled in direct proportion to their total acreage. Sampling is limited to forest stands greater than 40 acres in size and to stands typed as commercial forest land (even though their stocking index may be poor). Trained observers conduct one bird count (10 minutes in duration) at each point during the breeding season between .5 hours before to 4 hours after sunrise. All birds heard or seen from the center point are recorded in a circle with estimates of their distance from the center point (up to 100 m). Weather and vegetation data are also recorded. A general overview and assessment of the monitoring program is found in Section 1.B.1. of the final report. Key elements are summarized in greater detail in a draft paper entitled: "Experimental Design Considerations for Establishing an Off-Road, Habitat Specific Monitoring Program Using Point Counts" (Appendix 1-2).

■ Implementation and Assessment

With funding provided by the U.S. Forest Service, a pilot of the regional monitoring program was begun on the Chippewa and Superior National Forests during the 1991 field season. With funding from the Minnesota Environment and Natural Resources Trust Fund the program was expanded to include the St. Croix River Valley during the 1992 field season. Data is also being collected in all three regions in 1993.

Combining the 1992 field data with the pilot data collected on the two national forests in 1991, statistical procedures demonstrated that the monitoring program will do an excellent job of detecting annual population changes. Reasonable (50% or less) changes in the annual relative abundance for more than 50% of the forest songbirds found breeding within the Chippewa and Superior National Forests can be detected. These data represent among the best results ever reported for detecting annual changes for forest birds in North America.

Following the 1992 field season, project staff met with forest biologists and district biologists on both the Superior and Chippewa National Forests to discuss preliminary results and forest needs. As co-funders, both forests received an annual report on the 1992 monitoring results (Appendix 1-3, 1-4). Funding for the FY94-95 biennium will continue the sampling through 1995.

General recommendations for designing and implementing regional bird monitoring programs are included in the final report (Section 1.B.2.). Discussing the strengths and weaknesses of both the BBS and regional point count monitoring program, project staff recommend that the two programs complement one another and should be continued. In keeping with this recommendation, project staff worked with the Patuxent Research Lab to expand BBS coverage in Minnesota by an additional 29 routes for the 1993 breeding season.

3. Complementary Studies

Project staff are directly participating in four major complementary field studies:

- An investigation of breeding birds found in old-growth forest study sites that are being sampled as part of the LCMR Old-growth Forest Project (Minnesota Old-growth Forests: Characterization and Identification). Reasonably sized stands (i.e. > 15 acres) that are selected for field study by the old-growth project are surveyed the subsequent breeding season using the same point count protocol employed by the regional monitoring program. During the 1992 field season a total of six old-growth pine stands were sampled; 10-15 stands will be sampled during the 1993 breeding season.

Survey results from the 1992 breeding season are summarized in Section 1.C.1. of the project's final report. Although the data indicate a relatively high diversity of forest bird species associated with these stands, the results of this initial census are difficult to put into perspective because of the limited sampling. The forest bird project will continue to cooperate with the old-growth study during the FY94-95 biennium, thereby increasing the number of samples over time.

- Three Master's student projects have been initiated directly by project staff. Study plans for each of these projects is presented in Section 1.C.2.(a-c) of the final report. The projects address the following three areas of investigation:
 - 1) the value of reserve areas for forest birds in northern Minnesota aspen clearcuts (graduate student: Sam Merrill);
 - 2) predicting presence and absence of selected avian species using satellite imagery (graduate student: Kent Montgomery); and
 - 3) the effect of landscape patterns on the distribution and relative abundance of three forest bird species in mature aspen stands (graduate student: Carol Pearson).

Project staff are also cooperating with three other forest songbird projects:

- On the Chippewa National Forest staff are cooperating with the USFWS to investigate breeding success and habitat relationships of forest birds. The project is part of a larger nationwide project designed to identify habitat features and conditions that affect breeding productivity. Point counts were established in the forest stands that were a part of this study and were surveyed by LCMR project staff during the 1992 and 1993 field seasons. The USFWS's 1992 Annual Progress Report on the breeding productivity study is included in our final project report in Appendix 1-1.
- Preparation of a manuscript, "Bird Community Dynamics in Boreal Forests", that summarizes many of the population issues regarding bird communities in

boreal forests. The article is scheduled for publication in a book entitled Wildlife conservation in forested landscapes, edited by Dr. R.M. DeGraaf. A draft is included as Appendix 1-3 of the final report.

- Project staff are also collaborating with the U.S. Fish and Wildlife Service to compare the effectiveness of road counts and off-road sampling points in monitoring forest birds on national forest lands. Preliminary results suggest that only one species was not adequately sampled by road counts on the Chippewa National Forest (Palm Warbler) and two species were not adequately sampled by road counts on the Superior National Forest (Indigo Bunting and Lincoln's Sparrow). A final report is due December 1993.

A.6. Benefits: Analysis of existing data to evaluate 1967-1990 population trends will provide valuable information to help identify those species that are declining or otherwise at risk and in need of attention. Broadening this baseline database will be the first critical step necessary to document the impact that regional land use patterns may have on Minnesota's forest birds.

B. Assess and predict the response of forest birds to changes in the regional forest landscape.

B.1. Narrative: Identifying parameters of the regional forest landscape that are important to birds is essential for analyzing the effects of broad scale land use changes. The primary focus of this objective will be to digitize regional forest cover and land use information and to begin analysis of the relationship between regional bird populations and land use patterns.

B.2. Procedures: The primary task during the FY92-93 biennium will be to compile all existing forest cover and land use information for all ownerships across the northern forest region. This will involve utilizing both USGS digital LUDA land use/land cover data at 1:250,000 scale, and a more detailed classification of LANDSAT thematic mapper remote sensing data. This imagery will be processed and analyzed at the NRRI GIS Laboratory. A classified forest cover database of this detail and extent is not currently available for Minnesota, and will be crucial to follow up applications from this study, as well as to the forest songbird study. GIS techniques will then be utilized to merge the Phase I forest inventory data with the new forest cover/land use map to quantitatively describe the classified forest types. Forest bird and habitat data collected in Objective A will be related to the forest at this larger regional scale and will be used to develop scenarios of long-term forest landscape dynamics and forest bird population trends under various management scenarios, utilizing a forest simulation model. During the scope of this work the analysis will begin on a subset of the larger northern forest region described above. Concurrent with this process will be an analysis of the ability of existing forest inventory data to predict bird habitat relationships, the identification of additional data needs and their recommended incorporation into on-going forest inventory programs.

B.3. Budget:

	<u>LCMR Funds</u>	<u>Matching Funds</u>
a. Amount Budgeted:	\$ 105,000	\$ 70,000
b. Balance:	\$ 0	\$ 11,000

B.4. Timeline for Products:

	7/91	1/92	6/92	1/93	6/93
Compile existing forest cover and land use information	*****				
Digitize data		*****			
Analyze existing data and identify new data needs			*****		
Begin analysis of bird populations and land use patterns using available GIS based forest data				*****	

B.5. Status:

1. Compile and digitize existing forest cover and land use data

■ Compilation of data

Project staff examined those data which were available and of appropriate scale and coverage to describe landscape-scale characteristics relevant to monitoring the status of forest birds. Important criteria were 1) spatial resolution appropriate to distinguish habitat patches at a scale important to forest birds, 2) classification resolution which also discriminated adequately among habitat types, 3) appropriate date of coverage, 4) cost effectiveness and likelihood of repeatability, and 5) availability across a broad geographic area. Following an analysis of each data set, the Land Use/Land Cover (LUDA) data were selected as being most appropriate for pursuing further analysis of the BBS data and to characterize the northern forest landscape. Considerable time was spent investigating the applicability, in particular, of the Phase I and Phase II forest cover data. Numerous problems were encountered that preclude their extensive use at this time. Further discussion of the basis for this selection is provided in Section 2. of the final report (GIS characterization of forest landscape pattern of Minnesota ecoregions using land use/land cover data).

The 1:250,000 LUDA quadrangles for the forested region of Minnesota were assembled and processed using the ARC/INFO geographic information system (GIS). Because of the quad size and the configuration of our study region, this entailed processing and creating a coverage that covers most of the state, resulting in a product that should be of use to many others. The LUDA

coverage is maintained at the Natural Resources Research Institute in proper format for transfer to LMIC and DNR.

For the three regional study areas where detailed point count monitoring is being done at finer scales (i.e. Chippewa and Superior National Forests and the St. Croix Valley), project staff also evaluated available data sets according to the criteria listed above. The conclusion was that Landsat satellite imagery classified for our own purposes would best meet the study needs. As a result, Landsat images have been acquired and classification work and analysis will begin this summer.

■ Characterization of the Northern Forested Landscape

Using the LUDA data, landscape features in each of 12 forest ecoregions (using the MDNR Ecoregion classification) were described, including percent forest cover, landscape diversity, landscape dominance, patch complexity and patch connectivity. The spatial resolution and classification level of these data proved useful in discriminating among ecoregions and describing broad biogeographic patterns important to forest birds. However, the analysis show that not all characteristics important to birds at all scales are discernable using the LUDA data. Section 2. of the project's final report is devoted largely to a summarization of these analyses and general recommendations.

2. Preliminary analysis of bird populations and land use patterns

Initial work focused on describing how the relative abundance of forest birds changes in response to general forest cover and landscape patterns within the forested areas of Minnesota. The LUDA data were combined with the BBS data and TIGER line files to delineate biogeographic patterns of forest bird communities and to test the applicability of the LUDA data for assessing the relative abundance of bird species in different habitats and in different patterned landscapes. Details of these analyses are presented in Section 3.1-3 of the project's final report.

■ Biogeographic Patterns of Forest Bird Communities

Using the 60 most abundant bird species found on all 52 BBS routes in Minnesota and on six routes in west central Wisconsin (these routes broadly fell within the St. Croix Valley study area), a TWINSpan analysis identified six broad biogeographic regions based on the distribution and abundance of breeding birds. Each of the regions broadly overlap each other with few species restricted to one or two regions. Section 3.1. of the accompanying report illustrates the geographic boundaries of each region and provides a general characterization of each. In general, the mix of species and their

relative abundances vary considerably across the state. This information will be useful in framing questions regarding Minnesota's forest bird community and how different landscapes are related to forest bird biodiversity issues.

■ Relationships between Land Use and Relative Bird Abundance

Using 29 BBS routes in the northern forested regions of the state, staff utilized an exploratory statistical procedure to examine the extent to which relative abundance (the mean number of birds observed per route from 1975 to 1981) could be related to land use types along each route. In general, a wide variety of species showed high associations between the relative abundance of individuals and land use characteristics derived from the LUDA data. The data provided surprisingly high adjusted R^2 values for explaining variation in the relative abundance of many forest bird species with relatively coarse landscape variables. There are likely a number of reasons for these associations including the relatively large sample size of routes examined and the high contrast of landscapes examined (i.e. agricultural to heavily forested). The information will prove useful for general scaling of the relative abundance of forest birds with broad landscape characteristics found within various forest regions of the state.

■ Analysis of Forest Fragmentation and the Relative Abundance of Birds

The combination of the BBS data with the LUDA data allowed staff to analyze the capability of coarse level landscape data to detect forest songbird preference and/or avoidance of fragmented landscapes. A total of 15 BBS routes were selected for analysis based on their location in areas with contrasting fragmentation features - primarily in the transitional areas between agricultural and forested areas. The LUDA data were too coarse and inadequate to examine fragmentation due to other means such as forest harvesting or management.

Twelve species showed significant and consistent patterns of variation from a random distribution among three contrasting landscapes (highly fragmented, moderately fragmented and least fragmented). Four species, including the mourning dove, American crow, common grackle and northern oriole were more frequently observed in highly fragmented stops than expected by chance. Six species were found more frequently in the least fragmented stops: veery, hermit thrush, red-eyed vireo, Nashville warbler, chestnut-sided warbler and ovenbird. Two species were more frequently observed in the moderately fragmented stops: the gray catbird and European starling. These results provide additional evidence to suggest that two potentially area sensitive species (based on studies conducted in the eastern deciduous forest), the red-eyed vireo and ovenbird, may also be sensitive to forest fragmentation in

Minnesota. In contrast, using this analysis five other species that have been defined as sensitive to forest fragmentation were not found to be strongly associated with least fragmented landscapes (yellow-throated vireo, black-and-white warbler, Canada warbler, American redstart and scarlet tanager). However, many additional species that have been suggested as sensitive to forest fragmentation were not common enough to test using this approach.

This analysis of forest fragmentation and the relative abundance of forest birds is considered very preliminary, given the coarse level of both the LUDA and BBS data. More detailed data are needed to generate a clearer understanding of the response of Minnesota's forest birds to landscape fragmentation.

B.6. Benefits: Existing forest inventory programs aimed primarily at the needs of timber management will be assessed to determine whether the data they collect are adequate to predict population trends among forest birds and to meet the needs of a more integrated resource management policy. Where additional data needs are identified recommendations will be made to incorporate these needs into existing inventory programs rather than to design new forest resource inventory efforts. Bird survey points identified in Objective A. will be chosen to correspond with sites where forest vegetation data is available. Patterns of bird habitat selection observed in the field will be extrapolated and analyzed across the northern forest landscape using regional forest inventory data.

C. Develop management prescriptions to promote integrated resource management.

C.1. Narrative: Implementing an integrated resource management (IRM) policy that addresses the needs of all forest resources begins with developing an understanding and acceptance of the concept by land managers followed by the development of guidelines that direct the inclusion of IRM considerations in all forest management activities.

C.2. Procedures: During the first biennium, materials that explain biodiversity concepts and multiple species management needs will be developed. Interim forest management recommendations based upon current studies and available literature will be prepared and work begun to incorporate them into existing DNR Forestry-Wildlife Guidelines. MDNR will assume lead responsibility in accomplishing these tasks.

C.3. Budget:

	<u>LCMR Funds</u>	<u>Matching Funds</u>
a. Amount Budgeted:	\$ 15,000	\$ 15,000
b. Balance:	\$ 0	\$ 0

C.4. Timeline for Products:

	7/91	1/92	6/92	1/93	6/93
Develop materials that explain biodiversity concepts	*****				
Develop interim forest management guidelines		*****			
Begin work to incorporate into DNR Forestry-Wildlife Guidelines				*****	

C.5. Status:

1. Develop materials that explain biodiversity concepts

Several slide shows that explain biodiversity concepts, landscape ecology, the importance of forest songbirds, and the forest songbird project were developed and presented on over 60 occasions by project cooperators and staff since July 1, 1991. Audiences have included: DNR park resource managers, DNR forestry supervisors, DNR area and district foresters, DNR area wildlife managers, national forest biologists, private forest owners, local and statewide conservation groups, county forest managers, forest industry representatives and university students. Texts and slides for several of the programs have been copied and distributed to interested participants for further use and distribution.

2. Develop interim management guidelines and begin to integrate into existing DNR guidelines.

Landscape level management guidelines that address some of the broad management concerns associated with Minnesota's northern forest birds have been compiled from a variety of resource materials and presented with many of the public presentations discussed above. Most recently, project staff played a major role in developing the 1993 Forest Stewardship Workshops. The workshops were designed to target the information needs of resource managers who are responsible for preparing stewardship management plans for private woodland owners. Biodiversity and general management considerations for forest birds were among the topics covered during the training.

We have learned, during the course of this work, that there is often considerable confusion and/or misunderstanding about the concepts of landscape ecology and biodiversity conservation when applied at the regional landscape scale. One of the most misunderstood concepts, for example, is forest fragmentation, an issue of considerable importance to many forest birds. Discussions and meetings with forest land managers also have repeatedly highlighted the need to compile and make available basic information about Minnesota's forest bird resources. As a

result, project staff decided to initially focus their efforts at developing broad background materials that provide a foundation for understanding the importance of avian species to the forest community. The first two management products have been delineated as follows:

1. An information guide on forest birds for forest land managers. The 15-20 page technical guide, *A Primer on Forest Birds in Minnesota*, will provide managers with a general description of forest bird communities and with maps and graphs that depict their regional and statewide significance. Special emphasis will be placed on describing the relationship between birds and bird communities to important habitat components. A draft outline for the text is presented in Section 4.A. of the project's final report. It is anticipated that the final draft of the booklet will be ready for publication by summer 1994.
2. A 4-6 page leaflet that focuses on the issue of forest fragmentation by explaining and defining important concepts related to fragmentation, landscape ecology and wildlife-habitat relationships in "edge" habitats. The first draft of the leaflet is included in the project's final report, Section 4.B. A final version will be completed in early fall, following further field review. Current plans for distribution include developing it as an addition to the DNR Forest Stewardship Manual.

Beginning in the FY94-95 biennium, project staff will also begin reviewing and revising current snag management guidelines for eventual incorporation into the Forestry Stewardship Manual and the DNR Forest-Wildlife Guidelines.

C.6. Benefits: Materials for professional land managers will provide them with technical information to integrate the need of a broader spectrum of forest wildlife into traditional land management practices at the state level and will serve as a model for federal, county and private land managers throughout the state.

General Comments on Project's Overall Status

1. The first six months of the project (July 1991 to December 1991) focused on accomplishing two primary objectives: 1) building a broad coalition among federal, state and county resource agencies, conservation organizations, private foundations, industry, academic institutions, and private individuals to protect and manage Minnesota's rich diversity of forest songbirds; and 2) securing a required \$200,000 funding match. Both objectives were successfully accomplished. Commitments for the full \$200,000 were secured as of mid-December 1991 and Minnesota's Forest Songbird Project now represents a coalition of over 20 agencies, organizations, foundations, academic institutions and companies.

2. Considerable time was spent during the project's second and third quarter (January 1992 to January 1993) preparing and executing contract agreements, income agreements and grant agreements to transfer the \$200,000 in matching funds to the DNR. Numerous problems were encountered.

Securing funds from several of these groups required the preparation of extensive contracts and income agreements that required many months of work. Sometimes conditions were imposed that were not stated initially when the commitments were made. In two cases, the contract end dates actually extend into the next biennium.

As of the June 30, 1993, of the \$200,000 the project was obligated to bring in during FY92-93, actual receipts totalled \$180,425. The remainder of the gift funds will be received over the next 12 to 16 months. Because we were uncertain about the level of our operating funds during the biennium project staff budgeted conservatively. Our total expenditures, as reported here, are \$473,289. The \$300,000 Trust Fund appropriation was totally liquidated - the savings are in our gift accounts and will be directed to project expenses during the FY94-95 biennium.

3. A multi-disciplinary, inter-agency steering committee has been formed to guide overall program planning and implementation. The committee has met ten times since July 1, 1991.
4. On February 11, 1993, project staff met with several forest industry representatives from forest companies located throughout the Great Lakes states. An entire day was spent discussing the project, industry's need for management information, and potential avenues for cooperation.
5. The project has been featured in at least 4 newspaper articles, several newsletters, two radio spots, in the Minnesota Lottery Environmental Journal, on the Venture North TV series (a video copy of this broadcast was submitted to LCMR staff as part of the final report) and was the feature article in the September/October 1992 issue of the Minnesota Volunteer. One newspaper article led to the inclusion of forest birds in the Minnesota Milestones Report.
6. The program manager was the co-recipient of the Chuck Yeager National Conservation Award from the National Fish and Wildlife Foundation, Washington D.C. The award was given specifically to recognize the manager's contribution to forest songbird conservation efforts via the development of this project.
7. Project staff contributed to preparation of the following manuscript: "Status of neotropical migrant landbirds in the midwest: identifying species of management concern" to be published in the proceedings of the workshop on the status and management of neotropical migratory birds, Estes Park, Colorado in September 1992.
8. An annual report, prepared this spring, summarized the project's major accomplishments and was distributed to over 60 project cooperators and supporters.

9. As a result of presentations made at statewide, regional and national meetings, Minnesota's Forest Songbird Project is now widely recognized as a national model for forest songbird conservation and management.

IV. Evaluation:

For the FY92-93 biennium the program can be evaluated by its ability to: 1) assess the strengths and weaknesses of the USFWS Breeding Bird Survey methodology and whether it can be expanded to successfully monitor Minnesota's northern forest birds; 2) identify Minnesota forest birds that may be at risk because of population declines; 3) assess the breadth of coverage and amount of relevant detail available in regional forest cover and land use data and its capability to predict population changes in forest songbirds and 4) provide managers with recommendations to assist in their efforts to manage the forest landscape for all forest wildlife species.

In the long-term, the project should be evaluated by its ability to successfully utilize knowledge of the relationships between regional bird populations and the forest landscape to develop and implement landscape management practices to maintain and improve the status of the regional avifauna while still providing a sustainable resource base for industry.

V. Context

- A. The integration of wildlife management concerns and forest management practices has focused principally on game species, a select number of rare species and a few other special interest species (e.g. cavity nesters). The public and resource professionals alike are now calling for a broader, holistic approach to forest management. This project begins to address this concern by establishing a team of forest landscape ecologists and ornithologists from across the state who, under the DNR's lead, will serve as advisors and co-investigators.
- B. To date, work on forest songbirds in Minnesota, and elsewhere in the Great Lakes region, has focused primarily on delineating species presence and abundance in individual forest stands. The influence of the surrounding landscape on the bird community's composition has not been considered. However, recent work in the eastern deciduous forest has repeatedly demonstrated that vegetation patterns and composition across the landscape can be important predictors of the abundance and diversity of many forest birds within individual stands. Nevertheless, the majority of work conducted in the east has suffered from three major deficiencies: 1) it has been short-term in duration; 2) it has been conducted in forest areas that are extensively fragmented; and 3) it hasn't simultaneously tracked changes in the forest vegetation and changes in bird populations. The current project will address all three of these problems: it is a long-term monitoring project that will track changes in forest cover and bird populations in Minnesota's extensively forested northern landscape.

This project will also complement two other major biodiversity initiatives: the Great Lakes Biodiversity Task Force and the U.S. Forest Service's St. Croix River Valley Ecosystem Project. It will provide technical information integral to the Biodiversity Task Force's goal to establish common forestry and wildlife objectives for forest management throughout the Great Lakes region. It will also provide information on regional forest bird population trends that is critical for extrapolating results of bird field studies conducted along the St. Croix River to a broader landscape scale.

- C. The avian ecology work that has been conducted in Minnesota prior to this date has not been funded by LCMR. Forest inventory projects and land use cover classifications have received funding and will be utilized in the current project to the extent that the information is applicable. Proper stewardship of the forest landscape requires long-term monitoring of forest changes. The intent of this project is to establish a monitoring and research program that will be operable for a minimum of 10-15 years. It is anticipated that funding beyond the FY92-93 biennium will be sought from LCMR.

D. Not applicable.

- E. **Biennial Budget System Program Title and Budget:** Wildlife LCMR Songbirds (AID 332080, APID 31700 12 03 2). The \$300,000 appropriation will be allotted to the AID in early January.

VI. Qualifications:

1. Program Manager:

Lee Ann Pfannmuller
Nongame Wildlife Research Supervisor
Section of Wildlife - Minnesota Department of Natural Resources

M.S. Ecology and Behavioral Biology, University of Minnesota, 1979
Thesis Title: Bird Communities of the Regional Copper-Nickel Study Area

In addition to her thesis work, the program manager has been involved in bird census activities across the state since 1976. She has worked in her present capacity since 1981, supervising all research, inventory and data management activities of the Nongame Wildlife Program. Ms. Pfannmuller's primary role will be as program coordinator and to oversee work conducted under Objective C.

2. Major Cooperators:

A) Dr. David J. Mladenoff
Research Associate, Natural Resources Research Institute

Ph.D. Plant Community Ecology, University of Wisconsin, 1985
M.S. Land Resources, University of Wisconsin, 1979

Dr. Mladenoff has refereed publications and conducted research in the areas of forest ecology of the Lake Superior region, biodiversity, and landscape scale analysis using Geographic Information Systems. Current projects include a forest biodiversity project funded by the U.S. Forest Service and the Nature Conservancy. Besides research, his experience includes nearly eight years working cooperatively with state and federal land management agencies biodiversity issues. Dr. Mladenoff's primary role will be to utilize GIS techniques to correlate the bird data and vegetation data (i.e. Objective B.).

B) Dr. Gerald Niemi
Director, Center for Water and the Environment
Natural Resources Research Institute

Ph.D. Biology, Florida State University, 1983
M.S. Biology, University of Minnesota-Duluth, 1977

Dr. Niemi's interests and expertise ranges from studies of avian communities to the biodegradation of organic chemicals in aquatic environments; the common link is his interest in applying multivariate statistical techniques to complex ecological questions. He has more than twelve years of experience in: 1) studies of ecological systems; 2) multivariate statistical techniques; and 3) administration of research projects. Dr. Niemi's primary role will be to supervise the review and analysis of the BBS data and to assist in the development of a more comprehensive monitoring program (Objective A.)

C) Dr. Francesca Cuthbert
Assistant Professor, Department of Fisheries & Wildlife, University of Minnesota

Ph.D. Ecology and Behavioral Biology, University of Minnesota, 1981
M.S. Biology, Northern Illinois University, 1977

Dr. Cuthbert's primary expertise is in the area of avian ecology. She has worked on a wide range of species including terns, piping plovers, burrowing owls and osprey. Endangered species management has been a focus of many of her graduate student's projects. One student is currently investigating the composition of avian communities in the Mille Lacs Wildlife Management Area. Dr. Cuthbert's primary role will be to participate in the accomplishment of Objective A.

VII. Reporting Requirements

Semiannual status reports will be submitted not later than January 1, 1992, July 1, 1992, January 1, 1993 and a final status report by June 30, 1993.