A Prototype for Forest Health Monitoring in Indiana State Parks

Rachel Morse, KaDonna Randolph, and John W. Moser, Jr.

Abstract.—In 1997, 25 Forest Health Monitoring (FHM) plots were established in two Indiana state parks and a nearby parcel of privately owned land using a new protocol that differs from the systematic grid of the national program. All plots were reassessed in 1998. Data analysis focuses upon establishing baseline conditions for the study sites and providing relevant information for park management.

Indiana joined the National Forest Health Monitoring Program in 1996 with 144 plots from the national EMAP grid. Due to the agricultural and urban fragmentation typical of midwestern states, only 38 of those 144 plots actually contain at least one forested condition. Many of Indiana's forests are not well represented in the FHM data set, including forests within the boundaries of Indiana state parks. In fact, no systematic statewide forest inventory or monitoring program exists in Indiana state parks. Despite a mission statement that charges the Division of State Parks to protect places of natural heritage and biologic importance, much information about these forests has not been collected.

In 1997, this pilot FHM intensification project began with two objectives: (1) To create a protocol for installing off-grid FHM plots in small study areas to augment the FHM program in Indiana, and (2) To establish a baseline of forest health information in two Indiana State Parks that will provide management information for the Division of State Parks. This project represents one of the most intensive uses of off-grid FHM plots for a natural resource management study.

STUDY SITE DESCRIPTION

Three study sites were chosen: two state parks with a "hands-off" management plan and a selectively harvested private property. Practicality prevailed in site selection. Shades and Turkey Run State Parks contain large forested areas. They are located 15 miles apart and within 50 miles of Purdue University. The private property in Annapolis, IN, is within 21 miles of both parks and has similar topography and forest cover. All sites lie in the Sugar Creek watershed, contain steeply sloping ravines (measured slopes range from 0 to 73 percent), and have glacial soils. Elevations range from 500 to 700 feet above sea level. All plots are located on sawtimber-size stands of natural origin with stand ages ranging from 50 to 120 years.

Research Assistant, Research Assistant, and Professor of Forest Biometry, respectively, Purdue University, West Lafayette, IN, USA.

OBJECTIVE 1: CREATING A NEW PROTOCOL

Plot Location

Plots were located only in forested areas on both parks and the private property. Plots in the parks were located only in high-use recreation areas because of park managers' interest in the impacts of recreation on forest health. For this study, high-use recreation areas have been defined as within 300 feet of a trail, campground, shelter, or other park construction.

Due to the limited time in which FHM data can be collected (after full leaf-out and before fall coloration), a limited number of FHM plots could be established. Time, budget, and labor considerations restricted the number of plots to 25 (10 in each park and 5 in the private property). This number of plots was not enough to systematically assess the forested areas within the parks. Therefore, a random plot allocation method was created.

Plot Location Procedure

1. Grids of 5.25 acres were placed over aerial photos of the study sites. This was the minimum size allowing for plots located in adjacent grids not to overlap.

2. Areas that would not qualify as a forested condition for FHM protocol were eliminated, as well as low-use recreation areas in the parks.

3. Grid squares falling over acceptable conditions were numbered sequentially from west to east and north to south.

4. Random numbers were used to select grid squares for plots. Squares that fell in stands where the estimated age was less than 50 years were eliminated.

5. The center of each grid square was located on the ground, and a random azimuth and a random distance from the center (less than 200 feet) were taken. This became the center of the FHM plot.

OBJECTIVE 2: BASELINE FHM DATA

Forest health assessments can provide baseline data for state park forests. While it is important to have information about species composition, stand densities, damages, etc., the value of a forest inventory is in the continued reassessment and the comparability of assessments in different forests under a variety of management schemes. To provide the most useful baseline data for the Division of State Parks, we decided that the forest health assessments had to be repeatable and linked to a national monitoring program. We chose the National Forest Health Monitoring Program because of the interests of this program and of the Indiana Division of Forestry in increasing the number of forested FHM plots in Indiana. This well-established program has detailed measurement protocols.

Field crew members were trained and certified in FHM survey procedures at the USDA Forest Service Northern Region training sessions before the field seasons. All protocols from the Field Methods Guide (USDA Forest Service 1998) were followed, and data for all health indicators of the national program (mensuration, crowns, damage, soils, and lichen) were collected. However, we had to modify two protocols for plots in the state parks.

Trees and saplings in Shades State Park could not be painted at dbh due to the potential to negatively impact visitors' experiences if paint slashes could be viewed from trails. Site trees located in the nature preserves within each park (2 site trees in Shades and 10 site trees in Turkey Run) could not be cored to determine age at dbh. Ages for these site trees were estimated using written histories of the areas and cores of dead trees in the preserves.

RESULTS AND DISCUSSION

The data set for this project contains 93 forested subplots yielding a total of 499 trees. This distribution among sites is as follows: Shades: 38 forested subplots, 220 trees; Turkey Run: 38 forested subplots, 192 trees; Private Property: 17 forested subplots, 87 trees.

In addition to tree data, sapling, seedling, microplot, soil, and lichen data have been gathered for these plots. Listing the entire data set in this section would not be as useful as examining specific portions of the data with applications for park management. So, the following are three examples of specific applications of FHM data.

Defective Trees

Defective trees, those with damages that compromise structural integrity, are of great interest to park managers. Not only do defective trees affect visitors' perceptions of the forest's condition, but these trees have the potential to become hazard trees. A hazard tree is any defective tree with a high risk of causing injury to people or damage to property. Defects that could create hazard trees include decayed wood, cankers, root problems, dead branches, and cracks and seams (Albers and Hayes 1993).

The FHM Damage and Catastrophic Mortality Assessment makes it possible to list the defect trees located in each plot. Table 1 was constructed for the FHM plots in the parks based on the 1997 assessment. Cracks and seams were added to the assessment list in 1998; the data are not yet available.

Table 1.—*Number of trees assessed in Shades and Turkey Run State Parks, Indiana, with defect damages (1997)*

Defect	Number of trees
Decayed wood	85
Cankers	8
Broken roots	2
Dead branches	16

Special attention can also be given to species with particular damage problems, such as American beech (*Fagus americana*). The smooth bark of beech is often the target of tree carvers, especially when the trees are located along trails. Cuts deep into the cambium can become decay sites. Beech trees on park FHM plots have a 51.5-percent occurrence of decay compared to 18-percent occurrence for all other species combined. This finding may prompt further investigation into the detrimental effects of tree carving in these parks.

Mast-Bearing Trees

Wildlife viewing is a key attraction in Indiana state parks. One way to ensure the presence of wildlife in the parks is to provide the proper habitat, including food. Maintenance of mast-bearing species (including oaks (*Quercus* spp.), hickories (*Carya* spp.), and beech) is important for mast-dependent wildlife such as squirrels (*Serius* spp.), chipmunks (*Tamias striatus*), turkey (*Meleagris gallopavo*), and white-tailed deer (*Oedocoileus virginianus*), which derive a portion of their diets from mast.

A management strategy that favors shade-tolerant species such as maples and beech over oaks may cause a reduction in the production of mast (Mannan *et al.* 1996). Examination of seedling, sapling, and tree data from a per acre standpoint yields information about species composition (table 2).

Table 2.—*Number of maple, oak, hickory, and beech seedlings, saplings, and trees per acre in Shades and Turkey Run State Parks, Indiana, based on 1997 FHM assessment*

Species	Tree type	Number/acre	Species	Tree type	Number/acre
Maples (*Acer* spp.)	Seedling	213	Oaks	Seedling	12
	Sapling	95		Sapling	0
	Tree	34		Tree	16
Beech	Seedling	103	Hickories	Seedling	32
	Sapling	16		Sapling	8
	Tree	10		Tree	8

The comparatively few oak and hickory understory trees (no oak saplings were recorded on park plots) may signal a shift in species composition that is detrimental to mast-dependent wildlife. This is an issue park managers may wish to address.

Tree Crowns

Tree crowns shape the canopy structure, determine the light intensity beneath the canopy, and contribute to the amount of individual tree growth. All of these are important considerations for aesthetic value as well as health. Not only do poor crowns have a negative effect on tree vigor, but they also can decrease the visual enjoyment of people recreating in the woods. Even forest damages of less than 10 percent severity can have a negative effect on visual quality for the average recreationist (Buhyoff and Leuschner 1978). FHM evaluations provide appraisals for crown density, foliage transparency, and crown damages. These variables can be examined for certain plot locations or for certain species. Summaries such as figure 1 can be constructed to search for areas or species with visual quality problems.

CONCLUSION

The plot location protocol initiated in this project provides a method to locate FHM plots on specific study sites that guarantees the area of interest (such as high-use recreation forests) will be sampled. The plots established in this project provide baseline data for important landscapes missed by the systematic grid. In addition, comparisons

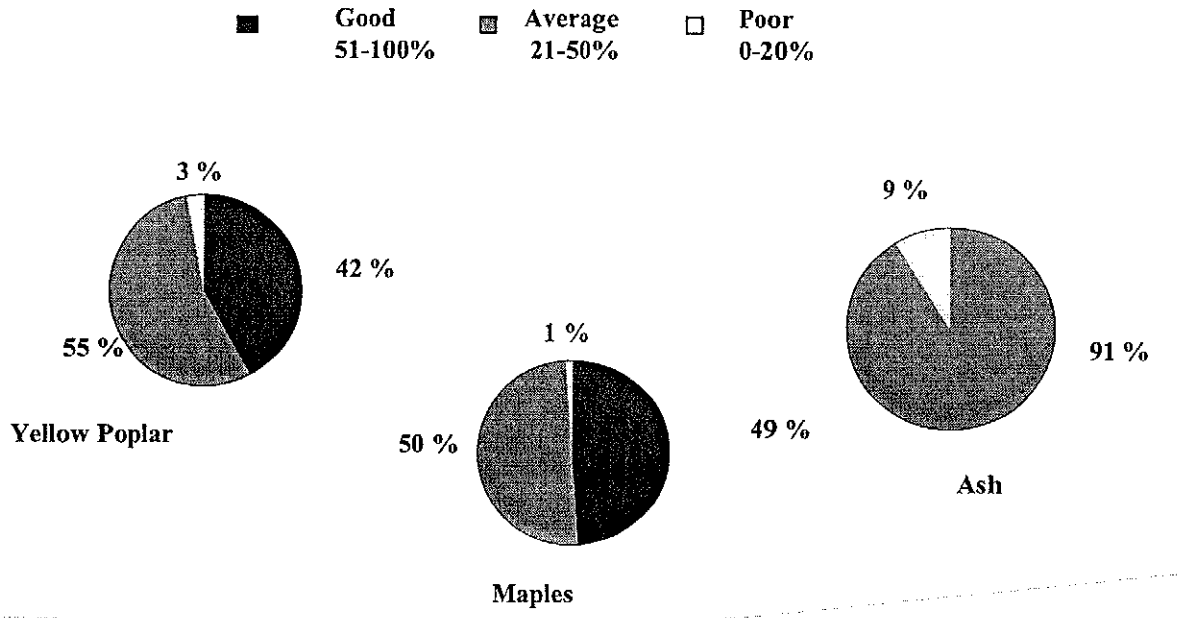

Figure 1.—*Crown densities for yellow poplar (*Liriodendron tulipifera*), maples, and ash (*Fraxinus *spp.) on FHM plots in Turkey Run and Shades State Parks, Indiana.*

can be made between the "preserved" forests of the park and other FHM plots. By linking the forest health plots in our study sites to the nationwide system of FHM plots, we can enhance both the local monitoring project and the national program.

ACKNOWLEDGMENTS

The authors thank the Indiana Department of Natural Resources Division of State Parks, Indiana Department of Natural Resources Division of Forestry, USDA Forest Service National Forest Health Monitoring Program, and USDA Forest Service Forest Inventory and Analysis Program for their support of this research effort.

LITERATURE CITED

Albers, J.; Hayes, E. 1993. How to detect, assess and correct hazard trees in recreational areas. Minnesota: Minnesota Department of Natural Resources. 63 p.

Buhyoff, G.J.; Leuschner, W.A. 1978. Estimating psychological disutility from damaged forest stands. Forest Science. 24(3): 424-432.

Mannan, R.W.; Conner, R.N.; Marcot, B.; Peek, J.M. 1996. Managing forestlands for wildlife. In: Research and management techniques for wildlife and habitats. Lawrence, KS: Allen Press, Inc.: 689-721.

USDA Forest Service. 1998. Forest health monitoring 1998 field methods guide. Research Triangle Park, NC: U.S. Department of Agriculture, Forest Service, National Forest Health Monitoring Program.