United States
Department of
Agriculture

Forest Service

**Southern Forest
Experiment Station**

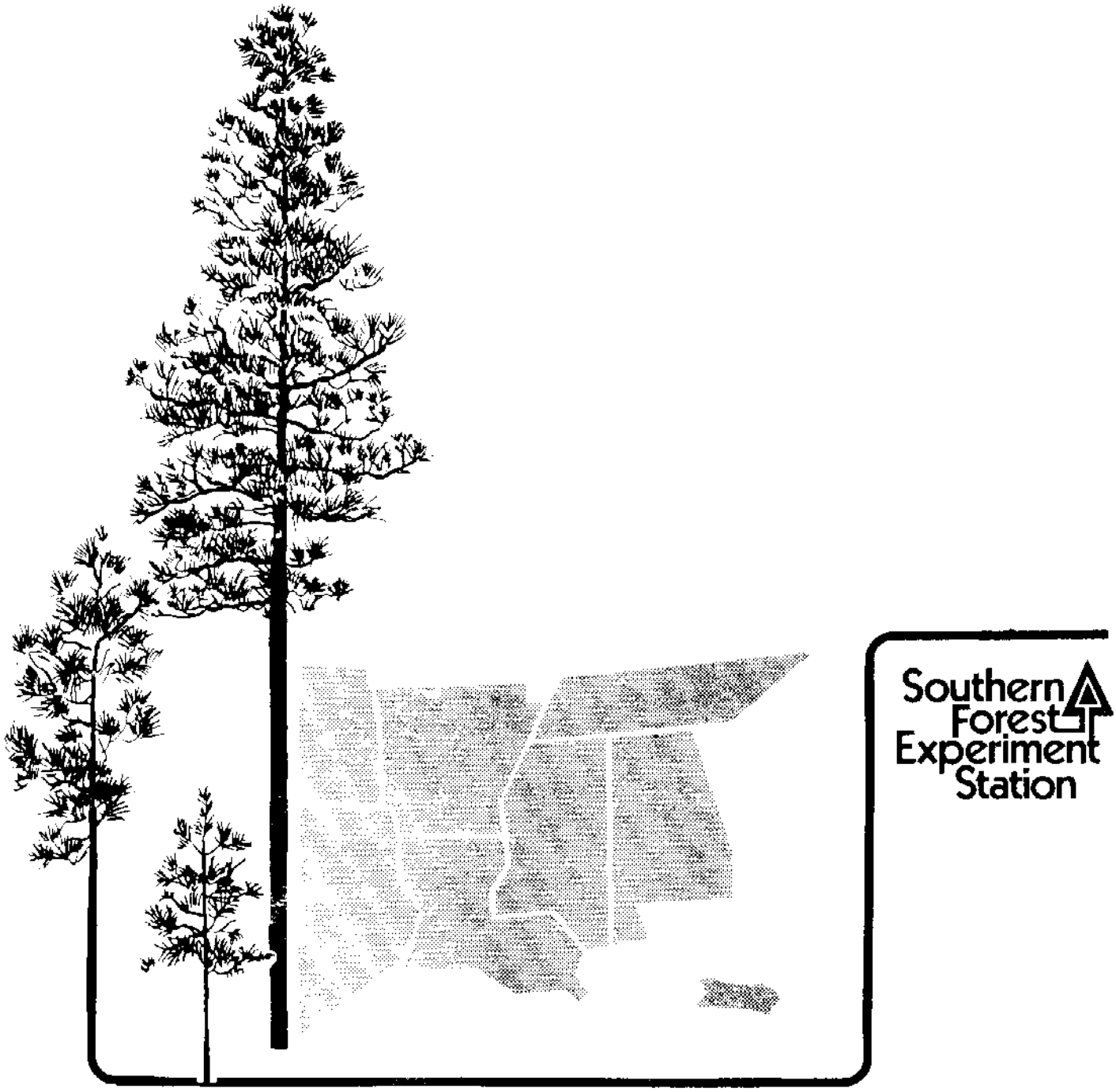
New Orleans,
Louisiana

Proceedings Reprint

MULTIPLE VALUE FOREST SURVEYS IN THE MIDSOUTH STATES

Rudis, Victor A.

In: State-of-the-art methodology of forest inventory: a symposium proceedings; 1989 July 30-August 5; Syracuse, NY. Gen. Tech. Rep. PNW-263. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station: 495-504.



Multiple Value Forest Surveys in the Midsouth States

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ABSTRACT

State-of-the-art achievements and limitations in integrating water, range, wildlife, and recreation ("nontimber") inventories with forest surveys of the USDA-Forest Service, Southern Forest Experiment Station, Forest Inventory and Analysis (FIA) Unit are reviewed. The FIA Unit surveys private and public forests in 7 Midsouth states: Alabama, Arkansas, Louisiana, Mississippi, Oklahoma, Tennessee, and Texas. Articles, works-in-progress, and the process of integrating multiple-value forest inventories while maintaining an ongoing forest survey are discussed with respect to: (1) current and projected trends, (2) new approaches and additional monitoring measures, and (3) establishment of a user constituency in nontimber disciplines. Recommendations for the future include studies of sample designs suited to multiresources assessment, focusing analytical reports toward newsworthy issues in nontimber disciplines, fostering interdisciplinary efforts to study regional forest resource issues through cooperative funding programs, and "outreach" activities to inform and involve individuals in the multiple value potential of forest survey information.

INTRODUCTION

The U.S. Department of Agriculture Forest Service (USDA-FS), Southern Forest Experiment Station (SO), Forest Inventory and Analysis (FIA) Unit, has been estimating current conditions and trends in private and public forest resources since its inception in the 1930's. The SO-FIA Unit conducts forest surveys on some 100 million acres of largely private forests in Midsouth states (Alabama, Arkansas, Louisiana, Mississippi, Oklahoma, Tennessee, and Texas). Public forests of the USDA Forest Service's National Forest System are surveyed by the SO-FIA Unit as well for regional analyses.

The forest survey sample design involves field observations of trees in forested areas, taken within 1-acre plots located systematically at 3-mile intervals throughout the Midsouth states. When combined with ground-truth of forest/nonforest photointerpretation on additional areas, field observations of trees and forested areas are expanded statistically to estimate forest area and timber volume for entire counties, states, and regions, regardless of ownership. Such data routinely are compiled, examined, and reported for states and the Nation about every 10 years.

Because SO-FIA forest surveys are the only source of detailed data on private forest resources for extensive areas in Midsouth states, and because comparable data are gathered for public forests, they have been extremely valuable in providing information relevant to regional forest planning and management issues associated with timber production. With the passage of new laws in the mid-70's, Congress mandated that the Forest Service provide a comprehensive assessment of forest resources to include not only timber, but water, range, wildlife habitat, and recreation attributes as well.

This mandate, essentially an interdisciplinary effort, is burdened by obstacles that may not have been envisioned when the laws were passed. Interdisciplinary studies that link social and natural sciences often lack an institutional support structure; can engender incompatible priorities and perceived responsibilities among disciplines; require more time to coordinate among disciplines; have few collected works from which to gather relevant information, and even fewer journal outlets; and often lack sources for research grants and a constituency concerned with interdisciplinary issues (Heberlein 1988). Because there are few journal outlets, interdisciplinary studies are reported frequently in

proceedings, rather than more widely disseminated and archived journals. My own experience leads me to believe that integrating multiple value forest surveys into an existing forest survey meets with the same types of obstacles.

I will discuss the status of multiple value integration by annotating multiple value SO-FIA research accomplishments and works in progress since the late-70's, touching on problem areas and possible solutions for the coming decade. Discussion of three subtopics follows: current conditions and trends, new approaches and additional monitoring measures, and establishment of a user constituency.

CURRENT CONDITIONS AND TRENDS

Forest survey data are in great demand by timber companies and forestry consultants. The social support structure for disseminating this information -- namely project administrators, lists of contacts, public information officers, and publications staff -- is built to provide timber-related statistics on a timely basis. Data needs have grown since the 1930's to include not only the current wood supply for a region, but also specific concerns about wood quality, availability from landowner groups, road accessibility, regeneration, and timber harvesting trends. At the National level, data needs are directed by the desire to maintain continuity in successive assessment reports, as well as to address user constituency needs for standardized statistics from different parts of the country.

In regions where the demand for timber production and other forest values conflict, private individuals and public advocacy groups have become sophisticated in articulating their demand for comprehensive planning, including multiple value forest resource information. Yet these individuals and groups frequently are unable to translate their demands to inventory data needs. Their needs are not readily answered by an ongoing, established forest survey -- a survey that was originally designed to answer questions about timber supply. Regional and National demand for other forest values is variable, as it is weakly defined in terms of priorities and statistical requirements. Organization, direction, and standardization of information needs at the National level are limited, although there has been some progress in this regard (Schlatterer and Lund 1984, Lund 1986).

Within SO-FIA's region, studies of tree biomass (e.g., Rosson and Thomas 1986) and incidence of insect and disease damage to timber resources (e.g., Mistretta and Bylin 1986) were recognized as logical and statistically definable extensions of the existing sample design. Tree biomass and tree damage analyses continue to be studied and reported at regional levels of aggregation. Coordinated efforts for National compilation are underway. Progress in the other disciplines (hydrology, soils, range science, wildlife, and recreation) is slower, but has been growing in recent years.

An important challenge for the current system of data collection, storage, and retrieval is in reorienting staff, reports, office and field procedures, forest survey data, and sampling methodology toward these other disciplines. Today's forest inventory specialist needs to be aware of the issues, methods, and literature in ecology, hydrology, range science, wildlife management, and recreation disciplines, as well as timber measurements if he/she is to be effective in implementing multiple value forest surveys. Office and field staff at the SO-FIA are being trained, or have been trained, in several of these other disciplines.

But since no one person or work unit can afford to have the expertise in all these disciplines, the SO-FIA Unit has taken a broad-brush approach to data presentation and analyses in "nontimber" (i.e., water, range, wildlife, and recreation components or values of forests) reports. The objective is to attract National, state, and university policy analysts and consultants with expertise in nontimber disciplines toward a more in-depth examination of inventory data. Graphics help reach a diverse audience not well versed in forest survey statistics. A cornerstone in our approach is an in-place, interactive data-base management system that helps answer detailed questions about issues relevant to the other disciplines.

There are gaps in our data collection effort, however. At the present time, detailed forest vegetation measurements are published and made readily available only for timberland plots -- not in designated forested wilderness areas, forested urban areas, or nonforested areas (FIA Staff 1988a). As such, habitat delineation for forest-dwelling species that utilize nontimberland areas is incomplete. Standardized bulletins and tabular information programs generally are focused on timely reporting of timber production statistics, rather than other resources. Trend information also is lacking for some of the added measures (e.g., FIA Staff 1988b), as many have been sampled only once since 1980 in Midsouth states. Data from other agencies are used to make comparisons of forest survey data with wildlife populations, soils, and recreation facility inventories, but quality, quantity, and level of detailed information vary from state to state.

Despite the above limitations, SO-FIA has succeeded in delineating habitats and trends for a few wildlife species and forest ecosystems at the state and regional level in response to issues gleaned from the ecological and forest recreation literature. At the regional level, Midsouth forest inventory data have been used to tie detailed forested area estimates with Soil Conservation Service (SCS) cropland estimates by county for multi-county physiographic units. The integrated data have been used to project land use changes (Alig et al. 1988), deer and wild turkey densities (Flather et al. 1989), and forested area, forest type, and ownership class changes (Alig et al. 1986) in association with U.S. Census county estimates of per capita income and population for Midsouth states.

An endangered forest-dwelling species, the red-cockaded woodpecker (RCW), has received attention by the press, environmental groups, and timber interests in the South, especially in east Texas. The RCW's habitat and trend estimates (Lennartz et al. 1983; Rudis 1988b: 8; Rudis 1988c: 6) have received close scrutiny in SO-FIA publications. Established criteria help delineate potential habitat and are based on detailed research from specific areas on known RCW sitings. Application of such criteria to FIA data without independent validation requires an important assumption. One must assume the generalizability of detailed research toward the larger area represented by FIA surveys. Despite this assumption, linkage of such criteria with an extensive-area data base does provide estimates about which opposing interests can argue. Because of the potential for litigation, the text is worded carefully, statistical confidence is noted, and -- most importantly -- estimates reflecting other opinions about habitat classification are provided.

Based on surveys conducted since the 1930's in the Midsouth states, we have noted declines in forested wetlands (Rudis and Birdsey 1986, McWilliams and Rosson, 1989). Subtle species and forest type shifts suggest a greater decline in moist, poorly drained forests than the wetter sites. In the Lower Mississippi Delta, historic logging for valued oaks, increases in water impoundments, and demand for soybean acreage over the years have resulted in increases in cull volume and changes in species composition toward cypress and away from overcup oak on remaining forests (Rudis and Birdsey 1986).

SO-FIA reports note dramatic declines in the fire-dependent longleaf pine forests that once dominated the southern portion of the Southern Coastal Plain in East Texas (McWilliams and Lord 1988: 2-4; Rudis 1988c: 6), Louisiana (Rudis 1988b: 18-20), and Mississippi (Kelly and Sims 1989). Our reports note that longleaf pine acreage has declined over the years and that regeneration to longleaf pine has been relatively rare. Several endangered species -- the red-cockaded woodpecker, the gopher tortoise, and several grass species -- are not exclusive to longleaf pine habitats. Nevertheless, several scientists (Seagle et al. 1987; Lohoefener 1981; and Steve Orzell, Texas Natural Heritage Program, Austin, TX, personal communication) suggest that the decline in natural stands of longleaf pine habitat explains part of the decline in the populations of these species.

Characterization of the regional landscape appears to be a strength of the existing sample design, as its use provides regional insights in studies of biogeography and landscape ecology. Individual species plot distributions, a relatively simple approach to spatial data analysis, provide thematic maps which highlight the physiography, biogeography, and human influences of selected species within the region. Maps of forested plots that highlight adjacent areas (e.g., water, urban land use, forested land cover) help one to grasp the regional context -- the landscape ecology -- of forest resources. For example,

remote or relatively contiguous forest cover and roadless areas have been noted as habitat for black bears and other species in need of seclusion, as natural area buffers for designated wilderness areas, and as potential wilderness recreation areas (Rudis 1986).

NEW APPROACHES AND ADDITIONAL MONITORING MEASURES

On a more routine basis, we have incorporated water, soils, range, wildlife, and recreation components of forest resources into Midsouth states' reports and field measures when possible. New approaches and measures have been required to reorient forest survey data compilation and analyses toward issues sought by individuals trained in other disciplines and agencies responsible to other types of constituents.

One approach has been to provide detailed information on oak species and noncommercial species, and to examine mast species by diameter class, physiographic region, and by county (Rudis et al. 1984: 25; Rudis 1988b: 6; Rudis 1988c: 11). Additional information also is provided on dead trees as a way to inventory potential habitats for cavity excavators and cavity-nesting wildlife. Forest area, ownership, and forest type statistics have been aggregated by human population planning districts to help land development agencies consider forest resources when planning for projected population growth (Rudis 1988b: 17; Rudis 1988c: 19). Data also are presented or made available at the county level to maximize flexibility in assisting planners and agencies when compiling forest statistics for their districts.

New field methods to integrate water, range, wildlife, and recreation values with SO-FIA forest survey data have been developed. These include methods to obtain consistent estimates of understory vegetative cover (Popham and Baker 1987) and screening (Rudis 1985b). Understory vegetative cover tied to forest surveys has been used to make projections of forage to estimate livestock potential (Joyce and Baker 1987). Screening measures have been associated with scenic beauty (Ruddell et al. 1989, Rudis et al. 1988) and cover for deer and wild turkey. The importance of several forest survey parameters -- proximity to roads, urban areas, and water -- has been associated with recreation use and the Recreation Opportunity Spectrum (Rudis 1983, 1985a, 1987). With little additional work, a classification scheme for designating a range of recreation potential from attributes of sampled plots can be developed from the conclusions in Rudis (1987). Evidence of litter, one of several human intrusions noted in recent forest surveys, is an attribute which limits primitive recreation opportunities. Because "evidence of litter" is part of the extensive-area data collected, our survey has been able to provide facts related to pollution and the recycling of disposable containers that have become important issues in the past decade (Rudis 1988a, Rudis 1988b: 14, Rudis 1988c: 24).

Field measures added in the survey include inventories of livestock use, standing dead trees, human intrusions (logging, evidence of human uses), fire evidence, signs, fences, and neighboring land uses (proximity to urban and built-up land, agricultural land, and other forests) (FIA Staff 1988a). Issues such as potential habitats for wildlife that use snags, fire potential of the wildland-urban land interface, access, and vulnerability of forest conversion to other land uses have been addressed in the most recent nontimber report (Rudis 1988c). As states are resurveyed, such data will grow in importance. Remeasurement of added field measures will enable agencies to gain a handle on the direction and rate of change.

Our staff has pilot-tested a number of measures that address information needs related to soil productivity. The need for improvements in site productivity estimates has been recognized for a long time. In central Tennessee, the Smalley system of classification (Smalley 1980) is being tested to assess its value in addressing site productivity by comparing forest land classification estimates with those from historic records of forest survey data on growth of stands (John Rennie, personal communication, University of Tennessee, Knoxville, TN). In North Louisiana, SCS soil scientists have cooperated with SO-FIA by taking soil samples on SO-FIA plots to correlate soil series and productivity estimates. In Arkansas, land use and cover classified from satellite photography has been verified on the ground by SO-FIA field personnel to aid in independent area estimation conducted by the SCS. In this way,

detailed soil and nonforest area measures (productivity, erosion potential, cropland area, etc.) conducted by the SCS one day may be integrated with the forest survey effort in a future geographic information system (GIS) and sampled-area data base.

Ordinal estimation of range resources has been based on surveys of limited areas. Early studies on the intensity of grazing in west Louisiana suggested that livestock use in southern forests was considerable -- over 50 percent of the timberland had been grazed (Sternitzke and Pearson 1974). Several surveys recorded potential browse and browse utilization in percent for west Louisiana, Tennessee, and Alabama. One study extended understory biomass estimates in south Alabama to plots where no measurements were taken, and projected understory biomass with changes in timber volume (Joyce and Baker 1987).

Nominal estimation of range utilization currently is based on the occurrence of livestock use evidence in Midsouth forests. Such an inventory provides wildlife agencies and others with an estimate of acreage, forest type, ownership, and approximate location of forested ecosystems where competition between wildlife and livestock needs can occur. Estimates of livestock use vary by region: 8 percent in Alabama (Rudis et al. 1984), 23 percent for East Texas (Rudis 1988c: 5), 38 percent for East Oklahoma (unpublished). Examination of the mapped data corroborate an independent study by Byington and others (1983) that livestock use of southern forests is a localized phenomenon -- occurring predominantly in pasture-dominated areas of states and in farmer-owned forests where the local history of forest land use includes livestock grazing of forested land.

Inventories of lesser vegetation associated with forests have been conducted in western Louisiana (Pearson and Sternitzke 1974), Tennessee, and Alabama (Joyce and Baker 1987). However, due to a variety of problems, comprehensive monitoring across all states has not been attempted. At this time, field measures are being considered to optimize cost-effective measures that limit observer variability and account for seasonal differences. Objectives are to establish field measures that estimate understory biomass and screening of vegetation, and to classify ecological communities -- i.e. seral stages and plant associations -- for range and wildlife habitat delineation. To help establish National standards, linkage of local field methods and classification schemes with National-level efforts, such as those being pursued by the Nature Conservancy, is also an important objective.

A survey of uncommon, rare, and endangered species was made in Arkansas at the request of the Arkansas Natural Heritage Program. When located on or near sampled plots, SO-FIA personnel were to identify and record potential red-cockaded woodpecker nesting sites, and record the presence or absence of 14 plant species (FIA Staff 1987). Of the 3,033 timberland plots, 90 plots (3 percent) contained uncommon, rare or endangered species. There were too few records of any one species to say anything statistically about the data collected. Because anonymity of exact locations was desired to retain continuity in the existing sample design, SO-FIA provided only general location parameters -- i.e. township, range, and section. Results of the survey yielded one previously unknown site where the endangered yellow lady's slipper might occur. Observations for 8 other species confirmed the continuing presence of these species in known areas of the State.

Integration and analysis of other inventory information from states, the National Forest System, and other federal agencies is an ongoing activity of the SO-FIA Unit. State agencies frequently provide data from their inventory efforts at little or no cost. The most versatile integration of other data sources with SO-FIA's data-base management system is at the county-level. Satellite remote sensing information has provided within-county information on land use and land cover for limited areas (Teuber 1987). Progress in these areas is encouraging and should prove fruitful for nontimber applications associated with juxtaposition of cover types, complete enumeration of forest area, and linkage with SCS soils data, U.S. Bureau of the Census population statistics, and state recreation inventories in a future GIS.

ESTABLISHMENT OF A USER CONSTITUENCY

SO-FIA's mission generally is aimed toward a consensus about what should be done. Just as with any public agency, priorities tend to shift toward issues of concern to a user constituency: knowledgeable groups and individuals able to fund special studies, and those with political influence. Hence the process by which SO-FIA determines multiple value information needs associated with forests becomes relevant.

Prior to surveying a state, the SO-FIA Unit cooperates with state forestry organizations and state-level National Forest System administrators to obtain support and encouragement for the data obtained. Field assistants, office analysts, vehicles, and funds sometimes are provided as a cooperative effort, principally to increase the speed at which surveys are conducted and reported. Instruction in log-grading, identification of trees with insect and disease damage, and orientation of field personnel to local features are provided by regional USDA-Forest Service managers and state forestry officials. Long-term support comes from federal and state legislatures, from the USDA-Forest Service research administration in Washington, DC, and from special-interest groups. Technical advisory groups are organized to advise the SO-FIA Unit in periodic reviews of its mission, priorities, and research accomplishments. These groups usually consist of individuals in public agencies, forest industries, forestry departments in land-grant universities, and forestry consultants.

Verbal and written support for multiple value surveys has come primarily from other FIA units, the National Forest System, and university researchers engaged in similar studies. Others that have recognized the importance of the multiple value forest survey effort include administrators of Alabama's TREASURED Forest program, and others sensitive to the need for a balanced overview of forest resource values. At times, individuals within technical advisory groups include those with expertise or interests in nontimber issues.

Cooperation from other agencies and disciplines, e.g. Fish and Wildlife Commissions, Planning Departments, Office of Recreation and Parks, etc. is variable. Our experience is that personnel in other agencies and disciplines are unaware of the task we perform or the data we generate. As a result, they frequently have limited knowledge of and experience with extensive area data and the potential for multiple value forest surveys. The informed social network of users outside of traditional forestry disciplines has been very narrow. Often we have found it useful to explain what we do, provide representative information related to their interests, and solicit suggestions on how we might serve their needs.

We are continuing "outreach" efforts by expanding the mailing of our reports to individuals, university research departments, non-profit organizations (such as state-level conservation groups), and editors of nature conservation and sportsmen magazines. A recently organized task force of conservation organizations has been formed to review Southern and Southeastern Forest Experiment Station research activities (Lewis 1988). Considerable time is spent in explaining our mission to solicit cooperative research projects and issues of concern that might be addressed in our reports. Contacts include individuals in universities and Natural Heritage Programs in the states we survey, as well as government agencies in planning, wildlife management, and tourism. At the regional and National level, these include: The Nature Conservancy, National Wildlife Federation, The Conservation Foundation, and The Wilderness Society.

An expanded social network also is fostered by incorporating or referencing state agency inventory efforts and conclusions where appropriate within our forest resource assessment reports. Comparison of their information with FIA data provides another view of natural resources and issues associated with forests. Our referencing of their recreation activity and supply statistics (e.g., Rudis 1988c: 22-23) has been useful to these agencies by enabling them to reach an audience of regional forest planners, forestry consultants, and forest landowners.

DISCUSSION AND CONCLUSIONS

There has been substantial progress in the development of multiple value forest surveys in the Midsouth states, particularly with the existing sample design, forest area trends, tree characteristics, and historic records of permanent plots. Greater progress in integrating water, range, wildlife, and recreation into forest surveys could be achieved if a number of obstacles are overcome. A few of these obstacles are: (1) the relatively high cost of field observations not associated with the existing sample design of widely-scattered 1-acre permanent plots, (2) the small network of experienced personnel in other agencies and disciplines that are familiar with forest survey statistics, (3) the scarcity of basic research and inventories on water, range, wildlife species, and recreation that can be linked feasibly and statistically to ongoing forest surveys of extensive areas, (4) limited trend information for much of the nontimber data available, and (5) the lack of substantive direction on data needed for National assessments of multiple use forest inventory information.

The SO-FIA effort currently focuses most of its annual budget on maintaining the resurvey of forested permanent sample plots through field measurements. However, efforts are being explored to expand the sample to accommodate inventories for other resources (specifically lesser vegetation identification, nontimberland influences, and larger sample areas needed to characterize wildlife habitat). Specific sampling designs include subsampling within existing 1-acre plots and remote sensing of larger areas with satellite imagery. In order to integrate data gathered from other disciplines, compatible geo-referenced data for all forest survey estimates will be needed. Flexibility in data analysis (e.g., by-county estimates of deer and turkey (Flather et al. 1989)), acceptance and cooperative funding of other sampling designs more suited to other resources assessment, elimination of gaps in data compilation (routine inclusion of comparable data from forested wilderness and nontimberland with trees), and standardization of natural resource terms and definitions, should provide increased opportunities for integration.

Our "outreach" efforts -- conveying the message about who we are, what we do, and how we can help land use planners and the other agencies and disciplines -- have had mixed results. Successes, measured in terms of verbal and written recognition of the importance of survey data, are derived from the "hot" issues -- scarcity of remote forests (Rudis 1986), red-cockaded woodpecker habitat (Lennartz et al. 1983), forested wetlands (Rudis and Birdsey 1986; McWilliams and Rosson, 1989), and littering (Rudis 1988a). Map displays, well-prepared graphics, and clear statements about statistical assumptions have been far more effective than presentation of data in tables. Tabular data in resource reports, without accompanying discussions of relative scarcity or trends, have yielded limited recognition.

I must conclude that focused research and reporting efforts directed toward the "hot" issues of the day in widely-distributed journals and popular magazines can establish an important source of visibility and a constituency in soils, water, range, wildlife, and recreation disciplines. Additional consideration given to map and graphic displays should help as well. Identification, analysis, and dissemination of existing FIA information in well respected journals should increase its credibility and visibility in the scientific community of other disciplines. In addition, any well publicized, cooperative funding program that fosters interdisciplinary efforts to study regional forest resource issues should further the mission of FIA Units by providing opportunities for involvement and information exchange.

National efforts to compile and analyze interdisciplinary inventory data, and to promote further data collection by specifying additional needs, have been influential in broadening the focus of forest surveys toward the other disciplines. Greater progress can be achieved if there are local, regional, and National organizations that represent a user constituency for the data collected. The first step to get this task accomplished appears to be to inform these organizations about the potential of forest surveys to address multiple use forest resource issues. The second step appears to be to involve these organizations in data compilation and analysis whenever feasible.

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