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A KNOWLEDGE BASE FOR FIA DATA USES

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ABSTRACT—Knowledge management provides a way to capture the collective wisdom of an organization, facilitate organizational learning, and foster opportunities for improvement. This paper features a knowledge base compiled from published uses of field observations made by the U.S. Department of Agriculture, Forest Service, Forest Inventory and Analysis (FIA) program and refers to a citation database of over 1,400 bibliographic entries from the past quarter century. This retrospective synthesis provides historical highlights of early, novel uses from the 1930s through 1976. It also considers later, evolving approaches toward comprehensive assessments, and current efforts to tally the types of users and attributes used.

INTRODUCTION

The challenges of assessing forest lands for their ability to provide products, services, and values to an increasingly diverse society have grown increasingly complex. Integrated knowledge is essential when selecting relevant attributes for measurement and common procedures for data collection, management, and analysis. For any organization concerned with efficient collection and distribution of data about field observations, it will be necessary to have a strategic business plan that considers the multiple processes involved in addressing current and satisfying future customer needs.

Knowledge management, a formal term with many definitions (Full Circle Systems, Inc 2003), provides a way for an organization to capture the collective wisdom about such processes, facilitate appropriate responsiveness to challenges, and foster innovation. Feedback from customers in the form of documented attributes of interest, the kinds of analysis requested, and the multiple and varied interpretations of data provide some of the knowledge needed for long-term planning. The same is true for public agencies, whose supporters include not only the customary end-users of data, but also legislators, nongovernmental organizations, businesses, and individuals. An agency's decision makers need knowledge of promising new ventures when funding is increased, or may need to take cost-cutting actions and periodically re-assess priorities in years of lean funding.

This brief, retrospective synthesis is intended to facilitate organizational learning of U.S. Department of Agriculture, Forest Service, Forest Inventory and Analysis (FIA) program staff, affiliates, and potential cooperators. Recent efforts now being used to capture what data are being used, what issues the data are addressing, and the FIA program's knowledge of data uses and users, are problematic. The paper highlights a recent compilation of the last quarter-century's reports that used FIA-based field observations for novel and nontraditional uses (Rudis 2003a). Included are early efforts involving other disciplinary perspectives and evolving approaches to conducting comprehensive forest resource assessments. Recent findings and new opportunities to assemble knowledge of unpublished data uses and users also are described.

EARLY MILESTONES

A search of the literature on FIA-associated data reveals an evolving program (Rudis 2003a, 2003b). When FIA surveys were begun in the 1930s, the chief goal was to identify timber resources, such as lumber and naval stores. But almost from the beginning, a broader audience was attracted to the information provided, particularly land use, forest land area, and forest types. Not long after the first reports came out, this single-purpose forest survey became a source of spatial information for an array of users. Map displays always have been a popular cross-disciplinary feature of forest survey reports and continue to this day to serve a diverse audience.

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In the 1950s, a second generation of reports included county based representations of otherwise tabular FIA data, including tree distributions of individual species for Mississippi (Sternitzke and Duerr 1950), timber supplies for Florida counties (Larson 1952), and hickory timber volume in the South (Cruikshank and McCormack 1956). The audience for the data remained diverse, but reports of the time focused primarily on directly-measured attributes of timber supply.

A decade later, the American Forestry Association sponsored a series of regional, community based assessments of forest management across the country. This effort produced three book-length (300+ pages) reports for three individual States. Those publications synthesized biological and physical attributes, ownership patterns, and geopolitical contexts for three regions: California (Dana and Krueger 1958), Minnesota (Dana and others 1960), and North Carolina (Pomeroy and Yoho 1964). Information assembled came from the forest survey as well as a much wider range of sources than would be common today. These reports served and may continue to serve as models of an accomplished synthesis from widely differing disciplines and sources. Though dated, they remain a treasure trove of information for those who would compare historic land use, forest ownership patterns, and land management practices across regions.

Beginning in the 1960s, the forest survey began an expansion into other disciplinary arenas. The then-pioneering concept—a "multipurpose" inventory—focused on the feasibility of combining deer browse inventories with forest surveys in the southeastern United States to address wildlife management concerns (Moore and others 1960). In the 1970s, understory plants were used to identify potential wood productivity in the Pacific Northwest (MacLean and Bolsinger 1973) and forest range resources in the south central United States (Pearson and Sternitzke 1974). Other reports were generated to document tree damage agents, e.g., laminated root rot (Gedney 1976). At the same time, growing recognition that more sociological information was needed to assess the availability of timber for harvest led to coordinated studies of nonindustrial owner intentions in the northeastern United States (Kingsley and Finley 1975).

By the mid-1970s, laws were enacted requiring comprehensive forest resource assessments, which would include reports of associated social issues and related resources such as range, recreation, water, and wildlife habitat. Efforts varied widely by region and are reported elsewhere (Rudis 1991, 2003a, 2003b).

EVOLVING APPROACHES TOWARD ASSESSMENTS

There have been varied approaches toward forest resource assessments, and many were intended to be comprehensive. Rudis (2003a) provides more details, but in brief, such approaches have ranged from those designed by (1) a singular discipline with a single data source for a single-discipline audience to address a single purpose, (2) a representative team of selected disciplines with a limited array of data sets to focus on a specific issue or topic, or (3) multiple disciplines and data sources to address a selected range of objectives. In the past quarter-century, FIA assessments have evolved from the first approach principally by making efforts to reach a broader audience.

Individual scientists and teams in selected disciplines also have made use of publicly available FIA data to address specific issues in subject-matter journals, e.g., for modeling biogenic emissions (Wiedinmyer and others 2001) and urbanization of forest ecosystems (Kline and others 2001), and for conducting regional assessments of early-successional habitat for wildlife (Trani and others 2001). In recent years, knowledge of FIA has reached to point where its data commonly are cited in national studies of forest resource issues, e.g., stewardship of private forest land (Best and Wayburn 2001). The prominence of studies that synthesize FIA data with other data sets cannot be overemphasized. Such studies often surface in widely read interdisciplinary journals, e.g., Science (Casperson and others 2000), newspapers, or other popular media.

Adapting and incorporating data and knowledge from other resource inventories and disciplines are hallmarks of a truly comprehensive forest resource assessment. However, the extensive time required to align data from disparate inventories and to communicate relevant knowledge among scientists in other disciplines are common problems in preparing them (Rudis 1993). Multi-discipline team-oriented forest assessments that focus on specific regions or issues are popular approaches toward streamlining the development of an integrated data set and an interdisciplinary synthesis.

Attempts at such an undertaking surfaced in the early 1980s for an environmental analysis of land cover and land use that produced one of the first integrated

data sets, now known as the GEOECOLOGY database (Olson and others 1982). A landmark, multi-discipline, team-oriented scientific effort conducted in the 1990s assessed timber harvesting in the State of Minnesota (Jaakko Poyry 1994), with support provided to collect additional data and analysis to fill in some of the then-recognized knowledge gaps. Narrowing the scope and streamlining data integration to complete the task in a timely manner is beneficial, however. One recent approach employed a 6-month or less analytical time frame and a series of reports on new FIA survey data by invited experts with different perspectives, e.g., in Arkansas (Guldin 2001). Another approach relied on a 1-to-2 year analysis of existing data, models, or published studies, and a multi-team synthesis, e.g., the Southern Forest Resource Assessment (Wear and Greis 2002).

In all of these approaches, common challenges are the limited time available to fill strategic cross-disciplinary information gaps and the paucity of protocols for modeling and analysis of data from several disciplinary perspectives. One interdisciplinary need, for example, is a way to link ecological land type classification systems with timber growth (Song 1994). Addressing such seemingly intractable problems often is left to imaginative, early career researchers, notably graduate students. Rudis (2003b) compiled and indexed abstracts of known graduate student reports. He highlights an array of new approaches to analyzing FIA data, which integrate them with other relevant data sets, or view them through the lens of other disciplinary perspectives or concepts.

KNOWLEDGE OF DATA USES AND USERS

Efforts to document uses of FIA data began in 1989 with an informal query of nontraditional uses, but expanded efforts found many more novel uses. Through time, the list of citations has been updated as an online citation database (Rudis 2002-2004). Citations include reports of studies that used FIA's regional, field sample-based forest surveys, as well as graduate student reports, collected works, and selected documents concerning integrated assessments and multi-disciplinary surveys. The list also includes representative timber resource assessments since 1975. The primary focus is on nontraditional and novel technical uses associated with FIA data from 1975 through 2001. Recent citation entries also include those that reference other data collected on FIA plots from sampling protocols established by the Forest Health Monitoring program[2].

For knowledge of data uses that may not be associated with publications, current sources of information include tallies of data requests and users made through FIA customer service centers. Requests for National FIA Spatial Data Services (http://www.fs.fed.us/ne/fia/spatial/request.html) illustrate the types of customers that request spatial data retrievals. LaPoint (in press) noted a plurality group for fiscal year 2003 included individuals from academic institutions—32 percent, followed by other Forest Service personnel—15, other Federal—16, other State—13, FIA staff—7, forest industry—7, nongovernmental organizations—4, National Forest System—1, and others—5. For the same period, the Southern Research Station FIA recorded 16 percent of data requests came from universities and a similar number coming from environmental groups (Carol Perry, Customer Service representative, April 2004). When considered with additional information about types of organizations, attributes used, and periodic tracking by year, such data may provide valuable feedback. Such aids will allow decision-makers to set data collection, analysis, and distribution priorities based on topical issues and modify or retain highly requested attributes desired by such users.

The Internet server that maintains the Forest Inventory Mapmaker (http://www.ncrs2.fs.fed.us/4801/FIADB/fim_tab/wc_fim_tab.asp) is a potential source of information about both FIA data uses and users. Security software automatically records the Internet protocol address, or domain name, of the user, and can be programmed to tally the attributes requested. Domain names themselves are not definitive, but do provide clues to the broad category of user. In fiscal year 2002, the categories of domain names and percentage of individual accesses were: Forest Service (FS.FED.US)—34 percent, commercial firms (forest industry—7, other or unknown—12), AOL—2, miscellaneous (NET—12), academic institutions (EDU)—12, government (GOV) and nonprofit organizations (ORG) combined—1, and other

[2] Mangold, Robert D. 1998. Forest health monitoring field methods guide. Revision O. 429 p. On file with: U.S. Department of Agriculture, Forest Service, Southern Research Station, Forest Health Monitoring Program, P.O. Box 12254, Research Triangle Park, NC 27709.

unknown—20.[3] Requests for attributes from the FIA database Web site might be useful for suggesting the kinds of desirable and already available data. For example, figure 1 illustrates the top 10 attributes for fiscal years 2002[3] and 2003[4]—other than county and State. However, the tally of requests includes attributes requested by default. Cooley and others (2000) detail some of the benefits and drawbacks in interpreting Web usage statistics. In the future, sophisticated analysis techniques for Web usage (Cooley and others 1999) may reveal even more worthwhile information.

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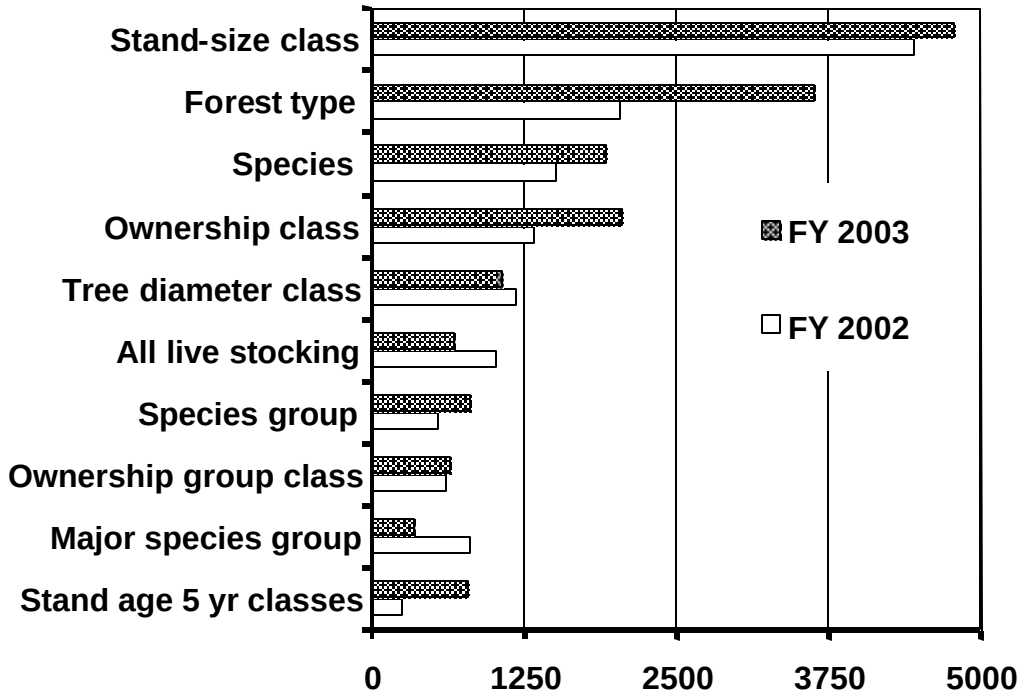

Figure 1.—*Top 10 attributes requested of the FIA database by number of requests, exclusive of county and State, fiscal years 2002 and 2003.*