DEVELOPMENT OF MULTIRESOURCE INVENTORY TECHNIQUES AND ANALYSIS METHODOLOGY USING REMOTE SENSING AND A GEOGRAPHIC INFORMATION SYSTEM FOR PLANNING, MONITORING AND MANAGEMENT OF WILDERNESS AREAS

Significance and Importance of Project

Wilderness is truly a resource for the future and just since the passage of the Wilderness Act of 1964, more than 89 million acres have been congressionally designated such. But even in that time, many of these areas have been severely impacted through either overuse or lack of management due to insufficient knowledge of the resource and lack of funding. Yet the legislative mandate to federal agencies for planning, monitoring and management of these areas or resources within them is clear: The National Environmental Policy Act of 1969 (PL91-190); the Endangered Species Act of 1973 (PL93-205); the Sikes Act of 1960; National Forest Management Act of 1976 (PL94-588); Clean Air Act Amendments of 1977 and 1987; and Water Quality Criteria established by the EPA Committee in 1972, 1977 and 1986.

Too much has been invested in the Wilderness resource to allow degradation of the very naturalness these preserves were created to protect. Management is required to minimize and modify negative impacts to preserve the natural conditions. It is difficult to do this, however, without basic knowledge of the total resource and its condition and a means of analysis and planning for effective management (Krumpe and McLaughlin, 1986; Stankey et al., 1985). We know of no effort utilizing cost-effective and state-of-the-art techniques to inventory, monitor and analyze the wilderness ecosystem to gain a comprehensive understanding of this natural system.

Objectives

We propose a project wherein we will develop multiresource inventory techniques (Lund, 1986; McClure et al., 1979) using remote sensing, and

analysis methodology using a geographic information system to portray the interrelationships of terrestrial and aquatic ecosystems within a wilderness area. The techniques and methodology would provide scientists and managers a means by which basic information may be gathered and subsequently analyzed at reasonable expense for future investigations of natural systems and their components and for planning and management to maintain or enhance natural diversity and protect wilderness values (Bell and Atterbury, 1983; Hart et al., 1985; Abula and Nyquist, 1987). Such would be applicable to any wilderness area or natural preserve in the world. This project will provide the base data and a test of the methodology for examining a much larger area in future work. Modeling and simulation of possible alternatives of management will be undertaken with this base.

Methodology

Specifically we would proceed as follows:

1. Establish a panel of interdisciplinary resource personnel to define needs (Scott, et al., 1981). Within the College of Forestry, Wildlife and Range Sciences we have nearly all the discipline specialists represented: ecology, sociology, forestry, fisheries, wildlife, soils, hydrology, range, water and air quality, wilderness, fire, pathology, entomology, statistics and sampling, planning, and remote sensing. The following specialties from other colleges will also be represented: geomorphology, geographic information systems, and archeology.
2. Derive the following specifics from the panel:
   a. The inventory attributes needed in each of the above specialty areas (e.g. Merigliano and Krumpe, 1985 and 1986).
   b. The resolution level for the attributes.
   c. The format for multilevel disciplinary data.

d. The grid system to which the multiple planes will be registered in the GIS system.

e. The output products desired from analysis of the data by GIS manipulation.

3. A wilderness presents many more operational and practical problems for inventory than other lands, problems which have not been thoroughly investigated before. The panel will assist in defining multistage inventory and sampling techniques which are statistically valid but also practical and cost-effective for rugged, inaccessible terrain. This will include defining the type of remote sensing imagery.

4. Using existing and acquired remote sensing, map, survey and descriptive data, do a multistage inventory of the Cabin, Cliff, Cougar, and Goat Creek watersheds (~33,000 acres) around the Wilderness Research Center field station at Taylor Ranch. There are 3 lakes, an elevation range from 3,900' to 9,000' and a variety of ecosystems within this area.

5. Interpret remote sensing data for many of the desired attributes and gather ground truth data through subsamples (Brass et al., 1983; Befort and Ulliman, 1985). Transfer the results to 1:24,000 scale maps.

6. Digitize each plane of data for entry into the GIS. Existing data, including Digital Elevation Model topographic data will be entered also.

7. Develop combinations of attributes and analyze data for possible alternatives of strategy in wilderness management.

8. Publish the results of this development through the RFF, the College Experiment Station, and refereed journal as deemed most appropriate.

Facilities

The University of Idaho is in a unique position to do this project, having in its possession the only wilderness research center in the country with field station (Taylor Ranch) located in a wilderness, the Big Creek drainage of the Frank Church-River of No Return Wilderness. The site is being considered for a Biosphere Reserve and a study site for the EPA monitoring network for baseline environmental monitoring of airborne pollution. There are 3.8 million acres of wilderness extant around this area within Idaho.

The Taylor Ranch consists of living quarters, a field laboratory, an airstrip to augment aerial reconnaissance and provide access, pack horses and mules to support on-ground logistics, and professional staff to carry out field investigations. The laboratory is equipped with a U.S. Weather Service station, an IBM PC computer, an herbarium, a small mammal collection, and field equipment.

The Taylor Ranch has functioned as the field headquarters for a variety of ecological investigations, providing a foundation for producing the interdisciplinary resource matrices applicable to the proposed study. Past research has been conducted on owl habitat partitioning (Hayward, 1983), big game utilization of different vegetation types in winter (Claar, 1973), ecological studies of cougar and bobcat (Hornocker, 1969, 1970; Seidensticker, 1973; Kohler, in progress), behavioral relationships of deer, elk and bighorn sheep in winter (Akenson, in progress), primitive area stream ecology (Buttner and Falter, 1977), and settlement and subsistence patterns of indigenous peoples (Hartung, 1978). Many more studies would develop if basic resource data were available.

The College of Forestry, Wildlife and Range Sciences has a remote sensing center with personnel and equipment for obtaining and analyzing remote sensing imagery. There are two GIS systems on campus and a proposal for obtaining another one for the college.

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