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Partners in Research: The Future Role of Forestry Schools and the Department of Agriculture
by Glenn A. Cooper

Where We Have Been

The Twentieth Century has produced many great scientific and technological advances. We have vaccines against many diseases, space travel, electronic computers, artificial organs, nuclear power, satellite communications, and fast growing, pest-resistant food and fiber plants. These have not been produced by the efforts of solitary scientists, but by organized research and development programs employing the genius of many scientists, the facilities of many laboratories, and funding from many institutions.

Over the past 50 years, industry, Forest Service, and University scientists have made many contributions that have advanced forestry. Tree growth studies have made it possible for us to establish management and harvesting guidelines for 40 major forest types. New and improved wood products such as particleboard and fiberboard have extended fiber utilization to meet new consumer needs. We were provided with ways to reduce losses from insects, disease, and fire. Added knowledge of fish and wildlife habitat requirements has made it possible for us to develop guidelines to help some species thrive. Through research on forest-associated rangelands, we were supplied with a basic understanding of range ecology and given the tools for making forage production compatible. We can now sustain high levels of recreation use while protecting our renewable resources.

We know much about the management of forests for clean water production. Forest, range, and related resources research has been conducted principally by the Forest Service, the State agricultural experiment stations and forestry schools, and forest industry. These research programs are interrelated by having common sets of research priorities and by joint planning and programming—particularly between the Forest Service and the State agricultural experiment stations and forestry schools.

Where We Are

The research effort to date has given us a bounty of continuing benefits from our forests, but if we are to minimize the contribution of forests to American society in the coming years, we must maintain a dynamic research program. In recognition of this need, there has been in the past 2 years a very concentrated research planning effort.

The Association of State Colleges and Universities Forestry Research Organization (ASCUFRO), the Cooperative State Research Service, and the Forest Service (USDA) have jointly planned research for the forests and associated rangelands of the United States. Their cooperative efforts provide guidelines for a public forestry research program through 1985 and suggest research needs, staffing levels, and funding projections.

The research program was developed within the framework of a Regional and National Planning System. In conferences in each of four regions of the United States in 1977, and in a National Conference in January 1978, the American public, university and USDA scientists, and research administrators developed regional and National research programs and projections of scientist effort needed to accomplish high priority research.

Seven major categories were used for aggregating studies and projects (Table 1). The research effort for forests and associated rangelands, to be made by universities and the

Where We Are Going

The USDA/university research program gives us direction and goals. It is optimistic, as it should be, about what can and really should be achieved by 1985. No attempt is made to separate the effort between university and USDA research. The projected effort for 1985 represents a 52 percent increase over the 1975 base. With this increase, we intend to make impressive contributions in each of the following seven program areas.

1. Multiresource Inventory, Appraisal, and Evaluation

Conflicts are increasing as the demand rises for more goods and services from the Nation's limited forest and rangeland base. How can we best provide multiple uses? Which uses should be provided in each location? First, we need to know what our resources are and what the demand is for each. We must find out what
resources the land can provide singly and in combination with many users. We must be able to predict the physical, social, and economic results of each land use. We will do this through multiresource inventory, appraisal, and evaluation research.

This research, recognizing that some uses are competitive, others complementary, will provide us with data for developing comprehensive forest land-use planning systems. These systems will recognize the need to allocate natural resources according to political and economic forces, while maintaining a quality environment.

2. Timber Management

Through research we will develop improved trees with faster growth and greater disease and insect resistance. We will evaluate the costs and benefits from genetic improvement and alternative cultural methods, and develop new reforestation methods to improve stocking of harvested areas and to reclaim abused land. Yield tables for managed stands of a number of major forest types will be available. We will strive for new cell and tissue culture technology to ease propagation and planting of superior trees; we will find ways to improve soil and site quality and seeding and planting techniques. It is expected that all of these methods will greatly increase the production of usable wood on our better sites.

3. Forest Protection

We will focus forest protection research on minimizing losses caused by insects, diseases, and wildfires—losses estimated at 2.4 billion cubic feet or about one-fifth the annual harvest. We will concentrate on preventive, as well as control, measures to reduce these losses. Besides developing effective insecticides that are environmentally safe, we will expand studies of biological control agents such as parasites, predators, pathogens (Figure 1), and synthetic behavioral chemicals such as sex attractants, insect growth regulators, and feeding deterrents. Improved understanding of insect population dynamics and methods of redetecting population trends will help prevent outbreaks. By 1985, we expect to have improved systems for integrated management of some major pests in commercial forests.

Through fire research we will strive to learn more about the physical, biological, ecological, economic, and social effects of fire management. Researchers will develop methods of prescription burning and devise more efficient fire planning and fire fighting techniques.

Prescribed fires can be used under specified conditions to reduce fuel accumulation, promote specific vegetation, and control forest stand composition. Studies will also lead to more effective prevention of man-caused fires and to fire use strategies that produce desired ecological goals.

4. Harvesting, Processing, and Marketing of Wood Products

Energy, environmental, and economic constraints dictate that we develop better harvesting methods with less waste. We expect to expand research to develop harvesting equipment and systems that will make it environmentally, economically, and technically feasible to remove a greater volume of the available fiber from steep slopes, areas of fragile soil, and small tracts that should be harvested. We will have lower cost equipment suitable for thinning diverse stands and harvesting small trees and dead material normally left as residue.

Future research in processing and utilization will enable us to make greater use of wood residues, wastes, and low quality trees as feed stock for petrochemical substitutes such as alcohols, chemicals, adhesives, and fuel (Figure 2). Wood products industries will be made largely energy self-sufficient through better utilization. Processes will be developed to recycle more wood fiber, and use more whole tree chips. Higher yielding pulping processes that use more hardwoods and the increased development of products made from reconstituted residues will greatly increase utilization efficiency. Construction will be improved through better engineering designs, and better methods of protection against termites, decay, fire, and weathering.

Economics research will provide the knowledge to develop public forestry programs through studies of wood use, foreign trade in wood products, forest taxation, and methodologies for multiple-use forest management. Such information will help managers improve timber utilization by allocating each part of the tree to its highest use. From marketing research we will have knowledge of economic and institutional factors that affect timber harvesting, production, transportation, and consumption of wood products. Such information will benefit private industry plus provide a major input into periodic assessments of national and international timber demand.

5. Forest Watersheds, Soils, and Pollution

Two-thirds of the Nation's high quality water comes off our forests and rangelands. Timber, forage, recreation, and wildlife habitat are provided for by the same lands; these uses influence water quality and yields. Through research we must develop ways to minimize impacts and maintain the best mix of activities. Thus, in the coming years we
Residue Fuel Flow Concepts

Figure 2.—The proximity of pulp and paper mills to the forests, and the capability of the mills to handle large volumes of wood make the pulp and paper industry a good prospect for becoming more energy self-sufficient by using wood based fuels from residues.

will seek better understanding of how water yield is influenced when vegetation is manipulated under different soil and climatic conditions. We will develop road design and construction criteria so that timber can be harvested without polluting nearby streams. With increased dependence on coal, we need to reduce the impacts of surface mining on water quality and soil erosion. We will be able, through research to properly select woody and herbaceous vegetation for planting on soil banks.

We plan continued research to determine the relationships of soil environment to the quality of water and growth of plants. The effects of intensified management on soil properties, water quality, and long-term changes in soil properties resulting from successive harvests with maximum fiber utilization will be investigated.

In pollution research we will aim at establishing practical guidelines for minimizing water and air pollution from forestry activities. We expect new research to focus on the nature, extent, and effects of pollutants resulting from intensive timber culture, prescribed fire, and construction. We must develop standardized procedures for predicting pollutants resulting from various land management practices. We will continue to determine the capability of forests and rangelands to absorb and neutralize pollution forced on it by people and technology.

6. Forest Range, Wildlife, and Fisheries Habitat Development

Increasing demand for red meat and rising feed grain costs increase the importance of range forage. Part of the forage demand must be met by forest rangelands which must also furnish wildlife forage and browse, and provide recreation, open space, and natural beauty.

We expect knowledge of the economic constraints and ecological impacts of grazing to help when designing alternative management systems. When developing scientific management systems for ranges, we will seek additional information on the interaction of several range uses. Expanded efforts will include adoption of nitrogen-fixing plants for rangeland use, biological control of pests and undesirable plants, prescribed use of fire, use of grazing livestock to beneficially manipulate wildlife habitat, and determination of habitat requirements and management plans necessary for maintenance of endangered species.

Through research efforts that emphasize game and nongame wildlife, fish, endangered species, and urban wildlife, we will develop better management guidelines. We will identify and quantify habitat requirements, and gain greater understanding of animal community responses to plant community changes. We will develop a predictive ability by learning the relationships between successional stages of vegetation and the associated impacts on habitat and wildlife population. Similar work on fish habitat will help us to determine the influence of both natural and man-caused activities on streams, stream banks, and aquatic ecosystems.

7. Forest Recreation and Environmental Values

The goal of forest recreation and environmental values research is to widen the variety and availability of amenity or noncommodity values. Projected research in this area includes assessment of present and
future recreation demands and identification of the relative capabilities of private and public forest lands to meet those demands. We will also study the carrying capacity of forest lands to provide recreation uses in harmony with other uses.

The goal of environmental research will be to enhance urban and rural forests by development of unique management systems. Planned research will lead to better protection of great plains shelterbelt plantings from the effects of insects and diseases. Such plantings alleviate severe climatic effects on crops and livestock, provide wildlife habitat, and prevent soil erosion. In urban areas environmental forestry research will assess the demand for and the quality of human benefits resulting from various intensities of urban forest management.

It will seek ways to improve forest vegetation for various urban needs and integrate forest management systems into the urban planning and development process. We will use research from the areas mentioned earlier to enhance environmental values of forest land by improvement of water quality, reduction of air pollution from forest fires, and through better insect and disease control.

**Conclusion**

The USDA-university forestry research partnership has a challenge that is of great social, economic, political, and environmental importance. We have met challenges in the past and achieved noteworthy results. We expect our present day planning efforts to increase our ability to meet the challenges before us. Today's students—as the researchers, planners, and users of 1985—will judge how well the USDA-university research planning effort has paid off.

1. Now part of the Food and Agriculture Science and Education Administration.

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Glen Cooper—is presently the Assistant Deputy Chief for Research in Washington, D.C. He graduated from Iowa State University with a B.S. and M.S. in forestry. He went on to get his Ph.D. from the University of Minnesota in 1971.

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