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Developing an Agenda to Guide Forest Social Science, Economics, and Utilization Research

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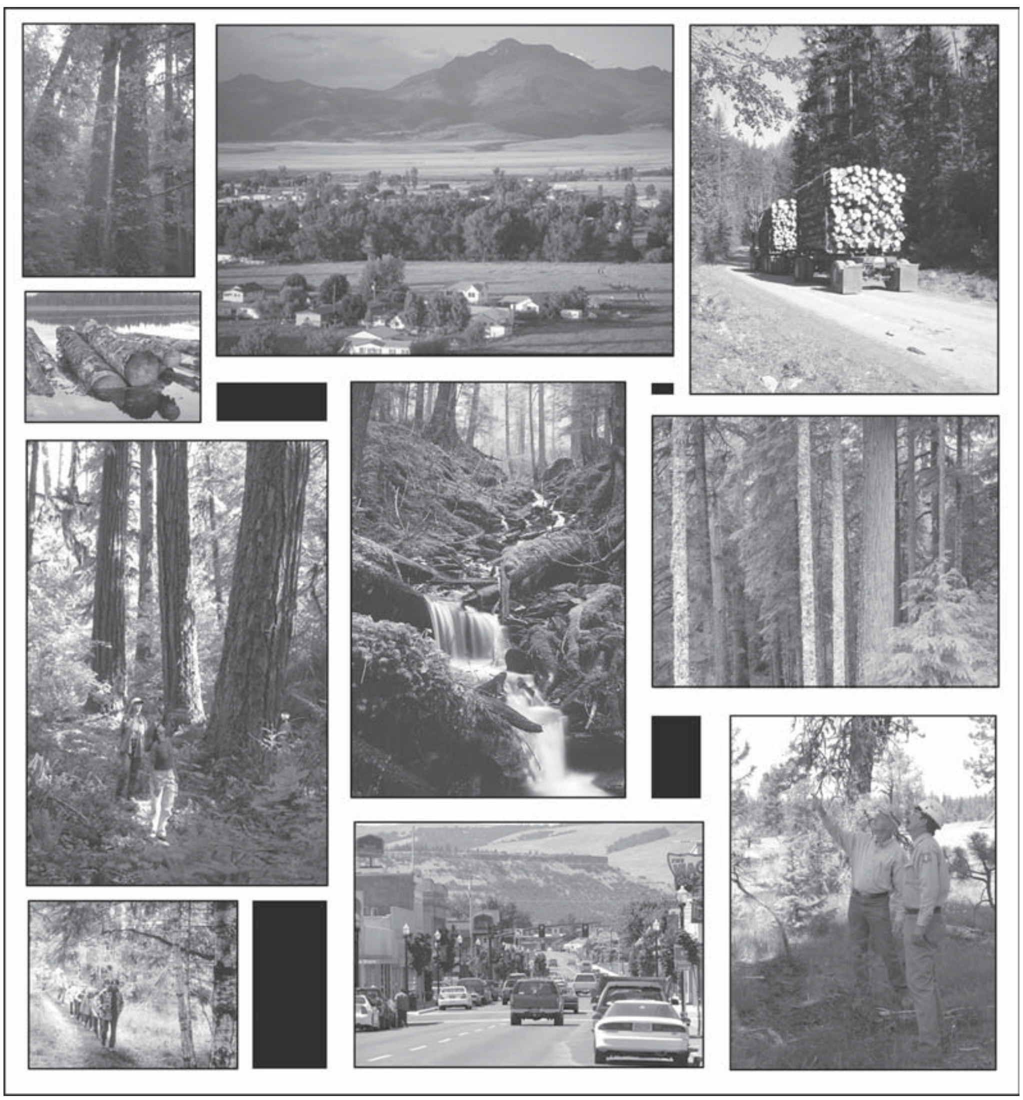

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Abstract

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The USDA Forest Service has had a longstanding presence in utilization, economics, and social sciences research and development activities. The magnitude and diversity of these activities have changed as the questions and the people asking them have changed over the past century. These changes challenge the social science and utilization research community to develop this collective research agenda for utilization, economics, and social sciences research and development activities conducted by the Forest Service. It sets the context for the utilization, economics, and social sciences research and development activities in the Forest Service. It deals with the need to balance knowledge creation with the constantly changing demand for information that guides various land management decisions and shapes policymaker perceptions in various environmental debates. The research agenda is built around six common themes that will help us create a larger pool of experience from which we can form judgments relative to outcomes and develop tools that can be used to solve a variety of problems. It assumes that the worth of utilization, economics, and social sciences research and development activities will be judged by our ability to create lasting solutions that alter outcomes. Finally, creating and implementing such a research agenda depends on leaders who can advocate for problem selection that recognizes the full integrated nature of contemporary questions, who can synchronize research oriented toward major questions with knowledge creation, and who can serve as defenders of social science research against ideological attacks by emphasizing the true nature of questions and the importance of taking integrative approaches.

Keywords: Research direction, program formulation, research leadership.

Contents

Introduction

Utilization, economics, and social sciences research and development activities have had longstanding presence among most forestry research organizations. In the USDA Forest Service, this research community is made up of a disparate array of research activities at the Forest Products Laboratory (Madison, Wisconsin) and individual units at the various research stations. A majority of the actual units (projects) are relatively small (two or three scientists) with a strong focus on regional and local issues. At universities, the social sciences (especially economics) are usually represented in the forest resources or management department, although a few universities have separate forest product departments. However, much of the economics and social science related to forest and resource management occurs in different departments such as agriculture and resource economics, rural sociology, etc.

The magnitude and diversity of research topics have changed as the questions and the people asking them have changed over the past century. The importance of many of the traditional questions (efficient forest utilization and management, specification of social and economic impacts associated with forest management decisions) in terms of their ability to generate funding for research has declined. At the same time, the growing complexity of multiscale forest management questions brings new focus to the traditional questions as well as those focusing on the interactions within and among economic, social, and environmental systems. Both aspects pose new challenges for the social science and utilization research communities.

The magnitude and diversity of research topics have changed as the questions and the people asking them have changed over the past century.

The changing nature of questions increases the challenge of describing a collective research agenda for utilization, economics, and social sciences research and development activities conducted by the Forest Service. There are a number of issues to consider. First is a group of questions about the content of our future program. Second, is a group of questions about the changing nature of how we accomplish our program of work. Included among these questions is the role for integrated research. Third, resolution of some general organizational issues might enhance greater success. Finally, there are questions about our role and responsibility as advocates for scientists' various contributions.

The resulting research agenda lays out a context for the utilization, economics, and social sciences research and development activities in the Forest Service. It also includes a discussion of how to organize various research and development activities to achieve greater significance. Much of the discussion reflects my experience at leading the only Forest Service Research unit (at the Pacific Northwest Research Station) that integrates long-standing programs of social science, economics, and utilization research. These programs have evolved both topically and organizationally in the context of the science policy issues of the Northwest.

This work was originally requested by the then-incoming Director of Resource Valuation and Use Research (RVUR) staff who has responsibility for overseeing all Forest Service utilization, economics, and social sciences research and development activities. This research agenda deals with the need to balance knowledge creation with the constantly changing demands for information to guide various land management decisions and to shape policymaker perceptions in various environmental debates. As in any scientific endeavor, the challenge is how to manage for a set of outcomes that combine artistic and creative talents with technical expertise. The development of this research agenda starts by describing the context and then turns to some of the forces shaping the agenda. It includes four appendixes providing indepth discussions, including two that provide contextual material.

Context

This section briefly reviews two important contextual components: utilization, economics, and social science information needed to support land management decisions, and emergent issues.

Underlying discussion of these components is the assumption that research is a form of information. In the science community, there is a tendency to argue about the typology of research and to assert higher values for basic research or knowledge discovery. In the development of this research agenda, I assume that there is a need for all types of research. (Appendix 1 contains a discussion of two important aspects of research common among USDA Forest Service researchers: the use of teams and the general science process.) Our publics expect that our results reflect a well-developed understanding of underlying processes, functions, and technologies and also answer the questions at hand. For some questions, our publics expect that we make special efforts to ensure the diffusion of information into the hands of those who will ultimately use and benefit from it. This is especially the case with many of the technology and utilization questions as well as market and land management planning questions. Recently there are requests for more metaanalysis and synthesis products given the recognition that many of the questions facing us have separable parts that have been studied independently and the necessary answers are a composite of these parts.

Changing Land Management Paradigms

The widespread controversy over different views about the goals for forest management and the relative importance of these views frames many of the questions facing our research community. Being systematic about these controversies will compel more attention to the development of planning frameworks, more diligence in development and application efforts that place our work in the context of those planning frameworks, research on the development and role of indicator variables for assessing status and trends, and research to develop measures of different outcomes associated with the various goals.

For the most part, there is general acknowledgment of the shifting paradigms for land management and the power of those paradigms for setting our research agenda. For example, we often see reference to one or another of five sets of management paradigms, each differentiated by sets of goals, management actions, and expected outcomes that provide competing (and complementary) sets of research questions. (1) There is the cut-and-accept-what-grows-back approach to forestry. Many of the forests we manage today are a legacy of this approach to management. Under some circumstances, this is one approach to sustainable management given unique sets of economic and social conditions. (2) There is the original Pinchot forest management goal of managing forest for the greatest good for the greatest number. This included notions of sustained yield resting on improved utilization and productivity of forests to meet the needs of a growing population including local social and economic needs. (3) Following World War II, there was a growing interest in broadening forest management to recognize the multiple benefits produced by forests. This led to changes in management direction for public timberlands (MUSYE 1960) and has influenced notions of the role of private timberlands for nonmarket and public goods. (4) The fourth management paradigm reflects attempts to manage ecosystems across broader landscapes. Here the emphasis is the relative relation of actions at one place or stand on conditions both there and across hierarchically linked sets of places, stands, and landscapes. During the 1990s, there were several attempts to apply ecosystem management across relatively broad landscapes often built around habitat conservation strategies. (5) Lastly, there is the globally motivated interest in sustainable forest management that in the United States means the application of the Montreal Process (Montreal Process Working Group 1998) to assessing progress.

As management paradigms have shifted, so have the related science questions and the role of science in providing information for the decisionmaking process.

This information helps clarify feasible boundaries, options within the boundaries, consequences of those options, and tradeoffs between options. Choosing among options is the domain of the decisionmaker—not the scientist—but the information helps decisionmakers understand the relative risks involved in alternatives so that they can develop reasonable methods to manage risks at biologically and socially acceptable levels. In this way, current scientific understanding of forests, grasslands, and related ecosystems influences management policies. Fundamental to this issue is the recognition that the management of natural and human processes is based on imperfect knowledge. The challenge for resource managers is to attempt to balance biological science with social science and with the philosophical views of how society values renewable and nonrenewable natural resources.

Emergent Issues

How humans interact (and react) to natural resources poses a number of social science and utilization issues unrelated to specific land management concerns. Over the years, these have included various concerns about economic efficiency and equity and improved efficiency of wood utilization (often also including financial considerations). In the past three decades, these have been expanded to include understanding public demands for a broader set of goods and services as well as understanding how different stakeholder groups form, interact with land managers, and advocate treatment of places special to them.

In addition to the evolution of these topics, we are seeing the evolution of concerns about the relations between the environment and society. During the past decade (1990s to 2003), these were often seen in stark black-and-white terms. One group views technological development and economic growth as being antithetical to environmental preservation, whereas other groups see continued economic development as offering the best option for escaping from the world's ecological crisis. Such views, and their expression in U.S. democratic and legal processes, provide some of the context for establishing a research agenda. Other parts of the context are tied to converging developments in forest products and processing; forest science and management; and to trends in society, technology, and politics. Public perceptions, public debate, and public policy are shaped by observations of unintended—and perhaps irreversible—human impacts on the global environment. Contemporary forestry issues such as the preservation of endangered species (for example, the spotted owl), management and use of old-growth or small-diameter-tree forests, and riparian management challenge the fundamental premises of forest management, the scale at which policies are formulated and implemented, and the methods used to accomplish objectives. Recent science results have demonstrated that living systems are complex: apparently independent parts are connected, and even simple actions have consequences that may spread, endure, and accumulate (FEMAT 1993).

There is a long history of economics, utilization, and social science research, both at universities and various research stations, but persistent and important questions remain. Answering these questions is complicated by differences among scientists trained in social, physical, and biological sciences and the various disciplines within the social sciences. By broadening the focus of forest management research to include an array of products and values, RVUR researchers can raise questions about how management regimes might affect tree and wood characteristics, how new products might take advantage of these characteristics and, ultimately, the potential of forests to provide the broad array of goods and services desired by society in perpetuity.

Science is playing a more substantial role in the evolving conservation debate that focuses on the relation between socioeconomic and environmental conditions. The integrated nature of the debate combines various disciplines from the natural sciences as well as from the social science community. The intent of the debate is to provide tangible, concise, practical information to managers, decisionmakers, and the public about the likely outcomes and the determinants of and dimensions of land use changes, the foreseeable economic and social consequences at different time scales, and the possible courses of action.

There are also issues surrounding the natural resource decisionmaking process. Currently, these issues are often complex, varied, and debated frequently and contentiously by various publics. The complexity of the issues poses new challenges for scientists who are being asked to actively engage in this debate. Questions arise about what is credible scientific information and how such information is used in often emotionally or politically laden natural resource management decisions. One result has been an uncomfortable partnership among scientists and natural resource managers. Scientists are being asked to frame their research in a way that maintains scientific independence yet is responsive to management questions, at scales that often challenge existing scientific knowledge and under severe time constraints. Resource decisionmakers are challenged to clarify their management goals, to fully understand and use the science, and to explicitly identify the level of acceptable risk. When properly generated, presented, and accountably used, science facilitates discussion among competing interests by helping define the range of available options and by focusing discussions on consequences of social choice. By expanding and revealing the range of possible outcomes, scientists increase the likelihood that management decisions are understood and that those decisions can endure.

Finally, several legal mandates guide our research program (NFMA [1976], RPA [1974], RRRPA [1978]), which strives to improve understanding of natural resource allocation at the local, regional, and national levels. In the context of the requirements of these legal mandates, there are several notable science gaps that include valuation of noncommodity goods, definition and estimation of social and cultural values, and behavioral explanations of both land management and final harvest decisions (especially on private timberlands).

Developing a Programmatic View

Key in discussing utilization, economics, and social science programmatic issues is to acknowledge the three forces that influence the Forest Service Research (FSR) agenda. One force consists of the traditional research functions of knowledge discovery and development. In this case, knowledge discovery is the creation of new information while knowledge development is a creative process for involving the continuous exploration of scientific knowledge. Much of this is driven by the intellectual curiosity of individual scientists and is often bounded by disciplinary and unit problem area assignments. Some scientists will argue that creation of knowledge is its own justification even if it may not have an immediate application. Some of these same scientists have a strong commitment to development that translates research results into viable products. The second force is the constantly changing array of questions and issues that compete for our attention. There is confusion at the research unit level about whose sets of questions are most compelling and also among the various signals for research activities. Changes in Station administration and strategic direction add to this confusion. The third force is more subtle and is a composite of the various broad changes within the science communities in which each unit conducts its science. Each of those communities is influenced by methodological developments, changes in academic training and colleagues, and changes in what are seen as important and acceptable solutions.[1]

Figure 1 illustrates the challenge of how to synchronize knowledge creation (both discovery and development) with addressing the questions raised both within the Forest Service and by the society that funds our research agenda. It illustrates

[1] Some see this as a lack of objectivity in the science community. It is important that scientists are embedded in various disciplinary cultures and their conditioning greatly influences their practices.

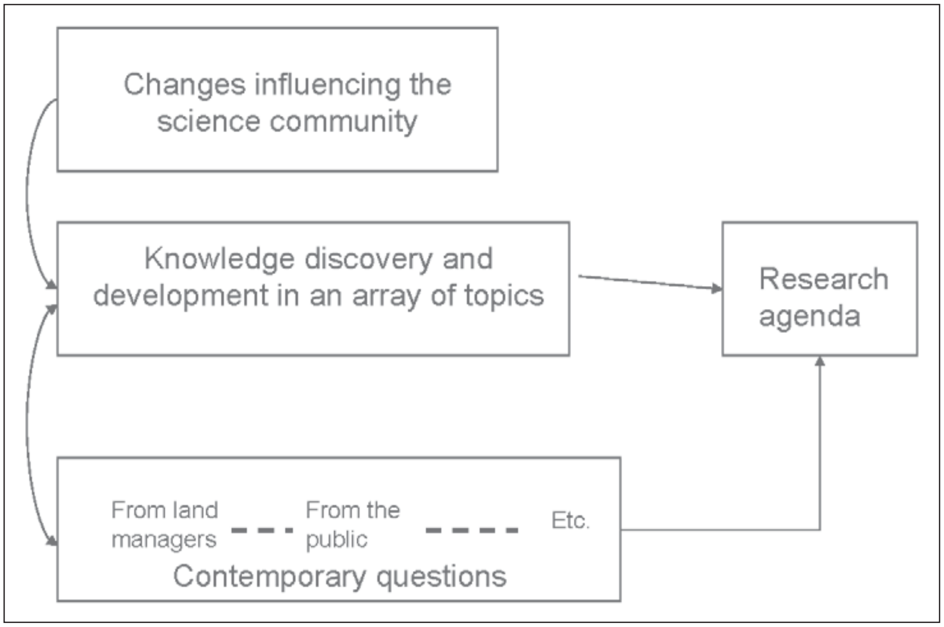

Figure 1—The relation between knowledge creation and contemporary questions.

Emerging science discovery and development along with contemporary questions seeking science-based information interact simultaneously to develop the research agenda.

that there does not need to be an exact correspondence between the science program and contemporary questions. Emerging science discovery and development along with contemporary questions seeking science-based information interact simultaneously to develop the research agenda. Addressing this challenge is a function of research leadership–both formal and informal as discussed in appendix 1 in the context of the role of teams. It is also a function of how we merge knowledge creation with being accountable for delivering information that is decisive and solves problems to land managers and owners and to society. As a science organization, we need to provide information for findings and judgments defendable as being based on the best available science.

Knowledge Discovery and Development

In the context of figure 1, what is a reasonable description of the knowledge creation aspect of the research agenda that integrates utilization, economics, and social sciences research and development activities? Appendix 2 illustrates such a program of work. It was developed from the charter[2] for the Human and Natural

[2] Charters are used at the PNW Station instead of Research Work Unit Descriptions (RWUD) used at other stations. Both of these documents identify broad problem areas that include both research and development activities and identify problems that will guide activities for the next decade.

Resources Interactions Program, which has problems assigned to it that integrate utilization, economics, and social sciences research and development activities.

Briefly, both the changing management paradigms and emerging issues suggest six broad problems that define the science program for utilization, economics, and social sciences research and development activities. The first is the need for understanding **market processes at multiple scales**. Market processes provide a powerful framework for policy studies and for understanding how processes work in the forest sector. The second problem area is **economics of land management**. This is a broad problem area that includes the economics of selected management regimes, links between land management and rural communities, the integration of economic and ecological values in decision processes, and the supply and demand for natural resource commodities, amenities, and other values. The third problem area concerns the **institutions for natural resource management**. This problem area is interpreted broadly and includes linkages to the first problem area where markets are seen as one type of institution. The fourth problem area deals with the **community and natural resource interactions at multiple scales**. The fifth problem area deals with **development, refinement, and diffusion of forest products and processing technologies**. This problem area includes building on the twin accomplishments of a long record of advances in understanding wood properties as well as demonstrated practical accomplishments that provide problem solutions from seemingly unrelated discoveries. The sixth problem area covers **characterization of forest resources and evaluating their uses**. This problem area links to issues associated with timber supply and demand, rural development, and ecosystem management. Each of these problems deals with the interface of science and policy. Several include the development of rigorous methods and tools for quantitative policy analysis.

Implicit in these problems is a deep commitment to considering the integrated aspects of the questions being considered and connections among various functions and processes being studied.

Contemporary Questions

The other basis for the research agenda as shown in figure 1 is the contemporary questions that are challenging our research community. These questions all involve some aspect of science-based information but require different degrees of research (knowledge discovery), development, and application. These questions are derived from societal needs, the land management community, and statements like the Forest Service strategic goals.[3]

These contemporary questions share a number of common attributes that differ from those arising within the science community. Foremost, these questions are typically more integrated in that they combine diverse types of information, time scales, and multiple spatial extants. The various challenges posed by integrated research are examined in more detail in appendix 3. Key to being successful in structuring research to answer these questions is resisting the natural tendency among scientists to reduce the scope and complexity of research problems. To a large extent, success will depend on our ability to answer them at the spatial scale implied (or stated) in the original question. This will depend on our ability to use metaanalyses, use nonexperimental approaches, and develop expert judgments that support more synthetic outputs appropriate to higher spatial scales.

The following sets of questions were developed in early 2004. They are based on the issues RUVR scientists are addressing or issues discussed as being appropriate for research help. The intent of the questions is to illustrate the diversity of questions challenging the research community. The order in which they are discussed does not reflect any particular priority.

Fire—Questions that emerge from the recent emphasis on fire:

- How do we develop hazardous fuel reduction strategies that integrate new technologies, market developments, and land/supply management issues?
- What are the implications of the emerging fire industry (based on both suppression and management activities) in rural communities? Is it being structured in a way that provides reliable, sustainable, family wage jobs? How can we structure fire-related jobs so that they meet the needs of rural communities? What is the nature of these jobs, and what expectations accompany them as far as the community is concerned? Are we creating a new kind of dependency?
- What are the opportunities for cost containment, especially on large fires?

Public expectations for goods and services from timberlands:

- What should be the role of public lands in supplying goods and sevices?
- How do we define the goods and services, and how do we anticipate tomorrow's demands?

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[3] These latter goals relate to fire, invasive species, recreation, energy, and watershed condition. Their near-term significance includes utilization, economics, and social science contributions to budget planning and the opportunity to make incremental programmatic changes.

- How can we help where public expectations for recreation activities (like off-highway vehicles) seem to conflict with land managers' perceptions about what is best?
- How can we value environmental services including developing frameworks (accounting stances), valuation issues, and defining and measuring outputs?

Benefits/costs (B/C) of our efforts to rehabilitate damaged lands:

- How do we demonstrate the B/C of active forest management of critical forest resources?
- How do we measure the social acceptability and the B/C of strategies to deal with invasive species?
- How do we gauge different public expectations about what are invasive species and desired nonnative species?

Public expectations:

- How do we measure the weight of various publics (how do we measure the power associated with different types of publics)?
- How can we expand our ability to state the impacts of forest management across traditionally underrepresented societal groups?
- Who should be managing public lands and what role should local communities play? This question emerges in various guises (e.g., charter forests), and in the Pacific Northwest right now one way it is emerging is in the form of tribes asking for public land to be returned to them so that it becomes tribal land.

Social and economic consequences of our land management actions:

- How can our land management actions make positive contributions to rural economies?
- How can our operations and land management actions help improve community capacity?
- What is the role of partnerships for stewardship activities? How can Forest Service and community capacities be improved to engage in partnerships for joint forest stewardship activities? What kinds of institutional arrangements can best enhance these? How can we foster them? What are their real contributions? Is this a viable way of getting forest management work done?

Effects of changes in the rural/urban split in the U.S. population on land management:

- How has increasing urbanization affected goals for land management?
- What are urban demands for natural resource goods and services?
- How has social acceptability of land management practices changed?
- What are different perceptions of the wildland/urban interface?
- What is the role of urban forest resources to meet the various needs of urban populations?

Understanding international issues as global context for national issues:

- How do changes in trade opportunities affect forest resources and markets?
- How do global issues affect wood utilization opportunities?

Broad-scale (sometimes international) discussions about societal objectives for the environment:

- How do we contribute in the Environmental Protection Agency (EPA) sense where land is one of four components of the environment?
- How do we contribute to the sense of developing a “national forestry program” for implementing sustainable forest management?

Support to Forest Service National Forest Systems (NFS) land management planning:

- How can NFS planners develop a sense of demand for different goods and services?
- What management strategies are sensitive to and help sustain cultural traditions and diversity?

Planning and conducting research about the relation between the economy and the environment, with particular focus on developing a better understanding of the links between natural resource management, environmental attributes, and economic growth:

- How can forest managers and communities best partner to develop recreation/tourism management approaches that provide social benefits to rural communities? How do we minimize negative social impacts on communities and provide benefits to them in relation to economic, political, and social justice concerns?

Estimating the benefits associated with both market and nonmarket forest goods and services observed both at a point in time and over extended (often decades) periods:

- How do we develop and test frameworks for assessing the aggregate set of values for the full suite of goods and services resulting from forest management?
- What are the determinants of amenity-based migration and how does migration affect economic well-being?
- How do we estimate benefits associated with specific forest management actions such as hazardous fuel reduction strategies?
- What are useful frameworks for examining tradeoffs among multiple forest values, in the context of social preferences for various forest goods and services?

Providing leadership and developing frameworks for valuing goods and services produced from managed stands:

- How do we combine timber production models and the effect of management decisions into decision models that consider both wood quality and value?
- How do we use these decision models (combining management/silviculture and wood quality models) in the development and evaluation of forest management and utilization approaches undertaken as part of hazardous-fuel treatments?
- How do we expand research on joint production of resources like timber or range and nontimber forest products?

The Delivery of Science to Managers–The Concept of "Tools"

The delivery of science products takes many forms. The traditional forms of publications written for both scholarly and lay audiences play a predominant role in terms of assuring creditable science and communication among scholarly and technical audiences. Interactions with the public and managers through workshops, small groups, and one-on-one consultation play an increasingly important role in development activities. Recently, however, much of the work at the science management interface has included a strong focus on developing tools useful to managers. This has especially been the case in the fire community where research outputs are denominated in descriptions of tools placed in managers' hands. This continues a trend started a decade ago when Forest Service Research managers stated that accomplishments should only be counted when activities were implemented by managers on the ground.

This raises questions about the definition of tools. Very often we look upon tools as substantive, physical devices that have the essential property of providing assistance or support for accomplishing a particular task. In the modern idiom of technology and science-based management, tools often take the form of software or other computer-based applications. "Decision support," for example, very often means computer programs that provide one or more functions such as information integration, problem structuring, analysis, and document formatting.

Such a definition of tools is too restrictive and, indeed, may do a disservice to both research and field operations by limiting the range of opportunities for mutual and constructive interaction. The concept of "tools" can be painted with a broader brush to include not only computer software, but also other forms of checklists, inventories, guidelines, and templates based on research and that can serve the needs of fire management. If the concept of tools is extended to include "means" of various types to achieve one or more "ends," then we can identify field-related outputs of research such as consultations, workshops, seminars, and other forms of training and education as forms of "tools" to support fire or other management operations.

Some Principles to Guide Implementation

There are some principles to guide how to implement this research agenda given the spatially and topically diffuse set of utilization, economics, and social sciences research and development activities. For the most part, these are general principles and could be applied to RUVR or broader research organizations. The first issue is the development of a vision statement that incorporates aspects of this research agenda and that is supported by those responsible for implementing it. Other issues include being more deliberate about the role and importance of leadership, trying to deal more specifically with barriers to implementation, stressing the importance of improved alliances, and strengthening the case for social sciences.

Leadership

The Director of RVUR can advocate for the need to synchronize research oriented toward major questions with knowledge discovery.

First, a vision statement needs to be developed by leadership. Once that is completed, then the twin issues can be considered of how to fit the vision into leadership of utilization, economics, and social sciences research and development activities and at the same time apply it at the unit level. Within the Forest Service, the Director of RVUR can advocate for the need to synchronize research oriented toward major questions with knowledge discovery. The Director can advocate for balanced programs, set reasonable expectations, and encourage unit leaders to meld that approach into their program of work.

Visioning is only one of several components of effective leadership (Senior Executive Service competencies cite these as leading change, leading people, results driven, business acumen, and building coalitions). The Director of RVUR can advocate that more deliberate efforts be made to select and train effective project leaders. These are key positions in fulfilling the vision for utilization, economics, and social sciences research and development activities. Unit organization can also be improved to enhance effective leadership. One way to do this is to combine smaller units into larger units that would share a common Research Work Unit Description (RWUD) and reduce administrative costs for project leaders duties.[4] Stations could accommodate geographically dispersed units by relying on team leaders who report to a project leader or program manager. These teams could

[4] Surveying the economics project leaders reveals that on average being a project leader requires 0.5 full time equivalent (FTE) employee. That is, each project leader reduces the effective scientific workforce by 0.5 scientists. For example, a Station with three economic and social science projects could gain the accomplishments of an additional scientist by merging the three projects.

be geographic, subdiscipline, or problem specific. In the program manager/team leader environment of the Pacific Northwest Research Station, team leaders spend 10 to 25 percent of their time (depending on team size) and the program manager spends 60 percent of his or her time on administrative duties.

Working to Reduce Barriers

There are a number of barriers to achieving this agenda for utilization, economics, and social sciences research and development activities. Among these are recognizing capacity limitations in land management agencies, functional thinking of Washington office (WO) staffs, preoccupation of managers with tools, and lack of recognized experts and skills to do synthesis.

Diminished capacity—

The diminishing capacity in NFS to use and interpret economics and social science information is a challenge to scientists and may force us to consider different ways to present our work in terms that are relevant. Equally challenging is the loss of land managers who consider themselves generalists in a technical sense (see Kennedy et al., in press). One consequence has been the decline in looking at the integrated aspects of questions and a greater reliance on using frameworks to combine disparate types of information. Often the use of various frameworks allows many of the participants to engage only those parts of the questions of interest to them and to ignore the harder (or more complex) issues of integration.

This is especially acute as we enter this next round of planning. In the first round, interdisciplinary planning teams often included individuals trained in economics or operations research (a smaller number had individuals trained in the social sciences). Many of these team members acted both as an advocate for considering social and economic aspects of the land management questions as well as a conduit for information and technology transfer from the science to management community. In this round of planning, few of these individuals are in place, and rather than an interdisciplinary approach, a planning process is being used that assembles plans from existing components. For our science products to be used, they will need to be in the form of the required components and available when needed.

One consequence of the diminished technical capacity in the land management agencies is the increasing use of scientists as coaches and advisors in developing and interpreting information. This creates additional concerns for both sides. The need of scientists for separation from management decisions to maintain integrity and credibility in the research community can create a tension between the scientists and managers who need immediate answers and interpretations for day-to-day decisions.[5] Another concern is the availability of scientists to provide advice, given their need to continue doing research. A need strongly felt in the management community is for more interactions with scientists rather than fewer.

Washington Office functional thinking—
Another barrier is the influence that functional thinking in the WO has on research agendas through various funding allocations and other budget structures. Here the Director of RVUR can provide an example by promoting the integrative nature of the questions compelling utilization, economics, and social sciences research and development activities. By being an ardent advocate for carefully considering the integrative nature of questions, he or she can accomplish much to overcome this influence.

The preoccupation with tools—
There is a current preoccupation with developing tools that can be placed directly into the hands of eventual users. This challenges researchers not only in the context of their work but also in the form that it is delivered to the users. There are two types of tools considered: first there are those designed to help managers do their own data gathering and analysis. Second, there are tools developed by placing our research results in a usable format so that they can be used directly in decision-making. The former (tools managers use themselves) is dependent on the ability of people in NFS and other land management agencies/organizations to gather and analyze data. For example, NFS is developing some tools to assist in doing the social component of roads analysis and watershed analysis, training modules for conducting social impact analysis, environmental justice/civil rights analysis, etc. In these cases, researchers can contribute as part of a collaborative process with NFS analysts. But leadership and funding for these development projects need to come from NFS so that the resulting projects are useful tools for managers. But the lack of economists and social scientists at the regional level will limit the success of these efforts. Expanding the analytical capacity in NFS would help remove this barrier.

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[5] One area of concern that can emerge when managers and scientists collaborate is the confusion over different ways in which they validate information. The peer-review process, often anonymous, is used in the science community as the benchmark for validating scientific inferences. The process focuses on plausibility of the assumptions, methods, and data behind a particular finding, whether or not the finding itself is accepted. Peer review is considered an assurance of the quality of the information. With management decisions, interdisciplinary teams and consensus processes may be used to reach a conclusion.

Lack of Experts and Skills to Do Synthesis

The nature of research questions (derived from the needs to support management actions and policies) and the people asking them have fundamentally changed for much of the science efforts. This has been especially true of the policy-related questions often posed by the public. Part of the change has been the need to frame science at multiple scales and with greater emphasis on understanding the dynamic aspects of ecosystems. We also need to recognize and address the considerable increase in complexity that considering the social system adds to the work.

The roles of scientists are changing to include altered scopes of research problems—that is, policy-relevant research, greater emphasis on communicating research results effectively, and timeliness. Among the changes in roles is the recognition of expert judgments based on demonstrated research expertise—that is, when peers recognize the significance and stature of a scientist's past research accomplishments in a general area of work. These role changes challenge today's scientists and suggest changes in how tomorrow's scientists will be developed.

The focus on broad-scale assessments can divert resources away from essential research that expands the scientific foundation.

Some utilization, economics, and social science scientists have participated in ecoregion or other broad-scale assessments and have become recognized as leaders in broad-scale science (see Haynes and Perez 2001 for a discussion of how the science community has been affected by broad-scale assessments). These assessments have allowed some scientists to become established experts in various science communities. They are recognized for their ability to communicate specialized information developed from often-disparate data by using generally replicable methods. Although recognized experts have always been a part of our science community, we may need to be more systematic in the development of scientists who can act as experts and work effectively at the science-policy interface.

The focus on broad-scale assessments can divert resources away from essential research that expands the scientific foundation. This essential research often plays a key role in developing the scientific skills of new employees. If this work diminishes, future scientists may not acquire the essential knowledge and skills needed to lead the next generation of scientists. In addition, the extensive focus on technology transfer and applied research has diverted attention away from long-term data-intensive science. This raises concerns about the data availability for future scientific inquiries. These assessments have also changed the nature of our science by placing greater emphasis on developing predictive models and systems approaches. These models can be used in conjunction with empirical data and expert judgments to produce information used to explain how broad-scale systems operate or to respond to management needs.

To fill these science roles, the leadership community can help in two ways. First, it can help newer scientists understand how to use direct evidence including results from empirical studies to form judgments. Second, it can help them use syntheses of empirical information and expert judgments to develop an understanding of how management actions influence forest changes including flows of goods and services.

More Effective Use of Alliances

The changing nature of our work is also changing the clients for our research. These clients include the traditional land managers, community and stakeholder groups, and forest management advocates as well as nontraditional individuals and organizations interested in stewardship issues. The nature of the traditional client relationship (individuals or organizations dependent on our information) is expanding to include partnerships and other forms of alliances to facilitate collaborative relations. Some of these clients are seeking information about how natural and human systems work and interact, how changing human values affect goals for managing whole ecosystems, and about outcomes of various stewardship actions. Some of these clients are seeking partners in collaborative stewardship projects where researcher contributions are to help determine the “best available science” for the project. These changing needs suggest the need for a greater focus on how to better inform various publics and on how to better communicate what is learned.

We need to consider alternative ways of how we will get work done in the future. The current approach of mixing internal with external work has been successful. Our collaborations with universities, nongovernmental organizations, and other government agencies have been notable accomplishments. There is a danger, however, in becoming more like contracting officers, portioning money out to other entities to do the research that we do not have time to do while we end up playing the research management role. This raises the question about the right mix of internal and external work.

Another form of alliance will be greater use of team approaches to accomplish work. These will be especially useful when dealing with complex questions. These team approaches can include a mix of internal and external collaborators.

There is a need for greater leadership presence to help define reasonable expectations of how and to what extent science findings are transferred to the management arena. The move to integrate management and science has required more extensive and more rapid transfer of information than is traditional. The more conventional view is that scientists can give summarized information to managers who will then quickly adopt the information that fits their needs. Sometimes this approach has been successful. An evolving approach involves science-management partnerships. Some of these partnerships have evolved into long-term interchanges and personal networking. On some units, this interaction has evolved into shared planning of projects and even the sharing of employees between research and management. The nature of these partnerships influences the form of internal communications. In some cases, research findings often are transmitted to the field through these networks, with managers likely unaware of the original sources.

Strengthening the Case for Social Sciences

The preponderance of biophysical scientists in FSR presents a particular challenge to Forest Service social science work. First, biophysical sciences often fail to include human processes in problem definitions. They instead assume the importance of questions such as global climate change or habitat conservation and then focus on studying the underlying biological or physical processes. Until recently, conservation biologists have generally been insensitive to social and cultural questions preempting social choice in their problem definitions. Recent attempts by the Ecological Society of America to develop a social science working group suggests some change in this attitude is underway as conservation biologists seek help to assess why "ecologically correct" solutions are not implemented.

A second set of issues concerns how social scientists have fared when their science accomplishments have been judged by those more (or only) familiar with the biophysical science process. Two aspects of this process are first the influence of exact physical sciences with its reliance on mathematics and second the process of advancing knowledge built on knowledge acquired earlier. In the first case, non-economist social scientists find themselves at a disadvantage as they are often reluctant to reduce the ever-changing and subtle forces of human nature to mathematical expressions. In the second case, social scientists can find themselves at a disadvantage when sequential knowledge development is not possible making it difficult to describe scholarly contributions in conventional terms. This is sometimes the case when dealing with the social (and economic) consequences of policy actions where experimentation is not possible.

In presenting their accomplishments, social scientists do have the opportunity to argue that qualitative research can address unique issues. This would include studies of values, studies of social structure, studies of risk perceptions, use of ethnographic approaches that consider contexts and interactions among complex variables rather than parsimonious single-variable explanations, and case studies. It might also address some of the limitations of surveys and quantitative social science methods: (1) low response rates may mean that the data from surveys are actually less accurate than (non-random-sampled) qualitative research, although random samples are claimed and statistical analysis used, and (2) some social groups can only be reached effectively with qualitative and ethnographic methods (e.g., minority landowners and resource users).

Third, there are influential individuals whose political ideology conflicts with the prevailing social science ideology. McCloskey (2001) points out the implicit ideology of devolution, localism, and voluntarism that characterizes recent social science research (and in his view threatens the progress of the environmental effort). There are also individuals who feel threatened by recent results suggesting alternative views to the value of environmental services from forests (where timber production, although valuable, is a small part of the total value as assessed by society) and the role that these different values play in changing economic conditions of nearby communities.

More ideological attacks will come, and the RVUR Director and others in leadership positions will be called on to serve as defenders. Their defense will rest on arguing the importance of getting greater knowledge of the true nature of questions (see app. 4 for a background paper that explains the importance taking an integrative approach had when preparing for such an attack in 2000).

There is the opportunity and the challenge to strengthen the case for utilization by taking a more integrative research approach.

Strengthening the Case for an Integrative Approach for Utilization Research

Recent policy initiatives such as the Healthy Forests Initiative (USDA and USDI 2004) call for improved utilization of traditionally underutilized timber. Different proponents have pushed selected technologies with little consideration of financial or forest management aspects of increasing utilization. There is the opportunity and the challenge to strengthen the case for utilization by taking a more integrative research approach.

The basis for this integrative approach is the development of strategies that recognize that most attempts to increase utilization of heretofore relatively underutilized species or sizes will rely on private investment and involve diverse stakeholder groups. We need to combine technical information about processes, species properties, and log recovery with information about forest operations, market opportunities for different forest products including market sizes and locations, and information about the various stakeholders who may be opponents or proponents of activities and may often provide the required labor and capital. Finally, we need to place these activities in both the biophysical and socioeconomic context to explain how forest resource conditions can be improved while maintaining (or improving) the conditions in local human communities.

As an example, we can advocate a three-pronged approach for developing strategies for improving utilization as part of hazardous-fuel-reduction strategies. First, there is a need to develop and transfer technologies adapted to the scale of the problem. Second, there is a need to develop and deliver a marketing strategy that harnesses the power of forest product markets to assist in improving utilization. Third, we need to include the links to land management and timber sales (or stewardship arrangements) that implement various treatments. Developing strategies that include all three elements will lead to more enduring accomplishments.

Developing a Vision

Discussions of a research agenda are necessary first steps in developing a vision statement to guide RVUR research. This discussion needs to be inclusive of the affected scientists and stakeholders. It needs to place research in a broad context such as helping interested publics, land managers, and landowners achieve land stewardship goals. Solomon, who wrote some 2,600 years ago, described the challenge of land stewardship as "one generation comes and another passes but the land remains." In that context, the task in research is to assist in stewardship of a finite set of land resources by helping diverse clients make choices about dynamic systems in the face of uncertainty and changing societal values.

What then is a reasonable description of the programmatic vision for utilization, economics, and social sciences research and development activities? Recalling figure 1, we need a program of research that melds knowledge creation along common thematic lines (such as those described for the science program) with contemporary and highly socially relevant dynamic questions. By using a set of common themes (and allowing for local variation), we create a larger pool of experience from which we can form judgments relative to outcomes. Another way to think of this is to consider how these underlying themes help us develop the tools that can be used to solve a variety of problems. Just as a carpenter can use a hammer and saw to build a house, fence or cradle, we can, for example, use an understanding of social well-being to discuss the consequences of land management or to pursue collaborative stewardship. As craftspeople we need to recognize that individuals will specialize around certain sets of problems. Carrying the analogy further, we need to be diligent about developing ourselves as craftspeople ready to apply our tools to a variety of questions. Because our work and tools need to rest explicitly on the best science, we also need to consider the opportunities to ensure adequate regeneration of knowledge discovery.

This vision assumes that the worth of utilization, economics, and social sciences research and development activities will be judged by how well we can resolve a problem and help create lasting solutions that alter outcomes. Successful solutions will be like a piece of fabric that weaves together foundation information (the warp) with other information (the weft) to provide answers or understanding to transitory problems. Finding a way to weave together disparate types of information in attempts to answer socially relevant questions will allow us to demonstrate the power of utilization, economics, and social sciences disciplines to explain phenomena, outcomes, or consequences of actions. It is an enterprise where we need to nurture both artistic and crafts values and skills.

Creating and implementing such a vision is a function of leadership. Such leadership plays a number of roles. We need leaders who advocate for careful problem selection that recognizes the integrated nature of contemporary questions and the role that utilization, economics, and social sciences research and development activities play in problem solution. We need leaders who can synchronize research oriented toward major questions with knowledge discovery and who can develop balanced programs and skills necessary to do synthesis. Finally, we need leaders who are ardent advocates for effective delivery of information to the eventual users, for it is those users who determine the value of scientific contributions.

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Appendix 1: How We Approach Research

Underlying the development of this vision are assumptions about how we approach research. These approaches are seldom explicitly discussed in our research community. In particular and of critical importance to the development of this vision is a common understanding of our use of team approaches, especially for complex research questions, and the contextual setting for how research questions are triaged, reduced in complexity, solved, and delivered. This section describes each of these two critical aspects in the context of contemporary Forest Service Research (FSR) and provides depth to the development of this vision.

Team Approaches

Most Forest Service researchers are used to the traditional project or program types of teams as the fundamental research team or unit. These are the formal teams that every Forest Service researcher is assigned to for administrative purposes. Often, however, the actual accomplishment of research involves a mix of both formal and informal teams. In this section we define both types of teams and the various roles played by individuals.

Until the late 1980s, most economics and social science research was organized and conducted by research projects that, for the most part, had evolved to be relatively small (two to three scientists) and functionally specialized research units. Both the small size and specialized nature of the units often limited the scope of problems and accomplishments. Attempts to overcome this latter tendency had been tried most notably by organizing research programs focused around problems requiring a wider array of specialized skills and formal technology transfer efforts. This latter approach was more common in the utilization research arenas.

For the most part, however, FSR teams (projects) were small and had a highly specialized scientific workforce. Problems assigned to these projects and approaches to problem solution were also greatly influenced by the implementation of the Research Guidelines Evaluation Guide for paneling scientists (first adopted in the early 1970s). The coincidental evolution of these two factors led to increasing emphasis on personal scholarly work with reduced emphasis on management applications. This especially became the case by the late 1980s when changes in publishing ethics made it difficult to publish the same work in both scholarly journals and publications focusing on the management community. Some also argue that reduced emphasis on general technical skills in the management workforce has complicated the technology transfer efforts.

The adoption of the Research Guidelines Evaluation Guide for paneling scientists was a mixed blessing for social scientists. Given the preponderance of biophysical scientists in FSR and a lack of guidelines for evaluating social sciences, social scientists found their science being judged against the biophysical science process. That is, social scientists often found themselves at a disadvantage, as they are often reluctant to reduce the ever-changing and subtle forces of human nature to mathematical expressions, and they make greater use of nonexperimental approaches.

In the early 1990s, the rigidities of the project structure started to change as a function of two shifts. First, the efforts to develop broad-scale land management or habitat conservation strategies changed the notions of teams and team assignments. Several of these efforts (FEMAT [1993], Southern Appalachian Assessment [USDA FS 1996], Interior Columbia Basin Ecosystem Management Project (ICBEMP) [Haynes et al. 1996], Sierra Nevada Framework [USDA FS 1998], TLMP (Tongass Land Management Plan) [Julin and Shaw 1999]) involved formal science teams where economists and social scientists were assigned on a short-term or part-time basis. Second, equally influential were the revisions to the Research Guidelines Evaluation Guide in 1995. These revisions described how scientists could document various types of team assignments and team accomplishments. Subsequently, scientists who were able to document their scholarly contributions to team accomplishments received credit for that work, contributing in many cases to recommendations that they be promoted to higher grade.

An important evolution stimulated by both of these shifts is an emerging understanding of the various roles for team participants. Figure 2 is a general schematic for both formal and informal team structures. As illustrated in figure 2, there are four roles for scientists: team leader, designer, subteam leader, and team member. Each is distinct and has implications for the skills needed in individuals assigned to each role, for the stature of team accomplishments, and for employee development. Many research administrators assume that projects are formal teams and expect that project members can fulfill the various roles relative to their assigned positions and problems.

Team leader—

In many instances, this individual has recognized technical and administrative skills. Many Forest Service project leaders are thought to have the necessary skills to fill this role. However, this is less true when the problems exceed the usual scope assigned to the project. For example, the large formal science team used in broad-scale assessments tended to include individuals with strong administrative

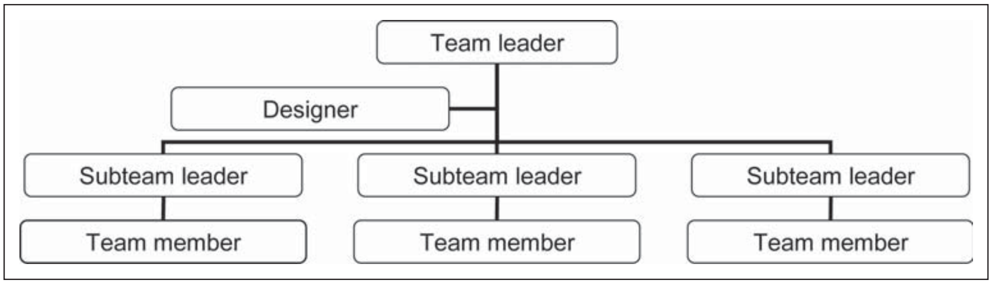

Figure 2—General schematic of team structure and roles.

capabilities. Informal science teams, however, tend to be headed by established scientists who have the stature to influence the research agendas of other scientists but who were not necessarily selected for their administrative skills. Only when the teams get large do the qualities of administrative skills come into question. Forest Service scientists assigned as formal leads of science teams are examples of this latter type of team. For example, the Resource Planning Act (RPA) assessments are led by scientists (called the RPA specialists) who are formally designated, but much of the actual work is accomplished by informal teams of researchers from different units and stations working on the RPA assessments that form around common research agendas.

Designer—

This is the most misunderstood role in teams. Developing a plan or framework is often not a full-time assignment, but the eventual success of the effort will depend on the quality of the plan. These plans or frameworks describe the questions, types of required information, common definitions, and the attributes of the successful science accomplishments. For small teams, the designer role is often fulfilled by the team leader, but in larger teams this role is fulfilled by individuals (perhaps subteam leaders) or small subgroups (from the science team) who design the framework that the science team will follow.

Subteam leader—

In many instances this individual has recognized technical skills and can lead disciplinary work. Subteam leaders also recognize the importance of placing their work in the context of the assigned questions and the constraints placed on work at the science/policy interface. This role is one of the most time demanding as it may require a full-time commitment for a short period. For example, the FEMAT assignment was full time for roughly 4 months, and the ICBEMP and TLMP assignments were part time (except for a few hired into full-time positions) for several years.

Team member—
An individual working within a specific disciplinary team. The work is relatively narrow in scope. These individuals may be either relatively new or experienced scientists.

Steps in the Science Process

This section discusses the general science process used in FSR. Most discussions of this process lack specificity, but being explicit about how we conduct science will help in the development of a vision statement. Figure 3 illustrates one view of this general science process. It is made up of a number of major functions often connected (representing information flows) in multiple ways. Some of these

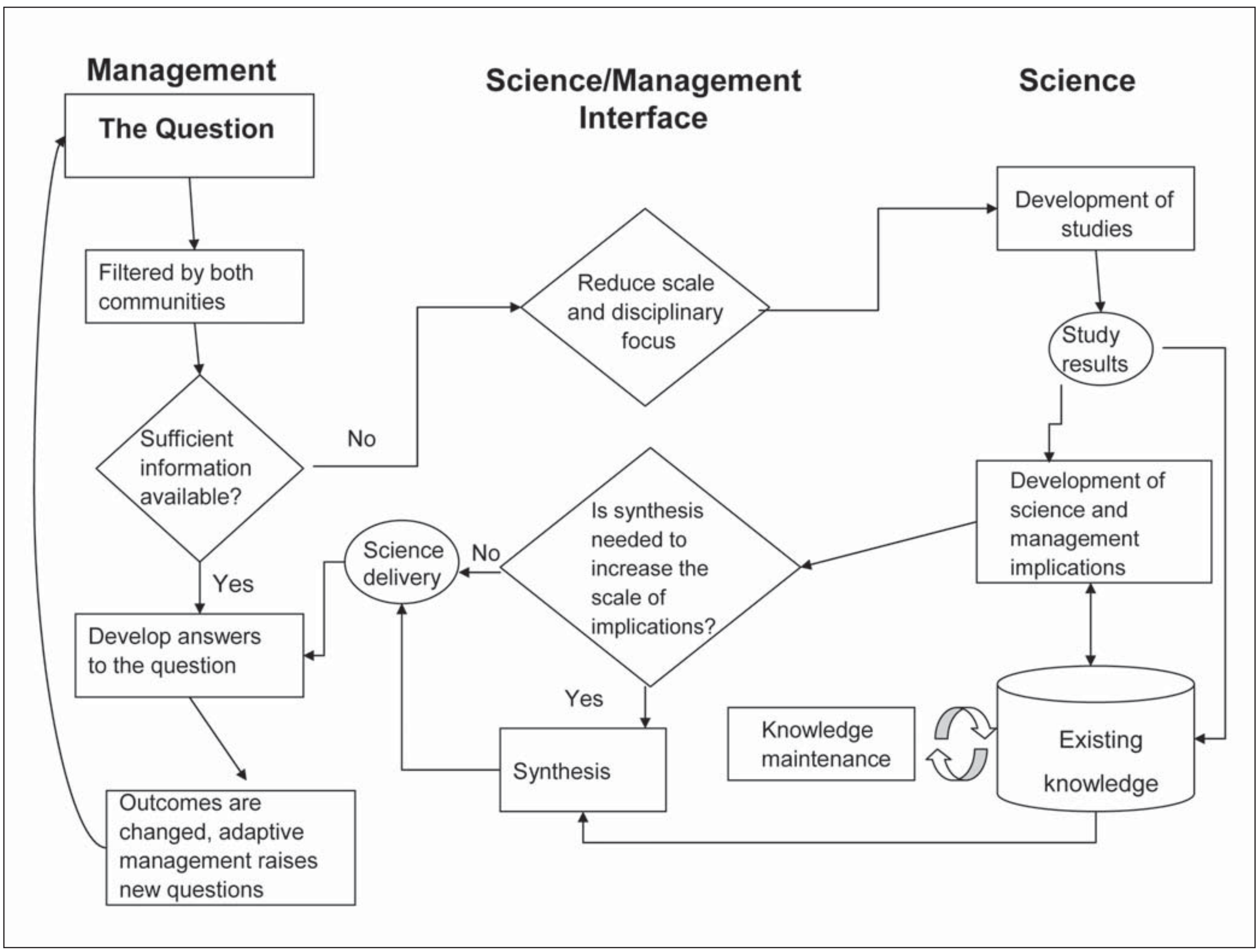

Figure 3—Forest Service Research science process.

connections include decisions and efforts to modify or package the information flowing along that arc. Taken together, the various functions and interactions shown in figure 3 describe some of the contextual issues surrounding our management and science environment.

The activities (boxes and arrows) on the left of figure 3 represent the management/science community, and the activities on the right represent the science community. These communities are not mutually exclusive (see Lee 1993), but we will assume that in discussion of FSR, the first reflects both land managers and various science advocates such as research administrators and staff as well as those individuals in positions that bridge the two communities including those engaged in research-management partnerships and those with formal technology transfer roles. The second community reflects those engaged in the conduct of science activities including both the researchers and research leaders. The emphasis in the first community is on bringing the best available science to various users including the land management community. The science advocates in that community help develop compelling science questions for research activities. They play a key role in helping to clarify various information needs and some notion of what will be acceptable products. Different functions in the science management community are also illustrated in figure 3.

Figure 3 illustrates importantly that the questions come from outside of the science community except in the cases of knowledge maintenance. Our community does not exist in isolation from the mission of the Forest Service. The first step (shown at the top right) is to filter the question for information needs. The two communities often interact to filter the information needs in two ways. First they assess the available information. The management community needs to use the best information available and often questions the value of improving that information. Science advocates engage in an interaction that reduces the questions to various disciplinary questions. Second, the resulting specific research agendas are often set by using place-specific data regardless of the spatial scale implied in the original questions.

If there is sufficient information then the management community (perhaps with the assistance of scientists engaged in technology transfer) develops the necessary answers. If there is not sufficient information, research questions are further refined often reducing the scope to match research capabilities. Moving down on the science side of figure 3, studies are developed and conducted. When the studies are completed, the results consist of both new knowledge and the necessary inputs to develop science and management implications relative to the originating questions. The next step involves deciding whether explicit synthesis efforts are needed to provide information necessary for fulfilling the needs of the questions. The last step develops the necessary information that leads to changed outcomes and, in the context of adaptive management, leads to new questions.

Shown at the bottom of figure 3 are the existing stocks of knowledge and an interaction within the science community dealing with both planned and unplanned knowledge maintenance. A hallmark of a vibrant science community is the recognition of the contributions made by intellectual curiosity. These include individuals who revisit former studies, observe changes, and extend their old results. Included here also are serendipitous knowledge discoveries. Both of these activities maintain and add depth to the stock of existing information. A research management challenge is how to handle these activities that are usually beyond those supported by formal research support allocations.

Moving across the two communities ideally involves assembling, weighing, and developing judgments from the existing and new information. The goal in this step is to assess whether answers are being provided in the same level of detail as the original questions. Too often, the reality falls short. This leads to the need for the additional step shown in figure 3 as synthesis. This is emerging as one of our greatest challenges: encouraging scientists to consider that their job is not yet done until they assemble, weigh, and develop judgments from both existing and new information relative to the original questions. Many scientists try to avoid this step as considering it something less scholarly than knowledge creation (the application of the current panel process often reinforces this perception).

Figure 3 illustrates a number of points. First, the management and science communities interact to filter the information needs. This interaction reduces the original questions to various disciplinary questions. In this reduction, we too frequently display a tendency to overemphasize biophysical sciences, treating human systems as too chaotic to understand.[1] Next, specific research agendas are often set by using place-specific data regardless of the spatial scale implied in the original questions. Research results lead to both new information (which may be an end in itself) but more importantly to the development of science and management implications. The later may combine both new and existing information.

As an example of the tendency to filter incoming questions, consider the question about the efficiency of different alternatives for management of a national forest. We often reduce this question to a harvest scheduling question where the

[1] Many scientists behave as if a system characterized by chaos (being formless) is not predictable and therefore can be ignored or treated as part of background uncertainty.

alternatives are reduced to differences in constraint specifications. Often, from a science perspective the different harvest schedules are the final product, and it is left to others to relate them back to the original management questions.

Another point is the growing importance of synthesis. Given the growing complexity in questions and the necessary reduction to their disciplinary constituent parts, it is more difficult to synthesize the various findings. It is becoming more difficult to allow scientists to persist in taking such synthesis for granted. In this situation, we need to foster the development of skills to do synthesis among our scientists. If we fail or are too slow, we run the risk of demonstrating our irrelevance for the management community who will continue to make decisions based on the information available to them.

Appendix 2: Typology of Research Areas

Problem 1

Improved knowledge of the opportunities to use local, regional, and international markets is key in understanding how to use management practices to sustain a diversity of forest conditions and outputs.

Element 1.1—
Improve understanding of how the forest sector (broadly defined) functions, including intrasectoral dynamics, and interactions between the forest sector and other sectors.

Element 1.2—
Improve understanding of how resource use, management, and policies are affected by economic and social change at the regional, national, and international scales.

Element 1.3—
Understand the conditions under which markets for nontraditional goods and environmental services originating from forests may develop.

Problem 2

The shift in management emphasis from stands to ecosystems poses challenges of how to reframe much of the existing information that has been gathered in the context of stand and forest (region) levels to apply it at linked and multiple scales.

Element 2.1—
Develop methods for integration of economic and ecological values in natural resource management decision processes.

Element 2.2—
Develop methods for evaluating the costs and benefits of alternative land management regimes, silvicultural practices, and policies to provide a range of commodity, amenity, and ecosystem values within the context of sustainable forest management.

Element 2.3—
Develop methods for understanding land use and land cover changes and their effects on biodiversity, timber supply, forest carbon, and other goods and services.

Problem 3

Effective, responsive, and efficient resource management requires information that identifies and evaluates alternative institutional (both formal and informal) structures and processes.

Element 3.1—
Improve understanding of how professional and organizational culture and values impede or facilitate collaboration with other professionals, agencies, and citizens.

Element 3.2—
Improve understanding about how various forms of knowledge (scientific, managerial, traditional) are used in decisionmaking and are integrated with one another.

Element 3.3—
Identify and evaluate the role that institutional barriers and opportunities play in resource management decisionmaking.

Element 3.4—
Develop and evaluate, under different social and political contexts and scales, frameworks for assessing existing and potential institutional structures and arrangements for natural resource management. Assess the factors affecting their usefulness.

Element 3.5—
Develop and evaluate theory, frameworks, methods, and mechanisms to assess and evaluate institutional capacity to implement integrated resource management programs.

Problem 4

There is a need to expand our understanding of community and natural resource interactions at multiple scales.

Element 4.1—
Improve understanding of the interdependencies between public knowledge, values, and uses of natural resources (e.g., wildlife, forests, water) and how they are managed.

Element 4.2—
Improve understanding of communities (both interest- and place-based) and how they are related to natural resources and their management.

Element 4.3—
Develop and evaluate frameworks and tools for understanding and assessing the role of places important to people with respect to natural resource values, uses, and management of those resources.

Element 4.4—
Improve understanding of the determinants of acceptability of resource management for different populations (e.g., rural, urban, minority) and user groups (e.g., recreationists, gatherers).

Element 4.5—
Develop and evaluate integrative frameworks, concepts, approaches, and tools for science and policy.

Problem 5

There is a need to foster innovation and evaluation of new products and processes.

Element 5.1—
Develop, refine, and diffuse improved forest products and processing technologies.

Problem 6

There is a need to improve our ability to characterize forest resources and evaluate their uses.

Element 6.1—
Assess the technical feasibility of producing primary and secondary wood products and nontimber forest products through empirical studies and simulation.

Element 6.2—
Evaluate the influence of alternative forest management options on the abundance and characteristics of forest-based goods and services.

Element 6.3—
Elucidate the influence of management and policy objectives across space and time and compare outputs associated with various resource goals.

Element 6.4—
Provide technical assistance to natural resource managers, technical organizations, users of natural resources, and others interested in the physical characteristics, processing, or marketing of forest resources.

Appendix 3: Research Integration at Pacific Northwest Research Station

In the winter of 1999, the Pacific Northwest (PNW) Research Station Director (Thomas J. Mills) hosted a discussion with selected Station scientists about different approaches to integrated research found at PNW. The meeting was stimulated by repeated discussions within the Station's science community about what is meant by the term integration. The purpose of the meeting was to summarize the successes of various approaches to integration currently used among Station scientists and to discuss how to broaden our commitment to integration. The discussion improved understanding about both the process of integration and the impacts greater integration has on the science community.

The Station Director strongly advocated increasing the quantity and quality of policy-relevant research, which he recognized as often integrating multiple disciplines or scales. He had several motivations. First, he had an abiding interest in research being an efficient provider of information. He believed that fiscal constraints encouraged pooling of resources necessitating greater collaboration. He believed that many of the environmental policy questions we faced were multivariate requiring us to define and understand notions of joint production, tradeoffs, and compatibility. Finally, he believed that encouraging scientists to engage in integrated work was a way to push them beyond the confines of their narrow intellectual interests and would lead to them becoming more able to anticipate upcoming new issues rather than dealing with them reactively.

The discussions revealed common agreement among the scientists that integration is a process—a means to answering complex questions. Some argued that it requires new ways of approaching problems and that integrated outcomes are not possible unless underlying planning, management, and research processes are reformed (see Clark et al. 1999). Those involved in ecoregion assessments argued that the intent of integration is to reconcile the separate and separable parts that confront managers and policymakers. That is, the ecological model in its most complete form is represented by combining the human and biophysical aspects.

Propositions

The nature of the questions and the people asking them have fundamentally changed for much of our science efforts. This has been especially true of policy-related questions, which also have increased in frequency. Many questions are now posed by the general public and are typically integrative in nature. That is, they often take a comprehensive systems point of view that increases the complexity of the answers especially when social systems are considered with biophysical systems. This complexity leads to confusion over what is meant by the term integration in programmatic discussions and if there is a "right" way to approach integration. These concerns can be restated in the following propositions:

1. The nature and extent of integration are driven by the questions determining research agendas or the development of information at the science/policy interface.
2. There is no "right" way of integration except that our answers need to consider the context surrounding the questions.

Background

The involvement of scientists at PNW in ecoregion (broad-scale) assessments and in other activities at the science/policy interface gave them extensive experience with a range of integrated approaches. Four general models are recognized: integration by stapler, the renaissance scientist, multidiscipline and interdisciplinary teams, and integration by design (framework) approaches.

Integration by Stapler

There have been a number of efforts where different disciplines worked on selected components of a common question followed by an effort to assemble and interpret them collectively. One of the better examples is the Forest Ecosystem Management Assessment Team (FEMAT) process that is sometimes held up as an example of integration of biophysical and social sciences. In hindsight we see that it was not driven by broadly integrative science questions. Instead, the initial questions dealt with species conservation coupled with an interest in social and economic effects. Its approach to integration was to let it occur naturally through coordination between different functional (discipline) groups. The final (FEMAT 1993) report represents integration through a common binding.

The Renaissance Scientist

There are individuals who by their breadth of interests, skills, and abilities are able to bridge several disciplines. This is not to say that these are necessarily solo efforts, as they may involve small groups of individuals where the bulk of integrated work is done by one individual. Examples are diverse and include efforts like Andy Carey's work[1] on multiple pathways to conserve biodiversity.

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[1] Carey, Andy. 1988. Biodiversity and intentional management: a renaissance pathway. Science Findings 9. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 6 p.

Interdisciplinary Approaches

There are two variations of work by interdisciplinary groups at PNW. The distinction is whether the groups are formally or informally assigned. For convenience we will refer to the former as interdisciplinary teams and the latter as multidiscipline teams. These approaches are often applied to integrated questions that involve bilateral tradeoffs of timber and some other value.

Integration using interdisciplinary teams—
This is the more formal variant of multidiscipline approaches. These teams are usually formed around formally assigned integrated questions, but the exact nature and form of integration are left to the group. These efforts are generally more inclusive of disciplines than less formal approaches, but, as with multidiscipline teams, the outcomes are subject to the competing egos of the individuals providing discipline expertise. One variation of this approach is where members are formally assigned to planning (also know as ID) teams.

Multidiscipline work—
At PNW, several teams of scientists have evolved in a nearly spontaneous and self-selecting fashion. Much of this has taken the form of informal assessments by groups of scientists of the questions surrounding the Northwest Forest Plan implementation (Haynes and Perez 2001). Some of these efforts like the Coastal Landscape Analysis and Modeling Study (CLAMS) have been extensive, whereas others have been more modest. Only a few efforts like CLAMS (Spies et al. 2002) have focused on broad-scale multiple-discipline questions; most have focused instead on extensions of existing work.

Integration by Design (Explicit Frameworks)

Several Station efforts (e.g., Eastside Forest Health Assessment [Bormann et al. 1994], Interior Columbia Basin Ecosystem Management Project (ICBEMP) [Haynes et al. 1996]) used explicit frameworks to integrate social, economic, and ecological systems to answer integrated questions in support of federal land management. The use of these frameworks recognized the increased interaction among social, economic, and ecological sciences in answering questions that reflect complex intertwined systems.

Discussion

Different aspects of issues related to integration emerged from the PNW experience. First, the experience at PNW leads to a series of questions that should be considered in an approach to integration: Who controls the definition of the integrated questions? How clearly developed are (and who develops) information needs to resolve the original questions? Who controls the science aspects of questions? Who controls the resources and how will judgments be made about the value of different types of information? Who decides on which disciplines to engage and the rules for engagement? How are common issues/protocols resolved across the disciplines? For example, how will a group of scientists representing different disciplines agree on the base year or period for temporal comparisons? What constitutes success? How are conflicts between science successes and policy successes resolved?

Second, one underlying theme not resolved was the deep divide between scientists who wanted to maintain their own terms and timing and advocates for greater science/policy interaction. That is, those interested in improving the performance of scientists at the science/policy interface expressed their views in such a way that implied that all research should be conducted explicitly considering the contextual environment and include both science and management inferences associated with the work. Many scientists are more cautious, wanting to maintain a portfolio of work that includes both integrated and strict disciplinary work. Finally differences (often vast) in spatial scales between where we conduct most of our research and where integrated questions evolve often add confusion. For example, much of our work on understanding environmental conditions is relatively fine scale, but broad-scale issues like jobs versus environment by their nature cover physically large spatial extants.

There is general agreement that the definition of integration is not fixed but that it is the study of relationships between interrelated components of systems. Within the Station there seem to be two variants of this definition. First there is integration with a capital "I." This seems to be integration that is driven by external forces either as a science/policy question or a major science issue. Second, there is integration with a small "i" that is driven often by local (or internal) multidiscipline questions. Regardless of the definition, there is general agreement that the nature of integration is driven by the questions stimulating the research.

Two types of integration efforts are presently underway at PNW. The first type is driven by external science policy questions. The three major ecoregion assessments are of this type. They are perceived within the science community as being top down in design, leadership, control of resource allocations, etc. Participation is often organized into discipline-specific subteams. The second type presents a more bottom-up approach where individuals select themselves for participation. These are informally organized, at least initially, around contemporary questions framed largely by the participants. The CLAMS project is an example of this second type of integration. The third type of integration (called research-management engagement) is what occurs among groups of scientists who have long collaborated at common sites, around specific data sets, in shared facilities, or in a long-standing engagement in research-management partnerships. It is the outgrowth of mutual learning among those scientists and other partners. The integrating questions are often vague and relate more to intersecting intellectual curiosity than any policy focus. The work at H.J. Andrews Experimental Forest illustrates this type of integration. The work there also illustrates how a sustained research-management partnership enterprise can feed policy events by making scientists familiar with management issues and culture, preparing local examples that can be scaled up when the policymaking window is open, and providing scientists and managers an opportunity for mutual learning.

In addition to operational and definitional issues, two other issues emerged from the discussions as important. First, what are the attributes of scientists prone to integration? Second, what advantages does the Station's science community enjoy relative to integration?

In the first case, although most Station scientists recognize the importance of greater integration, not all participate, nor do those who are currently involved continuously participate. The more frequent participants seem to be those who can think broadly across disciplines recognizing discipline boundaries and commonalities. These participants are risk takers both in terms of administrative structures and intellectual endeavors. Risk taking seems to be necessary if one is to take advantage of emerging opportunities. Also, from a practical point of view, these scientists are knowledgeable of our research legacies. Such knowledge seems fundamental if scientists are to see connections among phenomena. Finally, they have to be willing to work on teams including learning and practicing the different roles of various team positions.

In the second case, the science community at PNW enjoys a unique advantage from which to pursue integration. Foremost, as a natural resource research institute, it employs a uniquely rich and diverse community of scientists with a relatively large and stable funding base. Its relatively long (almost 80 years) existence has given it an eminent science legacy. This sustained research presence has also given it a respected place from which to conduct science and to seize opportunities to frame science around contemporary issues. Station management has in the past decade encouraged consideration of integrated questions. It has facilitated the participation of individuals in major science policy issues. This in turn has broadened perspectives of scientists and provided them greater clarity in pursuing subsequent questions. Station management has encouraged both top-down and bottom-up integration, but it still struggles with how to manage these two approaches simultaneously.

Finally, the culture of the Station has encouraged relatively informal forms of integration. Many of these are built around long-standing research efforts that have attracted many of the Station's scientists at some point in their careers. These seedbeds of ideas and data encourage intellectual development.

Summary

The nature and extent of integration are driven by the questions determining research agendas or the development of information at the science/policy interface.

Integration is driven by the nature of the questions or, in the case of active research-management engagement, by intersecting intellectual curiosity and management questions. Leadership that can recognize the links between management and science is key. Managing integration is a challenge especially when trying to simultaneously manage bottom-up and top-down integration as well as trying to maintain a strong foundational research program that can support broader questions.

There is no right way of integration except that our answers need to consider the context surrounding the questions.

There is no one "successful" way to do integration. There are multiple pathways, but leadership, both formal and informal, is essential. Work on integrated questions seems to improve subsequent research and encourages employee development in unexpected ways.

There are some lessons also about what might be necessary to reduce the barriers to achieving greater levels of integration. Foremost, we need to be more diligent about sensing the integrative nature of the questions that compel our research agendas. Research leadership (whether formal or informal) needs to develop a link between the mission to do this type of work, permission to do it, and encouragement. There are also a number of institutional changes needed to facilitate integration, including changes in how we describe assignments and accomplishments for those scientists covered by the Research Grade Evaluation Guide, improved communication within the science community about ongoing efforts where recruitment opportunities (for integrative projects) might exist, training new scientists in how to integrate, providing funding dedicated to promoting integration (most budget allocations are functional), use of initiatives or cross-cutting themes at the Station level to focus more open-ended integration work, and treating integration as an end rather than a process or means to get to an end.

Appendix 4: Resolving Complex and Controversial Forest Management Issues: The Critical Role of Social Science Research[1]

The Issue

Forest Service social science research has recently come under attack in Congress because it is not seen as central to the agency's mission. This is an important concern and one that we have addressed at the Pacific Northwest (PNW) Research Station as part of our ongoing priority-setting process.

Debates about natural resource management—what should be produced, how much, when, where, through what means, and at what cost—are fundamentally social in nature; that is, they involve conflicts over the importance and meaning of these resources and how these concerns change over time and across space. Understanding such changes—what they are, why they change, what the implications of these changes are, and how conflicts might be mitigated or resolved—forms a central focus for the PNW Research Station's integrated social science research efforts.

> The challenge we face as a society is to use research to improve understanding so that we can use what we learn to develop responsive policy and practices rather than impediments to natural resource management and use.

Although there are multifaceted interrelationships between various natural resources and their uses, the dominant approach today is to respond to conflicts in forest management focused separately on resources such as fish, wildlife, recreation, trees, and water. This approach often excludes the effects of policy and management on humans, as well as the effects from human use on these natural resources. Furthermore, a fragmented approach constrains consideration of interrelated and interacting biological, physical, and social processes. Solutions to resolving difficult and controversial issues are thereby limited and often polarize the public when their interests are not met in ways they believe are fair.

This situation calls for integrated research and development to provide information and technology to aid managers and the public in resolving complicated problems faced in natural resource management. Without the contribution of social scientists working in conjunction with their counterparts in the biophysical

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[1] This appendix was written by Roger Clark (USDA Forest Service, Pacific Northwest Research Station, 400 N 34th St., Suite 201, Seattle, WA 98103) in March 2000.

sciences, resource managers will not be able to successfully design and implement programs that are biologically sustainable, technically feasible, economically viable, and socially acceptable.

Background

Diverse and often conflicting demands are being placed on forests across the country. Our natural resources—forests, water, wildlife, and fish—have long been an essential feature of our Nation and its development. These resources have held special meaning and importance to our citizens through the various values, uses, and needs they serve. Historically, these resources have provided commodities necessary to the survival and development of families, communities, industries, and the Nation. Over time, however, the values and uses of these resources, and their associated meaning and importance change.

> What makes natural resources management an especially difficult challenge today is that traditional values and uses do not disappear, but are joined by new ones often in conflict with earlier ones.

The focus on important resource management issues provides a useful way to organize research efforts to better understand the dynamic relationship among people and natural resources and to isolate where complementary relationships between resource uses exist.

At PNW we have endeavored to place social science research and development (R&D) in the context of challenging and controversial issues and problems facing resource managers and the public. Our social science research is imbedded in integrated studies of important resource management issues; it is not driven separately by social research agendas, as is the case in academic institutions.

Our integrated research, which includes a social research component, is focused on resource management challenges and public concerns about issues such as forest productivity and sustainability, management of riparian areas for multiple values and uses, providing diverse opportunities for public uses of forests (including recreation), restoring forest health, providing a transportation network that serves multiple values and uses (including public access to areas of importance to them), maintenance of water resource quantity and quality for multiple uses, and improving the use of science in resource decisions.

We are not doing social science research for the sake of satisfying social science objectives or simply to learn more about interesting aspects of human concerns and values. Rather we are focusing our efforts on what we need to know about the interactions between the social and biophysical systems so that resource management programs and practices can be developed and successfully implemented to resolve important forest management issues.

The comparative advantage we have in Forest Service Research, and the scientific void we are filling with respect to our academic colleagues, is our capacity to integrate social research with biophysical sciences to address difficult forest management issues in a search for more comprehensive forest management options. When we need specific, more indepth expertise in a particular narrow topic, we seek assistance from the universities we work with across the country.

Making good land management decisions that are implementable is increasingly difficult. Such decisions need to be based on sound biophysical science. Problems we face, such as increasing forest productivity and sustainability, are very complex, making it difficult to understand and predict the various biophysical processes that are in operation.

It is also important that decisions make good economic sense; if the costs outweigh the benefits, it is unlikely they can be implemented for very long, irrespective of how sound the science underlying them is.

But to make the challenge before managers even more difficult, even if their decisions are based on the very best biophysical science and are economically viable, such decisions might still prove difficult to implement if they lack public understanding and support. Thus, we need better social science knowledge about the acceptability of various management practices and resulting conditions and guidelines on how this insight helps develop decisions that are sound (biophysically and socially), economically viable, and capable of implementation on the ground.

Research Goals

The basic goal of the PNW Station's integrated research, of which social science is a component, is to improve the ability of land managers to develop and successfully implement programs and practices to sustain vital natural resources and provide diverse public values and uses (both commodity and amenity) for both urban and rural populations.

The focus of past and continuing research is to develop improved ways for resource managers to resolve changing demands on forests resulting from rapid urbanization, conflicting viewpoints about what is "proper" forest management, and increasing public concerns about management of forest places of importance to them.

Research results, combined with findings from biological and physical scientists, will be used to develop and evaluate alternative approaches to help resolve policy issues such as (1) maintaining forest productivity and sustainability while improving public access to high-quality recreation opportunities, (2) restoration of forest health while providing for multiple forest uses and values, and (3) management of riparian areas and water quality and quantity for multiple uses.

This research will improve integration of public concerns and uses into resource management, the goal being a reduction in conflicts among different uses and between citizens and resource managers.

Research Response

Society faces increasingly complicated natural resource management challenges. Information necessary for small- to large-scale management requires analysis of a host of interrelated biophysical, social, economic, and management factors. Managers, scientists, and decisionmakers need new tools to support an integrated approach to decisionmaking and scientific assessments to facilitate development of implementable forest management policies.

Forest managers face many conflicting demands and expectations from increasingly diverse populations. The PNW Station continues efforts to improve understanding of how human uses, values, and concerns interact with biophysical and ecological systems. This information is essential to develop and implement responsive and effective management programs.

We are examining the linkages between human communities and public uses such as recreation and subsistence and resource management activities including forest productivity and sustainability, timber harvesting, road management, and forest health and riparian area restoration.

- We have formed integrated programs of research and development to understand resource use interactions and provide knowledge and technology to aid in development, implementation, and evaluation of resource management options.
- To understand biophysical and social questions requires a long-term effort focused on experimentation across diverse landscapes. Integrated research sites will help us learn about ecological processes and public acceptance of forest management practices.

Research focuses on improving the effectiveness and efficiency of the use of scientific information in resource decisionmaking. Two components are involved in this work.

- First, scientists are working to develop better technologies and approaches for acquiring and using knowledge from scientists, managers, and citizens to craft better decisions about controversial issues.
- A second focus is evaluating the adaptive management approach for using scientific knowledge in resource planning and management. The objective of this work is to identify what is working and what is not so that barriers can be overcome and effective solutions created.

Research is underway to help explain how and why stakeholders develop divergent perspectives on what is acceptable forest management. This information will help forest managers better respond to public concerns while developing and implementing programs and practices to resolve issues such as timber harvesting, restoration of forest health, and riparian management.

Research is planned to evaluate how decisions to restore riparian habitats can be accomplished in ways that consider the effects on recreation uses and opportunities. This work will be done in one or more drainages, providing a range of spatial scales to:

- Evaluate the processes through which such restoration-based decisions are made.
- Document the nature and extent of the effects of the decision on both the primary objective of stream restoration and habitat improvement, as well as on public uses such as recreation.
- Describe the management and policy implications of the results. With this information, land managers will be able to provide opportunities the public desires while meeting other riparian management objectives.

Research is underway for enhancing opportunities for diverse public uses and forest values. Concerns about management of sensitive species and areas (such as riparian areas) often lead to management practices that eliminate or constrain public uses and often alienate segments of the public.

- This research will help identify opportunities for creating and/or enhancing multiple public uses while protecting and sustaining other sensitive biological and physical resources.
- This research responds to increasing public demands for being included in resource decisions that affect them and for having their interests better reflected in resource management actions.

Some Recent Findings

Although the Station has undertaken a wide variety of studies and projects, several themes have been featured.

Acceptability of Resource Policy and Practices

Although public debates covered in the media and some popular literature are often conveyed as polarized, either-or extremes, past research reveals that in some cases, controversial issues such as restoring forest health, management of riparian areas, and increasing forest productivity often can be resolved in ways that accommodate important public concerns and uses desired by increasing numbers of citizens.

Social acceptability is based on the idea that for any given management practice, policy, or program to be implemented effectively, not only must it be based on good science and sound economic principles, but it also must have public understanding and support. If this understanding and support is lacking, it is unlikely any management program can be successfully implemented. We are interested in better understanding how these judgments of acceptability affect planning and implementing forest policy and practices.

- Research found that processes through which the decision or outcome was reached, specifically the public involvement, influence social acceptability. Much of what people care about involves process—how actions were planned, who was involved, how people got information, whether sources were credible, and whether their ideas were valued.
- Acceptability is often place based or situationally specific. Thus, geographic and other contextual aspects are central to public acceptance of any management action. These findings should help reduce conflict between resource professionals and stakeholders as each gains a better understanding of the importance of decisionmaking processes as well as the outcomes of decisions.

Studies and managers' experience show that many citizens are concerned about resource management practices and conditions that result from those practices. Research reveals some important aspects of this concern that might not always be apparent. For example:

- People often show a remarkable ability to understand highly complex resource management issues and problems.
- People are concerned about more than how things look; e.g., concerns with the effects of clearcutting or road construction go far beyond just appearance and esthetics. People are concerned with impacts on long-term site productivity, erosion and stream sedimentation, potential loss of biodiversity, and impacts on many types of recreation opportunities.
- Not all forest management practices are negative. For example, alternative silvicultural treatments and road designs can create or enhance recreation opportunities increasingly desired by citizens.

- People understand that tradeoffs must be made; they recognize that responding to their concerns will have impacts on other uses and values. When opportunities exist for open, honest discussion of these various tradeoffs, progress can be made to implement programs acceptable to more people.

To understand sustainability requires that considerations about ecological functions and processes be coupled with stakeholder values and objectives.

- An analysis of the literature on the concept of sustainability suggests that it unites ecological and social concerns.
- To implement management objectives, one recommended approach is to assess sustainability at the landscape level and define the processes, structures, and resources needed to meet the objectives of society.
- The pursuit of sustainable forest management practices and the resulting mix of goods and services must incorporate substantive stakeholder involvement. Science has an important role in informing this debate, but the ultimate decision as to these outputs remains a value choice by society.

Dramatic growth in the Pacific Northwest, especially in rural areas, has been fueled by inmigration (movement into a region). Such shifts raise important questions about the changing nature of human-resource interactions. We have completed an initial look at how population shifts are transforming relationships between human populations and forests.

- Lifestyles of new residents are creating new and broader demands for recreation access and opportunities. Studies confirm that amenities are increasing in importance as a reason for inmigration. Population growth in proximity to public forests poses a number of concerns for resource managers.
- We found that there may be important differences between inmigrants and long-term residents in how they relate to, use, and value the environment. Their expectations of forest management may also be quite different.
- This inmigration has important implications for management of public lands, including social acceptability of management actions and the processes used to develop plans and make management decisions. Understanding patterns of migration, the forces driving it, and the consequences of rapid growth are critical to policymakers.

Integration of Human and Biophysical Concerns in Policy and Management

Although we acknowledge that the goal of integrating biological, social, economic, cultural, and physical concerns in land use planning and management is desirable, we need to also acknowledge that to do so will require new ways of thinking and doing business. Thus, we have continued to emphasize the importance of understanding what changes are required, what it will take to implement them, what effects they will have, and how new technology can make the job of integrated resource management easier.

- Integration of resource management and research implies consideration of ecological, economic, and social factors. If consideration of these factors is lacking, full integration has not been achieved, and effective implementation becomes problematic. Problem framing is possibly the most critical part of integrative processes.

A major concern in resource management and research is how to improve our capacity to integrate various forms of information–social, economic, and biophysical. A promising approach to integrating biophysical and social information is the use of formal decision-support tools. The Ecosystem Management Decision Support system (EMDS) facilitates creation of integrated knowledge bases for research and management. Formal knowledge bases (based on decision-support technology) provide improved capacity to plan for and conduct consistent management assessments and research at multiple scales. The use of decision-support concepts and technology facilitates integration in both research and management.

- The EMDS combines formal reasoning with geographic information systems to enhance integration of biophysical and social knowledge that can be used in developing and evaluating forest management options.
- Research demonstrated that detailed evaluations of watershed conditions that integrate relevant knowledge needed for useful assessments of watershed integrity are possible.

Forest Policy and Management Effects on Human Communities

We have worked to improve understanding and integration of our knowledge of communities and knowledge and concerns held by citizens with other aspects of natural resource management. Resource managers, county commissioners, and educators have found the results of this work useful in developing agency-community-education partnerships to solve problems facing the agency and communities.

- Among other things, this work has revealed that although natural resource management actions and policies result in consequences for the region's communities and for the host of values and concerns that citizens hold, these consequences are often not recognized or effective policies to prevent or mitigate them are lacking. However, by more recognition, integration, and appreciation of the knowledge and ideas of citizens, we can more effectively anticipate these problems as well as fashion more innovative forest management policy and management.

- People who live, work, and recreate in or near forests know much about them. This local knowledge has the potential to reveal information about the patterns and processes of ecosystems that may not be part of the common information base.
- The concept of community (both of place and interest) provides a powerful framework for analysis of forest management options and effects.
- Local communities have different abilities to respond to changes in forest policy and practices. Some communities and individuals may be more severely affected than others.
  - Getting communities involved in their own community assessments puts local citizens in control of what to study so that the findings are useful for them as well as the agency.
  - Research confirms findings of other studies of displaced timber workers: lower wages, loss of occupational identity, and distrust of corporate and agency managers. However, most timber workers who participated in the study expressed support for better conservation of timber resources and had high capacity to cope with changes that affect them.
  - When community members themselves study the interrelationship between forests and their community, they are in a better position to improve their own situation while working with forest managers to respond to community concerns about forest policy.
- Findings suggest that the impacts of changes in forest management have multiple consequences that differ depending on individual, organizational, and community ability to respond to change that may be quite different from what we suspect.
  - Understanding these differences enables resource managers, local governments, and community groups to more effectively target adverse consequences and needs during times of change.
  - Research demonstrates that involving community members as researchers working side by side with scientists may have more useful outcomes than research conducted solely by “outsiders.”

Making Adaptive Management Work for Managers, Citizens, and Scientists

To make the idea of adaptive management more than just another slogan will require new ways of doing business. The promise and potential of adaptive management has created high expectations among citizens, managers, and scientists, yet our ability to implement it in an effective manner remains to be demonstrated. We have initiated a major evaluation of the concept including its specific application in the adaptive management areas (AMAs), as a means of developing a better sense of the kinds of changes required to implement adaptive management effectively.

Making adaptive management a reality requires new ways to learn and new roles for scientists, managers, and citizens. The essence of adaptive management is that management should be designed as an opportunity for learning, and that lessons learned through management activities and scientific study should be deliberately gathered and incorporated into future management and research activities. Adaptive management is an iterative process of planning, taking action, monitoring, and evaluating, with learning occurring along the way in order to apply what is learned to future problems and actions. Managers and researchers are challenged in this approach to work in new ways with each other and the public.

In spite of substantial barriers, citizens, scientists, and managers are learning how to collaborate in the AMAs. An ongoing evaluation of the AMAs indicates that each group brings different worldviews to the challenges facing natural resource management; these views are a source of tension but also the source of creative, innovative insight.

- In the Applegate AMA, for example, there has been a major effort underway for several years, predating creation of the AMA, in which various groups have begun learning how to work together.
- In the Central Cascades AMA, there have been close links between management and research for many years, built around the H.J. Andrews Experimental Forest and the Blue River Ranger District. Today, managers and researchers there are beginning to build improved links to local citizens.
- Elsewhere in the AMA system, these relations are still in the early stages of development. Although much might be learned from experiences in the Applegate and Central Cascades, it is also clear that individual AMAs will need to develop their own particular strategies based on local social, economic, biological, and management conditions.

Conclusions

Resource management problems today are often cast as either-or scenarios leading to less than optimum solutions, increasing polarization, or, in worst cases, gridlock and stalemates. This often leads to limited opportunities to address conflicts while providing a broad array of benefits to the American people.

We see ways in which past and current work will affect the work we are now beginning. For example, there is growing concern throughout the region and the Nation about threatened, endangered, and sensitive species (TES), forest productivity and sustainability, riparian resources, fisheries, and water quality. How we choose to respond to these challenges will have consequences and implications for a host of other values and concerns—recreation, subsistence, amenity values, communities.

Although there clearly are real conflicts and impacts to be considered, too often, effective responses to these challenges become lost in polarized, acrimonious debate. It is our view that where problems and challenges exist, opportunities for creative, innovative solutions exist as well; we can move to a situation in which there are more than simply winners and losers.

> A basic principle of our work is that by more effectively integrating social science research at the beginning, we increase the likelihood of anticipating many problems before they reach stalemate, as well as the likelihood of developing solutions that accommodate various competing, yet legitimate concerns. Rather than yield to reasons why something cannot be done, we are working to position our research as the source of information leading to creative solutions.

It is our contention that only by integrating social with biophysical research can we develop effective, efficient, equitable, and implementable forest and natural resource policy and management strategies.

> We believe that the current debate about the role and value of social science research can be likened to focusing through the "wrong end of the telescope." The discussion of priorities should not be construed as a concern focused on social science, but about broader critical management and policy issues confronting natural resource management and the vital role that social science information can play in their resolution.

This integrated work will lead to solutions that increase the probability we can:

- Provide traditional forest products while enhancing diverse opportunities for the public to use and appreciate areas important to them.
- Protect threatened and endangered species while maintaining, enhancing, or creating opportunities for public use and enjoyment of forests.
- Restore forest health and riparian areas while at the same time accommodating a diverse array of options for the public to use these areas in ways important to them.

Benefits of this work include:

- Increasing knowledge that will lead to optimization of uses rather than polarizing, exclusionary practices.
- Improved ways to incorporate and respond to public concerns.
- Public understanding and support as a result of addressing their concerns.

- Improved response to policy and management issues such as forest health, riparian management, productivity, and sustainability.
- Implementable decisions.

Why should an organization like the Forest Service and the PNW Station be concerned with developing and supporting a program of social science research? Of what possible value is such a program in addressing the agency's real mission of forest health and productivity?

First, such a program provides a rigorous basis for understanding what is important to people. Importance is not measured by the laws, policies, programs, or practices that govern an agency's behavior; these are only means to an end. However, what we want to make sure of is that the goals that an agency such as the Forest Service seeks to attain are consistent with what people are concerned about. Thus, a major responsibility and opportunity for social science is to help provide a clear sense of the key concerns and issues of society; this is especially challenging in a world of many interests, often in sharp conflict with one another.

Second, people are the primary beneficiaries of the programs an agency like the Forest Service implements. However, it often proves difficult to measure the extent to which programs are, in fact, delivering the kinds of benefits to people they purport to. Thus, another key role for social science is to help provide independent evaluation of the extent to which our deeds match our words; to the extent they do not, such research can also help define what is getting in the way and perhaps suggest strategies for resolving the barrier.

Third, many of the natural resource problems with which we are confronted can be traced to the interaction between people's use of those resources and unwanted or unanticipated impacts. Here, social science can provide important insight as to how the attitudes and behavior of people produce detrimental effects on natural resources and, can also help identify ways in which these adverse effects might be prevented or mitigated.

Finally, although it might be true, in one sense, that people are the problem, they are also the solution. Thus, an important role of social science research is to identify alternative institutions that can help solve natural resource problems. As a part of this, such work might also reveal how existing institutions might be part of the problem, thereby providing a basis for restructuring how we do our business in ways that eliminate unwanted effects. It could also help review successful experiences and the conditions associated with their successful application.

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