BITTERROOT ECOSYSTEM MANAGEMENT
RESEARCH PROJECT (BEMRP)

ECO REPORT

FALL, 1999

A Five-Year Summary from a Partnership in Landscape Level Ecosystem Management

1999 Symposium Highlights Five Years of Learning

On May 18-20, 1999, the Bitterroot Ecosystem Management Research Project (BEMRP) held a symposium in Missoula, MT, highlighting what has been learned during the past five years. The project, begun in 1994, is a partnership among scientists, land managers and the public, which has been working in the Bitterroot and nearby national forests to find ways of restoring ecosystems and collaborating with communities. Scientists from the University of Montana and Rocky Mountain Research Station (RMRS), collaborating with Bitterroot National Forest and Northern Region managers, have studied area fauna, historic and recent landscapes, and the local social setting. They have used landscape modeling to predict the consequences of land management choices and implemented demonstration treatments to learn how to restore and sustain diverse forest structures and landscapes. Managers, members of the public, and scientists have learned from one another at workshops, field trips, and public meetings.

Program Leader Greg Jones (RMRS) and Human Dimensions Chair Jane Kapler Smith (RMRS) co-chaired the 1999 symposium. Planning committee members included Steve Arno and Helen Smith (RMRS), Nan Christianson (Bitterroot Forest), and Bob Pfister and Joan Brehm (University of Montana). Helen Smith planned and coordinated a symposium field trip to four restoration treatment sites. She is also compiling and editing the symposium proceedings, which will be published in 2000.

Marcia Patton-Mallory (Deputy Director, RMRS) joined Greg Jones in opening the symposium and welcoming over 140 participants. Clint Carlson, Program Leader from 1994 to 1997, reviewed the project's history in a presentation, "Why Partnership? Why Ecosystem Management? Why in the Bitterroot?" prepared jointly with Leslie Weldon (Bitterroot Forest, 1992-1996). Perry Brown (Forestry School Dean, University of Montana) gave the key note address, "Sustaining People and Ecosystems in the 21st Century."

Symposium participants listen to a panel discussion moderated by Professor Jim Burchfield, University of Montana. Photo by Brooke Thompson.

Presentations highlighted projects designed to protect old growth, provide diverse habitat, and sustain ecosystems. Presenters covered four research areas: vegetation, wildlife, human dimensions, and landscape analysis. Symposium participants toured projects at four locations: Lick Creek (ponderosa pine/Douglas-fir), Larry Creek (riparian), Sawmill Creek Research Natural Area (ponderosa pine/Douglas-fir stringers within grasslands), and Snowbowl (old growth ponderosa pine/western larch/Douglas-fir). Bitterroot National Forest Supervisor Rodd Richardson and Greg Jones co-hosted the "Information Smorgasbord" poster session featuring 11 displays for the public in Hamilton, MT after the field trip on the first day. A no-host "Poster Session Reception" with 25 poster stations also took place in Missoula later in the week.

Helen Smith, Symposium field trip coordinator, shepherds participants at Lick Creek Demonstration Forest. Photo by Steve Slack.

Steve Arno (RMRS, retired) moderated symposium presentations on forest vegetation, bird, and mammal populations. The Human Dimensions section, moderated by Jane Kapler Smith (RMRS), featured presentations concentrating on understanding people and their relationship to the ecosystem. Landscape analysis presentations, moderated by Jim Chew (RMRS), focused on application of succession and planning models (MAGIS and SIMPPLLE), together with the Ecosystem Diversity Framework, in landscape planning and analysis. A final section, moderated by Jim Burchfield (University of Montana), provided an overview of five other ecosystem management research projects in the western United States: the Southwestern Borderlands (Arizona and New Mexico), Great Basin (Nevada), Rio Grande Basin (New Mexico), Front Range (Colorado), and Blue Mountains of Oregon.

To wrap up the symposium, Jim Burchfield moderated a panel discussion focusing on implications for future management. Panel participants included Greg Jones, Perry Brown, and representatives of the five other ecosystem management projects.

Inside

The Past Six Years (1994-1999)

What events led to the origin of the Bitterroot Ecosystem Management Research Project (BEMRP)? Former Program Leader, Clint Carlson, and University of Montana Forestry School Dean, Perry Brown provided an insightful overview in their remarks at the 1999 Symposium.

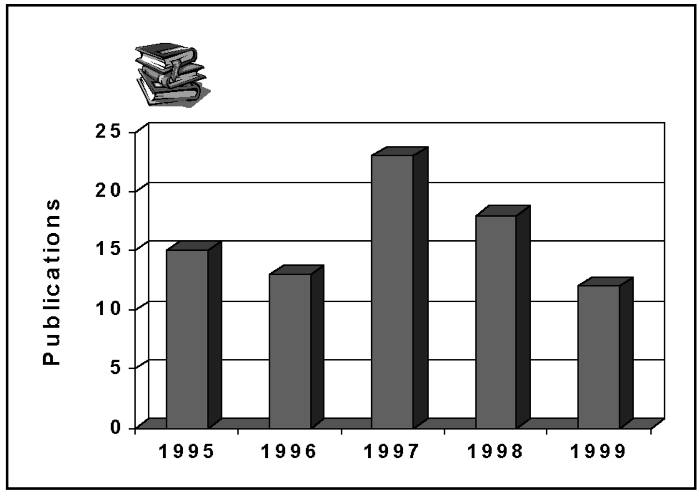
Carlson, Program Leader from 1994-98, chronicled project history. Initially, the project grew out of a Forest Service initiative to generate interest in ecosystems research. The Bitterroot National Forest was an ideal site because its lower elevation forest types have experienced 100 years of change due to fire exclusion and extensive logging, together with housing and agricultural developments along the forest boundary. Also, during the early 1990s, the Forest Service began its “New Perspectives” forestry, an ecosystem management (EM) initiative leading to establishment of the Lick Creek Research and Demonstration Forest, a ponderosa pine restoration project. This study, a cooperative effort between scientists at the University of Montana and the Intermountain (now part of Rocky Mountain) Research Station as well as Bitterroot managers, set the stage for future collaboration. Moreover, the Bitterroot was known nationally through the Bitterroot Controversy (see articles on pages 10-11), which occurred in the early 1970s, and public interest has remained high.

In 1994 the project, initially planned for five years, was begun with the objective of conducting cooperative research on the Bitterroot. It was organized around four dimensions of ecosystem management: flora, fauna, people, and modeling. Four committees linked to these dimensions have developed new studies, demonstration projects, public involvement efforts, and the project’s work program. Collaboration among academicians, scientists, and managers remains an integral feature. Each study has been allowed to stand on its own with integration facilitated via linkage variables, e.g., disturbance patterns or vegetation composition. This has allowed the project to deal with broader generalities as well.

Over 40 studies have been funded, and much has been learned. Vegetation studies have revealed the complex relationship between forest vegetation and natural disturbances like fire. Researchers have discovered creative ways of reducing tree density and better means of controlling weeds. Other studies have profiled public perceptions of forest management and how forest managers can interact more effectively with stakeholders. Increased understanding of forested habitat and mammal travel patterns has emerged. Earlier shortcomings of forest planning models have been remedied by adding a spatial component and identifying the necessary interactions between Interdisciplinary (ID) teams and landscape models to insure their successful use. Participants have also learned which research questions to ask for long term planning. Through interaction, managers, scientists, and the public have learned much about cooperating for the good of the forest ecosystem and developed a knowledge base enabling better EM.

On a broader scale, we have discovered the tremendous impact of the human dimension on forest health and come to better understand the politics of restoring ecosystems. This was the topic of Brown’s remarks to the Symposium. Researchers have concluded tools must be developed for understanding and working ***with*** the ever-changing human as well as biophysical environment. Human societies are undergoing their own kind of succession, and the Forest Service is shifting from forest management by “experts” to “collaborative” management. A new populism has made professional resource management expertise debatable and even suspect. Likewise, an “enfranchisement of a plurality of interests” spanning gender, ethnic, and income spectra has become commonplace in natural resource decision making (see “Book Corner” article by Brown on page 8). The information age has revolutionized human interaction, permitting the use and abuse of virtually unlimited information in all arenas, including natural resources. We have learned our environmental problems are complex, global and require incredibly sophisticated analyses and treatments. We have learned that all kinds of knowledge are important, including scientific, managerial, and common sense. We have grasped the importance of dialoguing with groups who hold diverse values. As the project enters phase two (see Jones article on page 6), our learning will hopefully lead to application of more appropriate treatments as we continue restoring ecosystems and all things touched by them.

Clint Carlson, Bitterroot Ecosystem Management Project Program Leader, 1994-1998. Photo by Jane Kapler Smith.



Graph of Bitterroot Ecosystem Management Research Project publications and reports by year.

ECO-Report

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The "Spotlight"...highlighting researchers at work:

"Fire all the way..."

Mick Harrington, fire effects research forester at the Fire Sciences Lab, RMRS, developed an affinity for Western Montana forests at an early age. A native Missoulian, Harrington has loved the outdoors since childhood. Enrolling in the University of Montana, he pursued forestry, motivated by his uncle, a career Forest Service employee.

Mick obtained his first job with the Forest Service as a University freshman. That summer he served as a lookout on the Kaniksu National Forest where he got his feet wet in fire, literally so, as it was a rainy summer. Here, he participated in his first prescribed burn. He realized that fire, appropriately used, was an effective tool. The next summer Mick worked as a forestry aid where he participated in prescribed burns and wildfire suppression. The next summer, Harrington received an appointment at the Northern Forest Fire Lab, Intermountain Research Station (later combined with RMRS). He got in on the ground floor of some early, well-known fire research projects, two of which are still ongoing. Mick's interest in fire blossomed, heralding a career in fire effects research.

Upon graduation, Harrington was drafted into the army, serving in Germany. Following his discharge, he returned to the Missoula Fire Lab and enrolled in graduate school. After receiving his degree, he obtained a position in fire effects research with the Rocky Mountain Research Station in Arizona. There he became involved in the efforts to reintroduce prescribed fire in forests there. Mick also assisted managers in resolving problems with fire application.

In 1987, Forest Service fire research was centralized, and Mick found himself back in his hometown, again working with familiar people and loving his work. Presently, Harrington and his wife, Gwyn, are very involved in church activities, enjoy many outdoor activities, and have a 19-year-old son.

"My love of the outdoors goes much beyond work. Our favorite thing to do is go hiking in the forest. We just feel such a part of creation that we long for our solitude in the forest!"

His own words best portray the philosophy that has guided him through his career:

Research Forester Mick Harrington ignites fuels in an underburning treatment on the Bitterroot National Forest. Photo by Kevin Ryan.

"We have been given the position as stewards of the land. We are in a position to utilize and enjoy natural resources, but that's all in the context of being caretakers of the land — not abusing it. Whatever we do that abuses and hurts the system will eventually hurt us so whatever we do that's good for the system is good for us too."

Recapping his research experience, Harrington reflected on how he has spent his entire career researching fire effects and methods to reintroduce it.

"Fire, as many other natural disturbances, impacts **all** parts of the forest system, and so it requires us to become familiar with other parts of the system…because everything is connected."

(Harrington's current research projects are highlighted on pages 12 and 13.)

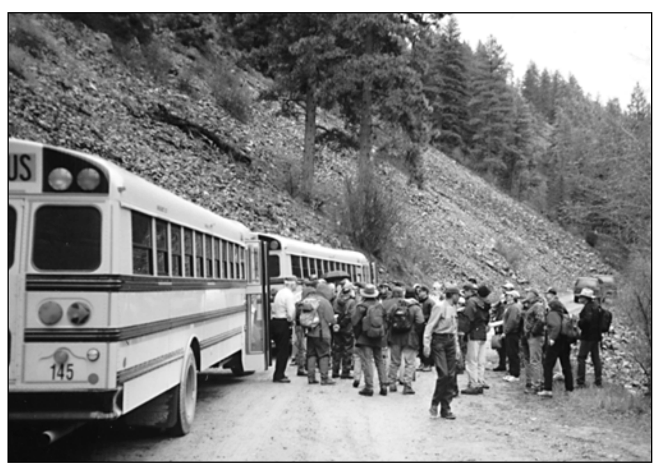
Field Trips Open and Close Symposium

By Jane Kapler Smith
RMRS, Fire Effects Research

BEMRP's May symposium began and ended in the field. On the first morning, 140 participants headed for Lick Creek, Larry Creek, and Sawmill Creek Research Natural Area in the Bitterroot National Forest. At Lick Creek, participants viewed results of thinning and underburning to improve conditions for old and second growth ponderosa pine and to increase grasses, forbs, and shrubs in the understory. Ponderosa pine growth has improved, willows have resprouted and been heavily used by elk, and some bitterbrush seedlings have germinated. Participants learned about effects of treatments and succession on the nitrogen cycle in ponderosa pine forests.

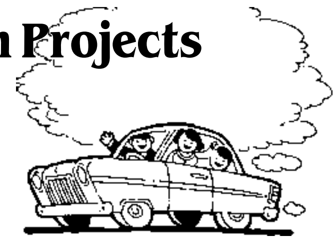
Weeds and conifer proliferation in native grassland and adjacent forested canyons concern managers at the Sawmill Creek Research Natural Area. Presenters here described their goals for reducing conifer regeneration and weeds and restoring the historic vegetative structure. A walk through the grassland illustrated suppression of native grasses and wildflowers by weeds and also

(continued on page 4)



1999 Symposium field trip participants convene for the hike to Sawmill Creek Research Natural Area. Photo by Steve Slack.

It's All in the Family —
Sibling Ecosystem Management Research Projects



In 1994, 15 ecosystem management (EM) projects were initiated throughout the United States. Of these, Rocky Mountain Research Station (RMRS), headquartered at Fort Collins, CO, has five ongoing EM projects, including BEMRP. The 1999 BEMRP Symposium featured presentations on each of BEMRP's sibling projects — Southwestern Borderlands, Great Basin, Rio Grande, and Front Range Projects, together with the Blue Mountains Research Institute Project, located at La Grande, OR and directed by the Pacific Northwest Research Station. Examining BEMRP's five siblings reveals their unique and common characteristics and contributes to understanding the essential characteristics of all EM-based projects.

Siblings share common traits, whether in appearance or temperament, and so do BEMRP siblings. For example, EM projects are interdisciplinary, integrating research on biophysical and human ecosystem dimensions. All rely heavily on partnerships with public and private groups whose interaction facilitates learning by all. EM projects collaborate with a variety of interests, including state and federal agencies, universities, private industries, private landowners, environmental advocates, Native American tribes, and county governments. All are strictly research oriented, having no authority over National Forest management. Their research focus is informed by input from their partners, technical committees, and governing bodies, which function similar to a Board of Directors. They disseminate information through tours, workshops, papers, newsletters, and conferences. Knowledge quests are science based, and research is accomplished by partnering with land managers to plan and apply treatments and measure responses. In virtually all cases, computer-modeling aids landscape analysis. Research is conducted on human as well as natural disturbances, and all attempt to stay abreast of shifting public values. Restoration and sustainability is the driving force behind all EM projects as scientists strive to understand and learn about all facets of the ecosystems in their project area.

Rio Grande Ecosystem Management Research Project

The Rio Grande Ecosystem Management Research Project focuses on the Middle Rio Grande Basin between Cochiti Dam and Elephant Butte Reservoir, New Mexico. Although humans have influenced Rio Grande ecosystems for at least 12,000 years, these systems have experienced significant changes in their biophysical and human components since the coming of European settlers in 1540. Project scientists are developing 1) ways to sustain biophysical, cultural, and socio-economic health and diversity within "space- and resource-limited" ecosystems and 2) methods for detecting and recovering sensitive species. Accomplishments to date include: 1) a comprehensive environmental history of land changes beginning with American Indian occupation (pre-1540), 2) a history of Basin irrigation, and 3) an evaluation of historic socio-economic impacts of livestock grazing. Emerging research priorities include: 1) understanding long-term human influences on riparian ecosystems, 2) developing conflict-resolution techniques to facilitate relationships between modern and traditional land users, and 3) studying the growing conflicts between species protection and rural economic uses.

Rio Grande River. Photo by Deborah Finch.

Great Basin Research and Management Project

The Great Basin Research and Management Project is a joint effort with the Humboldt-Toiyabe National Forest. Located in Central Nevada, the project is unique among its siblings because it focuses on stream incision and riparian degradation, examining linkages developed over millennia. Scientists are discovering the interactive effects of climate change together with natural and human disturbances. In the arid Great Basin, riparian ecosystems are scarce and highly valued for livestock forage, recreation, agricultural water, and animal habitat. Although these systems support most of the region's biodiversity, more than 50 percent are in poor ecological condition. Grazing, road construction, mining, recreation, and alteration of upland ecosystems account for much system degradation. Since continuing climate changes influence the systems' responses to human and natural dis-turbances, restoration and maintenance of riparian ecosystems re-quires an understanding of all factors. Wood rat middens (refuse piles) are playing a unique role in determining the distribution of certain plant species and the climate changes occurring over the past 11,000 years. Sampled midden strata range from 100 to 8,900 years old.

Robin Tausch discussing the results of meadow restoration research at one of the yearly field tours. Photo by jeanne Chambers.

Symposium . . . *(continued from page 3)*

showed increases in native plants after herbicide treatments. Visitors to this area learned about the habitat needs of the tiny Flammulated Owl, which requires a complex of old growth pine stands, grassy openings, and Douglas-fir thickets for food and reproduction. Plans for prescribed burning were described.

During a walk along the hillside above Larry Creek, participants viewed old growth pines intermixed with cottonwoods, aspens, and shrubs. This complex structure favors dozens of bird species. Fire exclusion has promoted conifer encroachment, reducing the diversity for wildlife. At treatment sites, cutting and prescribed burning have removed the dense grand fir understory that has developed in the absence of fire. Biologists will monitor treatment effects on birds, ungulates, and fish.

On the final afternoon, about 60 participants boarded buses with their questions and sack lunches to visit the "Snow Bowl site," an old growth ponderosa pine and western larch stand. This area was thinned and underburned about a month earlier to restore conditions for maintaining old growth and reducing wildfire hazard. Researchers described their plans to measure treatment effects on wildlife, understory vegetation, tree canopy, and soils.

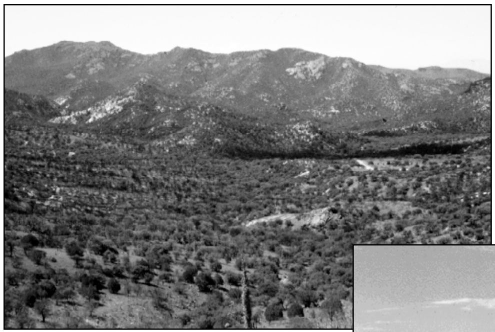
Blue Mountains Natural Resource Institute

The Blue Mountains Natural Resource Institute differs from BEMRP's other siblings in some respects. Formed in 1990, the Institute grew out of a grassroots effort by local citizens concerned with declining forest conditions in northeastern Oregon and southeastern Washington. Citizens requested research to help land managers plan for and implement forest restoration. Working to enhance the ecologically sound, sustainable, economic and social benefits derived from natural resources, the Institute approaches resource issues in a unique way. Project leaders initially determine whether an issue is value- or knowledge-based. If value driven, researchers conduct discussion forums, permitting a variety of interests to share their perspectives on forest health. If it is a knowledge question, scientists gather existing information and disseminate it through tours, workshops, seminars, papers, and conferences. If knowledge remains lacking, the Institute collaborates with partners to conduct new research. An adaptive approach informs all Institute activities. For example, researchers have partnered with citizens and land managers to plan, apply, and measure the effects of alternative fuel treatments in Blue Mountains National Forests. Project leaders point out that sound technical information is useful only when the public supports an objective and methods used to accomplish it. In this case, Oregon State University scientists, commissioned by the Institute, surveyed public acceptance of alternative fuel reduction methods, learning that respondents broadly support both thinning and prescription fire but prefer the latter. With this social information in hand, project leaders can interpret ecological results in a more meaningful context.

Streamwork in a Blue Mountains riparian area, La Grande, Oregon.

Southwestern Borderlands Project

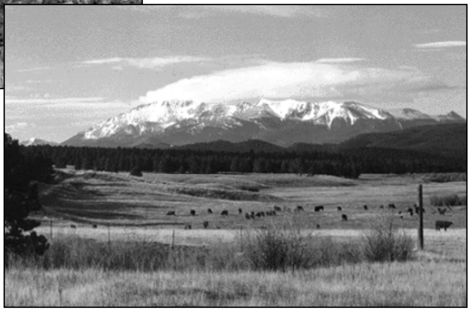
The Southwestern Borderlands EM project is located in SE Arizona and SW New Mexico, encompassing nearly a million acres of relatively unfragmented landscape. It supports exceptional biological and geographic diversity, particularly in terms of natural plant communities – from semi-desert grasslands and woodlands to mixed conifer forests. Developing methods of restoring natural processes and sustaining the health and productivity of plant communities is critical to preserving local rural economies and social structure. The project's work can be extended to adjacent areas of Mexico. International regional conferences on the Borderlands have been held in collaboration with University of Arizona and University of Sonora, Mexico. Scientists are synthesizing existing knowledge on the following: 1) the role of human and natural disturbances on plant communities, 2) wildlife, 3) pre- and early history, and 4) watershed research. An annotated bibliography for the Madrean biogeographical province (available on the RMRS web site) is being created. They are also developing a comprehensive landscape inventory and monitoring system useful to both researchers and land managers, including creation of a geo-referenced archive of research records at the Santa Rita Experimental Range, the oldest such station in the U.S. Finally, researchers have defined specific studies (cultural, fire, vegetation, archeological, and riparian) and field experiments to provide information critical to sustaining rural economies and Borderlands landscapes.



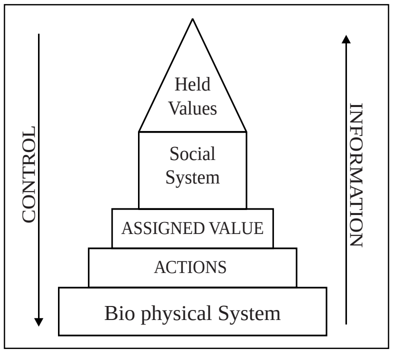
View across Cottonwood Basin reveals the Maverick Prescribed Burn area located in the southern Peloncillo Mountains of southeastern Arizona and southwestern New Mexico. Photo by Gerald Gottfried.

Colorado Front Range Ecosystem Management Research Project

The Colorado Front Range Ecosystem Management Research Project addresses ecosystem management issues generated by a rapidly growing human population, complex fragile biophysical communities, and diverse socio-economic systems. Stretching north to south along the east face of the Front Range lie the metropolitan areas of Fort Collins, Denver, Colorado Springs, and Pueblo. Much of this area includes extensive wildland-urban interface forests (predominantly ponderosa pine). Scientists at the Manitou Experiment Forest have constructed fire history records dating back to the 1200s and discovered old growth stands containing many 400+-year-old trees. Researchers are also collecting ponderosa seedling establishment data in order to develop viable prescriptions for increasing stand fire resistance. Improving forest health along the Front Range requires reducing catastrophic disturbance risks, including wildfires and bark beetle infestation, in ways that are effective and acceptable to humans. Researchers have developed a unique hierarchical model of collaborative ecosystem management, which incorporates public interests and desires into the decision-making process since resource management is a **human** action, motivated by human desires, and driven by human values.



View of Pikes Peak from the Manitou Experimental Forest Lodge in Colorado. RMRS Headquarters are located in Ft.Collins, CO. Photo by Wayne Shepperd.



The Hierarchical Model of Collaborative Resource Management

"A Look to the Future"

Greg Jones, Program Leader
RMRS, Bitterroot Ecosystem Research Management Project

As we turn the calendar to Y2K, the Bitterroot Ecosystem Management Research Project (BEMRP) embarks on the second year of its new 5-year charter. In these five years our mission is to strengthen the scientific theory and practice of managing Rocky Mountain ecosystems at the landscape level in the context of social, economic, and ecological opportunities and constraints. We've adopted five objectives to implement this mission:

1. Understand and manage changes within the landscape by developing and integrating vegetation, fauna, and aquatic information. Understanding these relationships provides much of the basis for ecosystem management. We have learned lots about disturbance dynamics of historical ponderosa pine and pine-mixed conifer forests and how to apply different silvicultural and burning prescriptions to restore a semblance of natural conditions and processes at the stand level. We now shift to evaluating impacts of landscape-level treatment options on native vegetation, exotic weeds, and fauna. We are also changing the focus from low-elevation, dry sites to disturbance dynamics of mid- and high-elevation forest types. Finally, research will address the historical range of variability and dynamics of riparian areas, as well as associated faunal relationships.

2. Increase the efficiency of landscape analyses and assessments, adaptive management, and monitoring by developing integrative models. Implementing ecosystem management involves conducting assessments at various scales and analyzing management alternatives. When viewed at multiple scales, processes of landscape change become difficult to analyze without modeling. Additionally, models, because they require specific data relating to specific processes, inform us which data are most useful to gather and the level of precision at which these data will be useful. Future research will 1) investigate data problems associated with landscape analysis, 2) propose and test possible solutions, and 3) increase integration of landscape change measurements with aquatic systems, wildlife, and social objectives. Other efforts will address data problems associated with landscape analysis and streamline the use of landscape models to make them easier and cheaper to apply.

3. Propose and test potential solutions to social, administrative, and environmental barriers to implementing ecosystem management. Much has been learned about ecosystems, natural processes, and forest health, but there are still too few examples of putting what we've learned into practice on the ground at scales that effectively address restoration needs. First, national forest managers and researchers will identify, describe, understand, and prioritize barriers to implementing ecological treatments in the Bitterroot River watershed. Next, research will be used to enhance understanding of barriers, if necessary. Then, possible solutions will be examined in a cooperative effort involving national forest managers, researchers, and the public.

...our mission is to strengthen the scientific theory and practice of managing Rocky Mountain ecosystems...

Greg Jones, left, Program Leader, Bitterroot Ecosystem Management Research Project, discusses restoration in Sawmill Creek Research Natural Area with field trip participant, Vince Novotny. Photo by Steve Slack.

BEMRP's future promises a rainbow of new studies and knowledge. Photo by Milo Burcham.

4. Explore collaborative management across landscapes of diverse ownerships and land-use classification. Many important ecosystem processes and relationships transcend ownership boundaries. For example, efforts to improve stream conditions must cross ownerships to be most effective. Needed are effective techniques, approaches, and tools for facilitating collaborative management with willing partners across ownerships and land use classifications. Collaborative planning research will 1) review results from past collaborative management efforts across ownerships and land-use classifications, including a review of literature and local efforts; 2) identify and assess issues that transcend ownership boundaries in the Bitterroot Valley; and 3) propose and facilitate collaborative assessment of one or more selected areas.

5: Develop and assess techniques for technical communication among researchers, managers, and the public. Communicating research results has been emphasized in past BEMRP efforts. Some approaches have been successful, but often the audience was limited or timing slower than desired. Techniques are needed to rapidly communicate what we learn to a diverse group of interested parties: managers, landowners, scientists, interest groups, and the general public. We will identify promising approaches to information transfer and examine how well these approaches address communications needs for interdisciplinary, collaborative research and management. A literature review, together with studies of other organizations and emerging technologies, will provide potential models.

Agencies Within Communities, Communities Within Ecosystems

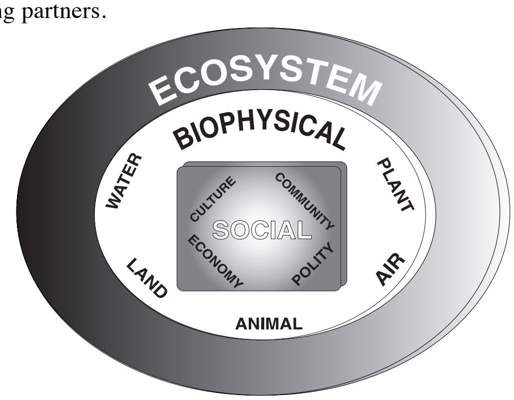
Jane Kapler Smith, RMRS, Fire Effects Research

If people have plenty of scientifically-based information and plenty of opportunities to learn about one another and the environment, then will they eventually reach consensus on goals and practices for wildland management? In a presentation at the Bitterroot Ecosystem Management Research Project symposium, Jane Kapler Smith (RMRS) and Kerry McMenus (Northern Region) suggested that this question has guided the Project's human dimensions program.

Five years of research and communications show that the answer is "not necessarily." Where people's values differ greatly, consensus is not a realistic goal for short term planning. What are some realistic goals and measures of success? Success has many dimensions in public involvement. Agreement is important, but a project is at least partly successful if all stakeholders are identified and included, if relationships among participants are enhanced, if *all* participants (managers, researchers, and members of the public) learn from one another, and if public input is used to improve management plans and practices. On-the-ground results— which can be viewed, evaluated, and used to improve future work— are another important aspect of success.

Agencies must continually work toward increased participation and mutual understanding among partners. How can agency staff improve this process? Based on the research and experience of the past five years, Jane and Kerry made these suggestions:

- Accept tensions within communities. Tensions are forces that contribute to balanced decisions. Agency outreach and actions can benefit from them but cannot make them go away.
- Think and work within the local community. Think like a member of the community, considering land management issues as extending across time, not consisting of single projects. Learn about community members' values and address them in management choices. Use the infrastructure of the local community to involve the public.
- Invest energy in long-term relationships with community groups and members of the public. Search for ways to include newcomers. Positive relationships with neighbors help agencies develop sound local management practices.
- Keep track of what is learned and use it! Use a variety of communications methods. This newsletter is one. Personal contacts, public meetings, field trips, educational programs, Web sites— all of these methods share knowledge and help maintain relationships among partners.



Agencies operate as part of social systems, which operate as part of ecosystems. Social systems have components and organization, just as ecosystems do. Like ecosystems, social systems change constantly, have limits to the change that can be survived, and are sometimes unpredictable!

The Economics of Ecosystem Management

Many of the approximately 40 million acres of ponderosa pine/ Douglas-fir forests in the western United States would benefit from treatments to improve ecosystem conditions. University of Montana researchers Carl Fiedler (Forestry) and Chuck Keegan (Business) conducted cooperative research funded through BEMRP on the economics of restoring such forests. In their talk at the Spring 1999 BEMRP Symposium, Fiedler and Keegan stated their research objectives were to 1) develop and evaluate alternative prescriptions for restoring stands to a desired ecological condition and 2) determine the potential value of forest products removed under each prescription to underwrite treatment costs.

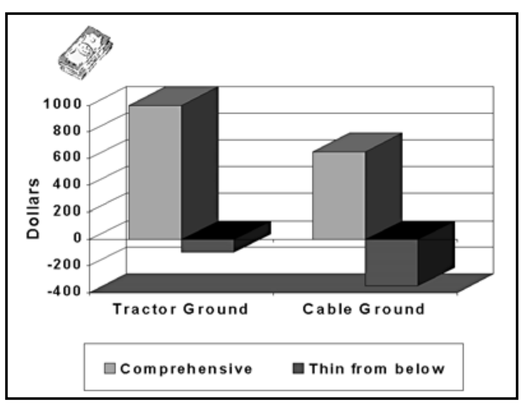
Fiedler and Keegan began by analyzing inventory records to quantify high hazard stand conditions. This effort provided a composite (average) stand possessing the following characteristics: 1) species composition - ponderosa pine/Douglas-fir, 2) 100 trees per acre 7-24" dbh (diameter at breast height), 3) 550 trees per acre less than 7" dbh, together with 120 square feet of basal area, and 4) presence of significant quantities of ladder fuels. Subsequently, they developed two stand restoration prescriptions in consultation with other ecologists and silviculturists:

1) The "comprehensive" prescription included: a) a modified selection cut designed to reduce basal area to 40-50 square feet, encouraging regeneration of ponderosa pine, b) a low thinning to reduce ladder fuels, and c) an improvement cut to remove most fir and other low-quality trees.

2) The "thin-from-below" prescription entailed cutting most trees up to 9" in diameter. For each prescription, the researchers then calculated a net worth of wood products removed and delivered to a mill (minus harvest and hauling costs) for trees >5" dbh.

Results indicated the comprehensive restoration treatment was superior in terms of ecological, financial, and employment benefits. The comprehensive restoration prescription more than paid for itself through the timber products produced. Ecosystem restoration generated a positive net value in terms of revenues, employment, and wages. When managers opt for comprehensive restoration treatments, the potential exists not only to sustain but even boost employment in the forest products industry. For example, comprehensive restoration treatments provide more wood products for processing and require more highly trained employees to design and implement the treatments. Keegan explained that some of the highest paying jobs in the inland rural west are found in the forest products industry.

The researchers offered some helpful hints for resource managers. First, analyze both the reasons for doing a treatment and the expected outcomes. Second, understand the economics of timber product values, markets, and harvest system costs. Prescriptions should be specifically designed to develop desired conditions (not just reduce fire hazard over the short-term), since no one size fits all. Finally, managers choosing stands most in need of treatment are likely to realize positive net benefits both economically and ecologically.



Net value per acre for the comprehensive prescription compared to the "thin from below" prescription on both tractor and cable ground.

Social Context:

Reaching a Sociological Maximum in the Bitterroot Valley

Historically, the human dimension has been difficult to characterize in natural resource management and research. This is an interesting artifact considering humans alone provide meanings to ecosystems by conceptualizing, defining, and manipulating them. One must gather, assess, and apply information on the social system as part of a greater effort to manage and restore ecosystems. For the past five years, BEMRP has been engaged in human dimension research centered on social context (setting) and communications (public involvement and public information). While developing a valuable profile of residents, communities, institutions, and processes making up the Bitterroot social system, researchers have documented significant change in the Valley's human dimension.

Bitterroot flower. Some things never change in the beautiful Valley named for this flower. Photo by Danny On.

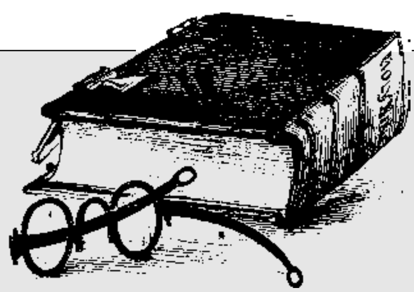
In a nutshell, the Bitterroot Valley social system is in the midst of its own kind of "health crisis." Fueled by 30 years of rapid growth, Ravalli County is the fastest growing county in Montana. The Valley is reaching a kind of sociological maximum as its heretofore-agricultural communities transform into more urban-like communities whose needs stretch existing infrastructure. Subdivisions are all-pervasive. Water quality is diminishing, and air pollution is growing. The county's rapid growth has been turning a once homogeneous culture into a conglomeration of diversified cultural groups whose differences have played out in value conflict over planning and other social policies. Community cohesiveness has declined significantly. The traditional sense of neighboring has also diminished in the wake of time-consuming commutes for work and recreation, together with a declining agricultural economy.

Can the Bitterroot ecosystem be restored to some historic range of variability? Restoration of ecosystem health poses a challenge because the social context in which biophysical systems were historically managed has been drastically altered. Viewed in the framework of social life even 40 years ago, today's population density and land use patterns would be unthinkable. Ironically, research indicates many newcomers hope to resurrect a historic set of pastoral, agrarian values and lifestyles.

Interestingly, the one value shared by old-timers and newcomers alike (albeit for different reasons) is a strong attachment to the natural environment. This appears to be one of the few forces preserving a historic sense of community, an effort that simultaneously binds residents together and tears them apart.

The interdependence between the human and biophysical dimensions is dynamic and variable over time and desired conditions always a moving target. Residents must concur that all natural resource management involves some degree of social tradeoff if they are to sustain the very environment most claim to be a major reason they live in the Bitterroot. This social reality makes BEMRP human dimension research a critical component of efforts to understand the total ecosystem. Since changes in the Valley's ecosystem, including the human dimension, have occurred over a 100-year period, restoration will likewise be a lengthy process. Only by understanding all dimensions of ecosystems can we gradually bring about a healthy, sustainable forest environment for all life in the Bitterroot Valley.

Book Corner



A Review of *Nature and the Human Spirit: Toward An Expanded Land Management Ethic*

By Perry J. Brown, Dean
School of Forestry, University of Montana

Ecosystem management suggests large-scale, integrative, and collaborative management. It further implies that management must be responsive to all with an interest in the land since they are part of the system. *Nature and the Human Spirit* directly addresses this issue by bringing many voices to our consciousness.

Over the past century many more voices have become enfranchised as we have moved from a small elite setting direction for land management, particularly public land, to listening to the ideas and concerns of a broadened array of interests. The constituency for land management continues to expand as we embrace the voices of more cultures and more people.

In *Nature and the Human Spirit,* Bev Driver and his co-editors allow us to sample many perspectives on the nature and meaning of land and natural resources. We hear from Philosophers, Economists, Sociologists, and Psychologists and, more importantly, from Native Americans, African Americans, Hispanics, and others who perceive the land differently from each other. We also hear from those with economic ties to the land as well as from those who see land in aesthetics and spirituality.

There exists a great plurality of land connections in America, and these give managers many opportunities for listening and learning about the land and its people. Land managers need to understand more clearly how different kinds of citizens define and relate to land and natural resources and how diverse groups satisfy their needs from the land. The chapters of this book give a glimpse into what others think and give voice to their perceptions and concerns. It suggests land has deep meaning to individuals and groups in society, it suggests there are many meanings and many connections people have to land, it suggests a sense of place is critical in understanding the relationships of people and land, and it suggests there are culturally diverse associations with land that must be recognized.

Reading through *Nature and the Human Spirit* will enlighten and inform. It gives us much to ponder and a lot to build into our conceptions of ecosystem management. It brings to light many hard to define values about land and natural resources, and it stimulates the mind to consider that land does enhance the human spirit.

Driver, B.L., Daniel Dustin, Tony Baltic, Gary Elsner, and George Peterson, editors.1996. *Nature and the Human Spirit: Toward an Expanded Land Management Ethic.* Venture Publishing, Inc. State College, PA. 467 pages.

Historical Perspective on Ecosystem-based Management

Stephen F. Arno
RMRS, Retired

Historically, ponderosa pine-dominated forests were widespread, covering more than 40 million acres in the Western U.S. During the1800's, forests in the Bitterroot Valley and many other areas of the inland Northwest were dominated by large "yellow pines," a term applied to old growth ponderosa pine. Yellow pine commonly grew in open stands as a result of frequent low-intensity fires that thinned out small trees and undergrowth. Some landowners, notably timber companies in California, practiced "light burning" in these forests to clean out underbrush and logging slash and to improve forage for livestock. However, the newly established profession of forestry considered fire damaging and unnecessary. Many people who were concerned about forests did not realize fire was a natural part of the ecosystem. They attributed all fires to human carelessness. The fledgling profession of forestry had been developed during the 1800's in humid regions of Europe, where fire was not known to have a natural role, and these concepts of forestry were brought to America. However, the principal concern of European foresters was re-establishing trees on lands that had been largely denuded for centuries, a much different application of forestry than was called for in the vast, natural fire-dependent forests of western North America.

Old Growth Ponderosa Pine. Photo by Pete Stickney.

In 1899, Gifford Pinchot, first chief of the U.S. Forest Service, published a detailed essay on fire in *National Geographic*. He recognized fire was a key factor in creating many of the magnificent Western forests and urged study of fire's ecological role. Not much came of this suggestion. After disastrous wildfires struck the forests of northern Idaho and northwestern Montana in 1910, the Forest Service (Pinchot having resigned for other reasons) led a campaign to eliminate fire, including "light burning," from all forests.

In the 1930's biologists and landowners convinced the Forest Service to allow controlled burning for maintaining pine plantations in the Southern states. In 1943, Harold Weaver, a government forester for Indian reservations in the West, published an article in the *Journal of Forestry* advocating controlled fire in management of Western ponderosa pine forests. Over the next 30 years, many other foresters and biologists came to support this viewpoint. They argued that even the most progressive kinds of harvesting and thinning were not an adequate substitute for natural fire, which had killed primarily the smaller, weaker trees, consumed excess fuels, and recycled nutrients.

Meanwhile, the mission of attempting to eliminate fire had become popular with much of the public and was entrenched in most land management organizations. Nevertheless, despite improved suppression technology and escalating expenditures, by the 1970's more and more large, severe wildfires were occurring. Congressional inquiries into these problems led to adoption of a new fire policy that called for integration of prescribed fire and fuels management in western forests.

This is some of the historical background that led managers to try ecosystem-based management in Western forests. In hindsight, it might have been easier to achieve EM. had light burning been allowed to continue. By the late1900's the structure of ponderosa pine forests had changed dramatically, with thickets of small trees, often firs, and a buildup of dead fuels. Now thousands of new homes are situated in dense forests, and concerns about smoke from prescribed fire is another relatively new major problem. Modern forest conditions often make it necessary to remove some excessive trees to restore less hazardous stand structures before fire can be returned as an ecological-based treatment.

"What Do You Mean By That?"

Have you ever wondered about the meaning of word treasures like model, collaboration, or transect, which appear in Eco-Reports and other EM publications? Beginning in Y2K, the BEMRP web page (url address=www.fs.fed.us/rm/ecopartner) will be upgraded. One addition will be an expandable glossary of unfamiliar terms. If you do not have Internet access or would like a hard copy of the forthcoming glossary, please contact the Eco-Report editor at 542-3248. You might also suggest new words you'd like added. Here is a preview of some of the words planned for the initial glossary.

BEMRP – Bitterrot Ecosystem Management Research Project.

COLLABORATION – a coalition of diverse people with diverse values and expectations working together at the community level to solve problems.

MODEL – a simplified representation of an aspect of the real world that contains the important features of real "life" for making predictions.

PARTNERSHIP – a voluntary, mutually beneficial and desired relationship entered into by two or more person(s) or group(s) to accomplish mutual objectives.

TRANSECT – a straight line of a given length containing study points located at specified distances.

New Publication Available

Eighty-Eight Years of Change in a Managed Ponderosa Pine Forest is edited by Helen Smith and Steve Arno. Follow the trail of the ecological changes in a ponderosa pine forest through a series of repeat photos taken over 88 years. Publication includes commentary by 19 contributing authors. Get your copy now by writing to Rocky Mountain Research Station, 324 25th Street, Ogden, UT 84401. You may also call 970-498-1392.

Smith, Helen Y.; Arno, Stephen F., eds. 1999. *Eighty-eight years of change in a managed ponderosa pine forest.* Gen. Tech. Rep. RMRS-GTR-23. Ogden, UT: U.S. Department of Agriculture, Rocky Mountain Research Station. 55 p. + 14 foldout photopoint pages, one poster.

The Bitterroot Controversy — A View from the Inside

Orville L. Daniels
USDA, Forest Service, Retired

I became Supervisor of the Bitterroot National Forest in 1970, during the height of the Forest's management controversy. Arriving then gave me the opportunity to be analytical about its cause and implications. I would like to share my personal observations and conclusions rather than attempt any broad agency perspective.

When I arrived on the Forest, the debate raging was the same one that exists today — how should the national forest be managed and for what purposes. The basic argument was over commodity versus amenity values of national forests, essentially, who was to get their desires and needs met by the way the Forest was managed. This was an era in which people were beginning to express discontent with forest management on a national level. There were five other national forests experiencing the same types of controversy as the Bitterroot. Within the context of this national debate, there was a significant consensus among local people. The rate of change taking place on the ground was too much, too fast, and unacceptable to the preponderance of local citizenry.

Clear-cuts were appearing on mountainsides, terracing was occurring on steep slopes, and roads were constructed or proposed into large blocks of undeveloped country, as well as along the Bitterroot face. Within the first few months, I heard from bankers, loggers, lawyers, business people and ordinary citizens, who were all dissatisfied with changes taking place within the Forest.

The cause of this rapid change was a combination of purposeful agency decisions in response to national demand for wood products and the influence of natural events. After decades of custodial management during which only low elevation ponderosa pine stands were managed, the Forest began selling timber in mid-elevation mixed conifer and higher elevation lodgepole types. Numerous sales were planned and sold but before they could be cut, two large fires (Saddle Mountain and Sleeping Child) burned over 30,000 acres of the same timber types. These fires were so significant that fears of future fires began influencing land management decisions.

The Forest started a massive road building and salvage effort within the burned over areas. Moreover, it began building road systems and selling timber to create fuel breaks that would help prevent the spread of future large, destructive fires. I recall one clear-cut that was planned to average one half mile wide and eight miles long.

The combination of sales sold prior to the fires, salvage sales, and fuel break sales quadrupled the timber harvested from slightly over 20 million to over 70 million board feet within two years, a practice which continued for nearly a decade. This massive and rapid impact on the forest was simply too much for people in the valley.

Other contributing factors of the Bitterroot controversy were numerous and extremely complex. Various groups and individuals played important roles in creating notoriety for the Forest. Environmental groups had national agendas, politicians had political agendas, and the University of Montana played a significant role. Pressures from the Administration factored into the situation, and ultimately policies and attitudes within the Forest Service played a part as well. I have chosen to focus on the underlying cause because I believe the most significant lesson to be learned from the Bitterroot controversy is we first and foremost must have the support and understanding of local people.

Orville Daniels was Supervisor of the Bitterroot National Forest at the height of the Bitterroot Controversy.

Public Involvement Efforts of Yesteryear

Early Attempts at Stevensville (1944-1965)

Charles McDonald was Stevensville District Ranger from 1944 to 1965. Photo by Jane McDonald.

Public involvement developed at the Stevensville Ranger District more than 50 years ago. District Ranger, Charles McDonald ("Mac"), supported by Bitterroot Forest Supervisors Guy Brandborg and Thurman Trosper, implemented a District-based public education program in the 1940s.

An early day ecosystem-based manager, Mac took his job as District steward seriously. Intent on developing a citizen-based forest stewardship ethic, he believed education was the key. He devoted his public career and private life to educating others on topics ranging from noxious weeds, wildflower identification, erosion, overgrazing, silvicultural practices, and fire suppression (like others of that era, he believed in fire suppression because of public safety and the need for a reservoir of standing timber). Mac accomplished his education program three ways: presentations to groups, "show-me" trips (field trips), and casual conversation.

He actively sought the public out as they did him. He was the featured speaker at community service organizations, schools, and university classrooms. However, he also gathered students and others around him for ad hoc presentations. If he wasn't providing formal lectures, Mac was conducting "show-me" trips to study plantations and other District sites. For example, busloads of University of Montana students routinely picked up Ranger Mac and together with their professors he guided them through the forest, delivering a curriculum rich in ecosystem-based teaching.

Mac's educational efforts extended beyond the Bitterroot Valley. For example, he conducted seminars for teachers and other professionals at Yellow Bay on Flathead Lake. At the national level, Mac

(continued on page 11)

The Bitterroot Controversy — Revisited

Dale A. Burk
Author and Publisher
Stevensville, Montana

As we open a new millennium, a fundamental reality faces resource managers who come to the Bitterroot National Forest. They inescapably walk in the legacy of the Bitterroot Controversy. The Forest and its inherited "Controversy" are writ-large in the annals of U. S. natural resource history.

Like their predecessors, today's Bitterroot land managers function in a spirited setting of contending public land ideologies which drives the pervasive, never-ending public scrutiny of almost every detail of forest management. Sanctioned public oversight of what takes place on citizen-owned forest lands is basic to the forest land management process.

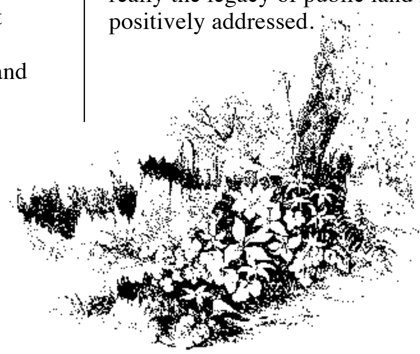
As an outside, intimate observer during, and after, the "Bitterroot Controversy", it's my judgment that adjustment of management practices, including demands for reform, has been painful. It has been tortuous at times and only partially fulfilled, despite new laws and constant personnel changes. That, too, is part of an uneasy legacy.

That legacy contains many parts, but a few have overriding significance. They are best stated in the famed "Bolle Report," (so-called because the issuing committee was chaired by UM Forestry School Dean, Dr. Arnold Bolle), "A University View of the Forest Service By a Select Committee of the University of Montana," released November 18, 1970, by U.S. Senator Lee Metcalf. Its major points are central to the "forestry issue" on the Bitterroot today. According to the Report:

While a reporter for the Missoulian*, Dale Burke, author and publisher, provided news coverage during the Bitterroot Controversy. Photo by Billie Linkletter.*

> "Multiple-use is stated as the guiding principle of the Forest Service. Given wide lip-service, it cannot be said to be operational on the Bitterroot Forest at this time. A change in funding to increase considerably the activities in nontimber uses would help, but could not be effective until legislative and executive emphasis is changed. But even with this modification the internal bureaucracy of the agency and the lack of public involvement in decision-making make real change unlikely. As long as short-run emphasis of timber production overrides long-run (and short-run) concern for related uses and local environmental quality, real change is impossible and the outlook is for continued conflict and discontent."

Since part of the Bitterroot Forest legacy has been "continued conflict and discontent," one must ask whether the Bolle Committee's statement was not both insightful and prophetic. That's why, I believe, despite controversy over public involvement at last spring's Symposium, the Symposium itself, "Bitterroot Ecosystem Management Research Project: What We Have Learned," lends hope to the cause. One Bolle Committee finding, directly manifested in the work presented at the Symposium, stated: "The research basis for management of the Bitterroot National Forest is too weak to support the management practices used on the forest." That, in large measure, is a part of the legacy that is being addressed in strong, positive fashion as evidenced at the Symposium. The more that is done, with research findings placed squarely and truthfully into the public arena, the more likely will all aspects of the Bitterroot Controversy legacy, which is really the legacy of public land forestry, be positively addressed.



Public Involvement *(continued from page 10)*

escorted conservation group directors and magazine editors, including the editor of Sunset Magazine, on pack trips into the heart of the Selway-Bitterroot Mountains. Astride a horse, alongside a stream at lunchtime or hovered over a campfire reflecting on a rocky cliff, they learned about intricacies of their natural environment from Ranger Mac. Forming life long friendships with him, they returned to their urban offices, publishing articles conveying his stewardship message to a national audience. His public involvement efforts in education led to his receipt of the American Motors Award for outstanding conservation work in 1962.

After he retired, Mac continued his public education efforts through summer Wilderness Living Classes. He taught his students the lore of wilderness riding, packing, and cutting out trails, together with backcountry ecology and geology. For Mac, public education was a way of life. He wanted people to understand and value the forest and grasslands he loved so that they would be preserved for posterity. Ranger Mac had many aliases, including "Tree McDonald." Some said, "If you cut him he'd bleed green." Mac was Forest Service through and through. He practiced a lifestyle of public involvement. It was his life.

Stevensville schools show-me trip conducted by Ranger Charles McDonald in 1951. Photo by Charles H. McDonald.

On the Move: Recent Happenings in Vegetation Research

Colin C. Hardy
RMRS, Fire Effects Research

Scientists either directly or indirectly associated with previous Bitterroot Ecosystem Research Management Project (BEMRP) vegetation studies continue to pursue both fundamental and applied vegetation research projects in the interior West. Most of the "recent happenings" in vegetation research relate to restoration of forested ecosystems, including activities in whitebark pine, lodgepole pine, old growth ponderosa pine, mixed conifer canyons, and fir-dominated riparian areas (figure 1).

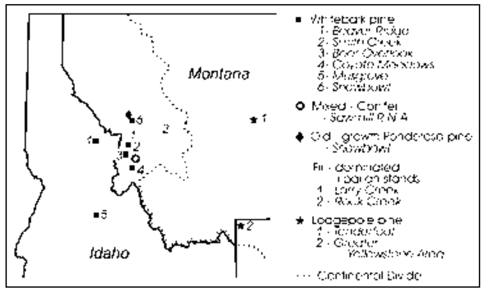


Figure 1—Vegetation research is taking place in five different vegetation types in the interior Northwest.

Whitebark pine—Two RMRS scientists are currently working in the high elevation whitebark pine forest type. Ward McCaughey, Research Forester at the Bozeman Forestry Sciences Laboratory, has several studies evaluating regeneration and plantation success of whitebark pine on high elevation sites in the Greater Yellowstone Area ecosystem. Research Ecologist Bob Keane (Missoula Fire Sciences Laboratory) is investigating silvicultural and prescribed fire methods to restore declining whitebark pine ecosystems in the northern Rockies. Keane's current research effort involves six sites in western Montana and central Idaho.

Lodgepole pine—McCaughey and Research Forester Colin Hardy (Missoula Fire Sciences Laboratory) are co-principals for an extensive, multiple treatment study on the Tenderfoot Creek Experimental Forest in central Montana. Various combinations of four treatment regimens are being imposed among eighteen separate blocks: prescribed fire only, a silvicultural cutting design called "shelterwood with reserves" with both even and grouped retention (figure 2), harvesting followed by prescribed underburning, and no-treatment controls.

Old-growth ponderosa pine—Mick Harrington, Research Forester from the Missoula Fire Sciences Laboratory, is conducting a restoration project in stressed, 320 year-old ponderosa pine and larch near Missoula. He is comparing five treatments, including cutting and several burning options in Douglas-fir thickets as well as removal of some old trees to allow pine and larch regeneration (see article on page 13).

Restoration of mixed-conifer forests—Harrington is also the principal investigator for a restoration project at the Sawmill Research Natural Area on the Bitterroot National Forest, where small diameter Douglas-fir have been cut and piled for burning beneath old growth and younger ponderosa pine. Some larger firs were also girdled to relieve competition. Invasive weeds have been treated, and subsequent tree and understory response to the integrated treatments will be monitored.

Riparian area restoration—A comparison of vegetation response to cutting and burning of grand fir thickets is being made by Harrington along two streams in western Montana. Final, 2nd-year post-treatment measurements have recently been completed.

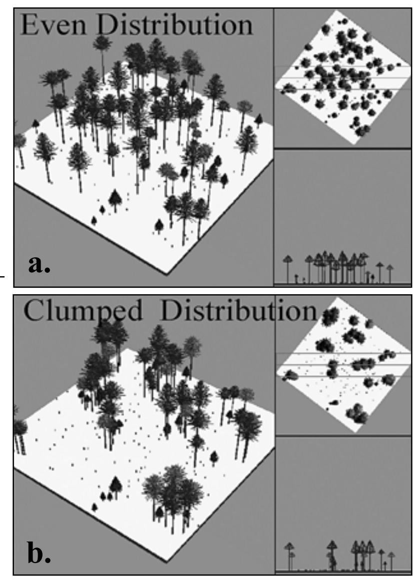


Figure 2—The two-aged silvicultural prescription, called "shelterwood with reserves," will retain 50 percent of the basal area in two different distributions—even (a) and grouped (b).

Fire and Silviculture to the Rescue

For some it might appear strange that fire **and** silviculture are used to return altered forest ecosystems to healthy presettlement conditions. We have been conditioned to believe these processes assault forest ecosystems rather restore their health. However, research forester Mick Harrington (RMRS, Missoula Fire Sciences Lab) and his colleagues assert both constitute a valid approach to system restoration and sustainability.

Because fire was historically a key disturbance factor in Northern Rockies forest ecosystems, its 20th century exclusion has produced unnatural conditions, including massive fuels buildup, loss of habitat, and extreme site stocking. Currently, fuel conditions prevent fire alone from returning these ecosystems to their desired presettlement conditions. How then does one obtain a healthier forest ecosystem and a reduction of fire hazard? Research has shown that one way to mitigate forest health problems is to use some form of mechanical treatment followed by prescription fire.

Researchers use prescribed underburning to restore riparian vegetation at Larry Creek. Photo by Mick Harrington.

Mick Harrington and his associates have conducted forest health restoration projects for more than 12 years. Usually, these involve some form of harvesting to prepare sites for fire treatments. "We have broken new ground and are working in controversial areas people have avoided in the past because of the controversies," said Harrington. For example, he and others are conducting riparian restoration treatments, applying mechanical activities (cutting), and then fire. Harrington explained that fire has been an historic disturbance in riparian as well as in upland areas. Because of fire's exclusion in riparian areas, a species shift has occurred which is detrimental to riparian ecosystems in general. Researchers aim to study ways of restoring riparian areas to a more sustainable condition for the vegetation and wildlife that live there. However, they want to be sensitive to the fragile nature of stream-side ecosystems.

Harrington explained that often researchers apply a treatment and measure the first or second year effects, never to return to examine the more subtle, important changes, which occur during the next decade such as new plants, tree mortality and growth release, soil changes, and the like. Since few long-term forest restoration studies have been published, Harrington plans to maintain his monitoring studies for the long-term. Fire and silviculture to the rescue!

Ameliorating Unhealthy Forest Conditions

Four distinctive types of deteriorating forest health conditions led BEMRP researchers Mick Harrington and Steve Arno (recently retired) to implement restoration studies combining the use of fire and silvicultural treatments. Study sites are located on the Bitterroot National Forest at Lick Creek, Fred Burr face, Sawmill Creek Research Natural Area (RNA), and Larry Creek as well as Snowbowl on the Lolo National Forest.

The Lick Creek Demonstration Forest site exemplifies the first condition. Initially harvested in 1909, this second growth ponderosa pine stand has more than 80 years of photographic records, making it a monitoring dream. While fire scars indicate natural fires returned to Lick Creek every seven years on average, historically, the last wildfire occurred in the late 1800s. These stands evidence deterioration in terms of 1) tree density and species composition, 2) deterioration of understory vegetation, and 3) loss of larger trees because of competitive stress and past cutting practices. Silvicultural and fire comparison treatments have been applied to 15 different units. Harrington noted Lick Creek has the honor of attracting the most interest in terms of visibility and visitation.

The Fred Burr site demonstrates the second condition being studied. It is a second growth stand more advanced successionally than Lick Creek. Prior to the early 1900s, ponderosa pine dominated this stand. However, because of harvest and fire exclusion, most of the site has been taken over by Douglas-fir displaying a multitude of forest health problems. Small comparative sivicultural treatments (logging with dozers, skidders, farm tractors, and horses) were applied side by side and all underburned together with an uncut control unit of similar size. The project began in 1995, continued with logging in 1996, and underwent burning in spring, 1997.

Old growth stands comprise the third condition under study. Two similar old growth areas, Snowbowl and Sawmill, are under restoration. At Snowbowl (see photos at bottom of page), research involves restoring old growth ponderosa pine and western larch. Most of the existing old growth trees are 280-320 years old. The stand is uncut and experienced a fire frequency of 20-year intervals prior to 1919. Since then, Douglas-fir (historically always a small part of the stand) exploded in numbers, placing much competitive stress on the old growth pine and creating excess ladder fuels. Restoration treatments began in 1998. In one treatment all Douglas-fir were cut, piled and burned. In another treatment all fir were cut and broadcast burned in place. In some places old growth pine and larch were harvested to open up the stands for successful regeneration of shade intolerant pine and larch.

I think the demonstration part allows people to observe, and then they can make their own judgment about what they like and don't like.

Old growth restoration at Sawmill Creek RNA differs from Snowbowl because a grassland adjacent to the forest is also being restored. Mechanical, on-site treatments at Sawmill have included cutting and piling all the Douglas-fir, which were burned in November 1999. A broadcast burn covering the grasslands in forested canyons is scheduled for 2000.

Larry Creek Riparian Project provides the fourth condition under study. Although fire intervals are longer in riparian areas, fire exclusion has, nevertheless, caused dense stocking of grand fir, resulting in exclusion of shrubs and deterioration of riparian vegetation. Researchers believe removing the overstory of grand fir, allowing more sunlight, space, nutrients, and moisture for seral species, will benefit the site the most. Several comparative treatments to accomplish this goal were accomplished as a part of a University of Montana masters degree project directed by Harrington.

Harrington believes research, as shown in these projects, is a valuable tool that forest managers can use to give a more scientific basis for treating unhealthy stands prone to severe fire. The most important aspect of restoration projects lies in their demonstration value:

"I think the demonstration part allows people to observe, and then they can make their own judgment about what they like and don't like. We do have to proceed cautiously and deliberately, but the worst thing we can do is not do anything. We won't be able to keep fire out of these stands entirely in the long run."

Pre-treatment (a)

Post-treatment (b)

Pre- (a) and post-treatment (b) conditions at the Snowbowl old growth site showing the effects of slashing and piling of fir for prescribed burning. Photos by Mick Harrington.

Understory Burning Gets the Job Done

Janie Canton-Thompson, RMRS, Eco-Report Editor
Dave Silvieus, Bitterroot National Forest

Understory burning in a ponderosa pine/Douglas-fir habitat type improves pine stocking and reduces wildland fire threats. Photo by Mick Harrington.

This past spring, during April and May, Stevensville Ranger District completed 1,300 acres of underburning in Silverthorn, Gash, Fulkerson, and Smith Creeks. The need for understory burning in these locations was identified in the Stevensville West-Central Environmental Assessment. Directed by Project ID (Interdisciplinary) Team Leader, Dave Silvieus, and District Fire Management Officer, Bruce Windhorst, forest staff ignited burns in ponderosa pine/Douglas-fir habitat types with three purposes in mind.

First, these areas have become overstocked with Douglas-fir, primarily because of fire exclusion. Many of the firs are infected with dwarf mistletoe. Killing Douglas-fir thickets will improve ponderosa pine stocking, protect old growth trees, and stimulate pine growth, which has been retarded in the absence of fire. Second, the underburning will help alleviate fire threat in the wildland-residential interface by reducing fuels near the forest boundary. Third, firefighter safety will be fostered by reducing ground and ladder fuels, which, in turn, should decrease the spread and intensity of potential future wildfires.

Managers intend to continue restoring some of these lower elevation areas where it is ecologically appropriate and compatible with other resource and social objectives. These prescribed fires will attempt to achieve more historic conditions where forest health was sustained by periodic natural underburning.

The Virtues and Travails of Whitebark Pine

Whitebark pine occupies a habitat visited by few but the hardiest outdoor visitors. This “keystone” species is the centerpiece of the valuable, upper subalpine ecosystems of the northern Rocky Mountains and Cascades. Historically the dominant species in the Northern Rockies upper elevation zone, today whitebark pine becomes obvious to sojourners only at the higher end of its former range, near timberline.

The virtues of whitebark pine are legion. For example, it protects snowpack by delaying snowmelt through shading the ground. Its presence also helps prevent steep slopes from eroding, a threat during rapid snowmelt. Whitebark pine communities provide critical wildlife habitat. Many species of birds and mammals utilize whitebark pine, consuming its large, nutritious seeds as their major foodstuff. Although this pine produces a good cone crop every 3-5 years, its seeds are wingless, rendering it helpless to reproduce without outside assistance. Enter the Clark’s Nutcracker which has developed a “mutualistic relationship” with whitebark pine. If it were not for this bird, the tree’s seeds would mold on the branch or be consumed by animals. However, its cones are displayed upwards, attracting the Nutcracker to harvest the seeds and store them in ground caches. Since the bird disregards a portion of its cached seed, viable seedlings germinate from the forgotten caches. Essentially, all whitebark pine regeneration initiates from unclaimed nutcracker caches. Interestingly, the nutcracker prefers to cache its seed collections in open areas created by wildland fire. Fire further assists the pine’s survival by thinning out the forest and creating openings for regeneration. Additionally, the nutcracker disperses whitebark pine seeds much further than wind-dispersed tree species, giving the pine a colonization advantage.

Given whitebark pine’s critical role in high elevation ecosystems, its decline in about half of its historic range concerns researchers. A combination of three events precipitated whitebark pine deterioration. Blister rust, accidently introduced around 1910, spread across the entire whitebark pine range by 1961. Implementation of fire exclusion policies during this same period exacerbated the pine’s struggle for survival. An extensive mountain pine beetle epidemic hit the Northern Rocky Mountains in the 1930’s, killing many mature whitebark pine, followed by other beetle epidemics in recent years. These factors produced a rapid demise of whitebark pine, which has been replaced with subalpine fir and Engelmann spruce.

Preserving whitebark pine necessitates innovative techniques. An ongoing study, Restoring Whitebark Pine Ecosystems, was implemented in 1992 by Bob Keane at the RMRS in Missoula. Five research sites differing in biophysical environment, stages of decline, and stand structure have been examined. Lessons learned so far include: 1) Without proactive restoration treatments, whitebark pine forests will continue declining, changing the character of high mountain landscapes; 2) Prescribed burning and selective cutting of competing tree species are the most practical restoration treatments; 3) Ensuring restoration of whitebark pine ecosystems requires the return of ecosystem processes like fire; and 4) Any ecologically sound treatment capable of opening the forest canopy and minimizing subalpine fir competition can favor whitebark pine.

Dying Whitebark Pine Tree. Photo by Bob Keane.

The Bitterbrush Problem: Survival Help for a Plant That Helps Game Survive

Kristi D. Pflug
University of Montana, School of Forestry

Antelope bitterbrush is found from New Mexico to British Columbia, and Montana to California, in grasslands and open pine forests. A member of the rose family, it has small, three-lobed, wedge-shaped leaves that vary in color from grayish to dark green and may be deciduous or evergreen, depending on ecotype. Growth form varies from tall and treelike to low and layering. Bitterbrush is sometimes mistaken for big sagebrush, but the two species can be easily distinguished by their flowers. Bitterbrush produces small single yellow flowers in mid-spring to mid-summer while sagebrush bears composite yellow flowers in late summer and fall. Bitterbrush is often a major component of the winter diet for mule deer and elk. Moose, bighorn sheep, yellow-pine chipmunk, deermice, chipping sparrow, and blue grouse are among the other species that use bitterbrush for food and cover. On some sites, bitterbrush is the most heavily consumed plant even when it comprises only a small portion of the plant community.

Bitterbrush. Photo by Danny On.

During the last five decades, lack of natural regeneration has become an increasing problem throughout much of its range, with many mature shrubs dying and leaving no replacements. Concern over this situation on the Bitterroot National Forest led to a 1997-1998 study of the impacts of four different treatments — 1) a control and 2) shelterwood cuts with a) no burn, b) a low consumption burn, and c) a high consumption burn — on flower and seed production and seedling recruitment. Flower production did not differ significantly among treatments, and no significant problems were found in seed viability. However, no seedlings were observed in undisturbed areas. Rodent "caches" of bitterbrush seed in bare soil areas are known to play a vital role in bitterbrush germination and establishment. The largest barrier to natural regeneration appears to be a ground buildup of dead plant matter on undisturbed sites, leading to a lack of suitable locations for rodent caching and seed germination. Necessary disturbances occurred on a regular basis, until this century, as low intensity fires swept through this site approximately every seven years before eliminated by fire suppression. Logging and/or fires which mimic those disturbances could be beneficial by providing litter removal for seedling recruitment while still retaining a number of mature bitterbrush, thus facilitating both present and long-term survival of this plant much favored by wildlife.

**For more detailed information on this study and others, please refer to: Pflug, K. D. 1999. Bitterbrush *(Purshia tridentata)* regeneration processes in a ponderosa pine stand at the Lick Creek Study Area. Master's Thesis. University of Montana, Missoula, Montana, 77 pp.

The Bear Overlook Prescribed Fire Project — A Case Study in Whitebark Pine Restoration

Bruce Winhorst, Bitterroot National Forest
Brooke Thompson, Bitterroot National Forest, Retired

On October 8, 1998, Stevensville District fire managers (Bitterroot National Forest) ignited a prescribed fire high in the Bitterroot Mountains overlooking Victor, MT. The project was designed to help restore whitebark pine (WBP) on a 170-acre stand where the species has been declining for decades. WBP here suffered significant mortality in a pine beetle epidemic during the late 1920's and is currently afflicted with white pine blister rust. Additionally, fire exclusion during the past century has favored subalpine fir (SAF) regeneration. The resulting crown closure inhibits WPB seed caching by Clark's Nutcracker, its primary method of regeneration (see article on page 14).

Project objectives included: 1) restoration of WBP on the stand by providing conditions favorable to natural reseeding and 2) reduction of fuel loadings to acceptable conditions for WBP's survival in a wildfire. The work required careful planning and execution to meet objectives. For example, SAF had to be greatly reduced or eliminated from large portions of the stand without signficantly affecting the remaining WBP. Beginning in 1996, selected portions of SAF were non-commercially cut, providing an acceptable fine fuels bed to carry fire spread. "Jackpot" burning under moist conditions to reduce fire intensity eliminated excessive fuel concentrations in some areas. Existing WBP trees were protected from fire damage by removing ladder fuels from near their bases, where possible.

Once the burning unit is properly prepared and fuel conditions are right, fire managers must wait for the prescribed weather conditions and forecast to successfully burn the unit. At this elevation the window of opportunity is small and in fact may not occur every year. One must be ready when it does.

For several weeks prior to ignition, fire managers monitored environmental conditions at the site, including weather and fuel moisture content. Their burn plan required a killing frost to ensure fuel conditions supported the needed fire intensity.

Subalpine fir goes up in flames in an effort to aid whitebark pine restoration. Photo by Bob Keane.

On October 6, 1998, everything came together – proper stand conditions and a favorable weather forecast. Gathering 50 firefighters skilled in this type of burning is a challenge, but by October 8 everyone was in place and ignition commenced. All went as planned, but after several hours a light rain curtailed the operations after about 40 acres had been burned. Follow-up monitoring in the summer of 1999 showed objectives were met. The remaining 130 acres of burning was successfully completed in October 1999.

Evaluating the Ecology and Restoration of Winter Range Sites

Yvette K. Ortega, RMRS, Wildlife Research
Kevin S. McKelvey, RMRS, Wildlife Research

Deer mouse being processed. Photo by Kevin McKelvey.

We have initiated a five-year study to examine effects of knapweed and its removal on winter range sites on the Lolo National Forest. These areas are dominated by grasses and forbs with scatterings of trees and shrubs. Using standard sampling techniques, vegetation, insects, small mammals, birds, and ungulates are being studied on eight sites. They are south to west-facing slopes of at least 5 ha (approximately 12.5 acres) located at elevations of 4,400 to 5,600 ft. Half have dense patches of knapweed while the others are dominated by native vegetation with only trace amounts of knapweed. To date, we have catalogued all species of plants at 800 sample stations, collected 4,160 insect samples, completed 6,000 trap-nights of small mammal sampling, mapped territories of avian species, monitored 55 bird nests, and sampled pellets of ungulates along 4 km of transect. From these data, we will obtain indices of abundance by species, as well as information on diet, reproduction, and survivorship for birds and small mammals. As part of this research, four sites will be treated, using both herbicide and subsequent broadcast burning to remove exotic weeds.

Changes in plant communities caused by knapweed invasion and treatment to remove knapweed may directly affect animals. Species of insects, small mammals, birds, and ungulates, to varying degrees, are closely associated with select types of plants. Vegetation structure also has direct effects on animals by determining availability of cover and sites for foraging, nesting, and denning. These changes in plant communities may also have indirect effects through interactions between species. For example, deer mice may increase on knapweed sites because they readily eat gall flies associated with knapweed seedheads. Small mammals depredate nests of songbirds and function as prey for larger birds, and knapweed-related changes in their densities could spur ecosystem-level effects.

By simultaneously considering plants, insects, small mammals, birds, and ungulates, we can relate observed changes to the underlying causes. For instance, if reproductive rates for a particular insectivorous bird change after treatment, we will be able to relate these changes directly to changes in the insect community, and the insect community in turn to the changes in vegetation. We believe that evaluating effects of weed invasion and treatment across multiple trophic (food chain) levels will therefore best serve the needs of restoration ecology and ecosystem management.

Doing BEMRP Bird Point Counts

Tom Thompson
RMRS, Wildlife Research

Imagine the thrill of getting up at 3:30 a.m. several days a week from late April through June to go bird watching! And get paid for it! That's what several researchers did to gather information about breeding birds in our area. Many of the first days included skiing several miles in the dark with headlamps to be ready to begin counts at dawn. Point counts for breeding birds generally begin within a half-hour of dawn and end by 11:00 a.m. This is the most active period for breeding birds; they perch prominently, sing loudly, and defend their territories against intruders. Only heavy rain (or snow) and high winds can damper their enthusiasm, or researcher's desire to go and count them. In this study, researchers had transects of five counting points, 200 meters apart, along a line 1 kilometer long, in eight study locations in old growth ponderosa pine stands.

What do you do after you've skied or hiked into an area to count birds? Upon arriving at the first transect point, you take a moment to catch your breath, get out your pencil, clipboard, binoculars, and start listening. That's right, listen. Most birds are identified by their songs or calls, not by sight. Not only do our intrepid researchers need to be able to identify some 60 species of birds by sight, but they also need to recognize their song and call. The species and number of birds seen or heard is recorded by time interval and approximate distance to the birds. Most important are birds seen or heard within 100m, but the observers record birds seen or heard up 200 meters. Other esoteric data recorded include count start and end time, temperature, wind speed, and other weather conditions.

From these data researchers can determine the relative abundance of bird species in the community, as well as how their detectability changes throughout the breeding season. They discovered many yearlong resident species such as woodpeckers begin their breeding season before the migrants from Central and South America return to Montana to breed. Therefore, the best time of year to count birds may very well depend on which species are of interest.

Bird counting in a treatment area.

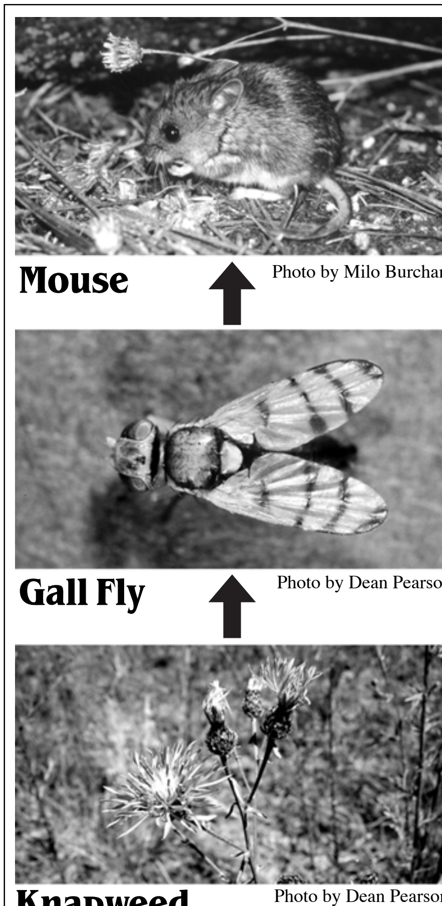
Incredible Interactions:

Deer Mice, Knapweed, and Gall Flies

Dean E. Pearson
RMRS, Wildlife Research

Although researchers and managers recognize that noxious weed invasions dramatically alter vegetative communities, little is known about how wildlife is affected by these changes. This is important when attempting to restore natural systems because ecosystem management tools such as fire and timber harvest can accelerate weed invasion. Exacerbating this situation is the fact that use of biological control agents further alters ecosystems in complex ways that are poorly understood.

The Rocky Mountain Research Station's Wildlife Habitats Unit and BEMRP have begun examining some of the complex problems associated with noxious weed invasion. We have found that deer mice consume the larvae of gall flies, insects introduced for biological control of spotted knapweed. As a result, deer mice aggregate in dense stands of knapweed during winter when larvae are present in seedheads, and may achieve higher than normal population densities in knapweed-invaded habitats. Other small mammals such as voles that feed on grasses and forbs may decrease as a result of knapweed invasion due to loss of their primary foods. The result may be a shift in small mammal communities that favors deer mice. At higher levels of the food chain, diurnal (daytime) raptors could be negatively affected because deer mice are strictly nocturnal. Furthermore, increases in densities and aggregations of deer mice may affect transmission rates of Hantavirus within deer mouse populations. This carries potentially important implications for humans since deer mice are the primary agent for transmission of Hantavirus. Additional research will be critical to further our current understanding of these complex ecological problems.



The Food Chain — Knapweed is eaten by gall flies; gall flies are consumed by deer mice.

Nest Challenges

The Continuing Saga of an Avian Community

A previous issue of Eco-Report featured the remarkable story of nest parasitism by the Brown-headed cowbird. This bird pawns its eggs off on a host songbird, which unwittingly incubates and rears the nestlings. Since cowbird young hatch earlier, behave more aggressively, and are larger than their step-siblings, they possess a competitive feeding advantage, thriving while songbird young starve. These findings come from a fascinating study by University of Montana researcher, Josh Tewksbury.

Over the past five years, Tewksbury followed the success story of over 3,000 nests involving 75 different songbird species. He has identified two distinctive theats to healthy songbird communities (nest parasitism and nest predation. Tewksbury found levels of both threats vary greatly among different deciduous riparian patches. The most significant factor affecting these phenomena seems to be the landscape surrounding avian habitat.

Tewkbury has discovered a strong linkage between cowbird abundance and interface housing/ farmstead density. His research indicates cowbirds capitalize on bounteous food reservoirs available in corrals, feedlots, bird feeders, and similar structures. Remarkably, addition of 1-2 houses or 1 corral within 1 km of deciduous riparian songbird habitat may double the percentage of cowbird-parasitized nests if there are few houses or farms on the landscape to begin with. Moreover, one female cowbird is capable of laying up to 40 eggs a season while one corral produces enough food to support large numbers of these birds. Lest our saga end in tragedy, Tewksbury reveals one heartening finding. Human structures built further than 1 km from the nests of songbirds have decidedly less effect on nest parasitism rates. From a manager's perspective, even small natural areas may provide sufficient buffers for protecting important bird communities.

University of Montana researcher Josh Tewksbury gives a talk on the Larry Creek riparian area field trip. Photo by Brooke Thompson.

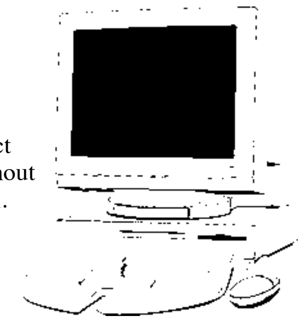
Tewksbury also says songbirds nesting in conifer-surrounded riparian habitats fall prey to red squirrels, which consume eggs and hapless nestlings. In comparison, habitat encompassed by agricultural landscapes, chiefly along the Bitterroot River, supports predators like magpies and jays. While songbirds lose many young in each case, the forested/agricultural interface produces their greatest threat. Here, squirrels, magpies, raccoons, and skunks eat most songbird young.

"Ecosystem management requires understanding not only the processes important within a habitat but also the connections between habitats and landscape," notes Tewksbury. He recommends special attentiveness to this linkage in the Bitterroot Valley because most songbird-breeding habitat lies in deciduous riparian areas close to the private/public land interface. He also endorses the return of natural disturbances, required by riparian deciduous forests to foster successful songbird breeding.

REAL WORLD EXPERIENCES — WHAT THE USERS ARE SAYING

Using MAGIS at the Fine Scale

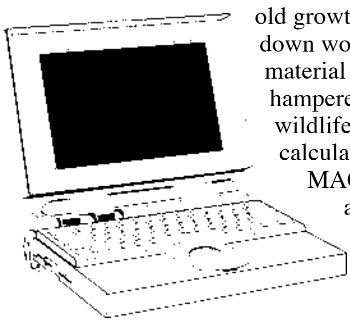
Dave Silvieus
Bitterroot National Forest



The MAGIS (**M**ulti-Resource **A**nalysis and **G**eographic **I**nformation **S**ystem) model for assisting managers in making resource decisions was used for the Stevensville West Central (approximately 39,400 acres) and Daly Creek (approximately 39,000 acres) analyses on the Bitterroot National Forest. Our objectives in using MAGIS included: 1) testing and evaluating MAGIS within the NEPA (National Environmental Policy Act) process and 2) utilizing it to develop and evaluate alternatives.

MAGIS was used to predict water and sediment yield by alternative. It was faster and more efficient than manually running the WATSED (water sediment) model. MAGIS also worked well for calculating equivalent clearcut area (ECA) road impact factors (RIF), along with sediment predictions and water yield. Our stand and compartment boundaries do not follow watershed boundaries, and problems occurred when stands had to be divided to stay consistent.

MAGIS was used to calculate the effects on management indicator species (MIS) habitat and old growth habitat. This saved time over historical analysis methods. Lack of accurate old growth and down woody material data hampered the wildlife effects calculations.



MAGIS was also used to predict vegetative treatment costs and the economic viability of timber sales by alternatives. With MAGIS we developed an alternative in the Daly analysis (Alternative 7) designed for selected stands and silvicultural options, which optimized net timber sale revenue while still meeting Forest Plan standards and guidelines.

Obstacles

The interdisciplinary team was unable to fully utilize the model within the 18 to 24 month NEPA time frame. Closer communication and additional assistance with computer applications and database management from the research group would have helped us stay within our schedule. We needed a full-time person on the interdisciplinary team to provide database cleaning, GIS setup, modeling, and coordination with the research group.

With the Daly analysis area, we used the optimizer for one run, but it was not utilized fully. We developed alternatives using our knowledge rather than MAGIS because of polygon (computerized spacial unit) problems, as well as inaccuracies and gaps in the database. Although we used the model to evaluate alternatives, we had too many obstacles to develop more than one alternative within our planning schedule. At the start of the project, our treatment units became parts and combinations of stands rather than the complete stands the Daly MAGIS was built to work with. This happened because silvicultural opportunities were identified at a finer scale in the field, and the team was unwilling to have the model select treatments without field validation. Digitizing the sub-stand treatment polygons (specifying the unit boundaries in GIS) required time and introduced errors. Had we known this, we could have:

- built a GIS layer based on the proposed action alternative with the maximum silvicultural treatment polygons identified (stand parts and combinations) and the rest filled with remaining untreated stands and portions of stands, or;
- stayed with stands as the basic foundation for data as we did with Stevensville West Central, limiting stand divisions and combinations to critical needs such as riparian habitat conservation areas or inventoried roadless areas.

The other major obstacle was lack of an accurate database that could be relied on at the sub-unit scale for such critical needs as volume estimates, old growth delineations, and dead and down wood. Stand exam inventories were not completed for many of the stands, and the photo interpreted data and strata-averaging was not consistent.

Where Do We Go From Here?

The model should be used only where the underlying database is adequate. We tried to apply the model to areas with over 2,000 stands, and this may be too broad. Also, it is important that the interdisciplinary team have confidence in the predictions. We probably need to spend more time at the beginning of the analysis determining how to best use the model. Minimizing polygon digitizing will reduce time and errors. A procedure to remove tiny stand fragments and GIS errors is also required.

The initial rule base needs more refinement, including more accurately selecting logging systems without manual adjustment. The model was also applying single-tree selection to stands inappropriately. There needs to be a way to factor in cover type and ecological needs when applying treatment options and for integrating silvicultural logic in the applications of systems for specific habitats.

ECO REPORT

Ecosystem Management Means Partnership

Furthering the goals of this project requires public participation in decision making. Would you like to become a partner? For more information, please contact

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Visit the Bitterroot Ecosystem Management Research Project on the Internet!
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REAL WORLD EXPERIENCES — WHAT THE USERS ARE SAYING
SIMPPLLE in Practice

Cathy Stewart
Lolo National Forest

SIMPPLLE (**SIM**ulating Vegetative **P**atterns and **P**rocesses at **L**andscape Sca**LE**s) is a useful model for tracking and analyzing lots of spatial data and processes at one time. It gives one the BIG picture, providing landscape patterns (pictures) over time. It considers past as well as adjacent processes and conditions, includes specific pest hazards, and identifies problem areas. The model can be tweaked to reflect local conditions and knowledge. Data needs are simple, basic, and reasonably inexpensive. It can analyze treatment impacts and provides a good public involvement tool to display various conditions and effects of different alternatives. It also has a good interface/window system that is being constantly improved.

Some disadvantages relate to fire and insect modeling. For instance, fire occurrence and intensity by decade can be high, and average-stand size polygons have higher fire probability than actual data suggest. Mountain pine beetle effects can be low in mixed stands, and pole mortality can be low during an epidemic, requiring adjustments. Other problems relate to the data. Smaller landscapes have less reasonable outcomes than larger ones, and old data (which is common these days) need to be adjusted. The current version is polygon-based and cannot be split. Data requirements include vertical stand structure, which can be hard to obtain.

Other system problems include the following: 1) Pathways and vegetation descriptions are not yet available; 2) On-line help is not fully developed, and the program is currently available only on an IBM Unix platform (the Forest Service IBM servers); and 3) Depending on the system size, large numbers of polygons can take some time to run. Remedies for many of the above problems are already underway. Continual upgrades are being made to the fire model portion, including adjustments for fire starts, size, and probability. One can now run SIMPPLLE for average or extreme fire conditions. Aquatics are currently included but only in a prototype version.

Recent Developments in Landscape Modeling

Janet Sullivan
RMRS, Forest Economics

Computer models are used to simulate ecosystems and test large-scale 'what if' questions like "What if we never suppressed any fires?" These questions cannot be answered by direct landscape manipulation, either because we can't wait that long or the possibility of negative consequences is too great, or both!

BEMRP has been participating in developing and testing two landscape modeling systems. SIMPPLLE (**SIM**ulating Vegetative **P**atterns and **P**rocesses at **L**andscape Sca**LE**s) simulates changes in vegetation patterns resulting from various disturbance processes such as insect infestation and wildfire. With individual SIMPPLLE simulations, we can produce possible levels of processes and vegetative conditions over decade time-steps. All simulations can be made with or without fire suppression and management activities. Occurrences of processes and conditions can be mapped. Since SIMPPLLE uses probabilities for disturbance processes, multiple simulations produce a range of outcomes useful for mapping the probability of occurrence for processes and vegetative conditions.

MAGIS (**M**ultiple-Resource **A**nalysis and **G**eographic **I**nformation **S**ystem) develops optimal schedules for management actions on the landscape and is driven by the multiple goals and constraints of land management. Using MAGIS, planners can predict "If we do this set of treatments, we will have a two percent increase in sediment for a short period, no loss of wildlife habitat, and produce approximately one hundred sixty thousand dollars." MAGIS also models transportation networks and addresses long-term management questions about the effects of removing specific roads.

MAGIS is an application in the process of development. Our current favorite addition is a graphical interface that allows users to assign yarding (log accumulation) methods and road loading points to treatment units, displaying elevation and contours to aid the process. Another enhancement vastly decreases the amount of database work needed; we can now add spatial data to MAGIS by importing a coverage directly from ArcView (a computer geographic information system). Previously, users had to "translate" spatial data into database files, a cumbersome process.

SIMPPLLE is also being improved. A recent project is programming SIMPPLLE in Java (a programming language) that allows it to be run on all types of computers. Other changes include an option to convert landscapes to uniform polygons (spatial units on the landscape used in geographic information systems) with size selected by the user. This decreases potential problems due to differing polygon sizes. A prototype for representing other ecological units such as aquatic and landform units is still under development. The SIMPPLLE team is also busy developing versions for both forested and grassland ecosystems in other areas across the country.

MAGIS and SIMPPLLE models are the product of eight researchers' efforts. Seated, left to right, are Janet Sullivan, Kirk Moeller, and Jim Chew. Standing, left to right, are Chris Stalling, Greg Jones, Kurt Krueger, and Steve Slack. Not pictured is Hans Zuuring (University of Montana). Photo by Janie Canton-Thompson.

The "Buddy System"

Choosing Effective Treatments for a Landscape

Greg Jones and Janet Sullivan, RMRS, Forest Economics Research
Jim Chew, RMRS, Forest Ecology Research

Addressing forest health issues at landscape scales requires techniques to predict the location and severity of natural disturbances such as fire, insects, and disease. When desired future conditions differ from predicted conditions, management alternatives accounting for these differences, together with other resource objectives, are needed. BEMRP researchers have been testing a sequential simulation/optimization modeling approach for analyzing landscapes that takes advantage of the strengths of both types of models. With this approach they have been successfully developing fuel treatment alternatives for a 60,000-acre landscape where the net cost of proactive management is LESS than the suppression costs alone for "no action." Also, the combined sediment from fuel treatments and natural disturbances is LESS than the amounts predicted for the natural disturbances for "no action." The exciting thing about this approach is that it captures the probabilistic nature of natural disturbances processes while developing activity schedules that best meet the objectives specified for a management alternative – a difficult task for either model alone. Furthermore, it provides a comparison of "no action" with site-specific treatment alternatives that includes the costs and effects of the treatments AND the costs and effects associated with the natural disturbances processes!

Data movement between the systems has been automated to minimize processing time. There are four steps in this simulation/optimization approach.

Step 1: SIMPPLLE is run to simulate the location and severity of future disturbance patterns on the landscape**,** assuming fire suppression but no other management treatments. A stand-specific disturbance index results.

Step 2: This index is brought into MAGIS, using the same polygons, where it is combined and run with other objectives (e.g., maintaining watershed and wildlife). MAGIS develops schedules of activities for the landscape that best address the simulated forest health issues and the other specified objectives. These spatially- and temporally-specific schedules provide alternative strategies for achieving desired conditions.

Step 3: These alternative schedules of activities are imported into SIMPPLLE to model the resulting effects on the extent and frequency of natural disturbance processes.

Step 4: The spatially- and temporally- specific predicted natural disturbances and treatments are imported into MAGIS to compute overall natural resource effects, costs, and net revenues.

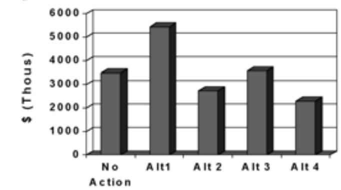

Fig 1. Discounted net cost (including treatment revenues, treatment costs, and fire suppression costs) for four fuel landscape treatment alternatives compared to the discounted fire suppression cost for the No Action alternative.

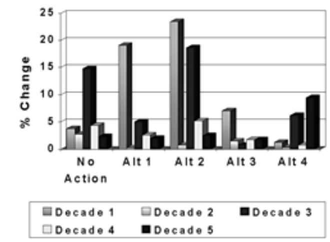

Fig 2. Percentage change in sediment from current condition resulting from the combination of treatments and natural disturbance processes for four fuel treatment alternatives and No Action.

ECO-Report

Bitterroot Ecosystem Management Research Project
USDA Forest Service
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The new editor Janie Canton-Thompson looks over the Eco-Report. Photo by Steve Slack.