

PAPER AND POSTER ABSTRACTS

24TH NATURAL AREAS CONFERENCE EXOTIC PEST PLANT COUNCIL CONFERENCE

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All abstracts received by July 11, 1997 have been included. Last minute changes do occur and, therefore, not every paper presented may have an abstract published in this book and not every abstract published may result in a paper presented at the conference.

KEYNOTE / PLENARY SESSION / BANQUET ABSTRACTS

(These abstracts are listed in the order of presentation.)

Robbins, William**Keynote Presentation**

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The Cultural in Natural Landscapes

Ideas about nature, the British literary critic Raymond Williams once remarked, embrace "though often unnoticed, an extraordinary amount of human history". Nature, William Cronon said more recently, "is not nearly so natural as it seems. Instead, it is a profoundly human construction". Even if we remove ourselves to the time of the European intrusion into North America, we must acknowledge the indisputable evidence in the historical record that anthropogenic activities, especially the use of fire, had profoundly influenced the physical world of the Native American; indeed, the idea that there existed a natural landscape unaffected by humans has no meaning to Indian America. To conclude that Indians inhabited a "virgin" or "pristine" environment, therefore, ignores the great influence that native people have had in determining the landscapes about them. Indeed, to deny Indian people a role in shaping their physical surroundings is to deny both their histories and their cultures. From that opening premise, the bulk of the presentation will shift to the increasingly intrusive anthropomorphic influences in North America as cultural activity moved from subsistence and pastoral to industrial modes of production. It is my contention that under the industrial paradigm, planet earth has become a thoroughly culturally scripted place. As humans, we inhabit both natural and social space. It would be wise for us to understand that what we call natural space has a history that is a blend of the natural and cultural. Moreover, if culture is now a factor in climate change - as the world's leading scientists now acknowledge - then I agree with historian Richard White, whose wonderful book, The Organic Machine, emphasizes the blurred boundaries that exist between the cultural and the natural, between human history and natural history.

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Is Wilderness a Social Construct?

The concept of wilderness, and the preservation of wilderness, has come under recent attack on grounds that "wilderness" is Western man's way of viewing nature, a framework setting up a dualism between nature and culture, a world view characteristic of the Enlightenment and modern science, but absent from most other cultures. "Wilderness" is therefore a social construct. "Wilderness" was a mistaken perception of what the indigenous Americans saw as their homelands; the landscape had, in fact, been greatly modified, managed by these peoples for thousands of years. "Wilderness," by this argument, continues to be a mistaken model for nature conservation; the ideal, rather, is humans and nature in harmony on inhabited landscapes. Such recent arguments are here argued to be themselves misperceptions of wilderness for real.

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Plenary Presentation

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The Ecological Importance Of Natural Areas

A recent debate has emerged within academic circles about whether wilderness is merely a social construction, and therefore whether it has any value as a target for conservation efforts. Negative reaction within the conservation advocacy community has been strong, and has focused largely on the idea that the "wilderness as social construction" argument is misguided. In my talk I will focus on the parallel but alternative perspective that the argument is irrelevant. I will develop four interrelated themes: (a) Wilderness at the present time serves ecological goals not achieved through other means; (b) The reality that humans are a part of nature offers nothing to discussions of conservation strategies; (c) The value and appropriateness of wilderness as a conservation tool must be evaluated in the context of the scale of environmental stresses experienced across the landscape; and (d) A distinction needs to be made between individual-level and species-level consequences of conservation actions and inactions. I conclude that unlike other efforts at linguistic deconstructionism in the humanities, the debate over wilderness is about a tool and not a concept, and therefore should be judged largely on whether it is the best strategy for achieving necessary conservation goals.

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Nature Reserves in an Era of Virtual Reality

Today, natural areas are valued for many reasons. They conserve biodiversity, provide educational opportunities, afford people spiritual sanctuary, are locations for recreation and adventure, and are a source of cultural identity. How will citizens value natural areas in the future? As more citizens grow up in urban areas they will meet nature on the Internet or the Discovery channel and find adventure indoors, sport-climbing at City Rock. The conservation benefit of natural areas is also becoming suspect. The baseline for natural conditions are hard, if not impossible, to define. Some managers call for the human management of every acre to ensure maintenance of disturbance regimes, while others call for nature to take its course without intervention. Adding to the controversy, scientists are now documenting the limitations of small natural areas for conservation and the likelihood that climate change will change the conservation value of all natural areas. As natural area managers, we can take advantage of new technologies to share the wonders of nature with a broad audience. But we must also address the key debates and provide leadership by voicing a clear message of the roles of natural areas. If we do not, will the virtual experience be deemed sufficient?

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Plenary Presentation

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***Obtaining, Retaining, and Maintaining Protected
Areas: Biological vs Social Strategies: What Works
Best?***

The system of protected areas in the U.S., while impressive, is widely recognized as being insufficient to protect the biodiversity of the country. Yet it is increasingly difficult in today's society to add to the exiting network of protected areas. Public antipathy toward seemingly nebulous conservation issues, i.e., the conversation of biodiversity and conflicts with conomic and social priorities, have often precluded the protection of unprotected ecologically important lands. As these issues show little likelihood of changing in the future, what then is a plausible solution? This paper briefly contrasts three existing or potential methods whereby important resources have been or can be preserved: 1) the approach used by the National Park Service; 2) the approach used by the Fish and Wildlife Service refuges; and 3) the efforts embodied by the GAP Analysis Program. While the first two approaches have been successful in persuading the American public to accept at least limited land protection measures, the latter remains untested over large land areas. This is significant as preliminary analyses have shown that many important biological resources are found outside parks and refuges. The paper explores the concept of whether a new system of publicly acceptable conservation areas can be created using an expanded system of parks and refuges as a base and GAP data as a driving mechanism.

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Plenary Presentation

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***Practical Nature Reserve Design and
Implementation***

In recent years, there has been much talk about science-based Nature Reserve design, both by scientists and conservationists, but, so far, little on-the-ground doing. The Wildlands Project and Sky Island Alliance are currently designing a Nature Reserve Network in the Sky Island region of Arizona, New Mexico, Chihuahua, and Sonora. As we develop this reserve proposal, we will assess whether 1) a science-based reserve design can be done on the limited funding available to the Wildlands Project and its cooperating groups; 2) a science-based reserve design can be completed in a reasonable period of time (one or two years) so that it can be used for current conservation issues; 3) citizen conservationists can be brought into reserve design so that they have a feeling of ownership and so that there is a grassroots constituency to help implement the proposed reserve network; 4) such a reserve design can pass scientific peer review; 5) we can ever implement a science-based reserve design; 6) a reserve network designed for wide-ranging large carnivores will protect a significant percentage of other species and representative ecosystems; and 7) cross-border Nature reserves are practical.

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Banquet Presentation

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Can We Save the West?

During the next two decades the fate of many western American species will be decided. The first decades of the new millennium will also be critical for rural western American culture. The fate of the two is inextricably linked. Rugged and ruthless individuals and industries have used their political dominance in the rural west to slow and often block efforts to preserve and restore ecosystems. This must change or the integrity of western ecosystems will be lost. The revolution in work and workplace that accompanies the new information/communication economy makes it feasible for many to escape the metropolis. These are the new "New Rural" and they bring with them a majority for those who win their votes. Conservation and restoration biologists, natural areas managers and biological educators need to ask: *"What can I do within my chosen field and sphere to build a rural majority that supports preservation and restoration?"* This alone, however, is not sufficient. Scientists, managers and teachers must be willing to organize, to play a collective role. They must become stakeholders, take a place at the table, forms alliances with other stakeholders, brings their talents, insights and values to bear. What we need is not scientists who are environmental activists but activist scientists, activist land managers and activist teachers. Ecosystem scientists and managers need to develop operational definitions for the terms "sustainable community", "sustainable resource use" and "sustainable ecosystem". I'll challenge them to take these definitions - and the rigor of science - into the plethora of social experiments unfolding in the rural West.

SYMPOSIA AND CONCURRENT SESSION ABSTRACTS

(These abstracts are listed in alphabetical order by author.)

(To find the scheduled presentation of a particular speaker,
match the number next to the speaker's name in this Abstract Book
to the number next to the speaker's name in the Conference Packet.)

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***Mapping Presettlement Vegetation of the
Willamette Valley, Oregon, Using General Land
Office Survey Data***

Mapping of pre-Euroamerican settlement vegetation of the Willamette Valley at a scale of 1:24,000 has provided a landscape-scale perspective of the former extent and diversity of the different vegetation types that were present in the Valley. This mapping is based primarily on 1850's land surveys performed by the U.S. General Land Office. The data in the survey notes are consistent with historical references that indicate that fire exerted a major influence over vegetation development in most of the Willamette Valley. Prairie and savanna ("openings") predominated on the valley floor and adjacent foothills, with closed canopy forest restricted mostly to floodplains, north slopes, and other fire-protected situations. In the northern valley and elsewhere in the higher foothills, vegetation was often described as "scattering timber", which we interpret as an open woodland with a shrubby understory. The results of this mapping project can be utilized to quantify the extent of both common and rare habitats within the study area, as well as to document the presettlement abundance and distribution of native tree and shrub species. The results are also potentially useful for natural areas inventory projects, conservation planning, site and landscape scale restoration planning, and endangered species recovery.

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Impacts of Invasive Plants on Western Wildlands

Estimates of populations of invasive species indicate that infestations are spreading at about 4600 ac per day on federal lands alone. These infestations degrade the quality of federal lands in the following ways:

1. Change community structure, impacting the water dynamics of the areas.
 2. Decrease biodiversity and endanger or cause extinction of rare plant populations.
 3. Chemical compounds are added to environment inhibiting native species.
 4. Wildlife habitat deteriorates.
 5. Land values decrease due to negative impacts on livestock and forage quality.
 6. Recreation values of these federal lands diminishes.
- 94% of federal lands are now infested - yet. We must act now to prevent further infestation by invasives.

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***Monitoring: A View From Within the National
Forest System***

Of the three types of monitoring (implementation, effectiveness and validation), the National Forest System (NFS) is best equipped to monitor the implementation of their projects. Typically, the degree to which prescriptions, or a set of objectives, were applied across the landscape is measured. Lack of funds and low priority are often given as reasons for not finishing the project (monitoring). Moreover, monitoring variables may not be standard or compatible with the corporate database structure, existing sample grids, or promptly entered. NFS is not monitoring effectiveness or validity. The long-term look and spatial controls needed are not being funded under the current structure. The Experiment Stations have provided, and are willing to develop, monitoring protocols, but actual monitoring is not their mission. It is not clear how we will determine whether our treatments are effective, or whether our approaches are valid without a more coordinated, integrated, long-term approach to monitoring. Natural areas, our controls, need to be monitored concurrently, with adequate replications, and over the long term. Without monitoring feedback, adaptive ecosystem management, a long-term proposition, is impossible. We need to establish monitoring as an essential part of ecosystem management, prioritize monitoring variables, and build a corporate database that can be used to describe and predict the outcomes of ecosystem processes. In the long run, ecosystem management should be under a maintenance or prevention, rather than a corrective strategy.

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***Comparison of Historic and Post-1900 Fire
Occurrence in the Columbia River Basin***

Information on the historic scale of fire in the Interior Columbia Basin Ecosystem Management Project (ICBEMP) study region is useful as a benchmark because fire has been an important ecological process shaping vegetation structure and composition in this region for thousands of years. Detailed records of fires are not available for the historic fire period, before fire suppression and land use change influenced the role of fire. To estimate the extent of historical burning, we calculated mean annual acreages burned based on estimated acreages of historical vegetation types (Losensky 1995) and their associated mean fire intervals - the average number of years between fires on any site within the vegetation type. Mean fire intervals were from a detailed review of site specific fire history studies, based on fire-scarred trees (Barrett 1995). The combined mean annual area burned has been about 10% of the historic value. In the most active fire years sine 1900 (1910, 1919, 1988, and 1994), 2 to 3 million acres have burned in the ICBEMP region. We discuss these data and their implications for ecosystem-based management.

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A Combination Treatment for the Control of Arundo donax using Mechanical Mulching and Herbicides, with a Comparison to the Cut Stump Method

A new method of controlling the invasive exotic grass *Arundo donax* (*Arundo* or giant reed) in two riparian areas of the Angeles National Forest was more efficient and less costly than the cut stump method. *Arundo* has degraded Soledad and San Francisquito Canyons which provide essential habitat for *Gasterosteus aculeatus williamsoni* (unarmored threespine stickleback), an endangered fish. *Arundo* replaces native riparian vegetation, reduces available water, and introduces a fire cycle into the riparian ecosystem, making it unsuitable stickleback habitat. *Arundo* was mulched using a Seppi Midiforst flail mower attached to a Ford 9030 tractor. Mulching occurred in October and November 1995. We treated resprouts with a 5-10% solution of glyphosate (Rodeo[®] or Round-Up Pro[®]) in April, May, July and August 1996. In San Francisquito Canyon, we treated 8.8 ac of *Arundo*. In Soledad Canyon we treated 6.5 ac. Prior to treatment, *Arundo* cover was 14%-37% at the Soledad Canyon site and 30%-80% at the San Francisquito site. By March 1997, *Arundo* cover had been reduced to less than 1% in both sites. Native vegetation at both sites appeared more vigorous and native plants had begun to re-colonize areas formerly occupied by *Arundo*. A pilot project in San Francisquito Canyon in September 1993 used Forest Service personnel to cut and pile *Arundo* and then apply a 100% solution of Rodeo[®] to freshly cut stems. Thirty gallons of Rodeo[®] were used on less than two ac of *Arundo* at a cost of \$9300/ac. No follow-up herbicide treatment occurred the following year and by 1995 *Arundo* had fully re-colonized the treated area. Using the Seppi/Tractor in the same area in 1995-1996, we mulched 8.8 ac and used 45 gal of herbicide at a cost of \$8425/ac.

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Red Butte Canyon Research Natural Area: The Last Ungrazed Watershed in the Intermountain West

Red Butte Canyon is a protected, near pristine canyon in the Wasatch Front near Salt Lake City, Utah. It contains a well developed riparian zone and a perennial stream; hillside vegetation ranges from grasslands on the lower limits to Douglas-fir and aspen stands at the upper elevations. The Canyon was the watershed for Fort Douglas, a US Army post built in 1862. As a protected watershed, these lands were, for the most part, kept free from grazing, farming and other human-impact activities. When the Army declared these lands surplus in 1969, the US Forest Service assumed responsibility for the Canyon. The Canyon was designated a Research Natural Area in 1970 and thus will remain permanently protected from further human disturbance. Research Natural Areas are public lands set aside to 1) preserve and maintain genetic diversity of our native flora and fauna, 2) to serve as reference areas for the study of succession, 3) to serve as baseline areas for measuring long-term ecological changes, 4) to serve as control areas for comparing results from manipulative research, and 5) to monitor effects of resource management techniques and practices. Red Butte Canyon has served as a research site for biologists for over 50 years (c.f. Cottam & Evans 1945, Dawson & Ehleringer 1991, Treshow & Stewart 1973). With the development of an updated management plan for the RNA, unique opportunities for research will continue into the future.

43. Biron, Tom

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***Native American Oral Tradition as a Natural
Knowledge System in Environmental Relationships***

Natural knowledge is shared by speakers everyday in the traditional life settings of indigenous Anishinaabek and other First Nation communities of the Great Lakes region. Oral tradition is considered to be a natural system of knowledge stemming from the relationships humans have with all of creation. This presentation explores the Seven Grandfather Teachings of the Ojibway Anishinaabek as a natural knowledge system founded on the oral traditions of the Ojibway people and rooted in the Great Lakes ecosystem. This knowledge system is compared to those associated with other contemporary logic and reasoning systems relevant to environmental relationships and sustainable resource strategies. Awareness of and access to the various knowledge systems by persons involved in natural area management reduces the possibility of conflict by facilitating cooperation.

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Prescribed Burning in the Urban Environment

After only four burn seasons, the Ann Arbor City Parks Department is emerging as one of the leaders in conducting prescribed burns in urban areas in Michigan. A 1995 dispute over city/township borders temporarily shut down the program, but eventually lead to a favorable interpretation of state air quality laws which makes it easier to do prescribed ecological burns in urban areas. In 1996 the City's burn program re-emerged with 17 separate burns conducted in 100 acres of prairie, oak savanna, and oak woodland communities. These numbers are expected to increase in 1997. Burns are conducted with staff and trained volunteers. Burn crews include Public Relations people and several Smoke Monitors, in addition to the usual roles. The presentation will cover the evolution of Ann Arbor's prescribed burn program; our dramatically improved training, equipment and process; and tips on how to improve or initiate prescribed burning programs in other urban areas.

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Selection for Natural Features in Irish Pilgrimage Sites

A survey of over 70 pilgrimage goals and shrines in Ireland indicated differences in the incorporation of natural features based on the age and purpose of the site. The more ancient locations and major pilgrimage routes often include multiple features such as cliffs, lakes, springs and hardwood forests. Even modern shrines, such as 20th century memorials to Our Lady of Lourdes, are preferentially situated near springs or forest remnants. Lourdes shrines are frequently associated with evergreen vegetation and rock outcrops. A catalog of the human imagery associated with the sites indicates "loric" or place-oriented shrines resist intrusion of racist or anti-Jewish imagery sometimes found in Christian art. The shrines and holy wells link religious practitioners to the landscape, and encourage protection of distinctive natural features.

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Effects of Local Conservation Zoning on Residential Property Values in Portland, Oregon: A Preliminary Survey

Economic impacts of environmental regulations on residential development have been the subject of much debate. Between 1989 and 1994, the City of Portland developed a series of conservation plans to protect natural resources. More than 17,000 acres of stream, wetland and upland habitats were protected using a combination of overlay, plan district and other zoning techniques. During public hearings on the plans, developers and landowners expressed concern that such regulation would decrease housing values. Since then, many developers have actually profited by incorporating these regulated areas into their development as open space set-asides. Previous studies have indicated that residential properties capitalize the benefits of natural areas into the value of the housing unit. This paper uses cross-sectional data and a hedonic model to ascertain what effects, if any, conservation zoning has on residential values. This study uses two local data sets: sales ratio data (10,000 records) from Multnomah County from July 1, 1995 through June 30, 1996; and the zoning layer from the City of Portland's Geographic Information System. The methodology includes the development of threshold distances from the protected resource where significant changes in land values occur. From a small sample survey conducted in 1994, authors found evidence of increases in property values on sites with or adjacent to conservation zones. It is anticipated that by using a larger sample, better data, and an econometric modeling technique, the present study will provide a more precise framework for planners, developers and elected officials when measuring impacts due to conservation zoning.

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Ecological and Social Functions Influencing Resource Governance

Society needs to make a fundamental shift in the way it views and uses natural resources if it is to ensure an ecologically sustainable future. Real solutions to the sustainable use of natural resources are constrained by institutional impediments, narrowly focused science and compartmentalized systems of resource management. In part, the problem relates to the dualism of rural and natural landscapes - agricultural land with freehold title, a commodity on one hand, and a set of interconnected ecosystem functions across a landscape with no regard to ownership boundaries on the other hand. Existing institutions are confined and inadequate to deal with these issues. Therefore, novel and radical approaches are needed if humanity is to find realistic solutions to social, environmental and resource sustainability issues that the citizenry can adopt and adapt with matching civic skills and knowledge. Sustainability of resource use depends on the system of resource governance that mediates the relationship between the citizenry and the economy, and continuance of ecosystem function. This paper discusses the theoretical concepts behind an ambitious research project in its infancy at the University of New England in Australia. New methods will be developed to synthesize "scales of influence" of interconnected social and ecosystem functional elements to demonstrate how ecosystem functional capacity might dictate resource governance. Related data on community and civic elements will guide analysis of social change and adaptation towards more reflexively competent, sustainable resource governance. The concepts developed and lessons learnt from this project will be of wide interest.

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What is Natural?: A Social Science Perspective

The concept of "naturalness" has been useful in defining conditions at one end of a spectrum of conditions defined by the degree of anthropogenic change. However, the distinction between "natural" and "unnatural" areas is inherently spurious and ultimately can defeat the purpose of modern ecosystem-based management. Naturalness is a dynamic concept, rooted in the environmental values which society holds most important at any given time. In this presentation I will first discuss what Euro-American cultures have meant by "natural" and how that definition has changed over time. Conditions that may be considered equally natural from an ecological standpoint are not necessarily seen as equally natural by non-scientist observers -- and this is important because it is for those non-scientists that institutions are asked to manage protected areas. Next I will suggest some dangers in the natural/unnatural dichotomy. These include the obvious omission of pre-industrial *Homo sapiens* as agents of "natural" change, as well as a more insidious and anti-biocentric implication that humans cannot be part of ecological systems. I will argue that a more useful (and perhaps more honest) approach to protected-area management may be to acknowledge that change, whether anthropogenic and not, is part all ecosystems, but that humans have the unique ability and responsibility to act in ways that can control the rates and direction of anthropogenic change.

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³Biological inventories and ecosystem management at Arnold Air Force Base, Tennessee

Rare Species Inventory and Land Management on Arnold Air Force Base, Tennessee

From 1991 to 1994, TNC and DNH completed rare (RTE) species surveys on Arnold Air Force Base's (AAFB) 16,188 hectare installation. Over 68 RTE species have been recorded. Five of these are new records for Tennessee and five species represent species range extensions. Given AAFB's high biodiversity, complex mosaic of plant communities and unique assemblage of rare and/or coastal plain disjunct species, a new management strategy has since emerged. AAFB is now moving from a natural resources program driven by resource extraction to one driven by a commitment to native biodiversity. A Core Team of natural resources experts and stakeholders has been established to guide AAFB's ecosystem management process. Current projects at AAFB that have been developed to inform future conservation decisions include: 1) distributional surveys for six RTE plants, including the listed *Helianthus eggertii* (Eggert's sunflower); 2) community classification system development for AAFB integrated with the TNC/Heritage regional classification; 3) status surveys for *Fundulus julisia* (barrens topminnow) and *Rana capito sevosa* (dusky gopher frog) and 4) barrens ecosystem restoration. Management recommendations developed by the Core Team will guide AAFB's future land use activities, help ensure Air Force mission success, and consequently, prevent the loss of biodiversity from this installation.

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Ecology and Management of *Melaleuca quinquenervia*, an Invader of Florida Wetlands

Invasive weeds are potent agents of environmental changes on local to global scales. Wetlands are valuable environments that frequently are impinged by a variety of threats including invasive weeds. *Melaleuca quinquenervia* (Cav) S.T. Blake (Broad-leaved Paperbark), though experiencing major diminishment of native populations in Australia, is naturalized and highly invasive in wetland habitats of south Florida, where it infests about 202,000 ha. These wetlands, including such renowned areas as the Everglades, are being transformed into *M. quinquenervia* swamps, with major environmental and economic impacts. Current management methods include herbicides, mechanical or hand removal, flooding, and prescribed burning. Insufficient information, high costs, non-target impacts, and the resilience of *M. quinquenervia* (epicormic sprouts and massive canopy seed bank) constrain the effectiveness of these methods. Biological control offers sustainable management potential, by lessening the spread and by reducing the vitality and growth rate of plants, rendering them more vulnerable to other environmental stresses and control methods. The snout beetle *Oxyops vitiosa* Pascoe, a natural enemy of *M. quinquenervia* in Australia, has now been released in Florida. Marked adults were released to enable recognition of field-produced offspring. Unmarked adults have now been found which suggests that they have successfully completed the first generation in the field. Additional agents are being studied both in Australia and in U.S. quarantine facilities. Ecological data is being developed to better understand the invasiveness of *M. quinquenervia* in Florida and the potential impacts of the biological control agents.

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The Noxious Presence on Willapa Bay

The accidental introduction of *Spartina alterniflora* (Smooth cordgrass or Spartina) to tideflats of Willapa Bay, Washington, at the turn of the century began one of the more controversial examples of managing non-native, invasive species in natural ecosystems. Since 1979, biologists from the Willapa Bay community, the Washington Departments of Fish and Wildlife and Natural Resources (DNR), and the United States Fish and Wildlife Service have been responding to the rapid spread of *Spartina* through Willapa's open tideflats. Aggressive rhizomatous growth, successful production of floating, viable seeds and warmer weather conditions in the Pacific Northwest have combined to produce an explosive growth rate in this pioneer species. In addition to the physical and technical challenges of working on Willapa's tideflats, legal, political, social and biodiversity issues have played dominant roles in shaping the state's course of action. After four years of environmental analysis and legal challenges to management plans, the second season of large scale control is underway. Many techniques, from hand weeding seedlings to mowing clones, and helicopter application of Rodeo® (glyphosate) to large meadows, are being used to stop the spread of the grass. Results from research and muddy field experience are both important planning components but the critical factor for success is the deliberate decision by state and federal agencies, county government and private landowners to pool equipment and labor to work cooperatively where ever possible. Large scale planning tools, control methods and the efficacy of DNR's work in the *Spartina* project will be discussed and evaluated.

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Flowering and Fruiting Response of Asimina tetramera Small Following Resource Management of Mature Sand Pine Scrub in Southeast Florida

Fire management techniques and mechanical manipulations were applied to a mature sand pine scrub community in Jonathan Dickinson State Park in southeast Florida. The research was conducted in 4.05 hectares of scrub on the Atlantic Coastal Ridge for the management of listed species in scrub habitat. The primary focus was *Asimina tetramera* Small (four-petal pawpaw) a federally endangered species that showed reduced flowering and fruiting under the closed canopy of *Pinus clausa* (sand pine). Following management applications in May 1996, more *Asimina tetramera* plants flowered in the burn treatments (>53%) compared to plants in the non-burn treatments (<34%). The chi-square value of 16.55 was significant at the .05 level. In addition, more flowers per plant were produced following treatments than were produced in 1995 or 1996 (ANOVA, $p < .0001$). Studies will continue to determine whether flowering response decreases over time. Land managers with small parcels of scrub habitat with listed species will benefit from the results of this study.

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Corvid Densities and Nest Predation in Rural Versus Wild Forests

Corvid densities were significantly higher ($p=0.05$, $n=34.13$ hours) in a developed canyon than in an undeveloped canyon of Colorado Front range montane forest. *Cyanocitta stelleri* (Steller's Jays) were the most frequently observed corvid in both study areas and comprised approximately 65% of total corvid detections. Both canyons are ecologically similar and fragmented by roads, but one is a closed watershed without rural homes. Most other bird species show no differences in density related to study site. It is believed the commensal food resources are responsible for the increase in corvids. Predation of *Turdus migratorius* (American Robins) was also significantly higher ($p<0.05$, $n=115$) in the developed forest than in the undeveloped. Predation frequency on artificial nests was significantly higher ($p<0.005$, $n=447$) in the developed forest than for the same nests of the undeveloped forest. Marks on plasticene eggs in artificial nests ($n=264$) were identifiable to species in 84.9% of the nests that experienced depredation. Most corvid impressions (81/98) were Steller's Jays. Squirrels and other potential predators showed no density differences between canyons. A clear demonstration of higher corvid densities resulting in higher nest predation rates is an important observation in the study of forest bird communities. Management recommendations are suggested regarding the practice of recreational bird feeding, especially in neighborhoods adjacent to natural conservation forests.

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Effects of Hydrologic Restoration on Two Exotic Grasses

In 1990 and 1991, forty ditch plugs were constructed to restore a more natural hydroperiod (i.e. duration and depth of flooding) on portions of the 8,900 ha Dupuis Reserve in South Florida. Vegetation transects and digital water level recorders were installed at two sites to monitor changes in vegetation relative to improved hydrologic conditions resulting from the ditch plugs. Plant density (number of rooted stems per 0.5 m^2 quadrat) and frequency of occurrence were recorded at quadrats placed at 5 m intervals along transects ranging in length from 100 to 135 m. Results from the period 1990-1997 indicated that increases in hydroperiod resulted in elimination of *Paspalum notatum* (bahia grass), an exotic species introduced to improve cattle forage. *Panicum repens* (torpedo grass), another introduced species, formed dense monotypic stands in response to increased hydroperiod, but was unable to penetrate areas where *Panicum hemitomon* (maiden cane) already existed. Two native wetland species, Maiden cane and *Pontederia cordata* (pickerelweed) increased after the second year and continued to be well established on both sites after the eighth year of monitoring.

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Overzealous Exotic Species Control as a Threat to Rare Species

Rare species may be threatened by exotic species control efforts. Misidentification of closely related and similar-looking rare and exotic plants is a likely source of such mistakes. During the course of a rare species survey of the Timucuan Ecological and Historic Preserve at Jacksonville, Florida, confusion of the well known pantropical exotic *Lantana camara* with the comparatively unknown listed endemic *Lantana depressa* was identified as a significant problem. Other uncommon plant species are at risk from similar mistakes. Some such situations have been described in the literature; others can be anticipated. Certain Florida species can be identified as at risk. Various herbiciding and weeding programs may also endanger unrecognized rare species.

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Implications of Cattle Grazing to Management of Natural South Florida Environments

We measured changes in plant biomass, litter standing crop, and species composition inside and outside 13 cattle enclosures on portions of Corkscrew Swamp Sanctuary that had a long history of grazing. We documented grazing effects on wet prairie, marsh, pine flatwoods, and hardwood hammock communities. The number of sites where significant differences were evident inside vs. outside the enclosures increased through the course of the study. Over the short period of the study, no major differences in species composition were noted. Grazing maintained a low ground cover and an open shrub stratum. The hammock vegetation was particularly sensitive; cattle damaged all but the largest trees and limited establishment of seedlings. Attempts to maintain the natural fire frequency in the pinelands and marshes were inhibited by the lack of fuel, and the lack of fire appeared to encourage shrub invasion. Degree of grazing effect was influenced by habitat type, grazing intensity, water levels, and locations of supplemental water sources and feeders. Significance of differences was affected by within-site variability, grazing intensity, and timing of vegetative production and its conversion to litter. Current South Florida plant communities have developed over the last 5,000-10,000 years in the absence of a large grazing herbivore. Although grazing favors certain desirable wildlife species, it does produce significant changes in the characteristics of natural South Florida plant communities and the processes that control them.

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**Response of *Festuca idahoensis* Grassland to
Prescribed Burning in the San Juan Islands,
Washington**

Grasslands on a 5 ha island belonging to The Nature Conservancy are dominated by *Festuca idahoensis* (Idaho fescue), *Camassia leichtlinii* (Large camas), and a diverse assemblage of other grasses and forbs. Permanent plots were installed in 1981 to track changes in plant composition, and to assess methods for arresting the encroachment of trees and shrubs into the grassland. Cover of all plant species has been recorded annually for 16 years. Portions of the grassland were burned in the summer of 1987, and reburned in 1996. The year following a burn, percent cover of most native perennials declined significantly; cover of Idaho fescue dropped from 57% in 1987 to 10% in 1988. One exception is *Camassia*, which increased following burning. Native and non-native annuals exhibited the largest increases, but returned to pre-burn levels in 4-5 years. Idaho fescue took 7 years to return to pre-burn levels. Among non-vascular species, cover of mosses and lichens dropped to near zero following burning. Both groups remained well below their pre-burn levels after 9 years. On-going studies on the island include investigating effects of more frequent burns in small test plots, manual removal of trees and shrubs, and herbicide treatments of clonal shrubs.

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**Growth Patterns of an Exotic Species, *Hedera helix*
(English Ivy), in the Pacific Northwest**

The purpose of the study was to examine growth characteristics of *Hedera helix* (English Ivy), an invasive, exotic species within Forest Park in Portland, Oregon. I measured the orientation of ivy growth relative to the nearest tree. Rather than growing in a random fashion as predicted, my study found that the ivy within 1.84 meters of the nearest tree grew preferentially toward the tree ($p=0.006$). Ivy growing at distances greater than 1.84 meters from the tree had greater tendencies to grow vertically or away from the tree. The study supports the idea that ivy seeks areas of light first and secondly a tree if the light is insufficient. In a follow-up study, data was recollected along with light intensity at each bud. The initial light data suggests a negative correlation between the amount of light absorbed by an ivy bud and the probability that it will grow towards a tree. Additional data will be collected and the results reported.

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California Roadsides: A New Perspective

Jones & Stokes Associates, in collaboration with the California Department of Transportation, developed a program for long-term management of roadside corridors. Program goals are to develop an efficient process for quality roadside design and management and to develop alternative vegetation management strategies. Objectives include increasing public/worker safety, improving environmental quality, reducing herbicide use, decreasing life cycle costs, and improving public perception. The program reinforces a commitment to reduce herbicide use and implement integrated vegetation management to ensure future-oriented, proactive stewardship. The methodology consisted of identifying vegetation management challenges, analyzing vegetation management alternatives, and coordinating over 30 focused workshops. The workshops provided a forum for discussion of divergent perspectives on corridor management issues from representatives of state and local resource agencies, fire protection officials, non-chemical control advocates, pesticide and farming industry representatives, and many others.

Recommendations include revising policies and procedures, developing a right-of-way corridor master plan, developing roadside design training, and improving coordination with local public groups and management partners. The proposed integrated design and management perspective is a departure from current philosophies in that roadway and roadside issues are synthesized on a segment-specific basis for long-term management. This a guide to a flexible program that considers best management practices with an integrated approach to vegetation, storm water, scenic resources, endangered species, and other resources. The program fosters the consideration of long-term management during project development and the design facilitates corridors that are safer, more sustainable, cost-effective, and environmentally sound.

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Local Wisdom Integrated with Traditional Research for Effective Resource Management

The commercial harvest of understory vegetation for floral and Christmas greenery has been in operation for over 80 years in the Pacific Northwest. While the timber industry has loudly and visibly sawed and pulled logs from the forest, the commercial plant harvester went about his business virtually unnoticed. Recently, expanding work forces and shrinking land bases have caused conflicts within the "brush" industry and thus attempts have begun by legislatures and land managers to try to regulate an unknown market. In response to this, researchers are scrambling to examine and find answers for this historically ignored field by traditional long term monitoring methods. While this scientific work takes place, lands are locked away from use or are being opened in only a few places where unsustainable harvesting practices subsequently take place. Rural workers desperately in need of employment are the sad statistics in this resource management dilemma. The main concept examined is how local wisdom may be gathered and incorporated into scientific research for timely management objectives. Life histories and management practices of old time harvesters in the Pacific Northwest are investigated along with changes being presented by business. This knowledge sets a baseline from which appropriate permits or land leases can be applied. This knowledge also sets the stage for a connection into more intense scientific research. With social groups looking toward community sustainability, ideas examined can also be applied toward furthering employment in forest assessment and other work by rural harvesters.

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***Indigenous Knowledge and Natural Area
Management***

Increased dialogue between tribes and U.S. public agencies in recent years has highlighted cultural differences concerning environmental knowledge of land and resources. Concerns regarding the cumulative effects of agency actions, including ongoing impacts to water quality and vegetative communities, lead to questioning standard agency methodology for environmental impact assessment which normally consists of looking at the environment in bits and pieces rather than holistically. This process is clearly not a reflection of traditional Indian experience and largely ignores complex plant community interactions. The presence and health of important plant habitats can be more effectively assessed by using both scientific ecological information and indigenous knowledge of traditional users. Most importantly for natural area managers today, some tribal peoples possess intimate indigenous knowledge of the ecological adaptations of native species in the isolated geographic pockets where the species persist today, and hence perhaps an accurate awareness of "indicator" species. The tribes desire an interconnected balance of physical landscape components, including upland terrestrial habitats, riparian areas, wetlands and clean, cold water. On the eve of the 21st millennium the knowledge of lands and resources traditionalists hold may increasingly begin to have a greater influence on how public lands are managed.

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***Local Opposition to a Natural Area Preserve:
Lessons Learned from the Elk River, Washington***

Located in Grays Harbor County, Washington, the Elk River estuary contains the largest, most diverse and highest quality salt marsh ecosystem remaining in the Pacific Northwest. In 1986, it was designated a state natural area preserve (NAP) by the Washington Department of Natural Resources (DNR). By 1995 over 3,330 acres had been acquired, making the Elk River the largest NAP in the state. A groundswell of local opposition to the Elk River began in early 1996. Numerous complaints were received from local residents who felt "locked out", particularly for recreational hunting. Media coverage exacerbated local discontent. Local legislators rallied behind vocal constituents. DNR hosted three public meetings, but by the end of 1996 two damaging legislative bills were introduced, taking direct aim at the state natural area program. One bill passed, changing the Elk River from a NAP to a Natural Resources Conservation Area (NRCA), with a stipulation permitting recreational hunting. DNR learned critical and difficult lessons in dealing with the Elk River predicament. Retrospectively, the following are recognized as essential to garnering public support for a natural area in a social landscape:

- comprehensive assessment of local historical and current site use
- meaningful involvement of local residents, current users, government officials, legislators, and media
- timely, respectful responses to public complaints and criticism
- well planned, facilitated and proactively initiated public meetings
- clearly communicated, cogent and consistent rationale for restricted access
- unified messages presented by coordinating government agencies
- supportive constituency cultivated *before* opposition or crisis erupts
- alternatives to recreational use (e.g. local residents participate in site management / protection)

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Ecosystem Conservation in the Political Landscape

Since the 1990 report of the Interagency Scientific Committee on the Spotted Owl, landscape-scale science has played a key role in the shaping of public lands management in the Pacific Northwest. But policy does not rest on science alone, and the planning and implementation of public lands management yield abundant examples of the disconnect between science and policy. This presentation will provide an advocate's brief overview of the last decade in Northwest public lands policy, in terms of ecosystem conservation. Particular emphasis will be given to NWEA's experience with implementation of President Clinton's Northwest Forest Plan and with the struggling efforts of the federal government's Interior Columbia River Basin Ecosystem Management Project to create a science-based plan for management of over 75 million acres of federal lands in the Inland Northwest. These efforts will be contrasted with citizen models for protection of biodiversity at landscape scales offered by NWEA, The Wildlands Project, and others. I will offer potential explanations for failures to adequately infuse science in policy, including bureaucratic momentum and misincentives and political intervention. I will also speculate on possible remedies, including bureaucratic reforms and the need for legislation to address management issues at landscape scales and to clarify whether, to paraphrase Jack Ward Thomas, biodiversity conservation is an objective or a constraint.

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A Survey of Algae and Invertebrates Associated with Borax Lake, a Natural Hotspring Lake in the Great Basin of Southeastern Oregon

Monitoring of algae and invertebrates was initiated in 1991-92 at Borax Lake as part of the recovery plan for the endangered *Gila boraxobius* (Borax Lake chub, Cyprinidae). Previous studies had revealed that algae and aquatic insects provide the major food source for the chub. Borax Lake is a hot, alkaline lake approximately 10 hectares in size with an average water temperature of 30°C. Total dissolved solids average 1,6000 mg/l. Periphyton algae were surveyed by scraping substrates and incubating microscope slides in the water column. Invertebrates were surveyed using dip and plankton nets, pitfall traps and Ekman dredges. During this study over 7,000 specimens representing more than 300 species of invertebrates were collected and identified. The algal community was composed of 23 species and dominated by cyanobacteria (mainly *Aphanocapsa thermalis*) and diatoms (mainly *Denticula elegans* and *Navicula* spp.). Chironomid midges (mainly *Pseudosmittia forcipata* and *Micropsectra nigripila* group) and ephydrid flies (*Scatophila* spp. and *Calacoenia platypelta*) were the most commonly collected insects. The invertebrate community at Borax Lake is composed of a mixture of cosmopolitan and highly restricted species. *Planorbella (Pierosoma) oregonensis* (lamb rams-horn) is a highly restricted species with the only remaining population occurring in Borax Lake; historical populations in Utah and Nevada appear to have been extirpated. Potential threats due to development of geothermal energy in the vicinity of Borax Lake have been temporarily suspended although Anadarko Petroleum Company still holds a lease and may pursue development in the future.

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***Fire History and Fire Regimes of East Humbug and
Scorpion Creeks and Their Relation to the Range of
Pinus lambertiana Douglas***

Fire history was reconstructed on a 3,540 hectare area in the west central Cascade mountains of Oregon. Within the study area are some of the northernmost populations of *Pinus lambertiana* Dougl. (sugar pine) in the natural range of sugar pine. Stumps and associated fire scars in clearcuts were aged, as were trees on forested sites. Fire events were mapped. Mean Fire Interval (MFI), the average of intervals between fires, and Fire Frequency Index (FFI), the average of fire free intervals and time interval since the last fire on all sample plots was calculated. Fire severity was estimated for each mapped event on a plot. MFI was less at low elevations. Sugar pine is most commonly found on south and west aspects at lower elevations in the study area. As FFI increases the amount of sugar pine decreased. Fire severity increased with increasing elevation. Sugar pine is found most commonly on sites that burn more frequently and where fires do not consume large areas of forest canopy. Fire disturbance may increase populations of *Ribes* spp. (currant) which are alternate hosts for *Cronartium ribicola* (white pine blister rust). Lack of fire disturbance results in increased stand densities or understory development which can increase stress in individual trees making them susceptible to *Dendroctonus ponderosae* (bark beetle) attack. Past management left some sugar pine in clearcuts, but subsequent broadcast burning killed most of these trees. Careful use of thinning and fire might improve chances that sugar pine will persist in this area.

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***Coles Levee Ecosystem Preserve Environmental
Education Program***

The Coles Levee Ecosystem Preserve (Preserve) is a 6000 acre endangered species compensation mitigation bank about 20 miles southwest of Bakersfield, California. This region has more rare and endangered species than any other region in the contiguous United States. Established as a private-public partnership between ARCO and the California Department of Fish and Game, the project has won many awards and has resulted in a variety of unexpected serendipitous benefits to the environment and nearby communities. From the initial visit by school children who made nest boxes to enhance riparian habitat, the environmental education program has developed region-wide acclaim for its local backyard approach to environmental awareness integrated with the common necessity for a healthy economy. The first visit by 40 elementary school children has grown to over 1500 students (grades K-8) per year. Regional biologists have volunteered as docents and ARCO provides a docent stipend for university students interested in teaching. Boy Scouts have worked on the Preserve for merit badges, community service and Eagle Scout projects, while researchers and industrial training groups have also benefitted from on-site research and training. The curricula includes nature walks, hands-on wetland studies, an interpretive center and outdoor educational exercises. The program at Coles Levee Ecosystem Preserve helps to inform and teach about the importance of environmental stewardship and a sustainable economic environment.

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Honduras Partnership for Biodiversity

In 1995 the U.S. Agency for International Development, Peace Corps, and U.S. Department of the Interior formed a partnership to help developing nations with resources conservation. The three-year (1996 - 1998) Partnership for Biodiversity chose as its first site the 815,000-hectare Río Plátano Biosphere Reserve in Honduras. Illegal settlement in the Reserve has caused deforestation and has pushed members of four indigenous tribes from parts of their homelands. This displacement, in turn, forced many indigenous persons to abandon their traditional activities for more destructive land uses. The Honduras Partnership includes four agencies of the Honduran Government and is headed by Mosquitia Pâwisa, a nonprofit organization that helps indigenous peoples. The Partnership has made progress toward five objectives:

- (1) sustainable economic development to help indigenous persons create and manage small businesses that are environmentally friendly and help stabilize local economies;
- (2) organizational development to help villagers identify and reach common objectives;
- (3) resource conservation to help Honduras establish administrative offices within the reserve and develop village-based systems for the use and protection of natural resources;
- (4) boundary delineations to help Honduras legalize and mark the boundaries of the reserve and moderate surrounding land uses; and
- (5) territorial ordinances to curb illegal settlement and help indigenous peoples secure legal protections to their traditional use areas.

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Does a Drawdown Period Influence Nest Predation?

Flooding and water drawdown are commonly utilized by freshwater marsh managers to optimize habitat structure for resident and migratory waterfowl, yet few studies have tested the effect of these management actions on the passerine birds which also utilize the marshes. During drawdown, flooded areas dry and form land bridges for terrestrial predators to access previously isolated emergent vegetation. Nesting success has been strongly correlated with nest predation in both aquatic and terrestrial systems. We studied the effect of drawdown on passerine nest predation through transect studies of 320 artificial nests containing *Coturnix coturnix* eggs. Replicate studies took place in a flooded and drawdown marsh where nests were exposed for 21 days with varying frequency of investigator disturbance. Point counts were used to sample the avian community in the two marshes. The drawn down marsh had lower predation rates and supported greater avian species richness and density of nesting passerine species than the flooded marsh. Species richness was greater in the flooded marsh due to the addition of waterbird guilds and higher nest predation rates appeared to be related to the abundance of predatory *Cistothorus palustris* (Marsh Wrens). Our results also suggest that increasing frequency of visits to a nest site increases predation rates.

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Restoration of a Freshwater Coastal Marsh: Effects on Avian Use

The freshwater coastal marshes of the Great Lakes are among the rarest communities in the Midwest. Attempts to restore such habitats thus far have relied on impoundments and artificial manipulation of water levels. The Metzger Marsh restoration project, along the southwestern shore of Lake Erie, offers an alternative to a totally impounded marsh. A lakefront dike was constructed with openings in the impoundment to allow lake/marsh exchange and natural water level fluctuations with the lake. Beginning in 1995 and running through 1998, we are studying the effect of restoration on avian use of Metzger Marsh before, during, and after restoration. An unimpounded coastal marsh was also included to serve as a reference for the study. During the 1995 pre-construction and 1996 drawdown period of restoration we found that a dramatic increase in annual vegetation on the newly-exposed mudflats did not stimulate increased nesting in the passerine or waterfowl species that bred in Metzger Marsh. Stabilized water levels, due to drawdown, did appear to correlate with increased nesting success in 1996. More wading birds, gulls and terns used the marsh for feeding in 1996 when low water levels concentrated fish in small pools. A peak in migrating passerines also occurred in late summer as the icterids fed on the seed crop produced by the annual plants.

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Conserving Canada's Ecosystems Through the Endangered Spaces Campaign

Though considered a conservation leader, Canada has yet to reach the halfway mark in permanently protecting examples of all its natural regions. A comprehensive system of representative, core protected areas is widely recognized to be critically important in maintaining and restoring biodiversity on a regional scale. Since 1989, World Wildlife Fund Canada has coordinated the nationwide Endangered Spaces Campaign to secure such a system by the year 2000 (terrestrial) and 2010 (marine). Employing a strategy of science-based advocacy, financial and technical support to local conservation groups, and cooperation with business, the campaign has mobilized the largest-ever conservation coalition in Canada. In 1992, the campaign goal became public policy for Canada with commitments from the federal, provincial and territorial governments. The total area protected to campaign standards has also doubled since the campaign began. The use of a coarse-scale, GIS-based ecological analysis to identify gaps and candidate sites for protection based on ecological representation and integrity, has made the campaign goal measurable and therefore "finishable", enhancing its political appeal. However, to succeed in reaching the ambitious goal depends on government leadership in ecologically-based regional land use planning, which only a few jurisdictions are undertaking in a period of fiscal austerity and deregulation. WWF is exploring marketplace incentives such as forest certification to complement traditional approaches by government.

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***The Changing Cultural Construct of Natural Areas:
A View from Australia and New Zealand***

Increasing promoted overseas as "clean, green" lands with a rich and well protected natural environment, Australia and New Zealand have undergone a dramatic shift over the past 200 years in terms of attitudes towards and understanding of the natural environment. The purpose of this paper is to present an overview of the key points of the environmental history of the two nations with respect to national parks and wilderness and the implications that this has for understanding natural area policy and decision-making and the institutional context within which natural area managers operate. The paper argues that Australia and New Zealand have shared common experiences in terms of several successive dominant visions of the natural landscape: Utilitarian, Romantic, Environmental and, more recently, Sustainable. The environmental vision led to the creation of a number of new parks and wilderness areas and the use of World Heritage nominations to both protect and promote natural areas. However, since the end of the 1980s, the vision has begun to change yet again as issues of biodiversity, indigenous access and ownership, heritage, multiple-use, corporatization, commercialization, exotic species management, and tourist promotion have emerged. This situation has led to the end of former certainties for managers and advocates of natural area conservation which is leading to a re-evaluation of the role of natural areas in Australia and New Zealand society.

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***Telling Stories: Providing for Other Voices to be
Heard in Heritage Interpretation and Marketing***

Storytelling is the essence of the interpreter's craft. However, increasingly, interpreters are being challenged by the awareness that a particular area or site has a multiplicity of stories, failure of which to acknowledge can not only lead to visitor disenchantment but also to dissatisfaction among the various stakeholders in the heritage site. This paper identifies a variety of mechanism by which managers can identify the range of stories which an area has to tell and better convey them to their various audiences as part of a strategic interpretive process. Approaches discussed include stakeholder audits, stakeholder participation exercises, the role of marketing strategies, interpretive techniques and evaluation. Reference is made to a number of case studies in Australia and New Zealand which highlight the way in which stories are both told and not told as part of the interpretive process. The paper concludes by noting the vital role that the ability to create spaces for a range of voices in heritage interpretation play in visitor and stakeholder satisfaction.

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Descriptive Analysis of the Pine Dunes Research Natural Area

Embedded in the surrounding sagebrush-steppe landscape, the Pine Dunes Research Natural Area (RNA), provides an opportunity to study a unique sand dune ecosystem containing a relict grove of *Pinus ponderosa* (ponderosa pine). Located in Lassen County, California, along the eastern edge of the Madeline Plains, the sand dunes are thought to be derived from a Pleistocene lake bed that formed the plains. The surrounding area, in contrast, consists of Miocene volcanic basalt and Pliocene volcanic pyroclasts at elevations of 5400 to 5600 feet. The vegetation within the sand dune system is heterogeneous in composition, patchy in distribution and appears to be different than the sagebrush-steppe matrix. A descriptive analysis of the sand dune habitat, by way of comparison with the sagebrush-steppe landscape, is presently being conducted. Floral composition, vegetation structure, relative abundance and relative frequency are among the data being collected. Disturbance history and the age of the pines will be determined by tree core analysis. Other environmental attributes, such as climate, precipitation, soil composition, local geology and hydrology are also included in this research. Data will be analyzed utilizing statistical techniques including, but not limited to, ANOVA, principle component analysis and other multivariate methods appropriate for the analysis of ecological communities. The results of this research will explain the diversity and distribution of the vegetation within the sand dune habitat and reveal the environmental differences that exist from inside the sand dunes to the area outside. Conclusions will also assist in making future management decisions regarding the preservation of the ponderosa pine population and native flora within the dune ecosystem.

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New and Increasing Uses of Native Species

This symposium will address both pre- and post-European subsistence and commercial uses of non-timber forest products until the 1980's. Since then, increased demand and increased scales of production/marketing as well as increased diversity in products, people, types of enterprises, and markets have had major ecological and social implications and have lead to increased pressures on land managers to incorporate other values in their policies. The symposium will present on-going research of case studies aimed at determining sustainability of mushroom harvesting, gathering knowledge and stewardship practices, labor relations and ethnicity issues, and tenure issues and participation in policy making.

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Research Lands in the Western United States

There are many land designations, often coinciding with natural areas preservation efforts, that recognize research as the primary use of specific land areas. Research lands range from very large areas to much smaller sites, and may include numerous components of a particular system of lands or be restricted to single locales. When various research-designated lands are tallied, however, the total area involved can be quite significant. The major focus of this analysis is on federal lands, but research lands are designated at a variety of governmental (and non-governmental) levels; any clearly identifiable research area is considered. Some of the more common research designations include Research Natural Area, Agricultural Experiment Station, Long Term Ecological Research site, and Experimental Forest and Experimental Range. New Mexico, Oregon, and Kansas illustrate extensive designation of lands for research purposes, including the variety of types and scales of research lands, as well as state-to-state variability. New Mexico is an 'extreme' example, with over one million hectares of land (3.3 percent of state area) designated for research or scientific purposes. Much smaller proportions of state territory have been designated elsewhere, but the total area still may be regarded as significant: Oregon has over 100,000 hectares of research lands. Better recognition of lands designated for research or scientific purposes would be beneficial to the research community and to the protection and management of these areas.

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The Ecosystem Consequences of Fragmentation: Biogeochemical Cycling at Old Growth Forest-Clearcut Edges in the Pacific Northwest

My research addresses the impact of forest-clearcut edges on biogeochemical processes which affect nitrogen retention within fragmented old growth Douglas-fir (*Pseudotsuga menziesii*) forests in the Pacific Northwest. The abrupt difference in height and structure at edges produces microclimatic gradients across forest patches, which, in turn, alter rates of nitrogen and carbon cycling. A major problem in extrapolating local-scale process studies up to regional areas is that totaling the area-weighted averages of process rates for component ecosystems does not equal cumulative rates for watersheds or larger spatial scales, due to the abundance of induced edges and the interconnections between ecosystems at edges. My approach examines the relationship between the magnitude of the edge effect on nutrient cycling and the distance the effect penetrates the forest, in order to more accurately predict the influence of land use on regional biogeochemical processes. Prior research has documented edge effects on microclimate and vegetation at the field site. I have selected the following processes for study: net seasonal nitrogen mineralization and nitrification in mineral soil and forest floor; litter decomposition and deposition; field emissions of N₂O; and nitrogen pool sizes in soil and foliage. Initial results indicate significant effects on nutrient cycling, extending up to 120 m into remnant oldgrowth forests from clearcut edges. Increased nitrogen availability is correlated with higher net ecosystem production in forest soils within edge environments relative to forest interiors. I will extrapolate within-stand results using complementary stable-isotope analyses and high-resolution (0.2-m) multispectral digital imagery.

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***Monitoring and Management of the Rare Plant
Calochortus umpquaensis in the Ace Williams
Candidate Area of Critical Environmental Concern***

Calochortus umpquaensis (Umpqua mariposa lily) is a rare serpentine endemic restricted to southwest Oregon. It is listed as Endangered by the State of Oregon and is a candidate for federal listing. Evidence indicates that habitat was primarily bunchgrass prairie and open woodland with a frequent fire history prior to European settlement. Fire suppression has since allowed closed canopy forest to become established over much of the species habitat, reducing population numbers, reproductive success, and the amount of occupied habitat. Population monitoring has been conducted in the Ace Williams Candidate Area of Critical Environmental Concern (ACEC) since 1993. Population densities in closed canopy habitat have averaged 18,850 per hectare with 13.3% flowering. Comparatively, densities in prairie and open canopy habitats averaged 72,950 per hectare with 27.8% flowering. A combination of thinning and burning will be applied to closed canopy habitat and analyzed over a seven year period to determine if these treatments will be useful in habitat restoration and in increasing population densities and reproductive success. Treatments will be applied in the fall of 1997.

96. Hornshaw, Dr Susan G.

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***Dinosaurs in our Midst: A Cultural Analysis of the
Construction and Preservation of Natural Areas***

Within the context of post-modern sensibilities and analytic moves, this paper is an exploration and examination of the cultural texts and discourses of the notions of 'natural areas' and the notions of 'management'. It enjoins the notion of Imperialist Nostalgia (after Rosaldo 1989), i.e., that we mourn the loss of the things we have had agency in destroying. It also enjoins a post-modern notion of "simulacrum" - a copy of a copy for which there is no original. No more does this become clear than in the performances and constructions of certain kinds of 'natural areas' within urban limits and contexts. Here we can see the core of the discourse of 'management' and the message and 'text' of 'virtual reality'. This is a powerful example of creating a copy of a copy for which there is no longer an original. The specific examples mobilized within this paper are performances and management of both 'wild' and 'natural phenomena within urban contexts. This discussion addresses the shear between what we actually create, re-create or construct and what we think we create, re-create and construct. The paper is a deconstruction of what we have purported to re-construct of that which we historically actually deconstructed.

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***The Use of Part Images to Evoke Perception of a
Whole Entity***

When we create and construct explanations, "stories" or "texts" about other people, other creatures or other parts of 'nature' for other people, we simultaneously create performances or 'texts' that are "stories that we tell ourselves about ourselves". This paper is an exploration of the "part images" that we create and how we deploy them to comfort ourselves in thinking that we are creating, or, in some cases, recreating whole images of, for example, ecological systems. Within the context of post-modern sensibilities, this paper examines the texts and discourses of environmental interpretation. We construct notions and images of nature and natural processes and, often, become more committed to protecting these notions than we are committed to protecting the nature that they represent. Our notions of nature are, in reality, cultural notions or our notions about nature proceed from our cultural notions. This paper is an exploration of the cultural notions and constructions of 'nature'. Specific examples focus on the texts and discourses of the constructions and re-creations of ecological systems such as Tall Grass Prairies.

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***Federal Management of Natural Areas on Ceded
Lands***

During the past ten years, Federal land managers have become aware of the trust relationship between indigenous peoples, the land, and the agency which manages it. This presentation will discuss the differing world views of Native Americans and Federal agencies; it will examine the process by which specially designated areas, such as ACEC's (Area of Critical Environmental Concern), can be created to protect lands and issues of Native American interest; and preview the future work that needs to be accomplished to further understanding of this land, the original people who lived on it, and modern management precesses.

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***Exotic Plant Invasions in Red Butte Canyon Research
Natural Area***

Red Butte Canyon Research Natural Area (RNA), a pristine watershed, has been used as a baseline reference site for riparian and shrub ecosystems in the Intermountain West. Although the canyon has been protected from development since 1890, the native vegetation on the adjacent foothills has deteriorated due to campuses expansion and heavy use by recreationists. As part of the management planing process for the RNA, foothills and canyon vegetation was sampled to identify exotic plant species that might threaten the integrity of the RNA> The preliminary survey (1996) indicates that 32% of the species in that study are introduced. Over 50% of the introduced species belong to the following three plant families: Asteraceae, Gramineae, and Brassicaceae. Four distinct plant communities, riparian, grass-forb, oak-maple, and coniferous , are represented. The grass-forb community is heavily impacted by exotic species which have invaded disturbed areas on the foothills and probably persist because of frequent fires.

50. Ivy, Don B.

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***Issues and Opportunities Facing Coquille Indian
Tribe Land Use Planning***

Since restoration of Federal-recognition status in 1989, the Coquille Indian Tribe has acquired a land base of more than 6,400 acres, much of it previously cut timberlands and lands surrounded by neighborhoods and businesses. With natural areas being critically important to the maintenance and renewal of tribal cultural practices, today the tribe finds itself searching for naturalness in unnatural landscapes. The translation of Coquille land use goals into realities is complex with the weighing of establishment of areas exclusively for tribal cultural activities against tribal economic and community development goals, such as forest lands for commercial timber production, agricultural land for crops, tribal residential housing and community facilities, business park development, and infrastructure requirements. The bridging of social and natural landscapes within the tribe is first a matter of creating pathways between a variety of compelling socio-economic concerns and the profound need to preserve and renew ancestral lifeways. Secondly, the Tribe must also consider how to build a bridge with the non-Indian community in such a way that tribal values and goals are maintained in ways compatible with the practices and purposes of neighboring land owners and users.

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***Protection of Bacopa rotundifolia (water hyssop)
from Illegal Off-Road Vehicle and Horse Traffic on
the Hoosier National Forest***

Water hyssop is a state endangered plant in Indiana which inhabits the shallow margin of sinkhole ponds. Only one site for the plant is known on the Hoosier National Forest in south-central Indiana. In the fall of 1996 it was brought to our attention that the water hyssop site was being severely damaged by illegal off-road vehicle and horse traffic around the pond edge. In 1994, four small but healthy populations were found in the pond. By 1996, plants were found only in a tire rut adjacent to the pond. Steps were taken starting in January 1997 to address this problem and recover the population. Fencing, discussions with adjacent landowners, media coverage, and other techniques were used to protect this site. The techniques used and their success or failure will be discussed.

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***An Integrated Approach for the Control of
Cogongrass (Imperata cylindrica (L.) Beauv.)***

Integrated management techniques have been utilized as an effective method of control for cogongrass. Combinations of herbicides, mowing, and disking have yielded positive results in the control of cogongrass. However long-term suppression of cogongrass will only occur if other desirable plant species are established in infested areas. The strategy has been to suppress cogongrass with the previously mentioned methods then establish desirable plant species to compete with and eventually replace cogongrass. The species used for revegetation included Partridge Pea (*Chamaecrista fasciculata*) with Lopsided Indiangrass (*Sorghastrum secundum*) and Saw Palmetto (*Serenoa repens*), Bermudagrass (*Cynodon dactylon*), and Mimosa (*Mimosa strigillosa*) with Slash Pine (*Pinus elliotii*). The study was located at three different sites that varied in terms of cogongrass infestation intensity: no cogongrass could become infested in the future, a sparse to medium infestation of cogongrass, and a heavy infestation of cogongrass. This integrated approach has shown some promise for the displacement of cogongrass. However, more effective native plant establishment methods need to be developed for large scale success.

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***Impacts of Exotic Forest Insects and Diseases at
Great Smoky Mountains National Park***

Great Smoky Mountains National Park is one of the largest forest areas managed as wilderness in the eastern US and contains extensive areas of old growth representing over 100 species of trees in relatively intact ecosystems. The forests have been undisturbed by direct human intervention for over 60 years, but exotic insects and diseases have devastated several tree species in the past three decades. Individual trees are not the only loss: birds, amphibians, bryophytes, herbaceous species and arthropods have also been affected. *Adelges piceae* (balsam woolly adelgid) was first discovered in the Park in the early 1960's and has caused over 70% mortality of the host tree *Abies fraseri* (Fraser fir). Park resource managers and cooperating researchers have documented the ecosystem impacts of balsam woolly adelgid in the spruce-fir forest and have now begun taking a similar approach to effects of other exotic pests. *Discula destructiva* (dogwood anthracnose), *Cryptococcus fagisuga* (beech scale) and *Nectria spp.* (beech bark disease), *Sirococcus clavigignenti-jugulandacearum* (butternut canker) are the most recent large-scale problems. Baseline studies are also being conducted in anticipation of *Lymantria dispar* (gypsy moth) and *Adelges tsugae* (hemlock woolly adelgid). This research will help in developing control strategies as well as in preserving biodiversity. Control of exotic plant species is also part of management efforts, since these would be poised to invade forests suffering defoliation or mortality. The Park has also developed a variety of education programs to increase public awareness of these problems.

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***Ecological Integrity in Theory and Practice: Lessons
about Attaining Environmental Goals***

"Integrity"--specifically ecological integrity--is a touchstone concept like "democracy," "health," or "civil rights" that can help people understand and reverse the trend toward impoverishment of the ecological, especially biological, systems on which the human economy depends. This impoverishment, which extends from physical and chemical degradation of the global environment to the impoverishment of human culture itself, results when society behaves as if ecological risks did not exist. "Integrity" as a policy goal builds on people's intuitive understanding of the word and on the concepts standing in US and Canadian law and treaty; it also sets an endpoint that can be translated into precise, integrative scientific indicators. Unlike the narrow and often inappropriate indicators usually relied on, measures of biological condition that are based on integrity enable scientists, managers, policymakers, and citizens to better evaluate the consequences of their activities, thereby providing a baseline for making more-informed decisions. Because rivers integrate all that happens in the landscapes they drain and their condition tells us much about our stewardship of those landscapes, I will use studies of rivers to illustrate the integrity concept and how measurement of biological condition in those rivers can be instrumental in protecting critical biological systems and thus human society.

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***Effects of Timber Harvest on Cimicifuga elata, a
Rare Plant of Northwestern North American Forests***

Cimicifuga elata (tall bugbane) is a rare plant of northwestern North America. Conservation of the species in forests of western Washington and Oregon creates the potential for conflict with timber harvest objectives. Previous reports indicate the species may be old-growth dependent, and that populations near clearcuts have low vigor. The objectives of this study were to compare populations in sites with differing timber-management histories to evaluate the effects of timber harvest. In contrast to previous reports, we found that *C. elata* in uncut old-growth forest was smaller and less reproductive than in clearcuts, probably because the plants respond well to the additional light in cut-over areas. Plants in areas with other management histories, such as second growth and thinned stands (both > 70 years old), had an intermediate size. No populations have been reported in clearcuts of moderate age (15-30 years), and it is possible that competing vegetation excludes *C. elata* from clearcuts after a few years. We recommend development of an interagency Conservation Agreement for *C. elata* that assures protection of selected populations, improvement of sites through adaptive management, and creation of gaps in forests to provide additional habitat for the species, as well as additional targeted research.

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***The Use of Prescribed Burning as a Restoration
Process: Lessons From Santa Cruz Island, California***

As part of a comprehensive effort to maintain, protect and restore the natural biotic diversity of Santa Cruz Island, California, a prescribed burning program was designed and implemented in 1993. The program consists of several different but integrated projects, and targets both populations and communities of native and non-native species. It is presently being used to control populations of individual alien species (fennel *Foeniculum vulgare*), increase the regeneration of individual native species (Bishop pine *Pinus muricata* and Santa Cruz Island live-forever *Dudleya nesiotica*), and enhance the habitat of native species within particular communities (grasslands). When combined with herbicide treatments, the use of fire has contributed significantly to the reduction of fennel in experimental sites. The regeneration of Bishop pine seedlings has been significantly greater in areas that were burned, as has been the diversity of native species within these burned units. Fires benefit to native species within grasslands has been mixed and has predominantly been weather dependent. Modifications to increase the effectiveness of the program include a fundamental analysis of what restoration on the island means, hierarchical implementation of experimental and management studies, and large-scale, comprehensive projects where fires effect on plant and animal diversity is monitored.

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The System of Protected Natural Territories in Khabarovsk Region of the Russian Far East

One of the most effective methods of conserving biological diversity is through development of a system of protected natural territories. Such territories represent the only guarantee for conservation of the numerous species of rare plants and animals in their natural habitat. The Khabarovsk region, due to its geographical position, has uniquely high biological diversity, stretching from territories occupied by southern pine-deciduous to the northern mountainous tundra. The Red Book of the Russian Federation contains 41 rare and endangered species of plants and 53 animal species from this region, including species such as the Amur tiger, Red-crowned crane, Eastern white stork and others. The Khabarovsk region has adopted a plan to increase the number and size of protected areas in the region by year 2005. Presently, the total area of protected natural areas, including zapovedniks (strict scientific nature reserves), wetlands, zakazniks (similar to wildlife refuges), and nature monuments, comes to 4,190,300 hectares, or 5.3% of Khabarovsk region. With the addition of those territories planned to come into existence by 2005, natural areas under some form of protection will reach 9.4% of the region's total area. The expansion of a system of protected areas will allow for conservation of viable populations of rare and endangered species in the region and of stable populations of southern species finding their northernmost habitat in Khabarovsk region.

7. Landres, Peter B.

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What is Natural?: An Ecological Perspective

Many areas, such as wildernesses and parks, are protected for their natural character and the benefits to society that are derived from this naturalness. When initially established, however, most of these areas were not pristine, and today all are beset with direct and indirect threats. The need to protect and sustain natural conditions without fully knowing what these conditions are is increasingly leading managers to question what they are managing for and the benchmarks they use in evaluating change in natural areas. This questioning is largely focused on defining "naturalness" and deciding how it should be protected and managed. This presentation reviews understanding about ecological integrity and variability, offers a framework for defining "naturalness" based on this understanding, discusses management implications of this framework, and closes with a discussion of the barriers to defining and using concepts of naturalness. I conclude that there will never be an absolute definition of naturalness because the definition is context-, scale-, and value-dependent. The crucial point is that decision-makers not use a single, rigid definition of naturalness applied to all cases in all areas. Instead, decision-makers need to explicitly and openly discuss spatial bounds, temporal bounds, and the value judgments used in deriving their definition of naturalness. Defining naturalness is a proactive step that, in addition to the reactive step of identifying and reducing threat impacts, will improve management by providing a target and benchmark, and by improving understanding about the ecological system to allow evaluation of change in natural areas.

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***Implications of Changing Social and Ecological
Values in Managing Wilderness***

Since passage of the Wilderness Act in 1964, the values our society places on natural areas, and the benefits we derive from these areas, have changed in profound ways. In a democratic society, social values ultimately drive nearly all agency policies and resulting management goals and actions. Yet how these values and benefits have changed over 33 years since passage of the Wilderness Act, and the influence of these changes on the management of natural areas in general, has not been examined. We offer a conceptual model of the interactions among societal trends and values, wilderness management, and the benefits derived from natural areas. This model illustrates the cyclical nature of these interactions, how each component depends on the others, and the potential fragility of natural area management. This conceptual model also clarifies the difference between "values" and "attitudes" towards natural areas, and between the "meanings" and "benefits" that are derived from them. We discuss general social trends as well as specific trends and current attitudes related to natural areas. We conclude that attitudes, meanings, and benefits all play an integral role in natural area management; that values and benefits need to be explicitly and openly discussed so that both managers and stakeholders are aware of them; that today's values and attitudes suggest increasing emphasis on long-term and regional stewardship goals for managing natural areas; and last that public involvement will be key to reducing (but not eliminating) conflict between traditional and emerging values.

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(abstract on next page)

42. Urban Natural Area Protection and Management

The Northwest conjures up a picture of large trees and patches of green. In the Portland metro area we have been accustomed to the 5000 acre Forest Park as a backdrop to downtown. The Willamette, Columbia, Tualatin and Sandy Rivers, forested buttes and Mt. Hood, primarily in public ownership, have been the anchors of our regional greeninfrastructure. Until recently there were vegetated corridors connecting many of these larger areas, and some type of open space in close proximity to most neighborhoods. Over the past ten years, as the population and development have increased, some of these connections have disappeared. Unlike the many east coast and midwest cities that already have regional park systems in place, we are trying to both maintain and enhance our current public land holdings while adding on and creating a larger system. Metro, the local regional elected government is responsible for acquisition of regionally significant open spaces, as well as development of a regional growth management strategy. Limited public funds for acquisition and even less for operations and maintenance has created the need for innovative partnerships and solutions. Public involvement and stewardship has become a priority for many local government programs. Teaching and getting citizens and school groups involved in natural area restoration, maintenance and stewardship is a wonderful goal, but also requires a lot of staff time. This panel will explore the regional landscape pattern and regional government strategies for protection of the landscape. The second part will look at different strategies for maintaining and restoring urban natural areas juggling limited funds, the increased invasion of undesirable plant species and how and when to involve the public.

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Ecological and Economic Consequences of Imperata cylindrica (cogongrass) Invasion in Southeastern Sandhill

Sandhill, with an exceptionally high diversity of herbaceous plant species, is critical habitat for numerous rare animals, and is an economically important source of pine wood. I studied the ecological effects of invasion by *Imperata cylindrica* (cogongrass), imported from southeast Asia. I found that cogongrass, a fast-growing rhizomatous invader, rapidly displaces sandhill's characteristically slow-growing clumping grasses, while shrubs, palms and small trees are displaced more gradually and larger longleaf pines are unaffected. Seedling recruitment of sandhill plants (including longleaf pine) in cogongrass is greatly reduced, especially for smaller-seeded, non-rhizomatous sandhill species, which encompasses most sandhill grasses and herbs. Thick litter in cogongrass presents a physical barrier to seed germination, coupled with by a 50% reduction in ground-level light due to cogongrass's comparatively high leaf area and shoot mass. If germination is successful, sandhill seedling roots must compete for soil space with cogongrass roots and rhizomes, 54-70% higher in root mass and 24-52% higher in root length density than for sandhill vegetation. Cogongrass's dense root/rhizome layer reduces soil water by 50% during peak transpiration, a significant resource limitation for sandhill seedlings. Cogongrass also displaces sandhill burrowing animals, important in soil processes, and changes parameters of sandhill fire regime, primarily to it's own benefit. Consequently, uncontrolled cogongrass invasion in sandhill will likely result in a shift from species-rich pineland to species-poor grassland dominated by cogongrass. Costs in terms of human uses would be increased fire hazard, loss of forest management jobs, fewer game animals, and a visually impoverished landscape.

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From a Native Perspective: There is No Such Thing as "Wilderness"

The present social landscapes overlay the turf wars that are rending apart the natural environments we all live in. Bridging the social landscapes between the dominant "McDonald's culture" (one that includes the disneyfication of 'wild' animals) and those of indigenous peoples demands understanding and accepting world views that, unfortunately, conflict in beliefs and behaviors. These conflicts have engendered polarized political actions making any kind of a "bridge" seem precarious and downright dangerous for those wishing to cross it.

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Wildlife as Weeds: A Review

Over 2,300 species of exotic animals are established in the United States, including 142 species of terrestrial vertebrates, over 2,000 insects and spiders, 70 fish, and 91 freshwater mollusks. From 1940-1990, the number of introductions of terrestrial vertebrates, fish and mollusks (combined) averaged 7.7 species per decade. Worldwide, humans have been responsible for at least 788 introductions of 118 mammal species and 771 introductions of 212 bird species outside of their historically natural ranges. A variety of factors enhance the success of invading species, including high population growth rate, high fecundity, excellent dispersal ability, phenotypic plasticity, short generation time and pre-adaptation. Only 14% of the non-indigenous species known to have harmful effects in the United States caused damage in excess of \$94 billion during the period from 1906-1991. It is difficult to predict the impact of introduced exotic species on the environment. Introduction of various mammals resulted in a plant or habitat effect through herbivory in 20% of all cases reviewed (n=788 introductions). Ecological impacts through predation were observed in 16% of 118 species introduced. In contrast, introduced birds were unimportant as herbivores and predators in their new ecosystems. Other impacts of invasive animals include competition, hybridization with native species, and the spread of diseases and parasites. In the final analysis, many introduced animals have caused enormous harm, both ecologically and economically. Given this track record, and the difficulty of predicting the impacts of exotic species, it is absolutely necessary to prevent further accidental releases and the introduction of unwanted species.

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Population Dynamics of Sarcodes sanguinea - Sixteen Years Amongst the Snow Plants

The northernmost known population of the mycotrophic plant *Sarcodes sanguinea* (Snow Plant) was discovered at Limpy Rock Research Natural Area, Oregon in 1982. *Sarcodes* occurs in a community type dominated by *Pseudotsuga menziesii*, *Pinus lambertiana*, and *Abies grandis* in the overstory. *Berberis nervosa* and *Linnaea borealis* comprise most of the shrub layer. The achlorophyllous, mycotrophic nature of this plant has long intrigued botanists. The nutrient transfer process from fungus to plant in the Monotropoideae has been studied in some detail. Members of the Monotropoideae such as *Sarcodes* can be considered parasites of their mycorrhizal fungi. Since the term "parasite" has negative connotations, the terms "obligate mycotroph", "mycotrophic", or "mycoheterotrophic" may be preferred. Monitoring of the Limpy Rock RNA *Sarcodes* population has occurred annually since its discovery. Plant locations have been mapped and number of flowering stalks recorded. The results show that recurrence of flowering by *Sarcodes* plants is variable and low in frequency. Over 150 plants, occupying an area of about 1 ha, have been located at the study site. The average number of plants flowering each year was 13 with a minimum of 3 and a maximum of 24. Relative number of plants flowering in the year subsequent to first appearance ranged from 0 to 35%. Few flowering recurrences beyond the second year have been recorded. The distribution of *Sarcodes* plants suggests a spatial association with specific overstory trees. Observations are discussed with reference to the implications of mycotrophic dependency to phytogeography in the face of potential climatic change.

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Restoration of Riparian Ecosystems on the Truckee River Through Adjusted Releases of Instream Flows

Organisms living in natural riverine ecosystems are generally adapted to wide variations in flow regimes. Seasonal variations in weather, such as timing, frequency, magnitude, and duration of precipitation and snow melt, results in a great variety of seasonal flow patterns. In most temperate systems, a great amount of natural variation in weather conditions exists over decades and centuries. As a result, organisms inhabiting temperate riparian systems are well adapted to highly variable flow regimes. Important ecosystem processes even depend on variability in flows. To sustain and perpetuate aquatic and riparian ecosystems, the managed instream flow regime ideally mimics the dynamics of the natural flow regime. However, competition for water resources constrains the imitation of natural flows. Therefore, to balance conflicting needs, an environmental flow management plan must be flexible, acknowledging ranges of water availability. Recent restoration efforts for the lower Truckee River, achieved by managing instream flow requirements, are based upon an understanding of the requirements of the system's various biological components. These studies have indicated that, in addition to flow volume, spatial and temporal variation of flow are also required to perpetuate function of the ecosystem. Also, larger-scale variations in flow regimes, including droughts and floods, influence the riverine system. Based on these findings, five parameters of instream flow have been identified as essential criteria for instream flow recommendations. From the available investigations of instream flow requirements, specific flow recommendations were compiled to create four instream flow regimes for the lower Truckee River.

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***Restoration Of Natural Hydrologic Conditions At
The Katharine Ordway Sycan Marsh Preserve,
Oregon***

Sycan Marsh is a 30,000 acre mosaic of open water, tule, sedge, and grass dominated wetlands located in the headwaters of the Klamath Basin. Hydrologic conditions at Sycan have been modified over the past 125 years to accommodate livestock grazing through the construction of drainage and irrigation canals and over 200 irrigation structures. The Nature Conservancy began restoring its Katharine Ordway Sycan Marsh Preserve in 1993. Our goal is to reestablish pre-development hydrologic conditions within current site, watershed, and water rights constraints. Restoration is complicated by multiple jurisdictions, competing endangered species needs, and the fact that pre-1909 water rights in the Basin have not been adjudicated. Historic conditions were reconstructed from General Land Office survey notes, soils, and aerial photographs. Engineering studies were completed to assess the condition and function of irrigation structures and other site constraints. Water budgets were developed to analyze the effects of alternative water management practices on the extent and hydroperiod of wetland habitats and downstream streamflow. The design and operation of irrigation structures were modified within water rights constraints to restore hydrologic conditions including the distribution of water, characteristics of conveyance, and residence time. Restoration efforts have resulted in on-site and downstream benefits including: restoration of over 10,000 acres of wetland habitat, increased use by migrating and nesting waterbirds, improved habitat for aquatic species, and modeled achievement of minimum streamflows in wet, average, and dry years. Funding for restoration came from regional foundations, federal agencies, state agencies, and natural resource based corporations.

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***Putting Natural Areas into Ecosystem Management
and Ecosystem Management into Natural Areas***

Historically, natural areas have been defined in large part in relationship to the perceptions and policies guiding the management of natural resources and the lands that support them. Cumulative impacts of past resource use and resulting high profile environmental conflicts have lead us to redefine these broader land use perceptions and policies. Most land managing agencies in the United States have adopted "Ecosystem Management" as their new paradigm for managing natural resources. However, for the most part, the implications of ecosystem management on the role of natural areas in providing goods and services to society has not been widely discussed. Despite the lack of a direct linkage, natural areas -- their purpose, roles, and as a result, goals for management -- have evolved and expanded as our understanding of natural systems has evolved and societal demand for natural area lands has increased. Natural area managers are faced with more and more complex management issues. What is natural? What resource uses are compatible with the goals of the natural area? How do we manage dynamic systems in a world of static boundaries and land use allocations? How do we reconcile the constraints of today's landscape context with the need to restore historic processes? The distinction between natural areas and general natural resources lands is blurring. Here I examine how ecosystem management is being applied on the ground and what implications it has for the identification, design, and management of natural areas.

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Restoration of Improved Pastures in Central Florida to Longleaf Pine/Wiregrass Communities

Since long abandoned pastures in Florida and the Southeast are not returning to flatwoods, in 1995 The Nature Conservancy initiated an upland restoration pilot project aimed at determining cost effective methods for restoring 1,500 acres of pasture to pine flatwoods (longleaf pine/wiregrass) at the 12,000 acre Disney Wilderness Preserve in central Florida. The pilot project is examining methods for removal of exotic pasture grasses, primarily bahia (*Paspalum notatum*), and methods for re-introducing native plants to the site. Five 30x30 m treatment plots were selected in six pasture sites and baseline vegetation monitoring was conducted in Fall 1995. Bahia covered an average of 81% of all plots. Percent cover of native species averaged 39% and was quite variable within and between plots. Pre-treatment sampling found 62 species. Bahia removal methods include single and multiple disking and herbiciding, and combination treatments from May - December 1996. In November and December, native seed was collected onsite and broadcast in January 1997. Winter rye was sewn on half of each plot to see if it would reduce germination of weeds during the winter. During Fall 1996, healthy pine flatwoods were sampled to establish a target for restoration. Fifteen 15x30 m plots in five different locations were sampled. We found 144 native species, with from 27 to 60 species per plot. No exotic species were found. Sufficient groundcover is critical to provide fuel for this fire maintained community. Only two of the fifteen plots had <60% average groundcover and eleven had an average cover 70%.

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Biohydrology of Coastal Plain Ponds

The Hyannis Ponds area in Barnstable, Cape Cod, Massachusetts, includes the best examples of the remnant coastal plain pond-shore environment in New England. The pond shores are characterized by a globally rare plant community adapted to fluctuations in pond levels and shoreline exposure. The primary abiotic factor affecting the pond shore community is hydrology. Alteration of the hydrologic regime may result in displacement or elimination of some elements of the pond-shore flora. The project area is also the site of a municipal ground-water supply. The Hyannis Ponds Biohydrology Project was initiated to assess the relationship between hydrology and pond shore community dynamics. The primary tasks of the project are a detailed hydrologic assessment and annual floral community monitoring. These will be integrated to produce a model of the biohydrologic relationships of this community type. This model will serve as the basis for recommendations to the water purveyor and local and state regulators on biologically "safe" water withdrawal levels and land-use practices. The hydrologic data gathered to date demonstrate the varying degrees to which ponds within the area are connected to the ground-water flow system, as well as the effect of wellfield pumping on pond levels. Event monitoring and pumping tests on individual wells and well combinations provide the most unequivocal demonstrations of the relationship between surface- and ground-water components of the hydrologic system. The biologic data are consistent with existing models of floral response to hydrologic changes, but additional annual samples under a variety of hydrologic conditions will refine our understanding of the biological components of the system.

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***Patterns of Natural Succession Within Subalpine
Herblands of the Wasatch Plateau, Great Basin
Research Station, Utah***

A number of meter-square plots were established between 1913 and 1916, as part of the work at the Great Basin Research Station to evaluate natural recovery of seriously disturbed mountain herblands. Study sites have been protected from livestock grazing for 82 years, and were periodically inventoried by panographic mapping to define species composition, cover and influence of microsites upon plant invasion and spread. Significant differences in species composition were recorded within 10 years after grazing was discontinued. The subalpine herblands are not homogeneous ecologically, but consist of a mosaic of micro-environments. Certain caespitose herbs such as *Penstemon rydbergii* (Rydberg penstemon) persist as the dominant species under continuous grazing and appear as homogeneous plant associations, yet differences among edaphic conditions had a profound effect on the processes of plant succession. Certain colonizers including *Achillea millefolium lanulosa* (western yarrow) and *Viola nuttallii* (Nuttall violet) invade openings during periods of abundant moisture, yet survival was higher within existing vegetation than in openings. Colonization proceeded more rapidly where vegetation was already established than where soil was bare. Establishment of *Geranium viscosissimum* (sticky geranium) and *Castilleja sulphurea* (sulphur painted-cup) was favored by the presences of existing plant cover. At some protected sites displacement of dominant herbs by *Solidago multiradiata* (low goldenrod), *Aster foliaceus* (alpine leafybract), Sulphur painted-cup and other herbs occurred within 27 years. Continued changes were recorded in 1995, yet severe disturbances have not adequately recovered.

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***Meadow Response to Packstock Grazing in Yosemite
National Park***

Although packstock grazing is completely unregulated in most of the wilderness areas where it occurs and can alter the conditions of meadows, few wilderness areas monitor grazing impacts. Yosemite National Park is developing a grazing monitoring plan to remedy this lack of information about impacts to the Yosemite Wilderness. The most practical parameters for wilderness rangers to measure are residual biomass and bare ground. Residual biomass is the amount of plant material that remains on a site following grazing. The Biological Resources Division of the USGS is laying the groundwork for monitoring packstock impacts by describing the relationship between bare ground, plant productivity, species composition and grazing intensity in three meadow series over a five year period. We selected three meadow series that range from xeric to mesic and applied three intensities of grazing with four replicates and four controls each. Winter snow levels were negatively related to production in all meadows, while cover of live plants at the ground surface was positively related to production. Productivity levels were similar between grazing intensities, although the *Carex filifolia* var. *erostrata* (shorthair sedge) and *Deschampsia cespitosa* (tufted hairgrass) series approached significant reductions in biomass between 1994 and 1996. This information will assist National Park Service managers in prescribing minimally acceptable levels of residual biomass and maximum levels of grazing intensity.

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Reconciling Ecosystem Management with the Rest of Conservation

The idea of ecosystem management arose, in large part, as a response to the prevailing approach of managing natural resources species by species, site by site, resource by resource, and threat by threat. The fragmentary approach to natural resources management was demonstrably not achieving well-accepted conservation or management goals: species were going extinct, conflicts between user groups and managers of different areas and resources were escalating, and critical ecological processes were being disrupted. The alternative approach of managing and conserving entire ecosystems (usually defined as large, heterogeneous landscapes with multiple ownerships and/or management objectives) is theoretically more efficient, cost-effective, and ultimately more likely to be successful. However, many proponents of ecosystem management have been too hasty to discard species-level conservation, protected areas establishment, and other well-accepted and proven approaches to conservation. Some ecosystem managers arrogantly seem to assume they possess the knowledge and skills to manage every square meter of Nature wisely. I advocate a more cautious approach to ecosystem management, one that fully incorporates the best of earlier approaches and is prudent, adaptive, scientifically rigorous, and non-anthropocentric.

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The Savanna Army Depot: A Case Study of Endangered Species Identification and Management Leading to the Protection of a 9,500 Acre Natural Area Via the BRAC Process

The Savanna Army Depot is a 13,062 acre ordinance storage and testing base located in northwestern Illinois that is slated for closing under the 1995 Base Realignment and Closure (BRAC) process. Military bases that are closed through BRAC are under federal requirements to reuse and develop the land that is declared federal surplus to relieve the economic burden of jobs lost when the Army leaves. Prior to Savanna being identified for closure, the Illinois Department of Natural Resources and the U.S. Fish and Wildlife Service worked with the Army to identify critical natural resources at the Depot and to begin a stewardship management program at the base. Because of the Depot's location in the Driftless Region on a large sand terrace adjacent to the Mississippi River, several hundred locations for thirty-five federal and state listed species were identified. Over 4,500 acres of sand prairie and savannas were also mapped. These grassland communities provide habitat for a large guild of grassland birds that are becoming increasingly rare in the Midwest due to habitat loss. The development of this information was crucial during recent negotiations between the Local Reuse Authority and the USFWS for the federal surplus land transfer. The final negotiations ended in 9,445 acres added to the Upper Mississippi River Fish and Wildlife Refuge and management encumbrances being placed on sensitive resource sites being transferred to the LRA, thus saving one of the largest remaining natural areas in Illinois.

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Ecosystem Conservation: The NCCP Experience in California

In the last five years the use of conservation planning on private lands, especially under the Endangered Species Act, has grown exponentially. Many in the scientific and environmental communities perceive such processes as undermining the strict protection afforded species under the ESA. Yet the success of regulation and enforcement on private lands has been extremely limited. The Nature Conservancy has recently begun exploring ecoregional conservation planning, a new approach to improving conservation success on private land. One such experience, the Natural Community Conservation Planning program in Southern California, provides an interesting case study of the challenges and issues arising from a regional, habitat-based approach to conservation planning. In discussing the NCCP program, this paper identifies the limitations associated with a traditional, regulatory, species-based strategy and how an ecoregional habitat-based method can significantly improve the outcomes for both biodiversity conservation and economic stakeholders.

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A Conservation Assessment of North American Terrestrial Ecoregions

We conducted a conservation assessment of the terrestrial ecoregions of North America, in order to identify biodiversity priorities across the continent and describe appropriate conservation activities for each ecoregion. North America, north of Mexico, was divided into 116 ecoregions, nested within 10 major habitat types (MHT). The conservation status of each ecoregion was assessed through an analysis of landscape-level features: total habitat loss, level of degradation, presence of remaining large blocks of habitat, and fragmentation, as well as degrees of protection and threat. The biological distinctiveness of each ecoregion was determined by its richness, endemism, and rarity of species, communities, and ecological processes at various biogeographic scales. Each ecoregion was compared only to others within its MHT, and thresholds and weighting of the criteria were tailored to the broad ecological dynamics of each MHT. The two discriminators were integrated using a simple matrix to identify the suite of conservation activities most appropriate for each ecoregion. Of the 116 ecoregions, we identified 32 ecoregions with globally outstanding biodiversity. Of these 32 ecoregions, 12 ecoregions are considered to be critical or endangered, and require immediate efforts to halt the erosion of the biodiversity they contain.

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Semi-Natural Grasslands in Scandinavia: Ecological Values and Conservation Challenges

Remains of pre-industrial agro-ecosystems, semi-natural ecological communities, and the land use practices that created them, are today rapidly decreasing. This development is caused by changes in agricultural practices related to the introduction of industrial agro-ecosystems. At the same time there is a growing awareness that such ecosystems harbor a large number of globally endangered species. Semi-natural grasslands and heathlands of Europe are human-shaped ecosystems and have been labeled hotspots of European biodiversity. A number of case studies from coastal and mountain sites in Norway and Sweden are presented and their prehistoric origins and maintenance through grazing of domestic livestock and reindeer are reviewed. The present conservation challenges are discussed especially as they relate to conflicting perspective of nature conservation and forestry and agricultural sectors. The potential role of semi-natural ecosystems as key areas for sustainable agriculture is also discussed.

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Classification of Panicum abscissum Dominated Natural Communities at Avon Park Air Force Range, Polk and Highlands Counties, Florida

Panicum abscissum dominated natural communities cover more than 9,000 acres at Avon Park Air Force Range (APAFR), the largest areal extent for this south-central peninsular Florida endemic graminoid. Diverse, fire-maintained *Panicum abscissum* vegetation continuum with intact species rich ecotones representative of topographic-hydrologic gradients on and in association with the Bombing Range Ridge (a central Florida Ridge) were studied at APAFR in Polk and Highlands counties. Preliminary results from floristic surveys (species composition, frequency data and vegetation physiognomy), environmental parameters (hydrology, edaphic factors and landscape position) and some quantitative vegetation sampling (268 0.25m² plots) indicate four *Panicum abscissum* dominated community types (Pond Margins, Wet Prairies, Wet Flatwoods and Seepage Slopes) and several microcommunity zones. Community type/microcommunity zones discussed are based upon species dominance, differential species, characteristic species and relationships to various environmental parameters from 230 floristic lists and analysis of quantitative data collected at APAFR. The total vascular flora of the four community types consist of 295 taxa. Each of the four community types are floristically compared to each other and to other related natural communities found at APAFR.

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A Partnership for Managing Invasive Plants in New York State

There is a growing concern within New York State over the possible adverse effects on biodiversity of invasive exotic plants. In order to address this concern in a more comprehensive manner, an Ad Hoc Group for Invasive Plant Management in New York State was formed in 1994. This group includes representatives from the New York Natural Heritage Program, New York State Parks, The Nature Conservancy, the State Botanist's office, and the USDA Natural Resource Conservation Service, as well as other interested state and federal agencies and private organizations. The Group has adopted a mission statement, created a glossary of terms relating to invasive species, and prepared an invasive plant species list. It has also identified the top 20 most serious problems with invasive plants in New York State. Funding sources and research projects needed to identify the impacts of invasives on biodiversity have been identified. The Group is in the process of identifying alternatives to the horticultural use of invasives, articulating statewide policies, and compiling available literature. Through its organization and distribution of information, the Group has begun to fulfill one of the most pressing needs with regard to invasive plants in the State -- that is, to disseminate information regarding invasives and the need for sensitivity to native species in landscape design. The Ad Hoc Group can provide a model for other states in providing a coordinated response to invasive plant issues.

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Burning Common Ground: Agreeing about Fire

An unusual partnership between a coalition of conservation groups and the US Forest Service was formed to promote understanding of the role of low intensity fire in eastside Ponderosa pine forests. The partnership has produced the "Fire Ecology" Poster, which features species which have evolved with fire against a smoky backdrop of lightning and old growth trees. The authors will explain the opportunities for focusing on agreement, championing the natural role of fire, and enhancing public support for the reintroduction of fire.

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***Hey Kids! Meet the Beetles: Grow Your Own
Biodiversity Work Force***

Basic knowledge about invertebrate occurrence and ecology is lacking. Study priorities have focused on larger, more charismatic, and better known wildlife. Basic invertebrate studies can be accomplished with the help of student volunteers. Pilot studies in the Metolius RNA used students between the ages of 8-16 to install traps, and collect and sort samples. Initial results indicate some invertebrates may be more closely associated with old growth forests. Spiders, springtails, and beetles rule the forest floor. Seasonal variations in soil invertebrate distribution were observed. The author describes the logistics of utilizing young volunteers and the opportunities for invertebrate biodiversity assessments.

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***Reestablishment of an Endangered Plant Species at
a Southern California Salt Marsh***

As part of a mitigation agreement under the Endangered Species Act, scientific studies and annual monitoring were conducted to determine whether a population of *Cordyianthus maritimus* ssp. *maritimus* (salt marsh bird's beak) reestablished at Sweetwater Marsh (San Diego Bay, California) was self-sustaining. Seeds were sown during 1990-1992 to an upper intertidal marsh near where the historical population was last seen in 1987. Initially, the reestablished population appeared comparable to the seed donor population (Tijuana Estuary, California) in terms of germination and plant size. Plant numbers in the reestablished population rose from ~5,000 in 1992 to ~14,000 in 1995. The reestablished population, however, initiated fewer seed capsules per flower (mean 0.2-0.4 capsules in 1992-1994) than the donor (up to 0.9 capsules in 1991). Experiments were conducted to determine what might limit reproductive success. Pollen supplementation (hand-pollination) increased capsule number by 89% in 1992 and 52% in 1993. In areas where pollen supply was sufficient, nitrogen availability seemed to limit seed capsule set. Germination, however, not seed set, may limit this population. Annual census results were a fraction of estimated seed production ($> 1.5 \times 10^6$ seeds from 1992-1994). While mitigation requirements were met, it is not clear that the population is self-sustaining. According to PERL surveys, below-average rainfall in 1996 was accompanied by extremely low germination and/or seedling survival rates ($< 2,000$ plants). The mitigation monitoring was performed in above-average rainfall years. Also, important ecological relationships for *C.m. maritimus* involve external factors, i.e, pollinators, nutrient inputs, and canopy disturbances that create openings for seedlings.

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Western Riparian Systems: Requirements, Alterations and "Fixes"

Western riparian systems compose a small part of the landscape but contribute extensively to biodiversity and offer many ecological services. Most of these systems have been degraded, and many are lost or threatened. Long-term sustainability of riparian systems requires knowledge of (1) their ecological requirements, (2) alteration by human activities, and (3) alternatives for restoration.

1. Riparian plant species are dependent on several hydrologic and geomorphic parameters for establishment, growth and survival, including floods which create seed beds and inundate floodplain surfaces, and a shallow alluvial water table.
2. Watershed alterations from resource extractive activities have altered downstream hydrologic and geomorphologic processes. Runoff is accelerated, often with increased sediment. Surface hydrology has been modified through dam construction and stream diversions, resulting in reduced stream flow with altered hydrographs. Groundwater withdrawal has lowered regional and local water tables, reducing stream flows and affecting alluvial water tables. Introduction of non-native plant species has altered the composition of western riparian communities, often reducing habitat values.
3. Initial steps in "restoring" western riparian systems should include understanding effects of human activities. Reestablishing "natural" processes, especially those associated with ecological requirements of riparian species, should take precedent over replanting methods. Mimicking natural stream flows below dams and restoring alluvial water tables through groundwater recharge are being practiced in the West. Alternative methods of resource use such as modifying (i) grazing within the floodplain, (ii) grazing and forestry practices in the watershed, and (iii) mining practices near or within the floodplain are also being considered or practiced. The future of western riparian systems is dependent on our willingness to change resource uses that directly and indirectly influence survival and sustainability of riparian species.

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Management of Melaleuca Quinquenervia at Big Cypress National Preserve

Melaleuca quinquenervia was introduced into the Big Cypress Watershed in the mid-1940s. The idea was to give seemingly useless wetlands an opportunity to produce something economically exploitable. Through wind dispersion and spread by off-road vehicles, the population of *melaleuca* continued to grow unchecked. By 1979, in what is now the 725,000 acre Big Cypress National Preserve, *melaleuca* covered 60 square miles. In 1984, an exotic plant control program was initiated with the primary focus on *melaleuca*. Historically, National Park Service (NPS) crews were used exclusively to treat *melaleuca*. However, since 1995, private contractors have been used to treat areas which contain dense monocultures of *melaleuca*. Outlier populations are treated by small groups of 1 to 3 people consisting of NPS employees, Americorps members, or volunteers. The result has been an increased in efficiency and cost effectiveness. To date, the combined efforts of NPS crews and private contractors have resulted in the treatment of over 6 million *melaleuca* stems at a cost of 2.5 million dollars.

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Management of Natural Area Preserves and Natural Resource Conservation Areas in the State of Washington

Accommodating tribal access to and use of plants and animals in specially designated natural areas in Washington State has been the subject of interaction between the state and tribal governments in recent years. Examples are provided in the allowing of traditional use activities in Natural Areas Preserves, commonly managed primarily for education and research uses, and tribal participation on local community advisory committees guiding management of Natural Resource Conservation Areas. Traditional hunting and shellfish and plant gathering are common activities considered in development of management strategies for these areas.

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Management for the Rare Butterfly *Speyeria zerene hippolyta* (Oregon silverspot butterfly) at The Nature Conservancy's Cascade Head Preserve

Effective conservation of rare species requires adequate information about the species' current status, population dynamics, and habitat needs. Annual population censuses, studies of habitat characteristics at oviposition sites, and experimental management treatments have helped guide protection of *Speyeria zerene hippolyta* (Oregon silverspot butterfly) at The Nature Conservancy's Cascade Head Preserve. Since 1989 we have employed a visual transect method to monitor *S. z. hippolyta* populations. The resulting indices of abundance are used as indicators of habitat quality and management effects at four Oregon silverspot butterfly populations. Habitat features associated with oviposition behaviors have been assessed to determine characteristics of preferred egg-laying areas. Female Oregon silverspot butterflies were followed, locations of oviposition-related behaviors were marked, and vegetation and environmental characteristics were sampled at those sites. Results of this study indicate that female *S. z. hippolyta* prefer to lay eggs in areas of high *Viola adunca* (common blue violet, the larval host plant) density, low thatch depth, and low vegetation height. In 1994, a habitat management study was initiated at the Cascade Head Preserve to test the effectiveness of burning and mowing treatments at re-creating this preferred oviposition habitat and maintaining the native grassland community. The combination of population monitoring and habitat investigations have led to specific restoration strategies designed to conserve this threatened butterfly.

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***Long-Term Monitoring of Wild Edible Mushrooms in
the Forests of the Pacific Northwest***

Developing efficient sampling methods has been a common goal in recent PNW Research Station studies of wild edible forest mushrooms. Statistical and practical comparisons of selected methodologies will be incorporated into regional monitoring protocol recommendations for federal forests. Ascertaining the impacts of commercial mushroom harvesting and forest management activities on mushroom production are two components of a regional monitoring program under development. Long-term monitoring of edible forest mushrooms in natural areas will be a third component of regional monitoring; it will account for potential background changes resulting from atmospheric pollution or climate change.

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Biological Control of Exotic Weeds in Wildlands

The ability of exotic plants to invade natural areas and wildlands may be due to several factors including climate, soil type, reproductive biology, and the absence of specific natural enemies in their new area of habitation. In particular, the lack of specific natural enemies can be significant for it allows the exotic plant to reproduce without hindrance. Thus, more seeds are produced, fewer seeds are destroyed, and more seedlings survive to reproduction than would occur in their native habitats. Classical biological control is an exotic weed control strategy that seeks to reunite an exotic weed with its natural enemies by introducing them into the new area of habitation. The objective is recreate the predator-prey relationship that controls the target weed in its area of origin. Once effective natural enemies are established, control is usually maintained indefinitely. Concerns regarding safety of biological control agents are directed at the possibility of their attack of native plant species. Safeguards are provided by subjecting all potential biological control agents to host-specificity testing prior to their release. Host specificity testing attempts to show how specific to the target is the feeding and reproduction of the potential biological control agent and provides information on the range of host species that may be affected. Host specificity testing follows standard protocols that assume that specific natural enemies are more likely to feed on close relatives of the target weed than on unrelated hosts and has been an effective tool in assessing the safety of potential biological control agents.

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***Using Natural Flow Regimes as Templates in
Riverine Conservation***

Managing or preserving natural areas requires that we understand the processes that create and maintain them. In general, ecosystem structure and function result from a complex interplay of biotic and abiotic selective forces acting over variable spatial and temporal scales in a landscape setting. Clearly, understanding how ecosystems function in terms of these selective forces is a formidable challenge for ecologists. In riverine systems, hydrological conditions regulate the physical structure and dynamic nature of the habitat and, accordingly, the types and abundances of species present. The flow regime of a stream or river can therefore be viewed as a template that regulates ecological expression, such that an alteration in the template results in a modification of ecological expression. The theoretical basis for using the flow regime as a template in riverine ecosystems will be presented, with particular focus on the significant role of hydrologic disturbance in maintaining native biodiversity. Geographic variation in the templates of streams and rivers in the U.S. will be used to illustrate differences in expected ecological expression at local and regional scales. Some examples of how the template approach has been used in explaining differences in ecological organization among streams and rivers will also be presented. Finally, a formal definition of the natural flow regime is offered in order to provide a framework for the preservation, restoration, and management of natural areas.

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Microbiotic Soil Crusts in Oregon's Shrub-Steppe

The lichen and bryophyte components of microbiotic soil crusts were assessed at nine shrub-steppe natural areas in central and eastern Oregon. Comparisons of areas fenced from domestic cattle grazing and adjacent grazed sites indicate that lichen and bryophyte species richness and cover are higher within the exclosures. Additionally, biotic soil surface roughness is higher within the exclosures, while there is more bare ground in the grazed areas. Patterns derived from gradient analysis indicate that precipitation and edaphic factors strongly influence lichen and bryophyte species composition and cover among sites. In particular, moisture has a strong effect on nitrogen-fixing lichen distribution, with *Collema* spp. being most abundant in dry conditions and *Leptogium* spp., *Leptochidium albociliatum*, and *Peltigera* spp. occurring at relatively moist sites.

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***Spatial Aspects of the Post-Soviet Expansion of the
Russian Nature Reserve (zapovedniki) System***

During the twentieth century Russia and the Soviet Union created one of the world's most extensive networks of preserved natural areas, known in Russian as zapovedniki. This paper investigates what has happened to this system since the collapse of the USSR. Expansion of this network has continued in the years since 1991, with 19 new reserves covering a combined 10,171,000 ha. being created in the 1992-1996 period. Although the additional hectareage is impressive, two of the new preserves take in almost 8 million ha. between them; the median size of the 19 new reserves is less than 40,000 ha. Few of them have any significant funding or staffs. The post-1991 reserves have tended to be concentrated in Russia's taiga and tundra zones where several large reserves already existed. Other natural zones, particularly along Russia's southern border where biodiversity is greater and more imperiled, have seen relatively few new reserves established. Since the breakup of the USSR there has been a disastrous decline in the funding available to all of these reserves, which has generated a corresponding decline in their biological integrity. The preserves are presently operating on minimal budgets and are often forced to seek foreign assistance. They must be given a higher governmental priority if their essential role in preserving Russia's biodiversity is to be maintained.

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***Seeking Common Ground: The Nursery Industry's
Emerging Views on Invasives***

The nursery industry has a dual vantage point from which to consider invasive plant issues. Nursery crop growers are challenged to manage weeds if they are to produce a quality product. Yet, increasingly, certain plants produced and used by the trade are being targeted as invasive. This presentation will explore emerging views in the nursery and landscape trade on topics such as defining the invasive plant problem; horticulturist concerns regarding the "native plant movement"; the case for "decoupling" native plant issues from invasive plant issues; industry opportunities and challenges relative to invasives issues; potential "win-win" solutions; and the viability of approaches to screening new plant introductions.

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Are Plant Invasions Dependent on Stochastic Interactions at the Invaded Site?

One of the persistent theories of plant invasions is that the success of an invasion is largely driven by the interplay of the characteristics of a species in conjunction with the characteristics of the invaded site, including physical conditions and biotic interactions. Such interactions are generally considered to be stochastic; this assumption has been used to assert that invasions are not predictable. To test whether this assumption is indicated by previous invasions I studied 350 woody plant species that invade North America and Hawai'i and determined which of eight general community types they were known to invade and to which they were native. I found that the species invade an average of 2.06 ± 0.91 community types and are native to an average 2.31 ± 1.13 . In general, species tended to invade communities that have similar physical conditions. For instance, species which invade areas with human disturbance also tend to invade forest gaps and edges and riparian zones which have generally similar physical characteristics. There are strong correlations between the community types to which a species is native and those which it invades. Furthermore, 63% of the species studied invade other parts of the world, often in many places. The data thus suggest that while specific random interactions may be necessary for some invasions to proceed, invaders are generally species which are capable of establishing under a variety of conditions.

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Using Traits of Invaders to Predict Invasive Woody Plant Establishment

Despite the considerable harm already done, species continue to be legally introduced into the country with no consideration of their ability to invade natural areas. If there is to be a shift to a more proactive approach of preventing invasive species from entering the United States we must first gain a greater understanding of what separates the invaders from non-invaders. I compared 239 woody species currently invading the United States with 114 species that do not invade. The invasive species have significantly shorter juvenile periods than non-invaders, are more likely to reproduce vegetatively, and do not require seed pretreatment before germination. They are mostly not native to other parts of North America and have a far high probability of being invasive in other parts of the world than non-invaders. Sixty-three percent of a subgroup of 76 serious pest species are from six families: Rosaceae, Fabaceae, Myrtaceae, Salicaceae, Oleaceae, and Caprifoliaceae. Predictive discriminant analysis and classification and regression tree models developed correctly predicted from 79% to 86% of the species as invasive or non-invasive. From the analyses an easy-to-use decision tree was developed which was also highly accurate in predicting invasive ability.

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Firestkaad Protection and Acquisition within the City of Tigard, Oregon

An inventory and assessment of forested areas within the City of Tigard's active planning boundary was conducted in 1993. A second inventory specific to Tigard's Bull Mountain area was conducted in 1995. Information from these inventories was used to prioritize forested areas for protection and acquisition programs. A combination of aerial photo interpretation and ground inspection were used to locate and collect information about potential natural areas. Forested Natural Areas were then ranked low, moderate, or high priority for protection based the numerical ranking of four criteria: 1) Natural quality; 2) Size; 3) Linkages; and 4) Unique features. In 1993, 42 Forested Natural Areas were identified. Twenty-five sites were ranked as having moderate or high priority for protection. Of these, 11 had no protection, 11 had partial protection and three had full protection. Sites were considered protected if they were in public ownership, were property held in common, were part of a dedicated open space, or were designated as wetlands. Much of the area with no protection was within the Bull Mountain Area. Between 1994 and 1995 the number of acres of forest on Bull Mountain decreased from 156 acres to 64 acres. Acquisition of land since 1995 has resulted in protecting two sites totaling 10 acres in size. Offers to purchase three additional sites were made but the asking price was higher than the established budget. Efforts to acquire additional sites are pending.

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How Much Water Does a River Need?

The natural flow paradigm suggests that the full range of natural intra- and inter-annual variation of hydrologic regimes, and associated characteristics of timing, duration, frequency, and rate of change, are critical in sustaining the full native biodiversity and integrity of freshwater ecosystems. Thus, the natural flow paradigm answers the question posed by the title of this presentation, and forms the goal of flow restoration efforts. Applying the natural flow paradigm in natural area conservation requires that we quantitatively define the natural flow targets; characterize the degree of flow alteration that has transpired; and move forward in an adaptive ecosystem management context toward natural flow restoration. We have developed an "Indicators of Hydrologic Alteration" (IHA) method for assessing hydrologic alteration at locations where daily hydrologic records are available (e.g., USGS streamgauges). The method is based upon an evaluation of 33 different hydrologic parameters describing the magnitude, timing, duration, frequency, and rates of change in hydrologic conditions. This method reveals the direction and magnitude of hydrologic alterations associated with various human activities such as river damming or diversion, watershed conversion for agriculture or silvicultural use, ground water pumping, etc. When human land and water uses have pushed one or more of the IHA parameters outside of their natural range of variation, native biodiversity and natural ecosystem functions may be compromised. Natural area or biodiversity managers will want to consider alternatives for restoring natural flow characteristics, such as through modifying reservoir operations or stream diversion practices, restoring wetland or riparian areas and associated functions within a watershed, etc. Some examples of such restorative efforts will be presented in this symposium.

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Removal of European Beachgrass (Ammophila arenaria) Using a Variety of Methods to Restore Coastal Sand Dunes in Oregon

European beachgrass (*Ammophila arenaria*) was introduced along the Pacific Coast in the late-1800's and planted extensively along the Oregon coast during the 1950's to stabilize coastal sand dunes. While this has been effective in stabilizing coastal sand dunes, some native plant and animal species have declined since its establishment. In recent years, efforts to remove European beachgrass from areas with critical biological resources (threatened plant and animal species) have increased. On the North Spit of Coos Bay a variety of methods have been attempted to remove European beachgrass, with varying success. The primary focus of these efforts has been to increase nesting and foraging habitat for the threatened western snowy plovers, but secondarily have focused on determining which methods are effective in controlling European beachgrass. Various control methods, including burning, mechanical tilling, hand pulling, herbicide, and summer salt water irrigation, have been employed with varying success during the years 1994-1997. These methods have been tried singly or in combination with one or more other methods. Because the treatments have been done which have not allowed enough time to test their effectiveness no statistical analysis is available, although many insights can be made. Initial results indicate that one method is not effective in controlling European beachgrass but repeat treatments or a combination of different treatments is more effective. This presentation will provide a summary of methods employed at this site, their effectiveness in controlling European beachgrass and applications for future work.

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The Rehabilitation and Reintroduction of Captive Spectacled Bears into the Maquipucuna Reserve, Ecuador

The only bear in South America, the spectacled bear (*Tremartcos ornatus*) is highly endangered because of loss of habitat and hunting. In spite of its cultural and ecological importance, little is actually known about the species in its natural habitat. The animal's future depends not only on the conservation of Andean forests and paramos, but also on effective management of wild bears as well as the increasing number in captivity. Therefore, in order to reduce captive populations and to learn more about bears in the forest, the Maquipucuna Foundation and an Ecuadorian biologist, with support from the World Society of the Protection of Animals, conducted a research-based reintroduction project in the 4,500-hectare Maquipucuna Reserve in northwestern Ecuador. It was the first time that captive spectacled bears had been purposefully rehabilitated and liberated in order to study their behavior and activity. Much was learned from the experience. First, we increased our knowledge of the bear's biological and ecological requirements by studying food preferences, movement, behavior and activity levels. Second, we gained insight into the process, consequences and feasibility of reintroduction of captive animals into the wild. We experienced difficulties in breaking these animals of their dependency on humans. Recommendations for future projects include: keeping the rehabilitation period as short as possible; minimizing contact with humans; and trying to anticipate the behavior of animals that are neither totally wild nor totally domesticated. A widespread and effective environmental education campaign, teaching communities to appreciate and value the spectacled bear, may be one of the most critical factors for ensuring species survival.

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***Representative Assessment of National Forest
System Research Natural Areas in Idaho***

A representativeness assessment of National Forest System (NFS) research natural areas (RNAs) in Idaho was conducted to determine the status of the natural area network and priorities for identification new RNAs. The natural distribution and abundance of communities was estimated on the subregional scale using modeled potential natural vegetation, published classification and inventory data, and Heritage plant community element occurrence data. Minimum specifications were applied at the landscape scale to select protected viable/high quality representative occurrences. In assigning community conservation priorities, decision rules were developed to encompass consideration of the adequacy and viability of representation. 1024 plant community occurrences within 214 conservation sites (including 115 NFS RNAs) were selected for analysis. Of the 1566 combinations of community and ecological section, 28 % require additional data for further analysis; 8, 40, and 12 %, respectively, are ranked from high to low conservation priority; 13 % are fully represented. Patterns in conservation need vary between section. The result provides an operational prioritization of RNA needs at landscape/subregional scales. Objective priority ranking criteria provide clear accounting of priority assignments which are easily updated to reflect changing information and/or conditions. The result demonstrates that, on the landscape and subregional scales, plant community conservation status may be effectively assessed at the plant association level of community classification hierarchy.

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***Monitoring Rare Plant Populations with Quadrats:
Should Quadrat Locations be Permanent or
Temporary?***

The monitoring of rare species often includes sampling procedures that involve counting plants within quadrats. Quadrats can be permanent, where the same locations are resampled during each visit, or temporary, where new locations are selected during each visit. Numerous disadvantages are related to permanent quadrat designs including the logistical cost and difficulty of marking and relocating quadrat locations and impacts from wildlife or repeated investigator trampling. The principal advantage with permanent quadrat designs is that, in some cases, fewer quadrats need to be sampled to detect population changes. The sample size advantage with permanent quadrats occurs when plant counts are correlated between two time periods. The degree of quadrat correlation is influenced by the specific population dynamics of the species being monitored. I used computer simulated sampling to evaluate the performance of temporary vs. permanent quadrat sampling designs under a wide range of different plant population changes that varied in patterns of recruitment, mortality, and seedling dispersal distances. In some cases permanent quadrat sample sizes were much smaller than temporary quadrat sample sizes (e.g., in one case, 22 permanent quadrats performed as well as 338 temporary quadrats). In other cases, there was no difference in sample sizes between permanent and temporary designs and the disadvantages associated with permanent quadrat designs would favor a temporary quadrat design. The decision to use permanent or temporary quadrats must take into account the life history of the target species, the potential sample size differences, and the disadvantages associated with using permanent quadrat designs.

69. Schoonmaker, Peter

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***Adapting Ecosystem Management Strategies to
People and Place: Case Studies from Three
Temperate Rainforest Ecosystems***

Recent land management controversies in the Pacific Northwest have focused international attention on the strengths and weaknesses of reserves and regulations as ecosystem management tools. Three large watershed complexes along the Pacific coast illustrate the strengths of three strategies - protected areas, resource use regulations, and community-based conservation - that have been taken to move toward sustainability. In northwestern British Columbia, the 275,000 ha pristine Kitlope watershed was protected from industrial development as a Cultural Heritage Site. A watershed assessment procedure examined alternative ecosystem management scenarios for an adjacent 40,000 ha watershed slated for timber harvesting. In Clayoquot Sound, a scientific panel made recommendations, which the provincial government has pledged to follow as regulations, for ecosystem management. Incorporating these recommendations into a geographic information system (GIS) has resulted in a series of maps that provide land managers with an ecosystem management blue print. In contrast to these two federally owned, and relatively pristine watershed complexes, the Willapa watershed in southwestern Washington is essentially a corporate tree farm. Willapa residents have formed a local community-based conservation group; one of its key efforts to promote sustainable resource use is an ongoing Indicators of Sustainability report. These three strategies - protected areas, resource use regulations, and community-based conservation - has produced initial success in each case, but a combination of the three may be needed to ensure long-term ecological integrity at watershed and bioregional scales.

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***Vertical and Seasonal Variation in Arthropod
Communities in Canopies of Four Conifer Species
in an Oldgrowth Conifer Forest in Southwestern
Washington***

We evaluated the relative effects of tree species (*Pseudotsuga menziesii*, *Tsuga heterophylla*, *Abies grandis*, and *Thuja plicata*), canopy level, and season on canopy arthropods in an old-growth forest at the Wind River Canopy Crane Research Facility in southwestern Washington. This study is the first to evaluate the relative effects of these factors on abundances and community organization of canopy arthropods. The canopy crane at this facility and new statistical methods for analyzing non-normalizeable data made such an evaluation possible. Tree species had the greatest effect on arthropod abundances and community organization, likely reflecting differences in nutritional quality and defensive chemistry among these tree species. *Thuja plicata* had a particularly distinctive canopy fauna dominated by several mite taxa. Canopy level and date significantly influenced abundances of several arthropod taxa. Interactive effects among all three factors significantly affected a number of taxa, as well. These data indicate that assessment of arthropod biodiversity or population size(s) in forest canopies may require representation of canopy levels, as well as tree species and season, depending on taxa of interest.

10. Shapavalov, Alexander

Natural Areas and Conservation Work in the Belgorod Region of Russia

The Belgorod region is situated in the south-central portion of the Chernozem Province of the European part of Russia near the border with Ukraine. The territory of the region looks like an elevation chiseled with rivers and grooves, where tributaries of the rivers Dnieper and Volga have their origin. The Belgorod region is situated in the forest-steppe zone and only its southeastern part occupies the steppe zone. Intensive utilization of the Belgorod region territory began in the 17-18th centuries. Agriculture was advantageously developed. Now ploughed, terrains occupy up to 90% in some regions, grasslands and pastures up to 20%. Medieval forest cover is about 9%. Massive mining is concentrated in the north of the Belgorod region. More than 200 protected natural territories (PNT) of various categories exist in the Belgorod region. Among these PNTs are 5 areas of the Central-Chernozem biosphere state reserves, including the state reserve, "Forest on the Vorskla River" which has superficies from 90 up to 1038 ha. The network of the PNTs ought to be precise and more developed in the future. The main avenue for practical participation in the PNT network is the Association of the PNT, formed in 1996. Initially, the staff of the Association consisted of employees of the state reserve "Forest on the Vorskla River". Currently, deputies are actively involved in the work as well as employees of educative organizations, students, etc. The Association's main activities include: preparation and confirmation of the law, decisions related to the natural protective orientation in regional and local representatives and executive organs, inspection of natural objects and projecting of PNT, monitoring, control on observing of the legislation, etc.

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Deer Management Techniques Used by the Columbus Metro Parks

Like many other park and natural resource management agencies throughout North America, the Columbus and Franklin County Metro Parks has encountered an overabundance of *Odocoileus virginianus* (white tailed deer) in many of its parks. This resulted from a lack of natural predators and spreading commercial, residential, and transportation development around the parks. Following extensive literature research, consultation, and attendance at national conferences, the resource management staff developed a list of nine options for dealing with the deer overabundance problem. Our interpretive staff presented numerous programs on the deer problem and the ecological damage it was causing. A promotional campaign gathered public and community input on the possible options. Incorporating this input, the park staff recommended a comprehensive deer management policy which was presented to and adopted by the Board of Park Commissioners. Over the past five years, Metro Parks have utilized a combination of sharpshooting, translocation, controlled public hunting, and chemical birth control. Use of these techniques has resulted in the removal of over 2,000 deer from 14,000 acres of park lands and now most areas are reasonably under control in terms of deer numbers. This paper will include statistics on costs and labor hours for our control techniques, problems encountered, and information on our media relations.

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What is Natural?: An Interdisciplinary Roundtable

The concept of "naturalness" is a human abstraction - an idea that is important solely because human societies have evolved to a stage where they have massive and often unanticipated effects on the earth's biophysical environment. This roundtable addresses the conference theme of "bridging social and natural landscapes" by allowing participants from differing disciplinary perspectives to share their ideas about what "natural" means and its implications for natural area management. It will open with presentations by an ecologist (Landres) and a social scientist (Brunson) who will discuss the concept of naturalness from the perspectives of their respective disciplines. After a break, the roundtable will reconvene with the presenters joining the audience in a facilitated (by Kruger) discussion of questions pertaining to the opening presentations and the basic concept of naturalness. Questions may include: Are humans part of ecosystems? Is a "natural regulation" policy desirable or feasible? Is it more "natural" after a disturbance to allow protected areas to transition "naturally" to a new kind of ecological state or to manipulate the area to achieve a state within the historic range of natural variation? Should natural scientists be the sole determiners of which natural condition to maintain in a protected area? After a second break, a discussant (Stankey) will offer a synthesis of ideas from both the formal and facilitated portions of the symposium, describing points of agreement and contention, then conclude by posing a series of questions warranting further exploration.

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***A GIS-Based Conservation Plan for the
Klamath-Siskiyou Ecoregion: A Progress Report***

In 1996, work began on assembling spatially explicit data and information needed to develop a GIS-based conservation plan for the Klamath-Siskiyou ecoregion, encompassing approximately 25 million hectares of southern Oregon and northern California. Physical, cultural, and biological data layers were assembled in conjunction with other ongoing conservation research efforts in the region. The project has now moved into the analysis and planning stages with the ultimate goal of producing an initial comprehensive conservation plan that includes: (1) the integration of a physically-based and biologically-based gap analyses; (2) aquatic and terrestrial considerations; (3) ecological needs for selected indicator species; and (4) consideration of a number of pertinent ecological integrity issues (e.g., landscape connectivity and disturbance regimes). The planning will develop a core-buffer-corridor model to the selection and design of a nature reserve system for this globally outstanding and imperiled region. Results of this study are intended to crystallize the debate about long-term protection for this region by offering a scientifically-defensible ecological reserve design. A summary of approaches used and progress to date will be reviewed.

46. Suderman, Beverly¹, Leigh Kuwanwisiwma²
Hopi Tribe, Kykotsmovi, AZ

Hopi Wetlands

Arid wetlands differ from coastal and other more familiar types of wetlands areas. They are small, very fragile, and important beyond their size. Approximately one-half of one percent of Arizona's land is classified as wetlands, yet 75% of Arizona species depend on the wetlands. Less than 1% of Hopi lands can be classified as wetlands. Hopi wetlands are important environmentally, but also culturally. Many wetland plants are used ceremonially. All springs are sacred. This presentation will focus on Hopi wetlands: threats and steps being taken by the Hopi Tribe to protect and rehabilitate them. Major threats to Hopi wetlands include erosion, aggravated by livestock grazing, and tamarisk infestation. The Hopi Tribe is planning a number of wetlands rehabilitation demonstration projects throughout the Reservation to determine the best approach to resolving some of the threats faced by Hopi wetlands.

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Vegetation Recovery at Simeonof National Natural Landmark, Alaska Maritime National Wildlife Refuge, Alaska

The natural ecosystem conditions at Simeonof Island, Alaska were studied to document vegetation recovery following the removal of cattle. To record changes in the vegetation, data were analyzed using photo-documentation, permanent plots, numerical classification, and comparative analysis with undisturbed ecosystems. Nine major community types are distinguished according to species composition using the multivariate methods of the MULVA-5 computing package. Results indicate that recovery differs in the various community types; these types are listed from the most impacted to least: 1) total plant cover has increased during the past fourteen years in the coastal *Elymus mollis* (beach rye) community type, which was the most severely impacted site originally, and natural successional processes are stabilizing these areas; 2) a successional shift occurred from the *Festuca rubra* (red fescue) grassland type to *Heracleum lanatum*-*Epilobium angustifolium* (cow parsnip-fireweed) forb meadow with corresponding changes in floristic composition; and 3) in the previously least-impacted sites -- the *Empetrum nigrum* (crowberry) heath and *Eriophorum angustifolium*-*Carex lyngbyaei* (wet tall cottongrass-Lyngbye sedge) community types -- little floristic change has occurred. Disturbance caused by cattle overgrazing and by extrapolation other grazing herbivores on other maritime islands in southwestern Alaska may also be alleviated through removal of herbivores and subsequent promotion or allowance of natural successional processes.

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Living with Mega-Diversity: Current Australian Approaches for Sustainable Development and Biodiversity Conservation

Australia, as a mega-diverse country, is seeking innovative approaches to try to fulfill its massive commitments for the conservation of biodiversity. Biodiversity planning and management is undergoing a number of changes. This paper discusses five major trends in biodiversity conservation and sustainable development:

1. Recognition by government that biodiversity conservation can only be achieved within the context of sustainable regional development / whole of landscape management.
2. Increasing acceptance by governments that conservation outcomes will be better achieved through integration of government reforms and land management using regional approaches.
3. Increasing reliance by governments on off reserve voluntary conservation initiatives to achieve conservation outcomes to complement statutory protected areas, particularly through community based conservation activities.
4. Increasing demand by indigenous land managers and land holders that their cultural mandate of 'caring for country' be recognized as achieving the goal of conserving biodiversity.
5. Increasing use by government of 'expert' knowledge on biodiversity values to address conservation issues, rather than longer term comprehensive ecological research and surveys.

14. Thackway, Richard¹, Ian Cresswell², Peter Coyne³, Kerry Olsson⁴, Gillian Lee⁵

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Achieving Conservation Objectives Within Regional Planning Frameworks: An Australian Perspective

Biodiversity conservation involves a significant commitment by governments, industry sectors and the wider community. The Australian Government, through its Natural Heritage Trust, is encouraging conservation partnerships at regional scales in several areas of Australia with the aim of developing effective integration between sustainable land management and biodiversity conservation. Partnerships which recognize the roles of the various levels of government, indigenous groups, industry, non-government organizations, and the wider community are being fostered to bring about sustainable, long-term development opportunities and biodiversity conservation. At the regional level, viable biodiversity conservation requires a "cocktail" of conservation management strategies, including the establishment of statutorily protected areas, complemented by a range of conservation management measures on leasehold and freehold lands. Monitoring the performance for the range of protected areas to achieve biodiversity conservation objectives requires a greater commitment by government. The agenda is to more effectively link top-down government programs, such as State of the Environment reporting, with more bottom-up approaches to land management, which are the domain of the wider community and industry sectors. This paper discusses demonstration projects which aim to develop effective models.

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Maine's Lakes & Ponds

The State of Maine has just concluded an extensive study for the Legislature and Governor on the use and management of the State's 2,700 lakes and ponds. Freshwater bodies greater than 10 acres are known as Great Ponds, and, thus, under State jurisdiction. Public policy issues of access, clean water, quiet waters, personal water craft, public drinking water supplies, water craft regulation, and public lands were addressed. The Great Pond Task Force's study resulted in a large legislative package that was introduced in March 1997 and a Strategic Management Plan that will guide the management of this public natural resource. Improving and funding water craft laws and enforcement was a higher policy issue than clean waters, "ecological reserve" or "quiet waters". Only a few lakes are incorporated into public conservation land holdings (Acadia National Park - 13, Baxter State Park - 43, Maine Department of Conservation - 72).

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Why Aren't RNAs an Integral Part of Ecosystem Management?

Ideally, the network of research natural areas (RNAs) established and managed by the US Forest Service is a cornerstone of ecosystem management because RNAs play key roles in (1) protecting and managing ecosystems to maintain biological diversity and natural processes within them, (2) serving as control or reference areas for monitoring effects of management on similar ecosystems, and (3) providing sites for non-manipulative research that yields information for management. However, integration of RNAs into ecosystem management faces several challenges: (1) RNAs are still widely viewed as set-asides rather than relevant to national forest management, (2) philosophies of land stewardship don't fully recognize the need for monitoring using reference areas such as RNAs, (3) RNA establishment and use for research and monitoring are inadequately funded and of low priority, (4) establishment goals have focused on representing forest communities at the stand level, rather than ecosystems at the landscape level, (5) many RNAs have limited value as reference areas because they are unique and not representative of ecosystems under management, or too small to represent landscape patterns or processes, (6) misconceptions continue that only pristine or rare elements are suitable for RNAs, (7) advocacy is lacking for new RNAs to fill gaps in the revised RNA framework tied to the National Hierarchy of ecological units, (8) skepticism exists as to whether RNAs can serve as controls if they are being actively restored for vegetation structure or natural processes, (9) replicate sites for research or monitoring are not usually available, and (10) many RNAs face increasing pressure from degrading uses. I will give examples of efforts to more fully integrate RNAs in ecosystem management, including (1) research using RNAs as baselines, (2) a regional assessment to determine what additional RNAs are needed to represent common ecosystems by ecological units, (3) field and data searches for areas to fill gaps in representation, (4) coordination with The Nature Conservancy ecoregional planning and state conservation efforts to identify RNA-equivalents, and (5) development of a monitoring guide for national forests using RNAs.

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***Predicting the Invasion of Non-Indigenous Plant
Species into the Wetland Communities of Everglades
National Park***

This project was designed to investigate characteristics that are shared by Everglades invaders and invaded communities. Models of successful and unsuccessful invaders were created in this study to predict future invasions and assess potential impacts. Initially, conceptual models identified relationships of ecological characteristics and successful invasion. Next, statistical models were used to correlate characteristics and their importance to invasion outcomes. Highlighted in this presentation are the characteristics that were good predictors and the feasibility of using this method to predict invasions in natural areas. The resultant framework for risk assessment of impacts based on the characteristics offers a simplistic method for resource managers and administrators to use in planning effective control of unwanted species. Ultimately, it is hoped that providing reliable predictions can justify prioritization of management efforts and funding of the control of threatening species early in an invasion.

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***Anthropological Perspectives on Native American
Sacred Geography***

This presentation provides results of comparative investigations identifying different types of sacred features in the geography of native North America. The varieties and functions of beliefs and ceremonies associated with sacred geography are examined and general comparisons between Euro-American and Native American relationships with the natural environment are offered.

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Batiquitos Lagoon Enhancement Project: Influence of Ecosystem Modifications on Endangered Species Management and Resource Stewardship

In an attempt to reverse detrimental environmental impacts caused by poor land use management, an enhancement plan was recently completed at Batiquitos Lagoon, a coastal wetland located in Southern California, through a cooperative federal, state, and local interagency agreement. The ecosystem scale enhancement effort included the construction of a permanent tidal inlet structure, removal of lagoon sediments through dredging to create adequate tidal volume and additional subtidal and intertidal habitat, nourishment of the adjacent ocean beaches with clean sand to encourage recreation and tourism, promotion of land stewardship in the local community through an interpretive center and docent training program, and the construction of five nesting sites, totaling 13 hectares, designed to accommodate the federally threatened *Charadrius alexandrinus nivosus* (Western snowy plover) and the state and federally endangered *Sterna antillarum browni* (California least tern). Through the enhancement, protection, and management of Batiquitos Lagoon the continued recovery and public awareness of these sensitive species within San Diego County and the State of California has been improved. Results from an intensive research monitoring program (1994-1997) that indicate a positive response by these sensitive species to ecosystem modifications will be presented. Further discussion will incorporate the methodology used to foster connectivity between the local community and the resource to ensure a sustained interest in the outcome of this large scale ecological restoration project.

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Prairies in Portland?

Successful seedings of native shortgrass prairie species have been made in four urban natural areas in the Portland, Oregon metropolitan region. Simple assemblages of the local genotypes of three bunchgrasses: *Bromus carinatus* (California brome-grass), *Elymus glaucus* (blue wildrye) and *Festuca roemerii* (Roemer's fescue) were seeded using several site preparation and seeding technologies. On one of the sites, plugs of hand collected forbs were later planted by volunteers after the grasses had established. Remnants of the historic Willamette Valley prairies now occupy less than 1% of their former range; in a small way, these urban grasslands illustrate the formerly prominent landscape of our home place. All plantings are designed to educate the public about the values of using native grasses for replacing turf, and improving habitat and water quality. Grass seed is harvested for use in future metro greenspace rehabilitation work.

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***The Social and Political Viability of Biological
Corridors on Private Lands: A Case Study in Lewis &
Clark County, Montana***

The Northern Rockies Ecosystem Protection Act (NREPA) proposes a system of biological corridors to reestablish landscape connectivity between wilderness areas and national parks through cooperative agreements, land sales, and exchanges with willing private landowners. Questionnaire responses from 44 landowners in Lewis & Clark County, Montana were used to determine the sociopolitical viability of corridors proposed by NREPA via contingency based evaluation and Likert analysis for this selected geographic sample. Landowners were queried about their observations and perceptions of wildlife and if and how they reacted to wildlife. They were asked about their willingness to change land use practices for the benefit of wildlife and their willingness to adopt conservation easements. Additionally, landowners were asked about their willingness to cooperate with the specific provisions of NREPA and their preference for cooperating with federal, state, or local agencies and groups. Results showed that landowners had mid-levels of tolerance for wildlife reacting most frequently by eliminating those species that interfered with land use practices. Half of those surveyed were willing to modify some ranching, farming, and timber harvest practices. More than half of the respondents were willing to adopt conservation easement provisions. Results also showed that respondents were almost evenly divided regarding their willingness to cooperate with the federal government. Less than half were willing to sell land or exchange land with the federal government to establish a corridor, yet more than half of respondents were willing to work with state agencies and local conservation groups to establish a biological corridor.

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***Application of a State and Transition Model for
Managing Shrub-Grasslands of Southeastern Arizona***

The Muleshoe Cooperative Management Area (CMA) of southeastern Arizona is jointly managed by the Bureau of Land Management, U.S. Forest Service, Arizona Dept. of Fish and Game, and The Nature Conservancy. Most of the rare components of biodiversity occur in the aquatic and riparian systems of the Muleshoe CMA. These occur in a landscape dominated by shrub-grasslands. Therefore, protection of aquatic and riparian values is strongly linked to management of the upland ecosystems. A State and Transition model (STM) was developed to portray vegetation dynamics and driving forces for the shrub-grasslands. The STM was used to propose management goals and a management plan (actions and a timeframe) for the Bureau of Land Management's Ecosystem Management Plan for the Muleshoe CMA. The STM hypothesizes that prescribed natural and ignited fires are the primary management tool to achieve the goals for upland areas. The STM predicts that grazing by domestic livestock will slow efforts to meet management goals due to negative effects on watershed conditions. The Ecosystem Management Plan proposes that livestock grazing will not be conducted for at least thirty years, allowing for approximately five fires on all suitable areas of the landscape. I recommend that State and Transition models are simple but powerful tools that should be applied more widely in natural resources management.

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The Tale of Two Jacks Creeks: Redband Trout Abundance in Relation to Stream Temperature

I examined redband trout (*Oncorhynchus mykiss gairdneri*) density and stream temperature with increasing distance from headwater springs in Big and Little Jacks creeks. These streams flow northeast from the Owyhee Mountains in southwestern Idaho. Despite strikingly similar stream habitats, trout abundance differed between the 2 streams. Redband trout density averaged 0.8 fish/m² (SE = 0.11, n = 6) for the upper 23 km of Little Jacks and 0.3 fish/m² (SE = 0.10, n = 6) for the upper 23 km of Big Jacks Creek ($P = 0.01$). Trout densities in both streams near the headwaters were about 1.0 fish/m² and decreased with distance from headwater springs ($P = 0.04$). However, trout numbers declined more rapidly in Big Jacks drainage, decreasing to 0.2 fish/m² by 8 km downstream of the headwaters. Trout densities in Little Jacks Creek declined to about 0.7 fish/m² by 12 km downstream of the headwaters and remained at that level to 23 km downstream. Water temperatures of headwater springs averaged about 10°C in both drainages. Maximum water temperatures (measured 23 km downstream of headwaters) differed significantly between the streams ($P < 0.001$). Maximum temperatures in Little Jacks ranged from 18-22.0°C and from 20.2-26.0°C in Big Jacks Creek during July 1996. Daily temperature fluctuations also differed between streams averaging 3.6°C for Little Jacks and 7.8°C for Big Jacks Creek ($P < 0.001$). Temperature differences were primarily due to lower levels of stream shading in the Big Jacks drainage resulting from summer long grazing by livestock.

POSTER ABSTRACTS

(These abstracts are listed in alphabetical order by author.)

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Fire History in the Columbia River Basin

A compilation of information from fire history studies in the northwestern United States was used to identify and map "fire episodes" (5-year periods) when fire records were most abundant between 1540 and 1940. Episodes of widespread landscape-scale fires occurred at average intervals of 12 years. We calculated mean annual acreage burned based on estimated areas of historical vegetation types and their associated fire intervals from fire history studies. An average of about 6 million acres of forest and grass/shrubland burned annually within the 200 million acre Columbia River Basin study region, and especially active fire years probably burned twice this much area. For comparison, the largest fire years since 1900 have each burned 2 to 3 million acres in this region. We also compared the occurrence of regional fire episodes to drought cycles defined by tree-ring studies.

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Reservoirs as Contingent Habitat - Illustrations of Biological Trajectories at the Willamette Valley Project, Oregon

The thirteen flood control reservoirs comprising the US Army Corps of Engineers' Willamette Valley Project were built between 1941 and 1969. Their primary purpose has been to facilitate the socio-economic development of the Willamette Valley floodplain, home to the majority of Oregon's population. There was an improving cognizance of the impact of the Project to some native biological resources throughout that three decade period, particularly to anadromous fish. Nonetheless, most biological outcomes of the Project were not foreseen, and probably could not have been accurately predicted. In many cases, species involved have only recently gained the attention of conservationists, including a wide array of herpetiles, plants, and other non-game fauna. The natural resource managers at the Project are achieving a broader perspective of both the influence of seasonal lakes placed within the Willamette's sub-watersheds, as well as for the variety of specific fates to habitat and wildlife. Perhaps surprisingly, there is a very mixed platter of biological trajectories since the construction period. We report of apparent improvement for some elements, mostly avian. An interesting assemblage of ecotones has arisen at many shorelines, including substantial emergent wetlands. There are drastic declines of some formerly abundant herpetiles and fish, though some refugia for remaining populations became preserved. The reservoirs appear to serve as prime habitat for problematic exotics common to the Willamette basin. The engineering requirement for a flood pool freeboard at each lake produced significant public land holdings, much now managed for wildlife or remnant native habitats. The overall complexion of these biological progressions makes up one illustration relating natural landscapes to our economic activities and infrastructures.

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Nuclear Wasteland or Botanical Refugium: New Taxa and Rare Plant Species on the Hanford Nuclear Reservation, Washington

The 560-square mile Hanford Nuclear Reservation preserves some of the highest quality remaining shrub-steppe in the Pacific Northwest. Livestock grazing, agriculture, development, and public access have been excluded since 1943, when Hanford was set aside for plutonium production. A three-year botanical and rare plant survey of the Hanford Site was sponsored by The Nature Conservancy of Washington as part of the Hanford Biodiversity Inventory. Three new plant taxa, three plant species new to Washington, and over 100 populations of 29 rare plant taxa (taxa tracked by the Washington Natural Heritage Program) have been documented. The new taxa include: *Lesquerella tuplashensis* (White Bluffs bladderpod), *Eriogonum codium* (Umtanum desert-buckwheat), and *Astragalus conjunctus* var. *novum* (Rattlesnake Mountain milk-vetch). *L. tuplashensis* is a calciphile and local endemic of the White Bluffs of the Columbia River. *E. codium* is a local endemic of Umtanum Ridge, and is not closely allied with any other species of *Eriogonum* in Washington. It is a long-lived shrub with extremely low seed production which grows on basalt flowtop. *A. conjunctus* var. *novum* grows profusely on the north-facing slopes of Rattlesnake Mountain. Plant taxa new to Washington include: *Loeflingia squarrosa* var. *squarrosa*, *Calyptidium roseum*, and *Gilia leptomeria*.

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Protecting a Resource that Varies in Time and Space: The Case of Pacific Salmon

The life histories of Pacific salmon (*Oncorhynchus* spp.) require us to begin at the watershed level, to expand our thinking to offshore currents and beyond national boundaries, and ultimately to consider these creatures in the context of their total environment - northwestern America's land/ocean interface. We attempt to provide some perspective for those wishing to both harvest and protect Pacific salmon by elucidating population, community and ecosystem trends at watershed and bioregional scales. We map past and present productive fisheries zones, describe changes in fisheries status over time ("depletion and switching"), and provide a bioregional model of the salmon resource, contrasting "wild" versus "managed" flows and pools of salmon biomass, from spawning gravel to dinner plate. We also map the health of salmon stocks on a watershed basis from California to Alaska, and contrast stock health with a composite map of watershed health that summarizes five classes of human impacts (dams/splash dams, canneries, and hatcheries, roads, and forest development). Issues of habitat, genetic diversity, overharvesting, cultural values, and the free flow of water all must be addressed at local and bioregional scales if we are to protect and restore Pacific salmon and their ecosystems.

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Failure of Reproduction in Natural Populations of a Rare Florida Clonal Shrub, Ziziphus celata (Rhamnaceae): Implications for Management

Ziziphus celata is one of the rarest plants of the dozens of narrow Florida scrub endemics. Viable fruit and seedlings have never been documented in natural populations. Only one natural population is clonally diverse while the other four may consist of one clone each. The breeding system of *Z. celata* was assessed by performing pollination treatments on ex situ collections at Bok Tower Gardens and on a natural population. Unlike near relatives, *Z. celata* cannot produce seeds without fertilization. *Z. celata* produces seeds only from crosses involving genetically different individuals. Crosses within the natural population did not result in fruit set. Crosses in the natural population using ex situ plants as pollen sources produced fruit which aborted within a few weeks. High canopy and low availability of water may have been contributing factors to fruit abortion. *Z. celata* plants in the natural population appear to be genetically-related and resource limited. Vegetative composition at the natural population indicates that this habitat is prone to regular fire disturbance. *Z. celata* plants responds positively to fire by resprouting. Fire suppression and the intrusion of urban development are some of the threats to the survival of *Z. celata*. Results of this study suggests that natural populations should be managed for genetic diversity and for prescribed burning.

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Conservation Land Acquisition in Florida

Florida's efforts to protect its dwindling natural areas include the largest governmental conservation land acquisition program in the world. Under Preservation 2000, a bond initiative, funding for Florida's various programs that acquire land for natural resource protection and outdoor recreation was increased from approximately \$75 million annually to nearly \$350 million annually. Through Preservation 2000, to date, over 830,000 acres have been set aside to preserve endangered species and habitat, protect water quality and water supplies, and provide outdoor recreation opportunities for millions of residents and tourists to enjoy "the real Florida".

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Tamarisk in the National Parks: United We Stand...A Chance!

Tamarix spp. (tamarisk or salt cedar) has invaded the desert southwest for decades and receives top priority on pest plant lists. Well known as an opportunistic exotic species in riparian systems, this genus threatens numerous critical desert watering points and has successfully replaced many native species on federal lands. Exotic species management has become an increasing problem for managers responsible for preserving natural ecosystems. As with many exotics, tamarisk infestations have become an overwhelming challenge for National Park Service managers. Guided by a recent Department of the Interior-led Weed Management Initiative, Lake Mead National Recreation Area developed a plan to create two mobile eradication teams for desert parks. During their first season, winter 1996, these crews have cut and treated tamarisk in ten national park units. With pre-season training in herbicide use and chainsaw operations, this type of cooperative team has proven to be extremely effective in treating large areas across the desert, and provides continuity to removal methods and monitoring of tamarisk. The objectives of the program are to: 1) complete initial tamarisk removal from high priority areas; 2) develop maintenance schedules for park staff; 3) develop a professional corps of NPS resource managers equipped with the knowledge and expertise to continue exotic plant management programs; and 4) provide each work site with a complete working report including acreage treated, maps, and recommendations. Monitoring ecosystem recovery of the project areas remains the responsibility of each park unit. While independent strategizing in the past has been costly and less effective, results from this group approach reflect how planning and prioritization can achieve more immediate, cost-effective success.

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An Examination of Annual Grass Control Methods for Use on the Lawrence Memorial Grassland Preserve

Lawrence Memorial Grassland Preserve, a National Natural Landmark, represents the finest remaining example of native, biscuit-scabland grassland in Wasco County, Oregon. Once widespread throughout the Columbia and Great Basins, many such grassland areas have become degraded by non-native grasses (e.g. *Bromus tectorum* and *Taeniatherum caputmedusae*). Recognizing this threat the National Park Service's National Natural Landmarks Program and The Nature Conservancy entered into a Challenge Cost-Share Program arrangement in 1993 to initially develop a monitoring system for the preserve. Now in-place, the monitoring system continues to be developed, providing the impetus and support for a restoration program that was subsequently funded through the 1995 Challenge Cost-Share Program. Based on results of the 1993 monitoring, The Nature Conservancy began research into controlling non-native grasses with prescribed burning, mowing and transplanting during 1994. Depending on the density of exotic grasses in areas treated in 1994, TNC took an integrated approach in 1995 involving fire, mowing in association with hand removal and herbicides as second year treatment strategies. The objective of the 1996 research, which is the basis of this poster, was to determine which combinations of treatments were most effective in reducing the abundance of medusahead rye and cheatgrass.

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Natural Areas of the Columbia Basin Assessment Area

Natural areas (NA) were assessed as part of the Interior Columbia Basin Ecosystem Management Project of USDA Forest Service and USDI Bureau of Land Management. NA of the interior Columbia Basin in the U.S. includes 10 designations among Federal, State, and private lands, and totals 5.7 million ha or 10% of the basin assessment area. NA vary widely in size. Most are wilderness (66% by total area) or national parks (11%), are small, occur in upper elevations, and do not necessarily adequately represent all ecosystems. Best-represented ecosystems are alpine tundra and some high elevation forests; worst represented are low-elevation grasslands, wetland and aquatic types, and woodlands and mid-elevation forests. Management implications include better represented ecosystems, protecting even small habitat areas for rare at-risk species, realigning some NA to better include hot spots of biodiversity and species rarity and endemism, and selecting and managing NA to better coordinate broader conservation objectives.

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Taxonomy of *Hackelia Venusta*

Hackelia venusta is an endemic species currently known from four locations in Chelan County, Washington. One population within the Tumwater Botanical Area occurs at a low elevation (365 meters), has large white flowers, and loosely branched crown. The other three populations occur at elevations above 2000 meters, are low in stature, and have smaller blue flowers. Recently, botanists working with this species have indicated that the two flower color forms may be different species. The purpose of this project was to collect and analyze a host of morphological data from each of the populations, including a comparison species, *H. diffusa* var. *arida*, to determine taxonomic affinities. From each population, data from 25 plants were collected on 18 morphological characters from three categories: vegetative, floral, and fruit. Data were analyzed using principal component and discriminate analysis. Both statistical analyses were successful in separating the two flower forms of *H. venusta*, as well as *H. diffusa* var. *arida* to a large degree. Blue-flowered plants were shorter, had smaller flowers, and wider radial and lower cauline leaves than white-flowered plants. Flower size was similar between the blue-flowered *H. venusta* and *H. diffusa* var. *arida*, but differed in respect to several other morphological characters. There was very little overlap in characters when comparing the white-flowered *H. venusta* with *H. diffusa* var. *arida*. These results suggest that *H. venusta* more limited in its distribution than previously thought and that the species is restricted to only the one white-flowered population within the Tumwater Botanical Area. The blue-flowered plants taxonomic status is unknown at this time, but data are being collected to determine its possible affinities with other *Hackelia* species.

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Cooperation in Research and Management of Willamette Valley Prairies

Prairies once covered large areas in the Willamette Valley of western Oregon. Agricultural and urban development, fire suppression, stream channelization, and pest-plant invasion have left native prairies highly fragmented and their historical ecological functions disrupted. The Willamette Valley Natural Areas Network formed as a response to these conservation and management challenges. Its active membership represents five federal and state land management agencies, three universities, and numerous private organizations. Specific objectives of the Network include restoring and protecting native habitats, building support for prescribed fire and other potentially controversial management practices, promoting research in prairie ecology, and fostering public understanding of Willamette Valley ecosystems. Network participants are conducting several dozen projects throughout the Valley. Research projects range from intensive field experiments to adaptive management trials to rare plant monitoring. We report current results from several of these projects. The Network promotes integration across studies by facilitating communication, suggesting common methodologies, and maintaining a central repository of species data. Developing infrastructure is also important because of the wide array of prairie ownership and management objectives. Network infrastructure projects include developing a joint fire and smoke management program, conducting a monitoring workshop for Network members, and recruiting volunteer and hired field support. Educational projects serve students from middle school to graduate school and include curriculum development and guided field trips.

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From a Drop of Rain - A Tale of Two Rivers

A Tale of Two Rivers is a cooperative project between the school districts of Eugene 4J, Bethel 52, McKenzie River 68 and the Eugene Water and Electric Board to develop an integrated curriculum based upon the study of selected natural and cultural sites within the McKenzie and Willamette watersheds. Numerous public land managing agencies and other institutions provide resources and technical assistance to the project. Since fall 1995, middle school and high school students have learned about watersheds, energy generation and conservation, ecology, natural system interactions, and stewardship in these outdoor settings. Each classroom is in progress on a multi-year study of their selected site. Each locality possesses one or more particular resource attributes or management issues pertinent to watersheds. While there are any number of established school curricula which address the basic scientific disciplines, little is available which integrates these into practical applications involving the challenges facing natural resource managers. A major goal of the Two Rivers project is to forge such an application for each resource site, enabling the students to engage in a substantial vignette of the stewardship experience. In addition to site specific products such as study results, interpretive media, etc. the entire project culminates in a 1998 museum exposition hosted by the University of Oregon Museum of Natural History. We report progress by individual classrooms at their sites, and towards preparation of their final museum exhibits.

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***Urban Ecology and Geographic Analysis of Cavity
Nesters in the City of Vancouver***

Urban environments are the areas where most people live. They are built up in the forested valleys, river courses, and estuaries equally desired by wildlife. This study will examine the distribution of cavity nesters in Vancouver. Information on location of injury, type of injury, date, and species were collected from Wildlife Rescue Association in Burnaby, BC for the year 1996. Data were compiled for the Greater Vancouver Regional District (GVRD) (N>200). Preliminary geographic information system analysis with IDRISI was done for the Vancouver core area on a subset of the original data (N=47). Locations of injured birds and bats were digitized into the GIS database of Vancouver and mapped in relation to urban green-space. Trends in distance of injury to the nearest park(s) were evaluated by season; density of birds per park catchment area was calculated using theissen polygonal analysis. Results indicate high bird densities around clusters of small green-space areas, near the Fraser River, comparable to densities around larger parks. Weak cavity nesters and less wary species were found, on average, farther from green-space than more habitat specific species; this trend was evident when some data related idiosyncrasies were accounted for. Species injured during fall and winter were found farther from green-space on average than those injured during spring and summer. This application of GIS demonstrates that it has potential as a powerful public education tool. It geographically displays where wildlife finds habitat in the city and could inspire the planting of native wildlife habitat gardens.

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***Fire Planning at Archbold Biological Station, Florida:
Incorporating Temporal and Spatial Variation***

Fire management planning at Archbold Biological Station attempts to balance diverse goals and provide temporal and spatial heterogeneity across the landscape. The six major goals are maintaining biological diversity, mimicking natural processes, providing a diversity of research and educational opportunities, reducing fire hazards, and conducting safe burns. The system is built around five fire return intervals, each of which is a range of years within which individual burn units are planned to re-burn. A key characteristic is the assignment of modal fire return intervals to vegetation types (e.g. most sandhill will burn every 2-5 years, most rosemary scrub will burn every 20-59 years). Using fire return intervals, rather than a fixed number of years, increases heterogeneity and flexibility and provides research opportunities. Initial burns in fire-suppressed areas are staggered to be burned over the modal fire return interval. Heterogeneity is also provided by assigning units to intervals other than the modal one for the vegetation. We also seek to promote variation in timing of fires, fire patchiness, fire intensity, and size of burns. Recent trends include more prescribed burns, more burns in the natural ignition season, and a range of fire sizes (< 1 to 73 ha). A variety of fire return intervals are also assigned to units containing critically-endangered species in order to provide research-based management information.

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Exotic Plant Presence and Regeneration of Native Herbs Following Fire in Riverside State Park, Washington

On July 11, 1994 a 300 ha crown fire burned through a *Pinus ponderosa* (ponderosa pine) dominated area of Riverside State Park, jumped the Spokane River, and threatened residences and businesses in north Spokane, Washington. Park staff and fire crews reseeded the burn in late summer 1994 with a "native grassland" seed mix. Regeneration of native herb species on the burn, on powerline and pipeline right-of-ways, along roads and on unburned control areas was assessed in 1997 using 10 x 10 m permanent monitoring plots that quantified basal area of live and dead trees and percent understory cover. In addition, 50 m long transects quantified populations of native wildflower species and non-native plants by use of scalars. Results indicate seeding was unnecessary, and wildflower genera such as *Castilleja*, *Dodecatheon*, *Fritillaria*, *Ranunculus*, *Silene* and *Sisyrinchium* regenerated in the burn within three years. Exotic plant invasion is a primary concern if fuels reduction is implemented along the park/urban boundary.

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The Use of a Native Insect as a Biological Control for Eurasian Water Milfoil

Experimentation under laboratory and field conditions demonstrated the potential use of a native North American aquatic weevil, *Euhrychiopsis lecontei*, as an agent of biological control for an exotic aquatic weed, Eurasian water milfoil (*Myriophyllum spicatum*). *E. lecontei* has been collected from Connecticut, Illinois, Indiana, Iowa, Massachusetts, New York, Ohio, Vermont, Washington, Wisconsin and Alberta, British Columbia and Saskatchewan. Its host, Eurasian water milfoil, introduced into the U.S. nearly 6 decades ago, has spread to 40 state and Canada. *E. lecontei* feeds only on *Myriophyllum* spp., with preference to *M. spicatum* over native species. Eurasian water milfoil has declined in lakes in Vermont where natural weevil populations occurred and Eurasian water milfoil has declined in lakes where weevil populations were artificially established. Life cycle experimentations demonstrated that current methods of milfoil control (harvesting and chemicals) are counterproductive to the build up of natural native populations. A twelve-lake trial is being conducted in Wisconsin and additional work is undergoing.

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Monitoring the Recovery of an Urban Grove of Quercus garryana (Oregon White Oak) Following Changes in Management Practices

A grove of approximately 100 mature *Quercus garryana* (Oregon white oak) graces the entrance to Linfield College in McMinnville. The grove serves as the site for many community cultural activities, such as commencement exercises, the International Pinot Noir Festival, and summer concerts. Recently, many trees have died or are showing signs of decline as a result of soil compaction and horticultural practices associated with maintaining a lawn under the trees. Pathogenic fungal diseases were identified in the grove and, in 1995, management practices were modified to minimize further damage by the fungi. We began a long-term study to quantify and describe changes in soil microflora as the grove is restored to health. We describe baseline measurements of soil bacteria and fungi in the grove and adjacent sites and document variation between seasons and among sites. Generally, bacterial and fungal counts were higher in summer, and high bacterial, but not fungal, counts are most often associated with high soil moisture conditions. In addition to pathogens, we detected the presence of beneficial (allelopathic) and symbiotic microorganisms. Twelve percent of the *Streptomyces* spp. isolated from soil samples produced chemicals that inhibited the growth of the pathogenic fungus *Armillaria mellea*. Forty-three percent of oak seedlings greenhouse grown in soil obtained from the sites were ectomycorrhizal. Soil sievings from all sites yielded spores of the endomycorrhizal genus *Glomus*.

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Wood River Wetland Restoration Project

In the Klamath Basin, wetlands have been reduced from over 350,000 acres prior to 1905 to less than 75,000 acres today due to agricultural conversion, urbanization, and other human induced changes to the landscape. In an attempt to reverse this trend, The Klamath Basin Water Resources Advisory Committee solicited the Congress to appropriate funds to purchase the Wood River property for the purpose of wetland restoration. In September 1992, the Congress appropriated funds for the Bureau of Land Management (BLM) to purchase the property. In July 1994 purchase of the property was completed. The primary goal for management of the Wood River Property is to restore the majority of the area to a functioning wetland community. The primary objectives are to improve water quality and quantity entering Agency Lake from the property, and to restore and maintain wetland habitat, primarily for the federally-listed as endangered Lost River and shortnose suckers, and secondarily for other species. Additional objectives to be pursued in accordance with the primary objectives include provision of public recreation and environmental education opportunities, and coordination of multi-agency research and monitoring. Potential research topics include the effects of wetland restoration on water quality, seasonal water regimes, water storage, and Lost River and shortnose sucker habitat on the Wood River property. Current monitoring efforts include data collection for amphibians, birds, fish, vegetation, and water quality. Current restoration activities include reconstruction of levees, construction of a new pump station, and pond construction, which will facilitate the recreation of historic hydrologic patterns.

