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Research Proposal: MARIN -- THE BURNING QUESTION

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Research Proposal: MARIN -- THE BURNING QUESTION

STATEMENT OF PROBLEM:

Five land management agencies, including the National Park Service, are responsible for managing wildland resources in Marin County sections of the Central California Coast Biosphere Reserve. These lands contain a variety of landscapes and ecosystems which exhibit different degrees of disturbance. Some contain core wilderness, as defined in the Man and the Biosphere Program. Growing urban development, continual encroachment of exotic plants and animals, as well as the natural processes of drought, fire and flood contribute to the complex management conditions of the resources in these wildlands. In particular, the fire hazard is very high in areas where residences and other structures are adjacent to or within forested and wildland landscapes. The residents of these urban/wildland interfaces are understandably concerned about how the areas adjacent to their homes and businesses are managed. With several agencies responsible for these lands, communication and coordination is vital but difficult, and potential exists for inefficient management of resources or even conflict of management objectives and techniques. Golden Gate National Recreation Area recognized this possibility in the Project Statement for GIS: "Shared knowledge and information between Golden Gate and Point Reyes and the five other land management agencies in the newly formed Biosphere Reserve is critical for efficient and effective resource management."

Specifically, wildfires are the most frequent destructive threat to the collective management of the wildlands in the Biosphere Reserve, and to the lives and properties of people who may live in or adjacent to these wildlands. These communities have fire problems similar to those commonly found in Southern California -- structures in a wildland setting, intermingled with heavy fuels on steep slopes and dead end roads. Although major fires, such as the recent Santa Barbara fire and those which occur in Los Angeles County each year are not as common in the Bay Area, they do occur. Even fires of small acreage are likely to destroy many residences and cause extensive damage to resources. The 1923 Berkeley fire, which completely destroyed 584 structures in a four hour period, remains the California record for the highest number of structures destroyed by a fire. Just six years later, July 2, 1929, 117 homes and 2,500 acres were destroyed on Mt. Tamalpais.

Further research is needed to provide baseline information on landscape structure and dynamics over time in wildland areas that will enable all the land management agencies to improve and coordinate their resource management in Marin County. This research is also needed to develop fire management plans that would help identify fire hazard areas in these wildlands regardless of jurisdiction and reduce their destructive impact when they do occur.

OBJECTIVES:

This study presents a landscape level framework for assessing the ecology and management of the Mount Tamalpais landscape area, based on the following considerations:

- 1) the greater Mt. Tamalpais area can logically and usefully be considered as a single, ecological landscape, regardless of jurisdictional boundaries;
- 2) the landscape of Mt. Tamalpais has undergone extensive, but little-recognized, structural and functional changes in historic times due to the interactions of human and natural processes; and
- 3) consideration of a landscape management perspective and recognition of widespread landscape change have significant implications for local land management agencies.

The specific objectives of the study are to test the ability of the Landscape Ecology Paradigm to:

- 1) identify, document and explain historic and current landscape and vegetation patterns,
- 2) identify and integrate the spatial and temporal scales of the eco-systems in terms of human land use practices and natural processes, using fire as the primary disturbance regime,
- 3) successfully assess overall management implications and communicate them in the planning process.

An overall picture of the entire Mt. Tamalpais landscape study area (or other designated study area) will be provided by compiling a research history, from the various agencies involved, and by reviewing past and current aerial and space photography of the area. Current field research conducted by the individual agencies, and all other appropriate data will be included and digitized for integration in GIS. All research results will be shared with the agencies responsible for managing the Mt. Tamalpais area, to supplement and assist on going studies.

SCOPE AND METHODS:

The most appropriate methodology to achieve these objectives is an integrative technique called the Landscape Ecology Paradigm, developed by Craig Allen, Ecologist, Bandelier National Monument.

A *landscape* is defined as an area at least several kilometers wide where a recurring pattern of relatively homogenous ecosystems (patches) is identifiable (Forman and Godron, 1986).

Landscape Ecology is concerned with the spatial distribution and interactions between ecosystem patches at the landscape level.

The *Landscape Ecology Paradigm* is an integrative technique that emphasizes spatial scales and identifies the spatial hierarchy of ecosystems, and considers changes in landscape structure and function through time (Delcourt and Delcourt 1988). It recognizes various disturbance regimes as ubiquitous and important processes that drive the interactive dynamics of landscapes and their component patches (Pickett and White 1985), and strives for integrative, interdisciplinary and holistic perspectives and approaches to research and management issues.

The Landscape Ecology Paradigm links the resource basic inventory, geographic information systems, *in situ* research activities and past studies in an identified landscape area to present an overall picture of the landscape in its regional ecosystem setting.

(Allen, Lissoway and Yarborough, Park Science, Winter 1990, Vol. 10 No. 1, "Landscape Ecology - A Concept for Protecting Park Resources", pg. 7)

STUDY AREA:

I would like to focus my research on the Tamalpais watershed and / or the Olema Valley of the Central California Coast Biosphere Reserve. The area of study could include ecosystems in Golden Gate National Recreation Area, Mt. Tamalpais State Park, Muir Woods National Monument, Marin Municipal Water District and other land managers in the reserve. The specific areas of study are dependent upon the capabilities of the Landscape Ecology Paradigm, the available historical data and the disturbance regimes (such as fire or grazing) identified for study. Specific ecosystems and landscape areas should involve identified priorities of any of the land management agencies involved.

There are other possible study areas such as the Presideo, Sweeny Ridge and the San Francisco Watershed lands.

EXPECTED RESULTS:

Golden Gate National Recreation Area has identified inventory and assessment of vegetation, development of a geographic information system (GIS) system, and implementation of the Fire Management Program including associated research as three of its highest priorities. The work described in this proposal will contribute substantially to meeting all three priorities.

The Action Plan for Biosphere Reserves, UNESCO, Nature and Resources, identifies the following "minimum set of activities" for Biosphere Reserves:

... Although each government has its own priorities, from an international perspective there is a minimum set of activities which should be implemented in each biosphere reserve and for which international organizations should provide support as appropriate. These are: baseline inventories of flora and fauna and their uses; monitoring; preparation of a history of research; establishment of research facilities and research programmes; establishment of training and education programs and preparation of a management plan which addresses biosphere reserve functions."

[See also Research and Monitoring Function #13.; Objectives and Actions, Objective 4., #34; and Recommended Actions, Action 15.]

By focusing on one of the identified study areas for Golden Gate National Recreation Area and the Central California Coast Biosphere Reserve, my Masters Degree research can help increase our understanding of the identified ecosystems, as well as integrate the data in a geographic information system. By using the Landscape Ecology Paradigm my research can help establish a context to organize and improve the management usefulness of the eclectic array of past and proposed future ecological research in the area.

POSSIBLE OUTSIDE FUNDING SOURCES:

The U.S. Forest Service - Pacific South West Fire Laboratory, Riverside: Wildland Recreation and the Urban Culture Research Work Unit. [Problem Number 3: Improving the Understanding and Communication Between Managers and Recreation User Groups.]

NASA, Ames Research Center - Ecosystem Science and Technology Branch "Earth Observation and Commercial Applications Project." (Letter of Intent to Propose has been submitted.)

Funding in Marin County through the Buck Trust Foundation.

TIMEFRAME:

Fall 1990 - Attend appropriate coursework at University of California, Berkeley; further develop proposal, pursue funding.

Spring 1991 - Continue coursework, finalize research methods, begin approval process, secure funding.

Summer 1991 - Conduct research.

Fall 1991 - Finalize research, prepare final reports and Masters thesis.

Landscape Ecology – A Concept for Protecting Park Resources

By Craig Allen, John Lissoway
and Keith Yarborough

The Southwest Region has been supporting Resource Basic Inventory (RBI) efforts to establish baseline data for comparisons with long-term monitoring results to be conducted in the future. This "pulse taking" is a part of the Servicewide initiative being fostered so that resource managers, scientists, and park managers will be able to track the health of park resources by determining changes and trends. The RBI work is being linked with the development of Geographic Information Systems (GIS) at Bandelier, Big Thicket, Big Bend, Padre Island, and Guadalupe Mountains. Many of the parks in the Southwest Region have only partially completed RBIs. This informational shortcoming is a pervasive threat to the parks because without detailed knowledge of the parks' respective resources the Service cannot protect them adequately.

To overcome this deficiency, the SWRO's Division of Natural Resources Management and Science has fostered at Bandelier a pilot research effort, which started in FY '87 and utilizes a **landscape ecology paradigm**. This concept links the RBI, GIS, and research activities in a park to present an overall picture of the park in its regional ecosystem setting. The flowchart diagrams this project's concept. The results have been encouraging. A final report was recently completed (Allen 1989). This concept may now be applied to other Southwest Region parks.

What is the Landscape Ecology Paradigm Used in this Study?

1. Spatial scales are important. Landscape ecology is based upon a spatial hierarchy of ecosystems (Urban et al 1987). A *landscape* is an area at least several kms wide where a recurring pattern of relatively homogeneous ecosystems (patches) is identifiable (Forman and Godron 1986). *Landscape ecology* is concerned with the spatial distribution and interactions between ecosystem patches at the landscape level.

2. Temporal scales also are important, as landscapes change through time. Since landscapes are dynamic, landscape ecology considers changes in landscape structure and function through time (Delcourt and Delcourt 1988).

3. Disturbance regimes of various sorts are recognized to be ubiquitous and important processes that drive the interactive dynamics of landscapes and their component patches (Pickett and White 1985).

4. Landscape ecology strives for integrative, interdisciplinary, and holistic perspectives and approaches to research and management issues (Risser 1985).

5. Landscape ecology shares the perspective that has developed in the emerging field of *conservation biology* that all reserves are islands set within and linked to larger landscapes (cf. Soulé 1986). Parks are thus subject to a variety of problems related to habitat fragmentation and isolation from the surrounding landscape. Further, as reserves become increasingly insularized they are found to be threatened with disruption from numerous external sources. Boundary considerations are important (Schonewald-Cox 1988). Effective management of the local ecosystems of parks requires attention to the landscape context in which they are embedded (Agee and Johnson 1988).

This pilot research project was set in the Jemez Mountains of north-central New Mexico, which rise as a large, island-like, volcanic landmass at the southern edge of the Rocky Mountains. Relatively homogeneous local ecosystems can be distinguished within the Jemez Mountains based on site-specific vegeta-

tion, landforms, and soils. These local ecosystems range from open shrublands of juniper (*Juniperus*), saltbrush (*Artriplex*), sagebrush (*Artemesia*), and rabbitbrush (*Chrysothamnus*) in Aridic Ustochrept soils on the alluvial floodplain of the Rio Grande at 1550 m in elevation, to spruce-fir forests (*Picea engelmanni*, *Abies lasiocarpa* var. *arizonica*) in Typic Cryoborall soils on the highest, north-facing, mountain slopes at 3500 m.

When spatially aggregated, the local ecosystems of the Jemez Mountains form a repeated mosaic pattern that may be considered to compose a single landscape. Bandelier NM comprises a complete altitudinal transect in the southeast flank of the Jemez Mountains, including examples of most of the ecosystems present in this landscape. Yet Bandelier (13,300 ha) is only a small fragment of the overall Jemez Mountains landscape (543,500 ha) in which it is set.

Past ecological work in the Jemez Mountains has focused on the level below local ecosystems, on studies of ecosystem parts; there has been a conspicuous absence of landscape-level work. Resource management and land-use planning activities in the Jemez Mountains have been hampered by this lack of landscape-level ecological information.

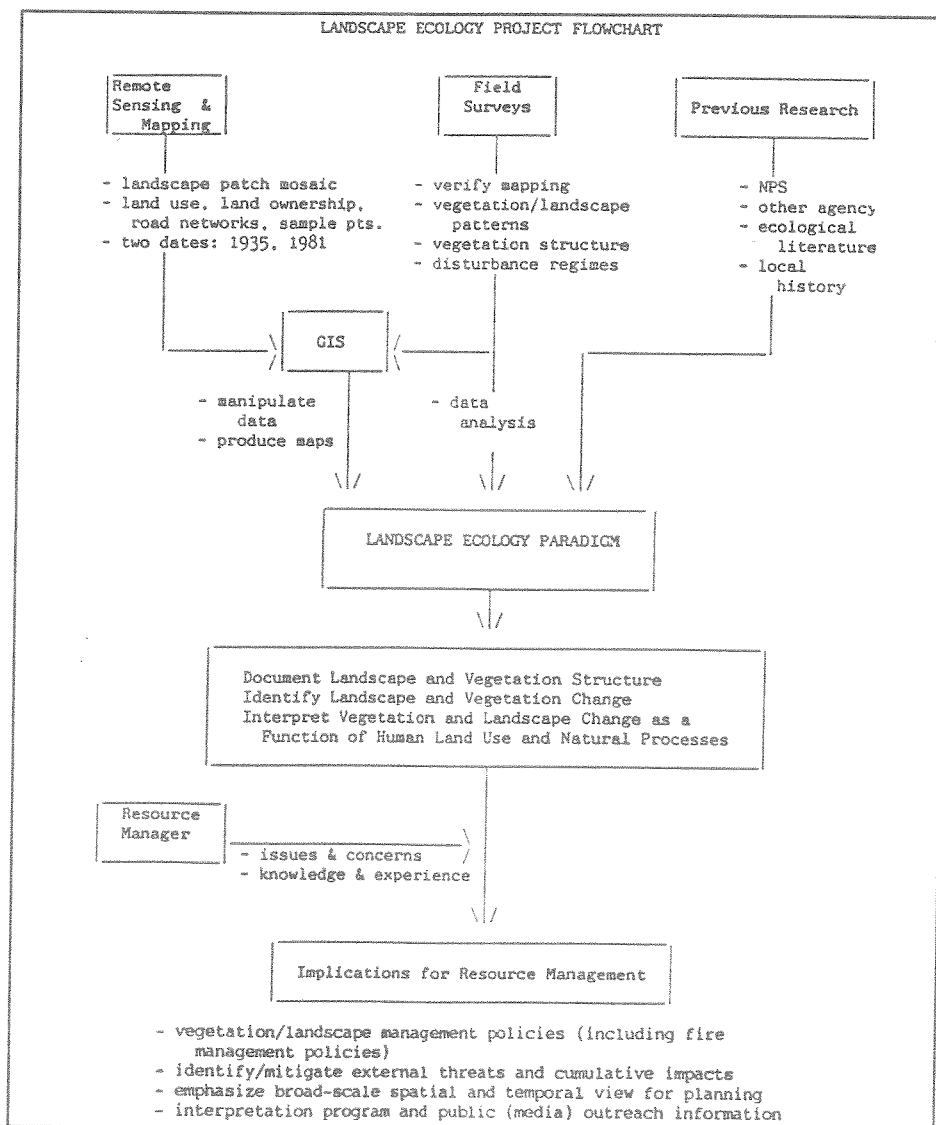
The Jemez Mountains are subject to an increasing variety and intensity of stresses from human activities,

with uncertain cumulative impacts on individual species, ecosystems, and the landscape as a whole. Especially worrisome are impacts from logging, grazing, mining, recreational activities, air and noise and water pollution, fire suppression, highways, reservoirs, powerline corridors, and human settlements. External impacts to park resources represent a major set of management issues for Bandelier. In the absence of a landscape vision of the Jemez Mountains many opportunities to mold a desirable landscape by conscious choice and awareness of tradeoffs have been lost to piecemeal "development."

In summary, this project developed a landscape-level framework for describing the structure of the Jemez Mountains landscape in which the ecosystems of Bandelier NM are embedded. This design allowed landscape-level changes to be noted and their implications assessed, thereby helping the NPS meet its goals for effective, long-term management of "our" ecosystems. An integrative landscape ecology framework also provided a context to organize and improve the management usefulness of past ecological studies. The methodology developed here is applicable to other NPS units.

Allen conducted this research while a doctoral student U/Cal, Berkeley; he is now an ecologist with

Continued on next page



regional highlights

Pacific Northwest

The Interior Department's Minerals Management Service (MMS) has funded several studies to investigate long-term effects of oil spilled from the barge Nestucca on the coast of Washington. About 6000 barrels of bunker C crude spilled when the barge was damaged by its tug offshore Grays Harbor, WA in late December 1988. Beaches were oiled from Grays Harbor to Vancouver Island, Canada, including Olympic NP. Most obvious effect to wildlife was the loss of an estimated 9000 seabirds.

Three of the MMS projects are being funded through a cooperative agreement with the US Department of Energy and in cooperation with NPS. Study participants include two research teams from U/WA and Batelle Pacific NW Labs. Twelve study sites include representative sites from the primary beach types in the area, both oiled and unoiled. The beach types included are sandy, cobble, and rocky beaches. Sites chosen in Olympic NP are sites for which pre-spill data have been collected.

John Aho, Olympic NP wildlife biologist, is park staff coordinator and will respond to inquiries from *Park Science* readers.

Doug Houston, PNR research biologist stationed at Olympic NP, is the NPS representative, serving as technical advisor, to a spotted owl research committee funded through USFS. The committee held its first meeting in late November, with field trips throughout spotted owl habitat in Oregon. Houston reports that a committee-produced plan for spotted owl conservation is scheduled for readiness by March 1990.

Ed Starkey, wildlife ecologist with the Oregon State University NPS/CPSU was in Washington, DC Dec. 5-6 for meetings to identify what is known about bru-

Landscape Ecology (Continued from page 7)

Bandelier. Lissoway is the Chief of Resource Management at Bandelier; Yarborough is a physical scientist with the Division of Natural Resources and Science, SWRO.

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Cole Memorial Publication

"Fate of Coho Salmon (*Oncorhynchus kisutch*) Carcasses in Spawning Stream," dedicated to the memory of one of its authors, Don Cole, who died before the study was completed, appeared in *Canadian Journal of Fisheries and Aquatic Sciences*, Vol. 46, 1989, pp. 1347-1355. Co-authored by Doug Houston, W.J. Scarlett, and C.J. Cederholm, the study found that much of the fish mass from the 945 coho salmon released experimentally into 7 spawning streams on the Olympic Peninsula was consumed by 22 species of mammals and birds, that the capacity of many streams and rivers to retain carcasses probably had been reduced by human activities, and that the importance of coho carcasses to populations of carnivores and to the dynamics of lotic (flowing water) food webs merit additional study.

Reprints are available from Houston at Olympic NP.

cellosis in the Greater Yellowstone area, recommend any additional research needed, and identify management alternatives. The meetings are being held under the joint aegis of NPS and the Animal and Plant Health Inspection Service (APHIS).

Dave Peterson was selected in November to fill the research biologist position at the NPS/CPSU, U/WA. His research background and interests include the effects of air pollutants on forest resources, effects of global atmosphere change on forests, and fire ecology.

Gerry Wright, NPS biologist with the U/ID CPSU, is spending 6 to 8 weeks assisting Gettysburg National Military Park with preparation of an EIS for managing deer damage to the park's cultural landscape.

Copies of the Pacific Northwest Region's *Annual Science Report - 1988* are now available from PNW Region headquarters in Seattle, WA.

"I had \$1.5 million, 25 biologists, and 9 birds - plus about 20 conservation groups who wanted to tell me how to run the California Condor recovery program."

Michael Scott, leader of the Idaho Cooperative Fish and Wildlife Research Unit at U/ID, was addressing the bi-annual meeting of the NPR science group Nov. 29-30 in Moscow, ID.

In addition to a sometimes-grim, sometimes hilarious account of his struggle to maintain those "magnificent flying garbage cans" as a viable population in the wild, Scott described something called "Gap Analysis of Species Richness and Vegetation Cover: An Integrated Conservation Strategy for the Preservation of Biological Diversity." He has promised a future article on the subject for *Park Science* readers.

Alaska Region

Dale Taylor, wildlife research biologist with the ARO, and Paul Haertel, Assoc. Reg. Dir. for Resources, were on the team of American and Soviet specialists who visited the Chukotskiy Peninsula in the USSR, the Seward Peninsula, and other regions in Alaska to investigate the feasibility of an international park. People in both countries expressed "overwhelming" support for the concept.

The team was part of Working Group 02.04-20 "Conservation and Management of Natural and Cul-

tural Heritage" under the Joint Soviet-American Agreement on Cooperation in the Field of Environmental Protection. The team was led by Denis Galt WASO, Chief of Planning, and included Rich Giamt dine, Denver Service Center. Superintendents and staffs at Bering Land Bridge, Northwest Areas, Galt of the Arctic, and Denali were integral parts of the visit on the American side.

Dr. Yuri Chernov, leader of the Soviet arctic M project, and Dr. Nada Matveyeva were escorted Noatak National Preserve and Biosphere Reserve Taylor and Kate Roney, NW Alaska Areas resource management specialist. The Soviet visit is a continuing step in pairing Noatak with a Biosphere Reserve in the USSR.

Al Lovaas spoke on "Monitoring for Global Change A National Park Service Perspective" at the September Arctic Science Conference on Global Change in Fairbanks. Al and Ted Birkedal participated in a conference workshop, "Long-term Data Sets Assessing Regional or Global Change." Dale Taylor, originally scheduled to give the natural resource presentations was "exiled to Siberia" at the time.

Sara Wesser, biologist and most recent addition to the ARO Natural Resource Division staff, recently completed requirements for the M.S. degree at U/AK Fairbanks. Her thesis, "Controls Over Species Distribution across a Forest-Steppe Transition in Interior Alaska: A Correlative Model and Experimental Tests," applies directly to species present at Yukon-Charley Rivers National Preserve.

Taylor and Lee Anne Ayres, biologist with NWAA, presented posters at the American Society of Mammalogy meeting in Fairbanks. Taylor's poster was on monitoring road traffic impacts on wildlife in Denali NP; Ayres' poster dealt with inventory of small mammals in Noatak River Basin, NW Alaska.

Regional Wildlife Biologist Layne Adams presented a poster on "Comparisons of Bear and Wolf Predation on Caribou Calves, Denali NP and Preserve, and co-authored with Alaska Dept. of Fish and Game biologists a paper titled "Influences of Body Weight on Early Puberty, Pregnancy, and Reproductive Histories in Alaskan Caribou" at an international workshop in St. Johns, Newfoundland.

Mid-Atlantic Region

From Jeff Marion, recently transplanted to the new CPSU at Virginia Tech, comes word of an organization known as the Multi-State Fish and Wildlife Information Systems Project (MSDWIP), which operates a computerized database through staff sponsored by cooperating states - typically in Natural Resource departments. Their national office is in Blacksburg, VA, and is closely associated with the VA Dept. of Fisheries and Wildlife.

According to Marion, MSFWIP has developed "a very impressive database, using Advanced Revelations - a package similar to dBASE - which operates on microcomputers. Cooperating states must sponsor the data collection and input, but if an adjacent state already has put in a lot of information, the data is shared and only revised. Data collected is on all animal species, not just RT&E. For more information contact MSFWIP at 102 Colony Park, 2001 S. Main St., Blacksburg, VA 24060. 230/231-7348.