

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 '87). 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 (Deicourt 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 1965).

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 (Schönewald-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 (*Artemisia*), 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 engelmannii*, *Abies lasiocarpa* var. *arizonica*) in Typic Cryoboralf 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.

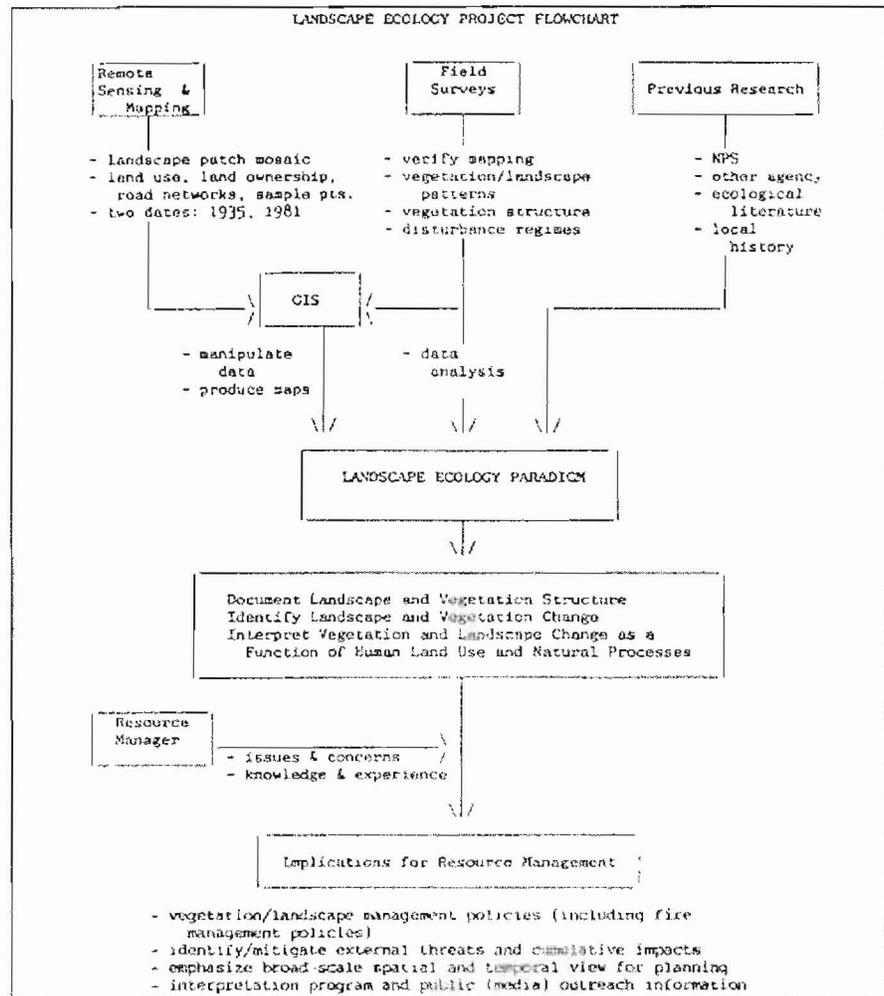
The Jemez Mountains are subject to an increasing variety and intensity of stresses from human activities,

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 at UC, Berkeley; he is now an ecologist with

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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 UAWA 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-

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 UAWA. 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 UID 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 \$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 UID, 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 Haerfel, 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 Galvin, WASO, Chief of Planning, and included Rich Giamberdine, Denver Service Center Superintendents and staffs at Bering Land Bridge, Northwest Areas, Gates of the Arctic, and Denali were integral parts of the visit on the American side.

Dr. Yuri Chernov, leader of the Soviet arctic MAB project, and Dr. Nada Matveyeva were escorted by Noatak National Preserve and Biosphere Reserve by 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 Lovvass spoke on "Monitoring for Global Change - A National Park Service Perspective" at the September Arctic Science Conference on Global Change in Fairbanks, AI 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 UAK 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 NWA 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 Manon, 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 Manon, 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.

Landscape Ecology

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FLASH – Winners of the Director's Awards:

For Science, Charles Stone of Hawaii Volcanoes National Park

For Natural Resource Management, Jeri Hall of George Washington Memorial Parkway

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