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FORT COLLINS SCIENCE CENTER

Ecosystem Dynamics

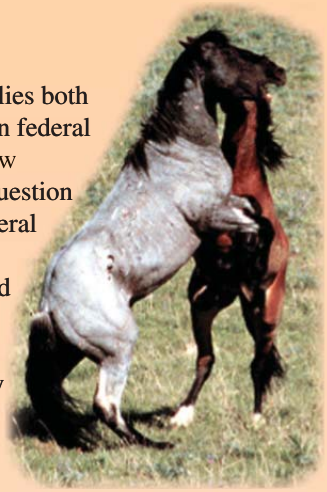
Capabilities

Many challenging natural resource management issues require consideration of a web of interactions among ecosystem components. The spatial and temporal complexity of these ecosystem problems demands an interdisciplinary approach integrating biotic and abiotic processes. The goals of the Ecosystem Dynamics Branch are to provide sound science to aid federal resource managers and use long-term, place-focused research and monitoring on federal lands to advance ecosystem science.

Current studies fall into five general areas. Herbivore-Ecosystem Interactions examines the efficacy of multiple controls on selected herbivore populations and cascading effects through predator-herbivore-plant-soil linkages. Riparian Ecology is concerned with interactions among streamflow, fluvial geomorphology, and riparian vegetation. Integrated Fire Science focuses on the effects of fire on plant and animal communities at multiple scales, and on the interactions between post-fire plant, runoff, and erosion processes. Reference Ecosystems comprises long-term, place-based studies of ecosystem biogeochemistry. Finally, Integrated Assessments is investigating how to synthesize multiple ecosystem stressors and responses over complex landscapes in ways that are useful for management and planning.

Selected Projects

Herbivore-Ecosystem Interactions



The problem of "overabundance" applies both to elk and to wild horses and burros on federal lands throughout the western U.S. How many ungulates are "too many" is a question for many national parks and other federal lands. Scientists at the Fort Collins Science Center (FORT) have conducted studies in Grand Teton, Yellowstone, and Rocky Mountain National Parks to evaluate the effects of elk herbivory on vegetation communities and nitrogen processes. Similarly, the Bureau of Land Management (BLM) oversees thousands of wild horses and burros on millions of acres, and is responsible for managing and monitoring these ever-growing herds. To help the BLM achieve greater science-based management, FORT scientists coordinated expert input on five key management topics—fertility control, genetic conservation, population dynamics, habitat assessments, and health and handling concerns—and developed a long-range strategic research plan for the BLM, incorporating BLM management goals for these animals. FORT scientists are also developing and testing more accurate population estimate techniques.

Riparian Ecology

Riparian ecosystems in the arid West support large and diverse communities of plants and animals, improve water quality, attenuate floods, and provide recreational opportunities. However, the dependence of riparian systems on streamflow and their desirability for a number of human activities and uses make them vulnerable to human impacts. FORT scientists are studying the factors that generate change in riparian systems to improve the scientific basis for management decisions. For example, relations between river hydrology and the distribution and abundance of riparian plant and animal species are being quantified at multiple sites in the Upper Colorado, Missouri, and Bill Williams River systems so that water resource managers can better understand the consequences of different flow scenarios. Other riparian research studies at FORT are addressing the role of vegetation in mediating flows of water and sediment, and the responses of riparian vegetation to dam removal and alluvial groundwater decline.

Integrated Fire Science

Fire affects many biotic and abiotic components of ecosystems, in addition to its substantial economic and social ramifications. Although the ecological importance of fire is widely accepted, sound fire management requires greater understanding of the effects of fire on public lands. FORT scientists are leading a team of experts in ecology, hydrology, geology, and social science in a multidisciplinary research effort on wildland fire effects in the Rocky Mountain West. This team is investigating the use of remote sensing data to compare pre- and post-fire

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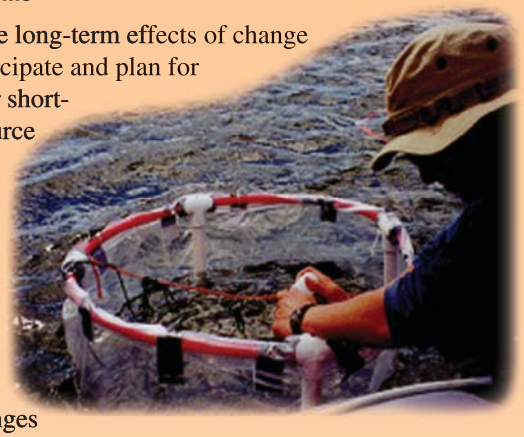
effects on avian communities, plant communities, nonnative plant invasion, erosion, and debris flow to learn how fire severity is affected by various fire management practices. Field data are being used to assess the efficacy of Landsat images. Social science incorporates how people living in fire-affected communities view fire management. This interdisciplinary approach will help managers integrate and evaluate the trade-offs among different fire management policies and practices, including prescribed fire, non-fire treatments, fire management in the wildland-urban interface, and post-fire rehabilitation and restoration.

Reference Ecosystems



Understanding the long-term effects of change helps managers anticipate and plan for change in both their short- and long-term resource management decisions. Over the decades, USGS scientists have developed a reference ecosystem network comprising sites protected from changes in local land use. They are located on national park and national forest lands from the Arctic to South Texas, and from the mountains of North Carolina to the Olympic Coast in Washington. Basic ecosystem study is conducted on each to assess the long-term effects of global change, especially from climate and atmospheric contaminant inputs. Owing to the long-term, ecosystem-level research design, the studies provide a unique perspective on the effects of human activity on natural areas. In a similar vein, FORT scientists staffing the Jemez Mountains Field Station are permanently stationed at Bandelier National Park, New Mexico, where they offer an on-site, place-based approach to science. The scientists design, conduct, and oversee long-term, landscape-scale research and monitoring activities for Bandelier and surrounding wildland areas.

Integrated Assessments

Covering about one-fifth of the state of Colorado, the South Platte Basin includes a vast diversity of landscapes: extensive national forests and parks along the Continental Divide to the west, a growing urban corridor at the mountain/plains boundary, and agricultural and rangelands that stretch eastward to the state border. As such, this region contains Colorado's most productive agricultural counties, the vast bulk of its population, and a large proportion of the people that recreate on public lands at the top of the basin. Consequently, human activity is a significant contributor to change in the South Platte environment. Population growth, land use, water use and quality, and climate change continue to be major stressors on this system. FORT scientists have initiated a cooperative integrated assessment effort among state and federal agencies and universities to provide objective, spatially-explicit information on the state of the environment and natural resources of the South Platte Basin. The objective of the South Platte Integrated Assessment is to understand the complicated interactions between societal activities and public lands and resources, identify critical issues, and provide the science to inform future planning and management decisions.

Staff

Branch Chief: Zack Bowen, Ph.D. Fishery Biologist: stream ecology, instream flow, impact analysis.

Allen, Craig, Ph.D. Ecologist: landscape ecology, forest ecology, biogeography, fire ecology, conservation biology, management applications of ecological information.

Andersen, Douglas, Ph.D. Ecologist: ecosystem, community, and population ecology; plant-animal interactions; terrestrial and riparian ecology.

Auble, Greg, Ph.D. Ecologist: riparian and wetland ecology, modeling, hydrology, operations research analysis, computer applications.

Baron, Jill, Ph.D. Ecologist: biogeochemical cycling/ecosystem ecology, water resources, watershed research, disturbance to alpine and subalpine ecosystems, regional integrated ecosystem analysis.

Friedman, Jonathan, Ph.D. Hydrologist: riparian and wetland ecology, dendrochronology, geomorphology, hydrology, plant community ecology.

Hogan, John, B.S. Physical Scientist: ecological field work, data collection and management, environmental education, and community-based science activities.

Kotliar, Natasha, Ph.D. Research Wildlife Biologist: avian ecology, fire ecology, wetland dynamics, landscape ecology, prairie dog ecosystems.

Ouren, Doug. Ph.D. candidate. Physical Scientist: Habitat analysis, GPS wildlife applications, road ecology.

Roelle, James, Ph.D. Supervisory Wildlife Biologist: population dynamics, modeling, computer applications, riparian ecology.

Schoenecker, Kate, M.S. Ecologist: bighorn sheep and wild horse ecology and behavior, human effects of wildlife, conservation of unique and small wild horse populations, natural resource policy.

Scott, Mike, Ph.D. Ecologist: riparian and wetland ecology, dendrochronology, botany, forest ecology, fluvial geomorphology, plant community ecology.

Shafroth, Pat, Ph.D. Ecologist (Plants): riparian and wetland ecology, botany.

Singer, Francis, Ph.D. Ecologist: conservation biology, large mammal population dynamics, mammalian predator dynamics, and ungulate herbivory, census techniques, and restoration.

Stottlemyer, Robert, Ph.D. Ecologist: ecosystem and watershed issues in parks, biogeochemistry, carbon and nutrient cycling.

Zeigenfuss, Linda, M.S. Ecologist: ungulate-plant interactions, ungulate habitat selection and population dynamics, ecological field work.

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