United States
Department of
Agriculture

Forest Service

Pacific Northwest
Research Station

United States
Department of the
Interior

**Bureau of Land
Management**

General Technical
Report
PNW-GTR-382
September 1996

Integrated Scientific Assessment for Ecosystem Management in the Interior Columbia Basin

And Portions of the Klamath and Great Basins

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Interior Columbia Basin Ecosystem Management Project

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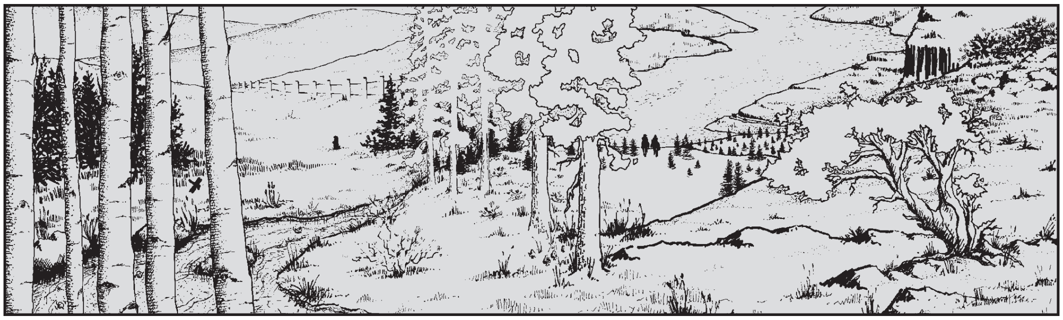

Integrated Scientific Assessment for Ecosystem Management in the Interior Columbia Basin

And Portions of the Klamath and Great Basins

Thomas M. Quigley, Richard W. Haynes,
and Russell T. Graham
Technical Editors

Thomas M. Quigley is a range scientist at the Pacific Northwest Research Station, Walla Walla, WA 99362;
Richard W. Haynes is a research forester at the Pacific Northwest Research Station, Portland, OR 97208;
Russell T. Graham is a research forester at the Intermountain Research Station, Moscow, ID 83843.

September 1996
United States Department of Agriculture
Forest Service
Pacific Northwest Research Station
Portland, Oregon

Abstract

Quigley, Thomas M.; Haynes, Richard W.; Graham, Russell T., tech. eds. 1996. Integrated scientific assessment for ecosystem management in the interior Columbia basin and portions of the Klamath and Great Basins. Gen. Tech. Rep. PNW-GTR-382. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 303 p. (Quigley, Thomas M., tech. ed. The Interior Columbia Basin Ecosystem Management Project: Scientific Assessment.)

The Integrated Scientific Assessment for Ecosystem Management for the Interior Columbia Basin links landscape, aquatic, terrestrial, social, and economic characterizations to describe biophysical and social systems. Integration was achieved through a framework built around six goals for ecosystem management and three different views of the future. These goals are: maintain evolutionary and ecological processes; manage for multiple ecological domains and evolutionary timeframes; maintain viable populations of native and desired non-native species; encourage social and economic resiliency; manage for places with definable values; and, manage to maintain a variety of ecosystem goods, services, and conditions that society wants. Ratings of relative ecological integrity and socioeconomic resiliency were used to make broad statements about ecosystem conditions in the Basin. Currently in the Basin high integrity and resiliency are found on 16 and 20 percent of the area, respectively. Low integrity and resiliency are found on 60 and 68 percent of the area. Different approaches to management can alter the risks to the assets of people living in the Basin and to the ecosystem itself. Continuation of current management leads to increasing risks while management approaches focusing on reserves or restoration result in trends that mostly stabilize or reduce risks. Even where ecological integrity is projected to improve with the application of active management, population increases and the pressures of expanding demands on resources may cause increasing trends in risk.

Keywords: Ecosystem assessment, management and goals; ecological integrity; socioeconomic resiliency; risk management

Preface

This document summarizes much of the work of the Science Integration Team (SIT) of the Interior Columbia Basin Ecosystem Management Project (ICBEMP). The background investigations that underlie this report are described in three other documents. The first is a *Framework for Ecosystem Management* (Haynes and others 1996); the second is the compilation of detailed reports from each science team staff, referred to as the *Assessment of Ecosystem Components* (Quigley and Arbelbide 1996); and, the third document is the *Evaluation of the Environmental Impact Statement Alternatives by the Science Integration Team* (Quigley and others 1996b). These reports supply the detailed information used by the Science Integration Team to assemble the integrated assessment.

The specific content of this Integrated Assessment was written primarily by Thomas M. Quigley, Richard W. Haynes, Russell T. Graham, James R. Sedell, Danny C. Lee, Bruce G. Marcot, Paul F. Hessburg, Steven F. McCool, Bruce E. Reiman, Wendel J. Hann, James A. Burchfield, Michael G. Karl, Amy L. Horne, Thomas P. Frost, John F. Lehmkuhl, Iris Goodman, and Christopher E. DeForest.

All members of the Science Integration Team participated in the discussions and contributed to the writing of two early versions of this report. Christopher E. DeForest helped write the final Current Status section. Three subsequent drafts were written by the technical editors based on review comments of the earlier drafts and intensive work by several groups of SIT members who developed concepts related to and estimates of integrity, resiliency, and risk ratings. James R. Sedell, Danny C. Lee, Paul F. Hessburg, Bruce E. Reiman, Mark E. Jensen, Kenneth C. Brewer, Bradley G. Smith, J.L. Jones, and Wendel J. Hann developed the ecological integrity elements and the forest and range clusters. The material related to composite ecological integrity was developed by James R. Sedell, Danny C. Lee, Richard S. Holthausen, Bruce G. Marcot, Wendel J. Hann, J.L. Jones, and Thomas M. Quigley. Richard W. Haynes, Amy L. Horne, and James A. Burchfield developed measures of socioeconomic resiliency. Richard W. Haynes, Wendel J. Hann, and Thomas M. Quigley developed the risk ratings for ecological integrity and risk to human assets from conditions in wildlands.

Content concerning American Indian Tribes originated from SIT Social Science Staff and the Tribal Liaison Group of the Project (specifically, Richard Hanes, Mary Keith, and Ralph Perkins). Content concerning management options originated from the Project's EIS Teams under the leadership of Jeff Blackwood, Steve Mealey, and Pat Geehan. Literally hundreds of individuals contributed to this product. We are certain to have failed in recognizing everyone's contribution. We apologize for any oversights.

The SIT Members Making Specific Contributions to This Document Include:

Aquatics:	James R. Sedell, Danny C. Lee, Bruce E. Reiman, Kristine M. Lee, Lynn Decker, Russell F. Thurow, Jack E. Williams
Economics:	Richard W. Haynes, Amy L. Horne, Nicholas E. Reyna
Landscape Ecology:	Wendel J. Hann, Paul F. Hessburg, Mark E. Jensen, Iris Goodman, Thomas P. Frost, Carl L. Almquist, J.L. Jones, Kenneth C. Brewer, Bradley G. Smith
Social Science:	Steven F. McCool, James A. Burchfield, Jon S. Bumstead, Steven J. Galliano, Stewart D. Allen, Richard C. Hanes
Terrestrial Ecology:	Bruce G. Marcot, John F. Lehmkuhl, Michael G. Karl, Richard S. Holthausen, Martin G. Raphael
Spatial Analysis:	Rebecca A. Gravenmier

SCIENCE INTEGRATION TEAM MEMBERS

Team Leaders

Arbelbide, Sylvia J., Geologist
USDA Forest Service, Pacific Southwest Region, Minerals Area Management Director, San Francisco, CA.

Graham, Russell T., Research Forester
USDA Forest Service, Intermountain Research Station, Forestry Sciences Laboratory, Moscow, ID.

*Quigley, Thomas M., Range Scientist
USDA Forest Service, Pacific Northwest Research Station, Interior Columbia Basin Ecosystem Management Project, Walla Walla, WA.

Aquatics

Decker, Lynn, Regional Fisheries Program Leader
USDA Forest Service, Pacific Southwest Region, Regional Office, San Francisco, CA.

*Lee, Danny C., Research Biologist
USDA Forest Service, Intermountain Research Station, Forestry Sciences Laboratory, Boise, ID.

Lee, Kristine M., Fisheries/Aquatic Ecology Program Leader
USDA Forest Service, Intermountain Region, Regional Office, Ogden, UT.

Rieman, Bruce E., Research Fisheries Biologist
USDA Forest Service, Intermountain Research Station, Forest Science Laboratory, Boise, ID.

*Sedell, James R., Principal Research Ecologist
USDA Forest Service, Pacific Northwest Research Station, Forestry Sciences Laboratory, Corvallis, OR.

Thurow, Russell F., Fisheries Research Scientist
USDA Forest Service, Intermountain Research Station, Forestry Sciences Laboratory, Boise, ID.

*Williams, Jack E., Science Advisor
USDI, Bureau of Land Management, Columbia Northwest Technical Assistance Network, Boise, ID.

Economics

*Haynes, Richard W., Research Forester
USDA Forest Service, Pacific Northwest Research Station, Forestry Sciences Laboratory, Portland, OR.

*Horne, Amy L., Research Forester
USDA Forest Service, Pacific Northwest Research Station, Forestry Sciences Laboratory, Portland, OR.

Reyna, Nicholas E., Forest Economist
USDA Forest Service, Pacific Northwest Research Station, Interior Columbia Basin Ecosystem Management Project, Walla Walla, WA.

Landscape Ecology

Almquist, Carl L., Geologist
USDI Bureau of Mines, Western Field Operations Center, Spokane, WA.

Borman, Michael, Range Ecologist
USDI National Biological Service, Forest and Rangeland Ecosystem Science Center, Corvallis, OR.

Brewer, Kenneth C., Landscape Ecologist
USDA Forest Service, Northern Region, Flathead National Forest, Hungry Horse Ranger District, Hungry Horse, MT.

Frost, Thomas P., Research Geologist
USDI Geological Survey, Western Mineral Resources Branch, Spokane, WA.

Goodman, Iris, Research/Landscape Hydrologist
U.S. Environmental Protection Agency (EPA), Office of Landscape Characterization Research and Development, Las Vegas, NV.

*Hann, Wendel J., Landscape Ecologist
USDA Forest Service, Northern Region, Regional Office, Missoula, MT.

*Hessburg, Paul F., Research Plant Pathologist/Entomologist
USDA Forest Service, Pacific Northwest Research Station, Forestry Sciences Laboratory, Wenatchee, WA.

*Jensen, Mark, E., Landscape Ecologist
USDA Forest Service, Regional Office, Missoula, MT.

Jones, J.L., Wildlife Biologist
USDA Forest Service, Northern Region, Beaverhead National Forest, Wisdom Ranger District, Wisdom, MT.

Karl, Michael G., Rangeland Management Specialist-Ecologist
USDA Forest Service, Pacific Northwest Research Station, Interior Columbia Basin Ecosystem Management Project, Walla Walla, WA.

Keane, Robert E., Research Ecologist
USDA Forest Service, Intermountain Research Station, Fire Sciences Lab, Missoula, MT.

Leonard, Stephen G., Range Specialist
USDI, Bureau of Land Management, Resource Division, Reno, NV.

Smith, Bradley G., Quantitative Community Ecologist
USDA Forest Service, Pacific Northwest Region, Deschutes National Forest, Silviculture Laboratory, Bend, OR.

Social

Bumstead, Jon S., Social Scientist
USDA Forest Service, Pacific Northwest Research Station, Interior Columbia Basin Ecosystem Management Project, Walla Walla, WA.

*Burchfield, James A., Sociologist
USDA Forest Service, Pacific Northwest Research Station, Interior Columbia Basin Ecosystem Management Project, Walla Walla, WA.

Galliano, Steven J., Landscape Architect
USDA Forest Service, Pacific Northwest Research Station, Interior Columbia Basin Ecosystem Management Project, Walla Walla, WA.

Hanes, Richard C., Anthropologist
USDI, Bureau of Land Management, Eugene, OR.

*McCool, Steven F., Social Scientist
USDA Forest Service, Pacific Northwest Research Station, Interior Columbia Basin Ecosystem Management Project, Walla Walla, WA.

Spatial

Gravenmier, Rebecca A., Natural Resource Specialist/GIS
USDI, Bureau of Land Management, Oregon State Office, Portland, OR.

Steffenson, John R., GIS Specialist
USDA Forest Service, Pacific Northwest Region, Regional Office, Portland, OR.

Wilson, Andrew E., GIS Specialist
USDA Forest Service, Pacific Northwest Region, Regional Office, Portland, OR.

Terrestrial

Croft, Lisa K., Plant Ecologist
USDA Forest Service, Pacific Northwest Region, Ochoco National Forest, Prineville Ranger District, Prineville, OR.

Hickenbottom, Randal J., Wildlife Biologist
USDA Forest Service, Pacific Northwest Region, Regional Office, Portland, OR.

*Holthausen, Richard S., Wildlife Ecologist
USDA Forest Service, Washington Office, Fish, Wildlife and Rare Plants Staff, Terrestrial Habitat Ecology Leader, Corvallis, OR.

*Lehmkuhl, John F., Wildlife Ecologist
USDA Forest Service, Pacific Northwest Research Station, Forestry Sciences Laboratory, Wenatchee, WA.

*Marcot, Bruce G., Wildlife Ecologist
USDA Forest Service, Pacific Northwest Research Station, Ecological Framework for Management Program, Portland, OR.

Naney, Robert H., Wildlife Biologist
USDA Forest Service, Pacific Northwest Region, Okanogan National Forest, Supervisor's Office, Okanogan, WA.

Nelson, Kurt, Supervisory Forester/Branch Chief
USDA Forest Service, Intermountain Region, Payette National Forest, Resource Ecology Branch, McCall, ID.

Niwa, Christine G., Research Entomologist
USDA Forest Service, Pacific Northwest Research Station, Forestry Sciences Laboratory, Corvallis, OR.

Raphael, Martin G., Research Wildlife Biologist
USDA Forest Service, Pacific Northwest Research Station, Forestry Sciences Laboratory, Olympia, WA.

Saab, Victoria A., Research Wildlife Biologist
USDA Forest Service, Intermountain Research Station, Forestry Sciences Lab, Boise, ID.

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* = Lead science responsibilities

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EXECUTIVE SUMMARY

In July 1993, as part of his plan for ecosystem management in the Pacific Northwest, President Clinton directed the Forest Service to "develop a scientifically sound and ecosystem-based strategy for management of Eastside forests." To accomplish this, the Chief of the Forest Service and the Director of the Bureau of Land Management jointly established the Interior Columbia Basin Ecosystem Management Project (ICBEMP). The overall assignment of the ICBEMP Science Integration Team (SIT) is to develop a scientific framework, to conduct detailed functional assessments, and to generate an integrated assessment. This document is the *Integrated Scientific Assessment for Ecosystem Management for the Interior Columbia Basin* and addresses one of the three primary assignments. This integrative assessment links landscape, aquatic, terrestrial, social, and economic characterizations to describe biophysical and social systems. Integration was achieved through the use of a framework built around six goals for ecosystem management and three different views of the future.

This assessment addresses the interior Columbia Basin east of the Cascade crest and those portions of the Klamath and Great Basins within Oregon with emphasis on land administered by the Forest Service (FS) and Bureau of Land Management (BLM). The total area includes more than 145 million acres (58 million ha) of which 76 million acres (30 million ha) are administered by the FS and BLM. Within the assessment area, the Klamath Basin comprises more than 4 million acres (1 million ha) and the Great Basin comprises more than 10 million acres (4 million ha).

In the last century, major changes have occurred in vegetation patterns, fish and wildlife distributions, processes of terrestrial and aquatic ecosystems, and human communities in the assessment area (the Basin). Some changes have permanently converted lands and ecosystems to something other than what was there before European influence. Fire regimes have changed in both frequency and severity; large, high intensity fires have begun to shape the landscapes. Extensive road networks have been constructed, increasing sediment production and transport, fragmenting wildlife habitat, but also increasing access for recreation users, management activities, and commodity production. Exotic plants have been introduced to the Basin and have spread widely, especially in the range ecosystems. Introduced fish and wildlife species, some highly valued, have left a legacy of wide-ranging non-native species that compete with, prey upon, or have replaced native species.

Changes in human uses of the Basin, as well as changes in values, have affected ecosystems and their management. Social change has been dramatic as scattered populations of American Indian tribes have given way to the European immigrants working farms, mines, mills, and ranches; to a diverse mix of ethnic backgrounds; and to the urban and rural dwellers of today. Human social and political institutions operate with greater variability and on shorter timeframes than most ecological processes. Local, regional, and national interests disagree about the costs and benefits of commodity extraction from the public lands, relative to other economic activity and ecosystem outputs.

Today, Federal land management in the Northwest is under scrutiny from more varied interests, each using Congressional, judicial, and administrative powers to gain advantage. Issues include protection of unique ecosystems and species, management of riparian areas and old forests, and experimentation with methods of forest and rangeland management. Proposed management strategies strive to retain processes and features important to ecosystem function and to mimic natural disturbance regimes. Tribal governments are concerned about culturally and economically significant resources. Other stakeholders are concerned about the availability of commodities from Federal lands and the protection of private property rights. Those with environmental interests express concern about the conditions in the forest, rangeland, and aquatic systems and particularly wildlife species in these systems. Issues arise from conflicting values, and often involve more than one spatial extent or timeframe. Therefore, issues play a major role in defining analysis boundaries, types of assessments, and data collection. The ICBEMP was initiated to address many of these issues as they relate to public land management.

In its broadest terms, management of ecosystem integrity is composed of two parts: maintaining ecological integrity, and maintaining the resiliency of social and economic systems. Ecological integrity is defined as the degree to which all ecological components and their interactions are represented and functioning. Resiliency is defined as the degree to which systems adapt to change.

Ecological integrity and socioeconomic resiliency are rooted in scientific concepts that reflect human values, including the normative purpose of maintaining the integrity of a combined natural and cultural ecosystem. These end-states may include some that are judged by management and the public as being "normal and good" but that may not be pristine or naturally whole. In this sense, the integrity of ecosystems is more an expression of environmental policy than scientific theory. We acknowledge that many resource managers may be reluctant to include societal issues and values in the definition (and evaluation) of ecosystem integrity. However, since maintaining the integrity of ecosystems is a management goal, it, by definition, needs to reflect the values of both managers and users.

We assume that goals that fulfill the purpose of ecosystem management are: maintain evolutionary and ecological processes; manage with an understanding of multiple ecological domains and evolutionary timeframes; maintain viable populations of native and desired non-native species; encourage social and economic resiliency; manage for places with definable values; and, manage to maintain a variety of ecosystem goods, functions, and conditions that society wants.

Ecological Integrity and Socioeconomic Resiliency

Ratings of ecological integrity and socioeconomic resiliency are used together to make general statements about ecosystem conditions in the Basin. Currently high ecological integrity and high socioeconomic resiliency are found on 16 and 20 percent of the area in the Basin. Low integrity and resiliency are found on 60 and 68 percent of the area. The ecological integrity ratings are relative estimates of the degree to which ecosystem functions and processes are present and operating. A low rating does not, in and of itself, imply low productivity or declining conditions; much of the area rated as low ecological integrity included lands used for agricultural and grazing uses. Finally, 84 percent of the area with high integrity is on FS- and BLM-administered lands while 39 percent of the area rated as low is on FS- and BLM-administered lands.

The results for socioeconomic resiliency are somewhat deceptive. While 63 percent of the area within the Basin is rated as having low resiliency, 67 percent of the people of the Basin live in areas with high resiliency. In terms of where people live, only 17 percent of the population lives in areas of low resiliency. One should not assume that those who live in areas of low resiliency experience low economic or social well-being, just as one should not assume that those living in areas of high resiliency experience high economic or social well-being. Rather, people living in areas with low resiliency are in areas that have a low level of adaptability to change.

A few areas like Flathead County, Montana, and Chelan and western Yakima Counties, Washington, have both high ecological integrity and socioeconomic resiliency. These areas would likely accommodate and respond to ecological or economic disruptions better than other areas in the Basin. Those areas with medium ecological integrity and medium or high resiliency include Hood River and Deschutes Counties, Oregon; Missoula County, Montana; Asotin County, Washington; and, Nez Perce County, Idaho. Areas of medium or high socioeconomic resiliency and low ecological integrity are dominated by the metropolitan counties and major transportation corridors. Although areas with high socioeconomic resiliency are more likely to be in areas of low ecological integrity, it is not always true. Likewise, although areas with high ecological integrity are generally associated with areas of low socioeconomic resiliency, it is not always true. These relations are not necessarily cause and effect either.

There are several areas where human pressures may pose risks to high ecological integrity. The Basin is fortunate in that some of the highest ecological integrity for both forest and rangelands is in large contiguous blocks in areas of low current and projected human population density. The greatest opportunities for restoration activities by Federal land management agencies are on FS- and BLM-administered lands in those areas with moderate or low ecological integrity. There are opportunities in systems exhibiting moderate integrity because they are resilient and provide for ecological restoration.

Future trends in integrity and resiliency were estimated for three views of the future. These different futures display the effects of broad management actions on biophysical and social ecosystem components. Three options were used to describe a set of possible futures and their consequences: continuation of current management, management emphasizing restoration, and management centered on a reserve system. The focus was on potential responses to an array of possible management activities and future events. Projected trends in ecological integrity for the three options are stable or improving in the restoration management option; mostly stable or improving but with a small area trending downward in the reserve option; and the majority of the FS- and BLM-administered land in the Basin is trending downward in integrity for the continuation of the current management option.

In terms of the risks to both the assets of people living in the Basin and to the ecosystem itself, we found that continuation of current management will lead to increasing risks. Both the reserve option and the restoration option resulted in trends that mostly stabilized or reduced risks. Developing strategies that actively manage risks where the interaction of people and ecological integrity are projected to increase risks will likely become more important. Even where ecological integrity is projected to improve with the application of active management, population increases and the pressures of expanding demands on resources cause increasing trends in risk. While these different management options explored for FS- and BLM-administered lands do not, in themselves, influence population growth, the ecosystems and the ability to manage change are greatly influenced by human populations. By the year 2040, the population may double and 80 percent of the population will likely live in relatively urbanized environments. Those areas most likely to experience increased risk owing to increasing human populations are northern Idaho and northwest Montana; the areas surrounding Spokane and Wenatchee, Washington; Deschutes County, Oregon; the area north of Boise, Idaho; and the area between the Flathead and Lolo National Forests in Montana.

We found that proactive approaches to ecosystem management within an adaptive framework would lead to higher ecological integrity and social and economic resiliency within the Basin. This approach would recognize the dynamic nature of the interior ecosystems, their current ecological status, and the human demands on interior ecosystems. Finally, these management options show that long-term sustainability of resources and environments, resiliency of social and economic systems, and meeting socially desired resource conditions cannot be predicted without continually assessing and monitoring results of management activities and adjusting management activities accordingly.

Characterizing Current Conditions and Trends

The characterization of historical (early 1800s) and current conditions within the Basin resulted in these highlighted findings:

1. There has been a 27 percent decline in multi-layer and 60 percent decline in single-layer old-forest structures from historical levels, predominantly in ponderosa pine and Douglas-fir forest types.
2. Aquatic biodiversity has declined through local extirpations, extinctions, and introduction of exotic fish species, and the threat to riparian plants and animals has increased.
3. Some watershed disturbances, both natural and human induced, have caused and continue to cause risks to ecological integrity, especially owing to isolation and fragmentation of fish habitat.
4. The threat of severe lethal fires has increased by nearly 20 percent, predominantly in the dry and moist forest types.
5. Rangeland health and diversity have declined because of exotic species introductions, historical grazing, changing fire regimes, agricultural conversion of native shrublands and herblands, and woodland expansion in areas that were once native shrublands and herblands.
6. Human communities and economies of the Basin have changed and continue to change rapidly although the rates of change are not uniform.

On FS- and BLM-administered lands, continuing to manage vegetation (for example, harvest, thin, and prescribe burns) at historical levels and managing individual stands is unlikely to reverse trends in vegetation conditions. In the last 100 years, fire suppression hazards and costs, fire intensity, and firefighter fatalities have doubled; insect, disease, and fire susceptibility have increased by 60 percent; blister rust has decreased western white pine and whitebark pine in moist and cold forested vegetation types; native grasslands have decreased by 70 percent; native shrublands have decreased by 30 percent; large residual trees and snags have decreased by 20 percent; and, old forest structures have decreased 27 to 60 percent depending on vegetation type. The greatest changes in landscape patterns and processes have been in roaded areas historically managed with intensive treatments.

Overall, we found that there is a limited scientific understanding of the current status of most individual species and their specific ecology within the Basin. Numerous species may play key ecological functions in maintaining ecosystem diversity, productivity, and sustainability. At present, there are many species of plants (including invertebrates and vertebrates) that might be in jeopardy of population declines or local extirpation owing to changes in their native habitats and environments. We also found that federally designated threatened, endangered, and candidate species of all taxonomic groups occur in the Basin.

There are 264 species within the Basin with Federal listing status under the Endangered Species Act of 1970 of which 27 are threatened or endangered. Habitat conditions for nearly all species were found to be more favorable historically. Continuing current management approaches would result in more species of potential concern than would management emphasizing restoration or reserves. Management options aimed at restoring ecosystems are projected to result in only moderate improvements in habitat. Current management practices will likely result in more species with habitat declines. The overall likelihood of extirpation has increased from historic to current times and is projected to continue increasing under current management; fewer extirpations are likely if a restoration approach is used. Species that are likely in decline are associated with habitat components that are declining, specifically old forest structures, native shrublands, and native grasslands. Habitat degradation is more pronounced at lower-elevation watersheds. Core areas remain for rebuilding and maintaining quality habitat for native terrestrial species. We identified centers of species concentration, centers of biodiversity, and hot spots of species rarity and endemism within the Basin.

Salmonid species have experienced declines in habitat, abundance, and life histories. Population strongholds for the key salmonids ranges from less than 1 percent to 32 percent of the occupied range of the species. The occupied area ranges from 28 percent to 85 percent of the historic range. Declines for anadromous species have been the greatest--even if habitat conditions stabilize, fragmentation, isolation, and off-site hazards put remaining populations at risk. Habitat degradation is greatest in lower-elevation watersheds, which include private lands. Though much of the native ecosystem has been altered, the core pieces remain for rebuilding and maintaining functioning native aquatic systems. Rehabilitating depressed populations of anadromous salmonids cannot rely on habitat improvement alone but requires a concerted effort to address causes of mortality in all life stages. These include freshwater spawning and rearing, juvenile migration, ocean survival, and adult migration.

Social and economic conditions within the Basin have changed considerably over the last several decades. People and communities within the Basin are undergoing rapid change. Social resiliency varies; drier climates are generally associated with lower resiliency, such as dry herblands and shrublands associated with ranching and agricultural communities. Communities that have experienced recent economic or social disruptions are generally more resilient. Human attachment to places are important in determining the acceptability of management actions. Overall scenic quality within the Basin is high and is projected to remain high.

Overall, Basin economies are experiencing growth, especially in metropolitan and recreation counties. Regional economies are diverse and have high resiliency, but resiliency varies by size of the economic sectors. FS and BLM activities account for 13 percent of the regional economies of the Basin. The importance of FS and BLM activities varies within the Basin; such activities are of the most importance in eastern Oregon. Recreation is highly valued as a regional, national, and international resource. At current growth rates, recreation use will double in the next 31 years.

At the Basin level, consistent databases to support assessments and planning are scarce. An interagency approach could greatly improve the quality of information, and support continuing assessments that are part of the adaptive management process.

Findings Related to General Issues Within the Basin

Accessibility—We found a great deal of ambiguity about the amount of roads required to satisfy public needs. Issues include the ecological consequences of roading, and the effects (both good and bad) on different kinds of public recreation. Many people oppose extensive road closures, but at the same time support improving habitats and reducing erosion. Management strategies include reducing road densities and redesigning and improving maintenance of road networks.

Communities—Communities are more complex than labels such as “timber dependent” make them out to be. Most communities in the Basin have mixed economies and their vitality is linked to factors broader than resource flows from FS- and BLM-administered lands. In the Basin, both communities and economies associated with agricultural or ranching operations are less resilient than other community types.

Fire—It is not possible to “fireproof” ecosystems in the Basin, but the potential of severe fire can be reduced by proactive land management. In terms of social and economic outcomes, the greatest potential management concerns are likely to be in the rural/urban wildland interface. Severe fires do put human communities and ecological integrity at risk. Management treatments aimed at reducing severe fire are not without risk to ecological integrity and to communities, pointing to the need for an integrated approach to risk management.

Fish—The identification of aquatic strongholds, areas of high fish community integrity, and other aquatic information provides a basis for the conservation and restoration of aquatic ecosystems.

It also provides a basis for building effective strategies that can simultaneously benefit terrestrial and aquatic ecosystems. This strategy could include protection of high-integrity areas and restoration of areas with lower integrity.

Forest health—We found that forested ecosystems have become more susceptible to severe fire and outbreaks of insects and diseases. Reducing these risks and hazards involves maintaining forest cover and structure within a range consistent with long-term disturbance processes.

Rangeland health—Rangeland ecosystems have been affected by historical overgrazing, woody species encroachment, changes in fire regimes, and exotic species invasion. Integrated weed management strategies, use of prescribed fire, and managing the season and intensity of grazing use can result in improved rangeland health. Grazing strategies with specific objectives for riparian areas within aquatic strongholds and with habitats identified for threatened and endangered species would address many of the concerns of rangeland health related to species diversity.

Managing risk to ecological integrity—We found that the management of risks to ecological integrity involves maintenance of high integrity and enhancement of areas with low integrity. We found that an integrated approach will be necessary because risks to integrity arise from many sources (hydrologic, forest, rangeland, and aquatic as well as economic and social). Reducing risks from one source may increase risks to another ecological component. The strategy for risk management will need to be both integrated and adaptive.

Restoration—We found that there are substantial opportunities to restore and improve ecological integrity on forest and rangeland areas with 74 percent of the FS- and BLM-administered lands in low or moderate integrity. There are opportunities to restore landscape patterns, improve connectivity in aquatic and terrestrial habitats, restore vegetation cover types and structure, and restore hydrologic functions within subbasins. There are opportunities to restore these patterns, structures, and vegetation types to be more consistent with those occurring under long-term disturbance processes. We found that opportunities exist, albeit at a different scale, for restoration in virtually every subbasin in the Basin.

Salvage—We found that salvage activities could contribute to the achievement of long-term ecological integrity by emphasizing prevention of insect and disease outbreaks rather than focussing on the removal of large recently dead trees. Such an approach would include removing smaller living trees as part of the overall management regime and emphasizing stand structure and composition at the watershed level, rather than managing at the stand level. Low risks to ecological integrity would exist from treating currently roaded areas, where companion efforts might include reducing adverse effects associated with roads. Such approaches can be consistent with attainment of economic objectives for salvage activities.

Special forest products—We found an increasing potential for conflicts between recreational, cultural, subsistence collection, and the growing commercial collection of products such as huckleberries, mushrooms, and firewood on Federal lands. Land management strategies will be complicated by the localized commercial and cultural importance of these products.

Timber—An ecosystem-based approach to timber harvest places greater emphasis on outcomes in areas treated than on volumes of timber extracted (that is, a focus on area rather than volume regulation). The implication is that the volumes and mix of species removed can become a by-product of achieving goals of stand structure and landscape patterns. Under this approach, volumes may be more variable than under past forest management approaches.