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Integrated Scientific Assessment for Ecosystem Management in the Interior Columbia Basin

And Portions of the Klamath and Great Basins

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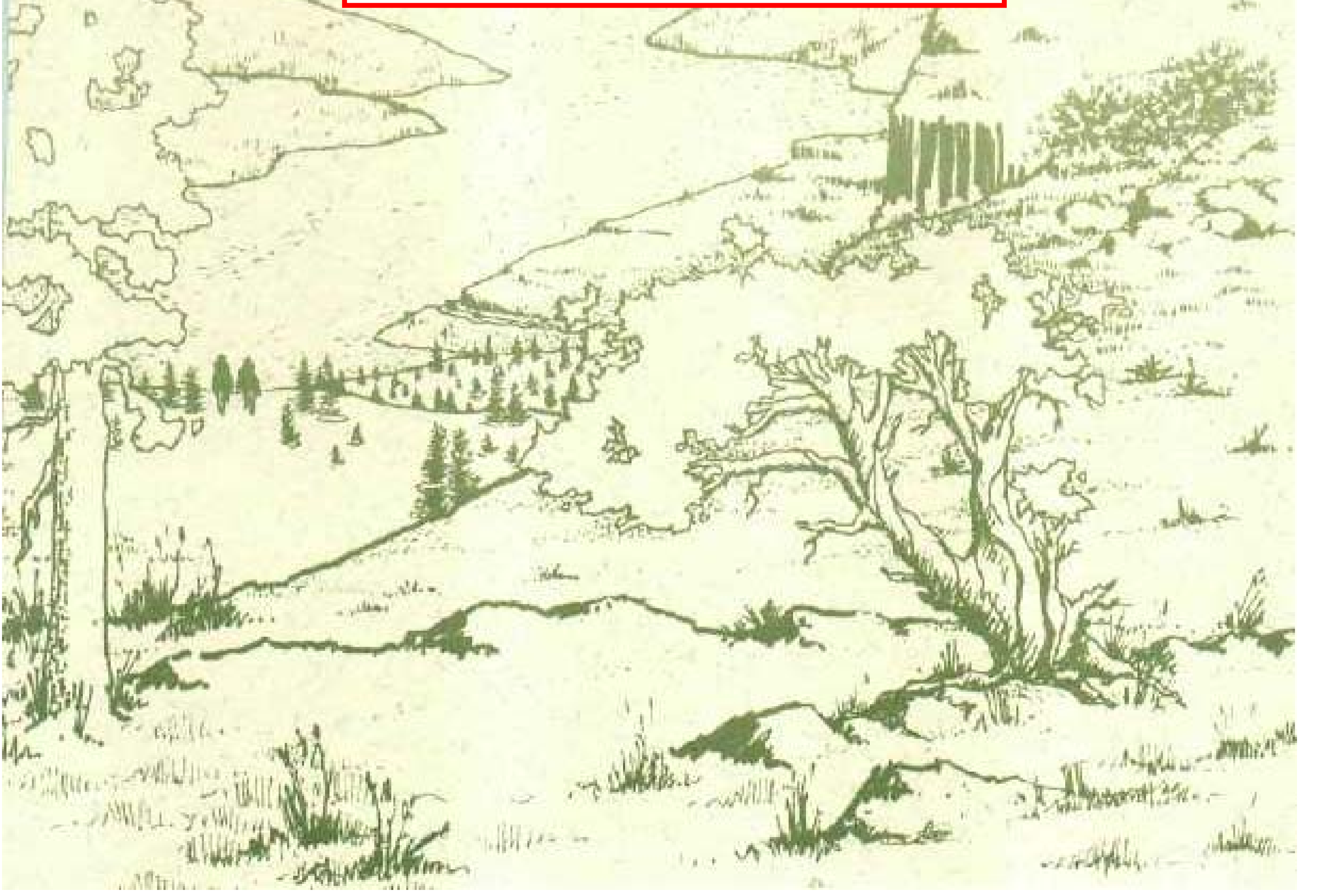

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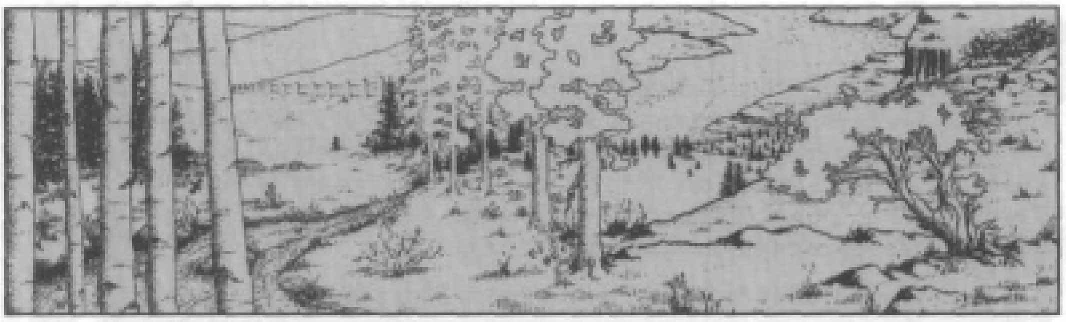

Integrated Scientific Assessment for Ecosystem Management in the Interior Columbia Basin

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.

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Portland, Oregon

Abstract

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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. Home, 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. Home, 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. Home, 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 E, 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 E.,** 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.

* = Lead science responsibilities

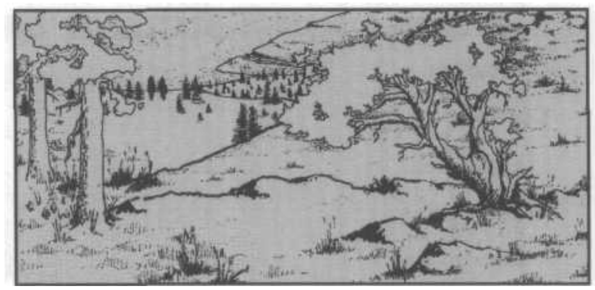


TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PHOTOS

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.

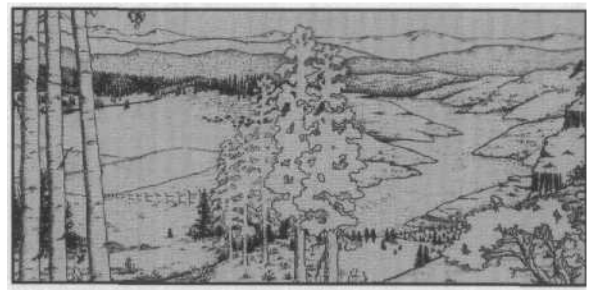
Salvage—We found that salvage activities could contribute to the achievement of long-term ecological integrity by emphasizing prevention of insect and disease outbreaks rather than focussing on the removal of large recently dead trees. Such an approach would include removing smaller living trees as part 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.

CHAPTER 1

INTRODUCTION



Ecosystem Management Mandate

In July 1993, as part of his plan for ecosystem management in the Pacific Northwest, President Clinton directed the Forest Service (FS) to "develop a scientifically sound and ecosystem-based strategy for management of Eastside forests." The President further stated that the strategy should be based on the *Eastside Forest Ecosystem Health Assessment* recently completed by agency scientists as well as other studies. The Chief of the Forest Service and the Director of the Bureau of Land Management (BLM) jointly directed through a Charter (see appendix A) that an ecosystem management framework and assessment be developed for lands administered by the FS and BLM east of the Cascade crest in Washington and Oregon and other lands in the United States within the interior Columbia Basin and portions of the Klamath and Great Basins (hereafter called the Basin) (fig. 1). Moreover, this ecosystem management approach was to be founded on basic natural resource management ethics (Thomas 1994).

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 ICBEMP was organized around several teams with specific assignments. The teams included Science Integration, Environmental Impact Statement, Tribal Liaison, Communications, Administration, and Spatial Analysis. The overall assignment of the ICBEMP Science Integration Team (SIT) included a scientific framework, scientific assessment, and an evaluation of management futures. This document is the *Integrated Scientific Assessment for Ecosystem Management in the Interior Columbia Basin.* 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.

There are nine chapters in this document. The first two chapters provide an introduction and describe the assessment process and ecosystem

The Eastside Forest Ecosystem Health Assessment (EFEHA) was an assessment of the effects of Forest Service management practices on the sustainability of eastern Oregon and Washington ecosystems. It recommended methods and practices that could be used to restroe stressed ecosystems. It is described in several publications. The concepts of ecosystem management and principles of landscape ecology as described in Volume II (Jensen and others 1994), the major findings of the assessment Volume 111 (Agee 1994, Harvey and others 1994, Hessburg and others 1994, Huff and others 1995, Irwin and others 1994, Johnson and others 1994, Lehmkuhl and others 1994, Marcot and others 1994, McIntosh and others 1994, Oliver and others 1994, Robbins and Wolf 1994, Wissmar and others 1994), the management insights concerning restoration needs and approaches Volume IV (Everett 1994), and insights from the EFEHA framework for ecosystem management Volume V (Bormann and others 1994).

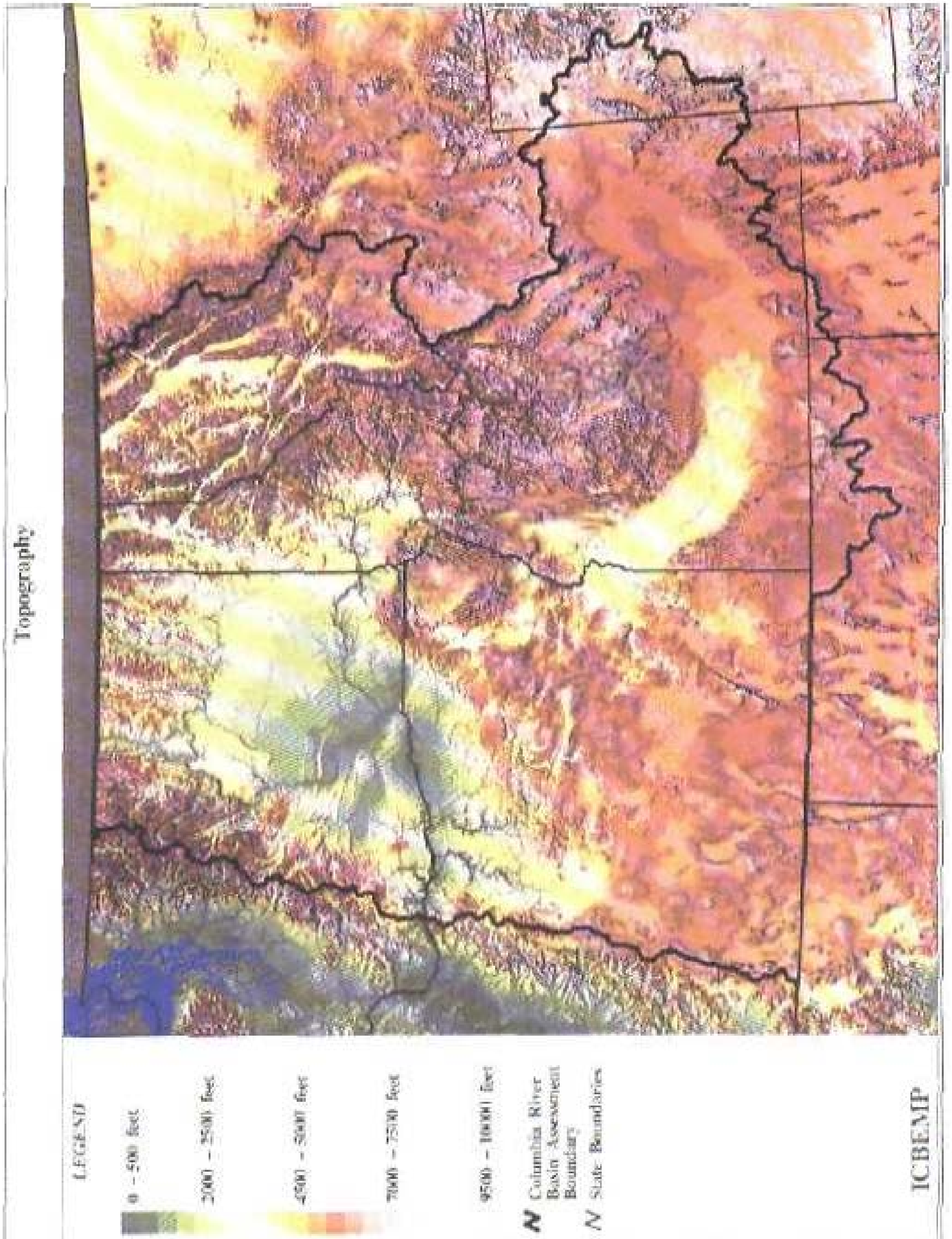


Figure 1—Topography of the assessment area.

concepts that were employed in conducting the assessment. The Basin's current status is described in Chapter 3. The fourth and fifth chapters in the document describe the current and future integrity and resiliency of the Basin. The sixth chapter discusses the policy questions outlined in the Charter. The final chapters discuss science gaps, emerging management issues, findings, and lessons learned.

Assessments

The general planning model (GPM) in the *Framework for Ecosystem Management* (Haynes and others 1996, called hereafter the *Framework)* describes four integral steps for ecosystem management (fig. 2). Assessments may lead to proposals for action. The emergence of a proposal triggers the formal decision-making process of notice and comment. During the open, public, decision-making process, the assessment can be modified. After the formal review process, decisions are made and actions are taken. Monitoring these actions may trigger changes to these actions or new proposals for action. Each step has considerable room for complexity, integration, and participation as has been the case with the Interior Columbia Basin Ecosystem Management Project.

In assessments, planners and managers often quickly identify a problem but then devote the bulk of their efforts to developing solutions. Effective ecosystem management implementation requires a clear problem definition, a clear understanding of management goals and objectives, and a clear and solid assessment of biophysical and social conditions, trends and management opportunities before recommending and selecting solutions. The GPM begins by noting who are the clients and what are their questions. In the case of the ICBEMP, the SIT adopted an approach that began with a set of policy questions and issues. These questions or issues reflect contemporary land management concerns as reflected in the Charter for the ICBEMP. These policy questions articulated public concerns about natural resources and the primary decision variables. They also comprised the spectrum of questions around which discussions of future management needs could be focused.

The role of scientific assessments is to describe and project the biophysical and social ecosystem components over several timeframes and spatial extents (fig. 3). Understanding the past, present, and possible future environments including vegetation, communities, cultures, fish, wildlife, and other ecosystem components, will help identify ecosystem limitations and choices.

Assessments represent a synthesis of current scientific knowledge including a description of uncertainties and assumptions. For Federal land managers, assessments are not decision documents. They do not resolve issues nor provide direct answers to specific policy questions. Rather, assessments provide the foundation for proposed additions or changes to existing land management direction. They provide necessary, though not always sufficient, information for policy discussions and decisions.

> The Ecological Society of America (1995) defines ecosystem management as "...management driven by explicit goals, executed by policies, protocols, and practices, and made adaptable by monitoring and research based on our best understanding of the ecological interactions and processes necessary to sustain ecosystem composition, structure, and function."

The Basin

This assessment covers the interior Columbia Basin east of the Cascade crest and those portions of the Klamath and Great Basins within Oregon (see fig. 1). The Basin's vegetation is nearly half forested vegetation types (46%). Agriculture

> For purposes of this assessment, the Basin is defined as those portions of the Columbia River basin inside the United States east of the crest of the Cascades in Washington and Oregon and those portions of the Klamath River basin and the Great Basin in Oregon. The total area of the Basin includes more than 145 million acres (58 million ha) and its boundary spans portions of seven western states (Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming).

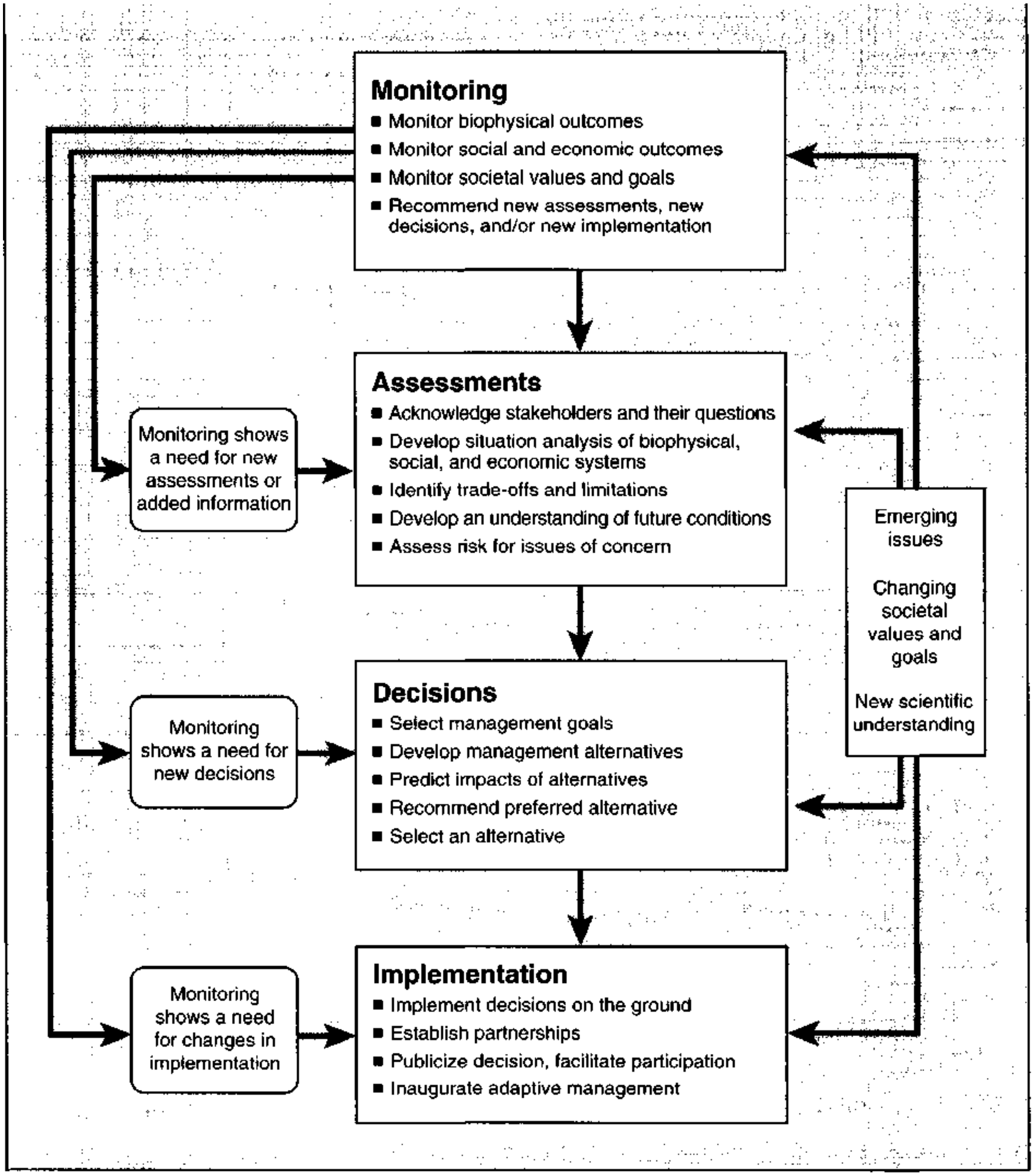


Figure 2—Each step of the General Planning Model for ecosystem management has several parts. Because the model is iterative, external or internal influences can initiate any step in the process and the process never ends.

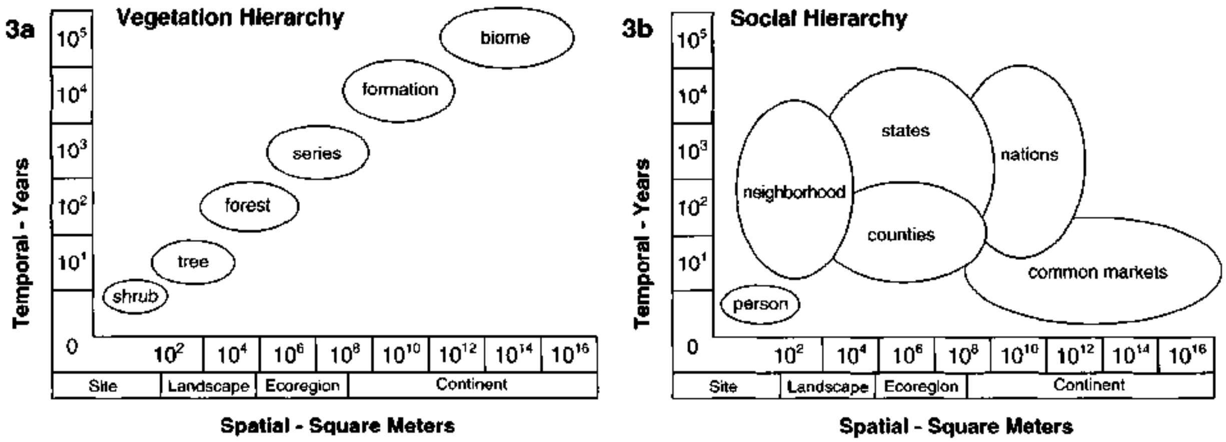


Figure 3—Ecosystem organization can be viewed as a hierarchy. Each level of the hierarchy has both time frames and spatial extents. A vegetation hierarchy is shown in 3a and a social hierarchy is shown in 3b.

occupies 16 percent of the Basin and represents what were historically rangeland vegetation types.

Federal Government projects and policies have played a major role in transforming the social, economic, and biophysical systems in the Basin. From the establishment of the forest reserves and the public domain to federal dam and irrigation projects, the Federal Government's presence in the Basin has a long legacy. Currently, the public lands administered by the BLM and FS constitute over half of the area of the Basin. In addition, national parks, monuments, wildlife refuges, energy facilities, and other public lands cover 8.1 million acres (3.3 million ha).

The transitions among the population of the Basin are as dramatic as the transitions among the mountains, plains, and rivers—from a scattered population of American Indian tribes, to the immigrants working the mines, mills, and ranches, to a diverse mix of ethnic backgrounds and urban and rural dwellers of today. Relative to other parts of the United States, the current population remains low in the Basin. The ranching and farming communities cluster along mountain valleys and lower slopes where perennial streams provide water. Some historically rural settings within the Basin have given way to expanding population centers. Spokane, Pasco/Kennewick/Richland ("Tri-Cities"), Yakima, and Wenatchee, Washington; Boise, Idaho; Bend, Oregon; and Missoula, Montana, are examples of places where once rural areas are now urban environments.

The Basin supplies goods and services to an expanding, changing, and demanding human population. The most dramatic changes have occurred in areas that attract retirees or are centers of recreation. Half of the Basin's population have rural lifestyles, particularly agricultural lifestyles, which is considerably higher than the national average of 20 percent. Moreover, nearly 50 percent of the workforce is employed in the service and trade sectors with around 10 percent employed in the farm and agriculture sectors.

Today, public perceptions and expectations regarding management of Federal lands in the Northwest have led to increases in the protection of unique ecosystems and species, increased concern with riparian areas, and experimentation with methods of forest and rangeland management. Increasingly these management strategies strive to retain features found in "natural" ecosystems and to mimic natural disturbance regimes. Tribal governments are concerned about culturally and economically significant resources, and other stakeholders[1] are concerned about the availability of commodities from Federal lands. 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 these issues as they relate to public land management.

Science Team

The Science Integration Team was composed of Federal employees from the FS, BLM, Environmental Protection Agency, U.S. Geological Survey (USGS) and Bureau of Mines (BOM). Contractors were brought in for specific tasks and assignments. The SIT was headquartered in Walla Walla, Washington. Detached analysis units were located in Missoula and Kalispell, Montana; Boise, Moscow and Coeur d'Alene, Idaho; Portland and Corvallis, Oregon; Seattle, Spokane and Wenatchee, Washington; and Reno and Las Vegas, Nevada. Its purpose was to develop a framework for ecosystem management, a scientific assessment of the interior Columbia Basin (of which this document is a part), and an evaluation of the alternatives in the Environmental Impact Statement. The SIT was organized around the functional groups of landscape ecology (physical and vegetative resources), terrestrial resources, aquatic resources, economics, and social sciences. A staff of Geographic Information System (GIS) specialists supported the spatial and data processing needs of the science staffs.

The SIT identified, designed, evaluated, and integrated all information for the science products associated with the project. The SIT integrated the information brought forward by five functional groups and described the tradeoffs and potential consequences of interactions. This document, *An Integrated Scientific Assessment for Ecosystem Management for the Interior Columbia Basin and portions of the KLamath and Great Basins* (hereafter called the *Integrated Assessment)* examined the current and future condition of the Basin by integrating the information brought forward in the detailed assessments of ecosystem components (Quigley and Arbelbide 1996, hereafter called the *Component Assessment*[2]*)*. This integrated assessment also examined probable outcomes of management under several futures. More detailed explanations of databases, models, and information layers will be published later, and will provide useful information to both public and private land managers.

Basin Assessment Objectives

The changes in public perceptions and expectations regarding Federal land management as outlined in the Charter led to the following objectives of this integrated assessment:

- Provide a basic characterization of landscape, terrestrial, aquatic, social and economic systems and processes of the Interior Columbia Basin and portions of the Klamath and Great Basins. This characterization should include diversity, distribution, and abundance of plant and animal species; watershed conditions; and economic, cultural, and community trends. The assessment will be bounded in time, space, issues being considered, and depth of analysis.
- Emphasize conditions, resources, and interactions within and among the components listed in the first objective.
- Describe probable outcomes (changes in goods and services, ecological states and conditions) of continued and potential natural resource management practices and trends.
- Describe risks and tradeoffs of management actions.

[1]In this document stakeholders are defined as tribal, state, county, local governments, and private landholders; as well as individuals and groups representing local, regional, and national interests in Federal land management.

[2]The *Component Assessment* is composed of separate chapters consisting of Biophysical, Landscape Dynamics, Aquatic, Terrestrial, Economic, Social, and Information Systems Development and Documentation (Spatial Analysis). Hereafter chapters are referenced by chapter name (for example, aquatic findings would be referenced to as *Component Assessment*—Aquatic).

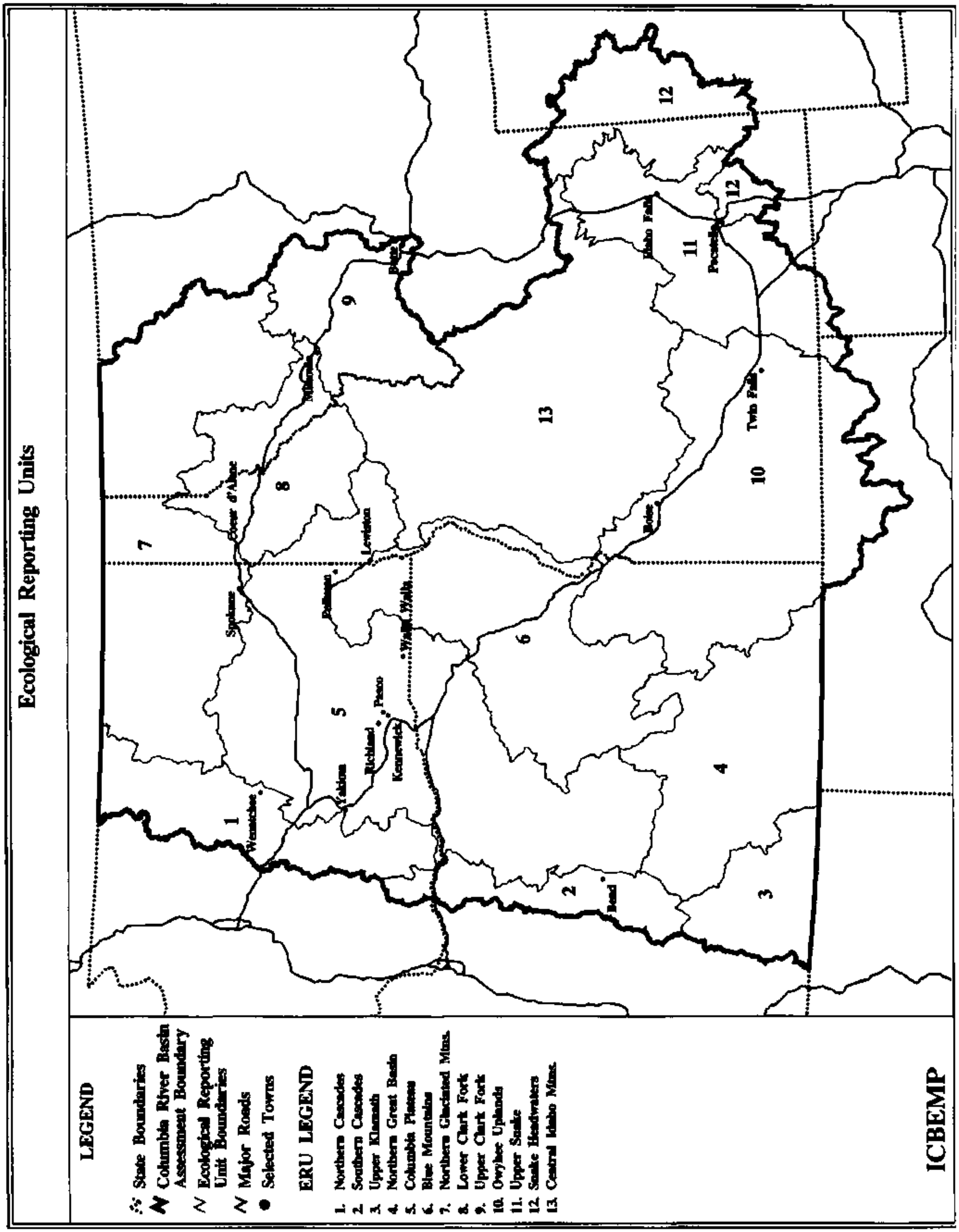


Figure 4—Ecological Reporting Units were used to differentiate the characterizations within the Basin.

Assessment Process

Assessments can differ not only in geographic extent, such as river basins versus watersheds, but also in the level of spatial and temporal resolution (see the discussion in Chapter 2 for further detail). Regional assessments show short- and long-term trends over broad areas (multiple river basins), while sub-regional assessments generally have higher data resolution and supply quantitative information on patterns and processes within smaller geographic areas (watersheds) and over shorter lengths of time. The Basin was characterized over different spatial extents and timeframes around the five broad functional groups (landscape, aquatic, terrestrial, social, and economic).

The Basin assessment analyzed the rates of change and the cause and effect relations of various social and biophysical elements, but some characteristics made linking biophysical and social processes difficult. First, there are differences in the geographic extent of commonly available biophysical and social science data. Much of the biophysical data is available at lower geographic units where the least is known about human behavior (how individuals respond to change). Second, there are also differences in the treatment of time. For social processes, various interactions are observed only for a specific point in time often described as annual or in some other temporal unit. Biophysical processes, while specific in time, are often described at longer time intervals (for example decades). Finally, there is the problem that biophysical processes are typically described for some fixed spatial extent (such as a square kilometer or a river reach) while social process are a function of human populations, which themselves have a highly variable relation with different spatial extents.

Ideally, an integrated assessment would consist of information that was integrated from its inception. Most resource information, however, is collected by individuals who, based on training, have different perspectives. To facilitate the analysis and presentation of information and results on geographic areas smaller than the entire Basin, the Basin was divided into thirteen geographic areas called Ecological Reporting Units (ERUs). Figure 4 shows the delineation of ERUs. These areas were intended to describe both biophysical and social systems but the ERUs were identified and delineated based on recommendations by the terrestrial and aquatics staffs (see Jensen and others 1996, *Component Assessment*—Biophysical for more detail). The aquatics staff proposed boundaries based primarily on watershed characteristics, stream data, and general data about the distribution of aquatic species. The terrestrial staff proposed boundaries based on groupings of potential vegetation groups. These two approaches yielded similar delineations and were combined using subwatersheds (6th code hydrologic units) as the basic mapping unit to create the ERUs (see figure 5 for the relation between the Basin, a subbasin, and a subwatershed). In the Basin there are approximately 7,500 6th code watersheds called "subwatersheds" [approximately 8,000 ha (20,000 acres) each]. To further facilitate discussions, these subwatersheds were grouped into 164 subbasins (4th code hydrologic units). The social science equivalent to the subbasin is the county (there are 100 counties in the Basin). Various social processes are discussed either at the county level or for groupings of counties.

The SIT used ERUs to describe biophysical environments, characterize ecological processes, discuss the effects of management activities, observe trends from past management, and to identify management opportunities. Some ecological and most socioeconomic processes and functions did not conform well to the ERU boundaries. Where this occurred the discussion and reporting was within a context deemed more appropriate. Some other topics could only be addressed for the entire Basin.

An integrative approach linking landscape, aquatic, terrestrial, social, and economic models was developed to link the biophysical and social systems. The goals outlined in the *Framework* and the questions outlined in the Charter guided the

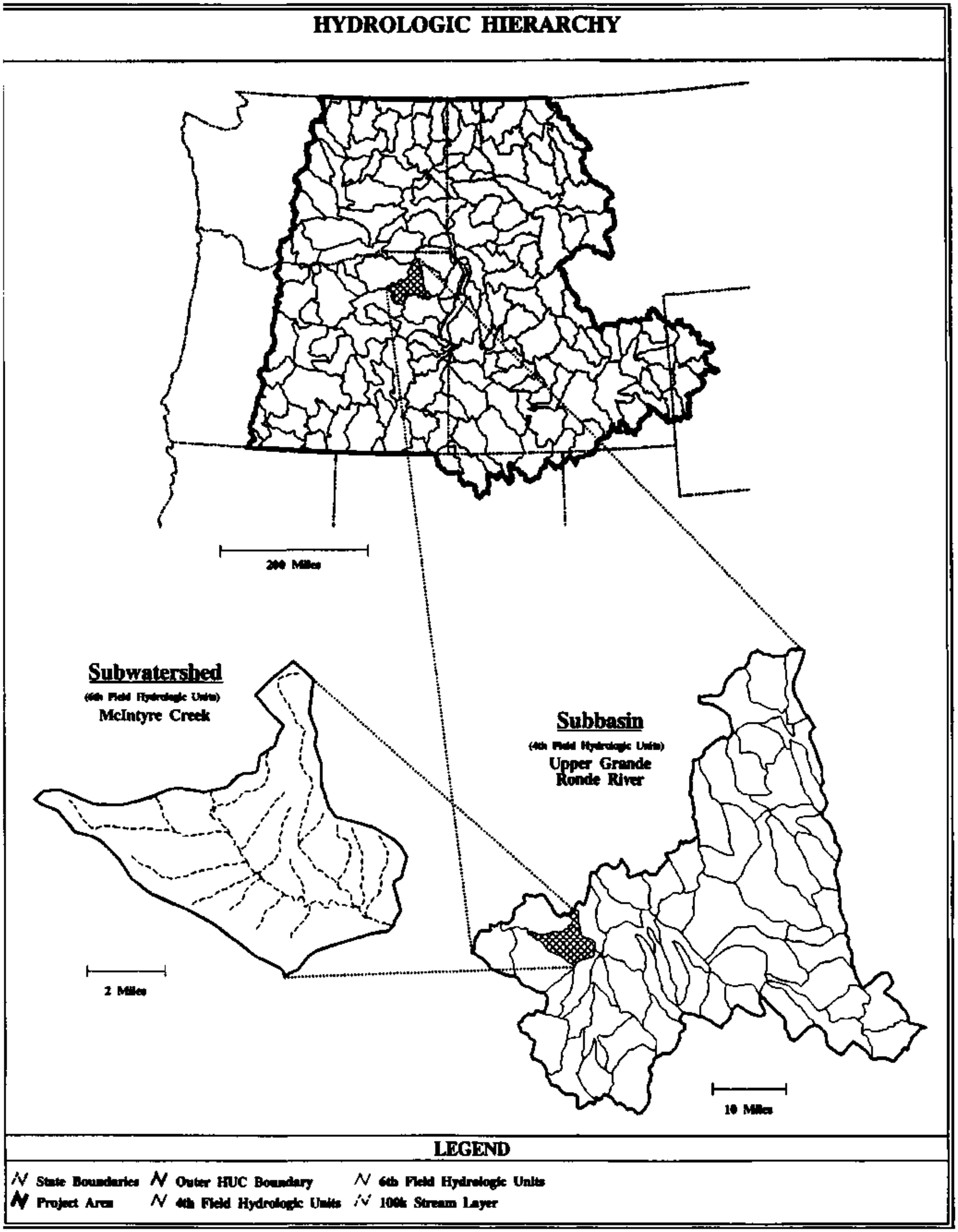


Figure 5—An example of hydrologic hierarchy from subwatersheds to subbasins.

integrated biophysical and social characterization of the Basin. The SIT used several management options as a way to display the possible effects of broad management actions on biophysical and social ecosystem components.

In this assessment, we recognize that a special relationship exists between the American Indian tribal governments and the United States Government. The sovereign status of the American Indian tribes is recognized through treaties and executive orders with those tribes and special provisions of law. These treaties and laws set the tribes apart from all other U.S. populations and define a set of Federal agency responsibilities. There are 22 recognized tribes in the Basin. Each tribe is a separate entity, and relationships need to be established with each tribe; government-to-government relations differ in format among tribes.

CHAPTER 2

ECOSYSTEM MANAGEMENT

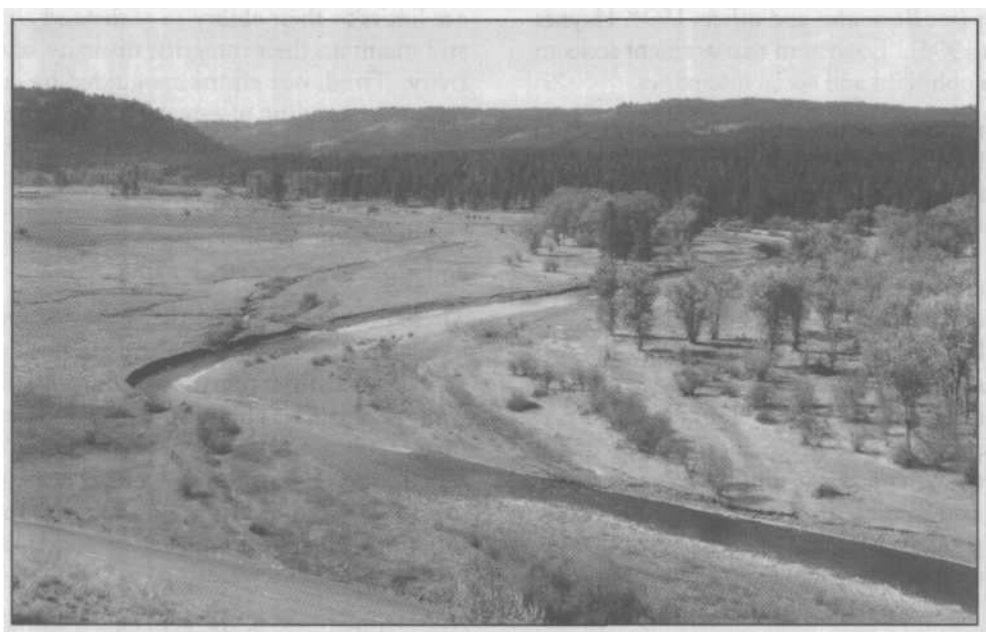
The notion of ecosystem management is evolving; so too are the concepts and principles underlying it. Frameworks for ecosystem management suggest that ecosystem management requires: (1) goals to establish a direction and purpose; (2) an assessment of resources at multiple resolutions, timeframes, and geographic extents; (3) decision variables and decisions; (4) a strategy for implementing decisions; (5) a monitoring program to evaluate the outcomes of these decisions; and (6) adaptive management approaches (see Bormann and others 1994, Haynes and others 1996). Ecosystem management seeks to integrate biophysical and social disciplines.

Ecosystem management goals for Federal lands in the Basin reflect changing societal values, new information, and the desire to maintain the integrity of ecosystems, including the maintenance of long-term ecosystem health and the provision of products and services within an ecosystems capabilities. Ecosystem management can be approached from the standpoint of managing ecosystems based on scientific knowledge and an understanding of what society wants the results of management actions to be. Scientific approaches can be used to characterize biophysical and social processes, and to measure outcomes. Public participation processes are one of many ways to determine the acceptance of management actions used to achieve specific goals. Monitoring can be used to determine baseline conditions, whether implementation achieves objectives, and whether assumed relations are valid.

Four broad principles have guided the SIT's efforts to understand ecosystems. The reasoning behind these principles is explained in greater detail in the *Framework.* First, ecosystems are dynamic; they change with or without human influence. Existing ecosystem conditions are a product of natural and human history—including fire, flood, and other disturbances; climatic shifts; and geological events such as landslides and volcanic eruptions. Second, although ecosystems are dynamic, there are limits to their ability to withstand change and still maintain their integrity, diversity, and productivity. Third, our efforts are guided by an increasing understanding of how larger ecosystem patterns and processes relate to smaller ecosystem patterns and processes. Fourth, there are limits in our ability to predict how ecosystems may change. Photos 1 a and 1 b illustrate that terrestrial and aquatic ecosystems are dynamic.

These principles suggest that scientists and land managers carefully observe and study ecosystems and adjust their actions as new information becomes available. They also reflect an appreciation that people are part of, and not separate from, ecosystems. Determining society's current and future expectations for public land outputs (goods, functions, and conditions) is the fundamental determinant of stewardship.

As described earlier, the general planning model for the implementation of ecosystem management has four iterative steps: monitoring, assessment, decision making, and implementation (see fig. 2). It is an adaptive model that combines both bio-



Photos la and lb—This Blue Mountain photo pair shows the change in stream, meadow, and riparian conditions between 1919 and 1992. Notice the forests in the background are more densely stocked. (Source: Skovlin and Thomas 1995.)

physical and socioeconomic processes and goals. Societal expectations for outputs (including ecological conditions) are an important feature. The model also recognizes that management objectives differ between public, tribal, and private lands. For private lands, this becomes more complicated as individual owners differ in land management objectives and how they respond to market and non-market (including regulatory) incentives. This model provides a context for how the different types of information might be integrated in conjunction with management goals.

Ecosystem Management Goals

Humans have diverse goals for ecosystem management, which in turn reflect diverse cultural perspectives. These goals are in the domain of public choice and not science. They are the result of decisions that follow from democratic and institutional processes and are stated or inferred in laws, regulations, policy statements, decisions, and budget direction. For example, the legislation guiding the management of FS- and BLM-admin-lstered lands in the early 1900s centered on protecting resources and reducing flooding. Goals shifted more toward providing commodities and stabilizing employment during the middle of the century. Concurrent with the environmental movement of the 1960s and 1970s, the emphasis shifted away from implicit goals toward establishing a planning process that developed specific goals. This shift is illustrated in current procedural laws requiring federal agencies to identify and disclose the effects of management activities on Federal land (NEPA 1969), and to develop long-range land use or general management plans (RPA 1974, NFMA 1976, and FLPMA 1976).

Currently, land and resource management plans which establish detailed goals, objectives, and standards are developed by the FS and BLM for each administrative unit (generally a national forest or BLM resource area). Legal mandates require Federal land managers to manage habitat to maintain viable populations of existing native and desired non-native vertebrate species (36 CFR 219.19). Regulations also require Federal land managers to provide for diversity of plant and animal communities, including endemic and desirable naturalized plant and animal species . consistent with the overall multiple use objectives of the planning area [36 CFR 219.26 and 219.17(g)]. Managers are also required to consider the American Indian treaties and the associated trust responsibilities. The Chief of the Forest Service recently emphasized the importance of managing the National Forests to maintain the integrity of ecosystems (Thomas 1994).

This direction provides insights into the goals of ecosystem management for the agencies managing Federal lands, but it does not provide a formal, clear statement of ecosystem management goals. In the absence of explicitly defined goals by the agencies and society, we assumed that the general purpose for ecosystem management is to maintain ecosystem integrity or system integrity, where system integrity is defined as the degree to which all components and their interactions are represented and functioning. Ecosystem, in this sense, is being used in its broadest form, where it encompasses social as well as biophysical components.

Ecosystem integrity and resiliency are rooted in scientific concepts that inherently reflect human values (see for example, Haynes and others 1996, and Wickium and Davies 1995). These human values include the normative purpose of maintaining the integrity of a combined natural and cultural ecosystem. Ecosystems are defined as having high integrity when their components have no substantive impairment in structure, composition, or function. In this sense, a living system exhibits integrity if, when subjected to disturbance, it maintains its capacity for self-organization. For the biophysical, social, and economic components of ecosystems, resiliency is denned as the capacity of these components to adapt to change. 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. Thus, there is a social context to ecological goals, and an ecological context to social goals.

Science can predict how systems respond to change, but it cannot state that one change is better than another. Judgments about whether a system condition is good or bad must be made within the context of social values. This raises the question of how to measure integrity, since the judgment of how resilient or complete an ecosystem is depends on subjectively chosen indicators. In that sense, the integrity of ecosystems is more an expression of environmental policy than scientific theory (Woodley and others 1993). Managers may be reluctant to include societal issues and values in the definition (and evaluation) of ecosystem integrity. However, because maintaining the integrity of ecosystems is a management goal, it by definition, needs to reflect the values of both managers and users. Finally, to define the integrity of ecosystems is to define a set of biophysical and social characteristics to be monitored for change from or toward specified values.

The *Framework* lays out how the SIT assumed the overall purpose of ecosystem management—to restore and maintain ecological integrity and social and economic resiliency—and six societal goals for ecosystem management that would provide benchmarks for evaluating changes in ecosystem integrity and social and economic resiliency. The six assumed goals 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: a "sense of place."
- Manage to maintain a mix of ecosystem goods, functions, and conditions that society wants.

These goals represent normative judgments about what best indicates ecosystem integrity, and social and economic resiliency. By addressing these goals, risk and uncertainty from unpredictable events may be reduced. The goals also acknowledge important social values derived from non-commodity use of natural resources. They acknowledge the extensive range of values and choices involved in managing for the integrity of ecosystems and social and economic resiliency.

The remainder of this section presents a discussion around each goal in the context of the Basin. It summarizes early SIT discussions where tentative findings were used to clarify our descriptions of the goals. The underlying documentation for the various statements in the section are given in the *Component Assessment.*

Goal 1. Maintain evolutionary and ecological processes

An ecological process is a sequence of events relating environmental, living, and nonliving components of an ecosystem. It may result in some outcome that in turn affects and is part of other processes. For example, some past management practices have increased erosion and sedimentation, which resulted in increased amounts of soil in streams and river pools. This reduced the amount of food available for fish species and the ability to spawn successfully, resulting in fewer fish available to humans and other species that depend on them. Ecological processes include those that operate at very small spatial and temporal extents, such as the growth of cells, and those that operate at very large spatial and temporal extents, such as plate tectonics. Ecological processes such as hydrologic cycles, nitrogen cycles, carbon cycles, and plant succession are essential for maintaining the productive capacity of the air, land, and water upon which life depends.

History demonstrates the propensity of humans to alter ecological processes. An example in the Basin is the emphasis on harvesting of large trees.[3] Large trees were typical in landscapes maintained by low-intensity surface fires. Harvest of these trees over the last two centuries did not parallel the pre-

[3]The definition of large trees varies by vegetation type. For pondcrosa pine and Douglas-fir it generally means diameters greater than 21 inches (53 cm). The selection of a specific diameter is related more to available data sets than to ecological definitions.

European disturbance regime, and consequently altered associated vegetation structures and disturbance processes. The resulting landscapes were less diverse (more simplified), more chaotic in terms of disturbance intensity, and less tolerant of fire, insects, and diseases. An additional ramification of this harvest strategy was that road development was often concentrated on landscape settings sensitive to erosion and sediment transport.

Continued human population growth in the Basin will increase demand for recreation and for housing in urban/wildland interface zones. This makes it increasingly difficult to maintain ecological processes and to reduce risk to human life and property. For example, in the Snake Headwaters ERU the human population density on private land is expected to increase from 20 to 50 people per square kilometer (30-80 people/sq. mile) increasing risk to ecological processes. The ERUs with highest projected development in the urban/wildland interface and fire-prone zones include the Snake Headwaters, Owyhee Uplands, Upper Snake, Northern Glaciated Mountains, and Lower Clark Fork.

In general, past forest management on Federal lands dispersed multiple uses across all landscapes, emphasizing commodity production. This has led to areas where ecological processes within landscapes are not fully functioning and have lower capacity to meet human needs and values.

The prerequisite to management actions is an understanding of the basic biophysical conditions and processes within an area (geology, soil, climate, landform) and their associated hydrologic and vegetation disturbance regimes, in relation to native biota and human habitats. To meet this goal, the highest priority for maintaining ecosystem processes would be in areas where the processes have been the least disrupted. The highest priority for restoration would be in areas where systems can be recovered and the knowledge and technology for recovery are available. A high priority for research would be to identify those areas where systems are degraded or in jeopardy, and where the methods and the technology for recovery can be developed.

Among the ERUs dominated by forest land, the Blue Mountains and the Lower Clark Fork have the greatest potential for restoring and maintaining ecosystem processes. Many vegetation and hydrologic processes have been impaired in these ERUs, but they still have high diversity of native plant and animal species, although populations are small and scattered. Proactive management at the watershed scale could provide significant improvements while diminishing further risks. Restoration programs slated for the urban/wildland interface zone pose the lowest risks to ecological integrity when applied in previously roaded portions of dry forest, shrub, and grass vegetative zones.

Among the ERUs dominated by rangeland, the Upper Snake, Owyhee Uplands, and Northern Great Basin have the highest potential for a posi-

A disturbance is an event that changes the trend of ecosystem development; disturbances are inherent to ecological processes. When disturbance regimes occur with an intensity, periodicity, or spaciat extent outside their accustomed character, evolutionary trends are compromised. For instance, fuel accumulations and shifts to more fire-susceptible tree species have resulted in less frequent, but more intense forest fires that can disrupt nutrient cycles, food chains, and decomposition processes. Floods are a disturbance essential to developing and maintaining riparian conditions. They establish cross-section stream bed characteristics, flush debris and accumulated fine sediment, and deliver material for soil development to the flood plain. Because floods may be detrimental to human life and property, in flood plains we attempt to control or minimize their impact; in so doing we often disrupt the accustomed processes.

tive response to restoring and maintaining ecosystem processes. These ERUs have high rates of decline of vegetation and hydrologic processes, but retain high residual native species diversity. The Owyhee Uplands and Upper Snake also have high potential for increases in human population. Much could be accomplished through proactive management in the urban/wildland interface. Management could likely meet human and ecological objectives, while diminishing further risks to ecological integrity.

Goal 2. Manage with an understanding of multiple ecological domains and evolutionary timeframes

An ecological domain is a large unit of land containing repeating patterns of life forms, climate, and physiographic features. The Northern Rocky Mountains, Great Basin, and the Interior Columbia Basin are examples of ecological domains. There are broad differences among ecological domains in their biophysical conditions, evolutionary processes, and their ability to provide goods and services for people. Evolutionary processes control how systems adapt and change in relation to time and disturbances. Ecological evolution is the integrated development through time of cellular processes, species, communities, and landscapes in relation to disturbances and their surrounding environment.

Similarly, landscapes evolve as a result of interactions between geology, climate, soils, landform, hydrologic regimes, humans, wildlife, and vegetation. Knowledge of the factors and relations comprising the biophysical and socioeconomic characteristics of ecological domains provides understanding of the evolutionary interactions of disturbances (such as fire, insects and disease, timber harvest and management, grazing, drought, floods, volcanic eruptions) with climate, geology, landform, and soils. This knowledge gives us the ability to understand how systems evolved and developed. In addition, there is the issue of intergenerational transfers: how will the Basin's ecological systems provide ecosystem goods, functions, and conditions for present and future human generations?

Species have evolved over the past thousands or millions of years adapting in part to changes in their environment. But human-caused disruptions of evolutionary processes in the Basin, such as the introduction of exotic species, can take place within decades. Such introductions can disrupt the relations of native species with their environment and alter evolutionary pathways. Another driver of an evolutionary process is climate change. Climate in the Basin has been highly variable over time. Drought (<70% of average annual precipitation) is relatively common, especially on rangelands where some plant and animal species (and their ecological functions) have adapted to wide fluctuations.

Managing natural resources in the context of multiple ecological domains can help explain the relations and dependencies that occur among ocean and terrestrial systems. The importance of ocean conditions, which are linked to global atmospheric circulation patterns, to anadromous salmonid life cycles has become understood in the last 15 years. Traditionally, research attributed variation in population size to freshwater conditions. Recent work strongly suggests that the abundance of salmonids and other fishes may be affected by short- and long-term variation in atmospheric and ocean circulation patterns. Northeast Pacific Ocean conditions shifted in the mid-1970s and salmonid populations along the entire west coast of North America have responded to these regional changes. One consequence of this is that management actions directed at restoring freshwater habitats of salmonids need to include the context and information about the fluctuating numbers brought on by climate and oceanic changes.

There is a need to recognize that management activities may affect ecosystems over multiple ecological domains and multiple timeframes. It is difficult to predict ecosystem trends and the ultimate outcomes of management actions. The practical implication of this is that today's management actions can reduce options for future generations. At the same time, large events are inevitable, and responses to these events play a major role in ecosystem development. Investment strategies for resource production or restoration can be designed to improve success and reduce risk of investment loss, given this type of understanding. By planning activities in the context of multiple ecological domains and evolutionary timeframes, natural resource management can provide buffers to large events (such as volcanic eruptions, fires, and floods) that may have significant ecological effects.

To date, natural resource management strategies in the Basin generally have not considered broad spatial and temporal views of how species, communities, and landscapes evolved in relation to ecosystem processes. Most project activities on FS- or BLM-administered lands are, at most, watershed-, single species-, or issue-specific and do not usually consider the broader context in which management actions operate. At the largest extent current management usually covers a single Forest or BLM District and has resulted in less complex landscape patterns. In part, this is the consequence of the institutional framework of the FS and BLM that is focused on decentralized short-term and issue-specific results. Although there are notable exceptions, previous management practices rarely considered managing the structure and composition of whole landscapes in a manner that was consistent with biophysical conditions and disturbance processes that maintained a mosaic of conditions over landscapes. As a result, a single large event (such as fire, floods, or volcanic eruptions, as well as the introduction and spread of exotic species or diseases) could eliminate a plant or animal community. Management activities that consider only short-term results may interrupt millennia of evolutionary processes in a span of decades. This short-term vision may lead to ecosystems developing in unforeseen ways, causing increased likelihood of unpredictable events.

Humans have the potential to increase the rate of change of evolutionary processes. Human activities have altered terrestrial and aquatic ecosystems in the Basin to the extent that restoring the original conditions through management activities is nearly impossible in many areas. Humans are currently responsible for moving more material about the surface of the earth than any other geomorphic process. They have introduced exotic species and toxins that have spread into native communities that are not well-adapted to the newcomers. Road building, urbanization, and pollution have reduced the diversity, resiliency, and productivity of the Basin. Exposure and erosion of soils that had co-developed with their vegetation cover alter the succession and productivity of many Basin ecosystems.

Goal 3. Maintain viable populations of native and desired non-native species

There is public concern that ecosystem management maintain viable populations of native and desired non-native species. In a broad sense, viability can be considered as the likelihood of continued existence of well-distributed populations of a species throughout its current range, to specified future time periods (Marcot and Murphy, in press). A population can be defined as a set of plant or animal organisms of a given species, occurring in the same area, that could interbreed. A population with high viability persists in well-distributed patterns for long periods (century or longer). A viable population is able to survive fluctuations in demographic, genetic, and environmental conditions and maintain its vigor and potential for evolutionary adaptation over a long period of time (Soule 1987).

Each species in an ecosystem has specific ecological functions. These functions are linked to other species and functions. Removal of a species may eliminate or compromise a function for which there is no functional substitute or equivalent. The functions of individual species are not completely understood or known, and therefore effects of their removal on ecosystem integrity are not known.

Viability is important because an ecological community, landscape, and ecoregion with a rich complement of viable populations of plants and animals has a greater capacity to maintain its ecological community structure in the face of disturbances. Maintaining the viability of individual species and species richness (number of species) alone are not adequate objectives for managing for biodiversity. Ensuring viable populations is also necessary for long-term ecological integrity. Viable populations help meet Trust responsibilities and keep the agencies within the framework of the Endangered Species Act (ESA) and other legal mandates.

There is no one static condition that constitutes a set of native species. Human activities as well as natural changes affect the ebb and flow of species and communities. Native is not necessarily permanent, so it is a challenge to define a particular "native" baseline from which changes can be measured.

Desired non-native terrestrial species include introduced vertebrate game species, invertebrates introduced for controlling introduced pest invertebrates or plants, and non-native plants. Chukar, gray partridge, wild turkey, and ring-necked pheasant (see appendix E for listings of species common and scientific names) are the primary desirable non-native terrestrial vertebrate species in the Basin, particularly in the agricultural regions. Changes in agricultural practices to "clean farming" have resulted in lower populations in many areas, notably the Columbia Plateau. Introduction of these non-native species may have adverse effects on other vertebrates (primarily birds), invertebrates, or plants, but ecological information is scant. Plant species that have been brought into rangelands and forests, including crested wheatgrass and other grasses used for range conversion or restoration, are desirable or undesirable depending on one's preference for commodity production versus maintaining native communities.

Desired non-native fishes, (such as brook trout and stocked rainbow trout), are spread widely throughout the Basin and form the basis for recreational fishing. The thousands of large and small reservoirs and the warm waters of the lower major river systems within the Basin have created an important bass and walleye fishery, which harms anadromous salmon recovery because of the walleye's predatory behavior. These warm water fisheries continue to increase in economic importance.

Angling for native fishes has become highly regulated either as part of the Snake River anadromous chinook recovery plan or, (as in the case of John Day steelhead trout) as maintenance of genetic diversity. For native resident fish, regulations include catch and release, designated wild fish streams, and special closures around migration or spawning times. For American Indians, the significance of salmon and steelhead transcend economic values. The social and ecological pressures to provide desired non-native species and to maintain native species will continue to challenge decision and policy makers at all levels of government.

The societal choice to maintain or restore species viability hinges ultimately on human land uses and human needs versus the needs of other species. For example, there has been widespread national support for the protection of rare plant communities on public lands. There is also sentiment for modifying endangered species laws to maintain local economies and communities while at the same time having effective habitat conservation strategies.

Private landowners play an integral role in maintaining species viability. For example, private landowners often control the water rights and generally own the historically most productive reaches of streams in the broad valleys and at low to mid-elevations, while public lands are concentrated in the upper reaches and headwaters. Providing spawning and rearing habitat at different seasons and in different locations within a subbasin is important to the likely persistence of all salmonid life history stages and forms. Dams, road networks, urbanization, and agricultural development have precluded a continuous ribbon of productive fish habitat, good riparian conditions, and fish passage up and down the river systems in the Basin. However, opportunities are numerous in the Basin to restore small reaches as way stations in the network that will be essential to fish moving up and down river systems to appropriate habitats.

Goal 4. Encourage social and economic resiliency

Resiliency, here, means adaptability, not necessarily a return to some prior state or condition. In the social sense, adaptability means the capacity for humans to change their behaviors, economic relationships, and social institutions such that economic vitality is maintained and social stresses are minimized. Resilient communities are those that tend to have a diverse economic base, forward-looking leadership, a pleasing look and "feel," a cohesive sense of community, and the physical capacity for expansion (such as, roads, sewer, and water). Resilient communities are adaptable to changes in federal policy, indeed, some Basin communities would be largely unaffected by any changes in Federal land management. Communities that lack the above-stated qualities are ill-equipped to deal with change.

Communities (within the Basin) differ in their dependency on Federal lands and policies. There are formalized requirements to consider (though not to perpetuate) community dependency in the National Forest Management Act of 1976 (NFMA 1976). These requirements identify local economic relations to federally managed lands that deal with the supply of materials and commodities. However, communities may depend on and benefit from federal ecosystem goods, functions, and conditions in other ways. For example, a national forest may provide significant amenity resources, resources that provide the scenic backdrop and physical setting attractive to business owners and their workers. Such communities may be dependent on natural resources, but in ways different than traditional extractive definitions imply. For example, communities may be economically dependent on government facilities, such as FS and BLM offices, defense bases, or research programs. Resident Federal workers themselves contribute to their communities economically and by providing experience and knowledge that might not otherwise be available in a small town. Native American communities can be both economically dependent and culturally dependent on the landscapes that provide links to ancestors. In addition, a community may depend on federally managed resources as a source of clean water for domestic, agricultural, and commercial purposes.

Residents of natural resource-based communities are concerned about the uncertainties of flows of commodities under current management. These concerns lead to an anxiety that revolves around people wanting to retain their community structure and accustomed lifestyles. In these communities residents believe that perpetual access to federal timber, grazing, and minerals is critical to their personal economic stability and the future of their community. Shifts in either demand for, or supply of, natural resources (timber, grazing) can cause unanticipated changes in a community's economic base and social and economic well-being.

Communities with higher levels of social and economic resiliency, can adapt to changes in management of forests and rangelands. This permits forests and rangelands to be managed with greater flexibility and options in an attempt to meet broad societal demands, and to promote ecosystem processes and functions. Less adaptable communities may become sensitive to changes in demands for commodities, leading to community instability, stress, and anxiety. If communities cannot adapt to change, there may be social and political pressure to maintain flows of resource commodities inconsistent with broader societal goals and with maintaining the integrity of ecosystems. Within the Basin, resilient communities tend to be those that are larger, those with active community leadership, or those that have confronted change. Agricultural and ranching communities tend to rate lower in resiliency when compared to other types of communities.

Goal 5. Manage for places with definable values

An important element of ecosystem management is the growing appreciation of intangible spiritual, cultural, and individual meanings that people assign to physical environments. Sense of place can encompass the feelings and emotions one has for favorite or special places based on one's experience, the spiritual values that American Indians identify with landscapes, or even the unique character or identity that people associate with specific communities. In other words, sense of place is the meanings and qualitative attachments that people give to specific locations on a landscape.

The relationships between humans and their cultural landscapes are also being increasingly identified. For example, landscape meanings can be sacred to American Indians, but identifying them for an ecosystem assessment is difficult because of a cultural reluctance to expose such locations and their meanings. Other cultures and communities of interest may assign different meanings to the same place, as when Asians may define a place as an important source of herbs, while Latinos may define the same place as an important source for tree boughs.

For people across the nation, there may be locations that contain important cultural and individual meanings, for example, the place where the Battle of White Bird Hill occurred, the Lewis and Clark campsites along the Lochsa River, or the Seven Devils area (see photo 2). While these places share a consistent definition, not all people may have the same depth of understanding, and

Photo 2—The area called the Seven Devils has both cultural and recreational significance.

individually recognized boundaries may not coincide. The different ways people define places (with quantifiable measures and physical processes or with unquantifiable emotional significance) can cause barriers in communication, and sometimes conflict.

With the projected Basin population growth and increased demand for recreation, scenery, and commodities, meanings of place for different communities may change rapidly and increasingly come into conflict. In general, humans prefer meaningful places to be stable or evolve slowly, a preference in contrast to the anticipated rapid rate of change. Rapid population growth and shifts in the economic base away from natural resource commodities may also affect community character.

Goal 6. Manage to maintain the mix of ecosystem goods, functions, and conditions that society wants

Ecosystems have many values to society. There are ecosystem goods that are removed such as minerals, timber, forage, mushrooms, huckleberries, wildlife, and fish (see photos 3 and 4). Some goods are not removed when used, but instead remain to be enjoyed by more than one person—these include a whole host of goods associated with recreation activities such as beautiful scenery and wildlife to view, and primitive country to experience. Finally there are goods that are valued simply for their existence such as salmon, grizzly bears, gray wolves,

Photo 3—Forest Service employee examining a log deck with a purchaser. FS- and BLM-administered lands accounted for 46 percent of harvest in the Basin in 1991.

Photo 4— American Indian picking huckleberries in an area of traditional cultural significance.

and large old trees. In addition to the goods listed, ecosystem functions include beneficial processes such as carbon sequestration, hydrologic cycles, and nutrient cycles. Ecosystem conditions include states people want to find on the land, including old-growth forests, clean air, clean water, unroaded areas, and scenic integrity.

Conflict over goals for ecosystem management has increased as the desired mix of ecosystem goods, functions, and conditions has expanded and changed over time. Because society's wants and needs will continue to evolve and knowledge about ecosystems will continue to improve, managers try to provide options for maintaining ecosystem integrity. Federal laws, regulations, and judicial conditions set the context for ecosystem management. Land managers can also keep abreast of society's wants and needs by working with stakeholders at all levels to define the mix of ecosystem goods, functions, and conditions that are deemed necessary. This will help society and managers recognize the trade-offs among ecosystems' outputs. Using adaptive strategies and sensing what society wants will bring a higher probability of achieving the ongoing goal of ecosystem integrity.

In this goal it is important to define both society and ecosystem goods, functions, and conditions. Society is broadly defined—it includes interests wherever located (in the Basin or across the country) and future generations. The point is to include in the analysis all values society holds for these lands. Interests of future generations can be explored through the options available to them under different management directions. The analysis applies to what the Federal lands in the Basin can provide society, and shows important variations among ecological regions within the Basin. The distribution of the value of ecosystem goods, functions, and conditions between various components of society—the "who benefits?" issue—needs to be explored as well.

Differences exist in the distribution of ecosystem benefits between generations: some management approaches favor current generations, others favor future generations. Similarly, some approaches to ecosystem management favor local over national interests, or vice versa. The challenge is to identify desired ecosystem goods, functions, and conditions. Current political/ institutional approaches were designed in a past era with less knowledge about the time and space consequences of management activities. Future ecosystem management needs to consider longer timeframes and larger areas. Moreover, current natural resource institutions and structures need to be examined.

Ecosystem Management Concepts

The implementation of ecosystem management depends on many concepts, some familiar and others unique. Among these latter concepts are notions of risk and risk management, scale, land classification, and biophysical templates. The purpose of this section is to briefly review these concepts.

Treatment of risk and uncertainty

Risk assessments help managers develop a sense about the likelihood of outcomes of various management strategies. In these assessments, analysts also have to make judgments about the risks associated with various indicators and findings. Contemporary ideas of risk, uncertainty, and ignorance acknowledge the traditional distinctions [for example those made by Knight (1921)], but generally use a practical definition of risk as either (1) the possibility of loss or injury or (2) events or circumstances that result in a chance of loss or injury. This distinction is useful to help managers develop a sense of the possible outcomes of management strategies. For example, in the ecological integrity section scientific and management uncertainty was estimated regarding ecosystem response to forest and rangeland management. We also provide statements regarding uncertainty in projections or interactions.

Risk management

Ecosystem management with its emphasis on spatial and temporal hierarchy facilitates risk management in the sense that it focuses discussions and management responses at the level that the risk occurs. The use of risk in this discussion is technically not risk in the sense of just the situation where all possible outcomes can be specified [see Knight's (1921) definition]. Rather, it is a more general characterization of the risks associated with a set of outcomes, a knowledge that not all outcomes can be characterized in advance, [see Faber and others (1992) for a discussion of the concept of ignorance] and some notion of the societal acceptability of those risks.

The greatest flexibility for management is attained to the extent risks (meaning events or activities that pertain to the likelihood of not reaching desired goals) can be managed at the lowest level possible. For example, a risk would be considered a "regional risk" if it could not be adequately addressed by making incremental, individual decisions at lower levels; such as activities that threaten anadromous fish populations. Insuring the viability of a wide ranging fish species includes providing high-quality suitable habitat for the species well distributed throughout its range. Making individual, separate decisions regarding where the species habitat will be emphasized will not insure that the habitat is well distributed. That is, unless the decision is made regarding which portion of all the potential habitat will be managed to insure quality habitat for this species. The alternative would be to conservatively manage all habitat by not permitting any of it to be adversely altered, thus, reducing flexibility for management. By strategically making the decision of where, specifically, the species habitat would be emphasized, management has potentially more options to consider as new decisions are made.

A method of partitioning the risks through a risk management approach can retain flexibility at the field level (figs. 6a and 6b). Figure 6a shows different amounts of risk at four geographic ex-

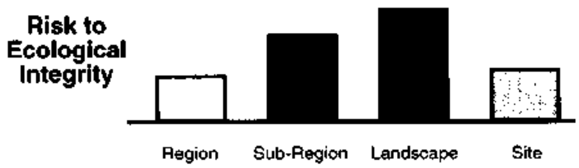


Figure 6a—Example of partitioning risk to ecological integrity across multiple geographic extents.

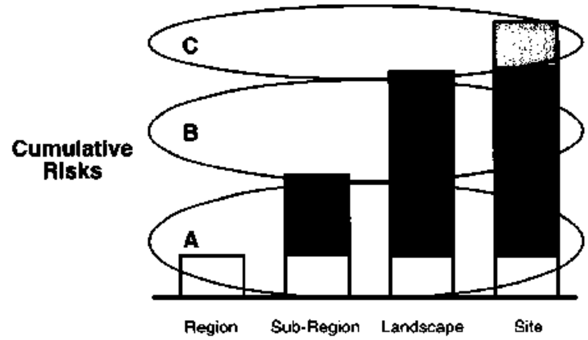


Figure 6b—An example of cumulative risks to ecological integrity at multiple geographic extents. Ovoids A, B, and C represent analysis and decision levels that address risks associated with those levels.

tents: region, sub-regional, landscape, and site. Figure 6b shows cumulative risks for these same geographic extents. Each site faces the cumulation of risks from all the greater geographic extents. The three ellipses define the analyses and potential decisions addressing each group of risks. The broadest extent of risks are addressed in regional and/or sub-regional assessments (ellipse A in fig. 6b). From these, the regional guides, forest plans, and BLM district plans can be developed and/or revised. The next step is assessments that focus on risks of the watersheds or landscape geographic extent (ellipse B in fig. 6b). The most detailed level of analysis is the site or project analysis (ellipse C in fig. 6b). Given the regional and landscape analysis as context, the remaining risks that need to be addressed are those specific to the particular site. When considered together, all the risks, individual and cumulative, have been addressed through a multi-level analysis and decision process.

One purpose of risk management is to allow flexibility at the local level to the extent compatible with managing risks. For example, establishing standards and guidelines at levels above the local site results in using averages or blanket prescriptions across a wide array of conditions, so for some sites the standards will be too high or for other sites too low. By attempting to manage risks at the levels that they occur, the possibilities for this son of miss will be reduced and desired outcomes can be achieved with greater frequency. Decisions that address all risks across a large geographic area result in fewer management options at the site level and increases the probability that a decision will be wrong for a particular site. This can best be reduced by managing the risks at the lowest level, thus allowing the greatest flexibility at the local level.

Managing directly to achieve opportunities, desired outcomes, and the provision of goods and services might result in new risks of failure in achieving the goals. For example, there may be management opportunities to increase recreation use associated with riparian areas but that use could increase risks to fish spawning beds in the same riparian areas. There is nothing inherently wrong with setting out to achieve some goals that are oriented toward commodity output. Managing the full complement of risks associated with all management goals then dictates that the new risks to ecological objectives, created through achieving the outcomes (outputs), be evaluated to determine how these affect the cumulative risks associated with not achieving ecological goals for the area. It may require some additional analysis and could result in changes in the way the practices are applied, the provision of other goods and services, or the total risks to the systems being analyzed. It becomes an iterative process, analyzing risks to

Table 1—Attributes and characteristics typically associated with broad resolution, regional assessments.[1]

Attributes	Landscape ecology	Terrestrial	Aquatic	Social/Economic
Geographic extent	River basin	River basin	River basin	States
Data resolution[2]	100 ha	100 ha	400,000 ha Sub-basins	State, County
Organizational hierarchy	Multiple watersheds	Community & species associations	Watersheds, communities of species	State, County
Map scale	1:100,000	1:2,000,000 1:1,000,000	1:100,000	1:1,000,000
Time period[3]				
Short term	1-10 years	1-10 years	1 -10 years	1 -5 years
Long term	10-300 years	10-100 years	10-100 years	5-50 years

[1]The general size of these assessments is millions to billions of km^2 and the general use is for national and regional planning and policy-making.

[2]Defining vegetation components is typically on a resolution of 100 ha while the aquatic components are defined by river systems (400,000 ha).

[3]Short- and long-term time periods for historical and projected patterns and processes differ between types of assessments.

resources, determining the effects on outputs (outcomes), modifying actions that result in new projections of output levels, determining risks to ecological goals, adjusting as appropriate, and cycling through the analysis until the risks to ecological goals are acceptable and the output levels are achieved to the extent possible.

In risk management, the final step involves determining the societal acceptability of risks.[4] It may be that even the broad magnitudes of risk (for example of species extinction) are not societally acceptable. On the other hand, reducing risks to future generations of, say, catastrophic fire might be highly desirable. Given the cumulative nature of these risks, there is danger that land managers too often take societal acceptability of land management actions for granted. By attempting to manage the risks, we increase the probability of societal acceptance of our management actions.

Scales

The term "scale" can have several meanings. These different meanings often are confusing when referring to geographic extent, timeframe, data resolution, and map scale. To avoid this confusion when describing assessments, we use two-part names designating both the geographic extent and the resolution of the data. Tables 1, 2, and 3 show the relations between the different definitions where we refer to geographic extent, with examples such as regional, sub-regional, landscape, and site. Map scale represents a ratio of a distance on a map to the distance on the ground, for example 1:1,000 kilometers map scale. This document provides information based on two types of assessments, a broad-regional assessment and a mid-sub-regional assessment. Different disciplines used different notions of geographic extent, timeframe, resolution, and map scale (tables 1,2, and 3).

[4]We acknowledge that social acceptability is the result of interactions within our pluralistic cultural, legal, and regulatory systems. It is not always clear that reaching overall societal acceptability of ecosystem management objectives and actions is feasible without conflict.

Table 2— Attributes and characteristics typically associated with mid-resolution, sub-regional assessments.[1]

Attributes	Landscape ecology	Terrestrial	Aquatic	Social/Economic
Geographic extent	Multiple watersheds	Province	Multiple watersheds	County
Data resolution	100 ha	1-5 ha	15,000 ha watershed	County
Organizational hierarchy	Watershed	Species groups	Species groups	County
Map scale	1:100,000 1:24,000	1:100,000 1:24,000	1:100,000 1:24,000	1:100,000
Time period[2]				
Short term	1-10 years	1-10 years	1-10 years	1 -5 years
Long term	10-300 years	10-100 years	10-100 years	5-50 years

'The general size of these assessments is thousands to millions of km^2 and the general use is for state, regional, and local planning and policy-making.

[2]Short- and long-term time periods for historical and projected patterns and processes differ between types of assessments.

Table 3—Attributes and characteristics typically associated with fine resolution, landscape assessments.[1]

Attributes	Landscape ecology	Terrestrial	Aquatic	Social/Economic
Geographic extent	Watershed	Watershed	Watershed	Household
Data resolution	25 ha	1-5 ha	Streams	Household
Organizational hierarchy	Streams and vegetation patterns	Species	Species	Household
Map scale	1:24,000	1:24,000	1:24,000	1:100,000
Time period[2]				
Short term	1-10 years	1-10 years	1 -10 years	Months-5 years
Long term	10-100 years			

The general size of these assessments is tens to hundreds of km^2 and the general use is for multi-forest/district, forest/district, or area planning and policy-making.

[2]Short- and long-term time periods for historical and projected patterns and processes differ between types of assessments.

Data resolution pertains to the amount of information incorporated in the data for a given area. As an example, using a hand lens to examine a rotting log yields more detail (higher resolution) than taking pictures from an airplane. The degree of resolution generally focuses on ecosystem patterns and processes that are best addressed at a particular geographic extent. For example, in regional and sub-regional scale assessments, it may be difficult to adequately address ecosystem patterns and processes using only low resolution information, such as habitat conditions for species with limited distribution or small home ranges (O'Neill and others 1986). Similarly, assessments of economic patterns in rural communities may be more appropriate at landscape or larger geographic extents. In terms of map scale, resolution is the degree that different features may be distinguished.

Assessments made on a regional geographic extent show general trends and rates of change in resource condition, and describe broad-based existing conditions for key biophysical, economic, and social components. Such assessments describe social trends including trends in human population increases and urban versus rural economic growth. These assessments usually contain low resolution information on the spatial patterns of resources (for example, species distributions or mineral deposits) and associated risks to resource values (for example, fire and insect hazard).

Mid, sub-regional assessments provide more specific information than regional assessments. Mid-resolution data are usually used to provide information on patterns of vegetation composition and structure for sub-regional assessments. Similarly, the mid-resolution data describe trends in social well-being for communities of interest stratified by counties or groups of counties. For the Basin, mid, sub-regional assessments provide basic information about communities of interest, counties, and communities (places) across the Basin.

Assessments at the landscape extent or specific site extent provide the greatest detail (tables 1, 2, and 3). These assessments may cover landscapes, watersheds, individual project sites, or specific human communities. These assessments typically rely on high-resolution data regarding geology, soils, vegetation, streams, social aspects and economic systems. These assessments include information on individual communities and existing land uses, such as recreation and mining sites.

Assessments conducted over multiple geographic extents are important when describing ecosystems. For example, assessments made at the landscape or site geographic extents cannot adequately address general patterns and processes, such as habitat conditions for wide-ranging species or global climatic processes. In addition, regional and sub-regional assessments provide a necessary context for landscape assessments and more localized decisions. Together, assessments (ranging from site specific to regional geographic areas) provide a comprehensive setting in which to make the best-informed management decisions.

Conducting assessments at different geographic extents using appropriate data with appropriate resolution also can promote more effective stakeholder participation and learning. Many people see their interests affected primarily at the local level. They may choose not to participate in sub-regional or regional assessments because of an assumption that their local concerns will be diluted or unnoticed. Moreover, without the sub-regional and regional assessments, stakeholders and decision makers may have difficulty assimilating the magnitude and complexity of highly detailed, or localized landscape to site specific assessments. Conversely, stakeholders whose interests are national or regional may find it difficult to participate effectively in multiple landscape assessments based on high-resolution data.

Undertaking assessments at multiple geographic extents promotes the inclusion of more interests into the assessment process. It also serves to provide decision makers with the appropriate information for particular levels of decision making. Depending on the issues and policies being addressed, the type of assessment, data resolution, and geographic extent can overlap (tables 1, 2, and 3).

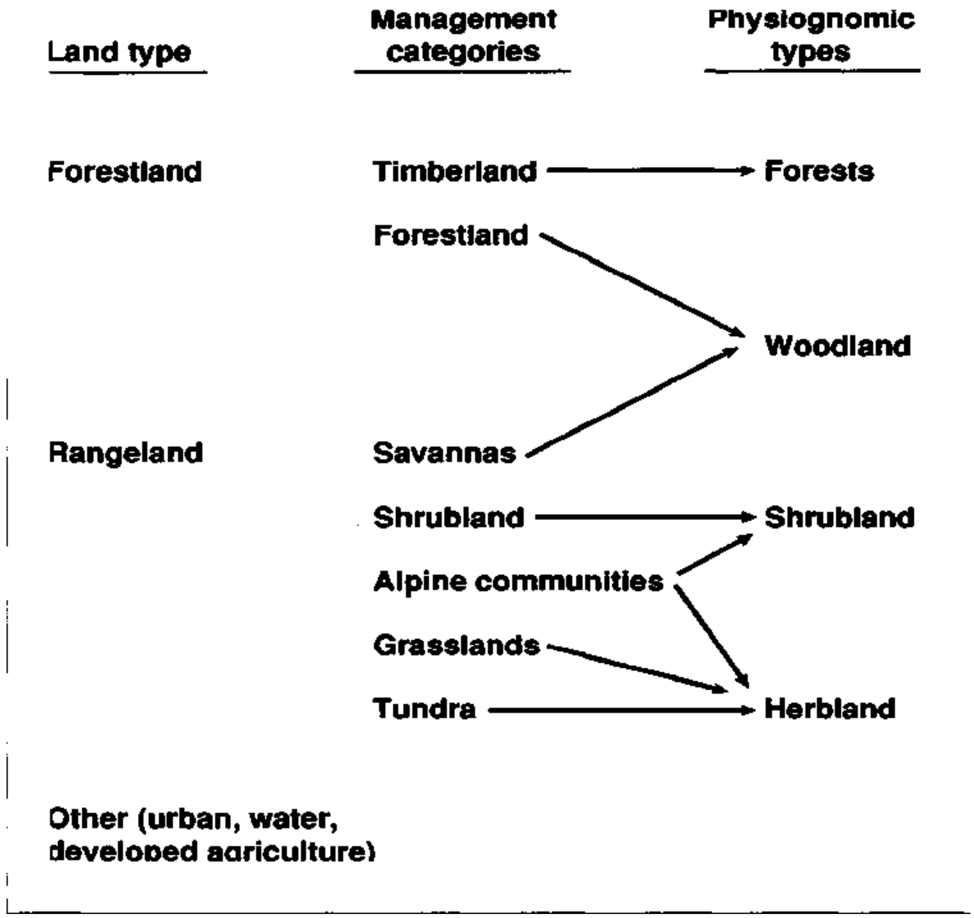


Figure 7—Typologies of land classifications.

Land classifications

Scientists and land managers use different terms when they describe the land base. In this integrated assessment we did not attempt to reconcile the terminologies but we do make clear how they fit together. The links between different typologies of land classification are shown in figure 7. On the left side are broad land classes as perceived by the public. In the center are management categories used by forest and range managers. These categories have formal definitions. Timberland is forestland that produces or is capable of producing crops of industrial wood, and that is not withdrawn from timber harvest, by statute or administrative regulation. It is capable of producing more than 20 cubic feet per year of industrial wood. Wilderness areas are an example of forestland that may be capable of growing 20 cubic feet per year but have been withdrawn (placed in reserved status) by Congressional action. Forestland is land with at least 10 percent of the area containing forest trees of any size. Forestland includes transition zones such as Pinyon-juniper in the Southwest portion of the Basin, and forest areas adjacent to urban and developed lands. Rangeland management categories are delimited by the types of native vegetation (climax or natural potential) that dominate a site. The five categories listed are those found in the Basin. The right column lists the four classifications of plant communities used in the landscape characterization in the ICBEMP study. The links between terms are shown although there are slight differences in exact definitions. For example, the definition of the woodland plant community relies more on a percent canopy than on a measure of growth. In this integrated assessment, forestland is a close proxy for woodland.

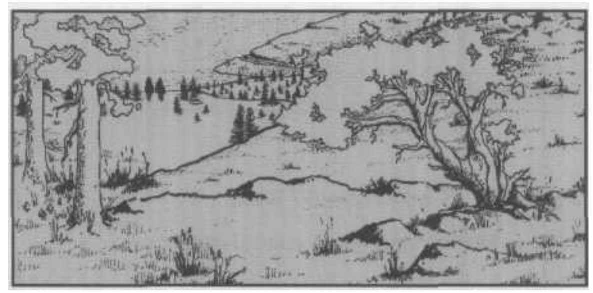
Biophysical template

The biophysical template is described by the interaction of disturbance and successional processes, and constrained by the spatial and temporal dynamics of the geologic, landform, hydrologic, soil, and climate processes. It controls the spatial and temporal dynamics in which species have evolved. The concern among ecologists is the lack of use of the biophysical template as a reference condition. Current biophysical conditions represent the accumulated effects of succession and disturbance regimes that have been significantly changed since the settlement of the Basin. The result has been both losses and gains of species, fragmentation of habitats, disturbance events that have higher intensities than co-developing soils and stream channels, loss of productivity, establishment of non-native species, and less favorable conditions for some native species.

Implicit in the goals for ecosystem management is working with the complexity of the biophysical template to provide people with ecosystem goods, functions, and conditions they want. Such an approach requires an understanding of rates of change and the evolutionary nature of the values that determine the biophysical template.

CHAPTER 3

CURRENT STATUS OF THE BASIN



This chapter describes the current status of the Basin. First, it paints the Basin in a broad brush, describing its physical features and some of the historical trends influencing current conditions. It sets the national and global context for management of FS- and BLM-administered lands in the Basin. It describes the ownership of land in the Basin, and illustrates the different ecological and economic areas that the SIT used to study Basin processes in greater detail. Finally, the chapter distills information on the current status of the Basin from each of the science staff areas: landscape ecology, aquatic/riparian ecology, terrestrial ecology, economics, and social science. Maps, figures, and tables are drawn from the individual assessments of ecosystem components, which is where much greater detail may be found describing conditions within the Basin. These reports are assembled in the *Component Assessment.*

Overview

The total assessment area of the Basin is 144.2 million acres (58.4 million ha), 76.2 million acres (30.9 million ha) of which are administered by 35 National Forests and 17 BLM districts (fig. 8, and table 4). The remaining area is divided among other Federal, state, county, and tribal governments and private land owners. The combined land administered by the BLM and the FS comprises about 53 percent of the total assessment area. Data were collected from an area somewhat larger than the assessment area to assist in landscape characterizations. Ownership differs substantially across the ERUs as shown in figure 9 (table 5). The proportion of each ERU administered by the FS or BLM is above average in the Central Idaho Mountains, Northern Great Basin, Lower Clark Fork, and Owyhee Uplands ERUs. The Columbia Plateau has the highest proportion of private owners, and the smallest percent of FS- and BLM-administered lands.

Among the forested ERUs, the FS and the BLM administer the largest proportion of area in the Central Idaho Mountains where they manage 81 percent of the land base. The FS and BLM administer the least proportion of area in the Northern Glaciated Mountains (FS and BLM manage 39%); and private ownership is the greatest in the Upper Klamath (50% private). Among the non-forested ERUs, the FS and BLM administer the greatest proportion of area in the Northern Great Basin (73% FS- and BLM-administered, 21% private), and the least in the Columbia Plateau (12% FS- and BLM-administered, *76%* private).

Vegetation is mapped into potential vegetation groups (PVG) that have similar environmental conditions and are dominated by similar vegetation (for example, the dry shrub PVG). They are often grouped by similar types of life forms. The PVGs found in the Basin and their relative proportions are shown in table 6.

The lands in the Basin are highly diverse. They range from the crest of the Cascades to the continental divide in the Rocky Mountains. The Basin contains some of the most majestic mountain

Table 4—Ownership of lands within the Basin assessment area.

Ownership	Lands		
	....acres....	—hectares—	-percent-
BLM- or FS-administered lands	76,274,273	30,867,100	53
Other Wilderness and National Parks	1,599,761	647,400	1
Private and other lands	54,666,141	22,122,600	38
State and other Federal lands	6,236,940	2,524,000	4
Tribal lands	5,437,061	2,200,300	4
Basin total	144,214,176	58,361,400	100

Note: Areas generated from 1 sq. kilometer grid using Geographic Information System. Totals will not match official Government Land Office totals.

landscapes in the nation. The Bitterroot, Selkirk, Steens, Cabinet, Salmon River, Lemhi, and Purcell mountain ranges commonly have elevations over 5,000 feer (1,524 m). Within these ranges, the valley bottoms can be low (725 feet/225 m) and the topography steep (McKee 1972). In contrast, much of the Klamath Basin is considered high desert with valley elevations generally over 4,000 feet (1,200 m). These mountains and valleys are underlain by metamorphosed schists and gneiss, marine sedimentary rocks, granitic batholiths, bedded sandstone, basalt, and belt series metasediments (Baldwin 1959, McKee 1972). Most have been altered by mountain and continental glaciation (McKee 1972).

In eastern Washington, northern Idaho, and western Montana, many of these mountains and valleys are covered with volcanic ash. During the last 4,000 years, volcanoes of the Cascade Range have erupted about twice per century. Effects of blasts, lava flows, floods, or other volcanic deposits are extensive. The ash deposits produced highly productive soils with excellent water-holding characteristics (Geist and Cochran 1991). In contrast, many of the soils derived from the batholith in central Idaho are very droughty and highly erosive (Ross and Savage 1967). The parent materials of the Klamath Basin developed into a variety of young soils, many with a pumice mantle (Geist and Cochran 1991).

In addition to the mountains and valleys of the Basin, there are vast plains, prairies, deserts, and rolling hills. Many of these features are the result of basalt flows. Twenty-five million to twelve million years ago, these flows created a broad basalt plateau that covered more than 26 million acres (10 million ha) in eastern Washington and Oregon and southern Idaho (McKee 1972).

From 18,000 to 14,600 years ago, a series of floods from glacial Lake Missoula scoured much of eastern Washington, removed topsoil, and eroded the underlying basalt (Allen and others 1986, Dietrich 1995, McKee 1972, USDI 1982). Silt and fine sand outwash from glaciers and glacial outburst floods were entrained by wind and redeposited as thick blankets of loess. Sequential layers of loess cover much of the Columbia Valley, Columbia Plateau, and Snake River Plain. These areas support much of the dryland and irrigated agriculture in the region.

The plains of southeastern Oregon, which are encompassed by the Great Basin, are primarily a series of depositional landscapes. Scores of lakes developed in the Great Basin during the Pleistocene

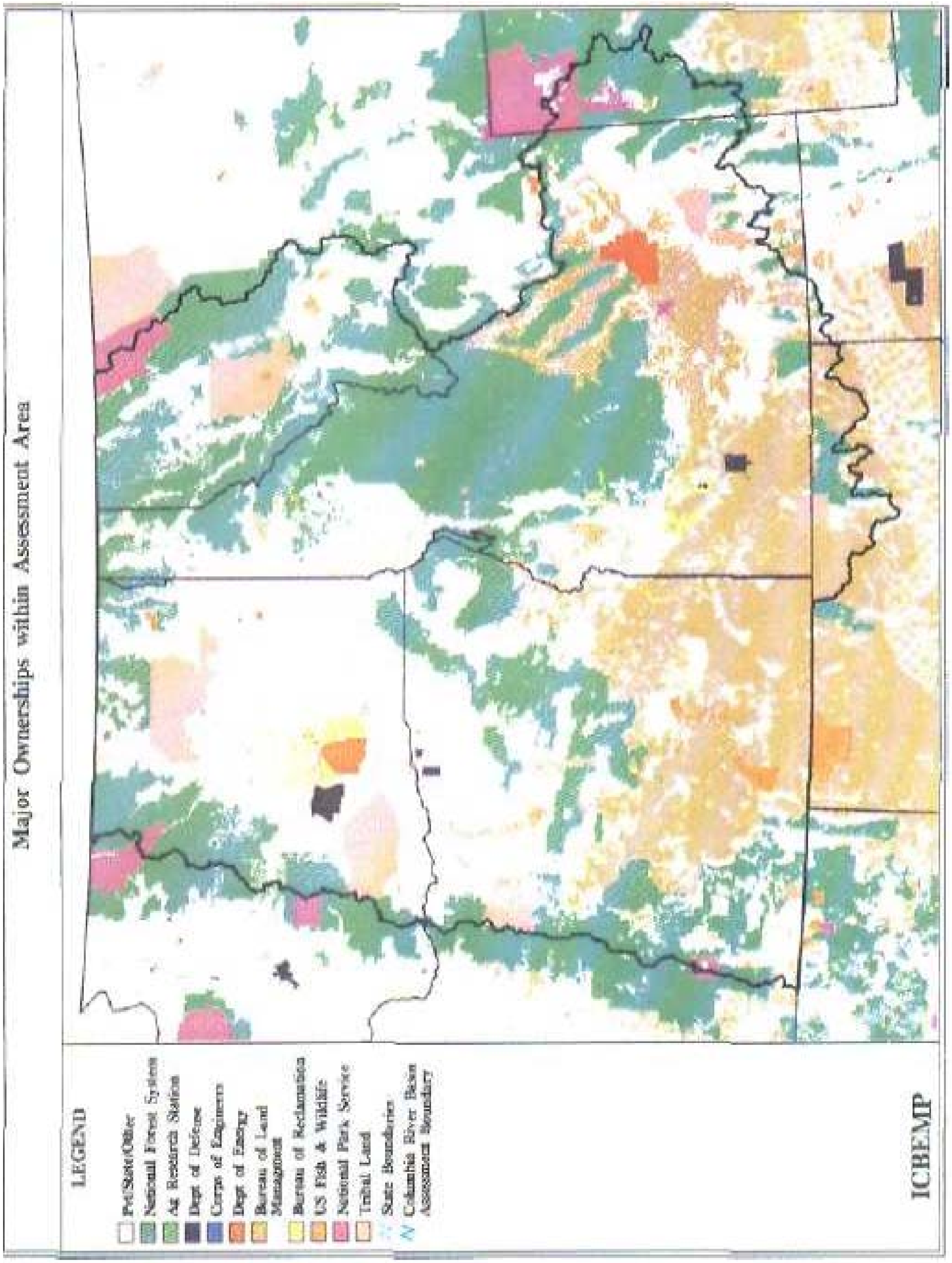


Figure 8—Major land ownerships within the Basin

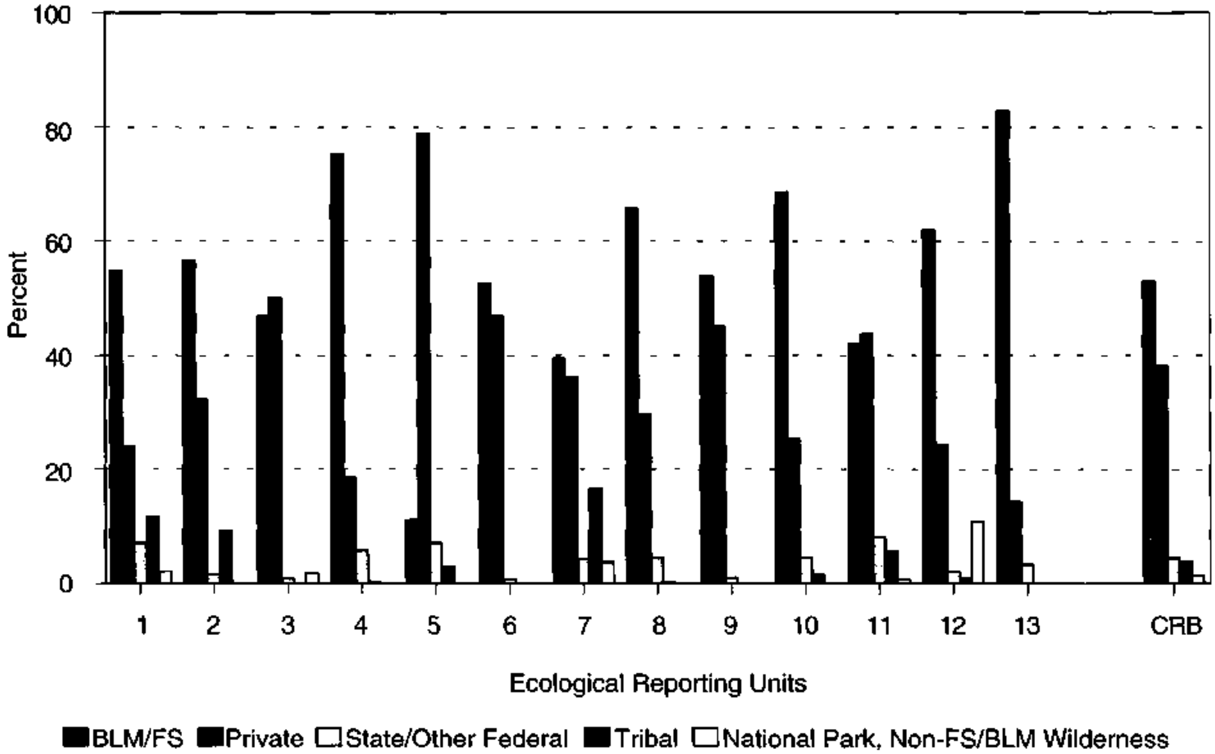


Figure 9—Percentage of Ecological Reporting Unit area by land ownership.

(Smith 1978). The largest of these, such as Bonneville and Lahontan Lakes, covered much of northwestern Utah, northwestern Nevada, and portions of southeastern Oregon (Harper and others 1994).

The climate in these landscapes varies, depending on elevation and the location of the site in relation to the rain shadows caused by the Cascades, Bitterroots, Salmon River, and other major north-south mountain ranges (Cooper and others 1987, Finklin 1983, Finklin and Fischer 1987, Franklin and Dyrness 1973, Graham 1990, Pfister and others 1977, Steele and others 1981). The landscapes of the prairies, deserts, and plateaus and distribution of vegetation vary depending on the soils, long-term precipitation patterns, and climate. They are often highly diverse and productive biospheres (Dietrich 1995, McKee 1972, Schwantes 1991).

The soils and climate of the mountain landscapes support vegetation ranging from moisture-loving species like western hemlock, western red cedar, and huckleberries to dryland species like sagebrush and Idaho fescue (Cooper and others 1987, Franklin and Dyrness 1973, Pfister and others 1977, Steele and others 1981). In the mountains of the Basin, tree species range from mountain hemlock and subalpine fir at the higher elevations to ponderosa pine in the valley bottoms. Mixed conifer forests dominated by white fir, grand fir, or Douglas-fir occupy many of the mid-elevation forests. Lodgepole pine forests occupy large portions of the Basin.

Huckleberries, buck brush, alder, and sagebrush are some of the shrubs present in the forests of the Basin. Manzanita is more common in the forests of the Klamath Basin than in other regions (Franklin and Dyrness 1973). In addition, juniper, bitter brush,

Table 5—Land ownership, by Ecological Reporting Unit for the Basin assessment area.

	Ownership/Administration					
ERU	**FS/BLM**	**Other Wilderness/ National Parks**	**Private**	**State/ other Federal**	**Tribal**	**Total land area**
1. Northern Cascades	1,399,800	54,100	609,300	181,300	296,800	2,541,300
2. Southern Cascades	768,700	0	440,300	20,200	126,200	1,355,400
3. Upper Klamath	737,700	31,300	786,600	11,800	0	1,567,400
4. Northern Great Basin	3,160,300	0	782,500	240,300	7,200	4,190,300
5. Columbia Plateau	1,053,600	800	7,514,700	674,900	282,600	9,526,600
6. Blue Mountains	2,667,900	0	2,378,100	35,200	600	5,081,800
7. Northern Glac. Mtns	2,734,200	256,400	2,500,800	294,000	1,155,200	6,940,600
8. Lower Clark Fork	1,782,000	0	803,000	120,100	3,400	2,708,500
9. Upper Clark Fork	1,238,100	0	1,033,900	19,800	1,900	2,293,700
10. Owyhee Uplands	5,452,500	0	2,002,200	355,300	117,000	7,927,000
11. Upper Snake	1,427,700	21,400	1,483,800	275,000	185,000	3,392,900
12. Snake Headwaters	1,635,400	283,200	639,100	55,400	24,400	2,637,500
13. Central Idaho Mtns	6,809,200	200	1,148,300	240,700	0	8,198,400
Basin total	30,867,100	647,400	22,122,600	2,524,000	2,200,300	58,361,400

(Source: Basin GIS data, converted to 1 sq. kilometer raster data)

and associated bunch grasses occupy many of the drier sites of the Basin. Included in these mosaics of vegetation are rich riparian areas that support willow, brome grass, and other similar species (Clary and McArthur 1992). Prior to cultivation, sagebrush and grasses dominated the prairies and plains (Daubenmire 1970).

Many species of wildlife inhabit the mountains and valleys of the Basin. Grizzly bears, black bears, mountain lions, and salmon exist within the Basin along with such highly prized game species as Rocky Mountain elk, mule deer, and white-tailed deer. The bald eagle and northern goshawk are important raptors that prey on squirrels, chipmunks, woodpeckers, and a host of other species (Reynolds and others 1992). The ecosystems of the Basin also support a multitude of other vertebrate and invertebrate species.

The Columbia River and its tributaries wind their way through this varied landscape. The source of the river is Lake Columbia in British Columbia, Canada. The river falls over 2,450 feet (750 m) between its source and the Pacific Ocean—four times the fall of the Mississippi River in half the distance. Before the construction of the dams, the Columbia River carried 7.5 million tons (7 million metric tons) of sediment to the sea every year (Dietrich 1995).

Table 6—Summary of potential vegetation groups within the Basin.

Potential vegetation group	Assessment area
	-percent-
Agricultural	16.1
Alpine	0.2
Cold Forest	9.9
Cool Shrub	7.8
Dry Forest	17.7
Dry Grass	4.0
Dry Shrub	22.8
Moist Forest	17.9
Riparian Shrub	0.5
Riparian Woodland	1.3
Rock	0.2
Urban	0.2
Water	0.9
Woodland	0.6
Basin total[1]	100.0

Note: Data from report Ah44; 0l-May-96.

'Total not exactly equal to 100 due to rounding.

Improvements to facilitate Columbia River navigation began in 1876 with the construction of locks and canals. The first large-scale dam, Minidoka, was built on the Snake River in 1909 by the Bureau of Reclamation. Dams like the Bonneville (1938) and Grand Coulee (1941) were the beginning of a 28 major dam system on the Columbia River and its tributaries. By 1975, the waterway between Lewiston, Idaho, and the Pacific Ocean had become a series of reservoirs. This dam system provides electricity throughout the Northwest, navigation and irrigation benefits, flood control, and recreational opportunities.

Agriculture, including irrigated and dryland farming and livestock production, is common in the valley and plateau regions. Today, some rural and natural settings within the Basin have given way to expanding population centers; such as Bend, Oregon; Boise and Coeur d'Alene, Idaho; Missoula, Montana; Pasco/Kennewick/Richland ("Tri-Cities"), Spokane, Wenatchee, and Yakima, Washington.

Context

The Columbia River Basin is part of larger natural and human systems. Studying the Basin by itself provides valuable information, but its economic, cultural, and ecologic significance goes beyond its own borders. It influences, and is influenced by, activities occurring within the United States, North America, the Pacific Rim, and the world. National and worldwide status and trends in population, resource use, and energy consumption are examples of factors that may affect conditions, options, and outcomes within the Basin. New technologies and efficiencies developed elsewhere change resource flows, limits, and use. Examining some of these factors provides context for this document, and for the ICBEMP.

Land area

The Basin covers about 8 percent of the United States land area and, at about 225,000 square miles (58.4 million ha), is just 20 percent smaller than Texas (all comparisons to the U.S. refer to all 50 states, unless noted otherwise). The Basin encompasses 24 percent of the National Forest System lands and 10 percent of the BLM-administered lands in the nation. Approximately 20.5 percent (11.5 million acres/4.68 million ha) of the acreage with American Indian reservations in the United States is also located in the Basin; of that, 2.2 million acres (0.9 million ha) are tribal lands within reservation boundaries. Designated wilderness, present in 46 of the 100 counties in the Basin, totals 10.3 million acres. As of 1990, the National Wilderness Preservation System (all agencies) totaled 92.2 million acres (37.3 million ha), with Alaska accounting for 57.1 million acres (23.1 million ha) of the total (Hendee and others 1990, in Cubbage and others 1993). Thus, the Basin includes 29 percent of wilderness acres within the contiguous United States.

Population

The total 1990 human population in the Basin was 2,913,927 about 1.2 percent of the nation's population (McGinnis and Christensen, in press) living on 8 percent of the nation's land base. The American Indian population by tribal membership is 64,000, which is 5.4 percent of the 1993 nationwide total. In the Basin, there are 22 federally recognized tribes, of 554 nationwide.

In a nation that has become largely urban, the Basin is strikingly rural. Over 77 percent of the U.S. population lives in urban areas; in the 13 western states[5] the percentage is even higher (84.6%)(Krannich and others 1994). By contrast, only 31 percent of the population in the Basin lives in urban areas, none of which contains more than 1 million people; only 6 of the 100 counties are considered metropolitan (McGinnis and Christensen, in press).[6] Sixty counties are in the most rural category defined by the Census Bureau (non-metropolitan), are not adjacent to a metropolitan county, and do not contain a community of at least 10,000 people. These 60 counties account for less than 25 percent of the Basin population.

Population density on non-public lands within the Basin is less than a third of the U.S. average: on average, 20 people dwell in 1 square mile (8/km) within the Basin as opposed to 70 people per 1 square mile (27/km) for the nation. Including Federal lands decreases population density to 11 people per 1 square mile (4/km). Sixty-two percent of the population within the Basin lives in communities of less than 10,000 people, in unincorporated places, or in open countryside—higher than the 43 percent average for the United States. These average population densities mask tremendous variation across the Basin, from fewer than 1 person per 1 square mile (0.26/km^2) in Clark County, Idaho, to as high as 338 people per 1 square mile (132/km) in Ada County, Idaho.

People living in the Basin are similar to other people in the Unites States in age structure, educational attainment, occupational distribution, and sources of income—although variation exists across the Basin. The Basin has a slightly higher percentage of people under the age of 18 than the U.S. average (28.9 versus 25.6%) and a lower percentage of people in the prime wage-earning years of 25 to 49 (36.0 versus 38.0%). Forty-eight percent of those people living in the Basin have achieved at least some level of higher education compared with 45 percent in the United States, suggesting it has a high-quality workforce. The racial and ethnic composition of the Basin is quite different from the rest of the country. Generally, the Basin has a higher percentage of Caucasians than the United States (91.7 versus 80.3%); it also has a greater proportion of Native Americans (2.4 versus 0.8%) and a smaller proportion of African-Americans (0.6 versus 12.1%), Hispanic Americans (6.7 versus 9.0%) and Asian Americans (1.1 versus 2.9%).

Recreation

There are about 4 acres (1.6 ha) of designated wilderness, national parks, and national recreation areas per person in the region compared with a national figure of 0.6 acres (0.24 ha). The relative rate of participation in outdoor recreation is higher than in other regions of the nation. Visits of over 200 million recreation activity days per year were made to Federal lands in the Basin. Currently there is a great deal of recreation activity in the Basin, averaging 31.5 recreation visitor days

[5]The West Census region includes Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

[6]The Census Bureau defines a metropolitan county as one in a metropolitan statistical area (MSA). An MSA has a population or at least 100,000 and includes a large population center of at least 50,000 and adjacent communities that are economically and socially integrated with it. The metropolitan counties in the Basin are: Benton, Franklin, Spokane, and Yakima Counties (Washington), and Ada and Canyon Counties (Idaho)(McGinnis and Christensen, in press).

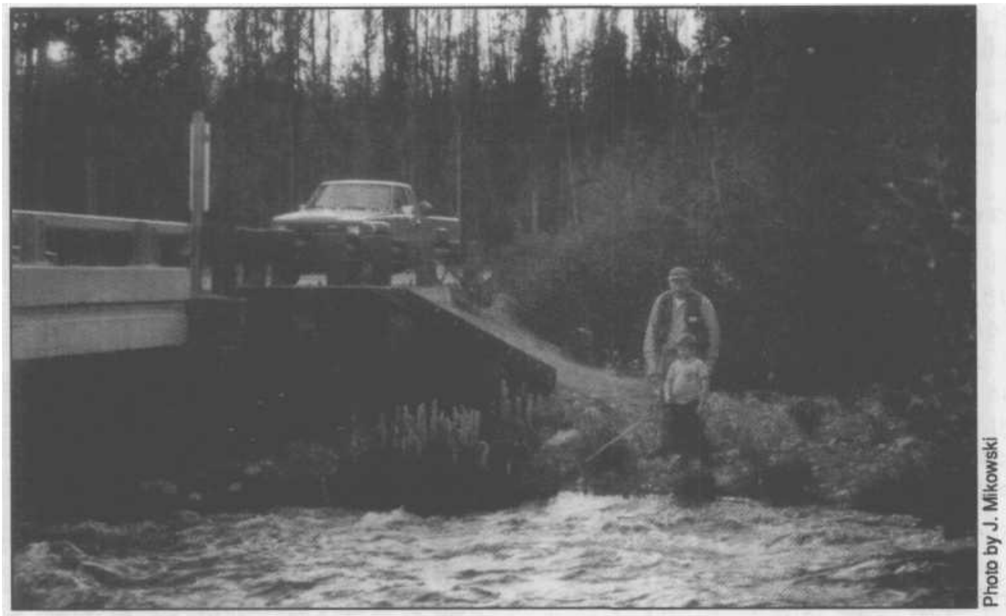


Photo 5- Roads provide access for a wide array of uses including cold water fishing.

(RVDs) per resident compared to a national average of 22.3 RVDs. Since 1980, RVDs of FS-administered lands in the Basin have increased 2.3 percent per year; at these growth rates recreation use will double every 31 years. Photo 5 illustrates the highest valued recreational activity in the Basin. Detailed data on recreation activities and use are given in the *Component Assessment-Economics* (Haynes and Home 1996).

Forestry

The forests of the Basin are categorized as temperate forests. Although there is a worldwide concern about deforestation, the temperate forests have actually increased in area (Brooks 1993). In the Basin, the total area in forest has remained relatively constant during the last two centuries *(Component Assessment*—Landscape Ecology, Hann and others 1996). Broad indicators of sustainability indicate that Basin forest acreage and inventory volumes are relatively constant. The Basin currently supplies about 10 percent of the total U.S. timber production, but this proportion has been declining since the early 1960s (fig. 10). This has resulted from increases in timber harvest in the southern United States and in Canada. These same trends are expected to continue (Haynes and others 1995).

Table 7 shows Basin forests and human populations in a national, continental, and global context. It illustrates that the Basin is relatively sparsely populated and well endowed with forests. In examining the number of forested hectares per person, it is important to consider the totality of values that forest ecosystems represent to people.

Forests (all ownerships) cover one-third of the total land area in the United States, about 737 million acres (298 million ha). Powell and others (1993) have summarized the forest resources of the United States. Some 490 million acres (198 million ha) of that is classified as timberland, that is, forestland capable of producing at least 20 cubic feet of industrial wood per year, and not reserved for uses incompatible with timber pro-

Table 7—Population, population growth rate, forest area, and forest area per capita, 1990.

Area	Population	Annual population growth	Forest area	Forest
	—millions—	—percent—	-million hectares--	-hectares/person-
Asia	3,071.6	2.0	484.5	0.16
Latin America	448.3	2.0	919.4	2.05
Africa	647.3	3.0	604.3	0.93
North America	275.7	1.0	751.4	2.73
Nordic	17.8	0.1	61.0	3.43
Europe	547.1	0.2	134.0	0.24
C.I.S.	287.7	0.7	941.5	3.27
Oceania	20.4	0.2	153.1	7.50
World	5,316.1	1.7	4,047.1	0.76
United States	248.7	0.8	298.1	1.20
Basin area	2.9	0.7	66.7	22.23

Note: Asia includes tropical and temperate zone countries. North America excludes Mexico. Nordic is Finland, Norway and Sweden. Europe category excludes Nordic countries and C.I.S. countries, includes Turkey. C.I.S. is Commonwealth of Independent States. Oceania is Australia and New Zealand only.

Sources: Haynes and Brooks (in press); Haynes and Horne (1996)

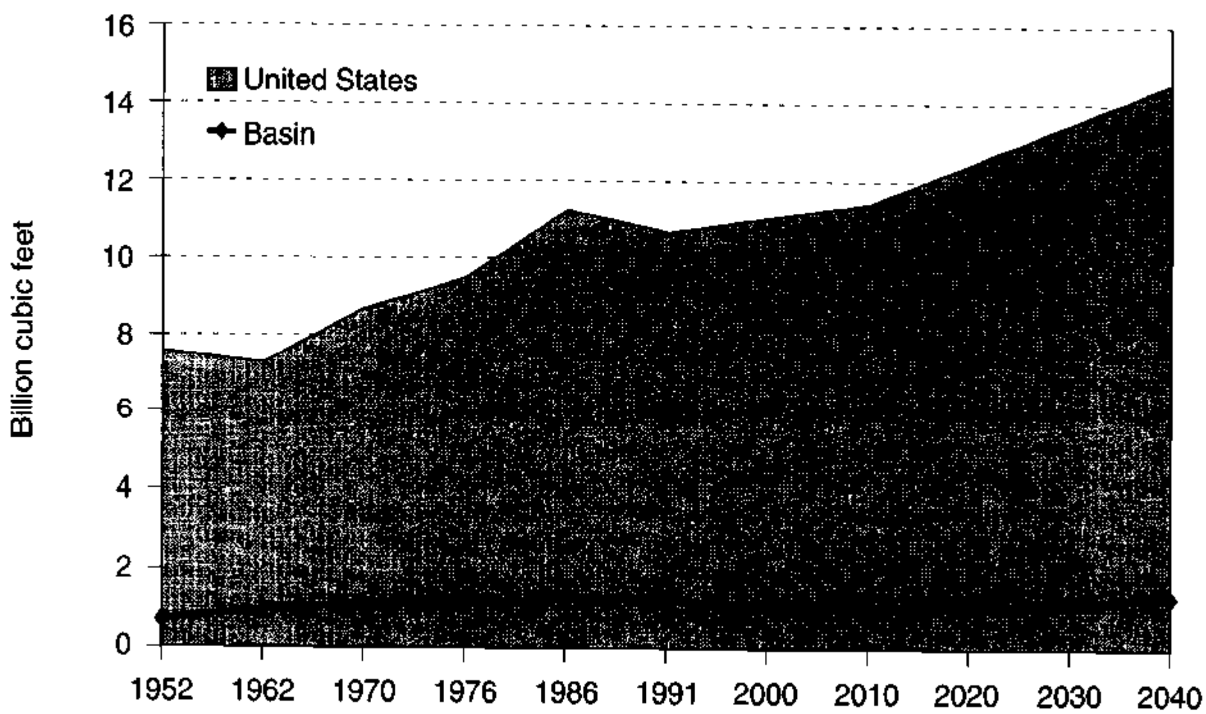


Figure 10—Historic and projected softwood timber harvest in the United States and in the Basin, 1952-2040.

duction. Almost all U.S. timberland is in the temperate zone and temperate tree species used for commercial purposes. Hardwoods, mostly in Washington and Oregon, occupy only 12 percent of the West's timberland. The forest inventory data suggest that forestland management in the United States is generally sustainable, but there are still unresolved issues such as biodiversity, soil depletion and productivity, lack of certain seral stages, and loss of what is publicly perceived as nonrenewable forest resources (such as Douglas-fir old-growth). About 73 percent of U.S. timberland is held in private ownership (358 million acres/145 million ha). The remaining 27 percent is held or administered by various public owners, with about 17 percent in national forests, 3 percent in other Federal ownership, 6 percent in state holdings, and 2 percent under county and municipal control. Timberland under American Indian sovereignty accounts for about 1 percent and is included in the category of private timberlands. Ownership of timberland areas varies substantially across the regions of the United States (table 8). In the Basin, private ownership accounts for 38 percent of the timberland, and 53 percent is FS- and BLM-administered. The other 10 percent is owned by state, and other governments and agencies. The national forests contain 89 million acres (36 million ha) of commercial forestland; the Bureau of Land Management (BLM) oversees management of another 6 million acres (2.4 million ha).

Range

Cattle grazing has been an important part of the Basin's economy since just after the Civil War. In 1992, the Basin accounted for four percent of the cattle inventories in the United States. More than 60 percent of this inventory is concentrated along the southern edge of the Basin coincident with the range PVGs. In general, cattle inventories in the Basin have fallen over the past four decades reflecting both changes in consumer tastes towards high-quality grain-fed beef and the development of large feedlot operations in the Great Plains states (Glover and Southard 1995).

The productivity of western rangelands is extremely variable; the better desert sites in Oregon and Washington produce up to 250 pounds of forage per acre, while grasslands may produce up to 5,000 pounds per acre (Joyce 1989). Rangeland condition has changed dramatically throughout the western states since Europeans first appeared. Misuse and overuse caused range conditions to be most degraded around the turn of the century, but range conditions have been improving in most areas since the 1930s (Joyce 1989).

There are 2.9 million Federal AUMs[7] in the Basin (see *Component Assessment—Economics)*. The FS accounts for 45 percent (35% in the upper Basin and 10% in the lower Basin) while the BLM accounts for 55 percent (38% in the upper Basin and 16% in the lower Basin). Reliance on Federal forage, defined here as the portion of total feed consumed by livestock provided by permitted use of FS and BLM lands, averages 7 percent for the Basin.

The degree of reliance on Federal AUMs is actually higher if the seasonal importance of Federal forage (which is at higher elevations and used for spring and summer grazing) is considered. For example, in the EIS we used a factor of 1.2 to estimate the effect of lost Federal AUMs. This was calculated from assumptions about the seasonal pattern herd size and extent of substitute feed during different grazing seasons.

Seven counties in the Basin had over 30 percent dependency on FS and BLM AUMs: Skamania, Washington (48%); Camas, Idaho (39%); Humboldt and Elko, Nevada (38% each); Custer and Clark, Idaho (36 and 34%, respectively); and Chelan, Washington (33%). Of the 100 counties in the Basin, *67* counties had less than 10 percent reliance on FS and BLM forage. Only five of the counties with over ten percent reliance on Federal grazing were large producers of cattle and calves (over $25 million).

[7]An AUM is the amount of forage required to sustain one cow, five sheep, or five goats for one month; forage includes grazed forage, hay, crop residue, silage, or grain.

Threatened and endangered species

There are over 17,000 known taxa within the Basin; there are 609 known vertebrate taxa within the Basin as compared with 45,000 vertebrate taxa globally (table 9). The Basin is home to 29 threatened or endangered species (table 10). Eleven percent (11 out of 100) offish taxa found in the assessment area are listed nationally as threatened or endangered under the Endangered Species Act (1973) by the Federal Government. The Columbia River Basin has relatively high diversity of fish species compared to other parts of the West (Great Basin, Colorado River, and others are lower), but lower when compared to eastern and Midwest states (such as states in the Mississippi drainage). Overall, from an aquatic standpoint the assessment area has a lower species diversity but higher endemism than the Mississippi drainage. The relative proportions of the threatened and/or endangered fish taxa are higher in the Great Basin and Klamath Basin portions of the assessment area than in the Columbia River Basin itself due in part to the greater degree of endemism in those areas.[8]

[8]Personal communication. June 18, 1996. Jack Williams, Bureau of Land Management. On file with: U.S. Department of Agriculture, Forest Service, U.S. Department of Interior, Bureau of Land Management, Interior Columbia Basin Ecosystem Management Project, 112 E. Poplar, Walla Walla, WA 99362.

Table 8—Areas of timberland in the United States by type of ownership and sections, 1992.

	Total United States		Region			
Type of ownership	Area	Proportion	North	South	Rocky Mt.	Pacific Coast
	Thousand —acres—	—Percent—		———Thousand acres.......		
National Forests	84,661	17.3	9,545	11,554	36,402	27,160
Bureau of Land Management	5,754	1.2	26	0	3,087	2,641
Other	6,239	1.3	1,252	4,456	253	278
All Federal	96,654	19.7	10,823	16,010	39,742	30,079
State	27,356	5.6	13,332	3,602	2,546	7,876
County and municipal	7,484	1.5	6,151	890	101	342
All public	131,493	26.9	30,306	20,502	42,388	38,297
Forest Industry	70,455	14.4	16,198	39,025	2,918	12,314
Farm	82,484	16.8	31,004	39,485	8,223	3,772
Miscellanous private	205,121	41.9	80,290	100,297	9,098	15,436
All private	358,061	73.1	127,492	178,807	20,239	31,522
All ownerships	489,555	100.0	157,799	199,309	62,628	69,819

Source: Powell and others 1993.

Table 9—Counts or estimates of total species biota of the Basin assessment area, estimated total U.S. species, and global diversity of organisms.

	Number of taxa in Basin		Global number of species	
Taxonomic group	**Known**	**Estimated**	**Described**	**Estimated**
Plants and allies				
Fungi	3,000	9,000	70,000	1-1.5 million
Lichens	736	736		
Bryophytes	811	860		
Vascular plants	8,250	8,350		
Algae			40,000	200,000-10 million
Plants			250,000	300-500,000
Total plants and allies	12,797	18,946		
Invertebrates				
Bacteria			4,000	400,000-3 million
Protozoa			40,000	100-200,000
Rotifers				
Nematodes				
Mollusks	380	770	70,000	200,000
Arthropods	3,400	23,500		
Viruses			5,000	perhaps 500,000
Roundworms			15,000	500,000-1 million
Insects			950,000	8-100 million
Spiders and mites			75,000	750,000-1 million
Crustaceans			40,000	150,000
Total invertebrates	3,780	24,270		
Vertebrates				
Fish-natives	87	87		
Fish-exotics	54	54		
Amphibians	26	26		
Reptiles	27	27		
Birds	283	283		
Mammals	132	132		
Total vertebrates	609	609	45,000	50,000
Total all taxa	17,186	43,825		

Note: Basin figures are number of taxa (mostly species, with a few subspecies of particular conservation concern); Basin fungi are macrofungi only. Global "Estimated" figures include undiscovered species.

[1] = No firm estimate available. Source: Marcot and others (1996).

Table 10— National and Basin federally-listed threatened and endangered plant and animal species.

Area	Number of taxa: Threatened	Endangered	Threatened or Endangered
United States			
Plants	92	434	526
Animals (including fish)	114	320	434
[Fish only]	[40]	[65]	[105]
US total	206	754	960
Basin Assessment area			
Plants	1	3	4
Animals (not including fish)	5	9	14
Fish	4	7	11
Basin total	10	19	29

Note: "Animals" category includes invertebrates as well as vertebrates.
Sources: Marcot and others (1996); U.S. Fish and Wildlife Service (1996)

Including subspecies, the assessment area supports 88 native fish taxa, of which 28 are narrowly distributed endemics. Of the 88, 11 are listed as threatened or endangered [out of 100 Threatened or Endangered taxa nationwide as of 8/20/94; 50 CFR 17.11 (U.S. Government 1994b)]. Of the 88, 13 are listed by the Federal or state governments as Threatened or Endangered; 47 of the 88 are listed as Threatened/ Endangered by the Federal or state governments, and/or as sensitive or candidate species by the Federal or state governments.

Water supply

Eighty-seven percent of the world's fresh water goes into agriculture (Giampietro 1994). In the United States, India, and many other countries, the decreasing level of water in aquifers affect food production (Brown 1995). Irrigation is by far the dominant off-stream use of water in the Basin, accounting for over ten times the combined volumes of water withdrawn by public supply, industry, and thermoelectric power plants (Jackson and Kimerling 1993). As elsewhere, competition for water in the Basin will likely become more contentious as demands mount for agricultural, industrial, and residential uses, as for recreation, fish and wildlife, and other in-stream uses.

Energy

World energy consumption was about 350 quadrillion (10^{15}) British Thermal Unit (BTUs) in 1990 and is expected to increase by a third by 2010 (Switzwer 1994). United States energy consumption was 81.5 quadrillion BTUs in 1991, four percent of which was attributable to hydropower (Wright 1994). Hydropower production on the Columbia and Snake Rivers represent 40 percent of the nations total hydropower production (Dietrich 1995). This source of energy will likely remain a substantial contributor to the region's energy demands.

Environmental initiatives

The FS and BLM, as part of a larger Federal Government system, are often connected to government-wide efforts to increase international coordination in the protection and maintenance of environmental quality. The Clinton Administration has made public commitments to manage the forests of the United States in a sustainable manner by the year 2000. The meaning of this commitment was clarified in February 1995, with the signing of the "Santiago Declaration" by representatives of the U.S. State Department in Santiago, Chile (*Component Assessment*— Social, McCool and others 1996). The Santiago Declaration is a non-binding agreement among the nations in the temperate and boreal forest zones to identify "Criteria and Indicators" for "the sustainable management of all types of forests," and it offers seven major criteria and *67* indicators to measure progress toward this goal.

Other types of non-binding, bilateral (two-nation) and multilateral (more than two nations) agreements have been signed to promote coordination among nations on specific issues. These agreements include protocols on the inspections for pests for international shipments of wood products, cross-boundary fire suppression (with Mexico and Canada), and management objectives for migratory species, such as Neotropical migratory birds. These agreements have been effective as long as there is voluntary compliance, and their major purpose has been to build a greater mutual understanding among nations on the various interests and problems in an increasingly interdependent world *(Component Assessment—Social)*. Finally, the ICBEMP does not cover the Canadian portion of the Columbia River Basin, but it does parallel Canada's Okanagan Desert ecosystem conservation project and other efforts.

Current Status of the Basin

This section provides highlights of the *Component Assessment* as it relates to the current status of the Basin. More in-depth discussions and detail are provided in the specific chapters of the *Component Assessment* report.

Landscape ecology[9]

The Landscape Ecology staff summarized the major biophysical patterns and hydrologic processes for each Ecological Reporting Area within the Basin. Each of the ERU summaries contains interpretations of subsection, lithology, potential vegetation, historical and current vegetation, basic climatic and morphometric descriptions; generalized soil characteristics and evaluation of productivity; stream type groups, valley bottom settings, and wetland complexes. Each summary describes upland erosion processes and sediment sources, vulnerability of stream channels to disturbances, channel recovery potential, and sensitivity of subwatersheds to disturbances. Summaries also include descriptions of terrestrial disturbances such as fire, succession, and grazing. The information delineates and describes terrestrial and aquatic ecosystems that behave in a similar manner given their potential ecosystem composition, structure, and function; delineates areas with similar production potentials for management; provides a basis for interpreting hazards and limits to management; outlines the natural disturbance processes that create finer-scale ecosystem patterns; and sets context for predictive models of ecosystem patterns and processes.

Throughout most forested ERUs, native herblands, shrublands, and old multi-layered and single-layered forests have declined substantially in area and connectivity since the Basin was first settled by European-Americans. In the last 100 years, exotic plant species have expanded throughout native forests and range-

[9]The material in this section is drawn from the material in the *Component Assessment—Landscape* Dynamics chapter and from the *Component Assessment*— Biophysical Environments chapter (Hann and others 1996; Jensen and others 1996).

lands, but most especially in areas that were once dry native herblands and shrublands (fig. 11). Over that same timeframe, area and connectivity of early-seral forests declined especially where historical fire regimes were predominantly mixed severity or lethal as in the Northern Glaciated Mountains. Intermediate-aged forest increased dramatically in area and connectivity as did the volume of timber in small-diameter classes. Affected by fire exclusion, selective harvesting, and grazing, forests expanded in areas of historical woodland and shrubland, and forest canopies became more complex and layered. Additionally, forests became more densely stocked, developed increasing dominance of shade-tolerant species, and became more susceptible to severe fire, insect, and pathogen disturbances.

Forest composition and structures have largely become more homogeneous. At the same time that late-seral structures have been declining, early-seral structures have also been declining (fig. 11). These structures have been replaced to a substantial degree with mid-seral structures, resulting in homogeneous forest structures. Although early-seral forests of shade-intolerant species have been fragmented, late-seral shade-tolerant forests have grown more contiguous. Consequently, many forest landscapes are now more homogeneous.

Fire severity has generally increased (lethal fires have increased by approximately 17%), and fire frequency has generally decreased (very frequent and frequent fire intervals have declined by approximately 32%) over the last 200 years (figs. 12 and 13, and table 11). The primary causative factors behind fire regime changes are effective fire prevention and suppression strategies, selection and regeneration cutting, domestic livestock grazing, and the introduction of exotic plants. Fire suppression costs, firefighter fatalities per year, and the proportion of high intensity fires have doubled between the periods of 1910 to 1970 and 1970 to 1995.

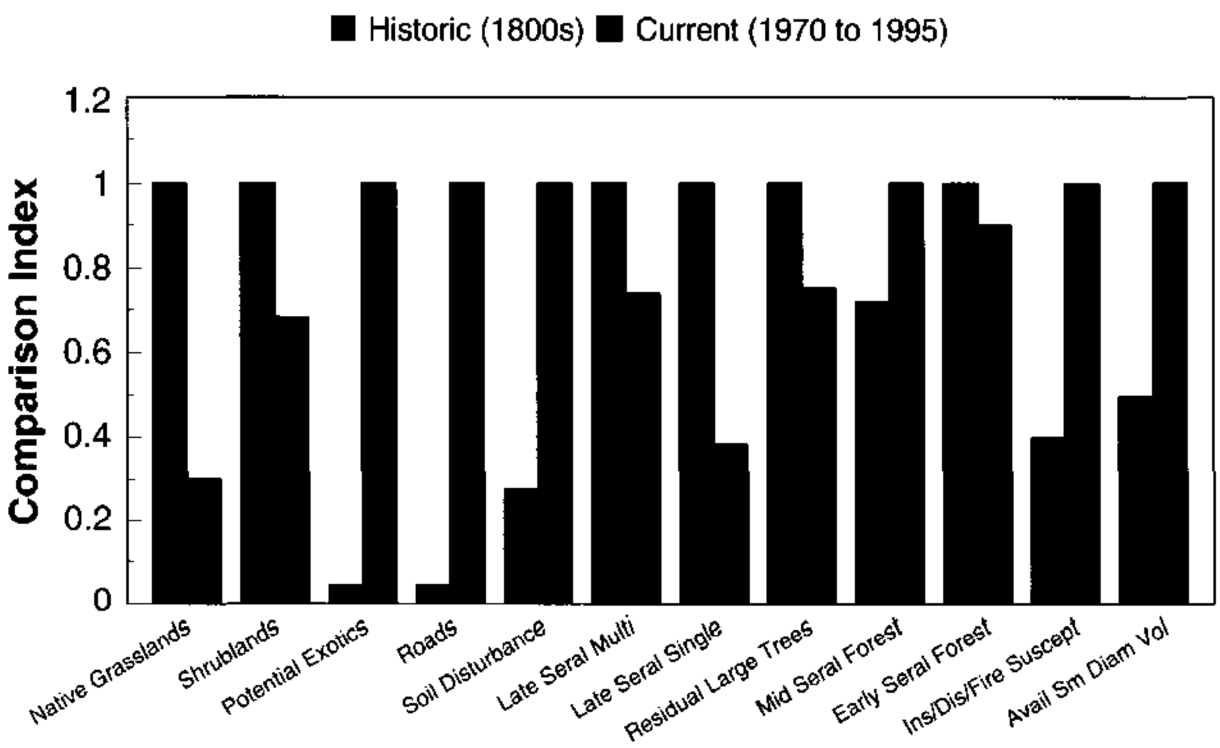


Figure 11—Comparison of historic and current selected landscape elements.

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Table 11—Fire regime severity/frequency classes within the Basin Assessment area.

Frequency Severity Class	Historic	Current	Change
		..............percent........—	
Lethal very frequent	0.0	14.2	14.2
Lethal frequent	21.5	6.0	-15.6
Lethal infrequent	20.4	34.5	14.1
Lethal very infrequent	3.2	8.1	4.9
Lethal extremely infrequent	2.2	1.5	-0.8
Mixed very frequent	0.6	0.0	-0.6
Mixed frequent	6.2	3.8	-2.5
Mixed infrequent	9.3	16.8	7.5
Mixed very frequent	1.3	0.0	-1.3
Nonlethal very frequent	24.3	1.4	-22.9
Nonlethal frequent	6.9	2.3	-4.6
Nonlethal infrequent	2.7	10.0	7.3
Rarely	1.3	1.5	0.2
No Data	0.1	0.1	0.0
Total	100.0	100.0	

Comparing fire severity between historic and current times for forested potential vegetation groups on FS- and BLM-administered lands show an increase in lethal fire from 20 to 50 percent of the area and a reduction in non-lethal fires from 40 to 15 percent (fig. 14). Subregional differences exists; although eastern Oregon and Washington as well as Idaho and western Montana show decreases in non-lethal fire, and increases in lethal fire, the drop in non-lethal fires in Oregon and Washington is greater than in Idaho and Montana. The increase in lethal fires has been greater in Idaho and Montana than in Oregon and Washington.

Altered fire regimes have been largely responsible for more homogeneous forests and rangeland landscapes. Large wilderness or unroaded areas prevail in ERUs such as the Central Idaho Mountains, Northern Glaciated Mountains, Northern Cascades, and Owyhee Uplands. Even in wilderness and unroaded areas, where fire exclusion alone has been the primary management influence, fire, insect, and pathogen disturbance regimes have been significantly altered. Despite these disturbance regime changes, wilderness and unroaded areas are among those least altered by management. Predicted road densities vary greatly across the Basin (fig. 15). Examples of road densities within subwatersheds are shown in figure 16. Roads are correlated with many changes in vegetation, land use, and hazards, yet a consistent inventory of roads across all ownerships within the Basin does not exist. Roads are important from both an ecological and socioeconomic perspective.

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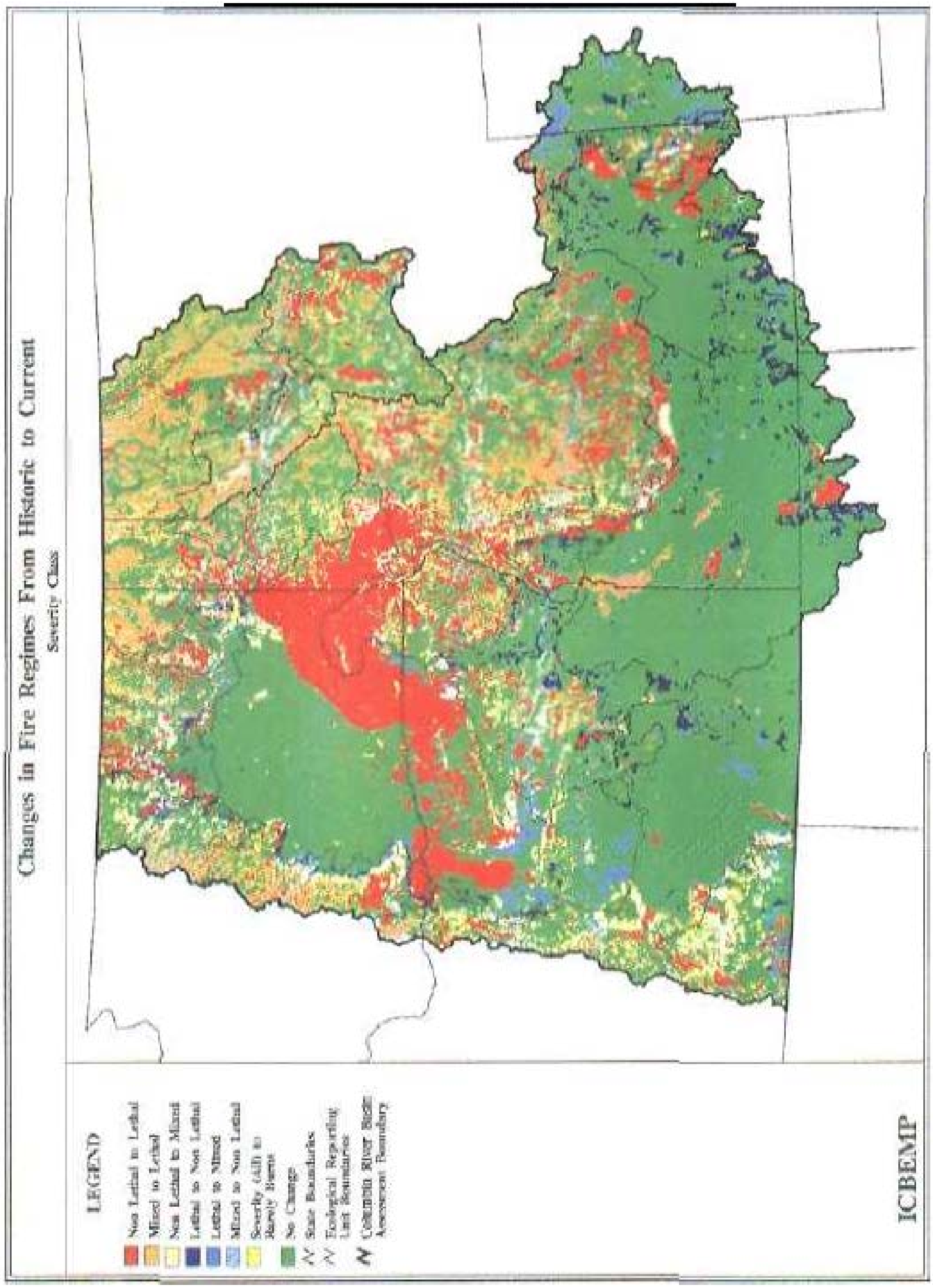


Figure 12—Changs in Basin fire regimes from historic to current by severity class.

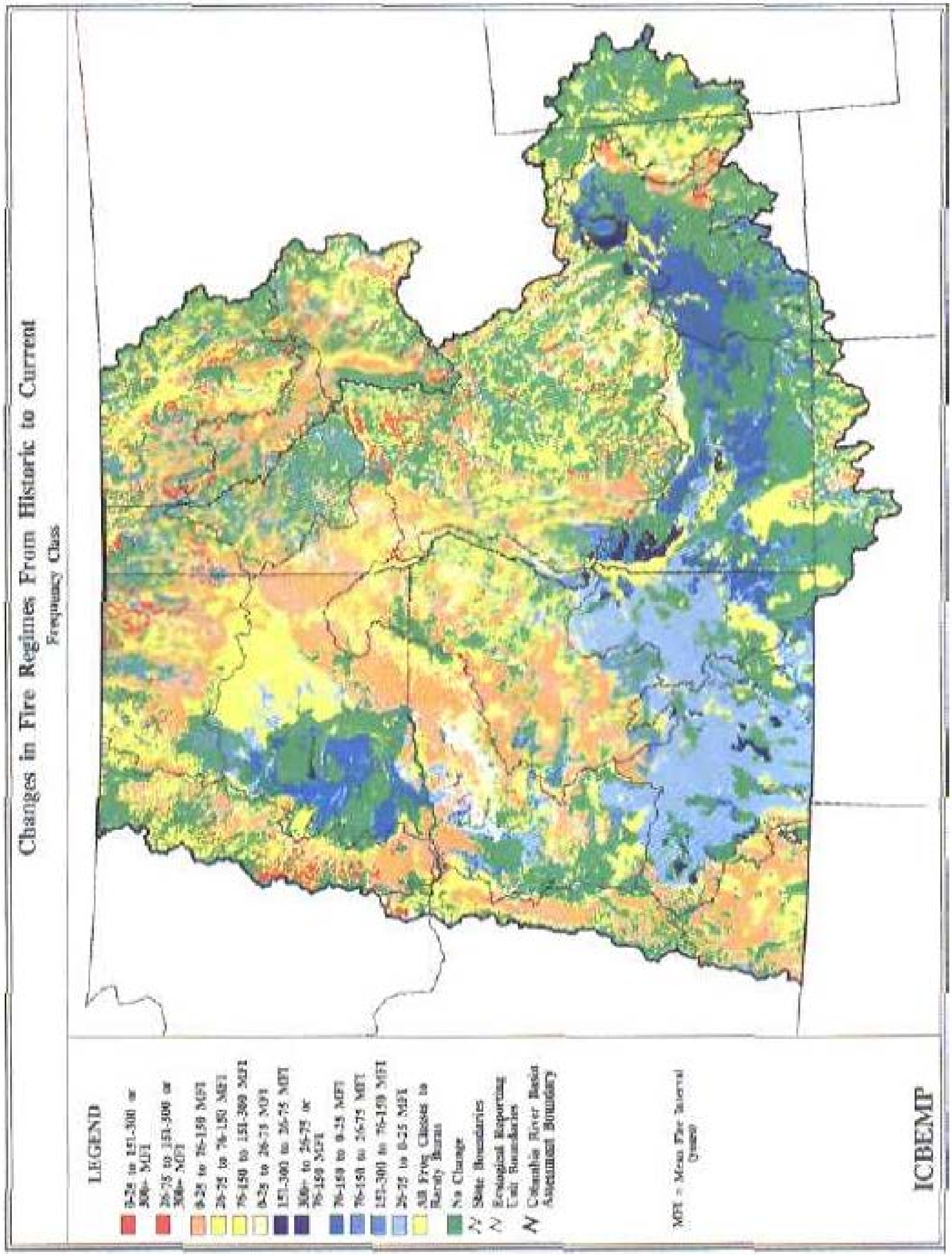
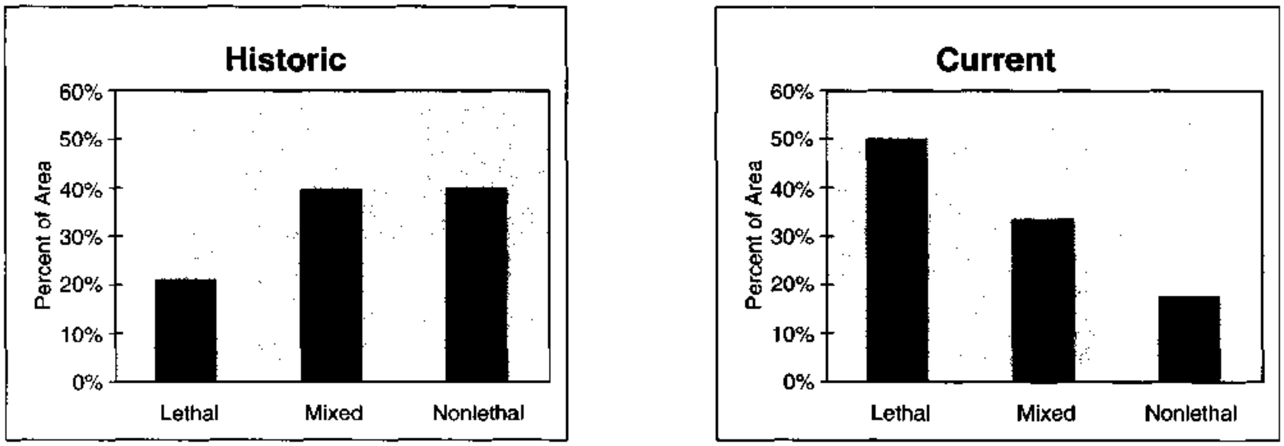


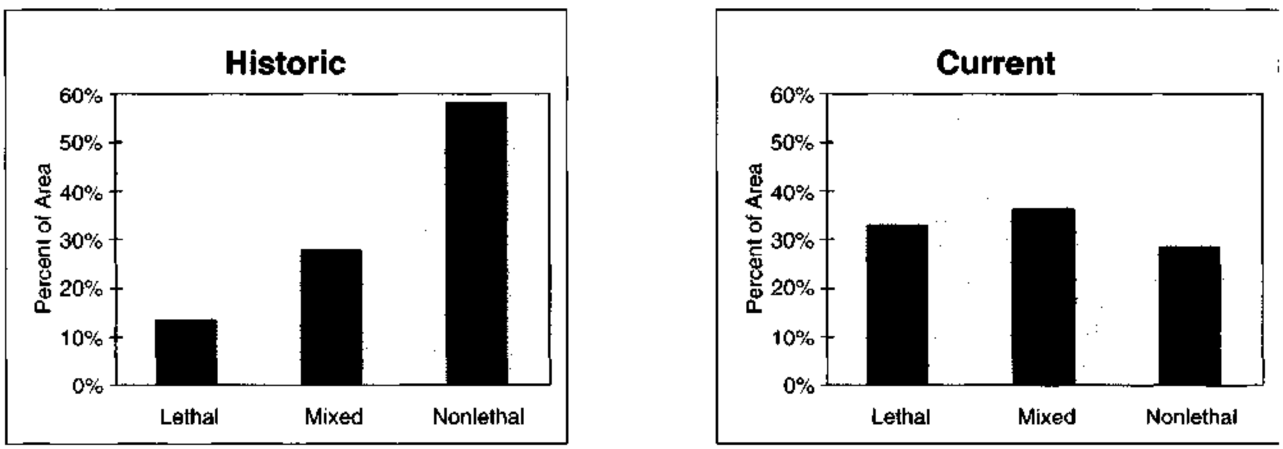
Figure 13—Changes in Basin fire regimes from historic to currem by frequency class.

Fire Severity for FS- and BLM-administered Forested Potential Vegetation Groups

Basin



Eastern Oregon and Washington



Idaho and western Montana

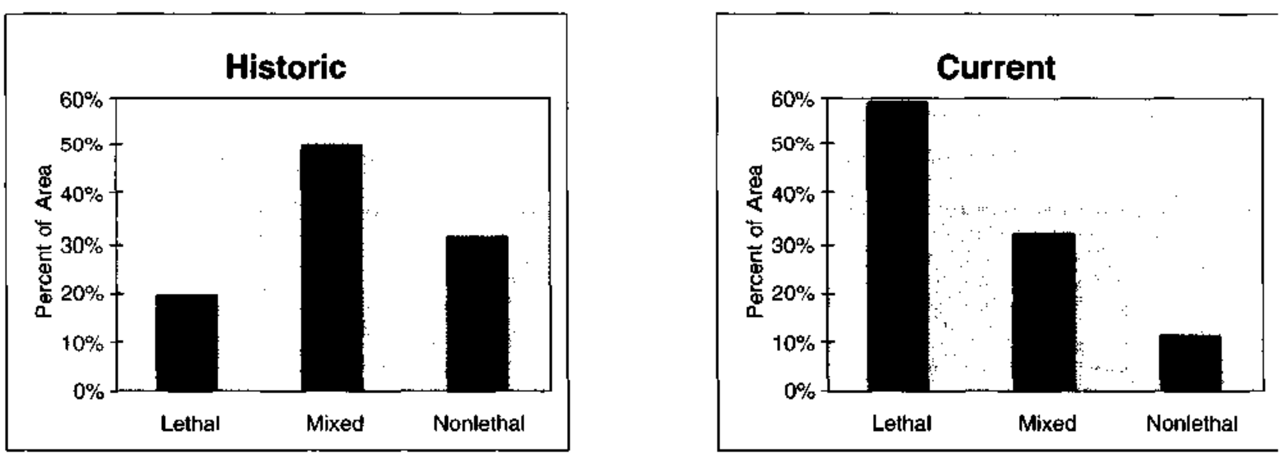


Figure 14—Fire Severity for FS- and BLM-administered Forested Potential Vegetation Groups.

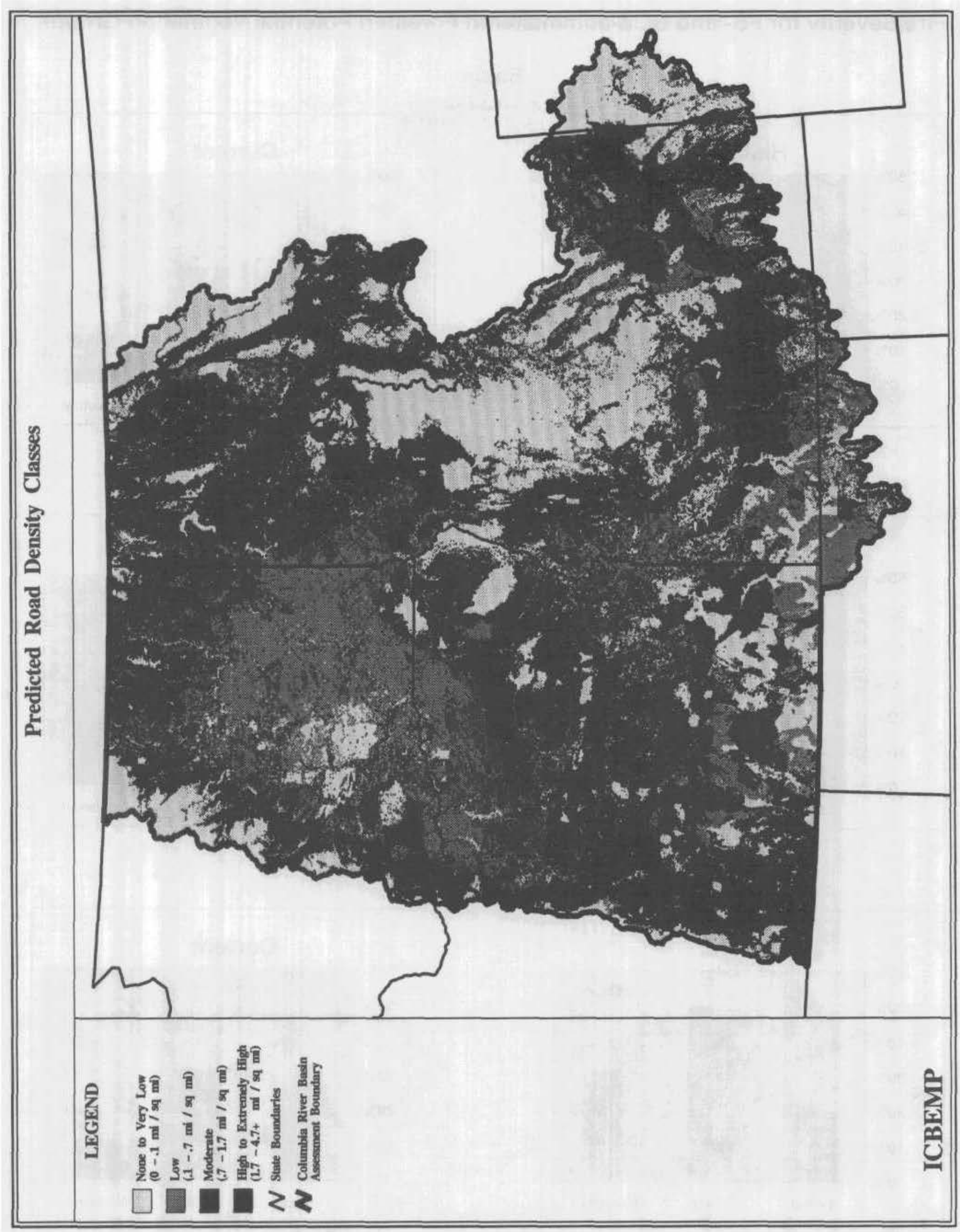


Figure 15—Predicted road density classes.

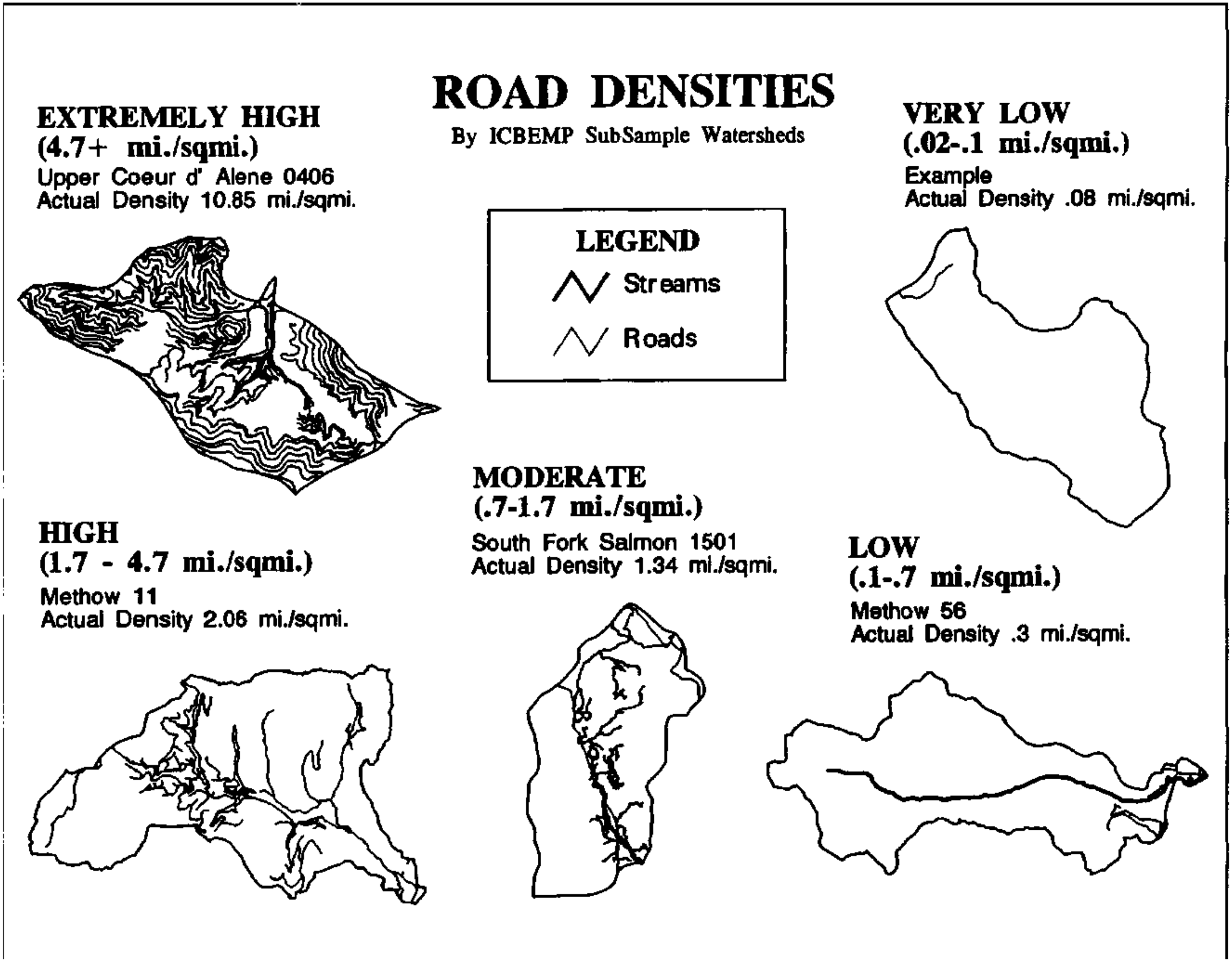


Figure 16—An example of road density categories for subwatersheds within the Basin.

Aquatic/riparian[10]

Seven key salmonids were selected for detailed analysis. These are bull trout, westslope cutthroat trout, Yellowstone cutthroat trout, and redband trout; steelhead; and ocean-type and stream-type chinook salmon. Less area within the basin is currently occupied by three or more key salmonids (fig. 17) than existed historically (fig. 18). Figure 19 shows the distribution of subwatersheds with by one or more key salmonid species stonghold. Key salmonid strongholds are subbasins that support strong populations based on the consideration of life history forms, trends in population numbers and relative abundance of individuals. Strong populations (fig. 20) are associated with higher-elevation forested lands, and the proportion declines with increasing road densities (fig. 21). The largest areas of contiguous watersheds supporting strong populations of key salmonids are associated with the Central Idaho Mountains, the Snake Headwaters, and the Northern Cascades ERUs. Important but more restricted areas are found in the Blue Mountains, Upper Clark Fork, and the Northern Glaciated Mountains ERUs. Strongholds varied between 32 percent of the occupied range for Yellowstone cutthroat trout and less than 1 percent for stream-type chinook/ salmon (table 12).

Many of the aquatic strongholds occur in areas of low road density (the definitions of road density categories are in figure 16). The higher the road density, the lower the proportion of subwatersheds that support strong populations of key salmonids (fig. 21). There is an apparent difference in the response of aquatic systems between FS-administered lands and all other lands at very low road densities. Strongholds within the "all lands" category decline more quickly as road density increases. Strongholds on FS-administered lands remain stable or slightly increase. At higher road densities FS-administered lands provide a greater proportion of strongholds. For the Basin, 56 percent of the unroaded area is in key salmonid strongholds but the proportion varies from a high of 76 percent in the Snake headwaters to none in the Upper Klamath (table 13).

Designated wilderness and potentially unroaded areas are important anchors for strongholds throughout the Basin. More than 19 million acres (8 million ha) (27%) of FS- and BLM-administered lands in the Basin contain strongholds (40% FS and 4% BLM). These stronghold subwatersheds contain large areas of unroaded land (about 11.6 million acres/4.7 million ha), averaging 58 percent of the area of an individual subwatershed.

The use of intensive forest management to re-establish more natural landscape patterns and disturbance regimes has variable risks and benefits across the landscape. However, the consequences of large fires are dependent on habitat conditions and the inherent resiliency of local populations. Damage to aquatic ecosystems from fire may be most severe when they have been seriously degraded and fragmented. Intensive management of watersheds that support healthy populations may pose greater risk for disruption of watershed processes and degradation of habitats than does fire.

Rehabilitation of 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. Thus, to realize the benefits of improved migration and ocean survival, there must be maintenance of good-quality freshwater habitats and healthy populations as well as increases in the distribution of high-quality spawning and early rearing habitats. Federal land management plays a key role in spawning and rearing habitats.

Analysis of the extensive stream inventory data reveals that major decreases in pool habitat, both frequency of pools and deep pools, have occurred over the last 40 to 60 years. These are attributable to losses in riparian vegetation, road and highway construction, timber harvest, grazing, farming,

[10]Details on historical trends and current status of the Basin's aquatic/riparian ecosystem are in the *Component Assessment*—Aquatic chapter (Lee and others 1996).

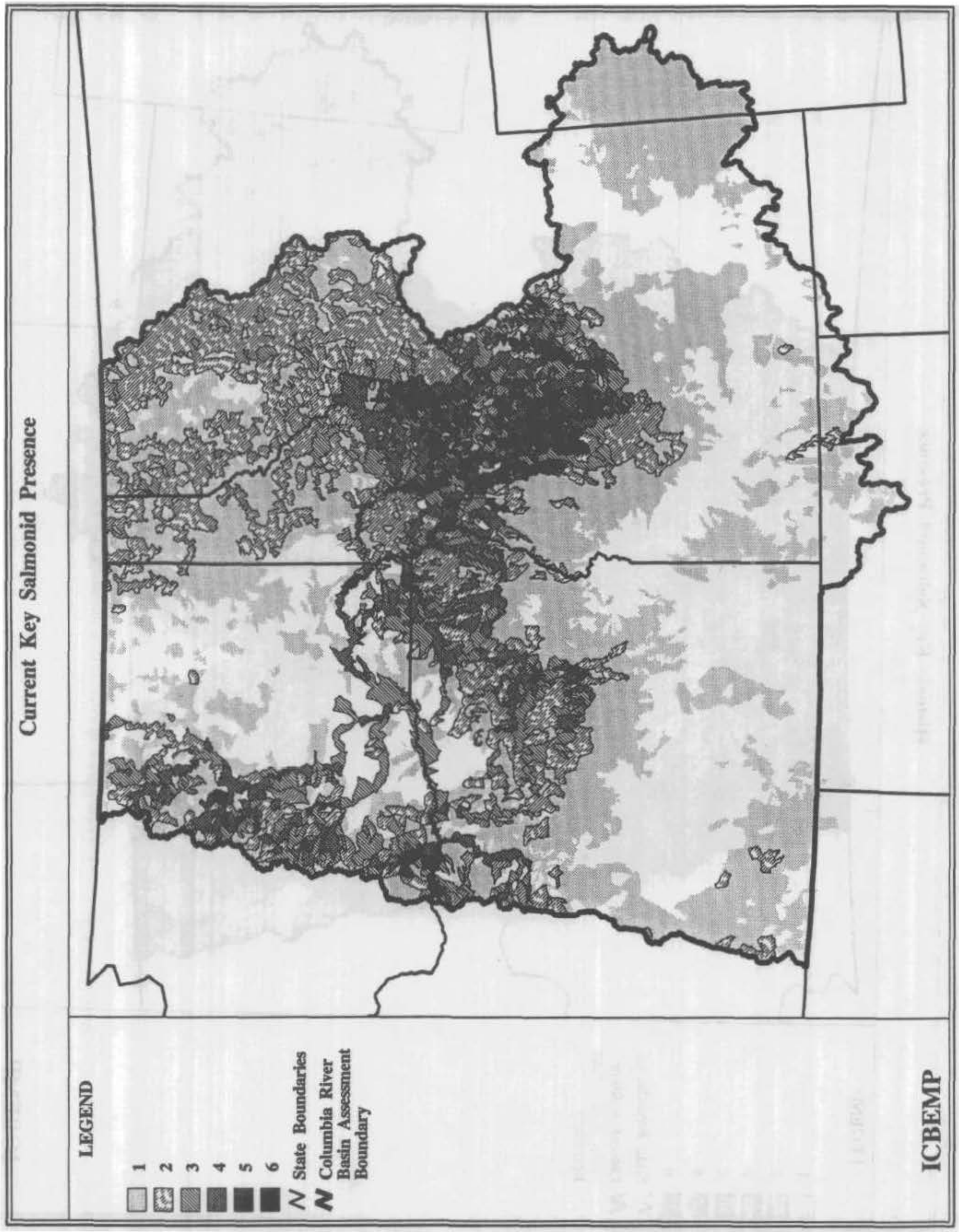


Figure 17—Current number of key salmonid species present within the Basin.

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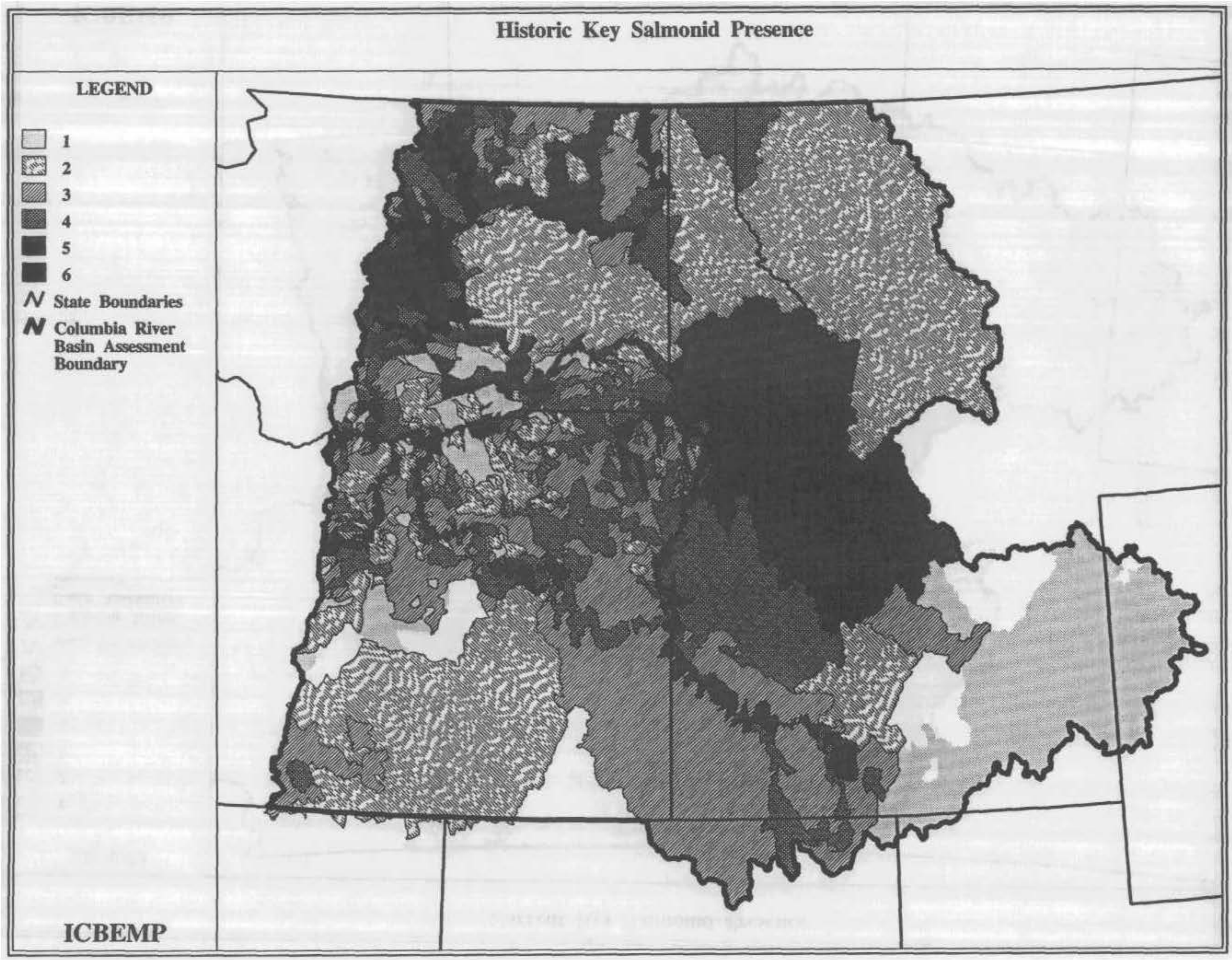

Figure 18—Historic number of key salmonid species present within the Basin

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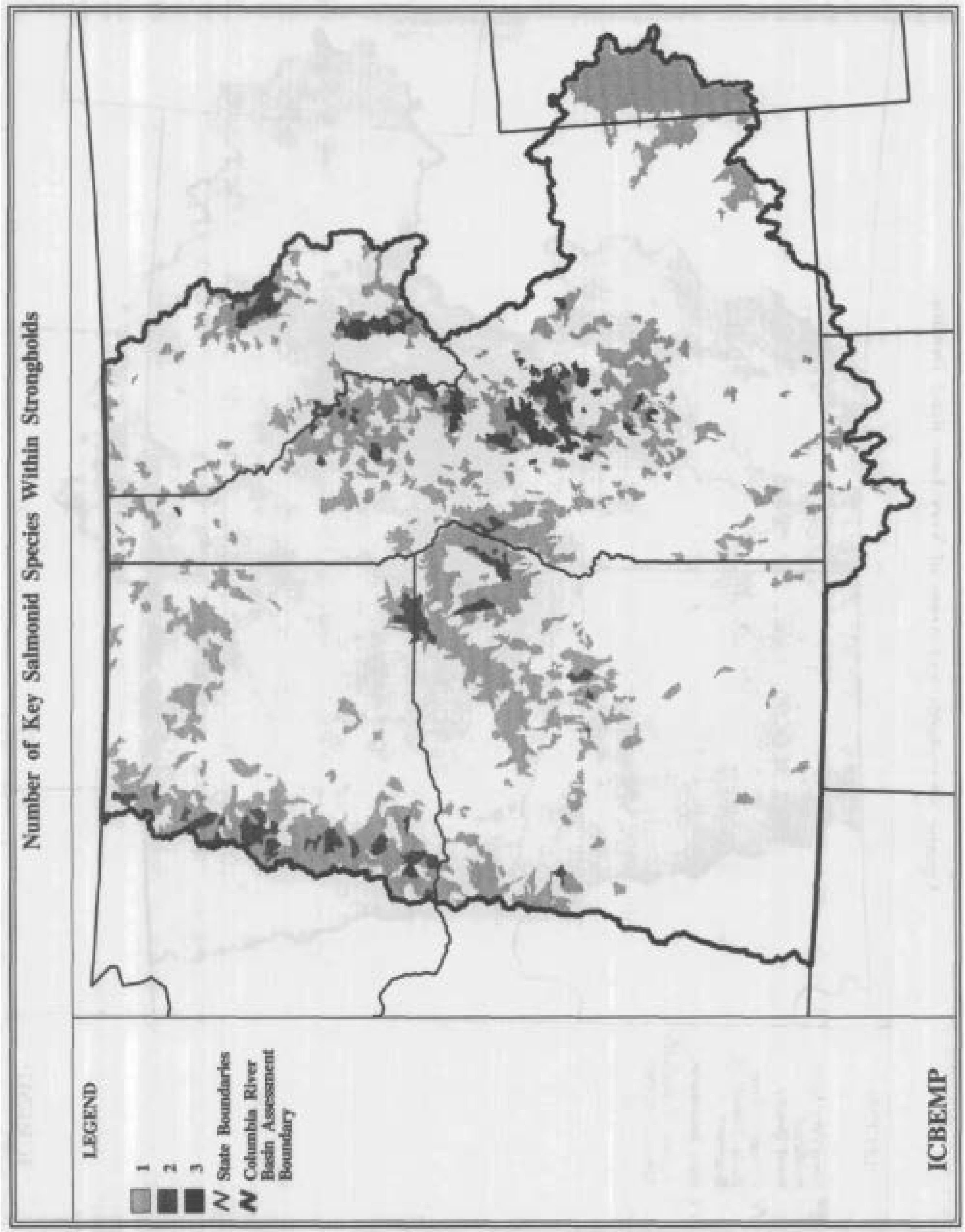

Figure 19—Number of key salmonid species within strongholds.

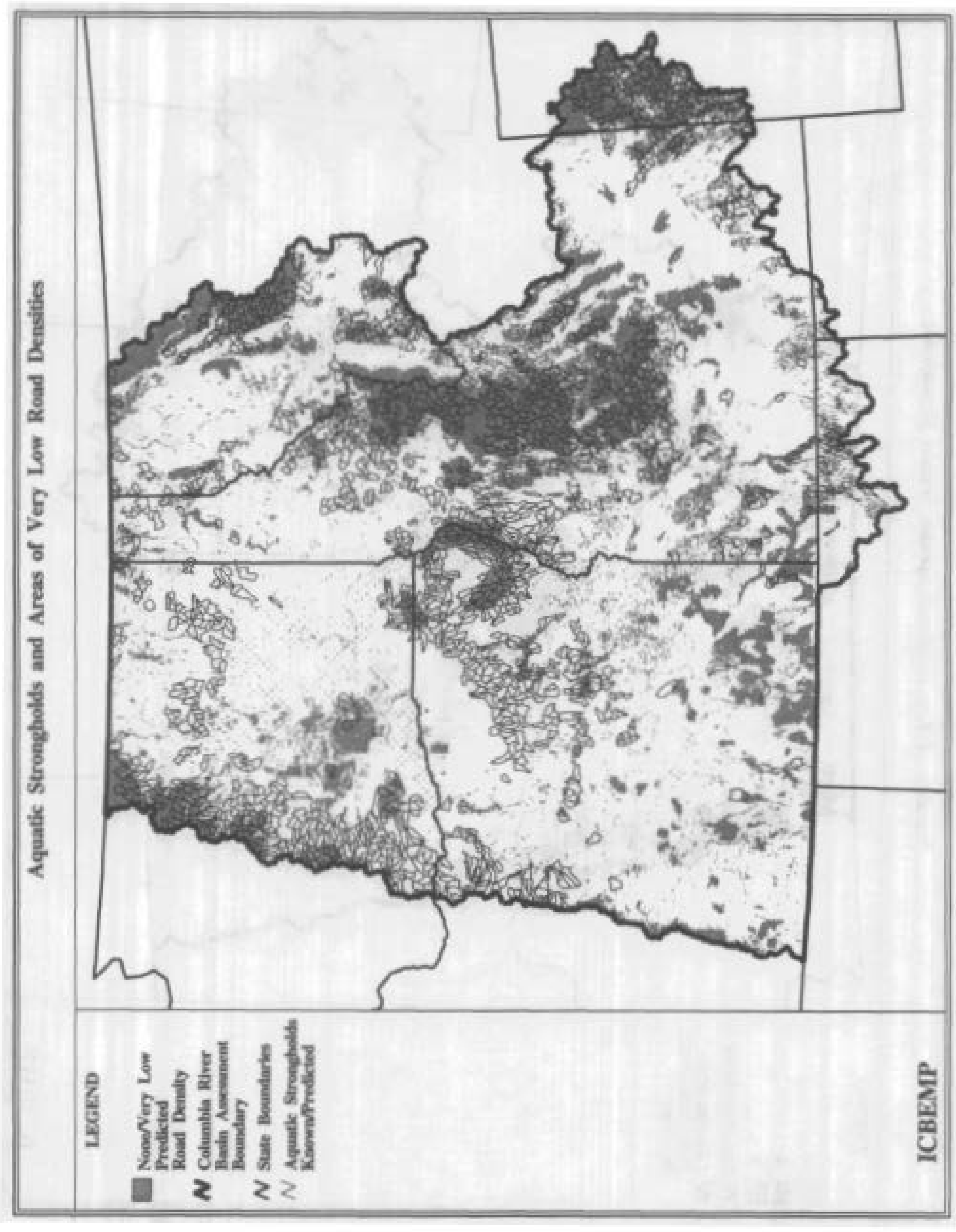

Figure 20—The location of aquatic strongholds in relation to areas of very low road densities.

and other disturbances. The losses appear to be greatest in low-gradient, biologically-productive areas. In-stream wood and fine sediment were also found to be influenced by management activities.

The composition, distribution, and status of fish within the Basin are different than they were historically. The overall changes are extensive, and in many cases irreversible. Even with no further habitat loss, the apparent fragmentation and isolation may place remaining populations of key salmonid species at risk. Much of the native ecosystem has been altered, but core areas remain for rebuilding and maintaining functioning native aquatic systems. The system of dams in the Basin has altered water flows in the larger water systems resulting in changes in water temperatures, timing and level of peak flows, barriers to fish migration,

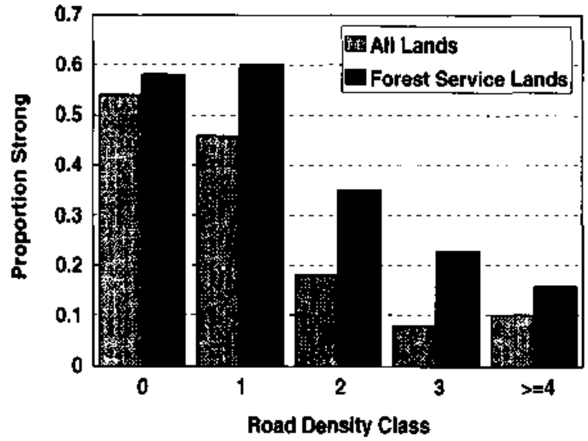

Figure 21—Proportion of subwatersheds supporting strong populations of key salmonids by road density class and land ownership.

Table 12—Historical and occupied range and habitat status for key salmonids within the Basin Assessment area.[1]

Species	Historical range occupied	Occupied range classed as strong	Strongholds in wilderness	Strongholds on FS/BLM	Depressed on FS/BLM	Sensitive to FS/BLM uses
			.......percent——			
Bulltrout	45	13	55	95	82	yes
Wests lope cutthroat	85	25	44	94	65	yes
Yellowstone cutthroat	66	35	19	70	46	yes
Redband	69	22	8	56	58	yes
Steelhead	46	1	9	70	61	yes
Stream-type chinook	28	<1	50	88	77	yes
Ocean-type chinook	30	15	0	20	25	minor influence

'For detailed explanation see Lee and others (1996).

Table 13—Percent of predicted unroaded (<0.1 km/km^2) area in subwatersheds (-8,000 ha in size) with key salmonid species strongholds.

Ecological reporting unit	Unroaded area in strongholds
	........percent........
Northern Cascades	45
Southern Cascades	13
Upper Klamath	0
Northern Great Basin	21
Columbia Plateau	30
Blue Mountains	45
Northern Glac. Mtns	54
Lower Clark Fork	33
Upper Clark Fork	49
Owyhee Uplands	42
Upper Snake	2
Snake Headwaters	76
Central Idaho Mtns	72
Basin Average	56

reductions in riparian areas, and changes in other physical attributes. Consequently, the aquatic ecosystem no longer supports the same species of fish, macroinvertebrates, and aquatic plants.

A variety of species such as kokanee salmon, chinook salmon, lake trout, brown trout, Atlantic salmon, coho salmon, black bass and other centrachids, and ictalurids were introduced in these systems to diversify angling opportunities, create trophy fisheries, and to provide forage for potential trophy species. Many ephemeral lakes in the Great Basin have been stocked with crappie, bass, bullheads, and other centrarchids and ictalurids. Cultured strains of rainbow trout have been widely used to sustain put-and-take fisheries in lakes and rivers where angler harvest or habitat degradation were too excessive to rely on natural reproduction. These introductions have provided increased fishing opportunities and socioeconomic benefits.

Terrestrial[7]

Over 43,000 species of macroorganisms are estimated to occur in the assessment area and 17,186 species are known to occur (table 9). Microorganisms, critical to ecosystem health and function, probably tally at least several hundred thousand species. This biodiversity results from the wide variety of habitats, topographic conditions, and prehistoric events in the Basin. The terrestrial ecology staff evaluated 14,028 species of

[7]Detailed information on historical trends and current status of terrestrial ecosystems is in the *Component Assessment*—Terrestrial chapter (Marcot and others 1996.

macroorganisms and explicitly included 1,339 individual species and 143 species groups in a database on species-environment relations. There were 296 species (excluding fish) of particular interest to American Indian tribes identified.[8] In terms of current status, the assessment produced: lists of habitats and associated species with greatest declines in area or distribution since historic times, and species-environment relations (SER) databases listing species by habitats and ecological functions, for use in determining potential effects of ecosystem management activities and crafting the activities to emphasize or restore specific habitats or functions. It also contains or cites 538 Geographic Information Systems (GIS) maps of species distribution and maps of biodiversity hot spots; and descriptions of key ecological roles of fungi, lichens, bryophytes, and invertebrates for maintaining ecosystem health and long-term productivity and sustainable use of resources.

Overall, 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 fungi and lichens) and animals (including invertebrates and vertebrates) that might be in jeopardy of population declines or local extirpation because of changes in their native habitats and environments. Federally designated threatened, endangered, and candidate species of all taxonomic groups occur in the Basin.

Some 264 taxa (species, subspecies, or fish stocks) have federal listing status. Among non-fish taxa, these include 184 category 2 candidate, 31 category 1 candidate, 11 endangered, and 6 threatened taxa, and 1 Federally proposed as endangered taxon. The FS and BLM list 538 species (excluding fish) as sensitive; some of the threatened and endangered species and many of the additional species of potential conservation concern are dependent on environmental or habitat components that were not evaluated at the broad scale. Table 10 indicates threatened and endangered species tallies; it does not project species viability or extinctions. By comparison, there are an estimated 43,684 species in the Basin: 18,946 plants and allies; 24,270 invertebrates; and 468 vertebrates (tally includes only macroorganisms; bacteria, protozoa, rotifers, nematodes, microfungi and fish are excluded) {*Component Assessment*—Terrestrial).

We mapped the locations of relatively high levels of both plant and animal biodiversity or species rarity and endemism (fig. 22). These centers of biodiversity were locations that either had unusually high numbers of species rarity and endemism, or were locations with unusually high numbers of species of all abundance classes. Locations with three or more centers of concentration of the two types mentioned defined smaller "hot spots" for plants and animals combined (fig. 23). We identified 12 hot spots of species rarity and endemism and seven hot spots of high biodiversity. Additional hot spots are likely to occur in Southern Idaho and could also be identified at finer levels of geographic resolution than were used in the *Component Assessment.* Hot spots included areas in southwestern Oregon, the Snake River, the Columbia River Gorge, and in the desert steppes of central and southern Washington. Natural areas on Federal lands total approximately 29 million acres (11.72 million ha) in 26 land allocation categories.

To determine how well natural areas might support vertebrates in the Basin, we compared the distribution of sizes of existing natural areas to the home range sizes of vertebrate species. Existing natural areas might be suitable for supporting small populations of at least 70 percent of vertebrate species. No estimates were made concerning

"Personal communication. 1996. Ralph Perkins, U.S. Forest Service, Interior Columbia Basin Ecosystem Management Project. On file with: U.S. Department of Agriculture, Forest Service, U.S. Department of Interior, Bureau of Land Management, Interior Columbia Basin Ecosystem Management Project, 112 E. Poplar, Walla Walla, WA 99362.

The Component Assessment—Terrestrial chapter reports on analyses conducted through October 1999. Since that time, USD! Fish and Wildlife Service has published a change in their species status program, (Federal Register, February 28, 1996) essentially replacing the three candidate species categories with a single category of candidates for listing with a one-year review period of this program change (U.S. Government 1996). In this change, most of the species that were classified as Category 2 or 3, and 303 taxa that were Category 1 candidates, are no longer included in the list of candidate species. A number of plant and animal species addressed in this assessment were denoted as Candidate Category 1 or 2 when the data were gathered. Of those 131 Category 1 or 2 plants, four became Candidates in the Federal Register notice: Castilteja christii, Erigeron basalticus, Sidalcea oregana var. Calva, and *Thelypodium howellii* spp. *Spectailis.* Of those 34 Category 2 animals (none had been designated Category 1 in the assessment area), only mountain plover *(Charadrius montanus)* and spotted frog *(Rana luteiventris)* were still designed as Candidates. All other plants and animals we dropped from the list of Candidates. The assessment retains the listings for two reasons: (1) their analyses and data collection preceded the ruling change; and, (2) their charge was to address species' ecologies and conservation status, and the C2 status in particular still helps to denote species of potential conservation concern deserving attention.

suitability of natural areas to support other types of animal, plant, and other life.

We also identified a number of taxa worthy of additional attention. These include 394 fungal species; 40 functional groups of lichen species; at least 400 apparently rare bryophyte species; 280 vascular plant species and 82 rare plant communities; 144 rare and endemic invertebrates (gastropods and insects); and additionally, various vertebrates and microbiotic crusts. Among the vertebrates are the aquatic-dwelling amphibians, reptiles susceptible to ground-disturbing management activities, and birds and mammals associated with habitats that are now scarce, declining, or increasingly fragmented including native grasslands, sagebrush, and old low- and mid-elevation forests.

Economics[13]

Overall, the economies of the four states making up the bulk of the Basin (Idaho, Montana, Oregon, and Washington) are doing well. In 1990 their economies comprised 3.6 percent of the U.S. economy with the economy of Washington being larger than the sum of the other three (U.S. Department of Commerce 1993). Of the four states, Washington is the only one with higher per capita income than the U.S. average, but in all four states, per capita income is growing faster than the U.S. rate (table 14). Similarly, earnings per job is increasing in Montana, Oregon, and Washington faster than in the United States; only Idaho has a smaller percentage change. Except in Montana the poverty rate is lower than the U.S. average. Unemployment rates in Idaho and Montana are lower than the U.S. average and decreasing at a faster rate. In Oregon and Washington the reverse is true: unemployment rates are higher than the national average and falling at a slower rate.

In the Basin, the six metropolitan counties (see fig. 24) have been the center of economic growth, with higher rates of growth in total employment, total personal income, non-farm labor income, and a greater ability to weather national recessions than other counties. They tend to have lower per capita incomes than their counterparts throughout the United States; this gap has been widening since 1980. Some economists believe this indicates that amenities are attracting surplus labor, as has been found elsewhere (Power 1996,Treyz 1993); alternatively, these smaller metropolitan areas may lack the highest paying jobs. Earnings per job in metropolitan areas of Idaho (primarily Boise) are increasing at a faster rate than the national average. Poverty rates in Washington's metropolitan counties are increasing at a faster rate than the national rate, though the levels are still lower than the national average.

"Detailed information on historic trends and current economic status of the Basin is in the *Component Assessment-Economics* chapter.

Table 14— Current economic indicators for the United States, Idaho, Montana, Oregon, and Washington; totals, metropolitan and non-metropolitan counties, current and percent change since previous year or decade.

	United States		Idaho		Montana		Oregon		Washington	
Category	Data	Percent change	Data	Percent change	Data	Percent change	Data	Percent change	Data	Percent change
Total:										
Per capita income[1]	$20,105	4.9	$17,512	5.0	$17,376	6.2	$18,605	5.0	$21,289	6.0
Earnings per job	$26,531	5.6	$23,216	5.4	$20,700	7.5	$23,916	5.7	$26,910	7.3
Poverty rate[2]	13.8%	11.3	13.3%	5.1	16.1%	30.8	12.4%	16.6	10.9%	11.0
Unemployment rate[3]	6.8%	-8.1	5.6%	-9.7	5.0%	-18.0	7.2%	-2.7	7.5%	1.4
Metro Counties:										
Per capita income	$21,247	4.7	$20,114	5.3	$19,154	4.7	$19,619	5.0	$22,084	6.0
Earnings per job	$27,944	5.7	$25,379	6.1	$22,561	5.8	$25,113	5.7	$27,844	7.4
Poverty rate	12.1%	6.1	10.7%	5.1	12.7%	30.8	11.3%	16.6	10.0%	11.0
Unemployment rate	6.7%	-6.9	4.3%	-10.4	4.3%	-18.9	6.5%	-4.4	7.0%	0.0
Non-Metro Counties:										
Per capita income	$15,682	6.2	$16,377	4.7	$16,817	6.8	$16,236	5.1	$17,400	5.7
Earnings per job	$20,085	5.5	$22,087	4.9	$20,058	8.3	$20,690	5.7	$21,431	6.6
Poverty rate	17.1%	8.2	14.3%	5.1	17.1%	30.8	15.0%	16.6	15.6%	11.0
Unemployment rate	7.4%	-7.5	6.2%	-10.1	5.3%	-15.9	8.9%	-1.1	10.3%	3.0

Source: USDA Economic Research Service, August 1, 1995 AUTO FAX State Fact Sheets.

[1] Income and earnings figures are 1992 with change 1991-92, for U.S., Oregon, Washington; Idaho and Montana are 1993 figures with change 1992-93.

[2] Poverty rates for all are 1990 data, with change 1980-90.

[3] Unemployment figures are 1993, with change 1992-93, for U.S., Oregon, Washington; Idaho and Montana are 1994 figures, with change 1993-94.

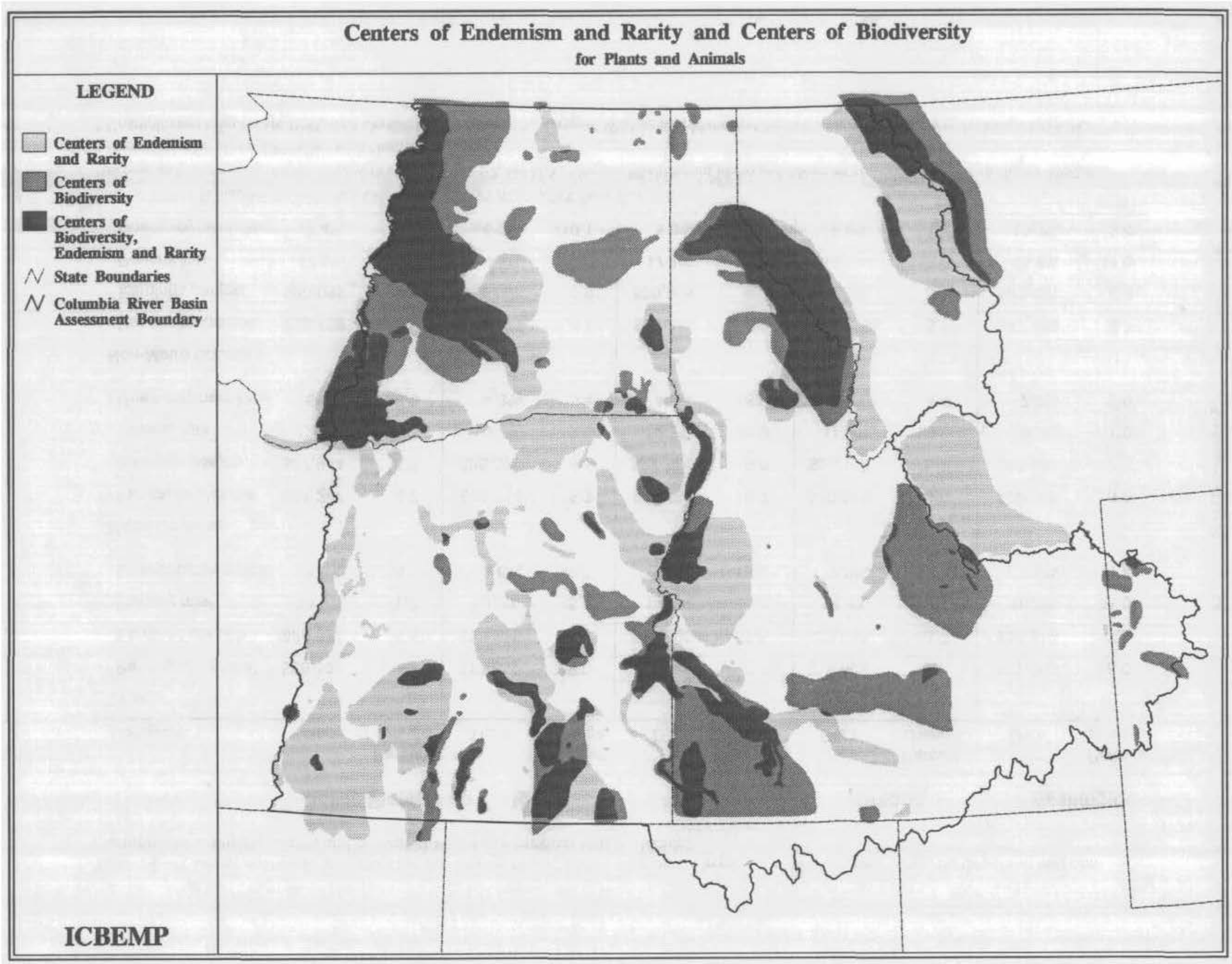

Figure 22—Location of centers of endemism and rarity and of centers of biodiversity (for plants and animals).

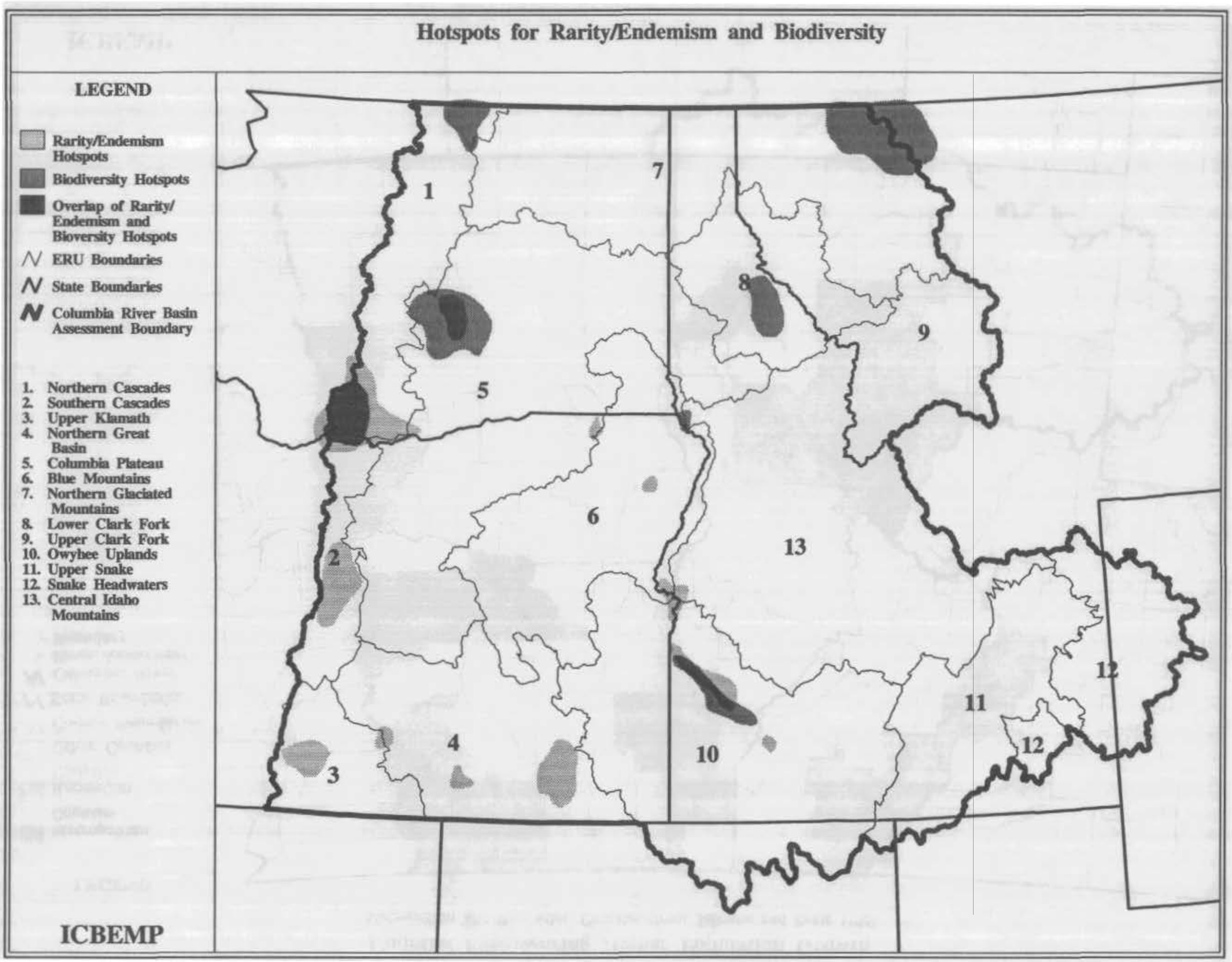

Figure 23—Location of hotspots for rarity/endemism and biodiversity.

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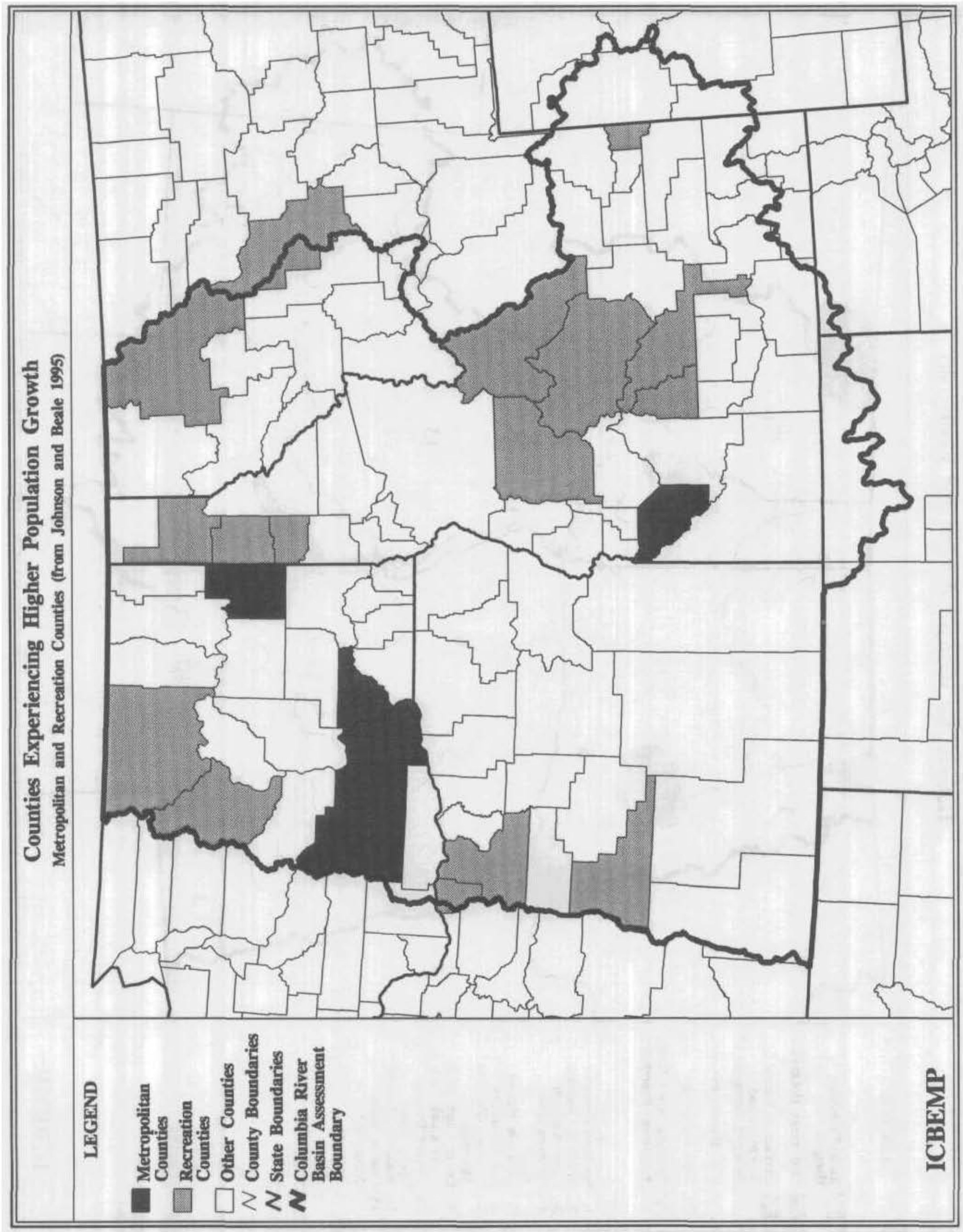

Figure 24—Recreation opportunities and metropolitan areas account for higher rates of population growth by county.

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Table 15—Employment in economic sectors of United States, the Basin, and Bureau of Economic Analysis (BEA) regions for 1995; asterisks indicate values above the national average.

Industry	Nation	Basin average	Tri-Cities	Spokane!	Missoula	Idaho Falls	Twin Falls	Boise	Pendleton	Redmond' Bend[1]	Butte
						percent					
Agriculture services	1.1	2.6*	4.4*	1.1	1.9*	2.7*	4.7*	2.5*	2.6*	2.1*	0.9
Mining	0.7	0.5	0.2	0.6	0.6	0.8*	0.3	0.4	0.0	0.0	1.5*
Construction	5.2	4.7	4.2	4.6	5.4*	5.4*	5.4*	5.1	3.5	4.6	3.5
Manufacturing	14.1	11.7	11.3	11.2	11.5	9.6	11.7	12.6	15.0*	16.0*	4.4
SIC 24[2]	0.6	2.5*	1.0*	2.8*	5.0*	0.5	0.5	2.3*	2.7*	5.5*	2.4*
Transportation	4.8	4.3	3.3	4.3	5.7*	3.7	4.7	4.9*	4.5	3.8	6.0*
Trade	21.5	21.1	21.1	22.1*	21.4	21.9*	21.1	20.4	19.0	20.7	20.3
FIRE[3]	**7.5**	6.0	4.6	6.7	6.2	5.5	5.6	7.7*	4.5	5.5	6.8
Services	28.4	25.0	23.2	26.8	27.4	27.2	21.4	24.2	20.9	23.7	31.7*
Government (all)	14.6	16.4*	14.6	18.8*	15.0*	15.8*	11.0	16.3*	17.8*	15.1*	23.1*
State & local	10.4	12.2*	11.9	14.0	10.5	11.8	9.0	10.3	13.4	11.1	18.5*
Federal	4.1	4.2*	2.7	4.7*	4.5*	4.0	2.0	6.0*	4.4*	4.1	4.6*
Farm employment	2.2	7.8*	13.0*	3.9*	4.9*	7.3*	14.2*	6.0*	12.2*	8.5*	1.8

Note: Farm employment is calculated as the difference between total employment and covered employment. Because it is calculated as a difference it includes rounding errors.

'Redmond-Bend is the portion of the Portland-Salem BEA region that is in the Basin.

[2]Timber and wood products,

financial, insurance, and real estate industries.

The non-metropolitan counties in the Basin have even better economic indicators than metropolitan counties. Per capita income is higher than the national average in all four states, although, except for Montana, growth rate is lower than the national average. Earnings per job in non-metropolitan counties are higher than the national average in the three Basin states, excluding Montana.

The Basin's economy is small relative to the United States, accounting for only one percent of U.S. employment in 1995. The economic strengths of the Basin were characterized by identifying those economic activities within it that have a higher percentage of employment than the benchmark economy of the United States. Data for the percentage of employment in various economic sectors and areas (see table 15) suggest that the traditional notion that manufacturing is the driving sector of the Northwest economy, is too narrow (for example see Beuter 1995). The economic strengths of the Basin include agriculture and agricultural services. Mining and manufacturing, are less important to economies in the Basin than for the nation. Basin-wide, including both public and private lands, timber and wood products account for 2.5 percent of the jobs, cattle grazing accounts for 1.0 percent of the jobs, and mining accounts for 0.5 percent of the jobs. The percentage of jobs attributable to recreation is not shown here because the Bureau of Economic Analysis (BEA) does not define it as an industry. In the discussion of recreation below, we calculate that 14.6 percent of jobs in the Basin are attributable to recreation.

A more complex story emerges by looking at individual economic areas (called BEA regions; fig. 25) within the Basin. Agriculture is an economic strength in every region except the Butte BEA region. Mining in the Butte BEA region is double that of the national average, and it is important in the Idaho Falls BEA region as well. Manufacturing is a strong activity only in the Pendleton and Redmond-Bend BEA regions, and forest products and food processing are important components of both. The importance of trade in each BEA region (except the Pendleton region) mirrors the United States. The same can be said about the service sector except there is more variability around the Basin. In the Boise BEA region, finance, insurance, and real estate are important activities. In several BEA regions construction and transportation are strong parts of the economy. The percentage of jobs supported by recreation is highest in the Idaho Falls (30%), Missoula (31%) and Redmond-Bend (25%) BEA regions.

The past two decades have seen rapid population growth, and the evolution of what was a mature, resource-based, economy into a diverse economy oriented toward technology-based, transportation, and service sectors, with manufacturing, agriculture, and government sectors expected to decline over the next 50 years. Changes in current FS and BLM activities have little effect on the economy of the Basin. FS and BLM activities may have greater affect in specific communities, however. This study found there are 29 out of 539 census-recognized places that may be sensitive to levels of public timber harvest[14] (fig. 26).

People hold both existence values and use values for ecosystem goods, functions, and conditions. Of the value provided society by the FS- and BLM-administered lands in the Basin now and by 2045, the existence of unroaded areas provides 47 and 41 percent; recreation provides 41 and 53 percent; timber provides 11 and 5 percent; and range provides less than 1 percent at both times. Market basket values per acre of FS- and BLM-administrated lands in the Basin are shown by ERU in figure 27. This market basket is only a subset of the measurable values of FS- and BLM-administered ecosystem goods, functions, and conditions: existence value of unroaded areas, recreation, timber, and range. This is the subset of ecosystem values (goods, function, and conditions)

[14] The *Component Assessment*— Economic chapter defined isolated timber- dependent communities as those communities located more than 50 miles from another incorporated area with more than 10,000 people, and not located in either recreation or metropolitan counties.

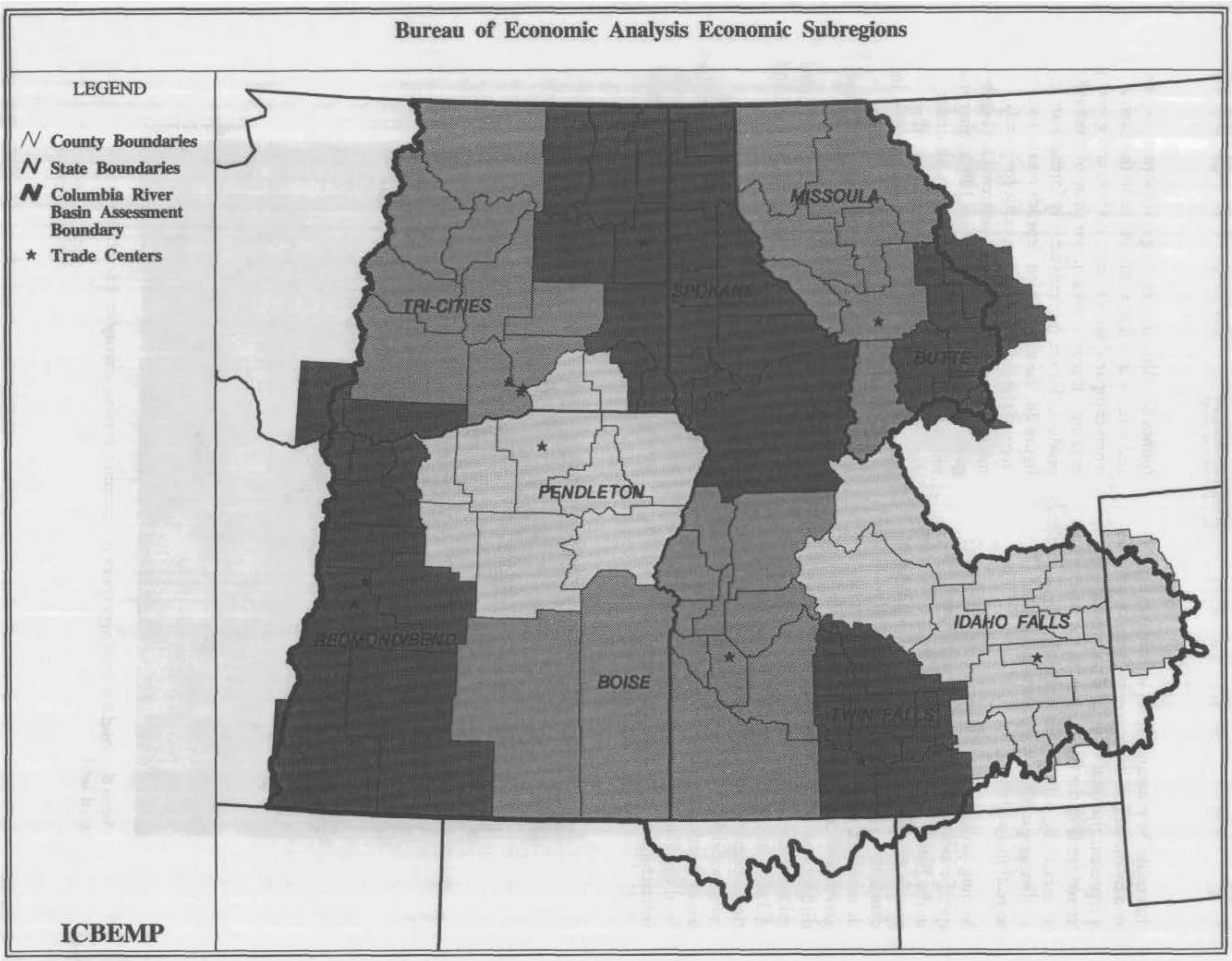

Figure 25—Economic subregions as defined by the Bureau of Economic Analysis.

that could be measured from information generated by the SIT; it is not comprehensive nor does it represent the total value of BLM and FS-administered lands in the Basin. It is an improvement on measuring only timber and range flows. Table 16 disaggregates the value of recreation for 12 recreational activities.

Mining has long been an important activity in specific areas of FS- and BLM-administered land in the Basin. The Economics chapter of the *Component Assessment* has details on the three major components of the Basin mining industry: metallic minerals, phosphates, and aggregates (sand, gravel, and crushed stone) each of which has distinct economic characteristics. For metallic minerals and phosphate, activity is minor in spatial scale but significant in national and international commodity markets. Aggregate mining is more widely distributed throughout the Basin and lower in value; aggregates are primarily traded in local markets and used to construct buildings and infrastructure associated with human populations (photo 6). Although mining is important to jobs and income in a few communities in the Basin, when compared with a large, diverse, and growing economy, it represents a minor share of gross state product. Future minerals activity forecasts are in figure 28; the distribution depends on the locations of the deposits—quite specific for metals, minerals, and phosphate, but scattered for aggregates. Across the Basin, there are 180 mining and mineral processing sites in operation, 11 under development, and ten maintained on standby status; the value of production from these sites in 1992 was approximately $2.7 billion. Future activity will depend on a number of factors, most of them not directly affected by BLM or FS policy: the minerals present and their grade, global prices, extraction and remediation technology, and access.

Counties differ in their reliance on timber and forage from FS- and BLM-administered lands. In some counties, FS- and BLM-administered lands provide a high proportion of the timber harvested

Photo 6—Production of aggregates is a common mining activity on FS- BLM-administered lands.

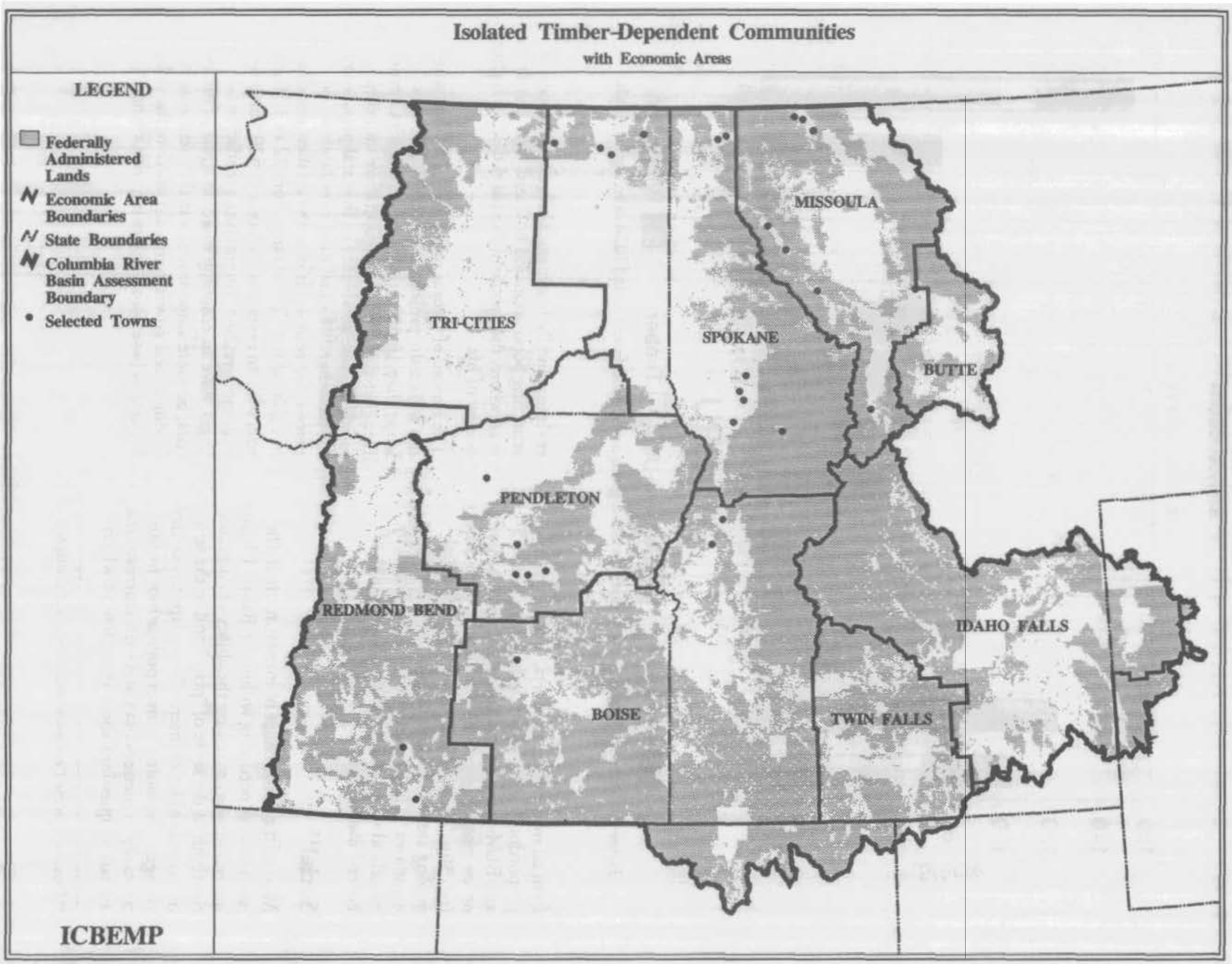

Figure 26—The location of isolated timber-dependent communities within each BEA area.

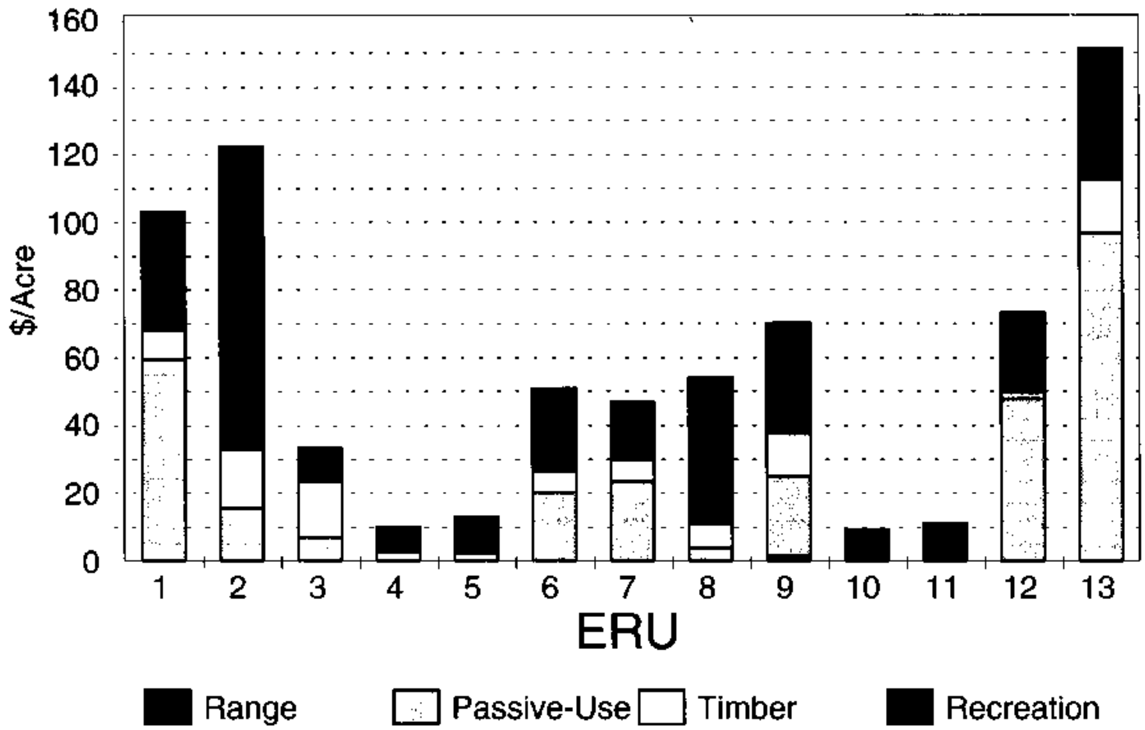

Figure 27—Per acre market basket value of selected goods and services from FS- and BLM-administered lands.

from all ownerships; in others, medium or low proportion (fig. 29). Similarly, forage from FS- and BLM-administered lands is a high, medium, or low proportion of the total feed in each county (fig. 30). Those areas most reliant on Federal grazing are in the southern portion of the assessment area. These latter areas are dominated by rangeland vegetation types and large blocks of Federal ownership.

Social[15]

Most of the social issues of interest relate to the rapid change occurring within the Basin. Changing economies are testing the ability of communities (both in the sense of "place" and in the sense of "communities of interest") to adapt to external changes. Increasing human populations focused primarily in metropolitan and high amenity areas are raising questions about the extent to which environmentally-based amenities are important in attracting population and business. Like people everywhere, the people of the Basin desire a higher quality of life.

The Bureau of Census recognizes 476 communities within the project area, including 29 cities larger than 10,000 in population and 49 Census-Designated Places, locations that are unincorporated but have an identity to the local population. Of the other 398 small rural communities, 68 percent are communities in the smallest size class of 1,500 or less. These range from 22 to 1,500 in size, with an average population of 520. In general, more-resilient communities tended to be larger, have an economy based on a mix of industries, be more autonomous, rated by residents as having a local government responsive to the public, and to have plans for dealing with change.

[15] Details are in the *Component Assessment-Social* chapter.

Table 16—Net economic value (willingness to pay) of current recreation activities on 'FS-BLM lands, by ecological reporting unit (ERU).

Activity	ERU1	ERU 2	ERU 3	ERU 4	ERU 5	ERU 6	ERU 7	ERU 8	ERU 9	ERU 10	ERU 11	ERU 12	ERU 13	Average by activity
	——Dollars per acre (in 1994 dollars) -													
Fishing	1.22	23.57	2.05	2.26	6.58	6.02	3.34	7.57	5.16	2.50	2.88	3.71	8.07	5.18
Hunting	3.22	6.96	1.44	1.48	1.47	5.59	4.44	15.56	14.29	2.86	2.82	4.03	8.90	4.97
Day use	4.20	12.80	1.58	0.80	0.68	3.02	2.35	6.89	3.50	0.29	0.71	3.13	6.08	2.77
Winter sports	5.43	14.88	0.31	0.50	0.24	3.29	1.35	2.24	2.31	1.10	2.11	5.68	5.78	2.65
Camping	5.87	6.33	2.80	0.86	0.48	2.53	1.52	3.44	1.83	0.49	0.64	1.41	2.78	1.81
Trail use	9.28	5.40	0.72	0.34	0.48	1.85	1.24	2.84	2.03	0.32	0.58	2.62	2.51	1.72
Motor viewing	5.09	5.44	0.36	0.39	0.19	0.68	1.01	2.33	1.14	0.17	0.29	0.92	2.25	0.98
Viewing wildlife	0.60	12.24	0.39	0.34	0.32	1.07	0.46	0.82	0.98	0.13	0.64	0.68	1.26	0.88
Motor boating	0.04	0.19	0.23	0.11	0.02	0.06	0.12	0.41	0.17	0.38	0.10	0.32	0.77	0.25
Non motor	0.05	1.21	0.06	0.05	0.07	0.04	0.21	0.27	0.25	0.03	0.04	0.77	0.52	0.21
Off road vehicle	0.34	0.14	0.02	0.06	0.02	0.07	0.07	0.33	0.18	0.05	0.11	0.11	0.31	0.12
Snow Mobile	0.16	0.15	0.04	0.02	0.01	0.06	0.05	0.16	0.25	0.01	0.02	0.20	0.14	0.07
Total by ERU	35.49	89.28	10.00	7.19	10.56	24.29	16.18	42.87	32.09	8.32	10.95	23.58	39.37	21.62

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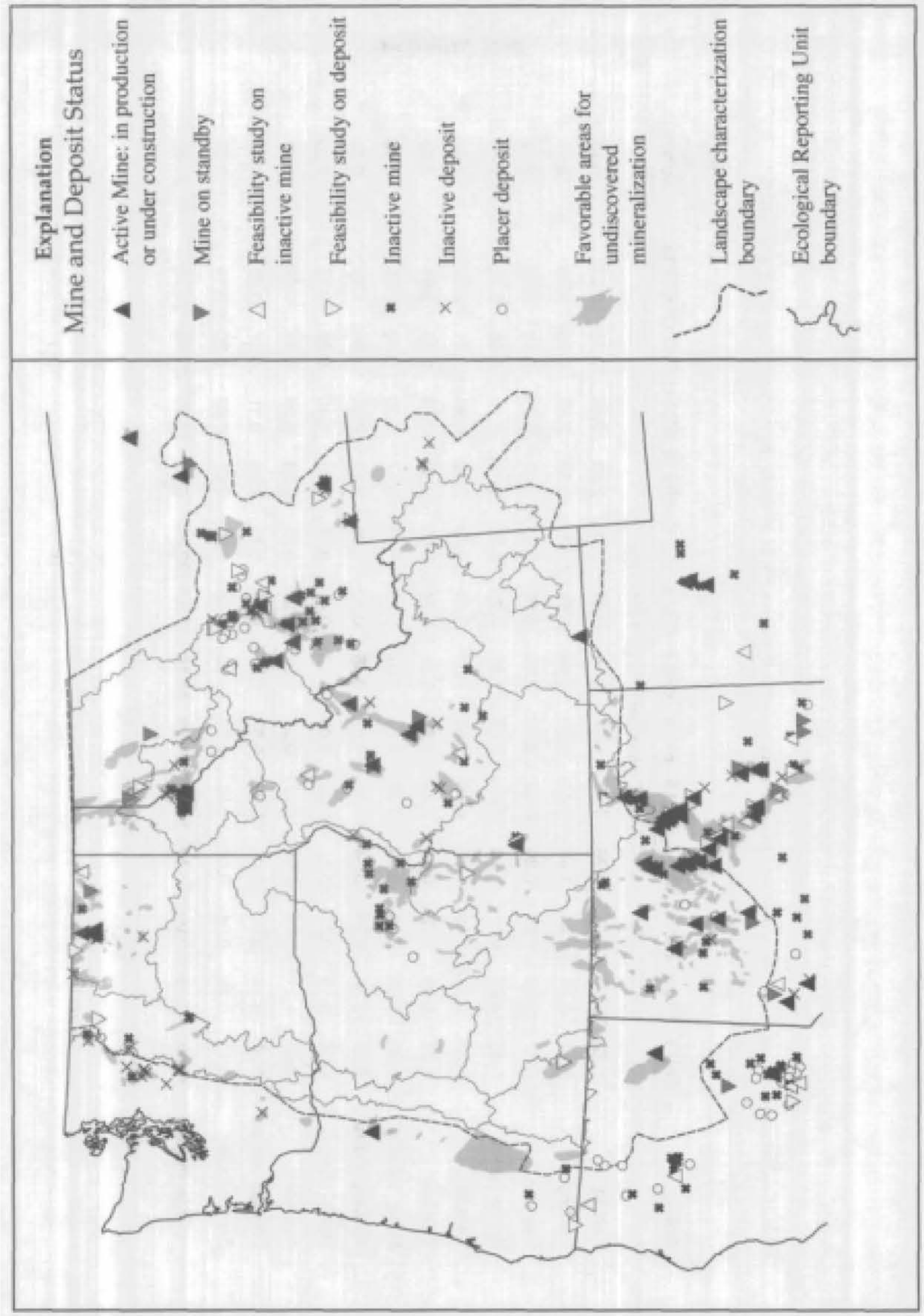

Figure 28—Mine and deposit status are shown for the Basin. Adapted from Bookstrom and others (1996), figures 2-6.

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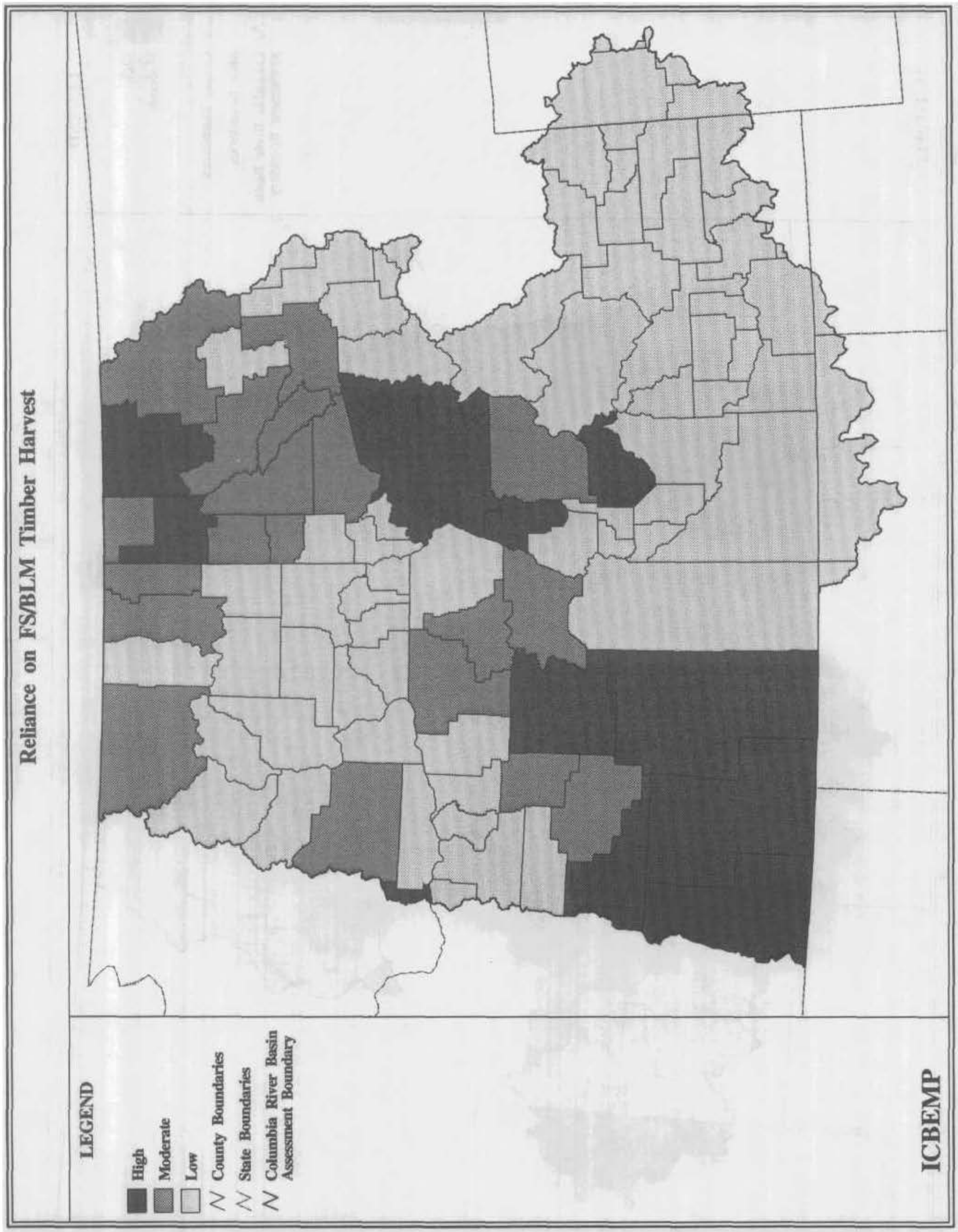

Figure 29—Reliance on timber harvested from FS- and BLM-administered lands.

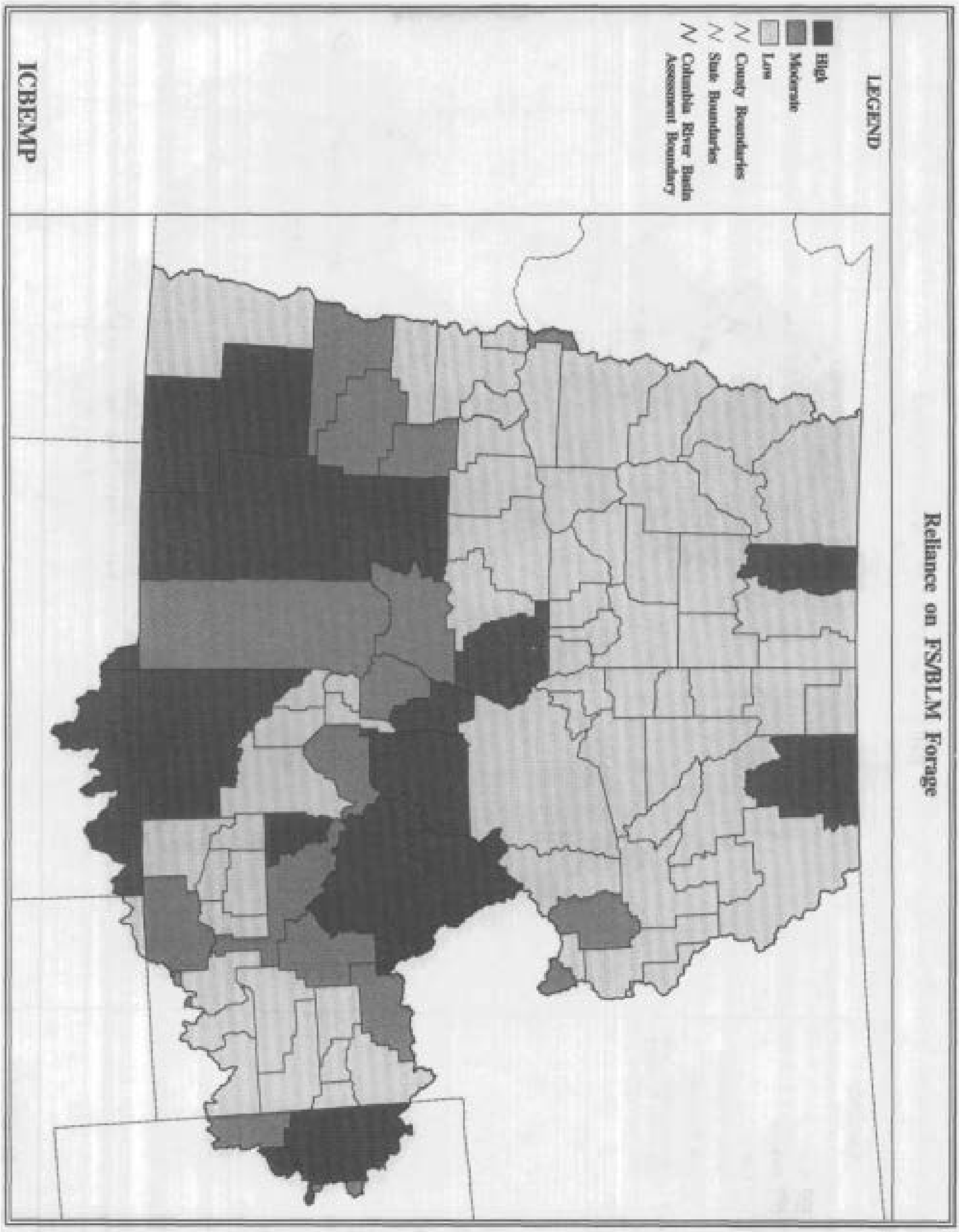

Figure 30—Reliance on forage from FS- and BLM-administered lands.

Human attachments to places are important in determining the acceptability of management actions. This is particularly true of American Indian tribes. The traditional American Indian economy is broad-based, including fishing, fowling, hunting, and gathering of terrestrial and aquatic resources over very large geographic areas encompassing a diverse range of important places. Uses of and values toward the land are both utilitarian and symbolic, merged in an inseparable manner. Through a long series of treaties, laws, and court cases, American Indians have special status, and the Federal Government relates to tribes on a government-to-government basis. Access to Federally-administered land is important to uphold rights to resource use that are reserved under treaties. The Federal Government's Trust responsibilities based on treaties and their subsequent interpretation is long-reaching yet has not been articulated satisfactorily in terms that all involved understand and to which all agree.

Project surveys found that the public (both national and within the Basin) is increasingly concerned with seeking a balance between species protection and costs to society, a concern that is especially strong among Basin residents. People support the goal of healthy forests and rangelands, but some are skeptical about the effectiveness and sincerity of ecosystem management. Others oppose the notion of ecosystem management because of concerns over possible effects on private lands, the costs of restoration efforts, and economic effects on people, communities, and broader economies. On the topic of appropriate avenues and levels of public participation, another survey queried the public about preferences for participation in planning, regarding FS- and BLM-administered lands. Some 32 to 39 percent supported the public acting as a full and equal partner; 30 to 32 percent favored serving on advisory boards. Providing suggestions and making the decisions were chosen by roughly equal numbers (about 10-18%), and letting resource professionals decide was chosen by just one to three percent. The public is also concerned about the efficiency of public participation.

People value how the land appears to them. The Basin was characterized using five landscape themes[16] that match the Forest Service's Scenery Management System (fig. 31). These five themes are:

Forest and Shrub Grasslands-lands where human intervention is minimum and natural processes dominate visually,

Forest-lands with a vegetative cover of forest species but where human intervention does not dominate the natural landscape;

Shrub/Grassland-lands with a vegetative cover of shrub, forb and/or grass species but where human intervention does not dominate the natural landscape;

Agricultural Lands-croplands and intensely managed timberlands where geometric patterns dominate the landscape;

Urban-lands where commercial and residential development visually dominate the landscape.

Themes were identified for all lands within the Basin. The Basin is divided among these five themes as 7, 37, 30, 20, and 6 percent respectively. These themes are an indication of how people perceive the Basin's environments in a very general sense. The results suggest that three-fourths of the Basin is perceived as appearing natural.

"Galliano, Steven J.; Loeffler, Gary M. 1995. Place Assessment: how people define ecosystems, a background report of the scientific assessment for the Interior Columbia Basin Ecosystem Management Project. On file with: U.S. Department of Agriculture, Forest Service, U.S. Department of Interior, Bureau of Land Management, Interior Columbia Basin Ecosystem Management Project, 112 E. Poplar, Walla Walla, WA 99362. 41 p.

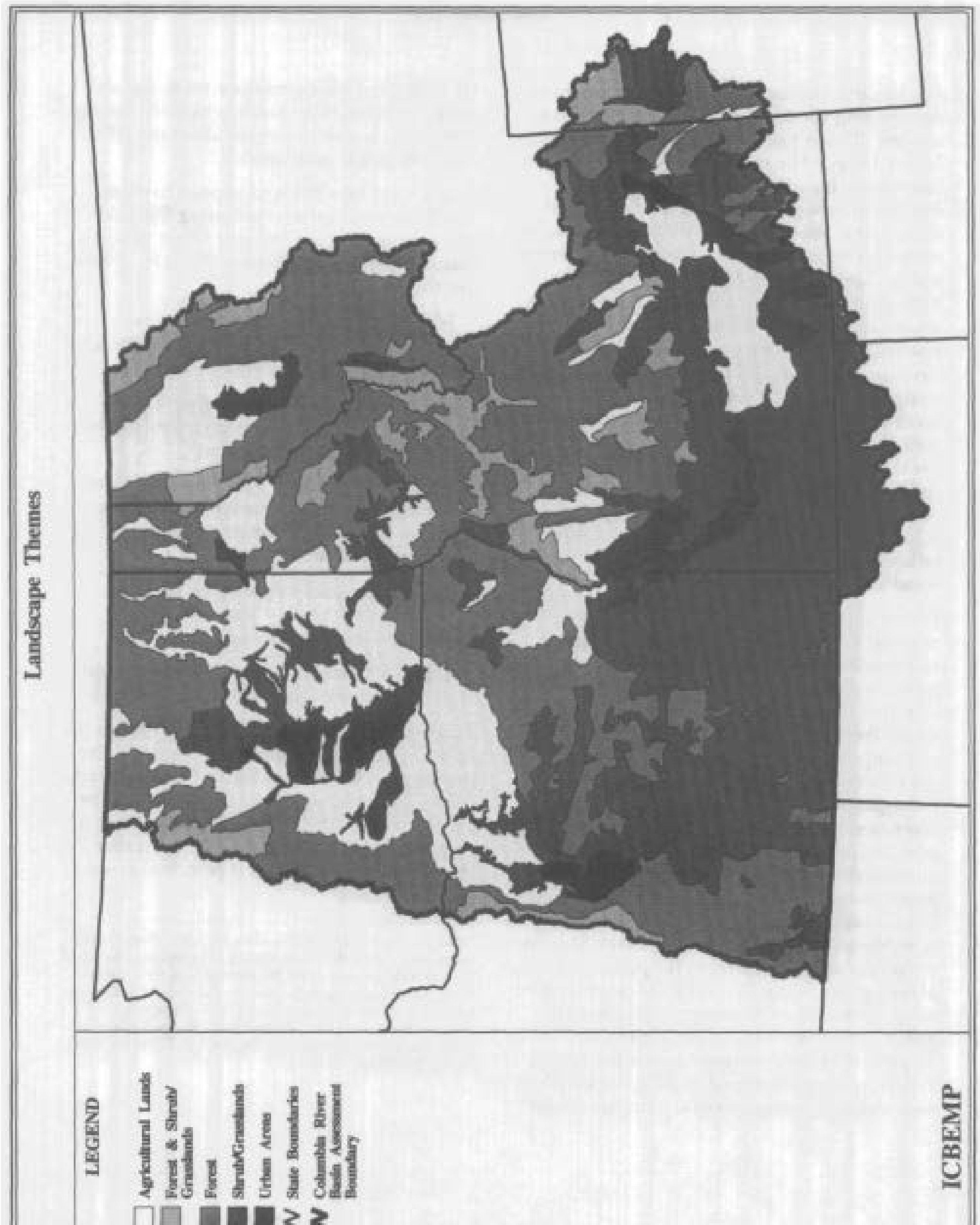

Figure 31—Landscape themes assigned to regions within the Basin.

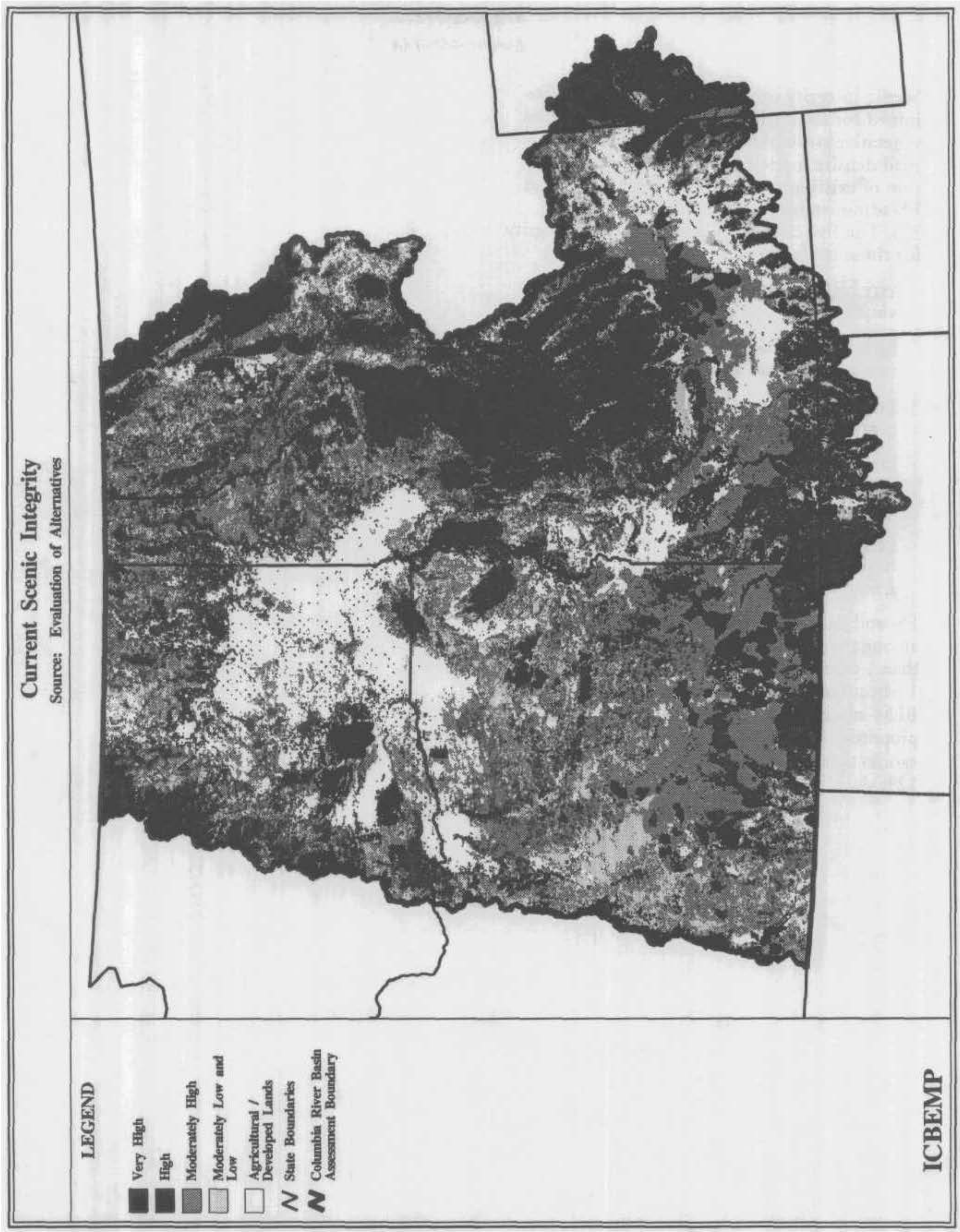

Figure 32—Current scenic integrity predicted across the Basin.

Scenic integrity or visual intactness was determined for the Basin. This measure combined vegetative structure, landform categories, and road density models to provide a broad depiction of existing scenic integrity for BLM- and FS-administered lands within the Basin (fig. 32). The five classes of Existing Scenic Integrity for those lands are:

very high-settings where the landscape is visually intact with only minute deviations;

high-settings where the landscape appears intact and human activities are not evident;

moderate-settings where the landscape appears slightly fragmented;

low-settings where the landscape appears fragmented, human activities dominate the landscape; and

very low-settings where the landscape is heavily fragmented and human activities strongly dominate the landscape.

FS- and BLM-administered lands are divided among these five classes as 42, 33, 17, 7, and less than 1 percent respectively. In addition, less than 1 percent of the area was not classified. FS- and BLM-administered lands contain much larger proportions in the highest 2 scenic integrity categories than in the two lowest categories (45 versus 12%).

CHAPTER 4

ECOSYSTEM INTEGRITY: ECOLOGICAL INTEGRITY AND SOCIOECONOMIC RESILIENCY

The land ethic recently described by the Chief of the Forest Service articulates the priorities and commitments toward an ecosystem-based management approach (Thomas 1994). This land ethic links together the concepts of sustainable interactions between humans and ecosystems to maintain health, diversity, and productivity. The management context and priorities are: 1) protect ecosystems, 2) restore deteriorated ecosystems, 3) provide multiple benefits for people within the capabilities of ecosystems, and 4) ensure organizational effectiveness. The SIT assumed the broad goal for ecosystem management of trying to maintain ecosystem integrity. We interpreted this as a focus on the component goals of ecological integrity and socioeconomic resiliency. From the scientific perspective, the ICBEMP has attempted to bring together an understanding of the capabilities of ecosystems within the Basin, to determine the current status of the ecosystems, and to describe the ecological risks and opportunities associated with attempts to achieve assumed goals.

We recognize that there are no direct measures of ecological integrity or socioeconomic resiliency and that this process is not strictly a scientific endeavor (Wickium and Davies 1995). Our assessment of ecosystem integrity draws from the assumed intent of the FS and BLM to achieve particular ecological and socioeconomic goals in the Basin. These two agencies have stated their intentions to file two EISs in order to achieve broad purposes and needs [see U.S. Government 1994c, (Feb. 28, 1994, 59 FR 4680; revised: May 23, 1994, 59 FR 26624; Dec. 7, 1994, 59 FR 63071)]. These broad purposes are to enhance or maintain ecological integrity while simultaneously providing a sustainable flow of desired goods and services consistent with the capability of the ecosystems.

To provide information useful to FS and BLM managers which was to be considered in the development of new management direction, the SIT addressed three broad questions:

1. Where within the Basin is ecological integrity and socioeconomic resiliency high, medium, or low?
2. Where are there opportunities to improve (restore) ecological integrity?
3. Where are there opportunities to produce desired goods, functions, and conditions with a low risk to ecological integrity?

Both Chapter 4 and Chapter 5 address these questions. Discussions related to questions 2 and 3 are mostly contained in Chapter 5.

The integrity of ecosystems encompasses both social and biophysical components. In this context, ecological integrity refers to the presence and functioning of ecological components and processes. The social and economic counterpart to ecological integrity is resiliency, which in the context of ecosystem management reflects the abilities of people to maintain well-being through personal and community transitions. To address the three previously listed questions, we developed two composite ratings (ecological integrity and socioeconomic resiliency) which were derived from more specific ratings for individual processes or functions. Application of these ratings to detailed planning at subregional or landscape levels may be inappropriate.

We began by carefully examining all the information brought together through the ICBEMP process to determine which elements might prove most useful in explaining differences in ecological processes and functions across Basin ecosystems. Use of these elements to classify subbasins resulted in six forest and six rangeland clusters of subbasins with common characteristics and descriptions of current ecological conditions. The variables found most useful to explain and characterize the clusters were used to develop relative integrity estimates across the 164 subbasins. We assume that high levels of ecological integrity indicate that evolutionary and ecological processes are being maintained; functions and processes dependent on multiple ecological domains and evolutionary timeframes are being maintained; and viable populations of native and desired non-native species are being maintained. These processes and functions are evaluated in a relative sense within the Basin, so that those areas exhibiting the most elements of a system were rated as high, and those with the fewest elements were rated low. The basic components of ecological integrity include the forest, range, and aquatic systems with a hydrologic system that overlays the landscape as a whole. These actual ratings are shown in appendix B (table B-l).

We rated social and economic resiliency for the 100 counties based on a county typology (specifically, a cluster of counties based on selected attributes). Social and economic resiliency deals with the adaptability of human systems. High ratings imply that these systems are highly adaptable. That is, changes in one aspect are quickly offset by self-correcting changes in other sectors or aspects. We assume that high levels of socioeconomic resiliency include communities and economies that are adaptable to change, that "sense of place" is recognized in management actions, and that the mix of goods, functions, and services that society wants from ecosystems is maintained. The actual ratings are shown in appendix B (table B-2).

We present these integrity and resiliency ratings as initial estimates based on available information. We acknowledge that these estimates are based on broad proxies for various processes. Some of the proxies for ecological measures, for example, reflect structure rather than the underlying process. These proxies represent the best approximations at this broad extent for the underlying processes that we have at this time. We do not presume to have measured nor revealed the absolute levels of integrity or resiliency within the Basin. Rather, these ratings represent the first attempt at estimating integrity and resiliency at this spatial level. Given more time and information, integrity indices might include direct consideration for elements such as recovery cycles, synergistic interactions between environmental components and biophysical linkages, and feedback mechanisms operating on different spatial and temporal scales within the area.

Ecological Integrity Ratings

Based on the data sets and analysis conducted through the project, each subbasin (4th Hydrologic Unit Code level, see appendix B, fig. B-l) was rated as having high, medium, or low ecological integrity for forestlands, rangelands, forestland hydrology, rangeland hydrology, and aquatic systems. These ratings were based on relative differences between subbasins. The ratings were described for the 164 subbasins [each approximately 800,000 to 1,000,000 acres/325,000 to 400,000 ha and included all ownerships within the Basin (for more detail see Sedell and others 1996)]. The actual ratings combined analysis based on descriptive data layers, empirical process models, trend analysis, and expert judgment. The basic data sets on which the ratings were based are aggregations of data from broad scale map themes, subwatershed (approximately 8,500 to 25,000 acres/3,500 to 10,000 ha) information, or model projections. We examined all the data sets, model outputs, and map themes brought forward through the ICBEMP or otherwise available for use as possible measures for estimating ecological integrity. We did not have consistent measures of elements that might be considered direct measures of integrity across all ownerships within the Basin. Proxies were selected from the data available to represent a broad array of functions, processes, conditions, and outcomes.

Forestland and Rangeland Integrity

A forest and range (terrestrial environment) system that exhibits high integrity is defined here as a mosaic of plant and animal communities consisting of well connected, high-quality habitats that support a diverse assemblage of native and desired non-native species, the full expression of potential life histories and taxonomic lineages, and the taxonomic and genetic diversity necessary for long-term persistence and adaptation in a variable environment. This interpretation is consistent with, and driven by, the goal of sustainable biotic diversity and the maintenance of ecological processes. Areas exhibiting the most elements of a system with high integrity were rated as high and those with the fewest elements were rated low; the medium rating fell in between.

Forestland integrity ratings were estimated for each subbasin if the forested vegetation component was at least 20 percent of the area. Likewise, relative rangeland integrity ratings were estimated if the rangeland potential vegetation types within a subbasin comprised at least 20 percent of the area of the subbasin. This resulted in 112 subbasins with a forest integrity rating and 86 subbasins with rangeland integrity ratings. Thirty-nine subbasins were classified as both forest and rangeland. There were five subbasins that were predominantly agricultural and were not rated as forest or rangeland.

Forestland integrity

Measures of forestland integrity include such elements as: (1) consistency of tree stocking levels with long-term disturbances typical for the forest vegetation present; (2) the amount and distribution of exotic species; (3) the amount of snags and down woody material present; (4) disruptions to the hydrologic regimes; (5) the absence or presence of wildfire and its effect on the composition and patterns of forest types; and, (6) changes in fire severity and frequency from historical (early 1800s) to the present. Specific proxies for forestland integrity include: (1) proportion of area in dry and moist forest potential vegetation groups; (2) proportion of area having estimated road densities of moderate or greater (> 0.7 miles/sq. mile); (3) proportion of the area in wilderness or essentially unroaded (< 0.1 miles/sq. mile); (4) proportion of the area where fire severity increased between historical (early 1800s) and current periods by at least one class (that is, nonlethal to mixed severity, mixed to lethal, or nonlethal to lethal); and, (5) proportion of area where fire frequency declined between historical and current periods by at least one class (fire frequency classes were 0-25 year return interval, 26-75 year interval, 76-150 year interval, and greater than 150 year interval). Seventeen percent of the forested subbasins have high integrity (fig. 33).

Rangeland integrity

Measures of rangeland integrity include such elements as: (1) grazing influences on vegetation patterns and composition; (2) disruptions to the hydrologic regimes; (3) expansion of exotic species; (4) changes in fire severity and frequency, (5) increases in bare soils; and (6) expansion of woodlands into herblands and shrublands. Specific proxies for rangeland integrity include: a) proportion of area in dry grassland and shrubland potential vegetation groups; b) proportion of area having estimated road densities of moderate or greater (> 0.7 miles/sq. mile); c) proportion of the area in potential agricultural vegetation groups; and, d) the proportion of the area comprised of western juniper and big sage vegetation types. Six percent of the rangeland subbasins have high integrity (fig. 34).

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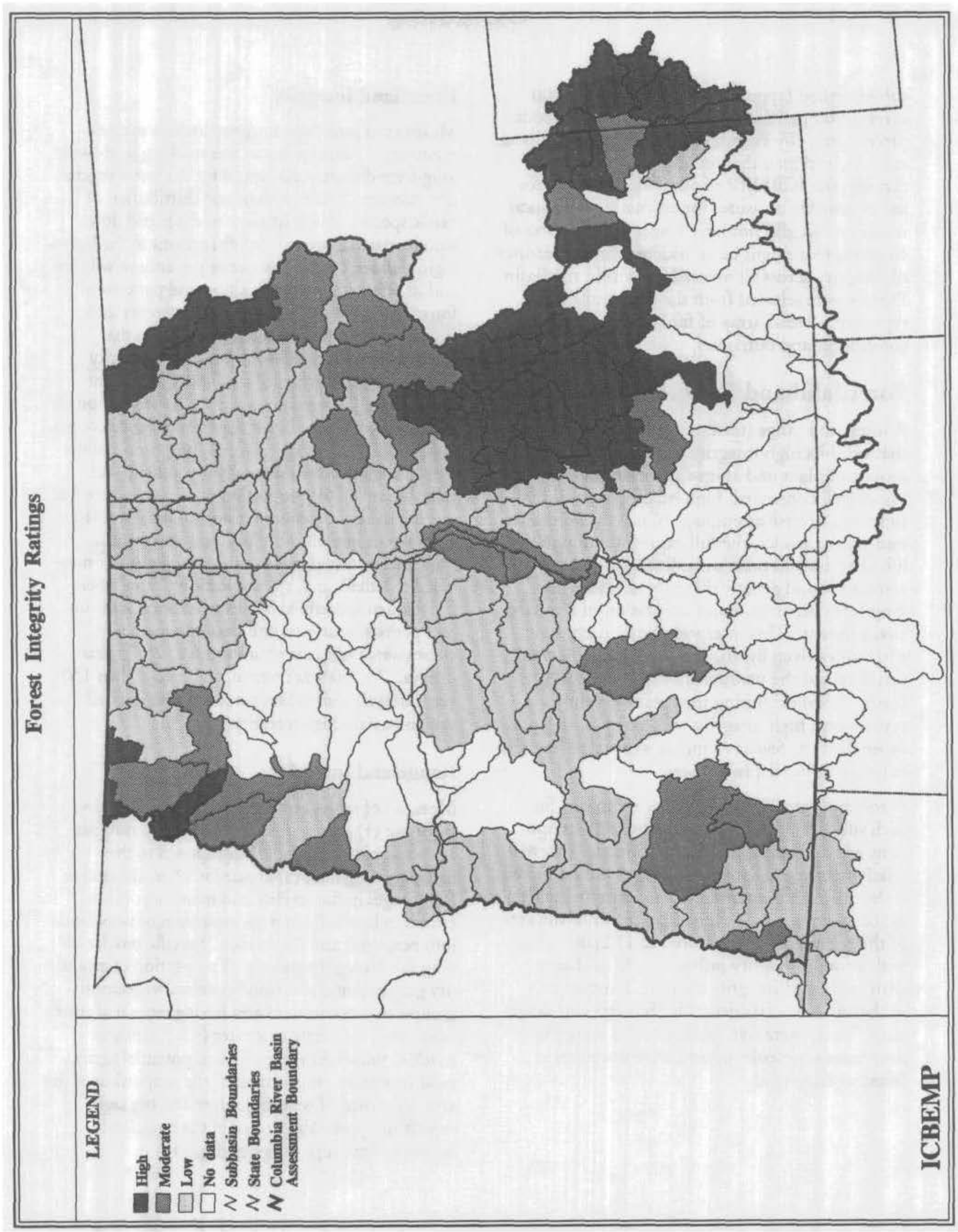

Figure 33—Forest integrity was rated for those 112 subbasins that had 20 percent of their area in forest PVGs.

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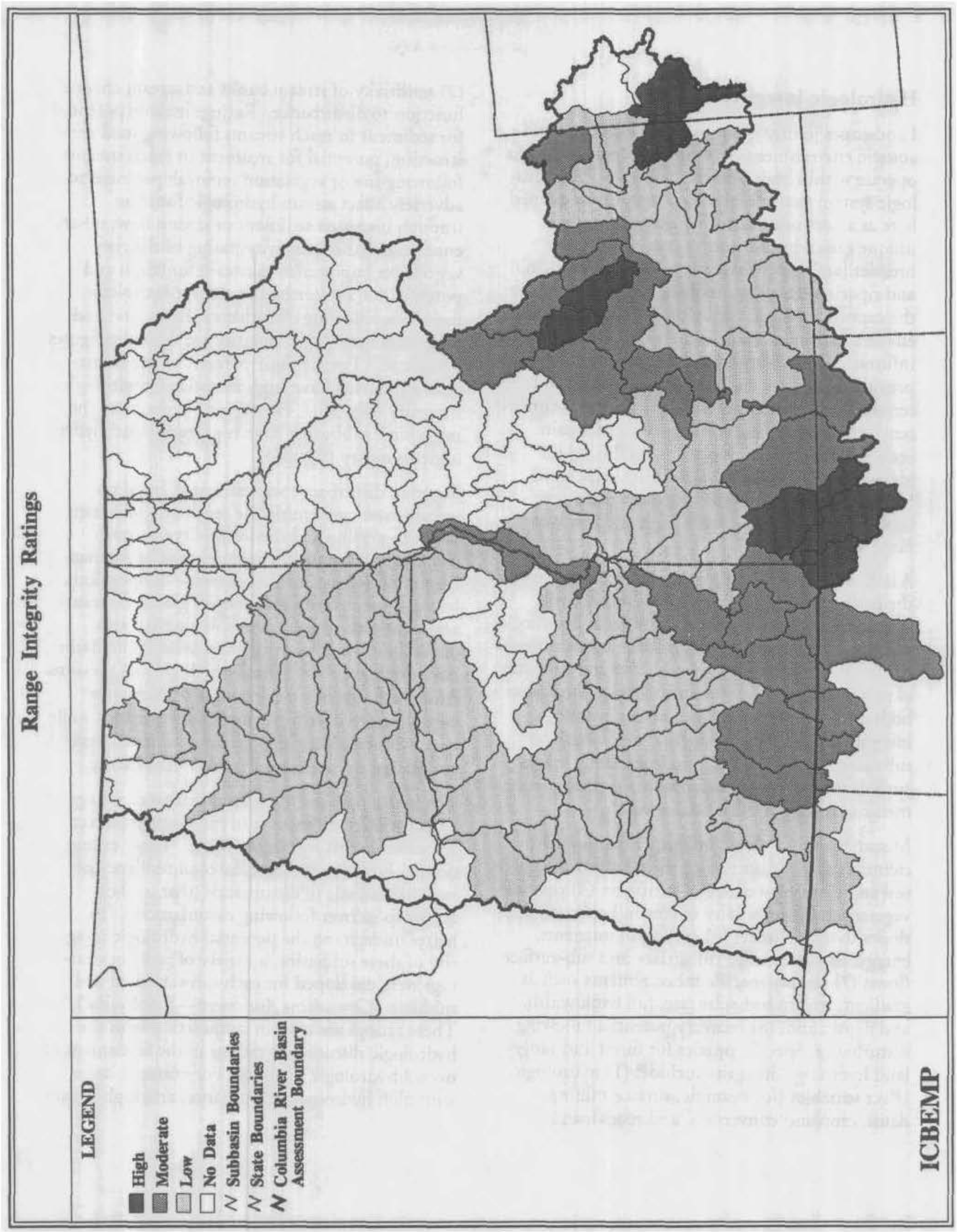

Figure 34—Range integrity was rated for those 86 subbasins that had 20 percent of their area in range PVGs.

Hydrologic Integrity

Landscapes jointly encompass the terrestrial and aquatic environments so that hydrologic networks operate within basins on the landscape. A hydrologic system that exhibits high integrity is defined here as a network of streams, along with their unique ground water ecosystems, within the broader landscape where the upland, floodplain, and riparian areas have resilient vegetation; where the capture, storage, and release of water limits the effects of sedimentation and erosion; and where infiltration, percolation, and nutrient cycling provide for diverse and productive aquatic and terrestrial environments. This definition is consistent with, and driven by, the goal to maintain ecological processes. Subbasins exhibiting the greatest level of these characteristics were rated high, those exhibiting the least were rated low; subbasins that were between high and low were rated as medium.

A lack of fine resolution stream characteristic data for the Basin necessitated a generalized probabilistic approach for use in determining subbasin hydrologic integrity in this analysis. Information concerning the resiliency of watersheds to disturbance and estimates of past management disturbance to watersheds were both used in determining the current hydrologic integrity of subbasins. Rangeland and forestland subwatersheds were assessed independently in this analysis to facilitate characterization of these environments separately at the subbasin level.

Measures of hydrologic integrity include such elements as: (1) disturbance to water flow; (2) bare soil and disturbances to soil structure; (3) riparian vegetation; (4) sensitivity of stream banks and hill slopes to disturbance; (5) cycling of nutrients, energy, and chemicals; (6) surface and sub-surface flows; (7) stream-specific measurements such as gradient, stream bed substrate, full bank width, and depth; and, (8) recovery potential following disturbance. Specific proxies for forest and rangeland hydrologic integrity include: (1) hydrologic effect variables (for example, surface mining, dams, cropland conversion, and roads); and (2) sensitivity of stream banks and stream channel function to disturbance. Ratings include potential for sediment to reach streams following road construction; potential for sediment to reach streams following fire or vegetation removal; potential to adversely affect stream hydrologic function through increased sediment or stream flow; inherent stream bank sensitivity; rating of riparian vegetation importance to stream function; and potential for a watershed to recover hydrologic functions following disturbance. Forestland and rangeland hydrologic integrity are shown in figures 35 and 36. Twenty-four percent of the forestland subbasins have high forestland hydrologic integrity (fig. 35). Twenty-one percent of the rangeland subbasins have high rangeland hydrologic integrity (fig. 36).

Riparian disturbance was estimated based on information concerning the sensitivity of stream banks to grazing and the sensitivity of stream channel function to the maintenance of riparian vegetation {*Component Assessment*—Biophysical). In this approach the resiliency of grazed riparian areas was used to infer probable riparian area disturbance since most riparian areas of the Basin have experienced historically high grazing pressure. Areas with low relative grazing resiliency were considered to have high riparian disturbance while areas with relatively high grazing resiliency were considered to have lower riparian disturbance.

The hydrologic and riparian disturbance ratings reflect relative differences in management effect across subbasins within the Basin. These ratings do not, however, indicate the total resiliency of such watersheds to disturbance (that is, their ability to recover following disturbances). To better understand the potential hydrologic integrity of these subbasins, a variety of resiliency ratings were developed for each subwatershed and subbasin {*Component Assessment*—Biophysical). These ratings are used in conjunction with the hydrologic disturbance ratings in the assessment of overall hydrologic integrity. For example, areas with high hydrologic disturbance, and high stream

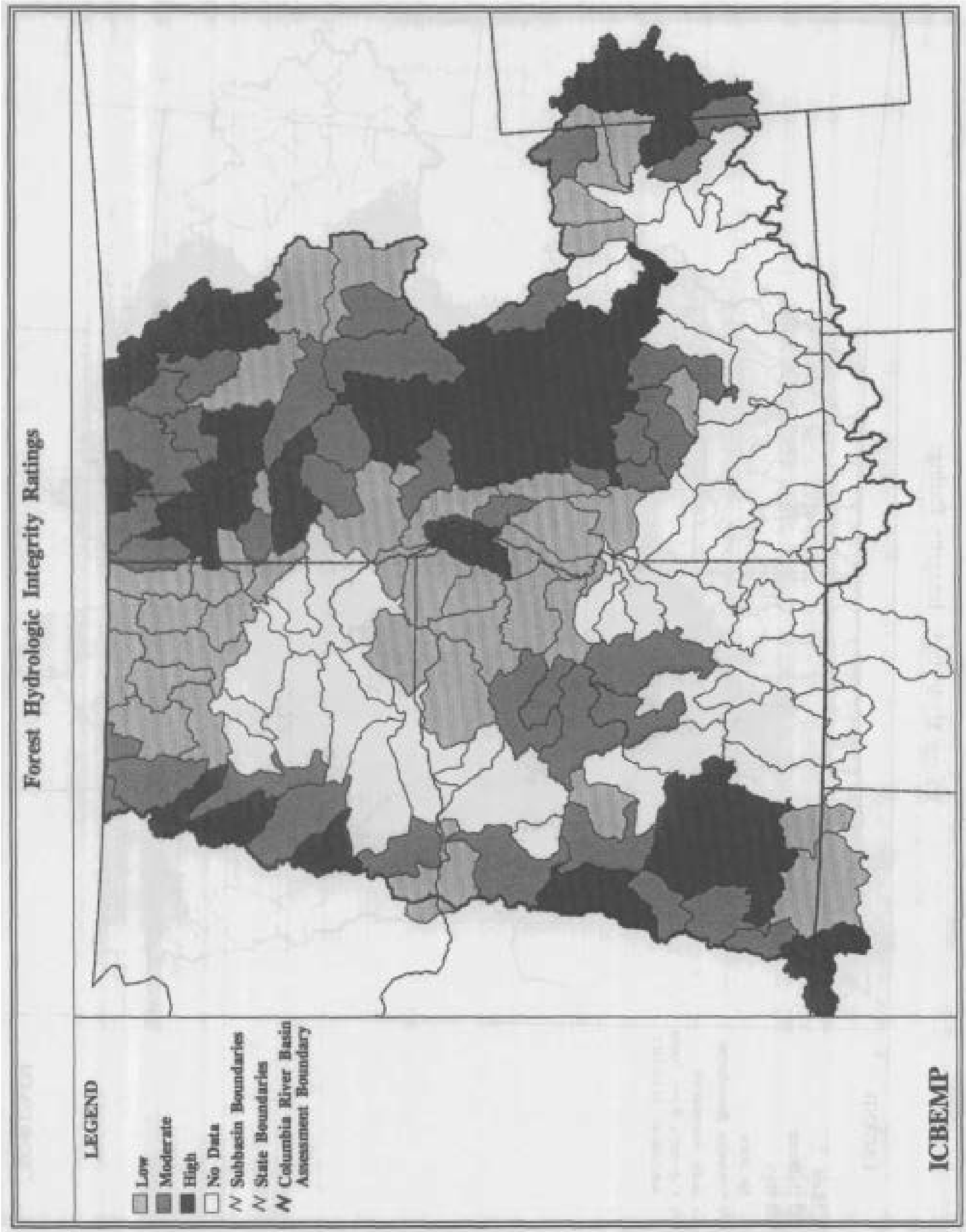

Figure 35—Hydrologic integrity was rated for the 112 subbasins that had forest PVGs.

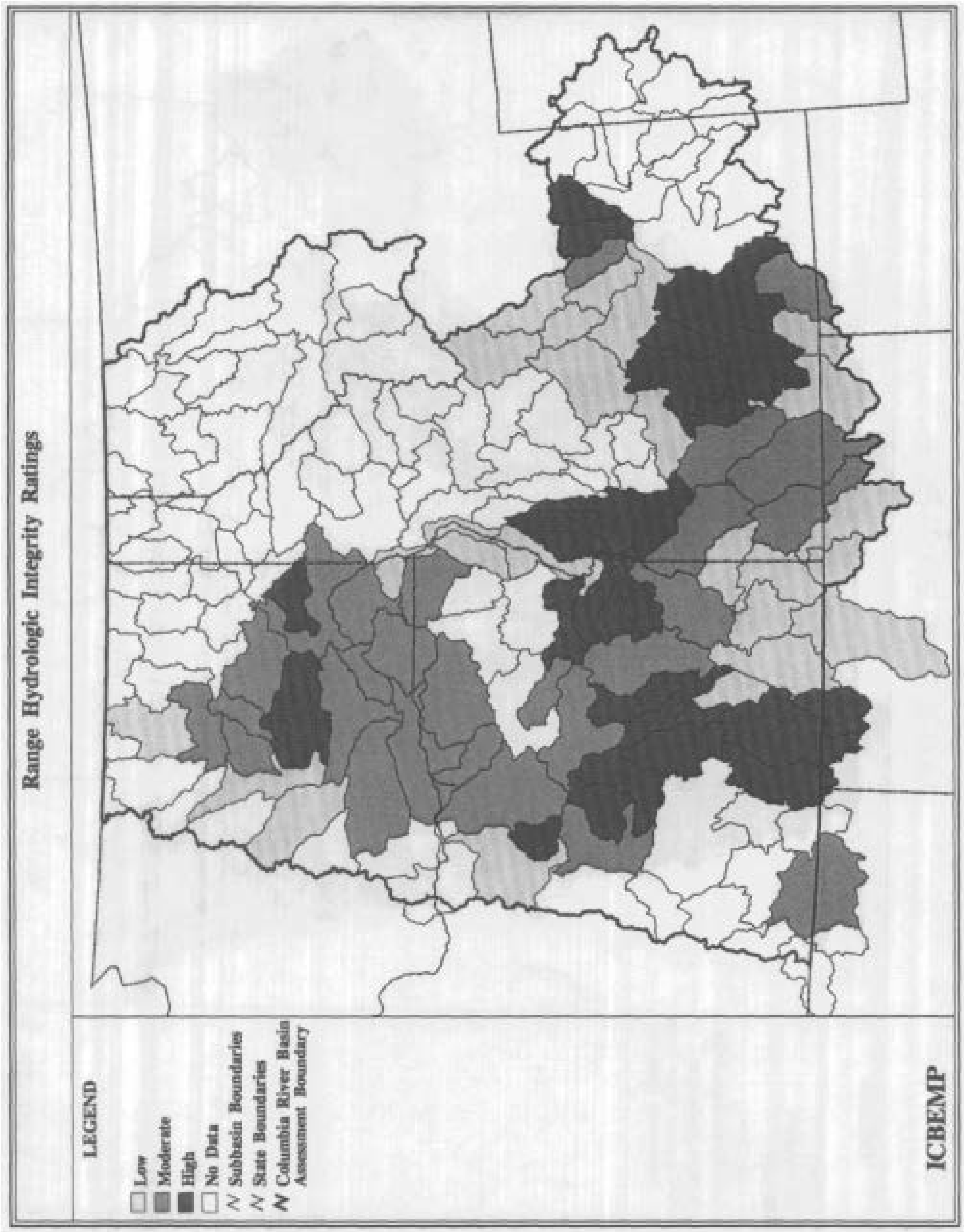

Figure 36—Hydrologic integrity was rated for the 86 subbasins that had range PVGs.

and riparian vegetation sensitivities are considered to have the lowest probable hydrologic integrity across the Basin. Areas with high hydrologic disturbance and low stream and riparian vegetation sensitivity, however, would likely possess higher hydrologic integrity because they are better able to absorb such disturbances without loss of hydrologic function. For these reasons, hydrologic resiliency ratings are appropriately used to interpret the effects of past management activities on hydrologic integrity.

The hydrologic integrity values assume that areas with high disturbance and low recovery potential (that is, they are not resilient) are more likely to have higher probabilities of containing altered hydrologic functions than other areas. Consequently, they are described as possessing low integrity in this report. Conversely, areas with low relative disturbance by mining, dams, roads, cropland conversion, grazing and high recovery potentials are considered to have the highest probable hydrologic or riparian integrity. The integrity values presented in this report reflect probabilities of finding altered hydrologic functions within subbasins based on relative differences between subbasins. Information presented in this section is appropriate to the description of relative differences across the Basin at the subbasin level.

Aquatic Integrity

An aquatic system that exhibits high integrity has a mosaic of well-connected, high-quality water and habitats that support a diverse assemblage of native and desired non-native species, the full expression of potential life histories and dispersal mechanisms, and the genetic diversity necessary for long-term persistence and adaptation in a variable environment. This definition is consistent with, and driven by, the goal to sustain biotic diversity and maintain ecological processes. Subbasins exhibiting the greatest level of these characteristics were rated high, those exhibiting the least were rated low, with medium ratings in between.

We have characterized subbasins along a gradient of conditions relative to a full complement of native fish and other aquatic species, well distributed in high-quality, well-connected habitats (fig. 37). Subbasins that support the full expression of life histories and a strong mosaic of productive and well-connected populations should be relatively self-contained and resilient to the natural disturbances anticipated over time periods approaching 100 years.

High aquatic integrity—These subbasins most closely resemble natural, fully functional aquatic ecosystems. In general they support large, often contiguous blocks of high-quality habitat and watersheds with strong populations of multiple species. Connectivity among watersheds and through the mainstream river corridor is generally unimpeded, and all life histories, including migratory forms, are present and important. Native species predominate, though introduced species may be present. These subbasins provide a system of large, well-dispersed habitats that are resilient to large-scale catastrophic disturbances.

Medium aquatic integrity—These subbasins support important aquatic resources, often with watersheds classified as strongholds for one or more species scattered throughout. The integrity of the fish assemblage is moderate or high. The most important difference between high integrity and medium integrity is increased fragmentation that has resulted from habitat disruption or loss. These subbasins have numerous watersheds where native species have been lost or are at risk. Connectivity among watersheds exists through the mainstem river system, or has the potential for restoration of life-history patterns and dispersal among watersheds. Re-establishing the necessary mosaic of habitats will often require conservation of existing high-quality sites as well as the restoration of whole watersheds that continue to support remnant populations.

Low aquatic integrity—These subbasins may support populations of key salmonids or have other important aquatic values (that is, threatened and endangered species, narrow endemics, and

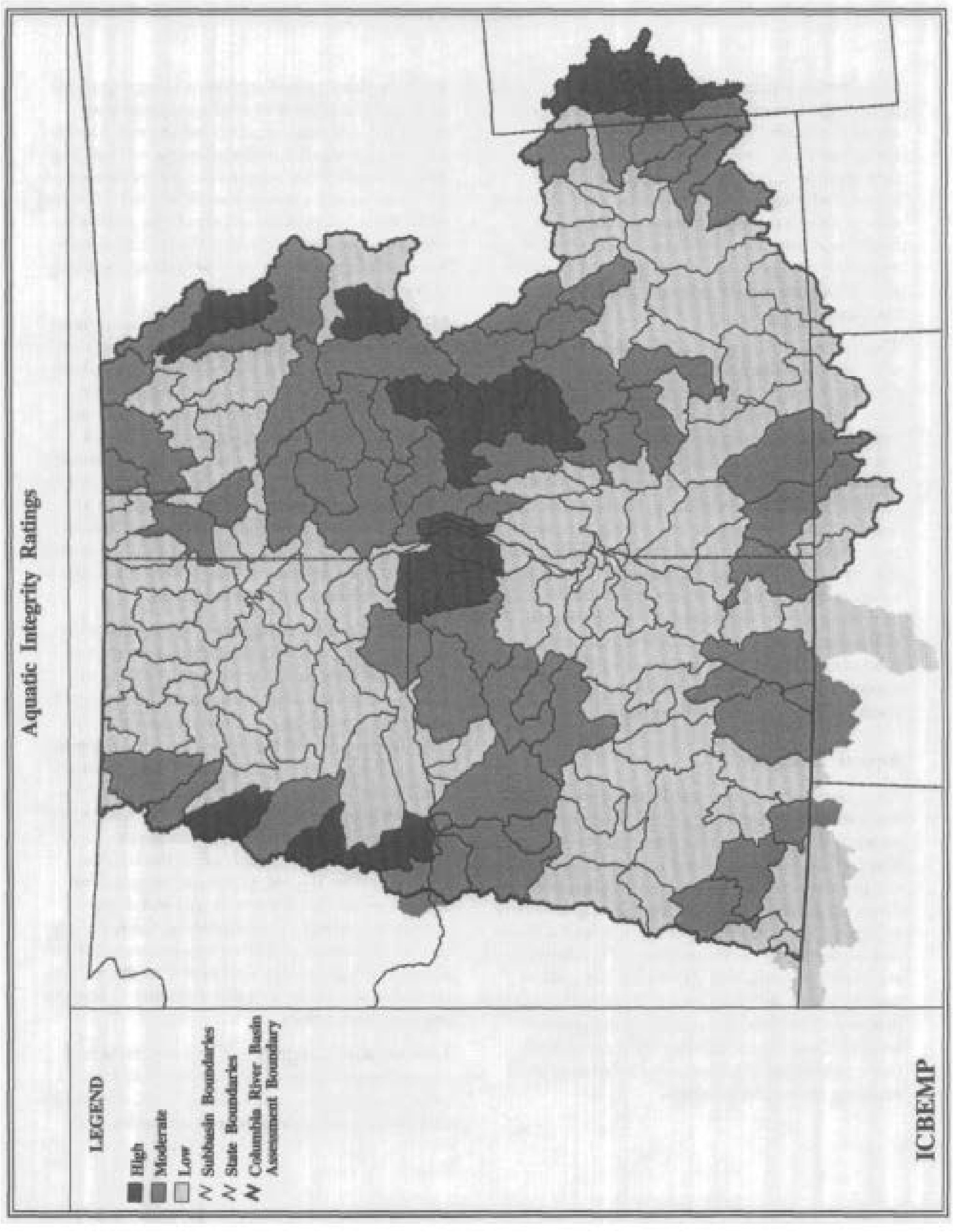

Figure 37—Aquatic integrity was rated for the 164 subbasins.

introduced or hatchery supported sport fisheries). In general, however, these watersheds are strongly fragmented by extensive habitat loss or disruption throughout the component watersheds, and most notably through disruption of the mainstem corridor. Although important and unique aquatic resources exist, they usually are localized.

Terrestrial Community Types

We aggregated 165 cover type and structural stage combinations into 24 terrestrial community types (*Component Assessment*—Landscape). Terrestrial communities have changed from historic to current time periods. Late-seral forested communities, herbland, and shrubland have declined (table 17). Terrestrial community types were simulated across the Basin for a 400-year period using pre-European conditions as the initial point. These broad-scale estimates provided a range of conditions that may have existed in presettlement times. Departures from this range of conditions were developed to estimate the magnitude of broad habitat changes in forestlands and rangelands within subbasins. Estimating broad habitat departures from estimated historical ranges of conditions enabled us to infer potential effects on current and future species habitat. Habitat departure estimates can be useful in setting priorities for terrestrial ecosystem restoration activities, and understanding important trade-offs and risks associated with vegetation management. Examples of species associated with terrestrial community types are provided in table 18. If substantial shifts in a specific terrestrial community are projected, reference to this table provides insight into some species that may be affected.

We further collapsed the forest terrestrial community types having late-seral/single-layered, and late-seral/multi-layered structures into a "late" class. We then estimated departure[17] from historical ranges of conditions by subbasin for nine resulting Forestland terrestrial community types (table 19) and three rangeland terrestrial community types (table 20). We estimated departures for those terrestrial community types that account for at least 1 percent of the subbasin area for any output period of the historical simulation run, or for the current condition.

[17]Terrestrial community type departures were determined by comparing the current areal extent of each type to 75 percent of the historical ranges (simulated) of each type.

Forest and Rangeland Cluster Descriptions

Each of the 164 subbasins in the Basin is unique. The challenge is to identify meaningful similarities among subbasins, while preserving these unique characteristics. We organized subbasins within clusters based on common ecological themes that highlight the similarities of subbasins grouped within clusters, while acknowledging substantive differences among the subbasins. These clusters reflect recurring patterns that emerged from the analyses. Clusters represent a simplified synthesis of common management history, resultant conditions, management needs, opportunities, and potential conflicts across large and complex landscapes.

Two sets of clusters emerged: six forestland and six rangeland groupings or clusters (figs. 38 and 39). The primary characteristics for the clusters are shown in tables 21 and 22. These clusters or groupings are a representation of the current ecological conditions for the Basin. As change occurs, the groupings would be expected to also change. The clusters can be useful to land managers as they make decisions about priorities, emphases, and where management activities might occur across the landscape in order to achieve specific goals and attain desired future conditions.

A brief description of each cluster in terms of its current characteristics and conditions is presented in the following paragraphs. Table 23 provides a quick highlight of the primary characteristics of each cluster, the primary risks to current ecological integrity, and primary opportunities to address ecological integrity. When a decline in occurrence of a terrestrial community is noted for a particular

Table 17—Changes of broadscale terrestrial communities between historical and current periods within the Basin assessment area.

Terrestrial community[1]	Historical area	Current area	Class change[2]	Basin change[3]
	percentage			
Agricultural	0.0	16.1	N.A.[4]	16.1[5]
Alpine	0.2	0.2	-0.2	0.0
Early-seral Montane Forest	8.7	7.9	-8.4	-0.7
Early-seral Lower Montane Forest	1.1	0.3	-76.8[5]	-0.9
Early-seral Subalpine Forest	1.2	1.8	48.2[5]	0.6
Exotics	0.0	2.1	N.A.[4]	2.1[5]
Late-seral Montane Multi-layer Forest	3.8	3.4	-11.2	-0.4
Late-seral Montane Single-layer Forest	0.8	0.9	8.4	0.1
Late-seral Lower Montane Multi-layer Forest	2.2	1.4	-34.6[5]	-0.8
Late-seral Lower Montane Single-layer Forest	5.6	1.1	-80.6[5]	-4.5[5]
Late-seral Subalpine Multi-layer Forest	1.2	0.5	-63.8[5]	-0.8
Late-seral Subalpine Single-layer Forest	0.6	0.8	36.3[5]	0.2
Mid-seral Montane Forest	10.5	16.6	58.6[5]	6.1[5]
Mid-seral Lower Montane Forest	4.9	7.5	53.0[5]	2.6[5]
Mid-seral Subalpine Forest	2.7	2.7	-1.0	0.0
Rock/Barren	0.2	0.2	0.0	0.0
Upland Herbland	14.9	4.9	-66.8[5]	-9.9[5]
Upland Shrubland	36.7	25.5	-30.5[5]	-11.2[5]
Upland Woodland	1.9	2.9	49.5[5]	0.9
Urban	0.0	0.2	N.A.[4]	0.2
Water	0.9	0.9	0.0	0.0

Note: numbers have been rounded.

'The terrestrial community types riparian herbland, riparian shrubland and riparian woodland comprised less than 1.0 percent historically and are not shown in the table.

[2]Class change = percent change historical to current for the terrestrial community.

[3]Basin change = percent change historical to current as a proportion of the Basin.

[4]Not applicable since the terrestrial community did not exist during the historical period.

'Ecologically significant changes.

Table 18—Examples of species associated with specific community types.

Terrestrial community type	Examples of associated species
Lower Montane:	
Forest generalist	Least chipmunk, dusky-footed wood rat, Nashville warbler
Late-seral	Olive-sided flycatcher, white-headed woodpecker, pygmy nuthatch
Mid/Upper Montane:	
Forest generalist	California myotis, creeping vole, blue grouse
Late-seral	American marten, northern spotted owl, northern saw-whet owl
Subalpine:	
Forest generalist	Wolverine
Late-seral	Boreal owl, heather vole, chestnut-backed chickadee
Herblands:	Idaho ground squirrel, savannah sparrow, bobolink, Say's phoebe, greater sandhill crane
Shrublands:	Mojave black-collared lizard, pygmy rabbit, black-throated sparrow, loggerhead shrike
Mixed conifer woodlands:	Uinta ground squirrel, fringed myotis, mountain quail
Juniper woodlands:	plain titmouse, pinyon jay

Table 19—Percent of subbasins within each Forest Cluster having a net departure [reduction (-) or increase (+)] in terrestrial community type from 75 percent range of the historic 400 year simulation run.

Terrestrial community type	Forest Cluster					
	1	2	3	4	5	6
	percent					
Lower Montane Early-seral	-36	-73	-85	-82	-91	-77
Mid-seral	+18	+42	+54	-18	+37	+27
Late-seral	-54	-95	-85	-96	-33	-82
Middle and Upper Montane Early-seral	+18	-6	-62	-65	-54	-41
Mid-seral	+9	+21	+62	+78	+13	+32
Late-seral	-64	-27	-23	-87	+42	-55
SubAlpine Early-seral	+36	+58	+39	-4	+4	+18
Mid-seral	+9	-26	-16	+8	-29	-5
Late-seral	-73	-42	-38	-91	+4	-41

Source: Hann and others (1996).

CONTINUED

Table 20—Percent of subbasins with range clusters having a net departure, reduction (-) and increase (+), in 400 year simulation run.

Terrestrial community type	Ranae Cluster					
	percent					
	1	2	3	4	5	6
Herblands	-100	-15	-68	-100	-62	-84
Shrublands	-67	-46	-46	-71	-4	-39
Mixed Conifer Woodlands	+100	-23	-32	+29	0	-24

Source: Hann and others (1996).

cluster, reference to table 18 provides examples of the species that are likely to be affected by a decline. More details on the terrestrial communities and hydrologic parameters are in the *Component Assessment*—Biophysical and Landscape Dynamics chapters.

Forest Cluster 1

High integrity cold- and moist-forest—These subbasins contain the greatest proportion of high forest, aquatic, and hydrologic integrity of all clusters. Subbasins in this cluster are dominated by wilderness and roadless areas and contain cold and moist/cold forests that are the least altered by management. Subbasins in this cluster are predominantly high elevation subbasins where forest structure and composition have been simplified by fire exclusion, and there has been little alteration from timber harvest. Late-seral structure has declined in all three (montane, lower montane, and subalpine) elevation settings. Early-seral and mid-seral structure has increased. Mean changes in fire severity and frequency are the lowest for this cluster. Where important changes have occurred, mixed-severity fire regimes have tended toward lethal regimes and fire frequency has generally declined as a result of effective fire suppression. Relatively limited road access in cold and moist forests of this cluster suggests that forest habitats provide a relatively high degree of security for a variety of species vulnerable to human exploitation and/or disturbance (such as, the Rocky Mountain gray wolf, grizzly bear, wolverine, lynx, moose, and elk). Hydrologic integrity of these subbasins is the highest of any forestland in the Basin. Connectivity among subwatersheds supporting native fish strongholds is good and strongholds for multiple species often exist in subwatersheds throughout these subbasins. Fish populations and communities associated with these subbasins are likely the most resilient in the Basin, are able to withstand large-scale disturbance events, and will likely persist without any human intervention.

Forest Cluster 2

Moderate and high-integrity forest—Subbasins in this cluster represent a mix of moderate to high forest, hydrologic, and aquatic integrity. In general the forestland contains semi-wild and moderately-roaded areas. Landscape vegetation patterns and disturbances are more highly altered in lower- and mid-montane settings, which coincide with higher road densities. Late- and early-seral structure has declined in most elevation settings with compensating increases in mid-seral, resulting in more homogeneous forest structure. Subbasins in this cluster provide relatively secure habitats for vertebrates vulnerable to human disturbance. The tendency in dry forests has been to move from non-lethal, to mixed and lethal fire severities with declining fire frequencies. The tendency in moist forest groups has been to move from mixed to lethal fire severity with

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Table 21—Summary of Characteristics of Forest Clusters.

Variable	Forest Cluster 1	2	3	4	5	6
	percent of area					
Ownership						
BLM/FS	80	86	40	58	50	35
Other	20	14	60	42	50	65
Potential Vegetation Groups						
Dry Forest	13	26	22	14	43	23
Moist Forest	23	25	33	67	6	16
Cold Forest	47	30	15	7	4	9
Dry Grass/Shrub	7	11	6	3	24	15
Cool Shrub	3	3	1	1	8	11
Other	8	5	24	8	15	26
Forested Vegetation Groups (% of forested area in each)						
Dry Forest	16	37	55	18	81	51
Moist Forest	27	27	52	73	11	21
Cold Forest	57	36	13	9	8	28
Road Density Classes						
Low or none	85	62	32	20	22	36
Moderate or higher	15	38	68	80	78	64
Cropland/pasture	0	3	20	2	11	21
<12" annual precipitation	1	4	2	3	14	14
Fire frequency change	37	60	66	51	60	60
Fire severity increase	36	50	57	47	35	36
High wildland/urban fire interface risk	0	17	6	1	29	10
Moderate wildland/urban fire interface risk	29	61	36	13	30	23
Change in juniper woodland	0	0	0	0	0	0
Forest Integrity						
Low	0	10	67	86	79	59
Moderate	0	43	33	10	21	17
High	100	47	0	4	0	24
Range Integrity						
Low	0	29	100	57	100	66
Moderate	61	48	0	43	0	35
High	40	23	0	0	0	0
Aquatic Integrity						
Low	5	0	8	54	52	87
Moderate	38	59	85	46	44	13
High	58	41	7	0	4	0
Hydro logic Integrity						
Low	0	4	47	12	39	76
Moderate	4	30	49	54	41	17
High	96	66	4	34	20	7
Composite Ecological Integrity						
Low	0	0	4	83	96	100
Moderate	0	3	96	17	4	0
High	100	97	0	0	0	0

Source: ICBEMP GIS data (converted to 1 km^2 raster data).

Table 22— Summary of characteristics of Range Clusters.

Variable	Range Cluster 1	2	3	4	5	6
	percent of area					
Ownership						
BLM/FS	36	81	44	5	75	55
Other	64	19	56	95	25	45
Potential Vegetation Groups						
Dry Forest	29	21	34	8	10	12
Moist Forest	5	33	28	4	5	2
Cold Forest	1	34	14	30	11	4
Dry Grass/Shrub	32	4	4	26	45	50
Cool Shrub	22	1	2	3	20	9
Other	11	7	18	59	9	23
Rangeland Vegetation Groups						
Dry Rangeland	49	34	17	30	61	61
Cool Rangeland	34	8	8	3	27	11
Other	17	58	75	67	12	28
Road Density Classes						
Low or none	20	71	30	62	64	30
Moderate or higher	80	29	70	38	36	70
Cropland/pasture	9	3	14	56	5	17
<12" annual precipitation	23	1	2	51	33	38
Fire frequency change	37	51	67	17	24	17
Fire severity increase	18	47	49	13	16	9
High wildland/urban fire risk interface	32	7	12	0	6	8
Moderate wildland/urban fire risk interface	10	59	33	4	58	39
Change in juniper woodland	+ 12	0	0	0	0	0
Forest Integrity						
Low	100	6	76	79	12	37
Moderate	0	37	15	21	27	43
High	0	57	9	0	61	20
Range Integrity						
Low	100	6	76	100	26	79
Moderate	0	37	15	0	50	21
High	0	57	9	0	24	0
Aquatic Integrity						
Low	39	4	43	84	37	79
Moderate	61	24	50	16	57	18
High	0	72	7	0	6	3
Hydrologic Integrity						
Low	34	6	49	100	7	44
Moderate	66	16	35	0	35	34
High	0	78	16	0	58	22
Composite Ecological Integrity						
Low	100	0	58	97	8	80
Moderate	0	3	32	3	63	20
High	0	97	10	0	29	0

Source: ICBEMP GIS data (converted to 1 km^2 raster data).

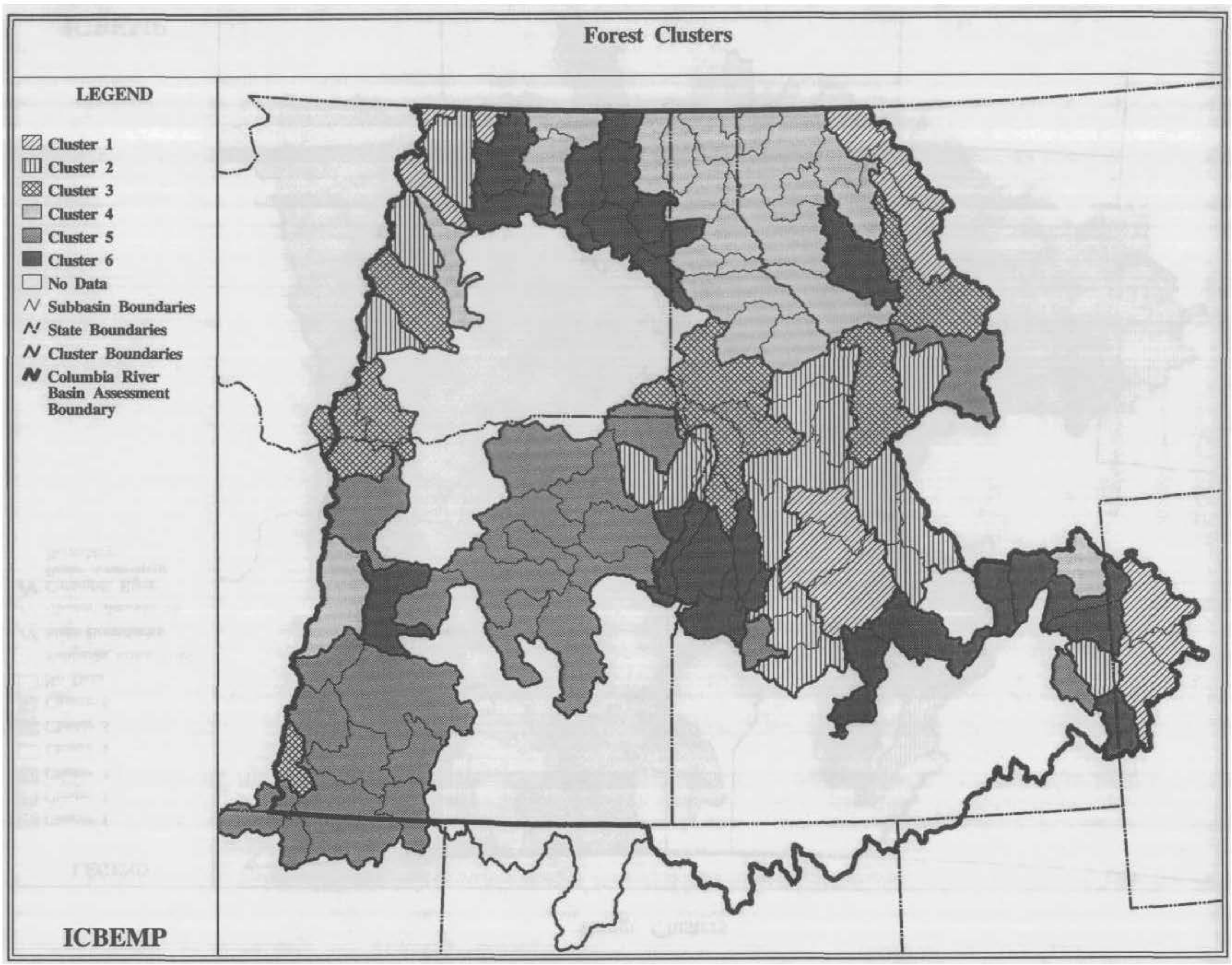


Figure 38—Subbasins grouped into six Forest Clusters.

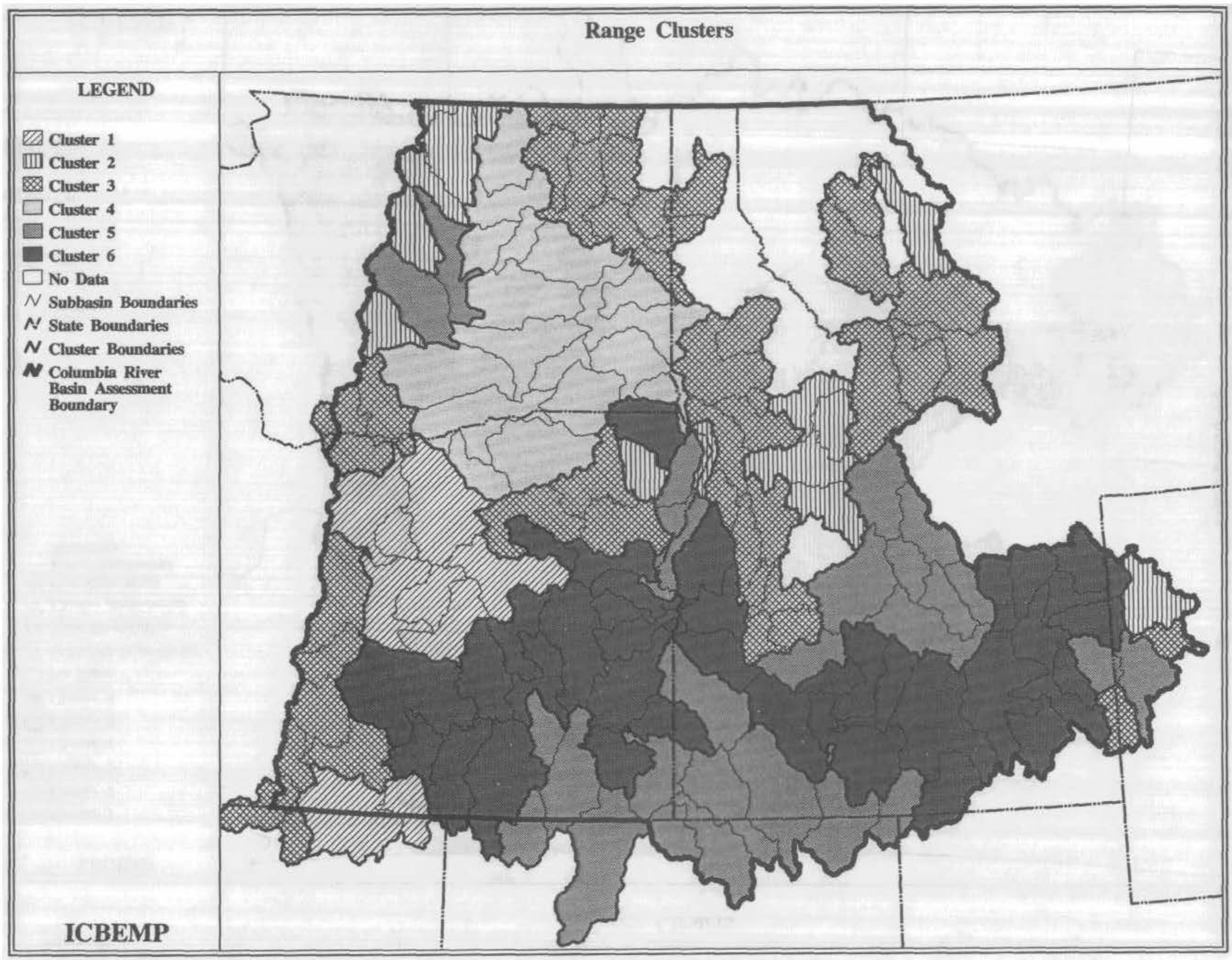


Figure 39—Subbasins grouped into six Range Clusters.

Table 23—Forest and Rangeland Clusters - primary characteristics, risks to ecological integrity, and opportunities to address risks to integrity.

Forest or Range Clusters	**Primary characteristics**	**Primary risks to ecological integrity**	**Primary opportunities to address risks to integrity**
Forest 1	1. Moist and Cold Forest types 2. Minimally roaded 3. High aquatic, forest, hydrologic, and composite integrity	1. Severe fire potential in lower elevations 2. Higher elevations sensitive to soil disturbances (i.e., roading)	1. Prescription of natural or prescribed fire to reduce risks of severe fire 2. Reduction of stocking levels in lower elevations - reductions of fire severity. Maintenance of integrity in higher eleva tions
Forest 2	1. Minimally roaded 2. Mix of high and moderate forest, hydrologic, and aquatic integrity 3. High composite integrity 4. Mix of cold, moist, and dry forest types (nearly equal)	1. Cold forest types sensitive to soil disturbance (i.e., roading) 2. Fire severity in lower elevations and dry forest types 3. Aquatic integrity induced by low forest integrity in dry and moist forest types	1. Reduction of fire threat in lower elevations and manage road densities 2. Improvement of aquatic integrity through improving connectivity 3. Reduction of fire severity through restoration practices
Forest 3	1. Moderately roaded 2. Moderate aquatic and composite integrity 3. Low and moderate forest and hydrologic integrity 4. Dry and moist forest types	1. Fire severity in dry/moist forest types 2. Aquatic integrity at risk in areas of high fire potential 3. Old/late forest structures in managed areas	1. Restoration of forest integrity 2. Maintenance of aquatic and hydrologic integrity 3. Management of road densities
Forest 4	1. Moist forest types 2. Highly roaded 3. Low forest, aquatic, and composite integrity 4. Moderate to high hydro-logic integrity	1. Hydrologic and aquatic systems from fire potentials 2. Late and old forest structures in managed areas 3. Forest compositions - susceptibility to insect, disease, and fire	1. Restoratoion of late and old forest structure in managed areas 2. Connection of aquatic strongholds through restoration 3. Treatment of forested areas to reduce fire, insect, and disease susceptibility
Forest 5	1. Dry forest types 2. Low to moderate aquatic integrity and low forest integrity and low composite integrity 3. Sensitive watersheds to disturbance 4. Highly roaded	1. Fish strongholds from sediment/erosion potential 2. Forest composition and structure, especially old/late 3. Hydrologic integrity due to fire severity and frequency	1. Restoration of forest integrity through vegetation management 2. Restoration of old/late forest structure 3. Restoration of aquatic and hydrologic integrity by reducing risk of fire, insect, and disease and road management
FoTQSt 6	1. Dry forest types 2. Low hydrologic, forest, aquatic, and composite integrity 3. Moderately roaded	1. Forest composition and structures especially old/late 2. Primarily present at finer resolutions	1. Restoration of forest structures 2. Maintenance of the scattered aquatic strong-holds that exist 3. Reduction of risk of fire, insect, and disease

Forest or Range Clusters	Primary characteristics	Primary risks to ecological integrity	Primary opportunities to address risks to integrity
Range 1	1. Highest level of juniper woodlands 2. High road densities 3. Low forest, range, and composite integrity 4. Moderate aquatic and hydrologic integrity 5. Fire regimes are more severe	1. Juniper encroachment into shrubland 2. Forage for ungulates (wild/domestic) reduced through woodland encroachment 3. Noxious weed expansion	1. Reduction of forest stocking could improve forage/cover relationships for livestock and big game 2. Curtailment of juniper expansion 3. Curtailment of noxious weed expansion 4. Management of riparian areas to enhance stream bank stability and riparian vegetation
Range 2	1. Forested rangelands in moderate to high integrity 2. High aquatic, hydrologic, and composite integrity 3. Minimally roaded	1. Fish and aquatic systems from dry vegetation types with fire severity/frequency changes 2. Dry forest types - especially late/old structures 3. Aquatic system sensitivity to disturbance	1. Restoration of vegeta tion and fuels treatments in dry forest types 2. Maintenance of aquatic and hydrologic integrity - emphasize connectivity 3. Restoration of mainte nance sagebrush ecotone 4. Restoration of forage production in winter range
Range 3	1. Low forest and range integrity 2. Low and moderate hydrologic, aquatic, and composite integrity 3. Highly roaded	1. Conflicts with big game management from conifer invasion reducing forage 2. Elevated fuel and fire from conifer invasion 3. Riparian conditions from disturbances 4. Increased susceptibility to insect, disease, and fire in forested areas	1. Management of to restore/ maintain riparian condition? 2. Prescription of fire to reduce risks from fire, insect, and disease in forested areas 3. Containment of noxious weeds 4. Maintenance of water quality for native and desired non-native fish
Range 4	1. Very low levels of FS/BLM lands 2. Lowest integrity in all components 3. Low levels of residual rangeland	1. Reduced fish habitat and populations from agricultural conversions	1. Reduction of threats to local populations of fish and their habitat
Range 5	1. Minimally roaded 2. Low croplands and other disturbances 3. High hydrologic and forest integrity 4. Moderate and low range and aquatic integrity 5. Moderate and high composite integrity	1. Continued declines in herb-land and shrubland habitats 2. Risks to local populations and habitats for fish	1. Maintenance restoration of riparian condition 2. Restoration of productive aquatic areas 3. Conservation of fish strongholds and unique aquatic areas
Range 6	1. Highly roaded 2. Highly altered from grazing and fire exclusion 3. High exotic species 4. Low composite integrity	1. Continued declines in herb-land and shrubland 2. Dry shrubland highly sensitive to overgrazing and exotic grass and forb invasion	1. Containment of exotic weed expansion 2. Maintenance restoration of riparian conditions 3. Management of grazing intensity, duration, and timing 4. Conservation of fish strongholds and unique aquatic areas

reduced fire frequency. Aquatic population strongholds are generally associated with headwaters and unroaded portions of the subbasins. These subbasins have good connectivity via unimpeded river corridors. Subbasins within this cluster are ideal for restoration because relatively small investments could secure relatively large, diverse and functional systems.

Forest Cluster 3

Moderate and low-integrity forest—Forests in these subbasins are generally rated as low in integrity with the highest mean departures in fire frequency and severity. The subbasins have moderate road densities. Areas of late- and early-seral structures have declined most significantly with compensating increases in mid-seral structures with the net result being more homogeneous forest structure. Vertebrates vulnerable to human disturbance have limited secure habitat. Risks are highest for those species relying on late- or early-seral forest structure and those species using small non-forest openings or canopy gaps. The aquatic ecosystems may be highly productive and resilient in the face of disturbance, or the cumulative effects of disturbance in streams may simply lag behind changes in watersheds. Considering current knowledge and uncertainty of outcomes for existing fish strongholds, management to restore forest structure and composition may well represent some of the most important risks and potential conflicts for maintaining productive aquatic ecosystems. Watershed analysis could be an important tool for increasing the certainty of outcomes from terrestrial ecosystem restoration activities in these subbasins. Hydrologic integrity of these subbasins is low to moderate. Disturbance of hydrologic function from past management activities is moderate to high, due in large part to roads, mines, and cropland conversion of lower-elevation valleys. Most subbasins in this theme are classified as having moderate aquatic integrity. Subwatersheds may be vulnerable to future degradation owing to existing development or dramatic changes in watershed processes from large fires that could produce extensive, synchronous changes in watershed condition.

Forest Cluster 4

Low integrity, moist forests—Forests in these subbasins exhibit low integrity and are likely to be dominated by moist, productive forest types and be heavily roaded. Forest structure has likely been altered by past management and forests generally show moderate to strong shifts in fire severity, but less change in fire frequency. Forest structure shows: decreases in late-seral structures in all elevation settings; large increases in mid-seral; decreases in early-seral; and a more homogeneous structure overall (see photo 7). Risks to terrestrial vertebrates that rely on late or early forest structure in the moist forest have increased significantly. Those species that are vulnerable to human distur-

Photo 7—This young mixed forest stand of western redcedar, western hemlock, and western white pine in northern Idaho illustrates characteristics of a moist forest cluster.

bance or exploitation have relatively low amounts of secure habitat as a result of extensive roading. Forest homogeneity has resulted in fewer canopy gaps and non-forest openings. Although the aquatic systems often have the connectivity to sustain multiple fish life histories, the distribution of important watersheds is often fragmented, perhaps through habitat disruption associated with intensive forest management. Hydrologic integrity of these subbasins is moderate. The moist landscapes are often associated with relatively high-frequency rain on snow events. Where timber harvest and roading are extensive, as in the Coeur d'Alene and St. Joe subbasins, peak flow events may be exaggerated resulting in aggravated channel scour and aggradation that may negatively influence some salmonids and their habitats (Rieman and Mclntyre 1993). Fuel management is a priority for maintenance of hydrologic function in these subbasins. Aquatic integrity in these subbasins is judged low or moderate. Recovery of both aquatic and terrestrial ecosystems requires active and intensive restoration efforts. These subbasins have high restoration potential with much to gain and relatively little to lose.

Forest Cluster 5

Low-integrity, dry forests—Forests in these subbasins are dominated by dry-forest with approximately 60 percent of the area showing changes in fire frequency. They are extensively roaded and have little wilderness. Late-seral structure increased significantly in montane forests resulting from conversion of a variety of forest structures dominated by shade-intolerant conifers (such as, pine) to forests dominated by shade-tolerant species (such as, fir). Mid-seral structure increased in lower montane and montane settings. Increases in late-seral montane have benefited species preferring densely-stocked forests composed of shade-intolerant species (for example, American marten, northern spotted owl, and red-backed vole). Habitat for species preferring more open, park-like structures (for example, white-headed woodpecker, silver-haired bat, and flammulated owl) has declined. Nearly 80 percent of the area in this cluster is classified as low forest and rangeland integrity. Hydrologic integrity of these subbasins is low to moderate. The subbasins associated within the Grande Ronde and John Day river basins are in better condition than average, supporting from 15 to 30 percent of the potential salmonid subwatersheds in a strong condition. Several of the subbasins in this cluster (that is, Lower Deschutes, Upper and Lower Grande Ronde, Umatilla, and the Upper, Middle, and North forks of the John Day) support sensitive populations of anadromous salmonids (the latter three subbasins also support endangered chinook salmon). Forests are less productive than those associated with Forest Cluster 4, and historical disturbance regimes imply the need for more frequent silvicultural and prescribed fire treatments. These subbasins show moderate opportunities for restoration.

Forest Cluster 6

Mixed-integrity dry and moist forests with low aquatic integrity—Half the forested area in this cluster is composed of dry forest types, the other half is split between dry and cold forest types. This cluster has the smallest amount of FS- and BLM-administered lands of all the forest clusters, yet still has over one-third of its area in low road-density classes. This cluster has the largest proportion of its area rated as low hydrologic integrity and aquatic integrity. Late- and early-seral structures have declined in most elevation settings; an increase in mid-seral was the most compensating change. Species vulnerable to human exploitation and disturbance have a relatively low amount of secure habitat. The aquatic systems tend to be especially fragmented and remaining populations of native species are often isolated. The subbasins seem to support few and widely scattered strongholds and the poorest measures of condition for fish communities. There will be little chance for recreating fully connected aquatic systems either because habitats are seriously degraded or because remaining populations are strongly isolated. Disturbance of hydrologic function from management activities is high primarily because of roads, dams, and cropland conversion of lower elevation valleys. Because remaining intact aquatic ecosystems are found primarily on Federal land, and because these lands represent a small area of these subbasins, flexibility in management may be limited.

Rangeland Cluster 1

Juniper woodlands—juniper woodlands are more common in this cluster than any other cluster within the Basin; additionally woodland area has substantially increased in each subbasin. Herblands and shrublands have significantly decreased. Forest rangelands included in this cluster are found in the lower montane settings. Forested rangeland changes have resulted in declines in ungulate forage and displacement of native ungulates from historic winter ranges to less productive montane forests. Climate associated with juniper woodlands is dry. Large areas receive an average of 12 or fewer inches of annual precipitation, especially in the Lower Deschutes, Trout, Lower Crooked, Upper Crooked, and Beaver South Fork subbasins in central Oregon. Juniper woodlands are frequently subjected to hot, droughty summers, and cold winters.

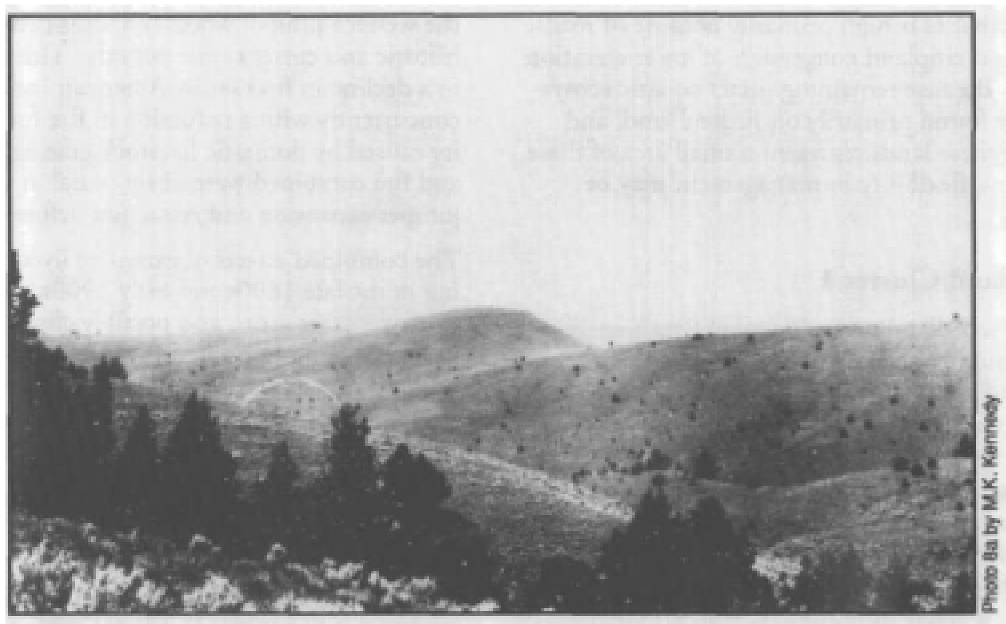
Western juniper communities in the subbasins of this theme typically exist as (1) inclusions in the forest zone, (2) old juniper woodlands, and (3) young woodlands that in the recent past have expanded into the sagebrush zone. Old western juniper woodlands contain an old tree component, one that contains trees that generally exceed 150 years. These old woodlands typically persisted on mesa edges, ridges, and knolls characterized by fractured bedrock near the surface, and well-drained, shallow soils that produced relatively little understory herbaceous vegetation. These sites were not relatively disposed to fire.

Fire, typically occurring at intervals ranging from 5 to 50 years, tended to restrict western juniper woodland extent in the sagebrush-bunchgrass zone. Fire frequency has declined substantially in the western juniper woodland areas between historic and current time periods. This is because of a decline in fires set by American Indians, concurrently with a reduction in fire fuel availability caused by domestic livestock grazing. Climate and fire combined were likely causal in western juniper expansion and retraction before 1800.

The combined effects of extensive livestock grazing in the late 1800s and early 1900s, fire exclusion over large areas, and possibly climate changes probably are responsible for expansion of western juniper woodlands during the last 100 years (see photos 8a and 8b). Concomitant reduction in the area of historical herblands and shrubland cover generally has not proceeded at a rate that equals or exceeds the rate of western juniper woodland expansion.

Diffuse knapweed, yellow starthistle, medusahead, whitetop, and Canada thistle are examples of problematic exotic weed species in this cluster on rangelands. Subbasins in this cluster support the highest average road densities, and roads are causal in the past and current spread of several exotic weed species in this cluster, for example diffuse knapweed. Diffuse knapweed, medusahead, and whitetop are extensive in some locations along the Deschutes and John Day rivers and tributaries.

Average area in cropland and pasture is low. The hydrologic integrity of these subbasins ranges from low to moderate and the riparian environment integrity is commonly low. Rangeland and forest integrity are low while aquatic and hydrologic integrity are mixed low and moderate; the composite integrity rating is low. The Lower Deschutes and the Upper John Day subbasins are strongholds for native rainbow and redband trout. The Lower Deschutes and Upper John Day subbasins currently contain important native steelhead and chinook salmon stocks and habitats, and dams do not preclude connecting these existing habitats with larger functional networks. These subbasins and their resident populations are key to any strategy to restore conditions for anadromous fish. The Trout subbasin (Trout Creek primarily) also contains native steelhead stocks but habitats are in poor condition.



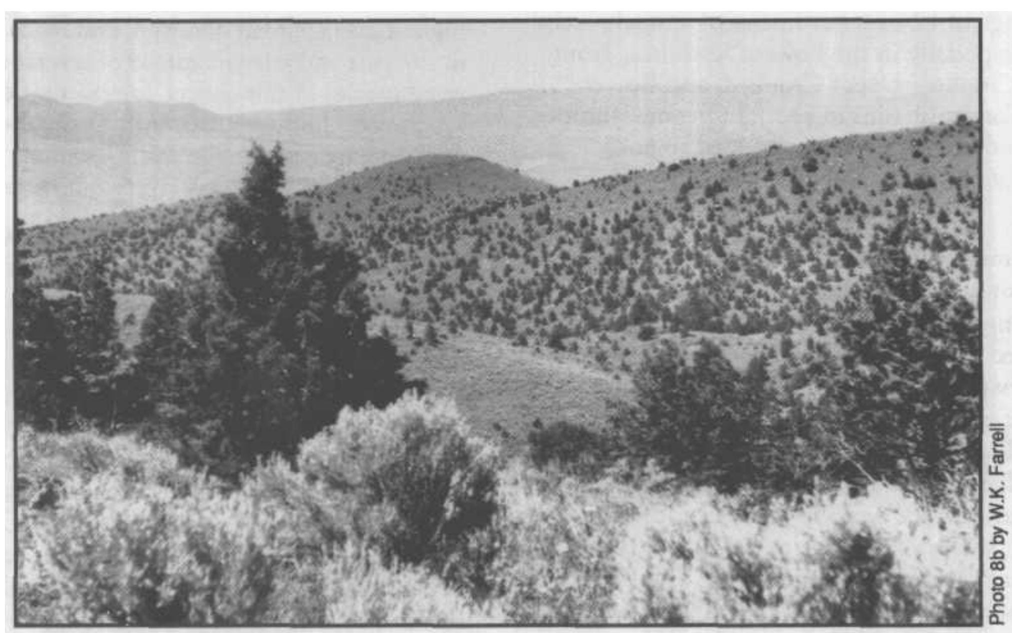


Photo 8a and 8b. The expansion of western juniper into sagebrush-grass is evident in this photo pair showing 1920 to 1956 change resulting form grazing and fire exclusion. The photo pair typifies changes commonly found in the juniper woodland rangeland cluster. Source: (Skovlin and Thomas 1995.)

Rangeland Cluster 2

High-integrity dry-forest rangelands—dry forested rangelands of these subbasins have been altered by livestock grazing, timber harvest, and exclusion of fire, but are rated as the cluster with the highest proportion in high forest, range, aquatic, and hydrologic integrity. The resulting composite integrity rating was high. Subbasins are largely blocks of wilderness and minimally roaded areas with more than 70 percent in low or minimal roading classes. Herblands, shrublands, and woodlands have significantly declined. In this century, conifers have invaded meadows, grassland and shrubland areas, and savannah woodlands reducing both livestock and big game forage, as well as creating elevated fuel and increasing fire. The loss of woodlands is most likely the result of conifer woodland progression to dry forest. Terrestrial vertebrates most associated with ecotones between shrubland and herbland and dry forests would be most affected. Lower elevations of forested rangelands support domestic livestock and big game, and are generally where conflicts arise between livestock production and big game management.

Diffuse knapweed, yellow starthistle, leafy spurge, and spotted knapweed are examples of problematic exotic weed species in this cluster on rangelands. Diffuse knapweed is especially prevalent in the Methow subbasin in north-central Washington; yellow starthistle is prevalent in the Hells Canyon subbasin. For the cluster as a whole, exotic weed acreage is not extensive on rangeland.

Hydrologic and riparian environment integrity of these subbasins is high. These subbasins support riparian environments that are some of the most resilient to livestock grazing. The best conditions in the aquatic ecosystems within rangelands are associated with the subbasins in this cluster. The subwatersheds and aquatic systems that are most degraded, however, may be associated with the lower gradient and lower elevation rangeland portions of these subbasins. Connectivity of subwatersheds that function as native fish strongholds is good, and strongholds for more than one species are often present in subwatersheds throughout the subbasins. Fish populations and communities associated with these subbasins are among the most resilient in the Basin and represent core distributions for many of the sensitive salmonids. Because these lands tend to be productive and more resilient to disturbance than others, there could be some opportunities to maintain commodity production with little risk to other components of the system provided they are focused in the areas least important to the aquatic system. These subbasins can likely withstand the consequences of some large-scale fires in the higher elevation cold and moist forest areas, and fish populations will likely persist in the absence of management intervention. The occurrence of large fires in the lower-elevation dry forests poses a somewhat different threat.

Rangeland Cluster 3

Moderate integrity dry-forest rangelands—These subbasins are among the most altered by livestock grazing, timber harvest practices, and exclusion of fire compared to presettlement condition. These subbasins are dominated by moderate or high road densities and have the highest level of fire frequency among the rangeland clusters. Substantial declines in the amount of herblands, shrublands, and mixed conifer woodlands have occurred. Effects of fire exclusion and grazing have been compounded by harvest practices in dry-forest types promoting dense, multi-layered forests with increasing amounts of shade-tolerant, insect and pathogen-susceptible conifers, and reduced understory shrub and herbaceous cover. Shrub and herbaceous understories are also typically less productive and diverse than they were historically. Subbasins of this cluster were severely affected by extensive, heavy cattle and sheep grazing in the late 1800s and early 1900s, both at low and high elevations. Many areas are recovering as a result of decreased grazing pressure (Skovlin and Thomas 1995), prescribed fire, and cultural treatments.

Curbing the expansion of introduced exotic weeds continues to be a substantial management challenge in these subbasins. Whitetop, diffuse knapweed, spotted knapweed, yellow starthistle, leafy spurge, sulfur cinquefoil, and medusahead are examples of problematic exotic weed species in this cluster on rangeland. Examples of subbasins that support extensive infestations of these exotic weeds include the Powder in northeast Oregon (whitetop and medusahead), Kettle, Sanpoil, Franklin D. Roosevelt Lake, Colville, and Lower Spokane in northeast Washington (diffuse knapweed), the Little Spokane, Upper Spokane, and Hangman in eastern Washington (spotted knapweed), and the lower Flathead, Blackfoot, Bitterroot, and Upper Clark Fork in Western Montana (spotted knapweed, leafy spurge, sulfur cinquefoil).

In this century, conifers have invaded meadows, grassland and shrubland areas, and savannah woodlands reducing both livestock and big game forage, as well as increasing fuel loadings and fire intensity and severity. Hydrologic and riparian integrity is low.

Aquatic integrity is rated as moderate or low, while forest and range integrity are mostly low. For the most part, remaining native fish populations are fragmented, represented by remnant and isolated populations scattered throughout the subbasins. Some subwatersheds within these subbasins support remnant strongholds, isolated populations of listed or sensitive species, or narrowly endemic species that will be priorities for conservation. More than 50 percent of the area of these subbasins is on public lands.

Rangeland Cluster 4

Columbia croplands—These subbasins are primarily composed of croplands and pasture. Rangelands in these subbasins have the lowest overall integrity of all rangelands in the Basin. Extensive irrigation systems are present. Herbland and shrubland have significantly decreased compared to presettlement. The climate of these subbasins is typically dry; area of subbasins experiencing less than 12 inches of average annual precipitation is 51 percent. Although the climate of the area is relatively dry, protracted droughts do not occur as commonly in subbasins of this cluster as in those of other clusters, and growing seasons are fairly long. Soils of the Columbia croplands are deep, wind-deposited loessial soils that developed with the retreat of the glaciers. Topography is gentle and much of the area was dominated by dry shrubland and dry grasslands. Narrow to wide, gentle valley bottoms were once dominated by riparian woodland, riparian shrub, or riparian herb types. Most of these areas have been converted to herbaceous pasture, hay, or croplands. Small areas of native herbland and shrubland amongst cropland still exist where steep slopes and relatively shallow soils predominate, or in military reservations, nuclear reservations, parks, reserves, cemeteries, or railroad rights-of-way. Of the grassland and shrubland areas that have not been converted to cropland or pasture, many have been heavily grazed and are now undergoing invasion by exotic weeds.

Whitetop, diffuse knapweed, yellow starthistle, Russian knapweed, Canada thistle, Scotch thistle, and cheatgrass are examples of problematic exotic weed species in this cluster on rangeland. Of these species, Canada thistle and cheatgrass are widespread in the cluster. For the remaining weeds listed, examples of subbasins that support extensive infestations include the Okanogan, Lower Yakima, Banks Lake, and Lower Crab (diffuse knapweed and/or Russian knapweed), and the Walla Walla, Lower Snake-Tucannon, Lower Snake-Asotin, and Umatilla (yellow starthistle and/or Scotch thistle). Conversion of native herblands and shrublands to agricultural types has diminished habitat for a large number of species.

Hydrologic and riparian environment integrity of these subbasins is low. The potential for streams to recover following disturbance is the lowest of any rangeland setting within the Basin. The subbasins in this cluster are strongly degraded from an aquatic perspective. Most native fishes currently exist as very isolated populations. There is little opportunity for restoration to more functional aquatic ecosystems.

Rangeland Cluster 5

Moderate integrity upland shrublands—These subbasins represent the bulk of high elevation ranges. Shrublands in this cluster, although influenced by grazing (see photo 9), fire exclusion, and exotic weed invasion, are least affected by humans. They have low levels of road densities and cropland, but have high levels of wildland/urban fire risk interface. Declines in herbland and shrubland habitats observed within Rangeland Cluster 5 have contributed to observed declines in populations of species associated with these habitats (table 18). An average of nearly 4 percent of the area of each subbasin has been invaded by exotic plants in this cluster.

Diffuse knapweed, yellow starthistle, spotted knapweed, leafy spurge, rush skeletonweed, medusahead, cheatgrass, and Canada thistle are examples of problematic exotic weed species in this cluster on rangeland. Examples of subbasins that support extensive infestations of these exotic weeds include the Upper Columbia-Entiat and Upper Yakima in Washington (diffuse knapweed), the Imnaha in Oregon (yellow starthistle), and the Upper Owyhee, Bruneau, and Salmon Falls in Idaho (cheatgrass and/or medusahead). Hydrologic and riparian environment integrity of these subbasins is high and moderate, respectively. These subbasins commonly provide the fewest limitations to rangeland management from a hydrologic integrity perspective (that is, they are resilient and have not been overly affected in the past). Areal extent of upland shrubland in the cool shrub PVG is larger relative to other clusters. Rangelands in these subbasins tend to be more resilient to grazing pressure and can be more likely maintained and/or restored to proper functioning condition. Because of the relatively good or improving condition of many of the rangeland communities and the remaining integrity in aquatic ecosystems, there is opportunity for management to benefit both.

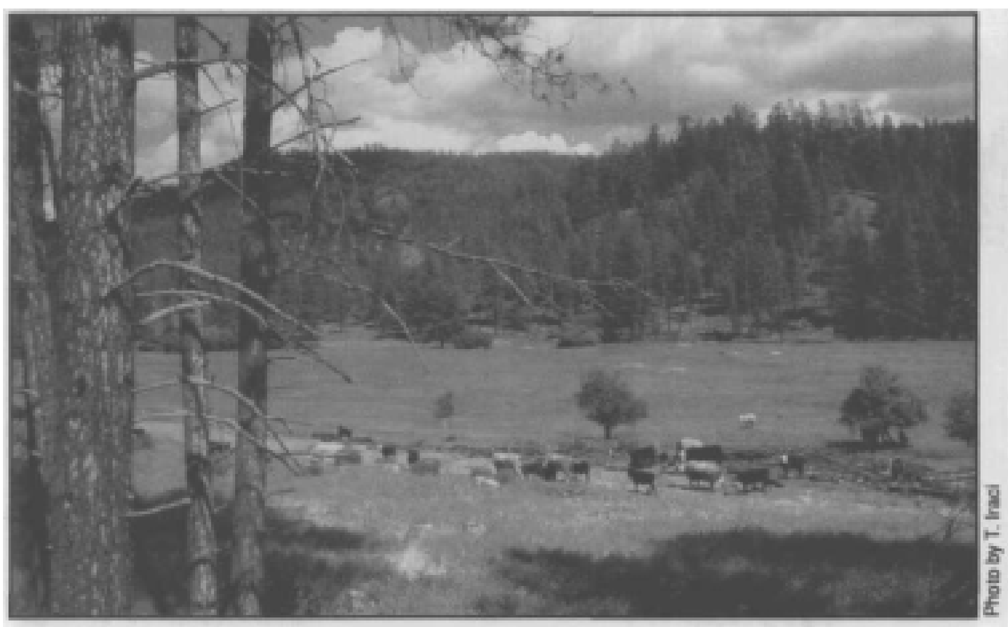


Photo 9—This photo illustrates characteristics of a moderate integrity, dry forest rangeland cluster. Livestock use on FS- and BLM-administered lands is common within the Basin.

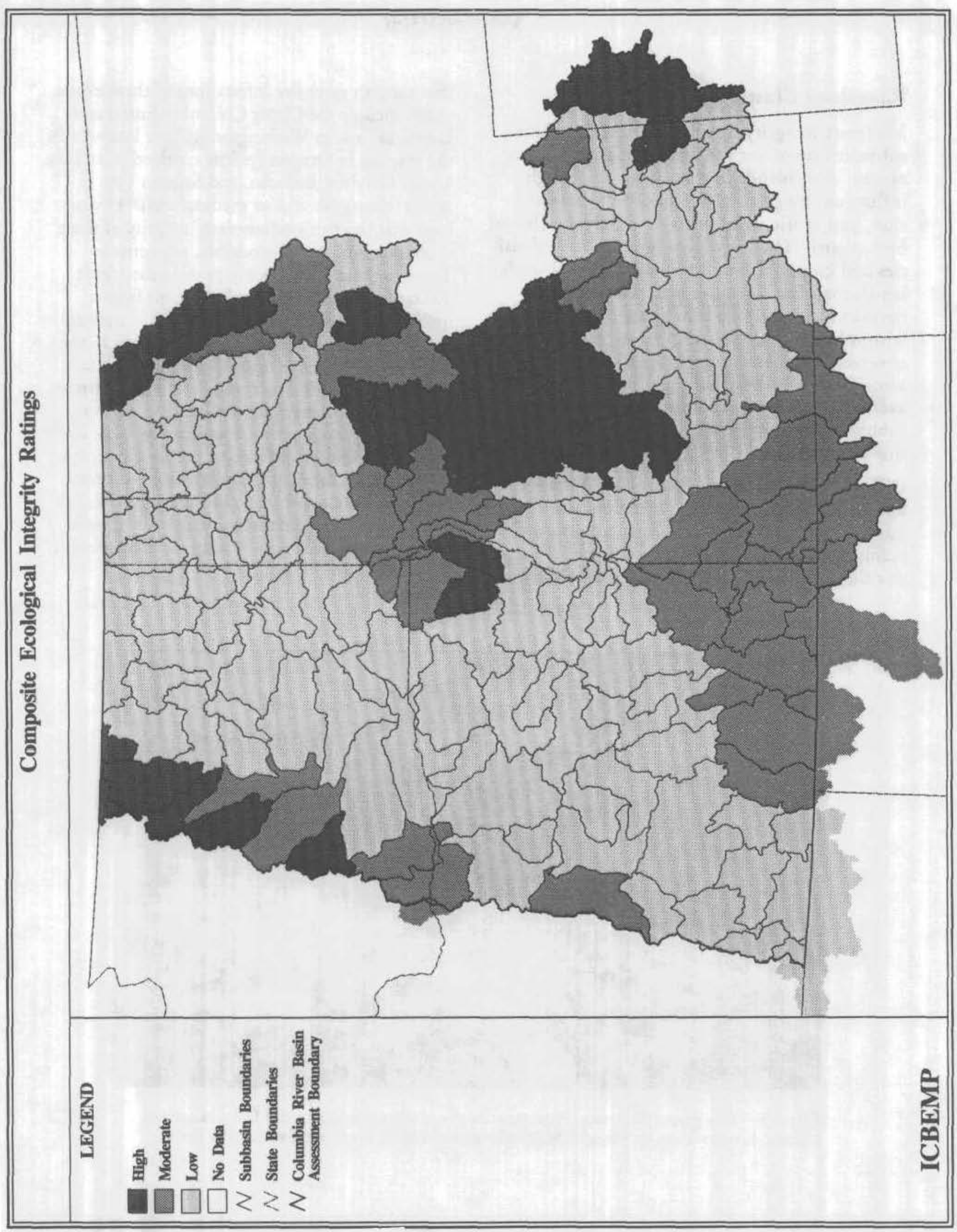


Figure 40—Composite ecological integrity ratings synthesized the forest, rangeland, forest and rangeland hydrologic, and aquatic component integrity ratings.

CONTINUED

Rangeland Cluster 6

Low integrity upland shrublands—These subbasins are primarily located on the Snake River Plain and in south-central Oregon and have been significantly altered by grazing and fire exclusion. They are dominated by dry shrubland vegetation, which is the most extensive rangeland PVG in this cluster. It is highly sensitive to overgrazing and susceptible to invasion by exotic grasses and forbs. Agriculture, dry forest, and cool shrub, in that order, follow in sensitivity the dry shrub PVG. Shrublands and herblands have declined owing to conversion to agriculture, change in fire regimes, increases in conifer woodlands, and encroachment by exotics, including the conversion to crested wheatgrass and other desirable exotic grasses. Similar to Rangeland Cluster 5> an average of nearly 4 percent of the area of each subbasin has been invaded by exotic plants in this cluster.

Dyers wood, diffuse knapweed, yellow starthistle, leafy spurge, medusahead, cheatgrass, Mediterranean sage, and whitetop are examples of problematic exotic weed species in this cluster on rangeland. Examples of subbasins that support extensive infestations of these exotic weeds include the Warner Lakes, Guano, and Upper Malheur in Oregon (medusahead and/or Mediterranean sage), the Lake Wolcott and American Falls in Idaho, (cheatgrass), and the Middle Snake-Payette (yellow starthistle). The increase in mixed conifer woodlands is most likely the result of conifer invasion of herbland and shrubland areas.

Hydrologic integrity of these subbasins ranges from low to moderate, whereas the integrity of the riparian environments they contain is commonly low. The subbasins in this cluster represent some of the most strongly altered conditions for aquatic systems in the assessment area. Where redband trout now persist, they generally occur in highly fragmented habitat and in isolated populations. Steelhead historically inhabited tributary basins of the middle Snake River (such as the Malheur and Owyhee Rivers), but are now blocked by the Hells Canyon complex of hydroelectric dams. The lower Grande Ronde and Middle Fork John Day River subbasins are exceptions within this cluster as they both support native chinook salmon and steelhead trout. In addition to the Federally listed chinook salmon, the Lower Grande Ronde River contains numerous continuous strongholds of native rainbow and bull trout. Aquatic integrity of the lower Grande Ronde River is among the highest because of the presence of native fish strongholds, even though it has low forest and hydrologic integrity. Consequently, these strongholds may be short lived. The Middle Fork John Day River subbasin has numerous strongholds of native rainbow and steelhead trout and has high fish community integrity; few exotic fishes have been introduced into this subbasin. Subbasins along the middle Snake River above Hell's Canyon historically supported anadromous fish, but do so no longer. In many of these subbasins, there is little hope of restoring any resemblance of historical structure and composition of aquatic communities.

Composite Ecological Integrity

We used five component integrity ratings (forestland, rangeland, forestland and rangeland hydrologic, and aquatic systems) to estimate the current composite ecological integrity of each subbasin (see fig. 40). Component integrity ratings were based on information brought forward through the *Component Assessment*, the *Evaluation of Alternatives* (Quigley and others 1996b, hereafter called the *Evaluation)* which includes a discussion of landscape integrity, terrestrial integrity (Marcot 1996), and our understandings of conditions and trends. Composite integrity was estimated by comparing the component integrity ratings and our knowledge of actual on-the-ground conditions, with how each subbasin met the definitions described above for systems with high ecological integrity. We found that at present 16 percent of the area is in high (of which 84 percent is FS- and BLM-administered lands), 24 percent is in moderate, and 60 percent is in low ecological integrity (fig. 4 la). Much of this last category includes lands used for agricultural and grazing uses, and a low rating does not imply low productivity or

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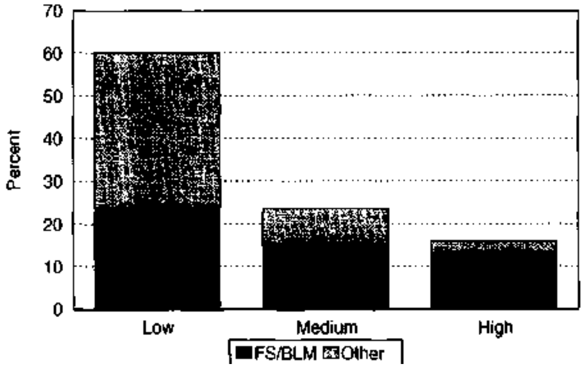


Figure 41 a—Percent of the Basin by composite ecological integrity.

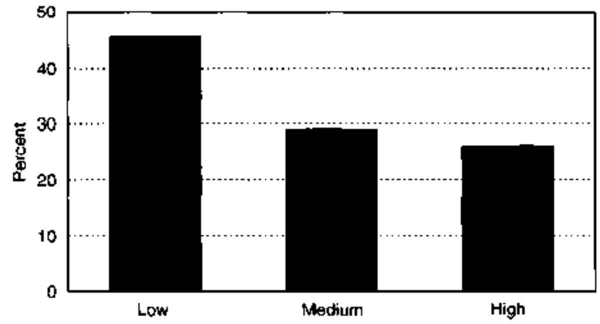


Figure 41 b—Percent of FS- and BLM-administered land by composite ecological integrity rating.

other similar implications. The rating system emphasizes ecological processes and functions and thus, has a tendency to rate human-altered systems lower than systems dominated by more natural processes. Finally, 26 percent of the FS- and BLM-administered lands are rated as high integrity, 29 percent are rated as medium, and 45 percent as low (fig. 41b).

Social and Economic Resiliency

Both social and economic resiliency measure the adaptability of human systems (*Component Assessment*—Economics). Social resiliency was measured using four factors: (1) civic infrastructure (that is, leadership, preparedness for change); (2) economic diversity; (3) social/cultural diversity (population size, mix of skills); and (4) amenity infrastructure (that is, attractiveness of the community and surrounding area). Economic resiliency was measured by the diversity among employment sectors. The assumption is that people in high resiliency counties have ready access to a range of employment opportunities if specific firms or business sectors experience downturns. Much like the biophysical components of the ecosystem, social and economic resiliency are affected by the size of the area measured (such as community, county, and trade regions) but they also reflect human notions of the landscape rather than hydrologic subbasins. In general, larger units display greater economic diversity (and by extension, economic and social resiliency) than smaller areas. Further, since resiliency attempts to measure a capacity for human response, classifications of either social or economic resiliency serve as relative estimates of adaptability, rather than absolute descriptors.

When we look at the Basin from the social and economic perspective our basic frame of reference is how humans organize themselves both in a community sense and how they relate to their biophysical environment. One overarching feature of this perspective is the speed at which human communities, interests, values, and economies change. Given this characteristic, one useful and relatively permanent administrative feature is the county. We observe that counties and available county data can be used to describe broad trends in social and economic resiliency. There is another powerful argument for considering counties. That is, their role as entities in a political system that simultaneously relates federal, state, and local interactions.

Economic Resiliency

The ratings for economic resiliency indicate that the economies within the Basin are diverse, and consequently have high economic resiliency. The average economic resiliency index for the nine BEA regions is 0.80 and there is little variation among BEA regions. These findings make sense as per capita income is rising rapidly and there are few pockets of poverty in the Basin. Furthermore, the economy of the Basin has shown resistance to national recessions except when they greatly affect the agricultural sector.

The highest resiliency ratings are for the Boise, Idaho Falls, Missoula, and Spokane BEA regions. The BEA economies in which employment associated with recreation is substantial have high resiliency suggesting they have high potential resilience to fluctuations in recreation activity (Idaho Falls, Idaho; Missoula, Montana; and Redmond-Bend, Oregon). The two BEA regions in which timber plays a major role (Redmond-Bend and Pendleton) also have fairly diverse economies, suggesting they are resistant to fluctuations in that industry. The resiliency rating for Butte, Montana is misleading because diversity is calculated for only that portion of the BEA region lying in the Basin.

Estimating resiliency at the county level based on employment diversity provides a different picture requiring some care to interpret. The average resiliency index for the 100 counties in the Basin is 0.70, much lower than the statistics calculated for the Basin BEA areas. This difference suggests that employment options, and thus employment diversity, is less at the county level than the larger BEA areas. This is generally true; the smaller the area the fewer options exist for employment as compared to larger areas. Seventeen percent of the counties within the Basin have high economic resiliency (fig. 42).

Social Resiliency

Like economic resiliency social resiliency could be addressed at many scales, and yet because of abiding local interest in the future of their communities, the examination of social resiliency is generally focused on the community level. Although communities are highly individualistic, a general distribution of levels of community resiliency was described by Harris in 1996.[18] Key differences were found among communities based on population size, local attractiveness, and economic diversity. These descriptions revealed a pattern across the Basin that is closely associated with annual levels of precipitation. In general, communities that are of smaller size and lower resiliency in the Basin follow the arid crescent that reaches south from the Columbia Plateau in eastern Washington, around the western and southern boundaries of the Blue Mountains in Oregon, and continues east along the Snake River plains in Idaho. This area includes the Columbia Plateau, the Owyhee Uplands, and the Upper Snake ERUs. This is the zone that receives less than 12 inches (30 cm) of precipitation each year, and although it contains prosperous, large, irrigated agricultural operations, the dry, climate has resulted in few towns of over 1,000 people and limited economic diversity.

Communities that exhibit higher levels of resiliency are located along the Cascade crest, the central mountains of Idaho, and in the vicinity of Missoula, Montana (in terms of ERUs, the Northern and Southern Cascades, the Central Idaho Mountains, and the Upper Clark Fork). These communities have high levels of scenic attractiveness and more diverse economies than those that are located in the arid crescent. These are the areas that contain the highest concentrations of Forest Service administered lands, have higher levels of rainfall, and are generally montane environments. These settings receive the greatest amount of recreational use in the Basin in terms of recreation activity days, and they are the location of the regions fastest rates of human population growth. When compared to other communities across the Basin, those exhibiting high levels of community resiliency did not show any differences in levels of perceived community cohesion, services, local government effectiveness, and civic leadership.

In examining community-level changes, Harris discovered that those communities that have been confronted with and survived challenges—such as sawmill closures—are among the most resilient because they have successfully learned how to deal

[18]Harris, Chuck. 1996. Rural Communities in the Inland Northwest, characteristics of small towns in the interior and upper Columbia River basins: an assessment of the past and present (final report: parts 1 and 2). On file with: U.S. Department of Agriculture, Forest Service, U.S. Department of Interior, Bureau of Land Management, Interior Columbia Basin Ecosystem Management Project, 112 E. Poplar, Walla Walla, WA 99362. 348 p.

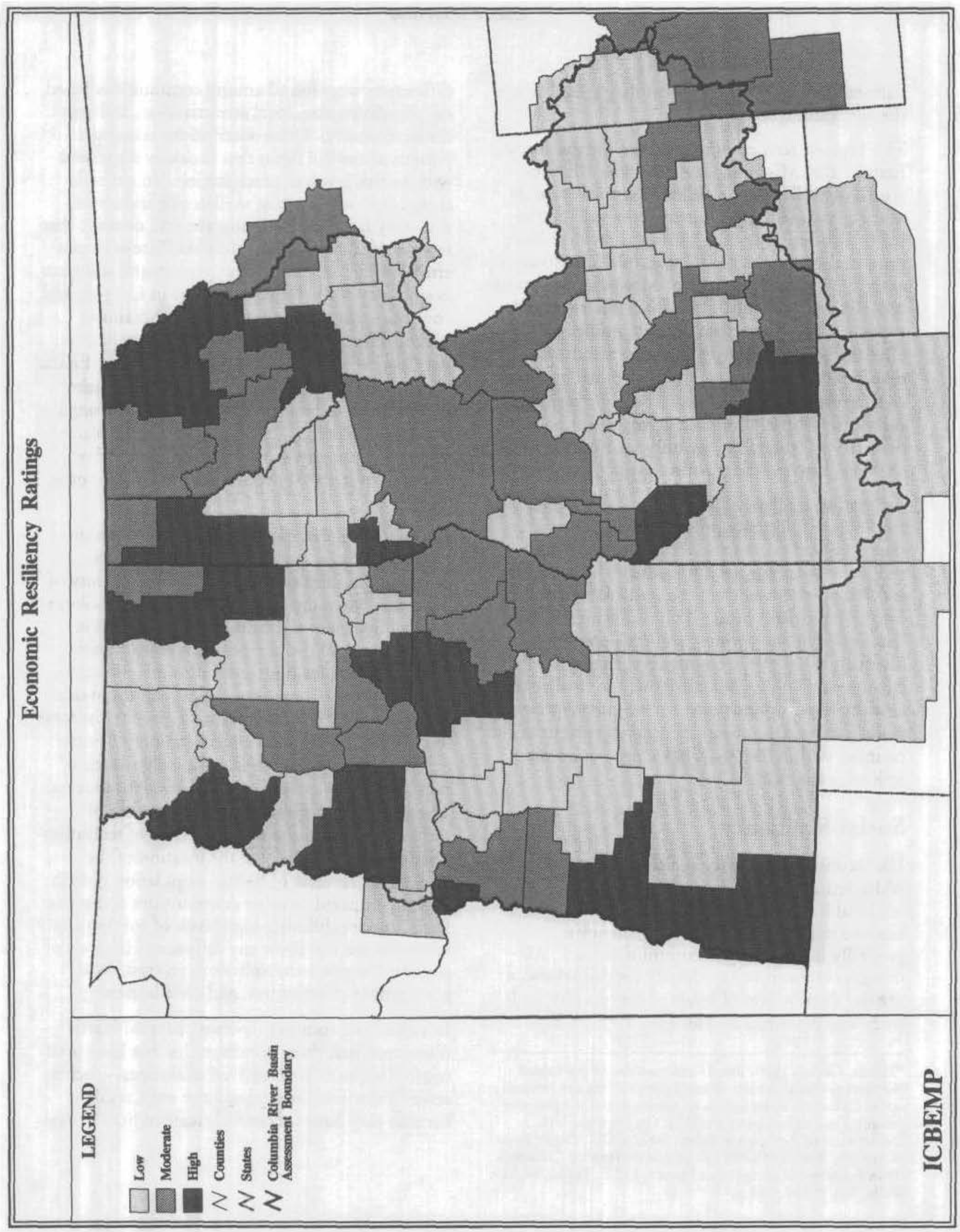


Figure 42—The economic diversity of each county was used to develop economic resiliency ratings.

with change. Communities that have experienced what may seem to be fatal blows, such as the closing of mines in Wallace, Idaho, have continued to carry on based on a reorientation to new economic activities. Adversity, although painful and not without casualties, often provides incentive for social interaction and cooperation, catalyzing organization and forward-directed actions.

It appears that a large majority of the communities in the Basin are well-positioned to adapt to the changes. In the Basin, education and skill levels are above United States averages and continue to improve with population growth. Although exceptions exist, the smaller communities in the arid, agricultural portions of the Basin face the greatest challenges. Their lower resiliency is associated with fewer physical amenities and fewer business opportunities, since consolidations and technological advances within agriculture have constrained new entries into this sector. The high-quality environments in the Basin, particularly those areas with water and forests, appear to be positive contributors to social resiliency. These settings attract new migrants, provide a diverse set of business options, and offer abundant recreation opportunities for an increasingly mobile and wealthy society.

Risks to Social and Economic Resiliency

These assessments of social and economic resiliency do not mean that human systems in the Basin face no risks. Structural changes in the U.S. economy (for example, the growth in the trade and service sectors) and technological changes, like telecommunications, will continue to affect economic and social well-being. These changes have allowed people greater choice about where and how to live. In the Basin, this freedom has manifested itself in the argument that quality of life is driving social and economic changes. Many of the notions behind social resiliency are based on the experience of the past five years which has been a period of rapid economic growth fueled in part by extensive immigration. From the standpoint of assessing risk, we caution that the Basin has experienced periods of both in-migration and out-migration. In the 1980s, for example, the Basin experienced net out-migration as the United States coped with periods of severe recession, structural changes in the economy that diminished the role of resource-based (including agriculture) economies, and booms in selected economic sectors and regions. Finally, there is the offsetting factor that humans are the most adaptable creatures in the Basins ecosystems and that in spite of the change they will adapt and continue to demand ecosystem goods and services.

Social and Economic Clusters

Like the forest and range clusters, groupings of counties can be developed based on physical and demographic attributes. The Johnson and Beale (1995) typology is one of several typologies that sort the 3,041 counties in the United States into different clusters (by economic activity, policy focus, or other). The Johnson and Beale typology was originally an attempt to identify the fastest growing counties in the United States. In general, they found that there were three patterns of growth. The first was a pattern of very high growth owing to high migration rates in counties that seem to contain significant recreation opportunities. These recreation counties are those that possess a combination of amenities and services that attract new migrants, many of whom are retirees or footloose entrepreneurs who seek environments and lifestyles that are cleaner and less stressful than those found in typical urban centers. The second were those counties that contained significant urban populations. The remaining counties experienced slower rates of growth. Figure 24 is a map of these three types of counties (there are 21 recreation, 6 metropolitan, and 77 others counties in the Basin). One implication from that map is that the social and economic systems in the Basin are affected by the ecosystems in which they are embedded. These same ecosystems are contributing to changes in human population densities. For example, the Basin is generally experiencing a period of population growth-96 percent of the Basins counties increased in population for the period 1990 to 1994, reversing the trend of the 1980s. Recent population growth has been concentrated, however, in those counties that Johnson and Beale classified as either "urban" (metro) or "recreation."

Developing a Measure of Socioeconomic Resiliency

After measuring social and economic resiliency separately, the next step was to devise a measure of social and economic resiliency that can be used to assess the broad goal for ecosystem management. This composite rating combines three factors discussed as part of social and economic resiliency: population density (expressed as people per square mile), economic resiliency (defined by economic diversity), and lifestyle diversity. We assigned the socioeconomic resiliency ratings (fig. 43) based on the sum of the total ratings for each of the three factors where each was weighted equally.

A low socioeconomic resiliency rating is defined as counties with low population density (<11 people/sq. mile, 4.3 people/sq. km), low or medium economic resiliency, and low or medium lifestyle diversity. In the Basin, there are 54 such counties. These counties account for 68 percent of the area but only 18 percent of the population. As shown in figure 43 many of the counties traditionally thought of as agricultural are in this category. There are 14 counties that have medium economic resiliency, but most of them are among the least densely populated counties in the Basin (<6 people/sq. mile, 2.3 people/sq. km) and most contain National Forests.

A medium socioeconomic resiliency rating is defined as counties with mostly medium economic resiliency ratings and generally either medium or high lifestyle diversity or population density ratings. In the Basin, there are 20 such counties. Exceptions include Klickitat County, which has low economic resiliency and high lifestyle diversity, and Cassia County, which has low population density but medium economic and lifestyle diversity. Baker County has the lowest population density ratings, but a medium level of economic resiliency reflecting a diverse economy, and the highest level of lifestyle diversity reflecting great adaptability of its social systems.

A high socioeconomic resiliency rating is defined as counties that are more densely populated (> 11 people/sq. mile) and have the highest economic resiliency. There are 26 such counties in the Basin. Counties with high socioeconomic resiliency typically have high population densities, medium economic resiliency, and medium to high lifestyle diversity values. The exceptions to these are Klamath County, which has low population density but high economic resiliency and high lifestyle diversity and Silver Bow County, which has low economic resiliency, but high population density and high lifestyle diversity. High lifestyle diversities in these two counties suggest that there are higher infrastructure values than the population densities would suggest.

This approach recognizes the 44 (of 100) counties with very low (< 6 people/sq. mile) population densities, sometimes called "frontier counties." Typically these counties have low socioeconomic resiliency, and include many of the 60 Basin counties labeled "Federal" in the sense that more than 33 percent of their area is in Federal ownership. The interest in identifying these so-called frontier counties is a concern that they may lack sufficient population to sustain existing services or to develop necessary social services. A related concern is whether they are able to maintain the existing infrastructure both in the physical sense and in the social sense especially in the sense of community. For example, there are counties that are too sparsely populated to sustain a medical clinic. This relative isolation also stimulates some people to locate in these areas. Some people choose these counties specifically because they are sparsely settled.

We caution against concluding that low to high ratings are equivalent to bad or good ratings; the intent is to describe the adaptability or vulnerability of these counties, not to rate them as good or bad. Generally, most of the people in the Basin (82%) live in counties that are medium or high in the degree of adaptability, as measured by the socioeconomic resiliency. Most of the land area (68%) in the Basin, however, is in the low category for socioeconomic resiliency.

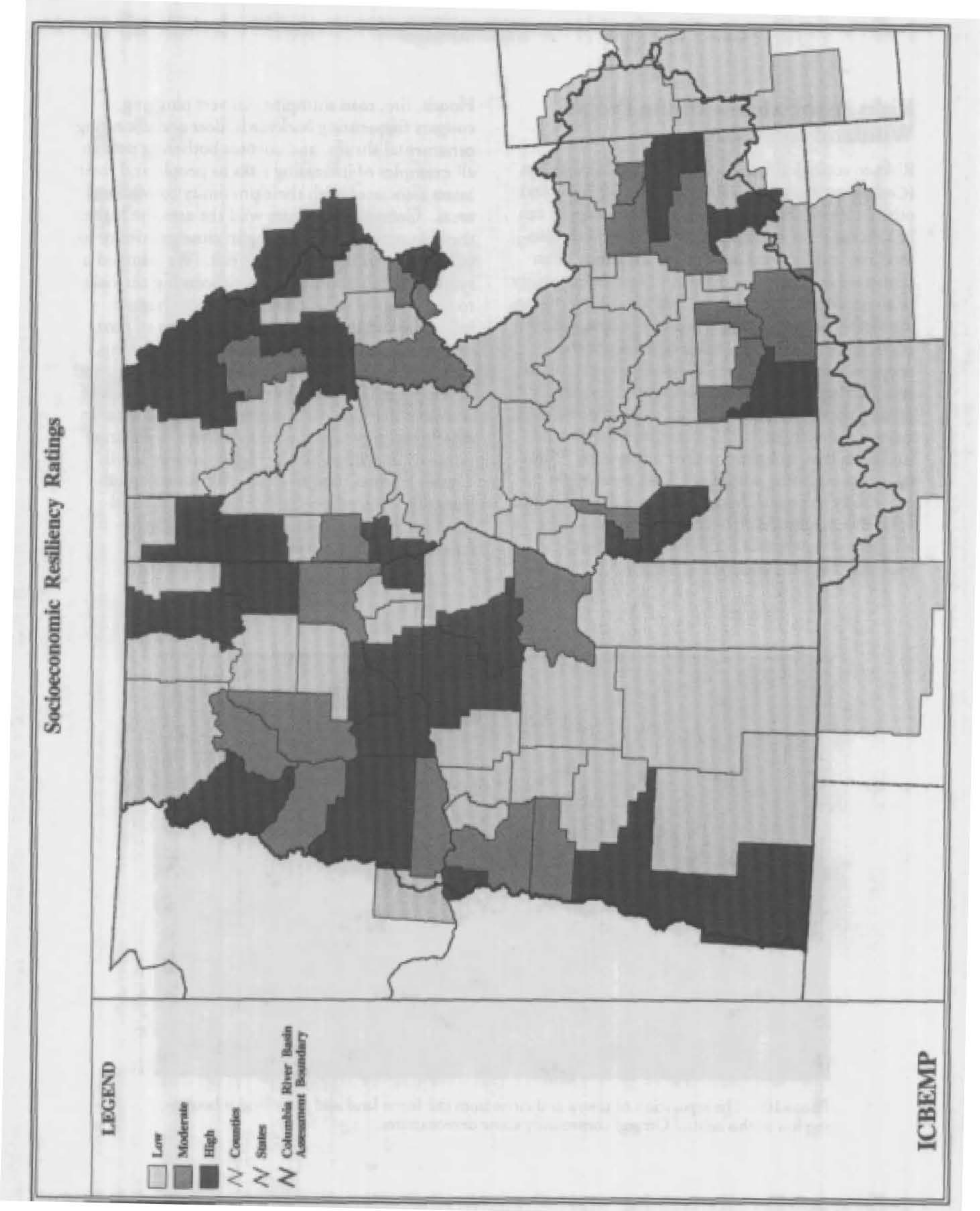


Figure 43—Socioeconomic resiliency ratings are the sum of ratings for economic resiliency, population density, and lifestyle diversity.

Risks Associated with the People-Wildland Interaction

Risks to ecological integrity are affected in two ways (*Component Assessment*—Introduction, Quigley and others 1996a). First, risks to ecological integrity can be affected if the demands of people (for both commodities and services) outstrip the capability of an ecosystem or if land-use decisions limit the capability of an ecosystem. Second, the risks can be affected to the extent biophysical systems affect people, their assets, and elements they value especially at the people-wildland interface. We assumed that risk to ecological integrity is generally higher in proximity to densely populated areas, and risk to people and their assets is generally higher in close proximity to wildland areas than to agricultural or urban areas. Natural events occurring within wildland areas might prove risky to people, homes, and other assets people value that are associated with wildland areas. The integrity of ecosystems is also influenced by the presence of people and their activities.

Floods, fire, road slumping, culvert plugging, cougars frequenting backyards, deer and elk eating ornamental shrubs, and coyotes bothering pets are all examples of increasing risks to people and their assets associated with their proximity to wildland areas. Generally the more wild the area the higher the risk; more humans living in close proximity to wildland areas the greater the risk. We assumed a symmetric relationship exists concerning the risks to the integrity of wildland areas from human influence and the risks faced by humans in proximity to wildland areas. Road building, fishing, camping, hiking, wood cutting, berry picking, and development of recreation sites are all examples of activities that tend to increase in wildland areas in close proximity to population centers, with larger population centers having higher activity levels. These activities tend to create risk to ecological integrity. Recreation tends more toward developed site recreation while still supporting increased dispersed recreation.

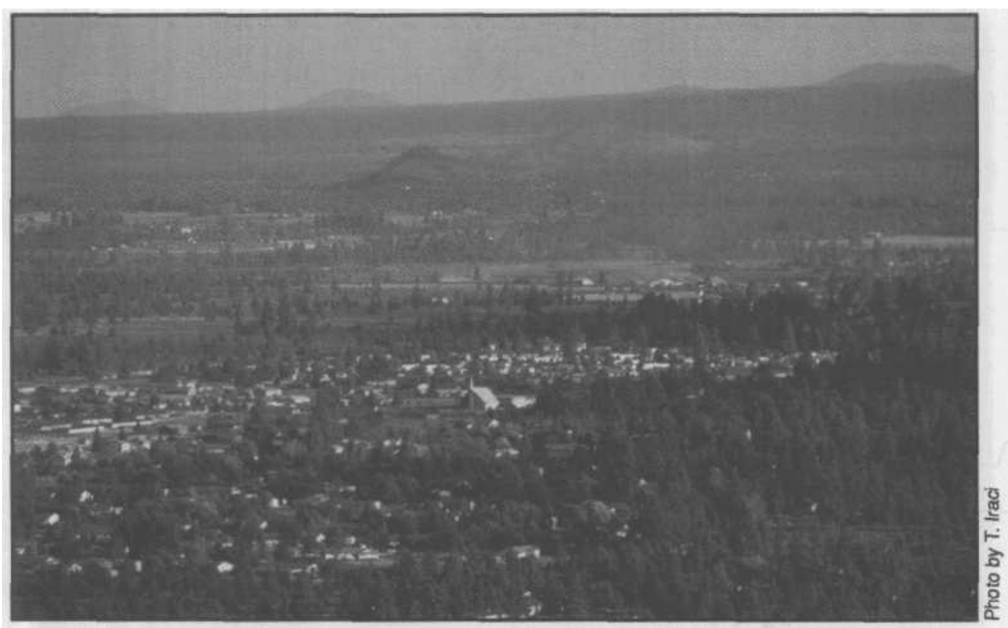


Photo 10—The separation of towns and cities from the forest land and rangeland is becoming less as this central Oregon community scene demonstrates.

Societal risk to ecological integrity and risk to people and their assets from wildlands were estimated using a set of rules that related population density to forest, non-forest, and agricultural wildland vegetation groups. Higher-population densities in proximity to forest and rangeland vegetation types were rated as having higher risk than low-population density areas (see photo 10). Agricultural lands were rated with lower risks than forest and rangeland areas. To estimate the risk associated with the FS and BLM portion of the wildland areas, a set of rules was developed that related urban-rural classes to FS and BLM vegetation groups. This relation assumes a generally higher risk associated with forested vegetation groups than with nonforested vegetation types and higher risk with increasing population densities.

Risks associated with the interaction of urban and wildland areas are associated with the six major metropolitan areas within the Basin (Boise area, Idaho; Missoula, Montana; Spokane, Tri-Cities, and Yakima, Washington). Missoula, the Boise area, and Yakima are in close proximity to FS- and BLM-administered lands and therefore are anticipated to have a greater risk associated with the interface of FS and BLM wildlands than Spokane or the Tri-Cities. Spokane does have substantial wildland interface risks, but they are mostly associated with private land. Tri-Cities is a mixture of wildland and agricultural interfaces. Where these metro areas are in close proximity to high-integrity wildlands, risks to the maintenance or improvement of ecological integrity would be high. Likewise these metro areas would pose higher risk to areas in close proximity of high integrity than to areas of low integrity, suggesting additional emphasis to manage the risks to attain and maintain high ecological integrity.

Risks to human assets from wildland areas and risks to ecological integrity are not restricted to metropolitan areas. Rural areas where people reside as well as primitive areas where people are only visitors also have risks. Risks include wildfire; flood; wild animals; maintenance of improvements; mitigation on cropland from elk and deer; cougars, bears, and coyotes killing livestock; and, increasing risks associated with implementation of management activities (for example, prescribed fire in proximity to people and structures). Additional human-related risks and complications arise from local publics who may prefer stability in scenery and lobby to have projects put in someone else's back yard, pressure to have low levels of harvest and grazing in specific areas, and pressure for increased recreation activities dispersed throughout the wildland areas. Sparsely populated areas generally have fewer resources to address risks or assist in control of natural events such as fire, flood, and insect outbreaks than exist in the metropolitan areas. The demand for FS and BLM participation in managing the risks within the least-populated areas will generally be high. Small communities typically have the least ability to provide social infrastructure and to manage risks (for example, fire) from wildland influences.

Considering all land within the Basin, approximately 58 percent of the area is classed as low urban/rural area with approximately 23 percent as high or very high. This reflects the low density of population within much of the Basin. Translating this societal risk to ecological integrity from people and the risk to human assets from wildland areas there is about 58 percent with low risk and 21 percent with high or very high risk (fig. 44). Thus

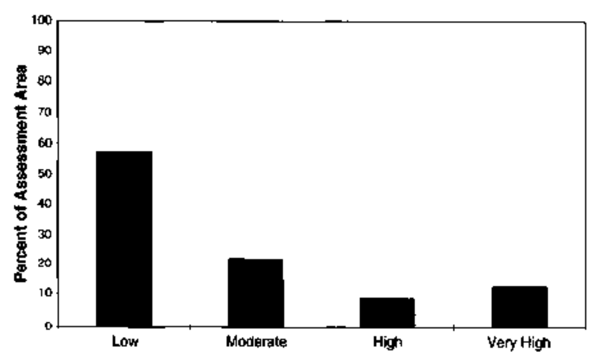


Figure 44—Societal risk of human-ecological interaction: percent of the Basin with low, moderate, high, or very high risk associated with the management of human ecological interactions.

Photo 11—The expansion of human habitation into the wildland setting introduces risks from fire and other disturbances. This complicates the FS- and BLM-management of these risks.

the majority of the area in the Basin would be viewed as having low risk from a societal standpoint. The risks differ by location with the very high risks associated with the major metropolitan areas in the Basin. The view from the FS and BLM manager s frame of reference would be slightly different (fig. 45). Removing the non-FS- and BLM-administered lands from consideration and recalculating the risk to ecological integrity from people and the risk to human assets from wildlands shifts to a higher risk in general. On FS and BLM lands approximately 50 percent is classed as moderate risk while about 19 percent is classed as high or very high (fig. 46). Thus, from the FS and BLM perspective there are more risks to manage the wildland areas than might be viewed by society as a whole. Forested vegetation occurring in areas of moderate urban-rural classes results in high risk from the FS and BLM manager's perspective, while society might consider this as a moderate risk to all ownerships (see photo 11).

Managing risks in areas where human populations are increasing becomes more complex as fewer options for treatment become available. Managing smoke from prescribed fire, reducing tree densities in areas with high scenic values, fencing riparian areas frequented by recreationists, and allowing flooding to occur naturally in stream channels are all examples of increasing complexity as human populations increase in proximity to wildland areas.

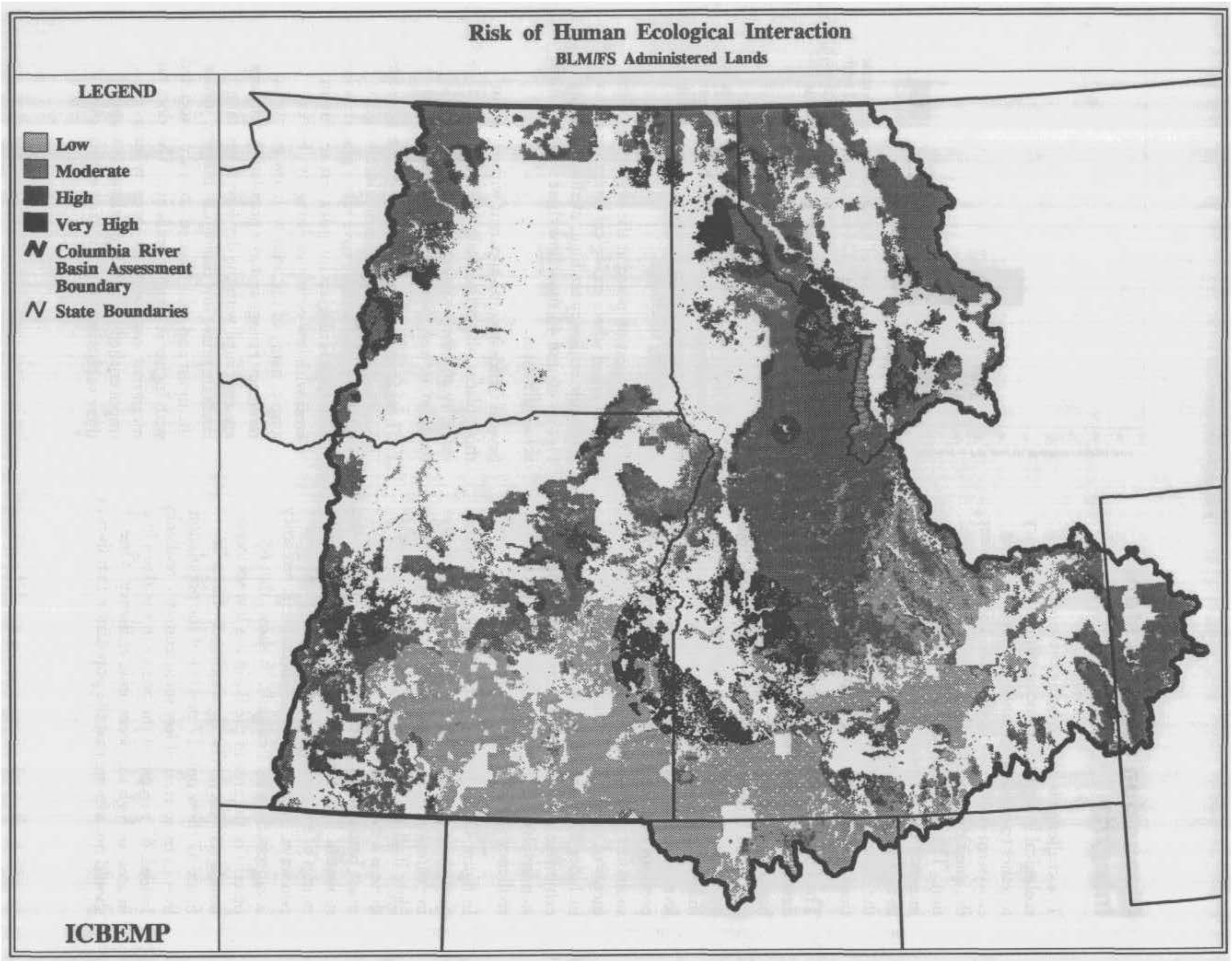


Figure 45—Level of risk associated with the management of human ecological interactions on FS-and BLM-administered lands.

Discussion of Ecosystem Integrity

The challenge is how to bring these notions of ecological integrity and socioeconomic resiliency together to make some broad statements about ecosystem conditions in the Basin and to answer the questions posed at the beginning of this section. The results for the twin themes of ecological integrity and socioeconomic resiliency are shown in figure 47. In this section we will briefly discuss the construction of this figure and the implications that can be drawn from it.

The first step in construction of figure 47 involves developing a rating of composite integrity (fig. 40) based on initial integrity ratings for aquatic integrity, forest integrity, range integrity, and hydrologic integrity. In figure 40, high ecological integrity includes the subbasins that exhibit the highest level of the elements of integrity described in the previous chapter. Low ecological integrity includes subbasins that exhibit the lowest level of the elements of integrity. Medium ecological integrity includes those areas that are intermediate in their exhibition of the elements of integrity. The next step involves adding the ratings of socioeconomic resiliency already discussed in this chapter.

In figure 47 the leftmost set of bars represent the composite ecological rating. If all of the underlying components are high, the composite rating is high; if all are low the composite rating is low; if there is a mix of ratings then an assignment is made based on judgment of the conditions in the subbasin. The next two sets of bars represent the ratings of socioeconomic resiliency expressed in two ways. In the center, socioeconomic resiliency is expressed on an area basis. It shows that 68 percent of the area in the Basin has low socioeconomic resiliency. The rightmost set of bars in figure 47 show only 17 percent of the population lives in these areas of low socioeconomic resiliency. Indeed, 67 percent of the people in the Basin live in areas of high socioeconomic resiliency. One should not assume that the population that lives in areas of low socioeconomic resiliency (17%) experience low economic or social well-being. Rather, that these people live in areas that have a low level of adaptability to change.

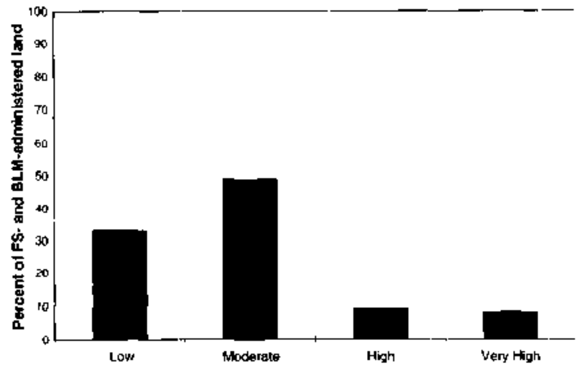


Figure 46—FS/BLM risk of human-ecological interaction: percent of FS- and BLM-administered land with very high, high, moderate, and low risk associated with the management of human ecological interactions.

The first question posed at the beginning of this section asked where ecological integrity and socioeconomic resiliency are high, medium, and low. Figures 40 and 43 show how these measures differ across the basin.

Several trends become apparent with regard to those places within the Basin where ecological integrity and socioeconomic resiliency is high, medium, or low. Some of these trends are:

1. There is an apparent relation between economic (and social) activity and ecological integrity. High levels of activity have taken place in areas with high ecological integrity, less activity in areas with low ecological integrity. For example, many of the areas with low economic resiliency ratings and low population densities are associated with the dry forests and rangelands that have low ecological integrity, just as the moist and cold forested areas are associated with higher economic resiliency. This does not mean that low ecological integrity leads to impoverished human conditions, as many of these subbasins are in counties with above-

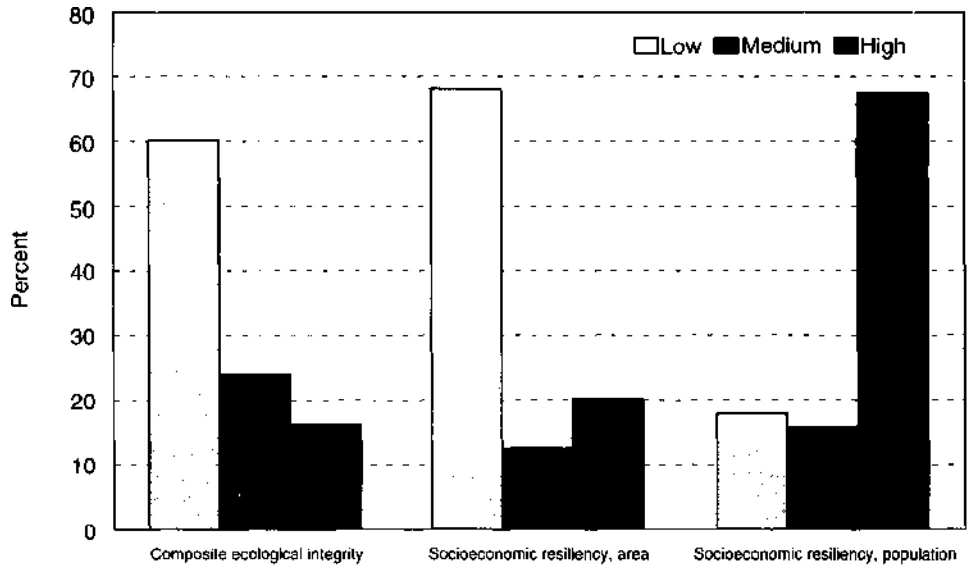


Figure 47—Percentage of the Basin by ecological integrity and socioeconomic resiliency ratings.

average per capita incomes derived from agriculture or less diverse areas of manufacturing. Other than for central Washington and parts of southern Idaho this same relation holds for population densities because the effects of Interstate 84 offset the underlying relations between the social and ecological factors. It is important to recall that the integrity ratings are relative ratings within the Basin and are keyed to the presence or absence of ecological processes and functions. Under this rating system one would expect agricultural lands to rate lower than areas that are managed less intensively.

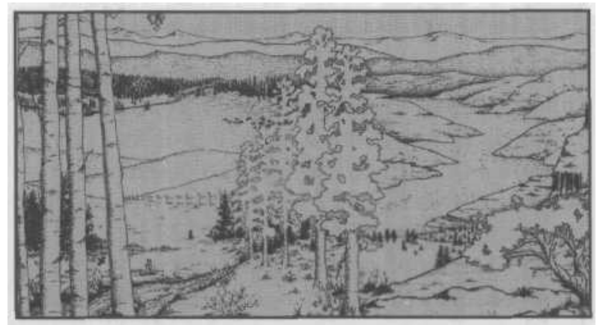
2. There are several areas where human pressures may threaten areas of high ecological integrity. Yakima and Chelan Counties are examples.

3. The urban/forest interface issue will be most acute where high population and high economic resiliency coincides with areas of moderate-to-high integrity (such as northern Idaho and northwest Montana). Another concern is the propensity for wildland fire in dry forest and range types that occur in an urbanizing environment such as the Spokane metropolitan area (Stevens, Spokane, and Kootenai Counties), Deschutes County, the area just north of Boise, Idaho (Payette, Gem, and Washington Counties), and the area between the Flathead and Lolo National Forests (Lake County).

4. The Basin is fortunate (as is the country) in that some of the highest ecological integrity for both forest and range clusters occur in large contiguous blocks in areas where human population density is low and is projected to remain low. One example is the central Idaho wilderness.

CHAPTER 5

THE FUTURE OF THE BASIN: ECOLOGICAL INTEGRITY AND SOCIOECONOMIC RESILIENCY CONDITIONS AND TRENDS



The objectives for the integrated assessment include a description of probable outcomes, risks, and tradeoffs associated with management actions. Meeting this objective necessitates an examination of some possible futures within the Basin. In the early stages of integration the Science Integration Team considered four broad scenarios that described a wide array of management futures on FS- and BLM-administered lands. These ranged from heavy emphasis on commodity production—to emphasis on reserves—to emphasis on active management. These scenarios and the accompanying projections of outcomes served as a basis for more fully defined alternative approaches to management. The EIS Team developed a set of projected alternatives for the Draft EIS. The consequences, outcomes, and tradeoffs associated with potential implementation of the alternatives were analyzed in the *Evaluation of EIS Alternatives* by the SIT (see the *Evaluation).* Understanding the past and recognizing the risks and opportunities present under current conditions, as described by the forest and rangeland clusters, provides the biophysical underpinnings for future management options.

We describe possible outcomes associated with three management options. Discussion of future outcomes as a part of the *Integrated Assessment* provides opportunity to describe integrated effects, risks, and tradeoffs. Although a more complete discussion of these is provided in the *Evaluation,* we thought a discussion that provides highlights for a few of the EIS alternatives would enable readers to better understand the relations and processes discussed in the assessment by providing discussion on historic, current, and potential future conditions in a single document.

The analysis of future management options involves four major steps. First, define the management approaches in terms of the objectives, standards, guidelines, description of desired future conditions, management emphasis, and activity levels. These elements were provided by the EIS team for each management option and are summarized here. Second, estimate future conditions for the ecologic and economic systems within the Basin. This involves modeling or otherwise projecting changes in vegetation structure and composition, terrestrial and aquatic habitats, and socioeconomic conditions. Third, estimate the trend in ecological integrity under each management option for the next 100 years. This starts with the current composite ecological integrity and examines indices that reflect change in composite integrity. Fourth, develop estimates of the socioeconomic resiliency for these management options. Because of limited abilities to forecast overall economic activity, we estimate changes in socioeconomic resiliency for the next decade. We also use the estimated shift in population density for the next 50 years as a broad proxy for socioeconomic change in the Basin. These provide useful estimates to show how the management options influence ecological integrity and socioeconomic resiliency and how the risks of implementation might change in the longer term.

Future Management Options

The future management options draw heavily from the Environmental Impact Statements being prepared as part of the ICBEMP process. They provide a coordinated approach to a scientifically sound, ecosystem-based management strategy for lands administered by the FS or BLM in the Basin. The emphases in the management options are to restore and maintain long-term ecosystem health and integrity, to support the economic and/or social needs of people, cultures and communities, and to support predictable levels of goods and services from National Forest System and Bureau of Land Management lands.

Three EIS alternatives[19] are used to illustrate possible futures for the Basin: Management Option 1, continuation of current management called the no action alternative (EIS Alternative 1); Management Option 2, emphasis on restoration (EIS Alternative 4); and Management Option 3, emphasis on reserve areas (EIS Alternative 7).

Option 1

Option 1 continues management specified under existing FS and BLM plans. Implementation of this option would occur assuming continuation of recent budgets and no interim direction such as Eastside screens, INFISH, or PACFISH.[20] This option displays the Federal agencies' use of existing plans to manage lands and resources into the future. Existing FS and BLM plans include Regional Guides, Forest Plans (for each National Forest), and Resource Management Plans and Management Framework Plans (for BLM Resource Areas). Option 1 includes direction from current land-use plans of 35 National Forests and 17 BLM Districts. Although substantial variation exists among agency plans, the general management approach is to emphasize or accommodate sustained timber and livestock forage production in an environmentally prudent manner while managing and protecting other resources and values. Timber and livestock management are integrated and coordinated with the maintenance or enhancement of wildlife and fish habitat, scenic quality, recreation opportunities, and other resource values to achieve overall multiple-use goals and objectives. On many areas, management of other resources or values is emphasized such as recreation, wilderness, big game and fish habitat, or cultural resources. The current plans were developed with little or no attempt to coordinate management with other FS or BLM administrative units (that is, National Forest or BLM District).

[19]The effects and outcomes reported here are for the EIS alternatives as they existed in April 1996. The alternatives were in draft form at that point and were subject to change. Readers should refer directly to the most recent version of the EIS to understand the proposed management actions as they are evolving.

[20]For a more detailed discussion see the Draft Environmental Impact Statements (INFISH 1995; Lowe 1993; PACFISH 1994,1995).

Option 2

This option is designed to aggressively restore ecosystem health through actively managing resources; the results of management can resemble disturbance processes including insects, disease, and fire. The option focuses on short-term (5-10 years) vegetation management to improve the likelihood of moving toward or maintaining ecosystem processes that function properly in the long term (50-100 years). Vegetation management is designed to reduce risks to property, products, and economic and social opportunities that can result from large disturbance events. Direct involvement with state, county, and tribal governments are to be used in planning, decision-making, and implementation of programs.

Priority in this option is placed on forest, rangeland, and watershed health, assuming that healthy streams, wildlife populations, and economic and social benefits will follow. Actions taken to achieve desired conditions are designed to produce economic benefits whenever practical. A wide variety of management tools are available under this option, for example, photos 12a and 12b show the results of prescribed fire in the dry forested vegetation types.

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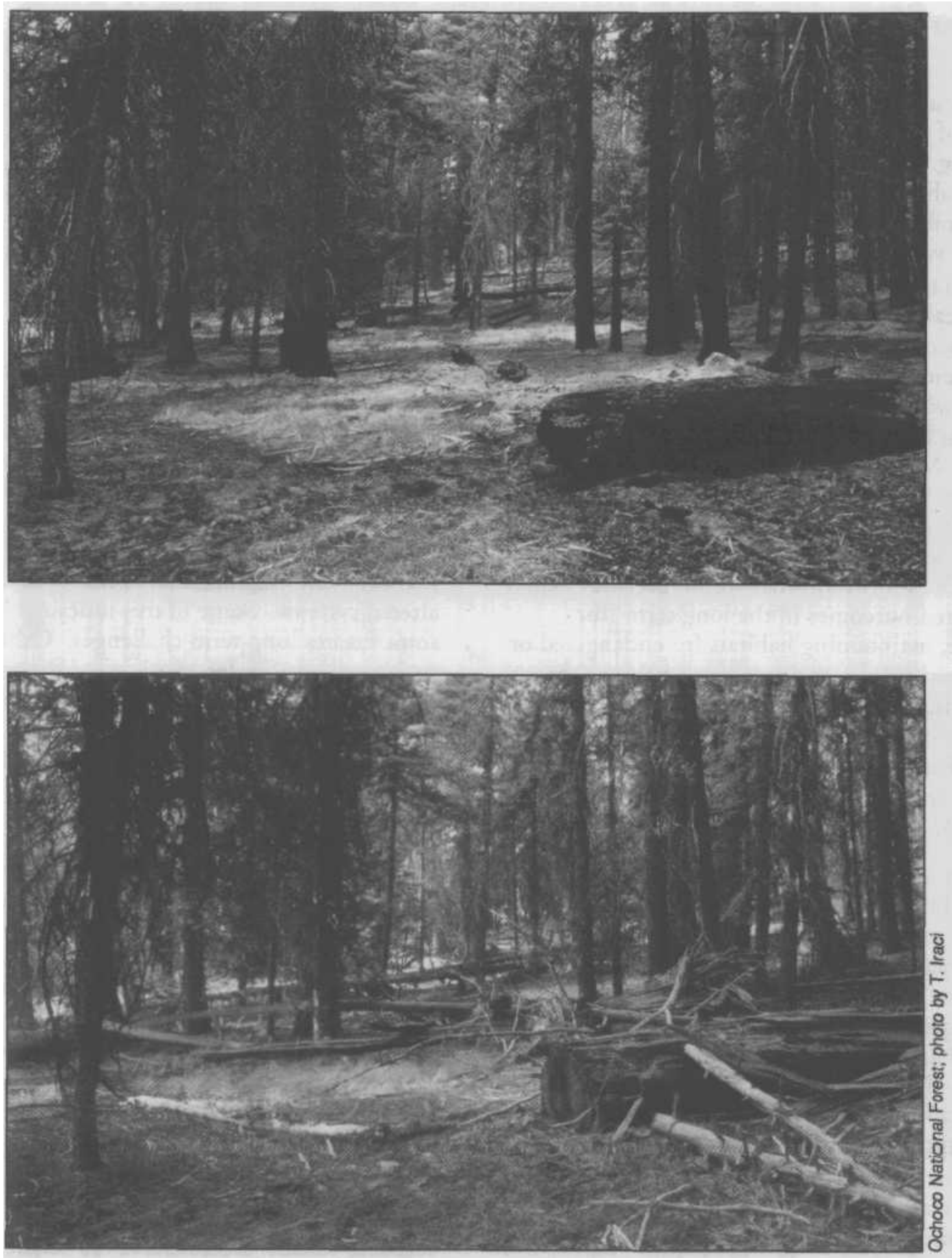

Photos 12a and 12b—One management tool considered in the dry forested vegetation types that addresses the role of fire in these ecosystems.

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Text errors identified by the software have been corrected;
however, some errors may remain.

Option 3

This option emphasizes reducing risk to ecological integrity and species viability by establishing a system of reserves on FS- and BLM-administered lands (fig. 48). Reserves would be located to include all representative vegetation types and large enough to contain disturbance events typical to those vegetation types. The level of human use and management is low within the reserves. Ecological disturbance events are expected and would occur naturally within the reserves. When disturbance events (such as fire and disease) occur, actions would be taken to reduce the likelihood of the event extending beyond the boundary of the reserve. Most restoration activities occur on lands managed by the FS and BLM outside reserves, although restoration actions could be taken within reserves where there is a high risk for events occurring in the short term that would preclude achieving desired outcomes in the long term (for example, maintaining habitats for endangered or threatened species or other scarce habitats, or controlling erosion by rehabilitating roads). Management outside the reserve boundaries includes an emphasis on conserving remaining old forest stands and roadless areas larger than 1,000 acres (405 ha).

Reserves are selected for representation of vegetation and rare animal species. Although some reserves may be designed around the needs of single species, the intent is to conserve biodiversity across the landscape, and to meet the needs of species groups or communities. No commercial timber harvest is permitted inside reserves, but limited silvicultural activities are allowed to enhance species viability. Livestock grazing is essentially eliminated from reserves unless it is needed to improve the long-term conditions for which the reserve was established. Dispersed, low-impact recreation use is allowed as long as these activities do not affect populations of rare species or their habitat. Management of reserves is focused on long-term maintenance of ecological processes and conditions with which plant and animal species have evolved. Areas adjacent to reserves are managed as buffers to help maintain reserves by avoiding barriers or breaks in the vegetation that would isolate the reserves. Management is allowed in buffers, but road densities are usually low. Reserves are connected where possible by vegetative corridors to allow interchange of animals. Management occurs within corridors also, but habitat conditions are important considerations for management activities to allow for dispersal of animals.

Differences among options

There are several differences between current plans (much of Option 1), restoration emphasis (Option 2), and reserve system emphasis (Option 3). Existing plans were designed primarily on the assumption that healthy ecosystem conditions existed. Options 2 and 3 recognize that some systems are unhealthy. Past timber and livestock management, roading, and exclusion of fire have altered systems. Some of this is desired by society; some creates long-term challenges. Other events, such as climate cycles, exotic weed expansion, and management of other lands influence how these Federal lands are managed, and vice versa. These conditions are more fully considered in Options 2 and 3 than in existing plans (Option 1).

Options 2 and 3 attempt to portray more consistent interagency approaches to broad-ranging issues, such as declines in cold water fish and riparian habitat, concerns about late-seral forests, and the expansion of exotic weed species as well as incorporating the use of evolving ecosystem management principles. They also incorporate more meaningful participation at all levels, and recognize the unique needs and contributions of tribes and local governments.

Current plans are heavily based on even-aged forest management. These plans emphasize commodity production with mitigation for other resource values. Options 2 and 3 rely less on even-aged management and focus on reversing the decline in large trees ana late-seral forest structure. Timber harvest volume from existing plans comes from all size classes; most volume from Options 2

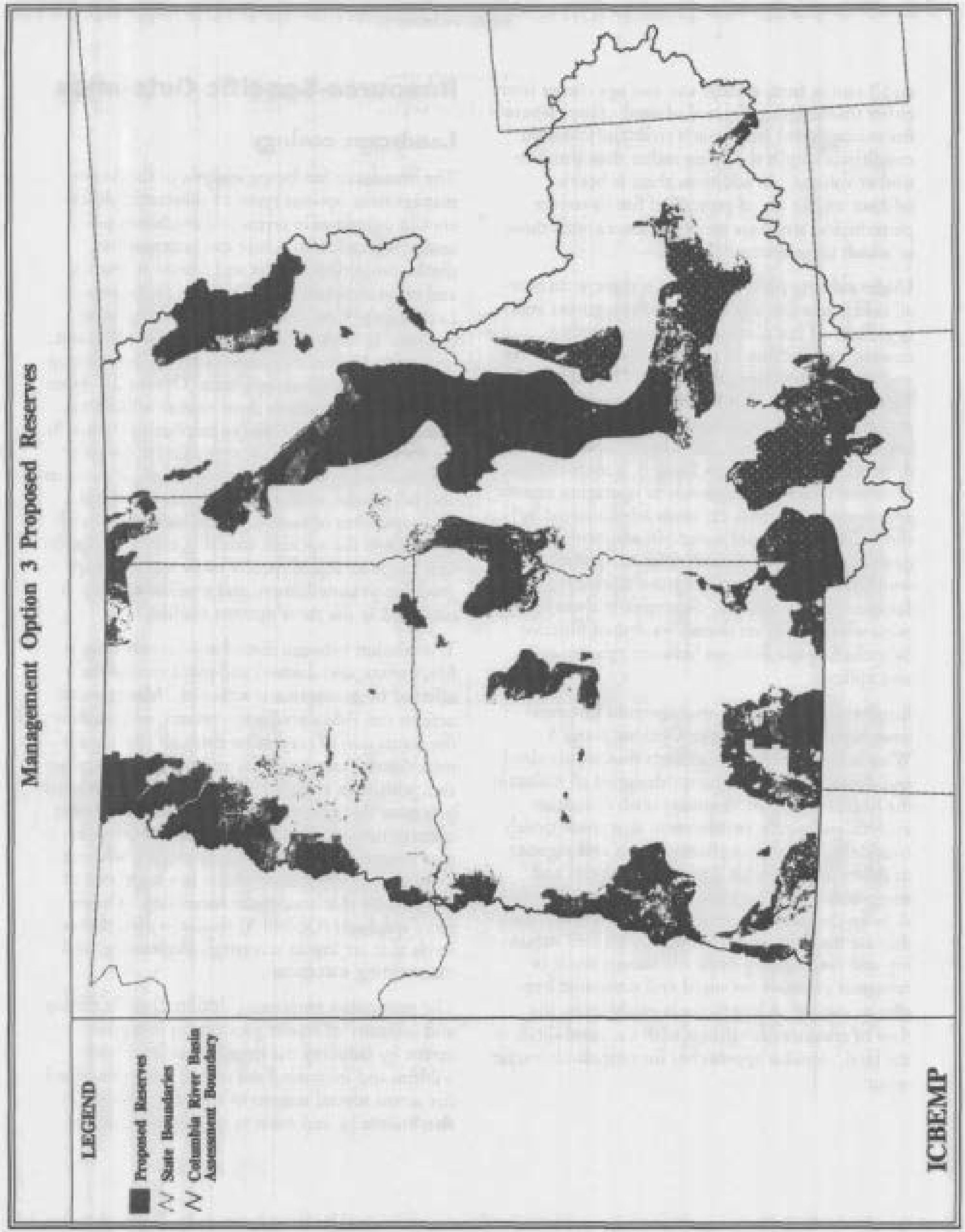


Figure 48—Proposed reserves on FS- and BLM-administered lands in Management Option 3.

and 3 comes from smaller size and age classes from either thinnings or removal of smaller trees where the management emphasis is to attain/maintain conditions within the forest rather than produce timber volume. In addition, there is heavier reliance on the use of prescribed fire to restore patterns and structure more consistent with those in which these systems evolved.

Under existing plans (Option 1), there is no overall cold water fish and riparian management strategy. Parts of the planning area are currently covered by direction in the Northwest Forest Plan and interim direction, PACFISH, INFISH, and Eastside Screens. This has been confusing, and makes consistent approaches to management, inventory, monitoring, and adaptive management difficult. Under Options 2 and 3, a more common and consistent approach to managing aquatic and riparian resources on lands administered by the BLM or FS would occur. In addition, the goals and objectives for activities in riparian areas would be to maintain or improve aquatic/riparian functions and processes. Strategies in these options would focus on overall watershed function by including the linkages between riparian areas and uplands.

Emphasis for vegetative management in forestlands would be different in Options 2 and 3. Whether considering treatments that reduce dead and dying trees or treatments designed to maintain the health of forests, emphasis is on ecosystem analysis and public involvement that more closely considers natural disturbance events and regimes to determine desirable patterns, structure, and composition of vegetation communities. Emphasis is on the patterns, structure, and composition that are desirable to carry into the future. Attaining and maintaining these conditions result in resources available for social and economic benefits to society. A key factor is establishing the flow of resources consistent with the capabilities of the land. Similar approaches for rangelands would occur.

Resource-Specific Outcomes

Landscape ecology

The broadscale landscape analysis of the future management options revealed substantial difference in outcomes in terms of disturbance processes, vegetation structure and composition, smoke projections, insect and disease mortality, and other elements (table 24) (see *Evaluation*--Landscape). Continuing current management (Option 1) results in higher levels of wildfire and smoke, and increases in exotics rather than managing with a restoration emphasis (Option 2). From a landscape perspective those elements likely to raise concerns from a reserve emphasis (Option 3) are the high potential for large wildfire events at the rural/wildland interface, high levels of summer and fall smoke, and moderate levels of wildfire. The expansion of exotics is rated as high or moderate across the options; reducing exotic expansion to a low level would require more aggressive approaches to containment and eradication than is proposed in the three options studied.

The relation between disturbance events (that is, fire, insects, and disease) and plant succession is affected by management activities. Management actions can either accelerate, reverse, or maintain the status quo of succession through altering the mix, density, composition, and pattern of vegetation within an area and by altering the disturbance processes that effect an area. Continuing current management (Option 1) results in disturbances that reverse succession to a high degree, whereas emphasis on restoration results in a high level of disturbance that accelerates succession. The reserve emphasis (Option 3) results in disturbance levels that are low in reversing, accelerating, and maintaining succession.

The restoration emphasis (Option 2) shifts timing and intensity of smoke production to a great extent by reducing the smoke associated with wildfire and increasing the smoke from prescribed fire across several seasons of the year. Option 2 also maintains and restores vegetation structure

Table 24—Selected landscape ecology related outcomes shown by future management options.

	Options		
	1	**2**	3
Relationship of disturbance to succession			
-Maintains vegetation structure	Very Low	Moderate	Low
-Accelerates succession	Moderate	High	Low
-Reverses succession	High	Low	Low
Fire and smoke			
-Wildfire	Moderate	Low	Moderate
-Prescribed fire	Low	High	Low
-Spring smoke	High	Moderate	Low
-Summer smoke	Moderate	Moderate	High
-Fall smoke	Low	Moderate	High
-Large wildfire events in the rural/wild land interface	Moderate	Low	High
Insect and disease mortality (ratio of projected to presettlement levels of mortality])	1.85	1.7	1.8
Expansion of exotics (noxious weeds)	High	Moderate	Moderate
Vegetation structure and composition similarity with presettlement conditions (percent of similarity of projected to presettlement vegetation)	12	40	24

and composition to more nearly approximate presettlement conditions, and reduces the likelihood that large wildfire events might occur at the rural/wildland interface. If managers were seeking a more aggressive approach to reducing wildfire concerns, change in habitat conditions, and expansion of exotics, then prioritizing restoration activities among subbasins with focus on these primary sources of risk would likely result in more favorable outcomes.

Terrestrial communities, at the Basin level, change in relatively small amounts at the 100-year timeframe (table 25). However, spatially, the change is more substantial. Considering smaller geographic extents reveals change among the terrestrial communities that are offset to some degree at larger geographic extents. In total, specific areas with increases are offset by other areas with decreases. These shifts are a complex result of disturbance activities (naturally occurring and human induced) and ecological succession. All of the options result in reductions in the mid-seral forested vegetation types, the vegetation most susceptible to insect, disease, and fire at the current time. Late-seral forest vegetation does increase under each of the options.

Table 25—Terrestrial communities for the current situation and management options (year 100) for FS/BLM administered lands.

Terrestrial communities	Current	Option 1	Option 2	Option 3
		--percent................		
Early seral montane forest	11.0	8.8	9.8	8.8
Early seral lower montane forest	0.3	1.4	1.7	1.3
Early seral subalpine forest	3.2	1.7	2.9	1.8
Exotics	2.2	2.9	0.7	1.6
Late seral montane multi-layer	5.2	6.4	7.8	8.4
Late seral montane single Layer	1.0	0.5	0.9	0.9
Late seral lower montane forest multi-layer	1.8	4.0	2.2	3.4
Late seral lower montane forest single Layer	1.1	1.1	4.3	2.8
Late seral subalpine forest multi-layer	0.8	2.7	2.3	3.0
Late seral subalpine forest single Layer	1.4	0.6	0.6	0.5
Mid seral montane forest	20.3	17.8	16.1	16.5
Mid seral lower montane forest	5.5	8.5	5.3	6.0
Mid seral subalpine forest	4.5	3.8	3.2	3.7
Other*	1.0	1.0	1.0	1.0
Riparian herb	0.2	0.1	0.1	0.1
Riparian shrub	0.3	0.3	0.3	0.3
Riparian woodland	2.3	0.9	1.0	1.1
Upland herb	4.5	8.2	10.1	9.7
Upland shrub	31.3	26.3	26.9	26.7
Woodland upland	2.1	3.1	2.7	2.4
Total	100.0	100 0	99.9	100.0

* Other includes Rock/Barren, Alpine, Agriculture, Water and Urban

** Tables may not total 100 due to rounding.

Terrestrial ecology

Terrestrial species habitats on FS- and BLM-administered lands were assessed for each of the management options. Assessments were based on expert opinion concerning the likely outcome for species and their habitats (see *Evaluation*—Terrestrial). The experts were asked to make judgments about habitat conditions for historic, current, and future timeframes. Habitat outcomes were classed into five outcome categories with 1 being the most broadly distributed and 5 being isolated local populations with strong potential for extirpation (see appendix C, table C-l, for definitions of habitat outcomes).

Continuing current management approaches (Option 1) generally resulted in the least favorable outcome, followed by the reserve emphasis (Option 3) then the restoration emphasis (Option 2) (see appendix C, table C-2 for outcomes for specific species). Habitat for nearly all species was more favorable under the historical conditions than either the current or projected future.

Outcome 4, where habitat conditions result in populations that are largely isolated, when combined with Outcome 5, where strong potential for extirpation exists, might be interpreted as identifying a set of species of potential concern. The total number of vascular plants and vertebrate species

Table 26—Societal acceptability for several variables considered important by the public compared for each management option.

	Options		
Variable	1	2	3
Prod ict ability	-	+	-
Access to decision making	-	+	-
Acceptability of effects on private land	-	+	-
Acceptability of effects on communities and quality of life	-	+	-
Acceptability of effects on American Indian Tribal interests	-	+	+

\+ = Effects are more likely to be socially acceptable.

\- = Effects are less likely to be socially acceptable.

analyzed with projected outcomes of 4 and 5 within eastern Oregon and Washington are 59, 41, and 45 for Options 1, 2, and 3 respectively, and for the Upper Columbia River Basin are 46, 32, and 33 (see appendix D for lists of species with projected and current outcomes of 4 and 5).

The grizzly bear and sharp-tailed grouse showed the most dramatic decline in habitat (increases in outcome scores) between historic and projected futures (*Evaluation--Terrestrial*). For these two species Option 1 is projected to have a less favorable rating for sharp-tail, but the other options provide similar outcomes; the grizzly bear shows similar responses across all options. The implications are that the options provided in this analysis did not address all the risks associated with these species. This is a complex situation in which some of the risks occur at fine scale where the management options provided little specific description of management direction, some of the risks are associated with factors not related to FS and BLM management, and some of the risks are from severely limited habitat that might not respond to new management emphasis on FS- and BLM-administered lands alone.

Social

Projections of social consequences and outcomes associated with the management options were developed primarily through a series of panels involving a wide array of publics, elected officials, and tribal members (*Evaluation*—Social). These panels were particularly helpful in narrowing the scope of concerns and gaining insight into perceptions and values held by participants.

From a social perspective the five main areas of concern were (1) predictability in commodity outputs and outcomes from the Federal lands; (2) the publics access to the decision-making processes; (3) primary or secondary effects that might occur on private lands; (4) the effects on communities and the quality of life; and, (5) the effects on American Indian tribes (table 26). Options 1 and 3 generally were predicted to be less acceptable, than Option 2.

An additional area of strong interest within the Basin is the scenic quality, especially associated with FS- and BLM-administered lands. Table 27 shows 90 percent of the FS and BLM lands are rated as having high scenic integrity in the current situation. Options 2 and 3 provide a slight increase in area rated as high scenic integrity for the first decade.

Table 27—Scenic integrity classes for the current situation and management options (year 10) for FS- and BLM-administered lands.

Scenic integrity classes	Current	Option 1	Option 2	Option 3
	percent			
Very high scenic integrity	32	33	33	34
High scenic integrity	26	26	30	32
Moderately high scenic integrity	32	31	30	28
Moderately low scenic integrity	8	9	6	6
Low scenic integrity	1	1	1	1
Total	100	100	100	100

Note: May not sum to 100 due to rounding.

There is considerable interest on the public's part in road access. Each option considered a different level of emphasis on road closure and obliteration. At the 100-year timeframe, FS and BLM lands would move to a higher percentage of moderate road densities (table 28) by shifting away from higher road densities. Future strategies for road management also were oriented toward achieving moderate road densities. In areas projected to have increases in road densities, the increases were not projected to exceed moderate.

Aquatic ecology

The management options are compared relative to their effectiveness in maintaining and protecting aquatic ecosystem function, structure, and processes, and to their expected effects on the effective distribution and abundance of habitat with reference to populations of 22 native fish species and subspecies (*Evaluation—Aquatics*). Specific emphasis is placed on protection, maintenance, and restoration of aquatic and riparian habitats offered by each alternative.

The evaluations center on core areas, where there are concentrations of strong populations and the species is well distributed among adjacent watersheds, and fringe areas, where a relatively few occupied watersheds are isolated and fragmented from the larger portions of the species range.

The species focus is primarily on seven key salmonids that are viewed as important indicators of aquatic integrity (table 29) (*Evaluation—Aquatics*). Fifteen endemic, narrowly distributed species were also evaluated against the management options. Option 1 was found deficient in conserving core strongholds and fringe distributions into the future. The result was a projection for all key salmonids and 14 of the endemic species that further declines would not be halted. Option 3 appears to provide the most favorable outcome associated with the key salmonids and the narrow endemics. This is largely a result of declining negative affects due to road reductions and reduced grazing, harvest and other disturbances in the large reserve areas. The options result in varying levels of effectiveness in providing for ecological functions and processes (table 30). Each option provided a different mix of protection and management processes related to aquatic/riparian systems. The restoration emphasis (Option 2) and reserve emphasis (Option 3) are generally effective at maintaining and protecting riparian functions; Option 2 has the added benefit, as viewed from a managers perspective, of increased flexibility.

Table 28—Predicted road density classes for the current situation and management options (year 100) for FS- and BLM-administered lands.

Road density classes	Current	Option 1	Option 2	Option 3
	-----------------------------	percent	-----------------------------	
None	33	**29**	**32**	**33**
Very low / low	19	**18**	**17**	**19**
Moderate	23	**27**	**49**	**45**
High /extremely high	26	**26**	**2**	**4**
Total	100	100	100	100

Note: May not sum to 1 00 due to rounding.

Table 29—Number of key salmonids or endemic rare or sensitive fish species for which the management options would conserve strong populations, prevent further declines or rebuild depressed populations.

Number of key salmonid species and rare and sensitive fishes given sufficient protection to:	Option 1			Option 2			Option 3		
6 Key Salmonid Species[1]	**Y**	**N**	**Uncertain**	**Y**	**N**	**Uncertain**	**Y**	**N**	**Uncertain**
Conserve Strong Populations	0	6	0	6	0	0	6	0	0
Prevent Declines	0	6	0	1	1	4	2	1	3
Rebuild Depressed Populations	0	6	0	6	0	0	6	0	0
15 Rare and Sensitive Species[2]									
Prevent Declines	1	14	0	–y	1	7	9	0	6

[1] The seven key salmonid species include bull trout, westslope cutthroat trout, Yellowstone cutthroat trout, redband trout, steelhead, stream-type chinook, and ocean-type chinook. Ocean-type chinook are minimally impacted by FS/BLM land and no core strongholds exist on FS/BLM administered land. They are, therefore, not included in this summary.

[2] Three of the eighteen rare and sensitive fishes addressed in the evaluation were not included in this summary because one species is protected under ESA Section 7 regardless of alternative, and two species have insufficient information to conduct an analysis. The fifteen endemic fish species included are Pacific lamprey, Pit-Klamath Brook lamprey, Lahontan cutthroat trout, pygmy whitefish, shortnose sucker, Lost River sucker, Klamath largescale sucker, slender sculpin, Goose Lake sucker, Wood River Sculpin, Wood River brideelip sucker, Malheur sculpin, torrent sculpin, shorthead sculpin, and margined sculpin. Also of note, pygmy whitefish are large Take dwelling fish which are minimally impacted by any alternative.

Economics

In general the Basin is experiencing growth and robust economies (*Evaluation—Economics*). This varies by county, community, and geographic area. The options were evaluated within the context of these current economic conditions. The FS- and BLM-administered lands within the Basin are valued for more than their ability to provide traditional commodities. They are a source of increasing recreation, increasing special forest products, and source of cultural and spiritual significance. The social evaluation of options indicated a declining acceptance of Option 1, inferring negative outcomes on the totality of values associated with that option. This is consistent with the idea that public values and perceptions are shifting. Options 2 and 3, though they provide lower levels of commodity production (table 31) may have higher combined value (by considering the entire basket of goods and services provided by the options).

Recreation use is highly valued within the Basin, but differences across the options appear to be offsetting. For example, Option 3 may be providing more semi-primitive/primitive experiences that offset declines in roaded recreation.

Table 30— Selected elements relating the aquatic conservation strategies of each option to their effectiveness in maintaining and protecting aquatic ecosystem function.

	Options		
Element	1	2	**3**
Will riparian protection maintain ecological function and process?	No	Yes	Yes
Is ecosystem analysis required for specifically identified watersheds?	No	Yes	Yes
Can standards and guidelines be modified after ecosystem analysis?	No	YeS	No
Relative benefits of the intensity of riparian and watershed restoration	Low	High	Low

Table 31— Selected economic measures for each of the management options.

	Options		
Economic Measures	1	2	3
Timber outputs (million cubic feet)	793	344	316
Range outputs (thousands AUMs)	2.59	2.55	1.43
Economic resiliency (weighted by population in counties)	100	100.4	99.5
Timber values (Millions of dollars)	1,061	457	306
Range (Millions of dollars)	24	24	13
Recreation Use (Millions of dollars)	3,433	3,565	3,565
Existence of unroaded (Millions of dollars)	3,854	3,861	3,861

Methods for Assessing Future Integrity

Trends in ecological integrity

Trends in ecological integrity were estimated for each of the options (see the *Evaluation).* The SIT developed models that simulated the implementation of each option. The simulation models consisted of a mix of potential activities (for example, harvest, prescribed fire, and thinning) and projected disturbances (for example, wildfire) that resulted in changes in succession for vegetation within the model. Projections were also made to estimate the potential changes in road densities that would result from the implementation of each management option.

We examined the projections we had available through the evaluation of the management options to determine which indicators might provide the most universal predictors of trends in integrity. We chose three primary indicators each having equal weight in contributing to composite ecological integrity trends: (1) forest and rangeland vegetation (as integrated indicators of such elements as disturbance, succession, management activities, exotics, and habitat); (2) riparian management (as an indicator of such elements as aquatic environment, riparian communities, connectivity of riparian and aquatic ecosystems across the FS- and BLM-administered landscapes, fragmentation, and habitats); and, (3) road density changes (as indicators of such elements as change in erosion, sediment, terrestrial habitat trajectories, habitat fragmentation, and exotic introductions). Each indicator was assigned a value indicating its contribution to composite integrity (-1, 0, +1). The trend was projected as the simple sum of the three indicators (the data are shown in appendix B, table B-3). Trends were estimated for each subbasin across each management option.

Summing across all the FS and BLM lands within the Basin shows that the options provide very different outcomes in composite ecological integrity trends (figs. 49, 50, and 51). Continuing current management approaches (Option 1) results in declining trends in integrity on 95 percent of the FS- and BLM-administered land (fig. 52). If the goal were to manage for stable or improving trends in ecological integrity, the restoration emphasis (Option 2) meets this goal for all FS- or BLM-administered lands while the reserve emphasis (Option 3) meets the goal for 95 percent of the area. Future management strategies that take a landscape approach and emphasize ecosystem processes and functions are more effective in improving integrity in the future than are strategies that emphasize stand-level treatments and commodity production. In the restoration emphasis (Option 2), substantial forested area is shown as stable, a much improved future projection than the declining trends projected for continuing the current management approaches.

Changing the management approaches in the restoration emphasis (Option 2) to result in more area with improving trends (rather than the stable trends as projected) involves a complex set of interactions that must be considered. A stronger emphasis on management of those elements represented by the proxy of changes in road density would tend to shift toward improving trends, yet it complicates the ability to effectively manage the vegetation (for example, access to treat overstocked stands, increase the mosaic patterns on the landscape, and suppress wildfire in highly fragmented watersheds of high importance to aquatic systems). Increasing the treatments (for example, prescribed burning, thinning, and harvest) associated with the areas most highly susceptible to insect, disease, and fire might contribute to improving trends from the vegetation management perspective, yet create potential risk to aquatic resources. Addressing these issues requires careful consideration, prioritization of risks, and identification of those areas that will respond most effectively to treatment.

The rangeland situation also involves a complex set of interactions that need to be considered in attempting to move to higher levels of integrity. Exotic weed expansion, trends in riparian condi-

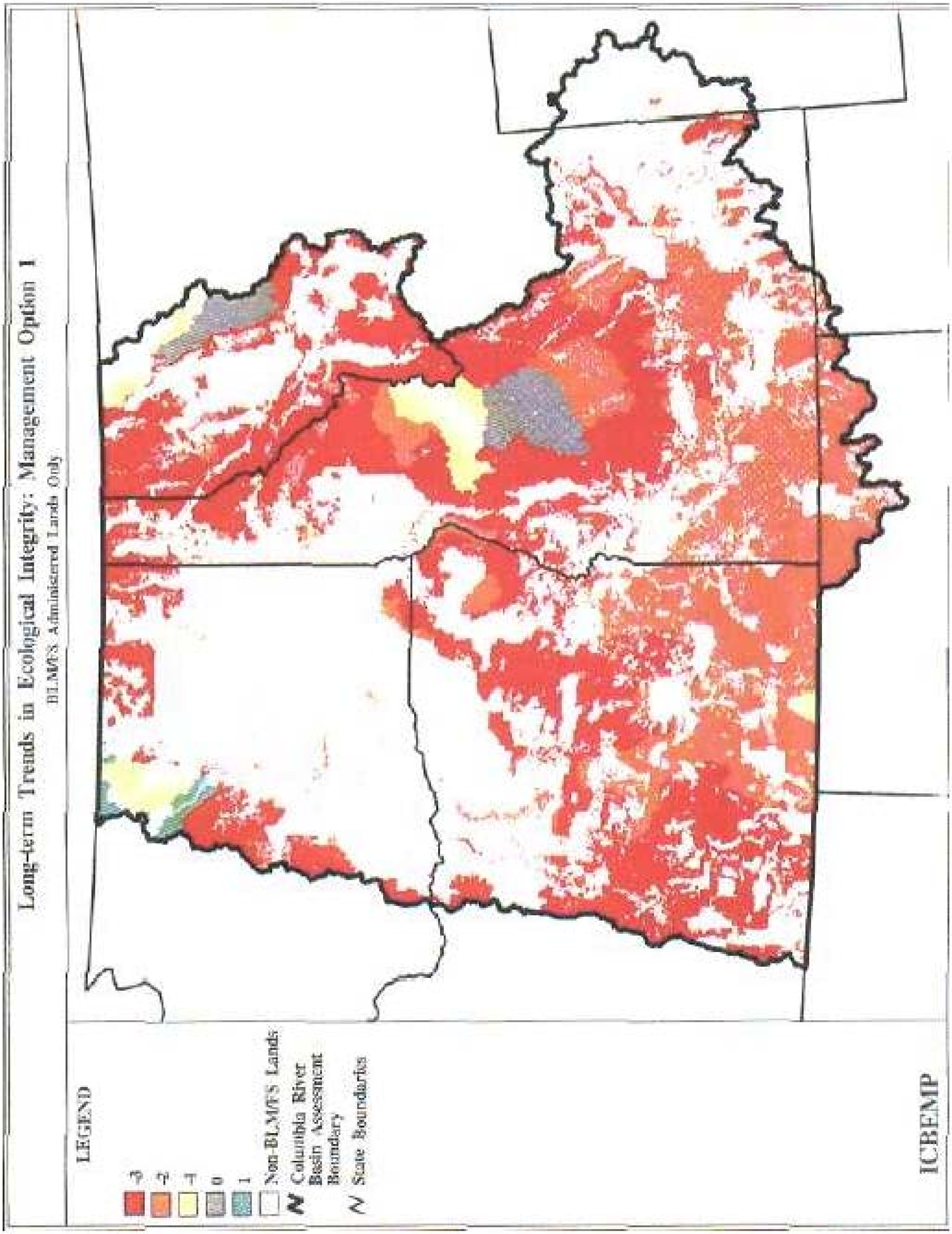


Figure 49—Long-term trends in ecological integrity for FS- and BLM-administered lands: Management Option 1.

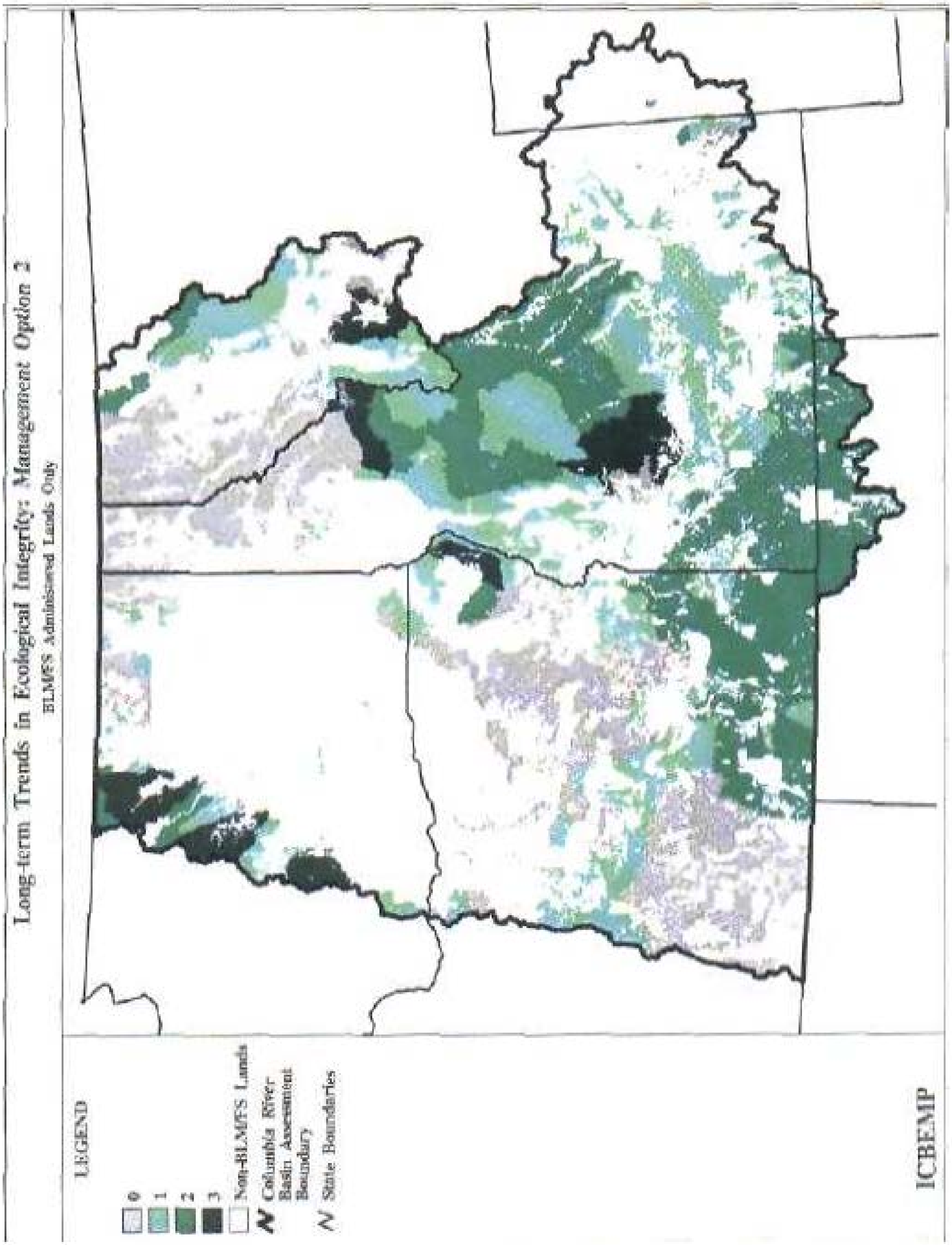
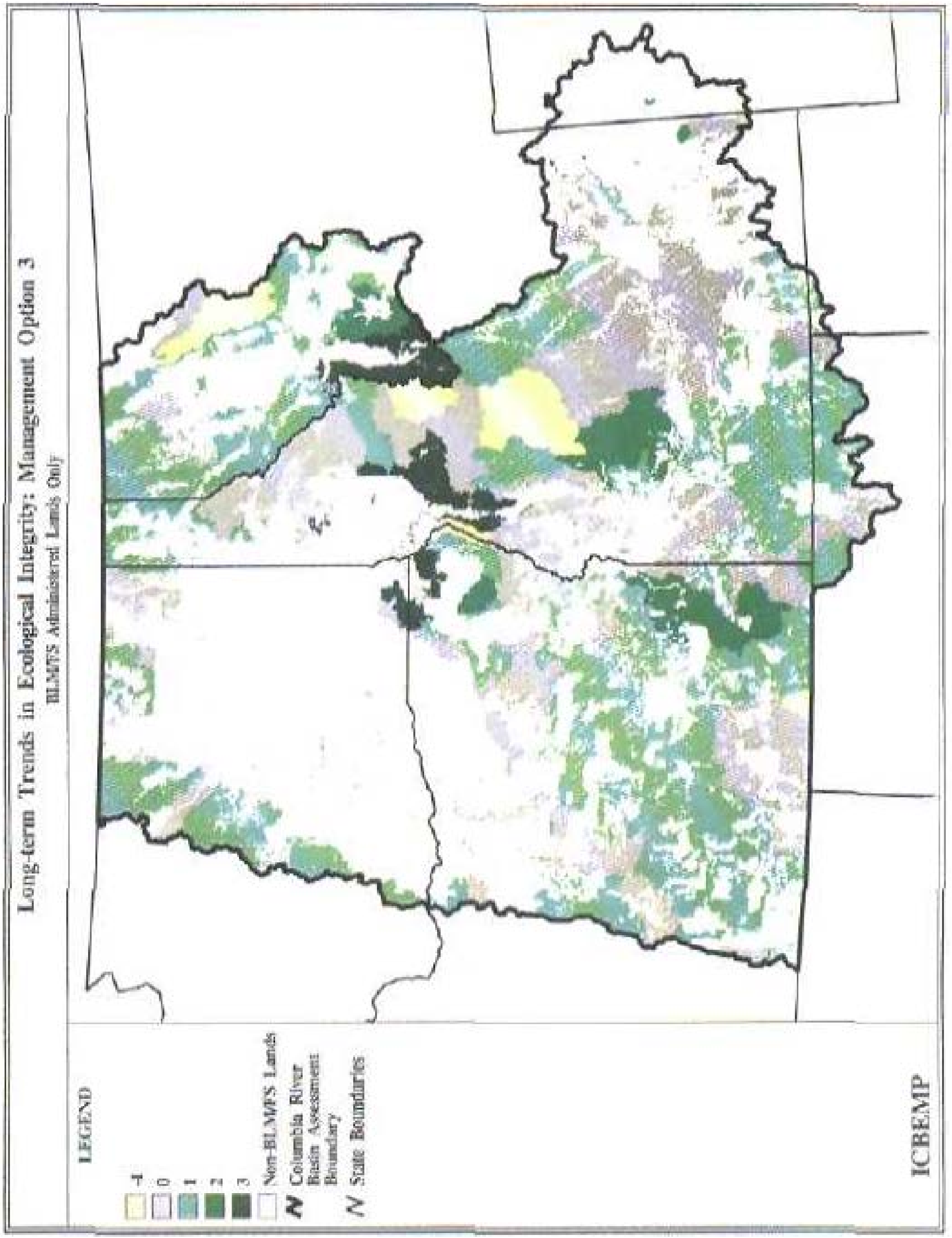


Figure 50— long-term trends in ecological integrity for FS- and BM-administered lands: Management Option 2.



Figiure 51— Long-term trends in ecological integrity for FS- and BLM-administered lands: Management Optio 3.

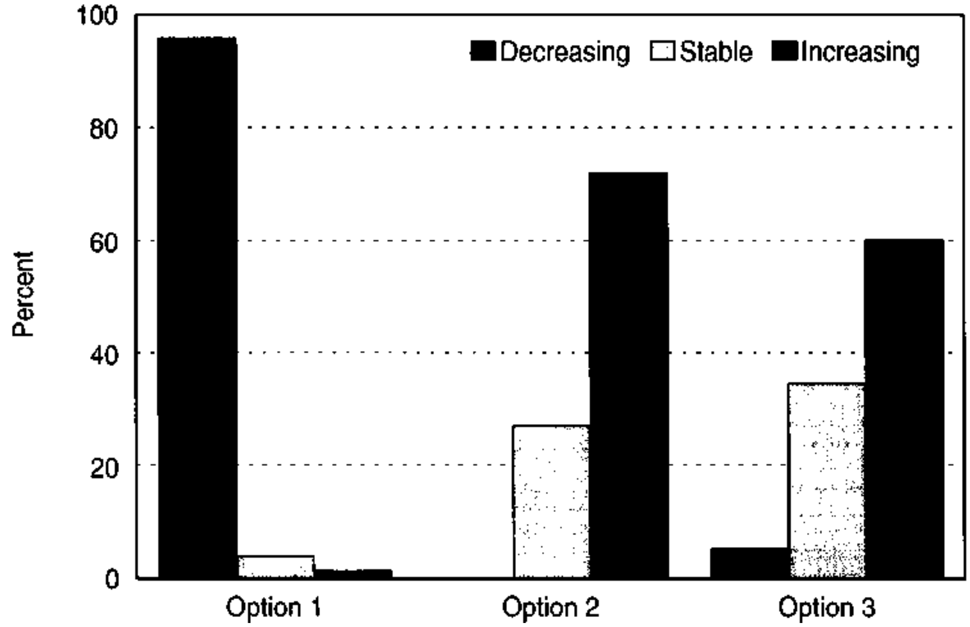


Figure 52—Trends in composite ecological integrity projected by Management Option.

tions, changes in fire regimes, and encroaching woody species are primary concerns in these vegetation types. Rangeland areas have been improving over the last several decades, but these concerns remain potential impediments to improving ecological integrity. Rangeland conditions may not be as responsive as forested areas to the aquatic conservation strategies. Prioritizing areas for new grazing strategies, integrated weed management, restoration treatments, prescribed fire, and reductions in woody species encroachment will likely yield the greatest potential to improve trends in ecological integrity.

Population density

The only component of social and economic resiliency that we have any ability to project is population density. But we can use population density as a proxy for social and economic resiliency to make some general assessments about resiliency trends. Economic resiliency, lifestyle diversity, and population density vary directly with each other. That is, these factors seem to be collinear, which suggests that any one of these three factors can be used as a proxy for the others.

As of 1994, the population of the Basin was 3.1 million. Population projections suggest that the Basins 100 counties will have 6.0 million people by 2040 (McCool and Haynes 1996). This is a growth rate higher than the population growth rate for the United States as a whole. Given these projections, the population density ratings for 61 counties remain unchanged. The remaining 39 counties shift to a higher category of population density. Figure 53 illustrates these trends in terms of the distribution of population density categories by population and by area. By the year 2040, nearly 80 percent of the population (up from 60% currently) will live in relatively urbanized environments. The proportion of the people living in the most rural parts of the Basin will decline by 50 percent. The area in the lowest population density category will change from 68 to 45 percent of the Basin.

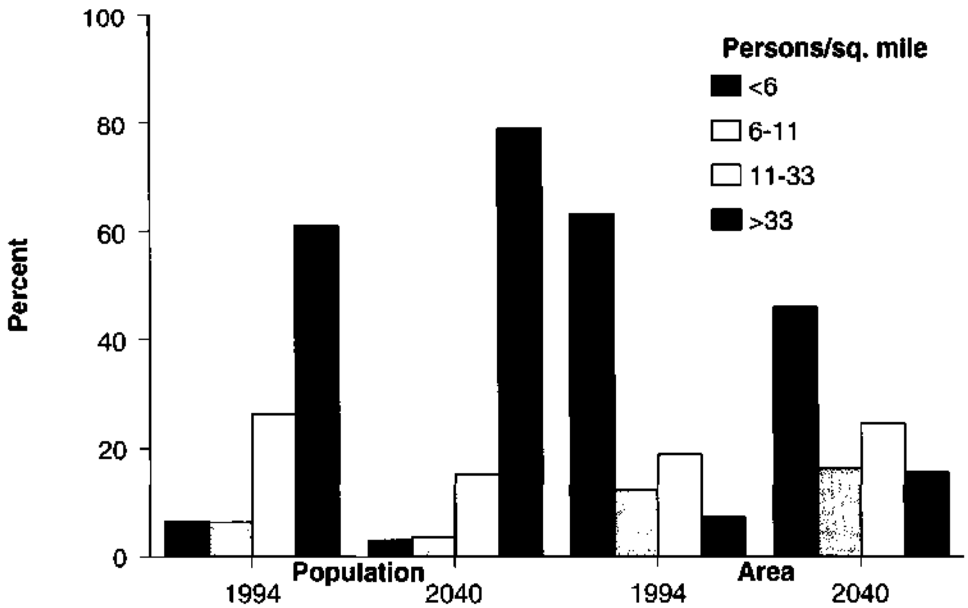


Figure 53—Distribution of population density categories by area and population of 1994 and 2040.

Because of the projected increase in Basin population, there will be more people in the high-density counties. This is particularly true in "recreation" counties, which are projected to attract a disproportionate number of immigrants (McCool and Haynes 1996). In terms of socioeconomic resiliency, this means a continued shift toward higher socioeconomic resiliency throughout the Basin, with the exception of counties with low population density that are not recreation counties or that have low economic resiliency. None of the 100 counties are projected to lose population between 1995 and 2045, although half a dozen will have only minor increases. As other areas become more densely populated, these half-dozen will be relatively more isolated and have difficulty attracting infrastructure and investments. On the other hand, they will be more apparent as "refuges" for people seeking solitude.

Predicting trends for social and economic resiliency is difficult because of the inherit uncertainty in social systems (because of both the speed at which they change and the uncertainties inherit in many of the underlying assumptions). The trends in economic resiliency for the first decade are shown in figure 54 for two of the three management options. Comparing figures 52 and 54 can be deceptive. Figure 52 illustrates changes in ecological integrity with regard to changes in forest and range ecosystems with little interaction with prospective human impacts on either management or changes in the mix of ecosystem goods, services, and conditions. Figure 54 speaks to the entire economic system within the Basin. As such, it includes goods, services, and conditions from both the forest and range ecosystems as well as the other parts of the Basin. It also only speaks to the conditions in the first decade of the planning period (where the trends in ecological integrity speak to changes expected in the next 100 years).

In the long term, population changes are a proxy for expected economic changes in the Basin (in *Component Assessment*— Economics there are projections of economic activity in the Basin for some of the major resources). The basic population shifts suggest that over the next 50 years, the Basin

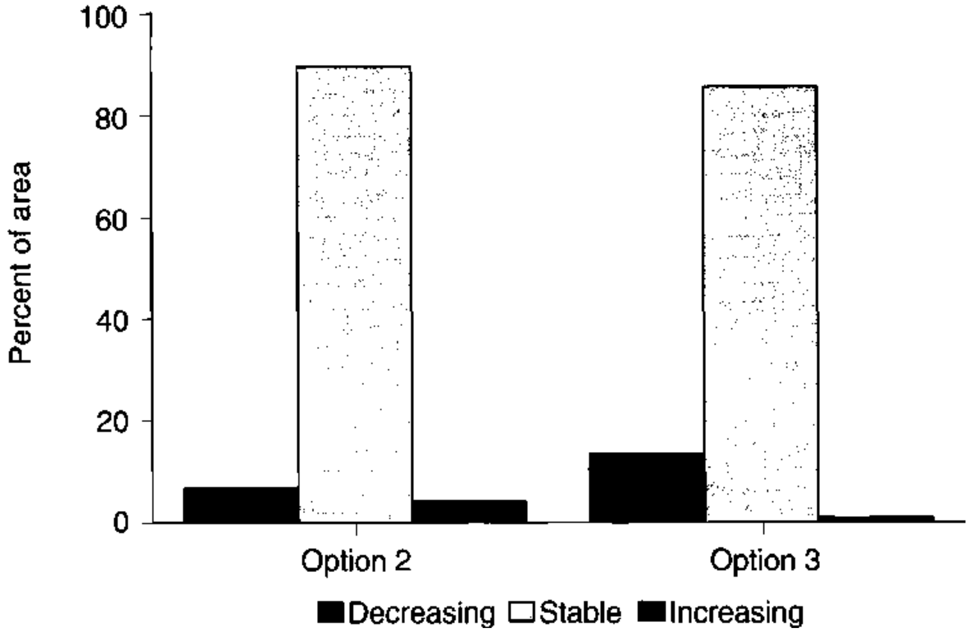


Figure 54—Trends in economic resiliency by area for Management Options 2 and 3.

will come to look like much of the West, in that an increasing proportion of the population will live in urban settings. Photo 13 shows a community in a low economic resiliency area where the resiliency is not expected to change. There will still be 45 percent of the Basin's area that remains in the lowest population class that we call "frontier" counties. Those counties will probably still generate concerns about their ability to provide social services without help from state and Federal governments, and we would expect that concerns about social resiliency would be most pronounced in them.

There is often the concern of the link between human conditions (and well-being) and the condition of the underlying ecosystems. When looking at figure 52, some may draw the conclusion that we have impoverished ourselves and that ecosystem and human community sustainability is imperiled. Such a view at the Columbia River Basin level leads to erroneous conclusions. First the forest and range ecosystems do not, in themselves, provide the economic foundations of the Basin. Second, many of the ecosystems have been modified by human action to increase their production of native (for example, timber and grass) or exotic (for example, wheat or cattle) crops or animals.

Risks to ecological integrity and people and their assets

We assessed future risk to ecological integrity in relation to people (growth in rural-urban areas and use patterns) and risk to people and their assets in relation to wildland areas (see *Evaluation).* The underlying assumption is that risk to ecological integrity is generally higher in proximity to densely populated areas, and risk to people and their assets is generally higher in close proximity to wildland areas, than to agricultural or urban areas. Natural or human-induced events and animal populations occurring within wildland areas might prove risky to people, homes, and other assets people value. Those risks are related to wildland areas and conditions associated with wildland areas. The integrity of ecosystems is also influenced by the presence of people and their activities.

Photo 13—Small rural communities have traditionally been closely linked to the flow of commodities from FS- and BLM-administered lands.

Similar to the current integrity section, societal risk to ecological integrity and risk to human assets from wildland was estimated using a set of rules that related population density to forest, non-forest, and agricultural wildland vegetation groups. This relation assumes a generally higher risk associated with forested vegetation groups than with nonforested vegetation types and higher risk with increasing population densities. It also generally assumes that the more wild the area the higher the risk; while at the same time, the more human populations increase in close proximity to wildland areas the greater the risk.

While population and associated risks are projected to increase throughout the Basin, by 2040 the most rapid growth is concentrated in five areas. Ten counties just east of the crest of the Cascades make up the first area. This area contains one metro county (Yakima, Washington) and several rapidly growing recreation counties. Six counties along the Interstate 90 corridor (from Spokane, Washington to Missoula, Montana) make up the second area. Two counties in this corridor (Shoshone and Mineral, Montana) are largely Federal, with growth concentrated on a relatively small private land base. Five counties at the western edge of Yellowstone National Park make up the third area. The six counties along Interstate 84 from Ontario, Oregon, to Twin Falls, Idaho, make up the fourth area. This area is the most populated part of the whole Basin having two metro counties and a large private land base. The three counties around Tri-Cities, Washington, make up the fifth area. Two of these counties (Franklin and Benton, Washington) are metro counties. Of the five areas, this area has the smallest amount of Federal land.

Several of the most populated counties (Missoula, Montana; Ada and Canyon, Idaho; and Yakima, Washington) are in close proximity to FS- and BLM-administered lands and therefore are anticipated to have a greater risk associated with the interface of wildlands than Spokane or Tri-Cities, Washington. Spokane has a substantial wildland interface, but the risks are mostly associated with private land. Tri-Cities is a mixture of private wildland and agricultural interfaces. Where these metro areas are in close proximity to high-integrity wildlands, risks to the maintenance or improvement of integrity are high. Likewise these metro areas pose higher risk to areas of high integrity than to areas of low integrity, suggesting additional emphasis to manage the risks to attain and maintain high ecological integrity.

The trends in risks to human assets and ecological integrity are summarized for the three EIS options as follows:

	Options		
	1	2	3
Decreasing risks	0	35	29
Stable risks	32	43	43
Increasing risks	68	22	28

As shown in this tabulation, risks to the ecosystem can be managed, and proactive management (Option 2) can generally lower the risks more than a passive approach (Option 3). The location of these trends in risks are shown in figures 55, 56, and 57 for the three options.

There is no difference between the options for the Interstate 90 (Spokane, Washington-Missoula, Montana) or Interstate 84 (Ontario, Oregon-Twin Falls, Idaho) corridors. Options 2 and 3 do make a difference by lowering the risks in the east Cascades and in the area west of Yellowstone National Park. Risks to ecological integrity in the Tri-Cities area with its large private land base are unaffected by the various FS and BLM futures. In the east Cascades there are two areas (west of Yakima, Washington and east of Bend, Oregon) where growing human populations overwhelm the management attempts to lower risks within the options.

There are three additional geographic regions where different land management approaches are unable to alter the risks to ecosystems and where increasing human populations are not the source of increased risks. These are the area east of Missoula, Montana, along the continental divide, the area from Ontario, Oregon, to Baker City, Oregon (along Interstate Highway 84), and the area further east of Bend, Oregon. In these areas the various management actions envisioned in the options are unable to reverse the increasing trends in ecological and human risks.

Risks to people and their assets from wildland areas and risks to ecological integrity are not restricted to metropolitan areas. Much of the Basin is expected to remain rural where risks are associated with residents and primitive areas where risks are associated with visitors. Local publics will be expected to continue to express preferences for stability in scenery and will lobby to have projects put in someone else's backyard. Recreation use is expected to increase sharply leading to greater conflicts between recreation use and land management actions including road closures. The proportion of the Basin that is sparsely populated and where Federal agencies are a visible part of the communities is projected to change very little and will continue to place demands on Federal resources to be part of their community infrastructures. This will be the case especially in the area of risk management where these counties have fewer resources to address risks or assist in control of natural events such as fire, flood, and insect outbreaks than exist in the more populated areas.

Discussion of Management Options and Ecosystem Integrity

At the beginning of Chapter 4, three questions were posed to help the development of management direction. The first question was answered in Chapter 4. The last two questions combine inferences drawn from material in both Chapters 4 and 5.

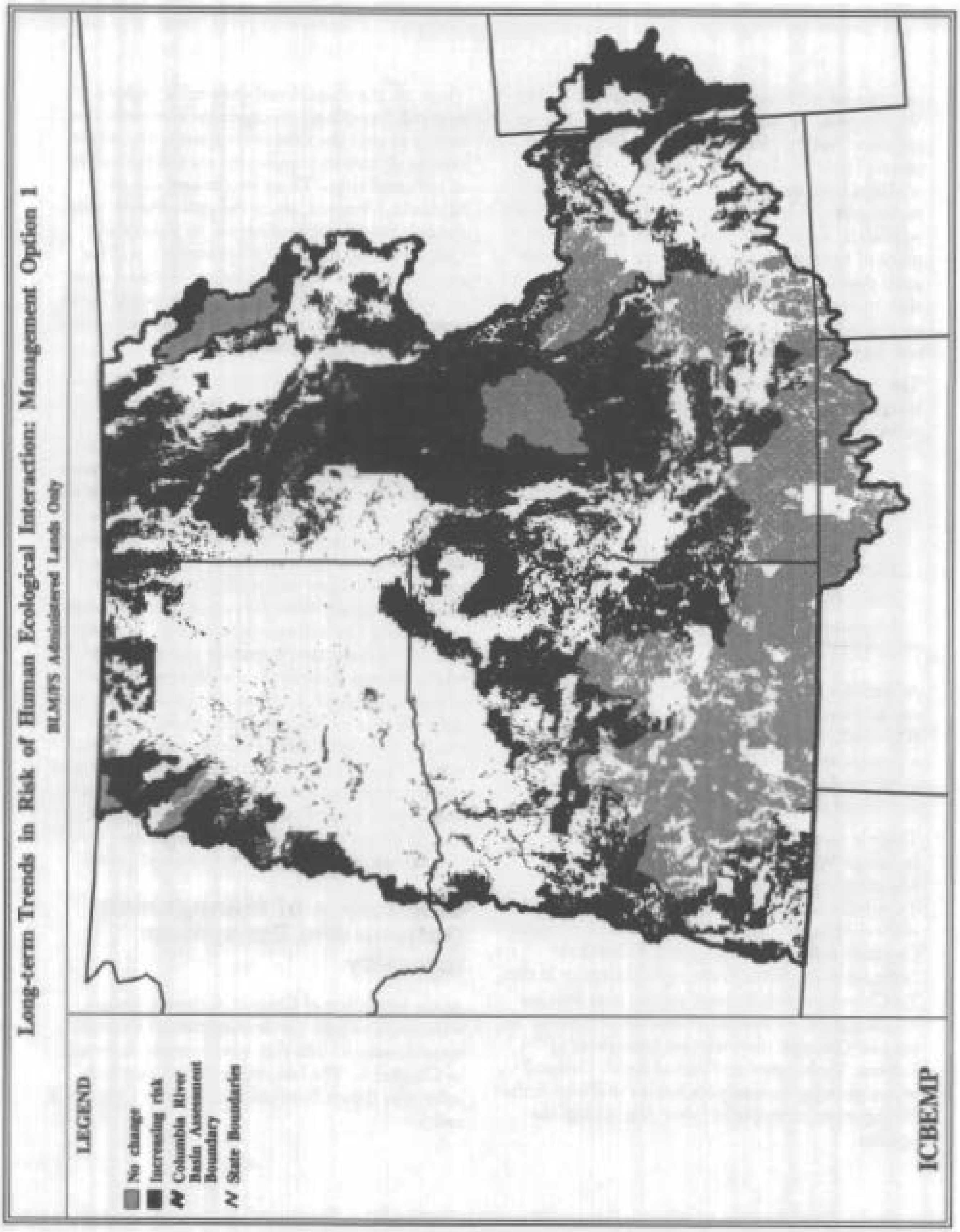


Figure 55—Long-term trends in risk of human ecological interaction BLM-administered lands only: Management Option 1.

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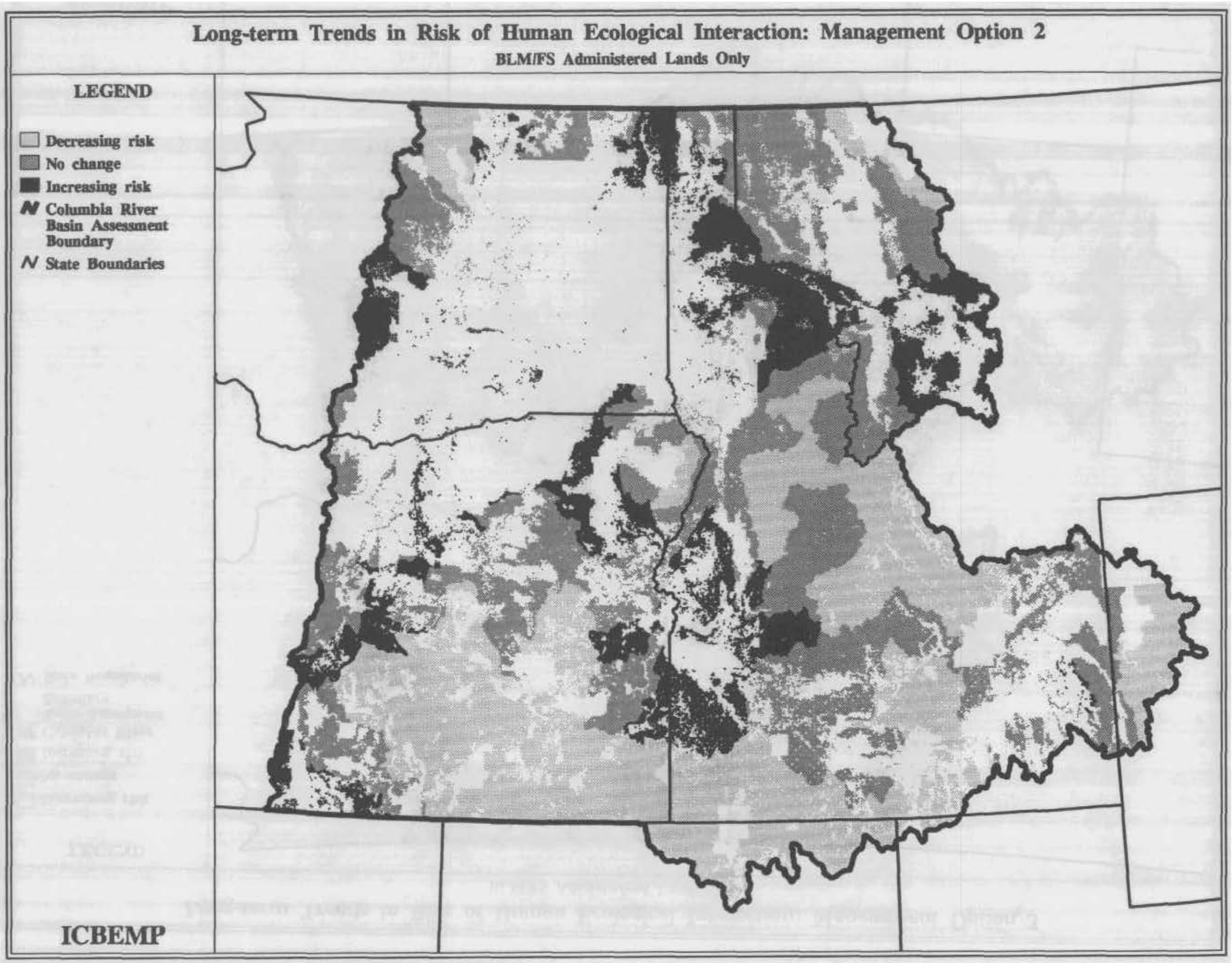

Figure 56—Long-term trends in risk of human ecological interaction BLM-administered lands only: Management Option 2.

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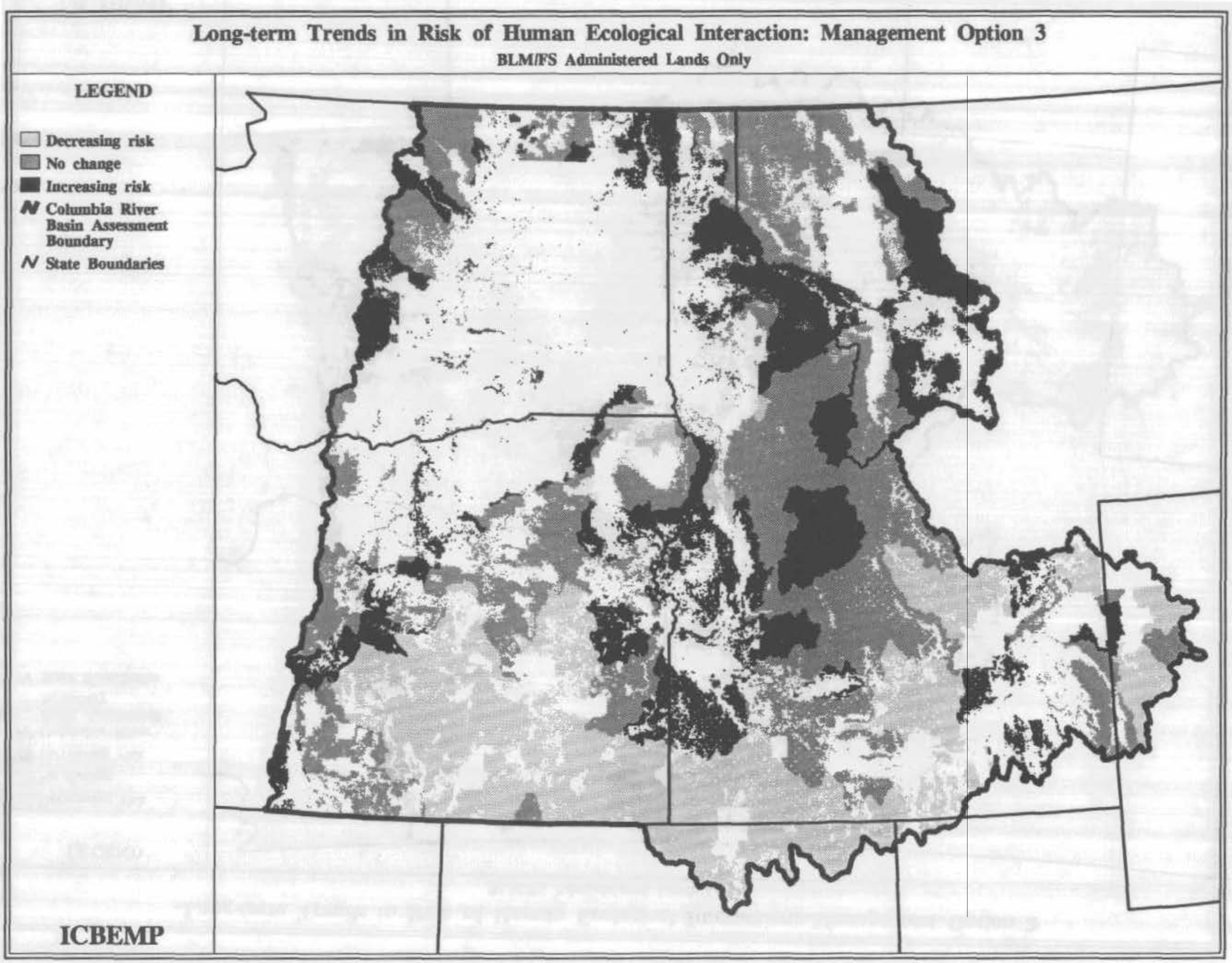


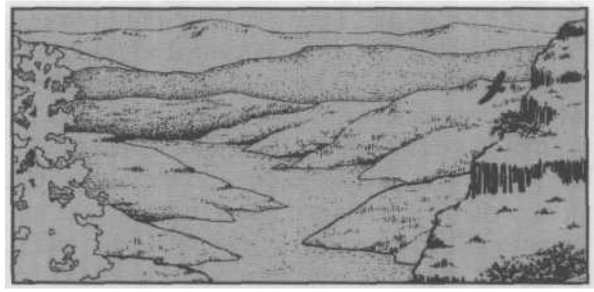
Figure 57—Long-term trends in risk of human ecological interaction BLM-administered lands only: Management Option 3.

The second question posed at the beginning of Chapter 4 asked where were the opportunities to improve (or restore) ecological integrity in the Basin? In general the greatest opportunities for restoration are in those areas with low and moderate ecological integrity. However, in terms of Federal agencies being able to assist in large-scale restoration, substantial opportunity exists in the dry and moist forest clusters and the rangeland clusters having low ecological integrity. There are also significant human populations in these same areas who could directly benefit from improved ecological conditions. For Federal lands, these areas will pose significant challenges to land management and will require extensive stakeholder involvement. Another opportunity to improve ecological integrity is in areas associated with moderate integrity that are positioned between large blocks of high integrity. They represent areas where terrestrial and aquatic systems can be connected. Examples include the Blackfoot and Bitterroot areas of western Montana.

The third question asked where there are opportunities to produce commodities with low risk to ecological integrity. There are two types of answers. First, timber and range outputs can concentrate in those areas of moderate integrity with low fire risk (for example, the moist forest and range grouping). The second answer is to focus commodity production in those areas that have low or moderate integrity but are candidates for restoration. In these areas there are low down-side risks both from fire and hydrologic problems. In addition, almost all of the isolated resource-dependent communities are in these areas, and maintaining commodity flows would have a positive effect on community resiliency.

CHAPTER 6

POLICY QUESTIONS, EFFECTS OF SPECIFIC POLICY ACTIONS, AND PROCESS QUESTIONS



The Science Integration Team derived, and the Executive Steering Committee approved, eleven policy questions from the Charter. They also sought to determine the effects of the Northwest Forest Plan, and the effects on FS- and BLM-administered land of implementing the PACFISH strategy. Two broad process questions were also identified.

Policy Questions

1. What are the effects of current and potential FS and BLM land allocations on ecologic, economic, and social systems in the Basin?

Current land allocations result in the simplification of landscape mosaics and ecological conditions. This is true whether the allocation is for commodity or amenity outputs (see discussion of continuation of current management and reserve area emphasis management options). Allocations tend to emphasize one resource goal (such as timber harvests) that is sometimes constrained by competing resource goals (such as fish and wildlife). In contrast, ecosystem management may emphasize multiple goals under a flexible, adaptive management. These goals would be accomplished within the biophysical capabilities of the ecosystem by seeking outcomes related to landscape processes balanced over large spatial and temporal scales. Strict adherence to land allocations does not allow the flexibility to respond to changing environmental conditions.

Most past land allocations have favored either commodity production or wilderness set-asides. These aimed either at the predictability of economic or social outputs over short timeframes and localized areas or the resolution of specific wilderness issues. Predictability of economic and social outputs may temporarily be reduced or changed during the short-term transition between the existing situation and the more flexible approach, until management plans can be established for the new approach. The long-term economic outputs could be predicted, but outputs may take a different form (for example, different mix of size and species of trees harvested).

The implementation of ecosystem management builds on the legacies of past management (for example, roads and past harvesting) and tradeoffs in production of ecological, economic, and social outputs. For example, roads may be detrimental to some aquatic systems, but enable some types of economic, cultural practices, and recreation activities to take place. Past cutting practices and fires also created some desirable ecological attributes or patterns in our current landscapes.

2. What are the ecological, economic, and social system outcomes associated with current (defined as the early 1990s) FS and BLM levels of activities?

Relative to historic practices, current management practices have focused on minimizing and mitigating disruptions to aquatic environments. However, the net gain in aquatic habitat improvements has been slow and many fragmented and isolated habitats remain. This has resulted in continuation of local extirpations even without any additional habitat loss. Though riparian systems are beginning to recover, upland forest areas are currently at greater risk from certain diseases, insects, and catastrophic fires, owing to fire suppression and exclusion. Upland range areas have shown improvement over the past forty years, but the encroachment of exotic plants, especially legally declared noxious weeds, and grazing strategies that are inconsistent with ecological processes continue to be important problems.

A focus on ecological outcomes likely will have mixed effects on economic and social resiliency. There may be a short-term decline in traditional commodities, such as timber, but in the long-term, commodity production could stabilize. Under current management, social resiliency is expected to be lower than average in the more arid portions of the Basin, and higher than average in forested areas with higher productivity. Much of these findings are tied to water. Water is a common link to both social and biophysical resilience.

3. What is required to maintain long-term productivity (in terms of various systems)?

Management practices designed to sustain long-term productivity need to incorporate the full complement of ecological processes within the context of the biophysical conditions. In addition to understanding the biophysical conditions, managers will commonly need to react to unpredicted, unalterable, environmental conditions that are outside the limitations of the system by adjusting management practices. Managers will have to address conditions such as introduction of exotic biota, erosion of soil, concentration of toxic pollutants, loss of habitats to urban and agricultural development, and global climate change.

Indicators of long-term productivity can typically be measured from above- and below-ground structural components and patterns. However, the basic ecological processes that drive productivity are the critical baseline. There are some general management recommendations that when followed will reduce risk of loss of long-term productivity.

To protect soil productivity, managers can conserve surface organic matter by minimizing roads in the moderate-to-high-risk areas for erosion, sediment transport, and landslides. Managers can design roads to better fit the land surface, to avoid cut slopes that bring subsoil water flow to the surface, and locate them in lower-risk areas. In particular, roads in flood plains constrain channels and increase rates of flow. Where possible, roads could be removed from flood plains or other areas subject to events that may affect hydrologic flows, erosion, or sedimentation. Maintaining bank cover in riparian areas, and emphasizing woody cover would help, as would managing to minimize soil disturbance activities in areas susceptible to establishment of exotic plant species. These areas are typically in the dry forest, shrub, and grass potential vegetation groups. Where feasible, there is also the opportunity to manage to reduce risk of introduction of exotics and contain their spread.

Management practices can be designed to retain diversity of vegetation and soil patterns and structural components. Special emphasis can be placed on the cycling of the dead component of vegetation. Management practices can include provisions to maintain dead standing and down vegetation material, and litter.

Management practices can be designed to maintain long-term water retention characteristics of the landscape, especially in wetlands. This will improve aquifer characteristics, will provide a buffer for riparian conditions, and provide habitat for wildlife. Vegetation herbivory can be managed to conserve vegetation cover and resiliency of the system to drought.

Human populations in the Basin are increasing, which, in turn, results in increases in associated pressures on the land. Managers can work with stakeholders and scientists to continually share new understandings and views of long-term productivity.

4. What can the FS and BLM do to mimic disturbance elements on the landscape?

The FS and BLM can mimic natural disturbances, but it is essential for managers to consider that current conditions may be considerably different than those conditions that occurred historically. For example, reintroduction of native processes such as fire without modification of structural patterns, fuel loading, and spatial distributions can produce unpredictable and undesirable effects. Managers could use strategies of livestock grazing in forests and woodlands that would result in the accumulation of understory fine vegetation. This would provide fuel for prescribed fires that can be useful in maintaining conditions consistent with long-term disturbance processes.

In planning vegetation management, it is important to recognize that native disturbances and mechanical treatments do not necessarily create the same conditions. Oftentimes the structure can be replicated with a mechanical process. The results may be a community that is very different or generally equivalent to the native system. This is highly dependent on the design of the mechanical disturbance process. When possible, management treatments would be designed to produce a mosaic of both live and dead vegetation structures in a more complex array of patterns than exists today. Livestock grazing and other herbivory can be managed to be more consistent with those patterns and structures that represent long-term disturbance processes.

In aquatic systems there is less known about how to mimic disturbance to create appropriate structures and composition of components. Because of the high rates of energy concentration in the aquatic system, and the cumulative nature of smaller drainages to larger drainages, many aquatic restoration or development projects fail. This often occurs because of failure to consider structure placement in the context of the hydrologic and geomorphic conditions.

Managers need to apply disturbance processes appropriately through time and in space. Management activities that truncate the successional sequences can cause significant negative impacts to ecological processes. Seeding of perennial exotic grasses following wildfire commonly replaces the early-seral native shrub and/or herb stage. These seed mixes can contain exotic weed seeds. Because of the risks of exotics, seeding of cover to reduce erosion would focus mostly on areas where the seed bank in the surface soil has been lost. Where seeding is deemed necessary and appropriate, seeding with annuals that do not produce fertile seed is an option. Typical patch sizes and scheduling of harvest continually through time in the same watershed, often do not represent the size and interval of more natural disturbance events. Containment of livestock in specific pastures usually does not represent the seasonal variation of ranges that were available to native herbivores.

5. What is required to maintain sustainable and/or harvestable and/or minimum viable population levels?

The ultimate concern and requirement for species are long-term persistence, assessed and provided within the context of ecosystems. A population with a high level of viability is one with a high likelihood of continued existence throughout its range (on at least Federal lands within the Basin) over the long term, for example the next 100 years. In contrast, a harvestable population is one that is sustainable and that can also provide a portion for hunting or gathering uses. To reach this level requires understanding the long-term and off-site effects of our short-term and on-site actions, as affecting the kinds and distributions of habitats, environments, and populations. Such a viable population is sustainable, and can be said to have a high likelihood of long-term persistence.

The concept of "minimum" viable populations does not apply to our assessment and we strongly advocate not using the term in management direction. Current scientific literature largely discounts the use of the concept because there simply is no one threshold population size that just barely assures long-term viability and below which the population is doomed. Instead, the focus should be on ensuring adequate distribution and abundance of environments and of individuals within and among populations to assure sustainable levels and, for some species, harvest use.

Species that might need individual attention for viability management include those species that are threatened, endangered, candidate, or rare and potential candidates. Additionally, a quick, simple, and inexpensive monitoring system can be instituted to ensure that currently secure populations do not become viability concerns in the future; the best application of population viability assessments is to prevent future listings of species. Then, the rest of the species can be addressed in broader guidelines for maintaining biodiversity, ecosystem processes, and species ecological functions, in pan by addressing species in ecological functional and community groups. In this way, critical species-specific issues *and* broader ecosystem management guidelines combine to ensure full conservation of both species and systems in one coherent approach.

Maintaining persistent populations requires well-distributed, well-connected, persistent high-quality habitat, and control of factors directly affecting mortality of individuals, such as harvesting, pollution, and competition or predation with domestic or introduced species. Well-distributed habitat will reduce the probability that disturbance or habitat loss, and consequent extirpation of the local population in any one area, will adversely affect overall population persistence. Connecting habitat patches with corridors or dispersal habitat, or eliminating barriers (such as roads and dams) will ensure that all parts of the regional population interact by allowing individuals to move between patches of habitat. That will allow for recovery of populations in areas that have been depleted by human or natural causes. Connectivity will also ensure adequate genetic interchange among segments of the population, which will promote vigorous populations with few genetic defects or reduced productivity resulting from inbreeding. Good connectivity generally is a goal, but in some cases persistence may be enhanced by restricting or controlling habitat connectivity where contagious disease or disturbances (such as crown fires) might be problems.

Not all species are naturally capable of persisting over the long-term; some are naturally scarce and rare. The best attainable goal for such species would be to maintain or restore their key environments and habitats and watch those habitats or populations for downward trends. However, if a species has become scarce because of human activities, much can likely be done to restore viability to higher levels.

All habitat is not created equal and the mere presence of individuals in a particular cover type or structural stage does not signal high-quality habitat. High-quality habitat consistently enables production and recruitment of young into the population, for example, where births equal or exceed deaths. Some habitats appear to be important, but are really "sinks" in the sense that those populations are not viable because mortality is higher than births. To persist, populations in sink patches need to be replenished from the high-quality "source" habitats. Habitat persistence could be assured by planning for habitat loss from disturbance, succession, or human encroachment and for its replacement through succession or active management.

Population viability can be managed by manipulating environments, habitats, other species, or sundry factors affecting demographic or genetic conditions and trends of the species of interest. Factors affecting population viability such as mortality differ among species. Mortality associated with human infrastructure and activities (such as roads, dams, irrigation systems, industrial pollution, residential and agricultural non-point pollution, and agricultural practices) can have large effects on some populations. Competition with domestic or feral livestock or introduced species can also lead to problems of habitat degradation or displacement of some organisms. Predation by domestic animals (dogs and cats) or introduced species can also be serious problems. For anadromous fish on-site and off-site (for example, ocean fishing, migratory species) harvest levels, stocking targets for some native and non-native species, and management of harvest (season, bag limits, methods) are critical issues for cooperation between land managers, state and tribal governments, and the public.

Finally, there needs to be the social will to maintain sustainable populations. Reasons for maintaining sustainable populations might be economic, social, religious, cultural, ethical, to provide for ecological services or ecological integrity, or to meet tribal treaty mandates. Cooperation among Federal, state, tribal, private, and public interest groups will be critical for achieving sustainable and harvestable populations.

6. What is required to maintain and restore biological diversity (biodiversity)?

The first step is insuring we have societal acceptance that biological diversity is a goal. If it is a goal, then maintaining and restoring biodiversity will require attending to several conditions in the Basin, including the following principal conditions:

- protecting or restoring seriously degraded and rare ecological communities,
- alignment of natural areas to represent ecosystems and to provide for rare and endemic species,
- conserving centers of species rarity, endemism, and richness,
- providing for a full array of historic vegetation conditions,
- providing the full array of key species ecological functions in an area,
- protecting type localities for rare plants,
- providing for full species' ranges, including disjunct populations, range margins, and endemic subspecies,
- maintaining soil structure and chemistry, and avoiding erosion,
- eradicating exotics or preventing further spread,
- and, modifying livestock-grazing strategies in some areas, particularly riparian areas,

To achieve these conditions, some high-quality environments or habitats need to be well-distributed, well-connected, and persistent, where biophysical conditions allow. Other environments or habitats associated with high biodiversity of unique or endemic plants and animals may be scarce and scattered; simple protection of such unique, sensitive sites (such as vernal pools) also may be needed.

Also, biodiversity can be in part maintained by providing for ecological processes. In the case of white pine blister rust and other exotic pathogens or insects, deployment of genetically resistant stock may be needed. In some instances, undesirable exotic species are now part of these ecosystems and cannot feasibly be eradicated or controlled with existing technology. Other exotic species have been deliberately introduced for purposes of biological control, erosion control, forage, productivity, and other purposes; they have become an inextricable part of the "naturalized" biodiversity of the area, but whether they are now a desirable component of biodiversity is a societal decision.

7. What is the effect of ecosystem management on major social issues and the maintenance of rural communities and economies?

Community and economic resilience—FS and BLM personnel are members of many rural communities, but the agencies are relatively minor players in fostering economic growth. Range and ranching communities are typically less resilient than those associated with forest products and logging. Some isolated communities or interests may be negatively affected by changes in conditions of the Basin brought on by new management strategies. If the desire is to alleviate these impacts, effective transition strategies could be designed and implemented.

Competing demands—Ecosystem management only partially reduces conflicts between competing uses of Federal lands. It may reduce conflicts between timber harvest and recreation uses by modifying harvesting techniques to allow harvest but reduce aesthetic impacts. Other conflicts such as between cross-country skiers and snowmobilers or between tribal and commercial gathering of mushrooms and huckleberries are not measurably affected. All conflicts will increase in the future with population growth.

Fire hazards in rural- and urban-forest zones—Residential development adjacent to Federal lands will continue, placing more people and property at risk from wildfires. Ecosystem management, appropriately targeted to these areas, can reduce these risks; ecosystem management cannot eliminate these risks.

Healthy ecosystems—Fire, flood, disease, decay, and production of commodities are all part of healthy ecosystems. Overall, ecosystem management can improve ecosystem health, although particular stands or landscapes may not appear attractive to some members of the public. Education about and commitment to the objectives of ecosystem management and what levels of fire, disease, and decay are within the parameters of ecosystem health are key to public acceptance.

Jobs—Ecosystem management will have a varied impact on the numbers of jobs in the Basin. When taken as a whole, the marginal impact on jobs of moving to new ecosystem management strategies will likely be neutral. Overall, the Basin economy is robust and changes in FS and BLM land management activities have little effect on overall economic growth. Timber-related jobs may increase slightly throughout the Basin for the next 50 years. Jobs associated with cattle grazing on Federal lands may decrease slightly, but the numbers affected are small relative to the total employment of the Basin. By producing more aesthetic landscapes, jobs created by attracting business to locations with a high quality of life will increase.

"Old-growth" forests—Ecosystem management will maintain "old-growth" forests in a number of ways. Timber harvesting practices will target smaller-diameter trees that will result in landscapes with larger trees, and increase recruitment into old-growth forests by accelerating growth rates of middle-aged stands. It will also reduce the risk of losing old-growth forests to fire, insect, and disease disturbances.

Quality of life—Ecosystem management has potential to improve the quality of life in the Basin by maintaining flows of both goods and services that can stimulate economic activity. In striving to meet the demands of competing interests it will also improve the quality of life by reducing conflict and strife.

Recreation—The effects of ecosystem management on recreation activity will be relatively minor, but can be positive or negative depending on how it is implemented. Closing roads in popular recreation areas will be controversial, as will building new roads into previously unroaded areas. Limiting recreation in riparian areas has the potential to disrupt a major resource use in many areas. On the other hand, ecosystem management can improve recreation by increasing aesthetic qualities.

Scenic integrity—Ecosystem management has potential to improve the visual condition of previously modified landscapes by increasing vegetative variety. It can also reduce the risk of losing highly aesthetic landscapes to wide-scale disturbances and human activity.

Unroaded areas—One of the major social issues in the Basin concerns "unroaded" areas. Building roads into an unroaded area presents a paradox; on one hand new roads provide access for recreation and other resource use, on the other they remove opportunities to experience back-country settings and cause potential risk to some ecological resources. If the desire is to reduce conflict over land management, ecosystem management would explicitly consider the balance of recreation access and unroaded areas through a variety of tools including analytical methods, survey instruments, and an open public process.

8. What is the effect of ecosystem management on maintenance of late-successional and old-growth systems?

Management has the potential to improve both the area and connectivity of late-successional and old-forest structures on landscapes where such structures would occur under natural disturbance regimes. Where the natural disturbance regime does not support late-successional and old-growth systems, it will be difficult to maintain these structures on the site.

The term old-growth has both a social and ecological connotation in this assessment. In ecological terms it refers to forests that are described as late-seral forests or old forests and have important characteristics and functions for native species habitats and ecological systems. They are often a small, but important component on many forested landscapes. The amount, structure, composition, and patterns of late-seral forests are variable. In the Basin late-seral forests are often found in specific settings that are correlated with low-intensity surface fire regimes, mixed fire regimes, or very long intervals (that is, 200 years or greater) between fires.

Late-seral forests are found in all forest potential vegetation groups, but differ in their structure and composition. Surface fire regimes are typically found in the dry forest or in the cold forests with herb and low shrub understories. Mixed fire regimes are typically found in the moist forest or in riparian areas. Very long-interval fire regimes are typically found in very wet areas.

This understanding of the biophysical setting and associated disturbance regimes provides a basic template for application of ecosystem management. Past harvest practices have typically reduced, fragmented, and/or changed structures of much of the late-seral forest. Ecosystem management would reverse these trends.

In many areas of the dry and moist forests, the suppression of surface and mixed fire regimes have allowed many single-layer late-seral forests (such as ponderosa pine), to succeed into multiple-layer forests (such as, Douglas-fir and grand fir). These late-seral forests usually have increased risks for high-intensity crown fires. To address these risks, these multiple-layer communities can be converted to single-layer communities through mechanically thinning understory trees and using prescribed fires. Where harvest has removed the long-interval, late-seral, multiple-layer forests, ecosystem management would actively promote restoration for rapid growth of similar structures. Wildlife species associated with these late-seral forests are cavity excavators and those with large home ranges.

It is important to point out that in the Basin a dominant forest structure described was scattered, large, residual, trees in a mid-seral forest. This forest structure occurs in a mixed fire regime where surface and crown fires left large residual dead or live trees and younger trees grew beneath the scattered residuals. The residual large live trees are usually the shade-intolerant, and insect- and disease-resistant trees that provide seed for the next forest. Removal of these trees has often resulted in conversion of the seed source from shade-intolerant species to shade-tolerant fire-, insect-, and disease-susceptible species, as well as losing the diverse structure. Harvest of the large live or dead residual trees from these types results in the loss of important habitats as well as components in long-term nutrient cycles. Management practices can promote the maintenance of these large residual trees where they exist and where they have been harvested or otherwise lost, management can focus on rapid growth of selected young trees with similar characteristics.

In cases where the long-term disturbance regimes do not support late-seral forests, management actions to maintain late-seral forests may be required to create short-term habitats for rare species. However, the risks of this strategy would need to be assessed and adequate investments made in fire suppression and other management activities to maintain the forest for the short term.

9. What management actions will restore and maintain ecosystem health (forest, rangeland, riparian, and aquatic health)?

If the goal is to restore and maintain ecosystem structure, composition, and disturbance regimes working toward a healthier system, there are several broad actions that are recommended. The *Component Assessment* provides an assessment of the conditions and trends of the Basin at a broad resolution over regional and sub-regional areas. Assessments having finer resolution will also be needed for management to recommend more specific actions. Tiering assessment information from broad to fine through more detailed and site-specific analyses will result in consistent management activities that address risks to resources as well as meeting broadly defined and site-specific objectives.

To assess ecological processes and the condition of viable populations, land managers need to consider strategies that match forest and range vegetation structure, composition, and patterns to the Basin's biophysical templates. For example, land type phases that are specific to small geographic areas and land type associations that are specific to large geographic areas could be used to develop descriptions of biophysical templates. It is critical that managers consider long-term (as well as short-term) effects on species viability, biodiversity, and ecological functions.

For aquatic and riparian systems, there are several opportunities to work toward a healthier system. Conservation and restoration of small watersheds will ensure short-term persistence of important aquatic populations, while conservation and restoration of habitat networks throughout large basins will provide for long-term stability, productivity, and biological diversity. If managers want to connect isolated clusters of watersheds, watershed restoration and exotic fish containment will be required with emphasis placed on those watersheds containing strong native populations and high aquatic integrity. Riparian areas function to filter sediment transport to streams, introduce woody debris for in-stream structure, provide structure and cover for terrestrial species, and water temperature regulation. Maintaining riparian areas to accommodate these functions will be important to aquatic systems.

If the objective is to have a full array of historic vegetation conditions, the ecosystems most in need of restoration are native grasslands, native shrublands, and old forests. In these ecosystems, a concern is woodland establishment and conversion of shrub-grasslands where fire-regimes have minimized tree establishment, and tree species have excluded understory species or have known potential to eventually exclude understory species. There is a need to curb expansion of exotic grasses and forbs and to prevent invasion and establishment of new exotic grasses and forbs.

10. What can the FS and the BLM do to implement adaptive management, and what are the consequences on ecologic, economic, and social systems in the Basin?

A variety of approaches are required to implement adaptive management. It will be necessary to regularly define what society wants from the Federal lands through a variety of methods including economic and sociological analytical methods, surveys, mutual learning, and collaborative planning. It will also be necessary to develop a process for regular input of knowledge and evaluation from the scientific community; to develop protocols for long-term research and learning; and, to develop the internal skills in agency personnel to operate effectively in the public and political environment.

In conducting adaptive management, agencies should use quantifiable experimental methods, including clear statements of hypotheses, initial inventory and characterization, establish experimental controls, replicated observations, and monitoring. Experiments should be allowed to be completed so that learning takes place. Ecosystem integrity is steadily improved with informed management decisions.

The consequence of adaptive management on economic, cultural, and social systems will be quite positive in that management will be more closely aligned with peoples expectations. By being so aligned, adaptive management reduces rapid changes in management direction. The public will be more invested in land management decisions and activities.

11. What can the FS and the BLM do to protect endangered species (such as salmon, grizzly bear, gray wolf, caribou) and to insure the viability of native and desired non-native plant and animal species?

The material and cultural legacy of the past has presented some difficult or immovable barriers to protection of endangered species; some likely will not change appreciably. Dams, major highways, power corridors, and irretrievable habitat loss to agricultural, industrial, and residential developments will set limits to protection of some endangered species. Public attitudes in some sectors toward wildlife, especially predators, and wildlife conservation relative to economic development are barriers to conservation of some species. Proposals for basing species conservation on economic gains or losses are not encouraging because traditional patterns of resource extraction, local culture and custom, and private property use favor consumptive uses of forest and rangeland ecosystems. Intensive management for consumptive uses often results in simplified ecosystems with unusual dynamics and exotic species that simplify diverse natural ecosystems. International issues of ocean fishing and land use north and south of the United States relative to neotropical migrating birds or wide-ranging terrestrial species (such as grizzly bear, wolf, woodland caribou) complicate effectiveness of local initiatives.

Agencies can work toward protecting species type localities and scarce, critical habitats; maintaining well-distributed, well-connected, persistent high-quality habitat; reducing mortality from human activities; and reducing or controlling exotic species (See response to Policy Question 5 for a discussion of managing habitat and populations for sustainable or viable populations). In some cases, habitat may be less important than direct negative effects on populations. Many wide-ranging threatened, endangered, or sensitive species (such as grizzly bear, gray wolf, wolverine) are relatively general in habitat use (that is, use many habitat types), but are limited mainly by human displacement or poaching. The solution for such species is isolation from humans, which may mean land-use allocations and control of road access. Roads also can degrade aquatic habitat quality. Introduction of non-native or exotic fish (such as rainbow trout and brook trout, bass, and walleye), plants (such as exotic weeds) and animal species (now well controlled) can complicate, and in some cases limit, efforts to improve populations of endangered species.

Conservation agreements and recovery plans among states, Tribes, and Federal agencies encourage cooperation in addressing these issues and offer an effective approach for Federal land management. These agreements require close cooperation between the FS, BLM, and the U.S. Fish and Wildlife Service (USFWS). Some cooperation would be enhanced by joint field offices. Coordination with the public can facilitate mutual learning.

Effects of Specific Policy Actions

1. Within the context of the Northwest Forest Plan (NWFP), what are the options for achieving the objectives where the NWFP overlaps the Eastside strategies?

Land allocations from the NWFP included emphasis to achieve integrity of the late-successional, "old-growth," and riparian systems. However, the late-succession and old forest reserves do not consider disturbance regimes of the biophysical settings they occupy. These reserves may not be maintainable in their existing state. For example, old forest structures typical of dry forest settings would be comprised primarily of open park-like stands of large trees of early-seral species such as ponderosa pine and western larch. Frequent underburns would maintain wide spacings and would eliminate shade-tolerant understories. Currently dry forest settings such as these are generally densely-stocked and multi-layered, with understories dominated by shade-tolerant species. In contrast, old forest structures of mesic settings occur in mosaics; a result of mixed severity fires having underburning and stand-replacement components. Old forest structures in mesic environments are both single- and multi-story structures. Current mesic setting late-successional and old-forest structures within the NWFP area are predominantly multi-story, lacking regular underburning. In the cool and moist settings, high-severity fire regimes predominated as they do today. Old forest structures in these areas are relatively unchanged, and current NWFP direction appears consistent.

The NWFP identifies key watersheds on the east side of the Cascade Mountains. The ICBEMP Assessment identified watersheds with high aquatic integrity (high species diversity, strong populations, and a high ratio of native to exotic species). Key watersheds identified in the NWFP correspond well with current watersheds of high aquatic integrity. These watersheds are well placed and will perform ecologically as intended; that is, they provide important anchor points or focal watersheds for maintaining strong salmonid populations and habitats.

In the NWFP, to identify management options requires local action (and site specific analysis). This poses problems for agencies used to prescribed planning methods and poses opportunities for those capable of institutional change.

2. What is the effect of implementing the interim direction of the PACFISH and/or other proposed aquatic conservation strategies on FS and BLM lands in the Basin?

The effect is positive on the Basin because it changes the focus from stands and specific project sites to conditions of whole watersheds. Where specific information about the riparian system and watershed exists, default buffers can be adjusted with better information about entire watersheds and site-specific conditions. If forced to manage by detailed metrics (for example, pools per mile, or number of large woody pieces per mile), standards and guides should be derived from general planning processes and inventory information that considers specific biophysical environments rather than rigid quantifiable thresholds. Overly prescriptive protocols will often lead to unachievable objectives.

The social and economic effects of implementing PACFISH are mixed and negative in the short-term. Short-term negative effects include temporary closure of developed recreation sites during spawning and critical fish migration periods. Longer-term negative effects potentially include some timber and range program reductions in localized areas prone to high surface erosion.

Process Questions

1. What are the principles and processes that can be used for ecosystem management?

The *Framework* outlines the principles and processes that can be used for implementing ecosystem management. A brief summary of these is provided here.

The Ecological Society of America (1995) defines ecosystem management as "...management driven by explicit goals, executed by policies, protocols, and practices, and made adaptable by monitoring and research based on our best understanding of the ecological interactions and processes necessary to sustain ecosystem composition, structure, and function." It is the application of management practices considering multiple geographic areas and multiple timeframes.

The BLM and FS can use four ecosystem principles as a foundation for developing ecosystem management strategies: ecosystems (1) are dynamic; (2) can be viewed hierarchically with spatial and temporal dimensions; (3) have limits; (4) and are not completely predictable. These principles can be used within a general planning process to achieve desired outcomes and conditions. Ecosystem processes, structures, and functions are constantly changing, requiring management strategies to constantly monitor outcomes and conditions. Interagency coordination and intergovernmental cooperation are desired as is the active involvement of stakeholders. Foremost for adaptive management strategies to succeed is that cumulative risks need to be managed to retain management options at all decision levels, from national to individual site. Such an approach necessitates that management activities be devised as testable hypotheses at the onset; monitoring is integral, not added as an after thought. Adaptive management strategies are iterative, where monitoring leads to continuous adjustments in land management decisions and implementation plans.

Goals for natural resource management of the FS and BLM are set at multiple administrative levels and geographic extents. Through policy statements, directives, budget decisions, executive orders, congressional direction, and National Environmental Policy Act (NEPA) process goals are set for national, regional, sub-regional, landscape, and site levels.

Ecosystem management goals can be achieved through developing an understanding of the conditions at each geographic extent, and determining the capability of the land through understanding the ecological processes now and in the future ("biophysical template"). These are influenced, in turn, by our actions. Examples include landtype phases, which are specific to small geographic areas, and landtype associations, which pertain to larger areas. For example, the ability of the land to produce fish is determined by conditions both "on site" (such as habitat, cover, and food sources) and "off site" (such as dams, harvesting, and disease). Thus, the biophysical template is both the basic capability of the land and the changes in capacity as influenced by past and future activities. In order to provide context, management actions need to be linked consistently within a hierarchy. To achieve ecological goals such as maintaining ecological processes, viable populations of native and desired non-native species, and the full set of key ecological functions of species, Federal land managers would match changes in forest and range vegetation structure, composition, and pattern to biophysical templates.

Assessments at larger geographic extents using broad data resolution provide context for smaller geographic extent assessments and regional decisions. These latter assessments provide context for watershed assessments and related decisions. In addition, mid-geographic extent assessments describe processes and functions not evident in large (that is, regional) assessments while the small (that is, watershed) geographic extent assessments reveal processes undetected with mid-geographic extent assessments.

An ecosystem management strategy can involve three levels of analysis: region and/or sub-regional assessments, landscape assessments, and site or project analysis. Ecoregion assessments can be used to develop Regional Guides and Forest Plan Amendments, BLM statewide direction and BLM district plans at regional geographic extents. Assessments provide understanding of the ecological systems within watersheds and incorporate concerns at the landscape geographic extent. Project or site analysis deals with specific land management actions. The FS and BLM, through the ICBEMP, will have at their disposal both a broad-regional assessment and mid-sub-regional assessment for some issues/questions. These data can be used to give context to the watershed assessments being conducted throughout the Basin and to set priorities within larger subbasins. It also will provide increased understanding of biophysical and social-economic systems to evaluate specific management actions at specific sites, through environmental impact statement processes.

Management flexibility is attained to the extent risks can be managed at the lowest level possible. For example, a risk would be considered a "regional risk" if the risk could not be adequately addressed by making incremental, individual decisions at lower levels. An example is activities that threaten anadromous fish populations. Insuring the viability of a wide-ranging fish species includes providing adequate connectivity, distribution, and abundance through high-quality suitable habitat for the species. Taking a piecemeal approach to where the species habitat will be emphasized will not ensure the habitat is connected, abundant, or well-distributed. Taking a systems approach to decisions regarding which portions of all potential habitats will be managed will help ensure quality habitat is well distributed for the species. The alternative would be to conservatively manage all habitat by not permitting any of it to be adversely altered, thus, reducing flexibility for management. By strategically making the decision of where, in specific, the species habitat would be emphasized, management has potentially more options to consider as new decisions are made.

Managing directly to achieve opportunities, desired outcomes, and the provision of goods and services might result in new risks to achieving the goals. There is nothing inherently wrong with setting out to achieve some goals that are output oriented toward commodities. Managing the full complement of risks associated with all management goals dictates that the new risks to ecological objectives, created through achieving the outcomes (outputs) be evaluated to determine how these affect the cumulative risks to the ecological goals for the area. This evaluation could result in changes in the way the practices are applied, the provision of other goods and services, or the total risks to the ecological objectives being analyzed. It becomes an iterative process, analyzing risks associated with not achieving ecological goals, determining the effects on outputs (outcomes), modifying actions that result in new projections of output levels, determining effects on risks to ecological goals, adjusting as appropriate, and cycling through the analysis until the risks to ecological goals are acceptable and the output levels are achieved to the extent possible.

The key components of a monitoring program include:

- management goals and objectives that clearly define the information needed in a monitoring program and reflects different geographic extents and timeframes,
- both biophysical and social components,
- an experimental design including a hypothesis, methods, and indicator variables with adequate sample size to insure inferences are made with sound statistical analysis,
- and, robust indicator variables that reflect changes before they become problems, so they can act as an early warning system for management activities.

In the general planning model, we identified four types of monitoring: implementation, effectiveness, validation, and baseline monitoring. How managers apply each type depends on the management objectives and goals developed within an ecosystem strategy.

2. How can we use the assessment to identify emerging policy issues that relate to ecosystem management within the Basin?

The assessment identifies a number of emerging ecosystem trends and conditions that could be addressed though various policy actions. In general the assessment did not propose policy actions, but its databases and models could be used to measure the consequences of proposed actions.

3. How can we deal with uncertainty in ecological processes, social values, predicting outcomes, and scientific understanding?

Uncertainty is present in virtually all management activities and scientific understandings. The real strength of statistical analysis is in being able to reject a hypothesis that was proposed as true, thus uncertainty is removed, not by proving the hypothesis is true, but by demonstrating that it is false. When we cannot disprove a hypothesis, we are really saying we do not yet have enough information to disprove it. Uncertainty then is present in each relation proposed in ecosystem management approaches. Perhaps the best way to address uncertainty is to reveal the level of confidence one has in predicting outcomes. High levels of uncertainty might lead to very conservative management approaches.

Each SIT product attempted to reveal the level of uncertainty associated with the information provided.

CHAPTER 7

EMERGING MANAGEMENT ISSUES AND SCIENCE GAPS

In developing the integrated assessment, the SIT encountered a number of science gaps and emerging management issues. Some of the science gaps reflect a lack of information, while others reflect lack of data at the geographic extents used in an ecoregion assessment. Some of the emerging issues are new findings; others confirm long-standing, but not documented, land management concepts.

Management Issues

In this section, we summarize new management issues that we identified in the course of our work.

- **To what degree, and under what circumstances should ecosystem restoration be active or passive?**

Ecosystem restoration activities should be assessed on a case-by-case basis for potential short- and long-term effects of restoring each ecosystem. There are instances where long-term benefits may not exceed short-term environmental costs or adverse ecosystem impacts, making a passive restoration approach more appropriate. Differences in geographic areas and the biophysical template may dictate when active or passive restoration is appropriate. For example, restoring a watershed that has stable channel types, has minimal erosion and sediment transport, and modest precipitation but which is highly sensitive, may cause detrimental effects. In other areas, active restoration is required to decrease the risk of catastrophic events. In addition, the timing of restoration work is also important for reducing adverse effects or risk from other disturbances. Finally, ecosystem restoration efforts—both passive and active—need to be appropriate and within the capability of the ecosystem being restored.

- **How will ecosystem management contribute to meeting treaty and trust responsibilities to American Indian tribes?**

Ecosystem-based management will enhance the Federal Governments opportunities to meet its trust responsibilities by (1) restoring (where possible) ecological processes, and (2) enhancing our recognition of the significance of the environment in American Indian culture and therefore our ability to protect specific places of significance. One goal for the restoration of ecological processes, including the restoration of aquatic and riparian habitats, could be to enhance the abundance and distribution of plants and animals important to tribes, especially in those places with social and traditional significance.

The intense interest in natural resource management by the Indian population in the Basin is based in their long-term cultural attachment to the land. Although the American Indian societies in the region differ in many ways, they hold shared beliefs and values about their relationship with the land and water. All tribes attach cultural and religious significance to various places especially standing presence of Indian peoples and the totality of landscape and resource importance have contributed to strong attachments to place. Ecosystem-based management recognizes the important cultural links American Indian people have with the environment.

Recognition of special forest products, such as beargrass, mushrooms, and berries also can be an important element of ecosystem-based management. We would expect that ecosystem management would provide enhanced opportunities for harvest of these products, particularly for their traditional cultural uses. Consultation with tribal governments would be an integral part of ecosystem management.

Basin treaties provide for reserved tribal rights to pasture livestock, and to fish, hunt, gather and trap the products of the land. Many places where harvest activities occur also have strong sociocultural place meanings and attachments. These traditional activities have developed together with the cultural and symbolic significance of place. Restoration and conservation of culturally significant places and species would contribute to the biophysical template and ecosystem structures, patterns, and processes.

• Can salvage timber sales be compatible with ecosystem-based management?

They can be, but much depends on the types of stand structures that are harvested. As currently defined (in Public Law 104-19, see U.S. Laws and Statutes 1995), salvage emphasizes the extraction of specified volumes of dead and green trees at risk of dying. As such, harvest will emphasize larger trees, both green and recent dead, of desirable species (ponderosa pine, Douglas-fir). Our findings suggest that this type of harvesting is not compatible with contemporary ecosystem-based management. Ecosystem-based management would emphasize removing smaller green trees with greater attention to prevention of mortality rather than removal of large dead trees.

The landscape ecology assessment found a substantial increase from historic to current times in the area of dense multi-story forest structures. For the most part, these types of stand structures originated as a result of past selective harvesting and the exclusion of fire, and generally now have elevated fuel loads, susceptibility to bark beetles, defoliators, and stand-replacing fires. In these landscapes because of past selective harvesting, more rather than fewer large or potentially large trees are needed to sustain ecosystem processes, and some medium-sized trees (16 in/4l cm in diameter or larger) are needed for large tree recruitment.

Tree harvesting can be a useful tool to promote desired stand structure and composition, but often (as in the Taylor Salvage Law, PL 104-19) harvesting appears to emphasize volume extraction. It is also a useful tool in managing fuel loads where the emphasis is on removing small and medium-size material, which comprises the bulk of the current fuel hazard. Cutting of small and medium-size trees can minimize these concerns, while harvesting of larger trees has little effect on reducing fuel loads. High-density stands dominated by small and medium-diameter trees are the focus of many current ecosystem health concerns.

Prevention strategies are more effective than corrective strategies at improving forest health; that is, it is preferable to make adjustments in the structure, composition, and pattern of living vegetation within a watershed than to work with what remains of living and dead vegetation after fire or pest outbreaks. Prevention strategies are best applied to whole watersheds. Traditional approaches to salvage are also less advantageous in an economic sense because they emphasize extraction of dead rather than green trees. They also tend to emphasize stand rather than watershed treatments. In an ecosystem sense, the highest priority treatment areas for salvage are the low- and mid-montane forests, and the dry and mesic forest settings where the greatest changes in structure, composition, and disturbance regimes have occurred. Within those settings, currently roaded areas should be treated first because they are already accessible for salvage without additional road-should be treated first because they are already accessible for salvage without additional road-building expense and effects. Salvage operations in already roaded areas can, in many cases, generate funds to reduce the adverse effects associated with roads. There is a lower ecological risk to anadromous and cold water fish and hydrologic systems associated with salvage operations in already roaded watersheds. Addition of new roads for salvage would in many areas further reduce and fragment existing fish strongholds. Salvage harvest methods in burned areas will also need to consider minimizing surface soil disturbance and reducing road-related sediment problems.

Science Gaps

Future research can be focused to address science and information gaps, including the design of monitoring protocols and data collection activities. The science gaps the SIT identified are within three areas: biophysical, socioeconomic, and methods.

Biophysical Science and Information Gaps

- There are currently no standardized sampling and monitoring methods. This includes population measurements, species distributions, and physical variables such as stream morphology or stream sediment geochemistry.
- Monitoring programs need revision, because monitoring programs typically measure easily determined variables, such as tree diameter, rather than focusing on rate- or process-determining variables. Monitoring programs typically are long-term activities and may require repeated measurements to obtain the needed information.
- Methods for archiving, accessing, and updating databases are inconsistent or uncoordinated.
- Additional information is needed to understand ecological processes and the interactions between processes.
- Studies are needed to determine species viability, population dynamics, and habitat relations in all environments.
- Empirical studies are needed to understand ecological functions of organisms.
- Studies are needed to understand how people access wildlands (for example, roads, trails, and their condition).
- More information is needed to determine how changes in climate affect vegetation and habitat changes, locally and over large geographic areas.
- More information is needed on the effects of geology on landscape, aquatic, and terrestrial patterns and processes. Over multiple geographic areas, such information can help predict range and habitats for aquatic and terrestrial species.
- Information is needed to help understand the interactions between terrestrial and aquatic systems.
- Improved engineering techniques are required so that future road building minimizes aquatic disturbance. This requires research on a variety of biophysical factors.
- Information is needed on how livestock grazing affects encroachment of woody species and invasion of exotic species.

Socioeconomic Science and Information Gaps

- Methods are needed for identifying places and their meanings, and more information is needed on these places, in order to help understand a community's and society's relationship with and value for places.
- Methods are needed to determine what values society places on healthy ecosystems.
- Methods are needed to help determine how people perceive risks associated with natural catastrophes. An important related issue is developing a broader understanding of the urban/rural interface, specifically concerning issues such as wildfire and wildlife.

Gaps in Scientific Methods

- Methods for determining ecological risk need to be improved.
- Information is needed on using information with different data resolutions and geographic extents. In particular, how can information from smaller geographic areas be applied at larger geographic areas; tree diameter, restoration, and recreation information do not translate to large landscapes.
- Methods are needed to determine public acceptance of ecosystem management strategies and disturbance regimes.
- Information is needed to link between ecological process models and spatial tools (Geographic Information System).
- More accurate computer models are needed for predicting effects of management practices on ecosystems and refining the role that computer models play in relating assumptions. This is particularly true on burned area salvage projects. For example, predictions are needed on what kind of trees and how many would be left to achieve different management objectives.
- More systematic integrative frameworks are needed. This includes protocols and methods for using data derived from expert opinion and the need for systematic databases that incorporate information from many sources.
- We need to learn how to make decisions on issues for which we have no data, determine which data is important, and learn how to most effectively collect the right data to provide the best information possible for decision makers.

Emerging Science Issues

Five main issues surfaced concerning how to implement ecosystem management on FS- and BLM-administered lands in the Basin. They are:

- We did not fully understand the extent or role of exotics in the Basin. There are several ecosystems where exotics—both desired and noxious—dominate ecosystems. This is especially true of some of the range and range/forestland ecosystems.
- We did not fully consider the correlation between roads and social desires. We found conflicting reasons, for example, for entering or not entering "roadless areas." We need to consider the balance between roaded natural and unroaded recreation settings, while considering the risks to aquatic strongholds and terrestrial habitats from road building.
- We had not anticipated the data indicating the extensive loss of large trees in the landscapes over much of the Basin. The harvest legacy has been more extensive than we thought. This raises questions about needed improvements in databases and monitoring of both harvest levels and stand conditions.
- There are several National Forests and BLM Districts where projected human population growth will change the mix of outputs. The Boise National Forest and others will likely become "recreation" forests like the westside forests near Seattle, Washington, or the front range forests near Denver, Colorado. The ERUs likely affected most will be the North and South Cascades, Columbia Plateau, Upper and Lower Clark Fork, Central Idaho Mountains, Snake Headwaters, and the Northern Glaciated Mountains.
- Ecosystem management advocates need to be more forward-looking. They need to anticipate how demands on resources from the public lands will change in coming decades. The tendency has been to judge ecosystem management by what has happened in the past two decades, rather than focus on how ecosystem management and conditions will evolve into the future.

CHAPTER 8
FINDINGS

The following findings draw from our experience in developing all the ICBEMP Assessment products (the *Framework,* detailed assessments of ecosystem components, *Evaluation of the EIS Alternatives* by the SIT, and this *Integrated Assessment).* More detailed findings specific to individual science areas and those related to trends, conditions, or processes are in each document. Findings are in three main categories—general issues, those specific to achieving goals, and those of an organizational nature.

Overall Findings

We found that an active approach to ecosystem management within an adaptive framework could lead to higher ecological integrity and social and economic resiliency within ecosystems of the Columbia basin and portions of the Klamath and Great basins. This approach would recognize the dynamic nature of the interior ecosystems, their current ecological status, and the demands placed on interior ecosystems to provide for human values and uses.

The highlighted findings are:

1. There has been a 27 percent decline in multi-layer and 60 percent decline in single-layer old-forest structures, predominantly in forest types used commercially.
2. Aquatic biodiversity has declined through local extirpations, extinctions, and introduction of exotic species, and the threat to riparian-associated species has increased.
3. Watershed disturbances, both natural and human induced, have caused and continue to cause risks to ecological integrity, especially owing to isolation and fragmentation of habitat.
4. The threat of severe fire has increased; 18 percent more of the fires that burn are in the lethal fire severity class now than historically. In the forest PVGs lethal fires have increased by 30 percent.
5. Rangeland health and diversity have declined owing to exotic species introductions, changing fire regimes, and increasing woody vegetation.
6. Rapid change is taking place in the communities and economies of the Basin although the rates of change are not uniform.

Landscape Ecology Findings

Continuing to manage vegetation using historical levels and approaches of stand management 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; white pine and whitebark pine have decreased in moist and cold forested vegetation types owing to blister rust (see photos 14a and 14b); 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 by 27 to 60 percent.

Photos 14a and 14b—Due to wide-spread infestation of white pine blister rust (*Cronartium ribicola*), white pine and whitebark pine have decreased in moist and cold forest vegetation types in the Basin. These photos show before and after effects of blister rust on forest stands dominated by western white pine.

The greatest changes in landscape patterns and processes have been in roaded areas historically managed with intensive treatments. Landscape patterns have changed on 97 percent of the landscapes basin-wide. Vegetation patterns have changed, thus altering the risks associated with their persistence.

Terrestrial Ecology Findings

There are 264 species within the Basin with Federal listing status under the Endangered Species Act of which 27 are threatened or endangered species. Some threatened and endangered species are dependent on habitat components that were not evaluated at the Basin level. Habitat conditions for nearly all species were found to be more favorable historically as compared to now. Continuing current management approaches would result in more species with declining habitat and more species of potential concern than would managing with restoration or reserve emphasis. Management options aimed at restoration are projected to result in only moderate improvements in habitat outcomes for species of potential concern. The overall likelihood of extirpations has increased from historic to current conditions and is projected to continue increasing under current management approaches; fewer extirpations are likely under the restoration approach to management than under the reserve approach. Species that are likely in decline are associated with landscape and habitat components that are declining, specifically old-forest structures, native shrublands, and native grasslands. Habitat degradation is more pronounced in lower elevation watersheds. The core pieces remain for rebuilding and maintaining quality native terrestrial species habitat. We mapped 7 centers of biodiversity and 12 hot spots of species rarity and endemism within the Basin.

Aquatic Ecology Findings

Key salmon species have seen declines in habitat, abundance, and life histories. Population strongholds for the key salmonids range from less than 1 percent to 32 percent of the occupied range of the species. The occupied range varies between 28 percent and 85 percent of the historic range. Declines for anadromous species have been the greatest; even if habitat stabilizes, 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 Findings

People and communities within the Basin are undergoing rapid change. Social resiliency varies; drier climates are generally associated with lower resiliency, such as in ranching- and agriculture-based communities. Communities that have weathered recent economic or social disruptions are generally more resilient. Human attachments to places are important in determining the acceptability of management actions. Ecosystem management will require strong cross-jurisdictional cooperation, yet is still evolving. Overall scenic quality within the Basin is high.

Economic Findings

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, with activities in eastern Oregon having the most importance. Recreation is highly valued as a regional, national, and international resource. At current growth rates recreation use will double in the next 31 years.

Geographic Information Findings

Consistent databases at the Basin level 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 for Selected Issues

This section summarizes our general findings around major issues identified through our various public interactions.

Accessibility—We found a great deal of ambiguity about the amount of road access needed 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, while at the same time many people 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" would imply. 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 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 ecological integrity at risk. Management treatments aimed at reducing severe fire are not without risk to ecological integrity and concern to humans, pointing to the need for an integrated approach to risk management.

Fish—The identification of aquatic strongholds and areas of high fish community integrity and other aquatic information provides a basis for the conservation and restoration of aquatic ecosystems. Such information 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 historic 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 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, 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 of 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 disturbance regimes more typical of biophysical environments. 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 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 green trees as part of the overall management regime that emphasizes stand structure and composition at the watershed level (rather than the stand level). Low risks to ecological integrity would exist from treating areas currently roaded, 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 increasing conflicts between recreational, cultural, and subsistence collection of products such as huckleberries, mushrooms, and firewood and the growing commercial collection on Federal lands. Land management strategies will be complicated by the local commercial and cultural importance of these products.

Timber—An ecosystem-based approach to timber harvest places greater emphasis on areas treated than 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 structure and landscape patterns. Under this approach, volumes may be more variable than past forest management approaches.

Findings From the Future Management Options

Projections of the future are mostly a result of evaluating options proposed by the FS and BLM as alternatives in the EIS. Three options were considered: (1) continuation of current approaches; (2) restoration emphasis; (3) and, reserve area emphasis.

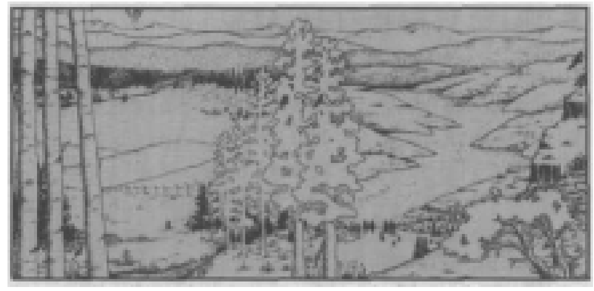
Managing FS and BLM resources under an approach that continues current management generally results in the lowest ratings compared to other approaches. Results would include declines in species habitat and population outcomes, increases in fire severity, continued declines in fish habitat and population strongholds, and continued departures from long-term disturbance processes. Trends would generally be decreasing in composite integrity and increasing risks in terms of people and ecological integrity interactions. From a social and economic perspective this option would continue, even accelerate, many of the conflicts in resource use present today.

Managing FS and BLM resources under a reserve area option within the Basin generally results in mixed outcomes against the ecosystem management goals. This approach provides improvements in aquatic and terrestrial habitat conditions as compared to continuing current management approaches, yet large severe fires are projected to have detrimental affects on landscape patterns and processes. Currently degraded systems within the reserve areas would recover very slowly, some may not recover for hundreds of years. Trends in composite integrity and the risks in terms of people and ecological integrity interactions will, for the most part, be improving (decreasing risk) or stable, albeit at a slightly lower level than for the restoration management emphasis. The social and economic effects associated with a large reserve system will be highly variable, mostly depending on the resiliency of the communities and counties in close proximity to the reserves.

Managing FS and BLM resources under a restoration emphasis option within the Basin generally results in more favorable outcomes than continuing the current approaches or managing with a network of reserves. This approach is more consistent with long-term disturbance processes, has fewer species with declining habitat outcomes, and generally halts the decline of salmonid fish habitats. It results in stable or improving trends in composite integrity, and also results in decreasing or stable trends in the risk to people and ecological integrity for most of the area. While having some negative effects on social and economic elements, it appears to be the most responsive to American Indian tribal concerns, public acceptability objectives, and contributes to overall economic and social resiliency.

Finally, one feature that these management options share is 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 results of management activities and adjusting management activities accordingly. When compared with traditional approaches, active management appears to have the greatest chance of producing the mix of goods and services that people want from ecosystems, as well as maintaining or enhancing the long-term ecological integrity of the Basin.

CHAPTER 9
LESSONS LEARNED



We described and measured ecosystem integrity in terms of ecological integrity and socioeconomic resiliency. We found that proactive management generally improved ecological integrity but had little effect on socioeconomic resiliency. We found that the social and natural resources of the Basin offer a heritage of exceptional significance to the nation and the world. Maintaining the integrity and resiliency of these resources for present and future generations depends on understanding how society values these resources, and understanding the natural and human processes occurring in the Basin. Conservation and management of these dynamic ecosystems within an ever-changing social setting are vitally important to the people who live within the Basin and throughout the United States.

But we also found (like in FEMAT) that political and budget realities will be the final deciding factor in the extent to which these findings will result in substantive changes in management. There are also practical lessons that we learned about the conduct of large multi-scale assessments. Foremost is the need for clear questions from decision makers. What decisions do they face and what information will improve those decisions? The issue is not so much about defining (and then limiting) the types of questions, but the science need is for clarity about types and nature of information needed. Given the cost of an assessment, we can ill afford to embark on a data hunt. Second, we need to find and then commit scientists to the assessment who are integrative, comfortable in the policy arena, and able to understand broad issues and concerns. The tendency in science communities to reward functional work over integrative work limits the pool of potential participants. Third, we learned to pay greater attention to the timeline and the balance between timelines, data quantity and quality, and emerging decision issues. We found it difficult as scientists to accept that existing information presented in a timely fashion had more influence than detailed data brought forward later. Fourth, we needed to identify goals early. In the ICBEMP, we closed on the goals for ecosystem management in the last quarter of the project. Fifth, we need a greater focus on cause and effect types of information (rather than just descriptive material) and the risks to achieving various effects.

In the end, though, we are reminded that public land management is really an issue of stewardship. One aspect of that stewardship is the responsibility to meet a wide array of societal needs such as wood fiber, beef, recreation activities, and places of spiritual and cultural significance. Another aspect is to seek a balance between todays needs and those expected in the future. The emergence of ecosystem management is but one step in the evolving process that attempts to balance current and future relationships between people and their environment. We have provided information that we hope will enlighten and motivate the debate about the balancing process. We have exposed strengths as well as weaknesses in the Basins ecological and socioeconomic systems. We as scientists provide this information so the political/decision process can continue in a more transparent fashion with outcomes, consequences, and interactions more visible and, we hope, understood.

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CHARTER

Eastside Ecosystem Management Project

112 East Poplar Street
Walla Walla, Washington 99362

phone: (509) 522-4030

Reply to: BLM: 1736 **Date:** Jan. 21, 1994
FS: 1400,1900

Subject: Eastside Ecosystem Management Strategy Charter

To: BLM: State Directors, OR/WA, ID, MT
FS: Regional Foresters, R-1, R-4,
R-6 Station Directors, PNW, INT/RM

In May 1993, a team led by Forest Service scientist Dr. Richard Everett completed an "Eastside Forest Ecosystem Health Assessment." In July, 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", and further stated that the "strategy" should be based on the forest health study recently completed by agency scientists as well as other studies. To further elaborate and extend this charge, we are jointly directing that an ecosystem management framework and assessment be developed for lands administered by the Forest Service (FS) and Bureau of Land Management (BLM) on those lands east of the Cascade crest in Washington and Oregon and within the interior Columbia River Basin (CRB).

We have jointly decided that the processes outlined in the Interim CRB Assessment and Eastside Ecosystems Management Strategy Project Charter are essential steps leading to sound management decisions. We, and our respective line officers, will use the science products (framework, assessment, and evaluation of alternative EM Strategies) derived from this process as input into our decision making processes. Line officers within the BLM and FS will develop management direction using the science products as a portion of the total input considered in developing such direction.

We have been motivated to request these products because management of the public resources within the interior CRB require new direction that is based on ecosystem concepts within the context of the larger Basin. Recent advances in our understanding of ecosystem principles, cumulative effects, biophysical interactions, and concerns of ecosystem integrity and species viability, point to the need to undertake the studies outlined in the Charter. Since current land and resource plans were signed, new information and changing conditions require a re-evaluation of management direction.

Therefore, updated management directions are needed for the Eastside National Forests and some lands administered by the Bureau of Land Management. From an ecosystem standpoint, an overall assessment is needed for the interior Columbia River Basin, so that management decisions can be made within this larger context.

Recognizing that ecosystems encompass lands that cross jurisdictions, and actions taken on lands administered by one agency affect outcomes on lands administered by another, there must be shared vision, commitment, and leadership among agencies in development of ecosystem management strategies and their implementation. The Forest Service is to take the lead responsibility in assembling the appropriate interagency structures and processes to accomplish this assignment. This includes invitations to State governors and tribal government leaders, local governments, key interested parties and affected parties, and other Federal and State agencies to participate in the process.

As part of this assignment, Jeff Blackwood, Forest Supervisor on the Umatilla National Forest, will assume the responsibilities of Project Manager for the project. Patrick Geehan will be the BLM Project Coordinator. Thomas M. Quigley, Manager, Blue Mountains Natural Resources Institute, will be the Science Team Leader, and George Pozzuto, District Ranger on the Lake Wenatchee Ranger District, will be the EIS Team Leader. Patty Burel, Public Affairs Officer for the Blue Mountain Narural Resource Institute, will be the Communications Team Leader. Kay Pennel and Cathy Weise will provide administrative support. Teams and activities will be located in Walla Walla, Washington. Team leaders will need your cooperation and support in filling needed positions and completing the project.

As further direction, we refer to several key points made by Assistant Secretary James Lyons in announcing the intent of the Forest Service to develop a new management strategy for national forests in eastern Oregon and Washington. The strategy will:

- be based on ecosystem management concepts;
- focus on restoring the health of forest ecosystems;
- be scientifically sound and ecosystem based;
- be based on the forest health study recently completed by agency scientists and other studies;
- be a multi-agency effort involving the public in an open process; and
- link with the development of a draft environmental impact statement to be completed by spring or summer of 1994.

Development of a scientifically sound and ecosystem-based management strategy for eastern Oregon and Washington will require (1) a framework for ecosystem management for the entire interior Columbia River Basin, and (2) a broad assessment of ecosystem processes and functions, species, social systems, and economic systems within the Basin.

This should lead to the development of an EIS useful to both the Forest Service and Bureau of Land Management that would result in decisions for implementing the strategy. The EIS would include the development of a wide array of alternative strategies for eastern Oregon and Washington and an evaluation of the consequences of each alternative based on the best technical and scientific information available. The EIS will be presented to the responsible federal decisionmakers for appropriate action.

Upon completion of each product, line officers within the Forest Service and BLM will consider the recommendations and make decisions to modify or retain existing management direction. The ultimate decision to adopt or reject the recommendations resides with us and our appropriate line officers. We will use the scientific information to enhance our understanding of trade-offs, interactions, consequences, and potential results. We will be issuing decision documents, policy statements, and other policy direction as we deem appropriate through the life of the Charter and following its completion.

Attached is the initial charter and summary of products we expect the team to produce over the next 9-12 months.

/s/ lack Ward Thomas	/s/ lim Baca
JACK WARD THOMAS Chief, Forest Service	**JIM BACA** Director, USDI Bureau of Land Management

INTERIOR COLUMBIA BASIN ECOSYSTEM MANAGEMENT FRAMEWORK AND ASSESSMENT
and
EASTSIDE OREGON AND WASHINGTON ECOSYSTEM MANAGEMENT STRATEGY PROJECT CHARTER

"Eastside Ecosystem Management Project Charter"

Definitions

"Interior Columbia River Basin" includes lands in the continental United States tributary to the Columbia River east of the crest of the Cascade Mountain Range. For purposes of this Charter, the terms "Basin-wide" and "Basin" are interchangeable with "Interior Columbia River Basin". This will include portions of Forest Service Regions 1,4, & 6 and portions of lands administered by the Bureau of Land Management (BLM) in Oregon, Washington, Idaho, and Montana.

"Eastside," in this charter, refers to the National Forests and appropriate BLM administered lands in eastern Washington and Oregon lying east of the crest of the Cascade Mountain Range. This may also include lands managed by other federal agencies within this geographic area.

Situation

Since forest plans were established in eastern Washington and Oregon in 1989 and 1990, a number of scientific and administrative studies have been conducted generating new information relevant to National Forest management. 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," and further stated that the "strategy" should be based on the forest health study recently completed by agency scientists as well as other studies.

The Forest Service and BLM are considering implementing the interim direction to conserve Pacific Salmon throughout their range in Oregon, Washington, Idaho, and California. This interim direction will be followed by development of a long-term management strategy to address this issue in these states as well as Alaska. This Charter identifies, as a minimum, initial studies and plans appropriate to implement the Anadromous Fish Habitat and Watershed Conservation Strategy (formally called "PACFISH") within the interior Columbia River Basin.

The combined tasks of developing an ecosystem management strategy and implementing the Anadromous Fish Habitat and Watershed Conservation Strategy, necessitate an overall framework to guide planning for ecosystem management within the Interior Columbia River Basin. Additionally, a Basin-wide scientific assessment is needed. It should examine the ecologic, economic, and social systems, looking at current as well as historic conditions, and the probability that outcomes associated with current practices and trends will result in change within the systems it will provide essential information for evaluating and implementing ecosystem management within the Basin.

Ecosystems transcend administrative boundaries. The evaluations undertaken will use available data where appropriate or applicable. This effort is not intended to request new data from private land owners, enter their lands, or otherwise establish direction for management of those lands.

Project Expectations

Implementing an ecosystem management strategy will require the development of several products. Two initial studies will include a Basin-wide scientific framework and a Basin-wide scientific assessment. The interior Columbia River Basin (CRB) ecosystem management scientific framework will provide the broad concepts and analytical processes recommended for ecosystem analysis, planning, and management. The interior CRB scientific assessment will examine historic and current ecologic, economic, and social systems and discuss probable outcomes if current management practices and trends continue.

Drawing from the concepts and principles of the Basin-wide scientific framework and information from the Basin-wide scientific assessment and the environmental impact statement (EIS) scoping response, an EIS will be developed for the eastside National Forests that will array a variety of ecosystem management strategies for management of lands administered by the Forest Service and a portion of the Bureau of Land Management lands in eastern Oregon and Washington. The EIS will, as a minimum, address the Anadromous Fish Habitat and Watershed Conservation Strategy recommendations. This EIS will be supported by a scientific evaluation of the issues and alternatives identified by the National Environmental Policy Act (NEPA) scoping and public involvement process. The decision document(s) resulting will address the management of affected BLM and Forest Service managed lands. It is anticipated that similar decision documents will be issued in Idaho and portions of California, although the nature of the decisions in addition to the Anadromous Fish Habitat and Watershed Conservation Strategy for those states has not yet been determined. The Anadromous Fish Habitat and Watershed Conservation Strategy will be considered in Forest plan revisions and BLM resource management plans in Alaska. The decision documents and processes for those states will be done in a coordinated manner among the Regions and Districts involved. Through these activities, a Basin-wide framework for ecosystem management and a Basin-wide assessment of resource conditions should result in a comprehensive, coordinated approach to resource management within the Basin.

The Forest Service and Bureau of Land Management are proceeding as outlined in this Charter with the full expectation of bringing in other federal agencies (for example, Environmental Protection Agency, Fish and Wildlife Service, National Marine Fisheries Service, and Soil Conservation Service) as cooperators in the process.

The EIS process proposed in this Charter will provide a basis for the Forest Service and BLM to make decisions to amend or revise current land management plans for ecosystem management strategies on the National Forests and participating Bureau of Land Management lands of eastern Oregon and Washington. It is assumed that scientific expertise will be assembled from a wide array of disciplines, agencies, universities, and other organizations to evaluate the issues and alternatives.

The role of the scientists in this regard is to assess, based on the best information available, the tradeoffs, consequences, outcomes, and interactions that are associated with each alternative. It is the Federal EIS team members' role to develop the array of alternatives and to critically review the science products for possible use within the EIS. Any land management decisions based upon the EIS will be made by the appropriate line officers in BLM and the Forest Service.

Key Participants and Roles

Chief, USDA Forest Service, and Director, Bureau of Land Management: Authorize an Executive Steering Committee to oversee the processes outlined in the Charter. Any subsequent changes to the Charter will be with the concurrence of the Chief and the Director.

Columbia Basin WO Coordinators: Director, Land Management Planning, Forest Service, and the Science Advisor to the Director, Washington Office, BLM, shall receive progress reports and arrange for resolution of issues that exceed the scope of the Charter.

Columbia Basin Executive Steering Committee: Shall oversee the implementation of the Charter, monitor and report progress, propose needed amendments, ensure other appropriate participants are involved in its implementation, propose resolution to issues within the Charter, elevate issues and suggested resolutions to the Chief and Director for resolutions. The Executive Committee shall include:

Regional Forester, R-6	Regional Forester, R-1
Regional Forester, R-4	Station Director, PNW
Station Director, RM/INT	State BLM Director, Oregon-Washington
State BLM Director, Idaho	State BLM Director, Montana

The Executive Steering Committee will solicit the participation of other potential partners (e.g., National Marine Fisheries Service, Fish and Wildlife Service, Environmental Protection Agency, and Soil Conservation Service). They will be added to the Executive Committee as appropriate through amendment to this Charter.

Eastside Project Managers: Are responsible to the Executive Steering Committee for accomplishing the actions and products outlined in the Charter. The Project Manager is Jeff Blackwood; Science Team Leader is Thomas M. Quigley; and the Bureau of Land Management Project Coordinator is Patrick Geehan.

Coordination with States, Tribal Governments, and Key Interested Parties

An essential element of this process will be to coordinate with, and seek involvement of, affected State governors and tribal government leaders. In addition, local governments, key interested and affected parties, and other federal and state agencies will also be encouraged to participate.

Key Actions, Products and Timelines

Updated management directions are needed for the Eastside National Forests and lands administered by the Bureau of Land Management. Since current land and resource plans were signed, new information and changing conditions suggest a re-evaluation of management direction. From an ecosystem standpoint, an overall assessment is needed for the interior Columbia River Basin, so that management decisions can be made within this larger context. All products developed from this charter will be presented to the responsible federal decisionmakers. The expected actions, timelines, and products for the Columbia Basin Project are summarized below. The Eastside Project Managers will take the lead in developing the four primary products under the direction of the Executive Steering Committee. Primary direction for the Eastside EIS and Scientific Evaluation of alternative ecosystem management strategies will be provided by a subgroup of the Executive Steering Committee consisting of the R-6 Regional Forester, PNW Station Director, and State BLM Director for Oregon and Washington.

(1) SCIENTIFIC FRAMEWORK FOR ECOSYSTEM MANAGEMENT IN THE INTERIOR COLUMBIA RIVER BASIN

Objective:

Develop an ecosystem management framework that includes principles and processes which may be used in a NEPA process to develop management direction for federal agency ecosystem analysis, planning, and management at all levels within the Basin. Concepts and principles from the framework will link to subsequent products.

Framework Components:

The framework will be based on an ecosystem approach to management with emphasis on biological and human ecosystems. It will examine the interrelationships of the biophysical, social, and economic systems. It will consider public expectations, management capabilities, biological/ecological capabilities, science processes, and current scientific literature (e.g., Eastside Forest Health Assessment, the product of the Forest Ecosystem Management Team (FEMAT), Eastside Forests Scientific Society Panel Report, and other material). The result will be principles and processes that can be used to develop management direction (consistent with NEPA, National Forest Management Act (NFMA), Federal Land Policy

(1) **SCIENTIFIC FRAMEWORK FOR ECOSYSTEM MANAGEMENT IN THE INTERIOR COLUMBIA RIVER BASIN** (continued)

and Management Act (FLPMA), and applicable laws) for planning ecosystem management at all levels on federal public lands within the interior Columbia Basin.

These preliminary planning actions will identify the scale, coarse filters, viability and risk assessments, economic and social assessments, monitoring and evaluation, technology needs, and public participation processes that may be useful in implementing ecosystem management on these lands within the Basin.

Framework Product and Timeline:

A Basin-wide scientific framework for ecosystem management on lands administered by the Forest Service and Bureau of Land Management in the form of a scientific, peer-reviewed document that will be made available for public comment prior to final publication. It provides recommendations on linking science processes and products with planning on Federal lands. It is not a decision document. The draft scientific framework will take approximately 3 months from the date the Charter is effective.

(2) **SCIENTIFIC ASSESSMENT FOR ECOSYSTEM MANAGEMENT IN THE INTERIOR COLUMBIA RIVER BASIN**

Objective:

The broad scientific assessment of the resources within the interior Columbia River Basin will characterize and assess landscape, ecosystem, social, and economic processes and functions and describe probable outcomes of continued management practices and trends. It will identify the primary social and ecologic values and functions that will be addressed through the additional planning and implementation processes outlined within the ecosystem management framework for the Basin. Information generated through this assessment will be used, as a minimum, in the NEPA process which will be conducted to provide a basis for management direction to modify and implement the Anadromous Fish Habitat and •Watershed Conservation Strategy within the Basin.

(2) SCIENTIFIC ASSESSMENT FOR ECOSYSTEM MANAGEMENT IN THE INTERIOR COLUMBIA RIVER BASIN (continued)

Scientific Assessment Components:

The broad scientific assessment of the natural resources within the interior Columbia Basin will characterize and assess landscape, ecosystem, social, cultural, and economic processes and functions. The assessment will describe relationships within and among ecologic, social, cultural, and economic systems and interpret effects of past human interactions. Primary components of the evaluation will include:

a. landscape, economic, cultural, and social characterization;

b. identify the probability that change may occur in the components of diversity (landscape, ecosystem processes and functions, species);

c. identify social, cultural, and economic systems;

d. identify emerging issues that relate to ecosystem management within the Basin;

e. identify the social and cultural values of natural resources.

f. identify technology gaps, research needs and opportunities to advance the state of knowledge.

Assessment Product and Timeline:

A Basin-wide narrative report on the ecologic, economic, cultural, and social systems, describing the relationship within and among systems while interpreting effects of past human interactions. In addition, a research, development, and application plan will be developed to fill knowledge gaps and advance technology. This will be published as a scientific, peer-reviewed document in a format useful to other public and private land managers and policy makers. The draft scientific assessment will take approximately 9 months from the date the Charter is effective. The Assessment will be made available for public comment prior to finalizing. This is not a decision document.

(3) EASTSIDE ENVIRONMENTAL IMPACT STATEMENT

Objective:

Develop an Eastside EIS proposing a broad array of alternative strategies that encompasses up to 10 eastside Washington and Oregon National Forests and portions of 4 BLM Districts. The EIS process will be consistent with the principles of the scientific ecosystem framework, incorporate information from the scientific assessment of the interior Columbia River Basin, and draw from the scientific evaluation described below. The scope of the EIS will include, as a minimum, all lands administered by the Forest Service east of the Cascade crest in the states of Oregon and Washington. It will also include eastside Bureau of Land Management lands within the existing range of the Pacific Salmon, forested lands, and bull trout habitat. The EIS process must include an open scoping process with the public.

EIS Components:

A NEPA scoping process will be used to identify issues. From that scoping and other information, a range of management alternatives will be developed that integrates considerations of sustained long-term economic, social, and ecological values of the region and issues identified in scoping. Analysis of alternatives for managing forest and rangelands will consider the Eastside Forest Ecosystem Health Assessment, recommendations of the Eastside Forests[1] Scientific Society Panel, and other information. A broad array of potential strategies will be developed. This array should reflect societal expectations for public lands within the planning area.

As a minimum, each alternative will take into account the following factors:

- effects on cultural, historic, and current public uses and values, including scenic quality, recreation, subsistence, and tourism;
- concepts of adaptive management;
- effects on environmental and ecological values, including air and water quality, habitat conservation, sustainability, threatened and endangered species, biodiversity, and long-term productivity;
- jobs attributable to natural resource management, both commodity and non-commodity oriented, including jobs attributable to investment and restoration associated with each alternative;

(3) EASTSIDE ENVIRONMENTAL IMPACT STATEMENT (continued)

- economic and social effects on local communities and other governments including tribes, and effects on revenues to counties and the national treasury;
- economic and social effects associated with the protection and use of forest resources that might aid in transition of the Region's industries and communities to sustainable economies;
- economic and social benefits from ecological services within each alternative;
- regional, national, and international effects as they relate to timber supply, wood product prices, and other key economic and social variables;
- practicality of and barriers to implementation.

EIS Product and Timeline:

A legally sufficient EIS developed through an open public process from which a Record of Decision can be developed that may include adjustments to land and resource plans. The draft Eastside EIS will take approximately 9-12 months from the date the Charter is effective. The final EIS will follow as soon as public review and evaluation is complete. From the final EIS, a Record of Decision can then be issued by the responsible federal decision maker.

(4) EASTSIDE ECOSYSTEM MANAGEMENT SCIENTIFIC EVALUATION OF PLANNING ALTERNATIVES

Objective:

The Eastside Ecosystem Management Evaluation is a scientific evaluation of issues and alternatives identified through the NEPA scoping process for the Eastside EIS. This evaluation will be done in conjunction with an analysis of the effects of implementation on tribal values and rights. It will address the practicality of implementation of each alternative strategy.

Evaluation Components:

The evaluation should analyze each alternative in terms useful for analysis of costs and benefits, to the extent possible, and consider, as a minimum, the criteria listed under the EIS component of this charter.

The evaluation will be based on concepts documented in the ecosystem framework with consideration for maintenance and restoration of biological diversity, particularly that of late-successional and old-growth forest ecosystems; maintenance of long-term productivity; maintenance of sustainable levels of renewable natural resources, including timber, other forest products, grazing, fish, and other resource-related values of forests and rarigelands; and maintenance of rural economies and communities. To the extent possible, the evaluations will link the biological, cultural, social, and economic concerns at each hierarchical scale.

Outcomes associated with each alternative should be evaluated relative to maintaining and/or restoring productivity, maintaining economic, social, and cultural systems, and maintaining and/or restoring forest and rangeland resources (commodity and non-commodity). The levels of protection, investment, and use that will be necessary to achieve the stated outcomes for each alternative will be described.

The evaluation should provide an integrated landscape characterization within a structural data base. This should include terrestrial and aquatic systems and, to the extent possible, social and cultural systems.

The evaluation should include implementing adaptive management within an ecosystem framework. The specific linkages to research, inventory, monitoring, and other ownerships should be highlighted, and ways should be discussed for transitioning to adaptive management.

(4) EASTSIDE ECOSYSTEM MANAGEMENT SCIENTIFIC EVALUATION OF PLANNING ALTERNATIVES (continued)

The evaluation will consider long-term ecosystem health. It will carefully examine the role that natural processes and human activities have played in shaping the eastside ecosystems, landscape patterns; patch sizes, productive potentials, and resource changes. It will consider the variability nature has provided through these disturbance and change elements, the implications these elements have on sustainable long-term ecosystems, and ways disturbances and change can be accounted for in the overall management scheme. Also it will examine the alternative means by which disturbance elements can be mimicked on the landscape and the role these management activities might play providing ecological and social benefits.

In addressing biological diversity, consideration should not be limited to any one species and, to the extent possible, each alternative should be assessed for long-term management against viability. On eastside spotted owl Forests, the assessment should examine alternative measures to maintain spotted owl habitat within the FEMAT framework on those areas where such habitat is temporally highly dynamic and may be lost to natural successional and disturbance processes.

The evaluation will consider social and cultural diversity as well as elements of ecological diversity. Changes in social and cultural diversity associated with shifts in resource flows, availabilities, access, and conditions will be specifically addressed. Probable impacts on lifestyles, social interactions, and interdependencies will be described.

(4) EASTSIDE ECOSYSTEM MANAGEMENT SCIENTIFIC EVALUATION OF PLANNING ALTERNATIVES (continued)

Product and Timeline:

A scientific peer-reviewed document evaluating the effects of implementing a variety of ecosystem management strategies on eastside National Forests. The draft scientific evaluation will be available for consideration by the Eastside EIS Team about 9 months from the date this charter is effective. It is anticipated the EIS Team will consider the Scientific Evaluation along with other information it considers relevant to preparing the draft EIS. This evaluation is not a decision document - it is a scientific evaluation of the effects of implementing the various ecosystem management strategies. It will be made available for review.

/s/ lack Ward Thomas

JACK WARD THOMAS
Chief,
USDA Forest Service

/s/ lim Baca

JIM BACA
Director,
USDI Bureau of Land Management

APPENDIX B.

ECOLOGICAL INTEGRITY AND SOCIOECONOMIC RESILIENCY RATINGS BY SUBBASIN AND COUNTY.

This Appendix presents the subbasin ecological integrity ratings for each of the component systems (forest, rangeland, aquatic, rangeland hydrology, and forest hydrology) as well as the composite integrity rating. Each of the 164 subbasins was rated for aquatic and composite ecological integrity. Ecological integrity ratings were developed for forest (range) systems if the subbasin had at least 20 percent of its area in forested (range) vegetation types. Subbasins were grouped into clusters based on similarities in ecological conditions and characteristics. Clusters were developed for forested systems and rangeland systems.

Figure B-l shows the distribution of the subbasins within the Basin and figure B-2 shows the distribution of the counties within the Basin.

Table B-l contains the integrity ratings for each subbasin, and they are also identified by name and number. See Sedell and others (in preparation) for details on how these ratings were determined. Briefly, integrity ratings reflect the relative level of ecological functions and processes that are present and operating within a subbasin, relative to the Basin. Thus, relative to the Basin as a whole, a subbasin with high ecological integrity would have more ecological functions and processes effective than a subbasin with a low rating. Proxies were used to estimate such elements of integrity as: consistency of tree stocking level with long-term disturbance processes; amount and distribution of exotic species; absence or presence of wildfire and its effect on composition and pattern of forest types; changes in fire severity and frequency from historical (pre-1800s) to the present; expansion of woodlands into herblands and shrublands; disruption of hydrologic regimes; and, the full expression of potential life histories. Composite integrity ratings reflect the ecological integrity of the subbasin based on its component integrity.

Table B-2 contains the assignment of counties (fig. B-2) by typology and resiliency ratings for each county. See Haynes and Horne (in press) for details of how these ratings were developed. Briefly, the economic resiliency ratings were developed where high, medium, and low resiliency meant that a county was in the top, middle, or bottom third of the counties nationally, based on employment diversity. Social resiliency was defined using population density and how a county ranked relative to the average for the Basin and the United States. Lifestyle diversity was defined by the top, middle, and bottom thirds of the counties in the Basin. Socioeconomic resiliency was defined as the linear summation of the ratings (where the ratings were converted to point scores) for economic and social resiliency, and lifestyle diversity. High, medium, and low ratings were assigned based on ranges of point scores.

Table B-3 contains the long-term trends in risks to ecological integrity for each subbasin by management option. See Quigley and others (1996) for details of how these ratings were developed. Briefly, long-term trends in ecological integrity were developed for each management option based on a set of indices reflecting forest and rangeland vegetation, riparian management, and management of road densities. Values assigned reflect either decreasing (-1), stable (0), or increasing (+1) trends for each index. Composite trends represent the summation of the three indices for each subbasin. Thus, composite trends ranged in value from -3 to +3. Trends in risks to ecological integrity were estimated using a rule set that related population density to forest, non-forest, and agricultural wildland vegetation groups. Generally, higher risk was associated with forested vegetation groups and areas of high population density.

Haynes, Richard W.; Home, Amy L. 1996. Chapter 6: Economic Assessment of the Interior Columbia Basin. In: Quigley, T.M.; Arbelbide, S.J., tech. eds. An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins. Gen. Tech. Rep. PNW-GTR-XXX. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, [irregular pagination]. (Quigley, Thomas M., tech. ed. The Interior Columbia Basin Ecosystem Management Project: Scientific Assessment).

Quigley, Thomas M.; Lee, Kris; Arbelbide, S.J., tech. eds. 1996. Evaluation of EIS Alternatives by the Science Integration Team. Gen. Tech. Rep. PNW-GTR-XXX. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, [irregular pagination]. (Quigley, Thomas M., tech. ed. The Interior Columbia Basin Ecosystem Management Project: Scientific Assessment).

Sedell, Jim; Lee, Danny; Hessburg, Paul [and others] [in prep.]. Ecological integrity in the Interior Columbia Basin. On file with: U.S. Department of Agriculture, Forest Service, U.S. Department of Interior, Bureau of Land Management, Interior Columbia Basin Ecosystem Management, 112 E. Poplar, Walla Walla, WA 99362.

Table B-l—Integrity ratings for each subbasin within the Interior Columbia Basin Project area-

Subbasin		Cluster #		Integrity Ratings					
ID #	Name	Forest	Range	Forest	Range	Aquatic	Hydrology (Forest)	Hydrology (Range)	Composite Ecological
1	Alvord Lake		5		M	M		L	M
2	American Falls		6		L	L			L
3	Banks Lake		4		L	L		M	L
4	Beaver-Camas	6	6	M	L	L	L	H	L
5	Beaver-South Fork		1		L	L		H	L
6	Big Lost	6	5	H	M	L	H	L	L
7	Big Wood	6	6	H	M	M	M	H	L
8	Birch		5		M	L		M	M
9	Bitterroot	3	3	M		M	M		M
10	Blackfoot	3	3	M		M	L		M
11	Blackfoot		6		L	M			L
12	Boise-Mores	5	3	L		L	M		L
13	Brownlee Reservoir	6	5	M	M	L	L	L	L
14	Bruneau		5		M	M		M	M
15	Bully		6		L	L		H	L
16	Burnt	5	6	L	L	L	L	H	L
17	Butte	5	3	L		L	H		L
18	C. J. Strike Reservoir		6		L	L		M	L
19	Camas		6		M	L	L	H	L
20	Chief Joseph	6	4	M	L	L	L	M	L
21	Clearwater	3	3	L		M	L		M
22	Coeur d'Alene Lake	4		L		L	M		L
23	Colville	6	3	L		L	L		L
24	Crooked-Rattlesnake		6		M	L		L	M
25	Donner Und Blitzen		5		L	M		L	M
26	East Little Owyhee		5		H	L		L	M
27	Fisher	4		L		L	M		L
28	Flathead Lake	4	3	L		L	M		L
29	Flint-Rock	2	3	M		H	M		H
30	Franklin D.Roosevelt Lake	6	3	L		L	L		L
31	Goose		5		L	L		L	M
32	Goose Lake	5	1	L	L	M	L		L
33	Greys-Hobock	1	5	H	H	H	H		H
34	Gros Ventre	1	3	H		H	H		H
35	Guano		6		M	M		H	M
36	Hangman	6	3	L		L	L		L
37	Harney-Malheur Lakes		6		L	L		H	L
38	Hells Canyon	2	2	M	M	H	H	L	M
39	Idaho Falls		6		L	L			L
40	Imnaha	2	5	M	L	H	H	L	H
41	Jordan		6		L	L		L	M
42	Kettle	4	3	L		L	L		L
43	Klickitat	3	3	L		H	M		M
44	Lake Abert	5	6	M	L	L	H		L
45	Lake Chelan	1	2	H		M	H		H
46	Lake Walcott		6		L	L		H	L
47	Lemhi	2	5	H	M	M	M	L	H

Subbasin		Cluster*		Integrity Ratings					
ID#	Name	Forest	Range	Forest	Range	Aquatic:	Hydrology (Forest)	Hydrology (Range)	Composite Ecological
48	Little Deschutes	5	3	L		L	M		L
49	Little Lost		5		H	M		L	M
50	Little Salmon	3	3	L		M	M		M
51	Little Spokane	6	3	L		L	L		L
52	Little Wood		6		L	L		H	L
53	Lochsa	2		L		M	H		H
54	Lost	5	1	L	L	L	L	M	L
55	Lower Boise		6		L	L		H	L
56	Lower Clark Fork	4		L		L	H		L
57	Lower Crab		4		L	L		H	L
58	Lower Crooked	6	1	L	L	L	M	M	L
59	Lower Deschutes	5	1	L	L	M	M	L	L
60	Lower Flathead	6	3	L		L	L		L
61	Lower Grande Ronde	5	6	L	L	H	L	M	M
62	Lower Henrys	6	6	H	L	L	L		L
63	Lower John Day		1		L	M		M	L
64	Lower Kootenai	4		L		L	M		L
65	Lower Malheur		6		L	L		H	L
66	Lower Middle Fork Salmon	1	2	H		H	H		H
67	Lower North Fork Clearwater	4	3	L		M	M		L
68	Lower Owyhee		6		M	L		M	M
69	Lower Salmon	3	3	L		M	L		M
70	Lower Selway	2	2	M		M	H		H
71	Lower Snake		4		L	L		M	L
72	Lower Snake-Asotin	3	4	L	L	L	L	L	M
73	Lower Snake-Tucannon		4		L	L		M	L
74	Lower Spokane	6	3	L		L	L		L
75	Lower Yakima		4		L	L		M	L
76	Medicine Lodge	6	6	H	M	L	L	H	L
77	Methow	2	2	M		M	M		H
78	Middle Clark Fork	4		L		M	M		L
79	Middle Columbia-Hood	3	3	L		M	L		M
80	Middle Columbia-Lake Wallula		4		L	L		M	L
81	Middle Fork Clearwater	3	3	L		M	L		M
82	Middle Fork Flathead	1		H		M	H		H
83	Middle Fork John Day	5	6	L	L	M	M	M	L
84	Middle Fork Payette	6	3	L		L	M		L
85	Middle Owyhee		5		M	M		L	M
86	Middle Salmon-Chamberlain	2	2	H		H	H		H
87	Middle Salmon-Panther	2	5	H	M	M	H	L	H
88	Middle Snake-Payette		6		L	L		H	L
89	Middle Snake-Succor		5		L	L		M	M
90	Moses Coulee		4		L	L		M	L
91	Moyie	4		L		L	H		L
92	Naches	2	2	M		H	H		H
93	North And Middle Fork Boise	2	3	H		M	M		H
94	North Fork Flathead	1		H		M	H		H
95	North Fork John Day	5	3	L		M	M		L
96	North Fork Payette	6	3	L		L	L		L
97	Okanogan	6	4	L	L	L	L	L	L

	Subbasin	Cluster #		Integrity Ratings					
ID#	Name	Forest	Range	Forest	Range	Aquatic;	Hydrology (Forest)	Hydrology (Range)	Composite Ecological
98	Pahsimeroi	2	5	H	H	M	H	L	H
99	Palisades	2	5	H	H	M	H		H
100	Palouse		4		L	L		M	L
101	Payette	6	6	L	L	L	L	H	L
102	Pend Oreille	4		L		L	L		L
103	Pend Oreille Lake	4	3	L		M	H		L
104	Portneuf		6		L	M			L
105	Powder	5	3	L		L	L		L
106	Priest	4		L		L	M		L
107	Raft		6		L	L		M	L
108	Rock		4		L	L		H	L-NoOwn
109	Salmon Falls		5		M	L		L	M
110	Salt	6	3	H		M	M		L
111	Sanpoil	4	3	L		L	L		L
112	Silver		6		L	L		H	L
113	Silvies	5	6	L	L	L	M	H	L
114	Similkameen	1	2	H		L	M		H
115	Snake Headwaters	1	2	H		H	H		H
116	South Fork Boise	2	5	M	L	M	M	L	H
117	South Fork Clearwater	3	3	L		M	M		M
118	South Fork Coeur d'Alene	4		L		L	L		L
119	South Fork Flathead	1	2	H		H	H		H
120	South Fork Owyhee		5		H	L		L	M
121	South Fork Payette	2	3	H		M	H		H
122	South Fork Salmon	2	3	H		M	H		H
123	Sprague	5	3	L		M	H		L
124	St. Joe	4		L		M	H		L
125	Stillwater	4		L		L	M		L
126	Summer Lake	5	6	M	L	L	H		L
127	Swan	3		L		M	H		M
128	Teton	6	6	M	L	M	L		L
129	Thousand-Virgin		5		M	M		H	M
130	Trout		1		L	M		H	L
131	Umatilla	5	4	L	L	M	L	M	L
132	Upper Clark Fork	5	3	L		L	L		L
133	Upper Coeur d'Alene	4		L		M	H		L
134	Upper Columbia-Entiat	4	5	M	L	L	M	L	M
135	Upper Columbia-Priest Rapids			4		L	L		M L
136	Upper Crab		4		L	L		M	L
137	Upper Crooked	5	1	L	L	L	L	H	L
138	Upper Deschutes	4	3	L		L	H		M
139	Upper Grande Ronde	5	3	L		M	L		L
140	Upper Henrys	4	6	H	M	M	M		M
141	Upper John Day	5	1	L	L	M	M	M	L
142	Upper Klamath	5	3	L		L	H		L
143	Upper Klamath Lake	3	3	M		L	M		L
144	Upper Kootenai	4		L		M	M		L
145	Upper Malheur	5	6	M	L	L	M	M	L

Subbasin		Cluster*		Integrity Ratings					
ID#	Name	Forest	Range	Forest	Range	Aquatic:	Hydrology (Forest)	Hydrology (Range)	Composite Ecological
146	Upper Middle Fork Salmon	1		H		H	H		H
147	Upper North Fork Clearwater	4		M		M	M		L
148	Upper Owyhee		5		H	M		M	M
149	Upper Quinn		5		M	L		L	M
150	Upper Salmon	1	5	H	M	M	H	L	H
151	Upper Selway	2	2	H		H	H		H
152	Upper Snake-Rock		6		L	L		H	L
153	Upper Spokane	6	3	L		L	L		L
154	Upper Yakima	3	5	L	L	M	M	L	M
155	Walla Walla		4		L	M	L	M	L
156	Wallowa	2	2	L		H	L		H
157	Warner Lakes		6		M	L		H	M
158	Weiser	6	6	L	L	L	L	H	L
159	Wenatchee	2	2	M		H	H		H
160	Williamson	5	3	L		M	M		L
161	Willow	5	6	L	L	M	M		L
162	Willow		6		L	L		H	L
163	Willow		4		L	L		M	L
164	Yaak	4		L		M	H		L

H = high integrity rating

M = medium integrity rating

L = low integrity rating

NoOwn = no BLM/FS ownership in subbasin
1,2,3,4,5,6 indicate forest or rangeland cluster numbers

Sources: Quigley, T.M.; Arbelbide, S.J., tech. eds. 1996. An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins. Gen. Tech. Rep. PNW-GTR-XXX. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, [irregular pagination]. (Quigley, Thomas M., tech. ed. The Interior Columbia Basin Ecosystem Management Project: Scientific Assessment).

Quigley, Thomas M.; Lee, Kris; Arbelbide, S.J., tech. eds. 1996. Evaluation of EIS Alternatives by the Science Integration Team. Gen. Tech. Rep. PNW-GTR-XXX. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, [irregular pagination]. (Quigley, Thomas M., tech. ed. The Interior Columbia Basin Ecosystem).

Table B-2—Social and economic resiliency ratings for each county within the Interior Columbia Basin Project area.

County	State	Typology	Economic Resiliency	Social Resiliency	Lifestyle Diversity	Socioeconomic Resiliency
Ada	ID	Metropolitan	H	H	H	H
Adams	WA	Other	L	L	M	L
Adams	ID	Other	L	L	L	L
Asotin	WA	Other	M	M	H	H
Baker	OR	Other	M	M	H	M
Bannock	ID	Other	M	M	H	H
Benewah	ID	Recreation	L	L	M	L
Benton	WA	Metropolitan	M	M	H	H
Bingham	ID	Other	L	L	H	M
Blaine	ID	Recreation	M	M	M	L
Boise	ID	Other	L	L	M	L
Bonner	ID	Recreation	H	H	H	H
Bonneville	ID	Other	M	M	H	H
Boundary	ID	Other	M	M	L	L
Box Elder	UT	Other	L	L	L	L
Butte	ID	Other	L	L	L	L
Camas	ID	Recreation	L	L	L	L
Canyon	ID	Metropolitan	H	H	H	H
Caribou	ID	Other	L	L	L	L
Cassia	ID	Other	M	M	M	M
Chelan	WA	Recreation	H	H	H	H
Clark	ID	Other	L	L	L	L
Clearwater	ID	Other	L	L	M	L
Columbia	WA	Other	L	L	L	L
Crook	OR	Other	L	L	H	L
Custer	ID	Recreation	L	L	L	L
Deer Lodge	MT	Other	L	L	M	M
Deschutes	OR	Recreation	H	H	H	H
Douglas	WA	Other	L	L	H	M
Elko	NV	Recreation	L	L	L	L
Elmore	ID	Other	L	L	M	L
Ferry	WA	Other	L	L	M	L
Flathead	MT	Recreation	H	H	H	H
Franklin	WA	Metropolitan	M	M	H	H
Fremont	WY	Recreation	M	M	L	L
Fremont	ID	Other	L	L	M	L
Garfield	WA	Other	L	L	L	L
Gem	ID	Other	M	M	M	M
Gilliam	OR	Other	L	L	L	L
Good ing	ID	Other	M	M	L	M

County	State	Typology	Economic Resiliency	Social Resiliency	Lifestyle Diversity	Socioeconomic Resiliency
Granite	MT	Other	L	L	L	L
Grant	OR	Other	L	L	M	L
Grant	WA	Other	M	M	M	M
Harney	OR	Other	L	L	M	L
Hood River	OR	Recreation	H	H	M	H
Humboldt	NV	Recreation	L	L	L	L
Idaho	ID	Other	M	M	M	L
Jefferson	ID	Other	L	L	M	M
Jefferson	OR	Other	M	M	M	M
Jerome	ID	Other	M	M	M	M
Kittitas	WA	Other	L	L	H	M
Klamath	OR	Other	H	M	H	H
Klickitat	WA	Other	L	L	H	M
Kootenai	ID	Recreation	H	H	H	H
Lake	OR	Other	L	L	M	L
Lake	MT	Other	M	M	M	M
Latah	ID	Other	L	L	M	M
Lemhi	ID	Recreation	M	M	L	L
Lewis	ID	Other	L	L	L	L
Lewis and Clark	MT	Recreation	M	M	H	H
Lincoln	ID	Other	L	L	L	L
Lincoln	MT	Other	M	M	M	L
Lincoln	WY	Other	M	M	L	L
Lincoln	WA	Other	L	L	L	L
Madison	ID	Other	L	M	L	M
Malheur	OR	Other	L	L	M	L
Mineral	MT	Other	L	L	L	L
Minidoka	ID	Other	L	L	M	M
Missoula	MT	Other	H	H	H	H
Morrow	OR	Other	L	L	L	L
Nez Perce	ID	Other	H	H	H	H
Okanogan	WA	Recreation	L	L	M	L
Oneida	ID	Other	L	L	L	L
Owyhee	ID	Other	L	L	L	L
Payette	ID	Other	M	M	M	H
Pend Oreille	WA	Other	M	M	L	L
Powell	MT	Other	L	L	M	L
Power	ID	Other	L	L	L	L
Ravalli	MT	Other	L	L	M	M
Sanders	MT	Other	M	M	L	L
Sherman	OR	Other	L	L	L	L
Shoshone	ID	Other	L	L	L	L
Silver Bow	MT	Other	L	M	H	H

CONTINUED

County	State	Typology	Economic Resiliency	Social Resiliency	Lifestyle Diversity	Socioeconomic Resiliency
Skamania	WA	Other	L	L	M	L
Spokane	WA	Metropolitan	H	H	H	H
Stevens	WA	Other	H	H	M	H
Sublette	WY	Recreation	M	M	L	L
Teton	ID	Recreation	L	L	L	L
Teton	WY	Recreation	L	L	L	L
Twin Falls	ID	Other	H	H	H	H
Umatilla	OR	Other	H	H	H	H
Union	OR	Other	M	M	H	H
Valley	ID	Recreation	M	M	L	L
Walla Walla	WA	Other	H	H	H	H
Wallowa	OR	Other	M	M	L	L
Wasco	OR	Recreation	M	M	H	M
Washington	ID	Other	M	M	L	L
Wheeler	OR	Other	L	L	L	L
Whitman	WA	Other	L	L	M	M
Yakima	WA	Metropolitan	H	H	H	H

H = high resiliency rating

M = medium resiliency rating

L = low resiliency rating

Sources: Quigley, T.M.; Arbelbide, S.J., tech. eds. 1996. An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins. Gen. Tech. Rep. PNW-GTR-XXX. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, [irregular pagination]. (Quigley, Thomas M., tech. ed. The Interior Columbia Basin Ecosystem Management Project: Scientific Assessment).

Quigley, Thomas M.; Lee, Kris; Arbelbide, S.J., tech. eds. 1996. Evaluation of EIS Alternatives by the Science Integration Team. Gen. Tech. Rep. PNW-GTR-XXX. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, [irregular pagination]. (Quigley, Thomas M., tech. ed. The Interior Columbia Basin Ecosystem).

This file was created by scanning the printed publication.
Text errors identified by the software have been corrected;
however, some errors may remain.

Table B-3—Long-term trends in ecological integrity and risks projected for each subbasin within the Interior Columbia Basin Project area.

Subbasin		Index												Trends in Risks to Ecological Integrity		
		Option 1				Option 2				Option 3						
ID#	Name	Veg	Rip	Road	Comp	Veg	Rip	Road	Comp	Veg	Rip	Road	Comp	Option 1	Option 2	Option 3
1	Alvord Lake	-1	-1	0	-2	1	1	0	2	0	1	0	1	0	-1	-1
2	American Falls	-1	-1	0	-2	0	1	0	1	-1	1	0	0	+1	0	+1
3	Banks Lake	-1	-1	0	-2	0	1	0	1	0	1	0	1	+1	0	0
4	Beaver-Camas	-1	-1	-1	-3	0	1	0	1	-1	1	0	0	+1	0	+1
5	Beaver-South Fork	-1	-1	0	-2	0	1	0	1	0	1	0	1	0	-1	-1
6	Big Lost	-1	-1	-1	-3	0	1	0	1	-1	1	0	0	+1	0	0
7	Big Wood	-1	-1	-1	-3	0	1	0	1	-1	1	0	0	+1	0	0
8	Birch	-1	-1	0	-2	1	1	0		0	1	0	1	0	-1	-1
9	Bitterroot	-1	-1	-1	-3	1	1	-1	1	1	1	1	3	+1	0	0
10	Blackfoot	-1	-1	-1	-3	1	1	-1	1	-1	1	1	1	+1	+1	+1
11	Blackfoot	-1	-1	0	-2	-1	1	0	0	-1	1	0	0	+1	0	0
12	Boise-Mores	-1	-1	-1	-3	0	1	-1	0	0	1	0	1	+1	+1	+1
13	Brownlee Reservoir	-1	-1	-1	-3	0	1	0	1	-1	1	0	0	+1	0	+1
14	Bruneau	-1	-1	0	-2	1	1	0	2	0	1	0	1	0	-1	-1
15	Bully	-1	-1	0	-2	0	1	0	1	-1	1	0	0	+1	0	+1
16	Burnt	-1	-1	-1	-3	0	1	-1	0	0	1	0	1	+1	0	0
17	Butte	-1	-1	0	-2	0	1	0	1	0	1	0	1	+1	+1	+1
18	C. J. Strike Reservoir	-1	-1	0	-2	0	1	0	1	0	1	0	1	+1	0	0
19	Camas	-1	-1	0	-2	0	1	0	1	-1	1	0	0	+1	0	+1
20	Chief Joseph	-1	-1	-1	-3	0	1	0	1	-1	1	0	0	+1	0	+1
21	Clearwater	-1	-1	-1	-3	1	1	-1	1	1	1	1	3	+1	+1	+1
22	Coeur d'Alene Lake	-1	-1	-1	-3	0	1	-1	0	0	1	0	1	+1	+1	+1
23	Colville	-1	-1	-1	-3	0	1	0	1	-1	1	0	0	+1	+1	+1
24	C rooked- Rattl es nake	-1	-1	0	-2	1	1	0	2	1	1	0	2	0	-1	-1
25	Donner Und Blitzen	-1	-1	0	-2	1	1	0	2	0	1	0	1	0	-1	-1
26	East Little Owyhee	-1	-1	0	-2	1	1	0	2	0	1	0	1	0	-1	-1
27	Fisher	-1	-1	-1	-3	0	1	-1	0	-1	1	0	0	+1	0	0
28	Flathead Lake	-1	-1	-1	-3	0	1	-1	0	0	1	0	1	+1	0	0
29	Flint-Rock	-1	-1	-1	-3	1	1	1	3	0	1	1	2	+1	+1	+1
30	Franklin D. Roosevelt Lake	-1	-1	-1	-3	0	1	0	1	-1	1	0	0	+1	0	+1
31	Goose	-1	-1	0	-2	1	1	0	2	-1	1	0	0	0	-1	-1
32	Goose Lake	-1	-1	-1	-3	0	1	-1	0	-1	1	0	0	+1	0	0
33	Greys-Hobock	-1	-1	0	-2	1	1	0	2	1	1	0	2	+1	-1	-1
34	Gros Ventre	0	-1	0	-1	1	1	0	2	0	1	0	1	+1	-1	0
35	Guano	-1	-1	0	-2	1	1	0	2	-1	1	0	0	0	-1	-1
36	Hangman	-1	-1	0	-2	0	1	0	1	-1	1	0	0	+1	+1	+1
37	Harney-Malheur Lakes	-1	-1	0	-2	0	1	0	1	0	1	0	1	0	-1	-l
38	Hells Canyon	-1	0	-1	-2	1	0	0	1	-1	0	0	-1	+1	0	+1
39	Idaho Falls	-1	-1	0	-2	0	1	0	1	0	1	0	1	+1	0	0

	Subbasin	Index												Trends in Risks to Ecological Integrity		
		Option 1				Option 2				Option 3						
ID#	Name	Veg	Rip	Road	Comp	Veg	Rip	Road	Comp	Veg	Rip	Road	Comp	Option 1	Option 2	Option 3
40	Imnaha	-1	-1	-1	-3	1	1	1	3	-1	1	1	1	+1	-1	0
41	Jordan	-1	-1	0	-2	0	1	0	1	0	1	0	1	+1	+1	+1
42	Kettle	-1	-1	-1	-3	0	1	-1	0	0	1	0	1	+1	0	0
43	Klickitat	-1	-1	-1	-3	1	1	-1	1	0	1	1	2	+1	+1	+1
44	Lake Abert	-1	-1	-1	-3	0	1	-1	0	0	1	0	1	0	-1	-1
45	Lake Chelan	0	1	0	1	1	1	0	2	-1	1	0	0	0	0	+1
46	Lake Walcott	-1	-1	0	-2	0	1	0	1	-1	1	0	0	0	-1	-1
47	Lemhi	-1	-1	-1	-3	1	1	0	2	0	1	0	1	+1	-1	0
48	Little Deschutes	-1	-1	-1	-3	0	1	-1	0	-1	1	0	0	+1	+1	+1
49	Little Lost	-1	-1	0	-2	1	1	-1	2	-1	1	0	0	0	-1	-1
50	Little Salmon	-1	-1	-1	-3	1	1	-1	1	1	1	1	3	+1	0	-1
51	Little Spokane	-1	-1	-1	-3	0	1	0	1	-1	1	0	0	+1	+1	+1
52	Little Wood	-1	-1	0	-2	0	1	0	1	-1	1	0	0	0	+1	-1
53	Lochsa	-1	-1	-1	-3	1	1	1	3	-1	1	1	1	+1	0	0
54	Lost	-1	-1	-1	-3	0	1	-1	0	0	1	0	1	+1	+1	0
55	Lower Boise	-1	-1	0	-2	0	1	0	1	-1	1	0	0	+1	+1	+1
56	Lower Clark Fork	-1	-1	-1	-3	0	1	-1	0	0	1	0	1	+1	0	0
57	Lower Crab	-1	-1	0	-2	0	1	0	1	0	1	0	1	+1	0	0
58	Lower Crooked	-1	-1	-1	-3	0	1	0	1	-1	1	0	0	+1	+1	+1
59	Lower Deschutes	-1	-1	-1	-3	0	1	-1	0	-1	1	0	0	+1	0	0
60	Lower Flathead	-1	-1	-1	-3	0	1	0	1	-1	1	0	0	+1	+1	+1
61	Lower Grande Ronde	-1	-1	-1	-3	1	1	-1	1	1	1	1	3	+1	0	-1
62	Lower Henrys	-1	-1	-1	-3	0	1	0	1	-1	1	0	0	+1	0	0
63	Lower John Day	-1	-1	0	-2	-1	1	0	0	-1	1	0	0	+1	+1	+1
64	Lower Kootenai	-1	-1	-1	-3	0	1	-1	0	0	1	0	1	+1	0	0
65	Lower Malheur	-1	-1	0	-2	0	1	0	1	0	1	0	1	+1	+1	+1
66	Lower Middle Fork Salmon	0	0	0	0	1	0	0	1	-1	0	0	-1	0	0	+1
67	Lower North Fork Clearwater	-1	-1	-1	-3	0	1	-1	0	-1	1	0	0	+1	0	0
68	Lower Owyhee	-1	-1	0	-2	1	1	0	2	1	1	0	2	+1	0	0
69	Lower Salmon	-1	-1	-1	-3	1	1	-1	1	1	1	1	3	+1	0	0
70	Lower Selway	-1	0	-1	-2	1	0	1	2	-1	0	1	0	+1	-1	0
71	Lower Snake	-1	-1	0	-2	0	1	0	1	0	1	0	1	+1	+1	+1
72	Lower Snake-Asotin	-1	-1	-1	-3	1	1	-1	1	1	1	1	3	+1	0	0
73	Lower Snake-Tucannon	-1	-1	0	-2	-1	1	0	0	-1	1	0	0	+1	+1	+1
74	Lower Spokane	-1	-1	0	-2	0	1	0	1	-1	1	0	0	+1	+1	+1
75	Lower Yakima	-1	-1	0	-2	0	1	0	1	-1	1	0	0	+1	+1	+1
76	Medicine Lodge	-1	-1	-1	-3	0	1	0	1	-1	1	0	0	0	+1	-1
77	Methow	-1	1	-1	-1	1	1	1	3	-1	1	1	1	+1	+1	0
78	Middle Clark Fork	-1	-1	-1	-3	0	1	-1	0	0	1	0	1	+1	+1	+1
79	Middle Columbia-Hood	-1	-1	-1	-3	1	1	-1	1	-1	1	1	1	+1	0	0
80	Middle Columbia-Lake Wallula	-1	-1	0	-2	-1	1	0	0	-1	1	0	0	+1	+1	+1

		Index												Trends in Risks to Ecological Integrity		
	Subbasin	Option 1				Option 2				Option 3						
ID#	Name	Veg	Rip	Road	Comp	Veg	Rip	Road	Comp	Veg	Rip	Road	Comp	Option 1	Option 2	Option 3
81	Middle Fork Clearwater	-1	-1	-1	-3	1	1	-1	1	1	1	1	3	+1	0	-1
82	Middle Fork Flathead	0	-1	0	-1	1	1	0	2	-1	1	0	0	+1	-1	0
83	Middle Fork John Day	-1	-1	-1	-3	0	1	-1	0	-1	1	0	0	+1	0	0
84	Middle Fork Payette	-1	-1	-1	-3	0	1	0	1	-1	1	0	0	+1	+1	+1
85	Middle Owyhee	-1	-1	0	-2	1	1	0	2	-1	1	0	0	0	-1	-1
86	Middle Salmon-Chamberlain	0	0	-1	-1	1	0	1	2	-1	0	1	0	+1	-1	0
87	Middle Salmon-Panther	-1	-1	-1	-3	1	1	0	2	0	1	0	1	+1	-1	0
88	Middle Snake-Payette	-1	-1	0	-2	0	1	0	1	0	1	0	1	+1	+1	+1
89	Middle Snake-Succor	-1	-1	0	-2	1	1	0	2	-1	1	0	0	+1	+1	+1
90	Moses Coulee	-1	-1	0	-2	0	1	0	1	-1	1	0	0	+1	0	+1
91	Moyie	-1	-1	-1	-3	0	1	-1	0	0	1	0	1	+1	0	0
92	Naches	-1	-1	-1	-3	1	1	1	3	-1	1	1	1	+1	+1	+1
93	North And Middle Fork Boise	-1	-1	-1	-3	1	1	1	3	0	1	1	2	+1	+1	+1
94	North Fork Flathead	0	-1	0	-1	1	1	0	2	0	1	0	1	+1	-1	0
95	North Fork John Day	-1	-1	-1	-3	0	1	-1	0	-1	1	0	0	+1	0	0
96	North Fork Payette	-1	-1	-1	-3	0	1	0	1	-1	1	0	0	+1	0	+1
97	Okanogan	-1	-1	-1	-3	0	1	0	1	-1	1	0	0	+1	+1	+1
98	Pahsimeroi	-1	-1	-1	-3	1	1	0	2	0	1	0	1	0	-1	-1
99	Palisades	-1	-1	-1	-3	1	1	0	2	1	1	0	2	+1	0	0
100	Palouse	-1	-1	0	-2	-1	1	0	0	-1	1	0	0	+1	+1	+1
101	Payette	-1	-1	-1	-3	0	1	0	1	-1	1	0	0	+1	+1	+1
102	Pend Oreille	-1	-1	-1	-3	0	1	-1	0	-1	1	0	0	+1	-1	+1
103	Pend Oreille Lake	-1	-1	-1	-3	0	1	-1	0	0	1	0	1	+1	+1	+1
104	Portneuf	-1	-1	0	-2	0	1	0	1	-1	1	0	0	+1	0	+1
105	Powder	-1	-1	-1	-3	0	1	-1	0	-1	1	0	0	+1	+1	+1
106	Priest	-1	-1	-1	-3	0	1	-1	0	0	1	0	1	+1	+1	+1
107	Raft	-1	-1	0	-2	0	1	0	1	0	1	0	1	0	-1	-1
108	Rock	0	0	0		0	0	0		0	0	0				
109	Salmon Falls	-1	-1	0	-2	1	1	0	2	0	1	0	1	0	-1	-1
110	Salt	-1	-1	-1	-3	0	1	0	1	-1	1	0	0	+1	0	0
111	Sanpoil	-1	-1	-1	-3	0	1	-1	0	0	1	0	1	+1	0	0
112	Silver	-1	-1	0	-2	0	1	0	1	0	1	0	1	0	-1	-1
113	Silvies	-1	-1	-1	-3	0	1	-1	0	0	1	0	1	+1	0	0
114	Similkameen	0	1	0	1	1	1	0	2	0	1	0	1	0	-1	0
115	Snake Headwaters	0	-1	0	-1	1	1	0	2	1	1	0	2	+1	-1	-1
116	South Fork Boise	-1	-1	-1	-3	1	1	1	3	0	1	1	2	+1	0	0
117	South Fork Clearwater	-1	-1	-1	-3	1	1	-1	1	1	1	1	3	+1	0	0
118	South Fork Coeurd'Alene	-1	-1	-1	-3	0	1	-1	0	-1	1	0	0	+1	+1	+1
119	South Fork Flathead	0	0	0	0	1	0	0	1	-1	0	0	-1	0	0	+1
120	South Fork Owyhee	-1	-1	0	-2	1	1	0	2	-1	1	0	0	0	-1	-1
121	South Fork Payette	-1	-1	-1	-3	1	1	1	3	0	1	1	2	+1	0	0

	Subbasin	Index												Trends in Risks to Ecological Integrity		
		Option 1				Option 2				Option 3						
ID#	Name	Veg	Rip	Road	Comp	Veg	Rip	Road	Comp	Veg	Rip	Road	Comp	Option 1	Option 2	Option 3
122	South Fork Salmon	-1	-1	-1	-3	1	1	0	2	0	1	0	1	+1	-1	0
123	Sprague	-1	-1	-1	-3	0	1	-1	0	0	1	0	1	+1	0	0
124	St. Joe	-1	-1	-1	-3	0	1	-1	0	-1	1	0	0	+1	+1	+1
125	Still water	-1	-1	-1	-3	0	1	-1	0	-1	1	0	0	+1	0	0
126	Summer Lake	-1	-1	-1	-3	0	1	-1	0	0	1	0	1	0	-1	-1
127	Swan	-1	-1	-1	-3	1	1	-1	1	-1	1	1	1	+1	0	0
128	Teton	-1	-1	-1	-3	0	1	0	1	-1	1	0	0	+1	0	+1
129	Thou sand-Virgin	-1	0	0	-1	1	0	0	1	-1	0	0	-1	0	-1	0
130	Trout	-1	-1	0	-2	-1	1	0	0	0	1	0	1	+1	0	0
131	Umatilla	-1	-1	-1	-3	0	1	-1	0	-1	1	0	0	+1	+1	+1
132	Upper Clark Fork	-1	-1	-1	-3	0	1	-1	0	0	1	0	1	+1	+1	+1
133	Upper Coeurd'Alene	-1	-1	-1	-3	0	1	-1	0	-1	1	0	0	+1	+1	+1
134	Upper Columbia-Entiat	-1	-1	-1	-3	1	1	-1	1	-1	1	1	1	+1	0	0
135	Upper Columbia-Priest Rapids	-1	-1	0	-2	0	1	0	1	-1	1	0	0	+1	-1	+1
136	Upper Crab	-1	-1	0	-2	0	1	0	1	0	1	0	1	+1	0	0
137	Upper Crooked	-1	-1	-1	-3	0	1	-1	0	0	1	0	1	+1	0	0
138	Upper Deschutes	-1	-1	-1	-3	1	1	-1	1	-1	1	1	1	+1	0	0
139	Upper Grande Ronde	-1	-1	-1	-3	0	1	-1	0	0	1	0	1	+1	+1	0
140	Upper Henrys	-1	-1	-1	-3	1	1	-1	1	1	1	1	3	+1	0	-1
141	Upper John Day	-1	-1	-1	-3	0	1	-1	0	0	1	0	1	+1	0	0
142	Upper Klamath	-1	-1	-1	-3	0	1	-1	0	0	1	0	1	+1	+1	+1
143	Upper Klamath Lake	-1	-1	-1	-3	0	1	-1	0	-1	1	0	0	+1	+t	-1
144	Upper Kootenai	-1	-1	-1	-3	0	1	-1	0	0	1	0	1	+1	0	0
145	Upper Malheur	-1	-1	-1	-3	0	1	-1	0	0	1	0	1	0	-1	-1
146	Upper Middle Fork Salmon	0	0	0	0	1	0	0	1	-1	0	0	-1	0	0	+1
147	Upper North Fork Clearwater	-1	-1	-1	-3	0	1	-1	0	-1	1	0	0	+1	+1	+1
148	Upper Owyhee	-1	-1	0	-2	1	1	0	2	0	1	0	1	0	-1	-1
149	Upper Quinn	-1	-1	0	-2	1	1	0	2	0	1	0	1	0	-1	-1
150	Upper Salmon	-1	-1	0	-2	1	1	0	2	-1	1	0	0	+1	-1	0
151	Upper Selway	0	0	-1	-1	1	0	0	1	-1	0	0	-1	+1	0	+1
152	Upper Snake-Rock	-1	-1	0	-2	0	1	0	1	0	1	0	1	+1	0	0
153	Upper Spokane	-1	-1	0	-2	0	1	0	1	-1	1	0	0	+1	+1	+1
154	Upper Yaki ma	-1	-1	-1	-3	1	1	-1	1	-1	1	1	1	+1	+1	+1
155	Walla Walla	-1	-1	0	-2	-1	1	0	0	-1	1	0	0	+1	+1	+1
156	Wallowa	0	-1	-1	-2	1	1	0	2	1	1	0	2	+1	0	0
157	Warner Lakes	-1	-1	0	-2	1	1	0	2	-1	1	0	0	0	+1	-1
158	Weiser	-1	-1	-1	-3	0	1	0	1	-1	1	0	0	+1	+1	+1
159	Wenatchee	-1	-1	-1	-3	1	1	1	3	-1	1	1	1	+1	0	
160	Williamson	-1	-1	-1	-3	0	1	-1	0	0	1	0	1	+1	0	0
161	Willow	-1	-1	-1	-3	0		-1	0	0	1	0	1	+1	+1	0

Subbasin		Index												Trends in Risks to Ecological Integrity		
		Option 1				Option 2				Option 3						
ID#	Name	Veg	Rip	Road	Comp	Veg	Rip	Road	Comp	Veg	Rip	Road	Comp	Option 1	Option 2	Option 3
163	Willow	-1	-1	0	-2	-1	1	0	0	-1	1	0	0	+1	+1	+1
162	Willow	-1	-1	0	-2	0	1	0	1	0	1	0	1	+1	0	0
164	Yaak	-1	-1	-1	-3	0	1 -1		0	0	1	0	1	+1	0	0

Veg = Forest/Range Vegetation

Rip = Riparian Management

Road = Road Density

Comp = Composite Ecological Integrity

Values assigned reflect either decreasing (-1), stable (0), or increasing (+1) trends for each index.

Source: Quigley, Thomas M.; Lee, Kris; Arbelbide, S.J., tech. eds. 1996. Evaluation of EIS Alternatives by the Science Integration Team. Gen. Tech. Rep. PNW-GTR-XXX. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, [irregular pagination]. (Quigley, Thomas M., tech. ed. The Interior Columbia Basin Ecosystem).

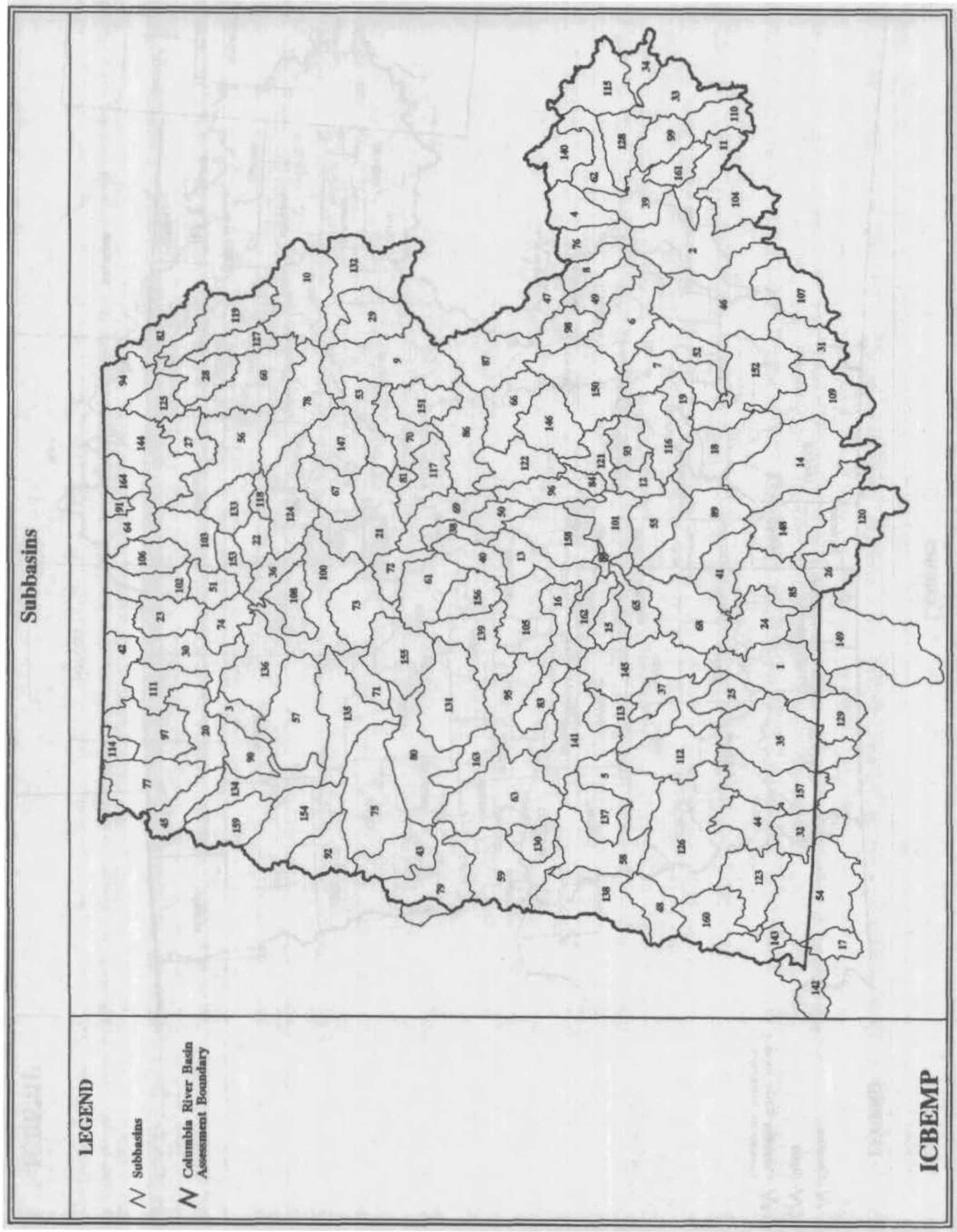


Figure B-2—Distribution of subbasins by identification number as referenced in tables B-l and B-3.

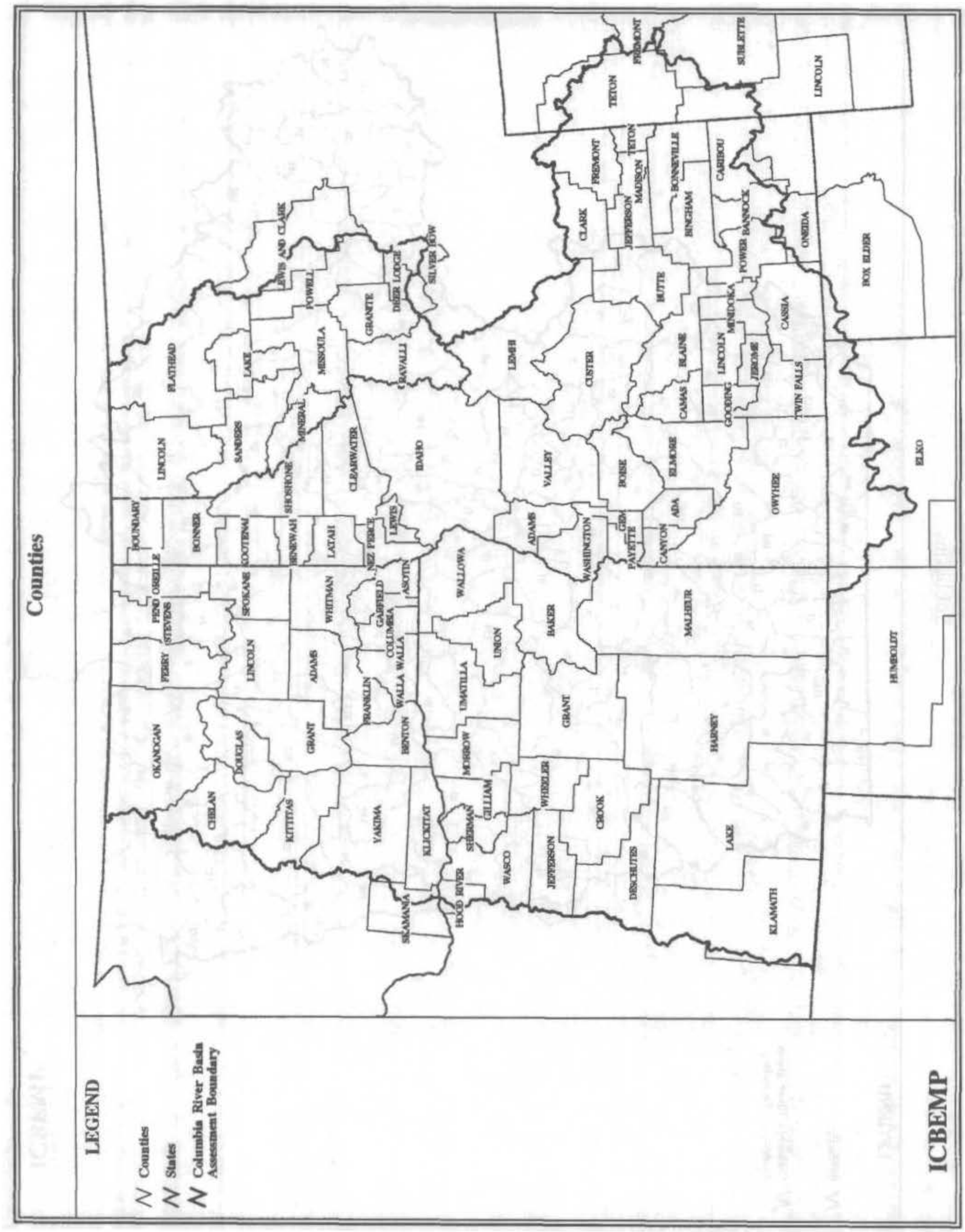


Figure B-2—Counties within the Basin.

APPENDIX C.

HABITAT OUTCOMES FOR SELECTED SPECIES WITHIN THE BASIN.

This appendix presents the definitions (fig. C-l) and outcomes of viability for individual species (table C-1) during historic, current, and projected future timeframes in the Interior Columbia Basin Ecosystem Management Project (ICBEMP) assessment area. Outcomes describe effects of habitat changes on federal lands only, and cumulative effects on populations from habitat changes on federal and non-federal lands and from other non-habitat influences.

Judgments on viability outcomes were solicited from expert panels provided with information on the species population and habitat relationships, and information on habitat conditions for the timeframes (see Lehmkuhl and others 1996 for details). The term "habitat" was defined as primary habitat capable of supporting a self-replacing population. Separate judgments were made for the historical and current periods and for each of the 3 future options in the two EIS planning areas [Eastern Oregon and Washington (EEIS), and the Upper Columbia River Basin (UCRB)].

For each timeframe and planning area, the experts were asked to first rate the species' likely distribution based only on habitat conditions on the Federal lands and the natural history characteristics of the species. The federal habitat judgments concerned potential population distribution across Federal land (FS and BLM only) based on population changes associated with habitat, environmental stochasticity, or natural catastrophes.

Then, panelists were asked to rate the cumulative effects on species populations across all ownerships given habitat conditions across all ownerships, the natural history of the species, and all other influences (such as, water pollution, trapping, etc.) on the species. The cumulative effects judgments concerned likely population response to management of federal habitat, population change associated with habitat, environmental stochasticity and natural catastrophes, changes in non-federal habitat, and other non-habitat influences.

Expert judgments were registered by likelihood voting using a structured outcome scale (fig. C-l). The outcome scale describes five distinct possible outcomes for the species or its habitat along a gradient ranging from broadly- distributed, with high likelihood of persistence, to poorly-distributed, with high likelihood of extirpation. For each judgment, each expert spread 100 likelihood votes across these five outcomes.

We calculated for each species the mean likelihood score for each outcome from individual experts' scores, then the weighted mean outcome (table C-2). The weighted mean was calculated by assigning a value to each of the outcome categories (Outcome 1 value=l, Outcome 2 value=2, etc.), multiplying the mean likelihood of that outcome by its assigned value, adding these products for all outcomes and then dividing by 100. The resulting weighted mean can be compared across time periods and across future options.

Table C-l—Mean viability outcomes for evaluation of ICBEMP management alternatives. Mean outcomes were calculated as the weighted mean of average likelihood scores in each outcome.

			Period/Outcome[3]				
Group[1]	**Species Name**	**Area[2]**	**H**	**C**	**1**	**2**	**3**
		VASCULAR PLANTS					
					Habitat & Populations		
PLT	*Astragalus mulfordiae*	EEIS BLM/FS	3.2	3.4	3.8	3.5	3.6
		EEISCumEff	3.2	3.4	3.8	3.5	3.6
		UCRB BLM/FS	3.2	3.3	3.8[5]	3.5	3.6
		UCRB CumEff	3.2	3.4	4.0[5]	3.6	3.8
PLT	*Astragalus oniciformis*	UCRB BLM/FS	3.1	3.4	3.8	3.5	3.4
		UCRB CumEff	3.1	3.4	3.6	3.5	3.6
PLT	*Astragalus paysonii*	UCRB BLM/FS	3.2	3.3	3.3	3.1	3.2
		UCRB CumEff	3.2	3.3	3.3	3.1	3.2
PLT	*Astragalus solitarius*	EEIS BLM/FS	3.2	3.3	3.3	3.2	3.3
		EEISCumEff	3.2	3.3	3.3	3.2	3.3
PLT	*Astragalus yoder-williamsii*	UCRB BLM/FS	3.1	3.4	3.3	3.2	3.3
		UCRB CumEff	3.1	3.4	3.3	3.2	3.3
PLT	*Botrychium ascendens*	EEIS BLM/FS	3.5	3.5	3.2	3.3	3.2
		UCRB BLM/FS	3.5	3.5	4.6[5]	4.6[5]	4.7[5]
		UCRB CumEff	3.5	3.5	4.6[5]	4.6[5]	4.6[5]
PLT	*Botrychium crenulatum*	EEIS BLM/FS	3.5	3.5	4.1[5]	3.8	3.5
		EEIS CumEff	3.5	3.5	4.1[5]	3.8	3.5
		UCRB BLM/FS	3.6	3.6	4.4[5]	4.2[5]	3.8
		UCRB CumEff	3.6	3.6	4.6[5]	4.6[5]	4.6[5]
PLT	*Botrychium paradoxum*	EEIS BLM/FS	3.5	3.5	3.6	3.6	3.6
		UCRB BLM/FS	3.5	3.5	3.6	3.6	3.6
PLT	*Calochortus longebarbatus* var. *longebarbatus*	EEIS BLM/FS	3.2	3.3	3.5	3.4	3.4
		EEISCumEff	3.2	3.4	3.5	3.5	3.4
PLT	*Calochortus longebarbatus* var. *peckii*	EEIS BLM/FS	3.0	3.2	3.2	3.2	3.1
		EEISCumEff	3.0	3.3	3.2	3.2	3.1
PLT	*Calochortus nltidus*	EEIS BLM/FS	3.4	3.7	3.7	3.5	3.8
		EEISCumEff	3.4	3.8	3.8	3.6	3.8
		UCRB BLM/FS	3.9	3.9	3.8	3.8	3.8
		UCRB CumEff	3.3	4.5	4.7	4.7	4.9
PLT	*Castilleja chlorotica*	EEIS BLM/FS	3.1	3.2	3.1	3.1	3.3
		EEISCumEff	3.1	3.2	3.1	3.1	3.4
PLT	*Collomia mazama*	EEIS BLM/FS	3.1	3.1	3.1	3.1	3.1
		EEISCumEff	3.1	3.1	3.1	3.1	3.1
PLT	*Cypripedium fasciculatum*	EEIS BLM/FS	2.3	3.2	3.2	3.0	3.3
		EEISCumEff	2.3	3.3	3.3	3.2	3.2
		UCRB BLM/FS	2.3	2.3	2.4	2.1	2.2
		UCRB CumEff	2.4	2.4	2.4	2.2	2.2
PLT	*Grindelia howellii*	UCRB BLM/FS	5.0	3.5	3.4	3.3	3.3
		UCRB CumEff	4.4	3.4	3.2	3.2	3.2
PLT	*Hackelia cronquistii*	EEIS BLM/FS	3.5	3.6	3.8	3.6	3.7
		EEISCumEff	3.5	3.7	3.7	3.6	3.6
PLT	*Haplopappus liathformis*	UCRB BLM/FS	2.2	4.8	4.9	4.9	4.9
		UCRB CumEff	2.2	4.9	4.9	4.9	4.9
PLT	*Howellia aquatilis*	EEIS BLM/FS	4.2	4.3	4.3	4.3	4.3
		EEISCumEff	3.4	3.6	3.6	3.7	3.7
		UCRB BLM/FS	3.1	3.2	3.2	3.2	3.2
		UCRB CumEff	3.1	3.2	3.3	3.3	3.2
PLT	*Lomatium suksdorfii*	EEIS BLM/FS	4.5	4.5	4.5	4.5	4.5
		EEISCumEff	3.4	3.5	3.6	3.6	3.6
PLT	*Mimulus pygmaeus*	EEIS BLM/FS	3.1	3.2	3.2	3.2	3.2
		EEISCumEff	3.1	3.2	3.2	3.2	3.2

Group[1]	Species Name	Area[2]	Period/Outcome[3] H	C	1	2	3
PLT	*Mimulus washingtonensis* var. *washingtonensis*	EEIS BLM/FS	3.7	3.8	3.8	3.7	3.8
		EEIS CumEff	3.7	3.8	3.8	3.7	3.8
PLT	*Mirabilis macfarlanei*	EEIS BLM/FS	3.1	4.0	4.0	4.0	3.9
		EEIS CumEff	3.1	4.5	4.3	4.2	4.1
		UCRB BLM/FS	3.1	3.8	3.8	3.8	3.7
		UCRB CumEff	3.1	4.0	4.0	3.9	3.9
PLT	*Penstemon glaucinus*	EEIS BLM/FS	3.6	3.3	3.2	3.2	3.3
		EEIS CumEff	3.6	3.3	3.2	3.2	3.3
PLT	*Penstemon lemhiensis*	UCRB BLM/FS	3.3	3.7	3.7	3.1[5]	3.6
		UCRB CumEff	3.3	3.8	3.8	3.2[5]	3.6
PLT	*Polemonium pectinatum*	EEIS BLM/FS	4.4	4.5	4.5	4.5	4.5
		EEIS CumEff	2.2	4.9	5.0	5.0	5.0
PLT	*Silene spaldingii*	EEIS BLM/FS	4.5	4.5	4.5	4.3	4.5
		EEIS CumEff	2.2	4.8	4.9	4.9	4.9
PLT	*Stephanomeria malheurensis*	EEIS BLM/FS	5.0	5.0	5.0	5.0	5.0
PLT	Trifolium thompsonii	EEIS BLM/FS	3.5	3.5	3.6	3.5	3.6
		EEIS CumEff	3.5	3.5	3.6	3.5	3.5
		AMPHIBIANS and REPTILES					
				Habitat & Populations			
AMP	Coeur d'alene salamander	UCRB BLM/FS[4]	3.7	4.3	4.6	4.2	4.1
		UCRB CumEff	3.7	4.4	4.9	4.7	4.5
AMP	Spotted frog species B	EEIS BLM/FS	2.5	3.5	3.9	3.5	3.4
		EEIS CumEff	2.5	3.5	4.0	3.6	3.5
		UCRB BLM/FS	2.1	3.1	3.6	3.1	3.0
		UCRB CumEff	2.1	3.1	3.7[5]	3.2	3.1
AMP	Northern leopard frog	EEIS BLM/FS[4]	3.2	4.5	4.7	4.4	4.3
		EEIS CumEff	3.2	4.5	5.0[5]	4.9	4.9
		UCRB BLM/FS[4]	2.9	4.7	4.9	4.3	3.9[5]
		UCRB CumEff	2.9	4.8	5.0	5.0	4.9
AMP	Spotted frog species A	EEIS BLM/FS[4]	2.5	3.6	4.1	3.4	3.1[5]
		EEIS CumEff	2.5	3.6	4.1	3.7	3.6
AMP	Tailed frog	EEIS BLM/FS	2.8	3.2	4.1[5]	3.2	3.0
		EEIS CumEff	2.8	3.2	4.6[5]	3.8[5]	3.6
		UCRB BLM/FS	2.8	3.2	4.0[5]	3.2	3.0
		UCRB CumEff	2.8	3.2	4.2[5]	3.6	3.5
AMP	Western toad	EEIS BLM/FS	1.8	2.4	3.4[5]	2.2	2.0
		EEIS CumEff	1.8	3.3	4.4[5]	3.4	3.3
		UCRB BLM/FS	2.1	2.6	3.5[5]	2.6	2.5
		UCRB CumEff	2.1	3.4	4.2[5]	3.6	3.5
AMP	Woodhouse's toad	EEIS BLM/FS[4]	2.5	3.9	4.5[5]	3.7	3.4
		EEIS CumEff	2.5	3.9	4.7[5]	4.5[5]	4.5[5]
		UCRB BLM/FS[4]	3.0	3.8	4.4[5]	3.7	3.4
		UCRB CumEff	3.0	3.8	4.7[5]	4.6[5]	4.6[5]
REP	Common garter snake	EEIS BLM/FS	1.5	2.5	3.5[5]	2.5	2.5
		EEIS CumEff	1.5	3.5	4.5[5]	3.5	3.5
		UCRB BLM/FS	1.5	2.6	3.2[5]	2.6	2.6
		UCRB CumEff	1.5	3.1	3.7[5]	3.2	3.1
REP	Desert horned lizard	EEIS BLM/FS	1.5	1.6	1.6	1.6	1.5
		EEIS CumEff	1.5	1.6	1.6	1.6	1.5
		UCRB BLM/FS	1.5	1.6	1.6	1.6	1.5
		UCRB CumEff	1.5	1.6	1.6	1.6	1.5
REP	Longnose leopard lizard	EEIS BLM/FS	3.5	3.8	4.0	3.8	3.8
		EEIS CumEff	3.5	3.9	4.1	3.9	3.8
		UCRB BLM/FS	3.5	3.8	4.0	3.8	3.8
		UCRB CumEff	3.5	3.9	4.1	3.9	3.8
REP	Mojave black-collared lizard	UCRB BLM/FS	2.5	2.8	3.0	2.8	2.8
		UCRB CumEff	3.8	3.8	4.2	3.9	3.8

			Period/Outcome[3]				
Group[1]	**Species Name**	**Area[2]**	**H**	**C**	**1**	**2**	**3**
REP	Night snake	EEIS BLM/FS	1.5	1.5	1.5	1.5	1.5
		EEIS CumEff	1.5	2.5	2.5	2.5	2.5
		UCRB BLM/FS	1.5	1.6	1.6	1.6	1.5
		UCRB CumEff	1.5	1.6	1.7	1.6	1.6
REP	Painted turtle	EEIS BLM/FS	2.4	2.7	3.2[5]	2.6	2.4
		EEIS CumEff	2.4	3.3	3.9[5]	3.2	3.2
		UCRB BLM/FS	2.5	2.7	3.1[5]	2.6	2.5
		UCRB CumEff	2.5	3.4	3.9[5]	3.4	3.2
REP	Rubber boa	EEIS BLM/FS	2.5	3.5	3.9	3.3	2.9[5]
		EEIS CumEff	2.5	3.5	4.9[5]	4.3[5]	3.9
		UCRB BLM/FS	3.0	3.6	3.8	3.5	3.2
		UCRB CumEff	3.0	3.6	4.3[5]	4.0	3.8
REP	Sagebrush lizard	EEIS BLM/FS	1.5	1.5	1.5	1.5	1.5
		EEIS CumEff	1.5	2.5	2.5	2.5	2.5
		UCRB BLM/FS	1.5	1.6	1.7	1.6	1.6
		UCRB CumEff	1.5	2.0	2.3	2.1	2.0
REP	Sharptail snake	EEIS BLM/FS[4]	3.5	4.5	4.7	4.4	3.9[5]
		EEIS CumEff	3.5	4.5	5.0[5]	4.9	4.5
REP	Short-horned lizard	EEIS BLM/FS	1.5	1.5	1.5	1.5	1.5
		EEIS CumEff	1.5	2.5	2.5	2.5	2.5
		UCRB BLM/FS	1.5	1.6	1.7	1.6	1.6
		UCRB CumEff	1.5	1.7	1.7	1.7	1.6
REP	Striped whipsnake	EEIS BLM/FS	1.5	1.5	1.5	1.5	1.5
		EEIS CumEff	1.5	2.5	2.5	2.5	2.5
		UCRB BLM/FS	3.5	3.8	3.9	3.8	3.7
		UCRB CumEff	3.5	3.8	3.9	3.8	3.8
REP	Western pond turtle	EEIS BLM/FS	1.9	2.6	3.0	2.2	2.2
		EEIS CumEff	1.9	4.6	4.9	4.6	4.6
		WATERBIRDS and SHOREBIRDS					
					Habitat & Species Group		
WAT	1) Open water birds	EEIS BLM/FS	3.0	3.6	3.8	3.3	3.5
		EEIS CumEff	3.1	3.5	3.7	3.3	3.5
		UCRB BLM/FS	3.2	3.5	3.8	3.3	3.3
		UCRB CumEff	3.1	3.4	3.7	3.2	3.3
WAT	2) Common loon	EEIS BLM/FS	3.7	3.6	3.8	3.5	3.6
		EEIS CumEff	3.5	3.3	3.6	3.3	3.3
		UCRB BLM/FS	3.8	3.6	3.8	3.5	3.5
		UCRB CumEff	3.6	3.3	3.6	3.3	3.4
WAT	3) Wood duck, mergansers	EEIS BLM/FS	3.6	3.5	3.7	3.1	3.4
		EEIS CumEff	3.6	3.6	3.8	3.2	3.4
		UCRB BLM/FS	2.9	3.0	3.3	2.8	2.9
		UCRB CumEff	3.0	3.1	3.4	2.9	3.1
WAT	4) Goldeneyes	EEIS BLM/FS	3.6	3.8	4.2	3.6	3.8
		EEIS CumEff	3.6	3.8	4.1	3.6	3.8
		UCRB BLM/FS	3.5	3.7	4.1	3.5	3.6
		UCRB CumEff	3.5	3.8	4.1	3.6	3.7
WAT	5) Western snowy plover	EEIS BLM/FS	4.0	4.0	4.1	4.0	4.0
		EEIS CumEff	4.0	4.1	4.2	4.1	4.1
WAT	6) Harlequin duck	EEIS BLM/FS	3.4	4.5	4.8	3.5[5]	4.1
		EEIS CumEff	3.3	4.6	4.9	3.6[5]	4.2
		UCRB BLM/FS	3.2	4.5	4.8	3.5[5]	4.1
		UCRB CumEff	3.2	4.6	4.8	3.6[5]	4.1
WAT	7) Herons, egrets	EEIS BLM/FS	3.0	3.4	3.4	3.3	3.4
		EEISCumEff	3.0	3.3	3.4	3.2	3.4
		UCRB BLM/FS	3.2	3.4	3.5	3.3	3.3
		UCRB CumEff	3.2	3.4	3.5	3.4	3.4
WAT	8) Dabbling ducks	EEIS BLM/FS	2.7	3.2	3.4	3.1	3.1
		EEIS CumEff	2.6	3.1	3.4	3.0	3.1

Group[1]	Species Name	Area[2]	Period/Outcome[3] H	C	1	2	3
		UCRB BLM/FS	2.8	3.3	3.5	3.1	3.3
		UCRB CumEff	2.8	3.3	3.5	3.2	3.3
WAT	9) Spotted sandpiper	EEIS BLM/FS	2.5	2.5	2.6	2.5	2.5
		EEIS CumEff	2.5	2.5	2.6	2.5	2.4
		UCRB BLM/FS	2.5	2.5	2.6	2.5	2.5
		UCRB CumEff	2.5	2.5	2.6	2.4	2.4
WAT	10) Greater sandhill crane	EEIS BLM/FS	3.1	3.5	3.7	3.3	3.5
		EEIS CumEff	3.1	3.4	3.6	3.2	3.4
		UCRB BLM/FS	3.1	3.2	3.5	3.1	3.4
		UCRB CumEff	3.0	3.3	3.5	3.2	3.4
WAT	11) Rails, avocets	EEIS BLM/FS	3.3	3.5	3.7	3.3	3.5
		EEIS CumEff	3.2	3.4	3.7	3.2	3.5
		UCRB BLM/FS	3.4	3.6	3.8	3.4	3.6
		UCRB CumEff	3.3	3.5	3.7	3.3	3.5
WAT	12) Curlew , willet	EEIS BLM/FS	3.7	3.9	4.0	3.8	3.9
		EEIS CumEff	3.7	3.9	4.0	3.8	3.9
		UCRB BLM/FS	3.7	3.9	4.0	3.8	3.9
		UCRB CumEff	3.7	3.9	4.0	3.8	3.9
WAT	13) Upland sandpiper	EEIS BLM/FS[4]	2.3	5.0	5.0	4.8	4.9
		EEIS CumEff	2.3	5.0	5.0	4.9	5.0
		UCRB BLM/FS[4]	2.3	5.0	5.0	4.8	4.9
		UCRB CumEff	2.3	5.0	5.0	4.9	5.0
WAT	14) Common snipe	EEIS BLM/FS	2.9	3.1	3.3	2.9	3.1
		EEIS CumEff	2.9	3.1	3.3	3.0	3.1
		UCRB BLM/FS	2.9	3.1	3.3	2.9	3.1
		UCRB CumEff	2.9	3.1	3.3	3.0	3.1
WAT	15) Migrant sandpipers	EEIS BLM/FS	1.8	2.1	2.2	2.0	2.0
		EEIS CumEff	1.8	2.0	2.2	2.0	2.0
		UCRB BLM/FS	1.9	2.2	2.4	2.0	2.2
		UCRB CumEff	1.8	2.0	2.2	1.9	2.0
		RAPTORS and GAMEBIRDS					
				Habitat & Populations			
GMB	Band-tailed pigeon	EEIS BLM/FS	2.0	3.0	3.0	2.6	2.8
		EEIS CumEff	2.0	3.1	3.1	2.7	2.9
		UCRB BLM/FS	4.0	4.1	3.7	3.5[5]	3.4[5]
		UCRB CumEff	4.0	4.1	3.8	3.5[5]	3.5[5]
GMB	Blue grouse	EEIS BLM/FS	1.7	2.2	2.3	1.9	2.0
		EEIS CumEff	1.7	2.2	2.3	1.9	2.0
		UCRB BLM/FS	1.5	2.2	2.3	1.9	1.9
		UCRB CumEff	1.4	2.2	2.2	1.9	1.9
GMB	Columbian sharp-tailed grouse	EEIS BLM/FS	1.3	4.8	4.6	4.0[5]	4.4
		EEIS CumEff	1.2	4.6	4.6	3.9[5]	4.3
		UCRB BLM/FS	1.4	4.6	4.6	4.0[5]	4.4
		UCRB CumEff	1.3	4.6	4.5	3.9[5]	4.3
GMB	Mountain quail	EEIS BLM/FS	2.5	3.9	4.0	3.5	3.6
		EEIS CumEff	2.4	3.7	3.8	3.5	3.6
		UCRB BLM/FS	3.4	4.8	4.7	4.4	4.6
		UCRB CumEff	3.2	4.7	4.7	4.3	4.5
GMB	Sage grouse	EEIS BLM/FS	1.6	3.2	3.4	2.3[5]	2.6[5]
		EEIS CumEff	1.6	3.1	3.4	2.3[5]	2.6[5]
		UCRB BLM/FS	1.6	3.1	3.3	2.2[5]	2.6
		UCRB CumEff	1.5	3.1	3.3	2.3[5]	2.6
RAP	Bald eagle	EEIS BLM/FS	2.8	3.6	3.4	2.9[5]	3.0[5]
		EEIS CumEff	2.6	3.7	3.5	2.9[5]	2.9[5]
		UCRB BLM/FS	2.8	3.6	3.4	2.9[5]	3.0[5]
		UCRB CumEff	2.6	3.7	3.5	2.9[5]	2.9[5]
RAP	Barred owl	EEIS BLM/FS	3.3	2.2	2.5	3.2[5]	2.3
		EEIS CumEff	4.8	2.4	2.5	2.9[5]	2.6
		UCRB BLM/FS	3.0	2.9	2.4[5]	2.5	2.2[5]

Group[1]	Species Name	Area[2]	H	C	1	2	3
			Period/Outcome[3]				
		UCRB CumEff	4.9	3.2	2.3[5]	2.4[5]	2.3[5]
RAP	Boreal owl	EEIS BLM/FS	4.1	4.2	4.3	4.0	3.7[5]
		EEIS CumEff	4.2	4.2	4.3	4.2	3.9
		UCRB BLM/FS	2.9	3.7	3.6	3.2[5]	3.0[5]
		UCRB CumEff	3.3	3.7	3.5	3.3	3.2[5]
RAP	Burrowing owl	EEIS BLM/FS	1.5	3.0	3.0	2.8	2.9
		EEIS CumEff	1.3	2.8	2.9	2.8	2.9
		UCRB BLM/FS	1.5	2.9	3.0	2.8	2.9
		UCRB CumEff	1.4	2.8	2.9	2.8	2.9
RAP	Cooper's hawk	EEIS BLM/FS	1.8	2.4	2.5	1.9	2.0
		EEIS CumEff	1.7	2.2	2.3	1.7	1.9
		UCRB BLM/FS	1.8	2.4	2.4	1.9	2.0
		UCRB CumEff	1.7	2.3	2.3	1.8	1.9
RAP	Ferruginous hawk	EEIS BLM/FS	2.3	3.0	3.0	2.5	2.6
		EEIS CumEff	2.2	2.8	2.7	2.5	2.5
		UCRB BLM/FS	2.3	3.0	3.0	2.5	2.6
		UCRB CumEff	2.2	2.8	2.7	2.5	2.5
RAP	Flammulated owl	EEIS BLM/FS	2.2	3.8	4.2	2.9[5]	3.3
		EEIS CumEff	2.2	3.8	4.2	2.9[5]	3.3
		UCRB BLM/FS	2.2	3.8	4.2	2.9[5]	3.3
		UCRB CumEff	2.2	3.8	4.2	2.9[5]	3.3
RAP	Great gray owl	EEIS BLM/FS	3.4	3.7	3.8	3.5	3.6
		EEIS CumEff	3.3	3.6	3.7	3.4	3.5
		UCRB BLM/FS	3.0	3.5	3.4	3.0[5]	3.1
		UCRB CumEff	2.9	3.5	3.3	3.0	3.1
RAP	Long-eared owl	EEIS BLM/FS	3.1	3.6	3.7	3.2	3.5
		EEIS CumEff	3.0	3.3	3.5	3.1	3.4
		UCRB BLM/FS	3.1	3.6	3.7	3.3	3.6
		UCRB CumEff	3.0	3.4	3.6	3.2	3.5
RAP	Merlin	EEIS BLM/FS	2.9	3.1	3.3	3.0	3.1
		EEIS CumEff	2.8	3.0	3.1	3.0	3.1
		UCRB BLM/FS	2.9	3.1	3.1	2.9	3.0
		UCRB CumEff	2.8	3.0	3.0	2.9	3.0
RAP	Northern goshawk	EEIS BLM/FS	2.1	2.5	2.7	2.3	2.4
		EEIS CumEff	2.1	2.4	2.6	2.2	2.3
		UCRB BLM/FS	2.1	2.6	2.6	2.2	2.3
		UCRB CumEff	2.1	2.5	2.5	2.2	2.3
RAP	Northern pygmy-owl	EEIS BLM/FS	1.4	1.6	1.7	1.4	1.5
		EEIS CumEff	1.3	1.6	1.7	1.4	1.5
		UCRB BLM/FS	1.3	1.6	1.7	1.4	1.5
		UCRB CumEff	1.3	1.6	1.7	1.4	1.5
RAP	Northern saw-whet owl	EEIS BLM/FS	1.3	1.7	1.8	1.5	1.6
		EEIS CumEff	1.3	1.7	1.8	1.5	1.6
		UCRB BLM/FS	1.3	1.7	1.8	1.5	1.6
		UCRB CumEff	1.2	1.7	1.7	1.4	1.5
RAP	Swainson's hawk	EEIS BLM/FS	2.0	1.9	1.8	1.8	1.8
		EEIS CumEff	2.0	2.0	2.0	1.9	1.9
		UCRB BLM/FS	2.1	1.9	1.8	1.8	1.8
		UCRB CumEff	2.1	2.0	2.0	1.9	1.9
RAP	Western screech owl	EEIS BLM/FS	2.4	2.8	2.9	2.6	2.6
		EEIS CumEff	2.4	2.8	2.9	2.5	2.5
		UCRB BLM/FS	2.4	2.8	2.9	2.6	2.6
		UCRB CumEff	2.4	2.8	2.9	2.5	2.6
		CAVITY NESTERS					
				Habitat & Populations			
CAV	Black-backed woodpecker	EEIS BLM/FS	2.2	3.2	4.1[5]	3.0	2.9
		EEIS CumEff	2.2	3.2	4.1[5]	3.1	3.1
		UCRB BLM/FS	2.2	3.1	4.0[5]	2.9	2.9
		UCRB CumEff	2.2	3.2	4.1[5]	3.1	3.0

Group[1]	Species Name	Area[2]	Period/Outcome[3] H	C	1	2	3
CAV	Downy woodpecker	EEIS BLM/FS[4]	1.8	2.7	3.1	2.8	2.9
		EEIS CumEff[4]	1.8	2.8	3.0	2.8	2.8
		UCRB BLM/FS[4]	1.8	2.7	3.2[5]	2.8	3.0
		UCRB CumEff[4]	1.8	2.7	3.2	2.8	3.0
CAV	Hairy woodpecker	EEIS BLM/FS	2.2	2.2	2.6	2.5	2.2
		EEIS CumEff	2.2	2.1	2.6	2.4	2.3
		UCRB BLM/FS	2.2	2.2	2.5	2.4	2.2
		UCRB CumEff	2.2	2.2	2.6	2.4	2.3
CAV	Lewis' woodpecker	EEIS BLM/FS	2.3	3.5	4.5[5]	2.5[5]	2.6[5]
		EEIS CumEff	2.7	3.9	4.8[5]	3.0[5]	3.0[5]
		UCRB BLM/FS	2.3	3.4	4.5[5]	2.7[5]	2.7[5]
		UCRB CumEff	2.8	4.0	4.8[5]	3.2[5]	3.3[5]
CAV	Pileated woodpecker	EEIS BLM/FS[4]	3.1	3.4	4.0[5]	2.5[5]	2.5[5]
		EEIS CumEff[4]	3.1	3.4	4.0[5]	2.5[5]	2.5[5]
		UCRB BLM/FS[4]	3.0	3.4	4.0[5]	2.5[5]	2.6[5]
		UCRB CumEff[4]	3.0	3.4	4.0[5]	2.5[5]	2.6[5]
CAV	Pygmy nuthatch	EEIS BLM/FS	2.2	2.9	3.6[5]	2.6	2.9
		EEIS CumEff	2.2	2.9	3.6[5]	2.6	2.9
		UCRB BLM/FS	2.2	3.0	3.6[5]	2.6	2.9
		UCRB CumEff	2.2	3.0	3.6[5]	2.6	2.9
CAV	Red-naped sapsucker	EEIS BLM/FS	2.0	3.3	3.8[5]	2.7[5]	3.1
		EEIS CumEff	2.0	3.3	3.9[5]	2.8[5]	3.1
		UCRB BLM/FS	2.0	3.3	3.8[5]	2.7[5]	3.1
		UCRB CumEff	2.0	3.3	3.9[5]	2.8[5]	3.1
CAV	Three-toed woodpecker	EEIS BLM/FS	2.6	2.9	4.0[5]	3.1	2.9
		EEIS CumEff	2.6	3.0	4.0[5]	3.1	2.9
		UCRB BLM/FS	2.6	2.9	4.0[5]	3.1	2.9
		UCRB CumEff	2.6	3.0	4.0[5]	3.1	2.9
CAV	Vaux's swift	EEIS BLM/FS[4]	4.0	3.7	4.5[5]	3.7	2.9[5]
		EEIS CumEff[4]	4.4	4.1	4.8	4.1	3.4
		UCRB BLM/FS[4]	3.9	3.8	4.5	3.7	2.9
		UCRB CumEff[4]	4.2	4.1	4.8	4.1	3.4
CAV	White-breasted nuthatch	EEIS BLM/FS	2.2	3.0	3.6[5]	2.8	2.9
		EEIS CumEff	2.2	3.0	3.6[5]	2.8	2.9
		UCRB BLM/FS	2.2	2.9	3.6[5]	2.7	2.9
		UCRB CumEff	2.2	2.9	3.6[5]	2.7	2.9
CAV	White-headed woodpecker	EEIS BLM/FS[4]	2.4	3.8	4.2	2.7[5]	3.1[5]
		EEIS CumEff[4]	2.4	3.8	4.3	2.8[5]	3.1[5]
		UCRB BLM/FS[4]	2.4	3.8	4.2	2.7[5]	3.1[5]
		UCRB CumEff[4]	2.4	3.8	4.3	2.8[5]	3.1[5]
CAV	Williamson's sapsucker	EEIS BLM/FS	2.2	3.1	4.0[5]	2.9	2.9
		EEIS CumEff	2.2	3.1	4.0[5]	2.9	2.9
		UCRB BLM/FS	2.2	3.2	3.9[5]	3.0	2.9
		UCRB CumEff	2.2	3.2	3.9[5]	3.1	2.9
CUCKOOS, HUMMINGBIRDS, AND PASSERINES							
Habitat & Species Groups							
FOR	Black-chinned hummingbird	EEIS BLM/FS	2.8	3.1	3.3	3.1	3.1
		EEIS CumEff	2.8	3.2	3.6	3.3	3.2
		UCRB BLM/FS	2.8	3.1	3.3	3.1	3.1
		UCRB CumEff	2.8	3.2	3.6	3.3	3.2
FOR	Broad-tailed hummingbird	UCRB BLM/FS	2.4	3.3	3.6	3.1	3.2
		UCRB CumEff	2.4	3.5	3.6	3.3	3.3
FOR	Chestnut-backed chickadee	EEIS BLM/FS	3.2	3.3	3.8	3.0	2.6
		EEIS CumEff	3.2	3.3	3.8	3.0	2.6
		UCRB BLM/FS	2.8	3.2	3.8	3.0	2.6
		UCRB CumEff	2.8	3.2	3.8	3.0	2.6
FOR	Hammond's flycatcher	EEIS BLM/FS	1.7	3.5	3.7	2.9[5]	2.9[5]
		EEIS CumEff	1.3	3.5	3.8	3.2	3.1
		UCRB BLM/FS	1.7	3.4	3.7	2.9	2.9
		UCRB CumEff	1.3	3.4	3.8	3.2	3.1

			Period/Outcome[3]				
Group[1]	**Species Name**	**Area[2]**	**H**	**C**	**1**	**2**	**3**
FOR	Lazuli bunting	EEIS BLM/FS	2.6	2.8	2.9	2.6	2.6
		EEIS CumEff	2.6	2.9	3.0	2.9	2.9
		UCRB BLM/FS	2.4	2.6	2.7	2.5	2.5
		UCRB CumEff	2.4	2.8	2.9	2.8	2.8
FOR	Olive-sided flycatcher	EEIS BLM/FS	1.2	3.4	3.5	3.2	3.2
		EEIS CumEff	1.2	3.4	3.7	3.5	3.5
		UCRB BLM/FS	1.2	3.2	3.4	3.0	3.1
		UCRB CumEff	1.2	3.3	3.6	3.4	3.4
FOR	Rufous hummingbird	EEIS BLM/FS	2.4	2.6	2.9	2.6	2.5
		EEIS CumEff	2.4	2.8	3.3[5]	3.0	3.0
		UCRB BLM/FS	2.3	2.5	2.9	2.5	2.5
		UCRB CumEff	2.3	2.8	3.3[5]	3.0	3.0
FOR	Rufous-sided towhee	EEIS BLM/FS	2.6	2.4	2.4	2.5	2.5
		EEIS CumEff	2.6	2.4	2.4	2.5	2.5
		UCRB BLM/FS	2.5	2.3	2.3	2.5	2.5
		UCRB CumEff	2.5	2.4	2.4	2.5	2.5
FOR	Western bluebird	EEIS BLM/FS	2.2	3.0	3.5[5]	2.4[5]	2.6
		EEIS CumEff	2.2	3.1	3.8[5]	2.7	2.9
		UCRB BLM/FS	2.2	3.0	3.5[5]	2.4[5]	2.6
		UCRB CumEff	2.2	3.1	3.8[5]	2.7	2.9
FOR	Western tanager	EEIS BLM/FS	1.1	1.1	1.3	1.1	1.1
		EEIS CumEff	1.1	1.1	1.7[5]	1.5	1.5
		UCRB BLM/FS	1.1	1.1	1.3	1.1	1.1
		UCRB CumEff	1.1	1.1	1.7[5]	1.5	1.5
FOR	White-winged crossbill	EEIS BLM/FS	3.0	3.0	3.4	3.2	2.9
		EEIS CumEff	2.9	2.9	3.3	3.0	2.7
		UCRB BLM/FS	3.0	3.0	3.4	3.2	2.9
		UCRB CumEff	2.9	2.9	3.3	3.0	2.7
FOR	Wilson's warbler	EEIS BLM/FS	3.2	3.5	3.6	3.4	3.3
		EEIS CumEff	3.2	3.5	3.6	3.4	3.3
		UCRB BLM/FS	3.2	3.4	3.6	3.4	3.3
		UCRB CumEff	3.2	3.4	3.6	3.4	3.3
FOR	Winter wren	EEIS BLM/FS	2.2	3.0	3.6[5]	3.0	3.2
		EEIS CumEff	2.2	3.5	3.7	3.4	3.6
		UCRB BLM/FS	2.0	2.9	3.3	2.8	3.0
		UCRB CumEff	2.0	3.3	3.8	3.3	3.5
GS	Black rosy finch	EEIS BLM/FS	4.0	4.0	4.3	4.0	4.0
		EEIS CumEff	4.0	4.0	4.3	4.0	4.0
		UCRB BLM/FS	4.0	4.0	4.0	4.0	4.0
		UCRB CumEff	4.0	4.0	4.0	4.0	4.0
GS	Bobolink	EEIS BLM/FS	3.7	4.4	4.6	4.1	4.3
		EEIS CumEff	3.4	4.6	4.7	4.4	4.5
		UCRB BLM/FS	3.3	4.3	4.5	4.0	4.1
		UCRB CumEff	3.3	4.4	4.5	4.2	4.2
GS	Brewer's blackbird	EEIS BLM/FS	1.1	1.1	1.4	1.1	1.1
		EEIS CumEff	1.1	1.5	2.1[5]	2.0	2.0
		UCRB BLM/FS	1.1	1.1	1.4	1.1	1.1
		UCRB CumEff	1.1	1.5	1.9	2.0	2.0
GS	Brewer's sparrow	EEIS BLM/FS	1.3	1.4	2.8[5]	2.8[5]	3.0[5]
		EEIS CumEff	1.3	2.3	3.2[5]	3.3[5]	3.3[5]
		UCRB BLM/FS	1.4	2.0	2.9[5]	2.8[5]	2.9[5]
		UCRB CumEff	1.3	2.6	3.3[5]	3.3[5]	3.3[5]
GS	Grasshopper sparrow	EEIS BLM/FS	3.6	4.9	4.9	4.8	4.9
		EEIS CumEff	1.9	4.9	4.9	4.8	4.9
		UCRB BLM/FS	2.8	4.0	4.1	4.0	4.0
		UCRB CumEff	2.6	3.9	3.9	3.8	3.8
GS	Horned lark	EEIS BLM/FS	2.5	1.5	1.4	1.3	1.3
		EEIS CumEff	2.5	1.5	2.3[5]	2.3[5]	2.3[5]
		UCRB BLM/FS	2.5	1.5	1.4	1.3	1.3
		UCRB CumEff	2.5	1.5	2.3[5]	2.3[5]	2.3[5]
GS	Lark sparrow	EEIS BLM/FS	1.3	1.4	2.8[5]	2.8[5]	3.0[5]
		EEIS CumEff	1.3	2.5	3.2[5]	3.2[5]	3.2[5]

Group[1]	Species Name	Area[2]	Period/Outcome[3] H	C	1	2	3
		UCRB BLM/FS	1.4	2.0	2.9[5]	2.8[5]	2.9[5]
		UCRB CumEff	1.4	2.6	3.3[5]	3.3[5]	3.3[5]
GS	Loggerhead shrike	EEIS BLM/FS	1.7	2.3	3.0[5]	2.9[5]	3.0[5]
		EEIS CumEff	1.7	2.8	3.4[5]	3.2	3.6v
		UCRB BLM/FS	1.7	2.3	2.9[5]	2.9[5]	3.0[5]
		UCRB CumEff	1.7	2.8	3.4[5]	3.2	3.5[5]
GS	Sage sparrow	EEIS BLM/FS	1.2	1.3	2.5[5]	2.4[5]	2.6[5]
		EEIS Cum/Eff	1.2	2.4	3.1[5]	3.1[5]	3.1[5]
		UCRB BLM/FS	1.2	1.3	2.5[5]	2.4[5]	2.6[5]
		UCRB CumEff	1.2	2.4	3.1[5]	3.1[5]	3.1[5]
GS	Sage thrasher	EEIS BLM/FS	1.3	1.4	2.8[5]	2.8[5]	3.0[5]
		EEIS CumEff	1.3	2.5	3.2[5]	3.2[5]	3.2[5]
		UCRB BLM/FS	1.4	1.8	2.9[5]	2.8[5]	2.9[5]
		UCRB CumEff	1.3	2.6	3.2[5]	3.2[5]	3.3[5]
GS	Vesper sparrow	EEIS BLM/FS	1.2	1.4	1.9[5]	1.8	1.9[5]
		EEIS CumEff	1.1	1.7	2.4[5]	2.3[5]	2.4[5]
		UCRB BLM/FS	1.2	1.3	1.9[5]	1.8	1.9[5]
		UCRB CumEff	1.1	1.7	2.4[5]	2.3[5]	2.4[5]
GS	Western meadowlark	EEIS BLM/FS	1.1	1.1	1.4	1.3	1.4
		EEIS CumEff	1.1	1.1	1.6	1.5	1.6
		UCRB BLM/FS	1.1	1.1	1.4	1.3	1.4
		UCRB CumEff	1.1	1.1	1.6	1.5	1.6
RIP	Red-eyed vireo	EEIS BLM/FS	3.4	3.7	3.7	3.5	3.6
		EEIS CumEff	3.3	3.7	3.8	3.6	3.7
		UCRB BLM/FS	3.4	3.6	3.7	3.4	3.5
		UCRB CumEff	3.3	3.7	3.7	3.6	3.6
RIP	Red-winged blackbird	EEIS BLM/FS	2.1	2.4	2.7	2.3	2.3
		EEIS CumEff	2.1	2.5	3.1[5]	2.8	2.9
		UCRB BLM/FS	2.1	2.4	2.7	2.3	2.3
		UCRB CumEff	2.1	2.5	3.1[5]	2.8	2.8
RIP	Veery	EEIS BLM/FS	2.7	3.3	3.4	3.2	3.3
		EEIS CumEff	2.7	3.6	3.7	3.4	3.5
		UCRB BLM/FS	2.4	3.3	3.4	3.1	3.2
		UCRB CumEff	2.4	3.5	3.6	3.4	3.5
RIP	Willow flycatcher	EEIS BLM/FS	2.6	3.4	3.6	3.4	3.4
		EEIS CumEff	2.5	3.6	3.7	3.6	3.6
		UCRB BLM/FS	2.6	3.4	3.6	3.4	3.4
		UCRB CumEff	2.4	3.6	3.7	3.6	3.6
RIP	Yellow warbler	EEIS BLM/FS	2.4	3.4	3.5	3.3	3.3
		EEIS CumEff	2.4	3.5	3.7	3.5	3.5
		UCRB BLM/FS	2.4	3.4	3.5	3.3	3.3
		UCRB CumEff	2.4	3.5	3.7	3.5	3.5
RIP	Yellow-billed cuckoo	EEIS BLM/FS	3.5	4.5	4.8	4.5	4.6
		EEIS CumEff	3.4	4.9	4.9	4.8	4.7
		UCRB BLM/FS	3.3	4.5	4.8	4.5	4.6
		UCRB CumEff	3.3	4.9	4.9	4.7	4.8
RIP	Yellow-breasted chat	EEIS BLM/FS	2.5	3.5	3.6	3.4	3.5
		EEIS CumEff	2.4	3.6	3.7	3.5	3.5
		UCRB BLM/FS	2.5	3.5	3.6	3.4	3.4
		UCRB CumEff	2.4	3.6	3.7	3.5	3.5
WD	Ash-throated flycatcher	EEIS BLM/FS	2.1	1.9	2.3	3.3[5]	2.6[5]
		EEIS CumEff	2.1	1.9	2.5[5]	3.0[5]	2.8[5]
		UCRB BLM/FS	2.1	1.9	2.3	3.3[5]	2.6[5]
		UCRB CumEff	2.1	1.9	2.5[5]	3.0[5]	2.8[5]
WD	Bushtit	EEIS BLM/FS	3.0	2.9	3.1	3.5[5]	3.4[5]
		EEIS CumEff	3.0	2.9	3.1	3.5[5]	3.4[5]
		UCRB BLM/FS	3.4	2.9	3.2	3.5[5]	3.4[5]
		UCRB CumEff	3.4	2.9	3.2	3.5[5]	3.4[5]
WD	Chipping sparrow	EEIS BLM/FS	1.1	1.1	1.1	1.1	1.1
		EEIS CumEff	1.1	1.1	1.4	1.4	1.4
		UCRB BLM/FS	1.1	1.1	1.1	1.1	1.1
		UCRB CumEff	1.1	1.1	1.4	1.4	1.4

Group[1]	Species Name	Area[2]	H	C	1	2	3
			Period/Outcome[3]				
WD	Green-tailed towhee	EEIS BLM/FS	2.7	2.5	2.8	2.4	2.5
		EEIS CumEff	2.7	2.5	2.8	2.4	2.5
		UCRB BLM/FS	2.7	2.5	2.8	2.4	2.5
		UCRB CumEff	2.7	2.5	2.8	2.4	2.5
		BATS and SMALL MAMMALS					
				Habitat & Populations			
BAT	Fringed myotis	EEIS BLM/FS[4]	2.7	3.7	4.2	3.7	3.5
		EEIS CumEff	2.7	3.9	4.8[5]	4.5[5]	4.4
		UCRB BLM/FS[4]	2.7	3.7	4.2	3.4	3.5
		UCRB CumEff	2.7	3.9	4.8[5]	4.5[5]	4.4
BAT	Hoary bat	EEIS BLM/FS[4]	2.2	3.2	3.7	3.3	3.4
		EEIS CumEff	2.2	3.6	4.4[5]	4.1[5]	4.1[5]
		UCRB BLM/FS[4]	2.2	3.2	3.6	3.3	3.4
		UCRB CumEff	2.2	3.6	4.5[5]	4.1	4.1[5]
BAT	Long-eared myotis	EEIS BLM/FS[4]	2.4	3.6	3.7	3.4	3.4
		EEIS CumEff	2.4	3.9	4.5[5]	4.1	4.1
		UCRB BLM/FS[4]	2.4	3.6	3.7	3.4	3.4
		UCRB CumEff	2.4	3.9	4.5[5]	4.1	4.1
BAT	Long-legged myotis	EEIS BLM/FS[4]	2.4	3.7	4.0	3.2[5]	3.3
		EEIS CumEff	2.4	4.0	4.7[5]	4.3	4.2
		UCRB BLM/FS[4]	2.4	3.7	3.8	3.2	3.3
		UCRB CumEff	2.4	4.0	4.7[5]	4.3	4.2
BAT	Pale western big-eared bat	EEIS BLM/FS[4]	3.1	4.0	4.4	4.0	3.9
		EEIS CumEff	3.1	4.1	4.8[5]	4.5	4.5
		UCRB BLM/FS[4]	3.1	4.0	4.4	4.0	3.8
		UCRB CumEff	3.1	4.1	4.8[5]	4.5	4.5
BAT	Silver-haired bat	EEIS BLM/FS[4]	2.5	3.4	3.9[5]	3.1	3.2
		EEIS CumEff	2.4	3.7	4.4[5]	4.1	4.2
		UCRB BLM/FS[4]	2.5	3.4	3.9	3.1	3.2
		UCRB CumEff	2.4	3.7	4.4[5]	4.1	4.2
BAT	Spotted bat	EEIS BLM/FS[4]	4.0	4.2	4.4	4.3	4.2
		EEIS CumEff	4.0	4.4	4.6	4.5	4.5
		UCRB BLM/FS[4]	4.0	4.2	4.4	4.3	4.2
		UCRB CumEff	4.0	4.4	4.6	4.5	4.5
BAT	Western small-footed myotis	EEIS BLM/FS[4]	2.2	3.3	4.3[5]	3.7	3.2
		UCRB BLM/FS[4]	2.2	3.3	4.3[5]	3.7	3.2
SMM	Northern flying squirrel	EEIS BLM/FS[4]	2.1	3.5	3.9	3.1	3.0[5]
		EEIS CumEff	2.2	3.6	4.5[5]	4.3[5]	4.1[5]
		UCRB BLM/FS[4]	2.1	3.5	3.9	3.0	3.0
		UCRB CumEff	2.2	3.5	4.4[5]	4.2[5]	4.1[5]
SMM	Pygmy rabbit	EEIS BLM/FS	3.7	4.5	4.5	4.5	4.5
		UCRB BLM/FS	3.7	4.5	4.5	4.5	4.5
SMM	White-tailed jackrabbit	EEIS BLM/FS	1.8	2.8	2.8	2.8	2.8
		EEIS CumEff	1.8	3.7	3.7	3.7	3.7
		UCRB BLM/FS	1.8	2.8	2.8	2.8	2.8
		UCRB CumEff	1.8	3.7	3.7	3.7	3.7
		CARNIVORES and UNGULATES					
				Habitat and Populations			
CAR	American marten	EEIS BLM/FS[4]	2.5	4.0	4.4	3.4[5]	3.0[5]
		EEIS CumEff[4]	2.5	4.0	4.6[5]	4.4	4.1
		UCRB BLM/FS[4]	2.1	3.7	4.2	3.0[5]	2.7[5]
		UCRB CumEff[4]	2.1	4.3	4.4	4.1	3.6[5]

Group[1]	Species Name	Area[2]	Period/Outcome[3] H	C	1	2	3
CAR	Fisher	EEIS BLM/FS[4]	3.9	4.8	4.9	4.2[5]	4.5
		EEIS CumEff[4]	3.9	4.9	4.9	4.9	4.6
		UCRB BLM/FS[4]	2.8	3.8	4.1	3.4	4.1
		UCRB CumEff[4]	2.8	4.8	4.7	4.7	4.3[5]
CAR	Gray wolf	EEIS BLM/FS	1.7	2.3	2.5	2.3	2.1
		EEIS CumEff	1.8	4.3	4.4	4.3	4.0
		UCRB BLM/FS	1.3	2.1	2.2	2.1	1.9
		UCRB CumEff	1.3	4.2	4.4	4.3	4.1
CAR	Grizzly bear	EEIS BLM/FS	1.7	4.4	4.5	4.4	4.2
		EEIS CumEff	1.6	4.9	4.9	4.9	4.7
		UCRB BLM/FS	1.4	4.0	4.1	4.1	3.8
		UCRB CumEff	1.5	4.8	4.9	4.8	4.6
CAR	Lynx	EEIS BLM/FS[4]	3.0	4.4	4.6	4.6	4.2
		EEIS CumEff[4]	3.0	4.6	4.8	4.8	4.6
		UCRB BLM/FS[4]	3.0	4.4	4.5	4.6	4.1
		UCRB CumEff[4]	3.0	4.6	4.8	4.8	4.6
CAR	Wolverine	EEIS BLM/FS[4]	3.0	4.4	4.5	4.4	4.2
		EEIS CumEff[4]	4.0	4.6	5.0	4.9	4.4
		UCRB BLM/FS[4]	3.0	4.0	4.1	4.1	3.8
		UCRB CumEff[4]	4.0	5.0	5.0	4.9	4.3[5]
UNG	California bighorn sheep	EEIS BLM/FS[4]	3.5	4.6	4.6	4.6	4.9
		EEIS CumEff[4]	3.5	4.7	4.7	4.7	4.9
		UCRB BLM/FS[4]	3.5	4.6	4.6	4.6	4.9
		UCRB CumEff[4]	3.5	4.7	4.7	4.7	4.9
UNG	Prong horn	EEIS BLM/FS[4]	3.0	3.5	3.9	3.3	3.9
		EEIS CumEff[4]	3.0	4.1	4.3	4.3	4.3
		UCRB BLM/FS[4]	2.0	2.5	3.0[5]	2.3	3.0[5]
		UCRB CumEff[4]	2.0	3.4	4.3[5]	4.3[5]	4.3[5]
UNG	Woodland caribou	EEIS BLM/FS	4.5	5.0	5.0	5.0	4.5
		EEIS CumEff	4.5	5.0	5.0	5.0	4.6
		UCRB BLM/FS	4.5	5.0	5.0	5.0	4.5
		UCRB CumEff	4.5	5.0	5.0	5.0	4.6

[1] Group: PLT - vascular plants; AMP - amphibians; REP - reptiles; WAT - waterbirds and shorcbirds; GAM - gamebird; RAP - raptor; CAV - cavity ncstcr; FOR - forest birds; GS - grassland/shrub birds; RIP - riparian birds; WD - woodland birds; BAT - bat; SMM - small mammal; CAR - carnivore; UNG - ungulate.

[2] Area: EEIS BLM/FS - Eastern Oregon and Washington planning area, BLM and Forest Service lands only; EEIS CumEff - all lands in Eastern Oregon and Washington planning area; UCRB BLM/FS - Upper Columbia Basin planning area, BLM and Forest Service lands only; UCRB CumEff- all lands in Upper Columbia Basin planning area.

[3] Period / Option: H - historical pre-European settlement period; C - current; 1 - Option 1; 2 - Option 2; 3 - Option 3

[4] Species for which panelists' scores were adjusted by Science Team. Scores were adjusted when considered to reflect a misinterpretation or incomplete understanding of the management alternatives or their outcomes, or the species ecology.

[5] Mean outcome for alternative departs from current outcome by greater than or equal to 0.50 units. Outcomes reported in table were rounded to 0.1 units; but, differences were calculated to 0.01 units. Hence, departure calculated from the table may be misleading.

Table C-2—Mean likelihood scores of viability outcomes for selected species or habitat and species groups for evaluation of ICBEMP management options. Likelihood scores for each period or option to 100 points. High scores indicate high likelihood of an outcome. Means are calculated from the individual likelihood scores of panelists.

Group[1]	Species Name	Area[2]	Outcome[3]	Period/Outcome[4] H	C	1	2	3
Vascular Plants								
PLT	*Astragalus mulfordiae*	EEIS BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	80	60	30	65	50
			4	20	40	60	25	40
			5	0	0	10	10	10
		EEIS CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	80	70	30	60	50
			4	20	20	60	30	40
			5	0	10	10	10	10
		UCRB BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	80	70	30	65	50
			4	20	30	60	25	40
			5	0	0	10	10	10
		UCRB CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	80	60	20	55	40
			4	20	40	60	30	40
			5	0	0	20	15	20
PLT	*Astragalus oniciformis*	UCRB BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	90	60	40	60	70
			4	10	40	40	30	20
			5	0	0	20	10	10
		UCRB CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	90	60	50	60	50
			4	10	40	45	30	40
			5	0	0	5	10	10
PLT	*Astragalus paysonii*	UCRB BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	80	70	70	90	85
			4	20	30	30	10	15
			5	0	0	0	0	0
		UCRB CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	80	70	70	90	85
			4	20	30	30	10	15
			5	0	0	0	0	0
PLT	*Astragalus solitarius*	EEIS BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	80	70	70	80	70
			4	20	30	30	20	30
			5	0	0	0	0	0
		EEIS CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	80	70	70	80	70
			4	20	30	30	20	30
			5	0	0	0	0	0
PLT	*Astragalus yoder-williamsii*	UCRB BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	90	70	80	90	80
			4	10	20	10	5	10

Group[1]	Species Name	Area[2]	Outcome[3]	Period/Outcome[4]				
				H	C	1	2	3
			5	0	10	10	5	10
		UCRB CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	90	70	80	90	80
			4	10	20	10	5	10
			5	0	10	10	5	10
PLT	*Botrychium ascendens*	EEIS BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	50	50	80	70	80
			4	50	50	20	30	20
			5	0	0	0	0	0
		UCRB BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	50	50	0	0	0
			4	50	50	40	40	30
			5	0	0	60	60	70
		UCRB CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	50	50	0	0	0
			4	50	50	40	40	40
			5	0	0	60	60	60
PLT	*Botrychium crenulatum*	EEIS BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	50	50	30	40	60
			4	50	50	30	40	30
			5	0	0	40	20	10
		EEIS CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	50	50	30	40	60
			4	50	50	30	40	30
			5	0	0	40	20	10
		UCRB BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	40	40	10	20	40
			4	60	60	40	40	40
			5	0	0	50	40	20
		UCRB CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	40	40	0	0	0
			4	60	60	40	40	40
			5	0	0	60	60	60
PLT	*Botrychium paradoxum*	EEIS BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	50	50	40	40	40
			4	50	50	60	60	60
			5	0	0	0	0	0
		UCRB BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	50	50	40	40	40
			4	50	50	60	60	60
			5	0	0	0	0	0
PLT	*Calochortus longebarbatus* var. *longebarbatus*	EEIS BLM/FS	1	0	0	0	0	
			2	0	0	0	0	0
			3	80	70	55	60	65
			4	20	30	45	40	35
			5	0	0	0	0	0
		EEIS CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	80	65	50	55	60
			4	20	35	50	45	40
			5	0	0	0	0	0

Group[1]	Species Name	Area[2]	Outcome[3]	Period/Outcome[4] H	C	1	2	3
PLT	*Calochortus longebarbatus* var. *peckii*	EEIS BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	100	80	80	80	90
			4	0	20	20	20	10
			5	0	0	0	0	0
		EEIS CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	100	75	80	80	90
			4	0	25	20	20	10
			5	0	0	0	0	0
PLT	*Calochortus nitidus*	EEIS BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	60	30	30	50	20
			4	40	70	70	50	80
			5	0	0	0	0	0
		EEIS CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	60	25	25	45	20
			4	40	75	75	55	80
			5	0	0	0	0	0
		UCRB BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	10	10	20	25	20
			4	90	90	80	75	80
			5	0	0	0	0	0
		UCRB CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	70	10	5	5	0
			4	30	30	20	20	10
			5	0	60	75	75	90
PLT	*Castilleja chlorotica*	EEIS BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	90	80	90	90	70
			4	10	20	10	10	30
			5	0	0	0	0	0
		EEIS CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	90	80	90	90	65
			4	10	20	10	10	35
			5	0	0	0	0	0
PLT	*Collomia mazama*	EEIS BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	90	90	90	90	90
			4	10	10	10	10	10
			5	0	0	0	0	0
		EEIS CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	90	90	90	90	90
			4	10	10	10	10	10
			5	0	0	0	0	0
PLT	*Cypripedium fasciculatum*	EEIS BLM/FS	1	0	0	0	0	0
			2	70	10	10	10	0
			3	30	60	60	80	70
			4	0	30	30	10	30
			5	0	0	0	0	0
		EEIS CumEff	1	0	0	0	0	0
			2	70	10	10	10	10
			3	30	60	60	70	70
			4	0	25	25	15	15
			5	0	5	5	5	5

Group[1]	Species Name	Area[2]	Outcome[3]	H	C	1	2	3
				Period/Outcome[4]				
		UCRB BLM/FS	1	0	0	0	0	0
			2	70	80	70	90	80
			3	30	10	20	10	20
			4	0	10	10	0	0
			5	0	0	0	0	0
		UCRB CumEff	1	0	0	0	0	0
			2	60	70	70	90	85
			3	40	20	20	5	15
			4	0	10	10	5	0
			5	0	0	0	0	0
PLT	*Grindelia howellii*	UCRB BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	0	50	60	70	70
			4	0	50	40	30	30
			5	100	0	0	0	0
		UCRB CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	0	60	85	85	85
			4	60	40	15	15	15
			5	40	0	0	0	0
PLT	*Hackelia cronquistii*	EEIS BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0.
			3	50	40	30	50	45
			4	50	60	60	45	45
			5	0	0	10	5	10
		EEIS CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	50	30	30	40	40
			4	50	70	70	60	60
			5	0	0	0	0	0
PLT	*Haplopappus liatriformis*	UCRB BLM/FS	1	0	0	0	0	0
			2	80	0	0	0	0
			3	20	0	0	0	0
			4	0	20	10	10	10
			5	0	80	90	90	90
		UCRB CumEff	1	0	0	0	0	0
			2	80	0	0	0	0
			3	20	0	0	0	0
			4	0	15	10	10	10
			5	0	85	90	90	90
PLT	*Howellia aquatilis*	EEIS BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	0	0	0	0	0
			4	80	75	75	75	75
			5	20	25	25	25	25
		EEIS CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	60	60	60	50	50
			4	40	20	20	30	30
			5	0	20	20	20	20
		UCRB BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	90	90	85	85	90
			4	10	5	10	10	5
			5	0	5	5	5	5
		UCRB CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	90	90	80	80	90
			4	10	5	10	10	5
			5	0	5	10	10	5

Group[1]	Species Name	Area[2]	Outcome[3]	Period/Outcome[4] H	C	1	2	3
PLT	*Lomatium suksdorfii*	EEIS BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	0	0	0	0	0
			4	50	50	50	50	50
			5	50	50	50	50	50
		EEIS CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	60	50	40	40	40
			4	40	50	60	60	60
			5	0	0	0	0	0
PLT	*Mimulus pygmaeus*	EEIS BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	90	80	80	85	80
			4	10	20	20	15	20
			5	0	0	0	0	0
		EEIS CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	90	80	80	85	80
			4	10	20	20	15	20
			5	0	0	0	0	0
PLT	*Mimulus washingtonensis* var. *washingtonensis*	EEIS BLM/FS	1	0	0	0	0	
			2	0	0	0	0	0
			3	30	20	20	30	20
			4	70	80	80	70	80
			5	0	0	0	0	0
		EEIS CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	30	20	20	30	20
			4	70	80	80	70	80
			5	0	0	0	0	0
PLT	*Mirabilis macfarlanei*	EEIS BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	90	5	5	10	20
			4	10	90	90	80	70
			5	0	5	5	10	10
		EEIS CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	90	0	10	10	10
			4	10	50	50	60	70
			5	0	50	40	30	20
		UCRB BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	90	25	25	30	30
			4	10	70	70	65	70
			5	0	5	5	5	0
		UCRB CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	90	10	10	20	20
			4	10	80	80	70	70
			5	0	10	10	10	10
PLT	*Penstemon glaucinus*	EEIS BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	40	70	80	80	75
			4	60	30	20	20	25
			5	0	0	0	0	0
		EEIS CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	40	70	80	80	75
			4	60	30	20	20	25
			5	0	0	0	0	0

				Period/Outcome[4]				
Group[1]	**Species Name**	**Area[2]**	**Outcome[3]**	**H**	**C**	**1**	**2**	**3**
PLT	*Penstemon lemhiensis*	UCRB BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	70	40	40	90	40
			4	30	50	50	10	60
			5	0	10	10	0	0
		UCRB CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	70	30	30	80	40
			4	30	60	60	20	60
			5	0	10	10	0	0
PLT	*Polemonium pectinatum*	EEIS BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	0	0	0	0	0
			4	60	50	50	55	50
			5	40	50	50	45	50
		EEIS CumEff	1	0	0	0	0	0
			2	80	0	0	0	0
			3	20	0	0	0	0
			4	0	10	5	5	5
			5	0	90	95	95	95
PLT	*Silene spaldingii*	EEIS BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	0	0	0	10	0
			4	50	50	50	50	50
			5	50	50	50	40	50
		EEIS CumEff	1	0	0	0	0	0
			2	80	0	0	0	0
			3	20	0	0	0	0
			4	0	20	10	10	10
			5	0	80	90	90	90
PLT	*Stephanomeria malheurensis*	EEIS BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	0	0	0	0	0
			4	0	0	0	0	0
			5	100	100	100	100	100
PLT	*Trifolium thompsonii*	EEIS BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	50	50	40	50	45
			4	50	50	60	50	55
			5	0	0	0	0	0
		EEIS CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	50	50	45	55	50
			4	50	50	55	45	50
			5	0	0	0	0	0
		Amphibians and Reptiles						
AMP	Coeur d'alene salamander	UCRB BLM/FS[5]	1	0	0	0	00	
			2	0	0	0	0	0
			3	40	3	0	5	10
			4	50	63	45	70	75
			5	10	33	55	25	15
		UCRB CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	40	3	0	0	3
			4	50	57	15	28	45
			5	10	40	85	72	52
AMP	Spotted frog species B	EEIS BLM/FS	1	20	0	0	0	0
			2	30	0	0	0	0
			3	35	60	30	65	73
			4	10	30	50	25	20
			5	5	10	20	10	8

Group[1]	Species Name	Area[2]	Outcome[3]	Period/Outcome[4] H	C	1	2	3
		EEIS CumEff	1	20	0	0	0	0
			2	30	0	0	0	0
			3	35	60	25	58	65
			4	10	30	55	30	25
			5	5	10	20	13	10
		UCRB BLM/FS	1	25	0	0	0	3
			2	50	20	5	20	23
			3	15	50	40	55	58
			4	10	30	50	25	18
			5	0	0	5	0	0
		UCRB CumEff	1	25	0	0	0	0
			2	50	20	0	18	20
			3	15	50	40	50	55
			4	10	30	55	33	25
			5	0	0	5	0	0
AMP	Northern leopard frog	EEIS BLM/FS[5]	1	0	0	0	0	0
			2	17	0	0	0	0
			3	50	17	0	15	20
			4	33	20	27	30	30
			5	0	63	73	55	50
		EEISCumEff	1	0	0	0	0	0
			2	17	0	0	0	0
			3	50	17	0	0	0
			4	33	20	3	8	15
			5	0	63	97	92	85
		UCRB BLM/FS[5]	1	3	0	0	0	0
			2	33	0	0	0	5
			3	33	0	0	20	30
			4	30	30	7	33	35
			5	0	70	93	47	30
		UCRB CumEff	1	3	0	0	0	0
			2	33	0	0	0	0
			3	33	0	0	0	0
			4	30	23	3	5	15
			5	0	77	97	95	85
AMP	Spotted frog species A	EEIS BLM/FS[5]	1	0	0	0	0	0
			2	60	0	0	10	20
			3	30	50	20	50	55
			4	10	40	50	35	20
			5	0	10	30	5	5
		EEIS CumEff	1	0	0	0	0	0
			2	60	0	0	0	0
			3	30	50	20	45	50
			4	10	40	50	40	40
			5	0	10	30	15	10
AMP	Tailed frog	EEIS BLM/FS	1	0	0	0	0	0
			2	50	25	0	30	38
			3	25	45	13	40	35
			4	20	18	65	18	18
			5	5	13	23	13	10
		EEIS CumEff	1	0	0	0	0	0
			2	50	25	0	0	0
			3	25	45	8	45	55
			4	20	18	25	38	33
			5	5	13	68	18	13
		UCRB BLM/FS	1	0	0	0	0	0
			2	47	23	3	27	35
			3	28	43	18	42	37
			4	22	22	57	22	22
			5	3	12	22	10	7
		UCRB CumEff	1	0	0	0	0	0
			2	47	23	3	5	7
			3	28	43	20	45	50
			4	22	22	27	37	32
			5	3	12	50	13	12

				Period/Outcome[4]				
Group[1]	**Species Name**	**Area[2]**	**Outcome[3]**	**H**	**C**	**1**	**2**	**3**
AMP	Western toad	EEIS BLM/FS	1	40	10	0	15	25
			2	45	50	20	53	50
			3	15	35	20	33	25
			4	0	5	60	0	0
			5	0	0	0	0	0
		EEIS CumEff	1	40	0	0	0	0
			2	45	20	5	18	23
			3	15	45	15	40	40
			4	0	25	20	35	30
			5	0	10	60	8	8
		UCRB BLM/FS	1	27	7	0	10	17
			2	43	45	15	40	40
			3	23	33	23	33	30
			4	7	13	55	13	12
			5	0	2	7	3	2
		UCRB CumEff	1	27	0	0	0	0
			2	43	18	3	12	17
			3	23	40	20	35	35
			4	7	30	23	37	33
			5	0	12	53	17	15
AMP	Woodhouse's toad	EEIS BLM/FS[5]	1	0	0	0	0	0
			2	55	0	0	10	15
			3	40	25	5	25	35
			4	5	65	45	50	45
			5	0	10	50	15	5
		EEIS CumEff	1	0	0	0	0	0
			2	55	0	0	0	0
			3	40	25	0	0	0
			4	5	65	30	50	55
			5	0	10	70	50	45
		UCRB BLM/FS[5]	1	0	0	0	0	0
			2	25	0	0	10	15
			3	50	30	5	25	35
			4	25	65	55	50	45
			5	0	5	40	15	5
		UCRB CumEff	1	0	0	0	0	0
			2	25	0	0	0	0
			3	50	30	0	0	0
			4	25	65	30	43	45
			5	0	5	70	58	55
REP	Common garter snake	EEIS BLM/FS	1	50	0	0	0	0
			2	50	50	0	50	50
			3	0	50	50	50	50
			4	0	0	50	0	0
			5	0	0	0	0	0
		EEIS CumEff	1	50	0	0	0	0
			2	50	0	0	0	0
			3	0	50	0	50	50
			4	0	50	50	50	50
			5	0	0	50	0	0
		UCRB BLM/FS	1	50	0	0	0	0
			2	50	50	23	50	53
			3	0	40	40	40	43
			4	0	10	38	10	5
			5	0	0	0	0	0
		UCRB CumEff	1	50	0	0	0	0
			2	50	25	20	23	25
			3	0	40	18	43	40
			4	0	35	38	35	35
			5	0	0	25	0	0
REP	Desert horned lizard	EEIS BLM/FS	1	50	45	40	45	50
			2	50	55	60	55	50
			3	0	0	0	0	0
			4	0	0	0	0	0
			5	0	0	0	0	0

Group[1]	Species Name	Area[2]	Outcome[3]	H	C	1	2	3
				Period/Outcome[4]				
		EEIS CumEff	1	50	45	40	45	50
			2	50	55	60	55	50
			3	0	0	0	0	0
			4	0	0	0	0	0
			5	0	0	0	0	0
		UCRB BLM/FS	1	50	45	40	45	50
			2	50	55	60	55	50
			3	0	0	0	0	0
			4	0	0	0	0	0
			5	0	0	0	0	0
		UCRB CumEff	1	50	45	40	45	50
			2	50	55	60	55	50
			3	0	0	0	0	0
			4	0	0	0	0	0
			5	0	0	0	0	0
REP	Longnose leopard lizard	EEIS BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	50	30	20	30	35
			4	50	60	60	60	55
			5	0	10	20	10	10
		EEIS CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	50	25	20	25	30
			4	50	60	55	60	60
			5	0	15	25	15	10
		UCRB BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	50	30	20	30	35
			4	50	60	60	60	55
			5	0	10	20	10	10
		UCRB CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	50	25	20	25	30
			4	50	60	55	60	60
			5	0	15	25	15	10
REP	Mojave-collared lizard	UCRB BLM/FS	1	0	0	0	0	0
			2	50	30	20	30	35
			3	50	60	60	60	55
			4	0	10	20	10	10
			5	0	0	0	0	0
		UCRB CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	50	40	20	25	30
			4	20	40	40	60	60
			5	30	20	40	15	10
REP	Night snake	EEIS BLM/FS	1	50	50	50	50	50
			2	50	50	50	50	50
			3	0	0	0	0	0
			4	0	0	0	0	0
			5	0	0	0	0	0
		EEIS CumEff	1	50	0	0	0	0
			2	50	50	50	50	50
			3	0	50	50	50	50
			4	0	0	0	0	0
			5	0	0	0	0	0
		UCRB BLM/FS	1	50	45	40	45	50
			2	50	55	60	55	50
			3	0	0	0	0	0
			4	0	0	0	0	0
			5	0	0	0	0	0
		UCRB CumEff	1	50	40	35	40	45
			2	50	60	65	60	55
			3	0	0	0	0	0
			4	0	0	0	0	0
			5	0	0	0	0	0

Group[1]	Species Name	Area[2]	Outcome[3]	Period/Outcome[4] H	C	1	2	3
REP	Painted turtle	EEIS BLM/FS	1	5	0	0	0	5
			2	50	40	15	45	50
			3	45	55	50	50	45
			4	0	5	35	5	0
			5	0	0	0	0	0
		EEIS CumEff	1	5	0	0	0	0
			2	50	20	10	20	20
			3	45	35	20	40	45
			4	0	45	40	40	35
			5	0	0	30	0	0
		UCRB BLM/FS	1	0	0	0	0	0
			2	50	35	18	40	50
			3	50	65	58	60	50
			4	0	0	25	0	0
			5	0	0	0	0	0
		UCRB CumEff	1	0	0	0	0	0
			2	50	15	10	13	18
			3	50	35	20	40	45
			4	0	50	45	48	38
			5	0	0	25	0	0
REP	Rubber boa	EEIS BLM/FS	1	0	0	0	0	0
			2	50	0	0	10	30
			3	50	50	10	50	50
			4	0	50	90	40	20
			5	0	0	0	0	0
		EEIS CumEff	1	0	0	0	0	0
			2	50	0	0	0	0
			3	50	50	0	10	30
			4	0	50	10	50	50
			5	0	0	90	40	20
		UCRB BLM/FS	1	0	0	0	0	0
			2	25	0	0	5	15
			3	50	48	25	48	50
			4	25	53	75	48	35
			5	0	0	0	0	0
		UCRB CumEff	1	0	0	0	0	0
			2	25	0	0	0	0
			3	50	45	15	25	38
			4	25	55	40	55	53
			5	0	0	45	20	10
REP	Sagebrush lizard	EEIS BLM/FS	1	50	50	50	50	50
			2	50	50	50	50	50
			3	0	0	0	0	0
			4	0	0	0	0	0
			5	0	0	0	0	0
		EEIS CumEff	1	50	0	0	0	0
			2	50	50	50	50	50
			3	0	50	50	50	50
			4	0	0	0	0	0
			5	0	0	0	0	0
		UCRB BLM/FS	1	50	40	35	40	45
			2	50	60	65	60	55
			3	0	0	o	0	0
			4	0	0	0	0	0
			5	0	0	0	0	0
		UCRB CumEff	1	50	30	20	25	30
			2	50	40	35	40	40
			3	0	30	45	35	30
			4	0	0	0	0	0
			5	0	0	0	0	0
REP	Sharptail snake	EEIS BLM/FS[5]	1	0	0	0	0	0
			2	0	0	0	0	0
			3	50	0	0	10	30
			4	50	50	30	45	50
			5	0	50	70	45	20

Group[1]	Species Name	Area[2]	Outcome[3]	H	C	1	2	3
				Period/Outcome[4]				
		EEIS CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	50	0	0	0	0
			4	50	50	0	10	50
			5	0	50	100	90	50
REP	Short-horned lizard	EEIS BLM/FS	1	50	50	50	50	50
			2	50	50	50	50	50
			3	0	0	0	0	0
			4	0	0	0	0	0
			5	0	0	0	0	0
		EEIS CumEff	1	50	0	0	0	0
			2	50	50	50	50	50
			3	0	50	50	50	50
			4	0	0	0	0	0
			5	0	0	0	0	0
		UCRB BLM/FS	1	50	40	30	40	45
			2	50	60	70	60	55
			3	0	0	0	0	0
			4	0	0	0	0	0
			5	0	0	0	0	0
		UCRB CumEff	1	50	35	30	35	45
			2	50	65	70	65	55
			3	0	0	0	0	0
			4	0	0	0	0	0
			5	0	0	0	0	0
REP	Striped whipsnake	EEIS BLM/FS	1	50	50	50	50	50
			2	50	50	50	50	50
			3	0	0	0	0	0
			4	0	0	0	0	0
			5	0	0	0	0	0
		EEIS CumEff	1	50	0	0	0	0
			2	50	50	50	50	50
			3	0	50	50	50	50
			4	0	0	0	0	0
			5	0	0	0	0	0
		UCRB BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	50	35	30	35	40
			4	50	55	55	55	50
			5	0	10	15	10	10
		UCRB CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	50	35	30	30	35
			4	50	55	55	60	55
			5	0	10	15	10	10
REP	Western pond turtle	EEIS BLM/FS	1	40	10	0	20	20
			2	30	30	30	40	40
			3	30	50	50	40	40
			4	0	10	10	0	0
			5	0	0	10	0	0
		EEIS CumEff	1	40	0	0	0	0
			2	30	0	0	0	0
			3	30	10	0	10	10
			4	0	20	10	20	20
			5	0	70	90	70	70
Habitat and Species Groups - Waterbirds and Shorebirds								
WAT	1: Open water birds	EEIS BLM/FS	1	0	0	0	0	0
			2	7	2	0	7	1
			3	91	46	37	65	53
			4	2	46	48	24	41
			5	0	6	15	4	5

				Period/Outcome[4]				
Group[1]	Species Name	Area[2]	Outcome[3]	H	C	1	2	3
		EEIS CumEff	1	0	0	0	0	0
			2	2	3	0	9	2
			3	90	51	43	59	53
			4	8	38	44	28	40
			5	0	8	13	4	5
		UCRB BLM/FS	1	0	0	0	0	0
			2	2	1	0	6	2
			3	80	61	36	67	65
			4	18	28	48	22	31
			5	0	10	16	5	2
		UCRB CumEff	1	0	0	0	0	0
			2	4	6	2	2	4
			3	78	59	38	60	61
			4	18	27	46	24	33
			5	0	8	14	4	2
WAT	2: Common loon	EEIS BLM/FS	1	0	0	0	0	0
			2	0	0	0	4	4
			3	26	39	28	40	36
			4	74	61	60	56	60
			5	0	0	12	0	0
		EEIS CumEff	1	0	0	0	0	0
			2	6	16	10	16	16
			3	36	40	34	41	40
			4	58	44	46	43	44
			5	0	0	10	0	0
		UCRB BLM/FS	1	0	0	0	0	0
			2	0	0	0	4	4
			3	18	45	34	44	42
			4	82	55	54	52	54
			5	0	0	12	0	0
		UCRB CumEff	1	0	0	0	0	0
			2	0	16	14	16	16
			3	37	35	24	34	33
			4	63	49	49	50	51
			5	0	0	13	0	0
WAT	3: Wood duck, mergansers	EEIS BLM/FS	1	0	0	0	0	0
			2		12	6	25	15
			3	40	36	36	42	41
			4	58	42	42	29	38
			5	0	10	16	4	6
		EEIS CumEff	1	0	0	0	0	0
			2	1	9	5	22	13
			3	36	34	33	41	41
			4	63	46	39	33	40
			5	0	11	23	4	6
		UCRB BLM/FS	1	0	5	2	6	5
			2	16	23	18	29	27
			3	74	45	38	46	43
			4	10	19	28	15	19
			5	0	8	14	4	6
		UCRB CumEff	1	0	6	5	6	6
			2	16	18	15	23	22
			3	72	44	30	51	42
			4	12	24	31	17	18
			5	0	8	19	3	12
WAT	4: Goldeneyes	EEIS BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	40	24	10	44	30
			4	60	70	61	54	64
			5	0	6	29	2	6
		EEIS CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	41	30	15	42	29
			4	59	65	65	56	65
			5	0	5	20	2	6

				Period/Outcome[4]				
Group[1]	Species Name	Area[2]	Outcome[3]	H	C	1	2	3
		UCRB BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	50	34	12	53	38
			4	50	62	65	43	60
			5	0	4	23	4	2
		UCRB CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	51	30	15	46	36
			4	49	63	64	50	62
			5	0	7	21	4	2
WAT	5: Western snowy plover	EEIS BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	0	0	0	0	0
			4	100	100	88	97	100
			5	0	0	12	3	0
		EEIS CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	0	0	0	0	0
			4	100	90	82	90	90
			5	0	10	18	10	10
WAT	6: Harlequin duck	EEIS BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	60	0	0	50	19
			4	40	50	19	50	57
			5	0	50	81	0	24
		EEIS CumEff	1	0	0	0	0	0
				0	0	0	0	0
			3	70	0	0	45	14
			4	30	43	15	55	57
			5	0	57	85	0	29
		UCRB BLM/FS	1	0	0	0	0	0
			2	20	0	0	0	0
			3	40	0	0	60	19
			4	40	50	21	32	57
			5	0	50	79	8	24
		UCRB CumEff	1	0	0	0	0	0
			2	20	0	0	0	0
			3	40	0	0	52	15
			4	40	41	17	34	59
			5	0	59	83	14	26
WAT	7: Herons, egrets	EEIS BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	100	64	61	76	61
			4	0	30	35	20	34
			5	0	6	4	4	5
		EEIS CumEff	1	0	0	0	0	0
			2	0	4	2	6	5
			3	100	69	60	71	59
			4	0	19	34	19	31
			5	0	8	4	4	5
		UCRB BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	80	68	55	74	68
			4	20	28	39	23	30
			5	0	4	6	3	2
		UCRB CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	82	67	53	68	64
			4	18	29	41	28	34
			5	0	4	6	4	2
WAT	8: Dabbling ducks	EEIS BLM/FS	1	0	0	0	0	0
			2	30	12	9	11	11
			3	70	58	46	73	65
			4	0	28	41	16	24
			5	0	2	4	0	0

Group[1]	Species Name	Area[2]	Outcome[3]	H	C	1	2	3
				Period/Outcome[4]				
		EEIS CumEff	1	0	0	0	0	0
			2	44	16	12	15	13
			3	56	57	42	67	66
			4	0	25	42	18	21
			5	0	2	4	0	0
		UCRB BLM/FS	1	0	0	0	0	0
			2	18	4	3	12	5
			3	80	60	47	66	61
			4	2	35	45	22	34
			5	0	1	5	0	0
		UCRB CumEff	1	0	0	0	0	0
			2	25	8	7	9	8
			3	75	58	43	63	56
			4	0	31	44	28	36
			5	0	3	6	0	0
WAT	9: Spotted sandpiper	EEIS BLM/FS	1	0	0	0	0	0
			2	46	54	43	51	52
			3	54	46	51	49	48
			4	0	0	6	0	0
			5	0	0	0	0	0
		EEIS CumEff	1	0	0	0	0	0
			2	50	55	51	55	56
			3	50	45	43	45	44
			4	0	0	6	0	0
			5	0	0	0	0	0
		UCRB BLM/FS	1	0	0	0	0	0
			2	48	54	43	51	52
			3	52	46	51	49	48
			4	0	0	6	0	0
			5	0	0	0	0	0
		UCRB CumEff	1	0	0	0	0	0
			2	52	54	51	59	60
			3	48	46	43	41	40
			4	0	0	6	0	0
			5	0	0	0	0	0
WAT	10: Greater sandhill crane	EEIS BLM/FS	1	0	0	0	0	0
			2	5	0	0	3	0
			3	80	50	34	69	50
			4	15	50	65	29	50
			5	0	0	1	0	0
		EEIS CumEff	1	0	0	0	0	0
			2	8	3	4	5	3
			3	79	56	39	70	54
			4	14	41	56	25	44
			5	0	0	1	0	0
		UCRB BLM/FS	1	0	0	0	0	0
			2	11	10	3	10	5
			3	73	61	46	68	53
			4	16	29	51	23	43
			5	0	0	0	0	0
		UCRB CumEff	1	0	0	0	0	0
			2	13	5	3	8	4
			3	71	63	45	70	51
			4	16	33	53	23	45
			5	0	0	0	0	0
WAT	11: Rails, avocets	EEIS BLM/FS	1	0	0	0	0	0
			2	0	0	0	1	0
			3	69	54	36	69	52
			4	31	46	54	30	46
			5	0	0	10	0	2

				Period/Outcome[4]				
Group[1]	Species Name	Area[2]	Outcome[3]	H	C	1	2	3
		EEIS CumEff	1	0	0	0	0	0
			2	8	2	2	3	2
			3	64	55	36	70	52
			4	28	43	53	27	44
			5	0	0	9	0	2
		UCRB BLM/FS	1	0	0	0	0	0
				0	0	0	0	0
			3	59	45	31	63	43
			4	41	55	60	37	56
			5	0	0	9	0	1
		UCRBCumEff	1	0	0	0	0	0
			2	4	2	2	3	2
			3	64	50	34	69	50
			4	32	48	56	28	47
			5	0	0	8	0	1
WAT	12: Curlew, willet	EEIS BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	28	10	3	21	9
			4	73	90	95	79	89
			5	0	0	3	0	3
		EEIS CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	33	14	5	24	13
			4	68	86	93	76	85
			5	0	0	3	0	3
		UCRB BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	28	10	3	18	9
			4	73	90	95	83	89
			5	0	0	3	0	3
		UCRB CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	33	14	5	24	13
			4	68	86	93	76	85
			5	0	0	3	0	3
WAT	13: Upland sandpiper	EEIS BLM/FS[5]	1	2	0	0	0	0
			2	68	0	0	0	0
			3	30	0	0	0	0
			4	0	0	0	25	15
			5	0	100	100	75	85
		EEIS CumEff	1	2	0	0	0	0
			2	66	0	0	0	0
			3	32	0	0	0	0
			4	0	0	0	12	2
			5	0	100	100	88	98
		UCRB BLM/FS[5]	1	0	0	0	0	0
			2	66	0	0	0	0
			3	34	0	0	0	0
			4	0	0	0	25	15
			5	0	100	100	75	85
		UCRB CumEff	1	0	0	0	0	0
			2	66	0	0	0	0
			3	34	0	0	0	0
			4	0	0	0	12	2
			5	0	100	100	88	98
WAT	14: Common snipe	EEIS BLM/FS	1	0	0	0	0	0
			2	20	12	9	20	15
			3	74	68	55	67	63
			4	6	20	34	13	22
			5	0	0	2	0	0
		EEIS CumEff	1	0	0	0	0	0
			2	18	12	10	18	14
			3	76	66	53	68	62
			4	6	22	35	14	24
			5	0	0	2	0	0

Group[1]	Species Name	Area[2]	Outcome[3]	H	C	1	2	3
				Period/Outcome[4]				
		UCRB BLM/FS	1	0	0	0	0	0
			2	20	12	9	20	15
			3	74	68	55	67	63
			4	6	20	34	13	22
			5	0	0	2	0	0
		UCRB CumEff	1	0	0	0	0	0
			2	18	12	10	18	14
			3	76	66	53	68	62
			4	6	22	35	14	24
			5	0	0	2	0	0
WAT	15: Migrant sandpipers	EEIS BLM/FS	1	32	20	15	25	24
			2	52	51	48	48	48
			3	16	29	35	27	28
			4	0	0	2	0	0
			5	0	0	0	0	0
		EEIS CumEff	1	36	25	17	26	25
			2	50	53	53	53	53
			3	14	22	28	21	22
			4	0	0	2	0	0
			5	0	0	0	0	0
		UCRB BLM/FS	1	28	12	5	22	12
			2	57	59	57	54	59
			3	15	29	36	24	29
			4	0	0	2	0	0
			5	0	0	0	0	0
		UCRB CumEff	1	35	24	13	25	22
			2	51	55	56	56	57
			3	14	21	29	19	21
			4	0	0	2	0	0
			5	0	0	0	0	0
		Raptors and Gamebirds						
GMB	Band-tailed pigeon	EEIS BLM/FS	1	34	4	2	16	4
			2	31	28	26	23	33
			3	32	40	42	43	39
			4	3	24	30	18	24
			5	0	4	0	0	0
		EEIS CumEff	1	36	2	1	15	3
			2	28	26	25	21	31
			3	33	42	41	39	40
			4	3	24	33	25	26
			5	0	6	0	0	0
		UCRB BLM/FS	1	0	0	0	0	4
			2	2	4	4	16	12
			3	22	22	36	29	30
			4	48	36	44	46	44
			5	28	38	16	9	10
		UCRB CumEff	1	0	0	0	0	0
			2	2	2	2	16	16
			3	24	22	36	27	28
			4	47	36	44	46	44
			5	27	40	18	11	12
GMB	Blue grouse	EEIS BLM/FS	1	42	16	14	27	22
			2	44	50	44	56	60
			3	14	34	36	17	18
			4	0	0	6	0	0
			5	0	0	0	0	0
		EEIS CumEff	1	44	16	16	27	23
			2	42	49	42	56	59
			3	14	35	36	17	18
			4	0	0	6	0	0
			5	0	0	0	0	0
		UCRB BLM/FS	1	54	14	17	29	25

Group[1]	Species Name	Area[2]	Outcome[3]	Period/Outcome[4] H	C	1	2	3
				44	50	41	54	57
			3	2	36	37	17	18
			4	0	0	5	0	0
			5	0	0	0	0	0
		UCRB CumEff	1	56	14	17	29	25
			2	44	50	43	55	59
			3	0	36	40	16	16
			4	0	0	0	0	0
			5	0	0	0	0	0
GMB	Columbian sharp-tailed grouse	EEIS BLM/FS	1	74	0	0	0	0
			2	26	0	0	2	2
			3	0	2	2	16	6
			4	0	20	32	58	45
			5	0	78	66	24	47
		EEIS CumEff	1	76	0	0	0	0
			2	24	0	0	4	4
			3	0	2	2	22	10
			4	0	32	39	52	41
			5	0	66	59	22	45
		UCRB BLM/FS	1	62	0	0	0	0
			2	38	0	0	2	2
			3	0	2	2	16	6
			4	0	32	37	59	45
			5	0	66	61	23	47
		UCRB CumEff	1	66	0	0	0	0
			2	34	0	0	2	2
			3	0	2	2	24	12
			4	0	36	42	53	41
			5	0	62	56	21	45
GMB	Mountain quail	EEIS BLM/FS	1	0	0	0	0	0
			2	62	2	0	8	6
			3	22	27	28	42	42
			4	16	54	47	43	38
			5	0	17	25	7	14
		EEIS CumEff	1	0	0	0	0	0
			2	68	2	0	0	0
			3	26	36	33	55	47
			4	6	57	59	45	51
			5	0	5	8	0	
		UCRB BLM/FS	1	0	0	0	0	0
			2	18	0	0	0	0
			3	38	0	2	12	8
			4	32	18	22	36	29
			5	2	82	76	52	63
		UCRB CumEff	1	0	0	0	0	0
			2	24	0	0	0	0
			3	37	2	3	12	8
			4	35	22	24	43	33
			5	4	76	73	45	59
GMB	Sage grouse	EEIS BLM/FS	1	42	0	0	16	5
			2	54	16	8	47	43
			3	4	52	47	33	42
			4	0	28	41	4	10
			5	0	4	4	0	0
		EEIS CumEff	1	48	0	0	14	5
			2	49	22	10	49	43
			3	3	49	48	34	43
			4	0	25	38	3	9
			5	0	4	4	0	0
		UCRB BLM/FS	1	44	0	0	20	5
			2	52	18	10	42	41
			3	4	56	49	34	42
			4	0	24	39	4	12
			5	0	2	2	0	0

Group[1]	Species Name	Area[2]	Outcome[3]	H	C	1	2	3
				Period/Outcome[4]				
		UCRB CumEff	1	50	0	0	14	3
			2	47	22	10	48	42
			3	3	53	50	35	44
			4	0	23	38	3	11
			5	0	2	2	0	0
RAP	Bald eagle	EEIS BLM/FS	1	0	0	0	0	0
			2	32	6	10	19	16
			3	60	42	52	70	70
			4	8	42	30	11	14
			5	0	10	8	0	0
		EEIS CumEff	1	0	0	0	0	0
			2	44	0	8	23	21
			3	50	45	49	66	66
			4	6	43	33	11	13
			5	0	12	10	0	0
		UCRB BLM/FS	1	0	0	0	0	0
			2	32	6	10	19	16
			3	60	42	52	70	70
			4	8	42	30	11	14
			5	0	10	8	0	0
		UCRB CumEff	1	0	0	0	0	0
			2	44	0	8	23	21
			3	50	45	49	66	66
			4	6	43	33	11	13
			5	0	12	10	0	0
RAP	Barred owl	EEIS BLM/FS	1	0	12	6	0	8
			2	12	60	49	21	56
			3	56	28	33	42	32
			4	18	0	12	35	4
			5	14	0	0	2	0
		EEIS CumEff	1	0	6	8	6	0
			2	0	52	42	24	52
			3	6	42	38	41	36
			4	10	0	12	29	12
			5	84	0	0	0	0
		UCRB BLM/FS	1	2	2	8	6	10
			2	18	32	51	50	62
			3	58	38	35	34	26
			4	22	28	6	10	2
			5	0	0	0	0	0
		UCRB CumEff	1	0	2	12	10	8
			2	0	24	51	47	60
			3	0	34	31	33	22
			4	14	32	6	10	10
			5	86	8	0	0	0
RAP	Boreal owl	EEIS BLM/FS	1	2	0	0	0	2
			2	2	0	2	2	2
			3	24	18	16	28	38
			4	32	40	37	35	36
			5	40	42	45	35	22
		EEIS CumEff	1	0	0	0	0	2
			2	2	2	2	2	2
			3	16	16	17	20	29
			4	46	38	35	38	40
			5	36	44	46	40	27
		UCRB BLM/FS	1	2	0	2	2	3
			2	36	7	10	24	26
			3	36	42	34	36	40
			4	24	24	39	32	30
			5	2	27	15	6	1
		UCRB CumEff	1	0	0	2	2	3
			2	22	7	10	10	12
			3	38	40	36	45	49
			4	30	26	39	39	36
			5	10	27	13	4	0

Group[1]	Species Name	Area[2]	Outcome[3]	Period/Outcome[4] H	C	1	2	3
RAP	Burrowing owl	EEIS BLM/FS	1	56	0	0	0	0
			2	38	33	31	37	34
			3	6	42	44	44	45
			4	0	21	21	19	21
			5	0	4	4	0	0
		EEIS CumEff	1	70	0	0	0	0
			2	26	38	33	37	35
			3	4	43	48	46	43
			4	0	19	17	17	22
			5	0	0	2	0	0
		UCRB BLM/FS	1	52	0	0	0	0
			2	42	36	32	39	35
			3	6	40	42	44	45
			4	0	20	20	17	20
			5	0	4	6	0	0
		UCRB CumEff	1	65	0	0	0	0
			2	31	40	34	38	35
			3	4	41	49	47	45
			4	0	19	15	15	20
			5	0	0	2	0	0
RAP	Cooper's hawk	EEIS BLM/FS	1	34	14	12	30	30
			2	50	36	34	50	40
			3	14	48	50	20	28
			4	2	2	4	0	2
			5	0	0	0	0	0
		EEIS CumEff	1	38	19	18	36	35
			2	52	41	39	54	45
			3	10	40	41	10	20
			4	0	0	2	0	0
			5	0	0	0	0	0
		UCRB BLM/FS	1	34	15	15	31	31
			2	50	36	34	50	40
			3	14	47	47	19	27
			4	2	2	4	0	2
			5	0	0	0	0	0
		UCRB CumEff	1	38	16	16	32	32
			2	52	43	40	58	48
			3	10	41	42	10	20
			4	0	0	2	0	0
			5	0	0	0	0	0
RAP	Ferruginous hawk	EEIS BLM/FS	1	2	0	0	0	0
			2	66	24	23	52	44
			3	32	56	57	46	52
			4	0	18	18	2	4
			5	0	2	2	0	0
		EEIS CumEff	1	6	0	0	0	0
			2	70	29	32	55	49
			3	24	66	66	45	51
			4	0	5	2	0	0
			5	0	0	0	0	0
		UCRB BLM/FS	1	2	0	0	0	0
			2	64	22	21	50	42
			3	34	58	59	48	54
			4	0	18	18	2	4
			5	0	2	2	0	0
		UCRB CumEff	1	6	0	0	0	0
			2	70	29	32	55	49
			3	24	66	66	45	51
			4	0	5	2	0	0
			5	0	0	0	0	0
RAP	Flammulated owl	EEIS BLM/FS	1	1	0	0	0	0
			2	76	2	1	26	14
			3	21	40	20	60	51
			4	2	38	39	13	27
			5	0	20	40	1	8

Group[1]	Species Name	Area[2]	Outcome[3]	Period/Outcome[4] H	C	1	2	3
		EEIS CumEff	1	1	0	0	0	0
			2	76	2	1	25	13
			3	21	39	19	61	51
			4	2	39	38	13	28
			5	0	20	42	1	8
		UCRB BLM/FS	1	1	0	0	0	0
			2	76	2	1	26	14
			3	21	40	20	60	51
			4	2	38	39	13	27
			5	0	20	40	1	8
		UCRB CumEff	1	1	0	0	0	0
			2	76	2	1	26	14
			3	21	40	20	60	51
			4	2	38	39	13	27
			5	0	20	40	1	8
RAP	Great gray owl	EEIS BLM/FS	1	0	0	0	0	0
			2	10	4	0	2	2
			3	48	44	38	49	50
			4	36	32	40	45	30
			5	6	20	22	4	18
		EEIS CumEff	1	0	0	0	0	0
			2	13	7	4	8	8
			3	51	44	43	50	50
			4	30	29	31	38	24
			5	6	20	22	4	18
		UCRB BLM/FS	1	0	0	0	0	0
			2	20	6	14	22	23
			3	62	46	44	56	43
			4	16	38	34	22	32
			5	2	10	8	0	2
		UCRB CumEff	1	2	0	0	0	0
			2	22	8	18	24	27
			3	58	44	39	52	38
			4	16	39	35	24	33
			5	2	9	8	0	2
RAP	Long-eared owl	EEIS BLM/FS	1	0	0	0	0	0
			2	21	10	8	19	11
			3	53	38	33	46	41
			4	21	43	46	30	40
			5	5	10	14	5	8
		EEIS CumEff	1	0	0	0	0	0
			2	26	14	10	23	14
			3	51	46	41	53	49
			4	19	35	39	23	30
			5	4	5	10	3	8
		UCRB BLM/FS	1	0	0	0	0	0
			2	21	8	6	15	6
			3	53	38	33	48	43
			4	21	45	48	33	44
			5	5	10	14	5	8
		UCRB CumEff	1	0	0	0	0	0
			2	28	10	6	18	6
			3	50	48	43	50	48
			4	19	38	41	30	39
			5	4	5	10	3	8
RAP	Merlin	EEIS BLM/FS	1	0	0	0	0	0
			2	30	20	16	24	19
			3	50	49	46	54	54
			4	20	29	35	21	24
			5	0	2	3	1	3
		EEIS CumEff	1	0	0	0	0	0
			2	35	25	19	27	22
			3	52	47	50	51	52
			4	13	28	29	22	24
			5	0	0	2	0	2

Group[1]	Species Name	Area[2]	Outcome[3]	Period/Outcome[4]				
				H	C	1	2	3
		UCRB BLM/FS	1	0	0	0	0	0
			2	30	20	19	27	21
			3	51	53	48	53	57
			4	19	27	33	20	22
			5	0	0	0	0	0
		UCRB CumEff	1	0	0	0	0	0
			2	33	27	22	30	24
			3	53	50	53	51	56
			4	14	23	25	19	20
			5	0	0	0	0	0
RAP	Northern goshawk	EEIS BLM/FS	1	16	8	5	16	11
			2	54	46	35	48	44
			3	30	35	44	29	37
			4	0	11	16	7	8
			5	0	0	0	0	0
		EEIS CumEff	1	20	10	6	20	12
			2	55	51	39	50	47
			3	25	32	46	24	37
			4	0	7	9	6	4
			5	0	0	0	0	0
		UCRB BLM/FS	1	16	9	6	16	11
			2	56	38	33	47	49
			3	28	36	54	34	40
			4	0	17	7	3	0
			5	0	0	0	0	0
		UCRB CumEff	1	20	10	8	20	14
			2	52	44	35	42	43
			3	28	32	53	37	42
			4	0	14	4	1	1
			5	0	0	0	0	0
RAP	Northern pygmy-owl	EEIS BLM/FS	1	65	44	35	59	51
			2	35	53	60	40	46
			3	0	4	5	1	3
			4	0	0	0	0	0
			5	0	0	0	0	0
		EEIS CumEff	1	66	45	36	60	53
			2	34	53	60	40	46
			3	0	3	4	0	1
			4	0	0	0	0	0
			5	0	0	0	0	0
		UCRB BLM/FS	1	68	46	38	61	51
			2	33	50	58	38	46
			3	0	4	5	1	3
			4	0	0	0	0	0
			5	0	0	0	0	0
		UCRB CumEff	1	69	48	39	63	53
			2	31	50	58	38	46
			3	0	3	4	0	1
			4	0	0	0	0	0
			5	0	0	0	0	0
RAP	Northern saw-whet owl	EEIS BLM/FS	1	71	37	32	56	49
			2	27	56	58	38	44
			3	2	7	10	6	7
			4	0	0	0	0	0
			5	0	0	0	0	0
		EEIS CumEff	1	74	38	32	57	50
			2	24	56	60	39	45
			3	2	6	8	4	5
			4	0	0	0	0	0
			5	0	0	0	0	0
		UCRB BLM/FS	1	73	39	32	58	51
			2	27	54	60	38	42
			3	0	7	8	4	7
			4	0	0	0	0	0
			5	0	0	0	0	0

Group[1]	Species Name	Area[2]	Outcome[3]	H	C	1	2	3
				Period/Outcome[4]				
		UCRB CumEff	1	76	40	32	59	52
			2	24	54	62	39	43
			3	0	6	6	2	5
			4	0	0	0	0	0
			5	0	0	0	0	0
RAP	Swainsons hawk	EEIS BLM/FS	1	23	32	32	35	31
			2	59	51	53	52	55
			3	14	17	15	13	14
			4	4	0	0	0	0
			5	0	0	0	0	0
		EEIS CumEff	1	23	27	27	30	26
			2	59	51	53	55	58
			3	14	20	18	14	14
			4	4	2	2	1	2
			5	0	0	0	0	0
		UCRB BLM/FS	1	23	32	32	35	31
			2	53	51	53	52	55
			3	20	17	15	13	14
			4	4	0	0	0	0
			5	0	0	0	0	0
		UCRB CumEff	1	23	27	27	30	26
			2	53	51	53	55	58
			3	20	20	18	14	14
			4	4	2	2	1	2
			5	0	0	0	0	0
RAP	Western screech owl	EEIS BLM/FS	1	0	0	0	0	0
			2	56	33	22	46	43
			3	44	58	67	53	57
			4	0	9	11	1	0
			5	0	0	0	0	0
		EEIS CumEff	1	0	0	0	0	0
			2	61	29	20	48	47
			3	39	59	67	52	53
			4	0	12	13	0	0
			5	0	0	0	0	0
		UCRB BLM/FS	1	0	0	0	0	0
			2	56	33	22	46	43
			3	44	58	67	53	57
			4	0	9	11	1	0
			5	0	0	0	0	0
		UCRB CumEff	1	0	0	0	0	0
			2	59	31	22	47	45
			3	41	57	65	53	55
			4	0	12	13	0	0
			5	0	0	0	0	0
Woodpeckers, Nuthatches, and swifts								
CAV	Black-backed woodpecker	EEIS BLM/FS	1	0	0	0	0	0
			2	80	3	0	15	15
			3	20	83	19	73	80
			4	0	15	58	13	5
			5	0	0	24	0	0
		EEIS CumEff	1	0	0	0	0	0
			2	80	0	0	13	13
			3	20	80	16	70	73
			4	0	20	55	18	15
			5	0	0	29	0	0
		UCRB BLM/FS	1	0	0	0	0	0
			2	80	5	4	23	23
			3	20	80	16	68	73
			4	0	15	59	10	5
			5	0	0	21	0	0

Group[1]	Species Name	Area[2]	Outcome[3]	Period/Outcome[4]				
				H	C	1	2	3
		UCRB CumEff	1	0	0	0	0	0
			2	80	0	0	13	15
			3	20	80	15	68	70
			4	0	20	59	20	15
			5	0	0	26	0	0
CAV	Downy woodpecker	EEIS BLM/FS[5]	1	25	0	0	0	0
			2	75	30	10	25	18
			3	0	70	70	73	78
			4	0	0	20	3	5
			5	0	0	0	0	0
		EEIS CumEff[5]	1	25	0	0	0	0
			2	75	25	15	25	23
			3	0	75	75	73	75
			4	0	0	10	3	3
			5	0	0	0	0	0
		UCRB BLM/FS[5]	1	25	0	0	0	0
			2	75	33	3	25	13
			3	0	68	75	73	60
			4	0	0	23	3	8
			5	0	0	0	0	0
		UCRB CumEff[5]	1	25	0	0	0	0
			2	75	30	3	25	13
			3	0	70	80	73	80
			4	0	0	18	3	8
			5	0	0	0	0	0
CAV	Hairy woodpecker	EEIS BLM/FS	1	0	0	0	0	0
			2	88	80	45	58	80
			3	13	20	55	43	20
			4	0	0	0	0	0
			5	0	0	0	0	0
		EEIS CumEff	1	0	0	0	0	0
			2	85	89	43	60	70
			3	15	11	58	40	30
			4	0	0	0	0	0
			5	0	0	0	0	0
		UCRB BLM/FS	1	0	0	0	0	0
			2	88	85	50	60	83
			3	13	15	50	40	18
			4	0	0	0	0	0
			5	0	0	0	0	0
		UCRB CumEff	1	0	0	0	0	0
			2	88	85	45	63	75
			3	13	15	55	38	25
			4	0	0	0	0	0
			5	0	0	0	0	0
CAV	Lewis' woodpecker	EEIS BLM/FS	1	10	0	0	0	0
			2	47	10	0	53	43
			3	43	27	0	40	53
			4	0	63	50	7	3
			5	0	O	50	O	0
		EEIS CumEff	1	10	0	0	0	0
			2	27	10	0	17	17
			3	47	17	0	70	67
			4	17	47	23	13	17
			5	0	27	77	0	0
		UCRB BLM/FS	1	15	0	0	0	0
			2	45	15	0	45	35
			3	40	30	0	45	60
			4	0	55	50	10	5
			5	0	0	50	0	0
		UCRB CumEff	1	15	0	0	0	0
			2	15	15	0	0	0
			3	45	15	0	80	75
			4	25	30	25	20	25
			5	0	40	75	0	0

Group[1]	Species Name	Area[2]	Outcome[3]	Period/Outcome[4] H	C	1	2	3
CAV	Pileated woodpecker	EEIS BLM/FS[5]	1	0	0	0	0	0
			2	25	10	0	50	47
			3	43	40	3	50	53
			4	32	50	97	0	0
			5	0	0	0	0	0
		EEIS CumEff[5]	1	0	0	0	0	0
			2	25	10	0	50	47
			3	43	40	3	50	53
			4	32	50	97	0	0
			5	0	0	0	0	0
		UCRB BLM/FS[5]	1	0	0	0	0	0
			2	25	15	0	50	45
			3	50	35	3	50	55
			4	25	50	97	0	0
			5	0	0	0	0	0
		UCRB CumEff[5]	1	0	0	0	0	0
			2	25	15	0	50	45
			3	50	35	3	50	55
			4	25	50	97	0	0
			5	0	0	0	0	0
CAV	Pygmy nuthatch	EEIS BLM/FS	1	0	0	0	3	0
			2	88	13	0	40	20
			3	13	88	43	58	78
			4	0	0	55	0	3
			5	0	0	3	0	0
		EEIS CumEff	1	0	0	0	3	0
			2	88	13	0	40	20
			3	13	88	43	58	78
			4	0	0	55	0	3
			5	0	0	3	0	0
		UCRB BLM/FS	1	0	0	0	0	0
			2	88	3	0	40	20
			3	13	98	43	60	78
			4	0	0	55	0	3
			5	0	0	3	0	0
		UCRB CumEff	1	0	0	0	0	0
			2	88	3	0	40	20
			3	13	98	43	60	78
			4	0	0	55	0	3
			5	0	0	3	0	0
CAV	Red-naped sapsucker	EEIS BLM/FS	1	0	0	0	0	0
			2	100	0	0	30	19
			3	0	75	45	70	56
			4	0	25	30	0	25
			5	0	0	25	0	0
		EEIS CumEff	1	0	0	0	0	0
			2	100	0	0	25	14
			3	0	75	43	75	61
			4	0	25	33	0	25
			5	0	0	25	0	0
		UCRB BLM/FS	1	0	0	0	0	0
			2	100	0	0	30	19
			3	0	75	45	70	56
			4	0	25	30	0	25
			5	0	0	25	0	0
		UCRB CumEff	1	0	0	0	0	0
			2	100	0	0	25	14
			3	0	75	43	75	61
			4	0	25	33	0	25
			5	0	0	25	0	0
CAV	Three-toed woodpecker	EEIS BLM/FS	1	0	0	0	0	0
			2	45	10	0	5	15
			3	55	89	20	88	79
			4	0	1	60	8	6
			5	0	0	20	0	0

Group[1]	Species Name	Area[2]	Outcome[3]	Period/Outcome[4] H	C	1	2	3
		EEIS CumEff	1	0	0	0	0	0
			2	45	10	0	5	15
			3	55	88	20	88	79
			4	0	3	60	8	6
			5	0	0	20	0	0
		UCRB BLM/FS	1	0	0	0	0	0
			2	45	10	0	5	15
			3	55	89	20	88	81
			4	0	1	59	8	4
			5	0	0	21	0	0
		UCRB CumEff	1	0	0	0	0	0
			2	45	10	0	5	15
			3	55	88	20	88	81
			4	0	3	59	8	4
			5	0	0	21	0	0
CAV	Vaux's swift	EEIS BLM/FS[5]	1	0	0	0	0	0
			2	3	0	0	3	10
			3	23	27	0	27	87
			4	40	73	50	67	3
			5	33	0	50	3	0
		EEIS CumEff[5]	1	0	0	0	0	0
			2	0	0	0	0	0
			3	3	0	0	10	63
			4	57	93	25	70	33
			5	40	7	75	20	3
		UCRB BLM/FS[5]	1	0	0	0	0	0
			2	10	0	0	3	10
			3	23	20	0	27	87
			4	33	80	50	70	3
			5	33	0	50	0	0
		UCRB CumEff[5]	1	0	0	0	0	0
			2	0	0	0	0	0
			3	10	0	0	10	63
			4	57	87	25	70	33
			5	33	13	75	20	3
CAV	White-breasted nuthatch	EEIS BLM/FS	1	0	0	0	0	0
			2	88	8	0	20	18
			3	13	88	43	80	75
			4	0	5	55	0	8
			5	0	0	3	0	0
		EEIS CumEff	1	0	0	0	0	0
			2	88	8	0	23	18
			3	13	93	43	78	75
			4	0	0	55	0	8
			5	0	0	3	0	0
		UCRB BLM/FS	1	0	0	0	0	0
			2	83	10	0	27	23
			3	17	90	37	73	60
			4	0	0	63	0	17
			5	0	0	0	0	0
		UCRB CumEff	1	0	0	0	0	0
			2	83	10	0	27	23
			3	17	90	37	73	60
			4	0	0	63	0	17
			5	0	0	0	0	0
CAV	White-headed woodpecker	EEIS BLM/FS[5]	1	0	0	0	0	0
			2	63	0	0	33	23
			3	38	35	2	68	48
			4	0	53	78	0	30
			5	0	13	20	0	0
		EEIS CumEff[5]	1	0	0	0	0	0
			2	63	0	0	25	20
			3	38	35	2	75	50
			4	0	53	65	0	30
			5	0	13	33	0	0

Group[1]	Species Name	Area[2]	Outcome[3]	H	C	1	2	3
				Period/Outcome[4]				
		UCRB BLM/FS[5]	1	0	0	0	0	0
			2	63	0	0	30	28
			3	38	33	2	70	43
			4	0	55	78	0	30
			5	0	13	20	0	0
		UCRB CumEff[5]	1	0	0	0	0	0
			2	63	0	0	25	25
			3	38	33	2	75	45
			4	0	55	70	0	30
			5	0	13	28	0	0
CAV	Williamson's sapsucker	EEIS BLM/FS	1	0	0	0	0	0
			2	88	10	0	28	25
			3	13	70	25	63	65
			4	0	20	55	10	10
			5	0	0	20	0	0
		EEIS CumEff	1	0	0	0	0	0
			2	88	10	0	25	25
			3	13	70	25	65	63
			4	0	20	53	10	13
			5	0	0	23	0	0
		UCRB BLM/FS	1	0	0	0	0	0
			2	88	5	0	23	25
			3	13	75	28	55	65
			4	0	20	58	23	10
			5	0	0	15	0	0
		UCRB CumEff	1	0	0	0	0	0
			2	88	5	0	23	25
			3	13	75	28	53	63
			4	0	20	55	25	13
			5	0	0	18	0	0
		Cuckoos, Hummingbirds, and Passerines						
FOR	Black-chinned hummingbird	EEIS BLM/FS	1	0	0	0	0	0
			2	23	0	0	13	13
			3	78	90	70	70	70
			4	0	10	30	18	18
			5	0	0	0	0	0
		EEIS CumEff	1	0	0	0	0	0
			2	23	0	0	8	6
			3	78	85	53	63	65
			4	0	15	43	28	28
			5	0	0	5	3	1
		UCRB BLM/FS	1	0	0	0	0	0
			2	23	0	0	13	13
			3	78	90	70	70	70
			4	0	10	30	18	18
			5	0	0	0	0	0
		UCRB CumEff	1	0	0	0	0	0
			2	23	0	0	5	6
			3	78	85	53	63	65
			4	0	15	43	30	28
			5	0	0	5	3	1
FOR	Broad-tailed hummingbird	UCRB BLM/FS	1	3	0	0	0	0
			2	58	3	0	13	8
			3	40	70	53	68	69
			4	0	28	43	20	24
			5	0	0	5	0	0
		UCRB CumEff	1	3	0	0	0	0
			2	58	0	0	5	5
			3	40	58	45	63	61
			4	0	40	51	33	34
			5	0	3	4	0	0

Group[1]	Species Name	Area[2]	Outcome[3]	Period/Outcome[4] H	C	1	2	3
FOR	Chestnut-backed chickadee	EEIS BLM/FS	1	0	0	0	0	0
			2	0	0	0	20	37
			3	83	75	20	57	63
			4	17	25	80	23	0
			5	0	0	0	0	0
		EEIS CumEff	1	0	0	0	0	0
			2	0	0	0	20	37
			3	83	75	20	57	63
			4	17	25	80	23	0
			5	0	0	0	0	0
		UCRB BLM/FS	1	0	0	0	0	0
			2	17	0	0	20	37
			3	83	83	20	57	63
			4	0	17	80	23	0
			5	0	0	0	0	0
		UCRB CumEff	1	0	0	0	0	0
			2	17	0	0	20	37
			3	83	83	20	57	63
			4	0	17	80	23	0
			5	0	0	0	0	0
FOR	Hammond's flycatcher	EEIS BLM/FS	1	35	0	0	0	0
			2	65	0	0	20	23
			3	0	58	35	70	70
			4	0	43	60	10	8
			5	0	0	5	0	0
		EEIS CumEff	1	75	0	0	0	0
			2	25	0	0	10	13
			3	0	50	30	60	68
			4	0	50	60	30	20
			5	0	0	10	0	0
		UCRB BLM/FS	1	35	0	0	0	0
			2	65	0	0	20	23
			3	0	68	40	70	70
			4	0	33	55	10	8
			5	0	0	5	0	0
		UCRB CumEff	1	75	0	0	0	0
			2	25	0	0	10	13
			3	0	60	30	60	68
			4	0	40	60	30	20
			5	0	0	10	0	0
FOR	Lazuli bunting	EEIS BLM/FS	1	0	0	0	0	0
			2	38	24	18	37	39
			3	62	76	70	63	61
			4	0	0	12	0	0
			5	0	0	0	0	0
		EEIS CumEff	1	0	0	0	0	0
			2	38	20	14	23	23
			3	62	67	70	68	67
			4	0	13	16	9	10
			5	0	0	0	0	0
		UCRB BLM/FS	1	0	0	0	0	0
			2	64	44	36	52	51
			3	36	56	61	48	49
			4	0	0	3	0	0
			5	0	0	0	0	0
		UCRB CumEff	1	0	0	0	0	0
			2	64	26	16	28	28
			3	36	68	74	68	64
			4	0	6	10	4	8
			5	0	0	0	0	0
FOR	Olive-sided flycatcher	EEIS BLM/FS	1	80	0	0	0	0
			2	20	0	0	4	2
			3	0	64	51	77	77
			4	0	36	49	19	21
			5	0	0	0	0	0

Group[1]	Species Name	Area[2]	Outcome[3]	Period/Outcome[4] H	C	1	2	3
		EEIS CumEff	1	80	0	0	0	0
			2	20	0	0	0	0
			3	0	57	35	54	53
			4	0	43	63	46	47
			5	0	0	2	0	0
		UCRB BLM/FS	1	80	0	0	0	0
			2	20	0	0	10	6
			3	0	84	61	79	82
			4	0	16	39	11	12
			5	0	0	0	0	0
		UCRB CumEff	1	80	0	0	0	0
			2	20	0	0	0	0
			3	0	67	42	63	64
			4	0	33	58	37	36
			5	0	0	0	0	0
FOR	Rufous hummingbird	EEIS BLM/FS	1	0	0	0	0	0
			2	61	41	33	48	49
			3	39	59	50	53	51
			4	0	0	18	0	0
			5	0	0	0	0	0
		EEIS CumEff	1	0	0	0	0	0
			2	61	34	10	16	18
			3	39	59	50	65	64
			4	0	8	40	19	19
			5	0	0	0	0	0
		UCRB BLM/FS	1	0	0	0	0	0
			2	66	51	33	50	51
			3	34	49	48	50	49
			4	0	0	20	0	0
			5	0	0	0	0	0
		UCRB CumEff	1	0	0	0	0	0
			2	66	34	10	16	18
			3	34	59	50	65	64
			4	0	8	40	19	19
			5	0	0	0	0	0
FOR	Rufous-sided towhee	EEIS BLM/FS	1	0	0	0	0	0
			2	44	65	63	48	48
			3	56	35	37	52	52
			4	0	0	0	0	0
			5	0	0	0	0	0
		EEIS CumEff	1	0	0	0	0	0
			2	44	59	60	47	46
			3	56	41	40	53	54
			4	0	0	0	0	0
			5	0	0	0	0	0
		UCRB BLM/FS	1	0	0	0	0	0
			2	48	70	68	50	50
			3	52	30	32	50	50
			4	0	0	0	0	0
			5	0	0	0	0	0
		UCRB CumEff	1	0	0	0	0	0
			2	48	63	64	49	48
			3	52	37	36	51	52
			4	0	0	0	0	0
			5	0	0	0	0	0
FOR	Western bluebird	EEIS BLM/FS	1	0	0	0	0	0
			2	88	3	10	63	45
			3	13	98	40	38	55
			4	0	0	40	0	0
			5	0	0	10	0	0
		EEIS CumEff	1	0	0	0	0	0
			2	88	0	0	49	29
			3	13	98	40	36	51
			4	0	3	40	15	20
			5	0	0	20	0	0

Group[1]	Species Name	Area[2]	Outcome[3]	Period/Outcome[4] H	C	1	2	3
		UCRB BLM/FS	1	0	0	0	0	0
			2	88	3	10	63	43
			3	13	98	40	38	58
			4	0	0	40	0	0
			5	0	0	10	0	0
		UCRB CumEff	1	0	0	0	0	0
			2	88	0	0	49	26
			3	13	98	40	36	54
			4	0	3	40	15	20
			5	0	0	20	0	0
FOR	Western tanager	EEIS BLM/FS	1	90	90	70	90	90
			2	10	10	30	10	10
			3	0	0	0	0	0
			4	0	0	0	0	0
			5	0	0	0	0	0
		EEIS CumEff	1	88	88	46	58	58
			2	12	12	40	34	34
			3	0	0	14	8	8
			4	0	0	0	0	0
			5	0	0	0	0	0
		UCRB BLM/FS	1	90	90	72	90	90
			2	10	10	28	10	10
			3	0	0	0	0	0
			4	0	0	0	0	0
			5	0	0	0	0	0
		UCRB CumEff	1	88	88	46	58	58
			2	12	12	40	34	34
			3	0	0	14	8	8
			4	0	0	0	0	0
			5	0	0	0	0	0
FOR	White-winged crossbill	EEIS BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	15
			3	100	100	65	85	85
			4	0	0	35	15	0
			5	0	0	0	0	0
		EEIS CumEff	1	0	0	0	0	0
			2	10	10	0	15	35
			3	90	90	75	70	65
			4	0	0	25	15	0
			5	0	0	0	0	0
		UCRB BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	15
			3	100	100	65	85	85
			4	0	0	35	15	0
			5	0	0	0	0	0
		UCRB CumEff	1	0	0	0	0	0
			2	10	10	0	15	35
			3	90	90	75	70	65
			4	0	0	25	15	0
			5	0	0	0	0	0
FOR	Wilson's warbler	EEIS BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	76	48	43	58	71
			4	24	52	57	42	29
			5	0	0	0	0	0
		EEIS CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	76	48	43	58	71
			4	24	52	57	42	29
			5	0	0	0	0	0
		UCRB BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	80	61	45	59	74
			4	20	39	55	41	26
			5	0	0	0	0	0

Group[1]	Species Name	Area[2]	Outcome[3]	H	C	1	2	3
				Period/Outcome[4]				
		UCRB CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	80	61	45	59	74
			4	20	39	55	41	26
			5	0	0	0	0	0
FOR	Winter wren	EEIS BLM/FS	1	5	0	0	0	0
			2	75	16	3	25	18
			3	20	68	43	55	48
			4	0	16	55	20	35
			5	0	0	0	0	0
		EEIS CumEff	1	5	0	0	0	0
			2	75	3	0	5	0
			3	20	53	33	53	43
			4	0	45	61	43	58
			5	0	0	6	0	0
		UCRB BLM/FS	1	10	0	0	0	0
			2	83	25	10	33	25
			3	8	68	55	55	49
			4	0	8	35	13	26
			5	0	0	0	0	0
		UCRB CumEff	1	10	0	0	0	0
			2	83	5	0	10	5
			3	8	63	30	50	43
			4	0	33	64	40	53
			5	0	0	6	0	0
GS	Black rosy finch	EEIS BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	0	0	0	0	0
			4	100	100	67	100	100
			5	0	0	33	0	0
		EEIS CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	0	0	0	0	0
			4	100	100	67	100	100
			5	0	0	33	0	0
		UCRB BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	0	0	0	0	0
			4	100	100	100	100	100
			5	0	0	0	0	0
		UCRB CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	0	0	0	0	0
			4	100	100	100	100	100
			5	0	0	0	0	0
GS	Bobolink	EEIS BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	30	0	0	6	4
			4	70	62	44	74	64
			5	0	38	56	20	32
		EEIS CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	62	0	0	10	4
			4	38	42	28	45	44
			5	0	58	72	45	52
		UCRB BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	66	6	2	18	16
			4	34	62	50	64	56
			5	0	32	48	18	28
		UCRB CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	66	0	0	12	12
			4	34	64	46	58	53
			5	0	36	54	30	35

Group[1]	Species Name	Area[2]	Outcome[3]	H	C	1	2	3
				Period/Outcome[4]				
GS	Brewer's blackbird	EEIS BLM/FS	1	92	90	65	89	86
			2	8	10	29	11	14
			3	0	0	6	0	0
			4	0	0	0	0	0
			5	0	0	0	0	0
		EEIS CumEff	1	92	57	20	26	23
			2	8	33	54	52	53
			3	0	10	26	22	24
			4	0	0	0	0	0
			5	0	0	0	0	0
		UCRB BLM/FS	1	92	90	65	89	86
			2	8	10	29	11	14
			3	0	0	6	0	0
			4	0	0	0	0	0
			5	0	0	0	0	0
		UCRB CumEff	1	92	57	30	26	23
			2	8	33	54	52	53
			3	0	10	16	22	24
			4	0	0	0	0	0
			5	0	0	0	0	0
GS	Brewer's sparrow	EEIS BLM/FS	1	71	60	2	4	0
			2	29	40	26	28	25
			3	0	0	58	54	54
			4	0	0	14	14	21
			5	0	0	0	0	0
		EEIS CumEff	1	75	12	0	0	0
			2	25	53	11	12	10
			3	0	32	57	50	48
			4	0	3	32	38	40
			5	0	0	0	0	2
		UCRB BLM/FS	1	64	22	2	4	0
			2	36	60	26	30	27
			3	0	14	56	50	52
			4	0	4	16	16	21
			5	0	0	0	0	0
		UCRB CumEff	1	68	0	0	0	0
			2	32	47	8	12	10
			3	0	45	53	50	48
			4	0	8	39	38	40
			5	0	0	0	0	2
GS	Grasshopper sparrow	EEIS BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	42	0	0	0	0
			4	58	6	6	21	8
			5	0	94	94	79	92
		EEIS CumEff	1	18	0	0	0	0
			2	74	0	0	0	0
			3	8	0	0	0	0
			4	0	6	6	19	8
			5	0	94	94	81	92
		UCRB BLM/FS	1	0	0	0	0	0
			2	26	0	0	0	0
			3	66	6	6	16	15
			4	8	86	80	73	74
			5	0	8	14	11	11
		UCRB CumEff	1	0	0	0	0	0
			2	40	0	0	2	0
			3	56	16	14	22	20
			4	4	82	84	74	80
			5	0	2	2	2	0
GS	Horned lark	EEIS BLM/FS	1	2	54	57	74	71
			2	42	46	43	26	29
			3	56	0	0	0	0
			4	0	0	0	0	0
			5	0	0	0	0	0

Group[1]	Species Name	Area[2]	Outcome[3]	Period/Outcome[4] H	C	1	2	3
		EEIS CumEff	1	2	51	10	11	11
			2	42	49	48	49	49
			3	56	0	42	40	40
			4	0	0	0	0	0
			5	0	0	0	0	0
		UCRB BLM/FS	1	2	54	57	74	74
			2	42	46	43	26	26
			3	56	0	0	0	0
			4	0	0	0	0	0
			5	0	0	0	0	0
		UCRB CumEff	1	2	51	10	11	11
			2	42	49	48	49	49
			3	56	0	42	40	40
			4	0	0	0	0	0
			5	0	0	0	0	0
GS	Lark sparrow	EEIS BLM/FS	1	67	58	2	4	0
			2	33	42	26	28	25
			3	0	0	58	54	54
			4	0	0	14	14	21
			5	0	0	0	0	0
		EEIS CumEff	1	71	2	0	0	0
			2	29	49	9	12	10
			3	0	42	59	56	56
			4	0	7	32	32	34
			5	0	0	0	0	0
		UCRB BLM/FS	1	60	20	2	4	0
			2	40	62	26	30	27
			3	0	14	56	50	52
			4	0	4	16	16	21
			5	0	0	0	0	0
		UCRB CumEff	1	64	0	0	0	0
			2	36	47	8	12	10
			3	0	45	53	50	54
			4	0	8	39	38	34
			5	0	0	0	0	2
GS	Loggerhead shrike	EEIS BLM/FS	1	34	11	1	4	2
			2	66	48	26	25	25
			3	0	41	45	44	42
			4	0	0	28	27	31
			5	0	0	0	0	0
		EEIS CumEff	1	34	8	0	0	0
			2	66	28	10	14	8
			3	0	40	40	53	28
			4	0	22	46	33	61
			5	0	2	4	0	3
		UCRB BLM/FS	1	34	11	1	3	2
			2	66	48	31	31	30
			3	0	41	43	41	38
			4	0	0	25	25	30
			5	0	0	0	0	0
		UCRB CumEff	1	34	8	0	0	0
			2	66	28	10	14	10
			3	0	40	42	55	29
			4	0	22	46	31	58
			5	0	2	2	0	3
GS	Sage sparrow	EEIS BLM/FS	1	77	66	7	10	2
			2	23	34	41	44	42
			3	0	0	46	40	48
			4	0	0	6	6	8
			5	0	0	0	0	0
		EEIS Cum/Eff	1	81	4	0	0	0
			2	19	56	19	22	20
			3	0	34	53	50	50
			4	0	6	28	28	30
			5	0	0	0	0	0

Group[1]	Species Name	Area[2]	Outcome[3]	H	C	1	2	3
				Period/Outcome[4]				
		UCRB BLM/FS	1	77	66	7	10	2
			2	23	34	41	44	42
			3	0	0	46	40	48
			4	0	0	6	6	8
			5	0	0	0	0	0
		UCRB CumEff	1	81	2	0	0	0
			2	19	58	19	22	20
			3	0	34	53	50	50
			4	0	6	28	28	30
			5	0	0	0	0	0
GS	Sage thrasher	EEIS BLM/FS	1	71	60	2	4	0
			2	29	40	26	28	25
			3	0	0	58	54	54
			4	0	0	14	14	21
			5	0	0	0	0	0
		EEIS CumEff	1	75	2	0	0	0
			2	25	51	12	15	14
			3	0	41	55	54	53
			4	0	6	33	31	33
			5	0	0	0	0	0
		UCRB BLM/FS	1	64	40	2	4	0
			2	36	44	26	30	27
			3	0	12	56	50	52
			4	0	4	16	16	21
			5	0	0	0	0	0
		UCRB CumEff	1	68	0	0	0	0
			2	32	51	10	15	12
			3	0	43	56	54	51
			4	0	6	34	31	35
			5	0	0	0	0	2
GS	Vesper sparrow	EEIS BLM/FS	1	80	64	30	35	30
			2	20	36	54	51	54
			3	0	0	16	14	16
			4	0	0	0	0	0
			5	0	0	0	0	0
		EEIS CumEff	1	86	40	4	6	4
			2	14	49	54	57	54
			3	0	11	42	37	42
			4	0	0	0	0	0
			5	0	0	0	0	0
		UCRB BLM/FS	1	80	66	30	35	30
			2	20	34	54	51	54
			3	0	0	16	14	16
			4	0	0	0	0	0
			5	0	0	0	0	0
		UCRB CumEff	1	86	40	4	6	4
			2	14	48	53	55	53
			3	0	12	43	39	43
			4	0	0	0	0	0
			5	0	0	0	0	0
GS	Western meadowlark	EEIS BLM/FS	1	92	90	60	70	60
			2	8	10	40	30	40
			3	0	0	0	0	0
			4	0	0	0	0	0
			5	0	0	0	0	0
		EEIS CumEff	1	92	90	41	49	43
			2	8	10	59	51	57
			3	0	0	0	0	0
			4	0	0	0	0	0
			5	0	0	0	0	0
		UCRB BLM/FS	1	92	90	60	70	60
			2	8	10	40	30	40
			3	0	0	0	0	0
			4	0	0	0	0	0
			5	0	0	0	0	0

Group[1]	Species Name	Area[2]	Outcome[3]	H	C	1	2	3
				Period/Outcome[4]				
		UCRB CumEff	1	92	90	41	49	43
			2	8	10	59	51	57
			3	0	0	0	0	0
			4	0	0	0	0	0
			5	0	0	0	0	0
RIP	Red-eyed vireo	EEIS BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	65	38	34	51	48
			4	35	63	66	49	53
			5	0	0	0	0	0
		EEIS CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	73	30	19	36	38
			4	28	70	81	64	63
			5	0	0	0	0	0
		UCRB BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	65	45	38	56	53
			4	35	55	63	44	48
			5	0	0	0	0	0
		UCRB CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	75	38	26	39	44
			4	25	63	74	61	56
			5	0	0	0	0	0
RIP	Red-winged blackbird	EEIS BLM/FS	1	2	0	0	0	0
			2	84	56	34	71	73
			3	14	44	66	29	27
			4	0	0	0	0	0
			5	0	0	0	0	0
		EEIS CumEff	1	2	0	0	0	0
			2	84	50	12	27	25
			3	14	50	67	62	64
			4	0	0	21	11	11
			5	0	0	0	0	0
		UCRB BLM/FS	1	2	0	0	0	0
			2	84	56	34	71	73
			3	14	44	66	29	27
			4	0	0	0	0	0
			5	0	0	0	0	0
		UCRB CumEff	1	2	0	0	0	0
			2	84	50	12	27	29
			3	14	50	67	62	60
			4	0	0	21	11	11
			5	0	0	0	0	0
RIP	Veery	EEIS BLM/FS	1	0	0	0	0	0
			2	28	4	4	8	8
			3	72	58	49	64	58
			4	0	38	47	28	34
			5	0	0	0	0	0
		EEIS CumEff	1	0	0	0	0	0
			2	28	2	2	4	2
			3	72	40	28	55	50
			4	0	58	70	41	48
			5	0	0	0	0	0
		UCRB BLM/FS	1	0	0	0	0	0
			2	62	6	5	10	10
			3	38	61	53	66	64
			4	0	33	42	24	26
			5	0	0	0	0	0
		UCRB CumEff	1	0	0	0	0	0
			2	62	4	2	6	4
			3	38	41	32	47	46
			4	0	55	66	47	50
			5	0	0	0	0	0

Group[1]	Species Name	Area[2]	Outcome[3]	Period/Outcome[4] H	C	1	2	3
RIP	Willow flycatcher	EEIS BLM/FS	1	0	0	0	0	0
			0	44	2	0	2	2
			3	56	56	40	54	55
			4	0	42	60	44	43
			5	0	0	0	0	0
		EEIS CumEff	1	0	0	0	0	0
			2	46	0	0	0	0
			3	54	42	27	42	38
			4	0	58	73	58	62
			5	0	0	0	0	0
		UCRB BLM/FS	1	0	0	0	0	0
			2	44	2	0	2	2
			3	56	56	42	54	55
			4	0	42	58	44	43
			5	0	0	0	0	0
		UCRB CumEff	1	0	0	0	0	0
			2	58	0	0	0	0
			3	42	42	27	42	42
			4	0	58	73	58	58
			5	0	0	0	0	0
RIP	Yellow warbler	EEIS BLM/FS	1	0	0	0	0	0
			2	60	0	0	0	0
			3	40	64	50	70	67
			4	0	36	50	30	33
			5	0	0	0	0	0
		EEIS CumEff	1	0	0	0	0	0
			2	62	0	0	0	0
			3	38	49	33	53	49
			4	0	51	67	47	51
			5	0	0	0	0	0
		UCRB BLM/FS	1	0	0	0	0	0
			2	60	0	0	0	0
			3	40	64	50	70	67
			4	0	36	50	30	33
			5	0	0	0	0	0
		UCRB CumEff	1	0	0	0	0	0
			2	62	0	0	0	0
			3	38	49	33	53	49
			4	0	51	67	47	51
			5	0	0	0	0	0
RIP	Yellow-billed cuckoo	EEIS BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	55	0	0	0	0
			4	45	50	28	53	45
			5	0	50	73	48	55
		EEIS CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	56	0	0	0	0
			4	44	10	10	28	26
			5	0	90	90	73	74
		UCRB BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	66	0	0	0	0
			4	34	54	28	53	45
			5	0	46	73	48	55
		UCRB CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	69	0	0	0	0
			4	31	13	11	29	28
			5	0	88	89	71	73
RIP	Yellow-breasted chat	EEIS BLM/FS	1	0	0	0	0	0
			2	55	0	0	0	0
			3	45	49	41	61	54
			4	0	51	59	39	46
			5	0	0	0	0	0

Group[1]	Species Name	Area[2]	Outcome[3]	H	C	1	2	3
				Period/Outcome[4]				
		EEIS CumEff	1	0	0	0	0	0
			2	60	0	0	0	0
			3	40	36	30	50	50
			4	0	64	70	50	50
			5	0	0	0	0	0
		UCRB BLM/FS	1	0	0	0	0	0
			2	55	0	0	0	0
			3	45	49	44	63	61
			4	0	51	56	38	39
			5	0	0	0	0	0
		UCRB CumEff	1	0	0	0	0	0
			2	60	0	0	0	0
			3	40	36	30	50	50
			4	0	64	70	50	50
			5	0	0	0	0	0
WD	Ash-throated flycatcher	EEIS BLM/FS	1	15	24	10	0	5
			2	63	65	58	13	48
			3	23	11	30	51	35
			4	0	0	3	31	13
			5	0	0	0	5	0
		EEIS CumEff	1	15	24	5	0	0
			2	63	65	53	23	39
			3	23	11	35	54	43
			4	0	0	8	24	19
			5	0	0	0	0	0
		UCRB BLM/FS	1	15	24	10	0	5
			2	61	64	56	13	46
			3	24	13	31	50	36
			4	0	0	3	33	13
			5	0	0	0	5	0
		UCRB CumEff	1	15	24	5	0	0
			2	61	64	53	23	39
			3	24	13	35	54	43
			4	0	0	8	24	19
			5	0	0	0	0	0
WD	Bushtit	EEIS BLM/FS	1	0	0	0	0	0
			2	0	25	20	0	0
			3	100	65	55	50	60
			4	0	10	25	50	40
			5	0	0	0	0	0
		EEIS CumEff	1	0	0	0	0	0
			2	0	25	20	0	0
			3	100	65	55	50	60
			4	0	10	25	50	40
			5	0	0	0	0	0
		UCRB BLM/FS	1	0	0	0	0	0
			2	0	25	15	0	0
			3	65	65	55	50	60
			4	35	10	30	50	40
			5	0	0	0	0	0
		UCRB CumEff	1	0	0	0	0	0
			2	0	25	15	0	0
			3	65	65	55	50	60
			4	35	10	30	50	40
			5	0	0	0	0	0
WD	Chipping sparrow	EEIS BLM/FS	1	95	93	93	95	95
			2	5	8	8	5	5
			3	0	0	0	0	0
			4	0	0	0	0	0
			5	0	0	0	0	0
		EEIS CumEff	1	95	86	60	64	64
			2	5	14	40	36	36
			3	0	0	0	0	0
			4	0	0	0	0	0
			5	0	0	0	0	0

Group[1]	Species Name	Area[2]	(Outcome[3]	H	C	1	2	3
				Period/Outcome[4]				
		UCRB BLM/FS	1	95	93	93	95	95
			2	5	8	8	5	5
			3	0	0	0	0	0
			4	0	0	0	0	0
			5	0	0	0	0	0
		UCRB CumEff	1	95	86	60	64	64
			2	5	14	40	36	36
			3	0	0	0	0	0
			4	0	0	0	0	0
			5	0	0	0	0	0
WD	Green-tailed towhee	EEIS BLM/FS	1	0	0	0	0	0
			2	35	58	26	56	49
			3	65	43	71	44	51
			4	0	0	3	0	0
			5	0	0	0	0	0
		EEIS CumEff	1	0	0	0	0	0
			2	35	58	26	56	49
			3	65	43	71	44	51
			4	0	0	3	0	0
			5	0	0	0	0	0
		UCRB BLM/FS	1	0	0	0	0	0
			2	35	58	26	56	49
			3	65	43	71	44	51
			4	0	0	3	0	0
			5	0	0	0	0	0
		UCRB CumEff	1	0	0	0	0	0
			2	35	58	26	56	49
			3	65	43	71	44	51
			4	0	0	3	0	0
			5	0	0	0	0	0
		Bats and Small Mammals						
BAT	Fringed myotis	EEIS BLM/FS[5]	1	0	0	0	0	0
			2	35	0	0	2	7
			3	63	33	17	43	45
			4	2	60	47	43	42
			5	0	7	36	12	6
		EEIS CumEff	1	0	0	0	0	0
			2	35	0	0	0	0
			3	63	22	0	3	10
			4	2	65	20	47	40
			5	0	13	80	50	50
		UCRB BLM/FS[5]	1	0	0	0	0	0
			2	28	0	0	5	7
			3	70	33	17	48	45
			4	2	60	48	45	42
			5	0	7	35	2	6
		UCRB CumEff	1	0	0	0	0	0
			2	35	0	0	0	0
			3	63	22	0	3	10
			4	2	65	22	47	43
			5	0	13	78	50	47
BAT	Hoary bat	EEIS BLM/FS[5]	1	0	0	0	0	0
			2	78	6	0	14	22
			3	22	70	43	50	34
			4	0	22	47	31	28
			5	0	2	10	5	16
		EEIS CumEff	1	0	0	0	0	0
			2	78	0	0	0	0
			3	22	56	13	20	18
			4	0	30	37	51	52
			5	0	14	50	29	30

Group[1]	Species Name	Area[2]	Outcome[3]	H	C	1	2	3
				Period/Outcome[4]				
		UCRB BLM/FS[5]	1	0	0	0	0	0
			2	78	4	0	14	20
			3	22	70	45	49	30
			4	0	24	48	33	36
			5	0	2	7	4	14
		UCRB CumEff	1	0	0	0	0	0
			2	78	0	0	0	0
			3	22	56	5	20	17
			4	0	30	40	54	53
			5	0	14	55	26	30
BAT	Long-eared myotis	EEIS BLM/FS[5]	1	0	0	0	0	0
			2	62	0	0	10	10
			3	38	50	36	50	50
			4	0	44	56	35	30
			5	0	6	8	5	10
		EEIS CumEff	1	0	0	0	0	0
			2	62	0	0	0	0
			3	38	28	8	19	21
			4	0	56	38	48	51
			5	0	16	54	33	28
		UCRB BLM/FS[5]	1	0	0	0	0	0
			2	62	0	0	5	10
			3	38	50	37	55	50
			4	0	44	57	35	30
			5	0	6	6	5	10
		UCRB CumEff	1	0	0	0	0	0
			2	62	0	0	0	0
			3	38	28	8	19	21
			4	0	56	39	48	49
			5	0	16	53	33	30
BAT	Long-legged myotis	EEIS BLM/FS[5]	1	0	0	0	0	0
			2	65	0	0	14	13
			3	35	44	24	56	45
			4	0	46	54	30	42
			5	0	10	22	0	0
		EEIS CumEff	1	0	0	0	0	0
			2	65	0	0	0	0
			3	35	23	0	5	15
			4	0	58	30	61	50
			5	0	20	70	34	35
		UCRB BLM/FS[5]	1	0	0	0	0	0
			2	65	0	0	11	13
			3	35	44	35	60	50
			4	0	46	46	25	30
			5	0	10	19	4	7
		UCRB CumEff	1	0	0	0	0	0
			2	65	0	0	0	0
			3	35	23	0	5	15
			4	0	58	31	59	53
			5	0	20	69	36	33
BAT	Pale western big-eared bat	EEIS BLM/FS[5]	1	0	0	0	0	0
			2	6	0	0	0	0
			3	78	12	2	13	20
			4	14	72	52	78	69
			5	2	16	46	9	11
		EEIS CumEff	1	0	0	0	0	0
			2	6	0	0	0	0
			3	78	12	0	2	3
			4	14	68	24	46	40
			5	2	20	76	52	57

Group[1]	Species Name	Area[2]	Outcome[3]	Period/Outcome[4] H	C	1	2	3
		UCRB BLM/FS[5]	1	0	0	0	0	0
			2	6	0	0	0	0
			3	78	12	2	13	30
			4	14	72	54	79	59
			5	2	16	44	8	11
		UCRB CumEff	1	0	0	0	0	0
			2	6	0	0	0	0
			3	78	12	0	2	3
			4	14	70	25	44	41
			5	2	18	75	54	56
BAT	Silver-haired bat	EEIS BLM/FS[5]	1	0	0	0	0	0
			2	52	2	0	15	10
			3	46	54	30	63	63
			4	2	44	48	18	22
			5	0	0	22	4	5
		EEIS CumEff	1	0	0	0	0	0
			2	60	0	0	2	0
			3	40	40	7	26	18
			4	0	46	42	32	43
			5	0	14	51	40	39
		UCRB BLM/FS[5]	1	0	0	0	0	0
			2	52	2	0	18	10
			3	46	54	34	61	62
			4	2	44	44	17	25
			5	0	0	22	4	3
		UCRB CumEff	1	0	0	0	0	0
			2	60	0	0	2	0
			3	40	40	7	26	18
			4	0	46	43	33	43
			5	0	14	50	39	39
BAT	Spotted bat	EEIS BLM/FS[5]	1	0	0	0	0	0
			2	0	0	0	0	0
			3	5	5	3	3	5
			4	90	75	55	65	75
			5	5	20	43	33	20
		EEIS CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	5	0	0	0	0
			4	90	60	43	53	55
			5	5	40	58	48	45
		UCRB BLM/FS[5]	1	0	0	0	0	0
			2	0	0	0	0	0
			3	5	5	3	3	5
			4	90	75	58	68	75
			5	5	20	40	30	20
		UCRB CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	5	0	0	0	0
			4	90	60	45	55	55
			5	5	40	55	45	45
BAT	Western small-footed myotis	EEIS BLM/FS[5]	1	0	0	0	0	0
			2	80	0	0	0	10
			3	20	70	0	50	60
			4	0	30	70	30	30
			5	0	0	30	20	0
		UCRB BLM/FS[5]	1	0	0	0	0	0
			2	80	0	0	0	10
			3	20	70	0	50	60
			4	0	30	70	30	30
			5	0	0	30	20	0
SMM	Northern flying squirrel	EEIS BLM/FS[5]	1	0	0	0	0	0
			2	90	15	0	24	25
			3	10	40	29	51	54
			4	0	33	51	20	21
			5	0	13	20	5	0

Group[1]	Species Name	Area[2]	Outcome[3]	Period/Outcome[4] H	C	1	2	3
		EEIS CumEff	1	0	0	0	0	0
			2	83	10	0	0	0
			3	18	43	5	18	20
			4	0	33	43	44	49
			5	0	15	53	39	31
		UCRB BLM/FS[5]	1	0	0	0	0	0
			2	90	15	0	25	26
			3	10	40	40	53	55
			4	0	33	32	20	10
			5	0	13	28	2	9
		UCRB CumEff	1	0	0	0	0	0
			2	83	10	0	0	0
			3	18	45	5	20	20
			4	0	33	46	45	49
			5	0	13	49	35	31
SMM	Pygmy rabbit	EEIS BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	40	0	0	0	0
			4	50	50	50	50	50
			5	10	50	50	50	50
		UCRB BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	40	0	0	0	0
			4	50	50	50	50	50
			5	10	50	50	50	50
SMM	White-tailed jackrabbit	EEIS BLM/FS	1	20	0	0	0	0
			2	80	20	20	20	20
			3	0	80	80	80	80
			4	0	0	0	0	0
			5	0	0	0	0	0
		EEIS CumEff	1	20	0	0	0	0
			2	80	10	10	10	10
			3	0	20	20	20	20
			4	0	60	60	60	60
			5	0	10	10	10	10
		UCRB BLM/FS	1	20	0	0	0	0
			2	80	20	20	20	20
			3	0	80	80	80	80
			4	0	0	0	0	0
			5	0	0	0	0	0
		UCRB CumEff	1	20	0	0	0	0
			2	80	10	10	10	10
			3	0	20	20	20	20
			4	0	60	60	60	60
			5	0	10	10	10	10
Carnivores and Ungulates								
CAR	American marten	EEIS BLM/FS[5]	1	0	0	0	0	0
			2	50	4	2	4	20
			3	50	22	10	50	60
			4	0	42	36	46	20
			5	0	32	52	0	0
		EEIS CumEff[5]	1	0	0	0	0	0
			2	50	4	0	2	4
			3	50	22	8	12	21
			4	0	42	29	33	34
			5	0	32	63	53	41
		UCRB BLM/FS[5]	1	24	0	0	0	0
			2	42	12	2	20	40
			3	34	34	17	60	50
			4	0	26	41	20	10
			5	0	28	40	0	0

				Period/Outcome[4]				
Group[1]	**Species Name**	**Area[2]**	**Outcome[3]**	**H**	**C**	**1**	**2**	**3**
		UCRB CumEff[5]	1	24	0	0	0	0
			2	42	4	0	2	6
			3	34	16	16	21	44
			4	0	30	27	39	37
			5	0	50	57	38	13
CAR	Fisher	EEIS BLM/FS[5]	1	0	0	0	0	0
			2	12	0	0	0	1
			3	22	2	1	28	12
			4	34	14	13	24	25
			5	32	84	86	48	62
		EEIS CumEff[5]	1	0	0	0	0	0
			2	12	0	0	0	0
			3	22	2	0	2	12
			4	34	10	8	10	20
			5	32	88	92	88	68
		UCRB BLM/FS[5]	1	0	0	0	0	0
			2	40	0	0	0	0
			3	40	40	20	70	20
			4	20	40	50	20	50
			5	0	20	30	10	30
		UCRB CumEff[5]	1	0	0	0	0	0
			2	40	0	0	0	0
			3	40	2	3	1	16
			4	20	14	22	31	43
			5	0	84	75	68	41
CAR	Gray wolf	EEIS BLM/FS	1	40	12	8	12	20
			2	50	42	42	47	48
			3	10	46	46	41	32
			4	0	0	4	0	0
			5	0	0	0	0	0
		EEIS CumEff	1	36	0	0	0	0
			2	48	4	2	6	10
			3	16	8	8	6	14
			4	0	42	43	44	44
			5	0	46	47	44	32
		UCRB BLM/FS	1	68	22	18	22	36
			2	30	43	44	43	39
			3	2	35	34	35	25
			4	0	0	4	0	0
			5	0	0	0	0	0
		UCRB CumEff	1	68	4	0	0	0
			2	30	4	0	1	3
			3	2	4	8	9	16
			4	0	42	46	46	50
			5	0	46	46	44	31
CAR	Grizzly bear	EEIS BLM/FS	1	44	0	0	0	0
			2	44	0	0	0	4
			3	10	12	4	4	11
			4	2	40	47	50	49
			5	0	48	49	46	36
		EEIS CumEff	1	46	0	0	0	0
			2	46	0	0	0	2
			3	8	2	0	0	4
			4	0	8	6	8	19
			5	0	90	94	92	75
		UCRB BLM/FS	1	62	8	4	5	10
			2	32	4	6	6	4
			3	6	10	6	6	16
			4	0	38	44	43	40
			5	0	40	40	40	30

				Period/Outcome[4]				
Group[1]	Species Name	Area[2]	Outcome[3]	H	C	1	2	3
		UCRB CumEff	1	58	0	0	0	2
			2	32	0	0	0	4
			3	10	4	2	4	6
			4	0	8	10	8	8
			5	0	88	88	88	80
CAR	Lynx	EEIS BLM/FS[5]	1	0	0	0	0	0
			2	10	0	0	0	2
			3	80	12	0	0	17
			4	10	40	42	42	41
			5	0	48	58	58	40
		EEIS CumEff[5]	1	0	0	0	0	0
			2	10	0	0	0	0
			3	80	0	4	4	0
			4	10	42	15	15	42
			5	0	58	81	81	58
		UCRB BLM/FS[5]	1	0	0	0	0	0
			2	10	0	0	0	2
			3	80	12	0	0	20
			4	10	40	50	42	44
			5	0	48	50	58	34
		UCRB CumEff[5]	1	0	0	0	0	0
			2	10	0	0	0	0
			3	80	0	4	4	0
			4	10	40	15	15	42
			5	0	60	81	81	58
CAR	Wolverine	EEIS BLM/FS[5]	1	0	0	0	0	0
			2	10	0	0	0	0
			3	80	12	4	4	11
			4	10	40	47	50	54
			5	0	48	49	46	35
		EEIS CumEff[5]	1	0	0	0	0	0
			2	0	0	0	0	0
			3	36	0	0	0	19
			4	30	38	0	6	21
			5	34	62	100	94	60
		UCRB BLM/FS[5]	1	0	0	0	0	0
			2	10	4	7	9	9
			3	80	20	13	12	21
			4	10	44	41	43	50
			5	0	32	39	36	20
		UCRB CumEff[5]	1	0	0	0	0	0
			2	0	0	0	0	0
			3	36	0	0	0	26
			4	30	4	2	8	23
			5	34	96	98	92	51
UNG	California bighorn sheep	EEIS BLM/FS[5]	1	0	0	0	0	0
			2	0	0	0	0	0
			3	50	0	0	0	0
			4	50	40	40	40	10
			5	0	60	60	60	90
		EEIS CumEff[5]	1	0	0	0	0	0
			2	0	0	0	0	0
			3	50	0	0	0	o
			4	50	30	30	30	10
			5	0	70	70	70	90
		UCRB BLM/FS[5]	1	0	0	0	0	0
			2	0	0	0	0	0
			3	50	0	0	0	0
			4	50	40	40	40	10
			5	0	60	60	60	90

Group[1]	Species Name	Area[2]	Outcome[3]	Period/Outcome[4] H	C	1	2	3
		UCRB CumEff[5]	1	0	0	0	0	0
			2	0	0	0	0	0
			3	50	0	0	0	0
			4	50	30	30	30	10
			5	0	70	70	70	90
UNG	Pronghorn	EEIS BLM/FS[5]	1	0	0	0	0	0
			2	10	0	0	0	0
			3	80	50	25	70	25
			4	10	50	60	30	60
			5	0	0	15	0	15
		EEIS CumEff[5]	1	0	0	0	0	0
			2	10	0	0	0	0
			3	80	20	10	10	10
			4	10	50	50	50	50
			5	0	30	40	40	40
		UCRB BLM/FS[5]	1	10	0	0	0	0
			2	80	60	20	70	20
			3	10	30	60	30	60
			4	0	10	20	0	20
			5	0	0	0	0	0
		UCRB CumEff[6]	1	10	0	0	0	0
			2	80	0	0	0	0
			3	10	60	10	10	10
			4	0	40	50	50	50
			5	0	0	40	40	40
UNG	Woodland caribou	EEIS BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	0	0	0	0	0
			4	50	0	0	0	46
			5	50	100	100	100	54
		EEIS CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	0	0	0	0	0
			4	50	0	0	0	42
			5	50	100	100	100	58
		UCRB BLM/FS	1	0	0	0	0	0
			2	0	0	0	0	0
			3	0	0	0	0	0
			4	50	0	0	0	46
			5	50	100	100	100	54
		UCRB CumEff	1	0	0	0	0	0
			2	0	0	0	0	0
			3	0	0	0	0	0
			4	50	0	0	0	42
			5	50	100	100	100	58

[1] Group: PLT - vascular plants; AMP - amphibians; REP - reptiles; WAT - waterbirds and shorebirds; GAM - gamebirds; RAP - raptors; CAV - cavity ncster; FOR - forest birds; GS - grassland/shrub birds; RIP - riparian birds; WD - woodland birds; BAT - bat; SMM - small mammal; CAR - carnivore; UNG - ungulate.

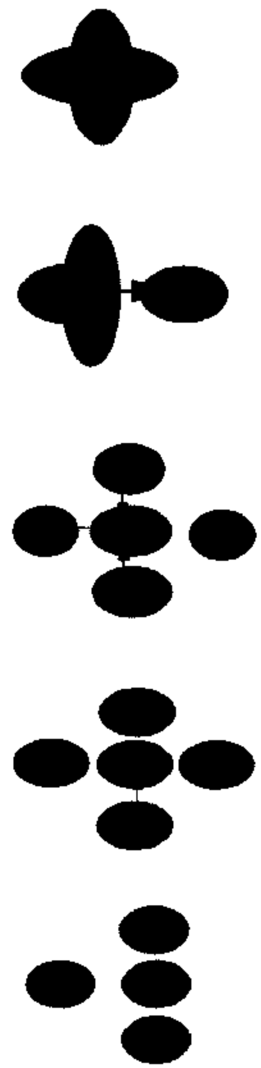
[2] Area: EEIS BLM/FS - Eastern Oregon and Washington planning area, BLM and Forest Service lands only; EEIS CumEff- all lands in Eastern Oregon and Washington planning area; UCRB BLM/FS - Upper Columbia Basin planning area, BLM and Forest Service lands only; UCRB CumEff- all lands in Upper Columbia Basin planning area.

[3] Outcome: 1- contiguous; 2 - gaps; 3 - patchy; 4 - isolated; 5 - scarce. See figure C.I for a complete description.

4 Period/Option: H - historical pre-European settlement period; C - current; 1 - Option 1; 2 - Option 2; 3 - Option 3.

[5] Species for which panelists' scores were adjusted by Science Team. Scores were adjusted when considered to reflect a misinterpretation or incomplete understanding of the management alternatives or their outcomes, or the species ecology.

Figure C-1—Habitat and population outcome scales.



FS- and BLM- administered land		Cumulative Effects
Habitat is broadly distributed across the planning area with opportunity for continuous or nearly continuous occupation by the species, little or no limitation on population interactions.	1	Populations are broadly distributed across the analysis area with little or no limitation on population interactions.
Habitat is broadly distributed across the planning area but gaps exist within this distribution. Disjunct patches of habitat are typically large enough and close enough to other patches to permit dispersal among patches and to allow species to interact as a metapopulation.	2	Populations are broadly distributed across the analysis area but gaps exist within this distribution. Disjunct populations are typically large enough and close enough to other populations to permit dispersal among populations and to allow species to interact as a metapopulation.
Habitat exists primarily as patches, some of which are small or isolated to the degree that species interactions are limited. Local sub-populations in most of the species' range interact as a metapopulation, but some patches are so disjunct that sub-populations in those patches are essentially isolated from other populations	3	The species is distributed primarily as disjunct populations, some of which are small or isolated to the degree that species interactions are limited. Local sub-populations in most of the species' range interact as a metapopulation but some populations are so disjunct that they are essentially isolated from other populations.
Habitat is typically distributed as isolated patches, causing strong limitations for population interaction among patches, and limited opportunity for dispersal among patches. Some local populations may be extirpated and rates of recolonization will likely be slow.	4	Populations are typically distributed as isolated sub-populations, with strong limitations in interactions of sub-populations and limited opportunity for dispersal among patches. Some local populations may be extirpated and rate of vacant habitat recolonization will likely be slow.
Habitat is very scarce throughout the area with little or no possibility of interactions among local populations, strong potential for extirpations, and little likelihood of recolonization.	5	Populations are highly isolated throughout the area with little or o possibility of interactions among local populations, strong potential for extirpations, and little likelihood of vacant habitat recolonization.

APPENDIX D.

CURRENT AND PROJECTED OUTCOMES FOR SPECIES WITH CURRENT OUTCOMES OF 4 OR 5.

(See appendix C for presentation of definitions and outcomes of viability for individual species.)

This appendix presents projected habitat outcomes on Forest Service and Bureau of Land Management lands (outcome rating system is described in appendix C) for individual species with current Outcomes of 4 and 5 (patchy/poorly distributed habitat with concern of extirpation/viability loss). Outcomes for vascular plant and vertebrate species were analyzed in two EIS planning areas of the Interior Columbia Basin Ecosystem Management Project—eastern Oregon and Washington, (EEIS) (tables D-l, D-2, and D-3); and, Idaho and western Montana, (UCRB) (tables D-4, D-5, and D-6).

The analysis is intended to describe likely future conditions for habitats and species given specific management options, and provide for comparison of those conditions to current conditions. Projected future conditions that result in improvements from current conditions should generally be considered as positive outcomes. Projected declines from current conditions may be viewed as negative.

The risk of extirpation/viability loss for a given species was estimated in two ways: (1) by a weighted mean Outcome of 4 or 5, and (2) by the number of likelihood points in Outcome 5 (see Evaluation of Alternatives—Terrestrial, Methodology section). The Science Integration Team chose 20 or more points in Outcome 5 as a conservative threshold of extirpation. Tables D-l and D-4 display the species with 20 or more risk likelihood points in Outcome 5 for current conditions or three management options. A species with a "D5" listing in these tables would have the highest risk of extirpation/viability loss compared with other scores and outcomes. To be considered an "increaser," weighted mean outcome needed to improve by 0.5 or more from the current condition for a given species.

Option 1 results in the highest number of species at risk of extirpation with 20 or more points in Outcome 5 compared to the other options. Options 2 and 3 equally, would have the lowest number of species at risk of extirpation. As a group, carnivores and ungulates would have relatively higher risk of extirpation/viability loss, compared with other species groups considered in this assessment. Option 1 would result in the highest number of species (25 in UCRB, and 19 in EEIS) that change from a high likelihood of persistence and viability of having a risk of extirpation/viability loss, out of the total species analyzed (132 and 141, respectively). Percentage-wise, Option 1 would have a negative effect on species, while Options 2 and 3 effect a relatively low number of species.

Options 2 and 3 would result in significant improvements in conditions and viability outcomes for 15 to 20 species (tables D-3 and D-5), whereas Option 1 would not improve conditions for any species. Each option would result in declining conditions for at least some species (tables D-2 and D-6). "Decreaser" species have a weighted mean score of 3.4 or less for current conditions with projected outcomes for an option being 3.5 or greater.

Source: Quigley, Thomas M.; Lee, Kris; Arbelbide, S.J., tech. eds. 1996. Evaluation of EIS Alternatives by the Science Integration Team. Gen Tech. Rep. PNW-GTR-XXX. Portland, OR; U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. XX p. (Quigley, Thomas M., tech. ed. The Interior Columbia Basin Ecosystem Management Project: Scientific Assessment).

Table D-l—Species with at least 20 or more likelihood points in viability in Outcome 5, under current conditions or under projected management options for FS/BLM lands in eastern Oregon and Washington.

Category	Current	Option 1	Option 2	Option 3
Plants:				
Crenulate grape-fern	A4	B4	B4	
Howellia	B4	B4	B4	B4
Suksdorf's lomatium	C5	C5	C5	C5
Washington polemonium	C5	C5	B5	C5
Spalding's campion	C5	C5	B4	C5
Malheur wire-lettuce	D5	D5	D5	D5
Amphibians/Reptiles:				
Columbian spotted frog	A4	B4		
Northern leopard frog	C5	C5	C4	C4
Oregon spotted frog	A4	B4		
Tailed frog	A3	B4		
Wood house's toad	A4	C5		
Long-nosed leopard lizard	A4	B4		
Sharptail snake	C5	C5	C4	B4
Waterbirds/Shorebirds:				
Goldeneyes	A4	B4		
Harlequin duck	C5	C5		B4
Upland sandpiper	D5	D5	C5	C5
Raptors/Gamebirds:				
Columbian sharp-tailed grouse	C5	C5	B4	B4
Mountain quail	A4	B4		
Boreal owl	B4	B4	B4	B4
Flam mutated owl	B4	B4		
Great gray owl	B4	B4		
Woodpeckers, Nuthatches, & Swifts:				
Black-backed woodpecker	A3	B4		
Lewis' woodpecker	A4	C5		
Red-naped sapsucker	A3	B4		
Three-toed woodpecker	A3	B4		
Vaux's swift	A4	C5		
White-headed woodpecker	A4	B4		
Williamson's sapsucker	A3	B4		
Cuckoos, Passerines, & Hummingbirds:				
Black-rosy finch	A4	B4		
Bobolink	B4	C5	B4	B4
Grasshopper sparrow	C5	C5	C5	C5
Yellow-billed cuckoo	C5	C5	B5	C5

Table D-l—(continued) Species with at least 20 or more likelihood points in viability in Outcome 5, under current conditions or under projected management options for FS/BLM lands in eastern Oregon and Washington.

Category	Current	Option 1	Option 2	Option 3
Bats & Small Mammals:				
Fringed myotis	A4	B4		
Hoary bat	A3			
Long-legged myotis	B4	B4		
Pale western big-earred bat	A4	B4		
Silver-haired bat	A3	B4		
Spotted bat	B4	B4	B4	B4
Western small-footed myotis	A3	B4	B4	
Northern flying squirrel	A4	B4		
Pgymy rabbit	A4	C5	C5	
Carnivores & Ungulates:				
American marten	B4	C4		
Fisher	C5	C5	B4	C5
Grizzly bear	B4	B5	B4	B4
Lynx	B4	C5	C5	B4
Wolverine	B4	B5	B4	B4
California bighorn sheep	C5	C5	C5	C5
	D5	D5	D5	D5
Total of "B"		26	13	10
Total of "C"		18	8	9
Total of "D"		3	2	2
Grand Total		**47**	**23**	**21**

Includes all species with at least 20 points in outcome 5 for any option. Weighted mean scores are included for reference.

A= 0-19 points in Outcome 5
B = 20-49 points in Outcome 5
C = 50-99 points in Outcome 5
D=100 points in Outcome 5

3 = Favorable outcome.
4/5 = Less favorable outcome.

Source: Quigley, Thomas M.; Lee, Kris; Arbelbide, S.J., tech. eds. 1996. Evaluation of EIS Alternatives by the Science Integration Team. Gen Tech. Rep. PNW-GTR-XXX. Portland, ORJ U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. XX p. (Quigley, Thomas M., tech. ed. The Interior Columbia Basin Ecosystem Management Project: Scientific Assessment).

Table D-2—Outcomes for species that currently have a "favorable" outcome (3.4 or less) changing to a "less favorable" outcome (3.5 or greater), under management options on FS/BLM lands in eastern Oregon and Washington.

Species	Current	Option 1	Option 2	Option 3
Mulford's milk-vetch	3	4	4	4
Long-bearded mariposa-lily	3	4		
Tailed Frog	3	4		
Black-backed Woodpecker	3	4		
Piliated Woodpecker	3	4		
Pygmy Rabbit	3	4		
Red-naped Sapsucker	3	4		
Three-toed Woodpecker	3	4		
White-breasted Nuthatch	3	4		
Williamson's Sapsucker	3	4		
Chestnut-backed Chickadee	3	4		
Olive-sided Flycatcher	3	4		
Western Bluebird	3	4		
Winter Wren	3	4		
Veery	3			
Willow Flycatcher	3	4		
Yellow Warbler	3	4		
Bushtit	3			
Hoary Bat	3	4		
Silver Haired Bat	3	4		
Western Small-footed Myotis	3	4	4	
Total number of species		19	2	1
Percent of total (141) species analyzed		13	>1	<1

Favorable outcome = a weighted mean score of (3.4 or less).

Less favorable outcome = a weighted mean score of (3.5 or more).

Scores were rounded to integers.

Source: Quigley, Thomas M.; Lee, Kris; Arbelbide, S.J., tech. eds. 1996. Evaluation of EIS Alternatives by the Science Integration Team. Gen Tech. Rep. PNW-GTR-XXX. Portland, OR; U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. XX p. (Quigley, Thomas M., tech. ed. The Interior Columbia Basin Ecosystem Management Project: Scientific Assessment).

Table D-3—Species with better viability outcomes (0.5 or more) under management options, than under current conditions on FS/BLM lands in eastern Oregon and Washington.

Species	Current	Option 1	Option 2	Option 3
Rubber Boa	3.5*			2.9**
Sharptail Snake	4.5*			3.9
Oregon Spotted Frog	3.6*			3.1**
Wood house's Toad	3.9*			3.4**
Columbian Sharp-tailed Grouse	4.8*		4.0	
Sage Grouse	3.2		2.3	2.6
Bald Eagle	3.6*		2.9**	3.0**
Boreal Owl	4.2*			3.7
Cooper's Hawk	2.4		1.9	
Ferruginous Hawk	3.0		2.5	
Flammulated Owl	3.8*		2.9**	3.3**
Harlequin Duck	4.5*		3.5	
Lewis' Woodpecker	3.5*		2.5**	2.5**
Piliated Woodpecker	3.4		2.5	2.6
Red-naped Sapsucker	3.3		2.7	
Vaux's Swift	3.7*			2.9**
White-headed Woodpecker	3.8*		2.7**	3.1**
Chestnut-backed Chickadee	3.3			2.6
Hammond's Flycatcher	3.5*		2.9**	2.9**
Western Bluebird	3.0		2.4	
Long-legged Myotis	3.7*		3.2**	
Northern Flying Squirrel	3.5*			3.0**
Marten	4.0*		3.4**	3.0**
Fisher	4.8*		4.2	
Woodland Caribou	5.0*			4.5
Total:	25.0	0	16.0	17.0

* = Species with less favorable outcomes (3.5 or more).

** = Favorable outcomes (3.4 or less) projected to result from option implementation-- represents a significant improvement in habitat conditions.

Source: Quigley, Thomas M.; Lee, Kris; Arbelbide, S.J., tech. eds. 1996. Evaluation of EIS Alternatives by the Science Integration Team. Gen Tech. Rep. PNW-GTR-XXX. Portland, OR; U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. XX p. (Quigley, Thomas M., tech. cd. The Interior Columbia Basin Ecosystem Management Project: Scientific Assessment).

Table D-4—Species with at least 20 or more likelihood points in viability Outcome 5, under current conditions or under projected management options for FS/BLM lands in Idaho and western Montana.

Category	Current	Option 1	Option 2	Option 3
Plants:				
Upward-lobed moonwort	A4	C4	C4	C5
Granulate grape-fern	A4	C4	B4	B4
Palouse goldenweed	C5	C5	C5	C5
Amphibians/Reptiles:				
Coeur d'Alene salamander	B4	C5	B4	
Northern leopard frog	C5	C5	B4	B4
Tailed frog	A3	B4		
Woodhouse's toad	A4	B4		
Long-nosed leopard lizard	A4	B4		
Waterbirds/shorebirds:				
Goldeneyes	A4	B4		
Harlequin duck	C5	C5		B4
Upland sandpiper	D5	D5	C5	C5
Raptors/Gamebirds:				
Columbian sharp-tailed grouse	C5	C5	B4	B4
Mountain quail	C5	C5	C4	C5
Flammulated owl	B4	B4		
Woodpeckers, Nuthatches & Swifts:				
Black-backed woodpecker	A3	B4		
Lewis' woodpecker	A3	C5		
Red-naped sapsucker	A3	B4		
Three-toed woodpecker	A3	B4		
Vaux's swift	A4	C5		
White-headed woodpecker	A4	B4		
Cuckoos, Passerines & Hummingbirds:				
Bobolink	B4	B5		B4
Grasshopper sparrow	A4			
Yellow-billed cuckoo	B5	C5	B5	C5
Bats & Small Mammals:				
Fringed myotis	A4	B4		
Pale western big-eared bat	A4	B4		
Silver-haired bat	A4	B4		
Spotted bat	A4	B4	B4	B4
Western small-footed myotis	A3	B4	B4	
Northern flying squirrel		A4	B4	
Pygmy rabbit	C5	C5	C5	C5

Table D-4 (continued)—Species with at least 20 or more likelihood points in viability Outcome 5, under current conditions or under projected management options for FS/BLM lands in Idaho and western Montana (continued).

Category	Current	Option 1	Option 2	Option 3
Carnivores&Ungulates:				
American marten	B4	B4		
Fisher	B4	B4		B4
Grizzly bear	B4	B4	B4	B4
Lynx	B4	C5	C5	B4
Wolverine	B4	B5	B4	B4
California bighorn sheep	C5	C5	C5	C5
Woodland caribou	D5	D5	D5	C5
Total of "B"		20	9	10
Total of "C"		14	7	8
Total of "D"		2	1	0
Grand Total		**36**	**17**	**18**

A = 0-19 points in Outcome 5
B = 20-49 points in Outcome 5
C = 50-99 points in Outcome 5
D = 100 points in Outcome 5

3 = Favorable outcome
4/5 = Less Favorable outcome

Note: Includes all species with at least 20 points in outcome 5 for any option. Weighted mean scores are included for reference.

Source: Quigley, Thomas M.; Lee, Kris; Arbelbide, S.J., tech. eds. 1996. Evaluation of EIS Alternatives by the Science Integration Team. Gen Tech. Rep. PNW-GTR-XXX. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. XX p. (Quigley, Thomas M., tech. ed. The Interior Columbia Basin Ecosystem Management Project: Scientific Assessment).

Table D-5—Species with better viability outcomes (0.5 or more) under management options, than under current conditions on FS/BLM lands in Idaho and western Montana.

Species	Current	Option 1	Option 2	Option 3
Lemhi penstemon	3.7*		3.1	
Northern Leopard Frog	4.7*			3.9
Harlequin Duck	4.5*		3.5	
Band-tailed Pigeon	4.1*		3.5	3.4**
Columbian Sharp-tailed Grouse	4.8*		4.0	
Sagegrouse	3.1		2.2	2.6
Bald Eagle	3.6*		2.9**	3.0**
Boreal Owl	3.7*		3.2**	3.0**
Cooper's Hawk	2.4		1.9	
Ferruginous Hawk	3.0		2.5	
Flammulated Owl	3.8*		2.9**	3.3**
Great Gray Owl	3.5*		3.0	
Lewis' Woodpecker	3.4*		2.7**	2.7**
Piliated Woodpecker	3.4		2.5	2.6
Red-naped Sapsucker	3.2		2.7	
Vaux's Swift	3.8*			2.9**
White-headed Woodpecker	3.8*		2.7**	3.1**
Chestnut-backed Chickadee	3.2			2.6
Hammond's Flycatcher	3.4*		2.9**	2.9**
Western Bluebird	3.0		2.4	
Long-legged Myotis	3.7*		3.2**	
Silver Haired Bat	3.4			
Northern Flying Squirrel	3.5*		3.0	3.0**
Marten	3.7*		3.0**	2.7**
Woodland Caribou	5.0*			4.5
Totals:	**25**	**0**	**20**	**15**

* = Species with less favorable outcomes (3.5 or more).

** = Favorable outcomes (3.4 or less) projected to result from option implementation-represents a significant improvement in habitat conditions.

Source: Quiglcy, Thomas M.; Lee, Kris; Arbelbide, S.J., tech. eds. 1996. Evaluation of EIS Alternatives by the Science Integration Team. Gen Tech. Rep. PNW-GTR-XXX. Portland, OR; U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. XX p. (Quigley, Thomas M., tech. ed. The Interior Columbia Basin Ecosystem Management Project: Scientific Assessment).

Table D-6—Outcomes for species that currently have a favorable" outcome (3.4 or less) changing to a "less favorable" outcome (3.5 or greater), under management options on FS/BLM lands in Idaho and western Montana.

Species	Current	Option 1	Option 2	Option 3
Mulford's milk-vetch	3	4	4	4
Picabo milkvetch	3	4	4	
Columbian Spotted Frog	3	4		
Tailed Frog	3	4		
Western Frog	3	4		
Herons, egrets	3	4		
Great Sandhill Crane	3	4		
Black-backed Woodpecker	3	4		
Lewis' Woodpecker	3	5		
Piliated Woodpecker	3	4		
Pygmy Rabbit	3	4		
Red-naped Sapsucker	3	4		
Three-toed Woodpecker	3	4		
White-breasted Nuthatch	3	4		
Williamson's Sapsucker	3	4		
Broad-tailed Hummingbird	3			
Chestnut-backed Chickadee	3	4		
Hammond's Flycatcher	3	4		
Western Bluebird	3	4		
Wilson's Warbler	3	4		
Willow Flycatcher	3	4		
Yellow Warbler	3	4		
Bushtit	3			
Hoary Bat	3	4		
Silver Haired Bat	3	4		
Western Small-footed bat	3	4	4	
Total number of species		**24**	**3**	1
Percent of total (132) species analyzed		18%	2%	<1%

Favorable outcome = a weighted mean score of (3.4 or less).

Less favorable outcome = a weighted mean score of (3.5 or more).

Scores were rounded to integers.

Source: Quigley, Thomas M.; Lee, Kris; Arbelbide, S.J., tech. eds. 1996. Evaluation of EIS Alternatives by the Science Integration Team. Gen Tech. Rep. PNW-GTR-XXX. Portland, OR; U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. XX p. (Quigley, Thomas M., tech. ed. The Interior Columbia Basin Ecosystem Management Project: Scientific Assessment).

APPENDIX E.

COMMON AND SCIENTIFIC NAMES OF SPECIES DISCUSSED IN THE DOCUMENT.

Common name	Scientific name[1]
Flora:	
Alder	*Alnus Hill*
Bitter brush	*Purshia tridentata* (Pursh) DC.
Blue-leaved penstemon	*Penstemon glaucinus*
Broad-fruit mariposa	*Cafochortus nitidus*
Brome-grass	*Bromus* L.
Buck rush	*Ceanothus cuneatus* (Hook.) T. & G.
Cheatgrass	*Bromus tectorum* L.
Clustered lady's-slipper	*Cypripedium fasciculatum*
Crenulate grape-fern	*Botrychium crenulatum*
Crested wheatgrass	*Agropyron cristatum* (L.) Gaertn.
Cronquist's stickseed	*Hackelia cronquistii*
Douglas-fir	*Pseudotsuga menziesii* (Mirbel) Franco.
Grand fir	*Abiesgrandis* (Dougl.) Forbes
Green-tinged paintbrush	*Castilleja chlorotica*
Howellia	*Howellia aquatilis*
Howell's gumweed	*Grindelia howellii*
Huckleberries	*Vaccinium* L.
Idaho fescue	*Festuca idahoensis* Elmer
Juniper	*Juniperus* L.
Kentucky bluegrass	*Poa pratensis* L.
Knapweed	*Centaurea* L.
Leafy spurge	*Euphorbia esual* L.
Lemhi penstemon	*Penstemon lemhiensis*
Lodgepole pine	*Pinus contorta* Dougl.
Long-bearded mariposa-lily	*Calochortus bngebarbatus* var. *Longebarbatus*
Macfarlanes four-o'clock	*Mirabilis macfarlanei*
Malheur wire-lettuce	*Stephanomeria malheurensis*
Manzanita	*Arctostaphybs* Adans.
Mountain hemlock	*Tsuga mertensiana* (Bong.) Carr.
Mt. Mazama collomia	*Collomia mazama*
Mulford's milk-vetch	*Astragalus mulfordiae*

Osgoodmountains millcvetch	*Astragalus yoder-williamsii*
Palouse goldenweed	*Haplopappus liatriformis*
Paysons milkvetch	*Astragalus paysonii*
Peck's mariposa-lily	*Calochortus longebarbatus* var. *Peckii*
Picabo milkvetch	*Astragalus oniciformis*
Ponderosa pine	*Pinus ponderosa* Dougl.
Pygmy monkeyflower	*Mimulus pygmaeus*
Sagebrush	*Artemisia* L.
Spalding's campion	*Silene spaldingii*
Subalpine fir	*Abies lasiocarpa* (Hook.) Nutt.
Suksdorfs lomatium	*Lomatium suksdorfii*
Thompsons clover	*Trifolium thompsonii*
Twin-spike moonwort	*Botrychium paradoxum*
Upward-lobed moonwort	*Botrychium ascendens*
Washington monkeyflower	*Mimulus tuashingtonensis* var. *Washingtonensis*
Washington polemonium	*Polemonium pectinatum*
Weak milk-vetch	*Astragalus solitarius*
Western hemlock	*Tsuga heterophylla* (Raf.) Sarg.
Western juniper	*Juniperous occidentalis* Hook.
Western redcedar	*Thuja plicata* Donn.
Western white pine	*Pinus monticola* Dougl.
Wheat	*Triticum aestivum* L.
White bark pine	*Pinus albicaulis* Engelm.
White fir	*Abies concolor* (Gord. & Glend.) Lindl.
Willow	*Salix* L.

Fish:

Bass	*Micropterus* spp.
Bull trout	*Salvelinus confluentus*
Brook trout	*Salvelinus fontinalis*
Chinook salmon	*Oncorhynchus tshauvytscha*
Goose Lake sucker	*Catostomus occidentalis lacusanserinus*
Klamath Largescale sucker	*Catostomus snyderi*
Lahontan Cutthroat trout	*Oncorhynchus clarki henshawi*
Lost River sucker	*Deltistes luxatus*
Malheur sculpin	*Cottus bairdi* ssp.
Margined sculpin	*Cottus marginatus*
Pacific lamprey	*Lampetra tridentata*
Pit-Klanath Brook lamprey	*Lampetra lethophaga*

Pygmy whitefish	*Prosopium coukeri*
Rainbow trout	*Oncorhynchus mykiss*
Redband trout	*Oncorhynchus mykiss* ssp.
Shorthead sculpin	*Cottus confusus*
Shortnose sucker	*Chasmistes brevirostris*
Slender sculpin	*Cottus tenuis*
Sockeye salmon	*Oncorhynchus nerka*
Steel head	*Oncorhynchus mykiss mykiss*
Torrent sculpin	*Cottus rhotheus*
Walleye	*Stizostedion vitreum vitreum*
Westslope cutthroat trout	*Oncorhynchus clarki lewisi*
Wood River Bridgelip sucker	*Catostomus columbianus hubbsi*
Wood River sculpin	*Cottus leiopomus*
Yellowstone cutthroat trout	*Oncorhynchus clarki bouvieri*

Birds:

Ash-throated flycatcher	*Myiarchus cinerascens*
Bald eagle	*Haliaeetus leucocephalus*
Band-tailed pigeon	*Columba fasciata*
Barred owl	*Strix varia*
Black-backed woodpecker	*Picoides arcticus*
Black-capped rosy finch	*Leucosticte arctoa*
Black-chinned hummingbird	*Archilochus alexandri*
Blue grouse	*Dendragapus obscurus*
Bobolink	*Dolichonyx oryzivorus*
Boreal owl	*Aegolius funereus*
Brewers blackbird	*Euphagus cyanocephalus*
Brewers sparrow	*Spizella breweri*
Broad-tailed hummingbird	*Selasphorus platycercus*
Burrowing owl	*Athene cunicularia*
Bushtit	*Psaltriparus minimus*
Chestnut-backed chickadee	*Parus rufescens*
Chipping sparrow	Spizella passerina
Chukar	*Alectoris chukar*
Columbia sharp-tailed grouse	*Tympanuchus phasianellus columbianus*
Common loon	*Gavia immer*
Common snipe	*Gallinago gallinago*
Cooper's hawk	*Accipiter cooperii*
Downy woodpecker	*Picoides pubescens*
Ferruginous hawk	*Buteo regalis*

Flammulated owl	*Otus flammeolus*
Grasshopper sparrow	*Ammodramus savannarum*
Gray partridge	*Perdix perdix*
Greater sandhill crane	*Grus canadensis tabida*
Great gray owl	*Strix nebulosa*
Green-tailed towhee	*Pipilo chlorurus*
Hammond's flycatcher	*Empidonax hammondii*
Harlequin duclc	*Histrionicus histrionicus*
Horned lark	*Eremophila alpestris*
Lark bunting	*Calamospiza melanocorys*
Lark sparrow	*Chondestes grammacus*
Lazuli bunting	*Passerina amoena*
Lewis' woodpecker	*Melanerpes lewis*
Loggerhead shrike	*Lanius ludovicianus*
Long-billed curlew	*Numenius americanus*
Long-eared owl	*Asio otus*
Merlin	*Falco columbarius*
Mountain quail	*Oreortyx pictus*
Northern goshawk	*Accipiter gentilis*
Northern pygmy-owl	*Glaucidium gnoma*
Northern spotted owl	*Strix occidentalis caurina*
Olive-sided flycatcher	*Contopus borealis*
Pileated woodpecker	*Dryocopus pileatus*
Pygmy nuthatch	*Sitta pygmaea*
Red-eyed vireo	*Vireo olivaceus*
Red-naped sapsucker	*Sphyrapicus nuchalis*
Red-winged blackbird	*Agelaius phoeniceus*
Ring-necked pheasant	*Phasianus colchicus*
Rufous hummingbird	*Selasphorus rufus*
Rufous-sided towhee	*Pipilo erythrophthalmus*
Sage grouse	*Centrocercus urophasianus*
Sage sparrow	*Amphispiza belli*
Sage thrasher	*Oreoscoptes montanus*
Short-eared owl	*Asio flammeus*
Southern red-backed vole	*Clethrionomys gapperi*
Spotted sandpiper	*Actitis macularia*
Swainson's hawk	*Buteo swainsoni*
Three-toed woodpecker	*Picoides tridactylus*
Upland sandpiper	*Bartramia longicauda*
Vaux's swift	*Chaetura vauxi*

Veery	*Catharus fuscescens*
Vesper sparrow	*Pooecetes gramineus*
Western bluebird	*Sialia mexicana*
Western meadowlark	*Stumella neglecta*
Western red-backed vole	*Clethrionomys californicus*
Western screech owl	*Otus kennicottii*
Western snowy plover	*Charadrius alexandrinus nivosus*
Western tan age r	*Piranga ludoviciana*
White-breasted nuthatch	*Sitta carolinensis*
White-headed woodpecker	*Picoides albolarvatus*
WTiite-winged crossbill	*Loxia leucoptera*
Wild turkey	*Meleagris gallopavo*
Willet	*Catoptrophorus semipalmatus*
Williamsons sapsucker	*Sphyrapicus thyroideus*
Willow flycatcher	*Empidonax traillii*
Wilsons warbler	*Wilsonia pusilla*
Winter wren	*Troglodytes troglodytes*
Wood duck	*Aix sponsa*
Woodpecker	*Picoides* spp.
Yellow-billed cuckoo	*Coccyzus americanns*
Yellow-breasted chat	*Icteria virens*
Yellow warbler	*Dendroica petechia*

Mammals:

American marten	*Martes americana*
Black bear	*Ursus americanus*
California bighorn sheep	*Ovis canadensis californiana*
Chipmunk	*Tamias* spp.
Elk	*Cervus elaphus*
Fisher	*Martes pennanti*
Fringed myotis	*Myotis thysanodes*
Gray wolf	*Canis lupus*
Grizzly bear	*Ursus arctos*
Hoary bat	*Lasiurus cinereus*
Long-eared myotis	*Myotis evotis*
Long-legged myotis	*Myotis volans*
Lynx	*Lynx lynx*
Moose	*Alces alces*
Mountain lion	*Felis concolor*
Mule deer	*Odocoileus hemionus*

Northern flying squirrel	*Glaucomys sabrinus*
Pale western big-eared bat	*Plecotus toumsendii pallescens*
Pronghorn antelope	*Antilocapra americana*
Pygmy rabbit	*Brachylagus idahoensis*
Rocky Mountain elk	*Cervus elaphus nehonii*
Rocky Mountain gray wolf	*Canis lupis irremotus*
Silver-haired bat	*Lasionycteris noctivagans*
Spotted bat	*Euderma maculatum*
Squirrel	*Ammospermophilus* spp.
Washington ground squirrel	*Spermophilus washingtoni*
Western small-footed myotis	*Myotis ciliolabrum*
White tail deer	*Odocoileus virginianus*
White-tailed jack rabbit	*Lepus toumsendii*
Wolverine	*Gulo gulo*
Woodland caribou	*Rangifer tarandus caribou*

Amphibians and Reptiles:

Coeur d'Alene salamander	*Plethodon idahoensis*
Common garter snake	*Thamnophis sirtalis*
Desert horned lizard	*Phrynosoma platyrhinos*
Longnose leopard lizard	*Gambelia wislizenii*
Mojave black-collared lizard	*Crotaphytus bicinctores*
Night snake	*Hypsiglena torquata*
Northern leopard frog	*Ranapipiens*
Painted turtle	*Chrysemys picta*
Rubber boa	*Charina bottae*
Sagebrush lizard	*Sceloporus graciosus graciosus*
Sharptail snake	*Contia tenuis*
Short-horned lizard	*Phrynosoma douglassii*
Spotted frog species A	*Rana pretiosa* sp. A
Spotted frog species B	*Rana pretiosa* sp. B
Striped whipsnake	*Masticophis taeniatus*
Tailed frog	*Ascaphus truei*
Western pond turtle	*Clemmys marmorata*
Western toad	*Bufo boreas*
Woodhouse's toad	*Bufo woodhousii*

[1] Source for flora is Hitchock, C.L and Cronguist, A. 1973. Flora of the Pacific Northwest, an illustrate manual. University of Washington Press, Seattle, Washington. Source for fish, birds, mammals, amphibians, and reptiles is Species-Environment Relations (SER) databases.

List of Acronyms

BEA	Bureau of Economic Analysis
BLM	Bureau of Land Management
BTUs	British Thermal Units
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ERU	Ecological Reporting Units
ESA	Endangered Species Act
FACA	Federal Advisory Committee Act
FEMAT	Forest Ecosystem Management Assessment Team
FIRE	BEA Finance, Insurance and Real Estate
FS	Forest Service
GIS	Geographic Information System
GPM	General Planning Model
GSP	Gross State Product
HUCs	Hydrologic Unit Code
ICBEMP	Interior Columbia Basin Ecosystem Management Project
ICRB	Interior Columbia River Basin
INFISH	Interior Anadromous Fish Strategy
NEPA	National Environmental Protection Act
NWFP	Northwest Forest Plan
PACFISH	Pacific Anadromous Fish Strategy
PVGs	Potential Vegetation Groups
RVDs	Recreation Visitor Days
SER	Species-Environment Relations
SIC	Standard Industrial Code
SIT	Science Integration Team

Metric Conversion

Mile (mi)=1.61 Kilometers (km)

Kilometer (km)=.62 Miles (mi)

Square Kilometers (km^2) =.39 Sq. Miles (mi^2)

Centimeter (cm)= .3937 Inches (in)

Meter (m)=3.28 Feet (ft)

Hectare (ha)= 10,000 Square Meters (m^2)

Hectare (ha)=2.47 Acres (ac)

Acre (ac)=43,560 Square Feet (ft^2)

Notes

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Notes

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.

The Integrated Scientific Assessment for Fxosystem Management in 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 imeframes; 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 sociocconomic resiliency were used to make broad statements about ecosystem conditions in the Basin. Currently in the Basin high integrity and resiliency arc 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.

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Pacific Northwest Research Station
333 S.W. First Avenue
PO. Box 3890
Portland, Oregon 97208-3890