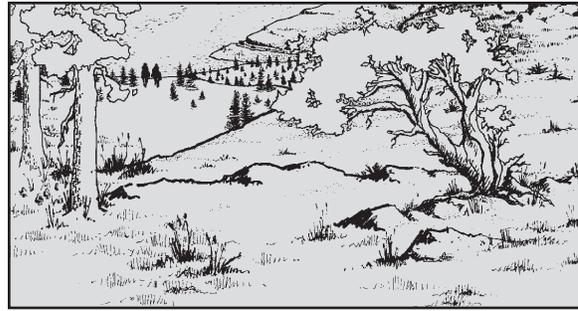


CHAPTER 5

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 alternatives¹⁹ 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).

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.

¹⁹The 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.

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



Ochoco National Forest; photo by T. Iraci

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

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 man-

aged 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 and late-seral forest structure. Timber harvest volume from existing plans comes from all size classes; most volume from Options 2

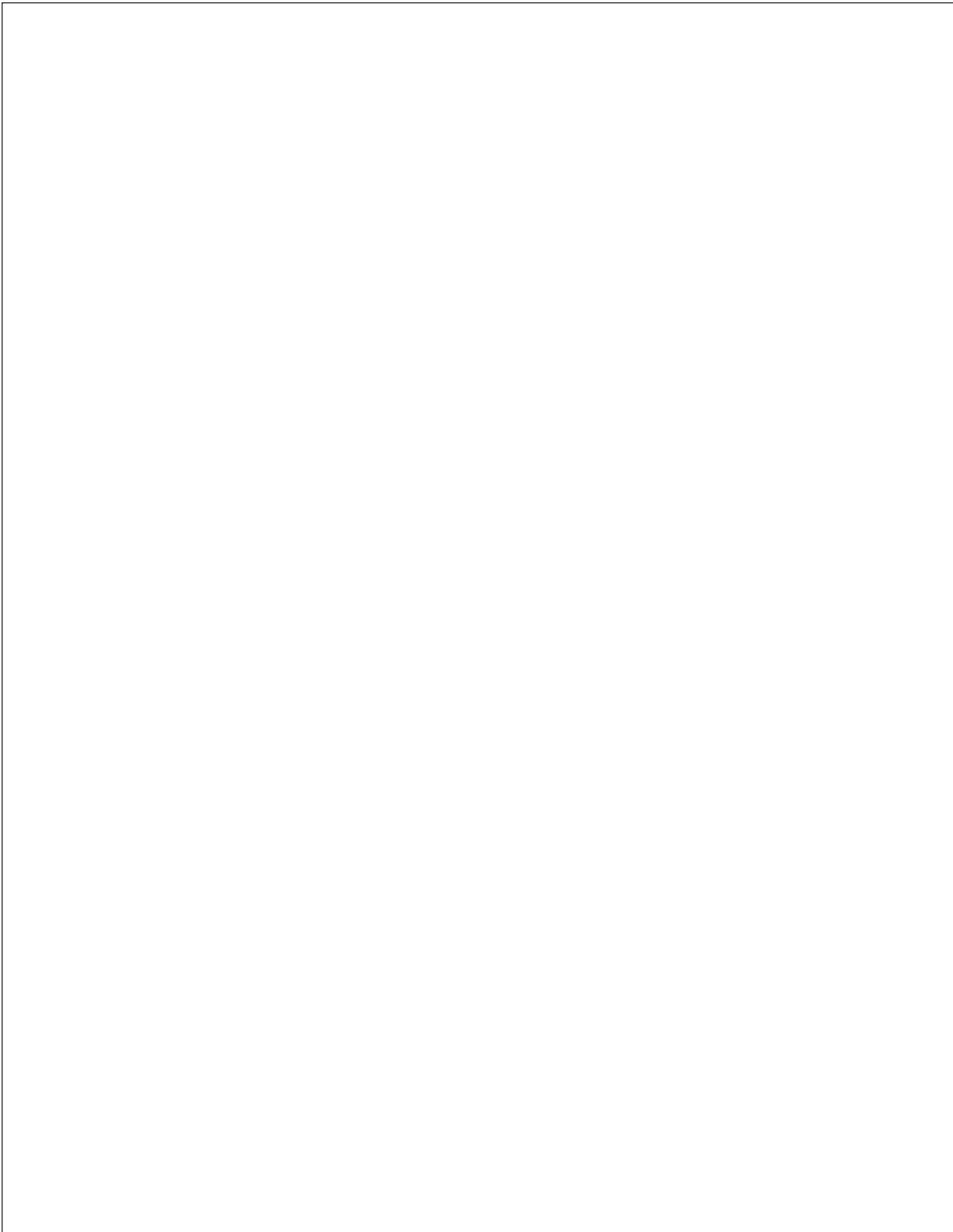


Figure 48—Proposed reserves on FS- and BLM-administered lands in Management Option 3.

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/wildland 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-1, 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.

Variable	Options		
	1	2	3
Predictability	-	+	-
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 public's 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 manager's 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 100 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		
	Y	N	Uncertain	Y	N	Uncertain	Y	N	Uncertain
6 Key Salmonid Species¹									
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 Species²									
Prevent Declines	1	14	0	7	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 bridgelip sucker, Malheur sculpin, torrent sculpin, shorthead sculpin, and margined sculpin. Also of note, pygmy whitefish are large lake 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.

Element	Options		
	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.

Economic Measures	Options		
	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 integ-

riety 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-

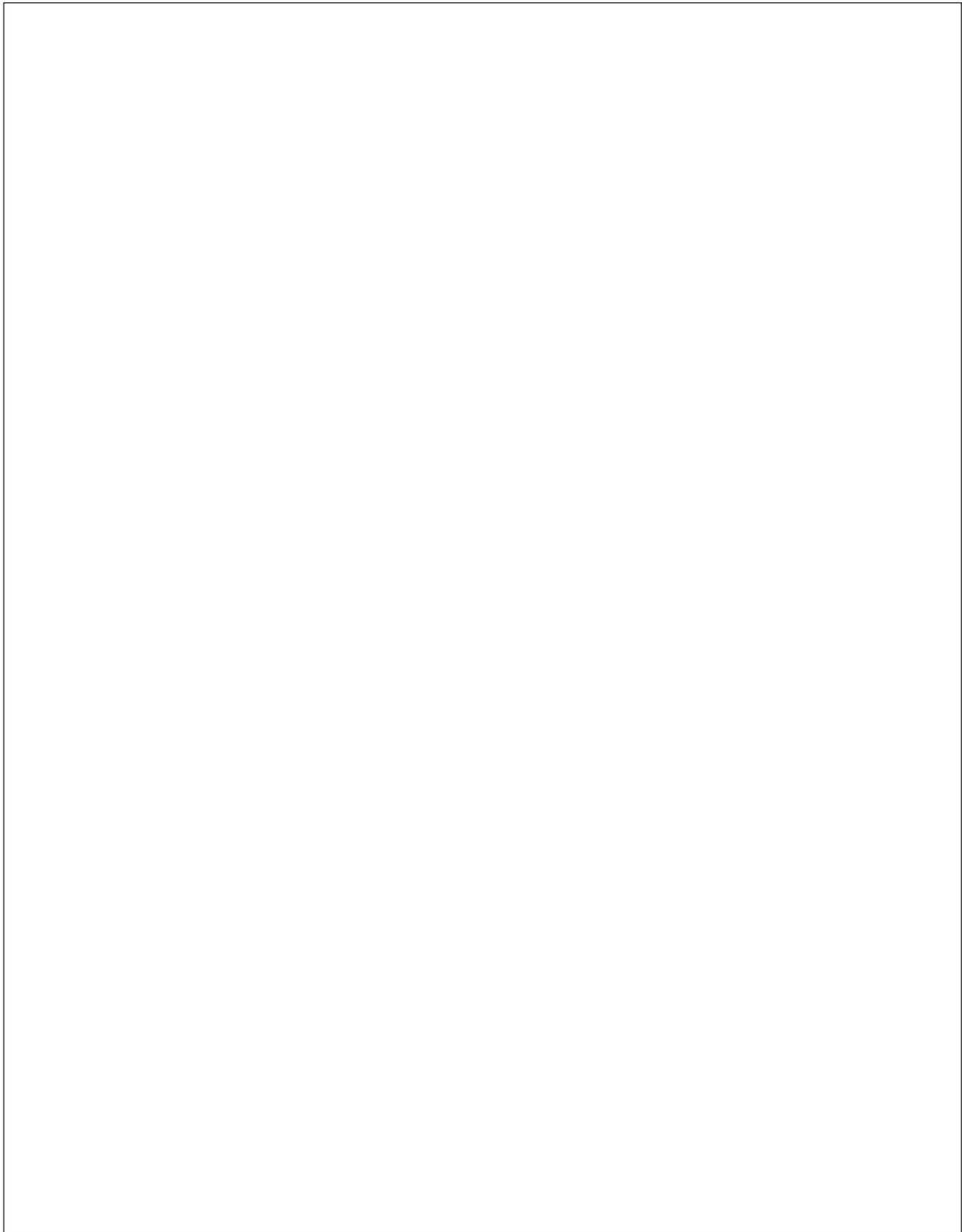


Figure 49—Long-term trends in ecological integrity for FS- and BLM-administered lands: Management Option 1.



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

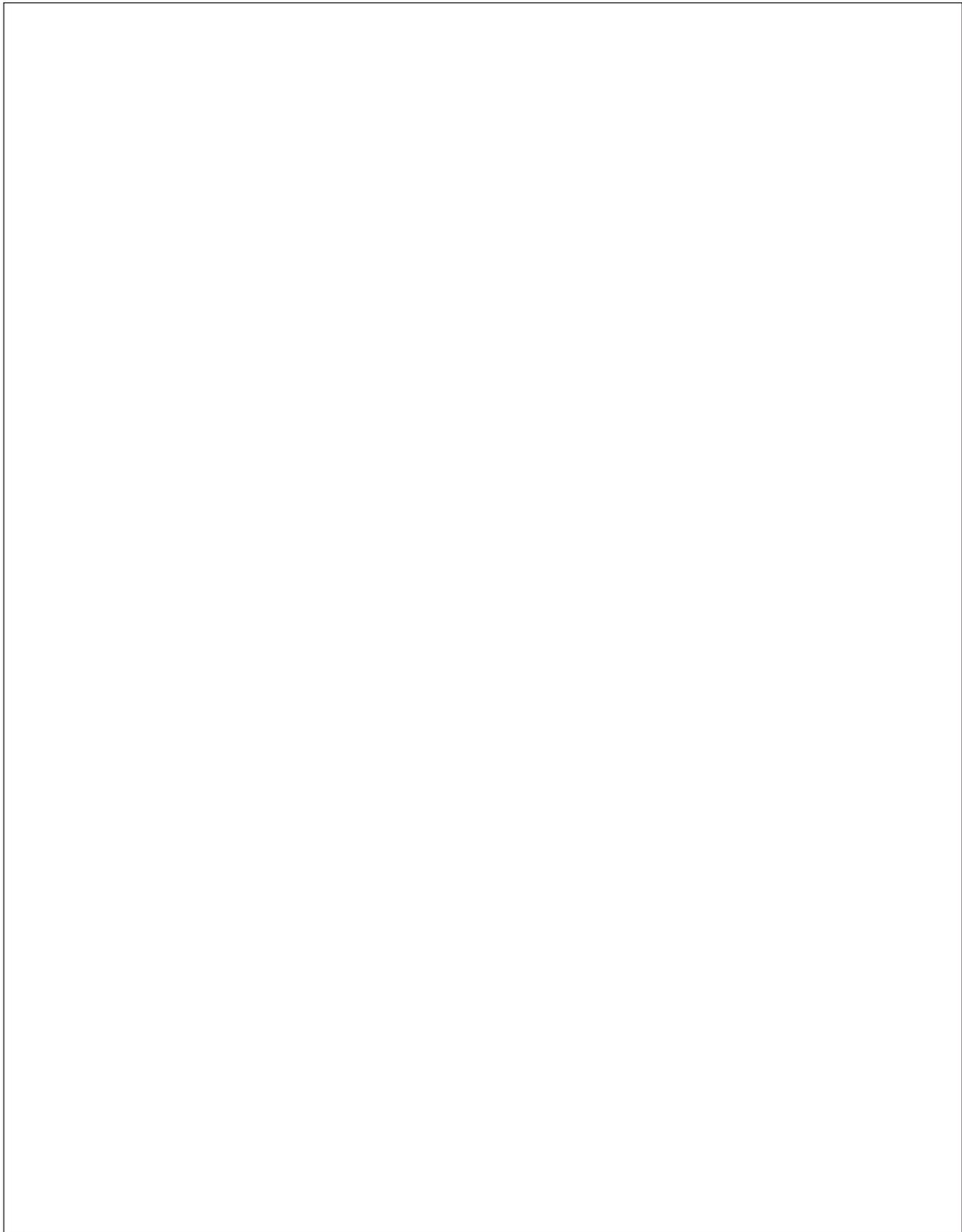


Figure 51—Long-term trends in ecological integrity for FS- and BLM-administered lands: Management Option 3.

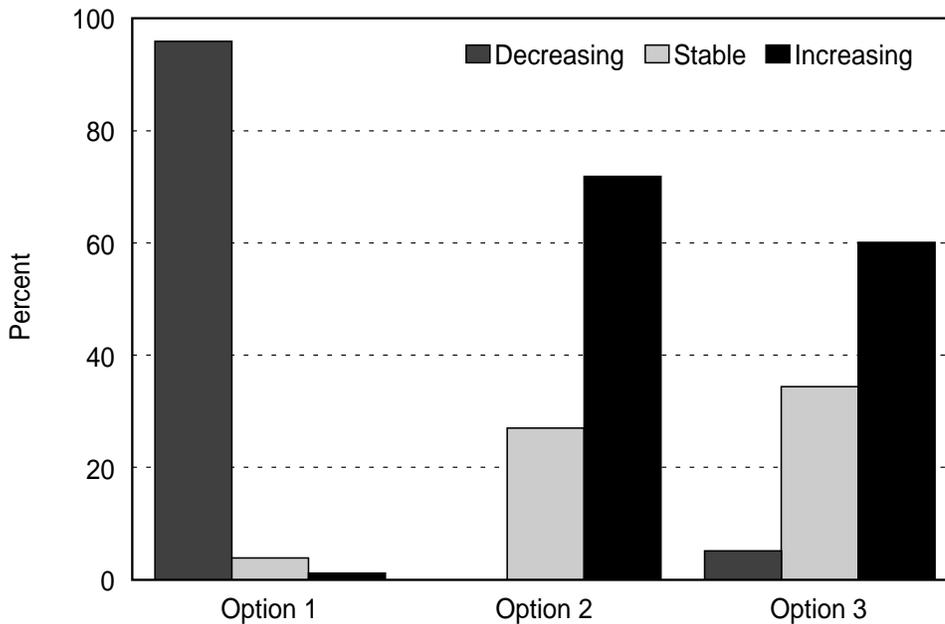


Figure 52—Trends in composite ecological integrity projected by Management Option.

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 col-linear, 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 Basin's 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.

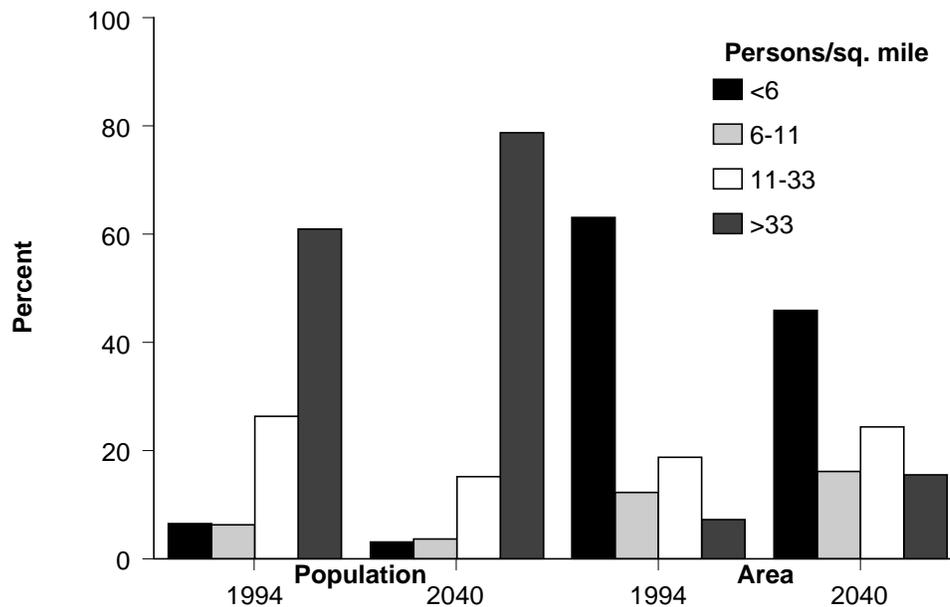


Figure 53—Distribution of population density categories by area and population of 1994 and 2040.

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 inherent uncertainty in social systems (because of both the speed at

which they change and the uncertainties inherent 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

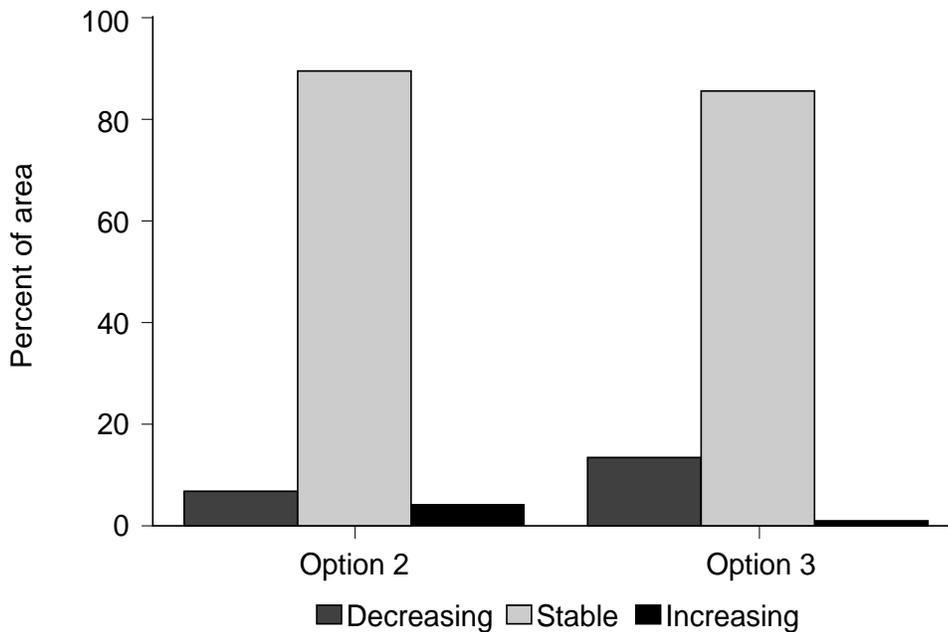


Figure 54—Trends in economic resiliency by area for Management Options 2 and 3.

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 pro-

duction 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 by T.M. Quigley

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
	-----percent-----		
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.

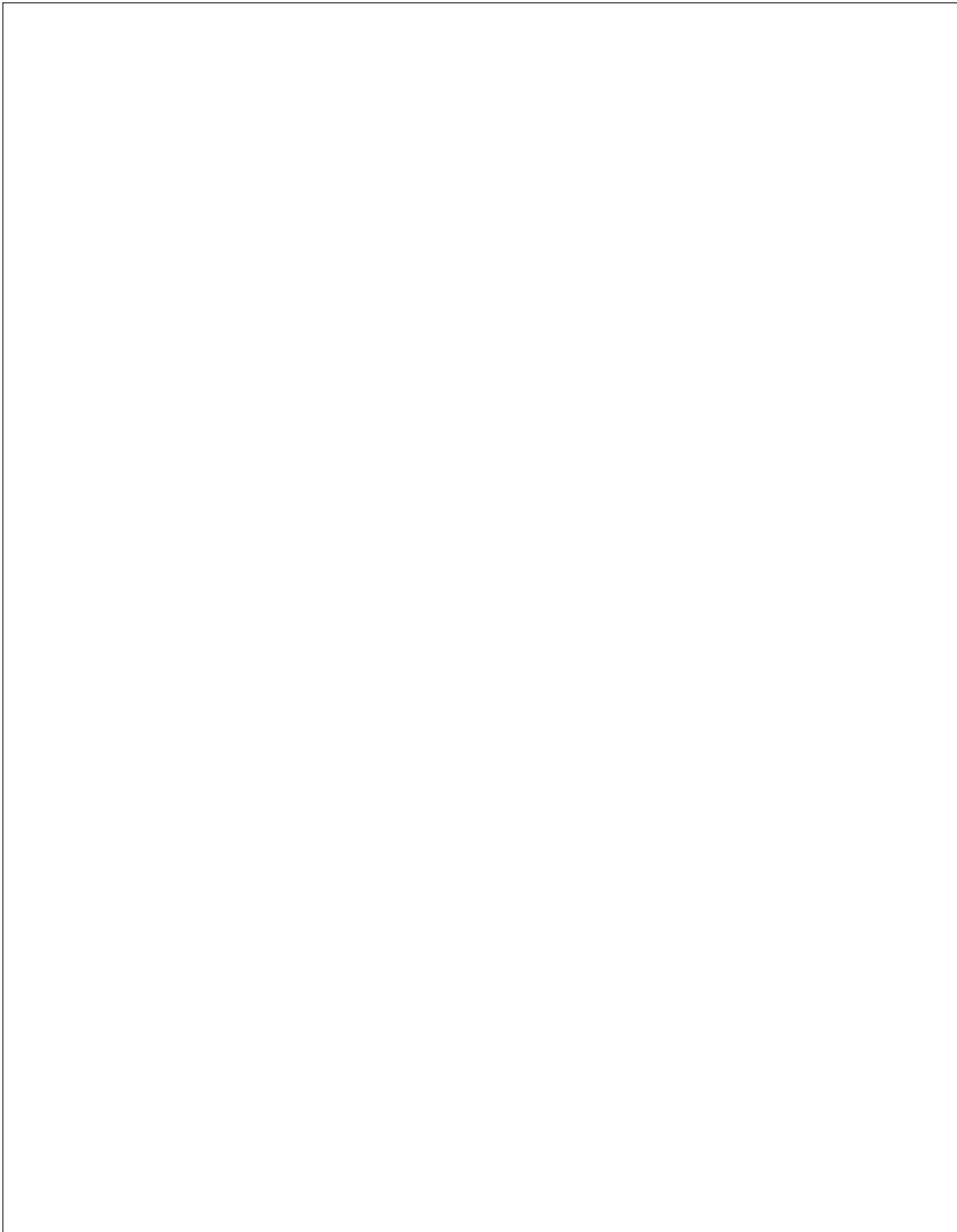


Figure 56—Long-term trends in risk of human ecological interaction BLM-administered lands only: Management Option 2.

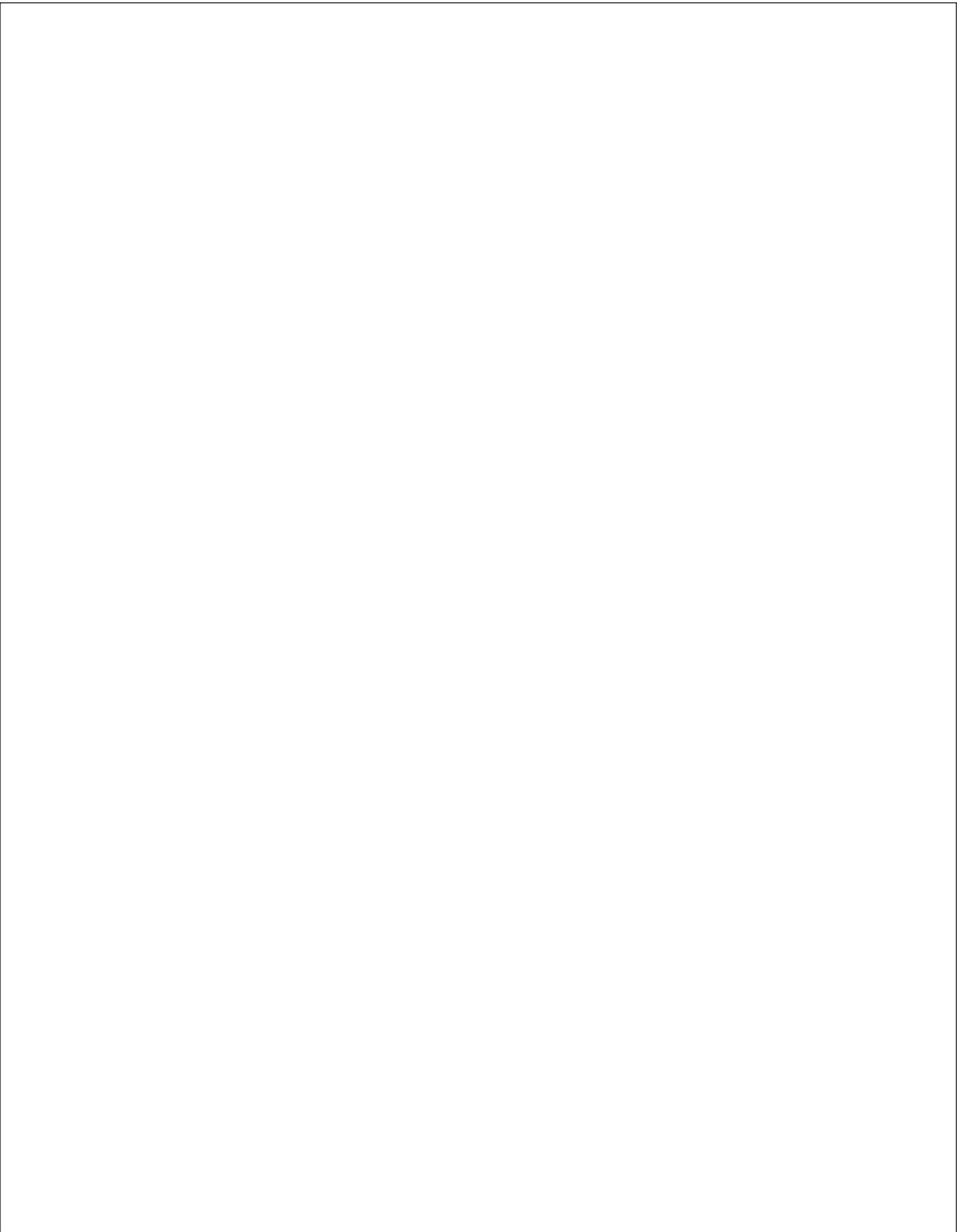


Figure 57—Long-term trends in risk of human ecological interaction BLM-administered lands only: Management Option 3.

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.

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