7 Effects on Riparian Areas and Fish Habitat

All forested riparian areas which are available for timber management activities, receive a moderate intensity of activity. Some riparian areas are located in scenic viewsheds These will receive a moderate intensity of timber management which will meet visual quality objectives (See Section E2 a in this chapter for descriptions of these riparian and visual prescriptions) Each alternative has some riparian areas which are located in wilderness, old-growth, or unroaded areas These will not receive timber management treatments All riparian areas are also available for livestock grazing except as specifically noted

a *Timber Management Effects*

Discussions of the effects of timber management activities on riparian areas and fish habitat are found in Chapter III In all alternatives with timber management activities occurring within riparian areas, a modified form of uneven-aged management is employed, except in lodgepole pine stands In those riparian areas which are within visual corridors, much of the large tree component will be retained Where moderate-to-high levels of fish habitat improvement are identified, two to three large trees per acre will be retained to provide instream woody material Otherwise, most large trees will be harvested from timbered riparian areas over time, and there will be a gradual shift to more shade-tolerant species such as Douglas-fir and white fir

Timber harvest can affect water quality and fish habitat in many ways Two important factors are shade for water temperature regulation, and instream large woody material which creates pools for rearing fish Timber harvest can remove both of these important fish habitat components

Standards for timber management activities in riparian areas are designed to address concerns for other resource values associated with riparian areas, especially water quality and fish habitat The riparian timber harvest prescription was developed in part to not only maintain sufficient shade to regulate water temperature to meet water quality standards (Forest Plan, Chapter IV, Section F, Management Area 3), but also to provide in-stream woody material This is done by limiting the amount of shade removed in any given timber harvest entry Any long-term reduction in amount of instream large woody material is mitigated by the addition of structural fish habitat improvement projects to maintain pools over time Thus, there will be changes in water temperature and fish habitat quality, but these changes are relatively small and localized The overall trend has been estimated to be stable or upward in all alternatives

Riparian areas will receive a lower-intensity level of timber management than that proposed in the Draft Environmental Impact Statement For viable alternatives, geographical boundaries of riparian areas as a minimum will be approximately 100 feet from the edge of all Class I, II, III streams and those Class IV streams supporting significant riparian vegetation Under Alternative C-Modified, no timber harvest from any tentatively suitable riparian lands adjoining Class I, II, or III streams is programmed For Alternative I, no timber harvest is scheduled within the interior one-third of all Class I, II or III streams (33 feet either side of the stream) Additionally, on Class I and II anadromous streams, no timber harvest would be scheduled for the entire riparian zone (100 feet each side of the stream) Alternatives A, B-Modified, and F have scheduled timber harvests on all tentatively suitable riparian acres associated with Class I, II and III streams Under all alternatives, for Class IV streams and for other riparian areas, such as around meadows, lakes and springs, the size of the area to receive a modified timber harvest will be determined with a site specific analysis For suitable acres, uneven-aged timber management would be featured, but site-specific silvicultural prescriptions would be tailored to meet riparian objectives

When applying group selection harvests (uneven-aged management), created openings larger than one-half acre in riparian zones would rarely occur Limiting the lineal distance of created openings alongside streams to 150 feet or less, while ensuring that adequate

stream surface shading remains would provide greater riparian resource protection For any Class I, II, or III stream, limiting the cumulative total acres of created openings to 10 percent or less of the riparian area acres along any given stream would also afford greater resource protection.

The effect of these prescriptions on water quality is to maintain shade, provide for streambank stability by designing timber harvesting activities along streams to provide for a future supply of large woody debris, maintain a filter strip to prevent sediment from reaching the streamcourse, and most important to ensure that timber harvests are subordinate to riparian-dependent resources

b. *Grazing Management Effects*

Livestock prefer to graze in riparian areas because of the relatively flat terrain and proximity to water. Typically, riparian zones provide 20-30 percent of the forage from only 3-5 percent of the area in a pasture The general effects of grazing on riparian areas are discussed in Chapter III.

In Alternative A, forage utilization of grass and grasslikes in riparian areas will be 70 percent of available forage Utilization of shrubs is not to exceed 67 percent of annual growth. An objective of this alternative is to achieve a stable or upward trend of riparian vegetation condition. Methods to reach this objective include upland water developments, salting, and riders.

Based on a literature review (Kauffman et al , 1983, Platts 1984, Platts and Wagstaff 1984), there remains the question of whether an upward trend of riparian vegetation can be achieved with 67 percent utilization on shrubs However, studies done at the Starkey Experimental Range indicate that these two objectives may be achieved concurrently. A high level of permit administration and monitoring is needed to accomplish these two objectives concurrently. At historic funding levels, this level of administration and monitoring would not be possible Therefore, there is a possibility that with planned livestock use levels, it would not be possible to achieve a continued stable or upward trend of riparian vegetative condition in all riparian areas on the Forest.

This potential problem could become more difficult over time At current funding levels, not all existing range improvement structures could be replaced as they reach the end of their useful life Thus, livestock control would tend to decrease over time This would make it more difficult to achieve the desired objective in the future

In all other alternatives, except Alternative A (possibly NC), riparian forage utilization is decreased from 70 percent to 45 percent. Utilization of shrubs is limited to 40 percent. Therefore, abundance and diversity of riparian vegetation, especially shrubs and hardwoods, should increase gradually over time This is assuming adequate funding for range administration and improvements to achieve good livestock distribution. This is a major factor in the expected steady increase in abundance and diversity of riparian vegetation Riparian areas in less than satisfactory condition are projected to attain a satisfactory condition within 50 years. Utilization objectives are not available for Alternative NC

In all alternatives except Alternatives A, and NC, additional range management practices result in accelerated vegetation recovery in anadromous riparian areas which are currently in unsatisfactory condition In alternatives B-Modified and F, these measures would be applied primarily in anadromous riparian areas In alternatives C-Modified and I, they would be applied in both anadromous and non-anadromous riparian areas. These measures are displayed in Table IV-7 and Table IV-8

There will also be investment in fish habitat improvement and watershed rehabilitation in riparian areas in less than desirable condition This instream and streamside structural work for watershed and fisheries also helps to accelerate vegetation recovery by stabilizing streambanks and raising the water table locally In all alternatives except Alternative

C-Modified and I, priority for this work is on streams with anadromous fish Thus, vegetative condition should visibly improve in a large portion of the riparian areas along streams with anadromous fish within the first two decades Improvement will occur at a slower rate in other riparian areas The rate of improvement for Alternative NC is not available

Increased abundance and diversity of riparian vegetation, especially the deciduous woody component, will give riparian areas a more aesthetically pleasing appearance for most Forest visitors. It will increase habitat diversity for a variety of wildlife species, and it will contribute substantially (over 80 percent of the increase) to increased anadromous fish outputs projected for these alternatives

In the Draft EIS, Alternative B would have 20,000 acres of range seeding to improve livestock forage occurring on relatively flat, nonforested range. These areas include moist meadows, but seeding would not occur in riparian zones along Class I and II streams For the Final EIS, this level of range improvement forage seeding was dropped from Alternative B-Modified due to a broad lack of public support for this proposal

In Alternative B-Modified, limited livestock grazing is prescribed along approximately 70 miles of anadromous streams with riparian areas in less than satisfactory condition This is to be continued until substantial recovery of riparian vegetation occurs After recovery, woody riparian vegetation should be of sufficient size and density to maintain growth and vigor with 40 percent utilization of the available annual production Rapid vegetation improvement is expected in these areas. Fish production is expected to increase by 200 percent within two decades (Hall and Baker 1982, Platts 1981) This is in addition to the increase in fish production due to vegetative improvement in other riparian areas, which should occur due to the change from 70 percent to 45 percent utilization of riparian forage

In Alternatives F and I, limited livestock grazing could occur on about 60,000 acres These areas would encompass about 150 miles of streams, including the 70 miles of anadromous streams with unsatisfactory riparian areas described previously for Alternative B-Modified. Limited use would be staged over a 30-year period The objective for riparian vegetation condition is to achieve the desired future condition in 30 years

In Alternative C-Modified, livestock would be limited or excluded from existing pastures containing less than desirable riparian areas In this alternative, priority does not necessarily go to those streams with anadromous fish Thus, improved riparian condition would be more evenly distributed across the Forest Because of the distribution of less than desirable riparian areas, it is estimated that 20-25 percent of existing pastures would be affected This alternative results in the greatest potential increase in fish production (very close to Max Fish Benchmark amounts), but also results in the largest reduction in livestock Animal Unit Months

Alternative I has features of Alternatives C-Modified and F As in Alternative F, it is expected that riparian pastures with lower forage utilization standards, or livestock exclusion for a few years, will be a common approach to achieving accelerated riparian recovery, with other techniques available to fit site specific needs. As in Alternative C-Modified, limiting, or excluding livestock to achieve accelerated riparian recovery is not limited to anadromous streams, although these streams will still generally receive higher priority due to the economic value of the anadromous fisheries The number of pastures and streams which will be affected this way is not known precisely at this time The inventory, evaluation and management recommendations (for livestock, timber and other resource management activities) to achieve the desired riparian condition, will be part of the Allotment Management Plan updates scheduled for completion in the first decade of the Forest Plan implementation

c. *Fish and Wildlife Management Effects*

Most wildlife habitat improvement projects occur on upland areas, so they do not generally affect riparian areas. One exception would be aspen and/or other hardwood regeneration projects, which would have the effect of improving vegetation vigor and diversity in riparian areas

The amount and quality of rearing area available during summer low-flow and winter icing periods are common limiting factors for fish carrying-capacity in streams on the Forest. Therefore, instream and streamside structures to improve the pool/riffle ratio and improve pool quality for rearing fish are common types of structural fish habitat improvement projects These structures also improve bank stability and raise the water table locally, thereby helping to improve riparian vegetation condition in the areas treated

Water temperature and overhead cover are important factors affecting the availability and quality of pool habitat Riparian vegetation is usually the key to water temperature regulation and cover Therefore, to receive the full benefit of structural fish habitat improvements, overall riparian vegetation condition must be good. Measures to improve riparian vegetation are also important fish habitat improvement projects

The overall improvement in riparian vegetation condition projected for all alternatives (except Alternative NC) plus about 60 miles per decade of fish habitat improvement (40 miles in Alternative I, approximately 30 miles in C-Modified) as mitigation for any loss of natural large woody material in the streams due to past activities, will meet or exceed *the Management Requirements and maintain fish habitat capability at or above current* levels Past success of this mitigation work is high Miles of fish habitat improvement in Alternative NC are not available.

It is assumed that funding by the Bonneville Power Administration (BPA) for fish habitat improvement as mitigation for dams on the Columbia River will continue through about 1994, with the possible exception of Alternative NC. This would result in a total of about 10 miles of stream treated on the Forest in the first decade If this funding is terminated prior to completion of all planned work, other funding sources, such as K-V funds, would need to be used to attain projected fisheries outputs

Planned structural habitat improvements for the first decade, in addition to the Bonneville Power Administration funded work, are shown in Table IV-6. In all alternatives except Alternative C-Modified and I, priority for fish habitat improvement above the Management Requirement level will be in anadromous fish streams. Fish habitat improvement work will also be accomplished with Knutsen-Vandenberg funds generated from timber sale receipts For all alternatives, except C-Modified, lower intensity habitat improvement work as mitigation for timber harvest in riparian areas would occur on about 60 miles of stream in the first decade (40 miles in Alternative I).

TABLE IV-6: Structural Fish Habitat Improvements in the First Decade
(Miles Treated. in addition to BPA funded work and mitigation)

Alternatives					
NC (No Change)	A (No Action)	B-Mod	C-Mod	F	I (Preferred)
N/A	20	30	50	20	20

d. *Mining Effects*

The combined effects of timber management, range management, watershed improvement, fish and wildlife habitat management and mining are all important factors affecting riparian areas and fish habitat. The amount of riparian improvement and increased

fish production potential varies by alternative In all alternatives except Alternatives C-Modified and I, vegetative condition should visibly improve in some portion of the riparian areas along streams with anadromous fish within the first two decades Improvement will occur at a slower rate in other riparian areas In Alternatives C-Modified and I, this improvement will be more evenly distributed across the Forest. Increases in the abundance and diversity of riparian vegetation, with the associated geomorphic recovery of the stream channel, will account for the larger part of the expected increases in fish habitat capability over time, in all alternatives Since this type of recovery generally takes several decades to achieve, fish habitat capability is expected to increase throughout the planning period The changes in potential anadromous fish production resulting from the combined effects of all of these management activities are displayed in Table II-5 The Smolt Habitat Capability Index numbers are displayed in Figures IV-7 and IV-8.

FIGURE IV-7: Smolt Habitat Capability Index - Steelhead

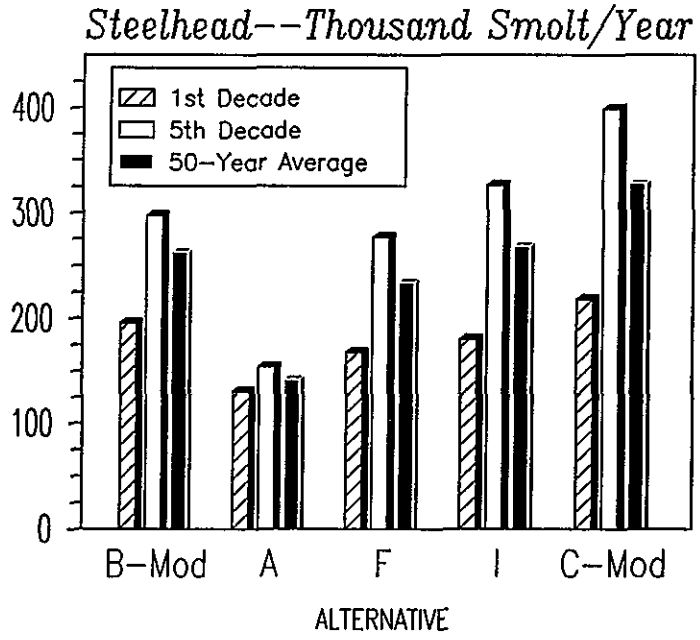
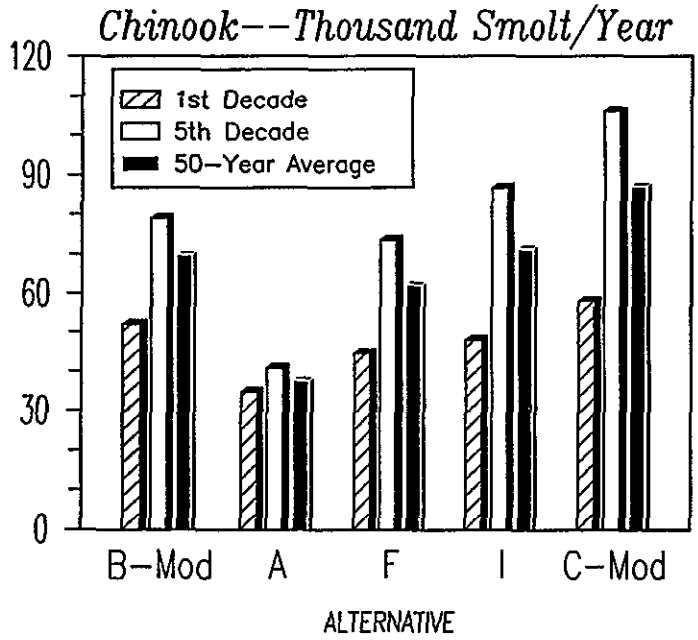


FIGURE IV-8: Smolt Habitat Capability Index - Chinook



Mining operations may have a significant impact on vegetation in riparian zones. Placer mining may particularly reduce riparian vegetation needed for soil stability and stream shading

Mitigation measures used in riparian areas to alleviate mining disturbances will include seeding to stabilize soil and re-establishment of brush to provide stream shading. In some instances, fencing to exclude grazing will be required to allow reestablishment of vegetation.

8. *Effects on Water*

Water quality and water yield changes are potentially affected by timber management. Although timber harvest can increase annual water yield, these increases are typically an insignificant part of the total runoff and are generally unmeasurable Research projects in watersheds managed for full sustained yield timber harvest have shown water yield increases by as much as six percent (Harr 1983) However, under the various alternatives, portions of every watershed will be unsuitable for timber production and have Management Areas that have less than full sustained timber yield applied. Therefore, water yield increases Forest-wide will be significantly less. Implementation of any of the alternatives will not have a measurable effect on water yield Implementation of any of the alternatives will have no measurable effect upon the municipal watersheds of the towns of Long Creek and Canyon City See Chapter III for additional information.

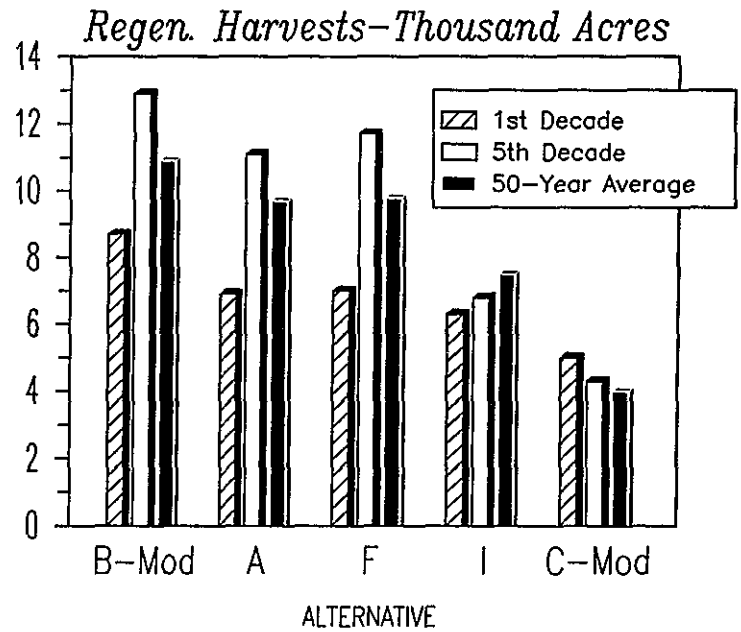
Due to the lack of specific information regarding management activities in Alternative NC, the effects of this alternative cannot be estimated and evaluated to the same degree as other alternatives Based on available information, Alternative NC will closely approximate Alternative A

The water quality goal in all alternatives will be to protect beneficial uses for all decades of the planning period, through implementation of the Forest Standards (Forest Plan, Chapter IV, Sections E and F) and other Best Management Practices.

a. *Timber Management Effects*

The risk of impacts to water quality increases in those alternatives which propose the greatest amount of timber removal, allocate the most land base to timber harvest, have the largest acreages under intensive timber management, treat the most acres under a clearcut/regeneration harvest method, and have the most acres harvested on steep slopes greater than 35 percent. Figure IV-9 displays the acres of regeneration harvest in each decade by alternative Table IV-7 displays the percentage of timber harvest occurring on steep slopes in each alternative Sediment production, with the risk of this sediment reaching a live stream, is probable whenever logging occurs. Increases in turbidity/suspended sediment are the result. Water temperature could also increase from the excessive removal of streamside vegetation Water quantity yield increases could occur because water yield increases are a function of the degree of vegetation removal. This could lead to an increase in streamflow with possible streambank and streamchannel erosion. The consequences of increased water yield need to be evaluated on a site-specific basis In a small watershed heavily impacted by timber harvest, water quality degradation could occur which would be "masked" when evaluated in the overall effect to major watersheds Refer to Table II-5 timber outputs, Table IV-1, Table IV-2, Table IV-3, Figure IV-2, Figure IV-5, and Figure IV-6 for additional information about specific practices designed into alternatives

FIGURE IV-9: Regeneration Harvest by Alternative



The percentage of the timber harvest occurring on steep slopes in each alternative is shown in Table IV-7.

TABLE IV-7: Harvest Occurring on Steep Slopes
(Percent of Acres over 35 Percent Slope)

Decade	Alternatives NC (No Change)	A (No Action)	B-Mod	C-Mod	F	I (Preferred)
First	N/A	4	4	4	4	4
Fifth	N/A	6	10	6	6	8

The type of logging system used also has various effects on water quality. The trend for all alternatives except Alternatives C-Modified and I is for more regeneration harvests occurring using ground-based skidding equipment (tractors). Tractor logging creates more surface disturbance which increases the potential for impacts on water quality.

The trend for Alternative C-Modified is for fewer overall entries because the large-sized ponderosa pine will be favored over other species Fewer entries and less total timber volume removed means less ground-disturbing activities, which will potentially maintain or increase water quality

b. *Range Management Effects*

The range program will have no significant effect on water yield or streamflow. All alternatives have the same base acres (1,351,275) available for cattle grazing. The differences among alternatives are a function of the number of acres assigned to various range resource management levels, utilization standards on grass and shrubs, and the livestock strategy to be implemented in those riparian zones currently in a less than desirable condition The following definitions explain range resource management levels

Level A (No Livestock) Management excludes livestock grazing from designated allotments to protect other values or eliminate conflicts with other uses.

Level B (Some Livestock) Management controls livestock so that livestock use is within present grazing capacity Improvements are minimal and constructed only to the extent needed to protect and maintain the range resource

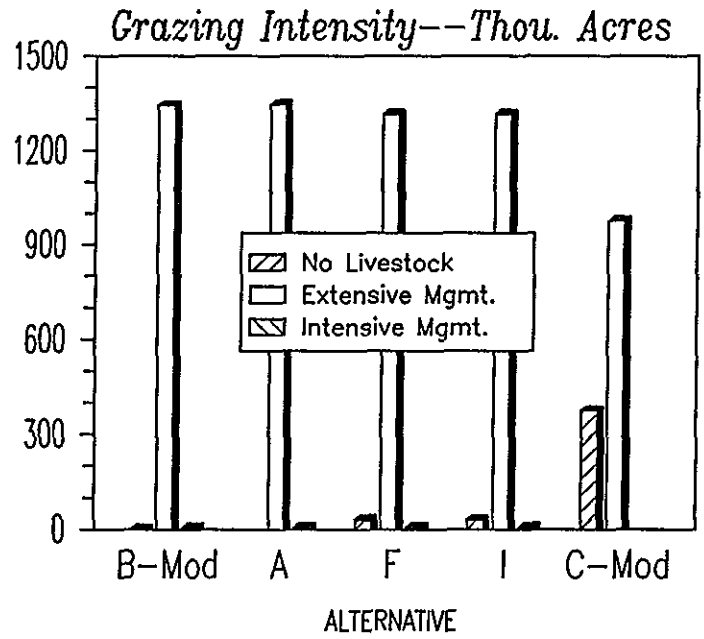
Level C (Extensive) Management seeks full utilization of forage available to livestock Cost-effective management systems and techniques, including fencing and water development, are designed and applied to obtain relatively uniform livestock distribution, use of forage, and maintenance of plant vigor

Level D (Intensive) Management seeks to optimize production and utilization of forage available for livestock use consistent with maintaining the environment and providing for multiple use of the range Cultural practices such as brush control, type conversion, or seeding may be combined with fencing and water developments to implement complex grazing systems

One of the purposes of different levels of management is to prevent over utilization of the riparian zone favored by livestock (see Chapter III for additional discussion) When over utilization occurs, higher stream temperatures, sedimentation, and channel instability can result For purposes of monitoring, less than desirable riparian area improves to satisfactory when water temperatures do not exceed the State standard of 68° Fahrenheit.

The following figure displays acres allocated to grazing by management level for the first decade of each alternative

FIGURE IV-10: Acres Allocated to Grazing by Management Level



Animal unit months output is displayed in Table II-5 in Chapter II

In Alternative A, riparian area grass and grasslike forage will be 70 percent utilized to 3/4-inch "stubble" height following livestock and big-game use in both the satisfactory and less than desirable riparian zones Shrub utilization can be up to 67 percent of available current year's growth Forage seeding in areas disturbed by timber management activities will occur on 6,000 acres a year A by-product of this treatment is that forage establishment will help to prevent erosion on those acres which might contribute sediment to adjacent streamcourses The less than desirable riparian areas will continue to contribute sediment, and recovery will not occur The improving trend now occurring in other riparian areas will continue at a slow pace over a long time span No additional investment is required to implement this alternative

Alternative B-Modified limits livestock use on all vegetation (grass and shrubs) on 2,000 acres immediately adjacent to anadromous fish streams which are in a less than desirable condition To attain 0-40 percent utilization where less than desirable conditions exist, controlled use of pastures or additional fencing will be required This alternative has the second highest outputs in Animal Unit Months of the alternatives. To obtain this rather high use-level, corridor fencing would most likely be employed This would only limit livestock use on 2,000 acres out of a total of 1,351,275 acres available Approximately 150 miles of new corridor fences would probably be constructed for the purpose of vegetative recovery. This would require a fairly high level of initial investment plus maintenance costs

The remaining 4,000 acres of less than desirable riparian areas that occur on resident trout streams would be grazed at 45 percent utilization rate on grasses and 0-40 percent utilization on the available current year's growth of shrubs Eventually, an acceptable condition will occur because the utilization rate for both grasses and shrubs would decrease from present The result of these modified grazing practices should be a decrease

in sediment levels and in low-flow summer stream temperatures, especially on anadromous fish streams Less than desirable resident trout streams would show the same improvement effect but not as rapidly Other satisfactory riparian areas would also show improvement in water quality because the utilization rate for both grasses and shrubs would decrease from present

To achieve reduced utilization standards when compared to existing forage utilization, the assumption must be made that there will be a sufficient budget to adequately administer livestock use Otherwise, the rate of vegetative recovery would be much slower or nonexistent. Adequate administration would also have to include monitoring utilization of the riparian shrub community. No more than 50 percent utilization can occur if rapid vegetative recovery is to occur. The consequences of insufficient budgets to administer livestock utilization apply to all alternatives and especially to Alternative A, because it has the highest use and therefore the greatest risk to the water resource

Alternative B-Modified also has the potential to increase sediment levels on a short-term basis by converting existing unpalatable vegetation (sagebrush) to a more palatable species (grass) for cattle These activities would occur on land that is less than 35 percent slope. If ground-disturbing activity such as disking or chaining is necessary to prepare the site for seeding, the land is susceptible to erosion until the seeded grasses become established. Forage seeding in areas disturbed by timber management activities will also occur on 6,000 acres a year in this alternative A by-product of this treatment is that forage establishment will help to prevent erosion on those acres which might otherwise contribute sediment to adjacent streamcourses

Alternative C-Modified requires controlled cattle use in entire pastures that contain less than desirable riparian areas until they improve to satisfactory condition This affects both anadromous and resident fish streams on 375,000 acres which are in this category Vegetative recovery, stabilization of streambanks, and water quality improvement take the least amount of time when no utilization occurs This not only applies to Alternative C-Modified, but also to all other alternatives where controlled use by livestock in the riparian zone is part of the treatment. After recovery, riparian zone grasses can be utilized up to 45 percent and shrubs can be utilized up to 40 percent of the available current year's growth. This should decrease the amount of sediment caused by cattle. When the vegetation becomes more established, it will start to provide stream shade which will lower water temperatures during the low-flow summer period. No additional investments in structural and nonstructural improvements are required to implement this alternative. However, additional monitoring will be required to assure that utilization objectives are met.

In Alternative F, grasses in satisfactory riparian zone can be utilized at 45 percent and shrubs utilized to not greater than 40 percent of the annual available year's growth Forage seeding in areas disturbed by timber management activities will also occur on 6,000 acres a year in this alternative A by-product of this treatment is that forage establishment will help to prevent erosion on those acres which might contribute sediment to adjacent streamcourses In less than desirable riparian zones, this alternative has a utilization standard of 0-40 percent on the grasses and 0-30 percent livestock utilization of the shrubs Streams are treated on a priority basis whether they are anadromous or resident fisheries. All methods can be used to obtain the reduced utilization standard. The method used will fit site-specific requirements for improving the riparian zone to a satisfactory condition Any one method or combination of methods might be incorporated to treat a less than desirable riparian zone such as corridor fencing, range riders, extra water developments, extra salting, nonuse of pasture, early- or late-season grazing, short-term grazing rather than season long, reduced livestock numbers, control of grass and shrub utilization, or fencing to create additional pastures Treatment of a total of 60,000 acres would be spread out over 30 years as would be the beneficial effects of treatment. The recovery period would therefore take longer to achieve reduced sediment and stream temperatures when compared to implementing all the treatments during the first decade.

No information about grazing management practices is available for Alternative NC

Forage utilization standards for Alternative I are somewhat different from the other alternatives, as it includes utilizing grasses in satisfactory riparian areas to 45 percent and up to 35 percent in less than desirable riparian areas Shrub utilization in less than desirable riparian areas are at a maximum of 30 percent, as there are more restrictive utilization standards than other alternatives Allotments which are found to have riparian areas in less than desirable condition would be identified through a process keyed to the Forest Plan.

Alternative I has riparian standards for both non-anadromous and anadromous riparian areas The major difference between the two is in the recovery period, 30 years for non-anadromous and 15 years for anadromous, for improving a less than desirable riparian area to a satisfactory condition. Riparian habitat recovery will be planned, designed, and implemented to reduce or eliminate the impacts of management activities that may slow recovery

Range management effects for Alternative I will improve riparian vegetative communities, benefit all riparian-dependent resources, and improve water quality more than other alternatives, with the exception of C-Modified

A schedule for updating all Allotment Management Plans (AMPs) on the Forest is listed in the Forest Plan, Appendix A, Activity Schedules Riparian objectives will be set for each Allotment Management Plan, identify management actions needed to meet the objectives, a time frame for recovery, and the monitoring needed to determine if the desired rate of improvement is occurring. A riparian inventory will be undertaken for key parameters, such as stream surface shade, streambank stability, and streambank vegetation The process used for doing this inventory will be the procedure described in "Managing Riparian Ecosystems (Zones) for Fish and Wildlife in Eastern Oregon and Eastern Washington" (1979)

The following tables, Table IV-8 and Table IV-9, display the livestock strategy in riparian zones by alternatives.

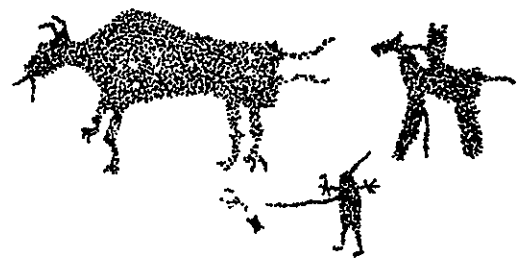


TABLE IV-8: Livestock Strategy in Less than Desirable Riparian Zones by Alternative

Utilization Standards[1]	Alternatives NC	A	B-Modified	C-Modified	F	I
Kentucky Bluegrass	N/A	70%	0-40%	0-40%	0-40%	0-35
No added emphasis on riparian zone management		Limit or	Limited or exclude use on all vegetation immediately adjacent to streams desirable riparian areas until they improve to satisfactory	Vary use no use on entire pastures that contain less than they improve to satis-factory, treatment of streams is on a priority basis	Vary use between 0-40 percent on less than desirable riparian areas until they improve to satis-factory, treatment of streams is on a priority basis	between 0-35 percent on less than desirable riparian areas until
Shrubs (Available current year growth)	N/A	67%	0-20% use within stream corridor	0-40%	0-20% within riparian pasture	0-30% within riparian pasture
Additional investment level	N/A	None	High	None	Moderate	Moderate

1/Livestock and big-game combined use

TABLE IV-9: Livestock Strategy in Satisfactory Riparian Areas by Alternative

	Alternatives NC	A	B-Modified	C-Modified	F	I
Kentucky Bluegrass	N/A	70%	45%	45%	45%	45%
Shrubs (Available current year growth)	N/A	67%	0-40%	0-40%	0-40%	0-40%

NOTE Use standards for shrubs will take precedence when shrubs are present in the riparian area Percentage figure is the average for the decade and may vary on a yearly basis as prescribed in the Allotment Management Plan Percent use is combination of livestock and big game

c *Fishery Management Effects*

On those anadromous streams where fish habitat improvement projects occur, there will be beneficial changes in water quality and streamflow. The structures used to improve fisheries habitat will also trap sediment, improve streambank stability, raise the water

table, and encourage riparian vegetation growth There are short-term degradations in water quality which arise from the construction phase of these projects. Streambanks and streambeds are disturbed by heavy equipment operating within the wetted perimeter of the stream. High levels of sediment are produced from these activities for a short time during construction Within those drainages where fish habitat improvement projects are completed, there will be a cumulative improvement from these projects which should continue through the first decade.

d *Watershed Management Effects*

Watershed improvement projects will have a beneficial effect on water quality and quantity Sedimentation will be reduced and water retention increased as gullies are check dammed and streambanks stabilized Watershed improvement projects are identified and prioritized on the Watershed Improvement Needs (WIN) inventory (see Appendix A of the Forest Plan) WIN projects will be coordinated with fisheries and wildlife when they occur in less than desirable riparian areas

Alternatives I and C-Modified will each treat 100 acres per year per decade, Alternative F will treat 50 acres per year per decade, and Alternatives B-Modified and A will each treat 20 acres per year per decade

FIGURE IV-11: Acres of Watershed Improvement by Alternative

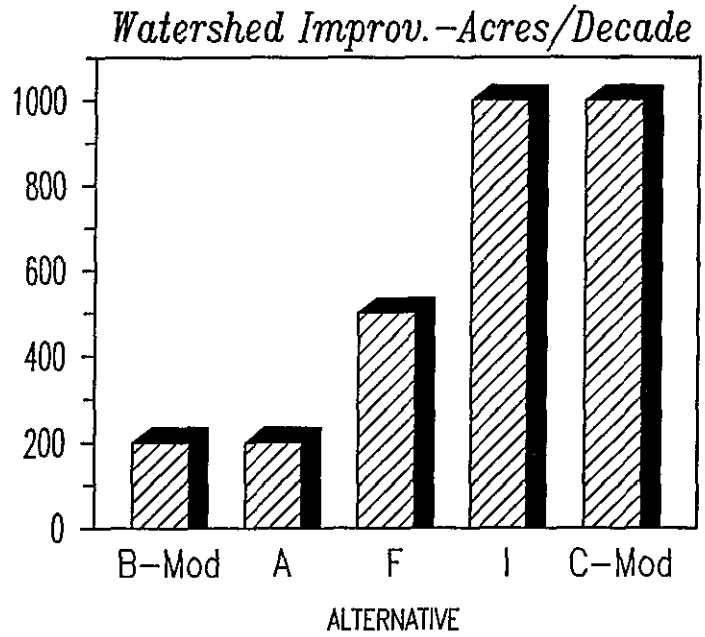


Table IV-10 provides a summary of watershed projects in less than desirable riparian areas by alternative.

TABLE IV-10: Watershed Projects in Less than Desirable Riparian Areas (Miles Treated per Year)

	Alternatives					
	NC (No Change)	A (No Action)	B Mod	C Mod	F	I (Preferred)
First Decade	N/A	0 2	2	2 5	1	3.3
Decades 2 - 4	N/A	0 2	1	2 5	1	3.3

If these additional sources of funding are available, then the target acres per year may be higher and the activity schedule adjusted as the projects are completed regardless of the source of the dollars These WIN projects are prioritized by each Ranger District. Projects will be accomplished throughout the entire Forest by working through the Ranger District's priorities from high to low

e *Visual Management Effects*

In all alternatives, those stream reaches in a visual management corridor will have the same effects as noted for timber harvesting, except there will be more entries on a smaller land base to meet the visual objective More stream-surface shading should result because more vegetation is left In mixed conifer stands the shade-tolerant species will be more prevalent.

f *Recreation Management Effects*

In all alternatives, potential exists for sanitation problems from dispersed recreation because limited sanitary facilities exist for Forest users These problems are expected to be very site-specific and insignificant overall

g *Transportation Management Effects*

Table IV-11 displays the miles of road built by alternative, comparing the miles of road construction and reconstruction by alternative. The ranking of alternatives in the first decade, from highest to the lowest number of roads built, is Alternatives B-Modified, A, F, NC, I and C-Modified The alternatives which propose more roads have a higher potential to adversely impact water quality

The potential effect on water quality is from sediment derived from the road prism during construction, with the majority occurring during the first two years. There should be less potential for delivering sediment to streams from road reconstruction, because it disturbs fewer acres Roads also have the potential to increase the efficiency of runoff when compared to an unroaded watershed Road water management structures (culverts) speed the time of concentration to the stream channel, which may increase the peak streamflow from a rainstorm or rapid snowmelt event This can cause stream channel erosion.

Table IV-11 displays the miles of road built by alternative Alternatives which propose more roads have a higher potential to adversely impact water quality

TABLE IV-11: Miles of Road Constructed and Reconstructed by Alternative

Decade	Alternatives NC 1/ (No Change)	A (No Action)	B-Mod	C-Mod	F	I (Preferred)
First	740/2120	810/1567	811/1585	489/1082	800/1563	618/1320
Second	N/A	328/1413	378/1372	103/1003	356/1423	297/1202
Fifth	N/A	45/1214	85/1200	72/992	35/1210	90/1169

1/Road miles are from the 1979 Timber Resource Management Plan and are not directly comparable to the figures for all other alternatives

h *Mining Effects*

Various mining activities can affect the pH, metals concentration, and chemical content of water in Forest streams Suspended sediment load in streams can also occur and is the most common mining impact, coming from placer gold processing operations. All operators are required to comply with State water quality laws, but accidents may occur Lode (hard rock) mining operations may change pH of water and, consequently, its capacity for carrying metal ions. Metal recovery operations may use chemicals which could pose a threat to water quality if not managed properly

i *Cumulative Effects*

The fish habitat improvements installed to date are serving the intended purpose of improving rearing and spawning habitat for resident and anadromous fish Water depth is often increased and should serve to maintain acceptable water temperatures

Concentrated cattle grazing in riparian areas may reduce the diversity of vegetation available as forage. Plants such as Kentucky bluegrass may increase in density, while native species such as tufted hairgrass could decline A change in plant composition, combined with soil compaction and reduction in litter coverage, may cause increased surface flow, erosion, and sedimentation

One cumulative effect of timber harvest, in particular clearcuts, applied on a continuing rotational basis is an increased water yield from larger forested watersheds, however, the increase will be small The cumulative effect of timber harvest on low flow will be small and difficult to measure Continued research and monitoring is necessary to determine the cumulative effects of timber harvest on peak flow Water yield is expected to increase from larger watersheds during spring snowmelt This is a cumulative effect of continued timber harvest in the areas of snow accumulation Increases in snowmelt runoff would probably be small (Geppert et al , 1985)

Timber harvest may cause a downstream effect by increasing nutrient levels as harvest progresses. However, because of the distance water must travel from harvest units, nutrient accumulations in the mainstem rivers will be small (Geppert et al , 1985).

A cumulative effect on water temperature is likely in larger watersheds if they are harvested within a short timeframe Large, continuous harvest blocks which contain streams may lack shade If future harvest is scheduled over a longer time period and spaced out, an effect is not anticipated (Geppert et al , 1985) The cumulative effects of reforestation on water are not presently known.

Currently, watershed improvements are very limited and the cumulative effects are not known.

The cumulative effects could be highly variable depending upon location, intensity, and duration of mineral extraction activities. If toxic contaminants are allowed to enter streams, these materials will create effects of various magnitude to water quality

The cumulative effect of roading any watershed is the increasing potential to change peak flows as the transportation system is completed To mitigate erosion, roads are designed and maintained to manage the water intercepted and concentrated upon the roadway Roadcuts intercept upland subsurface waterflow which becomes surface water upon the roadway. Surface water from the road prism is rerouted off the roadway through culverts. Increased peak flows will be influenced most by any road located adjacent to the stream channel network This is because water discharged from the ditch relief culverts will not be able to infiltrate slowly back into the ground. This water will then become readily available for streamflow rather than being slowly supplied by groundwater. Roads add additional artificial drainage channels to the watershed which deliver water more efficiently (faster) when compared to an unroaded watershed The road density, use pattern, and type of designed road-drainage features all affect delivery time.

Road construction, season of use, and road maintenance can increase suspended sediments in streams receiving road water drainage Increases are the greatest when roads are new or in active use during wet conditions The mitigation for roads is discussed in the following mitigation measures section.

The cumulative effect of wildfires cannot be anticipated and cannot be addressed. Repeated use of prescribed fire on individual sites should not cause adverse cumulative effects to either water quality or quantity (Geppert et al , 1985)

Changes between the Draft to Final Environmental Impact Statement have updated the mechanism for evaluating the effects of harvest activities on subwatersheds over time In watersheds where project scoping identifies an issue or concern regarding the potential for adverse cumulative effects of activities on water quality or stream channels, a cumulative effects assessment will be made An issue that occasionally arises is one which addresses the effects of timing on water runoff within certain subwatersheds. To facilitate this analysis work, the Forest will be further divided up into roughly 150 logical subwatersheds, varying in size from approximately 300 to 20,000 acres in size (third order watersheds).

A harvest effects model will be applied which converts a range of harvest activities to a common factor and applies a recovery rate to simulate hydrologic or watershed recovery over time. Timber harvest is the driver for cataloging watershed impacts. Harvest activities alter the vegetation on a watershed bringing about changes in interception, snow accumulation and snow melt, soil moisture, infiltration, exposing mineral soil to erosion, potentially affecting water quality, quantity and timing The following displays how the model will be used on the Forest

(a) It is a picture of harvest activity within an area over time
(b) It can be a measure of harvest dispersion effects within an area over time.
(c) It relies heavily on professional judgment and the evaluation process that is the basis of the interdisciplinary team approach.
(d) It identifies potential "red flag" situations
(e) It is not a decision maker. It does not provide a number that is the final answer but rather is another tool that is used to provide information for the decision maker to use
(f) It provides for the first time calculations of harvest effect which set a baseline to assist the Forest in monitoring and evaluating the effects of harvest management activities over time. Based on monitoring results, adjustments can be made to the Model to improve its accuracy

j. *Mitigation Measures*

Forest Service management practices will meet, as a minimum, the substantive State, Bureau of Land Management requirements, and other considerations required by the National Forest Management Act (NFMA), and other authorities, for the protection of the soil and water resource. For further discussion of Best Management Practices, see the Forest Plan, Chapter IV, Sections E and F.

Forest-wide Standards have been developed to protect the water resource and riparian areas (Forest Plan, Chapter IV, Sections E and F). These state that riparian resources will receive emphasis over other resources Other resource activities may occur to the extent that riparian resources are not adversely affected in the long-term Refer to the mitigation measures section in Chapter II which apply to specific alternatives, and those mitigation measures which apply to all alternatives, for additional information.

Range allotment plans also will include objectives for riparian areas When the current riparian condition is in less than the desired future condition, the plan will include a time schedule for improvement, actions needed to meet riparian objectives, and monitoring needed to determine that the desired rate of improvement is occurring Mitigation actions include reduced forage use, utilization standards, reduced livestock numbers, modified season of use, additional fencing of allotment pastures, development of water sources away from live streams, salt placement, and herding Local Forest experience and professional judgment have determined that forage mitigation measures can be 75 percent effective if sufficient resources are available to plan, administer, and monitor use If resources are not available, management intensity will be reduced and mitigated through reduced numbers of grazing and browsing animals

Timber harvest activities next to streams will maintain vegetation which is needed to provide cover/shade, root strength for bank stability, and future supply of woody debris. Logging equipment will be kept out of Class I streams; on Class II-IV streams, equipment will be kept out when practicable (see Chapter III, Section 5 for an explanation of stream classifications) When unavoidable, equipment use will be conducted at times of minimum flow and at previously determined locations where bank and channel disturbances are minimized Woody debris deposited in stream channels from logging will be removed unless it is allowed as a result of environmental analysis Site-specific water quality and hydrologic concerns are addressed during the timber sale planning process (environmental analysis) Locations of timber harvest units and logging systems are modified where potentially adverse water quality impacts are identified High erosion hazard areas, unstable landforms, and temperature-sensitive segments of streamcourses are avoided Streamcourse protection needs and riparian areas are delineated on timber sale area maps and marked on-the-ground during unit layout

A riparian area is the stream and the adjacent area where management practices, which might affect water quality and other aquatic resources, are modified as necessary. Management practices are generally more restrictive for Class I streams than they are for Class II, III, and IV streams However, the appropriate land management practices which will be applied are analyzed on a site-specific basis It is possible to have more restrictive measures applied to Class III and IV streams than a Class I or II stream based on the characteristics or sensitivity of the site in question

The timber sale contract provides for the unique nature of riparian areas through standards and special clauses designed to meet water resource objectives. The following clauses are frequently used streamcourse protection, erosion prevention and control, erosion control structure maintenance, operating period, protection of reserve trees, special felling objectives and special yarding objectives, location of temporary roads, landings, skid trails, firelines, and current operating activities

Mitigation measures for the potential effects of roads on water quality and quantity include avoidance, reduction, and minimization measures For example, fragile areas are generally avoided and the obstruction of stream channels by slash resulting from road

building is avoided by disposing of it by burning, chipping, or burying it away from the floodplain.

Other effects are reduced by mitigation measures. For example, the erosive effect of surface water concentrated by road drainage features is reduced by installing water bars, drain dips, and other physical means. Runoff is dispersed by outsloping, water spreading ditches, etc., and sediment loads further reduced by vegetative filter strips and settling ponds. Vegetative filter strips also maintain shade to avoid high water temperatures and retain stream channel stability. Closure and obliteration are mitigation measures to reduce road surface disturbance and resulting erosion. Other methods of mitigating erosion by reducing road surface erosion include treatment of the surface with water, oiling, sealing, or paving, and by conducting operations during minimal runoff periods

The risk of occurrence of potential effects is also minimized by mitigation measures For example, the possibility of cut and fill slope failures is minimized by installing underdrains and other stabilizing structures, and use of various construction techniques such as layer placement and controlled compaction. The risk of pollutants, such as fuels and lubricants, entering streams is minimized by selecting service and refueling areas well away from wet areas and surface water, and by the use of berms around such sites to contain spills.

Settling ponds or some other acceptable method of water clarification are required for mining operations in which a large amount of suspended sediment is generated Lode mines must have water quality measurements taken, and any problems in pH or metal content must be corrected before the water is allowed to enter the waterways Metal recovery operations must obtain all necessary State Department of Environmental Quality permits, and comply with all pertinent safety regulations for use of hazardous chemicals

The application of these various types of mitigation measures is determined on a site- and project-specific basis. No mitigation measure is 100 percent effective; however, professional judgment and experience indicate that measures to reduce sediment are 70 to 80 percent effective. When catastrophic events occur, there could be resultant localized slope failures, culvert blockages, and erosion

9. Effects on Recreation

Recreation opportunities are influenced by assignment of lands to other resources. Timber management has the most influence on the type of recreation opportunities available. The amounts of logging activity and road building determine how much area will be available for semiprimitive and roaded recreation opportunities. Where semiprimitive recreation opportunities are desired, it would not be appropriate to schedule timber harvest or build roads.

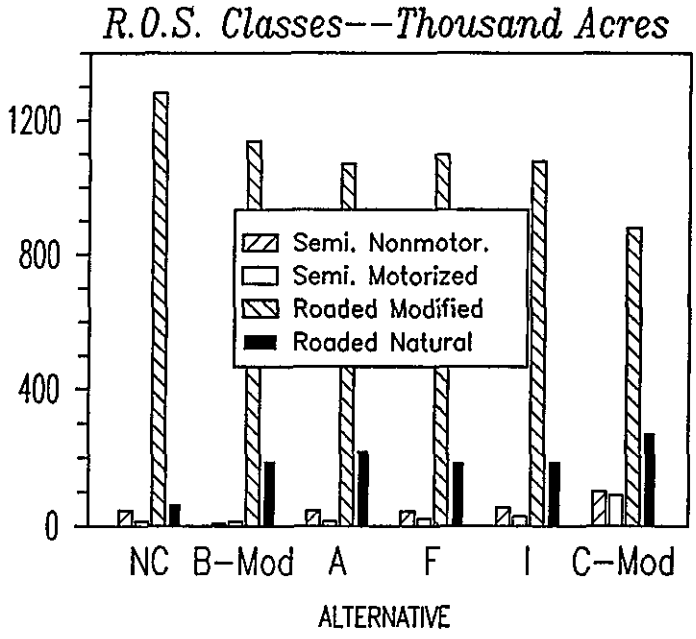
Alternative NC would manage all 25 campgrounds as developed sites Alternative I would manage 20 campgrounds as developed sites with the remaining 5 sites being managed as dispersed campsites. The other alternatives would manage 11 campgrounds as developed sites and 14 campgrounds would be managed as dispersed sites With 11 campgrounds, the capacity is 132,055 person-at-one-time days and with 13 campgrounds the capacity is 144,295 person-at-one-time days. Each of these management proposals will accommodate a projected demand of 105,972 person-at-one-time days in the fifth decade

Each alternative provides capacity to accommodate the projected demand for developed campgrounds. Even though there is substantial capacity for developed facility camping on the Forest, there may still be demands that exceed the supply at some individual campgrounds and for specific facilities

The capacity in visitor days for each recreation setting will vary by alternative Alternatives NC, A, B-Modified, F and I will not meet projected demand for semiprimitive motorized recreation opportunities through the fifth decade All alternatives will provide the capacity to meet projected demands for semiprimitive nonmotorized (outside

wilderness) and roaded recreation opportunities Figure IV-12 displays the recreation opportunity outside the Wilderness for each alternative

FIGURE IV-12: Recreation Opportunity Outside Wilderness



1/Due to the lack of specific information regarding management activities in Alternative NC, the effects of this alternative cannot be estimated and evaluated to the same degree as other alternatives Based on available information, Alternative NC will closely approximate Alternative A

a *Timber Management Effects*

The most suitable forested areas within roadless areas allocated to timber management will be roaded within the first decade, except for the Pine Creek, Shaketable, and Baldy Mountain roadless areas in Alternative F. In this alternative, timber harvest is not scheduled in these three roadless areas in the first decade Project activities such as timber sales and road building will alter the physical setting in those portions of the roadless areas entered, making them unsuitable for semiprimitive recreation experiences Most nonforested and unsuitable forested portions of roadless areas allocated to timber management will remain essentially unroaded These undeveloped areas will generally consist of noncontiguous parcels within each roadless area, with the size of individual parcels varying from a few hundred acres to several thousand acres Roads or areas may be temporarily closed to provide nonmotorized recreation opportunities during periods of high use (i e , hunting seasons)

All alternatives except Alternative C-Modified will reduce the amount of land available for semiprimitive motorized and nonmotorized recreation opportunities Cumulatively, areas allocated to semiprimitive nonmotorized recreation would be reduced the most in Alternative B-Modified followed by Alternatives F, A, NC, and I Cumulatively, the most reduction in semiprimitive motorized recreation would occur in Alternatives NC, A, and B-Modified, where these opportunities are eliminated completely

Currently, the Forest has approximately 828,000 acres providing a roaded, natural-appearing recreation setting In each of the alternatives, this setting will be provided by assignments to visual resource management and old growth Therefore, each alternative will reduce the number of roaded, natural-appearing acres from what is currently available The acres available will vary from a high of 294,091 acres in Alternative A to a low of 128,813 acres in Alternative B-Modified

Alternative C-Modified emphasizes mature ponderosa pine These acres will provide a recreation setting very similar to a roaded natural setting

b. *Range Management Effects*

All alternatives maintain a livestock grazing program. Livestock grazing and the facilities to support these operations have an effect on recreation use The most common conflicts between grazing and recreation stem from the presence of livestock near desirable fishing streams, on trails, and near favored campsites To some visitors, particularly those driving for pleasure, seeing livestock may be a welcome part of the recreational experience. To others, generally hikers, anglers, and dispersed campers, livestock detracts from their experience Alternative NC has the most potential to generate conflicts between recreation and grazing followed by Alternatives A, B-Modified, F, I and C-Modified

c. *Fish and Wildlife Management Effects*

Fish and wildlife improvement projects are designed to maintain or increase wildlife populations Increased opportunities to view or harvest fish and wildlife are beneficial to recreation visitors

Big-game hunting is the major recreation activity that occurs on the Forest (approximately 36 percent of the dispersed recreation use). Alternatives that provide high-quality big-game habitat have the potential for benefiting many recreation users. Habitat improvement often involves vegetative manipulation which normally requires timber harvesting and road building These activities reduce semiprimitive recreation opportunities and create roaded recreation opportunities. A discussion of the effects of each alternative on big-game is in Section E 4 of this Chapter

Anadromous fish habitat improvement projects provide recreation benefits primarily off Forest There are also benefits to resident fish habitat as a result of anadromous fish habitat improvements These benefits provide improved fishing opportunities on the Forest

Fish habitat is improved by various methods (e g , placing structural improvements in the stream, improving riparian conditions adjacent to streams) These methods increase fish numbers which increases potential for fishing opportunities.

Alternative B-Modified improves fish habitat with emphasis on high investments for instream structures Fishing opportunities under this alternative will occur on sites where there is noticeable evidence of human activities Alternative C-Modified improves fish habitat with emphasis on riparian enhancement Fishing opportunities in this alternative will occur in natural-appearing settings

Alternatives A and F also emphasize fish habitat improvement with instream structures while Alternative I emphasizes riparian area enhancement Due to the lack of specific information regarding management activities in Alternative NC, the effects of this alternative cannot be estimated and evaluated to the same degree as other alternatives. Based on available information, Alternative NC will closely approximate Alternative A.

Old-growth management benefits recreation by providing opportunities for viewing wildlife and by providing dispersed recreation opportunities in a roaded, natural-appearing setting. Alternative C-Modified provides high levels of old-growth that provide roaded natural opportunities, followed by Alternatives I, F, B-Modified, NC and A Due to the

lack of specific information regarding management activities in Alternative NC, the effects of this alternative cannot be estimated and evaluated to the same degree as other alternatives. Based on available information, Alternative NC will closely approximate Alternative A.

In 1986 the Oregon Department of Fish and Wildlife published the Oregon Bighorn Sheep Management Plan in which the introduction of California bighorn sheep was proposed for McClellan Mountain.

d. *Other Effects*

Management of the visual resource provides for recreation opportunities in roaded, natural-appearing settings Approximately 19 percent of recreation use on the Forest is sightseeing. Visual resource management will maintain or enhance scenic quality around recreation areas (lakes) and around developed recreation facilities (campgrounds). Alternatives A and C-Modified provide for high levels of visual management and roaded natural settings followed by Alternatives I, F and B-Modified.

Due to the lack of specific information regarding management activities in Alternative NC, the effects of this alternative cannot be estimated and evaluated to the same degree as other alternatives Based on available information, Alternative NC will closely approximate Alternative A

The treatment of fuels created by logging activities will not have major impacts on recreation If there is much burning activity during the fall, there could be some reduced air quality during the Forest's highest dispersed recreation use period Where slash is accumulated over large areas and is not treated, it would present barriers and a nuisance to cross-country travelers such as hunters These effects would be most prevalent in alternatives that have high timber harvest levels, primarily Alternative B-Modified followed by Alternatives NC, A, F, I and C-Modified Prescribed fire would have minimal effects on recreation. Fall burning could cause some reduction in air quality during the hunting seasons

Wilderness provides primitive and semiprimitive recreation opportunities where motorized use is not permitted. All alternatives maintain Strawberry Mountain and Monument Rock Wildernesses. Alternative C-Modified, in addition, recommends the Pine Creek Roadless Area for wilderness designation

Transportation management has an effect on recreation opportunities available on the Forest The development of roads in previously unroaded areas replaces semiprimitive recreation opportunities with roaded recreation opportunities Not all recreation activities are compatible with each other. The most noticeable conflict on the Forest is between recreationists wanting areas with road access and those wanting unroaded areas. For those looking for roaded recreation opportunities, Alternatives NC, A and B-Modified provide the most access For those looking for unroaded recreation opportunities, Alternative C-Modified maintains the most acres in an unroaded setting

Building roads into previously-unroaded areas generally reduces the number, and use, of existing trails and the potential for new trails Future trail construction and maintenance will be given priority in roadless areas and wilderness Alternatives that allocate more acres to a semiprimitive setting will provide more opportunity for trails. Alternative C-Modified provides the highest potential for trail construction and maintenance followed by Alternatives I, F, A, and B-Modified Where practical, trails may be relocated or restored when disturbed by road construction or timber harvest activity

Due to the lack of specific information regarding management activities in Alternative NC, the effects of this alternative cannot be estimated and evaluated to the same degree as other alternatives Based on available information, Alternative NC will closely approximate Alternative A.