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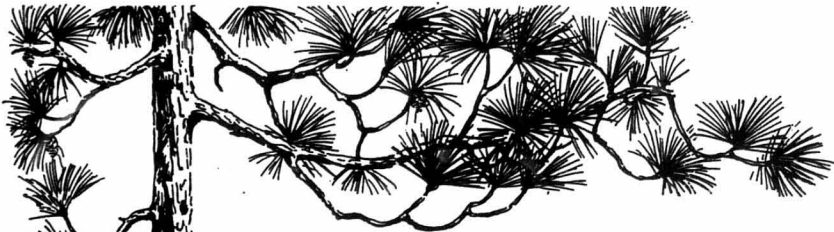
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**ENVIRONMENTAL ASSESSMENT
CARIBOU TIMBER SALE**

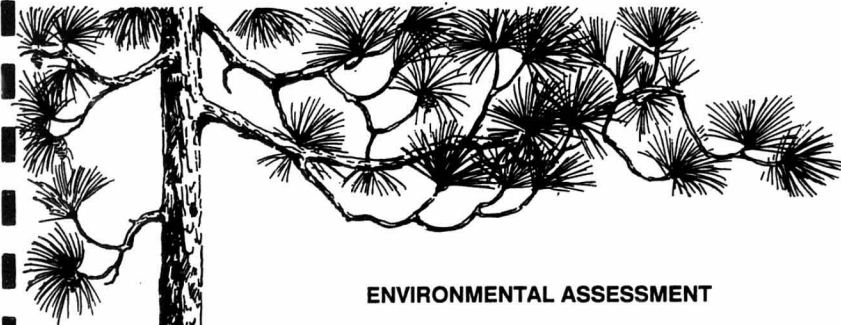
**USDA FOREST SERVICE, R-2
BIGHORN NATIONAL FOREST**

MARCH 1998



99-006433

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**ENVIRONMENTAL ASSESSMENT
CARIBOU TIMBER SALE**

March 1998

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**ENVIRONMENTAL ASSESSMENT
CARIBOU TIMBER SALE**

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CHAPTER 1
PURPOSE AND NEED

CHAPTER 1 - PURPOSE AND NEED

INTRODUCTION

One of the decisions made in the 1985 Bighorn National Forest Land and Resource Management Plan (Forest Plan) was that timber sale offerings would be made. The Caribou timber sale was proposed in order to implement that Forest Plan allocation decision. The selection of this sale area was based upon several factors, including:

- Past forest management decisions and silvicultural prescriptions.
- The existence of a road system, which will minimize impacts upon wildlife habitat and water quality.
- The opportunity to change the forested vegetation to improve, or at least maintain within the Forest Plan standard and guidelines and other legal requirements, forest productivity and wildlife habitat.

The purpose of this Environmental Assessment (EA) is to:

- Document the purpose and need for the Caribou timber sale.
- Identify issues developed during the scoping process.
- Display the environmental consequences of all alternatives.
- Display and address comments received from the public during the draft EA comment period.

The results of this assessment are presented in the Finding of No Significant Impact and Decision Notice. Decisions made based upon this analysis include:

- Should timber harvest be allowed in the identified areas, and if so, where, how, and how much?
- How should the road system in the project area be managed?
- Should the area around the timber sale area remain open to motorized off-road travel year round?

LOCATION

The project area is located in Johnson County, Wyoming, about 20 miles southwest of Buffalo. The scale of the area analyzed varied by scope of effects (direct or cumulative), and by resource.

FOREST PLAN DIRECTION

In the 1985 Forest Plan, lands were allocated to management area prescriptions. These prescriptions provide specific direction and state a management emphasis for the area. The following management area prescriptions and acreages were taken from the Resource Information System (RIS) database. The approximate locations of these areas are displayed in Appendix A2. Please see the Forest Plan for a complete description of the direction that applies to the areas.

Table 1: Management Area Prescriptions - Diversity Units 110-114

Forest Plan Prescription	Description of Prescription	Acres
2A	Emphasis on semi-primitive motorized recreation	3305
2B	Emphasis on rural and roaded-natural recreation	567
3B	Emphasis on primitive recreation in unroaded areas	12
4B	Emphasis on Habitat for Management Indicator Species	4031
6B	Emphasis on Livestock Grazing	2391
7E	Emphasis on Wood-Fiber Production and Utilization	17,283
9A	Emphasis on Riparian Area Management	1

¹ Neither the RIS database, nor the Forest Plan Management Area map, show 9A acres or areas. They were defined in the Forest Plan as "...the aquatic ecosystem, the riparian ecosystem (characterized by distinct vegetation), and adjacent ecosystems that remain within approximately 100 ft. measure horizontally from both edges of all perennial streams and from the shores of lakes and other still water bodies." The above listed management areas have 9A inclusions within them, and the approximate locations can be located using the management area map.

In the 27,589 acre area used to analyze this project, most of the approximately 1575 acres of potential cutting units are on 7E allocated land. There is approximately 12 acres of 4B allocation along the Pole Creek road near Goodman Creek, about 80 acres of 4B allocation along Pole Creek in units C1 and C3, about 4 acres of 9A, and about 240 acres of 6B allocation included within the cutting units.

PREVIOUS MANAGEMENT DECISIONS

This area has had several previous management analyses and decisions made, and resulting projects implemented, over the past 30 years. These projects included the timber sales and harvest prescriptions that resulted in the current road system and forest stand conditions.

Silvicultural prescriptions include more than one specific harvest entry. For example, the predominant decision made, and prescription applied, on the areas proposed for harvest under the Caribou timber sale was implementation of a three step shelterwood system. The goal of the shelterwood system is to regenerate an even-aged timber stand about 30 to 40 years after the initial entry. The initial entry in a 3 step shelterwood is a preparatory cut, which was implemented on most of the area proposed for harvest between 1975 and 1980. The previous prescriptions envisioned continuation of the shelterwood system, specifying that the second entry, or seed cut, would be conducted about 20 years later, and that the final, overstory removal, would occur upon the establishment of a satisfactorily regenerated stand. Previous silvicultural entries made for the stands proposed for harvest in the Caribou timber sale can be found in Appendix C5.

These previous decisions do not restrict this decision to a single, pre-defined outcome. However, a more complete understanding of the effects of the current decision is possible by understanding how the analysis

area got to its current condition. Likewise, the current decision of whether or not to conduct a timber harvest or what prescription to apply, does not bind future management decisions.

The complete planning documents for the previous analyses conducted upon this area can be found at the Buffalo Ranger District office, except for the environmental analysis for Rock Knob, which was not found. Among the most pertinent to the current analysis are:

- Link
- Crazy Woman
- Broken Pole
- Lookout

CLEAR CREEK/CRAZY WOMAN CREEK LANDSCAPE ASSESSMENT

The Clear Creek/Crazy Woman Creek Landscape Assessment (CCLA) was completed in August, 1997. It is an interdisciplinary report that analyzed past and present conditions for all resources in the area, compared those to Forest Plan objectives and desired conditions, and made recommendations for potential management actions. Many of the effects of past management in these watersheds are displayed and discussed in the CCLA. Therefore, it was used for the environmental analysis for the Caribou Timber Sale, and a copy is included in the project record.

PURPOSE AND NEED FOR ACTION

- **The primary purpose of the Caribou timber sale is to implement the Forest Plan objective of offering timber sales.** One of the decisions made in the Forest Plan was that timber sale offerings would be made.
- **There is a need to provide the Forest Plan minimum amount of hiding cover, and one of the purposes of the Caribou timber sale is to increase the amount of hiding cover in the stands harvested.** Past management decisions initiated a three step shelterwood silvicultural system. The goal of the initial entry, the prep cut, was to determine the windfirmness of the stand and to increase the windfirmness of the seed trees that would be left following the second entry. This thinning of the overstory resulting in stands that are not dense enough to provide wildlife hiding cover, and three of the diversity units being analyzed are below the Forest Plan standard for hiding cover. Hiding cover is very specifically defined, namely, topographic or vegetative cover that will hide 90% of an elk at a distance of 200' away. The current conditions of the stands provide too much shade and not enough mineral soil seed bed to result in lodgepole pine regeneration. When lodgepole pine reaches about 6-10' in height, with enough stems per acre, hiding cover will be provided. A regeneration harvest entry will provide cover in an estimated 20-30 years. If there is no treatment of these stands, it will take an estimated 60-80 years to establish hiding cover. Following up on the initial entry would provide the opportunity to increase the amount of hiding cover in these stands.
- **There is a need to improve the watershed health of Pole Creek and the North Fork of Crazy Woman Creek, in order to meet the objectives of the Forest Plan and to comply with the Clean Water Act.** The past management decisions resulted in the existing road systems. With the exception of FDR 476, the roads accessing the Caribou timber sale units are closed with metal gates, per the mitigation measures approved in the past decision documents. They were not revegetated, or otherwise rehabilitated following the past harvests. Those roads are currently connected to, and are contributing sediment to, Pole Creek and North Fork of Crazy Woman Creek. These two streams are on the Wyoming Department of Environmental Quality's list of streams that are partially impaired for their beneficial uses. Maintaining existing drainage structures, removing culverts on local intermittent roads, revegetation, or obliteration, just to mention a few options, can be used to improve watershed health. Timber sale receipts were used to construct these roads, so it is logical to use timber receipts to manage and maintain the road system.

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TIERING TO OTHER DOCUMENTS

This EA summarizes the many documents and reports that the decision maker used to decide whether or not a Finding of No Significant Impact (FONS) is appropriate, and if so, which action to implement. Several of the documents tiered to have already been listed, including the Bighorn National Forest Land and Resource Management Plan, the decisions and environmental assessments made for the previous timber sales in the area, and the Clear/Crazy LA. In addition, the project file includes reports by the members of the ID team, which include scientific literature source citations; letters from various individuals and groups submitted during the scoping process; notes from meetings associated with this analysis; and, numerous maps and overlays.

ISSUE DEVELOPMENT AND PUBLIC INVOLVEMENT

The initial development of the Caribou timber sale can be traced back to the Clear Creek/Crazy Woman Creek Landscape Analysis (CCLA) project. Public involvement for the CCLA began with a public meeting held on November 8, 1995 in Buffalo. About 55 people attended a meeting that was focused on travel management issues, but input on all other resource uses and issues were solicited. At that meeting, people submitted worksheets that identified issues, concerns, and suggested improvements that could be made to the National Forest lands in those watersheds. A second public meeting was held in the field on September 7, 1996. About 17 members of the public discussed a wide variety of resource issues with the members of the CCLA interdisciplinary team. Data collection, inventory, and reports were prepared throughout 1996.

Table 2 displays issue development and scoping meetings that were held specifically for the Caribou timber sale analysis.

Table 2: Issue Development/Scoping Meetings - Caribou Timber Sale

Date	Who Attended	Description of Meeting
7/9/96	South Ecological Management Unit Employees	Initial issue development/scoping
8/26/96	CCLA Interdisciplinary Team members	Field trip. Issue development, discuss initial proposal, allow for field inventory prior to winter NEPA work.
1/15/97	ID team members and public	Public scoping meeting held in Buffalo.

The notes for these three meetings, which includes a list of attendees, can be found in the Caribou project file.

During the public involvement process, organizations and individuals were contacted and invited to submit comments. Scoping notices were sent to approximately 150 individuals and groups, including natural resource interest groups, livestock grazing permittees, timber industry organizations, adjacent landowners, and individuals who had expressed interest in National Forest projects in the area. Scoping notices were sent to six newspapers across northern Wyoming, and legal ads soliciting scoping comments were printed in the Sheridan Press and Buffalo Bulletin. Eight Native American nations or organizations were sent scoping notices. Government agencies contacted included the Wyoming Game and Fish Department, the Wyoming State Forester, the state Historic Preservation Office, state legislators, and Sheridan and Johnson County Commissioners.

From these public and internal scoping efforts, issues were identified that relate to the proposed action. Appendix B1 is a complete list of issues, and Appendix B2 is a table that lists which issues were carried forth in the analysis, and which issues were not carried forth and why. Appendix B2 also identifies issues raised that were outside the scope of this EA. These appendices are included in this document so that people who commented during scoping can track how their issues and concerns were addressed in this analysis. Issues were grouped into the following categories, and these issue categories form the organization for Chapter 3:

1. What effect will the proposal have upon the range resource and livestock management?
2. What effects will the proposal have upon wildlife habitat, specifically upon elk and selected Management Indicator Species?
3. What are the effects of the proposal upon Threatened, Endangered, and Sensitive (TES) plants and animals?
4. What effects will the proposal have on the amount and function of old-growth?
5. Will Wilderness be affected by the proposal?
6. What effects will the proposal have on the water and soil resources?
7. What effects will the proposal have on the fire/fuels resource?
8. How will the proposal affect recreation use?
9. How will the proposal affect the visual resource?
10. What effects will different silvicultural prescriptions, including post sale regeneration treatments, have upon other resources, including the forested vegetation?
11. What are the effects of the proposal on special uses, such as outfitters and powerlines, among others.
12. What are the economic effects of the proposal?
13. What are the effects upon Heritage resources?

The public scoping comment period for the draft environmental assessment was from August 7, 1997 to September 15, 1997. A total of twenty-nine responses were received and those letters are responded to in Chapter 5 of this document.

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CHAPTER 2 ALTERNATIVES

CHAPTER 2 - ALTERNATIVES

This chapter describes the alternatives considered. The alternatives were developed in response to issues raised during public involvement, the environmental analysis process, and from Forest Plan direction. They were developed during a two day meeting of the core interdisciplinary (ID) team. Given the primary objective of providing for a timber sale opportunity, the major issues and needs that drove alternative development were visual quality, wildlife habitat, and water quality, specifically sedimentation. After the ID team drafted the alternatives, they were reviewed by the District Ranger.

The alternatives are described as a complete action package, and there is no separate, broken out, list of "mitigation measures". This was because the alternatives were developed in an interdisciplinary fashion, because it is more logical to analyze the effects on a complete package of actions, and because mitigation measures often have their own environmental effects.

Table 3 is a summary comparison of the alternatives, and can be found at the end of this chapter.

ALTERNATIVE 1

Alternative 1 is the no action alternative. This alternative was developed to serve as a baseline for effects analysis. The purpose and need of providing for a timber harvest opportunity is not met by this alternative.

In this case, no action means no change from the present management taking place. There will be no timber harvest and no regeneration treatments conducted. The forested stands will change under the processes of natural succession, with the disturbance elements of fire, insects and diseases operating. No watershed improvement work will be conducted in this area at this time. Off road vehicle use will be allowed under the current rules. The road closure gates will remain where they are, and be closed under the current enforcement and maintenance rules. Other travel management rules, such as seasonal closures for snowmobile trails, will be enforced as they currently are.

ALTERNATIVE 2

Summary and objectives:

This alternative is based upon the original proposed action as stated in the scoping document, but has been revised based upon public comment, Forest Plan direction, and interdisciplinary (ID) team input. Appendices C1 and C4 summarize this alternative.

The primary objective of this alternative is to meet the Forest Plan objectives for 7E prescription allocation areas. Timber harvest prescriptions include the continuation of the three step shelterwood system on 11330 acres, 10 acres of group shelterwood harvest in "bathtub ring" stringers along clearcut-meadow boundaries, and about 50 acres of sanitation/salvage.

This alternative is differentiated from alternative 3 in that alternative 2 places a greater emphasis upon visual quality issues than does alternative 3. Specifically, there will be no clearcutting, and units D4 and D8 will not be harvested.

The road management guidelines will be continued under the current rules, with the exception of the closure to motorized vehicles other than snowmobiles of FDR 480, 477, 478, and some non-system trails off of FDR 476. The issues addressed by these closures are to reduce the impacts of motorized use of these roads upon wildlife habitat, especially elk security, and to reduce the amount of sediment being generated in an impaired watershed.

During the Clear/Crazy LA and the Caribou scoping process, the issue of improving access for dispersed camping along the Pole Creek road was raised. To provide for this opportunity, and to offset the closure of the roads previously listed, alternative 2 includes the moving back of 4 of the already existing road closure gates.

Timber harvest methods:

Appendix C4 lists the potential timber sale units by acres and silvicultural harvest system. The 1330 acres of shelterwood harvest will mainly consist of the second step, or seed cut, of the 3 step shelterwood system originally initiated in the previous sales. This will consist of leaving about 40 to 60 square feet of basal area per acre (BA), which equates to removing about 40% to 50% of the existing trees. There will be small areas (less than 3 acres each) that are not windfirm enough for the seed cut that will receive a sanitation/salvage or a second prep cut harvest, and there will be small patches with sufficient regeneration to warrant the overstory removal step. These deviations from a "pure" seed cut harvest are due to the fact that the windthrow risk varies by topographic position, and the forest stands themselves are not completely uniform in tree size and density. A precise description of when to implement each prescription will be included in the marking guides, which will be prepared and monitored by a certified silviculturist.

Two areas, in the southwest corner of unit D5 and to the east of D6, will receive a group shelterwood harvest, in order to mitigate the current visual "bathtub ring" effect created by past harvest. The groups will be of variable size from 1/20th to 1/4 of an acre, in irregular shapes. The objective is to minimize the current visual effect of the bathtub ring through the creation of small forest groups.

Units C1, C2, B1, B2 and D5, along the Pole Creek road, and along the snowmobile trail portions of FDR 477 and FDR 476, will receive additional treatments with the objective of meeting the Forest Plan visual quality standards and guidelines, while at the same time maintaining barriers for off-road vehicle traffic. The barriers are necessary to mitigate the timber harvest effects of opening up the stands, thus increasing the possibility of off-road vehicles accessing the closed road systems. The depth of the area to receive the additional visual treatments will be up to one sight distance, or 300 feet, whichever is less, with an irregular back boundary to avoid the creation of an artificial line. The prescription will be for a seed cut of 60 to 70 BA (which would remove about 30-40% of the existing trees), with interspersed uncut patches. The cut/uncut patch size will vary from 1/4 to 1/2 of an acre. These patches will be identified on the ground by the Landscape Architect during the marking process.

To insure sufficient scarification for regeneration, log skidding will be restricted to the period June 1 to November 1. In addition, whole tree skidding will not be allowed. This measure will increase the amount of serotinous cones that will be available to continue the genetic diversity in the area, and the tops and limbs will be available for nutrient recycling and can aid soil stabilization. Existing regeneration within the units will be protected where it exists, especially Engelmann spruce and subalpine fir. Merchantable size spruce and fir will not be cut on the lodgepole pine habitat types in order to increase diversity. It is a best management practice to minimize soil compaction impacts by using already existing landings, so previously existing landings will be utilized for this harvest.

Marking guidelines for the riparian areas will follow the standards and guidelines for 9A management areas, and will be in accordance with the applicable BMPs (page 2-3). The marking guides and silvicultural prescriptions will incorporate and/or consider the following: directional felling must be used to point trees away from the creek; trees will not be felled over the watercourse; limbing will be done above the high water mark, or the limbs will be hand scattered above that mark; any slash that enters the water will promptly be removed per the applicable B provision; scarification other than what may occur in skidding will not be done, including burning. The definition of the riparian zone is shown on page III-198 of the Forest Plan, and will be included in the marking guide. The silvicultural prescriptions and the marking checks will be the tools used to insure that only the minimum trees necessary to achieve the objective of blending the residual density, from a visual quality standpoint, will be marked.

The portion of unit B1 to the east of the Pole Creek road will be accessed by a temporary road of about 500 feet, with a landing at the end. This area was accessed in the Rock Knob sale via FDR 476 and crossing Goodman Creek. Reinstallation of the culvert and road reconstruction along Goodman Creek would result in considerably more sedimentation than will the construction of this temporary road. The length of the road was specified to move the landing, and associated visual impacts, farther from the Pole Creek road.

Hauling logs will be prohibited on weekends and Federal holidays, to minimize conflicts with other forest users.

FDR 476, 28 and 31, the permanently open roads, will be utilized for firewood collecting opportunities. Wildlife trees will be signed before opening the area to firewood cutting.

An estimated two miles of livestock control fence will be constructed to mitigate the loss of natural barriers caused by the timber harvest. An estimated 5-10 acres, mostly concentrated around landing areas, will be sprayed with herbicide to control canadian thistle. Herbicide will only be used on areas sufficiently far from watercourses so that no herbicide will enter the water. In addition, all label specifications will be followed and only licensed applicators will perform this work.

Slash/fuels treatments:

The general rule will be to pile and burn landing slash, lop and scatter slash in the units to within 24" of ground level, and to cut damaged trees. If, in the timber sale administrator's judgement, there is not a sufficient amount of landing slash to justify the pile and burn method, scattering of the slash so as to not form windrows or piles will be used to dispose of landing slash. Within the visual treatment area (defined above) along the Pole Creek road, slash will be lopped and scattered to 18"; or, within the areas prescribed for burning, lopped to 24" and burned. Prior to sale closure, the Landscape Architect will review the visual treatment area, and make arrangements for additional treatments as needed.

In order to maintain a serotinous cone seed source, the following areas will be prescribed burned: the east half of B2, north half of D3, and the north and east portion of B1. The burning objective will be to open the serotinous cones, and will be implemented as a jackpot burn that will "flash" the red needles. This will be done under a relatively cool prescription, perhaps even with snow or wet ground, in order to inhibit fire spread.

Watershed Improvements:

The water quality issue was raised by numerous people, both internally and externally, plus is enforced by important laws, most notably the Clean Water Act. One of the purposes and needs of this project is to improve the watershed health of these streams. Pole Creek and the North Fork of Crazy Woman Creek are watersheds listed on the State 303(d) list due to, among other things, sedimentation. Since roads are considered to be a leading cause of sedimentation in this area, important watershed improvements can be made by conducting erosion prevention measures on the existing road system.

This alternative includes implementation of:

- Wyoming Forestry Best Management Practices (BMPs), Wyoming Department of Water Quality, 1992.
- The practices specified in the Watershed Conservation Practices Handbook (WCPH), FSH 2509.25.
- All Forest Plan standards and guidelines for watershed protection.

The following items will be incorporated into the project specifications, such as the timber sale contract, or road maintenance/reconstruction specifications.

1. Mandatory Best Management Practices described in 33 CFR 323.4 must be met in order to claim 404 permit exemption.
2. Use as appropriate the State of Wyoming Best Management Practices for Silvicultural treatments.
3. Division B and C provisions will be incorporated into the Forest Service Timber Sale Contract.
4. Avoid soil disturbing actions during periods of heavy rain or when soils are wet.
5. Existing roads will be used and will be reconstructed for long-term soil and drainage stability.
6. Conduct logging to disperse runoff as feasible.
7. Keep heavy equipment out of filter strips except to do restoration work.
8. Do not encroach fills, or deposit or sidecast soil into streams, swales, lakes or wetlands.
9. Protect existing vegetative ground cover on all cuts and fills. Revegetate cuts and fills to restore ground cover, and utilize fertilizer to overcome the acidity of the soils.
10. Harden rolling clips as needed to prevent rutting damage. Ensure that road maintenance provides stable surfaces and drainage.
11. Remove or breach berms that will concentrate runoff.
12. Skidding and yarding operations within the harvest units shall be restricted to minimize the potential for soil compaction. This measure will be controlled through the timber sale contract provision requiring prior approval of skid trail locations.
13. Skid trails shall be designed to ensure sediment from them does not enter stream courses.
14. Sediment traps (e.g. straw bales, silt fence and sediment basins) shall be placed at the outlet of all existing and new road drainage structures that do not have adequate ground cover and distance available to filter sediment. Locations for these structures shall be determined by a watershed specialist or engineer. All such structures shall be cleaned upon reaching 80 percent capacity. Cleaned material shall be removed to a flat area well away from surface water, then spread and seeded. Sediment traps in disrepair shall be fixed as soon as possible.
15. Perennial streams will not be crossed by skid trails. Intermittent and ephemeral streams that need to be crossed by skid trails will be crossed using temporary bridges or other stable material that will not impact the water course over the long-term. Crossings shall be removed immediately upon completion of harvest activities in that unit or units.

Monitoring Requirements

During the Timber Sale, at least one watershed management review will be conducted to monitor project implementation and effects. This review will include a watershed scientist, aquatic biologist, timber sale administrator, engineer and a District Ranger or Forest Supervisor.

1. Roads and skid trails will be monitored to ensure that they are stable and not eroding into stream courses.

2. Water quality will be monitored through the use of T-Walk on Pole Creek, Caribou Creek and the NF Crazy Woman Creek.

Engineering reconstruction design for the timber sale contract will specify the location and type of road maintenance and rehabilitation methods from this list, and that will be incorporated into the timber sale contract. Post-harvest measures for road rehabilitation and obliteration will be completed after the logging is complete, or after the regeneration treatments such as prescribed burning are complete, which ever is sooner.

The following list specifies the management regime for the roads to be managed for under this alternative:

Currently open roads that will remain open for public use:

FDR 31 (Pole Creek), FDR 28 (Sheep Mountain), FDR 476 and 479.

The following roads will be treated as Local Intermittent (LI) roads. Except for roads noted otherwise, these roads are currently closed to summer vehicular traffic, in accordance with previous environmental decisions. These roads will be kept on the transportation system, and utilized for future silvicultural activities. "Putting these roads to bed", using the rehabilitation measures specified in the WCPH and BMPs, will increase the effectiveness of the sediment reduction measures, plus will address the issue minimizing wildlife habitat disturbance caused by open roads.

FDR 534311 system, including 534213, 534212, and 534397.

480. This ~ 0.50 mile long road is currently open.

533112 system, including 533114 and 533113.

The trails going south from FDR 476 toward Goodman Creek. These are UN-C, UN-B, UN-D, and FDR 478 on the alternative map in Appendix D1. These are currently open.

477, which is currently open, and will be closed at the junction with FDR 476.

533117 system, including 533118 and 533119.

533120 system, including 533121.

533123 system, including 533124, 533125, 533416, 533417, 533418, 533419, and 533420.

To mitigate the potential increased road use due to the thinning of the forest stands, and the resulting increased sedimentation risk and wildlife disturbance impacts, additional "road barrier effectiveness" measures will be implemented behind the closure gates on the roads listed in this section. These road barrier effectiveness measures will include a combination of road bed obliteration/outsloping/cross-ripping, and the use of stumps, logs, and rocks to discourage use, except on snowmobile trails.

Recreation:

All snowmobile trails currently on the state of Wyoming maintained trail system will be protected by sale closure between December 1 and April 1.

The currently existing road closure gates on FDR 534311, 533112, 533120, and 533123 will be moved back from the junctions with the Pole Creek road. The gates will be moved up to one-quarter mile to a logical campsite, complete with adequate room to turn a camper around.

Wildlife and biological diversity:

To address the issue of old-growth, and Forest Plan standard for 5% old-growth in a diversity unit, RIS sites will be identified and managed as old-growth. Since old-growth is transient, this is not a permanent identification. The list for diversity units 110-114 is found in the project file, which also includes information on how the sites were selected for old-growth management.

A goshawk survey was conducted in June and July, 1997. No nests were found. Additional surveys for goshawks and other raptors will be conducted during sale preparation activities.

If an active raptor nest is found that would be affected by this timber sale prior to the timber sale contract, the wildlife biologist will specify the area to be deleted from the harvest unit(s). Appropriate NEPA modifications will be made at that time. The area will be based on logical topographic and vegetative features, and the size will not be limited to a set number of acres. The timber sale contract will specify that if an active raptor nest is found during logging operations, the area within 1000 feet of the nest will not be operated in between the period May 1 to August 15. In addition, an area a minimum radius of 2.5 tree heights surrounding an active raptor nest tree will be deleted from the timber sale contract by either B(T)2.37 Minor Changes, or in the case of Goshawk, a request will be made of the Chief of the Forest Service to delete that area in accordance with C8.2 Termination.

The amount of coarse woody debris left for wildlife habitat, nutrient recycling, and soil stabilization purposes will be maintained at current levels or improved. The specifications for this will be documented in the silvicultural prescription. The exception to this measure is in RIS site 1005040013, where the currently existing amount of pole-sized slash remaining from a thinning harvest in 1979 is excessive, and inhibits wildlife movement and forest floor plant growth.

The slash treatments prescribed will result in no barriers to wildlife movement.

The sale contract will include at least two subdivisions in order to temporally distribute timber sale activity and reduce human impacts upon wildlife populations.

The B and D units will be closed between 5/1 and 6/30, to protect elk calving.

About 1-2 snag habitat "islands" per 10 acres will be left uncut within the cutting unit boundaries. These islands will be about one tree height radius, not linear, and follow natural patterns. The key is variety, and there are no minimum numbers of species, snags, etc. There should be existing snags, trees near death, multiple canopy layers, multiple species, green trees for replacement, if possible. These islands will be at least three tree heights from the unit boundary.

Monitoring:

Monitoring project activities is important for several reasons. Validating that the actions described in this document are done accordingly, monitoring for maintenance needs, learning for future management, and legal requirements are among the reasons for monitoring.

Watershed BMP design, installation, and maintenance monitoring; raptor nesting location monitoring; and, visual quality marking oversight by the landscape architect are among the monitoring requirements built into the alternatives. In addition, silvicultural prescription implementation will be monitored by marking checks and post-sale regeneration surveys. Post sale monitoring will include monitoring the hiding cover projections made in this analysis. Many of the environmental protection measures specified in the alternative description will be implemented through the timber sale contract, which will be monitored and inspected by the Forest Service Representative and project engineers.

ALTERNATIVE 3

Summary and objectives:

Compared to alternative 2, this alternative places greater emphasis on timber and wildlife habitat, and less emphasis on visual quality. Appendices C2 and C4 describe this alternative.

The primary objective of this alternative is to meet the Forest Plan objectives for 7E prescription allocation areas. Timber harvest prescriptions include the continuation of the three step shelterwood system on 1414 acres, 40 acres of clearcuts in 4 cutting units, 18 acres of group shelterwood harvest in "bathtub ring" stringers along clearcut-meadow boundaries, and about 50 acres of sanitation/salvage.

This alternative is differentiated from alternative 2 in that alternative 3 places a greater emphasis upon timber production objectives than does alternative 2, by harvesting additional areas. In addition, alternative 3 places a greater emphasis on wildlife habitat by creating grass/forb structural stages through clearcutting. Additional clearcutting was considered, but not proposed in this alternative, as this was considered to be the maximum amount of clearcutting allowable under the Forest Plan standard and guideline of partial retention VQO. Specifically, this alternative adds units D4 and D8, which will be harvested using the shelterwood system, and includes 40 acres of clearcutting.

The road management guidelines are identical to alternative 3.

Concerning the issue of improving access for dispersed camping along the Pole Creek road, alternative 3 will include the moving back of 3 additional existing road closure gates. In addition to the gate relocations specified in alternative 2, gates on FDR 522211 and on both ends of 522114 will be moved back to a logical camp spot that will include an area feasible for turning a camper around.

Timber harvest methods:

Appendix C4 lists the potential timber sale units by acres and silvicultural harvest system. Alternative 3 adds units D4 and D8, and includes about 40 acres of clearcutting in 4 separate cutting blocks. Appendix C2 shows the locations of units D4 and D8.

Unit C2 will have one clearcut block of about 10 acres in the portion of RIS site 100504-0013 that currently has a ground cover of felled poles from previous thinning operations.

Unit C3 will be managed under a clearcut harvest system. There will be no other cutting in this unit between the clearcut units.

Unit D3 will have one clearcut block of about 8 acres in the southwest portion of RIS site 100536-0009. The remainder of unit D3 will be harvested under the shelterwood system.

Unit D4 and D8 are included in this alternative. They will be harvested using the shelterwood system. The eastern finger of unit D8 will receive the "bathtub ring" group shelterwood system described in detail in the alternative 2 discussion. The previously unthinned patch in RIS site 100536-0601 in unit D4 will not be harvested. In addition, unit D8 along FDR 522114, which is a snowmobile trail, will receive the visual quality "patch" seed cut prescription described in alternative 2.

Units C1, B1, B2, D1, D2, D5, D6, and D7 will receive the same silvicultural treatment under both alternatives 2 and 3.

Slash/fuels treatments:

The clearcut units, D4 and D8 will be lopped and scattered to 24", and the landing slash will be piled and burned or scattered. All other slash/fuels treatments are the same as alternative 2.

Watershed Improvements:

The watershed improvement measures described in alternative 2 will be done under this alternative. In addition, alternative 3 adds FDR 522114, 522211, and 522212 to the alternative 2 list of roads to be treated. These roads access unit D8, which was added under this alternative. They will be managed as LI roads, and will be kept on the transportation system.

Recreation:

As in alternative 2, sale closure between December 1 and April 1 to protect the snowmobile trails is included in alternative 3.

The currently existing road closure gates on both ends of 522114 and 522211 will be moved back from the current junctions with the Pole Creek and Sheep Mountain roads. The gate relocations specified in alternative 2 are included in alternative 3.

Wildlife and biological diversity:

All actions specified under alternative 2 under this heading are included in alternative 3.

Monitoring:

All actions specified under alternative 2 under this heading are included in alternative 3.

ALTERNATIVE 4**Summary and objectives:**

Alternative 4 is the same as alternative 3, except that about 18,000 acres, as defined by the map in Appendix C3, will be closed to off-road motorized vehicle traffic, except for snowmobiles operating on snow between November 16 and May 15.

The primary issue driving this alternative is elk security, while the issue of sediment yields and water quality is also addressed. Closing the area to off-road motorized vehicle traffic may decrease the pressure on elk during the hunting season. While there is a relatively small amount of off-road motorized travel compared to other areas of the Bighorn National Forest currently, the thinning of the forested stands by the timber harvest may open up the stands enough to invite and increase the amount of off-road travel. This action would also make the overall motorized travel management in the area more logical and consistent, compared to the current status of having the roads closed to motorized travel, but the surrounding area open to off-road motorized travel.

Water quality will also be improved by this action. The rationale for closing the area to off-road motorized travel for water quality purposes is found in standard 9 in the Watershed Conservation Practices Handbook, design criteria h, which states, "Designate, construct, and maintain OHV (off-highway vehicle) travelways for proper drainage." It also notes that "Uncontrolled OHV use can severely damage streams and riparian zones."

The third objective of this alternative is improve the consistency and effectiveness of the travel management strategy currently in place in this area. Many people commented that the current travel management in the area is not logical because nearly all of the roads are closed to motorized vehicles other than snowmobiles operating on snow, while the off-road area remains open to year-long motorized use.

This alternative is designed to display the environmental and social effects of the specific action of closing the area to off-road motorized travel, except for snowmobiles.

Timber harvest methods:

All actions specified under alternative 3 under this heading are included in alternative 4.

Slash/fuels treatments:

All actions specified under alternative 3 under this heading are included in alternative 4.

Watershed Improvements:

All actions specified under alternative 3 under this heading are included in alternative 4.

Recreation:

About 18,000 acres, as defined by the map in Appendix C3, will be closed to off-road motorized vehicle traffic, except for snowmobiles operating on snow between November 16 and May 15. The area is currently open to off-road motorized vehicle traffic all year. This will change the area from C to A on the Bighorn National Forest travel map.

In addition, all actions specified under alternative 3 under this heading are included in alternative 4.

Wildlife and biological diversity:

All actions specified under alternative 3 under this heading are included in alternative 4.

Monitoring:

All actions specified under alternative 2 under this heading are included in alternative 4.

ALTERNATIVE 5**Summary and objectives:**

Alternative 5 is different from the other alternatives in that it analyzes the environmental consequences of a similar, but separate action of increasing the amount of roads that will receive watershed improvement work. This work will consist of additional road rehabilitation per the Watershed Conservation Practices Handbook and the obliteration of roads/trails that were merely closed in other alternatives. This alternative contains the most watershed improvement work in this analysis.

The issue driving this alternative is water quality, specifically the amount of sediment. Implementing the non-point source pollution prevention measures specified in the Watershed Conservation Practices Handbook on these additional LI roads, and combined with the obliteration of some roads/trails, will further decrease the amount of sediment being delivered to the streams. Although the objective of this alternative is primarily water quality improvement, it will secondarily benefit elk security and wildlife disturbance issues by improving the effectiveness of the road closures.

This additional watershed improvement work, if implemented, will affect the same watersheds and will occur at about the same time as the timber sale. Therefore, the effects of this similar, but separate action are being analyzed in this EA so that the cumulative effects of all reasonably foreseeable actions are displayed and analyzed.

Timber harvest methods:

All actions specified under alternative 3 under this heading are included in alternative 5.

Slash/fuels treatments:

All actions specified under alternative 3 under this heading are included in alternative 5.

Watershed Improvements:

All actions specified under alternative 3 under this heading are included in alternative 5.

In addition, the following similar, but separate actions will occur:

1. An additional 6.47 miles of LI road will receive the watershed improvement work specified in alternative 3.

The following roads will receive this watershed improvement work. This is in addition to the roads already listed in alternative 3.

The following roads will be treated as Local Intermittent (LI) roads. These roads are currently closed to summer motorized traffic, in accordance with previous environmental decisions. These roads will be kept on the transportation system, and utilized for future silvicultural activities. These roads were originally built for the Link sale, and also were utilized for the Lookout timber sale. The Lookout timber sale decision prescribed entries at 20 year intervals, so it is possible that these roads may be utilized around 2006. "Putting these roads to bed" will increase the effectiveness of the sediment reduction measures, plus will increase the effectiveness of the road closures, which will minimize the amount of wildlife habitat disturbance.

FDR 534314 and 534312 system, including 533411, 533412, and 534313.

533413 and 533111 system.

534217, 534218, 534219 and 456 past camp E-La-Ka-Wee.

2. The following roads will be obliterated following this harvest entry. UN-B, UN-C, UN-D, and FDR 478 are currently open.

FDR 533113. The beginning of this road is in a riparian area, and is wet for at least part of the year.

UN-B, UN-C, UN-D, FDR 478 from the junction with FDR 476. These roads go from 476 towards Goodman Creek, and do not access significant areas.

UN-E that is near the west end of FDR 522114, and UN-A that is along FDR 534217. They are dead ends, and obliteration will result in sediment reduction and increase wildlife security.

Recreation:

All actions specified under alternative 3 under this heading are included in alternative 5.

Wildlife and biological diversity:

All actions specified under alternative 3 under this heading are included in alternative 5.

Monitoring:

All actions specified under alternative 2 under this heading are included in alternative 5.

ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL

The following alternatives were considered and eliminated from detailed analysis:

1. *Watershed improvement plan, without timber harvest.* This does not meet the purpose and need of providing for a timber sale offering.

2. *Conduct regeneration treatments, such as burning, planting, seeding, or scarification, without timber harvest.* This does not meet the purpose and need of providing for a timber sale offering.

3. *Clearcutting as the dominant silvicultural prescription.* This does not meet the Forest Plan standard and guideline for visual quality objectives. Alternative 3 approached the limit on the amount of clearcutting that would be allowed under the Forest Plan visual quality objectives for the area.

4. *Selection (uneven-aged silviculture) as the dominant prescription.* This ecosystem, as influenced by soil types (granitic) and climate (relatively dry for the Bighorn Mountains), is dominated by lodgepole pine habitat types. This area has been influenced over the millenia by even-aged lodgepole pine stands, and the plants and animals in this ecosystem have evolved under this regime. The decision maker decided not to "force" uneven-aged management on an ecosystem that is relatively far to the lodgepole pine, even-aged, end of the habitat type continuum. This does not preclude considering selection harvest on individual sites, nor in the future.

5. *The original proposed action as stated in the scoping notice.* Alternative 2 is based upon the original proposed action as stated in the scoping notice, but was revised based upon public comments, Forest Plan direction, and ID team input. The original proposed action was not analyzed in detail because it was so general and unpecific that it be difficult to compare to the developed alternatives, which have considerable detail as to the fuels treatments, road management, visual management, etc.

TABLE 3 - SUMMARY COMPARISON OF ALTERNATIVES

	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4	ALTERNATIVE 5
Summary and Objectives	No action, continuation of current management.	Timber harvest with greater emphasis on visual quality issues than alt. 3. No clearcutting, units D4 and D8 not included.	Timber harvest with greater emphasis on wildlife and timber issues than alt. 2. 40 acres of clearcutting, units D4 and D8 included.	Close area to off road motorized travel, except for snowmobiles traveling over snow. Same timber harvest as alt. 3.	Extend watershed improvements, namely road rehabilitation and obliteration, to larger area. This is a similar, but separate, action. Same timber harvest as alt. 3.
Timber Harvest	No timber sale - existing firewood use continues	1330 acres of shelterwood system, mostly seed cut. 10 acres of group shelterwood. 50 acres of sanitation/salvage. About 3.9 MMBF harvested.	1414 acres of shelterwood system, mostly seed cut. 40 acres of 5-10 acre clearcuts. 18 acres of group shelterwood. 50 acres of sanitation salvage. About 4.6 MMBF harvested.	Same as alternative 3	Same as alternative 3
Slash/fuels treatments	No treatment	Pile and burn landing slash; within units lop and scatter (L&S) to 24". Within visual zone, L&S to 18" or burn. 350 acres of prescribed burn.	Same as alt. 2, except clearcut units will be L&S to 24".	Same as alternative 3	Same as alternative 3
Watershed Improvement - Road Rehabilitation	No rehabilitation of existing roads will occur	14.65 miles of LI ¹ roads, 1.35 miles of currently open LI roads, and 1.25 miles of trails off of FDR 476 to receive rehabilitation per WCPH ²	15.58 miles of LI roads, 1.35 miles of currently open LI roads, and 1.25 miles of trails off of FDR 476 to receive rehabilitation per WCPH	Same as alternative 3	23.36 miles of LI roads to receive rehabilitation per WCPH, 2.55 miles of roads and trails to be obliterated.
Watershed Improvement - Road Closures	Current road status of open or closed to summer motorized traffic remain	Net closure to summer motorized traffic of 0.35 miles of FDR ³ . (FDR 477, 478, 480, less amount "opened" with campsite creation.) Close to summer motorized traffic 1.25 miles of "trails" off of FDR 476.	Net closure to summer motorized traffic of 0.35 miles of FDR ³ . (FDR 477, 478, 480, less amount "opened" with campsite creation.) Close to summer motorized traffic 1.25 miles of "trails" off of FDR 476.	Same as alternative 3	Same as alternative 3

TABLE 3 - SUMMARY COMPARISON OF ALTERNATIVES (continued)

	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4	ALTERNATIVE 5
Recreation	Current camping opportunities exist.	4 camping spots created by moving current road closure gates ~ 1/4 mile from Pole Creek road. Sale closed between 12/1 and 4/1 to protect snowmobile trails.	7 camping spots created by moving current road closure gates ~ 1/4 mile from Sheep Mountain and Pole Creek roads. Same snowmobile trail protection closure as alt. 2.	Same as alternative 3	Same as alternative 3
Recreation - Off-Road Travel	Area will remain open to off-road motorized travel	Same as alternative 1	Same as alternative 1	~ 18,000 acres closed to off-road motorized travel, except for snowmobiles traveling over snow.	Same as alternative 1
Wildlife and Biological Diversity	Natural processes will dictate course of forest development. Old growth meets Forest Plan S&Gs.	Timber harvest will change habitat structure. Old growth not harvested. Goshawk/raptor protection measures. B & D units closed 5/1 - 6/30 to protect elk calving. "Snag islands" left within units. No barriers to WL movement will be created.	Same as alt. 2, except one clearcut to cleanup existing slash to improve WL movement.	Same as alternative 3	Same as alternative 3
Monitoring	Existing amounts and types of monitoring continue.	Monitoring of BMP's, raptor nesting, visual quality protections, marking and regeneration surveys. Contract design and inspection includes additional monitoring.	Same as alternative 2	Same as alternative 2	Same as alternative 2

¹ LI - Local Intermittent

² WCPH - Watershed Conservation Practices Handbook.

³ FDR - Forest Development Road

CHAPTER 3
AFFECTED ENVIRONMENT
AND
ENVIRONMENTAL CONSEQUENCES

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CHAPTER 3 - AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter explains the current condition (affected environment) of natural resources in the analysis area. These environmental conditions form the basis for determining what changes and impacts occur should each alternative be implemented. The environmental consequences are described following the affected environment for each resource area. The final section for this chapter, entitled cumulative effects, provides a summary and additional information on the cumulative effects analysis listed under each resource area in this chapter.

RANGE AND LIVESTOCK MANAGEMENT

Affected Environment

The proposed project area is within the Muddy Creek grazing allotment. Eight term grazing permits authorize grazing of 801 mature cattle for the period 6/25 to 9/25. Three pastures west of US 16, Pole Creek, Caribou Creek and Crazy Woman Creek, would be directly affected by the proposed timber harvest. The number of cattle permitted for these pastures is 436, and a deferred grazing system is employed. Several of the proposed harvest units are bisected by pasture boundary fences, and some areas in and near the cutting units form natural barriers to cattle movement. The pasture rotation schedule, and fence and natural barrier locations, are displayed in the range specialist report.

Over the last 30 years, timber harvest in the western portion of the Muddy allotment has produced significant amounts of transitory range. Transitory range is the growth of naive grasses and forbs created early in succession after trees are removed from a site. It is temporary and lasts approximately 20+ years. The quantity, quality and duration of the transitory range produced is dependent upon the amount of trees removed, the scarification, and slash treatment of the harvested areas. Since the majority of the harvest occurred between 1970 and 1980, the productivity and amount of transitory range has been steadily declining. The areas of proposed harvest are currently providing little transitory range. Transitory range is not used in the determination of livestock stocking capacity.

Canadian thistle occurs in the area, and can readily invade areas where soil disturbance or burning has occurred.

Environmental Consequences

Alternative 1

Direct and Indirect Effects

Livestock movement between pastures will not be affected by the timber sale operations. The amount of transitory range will continue to decline in the western pastures of the Muddy allotment. Thistle infestations will remain at present levels.

Cumulative Effects

A summary of the cumulative effects upon the items analyzed in this section of the EA is shown at page 3-36. Alternative 1 creates no cumulative effects upon this resource area.

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Alternatives 2, 3, 4, and 5

Direct and Indirect Effects

Livestock movement: Some of the trees proposed for harvest currently provide natural barriers to livestock movement between pastures. To mitigate this effect, an estimated 2 miles of fence will be constructed. Additional livestock movement effects can be created by the timber purchaser's operations, such as taking fence down, fence damage, and gate closures. Standard timber sale contract provisions will be used to minimize these potential effects. Fence construction to replace natural barriers and the implementation of the timber sale contract provisions result in no significant effects upon livestock movement.

Transitory range and thistle: It is estimated that there will be little difference between alternatives regarding transitory range. Alternative 2 may create approximately 200-300 acres of transitory range. Because of the 40 clearcut acres proposed in alternatives 3, 4, and 5, approximately 240-340 acres of transitory range may be created under these alternatives. Because of the downward trend over the past 20-30 years in the amount of transitory range, and the fact that livestock use transitory range intermittently, the effects of the additional transitory range created by any of the action alternatives will be negligible. There will be 200-340 more acres of transitory range created under the respective action alternatives compared to alternative 1.

There is no evidence, based upon the regeneration monitoring of adjacent past harvests, and the regeneration that occurred on the roads and landings after the initial prep cut entries, that regeneration protection from livestock will be needed.

Increased amounts of canadian thistle on disturbed soils is expected following the timber harvest and the watershed rehabilitation work. Based upon the amount of thistle that occurred after previous entries, it is estimated that approximately 10 acres of herbicide application will be necessary to control the thistle. Herbicide will only be used on areas sufficiently far from watercourses so that no herbicide will enter the water. A small increase in the amount of thistle, an estimated 2 acres that will not be sprayed due to watershed concerns or incomplete application, is expected to occur as a result of the action alternatives. The effect of an increase of 2 acres of thistle out of the several thousand acre range allotment is small.

Cumulative Effects:

A summary of the cumulative effects upon the items analyzed in this section of the EA is shown at page 3-36.

Since there are no direct or indirect effects to AUMs or movement barriers under any of the alternatives, the incremental effects of the alternatives is zero. Therefore, there are no effects from Caribou to add to the collective effects of the other past, concurrent, or reasonably foreseeable actions (RFAs), so there are no cumulative effects to these resources. The cumulative effects to thistle populations is considered to be small, since only two acres are estimated to be added to the area affected, and thistle spraying is anticipated to provide some control. The current trend of declining amounts of transitory range is expected to continue, but this is considered to be a small effect as it does not directly affect stocking rates.

WILDLIFE

Affected Environment

The proposed cutting units lie within Diversity units 110, 111, 112, 113, and 114. This is the area analyzed for wildlife direct and indirect effects, and totals 27,589 acres. Cumulative effects upon elk hunting and elk habitat management are analyzed on the Clear/Crazy LA area, since that more closely corresponds to the larger hunt area scale that the Wildlife Task Force has used in the past.

Table 4 compares the existing amounts of elk hiding cover and grass/forb structural stages within the analysis area to the Forest Plan standards and guidelines. Elk hiding cover is defined as vegetation, topography, or other natural obstructions that hide 90% of an adult elk at a distance of 200 feet. The Forest Plan S&G's for these items are stated on a diversity unit basis, and the S&G for the grass/forb structural stage (SS) is 5% of the forested area. Diversity unit 112 meets the grass/forb S&G due to the Sheep Mountain fire.

Table 4. Existing Hiding Cover and Grass/Forb Structural Stages

Analysis Area	Existing Hiding Cover	Forest Plan Minimum for Hiding Cover	Grass/Forb SS
110	51.2%	40.1%	0.2%
111	41.1%	41.7%	0.1%
112	58.2%	44.1%	12.8%
113	16.4%	40.1%	0
114	13.3%	41.5%	0
5 DU's total	34.4%	41.6%	1.1%

Concerning snags, there are areas, especially along roads and in some of the 1960's vintage clearcuts, where snags and other large woody debris are less than are needed for optimal habitat. The Forest Plan standard and guideline for snags is for 90-110 per 100 acres in lodgepole pine forests, and that is met on the majority of the analysis area, with the above-mentioned exceptions.

The area appears to contain suitable nesting habitat for Northern Goshawk and other raptors. A Goshawk survey was conducted during June and July, 1997, and no active nests were located in the vicinity of the proposed units.

Elk was chosen as the management indicator species (MIS) for this project. This is because of a large number of public comments concerning this species. The harvest is primarily on granitic, dry, upland sites, and therefore, the vegetation is single-story, even-age, lodgepole pine habitat types. Elk are considered to be indicative of, or sensitive to, habitat changes likely to occur as a result of the alternatives considered in this analysis. Finally, elk were chosen as the MIS because there is voluminous data available and analyzed for elk, and therefore the most interpretations could be made on this species.

Elk population in Hunt Areas 35 and 36 (shown at appendix H page 24) is estimated to be 1200 elk, while the wintering population objective is 800. The Wildlife Task Force (WTF) report (summarized in appendix H pages 23-30) document past levels of timber harvest and road building, as does Tinker, et al. (in press). The WTF report shows that hunting recreation days and elk harvest numbers declined substantially between the 1970's and 1989, and cite the timber harvest and road building during the 1960's to 1990 as the cause. A review of the past EAs indicate that at least some of the roads, such as the Pole Creek road, were built to provide recreational access, in addition to the timber access purposes.

While none of the cutting units are within existing elk security blocks, there are two areas less than 20 acres each in units D3 and D7 that fall within areas that could become elk security blocks with regeneration. This information was derived from a map of elk security provided by the Wyoming Game and Fish Department, and can be found in appendix H, page 31.

A biological evaluation for wildlife species for the Caribou timber sale was prepared, and can be found in appendix F2. The biological evaluation is a review of species habitats and possible effects on endangered, threatened, candidate, or sensitive species.

There are wildlife species other than those listed above that inhabit the area that could be affected by some or all of the alternatives. A "coarse filter" analysis approach, using Forest Plan standards and guidelines for old growth, snags and large woody debris, and wildlife habitat structural stages, was used for this analysis to consider project effects upon the "other" species.

Environmental Consequences

Direct and Indirect Effects

All of the action alternatives incorporate actions that would avoid or minimize detrimental impacts.

In the short term (20 years) the amount of elk hiding cover will not change for any of the alternatives. After 20 years, harvested areas will begin to contain more elk hiding cover than under the no action alternative. This trend will continue into the future. Because the harvest acres are so similar for the action alternatives, there is no measurable difference in the amount of elk hiding cover that would be available after 20 years. Table 5, Total Acres of Hiding Cover, compares the current acres of hiding cover with projected acres of hiding cover in the year 2057. The data and information supporting this table is located in the project record.

Table 5. Total Acres of Hiding Cover

Diversity Unit	1997	Forest Plan Minimum	2057 With No Harvest	2057 With Alt. 2 Harvest	2057 With Alt. 3 Harvest
110	3607	2824	3709	3757	3757
111	2640	2676	3676	4000	4112
112	1073	813	1376	1376	1376
113	611	1497	1160	1481	1481
114	861	2691	2028	2267	2230
Total	8792	10,501	11,949	12,881	12,956

Elk habitat effectiveness measures hiding cover and open road density together. Alternatives 4 and 5 will provide the most elk habitat effectiveness, by closing the area to off road motorized travel except for snowmobiles traveling on snow and obliterating some roads, respectively. Alternatives 2 and 3 will close some roads, but leave the surrounding area open to off-road use. This may result in an increased in disturbance to elk compared to alternative 1 in the short-term (about 20 years), since the harvested areas would be opened enough to permit ATV's and motorcycles with access into areas they could not reach prior to harvest. After about 15 years, alternatives 2 and 3 will provide more elk habitat effectiveness than alternative 1, as the regeneration will begin to block off-road access.

There will be no direct or indirect effects to goshawks or other raptor species nests in the sale area because of the protection measures specified in the action alternatives.

All of the action alternatives will meet the intent of Forest Plan standards for snag retention and for retention of downed large woody debris. The "island" grouping for snag habitat will increase the amount and effectiveness of snags over the long term in the harvest units. Alternative 1 will result in the most snags over the long term, as natural mortality increased. The action alternatives will create more large woody debris in the short term, but as the unmanaged stands in alternative 1 age, they will create more large woody debris over the long term.

The risk of adverse effects from project activities (including related activities and/or cumulative effects) was evaluated for threatened, endangered, candidate, and sensitive wildlife and fish species. A determination was made that the action alternatives would not affect the majority of the species in these categories. The exceptions were the Northern three-toed woodpecker, the Olive-sided flycatcher (OSF), and the Pygmy nuthatch. The determination for these species was that the timber harvest may adversely affect individuals, but it is not likely to result in a loss of viability within the planning area, nor cause a trend to federal listing or a loss of species viability range-wide. The effects upon the OSF are considered to be small because while some individuals may be affected by cutting dead topped trees, there is research that shows that OSF abundance increases in partially cut forests (Hutto, et al. 1992). The effects upon the Pygmy nuthatch are considered to be small, because although the HABCAP model predicts a drop in P. nuthatch habitat capability, ponderosa pine types are the preferred habitat, and lodgepole pine is a minor component of the life cycle of this species. Finally, the effects upon Northern three-toed woodpecker are considered to be small because the 1% habitat capability decrease predicted by HABCAP was generated using a "worst case" model that assumed 1500 acres of clearcut. The BE, EA appendix F-2, contains the complete information.

Cumulative Effects

A summary of the cumulative effects upon the items analyzed in this section of the EA is shown at pages 3-36 to 3-38.

The Wildlife Task Force report (1991) and the Clear/Crazy landscape assessment document the magnitude and effects of past management activities upon elk and other wildlife species in the area. Those reports can be found in the project file. While there have been effects upon the number of elk hunter days the area supports, the cumulative effects of this action are not large, since the action alternatives improve the quantifiable elk habitat variables that the Forest Service manages for. Concerning elk hiding cover, the stands proposed for harvest do not meet the criteria now, and they will meet the criteria sooner under the action alternatives than under alternative 1. In addition, increasing the amount of hiding cover sooner in the four diversity units with Caribou timber sale units will help move the larger hunt area closer to the desired condition for cover. Although elk habitat effectiveness is not a Forest Plan standard it is a variable of interest. The action alternatives utilize existing roads, improve the closure effectiveness behind the gates, and will increase the amount of hiding cover after about 20 years. The third variable is elk security, which like elk habitat effectiveness is not a Forest Plan S&G. Like the other variables, elk security is precisely defined, and the areas identified by the Wyoming Game and Fish Department can be found on maps in the Clear/Crazy LA project file. The units proposed for harvest under the action alternatives are not in existing security blocks. However, there are two areas less than 20 acres each in units D3 and D7 that fall within areas that could become elk security blocks with regeneration, and the timber harvest alternatives will hasten this process. The road closure effectiveness measures in all the action alternatives, and the road obliteration measures in alternative 5, will increase elk security. This increase is at least partially offset by the moving of the road closure gates back to provide for dispersed camping.

Since there are no direct or indirect effects to the nests of goshawks and other raptor species, there are no cumulative effects.

Concerning snags and coarse woody debris, the action alternatives will result in less of these resources than would the no action alternative. However, since the action alternatives provide at least the Forest Plan minimum required amounts, the cumulative effects of the action alternatives upon these resources is considered to be small.

A small difference between alternatives 2 and 3 based on the clearcut areas are the affects of the additional entry anticipated under a shelterwood system. The overstory removal will create a less uniform distribution of stems in the regenerating stand, as skidding and falling damage will destroy some regeneration. This compares to a more uniform distribution of regeneration following the clearcut harvest. The effects of this are

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very small, because the spacing of the projected thinning will be equal to or greater than the width of the skidding and falling damage.

Page 3-38 summarizes the cumulative effects upon the wildlife species analyzed in the Biological Evaluation.

**OLD GROWTH
Affected Environment**

The Clear/Crazy LA, and the forested vegetation and wildlife specialist's reports, include considerable detail concerning the function, distribution, and history of the old growth forests found in this ecosystem. Included in these materials are maps and site lists of stands that qualify as old growth. Old growth stands for the Clear/Crazy LA were identified using old growth scorecards and using Stage II Inventory data applied to the criteria in Mehl (1992). Additional sites were added during a review by the wildlife biologist and silviculturist as part of this timber sale analysis.

During the Caribou project analysis, the wildlife biologist and silviculturist mapped the locations of known old growth, and reviewed data and the location of candidate stands that are adjacent to the known old growth. Candidate stands provide some old growth attributes now, and/or will be old growth in 25 to 75 years. This will help answer the question of whether or not current and potential future old growth blocks are large enough to provide "functional" habitat for large old growth dependant species. This discussion is to demonstrate future options, and to disclose whether or not this project may affect old growth. It is not a management allocation.

The Forest Plan requires that 5% or more of the forested areas of a diversity unit should be in old growth. Table 6 displays how the diversity units in the analysis area currently compare to this standard and guideline. The last column shows the size of the largest contiguous block of known and candidate old growth sites that can be formed in each diversity unit.

Table 6. Acres of Old Growth Currently in Caribou Analysis Area

Diversity Unit	Known Old Growth	Forest Plan 5% Requirement	% of Forested Acres in OG	Acres in Known + Candidate Block
110	354	310	5.7%	1366
111	464	300	7.7%	455
112	356	98	19.9%	538
113	378	158	11.9%	499
114	684	279	12.2%	958
All 5 DUs	2236	1145	9.8%	

None of the stands identified as old growth or as candidate old growth in Table 6 are proposed for any type of silvicultural treatment under any alternative.

Environmental Consequences

All alternatives

Direct and Indirect Effects

There are no direct or indirect effects to old growth, because none of the stands proposed for harvest currently are defined as old growth. All of the alternatives will meet the Forest Plan standard for maintaining 5% old growth.

Cumulative Effects

A summary of the cumulative effects upon old growth is shown at page 3-39.

The issue of providing old growth stands into the future was raised during the scoping process.

Forest growth projections made for this analysis indicate that even under the alternative 3, 4 and 5 harvest regime, many more acres than are necessary to replenish the 5% old growth requirement will move into mature forest types in the next 50 years. These are the forests that future old growth will be recruited from, and although some may be burned or harvested during that time, analysis indicates that future managers will have sufficient old growth forests to manage given today's objectives.

The Sourdough project is in a diversity unit that has 1184 acres of inventoried old growth, compared to a Forest Plan specified amount of 385 acres. About 60 acres of potential cutting units are within an inventoried old growth stand. The other reasonably foreseeable actions involve very few harvest acres of forest that is not in an old growth structural stage.

Based upon the current amount of old growth, the declining timber harvest trends, the aging trends of the forests in these diversity units, and the candidate block analysis, there will be no cumulative effects upon the old growth resource caused by any of the proposed alternatives.

**WILDERNESS
Affected Environment**

The two issues concerning the Cloud Peak Wilderness area are air quality and motorized access.

The Cloud Peak Wilderness ecosystem has been designated as a Class II airshed by air quality legislation. The Federal Clean Air Act requires the Forest Service to comply with all Federal and State air quality regulations. This includes assuring that resource management activities permitted on the Forest comply with air quality standards.

The Cloud Peak Wilderness is approximately 2 air miles from the nearest cutting unit or road proposed for maintenance or rehabilitation, and about 3 air miles from the nearest prescribed fire unit. No Forest Service Development roads or trails access the Wilderness from the proposed project area. There is no known off-road motorized travel entering the Wilderness from the project area. The area proposed under alternative 4 to be closed to off-road motorized travel between April 1 and November 15 is bounded for about 1.5 miles by the Wilderness area.

Environmental Consequences

Alternative 1

Direct and Indirect Effects:

Road maintenance, consisting of surface blading, can create dust, and burning projects create smoke. These projects currently occur in the Clear/Crazy watersheds. The amounts and timing each year vary. These projects are not expected to have any significant effects upon the air quality in the Cloud Peak Wilderness, because they are of short duration, the general wind patterns within the watersheds are away from the Wilderness, and these projects create relatively small amounts of particulate matter. The no action alternative does not have any effects on motorized access to the Wilderness.

Cumulative Effects:

A summary of the cumulative effects upon the Wilderness area is shown at page 3-40. The no incremental effects upon the Wilderness as a result of this alternative to add to the effects of the other actions considered in the cumulative effects analysis.

Alternatives 2, 3, and 5:

Direct and Indirect Effects:

Air quality: These alternatives include between 14 and 24 miles of road maintenance and rehabilitation, during which dust will be created. This work will be of short duration, on the order of several weeks total spread out over three or four years. These alternatives also include about 350 acres of jackpot prescribed burning and burning of the landing piles, which will create smoke. The burning will be of short duration, about five days. The prevailing winds during the day and nighttime downslope conditions will move the smoke and dust away from the Wilderness. Despite these factors, it is likely that some smoke will enter the Wilderness airshed. Historic, natural fires occurred in and near the Wilderness, so the smoke that enters the airshed for a short duration will have no long term effect upon the air quality. Because the amount of smoke or dust that will enter the Wilderness airshed is small, of short duration, and will not have long term effects, the direct and indirect effects of the burning and road work are not significant.

Motorized access: These alternatives do not affect the motorized access to the Wilderness. Therefore, there are no direct or indirect effects of these alternatives upon the Wilderness motorized access issue.

Cumulative Effects:

A summary of the cumulative effects upon the Wilderness is shown at page 3-40. The addition of particulates created by these alternatives are minor and of short duration, so the cumulative effects of these alternatives on the airshed of the Wilderness is small. These alternatives create no cumulative effects on motorized access to the Wilderness.

Alternative 4:

Air quality: This alternative has the same range of road maintenance and rehabilitation work, plus the same prescribed burning proposal, as alternatives 2,3 and 5. Therefore, for the reasons listed above, the cumulative effects of this alternative on the airshed of the Wilderness is small.

Motorized access: Closing the area currently open to motorized off-road travel would have no direct, indirect or cumulative effect upon the Wilderness access issue since there is no known motorized access at this time.

WATER AND SOILS

Affected Environment

Analysis Area

This analysis covers approximately 43 square miles in the North Fork Crazy Woman creek watershed located on the Bighorn National Forest. Included in this analysis were Pole Creek (10 sq mi), Caribou Creek (5.8 sq mi), Merle Creek (4.4 sq mi) and North Fork Crazy Woman Creek (22.5 sq mi) watersheds. The watersheds range in elevation from just over 7,000 feet at the Forest boundary to just over 12,000 feet at the upper portion of the watersheds in the Cloud Peak Wilderness.

There are approximately 128 miles of road within the watersheds and approximately 63 miles of stream. There are lakes within the analysis area, although most of them are high altitude lakes located within the Wilderness. The average annual precipitation within the watersheds is approximately 25 inches. Potential evapotranspiration ranges from 14 to 18 inches per year and the mean annual runoff ranges from 5 to 18 inches per year.

Historically, this area was utilized for grazing purposes in the open parks and meadows. More recently management activities have concentrated on wood fiber production and recreation. Mining has also occurred within the analysis area, however, this activity has been primarily exploratory and recreational. Natural fires, and smaller man caused fires, have also occurred in the watersheds.

Regulatory Framework

The Forest Service is directed by five major Federal laws to protect watersheds through sound management. The Forest Service must also comply with the Wyoming Environmental Quality Act and laws pertaining to it. A detailed description of the regulatory framework, and of Forest Service policy and objectives in relation to watershed conservation, is in the project file in the hydrologist's specialist report.

Past Assessments and Reports

The North Fork Crazy Woman Creek and Pole Creek are listed in the 1997 Wyoming Water Quality Assessment report as partially supporting designated beneficial uses. Beneficial uses of the water are aquatic life use and cold water fisheries. The cause of the degradation as listed in the assessment is siltation, flow alterations, suspended solids, nutrients and unknown. Water quality within the watersheds is considered to be good despite the North Fork Crazy Woman and Pole Creeks being listed on the State 303(d) list. It is believed that these streams were erroneously listed in prior years and a written request to delist the streams, supported with data collected, has been forwarded to the State of Wyoming. As of the date of this analysis, the draft 1998 Wyoming Water Quality Assessment report lists North Fork of Crazy Woman Creek on the proposed 1998 303(d) list, while Pole Creek is proposed to be placed in a 303(d) list monitoring category. However, since the final determination on the streams' 1998 category will not be made by the Environmental Protection Agency until this summer, for the purposes of this analysis, the streams are considered to be on the 303(d) list.

Although the Clear/Crazy LA was large and done in somewhat general terms, the information indicates that water quality is in good condition. There are some locations where isolated impacts are occurring; however, these impacts can be administratively controlled.

Previous project specific analyses include analysis for timber harvest, livestock grazing and recreational activities. Information from these analyses indicate that water quality is in good condition. Projects were monitored to ensure that project objectives have been met and that water quality has been maintained; however, this information is limited to areas of which are of concern.

Soils

The geology of the area is predominately layered granitic gneiss's which are magmatic. There are some areas of glacial outwash, limestone deposits and sandstone within the analysis area. The area is considered to be stable.

Soils within the analysis areas are of the Tellman-Granite-Agnewton association. These soils are primarily sandy to gravelly loam type soils. Soils are moderately deep and well drained. The organic matter is made up mostly of twigs, needles and moss. Permeability of the soils is moderate to moderately slow. The hazard to water erosion is slight to moderate. The risk of slump/earthflow movement is moderate for slopes greater than 27 percent. The potential for erosion from unsurfaced roads is slight to moderate and the shrink swell potential is moderate. The ability to revegetate these soils is moderate to severe due to the acidity of the soils, and the ability to reforest these soils is moderate. The interpretations of slight, moderate and severe, and how that impacts management activities, are taken from the Bighorn National Forest Soil Survey.

Wetlands

Wetlands have been mapped by the U.S. Fish and Wildlife Service. There are approximately 8.3 square miles of wetlands within the analysis area. Wetlands are considered special aquatic sites and are given special attention during project planning. The wetlands within the analysis areas are considered to be in good condition.

Environmental Consequences

The Watershed Effects Checklist, Table 7, lists all effects required by the Clean Water Act, Multiple Use-Sustained Yield Act, National Forest Management Act and the National Environmental Policy Act. The Special Designations Checklist identifies special values of concern. This checklist ensures that all required effects are analyzed, gives a snapshot of effects, and identifies items to dismiss from rigorous analysis. Blank means no effect, "x" means minor effect and an "ox" means substantial effect.

Table 7. Watershed Effects Checklist

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
AQUATIC ECOSYSTEMS					
Sediment	X	X	X	X	X
Bed/Bank stability	X	X	X	X	X
Flow regimes	X	X	X	X	X
Temp./Oxygen	X	X	X	X	X
Water purity	X	X	X	X	X
Aquatic life	X	X	X	X	X
TES species					
SOIL PRODUCTIVITY					
Soil erosion	X	X	X	X	X
Soil compaction	X	X	X	X	X
Nutrient removal	X	X	X	X	X
Soil heating	X	X	X	X	X
Regeneration hazard	X	X	X	X	X

Table 7. Watershed Effects Checklist (continued)

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
GEOLOGIC HAZARDS					
Landslides	X	X	X	X	X
Soil Failures	X	X	X	X	X
Earthquakes	X	X	X	X	X
SPECIAL AREAS					
Riparian ecosystem	X	X	X	X	X
Wetlands	X	X	X	X	X
Floodplains	X	X	X	X	X
CUMULATIVE EFFECTS					
Aquatic ecosystem	X	X	X	X	X
Soil productivity	X	X	X	X	X
Riparian ecosystem	X	X	X	X	X

The special designations checklist provided in the Region 2 NEPA streamlining protocol identifies special values that might require increased concern and protection. The special items that could be affected by alternatives in the Caribou timber sale are riparian management areas, jurisdictional wetlands, and critical watersheds. Other special items on the Region 2 checklist were not affected by any of the proposed alternatives. The ID team took these special items into account when alternatives were designed.

The remainder of the water and soils direct and indirect effects section discusses the items found in Table 7 in more detail, and provides the rationale for why the effects are considered minor.

Aquatic Ecosystem

Sediment: Connected disturbed areas, like roads and other disturbed soils, near streams can deliver sediment directly to the stream system during runoff events. This sediment can be deposited in the stream, affecting insect populations and fish habitat. If severe enough, sediment can reduce a stream's productivity and diversity.

There are several roads within the analysis area that are connected to stream systems. Some roads have inadequate buffers between the road and aquatic ecosystem to adequately filter sediments before they reach the streams. Also, there are several stream crossings, most of which are culverts, within the analysis area which also affect the aquatic ecosystem. For this project no new road construction is needed due to previous projects establishing the existing road network. Potential impacts associated with roading of the area should be minor.

Alternatives 2,3,4, and 5 will produce more sediment in the short term than alternative 1. However, over the long term, total sediment loads produced in the analysis area will be lower under the action alternatives than under alternative 1, because of the application of BMPs and WCPH standards to the existing road system, the removal of roads from sensitive areas, and disconnecting the streams from the drainage systems. These are the reasons why the effects of the sediment created by any of the alternatives is considered minor.

Alternatives 3,4 and 5 will produce the most sediment from management activities in the short term. However, alternative 5 will reduce sediment over the long-term the most due to closing and obliteration of additional existing roads within the analysis area.

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Closing the area to off-road motorized summer travel in alternative 4 will reduce sediment loads slightly since travel will be restricted to roads and trails that have maintained drainage systems and constructed stream crossings. The amount of sediment reduction created by this effect is less than the reduction under the alternative 5 similar action of closing and obliterating additional roads.

Bed/Bank Stability: Stream bed and stream bank stability can be damaged from management activities. If sediment enters the stream channel, pools can fill with sediment, streams may become wider and shallower, and aquatic habitat could be lost. Stream banks that are unstable could become more unstable through management activities, increasing the potential risk of unacceptable impacts to the aquatic ecosystem.

Under all action alternatives minimal activity is planned within riparian areas. Wyoming BMPs will be followed within these areas. The issue of affecting wetlands and riparian areas was addressed in the design of the action alternatives.

Bed/bank stability could be affected if sediment enters the stream channel. The effects of this are discussed in the sediment section.

Flow Regimes: Flow regimes can be altered through major changes in cover type conversions or through removal of ground cover. Chemical, physical and biological parameters can all be impacted through major changes in the flow regimes.

Under all action alternatives the changes in flow regime will be minor because of the type of harvest and site preparation being planned. Specifically, nearly all of the acres harvested are seed cuts, and the site prep includes light intensity burning and the scarification that occurs through the skidding operations. The increases in flows that will occur under any of the action alternatives will return to pre-treatment levels overtime as the stands become vegetated. Vegetating of disturbed areas will also accelerate the recovery rates of water yield increases within the analysis area.

Temperature/Oxygen: During the winter months water temperatures decrease while during the summer months water temperatures increase. Removing of streamside vegetation can alter stream temperature during the summer months. Oxygen typically is not a problem in mountainous streams because of the step/pool stream systems. However, dissolved oxygen can be reduced in summer months if water temperature is increased. Dissolved oxygen is important to the life cycles of the aquatic biota.

There will be no effect upon the water temperature under alternative 1. Concerning the action alternatives, emphasis was placed on location of the silvicultural units to minimize effects upon temperature or oxygen levels. In addition, the sanitation/salvage harvest planned within riparian areas is an extremely light cut which will change the shade conditions on the watercourses very slightly, at all. Because of these two factors, the effects upon temperature and oxygen is negligible.

Water Purity: Water purity can be impacted by having concentrated pollution sources near the water resource. Impacting water purity can degrade water quality beyond designated beneficial uses and degrade the aquatic ecosystem.

All the action alternatives pose minor effects to water purity as long as watershed conservation practices are followed, mitigation practices are properly implemented and the timber sale contract is enforced.

Alternatives 2, 3 and 4 pose the greatest risk of affecting water purity. Alternative 5 will affect water purity more than the other alternatives in the short-term. However, through closing of roads and reducing sediment sources within the watersheds water purity will improve the most under alternative 5 over the long-term.

Aquatic Life Uses: Aquatic life can be degraded by migration barriers, changes in flow regime, reduced riparian and wetland conditions, and through large influxes of sediment or chemicals.

At each stream crossing there is the potential to create a barrier to aquatic life migration. Culverts, if not properly installed or sized, can restrict aquatic biota movement. Also, leaving the culverts in while the road is closed leads to increased maintenance cost and the potential for culvert failure. This leads to long-term potential impacts from increased sediment loads as well.

Impacts from all action alternatives should be minor because the road network for this management activity is existing. Roads scheduled for rehabilitation and closure under alternative 5 have 17 culverts, while the roads scheduled for rehabilitation and closure under alternatives 2,3, and 4 have 6 culverts. Specifically which culverts will be removed will be determined during the project design. Therefore, alternative 5 has the potential for the greatest long-term benefit to resources affected by culverts, alternatives 2,3, and 4 provide the next largest potential benefit, while alternative 1 would not change the existing effects created by culverts.

TES Species: Several riparian/aquatic species were considered in the February 3, 1998 Biological Evaluation for animals, including, among others, the spotted frog, boreal western toad, columbia spotted frog, tiger salamander, yellowstone cutthroat trout, wood frog, common loon, harlequin duck, and sturgeon chub. The complete BE can be found in appendix F-2. The action alternatives, including their cumulative effects, are expected to have "no effect" upon the riparian/aquatic species considered in the BE.

Soil Productivity

Soil erosion: Severe erosion can impair long-term soil productivity if soils are heavily disturbed on shallow or highly-erodible soils. Soils within the analysis area have a slight to moderate erodibility. Because the road network is already in-place, the potential to increase erosion over existing conditions is minor. Following watershed conservation practices and requiring revegetation of all disturbed sites will reduce potential impacts.

Alternative 5 poses the greatest risk of increasing erosion rates in the short-term. However, by obliterating and rehabilitating roads, impacts will be the least under alternative 5 in the long term. The other action alternatives would also increase erosion in the short-term. In the long-term impacts should decrease to near pre-treatment levels as long as roads are vegetated and adequate closure devices are installed.

The closure of the area to off road motorized travel by other than snowmobiles traveling on snow in alternative 4 will decrease the amount of soil erosion and soil compaction. According to the 1995 Bighorn NF monitoring report under the heading of "Off-Road Vehicle Damage", "Off-road vehicle impacts continues (sic) to occur.Issues include the development of parallel tracks along low standard roads and the creation of new access routes for dispersed camping, firewood and poles." The current level of these impacts, and the rate of trail and road creation, will remain the same under the other alternatives.

Soil Compaction: Soil compaction is caused by excess weight of vehicles and animals. It impairs infiltration, root growth and soil biota.

Soils within the project area are subject to compaction by heavy equipment if operations occur when soils are wet. The effect of all action alternatives will be minor with the application of the WCPH and BMPs, and application of the timber sale contract provisions, such as pre-approval of skid trails. In addition, the action specifies reuse of existing landings, to minimize the amount of potential compaction.

Nutrient Removal: Soil fertility depends on organic matter and nutrients. Soil productivity can be degraded if humus and topsoil, including excess leaves and limbs, are taken off-site.

Due to the type of silvicultural treatment proposed, including the requirement that whole-tree skidding not be allowed, the potential impact from all action alternatives will be minor. Adequate residual material will be left on-site to protect the soil resource and to allow for soil fertility in the long-term.

Soil Heating: Soil heating is caused by severe fires that consume the humus and litter layer of the soil. Soil heating can sterilize the soil and removes nutrients from the site.

Approximately 350 acres of the project area will receive a light intensity burn to aid in regeneration of the timber stand. This is needed to open the serotinous cones to maintain that genetic diversity. The remaining area will regenerate from non-serotinous lodgepole pine cones and other species. Impacts caused by soil heating will be minor under all action alternatives, because of the low intensity and jackpot (scattered) nature of the burn.

Regeneration Hazard: Forested stands must be restocked within 5 years after a final silvicultural treatment. Regeneration of a site can be affected by seedling mortality, plant competition and other factors.

The soil survey interpretations indicate that reforestation potential is moderate due to the stoniness of the soils. With the scarification provided by summer logging, and based upon the evidence of regeneration from past harvests, the degree to which the stoniness of the soils will effect reforestation will be minor under all the action alternatives. The soil survey interpretation also indicates that revegetation of grass and shrub species could be difficult due to the acidity of the soils. Fertilizer will be incorporated into the grass seed mix to balance the acidity of the soils.

Geologic Hazards

Soil creep, debris avalanches and flows, slumps and earthflows can occur on unstable slopes if management activities occur on unstable ground. The degree of hazard will depend on the type of disturbance, nature of the material and water content.

Because the existing road network is already in-place and stable, and the proposed treatments are on slopes less than 27 percent, the potential impact for all alternatives is minor.

Special Areas

Riparian Ecosystems: Riparian ecosystems provide shade, bank stability, fish cover, and woody debris to the aquatic ecosystem. They also provide wildlife habitat, migration corridors, sediment storage and release, and surface-ground water interactions. Composition and structure of riparian vegetation can be changed by actions that remove certain species and age classes.

The type of timber harvest specified in the action alternatives is consistent with the Forest Plan objectives and standards and guidelines for riparian ecosystems. The sanitation/salvage prescription meets the single-tree selection methods criteria. The harvest is being conducted to achieve multi-resource objectives, namely the avoidance of creating additional areas exceeding the adopted Visual Quality Objective of partial retention.

Concerning the action alternatives, emphasis was placed on location of the silvicultural units to minimize effects on riparian ecosystems. In addition, the sanitation/salvage harvest planned within riparian areas is an extremely light cut which will utilize all applicable BMPs. Because of these two factors, the effects of the timber harvest upon riparian ecosystems is small.

Alternative 5 will obliterate and rehabilitate the most roads within riparian areas, which will provide the greatest benefit to riparian areas over the long-term through restoration of riparian area.

Wetlands: Wetlands control runoff and water quality. They also recharge ground water and provide special habitat for wildlife. Actions that impact wetlands can impair these special values.

The effect of the timber harvest in the action alternatives will be minor, due to light harvest involved, the small area impacted, and because of the application of BMPs and WCPH measures. In addition, all the action alternatives provide for disconnection of the existing road system to wetlands through the obliteration and

rehabilitation measures. Alternative 5 poses the greatest long term benefit to wetlands since a greater amount of obliteration and rehabilitation of roads and restoration of wet areas is planned.

Floodplains: Floodplains are natural escape areas for flood flows. They also control flood stages and velocities during flooding events.

The effect of the timber harvest in the action alternatives will be minor, due to light harvest involved, the small area impacted, and because of the application of BMPs and WCPH measures. Road obliteration in alternative 5 will improve floodplain function the most in the long term by removing roads from the floodplain areas and restoring vegetative cover to the floodplain.

Cumulative Effects

A summary of the cumulative effects upon the water and soil resources is shown at page 3-49.

Factors related to watershed cumulative effects were considered during the analysis of this project. Special consideration was given to:

- Additive effects of past and present activities
- Location of proposed disturbances related to sensitive areas and degraded systems
- Severity and duration of the disturbances and their effects
- Potential effects on State designated beneficial uses of the water
- Potential effects on aquatic life limiting factors
- Potential effects on soil productivity
- Potential recovery of watershed conditions and the potential of the project to aid in improving watershed conditions

Several management actions are currently being implemented within the Crazy Woman Creek watershed. Thinning of sapling sized stands, use and maintenance of roads and trails, campgrounds and dispersed recreation, other recreational activities including ATV use and fishing, livestock grazing, and summer homes are among the projects and activities that are currently ongoing. All of these activities pose potential impacts to the water resource and aquatic life. There is a certain level of risk that is taken when management activities pose impacts to a watershed. Additional risk is posed by periodic natural disturbances, which vary in size, duration and intensity. However, by following the Watershed Conservation Practices Handbook and properly implementing the Best Management Practices listed in appendix A, the risk to watershed conditions and beneficial uses posed by this project can be reduced to acceptable, non-significant, levels.

Although alternative 5 poses the greatest impact in the short-term, alternative 5 implements measures that would most benefit watershed conditions over the long-term. The short term impact is the disturbance created by the ground disturbing activities included in the rehabilitation and obliteration actions. "Short term" is expected to be 2-3 years, until the revegetation takes place and the disturbed soil stabilizes. The other four alternatives do not contain as much road rehabilitation and obliteration, so their short term and long term impacts are less than alternative 5, in direct relation to the amount of road treated. Rehabilitation of roads within these watersheds will reduce sediment loads to the stream, improve aquatic life habitat and migration, place land back into natural production and provide more filtering potential of the watershed. The bottom line rationale for why the cumulative effects are not significant for any of the action alternatives is that they provide a *net long term improvement* to the health of the soil and water resource when compared to the current, alternative 1, conditions.

Table 8 gives a comparative rank to each of the alternatives for the short and long term effects upon the soil and water resource. This is not a quantitative variable, but a comparative ranking. In table 8, 1 equals "Best for the soil and water resource, considering all of the variables discussed in this section, which cumulatively

make up the concept of watershed health', while 5 is the worst from a watershed health perspective. For purposes of this comparison, 'short term' is expected to be 2-3 years, until the revegetation takes place and the disturbed soil stabilizes.

Table 8. Comparative Ranking of Each Alternative on Watershed Health

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Watershed Health - Short Term	1	3	3	2	5
Watershed Health - Long Term	5	3	3	2	1

In early July, the Bighorn National Forest submitted a letter and data to the Wyoming Department of Environmental Quality (DEQ) requesting that Pole Creek and North Fork Crazy Woman Creek be removed from the state 303(d) list. The Forest Supervisor has determined that the monitoring information from this area indicates that state designated beneficial uses are being maintained.

As of March, 1998, the DEQ's draft 1998 Water Quality Assessment Report shows that North Fork Crazy Woman Creek is on the proposed 1998 303(d) list, and Pole Creek is proposed to be placed in a 303(d) list monitoring category. The public comment period has closed on the proposed 1998 303(d) list, and the DEQ will shortly make their final 303(d) list recommendations to the Environmental Protection Agency (EPA). The EPA is scheduled to publish the final 1998 303(d) list in June or July, 1998. For the purposes of this analysis, the streams are considered to be on the 303(d) list.

The rationale for pursuing this project prior to notification of delisting by the EPA is that the net result of the road rehabilitation and obliteration work specified in alternatives 2,3,4, and 5, and the summer off-road motorized vehicle area closure in alternative 4, will result in an improvement in watershed condition and health when compared to the current, no action, situation. The project record includes a letter from the watershed program manager for the Wyoming DEQ which states that the action alternatives "...will not only protect existing beneficial uses, but will result in water quality improvements through sediment load reductions in the streams." The greatest benefit to watershed health will be realized under alternative 5, since more miles of road are to be rehabilitated and that alternative includes road obliteration. The net result of implementing one of the action alternatives will be an improvement in the water quality conditions that support the beneficial uses for these streams.

FIRE/FUELS

Affected Environment

The Clear/Crazy LA describes the watershed scale fire environment. In summary, the ecosystems in these watersheds were subjected to periodic, large-scale, catastrophic fire. The stands proposed for harvest are, for the most part, in the lodgepole pine habitat type, although the west side of unit D8 and north aspect of unit C1 are marginally in an Engelmann spruce habitat type. Either way, the fire interval was on the order of 100 to 300 years for the stands proposed for harvest, while the higher elevation spruce stands had longer fire intervals.

The scale of the fires that affected the ecosystem at the stand and landscape scale were on the order of several hundred to thousands of acres. Although numerous small fires occurred, they affected a small number of acres. The scale of fires is witnessed by the size of the circa 1870 event in the Hazelton/Doyle Creek area, and by the 1988 Lost fire.

The past fire regime in the proposed stands resulted in a high percentage of serotinous cones in the lodgepole pine, and in a low incidence of dwarf mistletoe.

As described in Lotan (1985), lodgepole forests undergo a natural succession of fuel buildup.

Environmental Consequences

Alternative 1

Direct and Indirect Effects

The amount of cone serotiny will decrease over time, as non-fire initiated, 'open' cone, seed source is used to provide the regeneration that will occur without disturbance.

The risk of catastrophic fire occurring in the proposed harvest stands will change differently than it will if timber harvest occurs. Over the next 5 decades, the risk of catastrophic fire in the currently single story stands (alternative 1) will be less than under the action alternatives, where regeneration will provide a fuel ladder. After about 5 decades, however, the risk of stand replacing fire under the no action alternative 1 will be greater, because of the amount of fuel created through mortality, and because the lodgepole regeneration will begin to occur at about that time, creating the ladder fuel condition.

Since there is no prescribed burning under this alternative, there is no risk of an escape.

Cumulative Effects

A summary of the cumulative effects upon fire/fuels is shown at page 3-41.

The past timber harvest and logging activities have reduced the risk and reduced the probable size of future fires. This is due to the creation of lodgepole sapling and pole stands that are less susceptible to fire than old-growth stands and due to increased access created by the road systems.

Alternatives 2,3,4,5

Direct and Indirect Effects

These alternatives include 350 acres of jackpot prescribed burning, with the objective of providing a suitable seedbed and opening the serotinous cones. This will help maintain this seed source into the future.

There will be some risk of escaped fire during the burning of the landing piles and during the jackpot burning. In both cases, the risk will not be significant, as these burns can be done under cool, wet conditions.

The risk of wildfire will be increased over the no action alternative in the short term, approximately 1 decade, due to activity fuels. This risk will continue to be increased during decades 2-5 as the regenerated lodgepole will create a fuel ladder. However, at about decade 5, the risk of fire under these alternatives will become lower due to the structural differences of the single-story, even aged stands created under these alternatives, and the more mixed stand with heavier fuel loading that will occur under alternative 1.

Cumulative Effects

A summary of the cumulative effects upon fire/fuels is shown at page 3-41.

Past thinning harvests in the Clear/Crazy LA area has left considerable fuel loading under those stands. The probability of ignition is the same in these stands as in unmanaged stands, but the increased fuel loading

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will result in higher fire intensities, if amelioration treatments are not conducted. One of the potential Sourdough timber sale opportunities may, depending on the analysis and decision, result in treatments to lower the fuel loading.

Forested vegetation management, if fuels are properly managed, can result in lower fuel loading, decreased fire risk, and less area catastrophically burned.

RECREATION

Affected Environment

The proposed project area supports a range of recreation uses in both summer and winter seasons - including but not limited to - driving for pleasure, snowmobile travel, wildlife viewing, dispersed camping, fishing, all terrain vehicle (ATV) travel, nordic skiing and dog sledding. These activities are supported by a mixture of roaded natural and roaded modified ROS settings within the project area.

An inventory of campsites and interviews of campers in 1996 provided information on dispersed camping in the proposed project area. Interviews show that dispersed campsites serve as a base of operations from which they pursue the range of recreation activities supported in the area. Ease of access on the high standard Pole Creek Road attracts owners of large recreational vehicles and trailers. There is growing use of and demand for dispersed camping opportunities. The campsites inventory indicates a preference across the Buffalo District for camps at forested sites as opposed to meadows or other open areas. During interviews, it was suggested that setting road closure gates back off of Pole Creek Road would enhance these locations as campsites by allowing use further from traffic noise and dust. Seven potential sites for this enhancement were identified. 52 dispersed campsites used by recreationists have been inventoried in the project area. Only five sites are in proposed harvest units. There are three areas of concentrated dispersed campsites within the project area. These are located outside of proposed harvest units. They are located (1) near the intersection of Sheep Mountain Lookout Road and North Fork Crazy Woman Creek, (2) near the intersection of Pole Creek Road and North Fork Crazy Woman Creek, and (3) near the gravel pit on Pole Creek Road along the ridge between Hesse Creek and Muddy Creek.

Snowmobile and cross-country ski trails are located in the proposed project area. Pole Creek Cross Country Ski Area trails are located between U.S. Highway 16 and Pole Creek Road in the Pole Creek drainage. Camp E-La-Ka-Wee, a former Boy Scout cabin, is a National Forest facility located at the south edge of the ski area. It serves both skiers and snowmobile enthusiasts as a warming hut and is maintained under a volunteer agreement by the Buffalo Sno-Buffs snowmobile club. Groomed snowmobile trails are maintained by the Wyoming Department of Commerce/Division of State Parks in cooperation with the Forest Service. The groomed trails in the project area include the K Trail, M Trail, R Trail and J Trail. These routes frequently follow system roads (FDR's) but are also located along parks and on non-system ways.

Travel management affects recreation opportunities and use in the proposed project area. Travel by foot, horse and bicycle is unrestricted in the project area and on area roads. Off road use of motorized vehicles in the project area is not restricted, although damage or unreasonable disturbance of land, wildlife or vegetative resources is prohibited. Also, several restrictions apply to use of motorized vehicles on designated roads. Pole Creek Road #31 and Sheep Mountain Road #28 are closed annually to any motorized vehicle except snowmobiles operating on snow from January 1 to April 1 to allow for snowmobile trail grooming (Order 94-01). A dense network of local intermittent (LI) roads developed to support timber harvest activities is largely closed to motor vehicles with the exception of flotation type equipment operating on snow and snowmobiles operating on snow after November 15 annually (Order 90-06). The roads which are open to both motorized use and non-motorized use (including over-snow vehicles) are #28, #31, #456, #459, #476, #477 and #480.

Recreational travel by all terrain vehicle (ATV) is growing in the project area. The travel management rules, which close most of the local roads to ATV travel but leave the area open, are confusing to some citizens. There is a demand for ATV trail opportunity and riders are trying to use the Pole Creek - Sheep Mountain area. Travel restrictions limit ATV opportunities. Compliance with restrictions is not universal. On site signing of travel restrictions including explanations of the reasons is inadequate. Area users who do not travel by ATV frequently complain about the noise and object to their presence.

Environmental Consequences

Alternative 1

The area will continue to provide roaded natural and roaded modified settings for recreation. There will be an evolution toward roaded natural settings as mature replacement stands develop in past harvest areas.

Compliance with travel management regulations will continue to be a problem as a consequence of (1) conflicting management of roaded and off-road travel, and (2) poor on-site signing to inform users of the regulation and explain the reasons for restrictions.

Dispersed recreation use in the area, including camping and ATV travel, is expected to continue to increase.

Conflicts between ATV travel and other resources or uses are expected to increase.

Alternative 2

Roaded natural ROS settings in the vicinity of units C1, C2, B1, B2, D5, and D6 would be classified as roaded modified settings after harvest. Roaded modified settings typically are less attractive to recreation users than roaded natural settings. They support fewer recreation activities and fewer recreation users.

Most dispersed recreation use in the area is expected to be displaced during logging operations. Some users may be permanently displaced.

After harvest, use of 3 inventoried campsites in unit B1 is likely to decline and competition for other campsites would increase.

As many as four potential campsites could be enhanced by moving road closure gates back from Pole Creek Road. One site is in unit C1, one is in unit B1, and two are in unit D5.

Closure of FDR 480, 477, 478 and non-system routes off of 476 to motorized use would reduce ATV travel opportunities on local roads by 2.6 miles total. None of the affected road segments exceeds 0.8 miles in length. Non-system road UN-C offers a loop travel opportunity in combination with FDR 476.

Reduction in crown cover resulting from harvest in units C1, C2, B1, B2 and D5 may have negative impacts on snow deposition on segments of the K Trail (FDR 31) and M Trail (FDR 476 and 477). Reducing the harvest levels to 60-70 basal area and leaving some patches in the foreground of these trails will reduce the impact.

Compliance with travel management regulations will continue to be a problem as a consequence of (1) conflicting management of roaded and off-road travel, and (2) limited on-site signing to inform users of the regulation and explain the reasons for restrictions.

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Conflicts between ATV travel and other resources or uses are expected to increase.

Alternative 3

Roaded natural ROS settings in the vicinity of units C1, C2, B1, B2, D5, D6 and D8 would be classified as roaded modified settings after harvest. Roaded modified settings typically are less attractive to recreation users than roaded natural settings. They support fewer recreation activities and fewer recreation users.

After harvest, use of 3 inventoried campsites in unit B1 and 2 inventoried campsites in unit D8 is likely to decline. Competition for other campsites would increase.

As many as seven potential campsites could be enhanced by moving road closure gates back from Pole Creek Road and Sheep Mountain Lookout Road. One site is in unit C1, one is in unit B1, two are in unit D5, two are in unit D8 and one is off Pole Creek Road between D8 and D2.

Reduction in crown cover resulting from harvest in units C1, C2, B1, B2, D4, D5 and D8 may have negative impacts on snow deposition on segments of the K Trail (FDR 31 and 522114) and M Trail (FDR 476 and 477).

Other environmental consequences - in terms of user displacement, road closures, compliance and user conflicts - are the same as listed for alternative 2.

Alternative 4

Closure of about 18,000 acres to off-road travel by motorized vehicles, excepting snowmobiles traveling on snow, will substantially reduce ATV travel opportunities. In the absence of any designated trail opportunities for ATV's, conflicts with other users are expected to increase along open roads.

Elimination of the conflicting management of roaded and off-road travel is expected to improve public understanding of the travel regulations and support both compliance and enforcement efforts. However the change in off-road travel rules along the length of Pole Creek Road from open on the lower end to closed on the upper end may prove confusing for users.

A large number of new signs would be necessary to implement the proposal.

Cumulatively, there has been a reduction in the amount of off-road motorized recreation opportunities, except for snowmobiles on snow. In 1989, there were approximately 200,000 acres open to other than snowmobile off-road motorized use, and as of August 1, 1997, there are approximately 140,000 acres open. The closure proposed in this alternative would reduce that figure by another 18,000 acres. The net result would be that about 122,000 acres, or 62% of the total in 1989, would remain open to summer off-road motorized vehicle use.

Closing the area to off-road travel will close to dispersed camping those sites that are more than 300 feet from an open road. An inventory of dispersed camp sites in the off-road closure area shows that out of 89 known dispersed camp sites, 20 would be closed to vehicular access as a result of the area closure. This effect is at least somewhat offset by the moving back of the road closure gates for camping opportunities, so the net effect of this alternative to dispersed camping opportunities is small.

Other environmental consequences - in terms of ROS settings, user displacement, degrading existing campsites, enhancing potential campsites, road closures, and snow quality on trails - are the same as listed for alternative 3.

Alternative 5

Treatment of closed roads to enhance effectiveness of road closure devices is expected to improve compliance with the closure to motorized travel to some degree.

Other environmental consequences - in terms of ROS settings, user displacement, degrading existing campsites, enhancing potential campsites, road closures, and snow quality on trails, off-road restrictions, public understanding of restrictions, and signing - are the same as listed for alternative 3.

Cumulative Effects

A summary of the cumulative effects upon recreation is shown at pages 3-42 to 3-45. The first table item under recreation cumulative effects, labeled recreation-general, describes the additive effects upon the whole spectrum of recreation users that is larger than the effects upon individual user groups. The following three recreation cumulative effects sections in Table 14 list the effects upon individual user groups.

VISUAL QUALITY

Affected Environment

The characteristic landscape of the project area features expanses of lodgepole forest interrupted by narrow bands of riparian vegetation and small parks. Portions of Caribou, Goodman, North Fork Crazy Woman, and Hesse Creek are within the project area. Rock outcrop or rock piles are found in several locations. Sheep Mountain to the northwest and the Hazelton Peaks to the southwest are nearby landmarks.

Scenery in the project area exhibits the visual impacts of previous harvest activities including woody debris from past harvest; clear-cut units; patch cuts for landings; canopy thinning from partial cuts; and an extensive road system with related skid trails and gates. The project area has a low level of scenic integrity. As human alterations begin to fragment and dominate the characteristic landscape the quality of forest users' aesthetic experience declines. The project area is bordered by areas of large scale harvest with very low scenic integrity. These include Caribou Mesa to the northeast; lower Pole Creek Road to the north; the slopes of Sheep Mountain to the northwest; the North Fork of Crazy Woman to the west; and Hesse Mountain to the southwest.

Pole Creek Road #31 and Sheep Mountain Lookout Road #28 are sensitivity level one travel routes. Proposed units B1, C1, C2, D5 and D8 cross or border these routes. The Sheep Mountain Lookout provides a viewer platform for a panorama of the project area. U.S. Highway 16, a designated scenic byway, is also a sensitivity level 1 route. It curves around the project area on the east and south sides. Vegetative screens buffer views of the project area from the highway. There is very little topographic screening, so disturbance of the intervening timber stands by fire, wind, insect and disease or future harvest would expose the proposed units to highway users. All or part of routes 476, 522114, 480, 477, and 456 are included in the state's groomed snowmobile trail system and have a sensitivity level rating of two.

The inventoried visual quality objective for most of the project area is partial retention. A partial retention objective allows for management activities that remain visually subordinate to the characteristic landscape. A partial retention objective supports a moderate level of scenic integrity. A minimum standard for visual quality of partial retention applies to the foreground from Pole Creek Road (FDR 31 - a collector); the foreground from Sheep Mountain Lookout Road (FDR 28 - an arterial); the foreground from primary snowmobile trails; and riparian area vegetation based on the prescriptions for wood fiber production (7E) and riparian areas (9A). For the remainder of the project area the minimum standard for visual quality is modification. A modification standard allows for management activities that dominate the characteristic landscape; however,

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the activities of vegetation and landform alteration must borrow from naturally established form, line, color or texture so completely and at such a scale that its visual characteristics are those of natural occurrences in the surrounding area or character type.

Environmental Consequences

Alternative 1

The project area exhibits low scenic integrity with a trend toward moderate scenic integrity. Considered as a whole, the project area meets a modification VQO and is moving toward meeting a partial retention VQO.

The fragmented quality of the landscape - attributed to the extensive road system, past harvest units, and the leave strips - is likely to be carried forward during natural succession processes for an extended period.

Alternative 2

The project area is expected to continue to exhibit low scenic integrity with a trend toward very low scenic integrity. Considered as a whole, the project area is expected to meet a modification VQO at the low end of the scale after harvest. This is the minimum standard for visual quality established in the Forest Plan.

Reducing the harvest levels to 60-70 basal area and leaving some patches in the immediate foreground of the most important summer and winter travel routes [FDR 31, 28, 522114, 476 (533115), 477 (533116), 480] will conceal the scale and intensity of harvest activities from forest users who remain on these routes. This will meet the minimum standard in Forest Plan prescription 7E for partial retention in the foreground of arterial and collector roads and primary trails.

Factors in the predicted decline of scenic quality are the large scale of the treatment units, the accumulation of additional woody debris and the reduction in crown cover resulting from the second entry of a three-step shelterwood harvest.

The fragmentation of the characteristic landscape is expected to be reduced over the long term by treatment of leave strips from earlier clear-cut harvest. However, the areas treated are very small in relation to the total project area and will have little impact on the area-wide downward trend in scenic quality.

Alternative 3

The addition of unit D8 will increase the visual dominance of management activities in the landscape along the K Trail on FDR 52211 near Hesse Creek. The unit links two previous clear cut blocks. It will allow for treatment of an extended leave strip from earlier harvests. The net effect is roughly neutral for the visual resource.

The addition of unit D4 will create a new leave strip between it and clear cut units to the north. It is visible across a meadow from Pole Creek Road and from several dispersed campsites at its edge. Treating this unit would negatively impact scenery along Pole Creek Road.

The proposed patch cuts would create new breaks in the canopy and contribute to further fragmentation of the landscape. Layout of the units on the ground to echo the pattern of natural canopy breaks is important in determining the visual effect. Patch cuts is expected be more visually dominate than second step shelterwood harvest in these units.

Other environmental consequences - in terms of existing scenic integrity and trends, meeting minimum standards for visual quality, treatment of foreground zones, causes of visual effects, and fragmentation - are the same as listed for alternative 2.

Alternative 4

The change in travel management proposed in Alternative 4 is not expected to have consequences for visual quality.

Other environmental consequences - in terms of existing scenic integrity and trends, meeting minimum standards for visual quality, treatment of foreground zones, causes of visual effects, fragmentation, added units and patch cuts - are the same as listed for alternative 3.

Alternative 5

The obliteration of some roads will help unify the landscape (i.e. reduce fragmentation) experienced by forest users. However, the miles treated are very small proportion of the total miles in the project area. These treatments will have little impact on the area-wide downward trend in scenic quality.

Other environmental consequences - in terms of existing scenic integrity and trends, meeting minimum standards for visual quality, treatment of foreground zones, causes of visual effects, fragmentation, added units and patch cuts - are the same as listed for alternative 3.

Cumulative Effects

The project's cumulative effects upon visual quality are shown at page 3-45.

FORESTED VEGETATION AND SILVICULTURAL SYSTEMS

Affected Environment

This section of the report tiers heavily to the Clear/Crazy LA and the forest vegetation specialist report. Included in those reports are species and stand age information; tables and maps that display the type, amount, and location of past timber sales; and, information about the effects of those activities.

Briefly, the forests in the area are dominated by lodgepole pine, which is due to the soils and climate. Engelmann spruce is found along creeks, and with subalpine fir in the higher elevations. Small stands of aspen are also scattered along the meadow-conifer forest boundary. The cutting units are almost entirely lodgepole pine, with most of the spruce found on the north aspect in unit C1 and some in unit D8.

The vast majority of the cutting units are allocated by the Forest Plan to the 7E management area, as shown in the RIS database, and are on suited land. There is a two acre inclusion of 6B prescription, an approximately 40 acre patch of 4B prescription along the Pole Creek road in unit B2, and there are small areas of 9A prescription in units B2 and D5.

The Clear/Crazy watersheds in general, and the Caribou timber sale area specifically, have long been managed with a heavy emphasis on timber production. Large amounts of timber harvest, and the associated road building, occurred in the 1960's and 1970's. This rate slowed in the 1980's and 1990's. The harvest systems also have changed, based mostly upon social considerations, from several hundred acre clearcuts to shelterwood harvests to ten to twenty acre clearcuts over that time.

Silvicultural diagnoses describe the site conditions, past management activities and identify silvicultural alternatives. Diagnoses have been prepared for the proposed cutting units, and can be found attached to the forested vegetation specialist report. If the decision maker chooses an action alternative, silvicultural prescriptions will be prepared by a certified silviculturist prior to project implementation.

The windthrow risk in the stands proposed for harvest, using the guidelines in Alexander (1986), varies from low to high depending on the topographic position. Most of the area proposed for harvest is of moderate windthrow risk.

A silvicultural finding for National Forest Management Act compliance has been prepared by a certified silviculturist, and can be found in the project file. This includes the following findings:

- Soil, slope and other watershed conditions will not be irreversibly damaged.
- Reforestation will occur within five years of the final harvest.
- All lands proposed for harvest are on lands found to be suitable for timber production.
- Even-aged regeneration methods are appropriate or optimal, because they:
 - best meet the objectives of the Forest Plan in this area.
 - are scientifically sound methods of regeneration for lodgepole pine and Engelmann spruce.
 - the stands have generally reached culmination of mean annual increment (CMAI).

Personal use firewood cutting is currently allowed along the open roads.

Environmental Consequences

Alternative 1

Direct and Indirect Effects:

Natural successional and disturbance effects will dictate the course of future stand development. The stands proposed for harvest in the other alternatives are about 150 to 180 years old. The prep cuts in 1975-1980 thinned the stands. While there will be a low level of mortality over the next several decades, there is not likely to be levels of mortality large enough to result in significant amounts of regeneration for 50 to 100 years. This compares to regeneration development in the action alternatives in the next 10 to 20 years. Without harvest, these stands are likely to reach an old-growth structural stage in about 50 years.

Currently, 4 of the 5 diversity units do not meet the Forest Plan 5% grass/forb structural stage standard and guideline (S&G), while all 5 meet the 5% old growth structural stage S&G. Structural stage projections indicate that implementation of this alternative will not meet the 5% grass/forb S&G over the next 50 years, while the 5% old-growth S&G will be met over that time. These statements are based on no catastrophic disturbance.

Forest growth and yield will be lower under this alternative, and this alternative does not meet the Forest Plan objectives for this 7E dominated management area.

This alternative would not disturb the forested regeneration already existing on the roads and landings.

It is likely that as the stands move toward later successional stages that forest insects and diseases present in the stands would either persist at existing levels or may increase. There is no past evidence on this landscape of major mountain pine beetle epidemics, and considered with the current age and density of the stands, it is not probable that an outbreak will occur in the next few decades under the no action alternative. The amount of dwarf mistletoe will increase in the future under this alternative, and will be higher than under the harvest alternatives.

The proportion of lodgepole pine regeneration with serotinous cones will be less than will occur under the harvest alternatives. As the decades progress, the likelihood of fire will increase, as the stand fuel "succession" moves to more flammable stages. (Lotan, 1985) These effects will compound into the future, and this will increasingly lower the resilience of the lodgepole pine resource to respond to future fires.

There will be no direct or indirect effects upon the availability or opportunity to cut firewood under alternative 1.

Cumulative Effects

There is a trend on National Forests, at all scales (nationally, region-wide, forest-wide, and district wide), of doing less silvicultural manipulation of the forested stands, and offering less timber for sale. Adopting this alternative would continue that trend. The cumulative effects upon the forested vegetation created by this alternative would be small, since only 1500 acres out of nearly 23,000 forested acres in these DUs would be affected.

A summary of the cumulative effects upon the forested vegetation is shown at page 3-46. The cumulative effects of not managing suited, 7E land for forest regulation upon the forests of the nation, and the social and economic arenas, is beyond the scope of this EA. This is more properly addressed at the Resources Planning Act level, and during the Forest Plan Revision analysis.

Alternative 2

Direct and Indirect Effects

Approximately 1340 acres of shelterwood harvest, and fifty acres of sanitation/salvage harvest would be conducted. The diagnoses prepared for this document list by RIS site the specific harvest considered under this alternative. The prescriptions will specify the harvest system to be applied, based upon which alternative is selected in the Decision Notice.

Regeneration and the related changes to the structural stages resulting from a two storied stand will occur sooner within the forested stands than under the No Action alternative.

No grass/forb structural stages will be created as a result of this alternative, so the Forest Plan S&G of 5% in that structural stage will still not be met in 4 of the 5 diversity units.

This alternative, with less area harvested, does not meet the Forest Plan objectives for 7E management area as well as alternatives 3,4 and 5, but it does meet this objective better than does the no action alternative.

The incidence of dwarf mistletoe in the regenerated stand is likely to be less than under the no action alternative as the trees with mistletoe can be removed under the seed cut. The risk of future mountain pine beetle outbreak is lower than under the no action alternative.

Lodgepole serotinous cones will be managed for under this alternative, and the "natural" fuel succession will be set back, so the lodgepole forests involved will be more resilient and at less risk over the long term to large scale fires compared to the no action alternative.

There is a higher likelihood of windthrow than under the no action alternative. With proper implementation of the windthrow marking guidelines, and based upon the soil characteristics, the risk of a large windthrow event caused by this alternative is small.

Based on projections attached to this report, it is estimated that 3.9 MMBF would be harvested under this alternative.

There will be a small amount, about 1.5 miles, less open road/trail for firewood collection under alternative 2 compared to alternative 1.

Cumulative effects

A summary of the cumulative effects upon the forested vegetation is shown at page 3-46.

The Clear/Crazy landscape analysis extensively examined the amount of past harvesting that has occurred. Other analyses, using that information, have addressed the effects of this harvest history. The Wildlife Task Force report (Forest Plan amendment Draft Supplemental Environmental Impact Statement, 5/1/92), work by the Wyoming Game and Fish Department, including the satellite change detection maps, and a recent report by Tinker, et al. on forest fragmentation, also display the amount, timing, and to some degree, the effects of the past timber harvesting in this area.

A timber sale planning project is underway in the Sourdough Creek watershed, which is a few miles north of the Caribou project area. Preliminary office based projections indicate there may be about 1 MMBF harvested on up to 1400 acres.

The harvest acres by decade tables in this report and in the Clear/Crazy LA show that the rate of timber harvest has slowed considerably in the analysis area between the 1960's and 1970's to the 1990's.

This area has had a primarily timber management objective since the tie hack era of the 1920's. The Forest Plan allocated the majority of the area in the 5 diversity unit analysis area to the 7E management area.

Alternatives 3, 4 and 5

The effects of these alternatives are being described together since they plan the same silvicultural practices.

Direct and Indirect Effects

Approximately 1432 acres of shelterwood harvest, fifty acres of sanitation/salvage, and 40 acres of clearcut harvest would be conducted. The diagnoses prepared for this document list by RIS site the specific harvest considered under these alternatives. The prescriptions will specify the harvest system to be applied, based upon which alternative is selected in the Decision Notice.

Regeneration will occur sooner within the forested stands than under the No Action alternative. These alternatives have 91 additional acres of shelterwood harvest and 40 additional acres of clearcut harvest compared to alternative 2.

About 40 acres of grass/forb structural stage will be created by the clearcuts as a result of this alternative. The grass/forb structural stage will last about 5 to 10 years, when the areas will be classified in the seedling stage. As with alternatives 1 and 2, the Forest Plan S&G of 5% in that structural stage will still not be met on 4 of the 5 diversity units.

These alternatives, with more area harvested, best meets the Forest Plan objectives for 7E management areas compared to the alternatives 1 and 2.

The incidence of dwarf mistletoe in the regenerated stand is likely to be less than under the no action alternative as the trees with mistletoe can be removed under the seed cut. The risk of future mountain pine beetle outbreak is lower than under the no action alternative.

Lodgepole serotinous cones will be managed for under this alternative, and the "natural" fuel succession will be set back, so the lodgepole forests involved will be more resilient and at less risk to future large scale fires.

Because insect, disease and fire are not precisely defined risks, and the areas treated in alternatives 2, 3, 4, and 5 are approximately the same, at least on the landscape level, the effects of all 4 of the action alternatives on these risk items is about the same.

There is a higher likelihood of windthrow than under the no action alternative. With proper implementation of the windthrow marking guidelines, and based upon the soil characteristics, the risk of a large windthrow event caused by this alternative is small.

Based on projections attached to this report, it is estimated that 4.6 MMBF would be harvested under this alternative.

There will be a small amount, about 1.5 miles, less open road/trail for firewood collection under alternatives 3, 4, and 5 compared to alternative 1. This is the same amount available under alternative 2.

Cumulative effects

A summary of the cumulative effects upon the forested vegetation is shown at page 3-46.

The difference between the cumulative effects for alternatives 3,4, and 5 and those described for alternative 2 is imperceptible, since the acreage treated is nearly the same.

SPECIAL USES

Affected Environment

Within the proposed project area, there is one recreation residence special use permit. It is located in the southwest quarter of section 26, T49N, R84W, on a road that is not scheduled for road maintenance or rehabilitation. The gravel pit located in section 26, T49N, R84W is expected to be expanded. Although the gravel pit is not expected to be affected by the Caribou alternatives, the expansion proposals could have environmental effects that need to be considered under the Caribou cumulative effects analysis. The pit expansion proposals are shown in Table 12, and are considered under this analysis as reasonably foreseeable actions.

Environmental Consequences

There are no effects, direct, indirect or cumulative, to special uses from any of the proposed alternatives.

ECONOMICS

Affected Environment

There are two realms of economic consequences which need disclosure -- efficiency and impacts. **Efficiency** considers the benefits and costs over time and expresses the net benefits of the sale. Two efficiency analyses are provided: financial and economic. *Financial efficiency* considers the revenues and costs of each alternative from the standpoint of the agency. *Economic efficiency* considers the benefits (market and non-market) and costs of each alternative from the standpoint of society as a whole. Both these analyses are expressed in terms of Present Net Value.

Consistent with economic analysis standards, both analyses start from the decision point of the project; that is, all prior costs, benefits, revenues, and consequences (including this NEPA analysis) are "sunk" and not

considered. Inflation is not considered in either analysis. Only real (constant) 1996 prices and a 4% discount rate are used in the efficiency analyses. Where there are no changes in activities or costs between all alternatives, the associated costs or benefits are excluded from the efficiency analyses. The relative ranking of alternatives is not affected by excluding these costs or benefits.

Economic Impacts considers the local employment and income consequences of each alternative. These are expressed in jobs and employee compensation. Local is defined here as either 1) the larger Bighorn area of Big Horn, Johnson, Sheridan, and Washakie Counties or 2) the northern Shoshone area of Park and Hot Springs Counties. A description of this area can be found in *Economic Diversity & Dependency Assessment*, volumes 1 & 2, Rocky Mountain Region, 1992. A description of timber demand and supply can be found in *Timber Demand and Supply on the Bighorn National Forest*, 1991. A recent social analysis of Johnson and Campbell Counties prepared for the Clear/Crazy landscape assessment provides additional economic and demographic information. (All of these documents are in the project file and available for public review at the Forest Supervisors Office in Sheridan.)

Environmental Consequences

Direct and Indirect Effects

Efficiency Analyses

Both the financial and economic efficiency analysis results are shown in Table 9. The table includes the present net value (PNV) of the existing and future stands, and the volume of timber harvest projected under each alternative. The "existing" stand is the costs and revenues associated with the currently existing trees, while the "future" stand can be thought of as the costs and revenues associated with the trees that will be regenerated following the seed cut. The values, methodologies, and assumptions used for the PNV calculations are shown in Appendix E1.

Table 9. Financial and Economic Efficiency of the Caribou Timber Sale

	Alt. 1	Alt. 2	Alt. 3,4	Alt. 5
PNV, Existing Stand	Not applicable	\$591,586	\$676,307	\$673,284
PNV, Future Stand	Not applicable	-\$61,529	-\$68,803	-\$68,803
MMBF Harvest Estimate	0	3.9	4.6	4.6

For this sale, the financial and economic efficiency analyses are equivalent. Changes in range (AUMs) or recreation (RVDs) use between Alternative 1 and the action alternatives are estimated to be negligible. Some temporary, or even permanent, redistribution of dispersed recreation use on the Forest may occur, but no change in measurable recreation use is anticipated.

The Wildlife Task Force has documented that past management actions resulted in reduced hunter days. Lost benefit values associated with those actions are "sunk" costs that are not properly considered in efficiency analyses for this project. The consequences of this project, regardless of the alternative, are that elk populations will continue to exceed WG&FD objectives. Elk security areas will remain effective and intact. There is no winter range in the project area, which is generally considered a major limiting factor in setting the population objectives. Consequently, there is no National Forest (NF) habitat basis for projecting elk hunting use to change.

The overall amounts of dispersed camping and off-road vehicle use is not expected to change on the Bighorn NF under any of the action alternatives. Any use decreases, temporary or permanent, should result in use increases in nearby areas on the Forest. No net loss of dispersed camping and off-road vehicle recreation use on the Forest is expected.

Sawtimber in these analyses has been valued as \$235/thousand board feet (MBF), the average of the recently sold Twin Nickle and Schuler timber sales. This value exceeds the historical 3-year average of timber revenues on the Bighorn NF, but more closely fits the sawtimber of the Caribou sale. A sensitivity analysis was completed and a "break even" value of \$133/MBF for the existing stand was determined. Thus, timber revenues from this sale could drop by 40% and the sale would continue to be "above cost."

The PNV results shown in Table 9 need to be carefully interpreted. There are many non-market benefits and costs that were not included in this analysis, and the effects of discounting economic "values" over the long time horizons that it takes to grow a forest stand are somewhat tenuous. Nonetheless, some interpretations can be made:

- The present sale offering will be above cost. The roads are in place, volumes per acre are reasonable, and the topography is quite loggable. This analysis indicates there will be sufficient revenues to support the costs of rehabilitating and obliterating the roads under the action alternatives. There will also be receipts available for other post sale projects, such as regeneration surveys and prescribed burning.
- The PNV of silvicultural treatments on the future, to be established stand, is negative. This is entirely due to the costs of the precommercial thinning scheduled at stand age 30, while there are no revenues projected until stand age 124. It is intuitive that rotations over 100 years with costs in the early stages of the rotation will have negative PNVs.

Economic Impacts

Because range and recreation use is not expected to change, only timber harvest and processing is considered in estimated economic impacts. Sawmill studies recently conducted by the University of Wyoming (unpublished) were used to determine direct employment per million board feet (MMBF) of timber processed. Studies by the Wyoming Employment Resources Division (*Wyoming Labor Force Trends*, September 1995) were used to determine direct employee compensation per MMBF of timber processed. IMPLAN, an input-output modeling database and program, was used to determine the multipliers of the direct effects in the local areas. Multiplier differences between the areas were averaged. For every MMBF processed, 10 jobs and \$175,400 of income are supported in the area. If the timber is harvested by local crews and then sent out of the area for processing, 3 jobs and \$61,200 of income per MMBF are supported. These factors include all jobs and income, including part-time, from a variety of industries.

This project represents about the same volume of timber harvest as that sold and awarded by the Bighorn NF in fiscal years 1996 and 1997 combined. This project can be viewed as essentially one annual timber program on the Forest. Timber supply from all ownerships in the northern Wyoming/southern Montana area has been declining for several years, and is well below area mill capacity. Although the particular business situation of each potential timber purchaser is unknown, it is reasonable to assume from the area timber demand and supply that timber industry jobs in northern Wyoming are fully dependent on this sale. That is, that timber industry jobs will likely be lost if this sale is not sold. Table 10 shows the total jobs (timber industry and all affected industries) estimated to be sustained or lost.

Table 10. Estimated Total (direct + indirect) Jobs and Income Affected by the Caribou Timber Sale

	Alt 1	Alt 2	Alt 3,4,5
Jobs Sustained (full & part-time)	0	39	46
Jobs Lost(full & part-time)	46	7	0
Income Sustained (\$1,000)	\$ 0	\$684	\$808
Income Lost (\$1,000)	\$808	\$124	\$ 0

Recent history suggests that purchasers supply their own woods workers rather than contracting locally, so that all jobs will be tied to the purchaser's community. For instance, if Wyoming Sawmills, Inc. purchases the timber, the jobs would be sustained in Sheridan and Johnson counties, and jobs in Park county would be lost. If Cody Lumber purchases the timber, the jobs would be sustained in Park County, and jobs in Sheridan and Johnson Counties would be lost.

Cumulative Effects

The economic cumulative effects analysis area is the Bighorn Economic Impact Area (EIA) of Bighorn, Johnson, Sheridan, and Washakie counties and the North Shoshone EIA of Park and Hot Springs counties.

During the latter half of the 1980's the Bighorn Forest Plan ASQ amount of about 15 MMBF per year was met or exceeded. This output dropped to between 2 and 7 MMBF of sawtimber since 1991. The Shoshone NF's program also dropped after the Yellowstone fires of 1988. Mills in this area have expanded their supply area, most notably to southeast Montana, and lands of other ownership. Despite the increased supply area, they are currently below capacity. This trend mirrors the nationwide trend of NF timber sales dropping from over 12 billion board feet in 1987 to about 4 billion board feet in 1995.

The decreasing timber supply from National Forests in northern Wyoming and western Montana have created increases in timber harvests in eastern Montana. According to Charles Keegan of the Bureau of Business and Economic Research at the University of Montana, timber harvest went from 30 MMBF in 1985 to 220 MMBF in 1995 in eastern Montana. The mills in Sheridan and Cody have contributed to this increase. Because many ownerships with a wide variety of management objectives are involved in this increase, there is no way to predict the future level of production. Lands of other ownerships in Wyoming, including the state of Wyoming, Bureau of Land Management, and private, contain relatively small amounts of forested lands, so their contributions to the regional timber supply are minimal.

There are several reasonably foreseeable actions (RFAs) that could affect timber supply in this area. The following table summarizes timber sale projects on the Bighorn NF that have signed position statements, and are not in roadless areas, based on the assumption that roadless areas will not be considered for timber harvest for at least the next 18 months.

Table 11. Projects on Bighorn NF with Signed Position Statements

Project Name	Ranger District	Volume, MMBF	Planned Fiscal Year Offer
Blowdown Salvage	Various	0.9	1998
Cold Springs	Paintrock	1.5	1999
Woodrock I	Tongue	3.0	1999
Sourdough	Buffalo	1.0	2000
Woodrock II	Tongue	2.5	2000
Swamp	Tongue	1.0	2001

The current program, based on a Regional Forester letter, is that the Bighorn will offer about 4 to 5 MMBF between now and the time the Forest Plan is revised. The Shoshone NF has an ASQ of 4.5 MMBF annually, and is planning on offering between 2-3 MMBF of sawtimber in FY '98 and '99. The Tie Hack CG project involves some clearing, which is expected to provide less than 50 MBF of sawtimber. A few acres of clearing is anticipated with the gravel pit expansion, and is expected to yield about 20 MBF. The other RFAs are not expected to provide timber output.

Cumulative economic effects of this project upon the recreation and range resources were considered. Concerning past economic effects upon hunting use, the Wildlife Task Force report documents that past timber harvest and road building have resulted in reduced hunter days. Some of the RFAs are expected to increase economic benefits derived from recreational activities. Specifically, the Tie Hack reservoir is expected to provide an increase in RVDs with the addition of lake-based recreation opportunities. The Tie Hack CG is estimated to have 20 sites, as opposed to 9 site campground that was inundated. The Caribou action alternatives create no direct or indirect economic effects upon the recreation or range resources. Therefore, the incremental effect of this sale is zero, and there are no effects from Caribou to add to the collective effects of the other past, concurrent, or reasonably foreseeable actions. There are no cumulative effects upon the recreation or range resources.

A summary of the economic cumulative effects is shown at page 3-47.

HERITAGE RESOURCES

Affected Environment

During the 1996 and 1997 field seasons, Forest Service personnel conducted a Class III heritage resources survey of the area of potential effects. During this survey, three sites were located in Unit B of the Caribou Timber Sale areas. Site 48JO1572 is a prehistoric low-density artifact scatter. Site 48JO1573 is an historic cabin foundation and site 48JO1574 consists of two recent mineral prospect pits. None of the sites have been determined to be eligible for the National Register of Historic Places by the State Historic Preservation Officer (SHPO). The complete Heritage Resource Management Report, which lists the survey methods used for this project and a summary of the literature and past survey search, among other topics, is on file.

An examination of heritage resource information for the project analysis indicates that no previous surveys had been conducted within the project boundaries. No previously recorded sites were located within the project area.

Environmental Consequences

Direct and Indirect Effects

There are no direct or indirect effects from any of the proposed alternatives. In a letter dated July 14, 1997, the SHPO concurred with the no effect determination.

Cumulative Effects

A summary of the cumulative effects upon the Heritage resource is shown at page 3-48.

Since the adoption of any of the alternatives for this project will have no direct or indirect effects upon Heritage resources, the incremental effect of the any of the alternatives is zero. Therefore, there are no effects from Caribou to add to the collective effects of the other past, concurrent, or reasonably foreseeable actions, so there are no cumulative effects to Heritage resources from this action.

CUMULATIVE EFFECTS

This section supplements the cumulative effects discussions that are interspersed throughout the environmental consequences of each resource area. This section collects all the cumulative effects analysis into one portion of the document, in an attempt to better display the cumulative effects analysis to the reader.

Cumulative impact is defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions." (40 CFR 1508.7)

The amount of information available to consider and analyze the effects of past management actions is extensive. They are largely documented in the Clear Creek/Crazy Woman Creek Landscape Assessment. EA appendix H contains about 58 pages out of the 200+ page landscape analysis, and contains discussion on the past effects upon the water, soil and wildlife resources, and describes the past disturbance and timber harvest history. The majority of the recreation, range, visual quality, wilderness and heritage resource sections are described in the Landscape Assessment itself. "Watershed Analysis of Forest Fragmentation by Clearcuts and Roads in a Wyoming National Forest", Tinker, et al. is included in the project record. This analysis quantifies the amount of timber harvest and road building that has occurred on the Bighorn, although there are no direct effects conclusions made. Except for the 58 pages of the landscape assessment in EA appendix H, this material is in the project record located at the Forest Supervisor's office in Sheridan.

Table 12 lists the reasonably foreseeable future actions that, combined with past, present and proposed Caribou timber sale actions, may result in cumulative impacts upon the environment.

Table 12. Reasonably Foreseeable Actions for Caribou Cumulative Effects Analysis

Project Name	Location/Watershed	Description
Sourdough Timber Sale	Centered on Sections 8 and 9 T49N R84W. Sourdough Creek (Clear Creek) watershed. Diversity unit 101	Gate 1 position statement signed in 1997, estimated up to 2000 acres of forest could be available for timber harvest. Current field reconnaissance has reduced that to a maximum of about 1400 acres. Predominantly 7E, Wood Fiber Production, Forest Plan emphasis. Extensive past harvesting and road system. Municipal watershed. Estimated 1 MMBF. No roadless areas included in potential harvest area. NEPA scoping is scheduled for approximately April 1, 1998.
Other timber sales	Various areas on north and west portions of Forest, not in Clear/Crazy LA area.	Timber sales that have position statements completed, and/or are in some stage of the NEPA process, are listed in the economics section in EA Chapter 3. None of the sales listed are within the Clear/Crazy analysis area, so they do not affect any resource other than economics.
Existing Permit to Expand the Pole Creek Gravel Pit	NE 1/4 SE 1/4 Section 26 T49N R84W. Pole Creek watershed.	Decision Notice on this project signed 2/85, work expected to be done summer 1998. Slightly over 4 acres of timber to be cleared. Special use permit issued to Wyoming Department of Transportation to mine, crush, and stockpile gravel. Mitigation includes: pit restoration and reseeding; sanitation for workers; water trucks for dust control. Decision Notice/Finding of No Significant Impact states that no wetlands will be affected. Environmental Consequences section says that any of the action alternatives will have either a minimal effect or no effect on the resources.
Future Pole Creek Gravel Pit Expansion	NE 1/4 SE 1/4 Section 26 T49N R84W. Pole Creek watershed.	Wyoming Highway Department has proposed expanding the existing Pole Creek gravel pit permitted area by up to 12 acres. It is expected that the NEPA analysis will be conducted this year, pending completion of a Memorandum of Understanding between the USFS and the Wyoming Highway Department. The proposed project area is in a dry upland site, so it is anticipated that potential watershed impacts will be non-existent to negligible with the proper installation and maintenance of all applicable BMPs. Visual impacts are expected, although the magnitude depends on the particulars of the proposal and its implementation.
Cloud Peak Wilderness Management Prescription Area Standard and Guideline Revision	Wilderness area. North Fork Crazy Woman and Clear Creeks.	The proposed action is to combine the 4 existing Forest Plan management prescription areas into 2, and delete, add, or revise nine standards or guidelines. The draft EA comment period closed March 25, 1998.
Allotment Management Plan EA	Clear/Crazy LA area. North Fork Crazy Woman, Clear Creek, and North Fork Powder River watersheds.	On the NEPA timeline, this project has been scoped, and is currently in the draft EA preparation stage. The proposed action in the scoping statement is to: a) develop allotment specific objectives which will direct management toward goals described in the Forest Plan; and, b) authorize management of livestock and construction of range improvements which will result in meeting objectives. The Forest Plan has provided direction that the area to be analyzed is suitable for livestock grazing and provided standards and guides to follow if livestock are grazed. Using this NEPA analysis, the District Ranger will decide whether or not to continue to graze livestock on the allotments analyzed and how grazing will be managed if it is continued.
Tie Hack Replacement CG EA	Section 27 T50N R84W. Clear Creek.	The proposed action is to build a 20 unit campground to replace the previously existing Tie Hack CG. Associated improvements, including access road, camping spurs, pit toilet(s), water well(s) are included. About 15 acres of suited timber will be withdrawn from the suited timber base. The total CG area is about 40 acres. The draft EA comment period is past, and the next step is the issuance of the decision notice and final EA.

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Table 12. Reasonably Foreseeable Actions for Caribou Cumulative Effects Analysis (continued)

Project Name	Location/Watershed	Description
US 16 Reconstruction	West of Buffalo to Schoolhouse Park Road. Clear Creek watershed	The Wyoming Transportation Department is in the preliminary stages of planning a realignment of US 16. This project is expected to result in road widening, resurfacing, and could involve short stretches of relocation. There is no NEPA proposed action, as of this date. The remainder of US 16 in the Clear/Crazy LA area already meets standards, so no further reconstruction in the next decade is anticipated.
Crazy Woman Canyon Road	Sections 27 and 28, T49N, R83W. North Fork Crazy Woman Creek	In early 1997, a storm event(s) caused the closing of the Crazy Woman Canyon road, with associated damage to the water resource. As of the date of the Caribou decision, it is expected that funding may be available for bank stabilization work. Appropriate NEPA analysis and documentation will be conducted. The effects of this activity cannot be determined at this time since there is no proposed action.
Noxious Weed Management Plan	Forest Wide.	The Bighorn National Forest is in the draft EA preparation stage of a NEPA analysis to evaluate the environmental effects of implementing a management plan for control of noxious weeds. Currently there are several weed management techniques being used, but there is no overall, coordinated management plan. The proposed action is to implement a management plan to control noxious weeds on the Forest. The to be developed plan, if adopted, would specify methods, use restrictions, etc.

Table 13. Concurrent Management Actions Considered in Caribou Cumulative Effects Analysis

Project Name	Location/Watershed	Description
Thinning of 1960's Clearcuts	East Long Park (Caribou Mesa Road); Hesse Creek; Pole Creek. All are within North Fork Crazy Woman Creek.	The areas clearcut in the 1960's have regenerated prolifically, with stocking rates of up to several thousand stems per acre. Average tree heights range from 6 to 20 feet tall. The current density is likely to result in doghair conditions without thinning, and the length of time they will produce wildlife hiding cover will be increased by thinning (Smith and Long, 1987). The June 1995 decision memo included the decision to thin approximately 2500 acres along the Caribou Mesa road, and in Pole Creek and Hesse Creek drainages. Slash is being lopped and scattered, and small visual leave groups are being left along open roads. Observations of the thinning done to date show that if the thinned areas met the hiding cover definition prior to thinning, they still do; if it was not hiding cover, it still is not. There may be a very small percentage of the total area that had just reached the minimum requirements for hiding cover that were temporarily set back to a non-hiding cover condition. However, because of the large contiguous area necessary to effectively hide 90% of an elk at 200', these marginal areas that were set back comprise a very small percentage of the area. In addition, observation indicates that the trees in these stands are growing in height at about 4 to 10 inches per year, so this 'set back' effect will be of short duration, of less than 5 years.

Table 13. Concurrent Management Actions Considered in Caribou Cumulative Effects Analysis (continued)

Project Name	Location/Watershed	Description
Road Maintenance	Roads throughout Clear Creek and Crazy Woman Creek watersheds.	Road maintenance activities occur annually throughout the area. This work typically includes surface blading and maintenance of drainage structures such as culverts and waterbars. It also includes repair work from storm events. These roads were built for timber harvest and recreation access in the 1960's and 1970's. As identified elsewhere in the project record, these roads are considered to be a leading cause of sedimentation. This sale area was selected, and extensive road rehabilitation actions specified in alternatives 2-5, in order to remedy, at least in part, the sediment contributions of roads. The effects of the concurrent road maintenance are creation of a minor amount of dust during blading, and creation of small amounts of sediment, particularly when conducting the drainage maintenance work.
Tie Hack Dam Construction	Section 26, T50N, R83W. Clear Creek.	Construction was substantially completed in 1997, and the spring runoff in 1998 is anticipated to fill the reservoir. There will be a small amount of sediment, which will primarily be trapped by the dam, resulting from areas cleared for construction. As these areas revegetate and stabilize over the next few years, the amount of sediment will decrease. The 60 acre lake will add flat-water recreation opportunities to the area.

Table 14 is a summary of the cumulative effects analysis for the Caribou timber sale project, except for the effects upon the water and soil resource, which are shown in Table 15 because of space limitations. The first column, entitled "Resource" is an organizational process to define the resource that could be impacted by the cumulative effects created by the timber sale. For example, the first resource affected is range and livestock management. That row is meant to summarize the cumulative effects **upon** the range resource. The cumulative effects **created by the range resource** will be shown in other sections. For example, livestock grazing impacts water quality. The cumulative effects of livestock grazing upon the water resource is shown under the watershed heading. These resource headings match the organizational structure of Chapter 3 of the EA.

The column titled CE area refers to the area where cumulative effects for that resource topic were considered. Like the direct and indirect effects analysis, the cumulative effects analysis area is different for each resource. For example, the watershed CE analysis covers a defined area in the North Fork of Crazy Woman watershed. It does not include actions in Clear Creek, since those watercourses do not meet until they are well off the National Forest, and therefore, effects from actions upon the watershed resource do not become additive until they are so diluted that the effects of this sale would clearly not be discernable.

Table 14. Summary of Cumulative Effects Analysis for the Caribou Timber Sale, Except Water and Soils

Re-source	CE Area	Past Actions	Caribou Effects Summary	Future Actions	Cumulative Effects
Range	Muddy Allotment	Timber harvest over the past 30 years created significant amounts of transitory range. This is a temporary increase whose benefits last about 20 years, so the amount of transitory range on the allotment has been steadily declining because of the decline of timber sale activity.	EA pages 3-1 and 3-2. No action alternative continues declining transitory range trend. Alt. 2 is expected to create 200-300 acres, while alts. 3,4,5 are expected to create 240-340 acres of transitory range. Transitory range is not used in determination of livestock capacity. Movement barrier disruption plus thistle increase addressed by fence and spraying mitigation measures.	Range AMP EA in progress; future range decisions to be made there. The noxious weed EA process could provide more specific direction on as to the methods and techniques that will be used to control thistle in the Caribou area. None of the other foreseeable actions affect transitory range or stocking levels.	The cumulative effects of the action alternatives upon AUMs and movement barriers, is none, EA page 3-2. The current trend of declining amounts of transitory range is expected to continue, but this is considered to be a small effect as it does not directly affect stocking rates. Since only 2 acres of thistle is expected to be created by Caribou, and spraying is considered effective, the thistle cumulative effects are small.
Wildlife - Snags and Large Woody Debris	DU 110-114	Past timber harvests have cut snags throughout previously harvested areas. Firewood cutters have cut snags near roads. S&G mostly met, except for some past clearcuts and along some major roads.	Snag island designation will meet FP S&Gs for snags and large woody debris.	None of the reasonably foreseeable actions (RFA) that are within the CE Impact Area for this resource have effects upon snags or large woody debris. Current impacts of firewood cutters along open roads expected to continue.	Overall decrease of these resources under action Alts. vs. Alt. 1; however, maintains FP S&G. Since the action alternatives only affect 1500 acres out of nearly 23,000 forested acres in these DUs, and the FP S&G is maintained, the cumulative effects upon snags and large woody debris are considered to be small.
Wildlife - Goshawk	DU 110-114	Past timber harvests in DUs 113 and 114 have resulted in the best mix of the variety of structural stages the Goshawk needs in the Clear/Crazy LA area for nesting, hunting, and prey populations, EA appendix H page 42.	No nests currently known to exist within units. Monitoring and unit modification/deletion mitigation measures protect nests.	With the exception of a few acres of timber clearing for the Gravel Pit expansion, there is no timber harvest currently planned in these DUs. Overstory removal may or may not happen, see EA appendix C-5 page 1. HABCAP analysis was conducted as part of the BE, and it showed no effect to goshawk habitat as a result of the potential, future, overstory removal. The thinning of 60's clearcuts does not affect structural stage.	Since there are no known existing nests within the cutting units, mitigation measures will protect future potential nests, and there are no RFAs that affect Goshawks, there are no cumulative effects.

Table 14. Summary of Cumulative Effects Analysis for the Caribou Timber Sale, Except Water and Soils (continued)

Re-source	CE Area	Past Actions	Caribou Effects Summary	Future Actions	Cumulative Effects
Wildlife - Elk	Clear/Crazy LA	Impacts of past timber harvest and road building, and effects upon elk hunter days are shown on EA appendix H page 23-32. The Wildlife Task Force report is summarized in those pages. Tinker, et al. (1997) quantify the "fragmentation" effects of past harvest and road building. A review of past EAs (included in the project record) indicate that many of the roads were built or improved to provide for recreational access. The amount of timber harvest and road building has declined in the analysis area when comparing the levels in the 1960's and 1970's to the 1990's. Elk population remains above herd objective levels, EA appendix H page 27. Past timber harvest has contributed to three of the five diversity units within sale area to be below FP S&G for hiding cover. The Lost Fire occurred in 1988 and the 10,000+ acres burned are not hiding cover now, but are rapidly regenerating.	Hiding Cover: Action alts. will move cutting units toward FP S&G sooner than under Alt. 1. None of the proposed units currently provide hiding cover. Elk Habitat Effectiveness: Will be improved under action alts. more than under Alt. 1 due to improved road closure effectiveness measures, additional hiding cover. Will be improved the most under alt. 4, with the area closure to off-road summer vehicles. Elk security: Due to Pole Creek and Sheep Mtn. roads and US highway 16, none of the harvest is within existing elk security areas, so none of the alternatives affect existing elk security. Only about 20 acres of proposed cutting units are within an area that could become elk security with regeneration, so the action alternatives will hasten the creation of this security area. Elk was used as the Management Indicator Species for this project, see wildlife biologist's specialist report.	Sourdough timber sale is planned: depending on particular location of units, type of harvest, and road management decisions, could affect elk habitat and elk hunting opportunities. Tie Hack CG alters about 40 acres of low quality elk habitat (due to its proximity to US 16). The draft Tie Hack EA says that since the total area affected is relatively small and does not include any unique of important habitats, the impacts to Management Indicator Species (MIS) should be minimal and will not affect MIS habitats in relation to Forest Plan objectives. Range AMP EA decision could affect elk by fence location decisions, although concerning those effects upon movement, they should be mitigated to an effect level of none or negligible. Thinning of 60's clearcuts will retain hiding cover longer, Project Record Volume 3 pages 114 and 123, so the effects of that concurrent project are positive upon the elk parameters of hiding cover and elk habitat effectiveness. Effects of the Crazy Woman Canyon restabilization project will be analyzed during that NEPA analysis. The other RFAs do not affect elk.	Described in detail in EA page 3-4 and 3-5. While there were large impacts upon elk from the past road building and timber harvest, this trend has declined. The incremental impact of this action, most notably timber harvest resulting in hiding cover sooner than under no action alt., plus road closure effectiveness measures, plus alt. 4 area closure to summer off-road vehicle traffic, improve quantifiable elk habitat parameters analyzed in this EA. The RFAs effects are either none or small. For these reasons, the cumulative effects of this action are small.

Table 14. Summary of Cumulative Effects Analysis for the Caribou Timber Sale, Except Water and Soils (continued)

Re-source	CE Area	Past Actions	Caribou Effects Summary	Future Actions	Cumulative Effects
Wildlife - Species Analyzed in the BE	DU 110 - 114	<p>Past timber harvests are summarized in EA appendix H page 18 and in the summary of past NEPA decisions in the project record. Road building was generally associated with many of those sales, especially in the 1960's and 1970's. Tinker, et al. (1997) quantified "fragmentation" of the landscape matrix due to roads and timber harvest. The effects these activities have had on forest management indicator species is shown in the EA appendix H page 39-43 and in the Biological Evaluation (BE).</p>	<p>The biological evaluation for animals, EA appendix F-2, briefly describes habitat considerations and displays the effects of the proposed action upon threatened, endangered, candidate, and sensitive species. The determination made for the majority of species considered in the BE is that the project is expected to have no effect. This determination was made because these species either do not use the area impacted; or, if they do use the area, the project would either not affect them or the mitigation measures would provide sufficient protection. Three species would be affected by the harvest alternatives, namely the Northern three-toed woodpecker, the Olive-sided flycatcher, and the Pygmy nuthatch. The determination made for these species were that the timber harvest may adversely affect individuals, but it is not likely to result in a loss of viability within the planning area, nor cause a trend to federal listing or a loss of species viability rangewide.</p>	<p>Future, currently unplanned, timber harvest could affect species, but NEPA analysis and the BE process should allow decision makers to provide adequate protection for other species. Livestock grazing may continue, and the AMP EA will require preparation of a biological evaluation. The completed Pit expansion NEPA document concluded that other resource effects are minimal or non-existent, and it is expected that the effects of the proposed pit expansion will be the same. The other RFAs are outside the CE impact analysis area.</p>	<p>Since there are no direct or indirect effects upon the majority of species considered in the BE as a result of this timber harvest action, the incremental effects of any of the alternatives is zero. Therefore, there are no effects from Caribou to add to the collective effects of the other past, concurrent, or RFAs, so there are no cumulative effects to the majority of these species from this proposal. The cumulative effects the three species negatively impacted by this project are considered to be small, because the determination is that while individuals may be affected, the effects are not likely to result in a loss of viability within the planning area or rangewide, nor are the effects expected to cause a trend to federal listing. The RFAs are not specific enough to make cumulative effects determinations at this time, but they will have BEs prepared prior to issuance of a decision.</p>

Table 14. Summary of Cumulative Effects Analysis for the Caribou Timber Sale, Except Water and Soils (continued)

Re-source	CE Area	Past Actions	Caribou Effects Summary	Future Actions	Cumulative Effects
Old Growth	Clear/Crazy LA area	Past fire history, as defined by soils and climatic conditions, defined the vegetation types and structural stages that existed historically on this landscape. Human actions, namely fire suppression and timber harvest, have altered the natural pattern of old growth. The FP S&G of 5% of forested area within a diversity unit being old growth is met on 8 out of 32 DUs in the LA area. Approximately 5% of the forested area in the landscape assessment area is inventoried old growth. DUs 110-114 meet the FP S&G for old growth.	None of the proposed timber harvest units are in inventoried old growth stands. A candidate stand analysis, plus future structural stage projections, were used to model the amount of future potential old growth, and those analyses showed sufficient amounts to provide at least the FP minimums into the future. The Caribou action alternatives create no direct or indirect effects upon the old growth resource.	The old growth candidate analysis and structural stage projection analysis indicates there are sufficient areas "coming on line" for future old growth needs within DUs 110-114. The Sourdough timber sale diversity unit has 1184 acres of inventoried old growth in excess of the FP minimum amount of 385, and the currently proposed harvest areas may affect about 60 acres of old growth. The Tie Hack CG area is in a mature LP stand that is not old growth. The clearing for the gravel pit expansion is in immature to mature, but not late successional, lodgepole. The other RFAs do not affect old growth.	Since there are no direct or indirect effects upon old growth, the incremental effect of this action is zero, and there are no effects from Caribou to add to the collective effects of the other past, concurrent, or reasonably foreseeable actions. Therefore, there are no cumulative effects of this action upon the old growth resource.

Table 14. Summary of Cumulative Effects Analysis for the Caribou Timber Sale, Except Water and Soils (continued)

Re-source	CE Area	Past Actions	Caribou Effects Summary	Future Actions	Cumulative Effects
Wilderness	DU 110 - 114 area contiguous to Cloud Peak Wilderness	Class II airshed. No trailheads or motorized access points to Wilderness from analysis area. Past activities, including road maintenance and prescribed fire, have created dust and smoke.	Alternatives include prescribed burning and potential dust creation. Because of general wind direction and distance of units from Wilderness, effects are considered to be small and of short duration. Closure of area to off road summer vehicle travel will have no effect since there is no known motorized trespass.	The gravel pit actions could create dust, but the already completed decision notice includes the mitigation measure of water trucks for dust control. Wilderness S&G Forest Plan amendment is currently under way, but this will not create dust or smoke. The Caribou timber sale is not additive, positively or negatively, to this analysis. Other activities such as road maintenance and prescribed fire are expected to continue within the analysis area at existing levels, which is a small impact upon the Wilderness resource due to the short duration of these activities. US 16 reconstruction could create some dust, but it could also include mitigation measures to reduce the amounts created to minor levels. The other RFAs do not create air particulates, nor do they affect motorized access in this portion of the Wilderness.	The addition of particulates created by these acts are minor and of short duration, as are the past and future action levels. Therefore, the cumulative effects on the airshed of the Wilderness is small. These acts result in no cumulative effects by motorized access to the Wilderness.

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Table 14. Summary of Cumulative Effects Analysis for the Caribou Timber Sale, Except Water and Soils (continued)

Re-source	CE Area	Past Actions	Caribou Effects Summary	Future Actions	Cumulative Effects
Fire/ Fuels	Clear/Crazy LA area	<p>This area, characterized by lodgepole pine and subalpine spruce-fir forests, was subjected historically to periodic, large-scale, catastrophic fire. One result was a high percentage of serotinous LP. Lost Fire is example of typical historic fire event that most influenced this landscape. Fire suppression has changed that fire regime, so that less serotinous coned LP have regenerated than would have naturally. There are areas of high fuel loadings due to past thinning practices.</p>	<p>Alt. 1 has the least probability of fire occurrence in the short term, because of no logging and no prescribed fire. However, as fuels accumulate, alt. 1 has a higher probability of long term catastrophic fire occurrence. Action alts. include 350 acres of prescribed fire, and silvicultural guides have marking directions, to improve the chance of serotinous regeneration.</p>	<p>Tie Hack CG clearing debris will be disposed of, so while there will be no long term fuel buildup, there will be a very small short term increase in the fire risk due to the clearing and slash disposal activities. There are some locations of heavy thinning slash buildup in the Sourdough timber sale area, and that decision may result in treatments to lower the fuel loading. Depending on the silvicultural alternatives, there may be actions to promote serotinous LP regeneration. That timber harvest would have the same risks as Caribou concerning the potential for escaped fire if the decision included landing pile burning and prescribed fire. The slash for the current thinning of the 1960's clearcuts is being lopped and scattered, and given the small fuel sizes, is expected to deteriorate rapidly. There will be a short term increased ignition risk, until the red needles deteriorate. The other RFAs are not expected to have effects upon the fire risk or fuel loadings.</p>	<p>The incremental effect of any of the action alternatives in Caribou, added to the past and RFAs, are small for the following reasons: a) for cone serotiny, less than 1500 acres out of 100,000 acres of forest land within the CE area is being affected; b) although fire escaping from planned management activities is always a risk, proper planning and safety precautions can minimize that to acceptable levels, and those precautions will be included in burn plans; c) existing fuels created by past activities will likely be addressed in the Sourdough analysis; and, d) the increased risk created by the 1960's thinning is of short duration.</p>

Table 14. Summary of Cumulative Effects Analysis for the Caribou Timber Sale, Except Water and Soils (continued)

Re-source	CE Area	Past Actions	Caribou Effects Summary	Future Actions	Cumulative Effects
Recreation - General	Clear/Crazy LA area	<p>(The individual recreation effects parameters below describe cumulative effects upon individual recreation user groups. This section describes the additive effects caused by these individual displacements upon the entire range of recreation user types.) Recreation use of all kinds has increased over the past few decades, due largely to national demographic trends and improved transportation methods, including ATVs. A list of recreation activities that includes recreation visitor day estimates is at EA appendix H page 57. Those percentages are based upon a total annual RVD number of 261,900. A review of the past NEPA analyses conducted in the LA area shows that many of the past decisions to build roads were based upon both timber and roaded recreation needs. The Link timber sale decision implemented the "link" to complete the loop Pole Creek road for recreation purposes, in addition to the timber reasons.</p>	<p>Under the harvest alternatives, many recreation users would be displaced during the harvest operations. Under alternative 4, summer off road motorized users would be permanently displaced.</p>	<p>Recreation demand is expected to continue to increase across the Clear/Crazy LA area. Crowding and displacement decrease the quality of recreation experiences for some recreationists, and increase the level of conflict. Conflicts occur between recreation users with different pursuits, and between recreation users and other resource users. Conflicts often result in increasing recreation management costs. Some of the RFAs are expected to decrease the amount of conflict: a) Range AMP EA is expected to address some existing conflicts between dispersed recreation and grazing use; b) Developed camp sites proposed in Tie Hack CG EA would provide an alternative to dispersed camping; c) Tie Hack Reservoir will add flat-water recreation opportunities to the area; and, d) if the Crazy Woman Canyon road project includes reopening, it could bring some dispersed recreation area back into use. Some of the RFAs are expected to increase the amount of conflict: a) Sourdough TS could have similar effects to those projected under Caribou; and, b) The Tie Hack CG draft EA is expected to include a proposal to prohibit dispersed camping along the Tie Hack Reservoir road.</p>	<p>The majority of the recreation demand/use increases, and therefore, the majority of the crowding, displacement and conflicts, are expected to increase regardless of management actions. An increase to the cumulative level of displacement and conflicts is attributable to the Caribou action alternatives. That increase is considered to be small because: a) Some of the dispersed camping displacement is temporary during the sale itself; b) some of the dispersed camping displacement is offset by moving the gates back; c) the surrounding area contributes a large amount of "absorption" capacity for the displace off road motorized users; and, d) some of the RFAs provide increases in recreation capacity.</p>

Table 14. Summary of Cumulative Effects Analysis for the Caribou Timber Sale, Except Water and Soils (continued)

Re-source	CE Area	Past Actions	Caribou Effects Summary	Future Actions	Cumulative Effects
Recreation - ROS setting	Clear/Crazy LA area	Currently the Pole Creek Road and Sheep Mountain Road areas provide a combination of roaded natural and roaded modified recreation opportunities. Most of the area is classified roaded modified. There are islands of roaded natural setting.	Alternative 1 does not change the current mix of roaded natural and roaded modified recreation opportunities. Alternatives 2-5, with timber harvest, would change small areas of roaded natural opportunity so that the entire area would provide a roaded modified opportunity. The area is expected to be less attractive and support less recreation use after harvest. The duration of this effect is expected to diminish gradually with increased tree growth in older harvest units and increased decomposition of woody debris. In about 25 years, the area is expected to again provide a mixture of roaded natural and roaded modified settings.	Concurrent thinning of 1960's clearcuts is not changing the roaded modified ROS in those areas. The range AMP EA is not expected to change the ROS. Sourdough could have effects similar to those of Caribou on ROS settings, with similar user displacement effects. The Tie Hack CG decision is not expected to change the ROS for that area. The other RFAs do not effect the ROS.	The cumulative effects to the ROS setting are considered to be small since a) most of the harvest units are currently classified as roaded modified; b) tree growth in older harvest units and continued decomposition of woody debris will move parts of the area toward a roaded natural setting over time; and c) the effect is a displacement effect that can be at least partially "absorbed" in other areas of the Forest. This displacement effect is discussed in greater detail above.

Table 14. Summary of Cumulative Effects Analysis for the Caribou Timber Sale, Except Water and Soils (continued)

Re-source	CE Area	Past Actions	Caribou Effects Summary	Future Actions	Cumulative Effects
Recreation - Dispersed Camping	Clear/Crazy LA area	<p>Over the past several decades, the amount of dispersed camping in the area has increased. Forest Service actions that have affected this resource include road and travel management decisions that restricted use, thus defining the areas available for dispersed camping. In addition, decisions to build roads were at least partly based on the need to meet this recreation demand. For example, the rationale for completing the "link" in the Pole Creek Road under the Link analysis was for both timber and recreation access, and the result was an increase in the amount of dispersed camping opportunity.</p>	<p>Alt. 1 would not change the dispersed camping situation. All the action alternatives are expected to displace the dispersed campers from the cutting unit vicinity during logging operations. This effect will last for the two logging seasons that are anticipated for this sale. After harvest, use of 3 campsites under alt. 2, and 5 under alt. 3 and 5, is expected to decrease. Alts. 2,3,4,5 include the closure of about 2.6 miles of roads that would close motorized dispersed access. The area closure to summer off road vehicle travel under alt. 4 would affect 20 out of an estimated 89 existing dispersed sites by eliminating access. These effects will partially be offset by the action of moving road closure gates back on 4 roads under alt. 2, and 7 roads under alt. 3,4,5, and it is anticipated that many of the displaced users will go elsewhere in the analysis area.</p>	<p>The gravel pit RFAs are not expected to affect dispersed camping, since the pit already exists. For the same rationale, the range AMP EA is not expected to affect the overall amount of dispersed camping opportunities since cattle and campers already coexist. The Tie Hack CG EA includes a draft alternative that would close area along the road from US 16 to the reservoir to dispersed camping. Even if this was implemented, the effects are small, since the affected area is small relative to the large adjacent Forest. The Sourdough timber sale could result in the same direct displacement of dispersed campers during the logging operations. There is no proposals at this point under that project to change travel management or close roads. The Wilderness EA is not expected to affect this resource.</p>	<p>The cumulative effects of these actions to the dispersed camping resource is considered to be small because a) the direct displacement of users during logging is of short duration; b) while there are fewer dispersed camping opportunities expected, this is a displacement effect rather than a net loss of opportunity; and c) the surrounding National Forest is large relative to the area affected, and provides considerable "absorption" capacity.</p>

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Table 14. Summary of Cumulative Effects Analysis for the Caribou Timber Sale, Except Water and Soils (continued)

Re-source	CE Area	Past Actions	Caribou Effects Summary	Future Actions	Cumulative Effects
Recreation - Off road travel	Forest wide	In 1989, there were about 200,000 acres open to other than snowmobile off road motorized use. Decisions such as the closure of the Lost Fire area due to vegetation, soil, and water quality impacts caused by off road summer travel, and the Little Goose area closure reduced that opportunity to 140,000 acres as of August 1, 1997.	Alternative 4 would close about 18,000 acres to off road vehicle access to other than snowmobiles on snow. The existing use in this area is considered to be relatively small compared to other areas on the Bighorn NF, although the use is growing. It is small in this area due to the topography to some degree, but more to the heavily forested condition. This action was proposed as a mitigation to the thinning of the forested stands by the timber harvest, which may open up the stands enough to invite and increase the amount of off-road travel. Implementing this decision would result in a total of 122,000 acres, or 62% of the 1989 total, remaining open to summer off road motorized travel. 85,000 of the open acres are in the Clear/Crazy LA area.	At this time, there are no proposals or actions in the RFAs that might affect off road motorized vehicle travel.	With adoption of alt. 4, approximately 62% of the summer off road motorized travel opportunity that existed in 1989 would remain after the decision. The overall level of off road use during this time period has steadily risen, so the major effect has been to concentrate the summer off road vehicle use into smaller areas. This has in turn concentrated the watershed, user conflict, and wildlife impacts. This concentration effect is not considered significant, because it is dispersed over 122,000 acres.
Visual Quality	Area defined in paragraph 2, EA page 3-21.	Scenery in the project area exhibits the visual impacts of previous harvest activities including woody debris from past harvest, clear cut units, landings, canopy thinning and an extensive road system including gates. The project area is bordered by larger, more extensive clearcuts, which have resulted in a very low level of scenic integrity. The project area as a whole currently meets the modification standard for visual quality.	Alt. 1 would trend toward meeting a partial retention Visual Quality Objective (VQO). The timber harvest in alts. 2,3,4 and 5 would create conditions that would continue to exhibit low scenic integrity, with a trend toward very low scenic integrity. Unit D8 would be visually neutral, because the negative visual effect along the snowmobile trail would be offset by the leave strip rehabilitation. Unit D4 would negatively impact scenery along the Pole Creek road. After harvest, the project area is expected to meet the modification standards for visual quality. The varied marking level, the leave patches, and the slash disposal methods in the immediate foreground of the arterial roads and trails mitigate some harvest effects, and the FP minimum standard and guideline of partial retention visual quality along these routes will be met.	The range AMP EA are not anticipated to affect scenic integrity in the area. The gravel pit expansion actions would increase the visual impact of that area. Since the area disturbed is expected to be small, it is probable the effects will be small. The effects of Sourdough timber sale are uncertain since unit location and harvest methods are not known. Effects may be similar to those described for Caribou. The Tie Hack CG EA is outside the cumulative effects analysis area, and the Wilderness EA is not expected to result in decisions that would affect visual quality.	The cumulative effect of this project upon the visual quality of the area is considered to be small because: a) it falls within the established Forest Plan standards and guidelines; b) additional treatments are planned in the immediate foreground zone of major travel routes; and, c) negative impacts in the project area are balanced by continuing visual improvement as trees grow in older harvest units.

Table 14. Summary of Cumulative Effects Analysis for the Caribou Timber Sale, Except Water and Soils (continued)

Re-source	CE Area	Past Actions	Caribou Effects Summary	Future Actions	Cumulative Effects
Forests	DU 110 - 114	<p>This section describes CE upon the forested resource. This area is dominated by 7E management prescription emphasis, as shown on EA page 1-2. Dwarf mistletoe and comandra rust are less common in the vicinity of the cutting units than most areas of the Bighorn NF. Western gall rust is very prevalent. Monitoring of past timber sales shows that they have largely regenerated to satisfactory levels within five years, see EA appendix H page 15. The 5% grass/forb S&G is not met on four of the five DUs; it is met on DU 112 due to the Sheep Mountain fire. A review of the past timber harvest history of the area shows that there has been a long history of logging this area; there was heavy timber harvesting in these DUs in the 1960's and 1970's, but the rate of harvest has slowed over the past decade.</p>	<p>Under the no action alt., natural succession/ disturbances will dictate future stand development. Mortality to increase significantly after about 50 years. 5% FP requirement for OG and grass/forb not affected by this alt. Forest G&Y lower than under action alts. Without harvest, I&D levels likely to increase into the future. No action alt. continues downward trend in timber outputs. Under action alts., new stand will be regenerated, and will reach hiding cover density in about 20 years. Silvicultural finding analyzed soils, included a site review, and reviewed past sale regeneration, among other things, and the conclusion was that 5 year NFMA regen. assurance (see project record). Action alts. silviculturally treat 1350 to about 1500 acres, which achieves 7E FP objectives. I&D expected to be lower than under no action. Monitoring of past prep cuts on these sites indicate generally low risk of windthrow, only a few areas of moderate windthrow. (The low risk areas suffered no windthrow after the prep cut.)</p>	<p>Concerning the grazing AMP EA, grazing can affect forest regeneration, but there is Forest Plan direction that grazing transitory range must protect regeneration. Based on past sale regeneration monitoring, there is no evidence that grazing has affected regeneration in this area. The gravel pit expansions affect only a few acres of forested land, which is a very small amount compared to the approx. 23,000 acres of forest in these DUs. The thinning project is anticipated to reduce current and future I&D levels, and the only affect on structural stages is that stages will be reached sooner than without thinning. The RFAs listed above are the only ones in DUs 110-114 that will have effects upon forested vegetation. Sourdough timber sale could affect future stand development, OG and grass/forb structural stage requirements, forest growth and yield, insect and disease levels, and regeneration in much the same way as Caribou. There is projected to be a net loss of about 34 acres of 7E Forest Plan emphasis under the Tie Hack CG project. The other RFAs do not affect forest vegetation.</p>	<p>The cumulative effects of this project upon the forested vegetation are generally considered beneficial due to the dominant Forest Plan emphasis of providing wood fiber. Past regeneration monitoring shows that regeneration has generally been prolific in this area. The cumulative effects upon insect/disease levels, regeneration, and habitat structural stages is considered to be small, since a maximum of about 1500 acres is treated out of nearly 23,000 forested acres in these DUs.</p>

Table 14. Summary of Cumulative Effects Analysis for the Caribou Timber Sale, Except Water and Soils (continued)

Re-source	CE Area	Past Actions	Caribou Effects Summary	Future Actions	Cumulative Effects
Special Uses	Within 1 mile of cutting units.	There is one recreation residence in this area.	None of the alternatives affect this cabin.	The gravel pit is on the access road to this cabin. The analysis for the expansion scheduled for 1998 concluded that any of the action alternatives would have either a minimal effect or no effect on the resources. It is expected that the effects of the proposed pit are the same. The other RFAs will not affect this cabin.	There are no direct or indirect effects from any of the Caribou alternatives, so the incremental effect of this sale is zero. There are no effects from Caribou to add to the collective effects of the other past, concurrent or RFAs; therefore, there are no cumulative effect upon this cabin as a result of this action.
Economics	Bighorn EIA or North Shoshone EIA	The timber program on the Bighorn has generally been below cost. During the latter half of the 1980's the Bighorn Forest Plan ASQ amount of about 15 MMBF per year was met or exceeded. This output dropped to an output of between 2 and 7 MMBF of sawtimber since 1991. The Shoshone NF's program also dropped after the Yellowstone fires of 1988. Mills in this area have expanded their supply area, most notably to SE Montana, and lands of other ownership. Despite the increased supply area, they are currently below capacity. This trend mirrors the nationwide trend of NF timber sales dropping from over 12 billion board feet in 1987 to about 4 billion board feet in 1995. The Wildlife Task Force report documents that past timber harvest and road building resulted in reduced hunter days.	Alt. 2 is projected to harvest 3.9 MMBF, while the other alternatives project a harvest of about 4.5 million board feet. This represents about one years worth of output from Bighorn NF, based on current sale offer direction. It is assumed that if this sale is not sold, jobs will be lost in the timber industry as there are no longer any "substitute" capacity of either National Forest land or land of other ownerships. Sale impacts upon other resources are not expected to have financial effects for the following reasons: a) elk hunting days will not change as a result of any of the alternatives; and, b) recreation impacts are displacement impacts as opposed to actual declines in use. The table on page 3-28 of the EA lists the Present Net Value of the alternatives.	Sourdough timber sale may provide about 1 MMBF. Other timber sale areas through gate 1 on the Bighorn NF that are not in "roadless areas" are listed in table 11 on page 3-31. The current program, based on RF letter, is that the Bighorn will offer about 4 to 5 MMBF between now and the time the Forest Plan is revised. The Shoshone NF has an ASQ of 4.5 MMBF annually, and is planning on offering between 2-3 MMBF of sawtimber in FY '98 and '99. The Tie Hack CG project involves some clearing, which may result in up to 50 MBF. A few acres of clearing is anticipated with the gravel pit expansion, and is expected to yield about 20 MBF. The other RFAs are not expected to provide timber output.	Since this project is estimated to have no effect upon the economic benefits created by hunter days or other recreation related user day numbers, there are no incremental effects of this action that would create cumulative effects upon those resources. Selecting alt. 1 would continue the trend over the past decade for less timber offered off the Bighorn specifically, and National Forest land in general. The incremental effect of the action alternatives is to provide about one years worth of timber program volume from the Bighorn, combined with the overall declining program output trends in this area results in very small cumulative economic effects upon the timber industry in this area. Economic efficiency and impacts upon the local communities will be analyzed during the Forest Plan revision.

Table 14. Summary of Cumulative Effects Analysis for the Caribou Timber Sale, Except Water and Soils (continued)

Re-source	CE Area	Past Actions	Caribou Effects Summary	Future Actions	Cumulative Effects
Heri- tage	DU 110 - 114	<p>The National Historic Preservation Act (NHPA) was passed in 1966, and created the current requirements for protection of heritage resources.</p> <p>No heritage surveys were conducted for management actions in this area prior to 1974. Any ground disturbing activities in this area prior to 1974 may have affected heritage resources. Since 1974, specifically the Link timber sale, timber sales have been inventoried for heritage resources at a level that meets the NHPA section 106 requirements.</p>	<p>There <i>are</i> no direct or indirect effects upon heritage resources by any of the alternatives.</p>	<p>The other RFAs either have undergone, or will undergo, the legally required surveys and consultation with the State Historic Preservation Officer, as required by the NHPA section 106. It is not expected that there will be any effects upon the Heritage resource from these actions.</p>	<p>Since there are no direct or indirect effects to Heritage resources as a result of any of the alternatives, the incremental effect of the alternatives is zero. Therefore, there are no effects from Caribou to add to the collective effects of the other past, concurrent, or RFAs, so there are no cumulative effects to Heritage resources from this action.</p>

Table 15 summarizes the cumulative effects upon the water and soils resource that were considered in the Caribou analysis. These are shown in a separate table for formatting purposes. The cumulative effects analysis area is the Crazy Woman Creek watershed, as shown on EA page 3-15. This includes lands of other ownership off the National Forest.

Table 15. Summary of Cumulative Effects Upon Water and Soils for the Caribou Timber Sale

Past Actions	Proposed Action Summary	Future Actions	Cumulative Effects
<p>Past timber harvest, livestock grazing, road building and recreational activities have impacted the water quality, EA appendix H pages 1 to 8. These activities, plus additional activities, including but not limited to housing, herbicide application, and waste water disposal treatments, also occur on lands of other ownerships within these watersheds. North Fork Crazy Woman and Pole Creek are listed on the 1997 Wyoming 303(d) list, primarily due to sedimentation created by existing roads.</p>	<p>The action alts. have various amounts of road rehabilitation measures, including fill and culvert removal on the existing roads after the sale and soil stabilization measures. Alt. 5 includes additional road rehabilitation measures on roads outside the Caribou timber sale contract area and 2.6 miles of road obliteration. These measures are from the Wyoming BMPs and Watershed Conservation Practices Handbook. The effects analysis shows that these road rehabilitation and obliteration activities will result in various water quality impacts in the short run, which is estimated to be 2-3 years, until revegetation takes place and the soils stabilize. After that time, the watershed parameters analyzed will be improved. Most notably, sediment levels will be decreased below current levels. Silvicultural practices have been designed to incorporate the BMPs and WCPH measures, so it is anticipated that the direct effects from the timber harvest itself upon the water quality parameters analyzed in the EA are small to none. The closure of the area to off road summer vehicle traffic in alt. 4 is a WCPH measure, and will provide additional watershed improvements. EA page 3-16 has a summary table that compares, on a qualitative basis, the relative ranking of each alternative on the amount of short and long term watershed improvements.</p>	<p>Livestock grazing is expected to continue, and the current AMP EA process will address the impacts of the grazing upon water quality. The proposal includes improvements in watershed conditions. The already approved gravel pit project does not affect watershed conditions, and it is expected that the proposed pit expansion will have the same effect, with proper design and mitigation measures. Among the proposed actions in the Wilderness EA are creation of FP guidelines for retaining minimum amounts of large woody debris and restricting the amount of bare ground at campsites. These actions are likely to improve water quality and soil productivity. The thinning project is not expected to affect water quality, while over the intermediate term (3-15 years) it will likely create a small improvement in soil productivity as nutrients in the thinned material is released. Road maintenance, as described in table 11, is expected to continue into the future. Recreation activities on and off the NF, and the off-forest activities mentioned in the past activities, among others, are likely to continue to occur. As listed above, the effects of the Crazy Woman Road projects cannot be determined at this time, and they will be analyzed prior to NEPA-subject actions.</p>	<p>This effects summary focuses on the <i>incremental effects</i> that the Caribou actions have upon the environment when added to other past, present, and reasonably foreseeable future actions. Cumulatively, there are many past, concurrent and future activities, on and off the National Forest, that have affected, and will affect, watershed conditions. The incremental effects of the Caribou action alts. result in a net improvement to the water quality attributes analyzed. Improvements are targeted at sediment sources, namely the existing roads, which are considered to be the primary threat to the beneficial uses. EA page 3-16 compares the alts. in their watershed health effects. The project record includes a letter from the watershed program manager for the Wyoming DEQ, which states that the action alternatives "...will not only protect existing beneficial uses, but will result in water quality improvements through sediment load reductions in the streams." This improvement in water quality is the incremental effect of the Caribou timber sale. Therefore, while there are many activities within these watersheds that threaten the beneficial uses, the cumulative effects of this project is small, and is entirely based upon the short term sediment increases caused by the very actions that will result in the long term sediment improvements. This is the rationale that allowed the hydrologist for this project to find that cumulative effects for this project will be non-significant.</p>

CHAPTER 4
GLOSSARY
AND
ID TEAM MEMBERS

CHAPTER 4 - GLOSSARY AND ID TEAM MEMBERS

While the purpose of the EA is to allow public review of the analysis process and effects disclosure, some scientific, technical terms are included in the document to accurately, concisely convey certain information. This glossary is intended to assist readers in understanding the technical terms included in the EA. If there are additional terms that are not defined here, please contact the interdisciplinary team leader for more information.

The silvicultural definitions are adapted from "Silviculture Terminology", September 1994, compiled by the Society of American Foresters.

Basal area per acre (BA): A measure of tree density. It is the area of the cross section of a tree stem measured at 4.5 feet above the ground. For the purposes of this proposal, the units are square feet per acre.

Best Management Practices (BMP): These are practices designed to control nonpoint source water pollution. For this proposed action, the Wyoming forestry BMPs, as specified in the *Silvicultural Best Management Practices - Wyoming Nonpoint Management Source Plan*, are referenced. This plan was developed and approved by Wyoming State Forestry, the Wyoming Department of Environmental Quality, and the Wyoming Nonpoint Source Task Force. The action alternatives described in this EA adopt the BMPs.

Diversity unit: A specified area of land designed for project analysis purposes. A map of the 100+ on the Bighorn National Forest is available in the project file. The diversity units used for portions of this EA are 110 - 114, and shown in Appendix A3.

RIS site: RIS stands for Resource Information System, and is the database used to store vegetative and management information in Region 2 of the Forest Service. Site refers to a particular location on the ground, ranging from five to several hundred acres.

Roads

Road rehabilitation: For purposes of this document, this includes the application of the Best Management Practices and the items specified in the Watershed Conservation Practices Handbook. These roads will be left on the transportation system and may or may not be closed.

Road closure: For purposes of this document, this means the road will be closed for other than administrative use. These roads will be rehabilitated and have gates and other physical barriers installed. They will remain on the transportation system and will be used for future management.

Road obliteration: These roads are to be "removed from the face of the earth". They will be recontoured, seeded, closed to vehicular traffic except for snowmobiles traveling over snow, and removed from the transportation system.

Road reconstruction: The maintenance or improvement of a road that is already in place.

Local Intermittent (LI): This refers to roads that are utilized for some specific management purpose, such as timber sales, and are closed to other than administrative use after they serve that particular purpose. They are kept on the transportation system in anticipation of being utilized for management purposes in the future.

Temporary road: A road built by the logging contractor that is obliterated after that timber sale.

Scarification: Mechanical removal of competing vegetation or forest litter or the disturbance of the soil surface. The purpose is to enhance reforestation by providing a mineral soil seedbed.

Serotinous cones: Some lodgepole pine have cones that do not open until the resinous substance holding the cones closed is heated enough to melt. This trait is a genetic adaptation to the large scale, stand replacing fire regime, and allows lodgepole to store seeds until the fire event.

Silvicultural Systems: A planned process whereby a stand is tended, harvested and re-established. The system name is based on the number of age classes (even-aged or uneven-aged), and/or the regeneration method used (clearcut, shelterwood, selection).

Clearcutting: A method of regenerating an even-aged stand where all of the existing trees are removed. The regenerating stand is fully exposed to the sun and faces no to little competition from the surrounding tree stands.

Shelterwood: A method of regenerating an even-aged stand in which the regenerating stand develops beneath the "shelter" provided by the residual trees. The system implemented in the previous timber sales in this area was for a "three-step shelterwood" system, which includes the following:

Prep cut: The objective is to enhance the stand conditions for seed production. The prep cuts implemented in the previous sales removed trees with diseases, poor seed production, and tested and developed windfirmness.

Seed cut: The objective is to establish the new stand, by creating the proper environment for seedling establishment and development. In this case, it includes thinning the overstory to allow sufficient light to reach the ground and creating a mineral soil seedbed.

Overstory removal: The overstory trees are removed to release the established regeneration from competition. An overstory removal with reserve trees could leave any amount or distribution of overstory trees for wildlife habitat, visual purposes, etc.

Shelterwood cutting may be done uniformly throughout the stand (**uniform shelterwood**), in groups or patches (**group shelterwood**), or in strips (**strip shelterwood**).

Sanitation/Salvage: The removal of trees to improve the stand health by stopping or reducing the anticipated spread of insects and disease. The removal of dead trees or trees being damaged or dying due to factors other than competition.

Site Preparation: A hand or mechanized change to a site designed to enhance the success of regeneration. Treatments may include burning or scarification, among others. Site preparation treatments are designed to modify the soil, litter, and vegetation and to create microclimate conditions conducive to the establishment and growth of desired species.

Windfirmness: The degree to which a particular tree or patch of trees are subject to being blown over by the wind. The rooting habits of the particular tree species, where the trees are located topographically (on ridgetops, sidehills, draw bottoms, saddles, etc.), and soil depth are three major variables that define how windfirm a tree will be.

The interdisciplinary team for this project is:

Core Team:

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Extended Team:

Roger Wardlow
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Mike Retzlaff

Heritage
Range
Watershed
Fuels, Prescribed Fire
Economics

CHAPTER 5
RESPONSE TO PUBLIC COMMENTS
ON DRAFT EA

CHAPTER 5 - RESPONSE TO PUBLIC COMMENTS

The following lists the respondents to the Draft Environmental Assessment and the reference number assigned to their response.

1. Keith and Barb Barritt
2. Wind River Multiple Use Advocates, William G. King
3. Buffalo Chamber of Commerce
4. Dean Harrison, Backcountry Horseman
5. Big Horn County Land Planning Commission
6. Big Horn Mountain Country Coalition, Don McCracken
7. Cody Lumber, Inc., Michael Hanson and Charles Wright
8. James T. Dawson
9. Andy Tkach
10. John R. Swanson
11. Charlie Gould
12. David H. Larkin
13. Virginia Purdy
14. Wyoming Outdoor Council, Caroline Byrd
15. Bighorn Forest Users Coalition, Liz Howell
16. Bighorn Audobon Society, Carol Hett
17. J. and A. Maxwell
18. Gary and Cynthia Pfeiffer
19. Adrian Padon
20. Helen Moriarty
21. Lorna M. Wilkes
22. Lissa Omohundro
23. Wyoming Sawmills, Inc.
24. American Wildlands, Judith M. Brawer
25. Robert E. Damson
26. Beverly M. Hiza
27. Wyoming State Office of Federal Land Policy
28. Wyoming Game and Fish Department
29. Wyoming State Forester

The following responds to letters and comments pertinent to National Forest project and programmatic (Forest Plan level) planning level decisions and the context for project specific analyses and decisions:

1. One of the major objectives of Forest Plan level decision-making is to make program emphasis allocations. The 1985 Forest Plan did this, and allocated the majority of the Caribou analysis area to the 7E prescription, which emphasizes wood fiber production and utilization. This allocation did not mean that other resources were to be dismissed and not considered during later project specific planning; rather, standards and guidelines were designed to consider other uses. However, it is clear that the multiple use mandate of the National Forest System does not envision optimization of all resources on every acre.
2. Many people wrote comments on the "cost" of the action alternatives to elk habitat, hunter days, etc. This analysis indicates that, because of purposeful, planned decisions, elk habitat has been affected. Other resource benefits, such as dispersed roaded motorized recreation opportunities, which are more compatible with the timber management objectives, have been realized through the past management of this area. Forest Plan level allocations consider these tradeoffs, and specifically where to optimize the various resources. The Forest Plan level decisions recognized that these trade-offs would occur.

3. The purpose of project specific NEPA is outlined at page 1-1 of the draft EA. The analysis is not intended to revisit Forest Planning level decisions.

ISSUES

Wildlife - Elk Habitat

Because there were so many comments specific to elk habitat, these issues are broken out separately from the general wildlife section. Specific issues discussed in this section include elk calving areas, elk security areas, elk hiding cover, and elk habitat effectiveness. These individual parameters are the elements that are used to define and analyze "elk habitat."

- 21 **"Logging the areas identified by the G&F under alternative four as critical elk habitat will reduce recreational opportunities as well as an ecosystem which supports wildlife."**

Response: The area of critical habitat identified by the G&F is an area critical to elk calving, which is protected by the sale closure in the B and D units between 5/1 and 6/30, see EA page 2-6.

- 14 **"Moreover, the lack of hiding cover and the previous extensive cutting combined with the proposed sale, create significant concerns about the fragmentation of wildlife habitat, specifically security cover."**

- 14 **"Cutting more trees in this area will not address the issue of improving elk security."**

- 25 **"But hiding cover is only a small part of habitat. Besides, what good is hiding cover if the animals avoid the area due to all the traffic on the road? Nothing within 1/2 mile of the open road will raise the habitat value according to USFS research. In fact, the distance may be farther in the Bighorns, especially with so many stands thinned out by past treatments."**

Response: See Appendix B-2, page 2 for general fragmentation issue.

Elk security, see EA page 3-4 and 3-5. One of the reasons this sale area was selected was because of the existence of the road system, specifically the Pole Creek and Sheep Mountain roads. It is extremely unlikely that these roads will be closed in the foreseeable future, so none of the harvested areas within the 1/2 to 1 mile buffer criteria used to define elk security can ever function as elk security areas, so the vast majority of the proposed sale has no effect on elk security. The areas shown on page 66 of the CCLA (shown in yellow) could be security areas after regeneration only. The action alternatives will result in regeneration sooner than under the no action alternative. In addition, all action alternatives include measures increasing the effectiveness of the road closures, which will improve elk security. Finally, adoption of alternative 4 will increase elk security additionally by closing the area to off-road travel. While moving the road closure gates back up to 1/4 mile may intrude slightly on security areas, this affect should be partially offset by the other road closure effectiveness measures and by only moving gates as far as needed to achieve objectives. The action alternatives in this proposal either do not affect elk security, or improve it because of faster regeneration and travel management actions.

Other comment letters with this issue: 15,17,28

- 28 **"Wyoming Game and Fish Department preliminary habitat models indicate that only 5% of Hunt Area 35 is comprised of security areas, well below the recommended 30%. Hunt area 35 supported general license hunting until 1989. Currently only 1 in 6 hunters who apply**

to hunt the area receives a license. Therefore, we recommend no timber which comprises areas of security should be included in the proposed action. Furthermore, roads within 1/2 mile of potential security areas should be obliterated."

Response: The issue of utilizing the elk security model as a Forest Plan standard for the Bighorn National Forest may be addressed during the upcoming Forest Plan revision, but is not within the scope of this analysis to adopt it as a new standard. We have however, considered the effects.

Effects of this timber sale, and past timber sales and road construction, are documented in the EA at pages 3-4 to 3-5, and in Appendix H, pages 23-32.

Comparing the proposed units to the elk security area map that is on page 32 of Appendix H (and is legible in color at page 66 of the CCLA), there are an estimated 20-40 acres of proposed cutting units within the yellow, "After Regen Only", security areas. These do not currently function as security. The obliteration of all roads within 1/2 mile of potential security areas would involve closing of the Pole Creek and Sheep Mountain roads, which is outside the scope of this analysis.

14 "Specifically, the Forest Plan Standards and Guidelines for elk hiding cover are not met due to the previous stage of this timber sale....Rather than continue on with the proposed action, we suggest it is time to take a step back, and address the lack of hiding cover without marching forward with implementing the rest of this tree stage sale."

25 "But, if you are going to key in on hiding cover, what about the S&G to maintain it along 75% of the Pole Creek road and 40% of the stream edges? How well is that being met? I think you showed your hand by the statement, "There is a need to provide the Forest Plan minimum amount of hiding cover." There should be a desire to provide adequate habitat above minimums as a hedge against unknowns."

28 "We believe the Forest Service should not manage to the minimum requirement, rather, manage at or above the required standard."

23 "Current conditions in the timber stands awaiting the second step shelterwood cutting do not provide effective hiding cover by Forest Service definition and observation."

Response: **Hiding cover.** The purpose and need is not met without a timber sale, see EA at page 1-3. An alternative to conduct regeneration treatments without a timber sale was considered but eliminated from detailed analysis, see EA at page 2-10.

The hiding cover issue is discussed in the EA at pages 3-2 to 3-6. The harvest units are not cover now. The effects of the timber harvest alternatives are that they will become hiding cover sooner than under Alternative 1. This includes the areas along the Pole Creek road and stream edges. The hiding cover issue is further described later in this section under the elk habitat effectiveness section.

The minimum required level is not our management objective. However, hiding cover is improved to the maximum amount possible under the action alternatives, given the scale and scope of the proposed project. Future hiding cover improvements are not precluded, and as the table on page 3-4 of the EA indicates, further hiding cover improvements can be made into the future. There are other standards and guidelines, such as the 5% grass/forb requirement, which considered along with the hiding cover, old growth and other standards and guidelines, are intended to provide habitat diversity.

Other comment letters with this issue are: 8,9,10,13,15,16,21,20,28

28 "The Forest Plan defines the amount of hiding cover required for deer and elk. We believe hiding cover should be managed for this standard. However, because four of the five diversity units are below required hiding cover values [CCLA reference], cover provided by first entry shelterwood cut timber stands are more valuable than if they are thinned by 50% (at least until surrounding clear cuts regenerate to hiding cover.)"

Response: The rationale in the hiding cover analysis is shown in the EA at pages 3-2 to 3-6. The Forest Service and Wyoming Game and Fish have utilized three methods for elk habitat management and effects analysis. A parameter that assigns and/or requires habitat analysis on cover conditions that are less than the accepted definition of "hiding cover" has not been developed or adopted for use by scientists. This analysis utilizes standard accepted methodology and considers the effects upon elk and deer habitat from the standpoints of hiding cover, elk habitat effectiveness, and elk security.

28 "The environmental assessment indicates Diversity Units 110 and 112 meet the Forest Plan standard for hiding cover while Diversity Units 111, 113, and 114 do not. This is contrary to the Clear Creek/Crazy Woman Creek Landscape Analysis which states that Diversity Unit 112 is also well below the weighted standard. In fact, comparing existing hiding cover values in the Clear Creek/Crazy Woman Landscape Analysis and the environmental assessment indicate several discrepancies."

Response: These statements are true, and reflect the discrepancies that arise as analysis scale varies from the broad, programmatic level to more detailed site specific levels. At larger scales, where broader interpretations are made and applied, data compilation is less detailed and less accurate than on smaller, site specific analysis projects.

The Clear/Crazy analysis was conducted on nearly 150,000 acres, and while some updates of the RIS database were done in a stratified/systematic fashion, it would have been cost prohibitive to update every RIS site for every parameter. Since the landscape assessment was a compilation of existing information and not a decision document, compilation of data to the accuracy needed to make more precise decisions was deferred to the project level analysis. Hiding cover values for the Clear/Crazy analysis were calculated after a limited database update.

As the resolution of analysis dropped to the approximately 27,000 acre, 5 diversity unit scale, it became necessary to do further, site-by-site updates on certain RIS parameters. The Caribou analysis is the site-specific NEPA-level analysis from which management decisions are made. For this analysis, the wildlife biologist and silviculturist reviewed and updated the wildlife habitat structural stage for each RIS site in the 5 diversity units. Past activity records, aerial photos, and field knowledge were used to make these updates.

The hiding cover figures shown at page 3-4 are more accurate, and reflect the finer resolution of data compilation that is necessary in conducting NEPA site-specific level planning and effects analysis.

28 "The environmental assessment should include classifications of clear cuts into Wildlife Structural Stages and projections as to when regeneration will meet the hiding cover definition."

Response: This information is available in the wildlife and forested vegetation specialist's reports in the project record. The conclusions drawn from that information, and a summary of the information as it relates to hiding cover, is in the EA at pages 3-4 and 3-5.

16 "The practice of trying to increase hiding cover for elk by removing trees in an area that presently does not meet Forest Plan standards and guidelines for elk hiding cover is questionable. While the objective of hiding 90 percent of an elk at 200 feet may be met by young growth twenty to thirty years from now, in the interim there will be much less hiding cover for these animals in the harvested areas. Sixty percent cover is better than forty percent cover."

Response: This is discussed in the EA at pages 3-2 to 3-6.

The correct definition of hiding cover is listed above, the ability of topography or vegetative features to hide 90% of an elk at a distance of 200 feet. In applying this standard and guideline from the Forest Plan, an area either is hiding cover or is not, there is no 60% or 40%. The rationale for the action alternatives is that the harvest areas do not provide hiding cover now. Without harvest, regeneration that will eventually provide hiding cover will begin to occur in 50 to 100 years; with harvest, the resulting regeneration will begin to provide hiding cover in about 10 to 20 years. EA page 3-23.

25 "A Wildlife Task Force has been working to produce better methods of measuring wildlife needs for about a decade. Yet very little was said about their Habitat Effectiveness scores for this area."

28 "The environmental analysis lacks quantitative data on elk habitat effectiveness..."

Response: Elk habitat effectiveness. See EA, pages 3-3 to 3-5. In addition, elk habitat effectiveness is discussed in the Appendix H, pages 23-30, including the effects upon hunter days.

Wildlife - General

14 "The Nation (sic) Forest Management Act requires the Forest Service to "provide for diversity of plant and animal communities."... "Under NFMA, the Forest Service must recognize ecological interrelationships and must maintain viable populations of existing native vertebrate species."... "Additionally under NFMA, 16 USC 1604(f), resource plans for the use of National Forest System lands must be consistent with the land management plans. The BNF standards and guidelines for diversity are found in the Plan at III-23. The units in the Caribou Timber Sale are below many of these standards and guidelines (e.g. snags) due to the extensive created openings from previous sales.

Response: The EA analyzes biological diversity in the following ways:

Old-growth is analyzed at pages 3-6 to 3-7.

The grass/forb structural stage effects disclosure is at page 3-3. Despite not meeting this standard and guideline, we are not proposing additional management activities at this time to increase the grass forb component.

The Forest Plan requirement for a Patton edge index of 1.4 on created or modified edges. The silvicultural prescription and marking guide will reiterate this S&G if the alternative 3, 4, and 5 clearcut units are selected for implementation. This S&G will be met.

Snags: The snag island concept, page 2-6 of the EA, is an alternative approach that we believe addresses biodiversity better than the 2 dead trees per acre minimum envisioned in plan. It accounts for some cover in conjunction with existing snags, replacement snags, etc. The area involved is 2-4% of the entire area harvested, which is considerably above what would be maintained by saving 2 current snags per acre, and some replacement trees, 2 mature trees per acre and 2 pole sized trees per acre. This exceeds the FP standard and guideline. Specifically to this comment, page 3-3 describes the existing status of snags compared to the Forest Plan standard and guideline.

Viable populations: We have no indication that population viability is an issue for any species in this area. See the biological evaluation, Appendix F-2.

Wildlife habitat structural stages are displayed in the wildlife and forested specialist's reports. The structural stages are used to calculate the amount of hiding cover.

Biological evaluations for plants and wildlife are found in Appendices F-1 and F-2, respectively.

More detailed analysis of biodiversity is properly addressed at the Forest Plan analysis scale.

Other comment letters with this concern: 15,16,25

28 "Construction of 2 miles of fence to mitigate loss of a natural barrier and to address livestock distribution problems on the North Fork of Crazy Woman Creek raises some wildlife concerns. Options other than fencing should be thoroughly reviewed before fencing is approved."

Response: The fencing is mitigation for thinning the existing timber stands, which form natural livestock movement barriers. It is not to address previously existing livestock distribution problems. Specific wildlife concerns were not identified in this letter and we presume the concern is effect upon wildlife movement. Fence placement and design would be implemented to minimize adverse effects to wildlife movement.

16 "The fragmentation issue was not analyzed in the draft EA."

Response: Page 2, Appendix B-2 lists the rationale why fragmentation is not appropriately addressed at the individual project level, and why a fragmentation analysis was not done in the draft EA.

There are other sources available in order to determine whether or not the cumulative effects of the potential alternatives combined with past and reasonably foreseeable activities constitute NEPA significance on the issue of fragmentation. These documents provide a context for the decision maker to consider fragmentation issues at a larger scale than the project analysis area itself.

1. Appendix H from the Clear/Crazy Landscape Assessment documents cumulative effects of past actions on the following pages:

Pages 12 and 13 describe the frequency, size and type of historical landscape scale fragmentation events.

Page 18, Table 9, lists timber harvest and fire acres by decade for the CCLA area. In addition, the forested vegetation specialist report lists this same information for the five diversity units analyzed for Caribou.

Old growth forest fragmentation issues are listed on pages 43-49.

The Wyoming Game and Fish's change detection map, that lists forest vegetation change events by time period, is available in the CCLA, which is included in the project file.

2. Tinker, et al. Watershed analysis of Forest Fragmentation by Clearcuts and Roads in a Wyoming Forest. In press. A copy of this is included in the project record.

Other comment letters with this issue are: 17,

- 16 **"Two 4B prescription areas are included in the cutting units. The forest plan identified wildlife values associated with these two areas, so silvicultural practices must be modified to enhance wildlife values in 4B areas and hiding cover up to 80 percent."**

Response: The 80 percent hiding cover standard for 4B areas is applied to the forested areas of diversity units, not to individual prescription allocation areas within diversity units. Therefore, the hiding cover requirement has already been taken into account in the calculations. The diagnoses and alternatives for these areas recognize the 4B emphasis:

- Unit C1 in the 4B area would receive a sanitation/salvage harvest under all action alternatives. In addition, this north facing slope is an Engelmann spruce/subalpine fir habitat type, and that harvest proposal would result in increased proportions of those species, as lodgepole pine would be the dominant species removed. See EA page 2-2 and Appendix C1.
- Unit C3 in the 4B area would receive a seed cut under alternative 2, and 2-3 five to ten acre clearcuts under alternatives 3,4, and 5. While either harvest would produce hiding cover sooner than Alternative 1, clearcutting would benefit wildlife from the standpoint that there would not be another commercial entry for 40 years, as opposed to the anticipated 15 years between the seed cut and the overstory removal step. This effect analysis is shown in the EA at page 3-5.

- 16 **"The watch list is an issue—not just a "bird list" of no significance to this timber sale.....Past ignorance and denial of this issue is why we now have endangered species."**

Response: The biological evaluation for TES species was conducted, and can be reviewed in Appendix F-2 of the EA.

The Watchlist provided by Audubon lists species which utilize different habitat conditions and which each may be affected differently by forest management activities. This represents the trade-offs associated with land management decisions. Two Watchlist species that occur on the Bighorn National Forest are the Olive-sided Flycatcher and the Western Wood-Pewee. Research by Hutto, et al., (1992) compares bird species' abundance in clearcut or partially cut forest to uncut forest. According to Finch, the Olive-sided Flycatcher is more abundant in 0 to 10 year old clearcuts and in "partial cuts" than in uncut forests, while the opposite is true for the Western Wood-Pewee. Other species that are not on the Watchlist, but occur on the Bighorn National Forest, whose abundance

increases with timber harvest include the Rock Wren, Calliope and Broad-tailed Hummingbirds, Lincoln's Sparrow, Mountain Bluebird and American Kestrel. Species that occur on the Bighorn whose abundance is negatively affected by timber harvest include the Red-breasted Nuthatch, Brown Creeper, Golden-Crowned and Ruby-Crowned Kinglet, and the Mountain Chickadee. (Hutto, et al., 1994) Except in the case of TES species, the analysis did not attempt to describe effects on the species specific scale. The Forest Plan allocations and direction addresses habitat diversity to provide habitat conditions for an array of species. Standards and guidelines to meet the Forest Plan direction are analyzed for this project.

- 24 **"The EA does not address fisheries. Please discuss the fisheries resource in the project area."**

- 28 **"The content of this Environmental Assessment shows very clearly why a senior level fisheries biologist is needed on the Bighorn National Forest. There is no reference to fisheries anywhere in the Wildlife section of Chapter 3 despite our scoping comments which identified several streams in the area that support game fisheries. The only place aquatic resources are mentioned is under the Water and Soils section of Chapter 3, and statements made here are so elementary (water is warm in the summer and cold in the winter) they provide no useful information in assessing the potential impacts of the proposed timber sale on fishery resources."**

Response: At a slightly larger scale, the fisheries resource is discussed in Appendix H at pages 53 to 55.

Pages 3-11 to 3-14 of the EA list the effects the alternatives will have upon certain parameters that constitute and affect the aquatic ecosystem.

The effect on fisheries is that improvements in water quality and reductions in physical barriers, such as culverts, will improve fish habitat. Water quality improvements will be achieved through the implementation of the actions specified under alternatives 2-5 and the proposed off-road summer travel area closure under alternative 4.

- 28 **"On page 2-4, it is stated that a watershed management review will be conducted, and this review will included an aquatic biologist. Without a permanent aquatic biologist on staff, we request the Forest elaborate on how it proposes to accomplish this."**

Response: The purpose of this analysis is to determine what actions, if any, will be implemented. Once that decision is made, the resources needed to complete any work will be identified through work planning. There are many options for utilizing aquatic biologist skills in a watershed management review.

- 25 **"And don't assume goshawks just sit on nests. They like good forest cover for hunting. I have seen them hunting in this area, even though the nest was across the line on the map. Will sale preparation activities be done in the nesting season to assure accurate surveys?"**

Response: Appendix F-2, the biological evaluation describes the analysis, potential effects, and monitoring needed. The monitoring for Goshawk protection, and steps to be taken in case a nest is found, are at page 2-6 of the EA.

The original survey was done during the nesting season in June and July, 1997. See EA page 3-3 and biological evaluation, Appendix F-2.

25 "I see nothing increasing snags or woody debris, only some restrictions on reductions. Yet the EA says, "Improve the amount and distribution."

Response: This has been corrected. The EA at page 3-4 displays the effects of the alternatives upon coarse woody debris and snags. The cumulative effects are described on page 3-5.

Old-Growth

15 Pine martin (sic), a prevalent old growth dependent species in the Bighorns, needs to be protected as a sensitive species."

Response: The standards and guidelines provide a coarse-filter approach for late-successional species habitat needs by specifying the 5% old-growth requirement per diversity unit, rather than specific species requirements. That standard is met under all alternatives. Species requirements for threatened, endangered, proposed, and sensitive species are discussed in the biological evaluation, appendix F-2, and at page 3-5.

Project effects upon pine marten are shown in the biological evaluation for animals, page 14 of Appendix F-2.

Other comment letters with this issue are: 10,16

28 "Stands identified as old growth should comply with the Forest Plan definition."

Response: There is no definition in the Plan of old growth. The definitions by Mehl (1992) are considered to be the standard in Region 2 of the Forest Service. Further explanation of how old-growth was identified is listed below.

16 "Identify the RIS stand sites on a map for the 5% old growth forest. We want to visit these stands to see conservation for old growth. Why were these stands chosen as the best to retain in old growth?"

25 "It is not clear if old growth was completely inventoried on the ground."

Response: For the Clear/Crazy landscape analysis, old growth scorecards and Mehl(1992) scorecards were completed, as outlined on pages 44-45 of Appendix H. The amount of old-growth determined by those methods by diversity unit is shown in the table on page 82. Additional old growth was identified during the Caribou analysis process, based on more specific, detailed review of units on the ground and photo interpretation. This is documented in the EA at page 3-6. The total amount of old growth in the diversity units analyzed for Caribou is shown in the table on page 3-6.

In addition, the wildlife biologist and silviculturist identified candidate stands, EA page 3-6.

Topographic maps showing the location of the stands identified in the above listed analyses have been distributed to Audubon, Wyoming Outdoor Council, and Bighorn Forest Users Coalition members at their request.

The stands within the proposed cutting units are *not* included in the old-growth table found at page 3-6 of the EA.

Other comment letters with this issue are: 17,20

16 "We need at least 10 percent [old growth] to offset effects of fire and blowdown, and it should be well distributed."

Response: The Forest Plan requirement for old growth, 5% or more of the forested areas of a diversity unit, is shown in the EA at page 3-6.

25 "How many acres now standing will it take to avoid disease, fire, blowdown, etc. to make an acre of true old-growth? Stands need to be designated and highlighted, not stuffed in a folder and forgotten."

Response: The first question is answered at page 3-6 of the EA. The purpose of the candidate block analysis, and the forest growth projections, was to display that sufficient old growth will be available for management in future. We agree with you concerning the designated and highlighted comment, and expect that future managers in this area will review this environmental analysis and associated documentation, as was done for this analysis.

Water and Soil

27 "We do feel that you have addressed current water quality conditions and the Best Management Practices which will be applied to protect beneficial uses. The Environmental Protection Agency has approved the State of Wyoming's Silviculture Best Management Practices which were designed to be applied on a site specific basis and are intended to provide cost-effective mechanisms for maintaining land uses while protecting or improving water quality."

Response: Thank you for your comment.

14 "Pursuant to the Clean Water Act..., the Forest Service must comply with state water quality standards. In addition to the watershed improvement measures identified in the EA, at 2-3 through 2-5, the Forest Service must discuss how the CWA's federal anti-degradation policy will be implemented for this project. ... Given the presence of a cold water fishery in the creeks in the analysis area, we assume that the area's creeks are Tier 2, or high quality water capable of maintaining a sensitive native trout species. ...Any project or development which would constitute a new source of discharge must be issued a permit by the DEQ."

Response: The assumption that these are Tier 2 waters is correct.

The comment on discharge permits pertains to those activities that are point source in nature. Non-point activities, such as a silvicultural activity, have been expressly defined in the Clean Water Act, and are exempt from the requirements of a permit. Therefore, a timber sale is not a permitted activity and does not require certification. Non-point source activities are mitigated by the use of Best Management Practices (BMP) which have been approved by the State, or substitute BMPs that are more restrictive than the State practices. The BMPs necessary to reduce the impacts of the proposed activities to a level of insignificance will be keyed to the need to protect streams so that the classified uses are not impaired.

Other comment letters with this issue are: 8,10,11,13

24 **"What happened to the TMDL allocation that was going to occur at the same time as the Caribou timber sale EA?...There is no evidence of any TMDL allocation plan in the Caribou EA."**

Response: This comment is in reference to the June 10, 1997 letter, which states, in part, "The preparation of the TMDL allocation plan will be conducted at the same time as the Caribou Timber Sale EA." Based upon subsequent analysis of water quality monitoring data for the pertinent streams, the Forest Supervisor in a letter to the Wyoming Department of Environmental Quality dated July 2, 1997 requested delisting based upon the fact that the data indicated that the beneficial uses are in fact being maintained for both stream segments. See EA page 3-16.

Therefore, a specific TMDL allocation plan is not being prepared. The rationale for pursuing this project prior to notification of delisting by the EPA is shown in the EA at page 3-16.

Other comment letters with this issue: 28

24 **"The watershed improvement plan without timber harvest alternative should be given greater attention because of the potential to meet the legal requirements. The Forest Service is not legally mandated to provide timber. It is legally mandated to meet water quality standards."**

28 **"Alternative 1, the no action alternative is misleading in that this alternative leads the reader to believe nothing will be done to address the lack of hiding cover and habitat effectiveness, poor water quality and travel management without the timber sale taking place."**

"If off-road vehicles are the problem, they can be addressed by means other than timber sale."

Response: A non-harvest alternative can be selected. See EA page 2-1, "This alternative was developed to serve as a baseline for effects analysis." Selection of Alternative 1 does not preclude other management activities from being proposed and analyzed in the future. Any analysis already completed could be used to support an analysis and decision.

The rationale for not analyzing alternatives without timber harvest is shown in the EA at page 2-10.

Other letters with this comment: 25, 26

24 **Regarding BMPs, "In addition, these prevention measures should have been implemented during the past harvesting and roadbuilding activities that occurred in the project area. How can we be assured that they will work this time?"**

Response: The Forest Supervisor has determined, as documented in his July 2, 1997 letter, that the past monitoring information from this area indicates that state designated beneficial uses are being maintained. See EA, page 3-15. (Copy of letter in project record.) However, as documented throughout the EA, there is still room for improvement, and there have been effects upon the water resource from past activities, most notably roads. This is why there is such a heavy emphasis in alternatives 2-5 on watershed improvement actions.

The adoption of specific non-point source pollution prevention measures is voluntary, based upon the adoption of BMPs. This analysis is predicated on the adoption and implementation of BMPs. Implementation and effectiveness of the BMPs can be verified through monitoring.

15 **"For instance the chart on pg. 3-9-10 on Watershed Effects is useless with all the checks the same showing no variation or concerns."**

Response: That chart does not show there are no variation or concerns; see EA page 3-10, "Blank means no effect, 'x' means minor effect and an 'xx' means substantial effect." This analysis gets to the "heart of NEPA": the significance of the effects of each alternative upon specific water quality and soil parameters. "X" indicates that the effects of the alternatives on these specific variables is less than the NEPA definition of "significant". In addition, the chart should be read in conjunction with EA pages 3-11 to 3-15, which defines more specifically the effects to each of these watershed parameters.

Other letters with this issue: 25,

25 **"Many of the roads proposed for the timber sale access have grown some cover of trees or herbaceous vegetation. If the sale goes through, they will be bladed off. Such reconstruction can yield almost the same amount of sediment as new construction. If they are ripped to loosen compaction for seeding, there will be more disturbance."**

Response: The proper application of the BMPs, WCPH measures, and the specific items listed on pages 2-3 through 2-5 of the EA, which include monitoring, will result in a minimum amount of sedimentation from the clearing activities. The EA at page 3-15 displays the short term watershed effects due to the ground disturbing activities. However, the EA also displays that the long-term effects of the action alternatives are that watershed conditions will be improved, pages 3-15 and 3-16.

24 **Concerning noxious weeds, "Please discuss what type of permission or consultation is required regarding the spread of noxious weeds that will result from this project."**

Response: Licensed applicators are required, per Forest Service policy. Label directions will be followed. No consultation is required. The noxious weed management plan, listed at page 3-34 as a reasonably foreseeable action, is expected to be completed by the time weeds are sprayed as a result of this action. The weed plan will provide additional direction for this portion of the project.

16 **"Where is the documentation on how much organic matter is needed to maintain productive soil?"**

Response: Page 3-13 in the nutrient removal section. This is supported in the project record by Alexander, (1986), "Removal of logs in timber harvest represents a small and temporary net loss of nutrients, because only a minor proportion of the nutrients taken up by a tree is stored in the bole."

24 **"The EIS should identify the types of monitoring that will be done, including a schedule for visits by the Forest Soil Scientist to the project area. Also, please analyze the project-specific and cumulative effects of the long-term site productivity. The amount of land already out of productivity due to roads, skid trails, old mining sites, etc., as well as the aerial extent of disturbance from this project should be addressed."**

Response: Monitoring requirements built into the alternatives are found at page 2-6 of the EA.
Site productivity analysis is addressed in the previous response.

The WCPH handbook: standard 13 specifies that no more than 15% of any land unit should be detrimentally compacted, eroded or displaced. The design criteria listed in the WCPH which is incorporated into the action alternatives include:

1. Restrict roads, landings and skid trails to designated sites. Items 3,5,12,13,15, EA pages 2-3 and 2-4.
2. Do not operate heavy equipment when soils are wet. Item 4, page 2-4 of EA.
3. Conduct prescribed fire when soil, humus, and large fuels are moist. EA page 2-3.

Currently, about 5% of the minimum harvest alternative unit acreage (1330) is "impacted" by roads and landings. This is a very cursory, "maximum", calculation, as it does not include areas outside the unit boundaries that are accessed by the sale roads, and it does include a total of 7 miles of the Pole Creek and Sheep Mountain roads. (If the areas outside the unit boundaries that are also accessed by those roads were included in the acreage calculation, the impacted figure would be less than 5%) Therefore, a conservative estimate is that no more than 10% of any unit acreage should be in designated skid trails. This action is specified in the EA through the application and utilization of the appropriate BMPs and WCPH measures, page 2-3.

24 **"The proposed project will enter riparian areas and wetlands. The EA recognizes the importance of riparian and wetland ecosystems and the damage that timber harvesting does to their special values. ... AWL would like to see the Forest Service stay out of these riparian and wetland areas except for rehabilitation and restoration purposes."**

16 **"We requested a careful analysis of erosion, roads and harvesting effects to wetlands, seeps, springs, and riparian areas, and any degradation of fisheries and water quality. What are the short term (2 to 3 years) effects to the riparian areas and streams? No harvesting activities should be conducted in riparian and wet areas (100539-0012 and 100521-0014) unless there is a proven documented need for removal of trees for a specific habitat purpose."**

Response: The analysis of the alternatives upon wetlands and riparian areas, including short and long term effects, are documented in the EA at pages 3-11 to 3-16. The harvest activities specified for the cited RIS sites are included to "...achieve multi-resource objectives, namely the avoidance of creating additional areas exceeding the adopted Visual Quality Objective of partial retention." (EA page 3-14) These harvest activities are in accordance with Forest Plan standards and guidelines for 9A management areas, and will be done according to the applicable BMPs (EA page 2-3). These are listed more specifically in the next response.

Other comment letters with this issue are: 17,

25 **"The assumption that Sanitation/Salvage in riparian areas is a light cut is false. The Targhee NF was salvaged logged along the Yellowstone NP line, as shown in numerous "horror" pictures under the label "clearcuts". If there is a sale, it is hoped that a cut would be marked and BMP's followed. But, an EA doesn't guarantee a sale layout; a sale layout doesn't guarantee contract clauses; contract clauses don't guarantee sale administration."**

Response: Given the watershed concerns in this area, a section defining the sanitation/salvage harvest in the riparian areas was added to the EA, page 2-2.

21 **"Although no activity is planned within the wetlands, the adjacent ground cover will slough off and affect the total area of wetland under all alternatives, including #4. Sites in and around creeks in the Caribou sale area will be reduced if the ground cover is disturbed. For example, the riparian areas around Hesse Creek and Crazy Woman are downhill from the proposed clear cuts and would most likely be reduced in size as the soils sloughed off."**

Response: Page 1-2 of the EA lists that there will be about 4 acres of 9A prescription allocation area within cutting units D5 and B1. The effects of the diagnosed sanitation/salvage harvest, with full application of Forest Plan standard and guidelines and BMPs, are shown on page 3-14. Applications of the BMPs and WCPH, as specified at page 2-3 of the EA, should minimize the potential effects to wetlands.

Page 3-14 of the EA, under Geologic Hazards, shows the conclusion that soil creep, slumps, etc. are a minor potential impact because the road network is already in place and the proposed harvest units are on slopes less than 27%.

21 **"The repairs made [to the Hesse Creek crossing on FDR 31] disturbed the ecology of the stream, but of far greater concern is the idea promoted that "money" for aquatic improvements will only come if the Caribou sale goes through."**

Response: The primary purpose of this action is to implement the Forest Plan objective of offering timber sales. We also identified the need to improve the watershed health of Pole Creek and North Fork of Crazy Woman Creek. The purpose and need is described at EA page 1-3. These activities could occur separately but were examined simultaneously.

25 **"The culvert on Hesse Creek was blown out. This watershed has had logging nearly to the end. Doesn't this indicate there may be some correlation?"**

Response: This culvert has performed adequately for approximately 2 decades, including immediately after the bulk of the harvesting. The culvert's failure is more likely due to the heavy rainfall events that occurred this summer.

Recreation

25 **"The largest concentration of recreation users has been elk and deer hunters. They also use the area more thoroughly than others. Yet, they have been ignored in the Recreation section, just as the real needs for habitat and losses of revenue have been ignored in other sections."**

Response: Page 57 of Appendix H, Table 23, lists the Recreation Visitor Days (RVDs) by Activity for the landscape analysis area. While this is more of a "cumulative effect" recreation use scale of discussion, it approximates the use that the proposed timber harvest area receives as well. Camping and driving for pleasure account for nearly 50% of the total RVDs, while hunting accounts for just under 6%. The effects of declining hunter days are displayed on pages 26 and 27 of Appendix H, which summarizes the WLTF report.

25 **"How will the new restrictions be enforced, especially in view of declining personnel?"**

Response: The purpose of this analysis is to determine which, if any, actions, will be taken. This question relates to annual work planning and budgeting. Enforcement of travel regula-

tions is of concern forest-wide and has been particularly difficult in areas where some roads and trails are closed to motorized travel but the area is open. The changes proposed in Alternative 4 would simplify travel management and enforcement in this area.

25 **"Why are Roads #476 and 479 left open? Closure could really help wildlife habitat effectiveness, as can keeping campers closer to the Pole Creek Road than 1/4 mile."**

Response: FDR 479 is very short (.016 miles), is at least partially grassed in, and is so far from a watercourse that there would be no benefit in closing it. There is a fence, rocks and other topographic features that make it unlikely people will use it to access more area. In addition to wildlife habitat effectiveness, we are also managing for recreation opportunities that are provided by leaving FDR 476 open and moving the gates back for camping opportunities. There is only one other FDR off the Pole Creek road that is currently open to vehicular traffic.

Other comment letters with this issue: 28

3 **"We are concerned that continued off-road closures will result in restricting overnight camping to developed campgrounds. Recreational use in the Bighorns continues to increase and the existing camping facilities will not accommodate the numbers of overnight campers."**

Response: The effects of the off-road closure upon camping opportunities is shown in the EA at page 3-20.

Other comment letters with this issue are: 6,

11 **"Another reason I feel this sale should not go thru is the increased amount of truck traffic on the Pole Creek Road." "This increased noise and traffic on the road will certainly destroy any wildlife viewing that may be available."**

Response: The truck traffic on the Pole Creek road will be a temporary, short-term effect, an estimated two summer seasons. Safety signs will be required in the timber sale contract to warn other Forest users. This is a routine use of National Forest system roads, and is compatible with the Forest Plan management emphasis for this area. In addition, the EA was modified to prohibit weekend and holiday hauling, EA page 2-3.

6 **"We feel that the Forest Service should adopt a no net loss for roads. There should be a no net loss of access rule that is applied to all projects."**

Response: This is outside the scope of this analysis.

5 **"We feel alternative #3 is more acceptable. Public concern revolves around the proposed closure of 18,000 acres to off-road motorized travel, except for snowmobiles which is included in Alternative #4. The LPZC does not like additional restrictions placed on any of its public lands."**

Response: Thank you for your comment.

Other comment letters with this issue are: 11

10 **Agreed that area should be closed to summer off-road use.**

Response: Thank you for your comment.

Other comment letters with this issue are: 16,25

11 **"I can certainly believe you are trying to sneak this in under the disguise (sic) of a timber sale. It should be done as a separate proposal."**

15 **"However, the entire area is overrun with ORV uncontrolled use and further management decisions should be done in a "travel management plan" for the entire southern Bighorn Mountains, not just as a carrot to sell timber."**

28 **"We support eliminating off road travel and closing selected roads. However, we do not believe a timber sale is needed to justify this action." "To be truly effective in improving hunter opportunity, travel management must be addressed on a hunt area scale. With this in mind, we suggest all roads identified for closure in the Clear Creek/Crazy Woman Creek Landscape Assessment [Appendix H, page 30] be closed."**

Response: The area closure to summer off-road travel is a mitigation measure designed to offset the effects of a predicted increase in the amount of off-road vehicle disturbance of wildlife, and resulting decrease in wildlife habitat effectiveness. It will also improve water quality protection. See EA page 2-8.

A travel management plan for the southern Bighorn mountains is outside the scope of this analysis.

16 **"We want to know what trade offs will be made for multiple uses.", in reference to a wide range of recreational activities that may be effected by the proposal.**

Response: See the EA pages 3-18 to 3-21.

16 **"Our question of how this project will affect hunter opportunity and wildlife viewing opportunities was not answered."**

Response: The cumulative effects of this sale and the preceding sales and road building upon hunter opportunity is displayed in the EA at page 3-5 to 3-6, and at page 3-37, in the cumulative effects discussion of the hiding cover, habitat effectiveness, and elk security issues.

The effects of the alternatives upon recreational activities is shown on pages 3-19 to 3-21 of the EA. The effects were not displayed for every possible recreational activity, but instead were considered using the coarse filter Recreation Opportunity Spectrum analysis, page 3-19 paragraph 1 under Alternative 2.

Forested Vegetation and Silvicultural Systems

7 **"We disagree with the dismissal of some of the issues and concerns which we raised and having them labeled as statements. See page 3 - Purpose and Need - Issues and Concerns, see Items 68 & 69." "It is not enough to embrace the rhetoric that a NEPA document is old,**

so new directions and actions are presumed necessary." "We challenge disposition of issues 120-124 as not being a NEPA "issue". We maintain that it is. The initial prescription was part and parcel of a NEPA document that went through the public NEPA process."

23 "This E.A. has omitted an alternative that would follow through with the 1975-76 analysis and decision to implement three step shelterwood cutting over 3,800 acres to stimulate regeneration and reach a desired forest condition in the lodgepole pine."

Response: The past timber sale decisions and prescriptions were reviewed and considered in developing the proposed action and in this analysis, see EA page 1-2. The scope of this analysis was considered prior to the scoping period, and again after comments were received. These areas are not precluded from being analyzed in the future. Further rationale for this decision is at Appendix B-2, page 5.

24 "According to the EA, reforestation potential is moderate due to the stoniness of the soils... This fact was well hidden in the EA and must be discussed in more detail in the EIS. It would be most helpful if you would discuss the evidence of regeneration from past harvests and other proof and assurances that the forest stands will be restocked within 5 years as required by NFMA."

Response: Field reviews of the proposed harvest units show significant regeneration after the prep cut occurred in areas with sufficient bare mineral soil seedbed and sufficient sunlight, such as the roads and landings. This direct observation in the units is the most compelling rationale. Indirectly, the soils, parent material, and climatic conditions are very favorable for lodgepole pine regeneration. (Despain, 1973)

A silvicultural finding for National Forest Management Act compliance is in the project record, EA page 3-24.

Appendix H, page 15 documents some regeneration results from the surrounding area.

12 "Lodgepole is an even-aged fire species and should be managed as such through strips of patch clear-cutting and securing a propose seed bed source and the accompanying 3-10 year reproduction cycle."

23 "Clearcutting over selected areas within the original boundaries also has a greater potential to more quickly provide hiding cover over time and should be seriously analyzed in the E.A."

Response: See EA page 2-10 for alternatives considered but not analyzed in detail.

16 "Scientific sampling should be done to determine cone serotiny. Open cones can appear closed when casually viewed on the tree from the ground."

Response: A certified silviculturist made the initial determination of cone serotiny during field reviews, including during Stage II inventory. These areas have been reviewed by the Regional geneticist and another silviculturist. The lodgepole pine in the potential Caribou units, particularly the B units, have a very high proportion of serotinous cones for the Bighorn mountains.

12 "Most will blow down anyway." Reference to wind throw issue in shelterwood systems in lodgepole.

Response: See EA pages 3-25 to 3-27 for discussion of windthrow.

17 "One of my concerns is that the old prescriptions from the 1970's were used to help the Forest Service justify this timber sale. Back in the 1970's that information was the best science available. This is the end of the 90's and we have hopefully learned a few things since then."

Response: The previous prescriptions and decisions did not "justify" this sale. See EA page 1-2. They were used and reviewed to help understand the rationale and previous planning for this area.

The forested vegetation specialist report for this project, which can be found in the project file, details how the silvicultural "science", or objectives, for this area changed in response to the public's expectations for National Forest management. In the 1960's, 200+ acre clearcuts were the predominant prescription; in the 1970's, it was a 3 step shelterwood, and in the 1980's it was 10-20 acre clearcuts. These different systems were applied to sites within 1 mile of each other, on identical forest types, with the same soils, climate, etc. At this time, given the Forest Plan standard and guidelines and issues generated by the public, the prescriptions detailed at page 2-2 to 2-9 of the EA best meet the multiple goals and objectives.

25 "My old prescriptions are used as an excuse, even though I wrote you during scoping that they were no longer valid. The area has had far too much treatment in too short a time, something not anticipated when writing prescriptions for individual stands....In addition, I don't think the prescriptions were followed. Mild shelterwood entries were changed to clearcuts. Many of the areas in this EA said to have had a Preparatory Cut have been opened sufficiently to allow regeneration. No sale is needed to get the touted hiding cover. (By the way, The Forest Plan also decided in the hiding cover section that both commercial and non-commercial practices will be used to provide habitat.) All that is needed is prudent scarification and the seedlings will come in, as shown in many small openings for landings, etc."

Response: See the previous response for the excuse, justification, response.

The "too much treatment in too short a time" has been analyzed for various individual resources during the cumulative effects analysis. The decision maker will ultimately decide whether or not the sum total of this treatment is "too much" when she makes a determination of significance. The dominant Forest Plan allocation in this area is 7E, where the objective is on wood-fiber production and utilization of large roundwood. This would be the first non-salvage sawtimber sale decision notice in approximately 12 years in the Clear Creek/Crazy Woman Creek watersheds. The last decision notice for a timber sale, Taylor Creek, was signed in 1985.

Field reviews have shown that objectives of the prep cut were indeed met in the units proposed for harvest under the Caribou alternatives. The spatial (Wyoming Game and Fish change detection map, page 75 of CCLA) and areal (Appendix H, page 18) past timber harvest histories, and the resulting interpretations (WLTF report, page 24-28 of Appendix H) take into account whatever prescriptions may have been changed.

Page 2-10 of the EA documents the decision to not analyze in detail the alternative of conducting regeneration treatments without a timber sale.

28 "No information is provided on what basal area these stands currently support. ... Additionally, we recommend areas designated for cutting which have not been thinned with a prep cut or partial cut should not be harvested in order to maintain existing cover and diversity."

Response: The Stage II from stand 100521-0014 shows a stand average BA of 106 square feet per acre. Field reviews indicate that BAs of around 40 to 60, with scarification, will result in regeneration. The only areas proposed for harvest that have not been previously harvested are the "bathub ring" areas, described on page 2-2 of the EA.

25 "No Stage II data is presented to show BA, cone serotiny, or volume. A few stands were visited; out of date RIS data was looked at; photos were studied; extrapolations were made. This is not proper procedure for silvicultural prescription writing. The cone serotiny issue is particularly puzzling. It is my recollection that most trees in the area have both serotinous and non-serotinous cones."

Response: Stage II analysis was conducted in September 1996 by the project silviculturist on RIS site 100521-0014, which is proposed unit B1. The silviculturist walked all the other units in the area, and a great deal of the surrounding area. The Stage II data was used as a baseline from which comparisons for the field visited units were made.

Stage II data is not required to write prescriptions. Forest Service Handbook 2409.26d states, "The stand examination procedure will provide the information needed to diagnose treatment needs and prepare detailed prescriptions. The kinds and amounts of data gathered and their reliability will depend upon the resources to be managed and intensity of management to be applied. Enough information must be obtained to adequately describe the current condition of the stand or nonstocked area." The certified silviculturist who prepared the diagnoses for the action alternatives walked through each cutting unit; these are relatively simple stands structurally, occurring in primarily a lodgepole pine habitat type; the stands in question are relatively disease free, of uniform size and density, and have similar ground and fuel conditions due to the past prep cut. RIS habitat structural stage and cover type information were updated prior to this analysis.

Concerning cone serotiny, unit B2 has been visited by the Regional geneticist and another silviculturist, as well as the project silviculturist, and there is indeed a relatively high percentage of serotinous coned trees for the Bighorn National Forest. In the B units, 50% or more of the trees are serotinous. The rationale for the prescribed fire treatment is based upon research by Muir and Lotan (1984), "Trees of the two cone types differ mainly in the particular types of disturbance favoring their regeneration." Although the resulting stands will have mixed serotiny, there should be more serotinous cones as a result of the prescribed fire treatment.

29 "The use of clearcuts, sanitation/salvage and shelterwood harvest methods to accomplish the objectives of offering timber sales, improving hiding cover and watershed health will all be accomplished with the proposed actions."

Response: Thank you for your comment.

Economics

15 "The above chart shows not only how the elk have moved out of the area but have created a great decline in hunting opportunities and, thereby, an average yearly loss of \$231,275 of economic benefits derived from hunters using the area. Can the economic development of a community dependent upon tourism and hunting sustain that loss? The BNF needs to

fold this quarter million dollar yearly loss into their economic analysis of this proposed sale."

Response: The economic figure cited here, from the 1991 WLTF report (Appendix H, pages 23-28), is important information on the economic value of hunting and the economic impacts of declining hunter use days. While it can be concluded that reduced hunter use days on the forest will also reduce associated economic benefits, an economic analysis based solely on these figures is incomplete because it does not take into account the "costs" associated with hunting, the benefits associated with the road system, and other variables that affect hunter use days.

Elk hunting in Hunt Area 35 is one of the many uses which has an associated economic value. Forest Plan revision is the opportunity and mechanism for considering the social and economic values and trade-offs and changing overall management area allocations and emphasis.

Further information on the economic analysis used for this project can be found at EA pages 3-27 to 3-31 and at page 3-47.

Other comment letters with this issue are: 8,26,25

16 "Will the timber receipts through 2003 in fact be adequate to pay for the stream and road restoration/closure you propose after PILT and other payments are subtracted?"

Response: Watershed improvement work can be paid for by a variety of sources, one of which is timber receipts. Another is appropriated monies. The analysis shows that timber receipts will cover the anticipated post sale activities, see EA page 3-29 and EA appendix E-1.

13 "Why does the public have to pay the lumber giants for building their access roads? They get big credits of timber for what ever they build by credit of board feet of trees. And who monitors their payoff? Is there any other business so easily funded with our tax dollars?"

22 "Secondly as a taxpayer, it seems extremely unfair that our tax dollars are subsidizing the timber industry so that it can make a profit, while it destroys a resource that is very slow in recovering. It reminds me of the tobacco industry."

Response: This is outside the scope of this analysis. The Bighorn National Forest does not have the authority to make decisions related to these concerns.

Other comment letters with this issue are: 11,12,13,26

Clear/Crazy analysis availability

13 "I'm disturbed by not having sufficient info. available to analyze the impact of these timber sales. The lack of availability of your analysis seemed to circumvent any chance for the public to know what future plans were in the mold."

Response: The Clear/Crazy analysis is a compilation of existing information and is not a planning or decision document. It is standard procedure to have additional information that supports an environmental analysis but is not within the body of the environmental assessment. Maps, specialist's reports, and database queries are among the items included in the project record, but are merely summarized in the EA. During the public

review of a draft EA, only the draft EA, and not the complete body of supporting documentation, is typically circulated for review.

In the case of the Caribou EA, most, if not all of the information in the CCLA, was either available through other sources or was incorporated into the specialist's reports for the Caribou timber sale. This is especially true of the information and data that was used in the Caribou analysis. It is the EA that is the analysis for the timber sale, not the Clear/Crazy document.

Other comment letters with this issue are: 8,14,15,16,17,20,25,26,28

Cumulative Effects

14 "The Crazy Woman watershed has been the site of extensive timber activities since the early 1970's. The Clear Creek/Crazy Woman Creek Landscape Assessment (CCLA) maps (e.g. "Crazy Woman Watershed Tree Removal Activities") reveals that clearcuts and thinned canopy areas dominate the watershed. This extensive cutting is the source of our concerns for ecosystem health in the areas. The EA does not adequately address cumulative impacts (see EA at 3-4 through 3-5) and the BNF should expand on the cumulative impacts analysis."

24 "The EIS must provide a more indepth analysis of the cumulative effects. The EA mentions that there are several management actions currently being implemented within the watersheds, but does not provide adequate discussion of the cumulative effects of these actions along with the current one (EA at 3-14).

Response: The cumulative effects analysis received additional work since the withdrawal of the original October, 1997 decision. See EA pages 3-33 to 3-49.

The Clear/Crazy Landscape Assessment and other documents included in the project file, such as the Tinker, et al. report on fragmentation due to roads and harvest on the Bighorn National Forest comprise a very complete description of the past and existing condition in the area surrounding the Caribou analysis area. Appendix H is about 60 pages from the Clear/Crazy landscape assessment, and includes the summary of the 1991 Wildlife Task Force report and related effects upon hunting days.

The cumulative effects of the proposed alternatives, combined with the past actions and reasonably foreseeable actions are listed in the EA at pages: 3-1 to 3-2; 3-5 to 3-6; 3-7; 3-8; 3-15 to 3-16; 3-17 to 3-18; 3-24 to 3-27; 3-30 to 3-31; and 3-32. The forested specialists report lists harvest activities by decade for the 5 diversity units analyzed for this proposal.

28 "The cumulative effects analysis should evaluate how thinning of clearcuts will affect hiding cover, especially how long it will delay stands from reaching hiding cover."

Response: Walk through observations indicate this thinning has a negligible effect, if any, upon the hiding cover in the 1960's vintage clearcuts currently being thinned. Observations by the Forest and project silviculturists indicate that if it was hiding cover prior to the thinning, it still is. If it was not hiding cover, it still is not. There may be a very small percentage of those areas that had just reached the minimum definition of hiding cover that were temporarily set back to a non-hiding cover condition. However, because of the large contiguous area necessary to effectively hide 90% of an elk at 200', these marginal areas that were set back comprise a very small percentage of the area. In addition, observation

indicates that the trees in these stands are growing in height at about 4' to 10 inches per year, so this "set back" effect will be of short duration, of less than 5 years. Additional information concerning this concurrent action is shown in the EA at page 3-34.

28 "The environmental assessment mentions a timber sale proposal is being prepared for 2000 acres in the Sourdough Creek drainage, one of the few diversity units where hiding cover and elk habitat effectiveness meet Forest Plan standards. The cumulative effects analysis should address how future cuts and timber stand improvement practices (thinning) will affect already inadequate habitat values."

Response: At this time, Sourdough is the only other timber sale identified in the Clear Creek and Crazy Woman Creek watersheds. The number of acres and harvest units are only roughly described, and no proposed action has been developed, so it is not possible to provide precise information at this time. However, the applicable standards and guidelines, effects analysis, and cumulative effects analysis, will be performed on that sale area. The EA for Caribou shows that for the quantifiable elk habitat parameters (hiding cover, EHE and elk security) the Caribou action alternatives will either have no effect or will result in improvements, EA page 3-5 and 3-6. Other potential timber sales on the Bighorn NF are shown at EA page 3-31. This list includes sales that have signed position statements and are not affected by the roadless issue.

26 "We are exporting logs overseas so there must not be a real shortage here."

Response: Although this is outside the scope of this EA, the actual fact is that the United States is a net importer of wood products, in that we produce about 25% of the world's manufactured wood products and use about 33%.

25 "Take travel and watershed decisions out of the EA. They unfairly stack the deck simply because they are coupled only with timber sales. I am in favor of restricting off road travel and implementing watershed improvements, but not in this EA."

"The Forest Service has been severely criticized for putting up sales in order to fund their people and projects. The EA just adds more fuel to the fire for Randall O'Toole's "Forest Watch" and others. Please take these decisions out of this document, or, at least, show the positive effects of doing them with other funds in your "No Action" alternative.... As is, you essentially present only one Alternative - have a timber sale."

Response: A non-harvest alternative could still be selected. See EA page 2-1, "This alternative was developed to serve as a baseline for effects analysis." Watershed improvements and travel management restrictions can occur, after appropriate NEPA analysis, if alternative 1 is selected. The information used for the Caribou analysis could be utilized to analyze other proposals.

One of the primary purposes of this EA is to disclose the effects the action would have, so that the decision maker can decide whether or not this project has significant impacts per NEPA. The only way to accurately assess that is to consider all the actions being contemplated. The initial rationale, described in the EA at page 1-1, for this project is to implement the Forest Plan allocation decision that timber sale offerings would be made, and this is a 7E dominated area. The travel management restriction is a mitigation to the thinning of the stands that may result in increased summer off-road traffic, leading to effects upon the watershed and wildlife. The watershed improvements are included to address the need to improve the watershed health of Pole Creek and North Fork Crazy Woman creeks (EA page 1-3).

14 **"As requested in our scoping comments, we would like to see maps of previous timber harvests including the year they were cut, the regeneration level, and the cover level for each area, before a decision is reached for this sale."**

Response: Page 75 of the CCLA is a map provided by the Game and Fish that shows changes to the forests in the area by time period. The hiding cover amounts for the diversity units analyzed under the Caribou analysis are found at page 3-4 of the EA. Page 15 of Appendix H lists regeneration levels for some sales in the adjacent area.

General

18 **"Prefer alternative 5 over 4."**

Response: Thank you for your comment.

12 **"We are assuming that the off road motorized travel parcel does not include the road to sheep mountain lookout."**

Response: The Sheep Mountain road will remain open.

19 **"Multiply [sic] use as reported to your office by the Big Horn Users Coalition should be adhered to, so as not to be solely [sic] the option of the timber industry."**

Response: Multiple use considerations were taken into account in the design of the alternatives. Hydrologic, wildlife, visual, and recreation uses, as well as timber uses, were resource areas emphasized in the alternatives.

24 **"An EIS is required."**

Response: The decision maker will make this determination.

24 **"The most recent scientific research recognizes that areas of high road densities are often correlated with poor forest health and water quality....While the EA does not mention what the open and total road densities are for the project area, it appears that they are relatively high. Please include the this [sic] information in the EIS."**

28 **"This research indicates elk on the Bighorns are more selective against roaded areas than previously believed."**

Response: Road densities, and their effects on various resources, have been taken into account in this analysis:

1. Page 1, Appendix H: A description of the road situation in the assessment area, and the effects upon water quality and aquatic habitat are discussed. The roads built in these watersheds have had, over the years, several cumulative effects upon the water resource. Concerning the Caribou analysis, the rationale for how the cumulative impact of alternatives 2-5 is added to the existing effects of roads is shown at page 3-15 and 3-16 of the EA.
2. Page 31, Appendix H displays the effects of roads (combined with cover attributes) on elk security areas. Page 28, Appendix H displays a table showing how road densities, combined with hiding cover, effects elk habitat effectiveness. The effects of declining elk habitat effectiveness on hunter days is shown in Appendix H pages 23-27. The effects

of the Caribou analysis alternatives upon elk security and elk habitat effectiveness are shown in the EA at pages 3-5 to 3-6, and at page 3-37.

3. Page 3-11 to 3-13 of the EA list the effects of roads have upon certain parameters that constitute and affect the aquatic ecosystem.

Tinker, et al. (In press) documents that while the Clear Creek and Crazy Woman Creek watersheds have had considerable fragmentation due to past harvests and roads, the Piney Creek and Rock Creek watersheds to the immediate north have had very little to no fragmentation due to roads, or timber harvest. This analysis provides a context as to the amount of road fragmentation effects at a larger scale. This report is included in the project record.

Concerning road density and the correlation with the spread of exotic grasses, weeds, etc., the alternatives considered in the Caribou timber sale analysis will have no effect to a slightly beneficial effect as the net result is a closure of about 1.6 miles of currently open roads and trails.

25 **"How can the Forest make timber sales without a viable ASQ?"**

Response: Based upon the analysis and work done between 1990 and 1994 on the ASQ Forest Plan amendment, an administrative decision was made that 4-5 MMBF would be offered annually prior to Forest Plan revision. However, based upon policy, legal requirements and Forest Plan implementation guidelines, sales will not be offered that violate the standards and guidelines. Therefore, the effects of this timber sale cannot be judged against the ASQ level, but must be judged against the standards and guidelines.

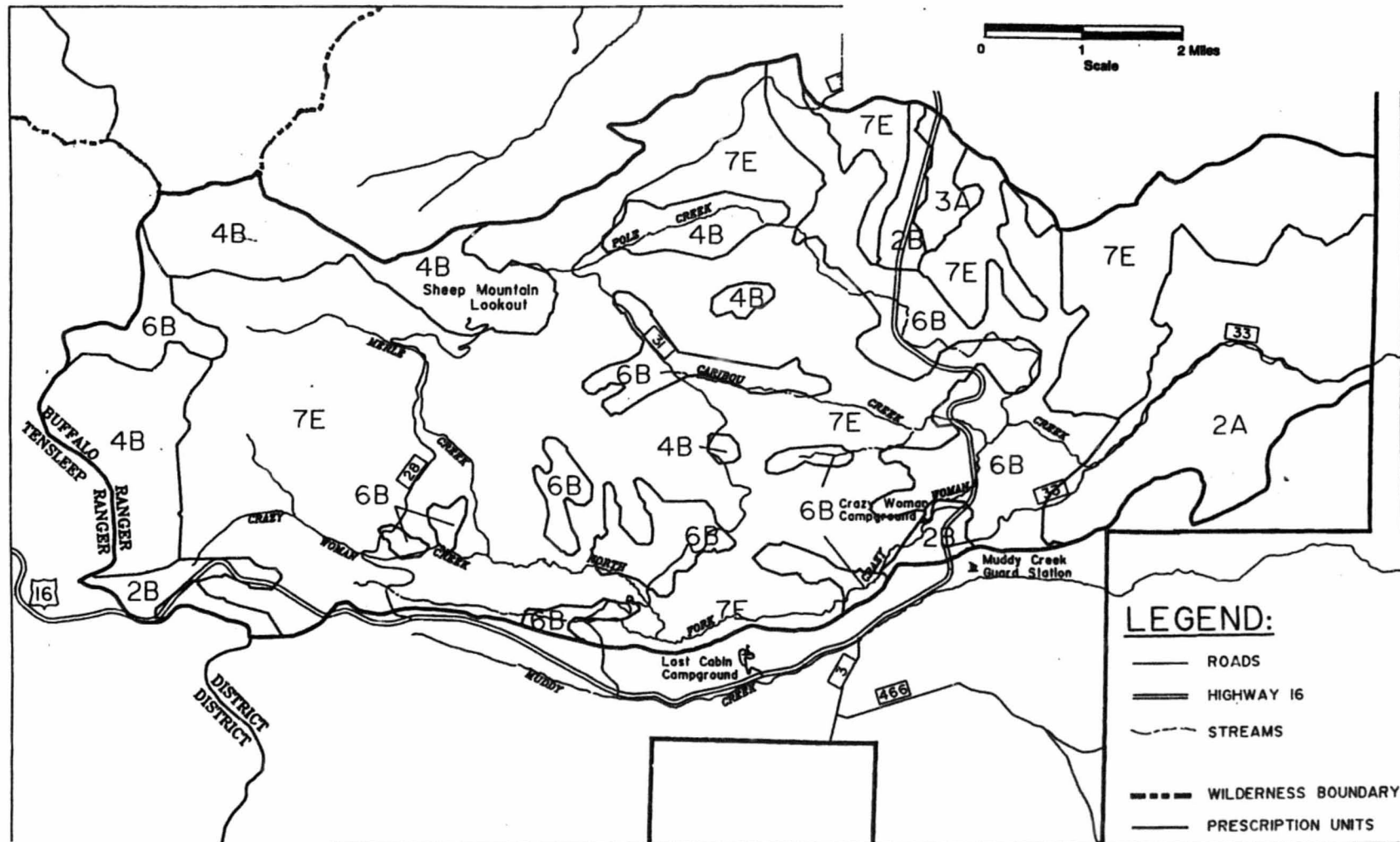
Other letters with this comment: 28

25 **"It is difficult, if not impossible, to tell the criteria for making decisions."**

Response: If there are no significant environmental effects, the rationale and criteria for making a decision will be documented in the decision notice.

FOREST PLAN MANAGEMENT PRESCRIPTIONS

This is an approximate map of the Forest Plan Management Prescriptions for the diversity units in the Caribou timber sale analysis area. Please note that this map does not show the location of 9A prescription areas, which are defined in the Forest Plan and on page 1-2 of the Environmental Analysis.

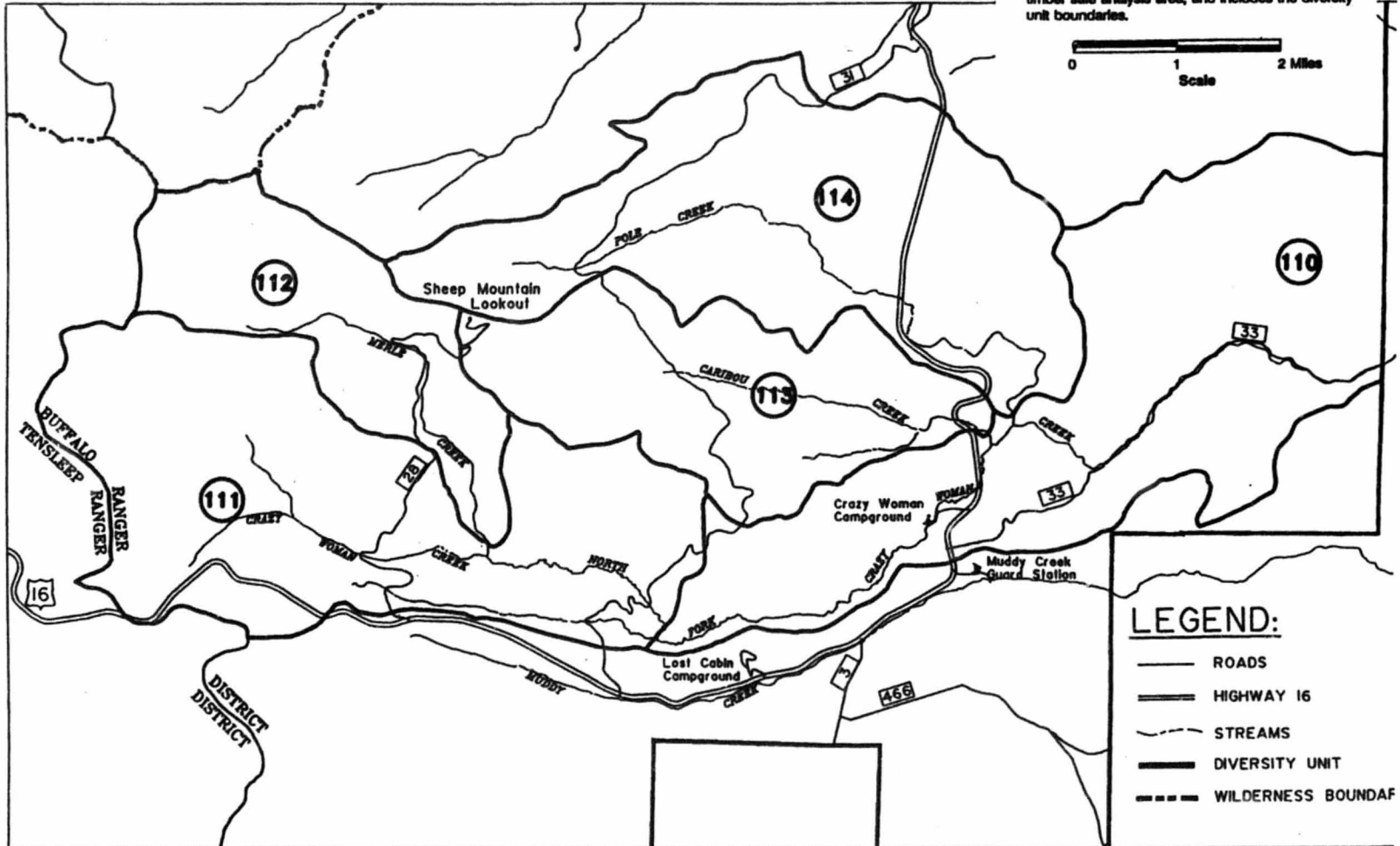


DIVERSITY UNITS

CARIBOU TIMBER SALE

DIVERSITY UNITS

This is a map of the general vicinity of the Caribou timber sale analysis area, and includes the diversity unit boundaries.



APPENDIX: B - ISSUES FROM SCOPING

List of Issues Raised B - 1
Grouping and Summary of Issues B - 2

List of Issues Raised B - 1

Issues - Caribou Timber Sale

This is a complete list of the issues developed prior to the 2/12/97 ID team meeting. They are grouped by resource area, and the grouping at this point is simply to aid thought organization, issue tracking, and the final issue development. This list was used by the ID team to group and summarize issues, and to determine which ones were actually not NEPA issues. The external issues have a number next to them so that the ID team members could find which letter they came from, if questions arose as to context.

RANGE:

Internal: - Transitional range/forage; barriers to movement/slash; trail/driveway creation; sharp stumps.

External:

1. "The mailer mentioned transitional range. This would be in direct conflict with the need to regenerate for at least ten years." Don't leave slash in meadows, why are livestock in timber? (1)
2. "As livestock operators on the grazing allotments adjoining these sale areas it is essential that livestock grazing management practices be recognized and that timber contracts recognize that coordination and communication with the allotment permittees is absolutely an issue as both of these managed activities allegedly affect the riparian zones, wildlife habitat and water quality of these drainages." (2)
3. "The EA should disclose the sources of potential introduction of noxious weeds. Control methods and techniques to discourage introduction of noxious weeds must be discussed." (3)
4. "Based on scoping Document, this issue should not require detailed analysis." (4)
5. Agree with FS scoping issues. (2)

WILDLIFE:

Internal: - Elk Bull:Cow Ratio;
- Hiding Cover
- Security Areas
- Adjacent Ownership
- Economic opportunities from WL
- Recreation opportunities from WL
- Snags

External:

General

6. "Also, we ask that you adequately evaluate the impacts of the proposed timber sale on elk habitat, hunter opportunity, neotropical migratory bird habitat, and TES species of plants and animals." (5)
7. "How will this sale affect other large game animals?" (1st reference to elk) Stand is critical cover - how will sale affect hunter days? (6)

8. "Enhance wildlife habitat by increasing forage production" (7)

8.5. Scale: WLTF recommended that elk habitat effectiveness analysis be conducted by DU, groups of DUs, and hunt area scale. (8)

9. "Wildlife issues will require analysis to assess affects of alternatives on WL populations and to measure consistency with forest plan S&Gs. Details such as elk bull:cow ratios are only tangentially related..." (4)

10. "It is doubtful that timber management activities alter elk bull and cow ratios" (9)

11. "Logging operations in elk parturition areas should be terminated between May 1 and June 30" (8)

12. This proposal is in the spring/summer/fall and parturition range of SE Bighorn elk herd unit, spring/summer/fall range of North Bighorn Mule deer herd unit, and yearlong range of moose herd unit. "Our management direction has been to increase the populations of all species in the project area." (8)

Hiding Cover and Impact on elk

13. "We question the practice of trying to increase hiding cover for elk by removing trees in an area that presently does not meet Forest Plan standards and guidelines for elk hiding cover." (5)

14. "Elk cover in shortest time frame possible" (10)

15. "How will this sale affect Elk (indicator species)?" (6)

16. "Promote future hiding cover by removing overstory to promote and establish regeneration" (7)

17. "The hiding cover and security areas are of less economic importance in these areas and probably should not be a priority management concern." (2)

18. "You have pulled one standard from the Forest Plan - Hiding Cover - and chosen to look at the negative view. So, it isn't optimum cover now, but it will partially hide elk." "A better move would be to scarify and/or plant existing openings to head toward the desired future condition immediately. Don't further reduce the cover." (1)

19. A lengthy discussion, with data, of wildlife task force information, past harvests on elk hunter days, elk security, hunt area 35, road stress on elk, need to protect bulls through limited quota licensing, urge adoption of 30% elk security standard. (11)

20. "The environmental analysis must discuss how these standards can be met as expeditiously as possible.", in reference to lack of hiding cover. Provide time frame for compliance, and why this cannot be met sooner, and justify not meeting the standards for the length of time in noncompliance. (3)

21. Will the EA explain the contradictory and seemingly nonsensical approach concerning the fact that area does not meet hiding cover standards now, and a timber sale is being proposed to create hiding cover decades sooner than if the stands are left alone. Include discussion of existing cover in stands on roads and landings, and thermal cover. (3)

22. Comments and statements on fact that harvest will initiate regeneration (Cover), but will lessen hiding cover currently existing. Request made to run HABCAP for pre-, during, and post-treatment stages. (8)

23. "The analysis should examine how additional loss of hiding cover and habitat effectiveness will be mitigated. Although stands in the shelterwood cuts currently do not meet hiding cover criteria, they do provide more cover than shelterwood cuts following the seed cut." (8)

24. "Wildlife habitat hiding cover will be created sooner by this regeneration cut." Short term impacts is not a concern when measured on a forest wide basis. "Doing what is best now for the timber resource is also doing what is best for wildlife." (9)

25. ELK: elk hunt area 35 greatly affected by past timber and roads. WLTF conclusions. "The proposed remedy (timber harvest) for elk habitat effectiveness and hiding cover deficiencies is also the primary cause of these problems." (8)

Diversity

26. "The FS must consider how each proposed alternative effects biological corridors." (3)

27. "Spruce/fir stands are very limited on Buffalo RD. Therefore, they should be retained for WL habitat and diversity values."(8)

28. "The best plan for wildlife would be to use harvesting or other techniques to create a good balance between old growth habitat, meadows, and openings, and younger growth of diverse age groups while preserving riparian and wet areas" (5)

29. "Another forgotten standard (the head liner in the Forest Plan S&G's) is **Diversity**. Continuing to treat this whole area all the same destroys the chances for diversity." (1)

30. "The NFMA requires FS to "provide for diversity of plant and animal communities."" Especially given that the units involved are below standards and guidelines for hiding cover and the extensive created openings from previous sales, the maintenance of viable populations and the support for biodiversity must be extensively covered in the EA." We urge the FS to cooperate with WYG&F, FWS, and EPA. (3)

30. "Additionally, the EA should discuss management practices that emphasize the need to establish vegetative diversity in the project area. The EA should address how this project could encourage diversification rather than maintenance of the predominance of lodgepole pine." (3)

30. Timber age diversity: comments on adjacent clearcuts are 27 years old, will not be mature for 100 years. "Diversity of timber age stands in these areas may be inadequate." (8)

MIS, other species

31. "We would like to see an analysis of the effects of the proposed activities on forest indicator species for this type of project." (5)

32. EA should fully consider...not only wildlife cover, but also indicator species and special areas of wildlife concern, e.g., calving areas, migration paths, salt licks, elk wallow complexes, etc." EA should "...include an analysis of the effects of the proposed activities on all forest indicator species." Include monitoring from previous sales, and their effects on indicator species. (3)

33. "The EA should include nesting surveys for goshawks, Great Gray owls, eagles and other raptors." Should be completed prior to fledging, end of July. (3)

34. EA should include inventories of each TES animal species in the area. Analysis needs to include cumulative effects of all past treatments.(3)

Snags

35. Snag management and recruitment needed. Recommend girdling, especially away from roads, and closing roads after cut. (8)

36. "Assess wildlife use of existing snags and retain the snags and number of snags recommended by your wildlife biologist." (5)

37. Healthy forest requires certain level of insects and diseases. By removing snags, you remove natural control agents, such as woodpeckers, and only increase chance of epidemic. (1)

38. "According to the Scoping Document, there are few snags in the project area. The EA should discuss the sale's snag management, i.e., the size, frequency, and location of wildlife snag patches, how the sale's snag management will meet wildlife objectives and general snag management for cavity nesters." Need to provide snags and large woody debris throughout rotation. (3)

39. "Based on casual observations, there does not appear to be a shortage of snags in the DU." (4)

Road density, Fragmentation, Habitat impacts by roads

40. "In addition to the detrimental effects of timber cuts, we are also concerned about the intrusion of roads into security cover." Requests security cover analysis and mitigation. (3)

41. "The lack of hiding cover and the previous extensive cutting combined with the proposed sale, create significant concerns about the fragmentation of wildlife habitat, specifically security cover. There is broad consensus among biologists that long-term protection of viable populations requires large reserves..." "Roads and logging are major causes of fragmentation. This sale presents many concerns regarding fragmentation..." "Specifically, the EA should analyze and discuss security cover requirements for wildlife species such as deer and elk. The effects of fragmentation on species such as songbirds and goshawks should also be discussed." (3)

42. Impact of roads well documented. Several citations. "We suggest all spur roads be closed and barricaded and the off-road travel designation be revoked to promote wildlife habitat and watershed values." (8)

43. WLTF report sez HABCAP not accurate for habitat effectiveness, need to include impact of roads. "Please use the new model for the analysis and consider carefully the value to elk security of closing roads after harvest." (5)

44. "Has the Forest Service maintained a complete and current road inventory, which accurately identifies system and non system roads?" followup on impacts of these roads in this area of the forest. "How many miles of roads will be created for this timber sale." (6)

45. "Our concern is that the open road density will have potentially significant impacts on elk security, wildlife habitat effectiveness, game vulnerability during hunting season, erosion and water quality." EA should fully discuss all impacts, and a full range of roading alternatives to protect the resources. (3)

46. Recommend comprehensive quantitative inventory of all the roads in the area. Would like to see GIS analysis and maps. (3)

47. "The discussion of roads is misleading. First of all, a well-planned and constructed road network is a prerequisite to forest management and to implementation of the Bighorn LAMP." "The habitat disturbance associated with roads is related primarily to use of the roads by people, especially during hunting seasons." (4)

HERITAGE/CULTURAL:

Internal: Sourdough: Tie hacking; Interpretive opportunities.

External:

48. "Any timber sale will comply with all necessary laws." (9)

49. "Has this and surrounding areas been on ground surveyed for archeological sites?" and followed all procedures (6)

50. "An opportunity is seen for compliance with laws and regulations for surveys and clearance. Were all the ten or twelve other sales in this area not in compliance?" (1)

51. "This issue should not require detailed analysis unless surveys determine potentially significant sites" (4)

52. "This area used to have a lodge and cabins. has any history of the Caribou Camp been preserved." (12)

WILDERNESS:

Internal: Buffer zone, noise.

External:

53. Should not count old growth in Wilderness to meet 5%. (13)

WATER AND AIR

Internal: Sediment and water yield; wetlands; air quality from activities; TES plants.

External:

Soil productivity

54. "Leaving downed woody material in addition to benefitting soil and wildlife, offers protection from soil movement and seedlings." Also protects grass and forbs. (14)

55. "How much organic matter is needed?"... to insure nutrient cycling and future soil productivity in terms of nutrients. (5)

56. "Wood removal over a number of rotations can have a long-term negative impact on forest productivity, especially on sites low in nitrogen." (11)

57. "The EA should include a soil survey map of the proposed sale area. Any harvest activity including road opening or improvement planned in an area or unstable soils should include mitigation measures. (3)

General Watershed

58. "Based on scoping document, this issue should not require detailed analysis. The EA should incorporate BMPs and Watershed Conservation Practices Handbook by reference. (4)

59. "We request a careful analysis of erosion and harvesting impacts to wetland and riparian areas, and the impacts to fisheries and water quality, including considerations of sedimentation, channel/bank stability, and increases in stream water temperature and flow." (5)

60. "Increase water yield by creating openings in the management area"(7)

61. "There is concern that logging activities and tree removal may cause erosion on the steep slopes surrounding the sale. This concern is exacerbated by the potential effects of erosion on the Crazy Woman Creek and Pole Creek at the bottom of the steep slope. Could this sale result in sedimentation of the Crazy Woman or Pole Creek". (These concerns are tied into having LA not complete.) (11)

62. "Given the primacy of riparian areas for ecosystem health, WOC is very concerned with the proposed sale's potential impacts on riparian areas." Exclude and protect; consider all effects; utilize FP S&G's in analysis. (3)

63. "In addition to water quality, the EA should carefully analyze the project's impact to fisheries." Include sedimentation, channel stability, water temperature increases. Current condition of fish habitat, including spawning and pool habitat. Include baseline, current and predicted sediment loads. (3)

64. Wyoming G&F provides some information concerning fisheries in area, including a Bighorn National Forest Decision Memo dated March 1, 1995 concerning fisheries in North Fork of Crazy Woman Creek. "Based on the above information, we do not support any timbering activities in this area until watershed conditions improve."(8)

65. "Pursuant to the Clean Water Act, ..., the Forest Service must comply with state water quality standards." "Impaired waters require a TMDL." Numerous state DEQ regulatory citations. (3)

66. The EA "...should discuss how this sale will implement the..." BMP for silviculture as developed by DEQ. Include effectiveness, funding, including non-timber sale funding, specific locations. Include monitoring plan. Include road building and road use effects, not just logging. Treat any water quality restoration activity separately, so that actual impact of logging on sediment loads is clear. (3)

67. Which watershed, what damage due to sedimentation will occur, granitic soils, watersheds are priceless, what research has been done to document the impact of logging to watersheds? (12)

68. "Sediment will not be a problem. The Forest plan is already operating on a selected alternative that meets all forest S&Gs relative to harvest levels. It is quite doubtful that a sale of this magnitude would violate those standards." (9)

69. "Air quality, wetlands, and water yield are not of concern." (9)

TES plants

70. "Has an inventory been done on plant species?" "Are there any T/E plants in this area?" (6)

71. "The EA should identify potential habitat for threatened, endangered, and sensitive plant species." And effects, by alternative. (3)

RECREATION:

Internal: Dispersed campsites; impacts and opportunities
Trail Uses: ATV, snowmobile, foot
Roads from dispersed recreation aspect
Firewood opportunities

External:

72. "Closed roads could be opened for firewood cutting, one or two at a time when roads are firm and elk calving is over" (10)

73. "Are the abandoned roads abandoned from use? Or just from upkeep by the Forest Service? Because I know that many motorcycles and 4-wheelers love to go out on this type of road." (6)

74. "Leaving the District open to off-road travel negates any written closure. This heightens the need for hiding cover. I think your first move should be to restrict ORV's to roads, motorized trails and direct transport of hunter kills if ground is frozen." (1)

75. Notes old-growth characteristics for recreation, large trees. (1)

76. Based on scoping document, this issue should not require detailed analysis. (4)

77. "Past sales have been winter projects"... due to accessibility. Notes increase in ski and snowmobile use since 1970's. (1)

78. "The EA must consider the project's impact on recreation. It must discuss how the Forest Service will prevent motorized recreationist from using now closed roads that will be opened during harvest. (3)

79. "What effect will timbering, including hauling, have on tourism in that area." Buffalo Bulletin said C of C interested in CGs, no one camps in clearcuts. (12)

VISUAL:

Internal: Sheep Mtn. view, scale of mgt. activities - re: naturally appearing landscape.

External:

80. Based on scoping document, this issue should not require detailed analysis. Meet forest plan VQO. (4)

81. "Protecting the Pole Creek Road corridor" different mgt. for aesthetics (10)

82. "...mature and overmature timber stands. These should be timbered out as soon as possible so that standing dead trees are not part of the scenery..." (15)

83. "Problems with visual areas should not be a major problem where newly seeded or replacement trees are provided in a good reforestation plan. (15)

84. "Much of the area is right along the much-used Pole Creek road. The old cuts have finally healed and look fairly natural." Then, after this harvest, OR to follow. (1)

85. "If view from Sheep Mountain is an issue, it can only get worse with more holes in the canopy." (1)

86. "One component of the consideration given visual quality should be the role it should play in education of the public on forest management. Hiding a timber sale does nothing to enhance public appreciation and understanding of forest management." Allows public to understand that production and consumption are tied to the utilization of natural resources. (9)

FUELS:

Internal: Structure protection, past activities, vegetation patterns/distribution.

External:

87. "This proposed activity will help prevent 1000 hour fuel buildup." (9)

88. "There is no need to remove slash if habitat cover is needed in the areas." If all slash not necessary, allow for fuelwood opportunity. Provide small game cover. (15)

89. "Fire should not be used as a management tool..." due to NF history of escaped fires. (15)

90. "Reduce fuel loads in sawtimber stands" (7)

91. Based on scoping document, this issue should not require detailed analysis. (4)

VEGETATION:

Internal: Past activities, structural stages, aspen management/retention; current condition; insects/diseases

External:

Reforestation

92. Existing regeneration on "abandoned roads and landings will have to be destroyed" seems to be counterproductive. (5)

93. "The roads are said to be regenerating, so will these roads be used by the loggers and once again need to regenerate? Very strange." (6)

94. "If you are looking for regeneration, leave the old roads and landings alone! Don't set these back twenty years in the cycle." (1)

95. "...winter logging should not have been allowed. Your own statements admit scarification is the key for regeneration, which can be done without a timber sale." Use KV or appropriated funding for regeneration prior to any harvest. (1)

96. "I have observed in one area of Caribou the regrowth of a variety of small evergreens. With two further stages of logging proposed, what damage will be done to this regrowth?" (12)

97. "If this project is designed to promote lodgepole regeneration, destroying established stands seems counter-productive" (8)

98. Consider other options, such as scarification, allowing clearcuts to regenerate, in lieu of timber harvest to get hiding cover. FS needs to id minimum amount of BA removal needed to initiate regeneration. (8)

Silvicultural system

99. "...the prescriptions you are using are outdated! I know, because I wrote them..." Based on get the cut out, and assumption that "...whole area wouldn't be treated at once." (1)
100. Poorly managed slash after sale has been the only cause of insect buildup in commercial tree species in 25 years of experience on Bighorn. (1)
101. Lowering BA from 100 to 60 does not emulate natural pattern of fires (1)
102. "Since the forest plan was adopted after initiation of shelterwood harvesting, it doesn't appear that detailed analysis is necessary." Utilize LRMP standards for analysis. (4)
103. Emulating historic landscape patterns and habitats: "This argument that timber sales can recreate the historic role of fire has little to no scientific credence." Describes how structural stages, soil/nutrient processes and coarse woody debris cycles created by fire in past cannot be imitated by timber harvest. (3)
104. "In regard to the Purpose and Need, the LRMP for Bighorn NF does not direct that management activities should emulate historic landscape patterns and habitats." (4)
105. Use other methods, other than timber sale, to increase snag and coarse woody debris habitat. Must provide protection measures for these resources no matter what method. (1)
106. "small clearcuts would be more feasible than the shelterwood proposal", because of elk cover, slash manipulation, less mistletoe. (10)
107. Continue 3 step shelterwood. Improve forest health through harvest and reducing mistletoe and comandra rust. Provide future forest by securing LP regeneration. Utilize products or face loss to fire/disease. Diversify harvest prescriptions where appropriate, especially patch clearcut where mistletoe or windthrow. (7)
108. "Three step shelterwood is a common practice with Ponderosa Pine. However, we have had problems with windthrow in LP near that area. Given the low BA needed to obtain natural regeneration in LP, partial cutting at least in the most susceptible areas may not be advisable." (14)
109. "Implementation of second step is behind schedule." (7)
110. "Do not limit the harvesting operations to 'conventional equipment' as mechanical harvesting can meet or exceed timber sale objectives." (7)
111. "I am very concerned at what appears to be consideration of limiting timber harvest to conventional equipment in order to ensure adequate levels of downed woody material for soil productivity and wildlife habitats." (4)

Insect, Disease, Forest Health

112. "We feel that the beetle danger is to be very high this year and for several years to come." (15)
113. Mistletoe in stands - will Shelterwood work? Windthrow risk in LP. (14)
114. Healthy forest requires certain level of insects and diseases - see snags. (1)
115. "Insect and disease will better be kept in check via this timber harvest."(9)
116. "Disease of timber stands in the Bighorns is rampant and the waste of unhealthy trees is not smart management." Healthy range is important, too. (2)
117. "Forest Health on the suitable timber base is more significant than ever."(9)
118. Points out seeming contradiction in scoping document that amount of I&D in area is relatively light, that forest health is a rationale for sale, that scoping statement says that traditionally forest health concerns would treat against I&D. (3)
119. "...the environmental analysis should discuss the important roles bugs, disease and fire play in enhancing forest health."(3)
- Should be considering 3500-3800 acres, all of 4 past sales**
120. "The decision to be made should be how to continue the implementation of the 3 step shelterwood harvest from the Link, Rock Knob, Pole Ridge, and Crazy Woman timber sales to meet the Goals and Objectives of the Bighorn NF L&RMP." "It is inappropriate for FS to arbitrarily limit consideration of timber harvest to only 1500 of the 3500 acres where shelterwood harvest was initially implemented in the 1970s."(4)
121. "Proposed action is too small to achieve forest plan objectives." 3800 acres originally prescribed in Pole Ridge, Link, Rock Knob, and Crazy Woman. 2000 acres are left untreated by this proposed action. That is not consistent with scientific silviculture, is an "inefficient use of taxpayers' dollars and lost/wasted resource." "Treating all intended acres as called for in original silvicultural prescriptions will produce the DFCs and comply with S&Gs. Actions which have negative cumulative impact of degrading the suitable timber base violate both the forest plan and intent of NEPA". "Compromise the validity of silviculture prescriptions with negative public perceptions and policy ramifications."-this has to do with not completing prescriptions, and leaving stands in less than S&Gs. (9)
122. "Treat the entire acreage as planned and implemented in the mid 1970's. Limiting the treatment to 1500 acres does not coincide with extensive, previous planning or contribute to forest health or fiber production i the 'entire' management area" (7)
123. "Today we support your proposal to follow through on the second step of this process which the Forest Service initiated over 20 years ago..." "We support implementation of step two on the 3500 plus acres..." for following reasons: increase FS credibility, maintain investment, provide goods and services to community, recent advances in mechanical harvesting. Main comment is complete shelterwood implementation on entire area envisioned in 1970's planning efforts. (16)
124. "If it is geographically, physically, and ecologically logical to consider vegetative treatment on more than just the acres currently proposed for Caribou, I believe we should do so under one EA. Geography, biology and past history would be a better guide to defining the area of consideration than acres of cultural clearance. I am not proposing necessarily that we treat all 2500+ acres but since we have additional acres in the vicinity that is supposedly in similar condition I feel it should be addressed now. (17)

Old growth

125. ID DUs in sale area. "Do they meet the present 5% required OG standard?" Need field verification, update RIS, quality OG, 10% need in ASQ amendment, pine marten and goshawk, interior forest, sale area seems to have plenty of edge ecotone, fragmentation of OG. (5)

126. "What about old growth is in this area? What is the percentage of old growth?"(6)

127. "In addition, OG is lacking in the affected diversity units. Buffalo RD should identify how this proposal affects the potential of this area to meet old growth standards as required by the Forest Plan."(8)

128. "The major concern here is the lack of 'old-growth'." Only at edge of these DU's, if any left. Recruitment old-growth modeling needed. (1)

129. "The BHF needs to plan for old growth." Leave some of the wood for 150 years, keep 2nd story to maintain diversity. Pine marten, old growth dependant, needs protection as a sensitive species. "The BHF does not have any studies on how much old growth is left in the area." Provide for future OG. (11)

130. "The Bighorn is notoriously lacking in old growth." Discuss how the EA will effect and enhance the area's stands of old growth. Discuss the importance of old growth to wildlife and ecosystem health. (3)

131. "Old growth values are realized when silvicultural prescriptions are appropriately applied. Old growth S&Gs are certainly met over thousands of acres on the Bighorn NF."(9)

SPECIAL USES:

Internal: Cabins, resorts, events, powerlines, lodges, etc.

External:

132. "Is this area used by outfitters?"(6)

133. "This issue should require only a cursory analysis to develop appropriate mitigation measures for any affected special uses. (4)

ECONOMICS:

Internal: Demand for various products: post and poles, sawtimber, houselogs, firewood.

External:

134. Based on scoping document, this issue should not require detailed analysis. "There does not appear to be a need to analyze economic opportunities from wildlife, recreation, fishing, grazing, etc. since those have been examined in the Bighorn LRMP and are not germane to this project decision." (4)

135. 'establishing a good sawmill type wood product' (10)

136. Mature and overmature timber for logging opportunities (15)

137. "Provide needed goods and services to local communities" (7)

138. "Is the Forest Service willing to assume the liability for the local economy?" What if the mill shuts down? Who is responsible for defaults? Buffalo's mill doesn't bid on FS. What is Local? (1)

139. Comment that timber sale economics usually override economic benefits of other resources. (12)

140. "Economics: i.e., Community stability is a recognized timber sale benefit." The discussion is on economic benefits of sales.(9)

141. "Economic opportunities in the market place affect both the timber industry and livestock industry...Scoping and red tape are a real hindrance to efficient planning of management and marketing of the products be it board feet of lumber or pounds of livestock or carcasses of big game animals."(2)

142. "The above chart shows not only how the elk have moved out of the area but have created a great decline in hunting opportunities and, thereby, an average yearly loss of \$231,275 of economic benefits derived from hunters using the area." (11)

143. Local community stability is not a requirement of the U.S. Forest Service. Documentation from OGC~~er~~ provided that supports this. In addition, timber harvesting causes less stability by negatively impacting other economic benefits. (11,3)

144. "Concern is noted that timber sales on the Bighorn Forest are at an all timber low and wildfires are apparently preferred to managed timber cuts. Jobs and access of a natural resource are critical to the economic environs of the eastern slope of the Bighorns." (2)

145. Comments on small timber companies, and local companies, vs. Wyoming sawmills of Portland OR. (12)

OTHER THINGS:

146. "I am concerned that this timber sale will damage soil, water, wildlife, plant, recreation, and scenic resources." (18)

147. General comments in support of proposal and timber harvesting in general. (19)

148: - cumulative effects.(5)

- "we suggest the EA include a map of the affected watersheds which identifies all past timber sales..." which will aid cumulative effects analysis. (8)

- Concern about 'overharvested throughout the years'. How many other timber sales in past 15 years. "When will this area be suitable to harvest again?" "How well have these other: adjacent timber sales regenerated?"(6)

- "You have to be kidding! Another timber sale on the 'butchered' Buffalo District?" Lists several other sales(1)

- "This is too much logging in too confined an area - being offered too soon." "The plan is out of date." (11)

- "In light of the history of extensive timber harvesting in the area, an in-depth consideration of cumulative effects must be included in the environmental analysis." (3)

"In general, past timber harvesting and extensive roading in the Caribou Sale area create significant concerns regarding elk and deer vulnerability, security and habitat effectiveness." Discuss cumulative effects in EA. (3)

"In my opinion, extensive timbering in this area is a mistake (and has been) both economically and esthetically." Cites WLTF report, and economic loss to hunting. (12)

The proposed project is located in an area that has been heavily timbered with shelterwood and clearcut harvests. (8)

Timber industry has proposed harvesting the 2000 other shelterwood acres in area; is Buffalo RD proposing that to increase hiding cover? (8)

...effects of the combined thinning and proposed action should be analyzed to determine the impacts on WL habitat values.* Re: caribou mesa and other precommercial thinning in area. (8)

149. Comments on incompatibility of logging on Bighorn mountains, incompatible with other resource uses. (12)

150. Utilize R2 streamlining strategy.(4)

151. *The initial issues developed by FS personnel should be carefully screened to ensure that detailed analysis is limited to the minimum necessary to make an informed decision. NEPA does not require exhaustive analysis...*(4)

152. - mitigation measures, including effectiveness, funding.(5)

153. *-Aspen regeneration should not be the focus of the Caribou timber sale either inside or outside the sale area on the suitable base.* *Timber sales should not be structured to have the negative cumulative effect of reducing the acreage of commercial species.*(9)

154: - We provided comments to LA, concerned that timber before LA done. "...proposing this action before completion of LA is premature.*(8)

- Extend comment period due to LA not done. separate response.(5)

- Points out LA not done, why do analysis if your mind is made up? Don't just follow timber beast. (1)

- Concern that LA not done, and much of analysis in that could help in analysis of caribou timber sale. (11)

- FS not willing to reschedule public meeting, ostensibly because cody lumber there, shows where public ranks. Not really seeking public input. (12).

- Why is area to be logged already picked when LA not done. (12)

155. *My assumption is that with the FS cutbacks and the scrutiny logging roads are getting (i.e. the so-called corporate welfare) you have chosen this area because it is heavily roaded already.* (12)

156. Comment on lack of fire history knowledge, timbering increases possibility of wildfire, frivolous to log more where logging and fires so frequent in past. (12)

157. - Bird list ("Watch List") included from Bighorn Audobon

158. - *Improve camping area by crazy woman creek bridge; also by caribou creek camp area.* (10) (NOTE: a CG by crazy woman crossing was envisioned during past sale planning.)

159. Support for caribou timber sale, items described in scoping document appear to cover issues. (20)

160. *Reallocation of the suitable timber base should not be attempted through this effort.* This is really addressed to LA. (9)

161. There is a perception that the schedule of planned activities for the Bighorn covering the first quarter, by saying that caribou is up to 1500 acres, is predecisional and we are wasting publics time, not really scoping. (21,9)

162. Comments on Sourdough TSI unit looked at during August field trip, not in current proposal (8)

163. Wyoming G&F has about 1-2 pages of specific sale design, road management, and reclamation mitigations and comments. There are 20 specific recommendations, some of which match, and some of which do not match, current forest plan S&Gs.

Grouping and Summary of Issues B - 2

Issue development: 2/12/97 caribou ID team meeting.

The first step in the issue development was for Bernie to make complete list of all issues people voiced during scoping procedure. Then ID team at meeting went through the list, and briefly summarized and combined those issues. This chart is the result of the ID team grouping and summarizing issues, and arriving at a disposition of others that are not issues, or are not appropriate for analysis at the project NEPA scale. These summary issue statements form the organization for Chapter 3, Alternatives, in the environmental analysis.

<u>Issue Statement</u>	<u>Which individual issue is this?</u>	<u>Disposition</u>
What are grazing effects upon regeneration	1	Included in summary issue statement.
How will proposal, during and post sale, affect livestock mgt./permittees.	2	Included in summary issue statement.
What will be the effect of the proposal on noxious weeds?	3	Included in summary issue statement.
sharp stumps	internal	Relates to precommercial thinning more than commercial timber sale - Not analyzed.
Trail/driveway creation	internal	Outside purpose and need, could be another project. Not analyzed.
	4,5	Not issues, they are comments.
Summary issue statement: What effect will the proposal have upon the range resource and livestock management?		
Cumulative effects on elk hiding cover and elk habitat effectiveness.	6-9,11-25	Included in summary issue statement.
Effects of roads on elk security and the effectiveness of road closures.	40,42,43,44,45,46,47	Included in summary issue statement.
Effects on structural diversity & how that effects wildlife habitat.	27-30	Included in summary issue statement.
Effects on nesting habitat for raptors	33	Included in summary issue statement.
Effects on management indicator species	31-33	Included in summary issue statement.
Effects on amount, availability, and recruitment of snags	35-39	Included in summary issue statement.
Effects of off-road travel on wildlife	internal	Included in summary issue statement
Summary issue statement: What effects will the proposal have upon wildlife habitat, specifically habitat for elk and selected Management Indicator Species?		

2

<u>Issue Statement</u>	<u>Which individual issue is this?</u>	<u>Disposition</u>
Effects on biological corridors	26,41	NOT ANALYZED - See RF letter dated 5/24/96 on NEPA streamlining, sections on fragmentation and corridors. This letter is included in project file. This decision is based upon several factors listed in the RF letter, including: 1) There is no evidence of specific species in the Bighorn Mtns. that are adversely affected by fragmentation or lack of corridors. 2) These issues cannot be adequately addressed at the scale of this project, even if there was a corridor/fragmentation issue on the Bighorn.
Effects of habitat fragmentation		
Summary issue statement:		
Effects of proposed action on TES plants and animals.	34,70,71	This is the summary issue statement. A Biological Evaluation will be prepared for plants and animals.
Effect of proposed action on future old-growth	128	Included in summary issue statement
Summary issue statement:		
Effects of activities on amount and function of old-growth	53,75,114, 125-131	This is the summary issue statement.
Summary issue statement:		
Will Wilderness be affected by timber sale	internal, 53	This is the summary issue statement
Effects of proposal on soil productivity	54-56	Included in summary issue statement
Effects of proposal on soil stability	57	Included in summary issue statement
Water yield	60, internal	Not analyzed - This decision to not analyze water yield is based upon hydrologist's professional judgement that water yield is not appropriate to analyze on this scale of project, that it is more appropriately analyzed at the Forest Plan level.
Effects of sediment	internal,59,61,67	Included in summary issue statement
Effects of proposal on wetlands	internal,59	Included in summary issue statement
Effects of off-road travel upon water quality	internal	Included in summary issue statement
Cumulative effects of past actions on water quality	59,	Included in summary issue statement

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<u>Issue Statement</u>	<u>Which individual issue is this?</u>	<u>Disposition</u>
Effects on water quality (chemical, physical, biological)	internal, 58-67	Included in summary issue statement
Effects on riparian areas	62, internal, 59	Included in summary issue statement
Effects on impaired streams (BMP, TMDL) beneficial uses.	65, 66, 64	Included in summary issue statement
Lack of monitoring and adequacy to assess past, present, and future mgt. activities	internal, 67, 66	Included in summary issue statement.
Effects on fisheries	63, 64	
Summary issue statement: What effects will the project have on water and soil resources?		
	68, 69	These are statements, not issues.
Effect of action on structures	internal, 89	Included in summary issue statement
Cumulative effects of all past actions on fuel conditions, including historic patterns, human/natural fire and change in historic patterns	internal	Included in summary issue statement
Insure adequate/coordinated site prep/fuel mgt.	Internal	This is a statement that will be addressed in the silvicultural prescription, the mitigation measures, and/or the description of the action.
Effect of proposal on future fire risk	Internal, 90, 87	Included in summary issue statement
Concern over escaped fire	89	Included in summary issue statement
Summary issue statement: What effects will the project have on the fires/fuels resource?		
Cumulative effects of all past actions on recreation use	internal, 79	Included in summary issue statement
Effects of action on motorized recreation opportunities, including snowmobiling	77, 78,	Included in summary issue statement
Effects on spatial distribution of recreation use; this refers amount and type of recreation use that will be displaced or increased by proposal	internal,	Included in summary issue statement
Effects on mix of recreation activities supported	internal, 79	Included in summary issue statement
Trail uses	internal	Included in summary issue statement
Effects on off-road travel	internal	Included in summary issue statement
Summary issue statement: How will the proposed action affect recreation use?		

<u>Issue Statement</u>	<u>Which individual issue is this?</u>	<u>Disposition</u>
	76	Statement, not issue
Effects on scenic integrity	internal, 81-86	Included in summary issue statement
Effects of scenery management on timber, public education, silviculture	86	NOT ANALYZED - The decision to not analyze the effects of this issue is because of the scale necessary to address this. The Forest Plan has already adopted a visual quality objective for areas, including along road corridors, that recognizes the visual sensitivity and objectives for managing for this, in certain areas. This could be included as a potential mitigation measure, to allow for some kind of public education; but even that is beyond the scope of this analysis, to educate people to the costs and benefits associated with timber harvest.
Effects on scenic quality from Pole Creek Rd. US 16, Sheep Mtn.	internal, 81,85,89	Included in summary issue statement
	80	Statement, not issue.
Summary issue statement: How will the proposed action affect the visual resource?		
	101,102,103,104,	These are statements not issues
	105,98	Statement, not issue. This proposed alternative does not meet purpose and need.
Effects on existing regeneration	92-94,96,97	Included in summary issue statement
Insure adequate regeneration	internal, laws 95	Included in summary issue statement
Is proposed action most appropriate silvi. RX to meet objectives	92-97,99,100, 106-119	This is the basic issue to any action alternative, and is included in the summary issue statement
Effects of method of harvest, i.e. mechanical vs. conventional	110,111	Included in the summary issue statement.
Effects of proposal on insects/diseases	112-119	Included in the summary issue statement
Cumulative effects of past management (action/inaction exclusion of fire) on area	internal, all	This is not an issue, it is a statement of the cumulative effects analysis that will be conducted concerning past management activities.
Effects of action on firewood collection	72, internal,	This is actually a road management issue: will the timber sale roads be left open after the sale for firewood collection?
Summary issue statement: What effects will different silvicultural prescriptions, including post sale regeneration treatments, have upon the other resources? This prescription selection and description is actually the actions, more than they are issues.		

Issue Statement

Summary issue statement: What are the effects of the proposal on special uses, outfitters, powerlines, etc.

Which individual
issue is this?
internal, 132,
133

Disposition

This is the summary issue statement.

Effect of only continuing treatment on part of the 3800 acres that was prescribed for 3 step shelterwood harvest in the 1970's: Link, Pole Ridge, Rock Knob and Crazy Woman.

120-124

This is not a NEPA "issue". It is a management prerogative on where, when, how and if to conduct NEPA analysis; what is the most efficient scale at which to analyze projects; and funding and personnel priorities.

This is actually an infinite question: If this proposal is expanded to 3800 acres, what is precluding analysis at this time of all 8188 acres of preparatory cuts conducted in the Clear Creek and Crazy Woman Creek analysis area in the 1970's and 1980's?

Cumulative effects of economic benefits to Buffalo?

134-145,
internal

This statement, as phrased, is actually outside the scope of project NEPA, and this analysis needs to be, and will be conducted, at the time of Forest Plan revision. The scale of this project is too small to detect on the large "screen" of the Buffalo and Johnson county economies.

To the extent these issues are appropriate to be analyzed at the project level, they will be. The economic analysis for this timber sale will tier to the large scale economic analysis done for the Forest Plan, and will follow the guidance in the Regional Forester's NEPA streamlining memo dated May 24, 1996, which cites guidance in the Forest Service Manual and Handbook. The process for this analysis is substantially defined, including suggestions to use specific TSPIRS values for costs and revenues.

Summary issue statement: What are the economic effects of the proposed action?

Will there be an effect on any eligible sites

48-52

This is not an issue. It may become one if we choose to implement project without SHPO clearance, per law.

Effects of not having Landscape Analysis completed prior to timber sale NEPA?

issues and
comments listed
as issue #154
on the Issues
worksheet

Similar to the question of how large an analysis area is appropriate, this is not an issue, but a management prerogative. As was stated at the public meeting, when landscape analysis was initiated on the Bighorn, it was not intended to bring the rest of the Forest Plan implementation programs to a halt. In addition, and perhaps most importantly, the information collection was substantially complete by the time the ID team developed issues and alternatives, and did their effects analysis. The draft information was available to Caribou analysis team members.

(The following section discusses the items listed in the "Other Things" category of the "2/12/97 Issues - Caribou Timber Sale" paper.)

Item 146, (18), is a general list of broad issue categories, which are covered in the issue statements.

Item 147, (19), is a comment, not an issue

Items grouped in 148, brought up by numerous people and concerning cumulative effects, will be analyzed in the cumulative effects section. These are either comments, or those that are issues, are included in the appropriate resource issue area.

Item 149, (12), is a Forest Plan allocation issue, and is not within the scope of this analysis.

Item 150, 151, (4), are comments, not issues.

Item 152, (5), will be discussed in the water resource area.

Item 153, (9), the issue of how aspen regeneration treatments effects the suitable base, is not within the scope of this analysis.

Item 154, various people, is covered above.

Item 155, 156, (12), are comments, not issues.

Item 157, (5), is a bird list, and is not an issue.

Item 158, (10), is not within the purpose and need of this analysis. Maybe discussed in mitigation, but not necessary.

Item 159, (20), is a comment, not an issue.

Item 160, (9), is a comment, not an issue, and is outside the scope of this analysis.

Item 161, (21,9), is a comment not an issue. This is an incorrect interpretation of the meaning of the scoping document, the quarterly NEPA projects list, and comments made at the public meeting. The quarterly NEPA list was written at the time of the scoping document in December, the acreage comments were made in mid-January, and the quarterly NEPA list was apparently received by parties after the public meeting in mid-January.

Item 162, (8), comments pertain to Sourdough drainage, not area in this analysis.

Item 163, (8), is a list of about 20 recommended mitigation measures.

LIST OF SUMMARY ISSUES: These include all of the components listed in the issues disposition table.

What effect will the proposal have upon the range resource and livestock management?

What effects will the proposal have upon wildlife habitat, specifically upon elk and selected Management Indicator Species?

Effects of proposed action on TES plants and animals.

Effects of activities on amount and function of old-growth.

Will Wilderness be affected by timber sale?

What effects will the project have on the water and soil resources?

What effects will the project have on the fire/fuels resource?

How will the proposed action affect recreation use?

How will the proposed action affect the visual resource?

What effects will different silvicultural prescriptions, including post sale regeneration treatments, have upon the other resources? This prescription selection and description is actually the actions, more than they are issues.

What are the effects of the proposal on special uses, outfitters, powerlines, etc.

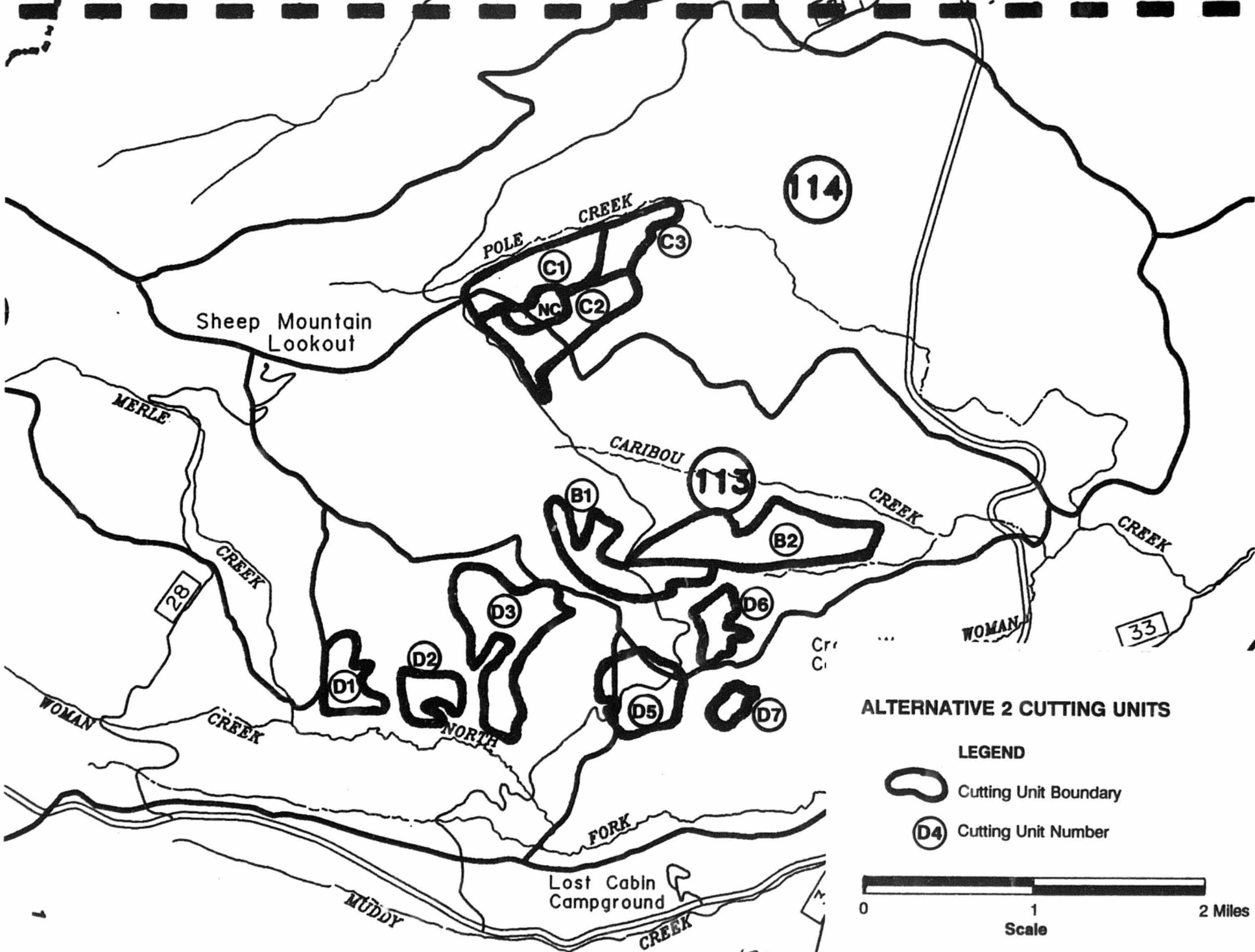
What are the economic effects of the proposed action?

What are the effects upon Heritage resources?

APPENDIX C: INFORMATION ON ALTERNATIVES



Alternative 2 Cutting Units	C - 1
Alternative 3 Cutting Units	C - 2
Alternative 4 Area Porposed for Closure to Off-Road ..	C - 3
Gross Harvest Acres by alternative	C - 4
Diagnosis by RIS Site List	C - 5

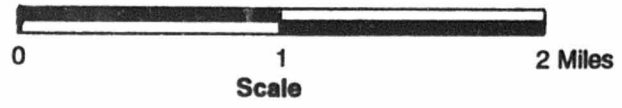
Alternative 2 Cutting Units C - 1



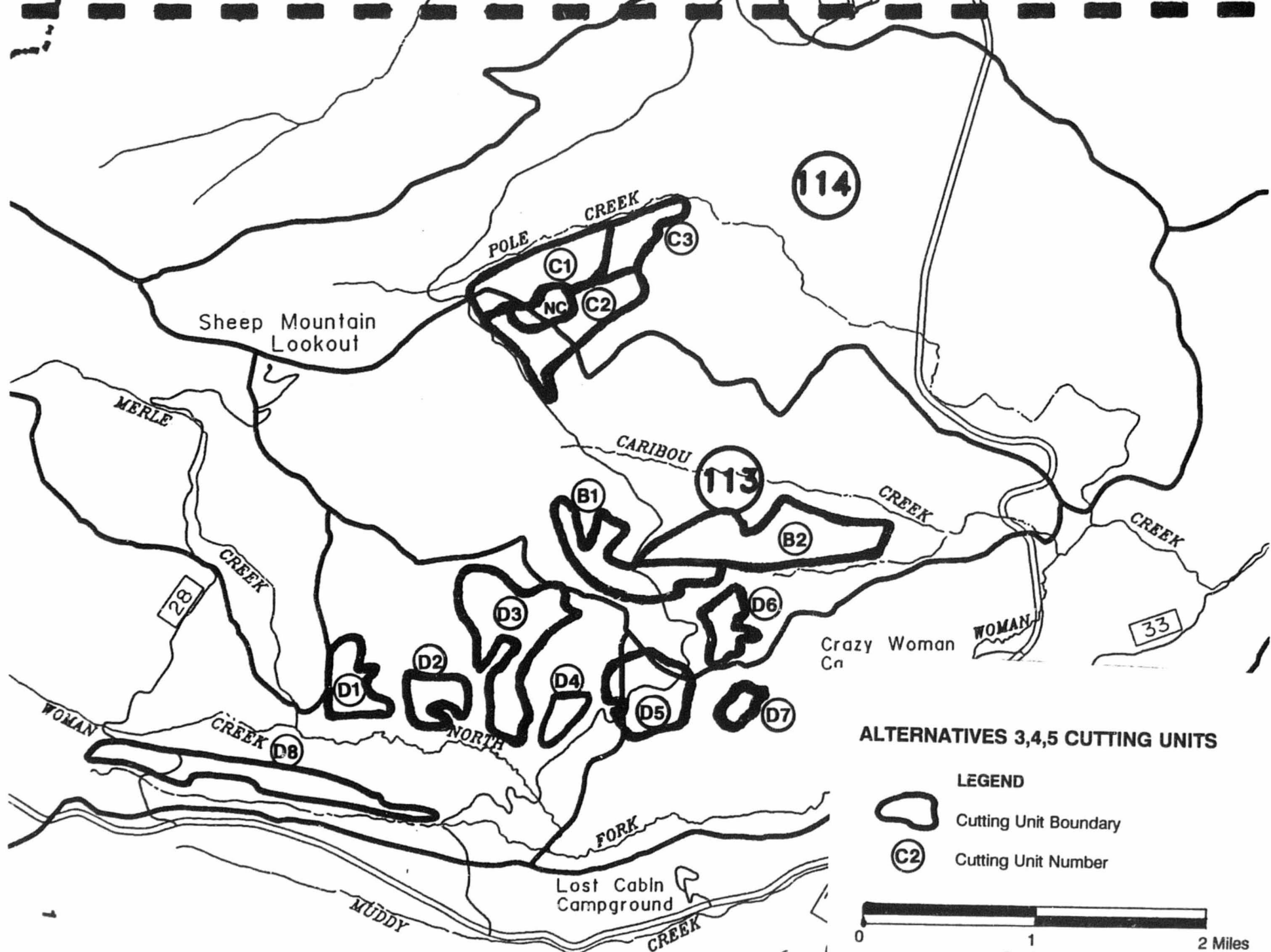
ALTERNATIVE 2 CUTTING UNITS

LEGEND

-  Cutting Unit Boundary
-  Cutting Unit Number





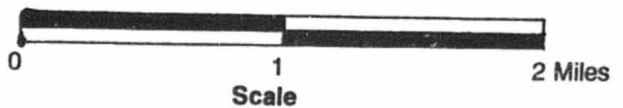
Alternative 3 Cutting Units C - 2



ALTERNATIVES 3,4,5 CUTTING UNITS

LEGEND

-  Cutting Unit Boundary
-  Cutting Unit Number



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Gross Harvest Acres by Alternative C - 4

CARIBOU GROSS HARVEST ACRES

This table shows the Gross Harvest Acres for the various Caribou alternatives. These acres are mostly from the RIS site acreage figures, with some dot gridding where one RIS site is in more than one cutting unit. These acres are the total number of acres within the unit boundaries as shown on the alternatives maps.

Key to silvicultural prescription abbreviations:

SW: Continuation of 3 step shelterwood system, primarily implemented as Seed Cut, may be small patches of Overstory Removal (3rd step).

CC: Clearcut.

GSW: Group Shelterwood. This is prescription used on "bathtub rings", for visual amelioration. The groups will be 1/20th to 1/4 of an acre, even-aged management is the objective. This is a temporary prescription to be used until majority of stand "catches up" to the ring, when the stand will be treated as a whole.

S/S: Sanitation/Salvage. To be implemented on north end of C1 to protect visuals from Pole Creek road and protect ES/AF understorey. Also, this will be implemented in the riparian areas that are in units B1 and D5. Minimal harvest, with winching, BMPs, etc.

UNIT	ALTERNATIVE 2				ALTERNATIVES 3,4,5			
	SW	CC	GSW	S/S	SW	CC	GSW	S/S
C1	154	0	0	46	154	0	0	46
C2	133	0	0	0	130	10	0	0
C3	<u>75</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>22</u>	<u>0</u>	<u>0</u>
	362	0	0	46	284	32	0	46
B1	134	0	0	2	134	0	0	2
B2	<u>196</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>196</u>	<u>0</u>	<u>0</u>	<u>0</u>
	330	0	0	2	330	0	0	2
D1	92	0	0	0	92	0	0	0
D2	95	0	0	0	95	0	0	0
D3	251	0	0	0	243	8	0	0
D4	0	0	0	0	42	0	0	0
D5	106	0	5	2	106	0	5	2
D6	65	0	5	0	65	0	5	0
D7	30	0	0	0	30	0	0	0
D8	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>127</u>	<u>0</u>	<u>8</u>	<u>0</u>
	639	0	10	2	800	8	18	2
TOTALS:	1331	0	10	50	1414	40	18	50

Bornong 8/5/97

Diagnosis by RIS Site List C - 5

CARIBOU DIAGNOSIS BY RIS SITE LIST - 5/27/97

This list is built from the RIS site list. Silvicultural diagnosis is the step prior to selection of a specific silvicultural prescription, which must be based upon the NEPA decision. The purpose of diagnosis is to compare potential silvicultural treatments by alternative. Detailed prescriptions are written after the decision notice is signed, so they will incorporate the objectives of the NEPA decision and any mitigation measures/requirements included in the decision.

For reasons stated in the alternative development section of the Environmental Analysis, widespread use of clearcut and selection silvicultural systems were eliminated from detailed analysis, even though they may be implemented on small, site-sized, areas. Extensive clearcutting will exceed the adopted Forest Plan VQO. Extensive use of selection silviculture was eliminated due to the historic landscape patterns, soil and climate influences, the resulting habitat types, and silvical characteristics of lodgepole pine, which has over the millenia developed predominantly in even-aged stands.

One item considered in developing the diagnoses for this area is a statement made to me personally by Wayne Sheppard, research silviculturist at the Rocky Mountain Forest and Range Experiment station in Ft. Collins, CO. Discussing ecosystem management and desired future conditions, he stated that he felt it was important that current silvicultural treatments allow future managers the option of "adaptive management", that they have the ability to adapt and revise the present silvicultural "trajectory" based on social and economic desires that may change at some time in the future. One aspect of conducting the seed step of the 3 step shelterwood at this time is that at the time of the overstory removal step, future managers may opt for a multi-storied, or perhaps even an uneven-aged stand. These options would be available under the implementation of the seed cut of a 3 step shelterwood at this time.

AREA B: The majority of this area was harvested in the Rock Knob timber sale in the mid-70s. The very western edge of this potential area was harvested in the Crazy Woman sale in the same era.

LOC-SITE	MGT. RX	TIMB COMP	PREV. CUT ACRE	PREVIOUS TIMBER SALE	RX AND YEAR CUT	RIS SITE ACRE	GROSS ACRES IN CARIBOU	ALT. 2		ALT. 3,4,5	
								Proposed harvest	Fuels Acres	Proposed harvest	Fuels Acres
100521-0003	7E	511	115	Rock Knob PC7	PC 1975	167	115	115	SC 2001. OR 2016. Thin 2026.	RX burn to open cones.	Same as alternative 2.
Eastern 1/3 of site qualifies as old-growth, and will continue to be managed for OG character. No treatment specified at this time.											
100521-0007	7E	511	53	Rock Knob 7	PC 1977	103	53	53	SC 2001. OR 2016. Thin 2026.	Lop and scatter.	Same as alternative 2.
Northern half of stand - no treatment recommended at this time. Re evaluate in 2016.											
100521-0009	7E	511	53 92	Link Unit 2 Crazy Woman	PC 1975 PC 1980	146	40	40	SC 2001. OR 2016. Thin 2026.	RX burn to open cones.	Same as alternative 2.
Northern portion of stand - no treatment recommended at this time. Re evaluate in 2016.											

<u>LOC-SITE</u>	<u>MGT.</u>	<u>TIMB</u>	<u>CUT</u>	<u>PREV.</u> <u>PREVIOUS</u>	<u>RX AND</u>	<u>RIS</u> <u>SITE</u>	<u>GROSS</u> <u>ACRES IN</u>	<u>ALT. 2</u>		<u>ALT. 3,4,5</u>	
								<u>Proposed</u> <u>harvest</u>	<u>Fuels</u> <u>Acres</u>	<u>Proposed</u> <u>harvest</u>	<u>Fuels</u>
<u>RX</u>	<u>COMP</u>	<u>ACRE</u>	<u>TIMBER SALE</u>	<u>YEAR CUT</u>	<u>ACRE</u>	<u>CARIBOU</u>	<u>Acres</u>				
100521-0014	7E	511	31	Rock Knob 8	PC 1977	93	93	91	SC 2001. OR 2016. Thin 2025.	40 A. RX burn, remainder lop and scatter.	Same as alternative 2.
			62	Crazy Woman 7	PC 1980			2	Sanitation/ Salvage along intermittent stream. S/S for future entries.	RX burn to open cones.	Same as alternative 2.
100521-0005	7E	511	5	Rock Knob 7	PC 1975	26	5	5	SC 2001. OR 2016. Thin 2025.	RX burn to open cones.	Same as alternative 2.
									The majority of this site is not scheduled for treatment at this entry. Reevaluate in 2016.		
100521-0006	7E	511	18	Rock Knob 7	PC 1975	18	18	18	SC 2001. OR 2016. Thin 2025.	Lop and scatter.	Same as alternative 2.
100521-0021	7E	521		None shown in RIS		38	5	5	SC 2001. OR 2016. Thin 2025.	Lop and scatter.	Same as alternative 2.
100521-0024	7E	511		None shown in RIS		28	3	3	SC 2001. OR 2106. Thin 2025.	Lop and scatter.	Same as alternative 2.

AREA C: Previously the Link timber sale, then Brokenpole windthrow salvage. This area was analyzed under the Lookout timber sale EA, and that is a good place to start, where watershed and elk cover seem to be two major issues. Harvest methods listed under comments were from previous sales.

LOC-SITE	MGT.	TIMB	CUT	PREV.	RX AND	RIS	GROSS	ALT. 2		ALT. 3,4,5			
				PREVIOUS		SITE	ACRES IN	Proposed	Fuels	Proposed	Fuels		
	RX	COMP	ACRE	TIMBER SALE	YEAR CUT	ACRE	CARIBOU	Acres	harvest	Acres	harvest	Fuels	
100504-0015	7E	511	230	Link #15	PC 1975	230	185	46	Sanitation/Salv. 2001. Thin 2025.	Lop and scatter	Same as alternative 2.		
			70	Brokenpole	Salv. '86								
								139	SC 2001. OR 2016. Thin 2025.	Lop and scatter	Same as alternative 2.		
								Portion of site west of Pole Creek Road was entered in Lookout sale with clearcut system. 20 year re-entry interval would indicate re-entry of that area in about 2007.					
100504-0013	7E	511	46	Link 15,16	PC 1975	78	60	50	SC 2001. OR 2016 Thin 2025	Lop and scatter	57	SC 2001. OR 2016. Thin 2025	Lop and scatter
			78	PC thin	Thin 1979								
			78	Brokenpole	S/S 1988						10	CC 2001. Thin 2025	Lop and scatter
100504-0008	7E	511	107	Link 16,17	PC 1975	107	107	107	SC 2001. OR 2016 Thin 2025	Lop and scatter	77	SC 2001. OR 2016. Thin 2025	Lop and scatter
			53	PC thin	Thin 1979								
											10	CC 2001. Thin 2025	Lop and scatter
											10	CC 2041. Thin 2066.	Lop and scatter
100504-0007	7E	511	55	Link 17	PC 1975	55	55	55	SC 2001. OR 2016 Thin 2025	Lop and scatter	12	CC 2001. Thin 2025	Lop and scatter
											25	CC 2041 Thin 2066	Lop and scatter
100504-0012	7E	511	13	Link	PC 1975	19	11	11	SC 2001 OR 2016 Thin 2025	Lop and scatter	Same as alternative 2.		

AREA D: Previously the Crazy Woman timber sale, which was cut around 1980. For the most part, these units follow the Crazy Woman cutting unit boundaries from the sale area map. The exception is in unit D5, which has extra area to the southwest and northeast, (both areas which have been previously harvested). For the most part, these units received a shelterwood prep cut, although there are small patches of very successful regeneration that were defacto seed cuts. There are patches in some of the units, particularly D1, D2, and lesser amounts of D3, that constitute small blocks of cover. These will be protected during marking.

LOC-SITE	MGT.	TIMB	PREV. CUT	PREVIOUS TIMBER SALE	RX AND YEAR CUT	RIS SITE ACRE	GROSS ACRES IN		ALT. 2		ALT. 3,4,5		
							CARIBOU	Acres	Proposed harvest	Fuels	Acres	Proposed harvest	Fuels
100536-0006	7E	511	35	Crazy W. 16	PC 1980	35	32	0	NA		32	SC 2001 OR 2016 Thin 2025	Lop and scatter
100536-0601	7E	511		No previous harvest in site.		10	10	0	NA		10	Within unit, area not previously cut will not be cut.	
100536-0001	7E	511	15	Crazy W. 5	PC 1980	15	15	15	SC 2001 OR 2016 Thin 2025	Lop and scatter		Same as alternative 2.	
100537-0007	7E	511	197	Crazy W. 1,6	PC 1980	207	100	95	SC 2001 OR 2016 Thin 2025	Lop and scatter		Same as alternative 2.	
								5	GSW 2001 GWS 2016 Thin 2025	Lop and scatter		Same as alternative 2	
100537-0701	7E	511	20	Crazy W. 5 20 TSI	PC 1980 1982	20	20	15	SC 2001 OR 2016 Thin 2025	Lop and scatter		Same as alternative 2	
								5	GSW 2001 GWS 2016 Thin 2025	Lop and scatter		Same as alternative 2	
100540-0010	7E	521	53	Crazy W. 4	PC 1980	53	2	2	SC 2001 OR 2016 Thin 2025	Lop and scatter		Same as alternative 2	
100536-0003	7E	511	0	No previous harvest in site (?)		7	7	7	SC 2001 OR 2016 Thin 2025	Lop and scatter		Same as alternative 2	

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LOC-SITE	MGT.	TIMB	PREV.		RX AND	RIS	GROSS	ALT. 2			ALT. 3,4,5			
			CUT	PREVIOUS				YEAR CUT	SITE	ACRES IN	Proposed		Proposed	
											ACRE	TIMBER SALE	ACRE	CARIBOU
100540-0009	7E	511	27	Crazy W. 4	PC 1980	27	27		SC 2001 OR 2016 Thin 2025	Lop and scatter		Same as alternative 2		
100539-0012	6B	NA		NA	0	49	2	2	S/S 2001 S/S 2016	Lop and scatter		Same as alternative 2		
<p>This is a wet drawbottom, with some trees at the end of the site within Caribou cutting unit D5. This site may end up within the cutting unit, but any trees marked in the site will have to be treated with all the protections of a 9A area, winched out, etc.</p>														
100539-0008	7E	721	10	Crazy W. 2	PC 1980	10	2	2	SC 2001 OR 2016 Thin 2025	Lop and scatter		Same as alternative 2		
<p>721 - irreversible damage, due to large rock pile. The 2 acres proposed for Caribou unit D5 are not in the rockpile.</p>														
100539-0009	7E	511	9	Crazy W. 2	PC 1980	9	9	9	SC 2001 OR 2016 Thin 2025	Lop and scatter		Same as alternative 2		
100536-0012	7E	511	50	Crazy W. 19	PC 1980	50	15	15	SC 2001 OR 2016 Thin 2025	RX burn to open cones		Same as alternative 2		
100536-0901	7E	511				26	14	14	SC 2001 OR 2016 Thin 2025	Lop and scatter		Same as alternative 2		
100536-0009	7E	511	49	Crazy W. 18	PC 1980	49	40	40	SC 2001 OR 2016 Thin 2025	Lop and scatter	32	SC 2001 OR 2016 Thin 2025	Lop and scatter	
											8	CC 2001 Thin 2025	Lop and scatter	
100536-0014	7E	511	17	Crazy W. 19	PC 1980	17	3	3	SC 2001 OR 2016 Thin 2025	RX burn to open cones		Same as alternative 2		
100536-0013	7E	511	98	Crazy W. 19	PC 1980	98	98	98	SC 2001 OR 2016 Thin 2025	Lop and scatter 30 A. RX burn to open cones 68 A.		Same as alternative 2		
100536-0902	7E	511	17	Crazy W. 18	PC 1980	17	17	17	SC 2001 OR 2016 Thin 2025	Lop and scatter		Same as alternative 2		

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LOC-SITE	MGT. RX	TIMB COMP	PREV. CUT ACRE	PREVIOUS TIMBER SALE	RX AND YEAR CUT	RIS SITE ACRE	GROSS ACRES IN		ALT. 2		ALT. 3,4,5		
							CARIBOU	Acres	Proposed harvest	Fuels	Acres	Proposed harvest	Fuels
100536-1301	7E	511	12	Crazy W. 19 12 PCT	PC 1980 1982	12	2	2	SC 2001 OR 2016 Thin 2025	RX burn to open cones	Same as alternative 2		
100536-1302	7E	511	62	Crazy W. 19	PC 1980	62	62	62	SC 2001 OR 2016 Thin 2025	Lop and scatter 27 A. RX burn to open cones 35 A.	Same as alternative 2		
100518-0001	7E	511	124	Crazy W. 22	PC 1980	124	95	95	SC 2001 OR 2016 Thin 2025	Lop and scatter	Same as alternative 2		
100518-0008	7E	511	93	Crazy W. 23	PC 1980	93	90	90	SC 2001 OR 2016 Thin 2025	Lop and scatter	Same as alternative 2		
100518-0007	7E	511	6	PCT	1974	49	2	2	SC 2001 OR 2016 Thin 2025	Lop and scatter	Same as alternative 2		
100539-0006	7E	511	15	Crazy W. 2	PC 1980	26	15	15	SC 2001 OR 2016 Thin 2025	Lop and scatter	Same as alternative 2		
100536-0010	7E	511	31	Crazy W. 2	PC 1980	31	15	15	SC 2001 OR 2016 Thin 2025	Lop and scatter	Same as alternative 2		
100534-0002	7E	511	93	Crazy W. 26	PC 1979	107	100	0	No harvest this entry; reanalyze in 2016.		92	SC 2001 OR 2016 Thin 2025	Lop and scatter
											8	GSW 2001 GSW 2016 Thin 2025	Lop and scatter
100533-0013	7E	511	35	Crazy W. 27	PC 1979	97	35	0	No harvest this entry; reanalyze in 2016.		35	SC 2001 OR 2016 Thin 2025	Lop and scatter

Note on the Gross Acres in Caribou column: Those figures are the gross acres within the proposed cutting unit boundaries. There will be areas within the units that will not be cut. For example in unit D4, site 100536-0601 is a 10 acre pole patch that is within the unit boundary as currently designed, but will not be harvested.

Adjacent sites not proposed for current harvest entry should either be reanalyzed in about 2007 (those sites in the Lookout timber sale area) or about 2016 for the remainder of the adjacent sites.

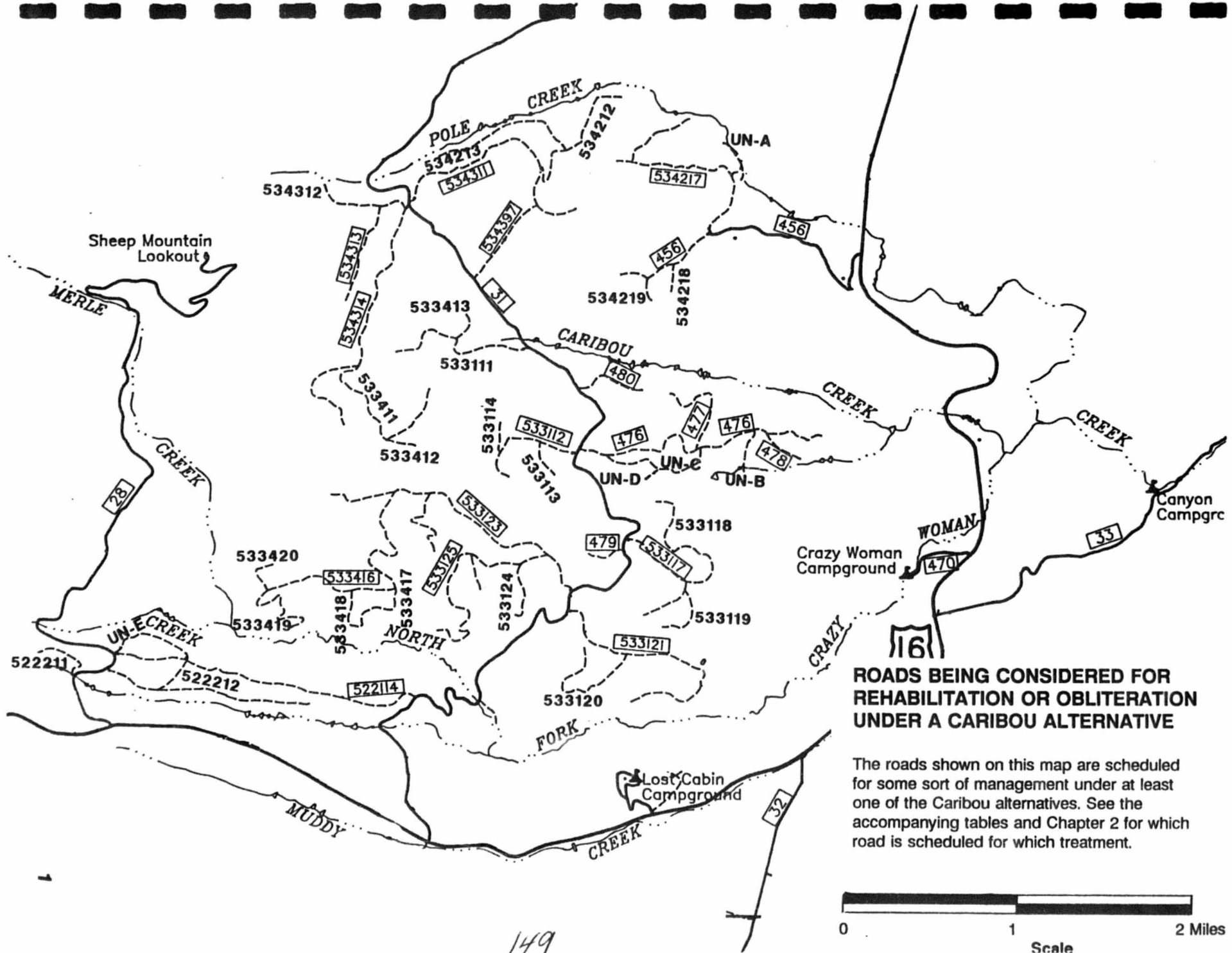
7/1/97 Bornong, Certified Silviculturist

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APPENDIX D: ROADS

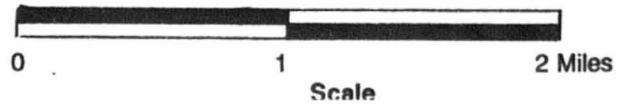
Roads Considered for Rehabilitation or Obliteration	D - 1
Caribou Road List - Actions by Alternative	D - 2
Caribou Road List Inventory	D - 3

Roads Considered for Rehabilitation or Obliteration D - 1



ROADS BEING CONSIDERED FOR REHABILITATION OR OBLITERATION UNDER A CARIBOU ALTERNATIVE

The roads shown on this map are scheduled for some sort of management under at least one of the Caribou alternatives. See the accompanying tables and Chapter 2 for which road is scheduled for which treatment.



Caribou Road List - Actions by Alternative D - 2

CARIBOU ROAD LIST - ACTIONS BY ALTERNATIVE

This table summarizes the road actions by alternative. The roads numbered "UN-" are not system roads, and do not have a FDR number. The location of the roads in this list is shown on the accompanying map in this appendix. The current status corresponds to alternative 1, no action, which is no change from current management.

Current Status: Closed = gated per past NEPA/environmental decision.
Open = No gate or barrier, open to vehicular traffic.

<u>FDR</u>	<u>Mileage</u>	<u>Current Status</u>	<u>Alternative 2</u>	<u>Alt. 3</u>	<u>Alt. 4</u>	<u>Alt. 5</u>
534311	1.55	Closed	Move gate back for camp spot, improve closure	Same as 2	Same as 2	Same as 2
533112	0.62	Closed	behind gate; apply Watershed Conservation Practices	"	"	"
533123	1.69	Closed	Handbook (WCPH) and Best Management Practices (BMP)	"	"	"
533120	1.1	Closed	after this entry.	"	"	"
522114	0.33 ¹	Closed	No Action	Move gate	Same as 3	Same as 3
522211	0.35	Closed	No Action	back, improve closure behind gate; apply WCPH and BMPs after entry.	Same as 3	Same as 3
534397	0.6	Closed	Improve closure behind gate; apply WCPH and BMP	Same as 2	Same as 2	Same as 2
533117	0.82	Closed	after this entry.	"	"	"
522212	1.00	Closed	No Action	Improve closure behind gate; apply WCPH and BMPs after entry.	Same as 3	Same as 3
534213	0.82	Closed	Remain closed. Apply WCPH and BMP after this entry.	Same as 2	Same as 2	Same as 2
534212	0.9	Closed	"	"	"	"
533114	0.13	Closed	"	"	"	"
533113	0.20	Closed	"	"	Same as 2	Obliterate
533124	0.55	Closed	"	"	Same as 2	Same as 2
533125	1.40	Closed	"	"	"	"
533416	1.67	Closed	"	"	"	"
533417	0.45	Closed	"	"	"	"
533418	0.10	Closed	"	"	"	"
533419	0.63	Closed	"	"	"	"
533420	0.15	Closed	"	"	"	"
533121	1.1	Closed	"	"	"	"
533118	0.87	Closed	"	"	"	"
533119	0.3	Closed	"	"	"	"

<u>FDR</u>	<u>Mileage</u>	<u>Current Status</u>		<u>Alternative 2</u>		
				<u>Alt. 3</u>	<u>Alt. 4</u>	<u>Alt. 5</u>
480	0.43	Open	Close road by installing gate at junction with FDR 31, include closure effectiveness measures behind gate. Apply WCPH and BMP. Can be implemented immediately, not needed for Caribou.	Same as 2	Same as 2	Same as 2
UN-C	0.25	Open	Close road by installing gate at junction with FDR 476, include closure effectiveness measures behind gate. Apply WCPH and BMP.	Same as 2	Same as 2	Obliterate
UN-D	0.80	Open		"	"	"
UN-B	0.2	Open		"	"	"
478	0.25	Open		"	"	"
477	0.67	Open		"	"	Same as 2
UN-A	0.25	Closed	No Action	Same as 2	Same as 2	Obliterate
UN-E	0.60	Closed	No Action	Same as 2	"	Obliterate
479	0.16	Open	No Action	Same as 2	"	Same as 2

<u>FDR</u>	<u>Mileage</u>	<u>Current Status</u>		<u>Alt. 2</u>	<u>Alt. 3</u>	<u>Alt. 4</u>	<u>Alternative 5</u>
				No Action	Same as 2	Same as 2	Improve closure behind gate. Apply WCPH and BMP. Can be implemented immediately as not needed for Caribou.
534312	0.5	Closed		"	"	"	
534313	0.65	"		"	"	"	
534314	1.65	"		"	"	"	
533411	0.9	"		"	"	"	
533412	0.12	"		"	"	"	
533413	0.55	"		"	"	"	
533111	1.2	"		"	"	"	
534218	0.23	"		"	"	"	
534219	0.20	"		"	"	"	
534217	1.2	"		"	"	"	
456 ²	0.58	"		"	"	"	

¹ This road is listed on the system as only being 0.33 miles long. That amount was reconstructed/improved for the Crazy Woman timber sale. It continues on past that point as a road/trail/snowmobile trail for nearly 2 miles.

² This is only the portion of FDR 456 past Camp E-La-Ka-Wee.

FDR 476, 28, and 31 will be used for Caribou timber sale, maintained and improved as necessary per the WCPH and BMPs, and remain open.

Bornong, 7/1/97

Caribou Road List Inventory D - 3

CARIBOU TIMBER SALE - ROAD LIST

These are the roads that are listed in at least one of the action alternatives developed for Caribou. Another table in this appendix describes how each is proposed to be treated by alternative. The roads numbered "UN_" are not system roads, and do not have a FDR number. That label is for locational purposes only. Comments are from inventory, or personal observations by Bornong.

FDR	MILEAGE	WIDTH	MAINT. LEVEL	SURVEY YEAR	MILES NEEDED TO HARVEST UNITS		COMMENTS
					ALT. 2	ALT. 3,4,5	
<u>Roads accessing units C1-C3:</u>							
534311	1.55	14'	LI	1990	1.55	1.55	Pictures show grass in middle.
534213	0.82	14'	LI	1990	0.82	0.82	"Harold". Pictures show grass between tracks.
534212	0.9	14'	LI	1990	0.9	0.9	Pictures show grass/forbs between tracks.
534397	0.6	8'	--	---	0.6	0.6	Pretty much grassed in. Gate at Pole Creek road. Wet spot.
<u>Roads accessing unit B1:</u>							
533114	0.13	16'	LI	1990	0	0	"Heavy regeneration occurring" 2 waterbars.
533113	0.20	15'	LI	1990	0.2	0.2	1 culvert. "Heavy regeneration and swampy in areas." This is road we walked to for 8/96 field trip, swamp first 200 yards, then 6-10 THICK LP regen.
533112	0.62	15'	LI	1990	0.62	0.62	6 waterbars. "Heavy regeneration occurring."
<u>Roads accessing unit B2:</u>							
476	1.63	8'	2	1989	1.63	1.63	Wood gate, 3 culverts. Grassy middle strip in pictures. "some areas where water doesn't drain from road. fair condition".
477	0.67	6-8'	2	1989	0.2	0.2	wood gate. "2 track in fair condition." Pics show grass in middle.
478	0.25	8'	-	---	0	0	Not on inventory. Minimal trail.
UN-B	0.25	8'	-	---	0	0	Not on inventory, minimal trail. Accesses meadow area where there used to be a cabin. Cabin was removed about 25 years ago. This would make a very nice campspot, but is not heavily used at present.
UN-C	0.80	10	-	---	0	0	West end is a very narrow track. East portion, to Goodman creek, was constructed to access east end of B1 unit for Rock Knob sale. Road comes right to Goodman Creek.
UN-D	0.2	10'	-	---	0	0	This is portion of UN-C that crossed into Caribou unit B1. The crossing has had the culvert removed, but the large (4' tall) berm at crossing is not completely revegetated.

FDR	MILEAGE	WIDTH	MAINT. LEVEL	SURVEY YEAR	MILES NEEDED TO HARVEST UNITS		COMMENTS
					ALT. 2	ALT. 3,4,5	
<u>Roads accessing units D1-D4:</u>							
533123	1.69	14'	LI	1990	1.35	1.35	7 waterbars. Pics show fair grass in between tracks; there is a wet spot just before D3, rocky bed there.
533124	0.55	16'	LI	1990	0	0.55	Pics show moderate grass cover, 50%.
533125	1.40	16'	LI	1990	1.4	1.4	Pics show 70% grass cover.
533416	1.67	16'	LI	1990	1.67	1.67	13 waterbars, 2 culverts. "Road is in good shape with a few swampy spots." 1996 survey: considerable amount of fill material in a couple of creek crossings, some 3"-5" 20' stretches of gullyng. Pics show 40-70% grass.
533417	0.45	15'	LI	1990	0.45	0.45	3 waterbars. "Heavy regeneration is occurring on Rd." pics show 50+% grass cover.
533418	0.10	15'	LI	1990	0.10	0.10	"Heavy regen. on road." Pics show 75% grass/LP coverage on road.
533419	0.63	15'	LI	1990	0.63	0.63	4 waterbars. "Heavy regeneration". Pic shows grass between tracks.
533420	0.15	15'	LI	1990	0.15	0.15	3 waterbars. "Regeneration is beginning." Pic shows about 50% grass cover.
<u>Roads accessing unit D5:</u>							
533120	1.10	14'	LI	1990	0.25	0.25	Pics show regen and fairly heavy grass on road.
533121	1.10	16'	LI	1990	0	0	Pics show regen and fairly heavy grass on road.
<u>Roads accessing units D6-D7:</u>							
533117	0.82	20'	LI	1990	0.45	0.45	8 waterbars. "Lots of regeneration" Pics show 75%+ grass.
533118	0.87	15'	LI	1990	0.87	0.87	10 waterbars. "Regeneration is beginning to occur." Pics show heavy grass.
533119	0.30	15'	LI	1990	0.30	0.30	"Lots of regeneration". Wire gate. Pic shows heavy grass.
<u>Roads accessing unit D8:</u>							
522211	0.35	12'	LI	1990	0	0.35	"Lots of regeneration." 5 waterbars. Pic shows 50-60% grass cover.
522114	0.33	15'	LI	1990	0	0.33	2 waterbars. "Road is in good shape, a little grass starting to grow over bed." Pic shows grass between track. This road was a Crazy Woman road.
522212	1.00	15'	LI	1990	0	1.00	15 waterbars. "Road is beginning to grow over and trees are coming up on road bed." This road was built for Crazy Woman access. Original assumption was this was so near creek would be good obliteration candidate. However, 522214 is apparently not a road, but is in fact a trail. Plus from pictures, there is no riparian shown, just rocky LP country.

28 Sheep Mountain Road and 31 Pole Creek road.

Temp. road: the only temporary road considered is to access a landing in unit B1 to east of Pole Creek road. This is considerable sediment improvement over previous entry, where road crossed Goodman Creek to B1. (That spot is still bare and in need of some rehab.) To protect visual quality from Pole Creek road, recommendation is to have landing 500' from FDR 31, Pole Creek Road. Based on watershed recommendations, construction of this temporary road for visual purposes needs to be balanced against not building this for watershed needs - will need decision maker input.

FDR	MILEAGE	WIDTH	MAINT. LEVEL	SURVEY YEAR	MILES NEEDED TO HARVEST UNITS		COMMENTS
					ALT. 2	ALT. 3,4,5	
<u>Roads off of Pole Creek Road, FDR 31, not needed for Caribou. Primarily Lookout timber sale access.</u>							
479	0.16	6-8'	LI	1989	0	0	"Rough and rocky road with many tree stumps. Grassed over."
480	0.43	6-8'	LI	1989	0	0	"Road is 2 tracks, some parts are grassed over. Last 1/2 of road is rocky and doesn't drain well". Tie rod busting stumps on this road!
534312	0.50	15'	LI	1990	0	0	Wire gate. 1 culvert, 6 waterbars. "Road good to MP 0.5, then road has been plowed and bulldozed over." (I think that was past end of road in CC unit. Also, end is swamp)
534313	0.65	15'	LI	1989	0	0	4 waterbars. Good until last 0.1, becomes skid trail.
534314	1.65	20'	LI	1990	0	0	14 waterbars, 4 culverts (at least one of which is not functioning in 1996 survey). "Good road to about MP 1.25, then gets swampy and rough with grass beginning to grow on road bed."
533412	0.12	15'	LI	1990	0	0	3 waterbars. "Heavy regeneration". Pics show road 75% grass.
533411	0.9	15'	LI	1990	0	0	8 waterbars, 2 culverts. "Good road with grass beginning to grow over road bed, with swampy areas across road bed." Pics show up to 75% grass, other spots pretty bare.
533413	0.55	15'	LI	1990	0	0	2 culverts, 3 waterbars. "Road gets swampy the last 0.10, other than that road bed is in good shape." Pics show up to 80% grass.
533111	1.20	20'	LI	1990	0	0	2 culverts, 8 waterbars. "Good condition with grass beginning to grow in middle of road."
<u>Roads not needed for Caribou. In Camp E-La-Ka-Wee area. Used for Lookout timber sale access:</u>							
534218	0.23	10'	LI	1990	0	0	"Lots of regeneration and erosion to rd. bed." Pic shows 90% grass cover.
534219	0.20			---	0	0	No information available.
534217	1.20	9'	LI	1989	0	0	Road north of E-La-Ka-Wee. "Road in good condition." Wood gate at 456 junction. (Snowmobile trail?)
456 (Past E-La-Ka-Wee)	0.58	12'	LI	1989	0	0	5 waterbars. "Road in good condition".
UN-A	0.25						Not on inventory. Near Pole Creek.
<u>Road not needed for Caribou. Off of FDR 28, at west end of unit D8:</u>							
UN-E	0.60				0	0	Obliteration possibility. Loop near 522114 and 28 junction.

APPENDIX E: ECONOMIC ANALYSIS

Economic Analysis E - 1

Economic Analysis E - 1

ECONOMIC FINANCIAL EFFICIENCY ANALYSIS
FSH 2409.18-95-6, Chapter 32

Assumptions:

- 2016 entry: Assume continuation of shelterwood system.
 Alt. 2: 1331 Acres SW (OR) x 3.8 MBF/A. = 5057.8 MBF
 10 Acres GSW x 2.0 MBF/A. = 10
 4 Acres S/S x 1.0 MBF/A. = 4 Total 5072 MBF
 Alt. 3,4,5: 1414 Acres SW (OR) x 3.8 MBF/A. = 5373.2
 18 A. GSW x 2.0 = 36
 4 A. S/S x 1.0 = 4
 5413
 3.8 MBF: Assume 6 MBF left in 100521-0014, some stands less vol/A., + snags/residual green replacement snags left.
- Alt. 3,4,5 Clearcut reentries in C3; on 40 year interval, treat about 1/3 each time.
 entries in 2041, 2081, in 2121 will cut clearcuts cut in 2001. 25 A. each entry x 7 MBF/A. = 175 MBF each entry.
 - 3 acres left in site for habitat.
- For this analysis don't include any other Link/Rock Knob/Crazy Woman units - Maybe someday will be added, but these numbers are used to portray different effects of the current alternatives.
- "Existing stand" analysis (FSH 2409.18, 32.4) includes SC and OR, regen. costs, road rehabilitation and work for those entries, and clearcuts of "existing" stands, or clearcuts in C3 thru 2081. TSI is on the regenerated stand, as are the 3 step shelterwood in 2121, 2141, 2161. That entry was estimated using FVS CMAI data. Basically, costs and benefits of existing stand are associated with the standing trees on site now. The costs and benefits of the future stand is based upon the trees that will regenerate as a result of this harvest.
- Bring all costs back to 1997, use interest rate of 4% (FSH 2409.18, 32).
- This does not take into account many costs and benefits associated with this project. This analysis is done using the guidelines in FSH 2409.18. The numbers should merely be used for comparison purposes between alternatives, as the absolute value of all the benefits and costs associated with this project are not calculated. Among missing benefits are increased fire protection, increased recreation access, tax and other "spinoff" economic benefits associated with commodity outputs. Among costs not accounted for are visual quality decrease. Many of these are not direct costs, and are largely not valued in marketplace.

Revenues

FY	n	Action	\$ Stumpage ¹	Volume, MBF		Future Value, \$		Present Value, \$	
				Alt. 2.	Alt. 3,4,5	Alt. 2.	Alt. 3,4,5	Alt. 2.	Alt. 3,4,5
2000	3	Harvest	\$235	1973	2300	412,188	480,503		
2001	4	Harvest	"	1973	2300	396,334	462,022		
2016	19	Harvest (OR)	"	2536	2707	282,868	301,941		
2017	20	" "	"	2536	2707	271,988	290,328		
2041	44	Harvest (CC)	"	0	175	0	7,322		
2081	84	Harvest (CC)	"	0	175	0	1,525		
EXISTING STAND, TOTAL \$ BENEFITS:						1,363,378	1,543,641		

Future Entires

2121	124	Prep Cut/CC-C3	"	4000	4500	7,261	8,169		
2141	144	Seed Cut	"	5000	5500	4,142	4,556		
2161	164	OR/CC-C3	"	6000	6500	2,269	2,458		
FUTURE STAND, TOTAL \$ BENEFITS						13,672	15,183		

Costs, Existing Stand

FY	n	Action	\$ Cost	Vol. MBF or Acres		Future Value, \$		Present Value, \$	
				Alt. 2.	Alt. 3,4,5	Alt. 2.	Alt. 3,4,5	Alt. 2	Alt. 3,4,5
1998	1	Sale Prep	51.53 ²	3946	4600			195,516	227,921
2000	3	Harvest admin.	59.06 ²	1973	2300			103,590	120,759
2001	4	" "	"	"	2300			99,606	116,115
2003	6	Regen. Survey	9.10/A. ³	1341 A.	1472 A.			9,644	10,586
2005	8	Regen. Survey	9.10/A. ³	1341 A.	1472 A.			8,916	9,788
2001	4	Rx burn	70.00/A. ⁴	350 A.	350 A.			20,943	20,943
2001	4	Burn piles	0.75/MBF ⁴	3946	4600			2,530	2,949
2003	6	Move gates	200/Gate ⁵	4 gates	7			632	1,106
2003	6	Road Rehab.	\$800/Mile ⁶	17.25 Mi.	18.18 Mile			10,906	11,494
2003	6	Road Obliteration	1500/Mile	0	2.55 Mile ⁷	This is in Alt. 5 ONLY!		0	(3,023)
2003	6	Road Closure	\$1000/gate	6 gates	6			4,741	4,741
OR, 3rd Step of 3 Step Shelterwood									
2013	16	Analysis	10.34	5072	5413			28,000	29,883
2014	17	Sale Prep	51.53	"	"			134,175	143,196
2016	19	Harvest Admin.	59.06	2536	2707			71,090	75,883
2017	20	" "	"	"	"			68,356	72,965
2018	21	Regen. Survey	9.10/A.	1341 A.	1432 A.			5,355	5,662
2018	21	Rehab. Roads	800/Mile	17.25 M.	18.18 M.			6,056	6,382
2017	20	Slash Disposal	0.75	5072	5413			1,736	1,853
Continuation of Clearcut regime in unit C3, 40 year harvest interval:									
2038	41	Analysis	10.34	-	175				363
2039	42	Sale Prep	51.53	-	175				1,737
2040	43	Open Roads	-	-	-				-
2041	44	Harvest Admin.	59.06	-	175				1,840
2044	47	Regen. Survey	9.10/A.	-	25 A.				36
2046	49	" "	"	-	25 A.				33
2042	45	Rehab. roads	\$800/Mile	-	1.6 Mile				219
Continuation of Clearcut regime in unit C3, 40 year harvest interval:									
2078	81	Analysis	10.34	-	175				75
2079	82	Sale Prep	51.53	-	175				361
2080	83	Open Roads	-	-	-				-
2081	84	Harvest Admin.	59.06	-	175				383
2084	87	Regen. Survey	9.10/A.	-	25 A.				8
2086	89	" "	"	-	25 A.				7
2082	85	Rehab. roads	\$800/Mile	-	1.6 Mile				46
TOTAL COSTS, EXISTING STAND:						\$870,357		\$771,792	\$867,334
						ALT. 5		ALT. 2	ALT. 3,4

² From 1996 TSPIRS 3 year average of 1994, 1995, 1996.

³ Cost estimate from Forest Silviculturist, includes overhead.

⁴ Burning costs from Forest Silviculturist, considering past planning rates for KV/BD.

⁵ Costs of gates and gate moving from Engineering.

⁶ Costs of road rehabilitation and road obliteration from Forest Hydrologist

⁷ Road obliteration is only under alternative 5: this will be separated from alternative 3 and 4 costs on bottom line calculations.

Costs, Future Stand

FY	n	Action	\$ Cost	Vol. MBF or Acres		Future Value, \$		Present Value, \$		
				Alt. 2.	Alt. 3,4,5	Alt. 2.	Alt. 3,4,5	Alt. 2	Alt. 3,4,5	
2026	29	Thinning	150/A.	1400 A.	1569 A.			67,337	75,465	
2066	69	Thinning	150/A.	-	25 A.				250	
2106	109	Thinning	150	-	25 A.				52	
Initial Prep Cut on shelterwood acres, plus 25 acre clearcut in unit C3 for alternative 3,4,5										
Initial reentry date based on CMAI from FVS run.										
2118	121	Analysis	10.34	4000	4500			359	404	
2119	122	Sale Prep	51.53	"	"			1,722	1,937	
2121	124	Harvest Admin.	59.06	2000	2250			912	1,026	
2122	125	"	"	"	"			877	987	
2123	126	Rehab. Roads	\$800/Mile	17.25 M.	18.18 Mile			99	104	
2123	126	Slash Disposal	0.75	4000	4500			21	24	
Seed cut on shelterwood acres.										
2138	141	Analysis	10.34	5000	5500			205	226	
2139	142	Sale Prep	51.53	"	"			982	1,081	
2141	144	Harvest Admin.	59.06	2500	2750			521	573	
2142	145	"	"	"	"			500	551	
2143	146	Rehab. Roads	\$800/Mile	17.25 M.	18.18 Miles			45	47	
2144	147	Rx burn	\$70/A.	1341 A.	1432 A.			294	314	
2143	146	Slash Disposal	0.75	4000	4500			10	11	
2145	148	Regen. Survey	9.10/A	1341 A.	1432 A.			37	39	
2147	150	Regen. Survey	"	"	"			34	36	
Overstory removal on shelterwood acres, plus 20 acres of CC in unit C3.										
2158	161	Analysis	10.34	6000	6500			112	122	
2159	162	Sale Prep	51.53	"	"			538	583	
2161	164	Harvest Admin.	59.06	3000	3250			285	309	
2162	165	"	"	"	"			274	297	
2163	166	Rehab. Roads	\$800/Mile	17.25 M.	18.18 Mile			21	22	
2163	166	Slash Disposal	0.75	6000	6500			7	7	
2163	166	Regen Survey OR	9.10/A.	1341 A.	1432 A.			18	19	
2165	168	" " CC	"	-	25 A.			-	<1	
2167	169	" " CC	"	-	25 A.			-	<1	
								TOTAL COSTS, FUTURE STAND:	\$75,201	\$83,986

This completes at least one full rotation based on the future stand.

SUMMARY:		ALT. 2	ALT. 3,4	ALT. 5
EXISTING STAND:	BENEFITS	1,363,378	1,543,641	1,543,641
	COSTS	<u>771,792</u>	<u>867,334</u>	<u>870,357</u>
	PRESENT NET VALUE	\$591,586	\$676,307	\$673,284
FUTURE STAND	BENEFITS	13,672	15,183	15,183
	COSTS	<u>75,201</u>	<u>83,986</u>	<u>83,986</u>
	PRESENT NET VALUE	\$-61,529	\$-68,803	\$-68,803

APPENDIX F: BIOLOGICAL EVALUATIONS

Plants F - 1
Animals F - 2

Plants F - 1

**Sensitive-Plants
Biological Evaluation
Caribou Timber Sale EA**

The proposed action is the Caribou Timber Sale. The sale is located in the Crazy Woman drainage of the Buffalo Ranger District. The proposed maximum extent of disturbance would effect approximately 1500 acres. The actions proposed are:

- Seed cut shelterwood timber harvest of 1,414 acres.
- Clear-cut timber harvest of 40 acres.
- Establishment of 7 parking/camping areas. These areas are where road closure gates will be moved approximately 1/4 mile back from the main Pole Creek road.
- Rehabilitation of 17 miles of road and 1.25 miles of trail.

There are no threatened and endangered plant species on the Bighorn National Forest.

Mitigation measures are described in the Environmental Assessment for the proposed action.

No conservation strategies have been developed for sensitive plant species on the Forest.

The Wyoming Natural Diversity Database, and Bighorn National Forest survey information was reviewed in the development of the following risk assessments.

Pre-Field Review

The following species have known sightings in or adjacent to the project area:

Species	Location
<i>Aster mollis</i>	T48N, R84W, S. 1-2; T49N, R84W, S. 26, 35-36; T50N, R84W, S. 7-17,21-22,27-29,34.
<i>Festuca Hallii</i>	T49N, R85W, S. 35.
<i>Sullivantia hapmanii</i>	T49N, R83W, S. 28.
<i>Rubus articus</i> <i>spp. acualis</i>	T50N, R84W, S. 17,26,34,35.
<i>Agoseris lackschewitzii</i>	T47N, R84W, S. 6 & 7; T48N; R84W, S. 30; T49N, R84W, S. 4; T50N, R84W, S. 26; T50N, R85W, S. 1,3,4,&6; T48N, R85W, S. 7 & 8.

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Past Surveys:

In June and August, 1993, a survey was conducted in the vicinity of the then proposed Tie Hack Reservoir project area. (Refer to *Tie Hack Dam and Reservoir Final Environmental Impact Statement*, September 1995). The only sensitive plant species located in the project area was *Rubus acaulis*, Nagoonberry.

In 1995, partially in preparation for the Clear-Crazy Landscape Analysis, a sensitive plant survey was conducted. Only areas with high probability of supporting sensitive plant species were surveyed (refer to map of 1992 and 1995 plant surveys). The survey concentrated on the eight species listed on the Region 2 sensitive species list for the Bighorn N.F. The results of that survey were documented and occurrences reported to WYNDD. Approximately 5,532 were surveyed.

Arnica lonchophylla, *Penstemon caryi*, and *Festuca hallii* were not observed. *Agoseris lackschewitzii*, *Aster mollis*, and *Rubus articus* *spp. acualis* were located and documented.

Common Name: Soft Aster
Scientific Name: *Aster mollis*
Rank: USFWS C2
USFS Sensitive

Species Description: Ray flowers violet or purple. Involucre of two or more overlapping rows of hairy bracts, green at tips, whitish below. Leaves entire largest at base. Leaves and stems pubescent with soft, grayish, non-glandular hairs. Perennial multisterned herb 30-50 cm tall. Identification is sometimes difficult as this species is thought to hybridize with other similar Aster species (*A. ascendens*, *A. foliaceus*, and *A. occidentalis*) Marriott 1992).

Range: Endemic to the Bighorn Mountains and Hoback Canyon in Wyoming.

Habitat: Sagebrush grasslands and relatively dry riparian areas, on deep, calcareous and granitic soils at the edge of aspen or pine woodlands. Elev. 6400-8500 ft.

Risk Assessment: Collections from the Bighorn National Forest and the Tensleep Preserve indicate that this species is much more common than previously thought. (WNNDB 1995). Collections from the 1994-1996 on the Bighorn National Forest indicate that *Aster mollis* is found on a variety of sites, that have been subjected to a variety of management practices. This species has been collected the year following prescribed burns at two locations, and on sites that have not been burned for more than 100 years. It has been collected on heavily grazed sites, as well as on areas that have not

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been recently grazed. Based on this information, we are assuming that *A. mollis* is tolerant but not dependent on grazing and fire.

Primarily because this species is not found in forested habitats, no impacts to *A. mollis* populations are expected to result from the Caribou timber sale. *Watch road placement*

References: Bighorn National Forest 1992; Fertig 1992; Jones 1984; Marriott 1992

Common Name: Hall's Fescue-
Scientific Name: *Festuca Hallii*
Rank: USFS Sensitive

Species Description: There are some taxonomic questions about the distinction between *F. hallii* and *F. scabrella* by some authors.

Range: *Festuca Hallii* is found from Canada south to North Dakota and Colorado. It is known from the Bighorn, Absaroka and Medicine Bow Mountains in Wyoming (Fertig 1994)

Habitat: Suitable habitat includes meadows, slopes and open woods. Elev. 7400-10500 ft. (Bighorn 1992)

Bighorn National Forest Distribution:

There is one historical collection of this species in 1898 on the Bighorn Mountains and this specimen has incomplete location information, described as being collected on a branch of Crazy Woman Creek (Bighorn 1992). This species has not been recollected on the Bighorn Mountains. Collections on the Shoshone National Forest indicate that this species is not as uncommon as previously thought (Houston pers. comm.).

Risk Assessment: The palatability and preference for this species to livestock is not known, but most *Festuca* species tend to be highly palatable and often preferred. Because this species is not found in forested habitats, no impacts to *F. hallii* populations are expected to result from the Caribou timber sale.

References: Bighorn National Forest 1992; Dorn 1992; Hallesten et al. 1987; Hitchcock et al. 1969; Pavlick and Looman 1984.

Common Name: Hapeman's sullivantia
Scientific Name: *Sullivantia hapmanii*
Rank: USFWS C2
USFS Sensitive

Species Description: Glandular pubescent perennial herb; stems 40 -60 cm high. Basal leaf blades kidney shaped or rounded. Inflorescence an open panicle, Flowers glandular, 5 petaled, white, stamens 5.

Range: Hapeman's sullivantia is limited in its distribution to southern Montana, north-central Wyoming and central Idaho (Fertig 1994). Elev. 4600-8200 ft.

Habitat: The habitat is moist calcareous outcrops and boulders along shaded canyons and streams (Fertig 1994).

Bighorn National Forest Distribution: This species has turned out to be relatively common on the Bighorn Mountains where suitable habitat exists such as Crazy Woman Canyon, Pass Creek, Tensleep Canyon, and in the Little-Bighorn Canyon (Bighorn and WNDDB collections). These collections indicate this species is not as uncommon as previously thought.

Risk Assessment: The proposed action is entirely within a granitic geologic type. The species is only found on calcareous types. This species is often found among rocks and on canyon walls, often on areas quite steep. Because of it's habitat, this species will not be effected by the Caribou timber sale.

References: Dorn 1992; Fertig 1993; Soltis 1991.

Common Name: Northern Blackberry.
Scientific Name: *Rubus arcticus* ssp. *acualis*
Rank: USFS Sensitive

Species Description: Flowers dark pink or rose-purple. Low growing perennial herb, stems not bristly nor prickly, to 15 cm high.

Range: Alaska to Newfoundland south to British Columbia and Minnesota, and in the Rocky Mountains from Montana to Colorado.

Habitat: Boggy woods and marshes. Elev. 7000-9000 ft.

Bighorn National Forest Distribution: This species is presently only found in the Sourdough drainage east of highway 16. Prior to this collection in 1994, this species had only been collected once in 1890. In 1995, portions of 17 streams across the Forest with similar habitat conditions to Sourdough Creek were surveyed. The timber sale area was

partially included in that survey. No individuals were found on the other 17 streams. However, additional plants were found to be abundant on Sourdough Creek.

Risk Assessment: In 1995, surveys were conducted along portions of Caribou and Pole Creek. This species was not found. This species is only found in riparian habitat. Because no activity will be directly occurring in riparian and mitigation measures in the Environmental Assessment are designed to prevent indirect effects to these areas, the Caribou timber sale will have no effect on this species.

References: Dorn 1992; Hitchcock and Croquist 1961; Moss 1983.

Common Name: Pink Agoseris
Scientific Name: *Agoseris lackschewitzii*
Rank: USFS Sensitive

Species Description: Heads one per stem, ray flowers light pink. Leaves thin-oblancoate, 6-20 cm long, in a basal rosette. Perennial herb, flowering stem 6-49 cm tall.

Range: Initially thought to be endemic to east-central Idaho, southeast Montana and the Wind River and Beartooth ranges of northwest Wyoming. Collections from the Bighorn Mountains in 1994 indicate that this species is relatively common on the Forest.

Habitat: The habitat includes wet montane and subalpine meadows. It was found across the Bighorn Mountains on a variety of sites from about 8000 to 10000 feet.

Bighorn National Forest Distribution: This species was collected 16 times during the summer of 1994. Species collected came from areas of both light and heavy grazing.

Risk Assessment: Because this species is associated with wet meadows, and no direct activities or indirect effects are anticipated to occur in these habitats, the proposed actions will not have an effect on this species.

References: Fertig 1993, Henderson et al. 1990; USDA Forest Service 1989, 1991.

Common Name: Northern Arnica
Scientific Name: *Arnica lonchophylla*
Rank: USFS Sensitive

Species Description: Flower heads 1-7, flowers yellow, leaves coarsely toothed lanceolate to ovate and opposite. Perennial herb to 40 cm tall.

Range: This species is found in portions of Canada, south to northern Minnesota. There are disjunct populations found in the Black Hills of South Dakota and recently has been determined to be prevalent in the Hills.

Habitat: Found in a variety of habitats usually in open woods on sandy gravel or limestone derived soils. It is sometimes found on forest edges or in forest openings, not under forest canopies. On the Bighorn Mountains it is found at elevations of 6,000 to 8,000 feet on both limestone and granitic parent material.

Risk Assessment: This species has only been found on the northern portions of the Forest primarily on the Medicine Wheel Ranger District. Because it is not known to occupy forested habitats, the proposed actions will not have an effect on this species.

References: Bighorn National Forest 1992; Fertig 1994.

Common Name: Giant Helleborine
Scientific Name: *Epipactis gigantea*
Rank: USFS Sensitive

Species Description: This species is in the orchid family. It has greenish yellow or coppery colored flowers. The stems are 30 - 140 cm tall.

Range: Found primarily west of the continental divide from Canada to Mexico.

Habitat: This species is usually associated with thermal features. No known suitable habitat exists on the Forest.

Risk Assessment: This species was found on Shell Creek 100 years ago. It was found at an elevation of 4,000 ft. which would be off the Forest. The proposal would not have an effect on this species.

References: Fertig 1994.

Common Name: Carey's Beardtongue
Scientific Name: *Penstemon caryi*
Rank: USFS Sensitive

Species Description: Stems leaves and inflorescence glabrous. Corolla tube-shaped, blue. Leaf blades linear to lanceolate, entire, longest at base of stem. Perennial herb; flowering stem to 40 cm tall.

Range: Endemic to the Bighorn and Pryor Mountains.

Habitat: Habitat is primarily on calcareous substrates, associated with meadows, sagebrush, juniper, Douglas -fir, and limber pine communities. This species has also been located on relatively bare substrates associated with road cuts. Elevation ranges from

5200 to 8500 feet. Though not found in Crazy Woman canyon, the canyon does provide suitable habitat.

Risk Assessment: Only one location has been found on the east side of the Forest on Dry Fork Ridge near Riley Pt. The proposed action will not have an effect on this species.

Wash road present

References: WYNNDB 1992, Fertig 1992.

Prepared by: Paul Beels

Date: 2/25/98

Reviewed by: Jerome A. Mast *I concur with the determination contained*

Date: 3/5/98

in this B.E.

Animals F - 2

BIOLOGICAL EVALUATION
of
ENDANGERED, THREATENED, AND SENSITIVE SPECIES
RELATED TO THE PROPOSED
CARIBOU TIMBER SALE

BIGHORN NATIONAL FOREST

Prepared by: Harold Golden 2/3/98
HAROLD GOLDEN, Wildlife Biologist

Received by: Kathy E Bulchis 2/6/98
KATHY BULCHIS, District Ranger

BIOLOGICAL EVALUATION FOR THE CARIBOU TIMBER SALE

INTRODUCTION

Forest Service policy regarding Biological Evaluations is stated in FSM 2672.4 as follows: "Biological Evaluation. Review all FS planned, funded, executed, or permitted programs and activities for possible effects on endangered, threatened, proposed, or sensitive (ETP&S) species. The Biological Evaluation is the means of conducting the review and documenting the findings. Document the findings in the decision notice."

DESCRIPTION OF PROPOSED ACTION

The Buffalo Ranger District, Bighorn National Forest, proposes to harvest timber over approximately 1500 acres, with no construction of new roads. The majority of the harvest area will be prescribed for a second entry of a three-step shelterwood system. This will result in a fairly open stand of mature trees and will encourage a second age-class of conifers to become established in the understory.

The project area is located in Johnson County, Wyoming, about 20 miles southwest of Buffalo.

For more detailed information, refer to the Caribou Timber Sale Environmental Assessment. This document is on file at the US Forest Service office, 1425 Fort Street, Buffalo, Wyoming 82834.

METHODS

The project area and habitats were visited on the ground in spring (March 7, 1997), and again in early-summer (June 23, 1997). Also, topographic maps, and aerial photographs were examined in excruciating detail. The Forest Service Resource Information System (RIS) database was also utilized in this analysis.

The occurrence and status of all species listed are based on site visits, examination of the Wyoming Game and Fish Department's Wildlife Observation System (WOS), the Nature Conservancy's Wyoming Natural Diversity Database (WNDD), Forest Service files, and personal communications with personnel at WYGF and Forest Service, and review of the scientific literature.

During the Caribou project analysis, the wildlife biologist and silviculturist mapped the locations of known old growth, and reviewed data and the location of candidate stands that are adjacent to the known old growth. Candidate stands provide some old growth attributes now, or will be old growth in 25 to 75 years. Proposed harvest units were then compared to the locations of old growth blocks. It was determined that no harvest was proposed in current old growth stands or in logical candidate stands.

The other information sources listed at the end of this document were utilized to help describe habitat needs and to analyze affects of the proposed project.

PROJECT AREA AND HABITAT DESCRIPTION

The project area is dominated by relatively even-aged lodgepole pine. Openings occur mainly along water courses and most are dominated by wetland vegetation. Small stands of aspen are also scattered along the meadow-conifer ecotone. There are also some openings created by past clearcutting.

This area has had several previous projects implemented over the past 30 years. These projects include timber sales with associated road construction. There are extensive blocks which have been previously clearcut. Most of these areas are now covered with young lodgepole pine from 5 to 12 feet high.

The Cloud Peak Wilderness is approximately 4 air miles from the nearest proposed cutting unit. There is no motorized road or trail access to the Wilderness from the proposed project area.

Spruce-fir timber types are extremely limited in the project area. The majority of this timber type occurs in stringers along streams and ephemeral drainages. Spruce-fir types are more abundant to the west of the project area becoming dominant inside the Cloud Peak Wilderness.

There are many areas, especially along roads and in clearcuts, where snags and other large woody debris are less than are needed for optimal wildlife habitat.

Riparian zones in the project area are relatively narrow and willows, if present, are scattered. There is some beaver activity.

The presence and distribution of old growth forest types was analyzed for this project. The table below describes the findings:

Diversity Unit	Known Old Growth	Forest Plan Req	% in Old Growth
110	354 acres	310 acres	5.7%
111	491 acres	300 acres	7.7%
112	356 acres	98 acres	19.9%
113	378 acres	158 acres	11.9%
114	684 acres	279 acres	12.2%

SUMMARY OF FINDINGS

The risk of adverse effects from project activities (including related activities and/or cumulative effects) was evaluated for wildlife and fish species listed below:

Threatened, Endangered, or Candidate Species

North American Lynx	No effect	Peregrine Falcon	No effect
Sturgeon Chub	No effect	Bald Eagle	No effect
Mountain Ptarmigan	No effect	Boreal Western Toad	No effect
Columbia Spotted Frog	No effect		

Forest Service Region 2 Sensitive Species

Townsend's big-eared bat	No effect		
Fisher	No effect		
Least Weasel	No effect		
Water vole	No effect		
Pine Marten	No effect		
Fringe-tailed myotis	No effect		
Spotted bat	No effect		
Allen's thirteen-lined ground squirrel	No effect		
North American wolverine	No effect		
Golden-crowned Kinglet	No effect		
Western Yellow-billed Cuckoo	No effect		
Loggerhead Shrike	No effect		
Northern three-toed woodpecker	May adversely impact individuals		
Olive-sided flycatcher	May adversely impact individuals		
Pymgy Nuthatch	May adversely impact individuals		
Common Loon	No effect	Boreal Owl	No effect
Harlequin Duck	No effect	Merlin	No effect
Osprey	No effect	Long-billed Curlew	No effect
Greater Sandhill Crane	No effect	Upland Sandpiper	No effect
Western Burrowing Owl	No effect	Lewis' Woodpecker	No effect
Baird's Sparrow	No effect	Fox Sparrow	No effect
Ferruginous Hawk	No effect	White-faced ibis	No effect
Northern Goshawk	No effect	Black Tern	No effect
Tiger Salamander	No effect	Northern Leopard Frog	No effect
Wood Frog	No effect	Yellowstone Cutthroat Trout	No effect

CONSULTATION WITH THE U.S. FISH AND WILDLIFE SERVICE (USFWS)

Interagency cooperation between the Forest Service (or other federal agency) and the USFWS, regarding proposed, threatened, or endangered species, is described in Section 7 of the Endangered Species Act. Definitions relating to "consultation" and "conference" are given in FSM Supplement 2600-94-2.

This project is expected to have "no effect" on any federally threatened, endangered, or candidate species (or critical habitat). The proposed project would not affect the population viability and distribution of sensitive species. Therefore, formal consultation with the USFWS is not required.

BIOLOGICAL EVALUATION FOR FISH AND WILDLIFE

PRE-FIELD (OFFICE) REVIEW OF EXISTING INFORMATION

A pre-field review of existing information was conducted for the project area, which included: aerial photograph interpretation, review of RIS information, review of previous timber management activities, and conversation with biologists from the Wyoming Game and Fish Department. The Wyoming Game and Fish atlas of birds, mammals, reptiles, and amphibians was utilized to search for documented sightings of selected species in the project area; this atlas is a summary report of WOS. The WNDD was also searched for documented sightings of the selected species in the project area. The analysis document for the Clear Creek/Crazy Woman area was also reviewed.

The occurrence and status of endangered, threatened, and candidate species of wildlife within the project area are based on previous site visits, examination of the Wyoming Game and Fish Department Wildlife Observation System, The Nature Conservancy Wyoming Natural Diversity Database, Forest Service files, and review of the scientific literature.

SUMMARY OF REVIEW FOR FISH AND WILDLIFE

Listed below are the Threatened, Endangered, Candidate, and Region 2 Sensitive fish and wildlife species that may occur within the Bighorn National Forest, but are not likely to occur within the project area.

Mammals

Fringe-tailed myotis, Myotis thysanodes pahasapensis.
Status: Region 2 Sensitive.

Prefers caves, mines, rock crevices for day and night roosting.

Fringe-tailed Myotis have been found on the Bighorns. However, there have been no documented sightings of this species within the southeastern portion of the Bighorn National Forest.

A review of the habitat requirements for this species, contrasted to the habitat types present in the project area, and combined with the lack of sightings in the project area, indicate that the selective harvest of lodgepole pine in this area will have no effect on Fringe-tailed myotis.

Spotted Bat, Euderma maculatum.
Status: Region 2 Sensitive.

Habitat use for Spotted bat indicates a preference for crevices in high cliffs, canyons, and caves.

There are no documented sightings within the Bighorn National Forest. Also, there is no suitable habitat within 10 air miles of the project area.

A review of the habitat requirements for this species, contrasted to the habitat types present in the project area, and combined with the lack of sightings in the project area, indicate that the selective harvest of lodgepole pine in this area will have no effect on Spotted bat.

Townsend's big-eared bat, Plecotus townsendii.
Status: Region 2 Sensitive.

Roosts in caves or rocky cliff crevices.

There have been no documented sightings within the Southeast portion of the Bighorn National Forest. Also, there is no cave or mine habitat within 10 air miles of the project area.

A review of the habitat requirements for this species, contrasted to the habitat types present in the project area, and combined with the lack of sightings in the project area, indicate that the selective harvest of lodgepole pine in this area will have no effect on Townsend's big-eared bat.

Fisher, Martes pennanti.
Status: Region 2 Sensitive.

Widely ranges from northern and montane boreal forests of Yukon and northern British Columbia, east to Labrador and Nova Scotia; ranges (rarely) south in Rockies to Yellowstone, Sierra Nevadas of central California and Utah. Inhabitant of middle-late developmental stage of spruce-fir and mixed hardwoods. Needs large tracts of relatively undisturbed dense, mature forests with downed timber, as opposed to open areas which they avoid. Physical structure of the forest and prey associated with forest structures are the critical features that explain fisher habitat use. Forest structures should have three functions important for fishers: structure that leads to high diversity of dense prey to fishers, and structure that leads to high vulnerability of prey to fishers, and structure that provides natal and maternal dens and resting sites. It appears from this description that spruce-fir old growth would best meet fisher habitat needs.

The last reliable reports of fishers in Montana and Idaho came during the 1920's, and reintroduction occurred during the late 1950's and 1960's. Fishers have occasionally been sighted in Wyoming, North Dakota, and South Dakota.

Neither WOS or WNDD contain any records of fisher sightings in the Bighorns.

Suitable habitat for fisher does not exist in the project area, and selective harvest of lodgepole pine with this proposal will not affect this species.

Allen's thirteen-lined ground squirrel, Spermophilus tridecemlineatus alleni.
Status: Region 2 Sensitive.

This subspecies likely no longer exists on the Bighorn National Forest. There is one record of an Allen's thirteen-lined ground squirrel being collected on the Bighorn National Forest. That specimen was collected on Canyon Creek, about 10 air miles from the project area, and was reported in the year 1898. There have been no records since then.

Ground squirrel habitat is dry shortgrass or tallgrass prairie; Juniper, basin-prairie and mountain foothills shrublands, grasslands, small grain agricultural areas, and roadside banks. Elevation from sea level to 10,000 feet. Due to the vegetative characteristics of the project area, Allen's thirteen-line ground squirrels are not thought to occupy this part of the Bighorn National Forest. Therefore, commercial harvest of lodgepole pine would have no effect on this species.

North American wolverine, Gulo gulo luscus.

Status: Region 2 Sensitive.

The primary habitat of wolverines is alpine tundra and subalpine coniferous forests. Uses timbered ridges and creek bottoms for travelling. Needs large areas with little human activity. Den sites in rocky areas, caves, logs, or snags. In Wyoming, the range is uncertain and it is listed as rare by the Wyoming Game and Fish Department.

There are 100 records available from 1961 to 1991, all in the western third of Wyoming. No observations of wolverines in the project area exist in the WOS or the WNDD. Wolverine are not known to occur on the Bighorn National Forest.

Descriptions of preferred habitat types, compared to habitats present in the project area, indicate that the proposed selective harvest of lodgepole pine would have no effect on this species.

Least weasel, Mustela rixosa.

Status, Region 2 Sensitive.

Needs small mammals for food source, usually those found in meadows, riparian, aspen and Ponderosa parklands, and mixed forests and suitable den sites (ground cover, logs, stumps, or burrows).

There are no records of Least Weasel occurring within the Bighorn National Forest.

A review of habitat requirements, compared to habitats present in the project area, and combined with the lack of documented sightings, indicate that the proposed selective harvest of lodgepole pine will have no effect on Least Weasel.

Birds

Western yellow-billed Cuckoo, Coccyzus americanus

Status: Region 2 Sensitive.

This bird favors moderately dense thickets of undergrowth near watercourses, second growth woodlands, deserted farmlands overgrown with shrubs and brush, and brushy country roadsides and orchards. Preferred habitat is a dense willow understory beneath a canopy of large cottonwoods growing along streams and ponds. They also inhabit open woods, but avoid extremely dense woods and high elevations. Nests are usually found below 7,000 feet elevation, with most nest sites occurring between 3,000 and 7,000 feet.

Habitat found in the project area is unsuitable for this species. Therefore, selective logging in lodgepole pine will have no effect.

Bald Eagle, Haliaeetus leucocephalus alascanus.

Status: Endangered.

Expected occurrence: Winter resident, Migrant

This species usually nests in large, open-canopied conifer trees or on cliffs near water. They are opportunistic feeders taking advantage of available food sources including fish, waterfowl, small mammals and carrion.

Suitable habitat occurs off the BNF. Bald eagles are sometimes observed on the Forest, but this is usually during the fall migration period. Because they do not nest on the Forest, nor normally occur at higher elevations, it was not designated as one of the management indicator species. If bald eagles are ever identified as nesting and/or roosting on the Forest, these habitats will be identified.

In conjunction with the Bighorn National Forest Plan, a biological assessment was prepared and coordinated with the US Fish and Wildlife Service for the bald eagle (September 20, 1983). The finding of the biological assessment was that none of the actions planned for implementation of the Bighorn Land Management Plan would effect bald eagles or suitable habitat.

The Clear Creek/Crazy Woman analysis reported that there has been only one documented report for bald eagles in the Clear/Crazy drainages. That sighting was 2 air miles from the nearest proposed cutting unit.

Habitat requirements for Bald Eagle, combined with the paucity of sightings in the project area, and the preponderance of unsuitable habitat in the project area, indicate that the proposed action will have no effect on this species.

Common loon, Gaview immer.

Status: Region 2 Sensitive.

This species is dependant on large water bodies (lakes). Needs vegetation along edges of lakes and rivers for nesting and water for feeding.

There is no such habitat within 6 air miles of this project. Only one sighting of a common loon has been reported on the Bighorn National Forest (WNDD). That specimen was on Sibley Lake in 1989, and was thought to be an early migrant.

The lack of lacustrine habitat in the project area, combined with the low number of sightings within the Bighorn National Forest, indicate that the selective harvest of lodgepole pine in this project area will have no effect on Common Loon.

American peregrine falcon, Falco peregrinus anatum.
Status Endangered.

Expected occurrence: Migrant, Summer resident

This species utilizes cliff recesses for nesting in open country and mountain parks. Most nests are on high cliffs (200-400 ft.) above 6,000 feet elevation on southern exposures. They forage in a wide variety of habitats, including riparian woodlands, coniferous and deciduous forests, shrublands and prairies. They prey on small to medium sized birds which are taken in flight.

No nesting pairs have been found on the Forest. However, pairs are nesting in the Bighorn Canyon National Recreation Area located within 10 air miles of the Forest Boundary. Approximately 16,100 acres of suitable habitat has been identified in Shell and Tensleep Canyons. A survey conducted in 1980 identified four additional areas adjacent to the Forest as having High potential for successful reintroduction. These areas are Cottonwood Canyon, Elk Springs Canyon, Trapper Canyon, and White Canyon.

During the summers of 1991 through 1995, the BNF in cooperation with the Peregrine Fund and Wyoming Game and Fish Department has attempted to reintroduce peregrines in Shell Canyon and Tongue Canyon. Potential nesting areas will be monitored to determine if these birds return to nest on the Forest. Additional falcons may be released during subsequent years if site specific evaluations are favorable.

This reintroduction program is designed to establish self-sustaining population on the BNF. On a larger scale, the BNF program is one component in the effort to reestablish this endangered species in the northern Rocky Mountains.

In conjunction with the Bighorn National Forest Plan, a biological assessment was prepared and coordinated with the US Fish and Wildlife Service for the peregrine falcon (May 18, 1984). The findings of the biological assessment was that none of the actions planned for implementation of the Bighorn Land Management Plan would effect peregrine falcons, or suitable habitat.

The analysis conducted for the Clear Creek/Crazy Woman area states that suitable cliff habitat exists in the Clear/Crazy drainage but is not extensive enough to provide prime habitat. There are no records of peregrine sightings in the WNDD for the project area.

Review of the habitat requirements, compared to the habitat types present in the project area, combined with the lack of documented sightings in the project area, indicate that the proposed timber harvest will have no effect on this species.

Osprey, Pandion haliaetus.
Status: Region 2 Sensitive.

Osprey are dependant on large water bodies such as lakes, to forage for fish, and snags for perching and nesting. Nests are typically less than 1.5 miles from feeding areas.

The nearest lake is 6 air miles from the proposed project. The project area does not contain suitable habitat for Osprey. Therefore, the proposed selective harvest of lodgepole pine would have no effect on this species.

Harlequin duck, Histrionicus histrionicus.
Status: Region 2 Sensitive.

Inhabits rivers and lakes in mountainous areas. Nests are located in rock crevices, logs, holes in trees or in hollows under a bush.

In Wyoming, they are considered an uncommon resident in the proper habitat. The nearest suitable habitat is 6 air miles from the proposed project. There are no documented sightings of harlequin ducks on the Bighorn National Forest.

Habitat types required for this species do not include upland lodgepole pine. The habitat in the project area is unsuitable for this species, and commercial harvest of timber will have no effect on harlequin duck.

Greater Sandhill Crane, Grus canadensis tabida.
Status: Region 2 Sensitive.

Nesting habitat for this migratory species consists of large marshes and willow-lined drainages of mountain meadows up to 9,500 feet in elevation.

Breeding confirmed on the northern part of the Bighorns. No documented sightings within 10 miles of the project area.

The lack of suitable habitat within the project area, combined with a lack of documented in or near the project area, indicate that the proposed harvest of lodgepole pine would have no effect on this species.

Western burrowing owl, Athene cucularia.
Status: Region 2 Sensitive.

Habitat is typically grasslands, basin-prairie shrublands, and agricultural areas. Commonly uses vacant prairie dog burrows in shortgrass areas of the high plains. Migrates south of Wyoming in winter.

While this species is ubiquitous throughout it's range, there have been no documented sightings on the Southeast portion of the Bighorn National Forest.

Habitat characteristics of the project area combined with the paucity of documented sightings, indicate that harvest of lodgepole pine would have no effect on Western burrowing owls.

Boreal owl, Agolius funereus.
Status: Region 2 Sensitive.

Prefers mature mixed and spruce-fir forests adjacent to parks and openings. Nests in cavities excavated by woodpeckers in dead or live conifers.

There have been no documented sightings of Boreal Owls within the Bighorn National Forest. Surveys are continuing.

Review of habitat preferences indicates that selective harvest of lodgepole pine in areas previously harvested would have no effect on this species.

White-faced ibis, Plegadis chihi.
Status: Region 2 Sensitive.

White-faced ibis typically occur in marshes and wet meadows and grassland. In Wyoming, they are listed as an uncommon summer resident, and they usually nest in bullrushes or cattails.

There have been no documented sightings of White-faced ibis within the Bighorn National Forest.

Comparison of habitat preferences with habitat types present in the project area indicate that selective harvest of lodgepole pine in areas previously harvested would have no effect on this species.

Black Tern, Chlidonias niger.
Status: Region 2 Sensitive.

Black terns are generally found near marshes and other aquatic settings where they nest on floating vegetation or muskrat houses. They are listed as a common summer resident in Wyoming. Winters in Central and South America.

There have been no documented sightings of Black Tern within the Bighorn National Forest.

Comparison of habitat types used by this species to habitat types present in the project area indicate that selective harvest of lodgepole pine in areas previously harvested would have no effect on this species.

Amphibians

Tiger salamander, Ambystoma tigrinum.
Status: Region 2 Sensitive.

This species occupies moist environments within a wide variety of habitat types. Elevation up to 11,000 feet. Open pools, ponds, lakes, slow-moving streams with sedges and grasses are required for breeding. Water temperatures for breeding 55 to 75 degrees Fahrenheit.

Extensive surveys have failed to turn up any specimens of this species on the Bighorns. Surveys are ongoing.

Preference for moist environments, contrasted with the availability of this type of habitat in the project area, combined with the lack of documented sightings, indicate that harvest of lodgepole on dry upland sites would have no effect on tiger salamander.

Boreal western toad, Bufo boreas boreas.
Status: USFWS Candidate, Region 2 Sensitive.

Requires open water of some type for breeding. Buries itself in loose soil or seeks shelter in burrows during the day. Elevation 1,000 to 10,000 feet.

Thorough research of available literature indicates that this species does not occur on the Bighorn National Forest.

Based on comparison of habitats required versus habitat available in the project area, selective harvest of lodgepole pine in areas previously harvested would have no effect on this species.

Fish

Yellowstone cutthroat trout, Oncorhynchus clarki bouveri.
Status: Region 2 Sensitive.

Inhabits cold clear headwaters of high mountain streams and cool clean lakes with sand or rock bottoms and abundant riparian vegetation. Requires shade and cover provided by overhanging vegetation, undercut banks, or eddies behind in-stream boulders.

This subspecies has not been genetically or phenetically documented on the southern half of the Bighorn National Forest.

Comparison of this species' special habitat requirement for riparian vegetation, to the proposed action (harvest of trees in upland sites), indicates that this project would have no effect on yellowstone cutthroat trout.

Sturgeon chub, Hybopsis gelida.
Status: USFWS Candidate.

Occurs almost exclusively in the Missouri River drainage from its headwaters to it's mouth in the Mississippi River. It lives over gravel in the current of larger silty rivers. Tolerates high turbidity.

There are no documented occurrences of this species within Johnson County which includes the southeast portion of the Bighorn National Forest.

Lodgepole pine habitat on dry upland sites is not critical habitat for this species. Therefore, selective harvest of lodgepole pine in areas previously harvested would have no effect.

Listed below are the Threatened, Endangered, Candidate, and Region 2 Sensitive fish and wildlife species that are known or expected to occur within the project area, or that the project potentially affects. Field surveys for these species were not conducted, with the exception of Northern Goshawk and amphibians.

Mammals

Pine Marten, Martes americana.
Status: Region 2 Sensitive.

Marten are distributed in boreal and northern coniferous forests. Mature forests of spruce-fir or lodgepole pine, with canopy cover ranging between 30 to 70%, are required for winter survival. They are known to use most montane and subalpine plant communities, as well as alpine communities. Habitat ranges from 8,000 to 13,000 feet elevation. Large clearcuts or burned areas are generally avoided, especially during winter. Dens are located in snags, hollow logs, burrows under trees and large rock piles. This species forages primarily on the ground but will also seek prey in tree canopies. Prey species include small mammals, birds, insects and carrion. Berries and other plant materials may be eaten seasonally.

Overtrapping has resulted in extirpation of this species in some areas of the United States. Marten are also sensitive to changes in habitat, which includes impacts from timber harvest and snag removal by firewood cutters.

In Wyoming, Pine marten are classified as a furbearer and trapping is permitted by the Wyoming Game and Fish Department.

Cumulative effects analysis was conducted for this species using the HABCAP computer model. As a baseline, the model was run using current habitat characteristics. Results indicated that current habitat capability is 79%, suitable acres used for feeding is 22,025, and suitable acres used for cover is 21,398. For cumulative effects, an assumption was made that 1500 acres of lodgepole pine would be clearcut (selective harvest is proposed with this project, but a future entry would essentially be a clearcut). Results indicated that habitat capability remained unchanged at 79%, suitable acres used for feeding remained unchanged, and suitable acres used for cover was reduced to 19,898. It should be noted that the projected drop in acres used for cover still provided 100% or more of optimum. A copy of the model outputs is attached to this document.

The WNDD contains one record of a marten sighting on the Bighorn. That sighting was 15 air miles from the proposed project.

A thorough search of habitat descriptions combined with results of the HABCAP model, indicate that this project will have no effect on Pine Marten.

Water vole, Microtis richardsoni.
Status: Region 2 Sensitive.

Inhabits riparian, cottonwood-willow, marshes, wet alpine meadows, grass-sedge areas. Prefers wet sites such as stream sides. Uses tunnels and burrows in dense willow or herbaceous vegetation.

Water voles are very selective for small, narrow patches of riparian habitat adjacent to alpine and sub-alpine streams, within 5 meters of stream edges. Inhabited sites range from 3,000 to 10,500 feet in elevation and streambanks with deep, well-drained soils are preferred. Water voles are very mobile underwater and burrow entrances are often built below the surface. Water voles remain active throughout the winter. They feed primarily on leaves and stems of forbs, as well as grasses, sedges, roots, bulbs and seeds to a lesser extent.

Water voles have a relatively short breeding season, small litter sizes and short life-spans. Site fidelity is high and seemingly suitable habitats in adjacent areas are often unused. These factors make local populations vulnerable to habitat disturbance and long-term extirpation. Concentrated use by livestock in riparian areas reduces habitat quality by changing the quality and quantity of riparian vegetation and causing soil compaction and bank sloughing.

Timber harvest on dry upland sites would have no effect on this wetland dependant species.

North American lynx, Felis lynx canadensis.
Status: USFWS Candidate.

Extensive tracts of dense forest with bogs, rocky outcrops, and thickets is the preferred habitat type of lynx. Lynx locate their dens in forested areas with rocks, hollow trees, dense windfalls, or natural cavities in ground. Needs dense boreal forest with good prey base.

In Wyoming, the lynx is rare. Dispersal and reproductive success is closely tied to snowshoe hare population fluctuations. On the Bighorns, there have been 5 records of sightings between 1969 and 1988. The 1969 record was from an adult killed near South Piney Lakes. Three sightings in 1970, 1972, and 1981 were taken from trapper records. The 1988 sighting is earmarked in WNDD as an unlikely record, and occurred near Porcupine Ranger Station, which is 62 air miles from the proposed project.

Cumulative effects analysis was completed for this species using the HABCAP model. Results are attached to this document. In summary, the analysis showed that clearcutting 1500 acres of lodgepole pine had no effect on habitat capability or on habitat suitability for this species. The HABCAP model indicates low suitability for this species with a habitat capability rating of 8%.

Review of the habitat requirements, compared to habitat availability in the project area, combined with the low number of reliable sightings, combined with the lynx's dependency on snowshoe hare, indicate that the proposed project will have no effect on North American lynx.

Birds

Ferruginous hawk, Buteo calurus.
Status: Region 2 Sensitive.

Habitat for Ferruginous hawks consists of basin-prairie shrublands, eastern great plains, mountain foothills grasslands, rock outcrops, and cottonwood riparian. They prefer live deciduous trees, riparian zones at lower elevations in the foothills and on the plains.

The WOS indicates that Ferruginous hawks do breed in the same latilong region as the project area, but WNDD does not contain any records for the Bighorn National Forest.

Comparison of habitat preferences for this species compared to habitat availability in the project area, indicates that the proposed project would have no effect on Ferruginous hawk.

Northern Goshawk, Accipiter gentilis.
Status: Region 2 Sensitive.

Goshawks are typically found in dense coniferous forests or conifer dominated mixed woodlands. Nesting sites generally occur in mature conifer forests with up to 85% canopy closure and a relatively open understory. Goshawks hunt in and around forest openings. Goshawks are highly intolerant of human disturbance during nesting periods and will aggressively defend an area up to 200 acres surrounding a nest. Excessive disturbance can cause nest abandonment.

There is suitable habitat for northern goshawks in the form of coniferous forests with varying habitat features located within the project area.

All the proposed harvest sites were surveyed for nesting Goshawks on June 23, July 21, and July 24, of 1997. No active nests were found.

A cumulative effects analysis was conducted using the HABCAP model. As a baseline, the model was initially run for the current habitat. Results indicated that the current habitat capability is 80%, suitable acres used for feeding equals 24,491, and suitable acres used for cover equals 22,273. The model was run again with the assumption that 1500 acres of lodgepole pine was to be clearcut and moved from structural stage 4A to structural stage 1. Results indicated that the habitat capability would remain unchanged at 80%, suitable acres used for feeding remained unchanged at 24,491, and suitable acres used for cover dropped to 20,773. It should be noted that the reduced cover still produced a cover value of 100% of optimum. Results of HABCAP analysis are attached to this document.

Observations of active goshawk nests in similar parts of the Bighorns, combined with the results of HABCAP analysis, indicate that selective harvest of lodgepole pine in this area will have no effect on this species.

Merlin, Falco columbarius.
Status: Region 2 Sensitive.

Nests in coniferous forest up to 8,500 feet elevation. Merlin habitat includes open areas such as forest edges, bogs, and lakes in boreal and moist Pacific coastal forests, and prairie-parklands of the northern Great Plains. They hunt in open woodlands, openings, marshes, and along the edges of lakes and ponds. Snags and riparian habitat are important habitat components.

Sightings have been documented within the Bighorn National Forest. Most sightings of Merlins occur in open stands of ponderosa pine and grasslands at lower elevations. The majority of these observations are at 4,000 feet.

Grazing affects Merlins where small bird and mammal populations are reduced. It is unlikely that grazing is the primary limiting factor on the Forest or that grazing would tend to move the species toward federal listing.

Selective harvest of lodgepole pine in the project area will not alter habitat use by Merlins. Therefore, implementation of the proposed action will have no effect.

Mountain plover, Charadrius montanus.
Status: USFWS Candidate.

Habitat consists of semiarid grasslands, plains, sagebrush-grasslands, and plateaus. In Wyoming, it is a summer resident of the basins and Laramie plains. Requires areas of dry grazed shortgrass flats for mating display and nesting.

WOS records indicate that the mountain plover is believed to breed in the same latilong region as the proposed project. There are no records of mountain plovers in the WNDD.

In this project area, most openings are located in lowlands and many are wetlands. Suitable habitat is marginal in the project area for this species. Selective harvest of lodgepole pine will have no effect on this species.

Long-billed curlew, Numenius americanus.
Status: Region 2 Sensitive.

Long-billed curlews typically inhabit grasslands and prairies as well as agricultural lands and rangelands. They prefer to nest on open buffalo-grama grass flats, but occasionally nest in wheat stubble or open fields. In Wyoming, they are described as an uncommon summer resident.

The habitat of the project area is unsuitable for use by long-billed curlews. There are no records in WNDD for the Bighorn National Forest. WOS records indicate that this species is suspected of breeding in the same latilong as the project area.

A comparison of habitat requirements for this species to the habitat types occurring in the project area, indicate that selective harvest of lodgepole pine would have no effect on long-billed curlews.

Upland Sandpiper, Bartramia longicauda.
Status: Region 2 Sensitive.

Prefers upland fields, grassy prairies. Nests in depression in mid to tall grass or hay fields. Winters in Pampas regions of South America.

WOS records indicate that the Upland sandpiper breeds in the same latilong region as the proposed project. WNDD does not contain any records of this species for the Bighorns.

Research of the literature indicates that suitable habitat does not exist in this project area. Therefore, commercial harvest of lodgepole pine in the project area would have no effect on Upland Sandpiper.

Lewis' Woodpecker, Melanerpes lewis.
Status: Region 2 Sensitive.

The Lewis' woodpecker differs from most woodpeckers in that it feeds primarily on winged insects. Therefore, openness is a prerequisite for aerial foraging. Habitats used also include burned or logged coniferous forest, and streamside woodlands. Open cottonwood drainages and parklike ponderosa forests are the major breeding habitats. Wyoming Game and Fish describes habitat as Ponderosa pine savannah, pine-juniper, other coniferous forests, aspen, cottonwood-riparian, below 8,500 feet.

WOS records indicate that Lewis' woodpecker breeds in the same latilong as the project area. WNDD does not contain any records of this species for the Bighorn National forest.

The habitat within the proposed project is marginal for this species, and they may not occur within the project area since Ponderosa pine and cottonwood are the most commonly used nest trees.

Cumulative effects analysis, using the HABCAP computer model, failed to identify any effects on this species from the proposed action. Even the assumption of clearcutting 1500 acres of lodgepole, which is beyond the proposed level of harvest, did not show any changes in habitat capability. A copy of the modeling results is attached to this document. The matrices for this model show that only Ponderosa Pine, Gambel Oak, and Cottonwood riparian habitats are used in the calculations. Therefore, this project will have no effect on Lewis' woodpecker.

Golden-crowned kinglet, Regulus satrapa.
Status: Region 2 Sensitive.

Prefers dense conifer forests, also aspen-conifer. Vertical migration takes place in spring and fall. Summer range is typically at higher elevations (8,000 feet and higher). This species has little tolerance for change in nesting habitat.

WOS records indicate that this species is presumed to breed in the same latilong region as the project area. WNDD contains 5 records for the entire forest. The nearest record is 4 air miles west of the project area.

This species is usually associated with spruce-fir habitats on the Bighorns. The proposed harvest of lodgepole pine in an area which has previously been selectively harvested would have no affect.

Northern three-toed woodpecker, Picoides tridactylus.
Status: Region 2 Sensitive.

The northern three-toed woodpecker typically inhabits montane forest above 4,000 feet elevation. Habitats used by this species include Lodgepole pine, Douglas fir, Englemann spruce-subalpine fir, especially those forests that have burned. Preferred foraging areas contain abundant dead and decaying trees infested with wood-boring insects. Optimal habitat is described as areas with 4-5 snags per acre occurring in clumps, 12 to 16 inches in diameter and 20 to 40 feet tall with bark mostly intact. Nest holes are excavated in trees with heartrot.

WOS records indicate that breeding is suspected but not confirmed in the same latilong as the project area. WNDD lists four sightings of this species on the Bighorn National forest. The nearest record is 8 air miles from the project area.

This species' dependency on dead trees for food (burned over areas) indicates that the habitat in the project area is marginal at best due to the lack of dead trees.

Cumulative effects analysis was conducted for this species using the HABCAP computer model. Baseline analysis was conducted using current habitat conditions. Results indicate that habitat capability is 20%, suitable acres used for feeding is 13,760, and suitable acres used for cover is 13,760. For cumulative effects, an assumption was made that with the next entry, 1500 acres of lodgepole would be essentially clearcut. Results indicate that habitat capability dropped 1% and suitable acres for feeding or cover were both reduced by 1500 acres. Results of the model outputs are attached to this document.

Inspection of the literature shows a strong preference for mature and overmature Subalpine forest, with mature and old growth lodgepole, ponderosa, and douglas fir types rated slightly lower in importance. The vegetation type affected by this project, lodgepole pine with canopy cover less than 40%, is discounted 80% by the matrix used in the HABCAP model.

Descriptions of preferred habitat types, combined with modeled responses, indicate that the proposed selective harvest of lodgepole pine in the project area may adversely impact individuals, but is not likely to result in a loss of viability on the planning area, nor cause a trend to federal listing or a loss of species viability rangewide.

Baird's Sparrow, Ammodramous bairdii.
Status: Region 2 Sensitive.

Habitat is typically long grass prairies. Breeding range extends from Canada south into Montana, but does not include Wyoming. Winter range extends from Mexico north into New Mexico, but again does not include Wyoming.

Described by Helen Downing as an extremely rare spring transient, and a rare fall transient. WOS records indicate that species has been observed in the L5 latilong, but no evidence of nesting has been documented. WNDD does not contain any records of sightings on the Bighorn National Forest.

Comparison of habitat preferences for this species to those found on the project area indicate that commercial harvest of lodgepole pine would have no effect on Baird's sparrow.

Olive-sided flycatcher, Contopus borealis.

Status: Region 2 Sensitive.

Habitat consists of cool coniferous forests, forest burns, open woodlands, and boreal bogs. This species feeds exclusively on winged insects which it captures from perches located on a dead branch or the dead top of a tree. Coniferous forests bordering mountain grasslands and meadows are the usual habitat of this species. Found between 8,000 and 11,000 feet elevation. Migrates to South America in winter.

Literature search indicates that the Bighorn National Forest is located at the very edge of the range for this species. WOS records indicate that breeding does occur in the same latilong as the project area. WNDD does not have any documented sightings on the Bighorn National forest.

Suitable habitat may exist within the project area. Special habitat requirements are edges between mature or old growth conifers and meadows. Dead-topped trees are needed for singing posts and perches. A research paper on the effects of silvicultural treatments on forest birds, stated that Olive-sided flycatchers may tend to be more abundant in partially cut forests. The proposed commercial timber harvest affects lodgepole pine trees in areas which have already been selectively harvested. Old growth stands adjacent to openings will not be affected.

Descriptions of preferred habitat types, combined with proposed harvest which will include dead topped trees, indicate that the proposed selective harvest of lodgepole pine in the project area may adversely impact individuals, but is not likely to result in a loss of viability on the planning area, nor cause a trend to federal listing or a loss of species viability rangewide.

Fox sparrow, Passerella iliaca.

Status: Region 2 Sensitive.

Habitat is native riparian shrub with adjacent coniferous forest or woodland-chaparral. Also burned coniferous and logged/thinned forests.

This species breeds from the tree limit south on outer coast to northwest Washington; in high mountains to southern California, central Nevada, central Utah, central Colorado. Winters from southern British Columbia through Pacific states; and from southern Utah, Colorado to southern Arizona, New Mexico, western Texas. Distribution maps in several texts indicate that the Fox sparrow does not normally occur on the Bighorn National Forest.

In the latilong of the proposed project, this species is considered an uncommon spring and fall transient, and breeding is not confirmed. WOS records that there is circumstantial evidence of breeding. WNDD does not contain any records of sightings on the Bighorn National Forest.

Review of habitat requirements, which include logged forests, combined with the paucity of sightings in the project area, indicate that selective harvest of lodgepole pine would have no effect on this species.

Pygmy nuthatch, Sitta pygmaea.

Status: Region 2 Sensitive.

Habitat preference is for yellow pine, other pines, and douglas fir. Leaves high elevations in winter. Special habitat requirement is for mature and old growth Ponderosa pine.

Breeding is confirmed in the same latilong region as the project area. WNDD has 1 record of this bird occurring in the southern half of this forest, and that sighting is 26 air miles from the project area.

Cumulative effects analysis was conducted for this species using the HABCAP computer model. Baseline modelling was conducted using current habitat conditions. Results indicate that habitat capability is currently at 17%, suitable acres used for feeding is 13,668, and suitable acres used for cover is also 13,668. For cumulative effects, another analysis was conducted with the assumption that all 1500 acres of lodgepole would be clearcut. Results showed a slight decrease in habitat capability (1% drop) and a 1,500 acre reduction in both suitable feeding area and suitable cover area. This model also predicted a 9% drop in the maximum number of nuthatches which could use the project area. It is important to note that this model was run for a future entry, not for the currently proposed project. Model results are attached to this document.

Ponderosa Pine has been identified as a special habitat requirement, and the mature age classes are utilized at 100% in the HABCAP model. Lodgepole pine is a minor component in the life cycle of this species, and the HABCAP model discounts the amount of mature age classes by 80% in calculating lodgepole's contribution to nuthatch habitat.

Descriptions of preferred habitat types, combined with modeled responses, indicate that the proposed selective harvest of lodgepole pine in the project area may adversely impact individuals, but is not likely to result in a loss of viability on the planning area, nor cause a trend to federal listing or a loss of species viability rangewide.

Loggerhead shrike, Lanius ludovicianus.

Status: Region 2 Sensitive.

Habitat is usually open or brushy areas with scattered cover and perch sites. In Wyoming, they are considered a common summer resident and are found in pine-juniper, woodland chaparral, and mountain-foothill shrublands. Shows a strong preference for areas with low density crown cover.

No observations of this species in the project area were found in either the WOS or the WNDD. The closed forested habitat within the project area is unsuitable for loggerhead shrikes, and they are not generally found in mountainous areas.

Comparison of habitat preferences to habitat availability in the project area indicate that selective harvest of lodgepole pine would have no effect on this species.

Amphibians

Columbia spotted frog, Rana luteiventris.

Status: USFWS Candidate.

Northern Leopard frog, Rana pipiens.

Status: Region 2 Sensitive.

Wood frog, Rana sylvatica.

Status: Region 2 Sensitive.

Since habitat requirements for the above 3 amphibians species are very similar, the discussion below serves for all three species.

Mountain amphibians are typically found at marshy edges of ponds and lakes and in slow moving stream pools with alga growth.

Searches in the vicinity of the project area have failed to locate any frogs. The nearest documented observation is one Northern leopard frog found in 1994 in a lake about 5 air miles north of the project area.

Observations of the habitat in the project area indicate that suitable habitat for amphibians is not present. Selective harvest of lodgepole pine from dry upland sites will have no effect on these three amphibian species.

FIELD SURVEY AND RISK ASSESSMENT FOR FISH AND WILDLIFE SPECIES

Survey techniques and results of surveys, previously documented sightings, mitigation, and risk assessment are offered below on a species by species basis.

No T&E species are likely to use the project area. No T&E species are known to be near the project area. Therefore, no surveys have been conducted.

The Wyoming Game and Fish Department is currently conducting a study of bats and cave habitats which includes the Bighorn Mountains. Preliminary results from their study indicated that no bat habitat would be affected by the proposed timber harvest in this area.

All proposed harvest areas were surveyed for nesting Goshawks using taped calls consistent with the Region 2 protocol and survey techniques. No active nests were discovered, but two trees which contained nests were found. It is not known at this time if the nests located are Goshawk nests or were made by some other species. Goshawk surveys will continue through the planning, prep, and contract phases.

Aquatic resources on the Bighorns are being surveyed for amphibians by the Nature Conservancy and by Forest Service biologists. No amphibians have been located in the project area.

Mitigation Measures in the Preferred/Recommended Alternative

The order of priority for mitigation is: 1) avoid the impact, 2) minimize the impact, 3) rectify the impact, 4) reduce or eliminate the impact over time, and 5) compensate for the impact (FSM 1909.15 and 40 CFR 1508.20).

Mitigation Measures:

Goshawk mitigation - Attempt to locate any active Goshawk nests prior to submitting the contract for bids. If active nests are located, remove an appropriate area, as designated by the wildlife biologists, from the proposed harvest. If an active nest is located any time during the life of the timber sale contract, use appropriate contract provisions to minimize the impact.

Riparian-dependant species mitigation - Avoid all direct impacts to wetlands. Allow no commercial harvest within 100 feet of open water

Risk Level

The consequences of adverse effects are None because most of the above listed species either don't use the project area, or because the affected habitat is not essential for the species, or because the mitigation specified is sufficient to avoid the impacts. The likelihood of adverse effects are none for all species listed above with the exception of Olive-sided flycatcher, Pymy nuthatch, and Northern three-toed woodpecker. The likelihood of adverse effects for Olive-sided flycatcher, Pymy nuthatch, or Northern three-toed woodpecker, are not likely to result in a loss of viability within the planning area, nor cause a trend to federal listing or a loss of species viability rangewide.

Therefore, the overall risk to any of the above listed species due to project activities is None.

Monitoring Plans for the Northern Goshawk: During the course of the timber sale contract cutting, the sale administrator will inform FS biologists of any Goshawk activity observed.

CONSULTATION WITH THE U.S. FISH AND WILDLIFE SERVICE

This project is expected to have "No effect" on any federally threatened, endangered, or candidate species (or critical habitat), so consultation with the USFWS was not necessary. Although the finding is "may adversely impact individuals," for Olive-sided flycatcher, Pymy nuthatch, and Northern three-toed woodpecker, formal consultation with the USFWS is not required for sensitive species.

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APPENDIX G

Stand Projections G-1

Stand Projections G - 1

APPENDIX G - PROJECTION OF HOW A SHELTERWOOD HARVEST SYSTEM WILL LOOK

The following four pictures are projections made by the Stand Visualization System (SVS) (McGaughey, 1997). SVS is linked to the Forest Vegetation Simulator (FVS), which is one of the most widely accepted Forest growth simulators in use in the United States. The 2006, 2016, and 2026 portrayals use the FVS model to "conduct" the seed cut in 2001, the overstory removal in 2016, and grow the remaining trees from the 1996 starting point.

These figures should be used for comparison purposes only. They do not portray precisely what the stands will look like following harvest, but they do allow people to gain a better understanding into what, in a general way, a shelterwood harvest system will look like.

The large box on the left represents the stand conditions on a one acre plot. The box in the upper right is from an overhead viewpoint. The box in the lower right is a profile display that represents the narrow area shown in the rectangular box shown on the overhead projection.

FIGURE 1. The initial 1996 scene is a representation of the existing stand conditions, and is based upon Stage II data collected in 1996.

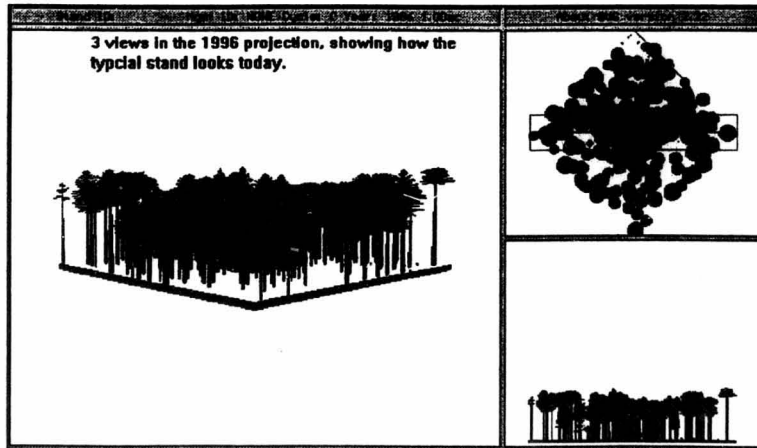


FIGURE 2. 2006, represents what the stand will look like after the seed cut, which in the simulation was conducted in 2001.

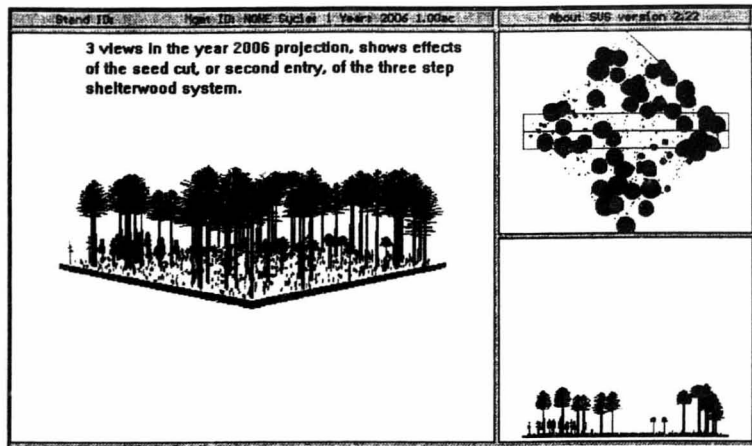
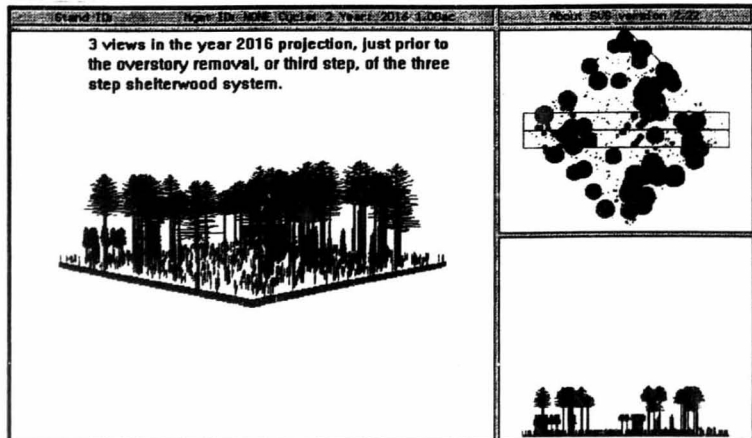
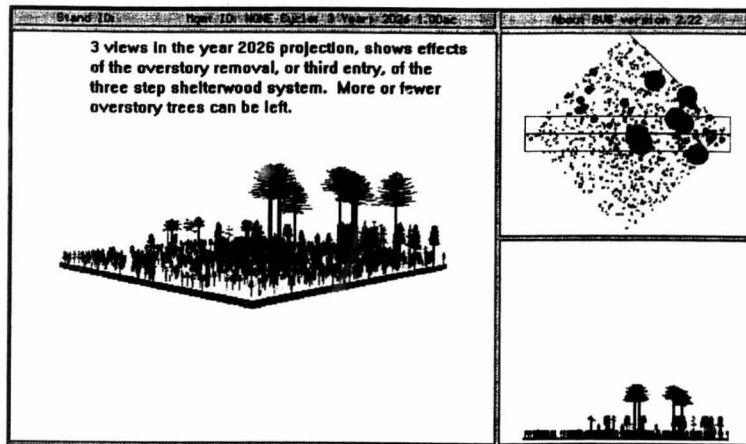


FIGURE 3. 2016, represents what the stand will look like in 2016, with no silvicultural treatments since the 2001 seed cut.



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FIGURE 4. 2026, represents what the stand will look like in 2026, after the overstory removal harvest in 2021. This portrayal does not display the "island" snag retention strategy very well. In reality, there will be no snag islands on some acres, and where the islands do occur, they will be about 1/5 of an acre.



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APPENDIX H

Excerpts from Clear Creek/Crazy Woman Creek Landscape AnalysisH - 1

WATER

In every stream system there exists a balance between many interrelated variables; sediment quantity and size supplied to the stream, channel gradient, hydraulic geometry, streamflow and substrate size. When a stream channel has achieved a balance between all these variables, it is said to be in dynamic equilibrium. Dynamic because there is some natural variability due to short term changes in the climate, sediment yields and other factors. A major shift in any of these variables will cause the stream channel to adjust one or more of the other variables. This is necessary to maintain an equilibrium between all components. The adjustment process will normally move the stream channel toward a new, usually less stable condition. The required adjustments degrade the land and water quality and can seriously disrupt the aquatic ecosystem.

Impacts from roads are primarily related to road location and drainage system. The Circle Park road and the Hunter Creek road were identified as causing the greatest impact to the aquatic ecosystem. Sediment has filled pools, the streams are adjusting laterally, streambanks have become unstable and water quality has been degraded. Both roads currently have the fill material entering the stream because the meander of the stream is eroding the fill slope material. Culverts are discharging sediment directly into the stream. This situation has led to a serious decline in water quality and overall stream health. Out of the 21 watersheds analyzed, 12 have road densities greater than stream densities. This may not be important until we look at the number of stream crossings and the miles of road located within the riparian/wetland zones. North Fork Crazy Woman Creek has the most road miles (approximately 61 miles) and has the most stream crossings (25). Most, if not all, of the crossings are culvert crossings. There is a loss of aquatic habitat at each location where a culvert is installed. The actual amount of habitat lost is dependent upon the width of the road and associated impact occurring from the road. It is estimated that approximately 2 miles of stream have been affected out of the approximately 38 miles of stream due to road crossings within this watershed. It was also noted that approximately 13.5 miles of roads within this watershed lie within the riparian/wetland zone. This impact accounts for a loss of approximately 26 acres of wetland areas within this watershed. The North Fork Crazy Woman is used here as an example, however, it is felt that further analysis on type, location and need of the transportation system within the watersheds needs to be accomplished.

1. Beneficial Uses

Regulatory Framework

There are several laws and regulations controlling water resource use and watershed management. The most significant of these is the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500), renamed the Clean Water Act (CWA) in 1977. This act establishes Federal water quality policies, goals and programs. Both the Environmental Protection Agency (EPA) and the states Wyoming Department of Environmental Quality, (DEQ), have responsibility for carrying out the CWA. The objective of the CWA is to "restore and maintain the chemical, physical and biological integrity of the nations water." States are required to establish water quality standards that allow for the protection of the beneficial uses made on the water resource. These standards have two components: 1. Designation of the beneficial uses of the water and 2. Water quality criteria, either numeric or narrative, sufficient to protect the designated beneficial uses. The beneficial use

identified for streams in CCLA is for cold water fisheries. Water quality criteria that Forest Management typically affect include, but is not limited to, Turbidity, Temperature, pH, Sediment, Dissolved Oxygen, Oil and Grease and Fecal Coliform. There are other Priority and Non-Priority pollutants that also can be affected. A list of these can be viewed in the *Wyoming DEQ Water Quality Rules and Regulation, Chapter 1, November 29, 1990.*

The EPA adopted regulations that required States to implement an antidegradation policy as part of the State water quality standard. The antidegradation policy is to fully protect the waters where existing quality is higher than necessary to support beneficial uses. The State can allow degradation of those waters only after full inter-governmental coordination and public participation while demonstrating that the degradation is necessary to accommodate important social or economic development in the area. At a minimum, existing uses will be fully protected (40 CFR 131.12). For example, any decrease in diversity, ecological stability or productivity of aquatic life would not protect beneficial uses.

Wyoming has established water quality criteria for all streams within the Analysis Area. When streams indicate signs of degradation of the beneficial use, as determined by the state, those streams are added to the State 305b report (Wyoming Water Quality Assessment). Streams which are currently included in this report as only partially supporting the beneficial use, cold water fisheries, are: Pole Creek, North Fork Crazy Woman, Little Sourdough, Upper Doyle Creek, Muddy Creek, Middle Fork of Clear Creek and Clear Creek.

Three streams were classified as having "major" impacts to the aquatic resource. These streams include French Creek, Hunter Creek and Circle Park Creek. The impacts related to Hunter Creek and Circle Park Creek are related primarily to the road location and the drainage system of the roads. Impacts along French Creek were related to natural stream events, grazing of livestock in wetlands, and road conditions in the upper portion of the drainage. In all three cases, sediment was the major contributor of the degradation of the aquatic ecosystem. This was determined through utilization of the 404b(1) guidelines, channel stability rating and field review.

The three streams classified as having "major" public interest associated with them were Muddy Creek, Hunter Creek and Circle Park Creek. Muddy Creek was classified in this category due to its proximity along the Scenic Byway. Hunter Creek and Circle Park Creek were classified here due to the aquatic resource impact that is occurring and the associated loss in resource value.

Susceptibility HIGH Resiliency LOW

Causes	Meets Forest Plan	Risk and Related Outcomes
Siltation, Flow Alterations, Suspended Solids, Priority Organics, Other Habitat Nutrients	N	RED Reduction in water quality, reduced productivity, loss of aquatic habitat, failure to meet water quality criteria, reduction in fishing

Causes	Meets Forest Plan	Risk and Related Outcomes
		opportunities. Reduction in future Management options.

2. Aquatic Resource

Current Condition

Impacts to aquatic habitat is occurring within the analysis area due to erosion processes. In some cases habitat has been lost due to filling of pools and spawning sites. At present it is believed that this impact is stabilizing somewhat. There are areas where impacts are still occurring, however, the number of areas is decreasing.

Table 3 Summary Watershed Data

Stream Name	Aquatic Resource Impacts (40 CFR 230)	Public Interest Review (33 CFR 320)	Partially Supporting Beneficial Uses
Pole Cr.			X
NF Crazy Cr.			X
Upper Doyle			X
French Cr.	Major	Moderate	
Doyle Cr	Moderate	Moderate	
MF Crazy W	Moderate	Moderate	
Little Sour	Moderate	Moderate	X
Muddy Cr.	Moderate	Major	X
S. Clear Cr	Moderate	Moderate	
M. Clear Cr.	Moderate	Moderate	X
Hunter Cr.	Major	Major	
Goodman Cr	Moderate	Moderate	
Circle Park	Major	Major	

Scale of Aquatic Resource impact:

Moderate = readily apparent and somewhat significant
Major = significant

Relative scale for Public Interest areas:

Moderate = loss of future options can be satisfied by use on other areas.
Major = significant loss of future options with no replacement.

Channel Stability scale:

Fair = Moderately low resource value.

Poor = Low resource value.

Susceptibility MODERATE , Resiliency MODERATE.

Causes	Meets Forest Plan	Risk and Related Outcomes
Travel Management (road/trails) Grazing, Recreation, Old Beaver Dam Failure, Soil Compaction	Y	YELLOW Reduction in water quality, reduced productivity, loss of aquatic habitat, failure to meet water quality criteria, reduction in fishing . opportunities.

Forest Plan Goals or Desired Conditions

The standards that are at risk include:

- Sediment yields not exceed "threshold limits".
- On-site erosion rates reduced by 75% within the first year after disturbance and 95% within 5 years of initial disturbance.
- Debris accumulations that reduce stream channel stability and capacity will be prevented or removed.

Opportunities/Possible Management Actions

Management actions include but are not limited to:

- Road relocation/closure
- Modifying grazing patterns and time
- Stabilizing streambanks
- Changing travel management plan
- Removing excess sediment
- Installing fisheries improvements, and
- Adjusting management emphasis to be more sensitive to aquatic resources.

3. Channel Stability

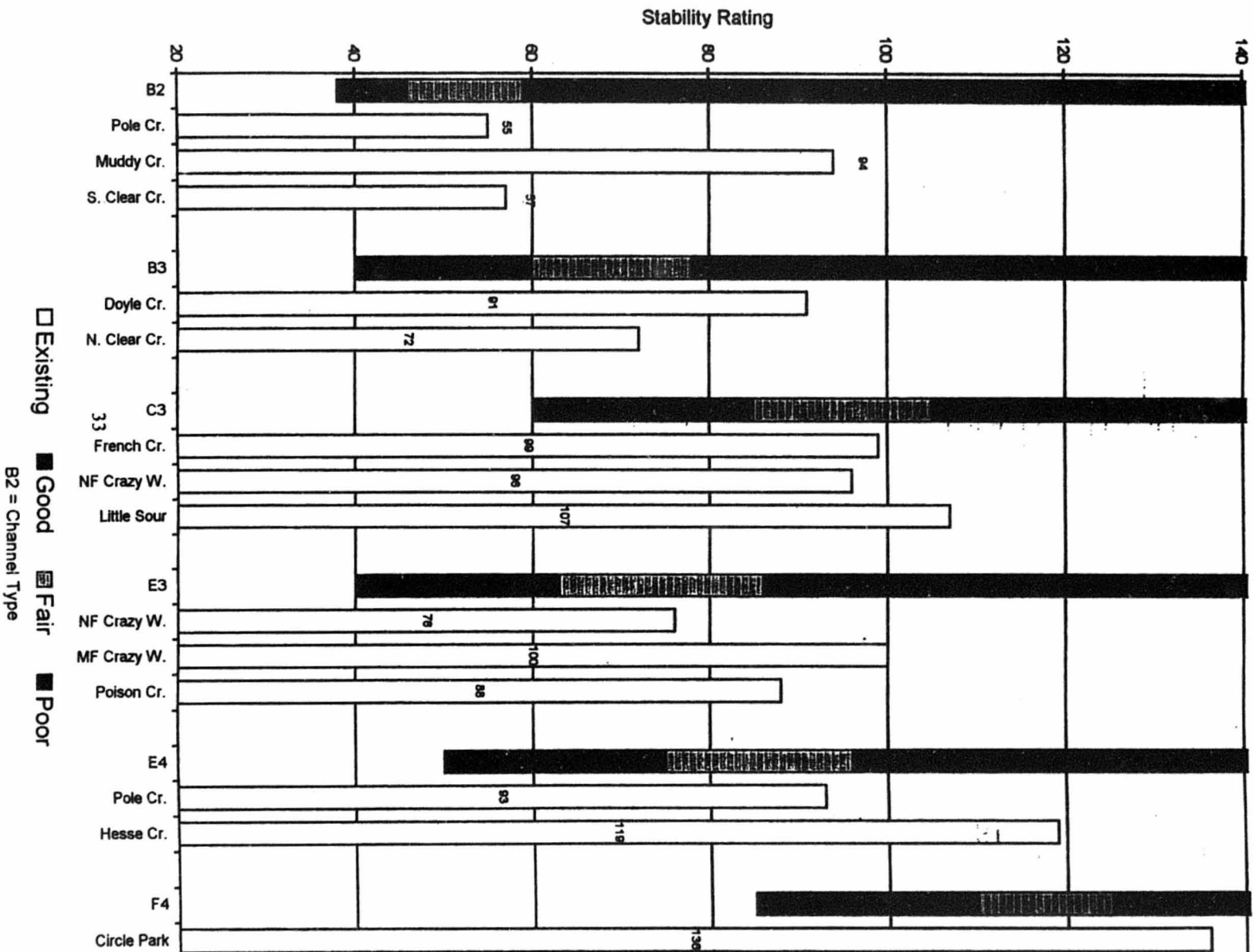
Current Condition

Table 4, Channel Stability , displays that of the 17 streams sampled in 1996, eight were in fair condition and nine were in poor condition. This would indicate that most of the streams are out of equilibrium and that channel adjustments are occurring. Some of this has been caused due to natural processes such as old beaver dams failing, however, much of the impact has been documented to be attributable to grazing livestock, recreation activities, roads, off road travel, and timber harvesting activities. Impacts to channel stability are continuing and in some cases are increasing causing streams to become more unstable.

Table 4 Channel Stability

Stream Name	Stream Type	Channel Stability	Desired Channel Stability
Muddy Cr.	B2	94/Poor	48-58
Pole Cr.	B2	55/Fair	38-45
S. Clear Cr	B2	57/Fair	38-45
M. Clear Cr.	B2	62/Poor	48-58
Doyle Cr.	B3	91/Poor	61-78
N. Clear Cr.	B3	72/Fair	40-60
NF Crazy W.	C3	96/Fair	60-85
French Cr.	C3	99/Fair	60-85
Little Sour	C3	107/Poor	86-105
NF Crazy W.	E3	78/Fair	40-63
MF Crazy W	E3	100/Poor	64-86
Poison Cr.	E3	88/Poor	64-86
Pole Cr.	E4	93/Fair	50-75
Hesse Cr.	E4	119/Poor	76-96
Circle Park	F4	136/Poor	111-125
Hunter Cr.	G3	134/Poor	108-120
Goodman Cr	G3	109/Fair	85-107

Figure 4 Stream Channel Stability Rating by Channel Type



Susceptibility is MODERATE Resiliency is MODERATE

Causes	Meets Forest Plan	Risk and Related Outcomes
Road/trails Grazing ,Recreation Old Beaver Dam Failure, Soil Compaction	N	YELLOW Reduction in water quality; increased erosion, reduced productivity, loss of aquatic habitat, decline of overall stream health.

Opportunities/Possible Management Actions

Management actions include but are not limited to:

- Road relocation/closure
- Modifying grazing patterns and time
- Stabilizing streambanks
- Changing travel management plan, and removing sediment
- Improving drainage structures.

4. Water Quality

Current Conditions

Although existing water quality data indicates that water quality criteria is being maintained, the data also indicates that impacts have occurred and are still occurring to water quality components. There is a lack of water quality data to adequately describe impacts to the water resource from management activities.

The associated water quality criteria that could be affected by Forest management activities are:

1. Currently, water quality parameters are being maintained through the use of Conservation Practices/Best Management Practices (BMP's). Examples include: Avoidance of an impact, limiting road number and widths, applying runoff controls, and designing stream crossings that allow free movement of resident aquatic life.

Due to an anticipated increase in management activities, a lack of monitoring data, and past and current field reviews, it is believed that water quality as a whole is on a downward trend. As use in the area increases and more demand is placed of the area this trend will continue.

Susceptibility MODERATE , Resiliency MODERATE

Causes	Meets Forest Plan	Risk and Related Outcomes
Travel Management (road/trails) Grazing , Recreation, Timber activities, Soil Compaction	Y	YELLOW Reduction in water quality, increased erosion, reduced productivity, decline of overall watershed health, failure to meet water quality criteria, reduction of management opportunities

Opportunities/Possible Management Actions

Management actions include but are not limited to:

- Addressing the travel management concerns within the area
- Modifying grazing systems
- Exclusion of livestock from sensitive areas and water sources
- Providing additional water sources away from natural water ways
- Improve road designs to be more sensitive to aquatic resource
- Relocate roads that are causing direct impacts to the aquatic ecosystem, and
- Adjusting management emphasis to be more sensitive to the aquatic ecosystem.

5. Roads/Travel Management

Current Conditions

Of the roads observed, the following roads are having effects on water:

Circle Park Road #20

The road currently is located in the riparian area of Circle Park Creek. The fill slope of the road is eroding into the stream. The culvert at the stream crossing has failed several times in the past. The road is currently being drained directly into the stream. Grazing is also occurring within this stream segment which is posing impacts to the stream banks. Sediment yields in Circle Park Creek are increasing far beyond the streams ability to move sediment. There are increased width to depth ratios and the riffles and pools are filling with sediment. Past and current management actions have lead to significant changes in stream stability, stream health, aquatic productivity and biological diversity. State beneficial uses of the water are not being maintained through this reach of stream.

Hunter Road #19

The road parallels Hunter Creek within the riparian area for some distance. Pools are filling and the stream is blocked in some locations. The stream is widening and aquatic habitat has been degraded. There are several locations where the road drainage system drains directly into the stream. Large amounts of road and ditch material are being moved into the stream system. The stream does not have adequate buffer from the existing road.

French Creek Road #368

Significant rutting is occurring. Some of the ruts measured 8 to 12 inches deep. The road passes through a meadow. In the meadow, these excessive ruts have caused individuals using the road to create new parallel travel paths. This situation is contributing to water quality problems within the French Creek drainage. The first portion of the road is located in a riparian area and the drainage structures drain directly into the stream without adequate buffer. Other causes include poor road location, travel during wet conditions and amount of use.

Forest Plan Desired Condition

The existing conditions of the above roads are not in compliance with the the riparian 9A management prescription, Forest Direction, Water Quality Criteria and Federal Laws pertaining to management of the water resource.

U.S. Highway 16

The highway has constricted stream channels at some locations. Some stream crossings and drainage systems are draining directly into stream channels. Road sanding material is being deposited into streams. This was apparent on Pole Creek, just below the highway, and on Muddy Creek, just off FDR 473. Road location, plowing, and increased winter recreational use are some causes.

Forest Plan Desired Condition

The current Forest Plan inadequately addresses these issues related to right of ways.

Poison Creek Road # 484

The headwall on the culvert on the Middle Fork Crazy Woman Creek is not armored and is eroding. This situation was documented as a common occurrence on most of the older Forest system roads within the Analysis Area. This condition has lead to several stream crossing failing during normal, expected, stream flows. It has also lead to increased stream degradation and impacts to the aquatic ecosystem.

Goodman Creek Road # 476

Culverts on this road are filled with soil and are becoming non-functioning. This is primarily occurring in the Goodman Creek area. Failing of the road drainage system is likely to occur unless the culverts are cleaned out.

Pole Creek Road # 31

The culvert on Hesse Creek is not passable by fish. This situation is a common occurrence throughout the Analysis Area. It is caused by improper installation of the culvert or natural stream channel adjustments

Forest # 497 (South of the Caribou Mesa Raod)

The road is washed out near it's end. Ruts are up to 12 inches in depth.

School House Park Road # 391/398

The first segment of this road is in good shape, up to the corrals. After this, the road is rocky and difficult to travel on. The road has wet sections that become rutted when traveled on during wet periods. The wet areas are primarily where the road crosses meadows. This is where the road becomes rutted and multi travel paths are developed. It was not uncommon to find ruts that were 12 inches in depth along this road

Vehicle travel is possible beyond Webber Park to Slab Park creating erosion problems. Road system provides access to Lake Angeline Trail. As the demand for more 4-wheel vehicles continues to increase its likely that additional environmental damage will occur.

Caribou Mesa Road, Forest # 148

There is a culvert sticking up in the road just past the FDR 458 intersection.

Opportunities/Possible Management Actions

- Relocating
- Improving stream crossings
- Paving,
- Closing the road,
- Installing sediment traps
- Removing sediment from the stream.
- Provide for year-round running surface
- Install adequate drainage systems
- Limiting when the road could be utilized.
- Work with the local Wyoming Department of Transportation regarding sanding.
- Clean out the culverts.
- Replace culverts to allow for fish passage/migration.
- Maintaining the road

- Closing the road and obliterating it.
- Converting the road to a trail.
- Close road travel into Slab Park. (Consider road closure and obliteration beyond Webber Park to Lake Angeline.

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DISTURBANCE PROCESSES

Fire Regime

Historic Range of Variability

In many ecosystems, fire suppression has interrupted the evolutionary history of fires role in disturbance regimes. In many areas in the western states, suppression efforts has led to tree population explosions, dead fuel accumulations and landscape level fuel continuity to such an extent that historical changes in habitat conditions for some species of plants, animals and microbes have become rare. In addition, the natural functioning of these ecosystems has in many cases been severely impaired with interruptions to the successional recycling processes being disrupted.

Table 5 Fire Characteristics

FOREST TYPES	FIRE DESCRIPTIVE PARAMETERS		
	FREQUENCY	TYPE OF FIRE	FUELS
Ponderosa Pine	25-50 years or less on drier, steeper slopes	Understory, non-stand replacement events	Fire burned mostly grasses/shrubs on forest floor; only occasional mortality to overstory trees.
Lodgepole Pine	100-300 years	Generally large, stand replacing events.	Fire was dominant disturbance event in regenerating new stands. Fuels evolved with structure/age of stand, until after several hundred years, multi-stories and heavy fuels made stand ripe for next fire.
Engelmann Spruce - Subalpine Fir	300-600 years	Large stand replacing events had the most influence at a landscape scale. Nearly every year, several small fires created gaps/mosaics in the ES/AF stands, usually a few acres(s) in size.	Years of severe fire weather had greatest influence on when these stands would burn. Typically, had heavy fuels, once ignited, difficult to extinguish.

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Figure 5 Engelmann Spruce Age Distribution

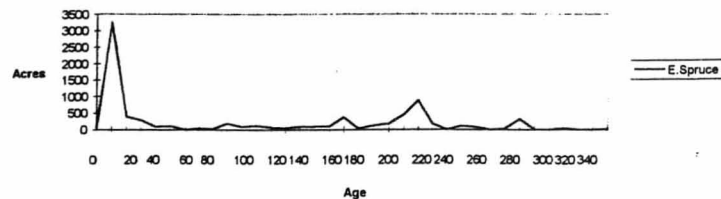


Figure 6 Lodgepole Pine Age Distribution

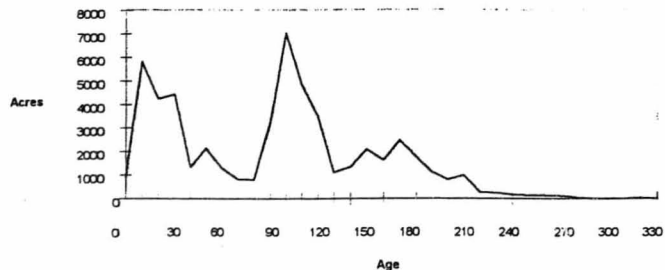


Figure 6 shows the age class distribution for lodgepole pine. Data is available for about 70% of the lodgepole pine cover type. There are several events that are evident in this table. The lodgepole areas burned in the Lost Fire dominate the 10 year age class peak. Attached to that spike is a "shoulder" spike in the 20-30 year classes that represents timber harvesting. There is a relatively small spike at the 50 year age class, which represents the 1943 Duck Creek fire. Finally, the other dominant age class spikes are in the 90-120 year range. These stands burned between about 1860 and 1900, and are still plainly visible on the landscape as the single-story, "blackbark", lodgepole stands that dominate such areas as Doyle Creek and the south aspect slope along Sourdough Creek. The number of acres represented by the two major age-class waves is approximately equal, with 14,470 acres in the 10-30 year LP classes. (18,399 acres if you combine

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the ES and LP acres in the 10-30 year age classes), and 18,579 acres in the 90-120 year age classes.

The lodgepole pine forests are probably the least removed from their natural range of variability of any of the other Lodgepole forests on the Bighorn, due largely to the Lost Fire. This statement is based upon the age class spike comparison discussed above, which supports the notion that the lodgepole pine forests were dominated historically by large scale, stand replacing fires on a 100-300 year frequency.

The timber harvests in the past 30 years, and the Lost Fire "replicated" large, stand replacement fire(s) in the lodgepole ecosystem. With the acres regenerated in the Lost fire, and the long naturally occurring fire interval, the ES/AF forests are within their naturally fluctuating range.

The age of the dominant trees in the Ponderosa ecosystems has not changed relative to the RHV. The proportion of younger trees has dramatically increased.

Without some disturbance event, the forests in the analysis area will get older. CCLA has a fairly large proportion of young-aged forests, which is historically the norm for this lodgepole pine dominated ecosystem. The total area currently meets the Forest Plan requirement for total acres in the Grass-Forb stage, but 13 out of 32 diversity units meet this criteria. The scale of historic landscape events was larger than our current diversity units.

Susceptibility MODERATE Resiliency LOW

Causes	Meets Forest Plan	Risk and Related Outcomes
Timber harvest activities, exclusion of fire.	O	Green??? - Different forest age-class distributions provide wildlife habitat and human desires. Without forest disturbance events, certain habitat needs and human desires may not be met.

2. Regeneration

Historic Range of Variability

Areas of grass-forb stage existed after stand-replacing fire events. Regeneration did not always occur within 5 years of the event.

Current Condition

In general, the environment for seedling establishment in CCLA is very favorable for lodgepole pine regeneration. The combination of climate, seed source, topography, and soils provide favorable conditions.

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The National Forest Management Act specifies that prior to timber harvests on National Forest land, there must be an assurance that the site can be regenerated within five years of the final harvest. Table 7 summarizes the status of regeneration of units that received a final harvest on the 7 largest timber sales since 1985. In the table, certified means regeneration has met the Forest Plan standards and guidelines for numbers and distribution of seedlings, and has been certified as reforested by the Forest Silviculturist. It is important to note that the assurance is made prior to harvest. The units in Table 7 in the columns, *certification in over 5 years*, and *not certified to date*, are still legal under NFMA, due to the prior-to-harvest nature of the assurance.

Table 7 Summary of Regeneration Results of Large Timber Sales since 1985

SALE NAME	SALE TOTAL		CERTIFIED IN <5 YEARS		OVER 5 YR., BUT CERTIFIED		NOT CERTIFIED TO DATE	
	UNITS	ACRES	UNITS	ACRES	UNITS	ACRES	UNITS	ACRES
Taylor Cr	14	144	14	144	0	0	0	0
Lookout	21	300	12	168	7	102	2	30
Elgin	17	254	17	254	0	0	0	0
Hatchet	4	15	3	8	1	7	0	0
Dullknife	4	15	3	12	1	3	0	0
Cr. Fork	2	9	2	9	0	0	0	0
Sawsite	14	201	12	177	1	6	1	18
TOTAL	76	938	63	772	10	118	3	48

Slightly older regeneration data from two sales harvested in the late 1970's also substantiate the fact that lodgepole pine regeneration is very successful in CCLA. This information is shown in Table 8, and is taken from the 1989 regeneration report.

Table 8 Summary of Regeneration Surveys Conducted in 1989 on the Sourdough and Crazy Woman Timber Sale Areas

Sale Name	# of Units Surveyed 1989	# of Acres Surveyed 1989	Harvest Years of Units	# of Seedlings/Acre - 1989
Sourdough	6	130	1977-1978	1250-2300
Crazy Woman	6	40	1978-1980	2100-8550

These regeneration figures compare to a Forest Plan minimum stocking level for lodgepole pine of between 150 and 245 seedlings per acre, depending on site productivity.

Aspen also successfully regenerates in the analysis area, but heavy browsing can have an effect on the height growth and vigor of the stands.

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A considerable portion of the Lost Fire area has prolific Lodgepole Pine regeneration, in some areas exceeding several thousand stems per acre. Most of the recent timber harvest units have been regenerated to satisfactory levels within 5 years of the final harvest. Regeneration of lodgepole pine on the granitic soils that dominate the analysis area is generally very good.

The Lost Fire area will continue to regenerate, as will the recent timber harvest units.

The National Forest Management Act requires that "final" silvicultural treatments have an assurance that adequate restocking, given current technology and knowledge, can be accomplished within 5 years of the event. For the most part, this has occurred when seedbeds were adequately prepared, seed source was sufficient, and other activities, such as firewood gathering and grazing, did not negatively affect regeneration. The granitic soils and seed source are very good for lodgepole pine regeneration.

Susceptibility HIGH, Resiliency LOW,

Causes	Meets Forest Plan	Risk and Related Outcomes
Granitic derived soils, lodgepole pine seeding habits	Yes, for most part	Green - Inadequate regeneration following both natural events and timber harvests affect water quality and quantity, wildlife habitat, scenic values, potential loss of timber volume.

3. Forest to Non-Forest Ratio

Historic Range of Variability

Given that the Lost Fire reached about 10,000 acres, it can be assumed that historic fires of perhaps 20,000 acres or larger, or about 14% of the total analysis area, occurred in the past. These areas would temporarily be set back to a transitory grass-forb stage, only to be restocked with forested species over time. We know that currently about 70% of the analysis area is forested. Therefore, the amount of "forests" on the landscape at any one time varied from about 56% to 70% of the total analysis area.

Current Condition

The 70% of forest cover types includes 8,920 acres that are currently in a transitory grass-seedling stage, wildlife habitat structural stage 1.

There are localized areas where meadow encroachment is occurring. Meadow encroachment is the process where, in the absence of disturbance, tree species invade areas that have been meadows for long periods of time. This is a different process than forest areas that are set back successional to the grass-forb stage by fire. In general, in the Bighorn mountains, soil properties indicate that

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Current Condition

Given the high proportion of granitic soils in the Clear/Crazy Analysis Area, and the rain shadow effect that is a factor causing the 100-300 year fire interval, this watershed probably has the highest percentage of serotinous lodgepole pine on the Bighorn National Forest. This estimate is also based on forest-wide field observation.

Events like the Lost Fire will maintain the genetic base of serotinous cones, while some timber harvests that do not manage for serotinous cones, such as shelterwood or selection systems without proper cone and seed bed preparation, will decrease the amount of serotinous cones on the landscape. Trend is currently continuing.

The change in the genetic base of the lodgepole pine due to fire suppression efforts is a very long term process, measured in terms of centuries. This would indicate a monitoring need at this point in time.

Susceptibility LOW, Resiliency LOW

Causes	Meets Forest Plan	Risk and Related Outcomes
Certain silvicultural activities that do not provide for serotinous cone regeneration can lead to a decrease in the amount of serotinous cones.	O	Green - Long term effect due to reduction of serotinous seed source could be a decline in the regeneration capacity following major disturbance events such as fire.

Opportunities/Possible Management Actions for the Forested Vegetation

The following relate to all of the forested elements above.

Administrative

- During Forest Plan revision, develop a desired condition for forested vegetation. Consider inclusion of the above 5 descriptive parameters as well as spatial amounts and arrangements of structural stage. Currently, the Plan does not integrate the outputs with the standards and guidelines, and many of the standards and guidelines are restrictions or limits instead of a description of a desired condition.

Resource

- Continue with the aspen regeneration and monitoring efforts. Utilize the latest methodology, such as pushing stems. This is accomplished by using a bulldozer to rip around clones. This technique has shown to produce excellent sprouting and survival. Wildlife/livestock utilization on the regeneration should be monitored.

6. Silvicultural and Wood Products Opportunities

Current Conditions

Approximately 25 timber sale and 39 other resource environmental reports have been conducted and are available, several of which predated NEPA.

Table 9 summarizes the timber harvest history of CCLA by decade since about 1940. The units listed are acres; for example, there were 3900 acres of clearcuts between 1/1/60 and 12/31/69.

Table 9 Timber Harvest History

Harvest Type	1940's	1950's	1960's	1970's	1980's	1990's
Clearcut			3900	2959	885	532
SW:Prep			18	6037	2151	67
SW:Seed				35	146	
SW:OR			142	1001	514	
Seed Tree			30	386		
Selection				769	4	
Com.Thin			782	1434	366	2
S/S				159	757	12
PCT			2537	1252	4070	403
Aspen CC				64	117	
Fire	1901				8807	250
Blowdown					573	50
Total Cut*	2982	883				

* - Total Cut is taken from the 9/13/89 district report on timber availability. The "total cut" is only listed for the 40's and 50's, as the RIS database does not list that many acres, so this was assumed to be the most accurate information for those decades. It is not applicable to the other columns.

SW:PC = Shelterwood prep cut
 SW:OR = Shelterwood overstory removal
 S/S = Sanitation/Salvage
 Aspen CC = Aspen clearcut

SW:SC = Shelterwood seed cut
 Com. Thin = Commercial Thin
 PCT = Precommercial Thin

State, private and Bureau of Land Management lands to the south and east of National Forest lands, some of which are immediately adjacent to National Forest boundary, have also had varying amounts of timber harvest activity.

Table 10 shows the the 1985 Forest Plan management prescription allocations for CCLA. About 35% of the area is allocated to 7E, emphasis on wood fiber production, which is 44% of the non-wilderness area. This emphasis allocation is even more pronounced in the area from Tie Hack dam

south to the Poison Creek watershed. This 1985 Forest Plan allocation is a continuation of the timber emphasis which has been placed on the area since European man first utilized the area.

Table 10 Management Prescription Allocation

Management Prescription Area	Acres	Percentage
2A - Semi Primitive Motorized Recreation Opportunity	7,104	5%
2B - Rural and Roaded Natural Recreation	2,135	2%
3A - Semi-Primitive Non-Motorized Recreation	5,387	4%
3B - Primitive Recreation Unroaded	14	~
4B - Wildlife Management Indicator Species	26,073	18%
4D - Aspen Stand Management	612	~
5A - Wildlife Winter Range Non- Forested	431	~
5B - Wildlife Winter Range Forested	3,185	2%
6A - Livestock Grazing, Improve Forage Condition	1,630	1%
6B - Livestock Grazing, Maintain Forage Condition	15,187	11%
7E - Wood Fiber Production	49,370	35%
8A - Pristine Wilderness Opportunites	26,196	19%
8B - Primitive Wilderness Opportunites	2,385	2%
8C - Semi-Primitive Wilderness Opportunites	1,249	1%

The 1985 Plan, and subsequent amendments, show the importance of timber productivity and resource emphasis allocation in the determination of timber suitability. This is especially true when compared to other areas of the Bighorn National Forest. Overall, on the Bighorn NF, 22% of all the forested land are identified as suited, while in CCLA, 41% of the forested land is suitable.

Regulation by Area Analysis

An important issue in forest management is the concept of forest regulation. One of the goals of the 1985 Forest Plan is to "use silvicultural systems and harvest schedules that achieve forest regulation, wildlife, diversity, and watershed objectives in an economically efficient manner."

Forest regulation is the process of providing a sustained yield of forest products in a manner that meets the needs of, and protects, all other resources as defined by the land owner, including legal constraints. (Davis, Kenneth P., 1966).

Forest regulation is a very complex issue, and in order to achieve sustained yield over time, it includes the concepts of site quality, stocking control, growth and yield information, and, fire and pest protection. Complete regulation analysis is done at the time of Forest Plan revision. One very cursory way to examine whether or not an even-aged forest is being harvested at a rate that exceeds the sustained yield concept is to look solely at area regulation. This is done by dividing the number of years in the rotation into the number of acres of forest land. For

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example, if your forest was 100 acres, and the rotation length was 100 years, you could harvest 1 acre per year. Full area regulation to maximize timber commodity output, was not the goal of the Forest Plan. Objectives for diversity, wildlife habitat, and others need to be factored in. The Forest Plan is designed because Plan.

Table 11 summarizes the results of area regulation analysis from 1960 to 1996 for CCLA.

Table 11 Forest Regulation

Database	Acres		All Forested Acres		Suited Acres Only	
	Total	Forested	w/Final Activity	Allowed if Regulated	w/Final Activity	Allowed if Regulated
RIS	147,336	102,726	20,170	31,077	13,265	18,860
WYG&F (GIS)	147,610	97,810	21,240		NA	

Both RIS and Wyoming Game and Fish (WYG&F) satellite imagery data are included in this table. The approximate 5% discrepancy in the total number of acres that had a "final event" can be accounted for in that the G&F data includes events prior to 1960.

Based upon the information collected during this analysis, and the issues identified by both Forest Service and the public, there are several areas that could be analyzed for timber harvest opportunities. Public and other agency input was solicited during the November 1995 meeting in Buffalo and during the September 1996 field trip. Internal input was gathered during the July 1996 SEMU meeting and during various Clear/Crazy meetings. The information used to assess timber sale opportunities included the review of past NEPA documents; location and status of hiding cover, habitat effectiveness and elk security areas; location and status of existing roads; the range of historic variability of the forests in the analysis area; the current condition and trends of the forests in the analysis area; and the current land management allocations made by the Forest Plan.

Diversity units 110, 112-115 received the first step of a three step shelterwood system in the mid to late 1970's. Those harvests left the stands below the density needed for hiding cover, and it is unlikely that sufficient regeneration, meeting the minimum definition of hiding cover, will occur for 50-100 years if the stands are left as they are. An option for improving the cover situation more rapidly would be to initiate silvicultural activities. An additional consideration is that no additional road building would be necessary.

Diversity unit 101 was analyzed for silvicultural activities in the early 1990's. There are stands that received precommercial thinning in the 1960's and 1970's that currently do not provide hiding cover. These stands have a significant amount of thinned material remaining on site. In some stands the density, and amount of this down material is inhibiting wildlife movement, grass and forb production, and is unattractive. Although this diversity unit currently meets the Forest Plan standard for hiding cover, there are stands where regeneration activities could be initiated to provide more cover sooner than if the stands were left unmanipulated.

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Harvest areas in the vicinity of Elgin Park also have large areas that were thinned 2 or 3 decades ago that could be improved for habitat by further thinning, removal of some of the thinned material on the ground, or by creating openings in the canopy to provide regeneration. These actions could stimulate tree growth, increase the amount of forage, improve the accessibility of the stands, or create hiding cover, among other benefits.

The Doyle Creek area also provides the opportunity for the utilization of timber products, while providing other resource benefits. This area was substantially burned in the late 1800's, and the result is large expanses of relatively dense (150-200 basal area), even-aged, single story, lodgepole pine. These stands have little to no grass/forb understory. The Taylor Creek timber sale decision, 1985, included 14 units totaling 144 acres in clearcuts, plus identified thinning needs in other stands. The thinning activities have not been conducted to date. The alternative selected called for a series of harvests over the prescribed 120 year and 180 year rotations, in order to improve vegetative diversity by creating age and size class diversity. Although the Taylor Creek environmental analysis was conducted for the area east of the Hazelton road, the area west of the Hazelton Road may offer the same opportunities, to begin regenerating areas, or to conduct thinning activities.

The Forest Plan amendment analysis conducted between 1991 and 1994 identified harvest opportunities in the Poison Creek area, diversity unit 119. That analysis was constrained to only schedule timber harvest opportunities in DU's that exceeded the Forest Plan standards for hiding cover, which DU 119 does. The Clear/Crazy analysis indicates that at least some of the stands available for harvest in this DU have a very high volume per acre, approaching 20 MBF/acre, but would require more road building than other harvest opportunities identified. In addition, the predominant silvicultural systems implemented to date in this DU were the large scale, 1960's era, clearcuts, so most of the other stands would be receiving the initial entry. Conducting an initial entry would meet several Forest Plan objectives, namely those concerning forest regulation and timber sale outputs. However, initial entries in the Poison Creek area would be the least responsive to the issues of old-growth and road building when compared to the other timber sale opportunities previously listed in this section. Many of the stands in the eastern portion of the DU include those burned in the late 1800's, but the center to western portion of the DU is dominated by previously unharvested, older stands.

Opportunities/Possible Management Actions

- Continue, or initiate Gate 1/NEPA timber sale analysis on the proposed Caribou timber sale, diversity unit 101, Sourdough timber sale.
- Thinning opportunities in the Taylor timber sale area should be conducted.

Roads/Travel Management

Much of the 7E timber emphasis area is accessible by road. There was a large amount of road construction in the 1960's and 1970's, a lesser amount in the 1980's, and almost none in the 1990's. Timber sale receipts were usually used to pay for road construction. Managing timber stands using silvicultural systems are expected to continue into the future. The roads built for the first harvests will probably be utilized in the future. There are economic benefits as repeated harvests utilize

existing roads. Roads also serve as access for the public for firewood, post and pole, Christmas tree gathering and recreation. Roads serve as fire fighting access, which is especially important in areas where significant investments have been made in tree planting and thinning. Any proposed road closures should consider the value of the road for future timber harvest as well as the prior investment in the road. Most of the roads in the Analysis Area were built for timber sale access. Where the primary purpose for the road was access to remove harvested timber, the objective should be to maintain the structure of the road for that purpose.

CLEAR CRAZY ELK HUNT AREAS

WILDLIFE

1. Spring, Summer, Fall, Elk Habitat

Current Conditions

The Clear/Crazy Analysis Area is part of the Southeast Bighorn Herd Unit managed by the Wyoming Game & Fish Department. Elk populations have been increasing in this Herd Unit since 1987, reaching objective in 1989. In 1994, the herd was estimated to be 31% above objective. The 1994 sex and age ratios were, 18 Bulls/100 Cows, and 48 Calves/100 Cows. These ratios reflect stable trends and indicate that bull ratios have remained healthy as harvest has increased from low levels in the 1970's and 80's. The herd's growth potential has been good. Bull harvest has been stable while cow harvest has increased. An increase in cow/calf harvest is needed to manage toward herd objectives. (1994 Annual Big Game Herd Unit Report)

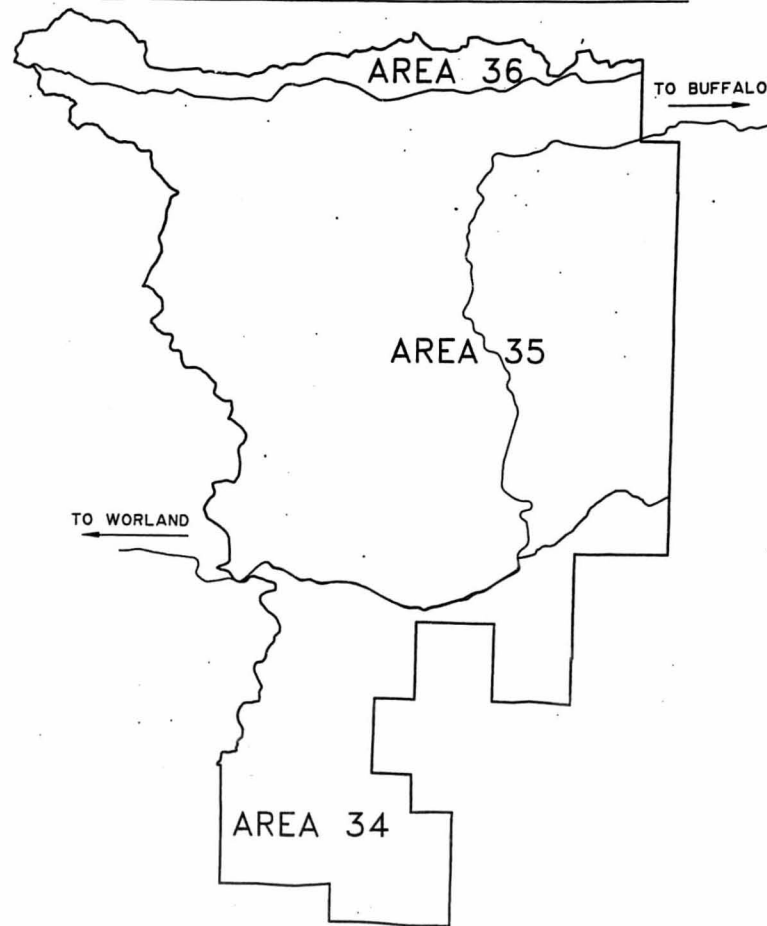
This herd unit consists of Hunt Areas 33, 34, 35, and 36. Of these, only Hunt Areas 34 and 35 fall within the boundaries of the Analysis Area. A major portion of HA 35 (approximately 60%) is on the Forest, while only about 15% of HA 34 is on the Forest. National Forest portions of hunt areas affect state management considerations in specific ways, primarily due to public access and ownership. They provide primary summer ranges for elk herds as well as transition and winter ranges. While the state is responsible for managing populations and hunting seasons, Forest Service management of access and habitat can significantly impact both elk and hunter behaviors on spring/summer/fall ranges.

Hunt Area 34

Much of this area burned in the late 1800's and has regenerated into large contiguous blocks of relatively dense pole stands. In the Poison Creek area, large scale clearcuts harvested in the 1960's have regenerated into young pole stands. Structural stage information for diversity units 117, 118 and 119 show 53% of the total area is classified as pole timber, predominantly in the lodgepole timber type. Road density (1.3 mi/sq. mi.) is relatively high.

About 15% of Hunt Area 34 is located on Bighorn National Forest land; the majority falls within the south portion of the Clear/Crazy Analysis Area. Although this is a small portion of the entire hunt area, it is critical to management of hunting because it is the only area where public access is guaranteed. Throughout most of the remaining area, access is controlled by private land owners.

The majority of this area is currently identified on herd unit maps as spring/summer/fall habitat. This area is part of the North Fork Elk Study, begun in 1994 and continuing through 1997. The study was initiated to fill information gaps about elk distribution and habitat use in relation to land management practices and hunting. Final study results should further define elk use in this area and provide information applicable to land management decisions. Crucial winter range exists just adjacent to the Forest boundary in the area extending from Bull Camp Park to North Fork of Crazy Woman Creek.



Post season numbers have increased above the objective of 900 wintering elk for this hunt area. Hunting seasons were adjusted to increase cow/calf harvest, while maintaining pressure on bulls and this trend will continue until the objective is reached.

Hiding cover for Hunt Area 34 is 52% which compares to the Forest Plan minimum weighted standard of 45%. Hiding cover in DU 117 is actually too high and reduces the overall habitat effectiveness rating because of limited forage potential.

The WTF recommended using the habitat effectiveness model to calculate habitat effectiveness. This method was used to calculate HE for the total hunt area as well as individual diversity units. HE for the total hunt area is 62%. The WTF recommendation called for using a minimum weighted standard. The weighted standard for hunt area 34 is 64%. The standard is high due to the fact that a large portion (52%) of Hunt Area 34 was designated 4B management prescription status in the Forest Plan. This management prescription requires 80% habitat effectiveness for areas designated 4B (Emphasis is on management for indicator species). DU 116 and 204 had the lowest habitat effectiveness scores for this hunt area. Habitat effectiveness will probably always be low for DU 116 because of its narrow linear shape that roughly parallels US Highway 16. Scores for DU 117 (53%), 118 (68%), and 119 (77%) generally reflect low densities of open road and large amounts of lodgepole pole stands with tight canopy closure.

According to preliminary analysis, there are 6 large patches of existing elk security cover in the Forest portion of Hunt Area 34, which helps to hold elk on National Forest land during hunting season. Collectively, DU 116, 119, 120 and 204 are below the 30% security cover which is the minimum recommended by Hillis (1991). Timber harvest during the 1960's in the Poison Creek drainage, significantly reduced security. Although these regenerated clearcuts are beginning to grow into hiding cover, they are not yet security. DU 117, 118 and 207 are both above the 30% threshold for security. In fact, these are the only diversity units in the analysis area above the 30% level. The potential for additional timber harvest activity in this portion of Hunt Area 34 is cause for concern by WGFD because of the potential to further reduce elk security and move elk off the Forest where hunter access is limited.

Two sections of Doyle Creek drainage have been delineated as important travel routes from winter range to higher elevations. In recent years, there have been several documented cases of elk cows with calves encountering problems crossing the woven-wire fences along Hazelton Road during spring migration.

Hunt Area 35

Hunt Area 35 is located in the northern portion of the Analysis Area. Much of the area provides spring summer fall range. The upper northeast portion of Hunt Area 35 is designated as crucial winter range by WGFD. Specific areas include Hunter Mesa, Cull Watt Park and Grouse Mountain.

In a cooperative effort to minimize disturbance during critical elk use periods, the Forest Service manages this area under B Area regulations (1996 Recreation/Travel Map) which restricts all

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motorized use including snowmobiles from November 16 to June 15. The northwest portion of this area is designated Wilderness with total restrictions on vehicle access. The Lost Fire burned over 10,000 acres in this hunt area in 1988, resulting in improved forage quality and production.

In 1991, the WTF completed an analysis of the entire Forest to assess impacts of wildlife related standards and guidelines on the allowable sale quantity of timber. Due to extensive timber harvest activity and associated road building in Hunt Area 35, this area was selected as a "worst-case scenario" to demonstrate relationships between timber harvest (removal of hiding cover), human disturbance via increased road access, and elk distribution. Related social factors such as harvest levels, hunter success rates, and economic revenue from elk hunting, were also analyzed. The final report (WTF, 1991) incorporated the following data:

Prior to 1960, there were 112.12 miles of roads (comprised of Highway 16, Crazywoman Canyon Road and logging roads in the Sourdough Drainage) in Hunt Area 35. After 1960, logging activity and associated road construction increased, continued through the 1970's and declined during the 1980's. Timber harvest dropped dramatically during the 1990's. Currently there are 360 total miles of road in the Analysis Area.

Each decade, as the road miles increased and hiding cover decreased, the habitat effectiveness for elk decreased. Due to topography, large barren areas and parks, and the natural fire regime, Hunt Area 35 had a habitat effectiveness of approximately 60% before roading and timber harvesting began. The weighted average minimum standard required by the Forest Plan for this area is 50%.

Although elk population and harvest data is sketchy for the years prior to 1970, there is evidence that elk use was significantly greater than in subsequent years. During the 1970's, elk harvest in Hunt Area 35 and adjacent Hunt Area 36 was about 170 elk year in both areas. During the 1980's only 64 elk year were harvested in Hunt Area 35, while harvest rates in Hunt Area 36 dropped by only 10%. The decline in harvest rates as well as information on changes in elk use in Hunt Area 35 prompted WGFD to change Hunt Area 35 from a general elk license area to a limited quota elk hunting area in 1989. The following two years the harvest rate was only 13 elk per year.

The average harvest from 1990 to 1995 has risen to 23 elk, still well below earlier figures. Hunt Area 36 located directly north of Hunt Area 35 provides something of a buffer for this portion of the herd unit because it remains relatively unroaded and untreated by timber harvest activities.

Table 12 Historic Elk Hunting Statistics for Hunt Areas 35 and 36

Period	Hunt Area 35		Hunt Area 36	
	Average Harvest	User Days (Yearly)	Average Harvest	User Days (Yearly)
1970's	168	5,320	170	3447
1980's	64	3721	152	4139
*1989	13	457	**	**

5,061 1960
12,457 1970
24,367 1980
29,170 1990

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Period	Hunt Area 35		Hunt Area 36	
	Average Harvest	User Days (Yearly)	Average Harvest	User Days (Yearly)
1990-95	23	644	**	**

*Change from General License to Limited Quota season.

**Statistics were not averaged for HA 36

The decline in elk use in Hunt Area 35 and poor hunter success resulted in fewer people hunting in Hunt Area 35. Elk hunter user days in the 1980's was 17% less than in the 1970's. After Hunt Area 35 became a limited quota area elk hunter user days dropped 90%. Monetary values associated with elk hunter user days vary by source and residency of the hunters; however, the DGECON (Forest Service Economic Program) value of \$52 per elk hunter user day can be considered a minimum value. Therefore, the economic loss resulting from the decrease in user days just since the 1970's in Hunt Area 35 is at least \$250,000 per year.

The combined wintering population objective for elk in Hunt Areas 35 and 36 is 800 elk. The current population is estimated at 1200 elk. Numbers have increased since initiation of limited quota hunting restrictions for Hunt Area 35 in 1989, which also improved harvest levels and hunter success in recent years. Increased cow/calf harvest is needed to manage herd to objective, while maintaining current pressure on bulls.

Hiding cover is currently at 34%; the Forest Plan minimum weighted standard requires 42%.

Elk habitat effectiveness was refigured for this hunt area using updated information which accounts for road closures, acres burned, blow-down acres, and clearcut acres that have regenerated into hiding cover since the study was completed in 1992. The results are similar to those derived during the WTF study. The average habitat effectiveness for the hunt area is 34% compared to the Forest Plan minimum weighted standard of 50%. DU 93, 98, 99, 101 and 110 are well above the 40% minimum standard as well as the weighted Forest Plan standard for habitat effectiveness for individual units. These are the diversity units that remain relatively unimpacted by timber harvest or natural stand regeneration events. Ninety percent of DU 103, 104, 105, 107, and 108 are in high elevation zones in Cloud Peak Wilderness where data is insufficient to determine habitat effectiveness. Large portions of these diversity units are identified as barren in the RIS database. The remaining diversity units in Hunt Area 35 are those that have been significantly impacted by timber harvest activities or the Lost Fire in the past 35 years. Habitat effectiveness scores range from 12% to 30% which is well below the 40% threshold level for habitat quality. DU 106 and 109 were significantly impacted by the Lost Fire in 1988, which partially accounts for habitat effectiveness of 12% and 15% respectively. Approximately one-third of both diversity units are typed as mountain grass and barren habitat which inherently affects cover quality. The Lost Fire further reduced over 50% of the area to early successional structural stages which won't provide elk hiding cover for twenty plus years. DU 101, 102, 111, 112, 113, 114, and 115 are all part of the area subject to intensive timber harvest activities in the past. Although some clearcuts have regenerated to the point where they are now providing hiding cover, overall habitat effectiveness scores, since WTF 1992, have not altered more than a few percent.

Table 13 Elk Habitat Parameters

Hunt Area	Diversity Unit	Hiding Cover %		Roads - Mi/Sq Mi		Habitat Effectiveness %	
		Existing	Min. St.	Existing	Weighted	Existing	Min. St.
35	93	57	43	0.55	0.43	79	61
	98	42	42	0.46	0.39	67	51
	99	41	40	0.87	0.65	58	46
	100	31	43	1.59	0.89	27	52
	101	45	43	1.03	0.75	62	52
	102	39	40	2.63	1.8	38	43
	106	13	42	0.9	0.76	12	47
	109	20	42	1.47	1.23	15	55
	110	46	40	1.12	0.85	56	41
	111	27	42	1.71	1.17	21	49
	112	29	46	1.37	0.93	24	62
	113	19	41	1.54	1.3	15	46
	114	31	42	2.23	1.28	24	48
	115	33	40	1.67	1.06	30	43
	Totals	34	42	1.32	0.93	34	50
34	116	29	42	2.85	2.06	18	52
	117	84	49	0.7	0.54	53	78
	118	51	48	0.86	0.71	68	73
	119	49	42	0.98	0.46	77	51
	120	21	45	3.43	2.1	13	65
	204	15	41	1.41	1.1	12	49
	207	91	49	0.32	0.29	51	78
	Totals	52	45	1.29	0.89	62	64

Preliminary mapping of elk security cover shows 10 existing elk security areas scattered over Hunt Area 35. More than half of the security cover is concentrated within three diversity units--DU 98, 101 and 115. None of the diversity units within this area achieve the 30% threshold for security cover.

The majority of the Analysis Area is managed under C Area regulations (1996 Recreation/Travel Map) which opens the area to off-road travel by vehicles on a yearlong basis. The amount of off-road travel has increased significantly in this area during the past few years and this trend is likely to continue in the future. Impacts to elk from this type of use are similar to those described for official roads.

Though hiding cover, habitat effectiveness and security area requirements are not satisfied at Forest Plan or research suggested levels, elk numbers have increased dramatically since the institution of the limited quota hunt. It appears as though this has been the primary factor responsible for the population increases.

Susceptibility HIGH, Resiliency MODERATE.

Causes	Meets Forest Plan	Risk and Related Outcomes
<ul style="list-style-type: none"> - Open road densities - Past timber harvest activities. - Unrestricted use of ATV's - Increased recreational demand both hunting & non-hunting. - Livestock fences. 	N	<p>YELLOW</p> <ul style="list-style-type: none"> - Poor distribution of elk. Elk moving off the Forest to private lands during hunting season. Quality of hunting. - Barrier to elk cow/calf migration in spring.

Forest Plan Goals/Desired Conditions

- In diversity units dominated by forested ecosystems, maintain a minimum of 40 percent in hiding cover.
- Provide wildlife habitats on a sustained yield basis to maintain a viable population of all existing vertebrate species.
- Provide necessary habitat for wildlife population objectives agreed upon with the Wyoming Game and Fish Department.
- Maintain or improve the habitats of wildlife management indicator species.
- Avoid creating movement barriers such as fences and excessive slash piles on known migration routes.

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- Habitat for each species on the Forest will be maintained at least at 40% or more of potential overall and 80% or more of potential for 4B and 5B management prescription areas.

Opportunities/Possible Management Actions

Administrative

- Reconvene a WTF to make recommendations to the Forest Supervisor for use in Forest Plan Revision, regarding application of CFWRU Elk Habitat Effectiveness model and Hillis Paradigm Elk Security model.

Resource

- Return to hunter visitor levels that existed in the 1970's. In order to achieve the above levels, habitat conditions would need to be improved to levels that more closely reached Forest Plan and research recommendations.

The following actions could be undertaken in order to increase elk habitat effectiveness and elk security.

- Reduce current open road densities. This would be most effective where closures would improve both elk habitat effectiveness and security. In order to be effective, closed roads should be obliterated or have debris pulled on to them to prevent access.

According to Game and Fish data, the following would be priority roads to be closed in order enhance elk security.

First Priority Road Closures





FDR 386	FDR 379	FDR 489	FDR 614
FDR 385	FDR 606	FDR 639	FDR 447
FDR 372 (Partial)	FDR 607	FDR 497	FDR 615
FDR 605	FDR 609	FDR 643	FDR 449
FDR 460	FDR 640	FDR 641+Spurs	FDR 86+Spurs
FDR 381	FDR 379	FDR 619+Spurs	FDR 84+Spurs
FDR 382	FDR 461	FDR 613	FDR 464
FDR 491	FDR 371	FDR 445	FDR 516
FDR 494	FDR 488	FDR 446	FDR 533
FDR 495	FDR 492	FDR 616	

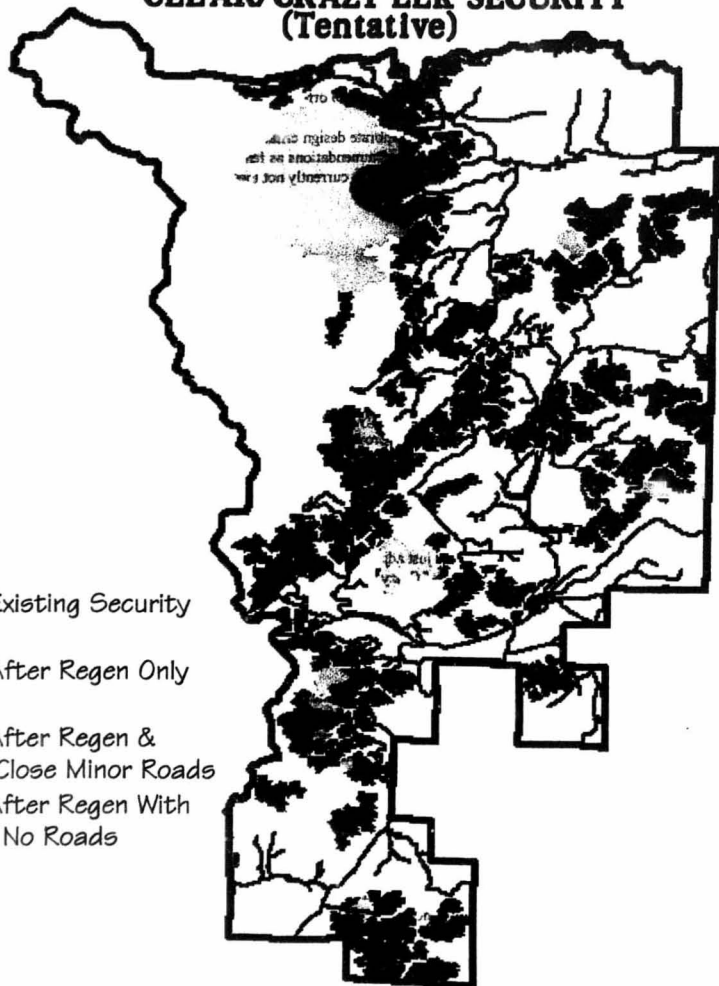
- Focus efforts where there is current potential elk security cover that could become effective through the closure of roads. (Figure 9)

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Figure 9 Elk Security Areas

CLEAR/CRAZY ELK SECURITY (Tentative)

-  Existing Security
-  After Regen Only
-  After Regen & Close Minor Roads
-  After Regen With No Roads



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- Manage for even distribution of security areas across a wide spatial and elevation range to provide a range of availability under various weather conditions during hunting season.
- Close or reduce areas currently open to off-road vehicle use.
- Livestock fences need to incorporate design criteria which allows for wildlife passage according to WGFD design recommendations as fences are constructed and reconstructed. Fences along the Hazelton Road are currently not meeting standards.

2. Winter Range Elk and Moose

Current Conditions

Elk

Winter range is defined as geographic sites where animals concentrate seasonally to avoid snow cover (Christensen, 1993). Traditionally, efforts to improve elk winter range emphasized improvement of winter forage through burning programs. Availability of forage was thought to be the most limiting factor. Recent studies show forage continues to be important, but during severe weather many animals adopt an energy conservation strategy for forage intake (Christensen, 1993). Management of winter range to improve thermal cover and prevent harassment may be just as important to elk winter survival as forage quality and quantity. Disturbance and harassment result in tremendous energy expenditure at a time when elk are struggling to conserve energy. Selective road and area closures as well as restrictions on recreational use have proven effective in other areas.

Crucial winter range exists just adjacent to the Forest boundary in the area extending from Bull Camp Park to North Fork of Crazy Woman Creek. The upper northeast portion of Hunt Area 35 is designated as crucial winter range by WGFD. Specific areas include Hunter Mesa, Cull Watt Park and Grouse Mountain. The Grommund Creek area along the Forest boundary is classified as winter range, though not considered crucial at this time. As the elk population in Hunt Area 35 recovers, increasing numbers of elk are wintering in this area and this trend is expected to continue.

In a cooperative effort to minimize disturbance during critical elk use periods, the Forest Service manages crucial winter range in Hunt Area 35 under B Area regulations (1996 Recreation/Travel Map) which restricts all motorized use including snowmobiles from November 16 to June 15. The northwest portion of this area is designated Wilderness with total restrictions on vehicle access.

In recent years, foot traffic has been on the increase during winter months in the area identified as crucial elk winter range in the northeast section of this hunt area. The increased interest beyond traditional uses of wildlife viewing and photography is attributed primarily to antler hunters (Theile, 1996). Elk antlers shed by bulls during winter months bring high prices and this area is noted for a quality bull population. The full extent of this impact is not well-documented at this time. An expected increase in this kind of activity raises the issue of implementing total restrictions on human presence on these important areas during periods when use by wintering elk

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is probable (November 16 through April 30). Such restrictions have already been initiated on the adjacent Bud Love Winter Range.

Moose (*Alces alces shirasi*)

Moose have been observed in the willow riparian habitats during the winter in an area extending from French Creek to Muddy Creek. Drainages adjacent to US Highway 16 are being used extensively during the winter. Ease of accessibility raises concern over the potential for conflicts between moose wintering along US Highway 16 and snowmobile users in this same area. Increased numbers of trophy bull moose wintering in this area also precipitates increased interest in antler hunting along the Hwy 16 corridor, which creates an added source of stress on wintering animals. (Theile, 1996)

Susceptibility HIGH, Resiliency MODERATE.

Causes	Meets Forest Plan	Risk and Related Outcomes
<ul style="list-style-type: none"> - Increasing foot traffic in crucial winter range by antler hunters. - Snowmobiles in riparian willow habitat. - Expansion of winter range habitat by elk. - Increasing demand for winter recreation on Forest. 	N	<p>YELLOW</p> <ul style="list-style-type: none"> - Stress resulting in mortality on wintering moose population along Hwy 16 corridor. - Stress resulting in mortality to elk on crucial winter range.

Forest Plan Goals/Desired Conditions

- Increase winter range capacity for elk and deer.
- Avoid management activities on documented important winter range and parturition areas during the season of big game use.

Opportunities/Possible Management Actions

ELK

Administrative

- Consider closure of crucial winter range for elk to human presence between November 16 and April 30.
- Implement B Area travel management regulations on Grommund Creek winter range area to minimize potential disturbance to increasing numbers of elk in this area.

MOOSE

Resource

- Monitor disturbances by snowmobilers and antler hunters to moose on winter range along US Hwy 16. Document instances where conflicts occur. Specific areas for monitoring include South Fork of Clear Creek, Pole Creek, Little Sourdough Creek, Sourdough Creek, Circle Park, Crazy Woman Canyon.
- Utilize public education contacts through lodges, snowmobile clubs and snowmobile map to acquaint winter recreation users with information needed to make informed decisions about their activities in winter moose habitat.
- Reroute snowmobile trails to avoid willow habitats wherever possible. Where trails must cross creek drainages, trails should be routed around high moose use areas and cross creeks at a perpendicular angle to minimize effects. Snow mobilers should not be permitted off-trail in these areas. Areas of special concern:

The Pines—the snowmobile trail south of the Pines Lodge follows the Hondo Creek drainage, which is often used by moose. The trail should be rerouted away from the riparian area if possible.

The "M Trail" crosses Willow Marsh near the Highway 16 pull-out. Snowmobiles should not be allowed to travel along or through Willow Marsh.

3. Biodiversity and Management Indicator Species

Though old growth is a component of biodiversity and vegetation type diversity, it will be addressed as a separate descriptive parameter below.

Current Conditions

Vegetation Type Diversity

Biological diversity is defined as the full variety of life in an area, including the ecosystems, plant and animal communities, species and genes and the processes through which individual organisms interact with one another and with their environment (USDA Regional Guide, 1992).

Wildlife populations generally reflect habitat conditions which exist at any one point in time. Habitats are dynamic and constantly changing due to both natural and human caused events.

Animal species have evolved over thousands of years in response to natural caused changes. In the past 100 years, human factors have figured more prominently in the analysis area. Two management strategies that have had the greatest impact on natural processes in forested areas are fire suppression activities and timber harvest.

Two parameters generally used to measure diversity of wildlife habitats are the variety of vegetative types and the distribution of structural stages within these types. The term vegetative type is self-explanatory. Structural stage is defined as any of several developmental stages of tree stands described in terms of tree age and the extent of canopy closure (Managing Forested Lands for Wildlife, 1987). Both the Forest Service RIS database and Game and Fish GIS database were used to analyze these parameters.

According to the RIS database, 72% of the Analysis Area is a forested vegetation type, meaning it is capable of growing trees. For the Clear Creek Watershed (WS #73) that figure is 66% forested vegetation and the Crazy Woman Creek Watershed (WS #75) contains 78%. The remaining area is composed of barren land (15%) which includes rock, talus slopes, and bare soils, mountain grasslands (10%), wet meadows (3%) and mountain shrubland (< 1%).

Outside the Wilderness, there are only a couple extensive areas of mountain grassland/herbaceous rangeland--the Hunter Mesa, Hospital Hill, Grouse Mountain region in the northeast section of the unit and Elgin Park. The wet meadow type is generally scattered throughout the Analysis Area in association with streams, seeps, and ponds.

Within the forested vegetation type, lodgepole pine is the predominant tree species accounting for 79% of the total forested acreage (72% of WS 73 and 82% of WS 75). On a regional basis, lodgepole pine extends from 7500 feet to 11,500 feet but the most favorable range is from 9,000 to 10,000 (Mehl, 1992). It is a shade intolerant, aggressive pioneer species which means it is adapted to develop on sites recently open by stand replacement events such as fire, windstorms and clearcuts. It is usually a seral species, meaning it will be replaced by shade tolerant species like spruce and fir but it may be considered climax where a seed source for shade tolerant species is not available or on sites with poor moisture and soil conditions. Conditions in the Analysis Area are conducive to lodgepole remaining on site for long periods rather than succeeding to shade tolerant species. Because of its shade intolerant characteristics, lodgepole tends to develop as even-age, one storied stands with relatively dense overstory canopies. This limits the diversity of tree heights and tends to suppress ground cover which in turn limits quality and quantity of wildlife habitat niches.

The remaining forested type is comprised of the Engelmann spruce/sub-alpine fir type (15%), ponderosa pine (3%), Douglas fir (1%) and aspen (1%). Spruce/fir occurs in the highest and coldest areas. It generally exists from 9,000 to 11,000 feet elevation but may range from 8,000 to 12,000 feet in the Rocky Mountain region. This forest type overlaps the range for lodgepole pine but inhabits wetter sites. Spruce and fir are both shade tolerant species which is an important component of perpetuating a stand over the long term. It is a climax cover type meaning it is not replaced by any other species over time. When disturbance like fire or timber harvest occurs at lower elevations, the spruce/fir type is often replaced by lodgepole pine or aspen. If a sufficient seed source is available, these stands will eventually revert back to spruce/fir. In the analysis area, the majority of larger spruce/fir stands are located in the diversity units where Wilderness exists, so there is a disproportionate amount of spruce/fir in the Clear Creek watershed.

Spruce/fir forests warrant further discussion because of their high productivity and value for many species of wildlife. Because both spruce and fir species are shade-tolerant, these stands have the inherent capability of providing multiple canopy layers that persist over long periods of time. Engelmann spruce trees have an average lifespan of 350-500 years. Climax stands tend to be very stable and persist on site indefinitely. The combination of high structural diversity and longevity promote stand characteristics that provide habitat for a high diversity of wildlife species in comparison to even-aged, one-storied relatively short-lived lodgepole pine stands. There are several indicator species which select for spruce/fir stands over other habitat types. There are few if any species that inhabit lodgepole pine stands exclusively: High elevation spruce/fir riparian stands are important for moose habitat. They also receive a disproportionate amount of use by elk on summer range.

Historically there were probably more spruce/fir stands in late successional stages of development than currently exists. The RIS database indicates approximately 2,500 acres of spruce/fir in the grass-forb structural stage. Most of these acres were burned in the Lost Fire in 1988 and were probably mature sawtimber prior to the fire. Only small amounts of spruce/fir (approximately 200 acres) have been harvested by clearcuts over the past few decades. Most received selective harvest treatments. It is probably safe to assume that most of the clearcut spruce/fir stands regenerated to lodgepole pine as a step in the progression towards climax spruce/fir.

It has been difficult historically to get spruce to regenerate following fire or clearcut treatment even with scarification of soils and seeding efforts. This has been a problem across the Forest as well as the Analysis Area.

The ponderosa pine type is found at the lower elevations (6,000 to 8,000 feet) on warm, dry sites on the east face. Small amounts of aspen and Douglas fir are found in most of the diversity units in both watersheds. All of these types are very limited in distribution but are an important component of diversity overall since each has wildlife species specifically adapted to it.

Figure 10 Forest Structural Stages

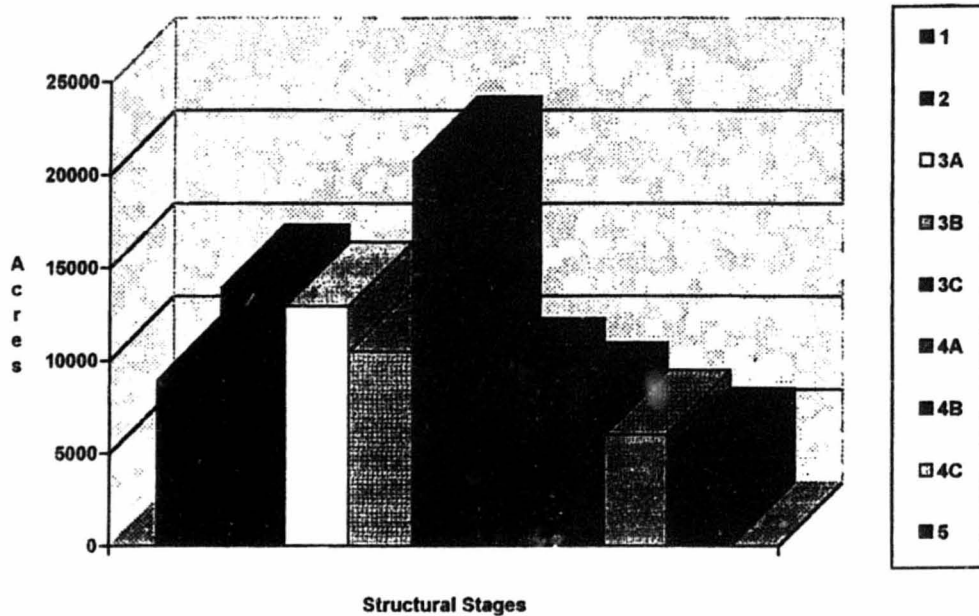


Table 14 defines the habitat structural stages portrayed in Figure 10:

Table 14 Forest Structural Stages

Code	DBH (Diameter) Range	Crown Cover %	Structural Stage
1	NA	0 - 10%	Grass - Forb
2	Less than 1 inch	10+%	Shrub - Seedling
3A	1 - 9 inches	10 - 40%	Sapling - Pole
3B	1 - 9 inches	41 - 70%	Sapling - Pole
3C	1 - 9 inches	71 - 100%	Sapling - Pole
4A	Over 9 inches	10 - 40%	Mature
4B	Over 9 inches	41 - 70%	Mature
4C	Over 9 inches	71 - 100%	Mature
5	Varies	Varies	Old-Growth

Forest Plan standard states that 5% of forested areas of a diversity unit should be in structural stages 1, grass-forb, and 5, old growth. Table 15 summarizes the status of these standards and guidelines for the entire Analysis Area. The area is comprised of 32 diversity units either in part or whole.

Table 15 Inventoried Acres of Structural Stages 1 and 5 in the Clear/Crazy Analysis Area

Structural Stage	Acres to meet 5% Standard	Total Inventoried Acres	# of DU's Known to Meet Standard
1	5190	8920	13
5	5190	5061	8

Forest Plan monitoring since the issuance of the 1985 Plan has resulted in the recommendation that the 5% grass/forb requirement be dropped. The Bighorn National Forest ecosystem naturally occurring fires prior to Forest Service management. A comparison of the grass/forb acres known, (which for the watershed as a whole exceeds the requirement) to the number of DU's meeting or exceeding the standard (about 40% of the DU's), is an indication that the scale of natural disturbances greatly exceeds the size of our diversity units. That is, analysis conducted on areas the size of our current diversity units may result in misleading or incomplete interpretations. These artificially created diversity units are not large enough for analyzing natural systems when the systems change in block sizes that dwarf the diversity unit.

Most of the DU's currently meeting the 5% grass/forb requirement are in the Lost Fire area. The Lost Fire burned over 10,000 acres in 1988, and is a good indication of the scale of naturally occurring fires prior to Forest Service management. A comparison of the grass/forb acres known, (which for the watershed as a whole exceeds the requirement) to the number of DU's meeting or exceeding the standard (about 40% of the DU's), is an indication that the scale of natural disturbances greatly exceeds the size of our diversity units. That is, analysis conducted on areas the size of our current diversity units may result in misleading or incomplete interpretations. These artificially created diversity units are not large enough for analyzing natural systems when the systems change in block sizes that dwarf the diversity unit.

Following a disturbance event such as fire or clearcutting, a stand reverts to the grass-forb stage similar in appearance to a natural meadow. They may provide foraging areas for herbivorous wildlife species and are particularly productive along the edges where openings join with tree cover. As small seedlings develop and grow, these areas continue to function as foraging areas until they reach the sapling-pole stage. Cover becomes a contributing factor as tree canopies develop. As trees continue to grow into maturity more habitat diversity is provided by larger diameter trees and multiple stories, dependent on the site and tree species. Habitat diversity is further enhanced as older trees begin to die and eventually fall to the ground providing feeding and cover substrates for a wide variety of species.

An analysis of structural stage distribution in the Clear/Crazy landscape area, indicates 44% of the forested type is in structural stage 3 or the sapling-pole stage. This is proportionately due to the amount of disturbance that has occurred over the last 50 years and the fires that occurred in between 1850-1900. The majority of these sapling-pole stands are in the lodgepole pine type (94%). These are probably the least productive sites within the forested cover type in terms of wildlife habitat. Tree layering is generally limited to one story. Snags (dead standing tree) and dead & down material are not well developed or the size is generally too small to be useful for nesting and feeding habitat. The ground vegetation is often sparse. Cover for big game tends to be limited in

value as well. Species that use this type are generalists for the most part, adapted to a wide variety of habitats and not requiring this type specifically.

Structural stage 3 has a wide range of tree diameters (1-9 inches). The stands with larger tree diameters are probably the result of wide-spread fire at the turn of the century. Many of the stands harvested in the 60's and 70's are just now converting to the sapling-pole stage with small diameter trees. The larger clearcut areas characteristic of that time period more closely approximate conditions under a natural fire regime than the smaller cuts that became standard during the 80's and 90's. In the last three decades, approximately 32% of the forested acres have been manipulated in some manner, including clearcuts, shelterwood and thinning activities. An additional 10% was impacted by a combination of natural events, eg. fire and blowdown for a total of 42% of the area. This is fairly intensive and is probably comparable to the upper range of acres affected by natural events historically. (Figure 11)

Snag and Downed Log Habitat

The Forest Plan standard is for 90-110, 10 to 12 inch snags per 100 acres, where biologically feasible, in the lodgepole and spruce cover types. It is estimated that snags are sufficiently provided for over the majority of the area. However, there are certain areas that do not meet the S&G. Some of the 1960's clearcuts, which range up to 300-400 acres, do not have any snags. In addition, while the more recent clearcuts are not of sufficient size to violate this S&G, some of them do not have snags either. Future adjacent cutting will have to provide for the snag requirements of these areas. Firewood cutters have been efficient at removing snags from along open roads, so it is likely that some "snag-less" corridors exist.

Downed log habitat has also been effected by timber harvesting, especially in the 1960's clearcuts. The post-sale treatment sometimes included roller-chopping, which helped to decrease the amount of downed-dead logs on some sale areas.

Management Indicator Species

The Forest Plan identified 24 MIS which are representative of three stages of vegetative development: 1) early forest successional stages or rangeland species 2) mid-successional species or those dependent on a variety of seral stages and 3) late successional species. The HABCAP model is the standard tool used by Forest managers in the Rocky Mountain Region to assess habitat capability for MIS. For model purposes, *habitat capability is defined as the ability of a given unit of land to support species of wildlife based upon specific vegetation characteristics. (Habitat Capability Model. 1994)*

The model has many limitations. Estimates are based on the total mix of vegetation without regard for spatial distribution of vegetation. The model considers forest overstory type and structure only and does not evaluate understory composition. This model emphasizes forested ecosystems and does not account for valuable habitat components such as edge and riparian interspersions.

Results of this kind of modeling are only indicators of the ability of habitat to support a particular species. They are most useful when applied to management situations where before and after

treatments are considered rather than an absolute measure of species occurrence. The results are most often used to show up-and-down trends following timber harvest activities.

Model information is available for 17 of the 24 species. The vesper sparrow was chosen to represent early successional species; mule deer and the red squirrel are indicators for mid-successional species or those dependent on a variety of seral stages, and the red-breasted nuthatch, goshawk and pine marten were used as indicators for late successional species. Species that select for specific forested types were also included in the table. The golden-crowned kinglet is very selective for spruce/fir communities, while the pygmy nuthatch and lewis woodpecker favor the ponderosa pine type particularly the late successional stages, since they are cavity nesters.

There was no attempt to use the model to determine range of historic variability. However, the current conditions for the various diversity units probably represent a fairly accurate measure of habitat conditions that could have existed over time. There are some diversity units that have remained relatively untouched by recent natural events or timber management activities. Others are in various stages of regeneration as a result of intensive timber harvest since the 60's and catastrophic wildfire at the turn of the century. Diversity units affected by the Lost Fire provide a measure of the early stages of regeneration and corresponding wildlife responses. It may be appropriate to look at the range of outcomes for diversity units as shown in Table 16 below to assess the potential range of historic variability.

Table 16 Indicator Species Habitat Capability

Species Name	Clear Creek Watershed		Crazy Woman Creek Watershed	
	HCI Range	Average HCI	HCI Range	Average HCI
Vesper Sparrow	21% - 98%	48%	9% - 47%	36%
Mule Deer	72% - 99%	83%	50% - 90%	76%
Red Squirrel	8% - 58%	37%	32% - 74%	51%
Red-breasted Nuthatch	0% - 43%	14%	18% - 60%	45%
Goshawk	5% - 51%	34%	22% - 57%	45%
Pine Marten	10% - 38%	19%	10% - 14%	4%
Lewis Woodpecker	0% - 08%	2%	0% - 5%	3%
Pygmy Nuthatch	01% - 35%	22%	20% - 46%	32%
Golden-crowned Kinglet	0% - 26%	5%	0% - 14%	4%

Results of habitat capability modeling are predictable. Generally low scores indicate a limited ability for the area to provide habitat for a particular species due to a lack of certain structural stages or tree species preferred by that species. High scores indicate the reverse situation. Consistently high scores reflect a generalist species that occupies a wide variety of habitats.

Not surprisingly, the vesper sparrow which prefers grass-forb and seedling structural stages scored highest for the diversity units (DU 106, 107, 109) where the Lost Fire occurred. The lowest score was for DU 117 and 207 which are predominantly dense lodgepole pine poles. Mule deer provide a

good example of habitat generalists. Again the highest scores for deer were in the recent burn while the lowest scores were in DU 117 and 207 indicating a response to the lack of forage habitat in natural or induced openings.

The red-breasted nuthatch and goshawk, both late successional indicators, are fairly comparable in their response to habitat conditions in the analysis area. The most favorable scores were in DU 113 and 114 for both species. This is probably due to a predominance of open-canopy pole (SS 3A) and mature sawtimber (SS 4A) stands which provide good foraging areas while maintaining cover values. Habitat capability scores were generally low for pine marten. The highest scores were found in DU 101 and 119 which indicates the documented preference for late successional spruce/fir stands and relatively dense overhead canopies in the lodgepole pine sawtimber type. It stands to reason that the lowest scores for all three of these late successional stage indicators was in the Lost Fire diversity units.

Currently, habitat effectiveness for summering mule deer for the analysis area is 79%. It breaks down further into 83% for watershed 73 and 76% for watershed 75. Using the weighted average for management area prescriptions in the Forest Plan, the minimum habitat effectiveness for the respective areas is 54.5% for the total analysis area, 51% for Watershed 73 and 58% for Watershed 75.

Susceptibility MODERATE, Resiliency LOW.

Cause:	Meets Forest Plan	Risk and Related Outcomes
-Fire suppression. -Natural soil & climatic conditions. -Extensive timber harvest	O	Yellow Aspen declines further. -Late successional ponderosa pine susceptible to stand replacement by fire. -Late successional Spruce/fir continues to decline as result of fire & timber harvest.

Forest Plan Goals/Desired Conditions

- Maintain and/or improve the habitat of the wildlife management indicator species.
- Ensure the maintenance of plant and animal diversity.

Opportunities/Possible Management Actions

Resource

- Identify late successional ponderosa pine stands and use prescribed fire to reduce susceptibility to stand replacement fire events.
- A large portion of the forested vegetation is in lodgepole pine poles. Determine extent of existing stagnant ("doghair") stands.
 - Offer stagnant pole stands for harvest
 - Portions of the Lost Fire area have regenerated in dense lodgepole pine seedlings that will grow into "doghair" poles if left undisturbed. Thin these stands during next ten years.
- Continue public education about the value of snags for wildlife species and wildlife tree signing efforts to protect snags from woodcutting.

4. Old-growth Forests and Fragmentation

Old-growth forests are an important component of biological diversity. On a landscape level, the number, size and distribution of old-growth stands contribute significantly to landscape diversity. Old-growth is difficult to describe in specific terms because it varies by species. In 1992, the Forest Service accepted the following generic definition: *Old-growth forests are ecosystems distinguished by old trees and related structural features. Old-growth encompasses the later stages of stand development that typically differ from earlier stages in structure, composition, function, and other attributes. (Kaufmann, 1992)*

Old growth is characteristically distinguished from younger growth by some but not necessarily all of the following attributes:

- *Large trees for species and site.
- *Wide variation in tree sizes and spacing between trees.
- *Relative to earlier stages, high accumulations of large, dead standing and fallen trees.
- *Decay in the form of broken and deformed tops or bole and root rot.
- *Multiple canopy layers.
- *Canopy gaps and understory patchiness. (Kaufmann, 1992)

From the fire history, we know that the majority of the landscape was dominated by single-story, even-aged lodgepole pine stands, with spruce-fir forests in the wet, riparian areas, and at higher elevations. Lodgepole represents a climax forest on the majority of the Analysis Area, and the stands were replaced on the order of every 100-300 years. Therefore, while those stands may not meet a definition of old-growth that requires multiple species and multiple stories, they are the *ecological* old-growth that existed in the landscape historically. The spruce-fir old-growth that exists meets the more "traditional" definition of old-growth that includes multiple canopy layers and multiple species.

Late successional stands have social/economic values as well as biological importance. They provide important forest products, unique recreational environments and an important cultural and spiritual heritage. But the most compelling reason to manage for conservation of old-growth forests is the role it serves for species that are dependent on the unique characteristics this type of habitat provides. Late successional stands are known to be the preferred habitat for a number of vertebrate species including pine martin, goshawks and a variety of cavity dependent species such

as woodpeckers for at least a portion of their life cycles. There is little knowledge about the breadth of ecological and habitat tolerance for these species much less the more complicated and less visible workings at the micro-organism level. The lengthy span of years required for a stand to progress from stand regeneration to old-growth status is another factor which raises the level of concern for this issue. Once a stand reverts back to the grass-forb stage following fire or clearcut harvest, it takes 150+ years for a stand to begin to develop the components characteristic of old growth timber.

Old-growth forests first gained recognition as an issue in forest management in the late 1970's and early 1980's. Intense timber harvest activity during the 60's and 70's converted areas from late successional stages to early successional stages over extensive acreages throughout the western states.

Historic Range of Variability

The amount of old-growth in the analysis area fluctuated between large catastrophic fire events. The most "stable" old-growth is found in the high elevation ES/AF habitat types. Old-growth occurred in the Lodgepole pine type, but was unstable on the landscape, given the fuel loading, fire frequency, and living fuel ladders that characterize these stands. Once a LP stand reached old-growth status, at about 200-250 years, its fuel loading made the stand inherently unstable, and extremely susceptible to fire. The wildlife, plant, and aquatic ecosystems evolved and developed over the millennia under this type of "unstable", unevenly distributed condition.

Current Conditions

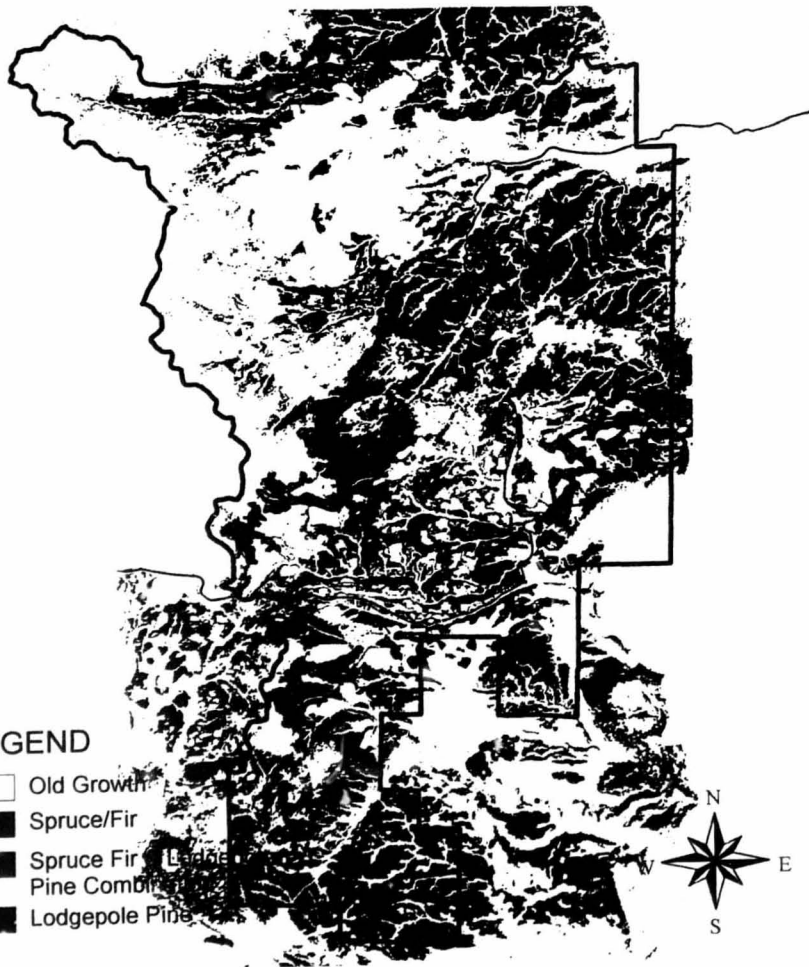
The Clear/Crazy Landscape Analysis Area was the setting for the most concentrated timber harvest activity throughout the Bighorn National Forest during the 60's and 70's. Approximately 40,000 acres of forested habitats in the Analysis Area have been altered by some means since the 1960's. The majority (30,000 acres) was accomplished by timber harvest activities and it is reasonable to assume that most of this area was in structural stages 4 and 5. There has been a growing recognition of the value of older stands to wildlife species as well as the health and welfare of total forest ecosystems.

During the ASQ amendment analysis, a cursory inventory of the 10 fifth order watersheds was conducted. Two of the ten were identified as lacking the recommended 10% old-growth. The Clear Creek Watershed was one of the two.

The RIS database identifies structural stage 5 as "old-growth" timber. It is unclear how the majority of these acres were assigned this designation. It may be based on age alone, stands that are greater than 150 years old. At any rate, this designation was found to be inconsistent and unreliable as it currently exists in the database. Approximately 5,862 acres of the Analysis Area have been surveyed for old growth attributes in the field using an old-growth scorecard. Much of this inventory work was completed through a volunteer partnership with the local Audubon Society. The scorecard rates a stand on structural characteristics that contribute to old-growth habitat values including number of species, percent canopy cover, average dbh, number and size of snags and dead & down materials. The final scores and descriptions were analyzed to determine which stands qualify as old-growth. (Figure 12)

Stage II inventory information, with standard and quality attributes described by Mehl (1992) for the different forested types occurring in the Rocky Mountain Region, were compared in order to more accurately assess the acreage of old-growth. Only those acres that qualified as old-growth on the scorecard and/or met the Mehl attributes were considered to be structural stage 5. Using this method, 4.9% of the total area qualified as structural stage 5 or old-growth. In the Clear Creek watershed the majority of old-growth acres, 74%, is in the spruce/fir type. Much of this is in the high elevation Wilderness zone. The opposite is true for the Crazy Woman Creek watershed where old-growth acres are primarily in the lodgepole pine type (73%). Eight of the twenty-three diversity units meet the minimum 5% for the Forest Plan standard and guideline. The current distribution of old-growth is very uneven across the landscape. It is probable that the historic distribution was also very uneven. Large contiguous blocks of old-growth are located in diversity units 101, 111, 114 and 119. These blocks are more likely to meet the intent of functional old-growth as described by the Old-growth Task Force. In the Clear Creek watershed, over 4,000 acres of uninventoried spruce/fir and 2,700 acres of uninventoried lodgepole pine exists in the Wilderness. There are approximately 15,000 forested acres in the Cloud Peak Wilderness portion of CCLA. Of the 15,000, only 248 have structural stage information in the database. The potential for an additional 5% old-growth in these stands is good. Spruce/Fir stands in Crazy Woman Creek watershed are very limited. The GIS database maps indicate there are some mixed lodgepole/spruce-fir stands in DU 118 and 119. There are extensive acres of mature lodgepole pine (Structural Stage 4) in this watershed providing the potential for future old-growth.

Figure 12 Old Growth Map



LEGEND

- Old Growth
- Spruce/Fir
- Spruce Fir/Lodgepole Pine Combination
- Lodgepole Pine

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Table 17 Old Growth by Diversity Unit

Water-shed	Diversity Unit	Total Acres	Ldgpole Pine OG	Sp/Fir OG	Total OG Acres	% Forested	Forested Acres	5% Forested Acres
73	93	6375				77%	4909	245
	98	5208				63%	3281	164
	99	5311	92		92	72%	3824	191
	100	5211	65	14	79	93%	4911	246
	101	8850	241	1328	1569	87%	7700	385
	102	3026				75%	2270	114
	103	3004				61%	1832	92
	104	7045				35%	2445	122
	105	5882				40%	2335	117
	106	8144	68		68	69%	5619	281
	107	5246				66%	3462	173
108	8734	80	174	254	22%	1921	96	
109	7967				64%	5099	255	
	Totals	80073	546	1516	2062		45784	2290
75	110	7242	318	36	354	86%	6228	311
	111	7146	134	305	439	84%	6003	300
	112	2881		356		64%	1844	92
	113	3760	62		62	85%	3196	160
	114	6542	398		398	87%	5692	285
	115	6347	459		459	85%	5395	270
	116	4388		76	76	62%	2721	136
	117	5456				88%	4801	240
	118	7588	151	1	152	75%	5691	285
	119	7069	420	216	636	75%	5302	265
	120	1810	67		67	75%	1358	68
	204	2565				50%	1285	64
	207	2446				91%	2226	111
	Totals	65,240	1,691	632	2,999		51,742	2,587

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The Clear/Crazy Landscape Analysis Area is 129 acres short of the 5% Forest Plan minimum standard for old-growth. Due to the uninventoried wilderness acres, it is probable that the 5% standard is being met.

Another recent concern, that relates to old-growth, is fragmentation of forested habitats. Fragmentation, in its simplest form, is the disruption of continuity. In some parts of the country, human occupation of natural environments and the resulting agricultural development, interstate highways and large cities have been blamed for isolation of species from others of their kind. The issue has been raised that timber harvest may be creating a similar effect in forested environments. Mullen (unpublished Forest Service memo, 1996) states that forests in the Rocky Mountain region have evolved under the influence of fire, insects and disease whereby patch forests, diverse structural stages and a high frequency of forest meadow edges are a common and long-standing phenomenon. Fragmentation of habitats has not been identified as a threat to any species in the region and there are no existing regulations, policy or Forest Plan requirements which address this issue. However, it warrants consideration during Forest Plan revisions and at the landscape analysis level.

The current scattered, poorly connected nature of the known old-growth stands emulates the spatial pattern that existed historically on the landscape. Old-growth was transitory on this landscape, considering the large-scale, relatively frequent disturbance history. High elevation, spruce-fir sites were the most likely to maintain old-growth characteristics for the longest periods of time. Finally, old-growth areas never were well connected on the landscape, with riparian areas being the most likely to provide corridors due to their increased fire resistance.

Two studies are currently in progress that relate directly to the issue of fragmentation of forested habitats in the Clear/Crazy Landscape Analysis Area and should provide a fairly comprehensive treatment of this issue. One study measured habitat structure in comparison to species richness and abundance for 15 mammal species along several gradients of clearcut intensity (Beauvais and Buskirk, unpublished). The other study evaluated the effects of forest composition and patterns on the abundance and diversity of bird species in the Big Horn Mountains (Merrill, unpublished). Study results have not yet been published for either research project, but are expected by summer 1997. Gary Beauvais provided some preliminary information from the mammal study. The study indicates that clearcutting reduces microhabitat diversity by eliminating the habitat features provided by large trees and snags. On the macrohabitat level, clearcuts increase diversity by temporarily adding openings and edges to widespread areas of mature timber. Clearcutting does not result in a net loss of wildlife abundance, nor does it reduce species richness, the overall number of species inhabiting an area. It does tend to change the composition of species by favoring habitat generalists (species that thrive in a wide variety of habitats) over habitat specialists (species that require specific habitat components for survival). Clearcuts are significantly warmer, drier and windier than interior forests in the summer. This appears to be limiting for species with high moisture requirements like dusky shrews, masked shrews and redbacked voles. Other species which select for high elevation, late successional forests are martens, snowshoe hares, and moose. Areas with high amounts of riparian and spruce/fir cover were especially favored. Species associated with early successional stands in drier areas with more edge were deer mice, least chipmunks, montane voles, weasels, bobcats, coyotes and elk. Study

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results indicate that persistent clearcutting tends to expand the distribution of the latter group at the expense of the former. This may ultimately reduce the diversity of mammalian species at the regional level which may not be apparent at the local level. This would be especially significant for areas like the Big Horn Mountains, which are isolated from the main Rocky Mountains, presenting little opportunity for immigration of individuals from mainland populations.

Preliminary results suggest that selective harvest methods such as shelterwood cutting, alter habitat structure at both stand and landscape level far less than clearcuts because they provide the opportunity to retain large sized trees, standing snags and dead & down woody material. Models developed by this study will assist managers in defining habitat requirements for 15 species of mammals and help predict the effects of timber harvest activities.

Of the major watersheds on the Forest, the Crazy Wpman watershed has the highest percentage of Clearcut area and the third highest density of roads. Clearcuts and roads have a major influence on patterns in the watershed. Relative to other watershedson the Forest, core area of patches is smaller, patch sizes are smaller, and edge density is greater. Implication of this are not well understood. Roads have been found to be more of a change agent than clearcuts, and roads roads which are more evenly distributed across the a watershed had a greater effect of landscape pattern than did those that were densely clustered.

Susceptibility MODERATE, Resiliency LOW.

Causes	Meets Forest Plan	Risk and Related Outcomes
Past timber harvest activities. Wildfires that have occurred in the past 60 years. Change in fire regime, vegetative treatments	Y/N	YELLOW Lack of quantity and continuity of old growth stands could be affecting old growth dependant species. Risk factors of loss are low, based on I&D models, approaching moderate, especially in high elevation, high value ES/AF OG. Would take many years to replace losses. Outcomes of loss are less biodiversity, loss of human experiential value, loss of habitat, loss of timber supply.

Forest Plan Goals/Desired Conditions

The Forest Plan provided for old growth values with the following standard and guideline under the General Direction section for diversity: *In forested areas of a unit, 5 percent or more should be in old-growth. General direction established the unit as an area 1,000 to 12,000 acres in size, or a fourth-order watershed, that is dominated by forested ecosystems.* These units are generally comparable to diversity units described in other parts of this document. In succeeding years, concerns were raised about the functional aspect of old-growth and the potential for fragmentation that could result if this standard and guideline were strictly applied.

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An Old-growth Task Force was formed on the Bighorn National Forest in December, 1992 to study the issue and address concerns. The task force made the following recommendations in the Draft ASQ Amendment (1993):

-Retention of at least 10-percent of forested areas of each fifth-order watershed in old-growth stands meeting the standard old growth attributes (Mehl, 1992). Half of these acres (5%) should meet the standard attributes as well as quality attributes specified by Mehl.

-All major forest cover types occurring naturally in a fifth-order watershed should be represented by old-growth stands.

-Particular emphasis should be given to retention of old-growth spruce/fir.

-Spatial attributes will be analyzed at the project level of planning and the results documented in the NEPA document for that project.

-If old-growth requirements cannot be met under current conditions, consider identifying and setting aside areas to be managed for future old-growth.

-Areas identified in a NEPA decision document to be managed for old-growth will be allocated to old-growth management prescription 11A-11C. To the greatest extent possible, areas identified for management as old-growth should be on lands not suited for timber production, and be delineated in conjunction with wildlife security areas.

Opportunities/Possible Management Actions

Administrative

- During Forest Plan revision, consider developing a standard for late successional forest. The historic disturbance regime should be taken into account to determine the appropriateness and cost of maintaining late successional forests in watersheds that were dominated historically by early and mid successional forests.
- There is a need for a dialog with the public, concerning old-growth forests. This dialog should include information on natural ecosystem disturbance and regulation processes, corridor location and characteristics and how much and what type of old-growth is desired.

Resource

- Consider a strategy and create fuelbreaks around potential old growth stands.

Field verify old-growth stands with the following objectives in mind:

- Validate application of Mehl old-growth attributes to Stage II timber inventory data as a method to identify old-growth stands and blocks of stands.
- Verify condition of conifer stands in Wilderness.

- Inventory all spruce/fir stands for long-term old-growth potential.
- Identify stands and blocks of stands to be managed for late successional/old-growth habitat in the Forest Plan revision. Do this for 5th order watersheds rather than diversity unit basis.
- Evaluate literature and on-going fragmentation studies to determine optimum size and need for corridor linkages.
- Manage all spruce/fir and mixed spruce/fir-lodgepole pine toward maintenance of climax stands over the long-term.
- Identify and manage for replacement stands for lodgepole pine old-growth.
- Provide a means in the database to identify stands that have been verified as old growth.

Information Gaps

- In order to integrate future timber harvests into existing landscapes, accurate quantification of landscape patterns, over large land areas, will be needed in order to predict how alterations will effect the landscape.

5. Threatened, Endangered and Sensitive Species

The term *endangered* refers to a species that is in danger of extinction throughout all or much of their range. The term *threatened* applies to a species that has a high probability of becoming an *endangered* species in the foreseeable future if measures are not taken to reverse current trends. The *Endangered Species Act* (P.L. 93-205) of 1973 provided for the protection and conservation of *threatened* and *endangered* species and critical habitats as a national priority. Sensitive species are species *vulnerable* to environmental alterations or are declining or predicted to decline in the *foreseeable* future (Finch, 1992). The Rocky Mountain Region, U.S. Forest Service identified a list of *sensitive* species in 1994.

Current Conditions

Wildlife Endangered Species

Bald Eagle (*Haliaeetus leucocephalus*)

The bald eagle is currently listed as an endangered species in Wyoming. Increases in bald eagle populations in several states have resulted in the bald eagle being downlisted to threatened in those areas. (P.R.L.A. 1995)

This species usually nests in large, open-canopied conifer trees or on cliffs near water. They are opportunistic feeders taking advantage of available food sources including fish, waterfowl, small mammals and carrion.

Suitable nesting habitat occurs off-Forest along major rivers in adjacent basin areas. Elevations within the analysis area limit suitable nesting habitat there. Several informal sightings have been reported in the Big Horn Mountains but these are believed to be transitory visits. The Wyoming Natural Diversity Database (WYNDD) prepared by the Nature Conservancy (1996) contains only one documented report for bald eagles in the Clear/Crazy drainages.

Peregrine Falcon (*Falco peregrinus*)

The peregrine falcon was placed on the federal endangered species list in 1970 and again in 1984. This species utilizes cliff recesses for nesting in open country and mountain parks. Most nests are on high cliffs (200-400 ft.) above 6,000 ft. elevation on southern exposures. They forage in a wide variety of habitats, including riparian woodlands, coniferous and deciduous forests, shrublands and prairies. They prey on small to medium sized birds which are taken in flight.

A rapid decline in population levels was noted in the 1950's and 60's. Blame is attributed to extensive use of chlorinated hydrocarbons such as DDT which cause eggshell thinning and nest failure. Peregrines were on the verge of extinction in 1965 with an estimated population of 20 breeding pairs nationwide, compared to 600-800 pair prior to population declines. Experimental release programs begun in 1974 brought that number up to 200 pairs in 1987 and they have become re-established throughout most of their former range.

Since 1991, the Bighorn National Forest has participated in a peregrine re-introduction program as part of the Recovery Plan to establish self-sustaining populations. Approximately 16,100 acres of suitable habitat have been identified in Shell and Tensleep Canyons. Suitable cliff habitat exists in the Clear/Crazy drainage but is not extensive enough to provide prime habitat. As peregrines become established on the Bighorn National Forest, they may expand their range to inhabit this secondary range.

Wildlife Sensitive Species

Water Voles (*Microtus richardsoni*)

Water voles were collected frequently in Wyoming during the 1940's, but few specimens were noted from the 1960's through the 1980's. Currently, water voles are found only on the Shoshone and Bighorn National Forests in Region 2. On the Bighorn National Forest, they have been verified on Wall Rock Creek, Fool Creek (exclosure), Willet Creek (exclosure), Granite Creek, and Wyoming Gulch Creek.

Water voles are very selective for small, narrow patches of riparian habitat adjacent to alpine and sub-alpine streams, within 5 meters of stream edges. Inhabited sites range from 3,000 to 10,550 feet elevation and streambanks with deep, well-drained soils are preferred. Water voles are very mobile underwater and burrow entrances are often built below the surface. Water voles remain active throughout winter. They feed primarily on leaves and stems of forbs, as well as grasses, sedges, roots, bulbs and seeds to a lesser extent.

Water voles have a relatively short breeding season, small litter sizes and short life-spans. They also tend to remain in preferred sites, leaving seemingly suitable habitat unused in adjacent areas. These factors make populations especially vulnerable to habitat disturbance and long-term extirpation. Johnson (1981) concluded that specialized species including water voles, that are limited to high cover densities in riparian areas, may be eliminated from localized sites due to grazing impacts. Concentrated use by livestock in riparian areas reduces habitat quality by changing the quality and quantity of riparian vegetation and causing soil compaction and bank sloughing.

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Resource

- Establish where there are areas of presence and develop a monitoring program to assess population changes.

Information Gaps

- Additional inventory is necessary so determinations of status can be updated. Known locations should be globally positioned for more accurate monitoring and future assessment.

FISHERIES

1. Habitat Condition

Current Conditions

Most dispersed overnight camping occurs along or adjacent to streams. In some areas like Circle Park, Doyle Creek, and lower Grommund Creek, access roads go through or are adjacent to riparian areas and as a result an excessive amount of road material has washed into the streams. This impacts aquatic habitat by decreasing water quality, macroinvertebrates and fish spawning habitat.

The Forest Plan standard and guideline for riparian vegetation is mid to late seral. Along some stream reaches, lower Grommund and North Fork Crazy Woman between the highway and the campground, livestock grazing has contributed to seral conditions below standard. Hunter Creek is an example where additional livestock water sources have been developed away from the riparian area to allow for sufficient rest of riparian vegetation. Visual observation of the riparian area, and updated cowfish surveys, suggests conditions are improving. Herding or moving livestock out of riparian areas after stubble height objectives have been met has also proven beneficial.

The majority of streams within the Analysis Area are class 3, fisheries of regional importance. The upper reaches of Pole Creek, Clear Creek, and North Fork of Crazy Woman Creek rated as class 4, low production trout waters. Fish habitat was improved on Middle Fork and South Fork of Clear Creek in 1990. This was accomplished through the installation of overpour structures, which have allowed for pool development.

Cowfish habitat capability ratings below 65% of optimum have been interpreted as being less than desirable. There are six streams where averages are below this level. They are:

Table 18 Stream Habitat Capability Ratings

Stream	Rating Average
N. Fork Clear Creek	59
Foot Creek	61

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S.Fork Clear Creek	58
Upper Grommund Creek	60
E. Sourdough	57

Most of the streams in the Analysis Area contain rainbow, brook, and brown trout. The Wyoming Game and Fish management emphasis is to maintain these populations through a wild trout strategy; i.e. to manage fish populations for natural reproduction. Besides the species above, lakes in the area contain Snake River cutthroat, golden, eagle lake rainbow, splake, lake trout, and grayling. The management emphasis in standing waters is for wild and basic yield, which provides for occasional stocking. The WGFD regulates the number of fish available for harvest through yearly fishing regulations.

Most of the lakes in the Cloud Peak Wilderness area have been stocked with exotic trout species since 1933, however little information exists on the effect of stocking on the aquatic environment. Fishing is the primary reason many visitors hike into the wilderness area. Recreational fishing is expected to increase in the future. The WGFD attempts to meet a diversity of fishermen wants through harvest restriction, and trophy management regulations.

There are several ponds/wetlands in the Analysis Area, that have no fisheries potential, however they serve as valuable wetlands for numerous species which may occur in the area, including sensitive species such as northern leopard frogs, wood frogs and western spotted frogs.

Riparian areas and aquatic species are impacted from poor physical and biological conditions on some streams and standing water as a result of roads, livestock, trails and ruts, and loss of forested cover.

Susceptibility HIGH, Resiliency MODERATE

Causes	Meets Forest Plan	Risk and Related Outcomes
Roads, Livestock Grazing, and reduction of forested cover.	N	YELLOW- Declines in aquatic biomass. Decline in fishing opportunities.

Forest Plan Goals/Desired Conditions

- Provide necessary habitat for wildlife/fish population objectives agreed upon with the Wyoming Game and Fish Department.
- Provide wildlife/fish habitats on a sustained yield basis to maintain a viable population of all existing native vertebrate species.
- Maintain or improve the habitats of wildlife management indicator species. This includes game fish.

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- Identify and protect all State and Federally designated and proposed threatened and endangered plant and animal species.
- Manage waters capable of supporting self-sustaining trout populations to provide for those populations. Wyoming Game and Fish Department desires to establish and maintain an entirely wild, self-sustaining fishery rather than "basic yield", which allows for stocking hatchery-raised fish. Basic yield will continue as a management emphasis on standing waters.

Opportunities/Possible Management Actions

- Change livestock management on those streams rated below 65% (cowfish rating). As a last resort fence riparian pasture.
- Close or reroute roads in riparian zones or where watershed has identified road material deposition into streams.
- In those drainages where past timber harvest has occurred, ensure adequate reforestation has taken place before additional cuts are proposed.
- Continue educational programs such as "Leave No Trace" along highly used streams and standing waters, to decrease rutting and compaction from humans.
- For FDR 516 and FDR 460, three levels of management action are possible with level 1 being preferred and most effective in reducing impacts.
 - 1) Close the road section
 - 2) Reroute the road away from the stream
 - 3) Improve crossings with bridges to reduce siltation.

NEOTROPICAL MIGRATORY BIRDS

Up until the past few years, little has been known about neotropical birds in the Analysis Area. Breeding bird surveys conducted by U. S. Fish and Wildlife Service indicate that over half of the neotropical birds that occur or may occur in the area, have been showing declining numbers in Wyoming since 1966.

The Forest Service conducted a constant-effort mist netting project on Hunter Mesa and North Fork of Powder River beginning in 1994 and continuing through 1996. One objective of the work was to determine the importance of several habitat types to passerine birds. Another objective was to help determine the effect cattle grazing may have on birds using these areas. The results of this work provides the basis for inferences to the Analysis Area.

At each location at Hunter Mesa, three nets were erected; in an upland grassland type, a fenced riparian type, and an unfenced riparian type. Netting occurred every 10 days beginning in early June and ending in mid to late August. Netting began at first light and was completed by approximately noon. Nets were checked and birds were collected every 45 minutes to an hour.

The riparian types at Hunter Mesa are isolated seeps and have been available to cattle for grazing since cattle grazing began in the area sometime in the late 1800's. One of the seeps was fenced to exclude cattle in 1994. Extensive vegetative analysis of the area has not been conducted, however

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permanent ecodata plots, one inside the fenced area and one in the unfenced area, were established in 1990. The riparian ecological type is classified as tall willow. The grassland type is dominated by Idaho Fescue.

1. Abundance of NMB and habitat usage.

Current Conditions

Twenty-four species of birds were captured during the three years of netting. Seventy-one percent of the captures were comprised of three sparrow species, Vesper, Lincoln's, and Savannah. These three species are omnivorous ground nesters.

Table 19 Total Birds Captured 1994 through 1996

SPECIES	*STATUS	MIGRATION	CAPTURES			
			1994	1995	1996	TOTAL
Vesper Sparrow	*	B	50	25	9	84
Lincoln Sparrow	N.D.	A	39	25	22	86
Savannah Sparrow	+	B	19	21	12	52
Pine Siskin	-	B	4	14	2	20
American Robin	-	B	8	3	3	14
Brewer's Blackbird	-	B	5	5	2	12
Western Meadowlark	+	B	3	5	3	11
Baird's Sparrow	N.D.	A		3	2	5
Northern Flicker	N.D.	B	4		1	5
Black Rosy Finch	N.D.	R			1	1
Brewer's Sparrow	*	A	1	1		2
Brown Headed Cowbird	+	B	1			1
Cassin's Finch	-	B		2	2	4
Chipping Sparrow	-	A	1		1	2
Common Snipe	N.D.	R	2	1		3
Dark Eyed Junco	*	B	1		1	2
Dusky Flycatcher	-	A		1	1	2
Lazuli Bunting	-	A	1			1
Mac Gillivray's Warbler	+	A	1		1	2
Mountain Bluebird	-	B			1	1
Warbling Vireo	+	A			1	1
White Crowned Sparrow	*	B	1	2		3
Yellow Warbler	-	A		1		1
TOTAL			141	108	66	315

* Idaho G&F, 1992

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Table 22 Recreation Opportunity Spectrum Class

ROS Class	Forest Acres	Percent of Total
Primitive (P)	22,142	15.0
Semi-Primitive Non-Motorized (SPNM)	36,312	24.6
Semi-Primitive Motorized (SPM)	30,408	20.6
Roaded Natural (RN)	24,208	16.4
Roaded Modified (RM)	27,455	18.6
Rural (RN)	7,085	4.8
Urban (U)	0	0
Totals	147,610	100%

1. Supply of Opportunities

What recreation opportunities exist? What are the recreation use patterns and trends? Are we meeting current demand?

Current Condition

Three different variables are used to describe existing recreation opportunities. The *first* is a simple listing of recreation activities and participation rates. The *second* is a listing of developed facilities and their capacity/occupancy rates. The *third* variable classifies the land base for recreation experiences using the Recreation Opportunity Spectrum. Brief discussion points follow each table.

Table 23 Recreation Visitor Days by Activity

Activity Category	Use In RVD's *	Percent of Total
Camping ¹⁾	66.8	25.5
Driving For Pleasure ²⁾	62.2	23.7
Hiking/Horseback Travel	38.4	14.7
Resort/Cabins ³⁾	27.0	10.3
Fishing	21.9	8.3
Winter Sports ⁴⁾	17.5	6.7
Hunting	14.8	5.7
Others ⁵⁾	13.3	5.1
Totals	261.9	100%

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