ENVIRONMENTAL ASSESSMENT

TENDERFOOT CREEK EXPERIMENTAL FOREST

VEGETATIVE TREATMENT RESEARCH PROJECT

KINGS HILL RANGER DISTRICT
LEWIS AND CLARK NATIONAL FOREST
MEAGHER COUNTY, MONTANA

FEBRUARY 1998

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I. PURPOSE AND NEED FOR ACTION

This chapter identifies the following: the proposed action, the project area, the purpose and need for the proposed action, and the decision needed. It describes the planning process, public scoping for the proposed action, and lists the significant issues to be addressed.

A. PROPOSED ACTION

The Tenderfoot Creek Experimental Forest (TCEF) is a 9,125 acre experimental forest located in the western portion of the Little Belt Mountains. The TCEF was established as an experimental forest in 1961 for the development of management techniques for harvesting lodgepole pine while maintaining soil stability. The research emphasis was expanded in 1991 to develop and evaluate ecosystem-based treatments for sustaining productivity and biodiversity of lodgepole pine forests and watersheds. Water related issues are still of high concern, however, through ecosystem-based management, all forest resources are integrated into the research planning.

The Rocky Mountain Research Station (RMRS) submitted to the Forest Supervisor of the Lewis and Clark National Forest (LCNF) the research project proposal which is analyzed in this Environmental Assessment (EA). The Northern Rocky Mountain Forest Ecosystems Research Work Unit (previously named the Intermountain Research Station) is responsible for the management of the TCEF. The LCNF shares in this management because fire protection, timber harvest, road development, and other improvements are directly related to their programs. A Memorandum of Understanding was signed by the Supervisor and Project Leader from the LCNF and RMRS in April of 1997, defining roles and responsibilities in managing the TCEF. This document can be found in the project file for this proposal.

The Tenderfoot Research Project will test an array of management treatments for regenerating and restoring healthy lodgepole pine forests through emulation of natural disturbance processes, but avoiding catastrophic scale disturbances. This research project proposes to harvest timber in two treatment sub-watersheds, Spring Park Creek and Sun Creek. These drainages have hydrologically matched sub-watersheds located to the west of each which will be used as control areas for treatment sub-watershed effects. An additional control area will be the headwaters of Tenderfoot Creek which is a Research Natural Area (Onion Park RNA). The silvicultural system proposed is a two-aged system termed "Shelterwood with Reserves," using even distribution of single or small groups and uneven distribution and shape of large residual groups. Two site preparation methods are scheduled to be used, burn and mechanical only. In addition to site preparation burning, prescribed fire treatments will be applied in each treatment sub-watershed. Two kinds of prescribed fire treatments will be applied, low-intensity underburn and mixed severity broadcast burn. This proposed project will require 4.1 miles of new system road and 2.3 miles of temporary road. Spring Park Creek sub-watershed is approximately 1,032 acres and Sun Creek is approximately 859 acres is size. Activities are proposed on approximately 376 acres and 389 acres, respectively. In order to evaluate hydrologic response to ecosystem-based treatments it is necessary to treat a large percentage of each sub-watershed.

B. SCOPE OF THE PROPOSED ACTION

The scope for this project consists of the range of actions, alternatives, and impacts to be considered in the Environmental Assessment (EA) for the TCEF. The analysis will examine connected, cumulative, and similar actions as well as direct, indirect, and cumulative impacts. The scope of the proposed action was determined by evaluating two alternatives. Alternative 1 is the no- action alternative and Alternative 2 is the project proposal or action alternative. Only one action alternative will be considered in order to meet research objectives .

C. PROJECT AREA

The entire project area is within the TCEF. For the purposes of the study 8,867 acres are being analyzed. The TCEF is located in the western portion of the Little Belt Mountains situated about 25 miles north of White Sulphur Springs, Montana, on the Kings Hill Ranger District. See the Vicinity Map 1-1 located at the end of Chapter 1. The legal location of the TCEF is within T14N, R6E, Sections 25, 26, 35, 36; T13N, R6E, Sections 1, 2, 11, 12; T14N, R7E, Sections 19, 29, 30, 31, 32; and T13N, R7E, Sections 3, 4, 5, 6, 7, 8, 9, 17, Meagher County, Montana. Within the TCEF, research activities have been scheduled for the Spring Park Creek and Sun Creek sub-watersheds, 1,032 and 856 acres in size, respectively. Onion Park RNA will serve as a control area for this research project and will not have treatment units within its boundary. All of the lands within the project area are National Forest System Lands.

D. PURPOSE AND NEED

The purpose and need for the proposed action in the TCEF project area is to research, test, evaluate, and demonstrate ecosystem based treatments for sustaining productivity and biodiversity of lodgepole pine forests and watersheds. This will be accomplished by using an array of management treatments and scientifically designed experiments for regenerating and restoring healthy, lodgepole pine forests through emulation of natural disturbance processes, but avoiding catastrophic-scale disturbances.

The proposed practices are designed to help achieve the goals and objectives (including compliance with applicable laws, regulations, and policies) identified for the TCEF. The Lewis and Clark Forest Plan states that the goal for the TCEF is to meet research objectives. Research objectives for the Tenderfoot Research Project are to:

* Evaluate and quantify the ecological and biological effects of alternative silviculture treatments and prescribed fire in lodgepole pine forests by creating reserve structures that emulate those created by natural disturbance.

* Evaluate damage to reserve trees relative to alternative stand densities and structures and examine regeneration and understory vegetation changes over time associated with alternative silviculture treatments.

* Develop linkages between vegetation management activities and hydrologic responses in order to test and verify hydrologic models.

* Manage and integrate the knowledge gained from the variety of studies at TCEF to improve ecosystem-based management in lodgepole pine forests.

* Develop demonstration sites at TCEF for education of the general public, students, professionals, and researchers.

* Test and verify vegetation models and evaluate harvest costs and product recovery values associated with alternative silviculture prescriptions and harvest systems.

* Contribute to scientific knowledge through publication of results in appropriate outlets.

* Integrate knowledge gained from TCEF studies into ecosystem management guidelines that enhance the function and sustainability of lodgepole pine forests in the Northern Rockies through a variety of technology transfer products.

E. DECISION NEEDED

The decision needed includes:

1. Determining whether to proceed with the vegetation manipulation project in order to research, test, and evaluate ecosystem based treatments for sustaining productivity and biodiversity of lodgepole pine forests and watersheds.

2. Creation of demonstration sites and interpretive signing for researchers, land managers, conservation specialists, students, and the public to see and understand the research project and its results.

3. Identify mitigation measures for rehabilitation and recovery needs.

F. RELATIONSHIP TO THE LEWIS AND CLARK NATIONAL FOREST PLAN

Direction for the research project proposed in the TCEF EA is derived from the Lewis and Clark National Forest Plan. The Forest Plan provides broad management direction through the establishment of Forest multiple-use goals and objectives, standards, and management area prescriptions. The Lewis and Clark National Forest Plan EIS is the environmental review for the Forest Plan.

G. FOREST PLAN MANAGEMENT DIRECTION

The TCEF project area is located within the Tenderfoot-North Divide Geographic Unit: LB-2 (Forest Plan, page 4-46). The project area is 8867 acres and is entirely within Management Area K. The primary goal for Management Area K is to manage the TCEF to meet research needs (Forest Plan, 3-49).

The Forest-wide Management Standards in the Forest Plan provide overall direction for Forest operations, maintenance, and protection. Resource prescriptions and a schedule of management practices are further defined by area. Specific Forest-wide management standards that are applicable to the proposed actions are discussed in Chapter II.

H. PROJECT ANALYSIS

An Interdisciplinary Team (ID Team) of Forest Service resource specialists and research scientists reviewed the TCEF project proposal. The ID Team considered relevant Forest Plan goals and objectives, and standards for management activities in this area. The ID Team identified known issues and opportunities within this proposal.

The TCEF project file, which contains all of the planning records; including meeting notes, specialist reports, maps, and letters received during the process; is located at the Forest Supervisors Office, Great Falls, Montana.

I. SCOPING SUMMARY

The formal scoping process for the TCEF project began in May 1997. On May 22, 1997, letters attached to a project summary were sent to 319 individuals, interest groups and tribes. News articles were published in the Great Falls and White Sulphur Springs newspapers in conjunction with the mailing of the initial scoping letters. The comment period for the project proposal was from May 22-June 26, 1997. A public meeting was requested by interested individuals who wanted a better understanding of the proposal by visiting with the research scientists before commenting. This was offered to the general public on June 25, 1997. Eleven people attended. The comment period was extended to July 11, 1997 in order to accommodate the needs of the public. Written responses were received from 14 individuals or interest groups. No responses were received from the contact with the tribes concerning this proposed project. Personal responses were written back to all those who responded. The written responses addressed individual questions and acknowledged those issues raised which would be passed on to the ID Team. As request by the public, a field trip to the project area was scheduled for August 15, 1997. Forty-one letters were mailed inviting those who had shown interest in the project to the field trip. Fifteen people attended. The project was also listed in the Lewis and Clark National Forest NEPA Quarterly Report which lists the schedule of proposed activities for the Forest.

J. ISSUES

Four significant issues were identified during the scoping process, research, vegetation, wildlife, and water resources. Significant issues, as defined under 40 CFR 1501.7(a)(2), guide the range of alternatives and development of mitigation measures. The four issues focused the environmental disclosure on site-specific, direct, indirect, and cumulative effects that could occur under any alternative. As directed under 40 CFR 1501.7(a)(3), other impacts were also analyzed and summarized as they related to the proposal. Significant issues for the TCEF proposed action are:

ISSUE 1 - RESEARCH

* How can the action create a managed stand condition to provide site specific information for practices that have landscape level ecological benefits in lodgepole pine in the Northern Rockies?

Research opportunities are identified in Issues 2-4 which follow.

ISSUE 2 - VEGETATION

* How has the lack of fire affected vegetative development?
* How will two-story management of lodgepole pine restore the forest structures that were once present under mixed intensity fire regimes?
* How does the return of fire processes affect forest vegetation?
* How can timber harvest be used to achieve ecosystem management goals?

ISSUE 3 - WILDLIFE AND SENSITIVE PLANTS

* What wildlife species or habitats will be affected by the implementation of the proposed action?
* What plant species or habitats will be affected by the implementation of the proposed action?
* What fish species or habitats will be affected by the implementation of the proposed action?
* How will the proposed action affect the before determined species in regards to habitat modification, displacement, and/or mortality risk.

Table II-4 and coordination with Jim Williams (MFWP) was used to answer the first three wildlife questions above. The direct, indirect, and cumulative effects addressed the forth question, once the first three questions were answered.

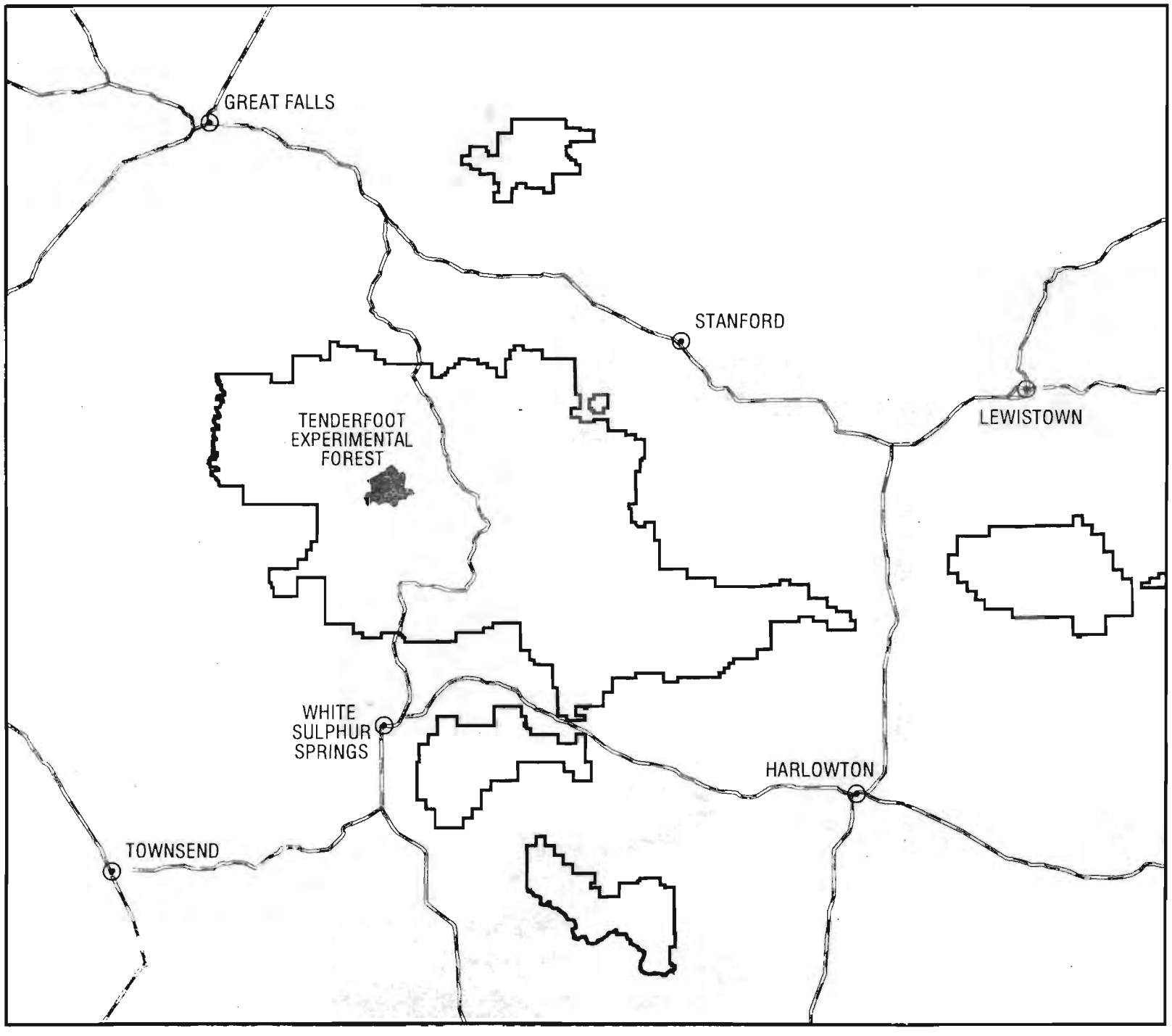
ISSUE 4 - WATER RESOURCES

* How do the alternatives affect peak streamflows, sediment yields and channel conditions?

ADDITIONAL ISSUES TO BE CONSIDERED

The following is the list of other resources that are being considered in the analysis:

1. Heritage Resources
2. Recreation
3. Noxious Weeds
4. Visual Resource
5. Range
6. Transportation Systems
7. Environmental Justice (E.O. 12898)
8. Roadless



TENDERFOOT CREEK
EXPERIMENTAL FOREST

Map I-1
Vicinity Map

Experimental Forest
Major Highways
Cities and Towns
National Forest Boundary

N

5 0 5 10 Miles

II. ALTERNATIVES

This chapter discusses: (A) the project analysis, (B) the process used to develop alternatives, (C) discusses the alternatives considered but eliminated from detailed study, (D) describes each alternative developed, (E) displays a table comparing each alternative considered in detail to the four significant issues identified in Chapter I, part J, and (F) identifies mitigation measures applicable to all action alternatives and sale area improvement opportunities, and (G) monitoring.

A. PROJECT ANALYSIS

Management practices for the TCEF project area were identified following a series of ground reviews examining the existing condition, as well as, considering the research needs and desired future conditions for the experimental forest. The final research project proposal for this analysis was submitted to the Lewis and Clark National Forest Supervisor in May 1997 by the Rocky Mountain Research Station. An ID Team was assembled to analyze the affected environment and environmental consequences concerning the activities associated with the project proposal. Chapter III of this EA documents the findings from the ID Team.

1. Consistency with NFMA

Timber management consistency requirements (36 CFR 219.14 and 219.27) document the results of timber management practices to (a) vegetative manipulation, (b) silvicultural practices, (c) even-aged management, and (d) suitability for timber production.

a) Vegetative manipulation 219.27(b)

Planned harvest meets the requirements for the manipulation of tree cover. The proposed actions are best suited for the multiple-use goal and the seven requirements listed under CFR 219.27(b).

b) Silvicultural Practices 219.27(c)

The proposed activities meet the requirements for harvesting timber on lands to meet the objectives of the Forest Plan. Although trees in this research project are not being cut to achieve timber production objectives, experience has shown these lands can be regenerated. Regeneration on alpine fir/grouse whortleberry and alpine fir/blue huckleberry habitat types has been very successful on the Kings Hill Ranger District and throughout the Lewis and Clark National Forest primarily with natural regeneration of lodgepole pine. Of the 5,667 acres harvested on these habitat type sites since 1976, 93% were satisfactorily stocked within 5 years. At the present time, over 99% are stocked. The only unstocked stand is 27 acres which was stocked but burned in the Coyote Fire of 1996. The past harvesting was mostly clearcutting which differs from this proposal, but this should not affect the availability of cones and seeds; it does, however, affect tree growth and development discussed in vegetation section of Chapter III. As well, residual overstory will be a continuous seed source, although may be somewhat light due to the low levels of non-serotinous cones present. In units being burned, serotinous cones on standing lodgepole pine should be a good seed source, which has been experienced on many wildfires including the Coyote Fire in a nearby drainage. The alpine fir/lodgepole pine units have fewer cones than the other units, however, it is expected to be sufficient. Regeneration study plots will quantify the regeneration time periods, seedling densities under varying treatments, and seedling development under differing light levels which will further the research objectives of this management allocation.

c) Even-aged Management 219.27(d)

As required by this regulation, the proposed project is consistent with the Northern Regional Guides (USFS, 1983) for creating openings larger than 40 acres. Although the proposed treatment will not create "typical openings", the two story silvicultural system is an even aged system and "Shelterwood with Reserves" is the best available term for the treatments. The patch sizes of contiguous harvest units within the mosaics are 38, 102, 138, 180, and 191 acres. These patches will not appear nor function like openings created by clearcutting, due to the leave tree density and arrangement. The mosaic of treatment along with the parks, scree, and non-treated forest have the diversity created by varying intensities of fires. The treatment design and size will fit the topographic conditions, facilitate burning, and not affect the ability to regenerate the site . The mosaic is compatible with goals for vegetation, hydrology, wildlife, visuals, and is consistent with fire processes. The public was notified during the public involvement process on May 22, 1997, and Regional Forester approval will be received prior to a decision on this project.

d) Suitability for Timber Production 219.27

All the acres scheduled for treatment in this proposal are capable of timber production and management, however, they are not allocated under the Forest Plan as suitable timber lands. According to CFR 219.27, "No timber production shall occur on lands classified as not suited for timber production pursuant to CFR 219.14 except for...activities that meet other objectives on such lands if the forest plan establishes that such actions are appropriate." This area is designated by the Forest Plan as Management Area K which has the primary goal to manage the TCEF to meet research needs (Forest Plan, 3-49). The research needs , in this case, are to harvest timber through an array of management treatments and scientifically designed experiments for regenerating and restoring healthy lodgepole pine forests through emulation of natural disturbance processes, avoiding catastrophic-scale disturbances.

2. Forest Plan Consistency

The location and analysis of timber and fire management practices are tiered to the Forest Plan (40 CFR 1508.25). All natural resource management activities must be based on the Forest Plan (36 CFR 219.10 (e)). Management practices were analyzed to ensure their consistency with Management Area K prescriptions and applicable Forest-wide Management Standards (Forest Plan, pages 3-49 to 3-51).

The location and analysis of this project are consistent with the Forest Plan (40 CFR 1508.28), Management Area K (Forest Plan, page 3-49), and applicable Forest-wide Management Standards (Forest Plan, pages 2-6 to 2-53).

The following Forest-wide Management Standards contain some standards applicable to the proposed action and will be considered in the analysis: Cultural Resource Management (A-7), Visual Resource Management (A-8), Wildlife Coordination and Habitat Management (C-1), Threatened and Endangered Species (C-2), Wildlife Trees (C-4), Management Indicator Species (C-5), Noxious Weeds and Other Pests (D-2), Reforestation (E-3), Timber Harvest (E-4), Erosion Control (F-1), Data Collection (F-2), Soil, Water, and Air Pollution (F-3), Maintenance and Construction of Roads, Trails, and Other Facilities (L-4), and Debris Control (P-2).

3. Road Construction Practices

Road construction consistency requirements document the findings that the intended road construction is economic and environmentally sound and that the roads are designed to a standard appropriate for the intended uses considering, safety, cost of transportation, and impacts on the land and other resources.

Forest Plan management practices for existing roads in Management Area K states, "minimize public access by allowing motorized access on existing roads and travelways." Closure or restrictions may be used to: (1) resolve user conflict; (2) promote user safety; and/or (3) protect resources. Roads constructed for research activities will be closed to public use.

The proposed transportation system road construction will be the minimum density, cost, and standard necessary for the intended need, user safety, and resource protection. Where applicable, Forest Management Guideline L-4 (Forest Plan, pages 2-65 to 2-77) will be adhered to for the construction of roads on this project.

4. Research

The scheduled research is consistent with the regulations found in 36 CFR 219.28. This section of the regulations states a) research needs on the National Forest shall be planned for, b) reseach shall be budgeted for and, c) there shall be an annual report prepared at the national level describing the status and findings of research programs.

B. ALTERNATIVE DEVELOPMENT

Due to the unique setting, an experimental forest set aside for research, only one action alternative was suitable to meet the purpose and need for the research. Before coming to a final proposal, various research options were considered. These options included varying leave tree densities, location and size of units, road access, and logging equipment. Since the purpose of this analysis is for research, the ID Team did not develop action alternatives other than that which was submitted by the Rocky Mountain Research Station. There are two alternatives being considered by the ID Team, the action alternative and a no-action alternative. The analysis will consider research needs, on-the-ground studies, field reconnaissance, purpose and need of the proposed action, the results from the project analysis, and significant issues.

C. ALTERNATIVE CONSIDERED BUT NOT GIVEN DETAILED STUDY

The original proposal, submitted in February 1996, has gone through many modifications from its origin to the current proposal which was analyzed in this EA. These modifications were due to ID Team input, research planning committee analysis, on the ground review, public input, and research needs. Modifications included actions such as moving proposed road locations to an area that was better suited for roads, changing silvicultural prescriptions to better suit the vegetative condition, interpretive signing as requested by public comment to the proposal, and altering unit boundaries to better fit the layout of the land. The modifications to the original proposal can be tracked in the documentation in the project file for this analysis.

D. ALTERNATIVES CONSIDERED IN DETAIL

The action alternative was designed to address the purpose and need as well as the four significant issues outline in Chapter I, part J. Table II-3 compares the action and no-action alternative. These alternatives conform to the Forest Plan. After many modifications to the original proposal, the action alternative (Alternative 2) is site specific to unit size and location, treatment, and road locations.

Alternative 1 - No Action

The National Environmental Policy Act (NEPA) requires the consideration of a "no action" alternative (40 CFR 1502.14d). This alternative serves as a comparison for other action alternatives. Under Alternative 1, there would be no harvest or burning activities as described in the Tenderfoot Research Project Proposal (May 1997, RWU-4151). The opportunity to study managed lodgepole pine stands would be foregone at this time. Alternative 1 would maintain the current stand condition of an unmanaged state. Monitoring of climate, hydrology, wildlife and vegetation of unmanaged stands would continue.

All of the TCEF is within Management Area K. The goal for Management Area K is to manage the TCEF to meet research objectives. This alternative is not consistent with the Goals and Objectives for the Lewis and Clark Forest Plan for Management Area K.

Alternative 2 - Proposed Action (Preferred Alternative)

This alternative was designed specifically to meet the purpose and need. Two treatment subwatersheds were selected for this research proposal, Spring Park Creek and Sun Creek. They are approximately 1032 and 856 acres, respectively. These drainages have hydrologically matched subwatersheds located to the west of each, which will be used as control areas for treatment subwatershed effects. An additional control area will be the headwaters of Tenderfoot Creek which is the Onion Park RNA. The research proposal will treat over 778 acres on a variety of stand and site conditions to create two-storied stand conditions. The proposal includes 18 treatment units from which 8 will be mechanically harvested, 8 will be mechanically harvested with prescribed burning, and 2 which will be prescribe burned only. The acres associated with each treatment type are as follows: harvest only (403 acres), harvest with burning (246 acres), and prescribed burning only (129 acres). See Tables II-1 and II-2 for unit by unit acres and treatments and Map II-1 for the project area and road/unit locations.

The harvest will be termed shelterwood with reserves because it is the best term suited for the harvest and regeneration goals. The two story silvicultural system is an even aged system, however, the proposed treatment will not create "typical openings". The patch sizes of contiguous harvest units within the mosaics will be 38, 102, 138, 180, and 191 acres. The treatment design and size will fit the topographic conditions, facilitate burning, and not affect the ability to regenerate the site .

In the 16 harvest units, the leave trees will consist of 40-60% of the current overstory density in either a grouped or even distribution pattern. The units with an even distribution pattern will appear like a thinning or heavy shelterwood treatment. The units with the grouped distribution will resemble clearcutting with leave islands on 40-60% of the unit area. Burning will further reduce leave tree densities, maintaining at least 25% of current overstory over 6 inches diameter. Densities will be controlled by fuel and burning conditions. Tables II-1 and II-2 summarize treatments by unit and subdrainage.

TABLE II-1

Sun Creek Subdrainage

Unit	Acres/Unit	Acres to be Harvested/Burned	Treatment*	Estimated Harvest Volume CCF/MBF
1	16	16/16	SE/B	300/140
2	22	12/22	SG/B	260/120
3	36	36/36	SE/B	790/340
4	36	19/36	SG/B	1010/300
5	30	30/0	SE	450/210
6	78	46/0	SG	1390/590
7	61	36/0	SG	670/290
8	77	77/0	SE	1360/580
B1	37	0/37	PB	0/0

TABLE II-2

Spring Park Creek Subdrainage

Unit	Acres/Unit	Acres to be Harvested/Burned	Treatment*	Estimated Harvest Volume CCF/MBF
9	21	21/0	SE	340/160
10	42	42/42	SE/B	710/320
11	9	6/0	SG	160/80
12	30	17/30	SG/B	570/270
13	22	22/22	SE/B	320/150
14	54	54/0	SE	790/340
15	73	43/0	SG	1000/420
16	42	25/42	SG/B	810/370
B2	92	0/92	PB	0/0

*Treatment

SE = Shelterwood with reserves, even distribution
SG = Shelterwood with reserves, group distribution
SE/B = Shelterwood with reserves, even distribution, prescribed burning
SG/B = Shelterwood with reserves, group distribution, prescribed burning
PB = Prescribed burning only

Fuels treatment and site preparation will possibly include slashing excess understory trees to reduce density and in units scheduled for burning treatments to facilitate burning. This site preparation will be completed in those units which show a need for this treatment. The upper limit for leaving untreated slash after harvest is 15 tons per acre as a maximum (large fuels). None of the units were estimated to create less than 13 tons per acre during harvest activities. Tops will be removed in all of the units that are not going to be prescribed burned after harvest. The harvest units that will be prescribed burned will be burned using a mixed severity underburn. Burning will be completed under summer-like conditions in order to achieve the effects similar to historic wildfires and to reduce the variability in fire effects. Prescribed burning will reduce activity fuels and prepare the seed bed for natural regeneration. In the non-burn units, site preparation and fuels reduction will be achieved with harvest operations and excavator piling, if necessary.

Natural regeneration will be planned for all treated acres. Lodgepole pine will be the dominate species with seed coming from the cones with viable seed that are left on the ground following harvest operations. For those units scheduled for burning, the burn will also open cones and provide additional seed to those units.

Snag objectives will be from 9-15 trees per acre of 9-10 inches minimum diameter breast height in three age classes for the shelterwood treatments that have no prescribed fire. For those units that are scheduled for shelterwood harvest and prescribed burning mortality estimates from the prescribed fire will be accounted for in the snag retention classes.

There will be approximately 4.1 miles of new system road and approximately 2.3 miles of temporary road built. All temporary roads will be closed following completion of sale activity. The new permanent road will be closed by means of a locked gate to public use after construction. The use of this road will be restricted to administrative uses.

All units will be harvested in the same season for purposes of the research project. This will reduce variability of regeneration and other measured treatment responses which occur due to year to year variation in climate. The project activities are scheduled for three years. The roads will be constructed in the first year, harvesting will be completed in the second year, and prescribed burning will be in the third year.

A vista point will be developed along the north boundary of the experimental forest which will provide a viewing point for the project area for demonstrational and educational purposes. Interpretive signing will be placed at the vista point and possible along Road 586, which borders some treatment units. The new road constructed to the vista point will be closed seasonally for site protection.

Firewood removal will not be permitted on the entire TCEF.

Alternative 2 has a benefit/cost ratio of 1.29 and a present net value of $203,700. Appendix D contains a more detailed economic summary. This alternative will yield 11,200 CCF (4.8 MMBF).

TENDERFOOT CREEK
EXPERIMENTAL FOREST

Map II-1
Alternative 2

Project Area

Vista Point

Proposed Roads
system
temporary

Treatment Units
Prescribed Burn
Even Distribution
Even Distribution w/burn
Grouped Distribution
Grouped Distribution w/burn

Onion Park RNA

N

0.2 0 0.2 0.4 0.6 0.8 Mi

E. COMPARISON OF ALTERNATIVES BY ISSUE

Table II-3 summarizes the estimated effects and features of each alternative. The effects are described in more detail in Chapter III for the both the No-Action and Action Alternatives.

TABLE II-3 Alternative Comparison by Issue

ISSUE		ALTERNATIVE 1	ALTERNATIVE 2
Research		No research of managed lodgepole pine stands would occur at this time	Research, test, evaluate, and demonstrate ecosystem based treatments for sustaining productivity and biodiversity of lodgepole pine forests and watersheds in a managed condition
Wildlife	Elk Security within the TCEF	52% of TCEF will function as a security area for elk	44% of TCEF will function as a security area for elk
	Hunting District (HD) 413 elk security	68% of HD will function as a security area for elk	67.8% of HD will function as a security area for elk
Sensitive Plants	Pink Agoseris	No Effects	possible individual plants lost in logging but units designed to minimize effect an increase in potential habitat
	Old Growth (OG)	No Effects	178 acres of OG effected only 69 acres modified so that it would not function as Old Growth
Vegetation	acres harvested only	0	403
	acres harvested and burned	0	246
	acres burned only	0	129
	miles of new temporary road	0	2.3
	miles of new permanent road	0	4.1
	estimated CCF	0	11,200
	estimated MBF	0	4800
	present net value	0	$203,700.00
Water Resources		Scenario 1 FORESTED - low peak flows, low sediment yields, and stable channel conditions Scenario 2 WILDFIRE - high peak flows, high sediment yields, and unstable channel conditions	Moderate peak flows, moderate sediment yields and mostly stable channel conditions

NORTHERN REGION
SENSITIVE SPECIES BIOLOGICAL EVALUATION
SUMMARY OF CONCLUSION OF EFFECTS

Project Name: TCEF Timber Harvest

TABLE II-4

SPECIES	ALTERNATIVE 1	ALTERNATIVE 2
1. Boreal Owl	NI	MIIH
2. Wolverine	NI	MIIH
3. Lynx	NI	MIIH
4. Pink Agoseris	NI	MIIH

Prepared by: /s/Donald Godtel /s/ Date: Dec 16, 1997

Approved by: /s/Donald Godtel /s/ /s/
Wildlife Biologist Fisheries Biologist Botanist

NI = No Impact
MIIH = May Impact Individuals or Habitat, but Will Not Likely Contribute To a Trend Towards Federal Listing or Cause A Loss of Viability to the Population or Species
WIFV* = Will Impact Individuals or Habitat with a Consequence that the Action may Contribute to a Trend Towards Federal Listing or Cause a Loss of Viability to the Population or Species
BI = Beneficial Impact

***Trigger for a Significant Action**

Form 2 (R-1-2670-95)

F. MITIGATION MEASURES AND SALE AREA OPPORTUNITIES

MITIGATION

The following mitigation measures will be implemented to minimize, reduce, rectify, avoid, eliminate, and/or compensate the potential impacts to resources identified in Chapter III (40 CFR 1508.20). Also see identified Best Management Practices (BMPs), Appendix B.

Sale Activity

1. Units 1, 2, and 3 will require winter logging or dry conditions for logging activity. This will be monitored by the sale administrator.

2. Leave trees will be marked to represent diameter classes and species composition of the forest population. Leave trees will not have a higher incidence of mistletoe, forking or sweep, or other damaging agents to avoid the potential for dysgenic effects or spread of disease to understory. Stream Management Zones (SMZ) will be protected by maintaining +50%. Leave trees will be windfirm as much as possible.

3. Timber sale contract clauses will be used to minimize logging related damage to residual trees.

4. Activities will be designed to achieve natural regeneration and maintain a two-story stand structure. Post activity and regeneration surveys will be done to assure target stand stocking levels in all treatment units.

Sensitive Plants - pink agoseris

1. Delineation of group harvest areas within Unit 4 will avoid the known locations either by unit design or during logging operations in order to minimize disturbance to potential habitat.

2. Delineation of SMZ's will provide additional protection of potential habitat.

3. Coordinate unit layout to undulate edges along wet meadow complex by Units 3 and 4.

Recreation

1. Hauling of logs and snowplowing will not be permitted on Divide Road 839 between U.S. Highway 89 and Williams Mountain Road 586 after December 1, in order to protect a portion of snowmobile trail "P". During other time periods and for other haul routes there will be notification to recreation users in local newspapers when log hauling and snowplowing is planned to occur on high recreation use areas during hunting season and snowmobile season. Road signs will notify users of logging traffic. Snowmobile clubs will be notified of haul routes. Log haul routes will be limited to provide options for snowmobilers or other recreation users.

2. Firewood cutting will be restricted within the entire TCEF. There will be signs posted prohibiting firewood cutting.

3. The TCEF will change from area restriction "R" to area restriction "C". The area will be closed yearlong to road vehicles, ATVs and trail bikes and closed to snowmobiles from October 15 through

December 1. All existing designated routes and trails through the TCEF will remain open or at their current designation.

4. New roads will be closed to public use after construction. The use of these roads will be restricted by locked gates.

Cultural Resources

Timber harvest has the potential to impact the identified stock driveway used prior to the 1970s to move sheep between pastures. In order to mitigate anticipated effects, trees delineating the route will not be harvested and adjacent trees will be harvested in a manner which retains the visual characteristics of the trail. This will ensure the trail will be distinguishable after timber harvest has occurred. The Judith Ranger District Archaeologist will traverse the stock driveway through the cutting units with the timber marking crew to ensure retention of the visual characteristics.

Additional activities associated with timber harvest also have the potential to effect the identified sheep driveway. Skidding logs through the driveway may cause some ground disturbance but will not affect the setting or historical integrity of the driveway. Accumulation of slash will also occur during timber harvest and logging slash has the potential to impact the visual qualities of the driveway. This potential impact, however, will be mitigated by burning the slash after logging.

Signed trees along the driveway and trees delineating the location of the driveway will be protected on an individual basis where possible by removing slash from the base of trees to protect them from burning.

Proposed road construction through the sheep driveway has the potential to have an adverse effect on the site. Interpretation of the sheep driveway, road closure after construction, and use of the road to access the sheep driveway for interpretive purposes will mitigate the anticipated adverse affects to this site.

Sale Area Improvement Opportunities

The following work activities will be identified as needed on the Sale Area Improvement (KV) Plan. These activities were selected to enhance resource management and mitigate adverse environmental effects within the project area. Priority of treatment would be as follows:

1) Reforestation Exams

Reforestation exams will be conducted to monitor reforestation progress in association with more in-depth regeneration monitoring for research purposes. KV funds will be used to fund a portion of the survey associated with "routine" stocking surveys to assure target stocking levels are achieved.

2) Burning Activities

Burning activities will be accomplished on 375 acres within the project area. The total acres to be burned breaks down as follows: 246 acres will be burned to achieve reforestation objectives within harvest units and 129 acres will be burned to meet multiple objectives not associated with harvest. These costs will be shared by benefiting functions funds which include KV, natural fuels, and BD.

3) Noxious Weed Control

Management guidelines for the prevention and control of noxious weeds will be applied during development and maintenance activities in accordance with Forest Plan Standard D-2, Noxious Weeds and Other Pest (pp. 2-38 and 2-39), the Lewis and Clark Forest Supplemental Environmental Impact Statement for Noxious Weed Control, May 1994 and Weed Seed Free Feed Special Order 96-1, May 1996.

In order to reduce the spread of noxious weeds, timber sale contractors and operators will be required to take precautions such as washing and/or sterilizing all equipment (except logging trucks) before it is brought onto the project. This will include all equipment used in construction of roads and the crushing of material for roads. Post-sale weed control will be monitored for a minimum of five years and appropriate control actions taken.

Disturbed sites will be re-vegetated in accordance with the Lewis and Clark National Forest Native Seed policy. All temporary roads will be revegetated (seeded) upon closure. Only certified weed-free seed or mulch will be used for erosion control work. This will limit the opportunity for noxious weed invasion on disturbed sites.

4) Vista Point

A vista point will be created north of the project area within TCEF and will provide a viewing point for demonstrational and educational purposes. Interpretive signing will be placed at the vista point and along Road 586, which borders some of the treatment units. The new road constructed to the vista point will be gated.

G. MONITORING

Monitoring and evaluation will be used to determine if the physical, biological, social, and economic effects of implementing the action alternative will occur as predicted. This project will be subject to the monitoring and evaluation requirements identified in the Lewis and Clark Forest Plan (FP, Table 5.1, page 5-9 through 5-19). Monitoring aspects will be conducted by both the Lewis and Clark National Forest and the Rocky Mountain Research Station.

As stated in the Forest Plan the following monitoring requirements apply to Management Area K:

MONITORING ITEMS	DATA SOURCE
Recreation Opportunity Spectrum setting being implemented (A-1)	Rim Report, Forest Plan data base
Direction meets expectation of visitor (A-2)	Visitor contacts, Inspections, Plans
Actual use of recreation as compares with project use levels (A-3)	RIM Report
Recreation Opportunity (A-5)	Recreation Opportunity Guide
Off-road vehicle damage and Travel Plan Effectiveness (A-6)	Travel Plan
Condition of visual resource meets objectives in plan (A-7)	Project EA
Comparison between Forest projects which needed cultural resources consideration and Forest projects which receive consideration of the cultural resources (A-8)	Cultural/NEPA project list

MONITORING ITEMS	DATA SOURCE
Elk:Winter range capacity, sex, and age ratios and Habitat Effectiveness (C-3)	MDFW&P annual progress reports and Montana Coop Elk/Logging Study models (Lyon) Program and project EAs
Other big game species: mule deer population trend, sex, and age ratios (C-5)	MDFW&P annual progress reports
Small game (blue grouse): harvest level (C-6)	No further
Furbearer special interest (lynx and wolverine) distribution (C-7)	Sighting reports
Old growth habitat (goshawk): active nesting territories (C-8)	Old growth forest inventory program and project EAs, special surveys
Special interest species (golden eagle, prairie falcon): nesting territory (C-9)	Known nesting territories RMFMP reports
Cavity nesting habitat (northern 3-toed woodpecker)percent optimum habitat (C-10)	Forest Plan snag management guidelines, program and project EAs
T&E habitat improvement outputs and wildlife and fish habitat improvement outputs(C-12)	Forest Plan, high attainment report
Evaluate availability of lands classified as suitable/unsuitable (E-10)	Stage 1 examination; timber sale reports
Projects yields (E-11)	Growth plots and other placement plots
Adequacy and cumulative effects of project BMPs (F-1)	EAs and water quality predictions
Revegetation of temporarily disturbed areas and roads within 5 years (F-2)	EAs and environmental reviews by ID teams
Effects of other activities on watershed conditions (F-5)	Administrative reviews
Elimination of soil and water restoration backlog (F-6)	Soil and Water Reports; management attainment reports
Effect of mining activities (G-1)	Notice of Intent Operating Plans
Effect of Geophysical Seismic Prospecting (G-2)	Prospecting Permits
Effect of drilling (G-3)	Drilling Permits
Rehabilitation of disturbed areas (G-4)	Completion of Operations
Mineral Availability (G-5)	Areas identified in Table 2.1 - Mineral Category
Compliance with use permits (J-1)	Case folders Forest Service Manual
Road and Trail Construction/ Reconstruction; local roads; trails; arterial/ collector roads (L-1)	Transporation Inventory System
Miles of roads open to public use (L-2)	Travel Plan
Acres and volume of insect and disease infestations (P-2)	FPM aerial observation by R.O. Entomologists
Management practices to ensure activities do not promote an increase in insect and disease organisms (P-3)	Post-sale reviews, insect and disease survey, silvicultural examinations, and plantation survival surveys
Assure prescribed fire meets air quality standards (P-4)	Form R1-5150-1 project reports
Fuel treatment outputs (P-5)	Accomplishment Reports
Wildfire Acres Burned (P-6)	5100-29
Cost of Suppression and Protection Organization (P-7)	5100-29 and PAMARS
Validation of costs and values used in plan (1-1)	Timber sale appraisals, contracts, allotments, management plans, cost/output for various projects, PAMARS
Effects of emerging issues of changing social values (1-2)	I&I Plan, issue and target group analyses
Evaluate lands identified as not meeting physical or biological characteristics used in initial allocations (1-3)	Environmental analysis, ID team evaluation, Ranger District assessments, timber sale feasibility analyses
Validation of employment and income projections (1-4)	Input/output model, Montana population projections

III. ENVIRONMENTAL CONSEQUENCES

This Chapter describes the effects from implementing the alternatives described in Chapter II, Section D. Direct, indirect, and cumulative effects are woven throughout the discussion. Existing conditions related to the issues and environmental consequences of the alternatives are also described.

A. RESEARCH

The TCEF was established in 1961 for the purpose of watershed research. In 1991 this emphasis was expanded to develop and evaluate eco-system based treatments for sustaining productivity and biodiversity of lodgepole pine forests and watersheds. Since 1992, several climatic and stream variables have been monitored on the TCEF. Climatic information includes precipitation, air and soil temperatures, humidity, and solar radiation. Snow accumulation and melt have been recorded using a combination of snow courses and snow pillows at low and high elevation sites. Electronic weather stations located adjacent to the snow pillows have measured and recorded summer precipitation with tipping buckets.

Stream measurements include streamflow at eight flume gages located on sub-watersheds and two on Tenderfoot Creek, one each at a high and low elevation location. Sediment production has been periodically collected manually at all ten flume locations and daily sediment production has been recorded at six flume locations with automatic samplers (ISCO). The automatic sampler locations include Tenderfoot Creek above and below the proposed treatment areas, at the flume location of the proposed treatment sub-watersheds, and at the flume locations of the two proposed control sub-watersheds that are hydrologically matched with the treatment sub-watersheds. Other water quality measurements taken periodically at all ten flume locations are water temperature, pH, specific conductance chemical composition, and nutrient information.

Vegetation information that has been collected within the proposed treatment areas includes vegetation composition, regeneration, tree data, duff depths, duff decomposition rates, site physical characteristics, and standing and down woody fuels. Pre-treatment wildlife studies have included deer and elk pellet counts, migratory bird, small mammal, and fish population estimates.

Implementation of Alternative 1, No Action, restricts research to monitoring unmanaged stand conditions. The opportunity to study the affects to vegetation, wildlife, water resources, and other resources in a two-story managed lodgepole condition if foregone at this time.

If Alternative 2 is selected and implemented, the RMRS will study the effects of treatments on streamflow and water quality, the response of understory and overstory vegetation, and wildlife populations. Sediment will be measured below each treatment area, at each flume location at the bottom of each treatment and control sub-watershed, and in Tenderfoot Creek well below the treatment areas.

Additionally, the RMRS or other research groups could study such things as visual perception by the public of two-aged management in lodgepole pine stands. Measured variables would include post-treatment damage on residual overstory and understory, windthrow, fuel loading, and decomposition rates.

Within the research issue, vegetation, wildlife, and water resources will be analyzed and studied. However, each of these resources are also considered independently of the research issue. Below and listed

by resource are some statements that describe what research will study :

Vegetation

- The effects of two-storied lodgepole pine management will be useful in analyzing the effects in other management situations.
- The use of multi-aged stocking guidelines in mature lodgepole pine communities.
- The feasibility and effects of underburning in shelterwood systems in lodgepole pine.
- Response of regeneration and understory vegetation and growth of overstory trees in lodgepole pine stands.
- The snag dynamics in stands following shelterwood harvesting and prescribed burning.
- The fuel accumulation and decay.
- Harvest costs associated with two-story management in lodgepole pine stands.
- The viability of prescribed burning when not associated with harvest.

Wildlife

- The effects to migratory bird populations associated with two-story management in lodgepole pine stands. The effects of two-story management on small mammal population dynamics.
- Two-story management in lodgepole pine stands and the affected use by deer and elk.

Water Resources

- Harvesting in lodgepole pine forest communities and the affect on snow accumulation, rain through-fall, water quality, water production, and stream discharge patterns.
- Fish habitat and populations change in high-elevation streams following two-story management and burning in lodgepole pine stands.
- Two-story management and the affect on stream channels in high-elevation environments.

B. VEGETATION

Existing Condition and Effects of Alternative 1 (No Action)

The upper reaches of the Tenderfoot drainage are dominated by lodgepole pine forests. Alpine fir and spruce are also common on some sites and Douglas-fir, aspen, and whitebark pine are found but in fewer numbers. The major habitat types are alpine fir/grouse whortleberry on well drained areas, alpine fir/blue huckleberry on more sheltered sites, and alpine fir/bluejoint in moist microsites and draws. Alpine fir/whitebark pine/grouse whortleberry is also present on the ridge lines. Wet and dry parks are common in the drainage interspersed with forested areas.

The species composition and forest structure have been most influenced by historic fires. Steve Barrett's Fire History Report (1993), prepared for the TCEF, shows that over 90% of the TCEF stands were initiated following one of four fires, 1726, 1765, 1845 and 1873. These stand replacing fires burned more than 7,600 acres. Of this, over 3,700 acres burned again in a later fire with mixed levels of mortality. Table 1 shows the number of acres burned by year on the TCEF since 1580. For the TCEF, stand replacement intervals (SRI) ranged from 57 to 421+ years in the Tenderfoot Creek bottom (canyon) area with an mean average fire interval (MAFI) of 179 years. The dry upland stands, which

comprise the majority of the TCEF, have a SRI of 105-316+ years and a MAFI for mixed intensity underburns of 55 years. The stand replacing fires created single aged stands and mixed intensity fires created two aged or multiple aged stands due to the mixed mortality and areas suitable for regeneration. The fires were of varying sizes, the largest being 2,122 acres in 1873. Lodgepole pine generally dominated due to these fire intervals at the expense of more shade tolerant species. Without fire, alpine fir and other shade tolerant species regenerate under the lodgepole pine and become the dominant species.

Table III-1 Acreage burned by year on the TCEF

Year of Fire	Total Acreage Burned*
1580	96
1676	79
1726	2738
1765	1985
1831	135
1845	2605
1873	4295
1882	148
1889	104
1902	558
1921	35
1947	29
1996	<1

*Total Acreage Burned includes both stand replacing and mixed intensity burned acres

From a landscape perspective, historic fire patterns created a heterogeneous mix of age classes. Stand replacing events created diversity between patches (burned versus unburned) and mixed intensity burning created diversity within patches (smaller areas of mortality, burning of the understory). With longer fire intervals, larger patches tend to age uniformly. Nearly 120 years have passed since the last major fire, and the master fire chronology contains evidence of one or two other relatively long fire free intervals over the last four centuries (Barrett, 1993). Currently, as much as 90% of the TCEF is occupied by stands whose ages are well within the range of stand replacing fire intervals for this forest type (nearly 30% are approaching the upper threshold of the fire interval range).

Stand decadence was commonly observed during the fire history sampling, and stands in adjacent drainages have experienced large amounts of mortality - 20,000 acres from "red belt" winter kill linked to rapid and extreme fluctuations in temperature and 3,000 acres of blowdown. Consequently, it is reasonable to conclude that the stage is being set for renewed fire activity in the coming decades (Barrett, 1993). The uniform aging of the stands can also result in large insect and disease epidemics such as mountain pine beetle, or wildfires may be unnaturally large in the future. An extended fire interval also results in a shift from seral species, particularly lodgepole pine, to shade tolerant species such as alpine fir and spruce. While these species are important components of the forest, they did not dominate in the historic fire dependant system. This shift in species affects such components as wildlife habitats, nutrient reserves, and fire patterns. Under no action, Alternative 1, the TCEF and other areas will continue to move in this direction.

Lodgepole pine-Single Story and Two-storied Stands

About 64% of the TCEF is dominated by lodgepole pine. These are primarily single storied or two storied stands that originated after stand replacing fires in 1845 or 1873 , or in 1726 or 1765 and burned with mixed mortality again in a later fire. The result is large areas of 100 to 130 year old lodgepole pine interspersed with areas where there is a mix of 200 year old overstory and 100 year old lodgepole pine. Table III-2 in the following section describes current stand structures. Both the single and two-storied lodgepole pine stands are fairly open and ground vegetation is light consisting of blue huckleberry, grouse whortleberry, and a number of forbs and grasses. Wet site plants such as bluejoint reed grass and arrowleaf groundsel are present particularly scattered throughout small areas of Unit 3 and portions of Units 1 and 2. Lodgepole pine snags are scattered throughout the TCEF and for the most part have not started to rot or blowdown, thus down woody debris is light. There are isolated stands where blowdown has created large amounts of down woody debris. Dwarf mistletoe and gall rust are light and not a major influence in the stands now.

Without fire, harvest, or other major disturbance, the lodgepole pine will be replaced by alpine fir and other shade tolerant species. The dead lodgepole pine will create a heavy down fuel loading as they rot and blowdown. This, however, is a relatively short lived situation. As evidenced by historic fire records, the forest condition becomes increasingly high risk to fire and will eventually burn. With high fuel loadings, a stand replacing fire is likely to occur.

Under current management practices, dwarf mistletoe will likely increase in the lodgepole pine reducing growth and cone crops, and predispose them to secondary insect attack. There is a potential for mountain pine beetle epidemics with the large expanse of relatively even aged lodgepole pine.

Lodgepole pine/Alpine fir- Multi-storied Stands

About 36% of the area is primarily tolerant species which has not had a fire in over 230 years. These stands consist of alpine fir, lodgepole pine, and varying amounts of spruce. The lodgepole pine, which initiated soon after the fires in the 1700s, has matured and is declining and dying. Alpine fir and other tolerants are becoming the dominant species. The tolerant overstory and mid-story is 100 years or younger, having developed under lodgepole pine. This understory is also dominated by alpine fir and is very heavy; stand exams show 13,000 to 19,000 trees per acre less than one foot tall. Other ground vegetation is blue huckleberry, grouse whortleberry, and various grasses and herbaceous vegetation. There are significant amounts of downfall and other woody debris throughout the stands.

The fire regime for these sites is the same as described under the lodgepole pine single storied stands. The successional trend in these stands, however, has not been interrupted by fire in the last 230 years and is progressing to a climax species condition. Under Alternative 1, current management, this trend will continue with an increasing risk of a large wildfire.

Effects of Alternative 2 (Proposed Action)

General Effects

Effects common to all stand types are discussed in the following paragraphs. Effects more specific to lodgepole pine versus lodgepole pine/alpine fir stand types are under separate headings.

The effects of the harvest and prescribed burn activities as proposed in Alternative 2 will create the mosaic of age classes and structures resembling that created during mixed intensity fires on about one-third of the Sun Creek and Spring Park subdrainages. The target condition is a two-story structure. Lodgepole pine, a fire adapted seral species, will be dominant in the regeneration, and will also dominate in the overstory with long term management. This is a condition similar to those created with recurring fires on these habitat types and on gentle slopes. Although this treatment is applied to a small portion of the drainage, it will increase patch diversity and increase the resiliency for site recovery following natural disturbances.

There is a mix of stand conditions within the Sun Creek and Spring Park subdrainages. The following is a summary of predominant current condition and the condition following the treatment proposed in Alternative 2.

TABLE III-2

Unit	Dominant Species	Current Stand Structure	Post Treatment Structure, distribution	Fire Year
1	LP	single story	two story, even	1873
2	LP	single and 2-story	two-story, grouped	1873,1765
3	LP	single and 2-story	two story, even	1873,1765
4	LP	single story	two-story, grouped	1873
5	LP	single story	two story, even	1873
6	LP	single and 2-story	two-story, grouped	1873,1765
7	AF/LP	multi-story	multi-story	1765
8	LP	single and 2-story	two story, even	1873,1765
9	AF/LP	multi-story	two story, even	1726
10	AF/LP	multi-story	two story, even	1726
11	AF/LP	multi-story	multi-story	1726
12	AF/LP	multi-story	two-story, grouped	1726
13	LP	single and multi	two story, even	1873,1726,1889
14	LP	single and multi	two story, even	1873,1726,1889
15	LP	single story	two-story, grouped	1873
16	LP	single and 2-story	two-story, grouped	1873,1726
B1	LP	single story	two-story, irregular	1873
B2	AF/LP	multi-story	two-story, irregular	1726,1873

The proposed activities in the single story lodgepole pine areas will perpetuate lodgepole as the dominant species and provide an opportunity to manage two distinct age classes. In the lodgepole pine/alpine fir units, there will be a shift from the multiple stories of seral and tolerant species to two story stands eventually dominated by seral lodgepole pine. In areas not being burned, the shift will occur after another harvest entry. The long term goal is to manage the two age classes with an age span of 40 to 50 years which will maintain differentiation in crown classes and vigorous trees.

The project will be designed to avoid some undesirable effects which can occur with two-story management. Dwarf mistletoe in lodgepole pine overstory will infect an understory. Mistletoe in the project area is light and thus not a major concern at this time. This will change, however, if the mistletoe increases in the overstory as the trees age. This tends to be a common condition in older lodgepole pine.

Dysgenic effects are caused by removing the superior trees and leaving those trees with poor genetic qualities, like crook, sweep, forking, and insect and disease resistance. Leave trees will be selected that are representative of the current population to reduce the risk of a decline in genetic controlled qualities.

The risk of blowdown increases with reducing stand densities. The risk and extent of blowdown is decreased with the density of leave trees and gentle topography. Research will evaluate the association of blowdown with leave tree density. The residual trees will develop wind-firmness as they adapt to a more open canopy condition.

Logging operations will likely result in some damage to residuals. Contract specifications will minimize damage but working amongst dispersed trees, as in the even distribution units, will result in some damage. Alpine fir is particularly susceptible to stem diseases if it has any basal damage or broken tops. Extensive damage in all species can kill or significantly weaken the trees. Although tree damage reduces timber volume and tree cover, it does provide additional wildlife habitat. The future harvest entries will have greater risk of damaging trees that have been cultured for stand management. Directional tree felling and carefully planned skid patterns will be especially important at that time to reduce unnecessary damage.

The First Order Fire Effects Model (Reinhardt, et al., 1997) was used to determine what flame lengths would be needed in order to achieve the desired mortality levels in each stand. Overall, in order to achieve an average of 50% mortality figure in all stands, it would be necessary to have a flame length of 1 to 2 feet, given that the fuels left after harvest will not be evenly distributed across the unit. This lack of uniformity will undoubtedly result in flame lengths that will vary from less than 1 foot to over 4 feet in height as the fire spreads through these concentrations of fuels. This varying flame length will result in varying mortality figures throughout the stands. It is estimated that mortality will be variable ranging from 0 to 100% on a specific point basis. The goal of the burn, however, is to maintain 25 to 60% of the current tree numbers *averaged* over the *stand.* Variability and risk will be dependant on the amount of slash involved and the weather conditions at the time of burning.

The impacts of burning will be minimal to the general public and surrounding communities. The closest community downwind would be Judith Gap at a distance of approximately 57 air miles. It is highly improbable that smoke in detectable quantities would reach the small community of Judith Gap. All prescribed burning operations will comply with the State of Montana Smoke Management Implementation Plan and will be implemented within the guidelines of the Smoke Management Program. Individual unit burn plans and prescriptions will be prepared based on actual fuel complexes existing post harvest and will be formulated to reduce total emissions of PM2.5. PM2.5 is defined as any liquid or solid particles less than or equal to 2.5 microns in size that are suspended in or falling through the atmosphere.

Activity burning is likely to result in the following emissions. The figures are based upon fall -like burning condition for 1,000 hour fuels and an emission rate of 10.8 pounds/ton for pile burning, 22 pounds/ton for broadcast burning following harvest, and 27 pounds/ton for mixed severity burning of PM2.5 produced/ton fuels consumed by burning.

TABLE III-3

Pile Burning	9.5 Tons
Broadcast Burning	99.8 Tons
Mixed Severity Burning	15.2 Tons

The activities in Alternative 2 are designed to evaluate two aged silvicultural systems in lodgepole pine. Data plots are in place and will be used to gather information to model and evaluate the stand development and refine management schedules and strategies. The stand culturing activities will be scheduled to assure the biological requirements are met and the trees can maintain health and vigor, insect and disease resistance, and provide the many resource values that are needed.

To assure two healthy age components, it will be necessary to shift growing space from older trees to the younger trees over time. Growing space is a representation of the biological needs of the trees for various resources and not the actual area or square footage occupied by a particular tree. As young trees get older, they require more space or they will be suppressed by the overstory or become spindly growing towards sunlight. To avoid these conditions, growing space must be adjusted to perpetuate two vigorous tree stories. Monitoring will determine when an intermediate harvest is needed to reduce the numbers of overstory trees shifting needed resources to the developing understory, or thin the understory allocating resources to fewer trees. It is estimated that in about 40-50 years the main harvest to remove residual trees from this entry will be done and a younger stand component regenerated. This will be maintained through rotation. A two story stand with the components being about 40-60 years apart will result.

Lodgepole Pine- Single and Two-storied Stands

a. Effects of Harvest

After harvest, there will be an overstory of lodgepole pine and an environment favorable for lodgepole pine regeneration. After the first entry, the overstory will be about 120 years older than the younger story. Future actions will result in a move towards a 40-50 year interval in the two age classes. Lodgepole pine will be the dominant species after treatments, which is typical in disturbance dependant ecosystems and diversity in structure within patches.

In Units 2, 4, 6, 15 and 16, the overstory retention trees will be in a grouped distribution and will appear like patches of older trees with a patchy but light understory, representative of current stand conditions. The forest understory and soil organic layers will remain intact. Outside the leave areas, all trees will be harvested and lodgepole pine will seed in, developing into a healthy understory. About 40-60% of the area within these units will be in leave areas (the older story) and the remainder in the younger age class.

Overstory trees will not directly shade the regeneration but due to their proximity, they will affect the environment of the establishing regeneration. The regeneration will be partially shaded during part of the day and the two stand components will be in competition for moisture and other site resources. The area will be managed to maintain the two story stand structure in this grouped or clumpy distribution.

The residual overstory trees in Units 1, 3, 5, 8, 13 and 14 will be in an even or dispersed distribution. The effects, similar to the grouped distribution in that 40-60% of the existing trees, will be removed with size classes in proportion to the current diameter distribution, and regeneration will establish as a second story. The trees, however, will be dispersed fairly evenly throughout the units. The regeneration will be in more direct competition with the overstory and will be shaded during longer periods of the day. These areas will be managed to maintain this even distribution.

Lodgepole pine will be the dominant species in the overstory and in the regeneration. Minor species will be alpine fir, spruce, and occasionally whitebark pine. Serotinous cones left on the ground will be the

primary seed source with wind disseminated seeds a secondary source for regeneration. As the young trees grow, the need for moisture, nutrients, and sunlight will increase.

b. Effects of burning following harvest

The fire treatments will further reduce the numbers of trees and provide a post fire condition like that historically present. There will be more variety in the leave tree distribution and most smaller trees will be killed. In the even-distribution stands, we can expect the burn mosaics to be different than in the grouped distribution stands. The mosaic in the even-distribution units will be more uniform as fuels will be dispersed and each stem will roughly have the same probability of having a flame front pass by it as any other stem in the unit. Burning in the units with grouped leave trees will have some islands that do not burn at all or have a limited amount of fire in them. Other islands may have a fire run through them and have fairly high mortality . The burn mosaic will be more diverse than in the even distribution stands due to variations in the amount of slash, the amount of ground disturbance, and the amount of time that a strip of fire has to impact each island.

Seed necessary for regeneration will be released from the serotinous cones still on the trees. Various nutrient processes will also be enhanced with the burning. The burning will open additional growing space for establishing regeneration and provide for natural fuels reduction. Snags will be more abundant.

c. Effects of burning only

The prescribed burning in Unit B1 will reduce the numbers of trees of all size classes in an irregular distribution. Mortality will be variable with patches of very heavy mortality to areas of few or no trees killed. Overall, the goal for the burn is to maintain 25-60% of the current stand density, considering only trees 6 inches and greater in diameter. Most smaller trees will be killed. As with the activities previously described, a two story stand will be created. In Unit B1, there will a high number of snags left on site following the management activity, and there is the potential for greater diversity in the overstory/understory distribution. Serotinous lodgepole pine cones will be opened by the fire releasing sufficient seed for regeneration and the burning will provide for natural fuels reduction.

Lodgepole Pine/Alpine Fir - Multiple Story Stands

a. Effects of Harvest

Harvest in Units 7, 9, 10, 11, 12 will reduce the number of overstory trees and create light and seedbed conditions for regeneration of lodgepole pine. These stands will have multiple stories, primarily tolerant species in the residual overstory and understory, and lodgepole pine in new reproduction.

Units 7, 11, 12 are group distribution units. Leave areas will be comprised of alpine fir, lodgepole pine, and spruce in a multiple story condition, representative of the current condition. Areas which will not be burned will maintain this structure until the next major entry. The regeneration areas will be dominated by lodgepole pine due to its competitive advantages as a seral species. Alpine fir and spruce will also seed in, and residual alpine fir will intermix with the new regeneration. The proportion of alpine fir will be greater in areas where lodgepole pine overstory is light and cones are sparse. The proximity of

the leave areas will shelter the regeneration reducing open sunlight and seedlings will be competing for site resources to various degrees.

The residual overstory in Units 9 and 10 will be in a more uniform distribution. Alpine fir and lodgepole will be the primary overstory trees; spruce and occasional other species will also be mixed in. Lodgepole pine will dominate in the understory with alpine fir and spruce also present. The lower stories will be reduced with the site prep activity following harvest resulting in a two story condition. As in the lodgepole pine stands, the regeneration will be in more direct competition with the overstory for light, moisture, and other necessary resources.

b. Effects of Burning following Harvest

The prescribed burning that will follow harvest in Units 10 and 12 will have similar results to those described for the lodgepole pine units and result in two-storied stands. It is likely that the fire will burn more extensively in the understory on these lodgepole pine/alpine fir units because of the low crowns and high density of smaller trees. As with the lodgepole pine stands, variability in the resulting mosaic will also be dependant on the arrangement of leave trees, grouped versus evenly dispersed. The burn will be planned to maintain 25-60% of the overstory trees considering the stand as a whole. The majority of the understory will be killed in cut areas, creating an environment for regeneration consisting of primarily lodgepole pine. Serotinous cones on residual trees will be the primary seed source. Burning will provide for natural fuels reduction.

c. Effects of Burning only

The prescribed burning in Unit B2 will reduce the numbers of trees of all size classes in an irregular distribution. High mortality is expected in the smaller alpine fir and spruce. As with the activities previously described, the burn will create two story stand conditions with residual overstory and new regeneration. There may be a greater diversity in these multi-story stands following the burn compared to Unit B1 because the fire behavior will be more variable. In B2, there will be the highest number of snags left on site following the management activity, and there is the potential for greater diversity in the overstory/understory distribution. Serotinous lodgepole pine cones will be opened with the fire to provide seed for regeneration. Burning will provide for natural fuels reduction.

C. WILDLIFE AND SENSITIVE SPECIES

As shown in Table III-4, the following species or habitats are addressed in this Environmental Assessment (EA): elk, boreal owl, wolverine, lynx, pink agoseris, and old growth forest (this list and the effects of the alternatives have been coordinated with the Montana Department of Fish, Wildlife and Parks area biologists, Jim Williams). The two drainages; Sun Creek and Spring Park Creek within the TCEF will be the basis for the discussion of direct and indirect effects. Cumulative effects boundaries will differ by species or habitats.

TABLE III-4 Threatened, Endangered, Sensitive Species, Management Indicator Species, and Others

SPECIES NAME	EXISTING HABITAT AND NEED FOR FURTHER ANALYSIS
Grizzly Bear (T)	Habitat does not exist in the project area, outside the Recovery Zone, no further analysis will be completed.
Gray Wolf (E)	No den sites in the analysis area, potential habitat is within the 10-j rule area, BA determined "no effect" from the proposed action, no further analysis will be completed.
Bald Eagle (T)	Habitat or nest sites do not exist within the analysis area, BA determined "no effect" from the proposed action, no further analysis will be completed.
Peregrine Falcon (E)	Habitat or nest sites do not exist within the analysis area, BA determined "no effect" from the proposed action, no further analysis will be completed.
Swift Fox (C)	Habitat does not exist in the project area, no further analysis will be completed.
Mountain Plover (C)	Habitat does not exist in the project area, no further analysis will be completed
Elk (MIS)	Habitat exists, will be used as a surrogate for big game species, **further analysis will be completed**.
Mule Deer (MIS)	Habitat exists, habitat coordination requirements for elk and old growth management meet needs for mule deer. Mitigation for elk meets needs for mule deer, therefore no further analysis will be completed.
Whitetail Deer (MIS)	Primary habitat at lower elevation and private land, incidental sightings in the project area at the higher elevations. Habitat coordination requirements for elk, riparian habitat, and old growth management meets the summer needs for whitetail deer, therefore no further analysis will be completed.
Black Bear (MIS)	Habitat exists. Habitat coordination requirements for elk, snags, and dead and down components, and old growth meets needs for bear, therefore no further analysis will be completed.
Bighorn Sheep (MIS)	No habitat or population exists, therefore no further analysis will be completed.
Mountain Goat (MIS)	No habitat or population exists, therefore no further analysis will be completed.
Mountain Lion (MIS)	Highly adaptable to environment, regulated by permit harvest, management of prey base (deer) aids in management of lion, mitigation such as cover, access restriction for elk will help maintain habitat for lion, therefore no further analysis will be completed.
Blue Grouse (MIS)	Generally occur at higher elevation where timber/grassland mosaics occur. Species is quite adaptable to vegetative manipulation. Proposed activities will not effect habitat within the project area, therefore no further analysis will be completed.
Brook, Rainbow Trout (MIS)	Habitat and populations exist, water quality parameters will be adequate to protect the habitat and beneficial uses, watershed impacts are determined to be minimal and of short duration, therefore no further analysis will be completed.
Beaver Habitat (MIS)	Confined to riparian stream habitat, no timber harvest activities planned in riparian habitat, no beaver activity present in the area, therefore no further analysis will be completed.
Bobcat (MIS)	Preferred habitat-rough broken terrain, open or semi-open overstory canopy, use of riparian corridors to link habitat segments. No new access being created in the preferred habitats. Habitat coordination requirements for big game (eg., road restrictions and travel corridors), dead and down woody material, old growth forest, and biodiversity also enhance habitat for the bobcat, therefore no further analysis will be completed.
Golden Eagle (MIS)	No known nest sites within the project area, therefore no further analysis will be completed.
Prairie Falcon (MIS)	No known nest site or areas of suitable cliff nesting habitat, therefore no further analysis will be completed.
Northern Goshawk (MIS)	Preferred habitat is outside the area, no known nest sites in the area, therefore no further analysis will be completed.

Table III-4 continued

SPECIES NAME	EXISTING HABITAT AND NEED FOR FURTHER ANALYSIS
N. 3-Toed Woodpecker (MIS)	Habitat and species exist, however the proposal has snag management guidelines within whereby maintaining or increasing habitat for this species, the proposal also has proposed fire treatment to increase the amount of post fire habitat; therefore no further analysis will be completed.
Blackbacked Woodpecker (S)	Habitat does not exist in the project area, this species has not been found to occur in the Little Belt Mountains, therefore no further analysis will be completed.
Flammulated Owl (S)	Habitat does not exist in the project area, therefore no further analysis will be completed.
Boreal Owl (S)	Habitat exists and the owl has been located adjacent to the project area, **therefore further analysis will be completed**.
Townsend's Big-eared Bat (S)	Habitat does not exist in the project area, therefore no further analysis will be completed.
Wolverine (S)	Past track sightings in and adjacent to the project area, **therefore further analysis will be completed.**
Lynx (S&C)	Past track sightings in and adjacent to the project area, **therefore further analysis will be completed**.
Harlequin Duck (S)	Habitat does not exist in the project area, therefore no further analysis will be completed.
Fisher (S)	Habitat does not exist in the project area, therefore no further analysis will be completed.
N.Bog Lemming (S)	Habitat may occur, no presence found during trapping for small mammals, the potential habitat is avoided by the treatment areas, therefore no further analysis will be completed.
Ferruginous Hawk (S)	Habitat does not exist in the project area, therefore no further analysis will be completed.
Cutthroat Trout (S)	There are no pure strain populations in the project area (TCEF). There are populations of cutthroat that are 90%+ hybridized with rainbow trout in the TCEF below the confluence of Stinger Creek and Tenderfoot creek. There are no cutthroat trout within the two treatment water sheds. Water quality parameters will be adequate to protect the habitat and beneficial uses, watershed impacts are predicted to be minimal and short term. Consultation with Brad Sheppard (MFWP fish bio) and Mike Enk (FS fish bio) agree that predicted impacts will not lead to significant adverse impacts on the hybridized populations below the treatment areas, any sediment will be flushed through the system and settle out of the water column below the TCEF, therefore no further analysis will be completed.
Pink Agoseris (S)	This is the only sensitive plant that has habitat in the TCEF and the plant was found in the area, **therefore further analysis will be completed.**
Neotrop Birds (O)	Just the general forest species are present, habitat does not exist for species that are restricted to special habitats (ie, shortgrass prairie, sagebrush, marshlands, post fire, older forests of the cedar-hemlock type) or have demonstrated downward trends, therefore no further analysis will be completed.
Amphibians (O)	Habitat exists, but none found during survey work, therefore no further analysis will be completed.

T= Threatened, E=Endangered, C=Candidate, S=Sensitive, MIS=Managment Indicator Species, O=Other

Alternative 1 (No Action)

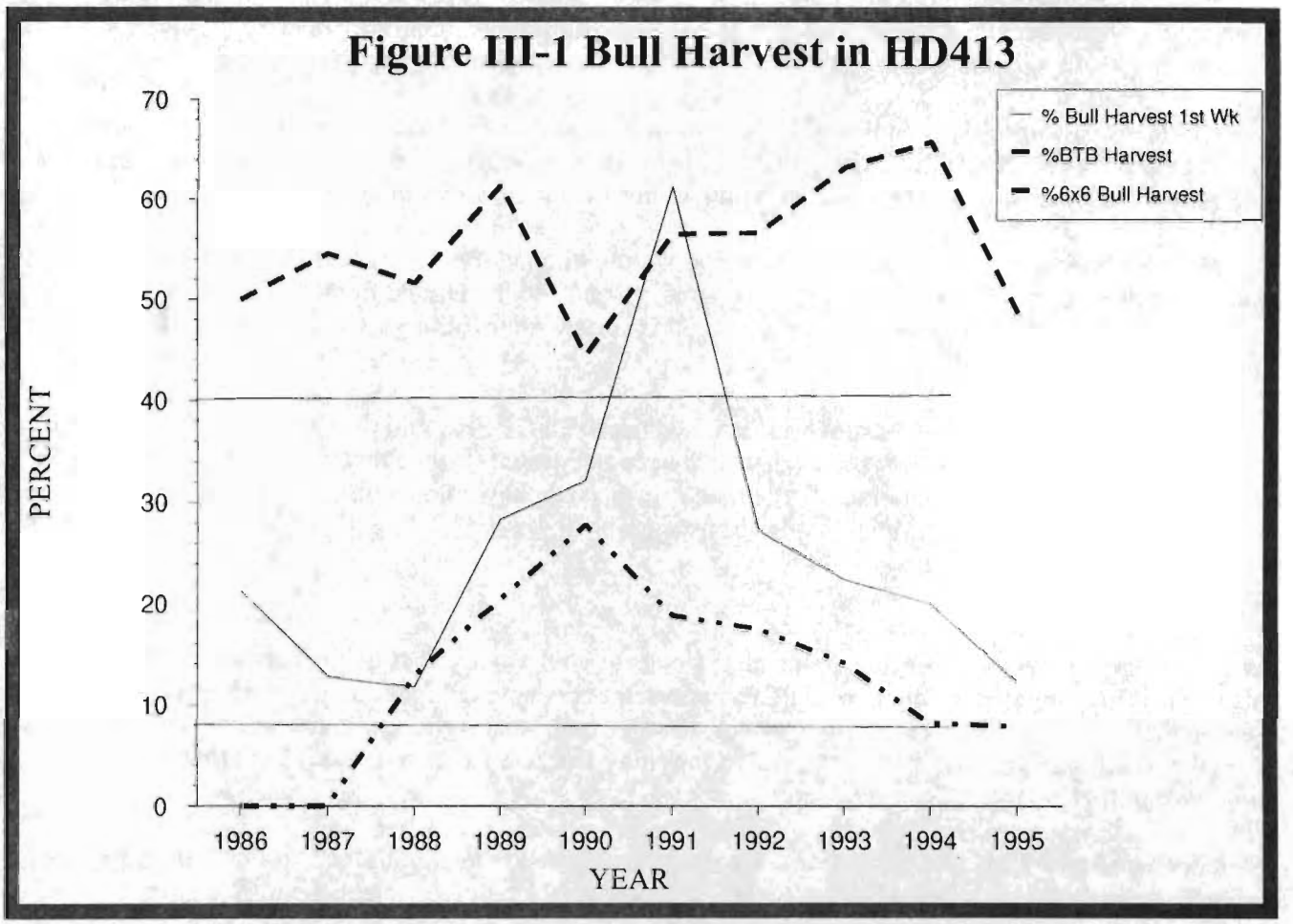
Elk

Currently, the TCEF is used by elk as summer and fall range. The gentle ground, wet meadow complexes, and presence of old growth spruce/fir forest makes this area ideal for rearing calves once they have been born at lower elevations. The presence of wet microsites scattered throughout the TCEF has been associated with rutting activity by elk. Presently, the area has a high degree of cover within it. The only open areas are the natural openings. Road densities are low within the area, with the major portion of the road system actually at the periphery. Road densities computed for the TCEF are 1.0 mile per square mile (this was determined by adding all road miles and dividing by total project area acres). The Forest Plan has no standard for road densities for the TCEF, but states in the management area prescription (Forest Plan, page 3-54) that public access will be minimized by only allowing motorized access on existing roads and travelways. See Chapter III, Section E, Transportation Systems; for more discussion on roads.

The TCEF contributes to the security of elk during the hunting season. If one uses a half mile buffer around all roads that are open for public travel during the hunting season, 52% of the TCEF serves as a high security area for elk (Map E-1, Appendix E). The TCEF lies within hunting district (HD) 413 and has considerable area of secure habitat due to the presence of large unroaded areas within the Forest boundary (see Map E-1, Appendix E). Approximately 68% of HD 413 offers habitat security for elk during the hunting season.

Examining the harvest data for HD 413, it is apparent that the objectives established by Montana Fish, Wildlife, and Parks (MFWP) for the Little Belt-Castle Mountains Elk Management Unit (EMU) are being achieved within HD 413. The objectives include, the harvest of bulls during the first week < 40%, and maintaining an annual bull harvest comprised of 40% branch antlered bulls (BTB), 8% of which are 6-point bulls (Figure III-1).

Elk habitat conditions will remain unchanged for the next 10-15 years with the implementation of alternative 1. The highest potential of the area for change would be one of modification by wildfire. The actual occurrence of wildfire cannot be predicted, however, one could predict that the risk of fire within the TCEF is moderate to high because of the time that has elapsed since the last fire and the present stand conditions.



Boreal Owl

Boreal owls nest in cavities within forests of the spruce-fir zone in the Northern Rocky Mountains. In general east-side forests boreal owl habitat is spruce-fir, lodgepole pine and Douglas-fir forests and starts at about 7000 feet elevation. However, in a study on the Lewis and Clark Forest, boreal owls were detected between 6400 to 8080 feet (Carlson, 1991). Nest cavities may be more available within aspen and within mixed conifer forest at the lower elevation spruce-fir zone. Pileated woodpecker and northern flickers are the primary excavators of cavities used by boreal owls. Nest trees have only been located in aspen and subalpine fir forests (USDA-FS, 1995, unpublished).

Indirect evidence from the study of boreals in Idaho suggest that spruce-fir forests are important foraging habitat. Voles (Microtus spp. and Clethrionomys spp.) were the most frequently taken prey. Clethrionomys spp. is found in mature, mesic forests, particularly spruce-fir where rotting logs and

stumps are abundant. Non-forest voles (Microtus spp.) are found in shrub/grass habitats in and amongst forested stands. Both groups of voles are active year-round spending winter at the snow-ground interface. Less frequently taken prey include; northern pocket gophers (Thomomys talpoides), shrews (Sorex spp.), mice (Peromyscus spp., Zapus spp., Napaeozapus spp.), northern flying squirrel (Glaucomys sabrinus), and chipmunks (Tamias spp.). Thrushes, juncos, warblers, robins, kinglets, and chickadees are also taken in substantial frequency (24%) during the months of January to March (USDA-FS, 1995, unpublished).

A small mammal survey was completed this past summer and most of the preferred forage species were found to exist within the TCEF. The preferred bird species were recorded in a bird study that was completed in 1978 by Sewall Young and also during old growth inventories in 1997.

A survey for boreal owls on the Lewis and Clark National Forest was completed in 1991. One survey route began at the junction of the Williams Mountain Road and the Divide Road, and ended at the junction of Eagle Park Road. An owl was located on this survey route, but was south and west of the project area.

Based on the literature and the survey work on the Forest, the TCEF could provide habitat for the boreal owl, especially in the old growth stands that have been delineated on the Old Growth Map, Appendix E, Map E-2. With the implementation of Alternative 1, this habitat would continue to provide habitat unless modified by a wildfire or other major disturbance.

Wolverine

Wolverines range widely, from subalpine talus slopes to winter ranges. A distinct seasonal, elevational pattern was documented in Montana, with the wolverines occupying higher ranges during snow-free season than in winter. However, through track surveys and visual sightings, it appears the wolverine uses the TCEF yearlong. In the spring, wolverines may frequent riparian habitats (USDA-FS, 1995, unpublished).

Seventy percent of 576 radio-relocations of wolverines studied in the South Fork of the Flathead River were "...in medium or scattered mature timber, with strong selection for forests featuring alpine fir, while the rest were primarily ecotonal areas. Dense young timber, burns, and wet meadows were rarely used, and there were no relocations in logging clearcuts" (USDA-FS, 1995, unpublished). It is believed that food availability was the primary factor determining movements and habitat use. Mature or intermediate timber stands, especially edge and ecotonal areas such as around cliffs, slides, basins, and meadows, was preferred habitat. It has been reported that: "...animals occasionally crossed clearcuts, but usually in a straight line and at a running gait, as compared to more leisurely and meandering (hunting) patterns in timber" (USDA-FS, 1995, unpublished).

Forest cover may be important in some areas to escape predation by other predators. There does not appear to be any single habitat type that can be identified as important for the species, but large, isolated areas supporting a diverse prey base and diversity of habitats are believed to be required (USDA-FS, 1995, unpublished).

Wolverine are primarily scavengers. Many authors report carrion as a significant portion of winter diet, while other food items occurring in high percentages of the diet may include ground squirrels, marmot, snowshoe hares, mice and voles, and blueberries. Common winter foraging behavior involves

wandering about searching for caches made by itself, other wolverines, or other carnivores. The presence of other predators is important to wolverine because of their reliance on carrion (USDA-FS, 1995, unpublished).

Wolverines breed from late spring to early fall, but most breeding occurs during early summer. From one to five kits, generally two or three, are born from February through April. The kits grow rapidly, are weaned beginning in 7-8 weeks, and leave the den at 12-14 weeks. They reach adult size by early winter (USDA-FS, 1995, unpublished).

Den sites have been found in a variety of situations. Dens may be made under tree roots, under fallen logs, under boulders, in caves, in burrows under overhanging banks, talus habitats or in deep snow (USDA-FS, 1995, unpublished).

The TCEF provides habitat for wolverines and they have been seen in or adjacent to the TCEF as well as tracks recorded during winter snow track surveys. Quartzite Ridge appears to be potential denning habitat. In snow track surveys conducted during the winter of 1997, a dozer pile that was left in a clearcut was used as a secondary denning site.

Implementation of Alternative 1 will result in no change to the habitat for the wolverine or increase the mortality risk to the species.

Lynx

Lynx have special adaptations which enable them to live at high elevations and endure the cold winters and deep snows of the high mountains. Lynx are known to occur above 4,000 feet in Idaho and Montana. Lynx require a mosaic of forest conditions, from early successional to mature coniferous and deciduous stands. They use areas with dense, young vegetation (frequently shrubs and lodgepole pine) for hunting. Denning habitat is described as dense, mature spruce or subalpine fir forest, with a high density of downfall logs. Minimal human disturbance is an important feature of denning sites (USDA-FS, 1995, unpublished).

The lynx's selection of habitat is closely linked with the habitat of its primary prey, the snowshoe hare (Lepus americanus). In general, hares prefer mixed conifer stands for cover, with openings of shrubby hardwoods for feeding (USDA-FS, 1995, unpublished).

Travel corridors are believed to be an important component of lynx habitat in view of their large home ranges (4-94 square miles, generally 6-8 square miles) and movement patterns. Travel cover consists of contiguous coniferous or deciduous vegetation, greater than six feet in height. Mountain ridges and saddles may also serve as lynx travel corridors. Lynx avoid large openings and generally do not cross openings greater than 300 feet wide (USDA-FS, 1995, unpublished).

The TCEF does provide habitat for both the lynx and its preferred prey species the snowshoe hare. To date, no sightings of the lynx or its tracks have been recorded within the TCEF. However, it has been recorded near the TCEF and it maybe a function of lack of detection versus the lynx not being there.

Implementation of Alternative 1 will leave the habitat unchanged for the lynx and not increase the risk of mortality to the species.

Pink Agoseris

Pink agoseris is a plant species that is associated with wet meadow habitats in the subalpine fir zone on north and northeast aspects at elevations ranging from 6,000 to 7,800 feet. It is associated withsubalpine fir/bluejoint reed grass habitats in the TCEF. It is strongly associated with landtypes 11, 11a, and 201. The Sun Creek and Spring Park Creek drainages were modeled as having high potential habitat. Surveys were completed in the summer of 1997 and one location of the plant was found in the Sun Creek drainage. This plant also inhabits Onion Park RNA which is immediately to the east of the area.

Implementation of Alternative 1 will have no effects on this plant species. A wildfire may change the habitat if it was to occur within the project area, but it is anticipated that the species would be unaffected.

Old Growth Forest

An old growth forest inventory has been completed for the TCEF. A total of about 1475 acres exists within the TCEF or 16.6% of the project area. Table III-4 displays the size of the stands and the type of old growth vegetation. Map E-2, Appendix E, shows the distribution of the old growth across the TCEF. A portion of the old growth lies within the Onion Park RNA at the head of the Tenderfoot Creek. The existing old growth is a function of the past fire history. The old growth forest provide habitat for all the before mentioned species.

Table III-5 Old Growth Stands in the TCEF

Old Growth Type	No. of Stands	Acres
Lodgepole (LPOG)	2	269
Whitebark Pine/Lodgepole (WBP/LPOG)	2	146
Wet Mix Coniferous (subalpine fir, spruce, lodgepole) (WMCOG)	11	1060

Implementation of Alternative 1 will not effect the old growth habitat. This habitat is of the greatest risk of any habitat to a wildfire if one was to start in the TCEF. The fuel loadings are high and ladder fuels are abundant.

Alternative 2 (Proposed Action)

Direct and Indirect Effects

Elk

Implementation of Alternative 2 would result in the displacement of elk from the general area due to road construction and logging operations. This displacement would be for a period of approximately two years when management activity is taking place. Because the action will occur in both the Sun and Spring Park Creek drainages concurrently, it is predicted that the shift of elk would be down the main Tenderfoot Creek, to the south over Quartzite Ridge, or north into James-Horn Creek area.

The meadow complex in both drainages will be affected by the proposed treatment units. The meadow complex in Sun Creek will be given some protection by buffers along the edges of the Units 1, 2, 3, 5, and 8 as well as the marking intensity in all units. The visual cover from the Williams Park Road #586 will be reduced by about 50-75% in Units 1-4 depending on mortality and residual densities after burn-treatment. This will make the parks more visible from the road and may result in less use by elk or a change in timing of use by elk. It is anticipated that there will be an increase in forage available for elk in these units because of the high water table and habitat types. The utilization of this forage may not be totally realized until the units have advanced tree regeneration to provide some more structural cover from the Williams Park Road.

The meadow complex in Spring Park Creek will be given protection by buffers along the edges of Units 13 and 15 as well as the residual tree density in all units. The burn Unit B-2 will have some of the cover reduced but the main tree boles will still provide for some visual screening. This park is not seen from any open road, therefore, use along and in the park should remain similar to existing use after treatment. It is anticipated that Unit B-2 should provide additional forage for elk after the burn. Because it is hidden from any of the open road system it should be utilized immediately.

Elk security within the TCEF will be reduced approximately 8% by the proposed action resulting in 44% of the area remaining in elk habitat security. The 8% loss of habitat security is due to the reduction in cover in the treatment areas, and increased access to the areas via closed roads. This reduction is not expected to result in a negative impact on the MFWP goals for elk management within the HD or EMU.

Cumulative Effects

The cumulative effects area for elk is the portion of the Lewis and Clark National Forest within HD 413 (See Map E-1, Appendix E). The proposal results in a reduction in secure habitat within HD 413 from 68% to 67.8%; however, this reduction is not expected to result in an impact on the MFWP goals for elk management within the HD.

Currently, within the HD, there are no large timber sales scheduled and no major road construction taking place. To the south and east of the TCEF is the Coyote Creek Salvage Timber Sale, however, there is adequate space between the two areas for elk to move about without being further displaced from their home ranges. Timber harvest is or has taken place on private land within the South Fork of Tenderfoot Creek, downstream from the TCEF. There is adequate distance and topography relief between projects which result in no effects on the elk using the TCEF from this operation.

Boreal Owl

Direct and Indirect Effects

The direct and indirect effects of the action on the boreal owl will result in some direct habitat loss by the harvest/burn of old growth spruce fir/lodgepole stands. This will result in a loss of some of the nesting and roosting habitat, however, because the residual density will vary from 25-60% of current stand the loss will not be as severe as if the units were to be clearcut. The loss will be greater in units that will be cut and burned if only 25% of the residual stand is left and will be less in the units that will be

harvested with an average of 40-60% of the stand left. In these units, it is anticipated that very little habitat would be lost. Overall, it is predicted that 69 acres of boreal owl habitat would be lost.

Cumulative Effects

The TCEF has about 17% of its area in old growth forest. The major percentage of this old growth is in a wet mix coniferous type (see Map E-2, Appendix E). The rest of the old growth within the TCEF will not beaffected in anyway, thereby maintaining at least 14-15% of the area in old growth forest that would be usable by the boreal owl. Based on the direct, indirect, and cumulative effects, this alternative will result in a **"may impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or loss of viability to the population or species"**.

Wolverine

Direct and Indirect Effects

Very few direct effects to the wolverine are anticipated by implementation of the proposed action. The prescription for timber harvest should allow enough residual canopy that will allow the treatment units to function as usable habitat (i.e., foraging areas and travel corridors) for the wolverine. There are no large openings that will result from the proposed treatment. All new roads will be closed to public travel yearlong. There may be a reduction in denning areas within the old growth stands, however, there are still sufficient areas of old growth remaining for denning and foraging activities within the TCEF. The wolverine may be displaced from the immediate area during the timber harvesting activity.

An indirect effect that probably will occur is displacement from the potential denning habitat by snowmobiles if they use Unit B-1 to reach Quartzite Ridge. Snowmobiling on the talus slopes along Quartzite Ridge to the east of the TCEF is presently occurring, however, because the intensity of the burn in Unit B-1 is anticipated to be low with little stem reduction, this effect will be minimal.

Cumulative Effects

The area that surrounds the TCEF has had timber harvest in the past with most of it located to the east along the main Divide Road #839. During winter track surveys of 1997, considerable wolverine activity was recorded. Along a 17 mile transect (which includes about 7 miles along the TCEF boundary), which was ran three different times , wolverine tracks were recorded 12 times. It was evident by the tracks that stands of wet mix conifer mature/old growth were used more than other types along the transect. Other transects were run across the high elevation areas of the Little Belts during the winter of 1997, but none of them compared with the number of tracks encountered along this Divide Road transect. This area is one of the highest used areas for snowmobiling in the Little Belt Mountains and it is also one of the areas that timber harvest has been taking place since the 1950s. The wolverines appear to have been able to adjust to the amount of past activity within this area and are still able to reproduce and move through the area due to the sufficient areas of habitat security in Pilgrim, O'Brien, Lower Tenderfoot, and Deep Creek that meet the seasonal needs of the wolverine.

The timber sales that are scheduled or have been harvested (Smokey Corridor, Moose Creek, and Coyote Creek Salvage) in the area to the east and south of the TCEF have maintained travel corridors for other species as well as the closing of new and old roads to create secure areas for elk. All of these mitigation requirements for other species will also insure usable habitat for the wolverine. The maintenance

of the large amount of secure areas for elk within the area of the TCEF as well as maintaining a high amount of wet mix coniferous old growth will ensure large areas of undisturbed habitat for the wolverine. The additional treatment proposed by this alternative combined with the past activities does not appear to be a major impact that will decrease habitat significantly for the wolverine. All of the proposed new roads will be created with the minimum standards needed to harvest the timber and will be closed to public travel yearlong. Therefore, based on the direct, indirect, and cumulative effects this alternativewill result in a **"may impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or loss of viability to the population or species"**.

Lynx

Direct and Indirect Effects

The greatest effect on lynx habitat would be the harvesting of the wet mix coniferous old growth stands. The potential denning habitat for lynx is the same nesting and foraging habitat for boreal owls. The loss of habitat will be greatest in the units that are harvested and burned if only 25% of the stand is left. This would result in a potential loss of 69 acres of denning habitat, however, there still would be 14-15% of the old growth remaining within the TCEF. Because none of the treatments would result in a total loss of canopy, movement of lynx throughout the treatment area should not be compromised.

Lynx maybe displaced from timber sale activity during the summer/fall period. However, in cases of timber harvest within old growth stands, there are still old growth forest adjacent to the treatment units and adequate cover for the lynx to move their kittens to alternative den sites, if necessary.

Large blocks of undisturbed timber will still remain in the TCEF and adjacent areas. The large secure areas for elk will also suffice as refugia for lynx. Mortality risk will not be greatly increased because all roads will be closed to public travel and the lynx harvest is still regulated by a State quota.

A long term beneficial effect of the proposed treatment will be one of creating a mosaic of different successional stages within the TCEF. This will provide additional habitat for the major prey species, snowshoe hare.

Cumulative Effects

Cumulative effects for the lynx are very similar to what has already been covered for boreal owl, wolverine, and old growth. Based on the direct, indirect and cumulative effects, this alternative will result in a **"may impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or loss of viability to the population or species".**

Pink Agoseris

Direct and Indirect Effects

This alternative has been designed to minimize effects to the wet meadow complexes that exist within both of the treatment drainages. Units 3 and 4 are the units with the highest potential to provide habitat for pink agoseris based on the habitat type and wetness. Both units have considerable amounts of bluejoint, a wet site indicator plant, within them and this habitat is expected to expand once the logging has taken place. This will provide for an increase of potential habitat for pink agoseris. During the logging

some plants may be affected from the skidding, however, because the units have been designed to minimize effects to wet areas, very little long term damage is anticipated to this species.

Cumulative Effects

Additional habitat for pink agoseris exists throughout the TCEF in Onion Park RNA, Stringer Creek, Lonesome Creek, and the upper end of Sun and Spring Park Creeks. There are no anticipated effects to any of this potential habitat at this time. The implementation of this alternative would result in a **"may impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or loss of viability to the population or species"**. This is based on the amount of potential habitat that exists in the TCEF and the minimal amount of disturbance that will take place in the occupied habitat in Units 3 and 4.

Old Growth Forests

Direct and Indirect Effects

The direct effect of the proposal on old growth forest will be a reduction in canopy closure on about 178 acres. The treatment will not be a total loss of canopy because of the partial harvesting that will take place. There are 8 units for a total of 109 acres that will be harvested, but there will be on the average about 40-60% of the stand remaining. The remaining treatment areas, including the burned units may reduce the canopy down to 25% remaining on 69 acres. The loss of 75% of old growth canopy will alter the stand enough that they will no longer serve as old growth forest. So even though there is a total treatment of 178 acres, only 69 acres will be greatly affected by this entry. The vista point access will require clearing less than 1 acre of old growth. This disturbance may be reduced to zero if during road design and layout the road location is moved outside of the old growth stand.

Cumulative Effects

This alternative will have only a maximum effect on 2% of the existing old growth forest. Areas adjacent to the TCEF have had some analysis completed and all met or exceeded the Forest Plan Standard of 5% and in most cases exceeded 10%. These areas are the Moose Creek Area, south and east and the Belt Creek assessment area, that lies to the north of the TCEF. The old growth forest in the TCEF will continue to add to the total inventory for the Little Belt Mountains. It appears that Forest Plan Standards are being met and even exceeded within the project area and surrounding landscapes.

D. WATER RESOURCES

Information concerning the analysis boundary, data collection and analysis, and water quality and beneficial uses can be found in Appendix C of this document.

EFFECTS COMMON TO ALL ALTERNATIVES

Both natural events and human activities can have significant effects upon stream systems and water quality and quantity. The degree of effect depends upon the natural characteristics of the area, i.e., geology, landform and climate, and how sensitive and resilient these characteristics are to disturbance . Processes and components that result from these natural characteristics include soils, erosion, flow regimes, and vegetation. Natural events, such as wildfire and floods, and human activities such as fire suppression, timber harvest, and road construction can alter these processes and components and ultimately affect the beneficial uses of the water resource.

Natural Characteristics, Processes and Components

Precipitation and Flow Regimes

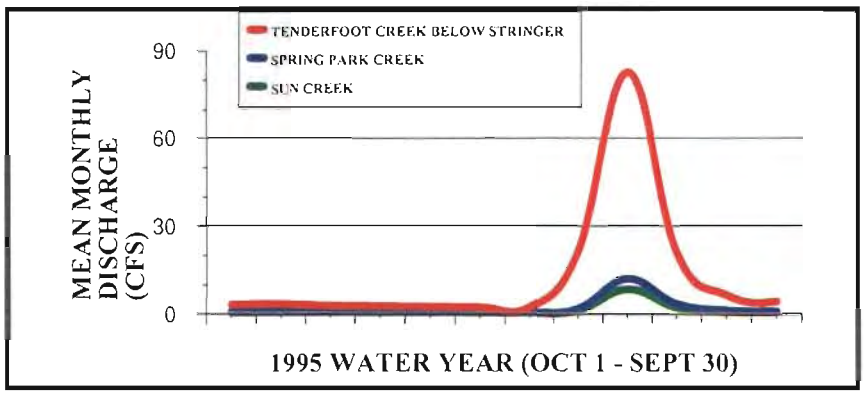
The underlying geology within TCEF includes gneiss, sandstone, shale, and rhyodacite. These structures have weathered to form rounded, relatively gently sloped landforms. The TCEF watershed has a general east-west orientation, while Sun Creek is north facing (low energy), and Spring Park is south facing (high energy).

Elevations within the TCEF range from 6030 feet on Tenderfoot Creek to 7944 feet at the head of Spring Park Creek. Mean elevations for Sun and Spring Park Creeks are about 7400 feet. Average annual precipitation associated with these mean elevations and based on the 1960-1990 period of record is 37 inches (USDA-SCS, 1977). The average annual precipitation based on the four precipitation stations in the TCEF near 7400 foot elevation is 36 inches (1993-1997 period of record). Although the majority of the precipitation falls as snow, a significant portion falls as spring rain in May and June. It is the combination of spring rains on top of melting snowpacks and/or saturated soils that causes infrequent, high magnitude flood events.

Extrapolating data from the Spur Park precipitation station (30 year record) suggests that the range of variation in annual precipitation for Bubbling Springs (elevation 7430 feet) could be as low as 18.5 inches (60% of average in 1987) to as high as 46.6 inches (128% of average in 1978). Comparing Spur Park data to a station near Cascade, Montana that has a period of record from 1905 to present, suggests that these values could very well represent the extremes in annual precipitation levels for the last century.

The precipitation regime and geologic characteristics are adequate to maintain streamflows throughout the year, and most likely even during drought years. Refer to Figure III-2 for hydrographs within the TCEF during an average precipitation year (1995).

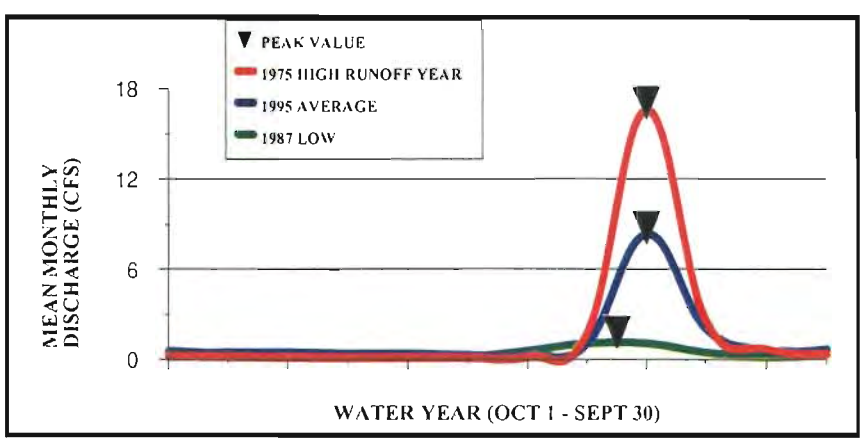
FIGURE III-2
TENDERFOOT, SUN AND SPRING PARK HYDROGRAPHS
AVERAGE PRECIPITATION/RUNOFF YEAR - 1995



Differences in geology, aspects, and drainage area do create differences in the stream runoff characteristics. The annual and peak discharge of Spring Park Creek is generally higher than Sun Creek because of the slightly larger drainage area and higher elevations that produce slightly higher precipitation levels. The discharge of Tenderfoot Creek, just below Stringer Creek, is higher than the sub-watersheds because of the larger drainage area.

Variations from the average runoff conditions result from changes in snowpack characteristics, melting rates, soil moisture, rainfall intensity/duration, and vegetative conditions. Figure III-3 depicts the range in runoff conditions that were measured and extrapolated for Sun Creek. The 1995 hydrograph was developed from actual discharge data measured on Sun Creek. The 1975 and 1987 hydrographs were extrapolated from the USGS/NRCS gaging station on Sheep Creek which has a 56 year record. During 1975, the spring discharge (May through June) on Sheep Creek was about 150% of normal, while 1987 was about 40% of normal.

FIGURE III-3
SUN CREEK HYDROGRAPHS
NATURAL RANGE OF VARIATION
FORESTED CONDITIONS



It is important to understand that this chart depicts the runoff characteristics under the current vegetative conditions of a mature forest. Runoff characteristics are expected to be significantly different under different stand conditions resulting from wildfire. The peak discharge values for the above hydrographs are also displayed in Figure III-4 (▼ symbol), Effects by Alternative, to define the lower limit of the range of natural variation for the three levels of runoff.

Erosion and Sediment

Erosion is a natural process of geologic decomposition that occurs in all watersheds and is a function of soil and stream characteristics, precipitation/flow regimes, and vegetative cover. There are three basic types of erosion; 1) detachment and routing of individual soil particles from the land surface; 2) mass movement such as landslides and slumps; and 3) detachment and mobilization of stream channel banks or bottom material, i.e., instream erosion. All of these processes produce "sediment", and all stream systems transport sediment downstream. Sediment is a loosely used term that can refer to a wide range of channel substrate particle sizes, i.e. silt, sand, gravel, cobble, boulder, etc. The larger particle sizes are generally produced through instream erosion or mass wasting and are commonly referred to as bedload. The finer particles that are suspended in flowing water can be produced through all of the erosion processes mentioned above.

The treatment areas are characterized by both weakly and strongly developed colder soils (classified as Cryochrepts and Cryoboralfs, respectively). Landtype 11 occurs in slightly sloping basins and has developed from old clay deposits overlying quartzite and sandstone beds. It dominates proposed treatment Units 1, 2, and 3, as well as the lower southern portion of Unit 8. It supports a mosaic of understory plant species (such as bluejoint reedgrass and false helibore) indicative of seasonal perched water tables. The topsoil is typically loam or clay loam with occasional quartzite cobble or stone. The subsoil is often clay or gravelly clay. These soils have poor bearing strength and thus are extremely susceptible to puddling (rutting) when wet and they compact easily when moist. Soil Resource Inventory landtype 20 occurs on ridgetop flats and basins with slopes generally less than 10 percent. It is associated with Units 5, 6, 7, 13, 15 and 16 as well as the upper part of Unit 8 and lower portion of Unit 14. Landtype 20 is characterized by well drained, very deep soils which have weathered from quartzite and sandstone. They typically have thin sandy loam or loam surface soils over very or extremely cobbly or bouldery sandy loams. Units 4 and B1 appear to be on a better drained inclusion within landtype 11 characterized by soils more typical of landtype 20. Landtype 27 dominates upper valley ridges associated with rhyolitic volcanic rock. It occurs in Units 12, 14, 15. It has thin silt loam surface soils (generally less than 5 inches thick) over very cobbly clay loam. The soils are generally less than 40 inches deep to bedrock and are well drained. These landtypes are relatively stable and not prone to mass soil movements such as slumps. The erosion hazard of the materials exposed during road construction is low due to high subsurface rock content.

Subsoils have varying degrees of permeability. Impermeable quartzite and sandstone structures have resulted in seeps and the formation of open wet meadows in the middle portions of the Sun and Spring Park sub-watersheds.

Soil organic matter and nutrients are concentrated in the relatively thin, poorly developed surface layers which are susceptible to mechanical displacement by heavy equipment. Excessive disturbance reduces overall site productivity and resiliency. These soils have medium textured surface soils (mostly loam or clay loam) which are conducive to compaction due to the wide range of soil particle sizes, prolonged

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periods of soil moisture favorable to compaction associated with the higher precipitation zone, and a relatively thin layer of protective ground cover (litter, duff, debris).

The hillslopes are timbered, except for the open talus slopes and meadows. These vegetation characteristics, combined with the landform and soil characteristics mentioned above, result in very low sediment delivery to streams, therefore, the current erosion process in TCEF is instream erosion. Mass wasting does occur but is limited to very small localized areas. Except for the infrequent influences of wildfire on vegetation and soils, surface erosion does not contribute significant sediment to Tenderfoot Creek under the current climatic regime. NOTE: Existing roads through TCEF have likely increased surface erosion but to a very limited extent.

The estimated average annual total (bedload plus suspended) sediment yield routed to the mouth of the sub-watersheds is approximately 2 tons/square mile/year and 14 tons/square mile/year for Tenderfoot Creek just below the confluence with Stringer Creek. This is based on suspended sediment data from water years 1995 and 1996 and an estimate for the percentage of bedload. This indicates that instream erosion on the Tenderfoot mainstem contributes a much higher proportion of the total sediment load within TCEF than do the smaller subdrainages. In general, sediment transport capacity exceeds sediment supply under average flow regimes.

Since sediment models are independent of precipitation and flow regimes, they are unable to generate sediment values that would represent the natural range of variation due to changes in precipitation and flow regimes. Since the major erosion process is instream erosion, we can expect the range in sediment yields to be roughly proportional to the range in peak flow levels. The range of variation in surface erosion induced sediment yields as they relate to changes in vegetative conditions, namely fire, can be modeled and are discussed under Alternative 1.

Human Influences on the Natural Processes and Components

The only major human-induced impacts to stream systems are roads and fire suppression. Other human-induced impacts which are not significant in the analysis area of the TCEF include timber harvest and grazing by wildlife.

Roads- Existing public roads are limited to Road #586 from Williams Park through Onion Park and the headwaters of Sun Creek (2.9 miles), Road #253 through the headwaters of Spring Park Creek (3.1 miles), and Road #840 which lies along the mainstem of Tenderfoot Creek, from Onion Park to the confluence with Passionate Creek (3.7 miles). Overland and shallow subsurface flow patterns in Onion Park and along areas above the wet meadows in Sun Creek, immediately adjacent to the road have likely changed. However, overall water quantity and quality are not expected to have changed significantly in the wet meadow complexes and stream systems further down slope. The road through upper Spring Park is near the divide and is not considered to have a significant impact. Portions of the road along the mainstem of Tenderfoot Creek have routed road drainage and low levels of sediment to Tenderfoot Creek for decades. Fillslopes and crossing sites with culverts have likely constricted flood flows. However, these effects are not considered to be significant during most runoff events.

Fire - Fire suppression efforts since the early 1900's have reduced the frequency and size of wildfires from historic levels. This has resulted in a nearly continuous canopy cover for most of this century. These conditions have likely resulted in reduced water yields (Farnes and McCaughey, 1997) as compared to historic levels when fire played a role in creating large openings in the forest canopy (refer to

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Alternative 1 discussion). It is also likely that erosion processes have changed without the influence of fire and have resulted in reduced sediment yields compared to historic levels. Suppression efforts have resulted in excessive fuel accumulations that may now create large and more wide spread stand replacement fires in the future.

Timber harvest - Past timber harvest is limited to a portion of one unit that lies along the ridgetop between Iron Mines Creek and Stringer Creek, and between Onion Park and Harley Park.

Grazing - Livestock grazing within TCEF is not currently allowed. However, it is likely that the open meadows and parks were used extensively by sheep in the early part of this century. Any lasting effects of this grazing is not currently observed. Some concentrated wildlife grazing currently occurs within the open meadow habitats and has resulted in excessive shrub utilization and localized, but minor bank damage.

Channel Conditions

The mainstem of Tenderfoot Creek is moderately entrenched with moderate sinuosity and gradients between 3-5%. Cobble sized material make up a majority of the channel substrate, including recent deposition areas. This equates to a B3 channel type. This stream type is relatively resistant to low/moderate increases in streamflow or sediment.

Channel scour and deposition is excessive and widespread throughout the mid and lower mainstem within TCEF. This is due to past flood events within the last few decades, and high intensity rain events that occurred in June of 1997. Record snowpacks and moist/saturated soils compounded the effects of these rain events. Woody debris and large cobble sized material in the stream moved easily under these flood conditions.

The valley bottom of the mainstem is forested and therefore, influenced by large woody debris. This debris helps to dissipate stream energy, control channel grade, and provide for diverse aquatic habitat. The valley bottom is also vegetated with willows and alder which help to trap sediment, reduce stream velocity, increase bank stability, and maintain channel form and water tables.

The mainstem of Sun and Spring Park Creeks are also B3 stream types, but with higher gradients, in the 6-8% range. They were also affected by the rain events in June, but not nearly to the same extent as Tenderfoot Creek. The channels are typically very stable as the channel bottom and banks are composed of cobble and boulder sized substrate and vegetated with deep rooted grasses. Only short segments of banks are stabilized by shrubs. Overbank flows appear to be well dissipated as deposition and scour are mostly absent.

The headwater reaches of Sun and Spring Park Creeks are comprised of open, wet meadow complexes with numerous small channels that flow year-round. Sinuous, low gradient streams dominated by gravelly or finer textured channel substrates occur in these wet meadows and a segment of less sinuous streams occurs with a gravelly substrate below the meadow in Spring Park Creek. These stream types are much more sensitive to increases in streamflow and sediment than B3 types.

Currently, beaver do not play a significant role in channel development. No evidence of beaver activity was found in the sub-watersheds of Sun or Spring Park, or on the mainstem of Tenderfoot Creek below these sub-watersheds.

2. EFFECTS BY ALTERNATIVE

Introduction

Only the Sun Creek sub-watershed was chosen for modeling water and sediment yields. The rational for this is due to the fact that the proposed activities are expected to be greatest in this sub-watershed compared to any other possible cumulative effects point in the Tenderfoot Creek drainage. Also, because of the low energy aspects of this sub-watershed and the potential for it to hold snowpacks longer, spring streamflows have the potential to be quite flashy, i.e., rise and lower rapidly. Therefore, Sun Creek was used as it would create the greatest effects for modeling the proposed harvest activities and past wildfire conditions.

The proposed activities of timber harvest and burning were converted to a equivalent clearcut area (ECA) and the results displayed in Table III-5. In general, activities that disturb more than 20% ECA within a watershed are likely to be measurable and may potentially cause changes in water quantity/quality and channel conditions. With respect to the sub-watersheds, Sun and Spring Park, the ECA values indicate that Sun Creek has the potential to be the most impacted.

TABLE III-5
PROPOSED HARVEST/BURN/ROAD ACRES

WATERSHED	TOTAL ACRES DISTURBED	% OF DRAIN-AGE	ECA ACRES	% OF DRAIN-AGE
SUN	377	43	205	24
SPRING PARK	387	37	218	21
TENDERFOOT BELOW SPRING PARK CREEK	780	25	433	14
TENDERFOOT AT TCEF BOUNDARY	780	10	433	5
TENDERFOOT AT SMITH RIVER	780	1	433	<1

ECA = equivalent clearcut area. The area that is equivalent to one clearcut acre. For example, one acre of harvest (50% crown removed) is equal to 0.4 ECA acres.
NOTE: The Total Acres Disturbed may not match other acres listed in this document because 1) roads are included here and 2) a portion of Unit 7 lies outside of the Sun Creek watershed.

Increases in peak flows are considered to be the main concern with respect to impacts to the water resources. The rational for this is due to the fact that the existing erosion process in TCEF is instream erosion. Increases in peak flows have the potential to compound these instream erosion processes. As previously mentioned, sediment models are unable to generate sediment values derived from in-stream erosion. Modelling results are presented, but only in relation to changes in surface erosion due to wildfire and harvest/burn/road activities. Since landtypes have a relatively low erosion hazard, and since ground disturbance will be minimized through planned harvest operations, increases in sediment loads to streams is not a major issue. Therefore, the main focus of the effects discussion will be on changes to spring runoff processes and subsequent effects of increased peak flows on instream erosion processes.

Alternative 1 - No Action

Watersheds, undisturbed by human influences, are not static systems. Deep snowpacks and heavy spring rains can cause significant flooding to occur. Catastrophic mortality in terms of wildfire, wind, or insects and disease can drastically alter the vegetative composition of a watershed. Depending on the degree of mortality and rate of stand decomposition, impacts to stream systems can be significant (Bethlahmy, 1975 and Tiedemann et al., 1975). Beneficial uses, including fisheries habitat, can be negatively affected by these natural events. However, watersheds left undisturbed after these events, can and do recover rapidly, and ultimately provide conditions that fully support all beneficial uses within a relatively short period of time (30-60 years).

Water and sediment yields were modeled using parameters that represent the hypothetical conditions that were present after the 1873 fire in TCEF. Since post-fire streamflows will vary dramatically depending on the precipitation/runoff conditions following a fire, results were generated using values for high, average and low precipitation/runoff conditions. The peak discharge values for these three conditions are displayed in Figure III-4 (symbol).

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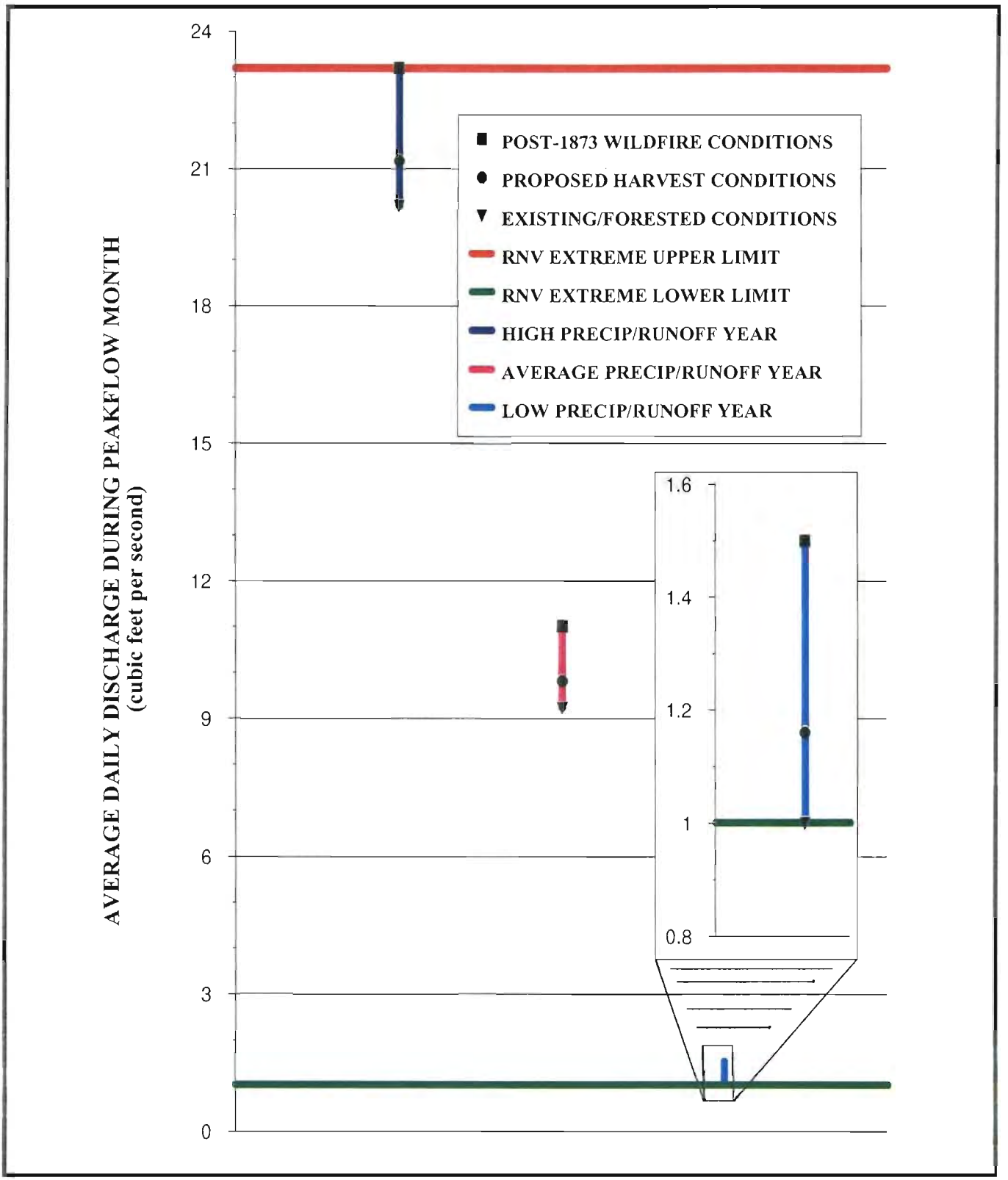
FIGURE III-4
SUN CREEK
RANGE OF VARIATION IN PEAKFLOW

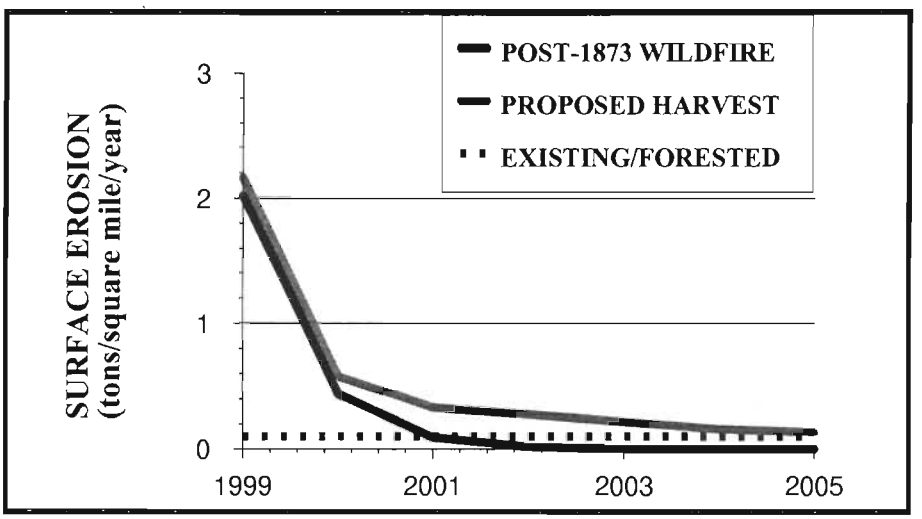


RNV= Range of Natural Variation

The discharge levels for post-1873 fire conditions were expected to have produced peak flows of 15%, 19% and 50% above the existing/forested conditions for high, average, and low precipitation/runoff years, respectively. Although the percent increases for low precipitation/runoff years are much higher than average and high years, peak flows are not expected to even approach bankfull flow levels and therefore, would not affect instream erosion processes. The discharge levels for post-1873 fire conditions followed by a high precip/runoff year define the extreme upper limit of the range of variation (red line), while the levels associated with the existing forested conditions under low precip/runoff conditions define the extreme lower limit of the range of natural variation (green line).

The modeled results for post-fire sediment yields suggest that surface erosion could increase to 2.0 tons/square mile/year. Please refer to the figure below.

FIGURE III-5
SUN CREEK
ANNUAL SURFACE EROSION



As previously discussed, current surface erosion within TCEF is basically non-existent under forested conditions. Therefore, the natural range of variation in surface erosion induced sediment yield in Sun Creek is from essentially 0-2 tons/sq.mi./year. The chart suggests that sediment yields resulting from wildfire events will decrease rapidly and return to near zero within three years. Since sediment models cannot account for increases in instream erosion as a result of increased streamflows, we can only surmise that total sediment yields (surface and instream erosion) would have been higher during abnormally high precipitation/runoff years following the 1873 fire. NOTE: The existing level of surface erosion depicted in Figure III-5 is estimated to be 0.1 tons/sq.mi./year due to the existing road through the south end of the drainage.

The stream systems within the TCEF have historically gone through cycles of stability and instability in relation to the ranges of variability in peak flows and erosion as previously described. Given the current vegetative conditions, the potential for stand replacement fires to occur is high. When they do occur, significant channel adjustment is expected, but only during years of average or higher precip/runoff conditions. The effects may be similar to those created after the 1873 wildfire if fire magnitude is similar. If

left undisturbed for the long term, i.e., no salvage timber sales or road construction, stream systems are expected to stabilize within 30-60 years as timber stands regenerate.

The actual soil disturbance for this alternative would be mostly within the "historical common range of variation". It would be restricted mainly to disturbances related to tree blowdown, burrowing animals, and ungulates. Scattered soil (physical and chemical) alteration may occur in the event of a severe wildfire. This is mainly associated with existing ground fuel concentrations. Soil organic matter and nutrient loss is likely due to the relatively high temperatures associated with severe fires (especially where greater residence times are involved).

Cumulative Effects

The effects of a stand replacement fire, downstream from the TCEF, will be highly dependent on the intensity and amount of area burned. Even if the entire Sun Creek watershed burned with high intensity, it would cover only 10% of the area within the TCEF and only 1% of the entire Tenderfoot watershed to the Smith River. The effects on streamflows and erosion may be measurable immediately below TCEF, but are not expected to be significant. Fires of the magnitude of those that occurred in 1873 and covered large areas throughout the TCEF, would begin to impact downstream reaches in terms of channel adjustment.

The effects of a stand replacement fire within Spring Park Creek are expected to be similar to those discussed for Sun Creek.

Alternative 2 - Proposed Action

Management activities have the potential to alter the hydrologic and erosion processes and ultimately cause changes in channel characteristics and beneficial uses. Timber harvest and road construction activities that remove forest canopy, may increase snowpack depths and melting rates, which may result in increases in on-site water yield (USDA-FS, 1974). These same activities may cause varying degrees of soil exposure, soil compaction and changes in surface runoff efficiency.

The Best Management Practices, found in Appendix B, are intended to control the extent, kind, and distribution of soil disturbance. They permit areas to be treated and site specific objectives met, while reducing the impact on long term productivity and watershed function. Forest Service Soil Quality Standards and Guidelines (FSH 2509.18, R-1 Supplement No. 2509.18-94-1, effective 5/4/94) and the soil resource guidance in the Forest Plan (page 2-50 through 2-52) would be satisfied. They would protect soil quality sufficiently and would not result in impairment of land productivity as prohibited by the Forest and Rangeland Renewable Resources Planning Act of 1974 and the Multiple Use Sustained Yield Act of 1960, respectively.

The primary adverse impact which can result from ground based mechanized silvicultural treatments most often directly observed in field studies results from the combined effects of both compaction and displacement of surface soil (Childs et al. 1989). Productivity losses resulting from soil disturbance are difficult to predict. Actual losses depend on the percentage of area impacted, associated growth decline for a given level of impact, and the rate of recovery. The percentage of area impacted is relatively easy to estimate and manage (Clayton et al. 1987). Reduction in root growth, tree height, and timber volume have been associated with compacted soils (Clayton et. al. 1987 and other studies referenced in Perry et

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al. 1989). In central Idaho, the physical effects of compaction have persisted for more than 40 years at moderate depths in volcanic soils and only surface recovery was noted in granitic soils (often considered resistant to compaction due to their high sand content) after 25 years (Froehlich and others as referenced in Clayton et al. 1987). The temperate climate in central Idaho is somewhat similar to the Tenderfoot Research area in that freezing and thawing cycles would be expected to have at least a limited role in amelioration of compacted surface soil. Most of the affected soils in the TCEF have medium textured (loamy) surface layers with relatively low clay contents. They would not be subject to exaggerated shrinking and swelling when soil moisture fluctuates - further reducing the potential for rapid natural breakup of compacted soils. Such detrimental disturbance may result in increases in feeder root pathogens and host stress, predisposing trees to insect and disease attack (Harvey, et al. 1989).

For analysis purposes it is estimated that a 25-60% loss in growth potential could occur on the most severely (detrimentally) disturbed areas over the rotation. It is assumed that areas occupied by system roads are irretrievably committed to that use and are rendered relatively nonproductive from a vegetative standpoint.

Ground based yarding would result in approximately 8-12% detrimental disturbance of the soil surface area within the treatment units. This disturbance would be mostly a combination of compaction and displacement associated with more heavily used skid trails. Landings in Units 3, 4, 5, 6 and 7, and temporary roads would increase the probable extent of detrimental disturbance. Additional mechanical scarification to enhance seedling germination is not planned. Restricting heavy yarding traffic to a minimal number of well located approved skid trails and managing the size of landing areas would reduce the extent of detrimental disturbance. Yarding when the soils are dry or over slash could reduce the extent and severity of soil compaction by 25-50% in all but the heaviest traffic areas. Yarding over snow or frozen ground would likely reduce the amount of detrimental disturbance by 90% or more. Mechanized ground based equipment operations would be contractually restricted to dry soils, frozen ground and/or snow conditions in the relatively wet to moist Units 1, 2, and 3. In the event unexpected rutting should occur (a form of "resource damage" under the timber sale contract), the operation would be delayed until more favorable ground conditions exist.

Additional compaction and displacement should be minimal in Units 5, 6, 7, 8, 9, 11, 14, and 15 as a result of excavator piling because such equipment usually operates over a bed of slash. Only the excess slash would be piled. The remaining material would contribute to fine and coarse woody debris available to soil organic matter and nutrient cycling.

Fire produces charcoal and ash which have been linked with the maintenance of adequate michorrhizzal activity. Burning within prescription (which consider the level of duff reduction and adequate retention of coarse woody debris) poses little risk to long term soil productivity and often provides a nutrient flush. Hand lines built in conjunction with the prescribe burns causing only superficial soil disturbance.

Where such detrimental disturbance occurs site productivity would be lowered and plant species adapted to more disturbed soil conditions would be favored. Although these effects are severe they would be limited in extent to areas more heavily impacted by machinery. Although this projected disturbance would be within the Agency's current standards for soil protection, it exceeds that which would likely occur within the "historical common range of variation" (associated with the pre-European man influence period). It would be impractical to manage strictly within the very low historical natural range of soil disturbance due to access requirements, vegetation treatment needs, and economic considerations. Reduced levels of detrimental disturbance complement long term maintenance of ecosystem function.

The limited, well located skid trails and less impactive site preparation practices included in this alternative restrict and lessen the impact.

The effectiveness of ripping skid trails and landings as a rehabilitation measure would be limited by high subsurface rock contents and shallow loamy surface soil layers (often less than 10 inches thick) associated with the forested soils. In Units 4, 5, and 6, large surface rock provide a further obstacle to ripping or subsoiling of compacted areas. Field sampling of Units 9, 10, 11, and 12 indicate thicker (10 inches plus) loamy surface layers which would be more conducive to effective mitigative ripping and subsoiling of compacted areas if required.

The main skid trails associated with the even distribution shelterwood harvests could possibly be reused in future entries - reducing the longer term cumulative impacts. This scenario seems less likely in the case of the grouped distribution shelterwood harvests as the next entries would require new trails to different areas of the units.

Water yields were modeled for the proposed harvest and road activities. As with forested and wildfire conditions, results were generated using values for high, average and low precipitation/runoff conditions. The peak discharge values for these conditions are displayed in Figure III-4 (● symbol). The discharge levels for post-harvest/burn/road conditions are expected to have produced peak flows of 5%, 6% and 16% above the existing/forested conditions for high, average, and low precipitation/runoff years, respectively. Although the percent increases for low precipitation/runoff years are much greater than average and high years, peak flows are not expected to even approach bankfull flow levels and therefore, would not affect instream erosion processes.

Surface erosion due to the proposed harvest/road/burn activities is expected to increase to 2.2 tons/sq.mi./year for the year immediately following the completion of all proposed activities. Approximately 80% of this is due to new road construction (system and temporary). The proposed new roads are located in well drained soils and there is no risk of mass soil movement should the proposed action be implemented. Since the proposed system roads will be closed yearlong after completion of harvest activities and temporary roads obliterated, 80-95% of the road related sediment would be mitigated. Surface erosion is expected to return to the existing level of 0.1 tons/sq.mi./year within five years. Refer to Figure III-5.

The percentage of fines within the channel substrate are expected to increase slightly for 3-5 years following the activities. However, due to the high sediment transport capacity of these streams, these fines are expected to be transported downstream from the TCEF. Instream erosion is expected to increase roughly proportional to the expected increase in peak flows, but only during years of average or higher precip/runoff conditions. It would be measurable only during the high precip/runoff conditions.

The effects of the proposed activities within Spring Park Creek are expected to be similar to those discussed for Sun Creek.

Cumulative Effects

The information from the ECA calculations suggest that impacts of the proposed activities on the mainstem of Tenderfoot Creek below the TCEF boundary are likely to be very low. Therefore, the proposed activities are not expected to be measurable and therefore, add to the existing or future impacts that have

orwill occur along the lower reaches of Tenderfoot Creek on private or National Forest lands. Nor are these proposed activities expected to impact the existing conditions of the Smith River, a water quality limited stream (MT-DEQ, 1996). This is due to the buffering effect of 10 to over 20 miles of Tenderfoot Creek that exist below the treatment drainages, and also due to the differences in water quality and quantity between Tenderfoot Creek and the Smith River.

Comparison of Alternatives

Peak flows are expected to increase due to the proposed harvest/road/burn activities, but will not reach the same levels as post-1873 wildfire conditions. The modeling results suggest that peak flow increases after the proposed activities will be 9 to 22% lower than under the post-1873 wildfire conditions.

Instream erosion due to the proposed activities is predicted to be lower than post-1873 wildfire conditions under average and high precip/runoff conditions. Surface erosion due to the proposed activities is predicted to be 7% higher than post-1873 wildfire conditions. However, this difference is likely not significant when modeling errors are accounted for. Surface erosion will never return to the lower limit of the range of variation (essentially zero) because of the existing and maintained road in Sun Creek.

However, an absolute, 1:1 comparison of these two impacts is not completely justified, since the wildfire modeling parameters included all of the acres burned within Sun Creek, which amounted to over 700 acres. There are only 384 acres of proposed harvest activities. Modeling the post-1873 wildfire conditions was mainly to identify the upper limits of the range of natural variation.

It is likely that the proposed activities will remain within the extreme limits of the natural range of variation for peak flows. However, a comparison with the natural range of variation should not be limited to the magnitude of the variables, but should also include the frequency of occurrence. The mean average stand replacement fire cycle is estimated to be 179 years. Since post-fire hydrologic recovery is expected to take 30-60 years, relatively undisturbed conditions (except for smaller intermediate fires) could be expected during most of this time frame, i.e., 120 to 150 years. This is commonly referred to as a "pulse" disturbance; high intensity, low frequency.

In contrast, current timber management leans towards low to moderate intensity and moderate to high frequency. This is commonly referred to as "chronic" disturbance and is somewhat opposite of natural cycles. If additional activities are implemented in Sun Creek, to a degree similar to the proposed and within the next 180 years, disturbance frequency would be outside the natural cycles for water yield and subsequent instream erosion. Even if future activities do not involve new system road construction, there would likely be some level of temporary road construction. Therefore, the frequency of surface erosion induced sediment would also likely exceed the frequency associated with natural fire cycles. It is apparent from this discussion that implementing two-story management of lodgepole pine while attempting to maintain natural cycles of sediment delivery pulses to stream systems will be difficult.

It is likely that the proposed activities could reduce the potential for future wildfires and related impacts within the subdrainages. However, unless future vegetative treatments occur within other areas surrounding these subdrainages, Tenderfoot Creek, both within TCEF and downstream, could still be significantly impacted in the event a future catastrophic event occurs.

E. Additional Issues to be Considered

1. Heritage Resources (Survey No. 97-LC-07-047)

A review of the archaeological data base on the Forest indicated that minimal data exist for the Tenderfoot Experimental Forest. As of May 31, 1997, only 51 acres (or .57% of the analysis area) within the experimental forest had been surveyed for cultural resources. No cultural resource sites were documented as a result of these surveys although surveys conducted outside of the analysis area boundary resulted in the discovery and recording of one historic trail and one prehistoric period lithic scatter. An estimated 125 acres have been surveyed for cultural resources within one mile of the designated analysis area.

In 1995 an ethnographic overview (Deaver 1995) for the Forest was completed under contract to identify locations of traditional cultural concern from American Indians. A review of this document indicated that no traditional cultural sites have been identified within the analysis area.

Two cultural resource sites were documented within proposed cutting units and three cultural resource sites were documented within the analysis area but outside of proposed cutting unit boundaries.

The no action alternative will have no effect on any identified or previously unidentified cultural resources. The proposed action alternative, however, does have the potential to effect two of the identified cultural sites. The three cultural sites located beyond the cutting unit boundaries will not be impacted by proposed timber harvest and prescribed burning. These sites are also located within the boundary established for the Onion Park Recreational Natural Area and therefore are afforded protection from ground disturbing activities.

The only historic sites identifies were two sheep driveways which traverse some of the cutting units. One of these sites has been determined to be insignificant due to loss of historical integrity. Proposed harvest and burning activities will not impact this site because past road construction and natural regeneration have significantly altered the setting and appearance of this site; additional impacts will be no greater than those already existing. In addition, the Forest is only required by law to consider impacts and manage significant sites determined eligible for inclusion in the National Register of Historic Places.

The second sheep driveway is an excellent example of past driveways and maintains its historical integrity. This site traverses portions of cutting Units 3, 4 and 8 and is readily visible in its forest setting. A line of stock driveway signs mark either the centerline or the external limits of this driveway. Because it retains integrity, is readily apparent, and is a good representation of stock driveways during the period from 1919 to the early 1960's, this site has been documented as a significant cultural resource. Proposed harvest activities and burning have the potential to effect this site although special provisions have been designed to mitigate anticipated effects. Refer to the Mitigation section of this document for specific mitigation concerning heritage resources.

2. Recreation

The present recreation setting within the project area is "Roaded Natural." The primary activities in the area are hunting, fishing, motorcycle riding, snowmobiling, dispersed camping and viewing scenery. The Onion Park Research Natural Area (RNA) is located on the east end of the project area. The Onion Park RNA is a popular destination for photography and botanic interests, as indicated through comments during the scoping period.

There are two marked and groomed snowmobile trails within the project area. The "V" loop which links Road #839 to Road #586, crossing the upper portion of Tenderfoot Creek. The other is trail "P" which follows Road #586 and connects with Sheep Creek Road #119, trail "I". There is one system trail which starts at Road #840 at Onion Park and leads into Tenderfoot Trail #342. The road portion of the trail within the project area is presently closed yearlong to ATV's and road vehicles.

The highest use of the area occurs in the fall during big game hunting season. The main roads used by hunters to travel through the project area are Williams Mountain Road #586 and Divide Road #839. There are several dispersed camping sites throughout the project area.

Implementation of Alternative 1, no action alternative, would not effect the recreation setting. The area would continue to be used for hunting, fishing, motorcycle riding, snowmobiling, dispersed camping and viewing scenery. Onion Park RNA would continue to be a popular destination for photography and botanic interests.

Implementation of Alternative 2, the action alternative, would not affect the recreation setting of the TCEF. The area would remain "Roaded Natural." If logging activity continues into hunting season, hunters will be displaced to other areas. New road construction would provide easier access by foot and horseback into the project area, therefore, hunting would most likely increase due to increased and easier access in subsequent years. Winter logging, hauling, and snowplowing might cause displacement of snowmobilers during logging activities along portions of Williams Mountain Road #586, trails "V" and "P", and a portion of Road #839, trail "P". To meet research objectives of the TCEF a vista point/interpretative site would be constructed. This site would provide viewing, educational and recreational opportunities. Firewood removal on the entire TCEF will be restricted for future research purposes.

3. Noxious Weeds

Noxious weeds are rapidly spreading throughout the State of Montana. A weed is defined as a plant that is growing outside of its desired location. The term "noxious weed" is a legal term, designated by State and County weed control laws. Noxious weeds designated by the state as Category 1 are those species that are currently established and generally widespread in many counties of the state. Category 1 noxious weeds known to occur near the project area or along the transport routes include Canada thistle, Bull Thistle, Spotted Knapweed and Leafy Spurge. These infestations are currently being treated by chemical control methods and will continue to be in the future within the project area. [Lewis & Clark National Forest Supplemental Environmental Impact Statement for Noxious Weed Control, May 1994].

When more of an area is disturbed more suitable sites for noxious weed spread would be created. Alternative 2 potential for noxious weed spread and establishment is directly related to the acres disturbed by road construction, timber harvest and burning. Thus, Alternative 2 provides a greater risk for the spread of noxious weeds. Even though there would not be any additional disturbance in Alternative 1, no-action, the risk of additional noxious weed infestations would increase due to a projected increase in vehicle travel and recreation use within the project area which is expected to continue in future years.

Another opportunity for the spread of noxious weeds is through the use of weed infested products utilized during road construction. In 1996, The Lewis & Clark National Forest implemented Weed Seed Free Feed Order #96-1 effective May 30, 1996. This order states: "Only pelletized feed or certified weed seed free hay, straw, whole grains, and cubed products are authorized within the Lewis & Clark National Forest. All hay, straw, whole grains, and cubed products must be certified by an authorized federal, state, or county office as being free of noxious weed seeds. Each bale or container of forage shall have a tag or label referencing the written certification attached." This order is part of the Forest Service integrated pest management approach to prevent and control noxious weeds.

Soil disturbance associated with road construction/reconstruction, timber harvest activities, and slash treatment would create suitable sites for the establishment of noxious weeds. Noxious weed seeds can be dispersed from machinery (e.g. log trucks, pickups, dozers, skidders) traveling along and within these disturbed areas. Special management guidelines for the prevention and control of noxious weeds would be applied during development and maintenance activities in accordance with Forest Plan Standard D-2, Noxious Weeds and Other Pest (pp. 2-38 and 2-39), the Lewis and Clark Forest Supplemental Environmental Impact Statement for Noxious Weed Control, May 1994 and Weed Seed Free Feed Special Order 96-1, May 1996. Specific mitigation for noxious weed control can be found in the Mitigation section of this document, Chapter II, Section F, Sale Area Improvement Opportunities.

4. Visual Resources

The area being considered for harvesting is not visible from any Forest Plan viewpoints. The VQO (visual quality objective) for the management area is Partial Retention or Modification. Proposed shelterwood treatments and prescribed burns will meet those VQO's. Proposed treatments are also in scale with past burn patterns.

5. Range

Forage is an important resource in the TCEF project area. Grasses, forbs, and shrubs provide forage for both wild and domestic grazing animals. There are currently no grazing allotments located in the project area. The Harley Park Camp Unit of the Deep-Iron S&G Allotment is located along the northeastern boundary of the project area. The allotment is grazed under a two-unit rest rotation system by 900 ewe/lamb from July 1 to August 31. This results in the Harley Park Camp being grazed approximately 6-8 days every other year. Sheep are loaded/shipped out of Harley Park each year at the end of August.

6. Transportation Systems

The TCEF is accessed by Forest Development Road (FDR) #253, Dry Park Road, on the North, FDR #586, Williams Park on the Southeast, and FDR's #840 & #840A (Tenderfoot and Onion Park, respectively) along the East end and down Tenderfoot Creek. Road #840, Tenderfoot Creek, begins at the head of Tenderfoot Creek and extends westward down along the creek for 2.5 miles where it becomes Tenderfoot Pack Trail #342. Road #840 is gated at the beginning and open to vehicular travel for administrative use only. Additionally, a sheep drive trail passes through the area and is used by the grazing permittees in moving between allotments. The roads and trails have been constructed for timber removal, mining access , and fire protection over the years. There are 14.1 miles of existing roads in the TCEF. Of these, 5.2 miles are improved graveled road and the remainder are unimproved, native surfaced roads.

FDR Road #586, Williams Park Road, provides the main access to this area. It joins FDR #839, Divide Road, at the east edge of the TCEF. Both these roads are improved graveled roads suitable for travel by cars and other two-wheel drive low clearance vehicles. Williams Park Road was reconstructed in 1980, and Divide Road was reconstructed and graveled in 1996. The routes, other than FDRs #840 & #840A, are open for traffic yearlong and closed seasonally by weather conditions

For Management Area K, the Forest Plan calls for minimizing public access by allowing motorized access on existing roads and travelways; and roads constructed or reconstructed for research activities will be closed to public use. TCEF has 8,873.7 acres, or 13.87 square miles. The existing roads density is determined as 14.1 miles per 13.87 square miles or 1.02 miles of road per square mile. In the TCEF there are 9.9 miles of open road which equals 0.7 miles of open road per square mile.

The transportation system is currently managed in accordance with the Forest Travel Plan as revised in 1997. The Travel Plan designates the TCEF and areas around it Area Restriction R. Area Restriction R prohibits road vehicles and all-terrain vehicle operation yearlong except on roads designated for unrestricted travel. Roads #586 and #253 are unrestricted yearlong. Roads #840 & #840A are gated and closed yearlong to vehicular through traffic.

The responsible official is proposing to change the area restriction designation from "R" to "C". Area restrictions "R" and "C" are very similar. The only change that would result from moving the area restriction from "R" to "C" would be that trailbikes would be restricted "Yearlong" rather than Oct 15 to Aug 30, as is the current restriction.

Proposed road construction associated with the research project involves building 4.1 miles of new system road. The system roads constructed will be of the minimum standard necessary for the vegetation management plans associated with the various units while protecting the resources, providing for long term management of the area, and user safety. Avoidance of user conflict in the TCEF will be maintained by continuing restricted public access to the area during and after harvest operations. Vehicular access on the roads in TCEF will remain limited to administrative and fire control operations associated with research projects. There will be an estimated 2.3 miles of temporary roads constructed for access within the treatment units and around leave islands within the units. These temporary roads will be restored after harvesting and put back into production by seeding and planting with native plant species. This work will be accomplished under provisions of the timber sale contract, specifically those relating to temporary roads (CT 6.6, CT 6.601#, and CT 6.603#).

7. Environmental Justice (E.O. 12898)

Examination of community composition, as required under E.O. 12898, found no minority or low income communities to be disproportionately affected under any of the alternatives. This was not raised as an issue during public scoping.

8. Roadless

This issue is being considered due to public concern expressed during the scoping period. The project area, the TCEF, is not within a roadless area. The TCEF is neither unroaded nor undeveloped. Roads were constructed into the TCEF to provide access in the early 1960's. There are four roadless areas in close proximity to the TCEF. They are Tenderfoot-Deep Creek, Calf Creek, Eagle Park, and Pilgrim Creek Roadless Areas. There would be no effect to the roadless characteristics of any of the roadless areas as a result of the proposed research activities.

IV. LIST OF PREPARERS

The following list includes all the individuals who contributed to the preparation of the Tenderfoot Creek Experimental Forest EA. The interdisciplinaary planning team and technical support group consisted of individuals from the Lewis and Clark National Forest (LCNF), Helena National Forest (HNF), Beaverhead-Deerlodge National Forest (BDNF), Rocky Mountain Research Station (RMRS), and the Northern Regional Office (R1).

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Don Godtel	Wildlife Biologist, LCNF
Dr. Colin Hardy	Assistant Project Coordinator, Research Forester, RMRS
Larry Laing	Soils Scientitst, LCNF/HNF
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Dr.Ward McCaughey	Project Coordinator, Research Forester, RMRS
John Metrione	Forestry Technician, LCNF
Mark Nienow	Hydrologist, LCNF
Guy Schmidt	Transportation Planner, LCNF
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Jefferson Division

Listed Species

Peregrine Falcon	Falco peregrinus anatum	Endangered
Gray Wolf	Canis lupus irremotus	Nonessential Experimental
Northern Bald Eagle	Haliaetus leucopcephalus	Threatened

Candidate Species

Mountain Plover	Charadrius montanus
Swift Fox	Vulpes velox

Rocky Mountain Division

Listed Species

Peregrine Falcon	Falco peregrinus anatum	Endangered
Gray Wolf	Canis lupus irremotus	Endangered
Northern Bald Eagle	Haliaetus leucopcephalus	Threatened
Grizzly Bear	Ursus arctos horribillis	Threatened

Candidate Species

Swift Fox	Vulpes velox

The USFWS concurred with the list of species in a letter to the Forest Supervisor dated April 8, 1997 (filed in 2670 FY 97 Forest Supervisor Files, Great Falls, Montana), and also stated that no Proposed Species existed on the Forest. In a May 27, 1997 letter from the US-FWS to the Forest Supervisor, the Service stated that the status of the **Canada lynx (*Lynx canadensis*)** had been reassessed and it was determined that it was warranted but precluded from listing. This finding automatically elevated the lynx to candidate species status. Therefore, lynx has been added to the list of candidate species for both Divisions.

II. AFFECTED ENVIRONMENT

A. Threatened and Endangered Species

Northern Bald Eagle: Bald eagles are occasionally seen hunting for carrion and other food sources during the spring and fall migrations. Bald eagles are also known to winter along the Smith River drainage bordering the Little Belt Mountains.

Bald eagle nest sites typically require large overstory trees with an average bole size of 43 inches dbh (Issacs and Anthony 1987). Nest sites tend to be near bodies of water with relatively little human disturbance. Nesting takes place in January or February, with incubation occurring by early March. Fledging occurs from late June to early July. Food items are variable. Scavenging occurs on whatever is available (e.g. roadkills) during the winter months with a general transition to fish and small mammals during the spring. Bald eagles seem to be expanding their nest sites throughout Montana. Maintenance of roosting, foraging, and nesting habitats is important when possible. Typical foraging habitat, rivers or lakes are not found within the project area. Lack of a preybase and preferred habitats are the limiting factors for bald eagles in the TCEF. No known nest sites, nesting territories, or winter roost sites have been found on National Forest System Lands in the TCEF.

No bald eagles nest territories have been located during general field reconnaissance, since 1991, which were associated with timber sales, livestock grazing, road access, and northern goshawk nest territory monitoring. Bald eagles are one of several large raptors that do not need specialized equipment for their detection. No bald eagle nest territories were recorded for the Little Belt Mountains during extensive raptor surveys completed by Elenowitz in 1978 and Vandehey in 1986. The Little Belt Mountains are not historically known or considered to be bald eagle habitat.

Peregrine Falcon: Peregrine falcons have relatively strict nesting requirements: vertical cliff habitat with large potholes or ledges that are inaccessible to land predators and are preferably located near habitat with a high avian prey population (Hunter et al. 1988). Peregrines nest on cliffs and forage over broad, open areas especially associated with riparian and wetland areas. Suitable nesting habitat for peregrines exists on most of the major drainages in the Little Belt Mountains, however none exist in the TCEF project area.

Even though the Little Belt Mountains support suitable peregrine falcon habitat, peregrine falcons are not known to inhabit them. No peregrine falcons or nest territories were identified during the Elenowitz and Vandehey surveys. No peregrine falcons were detected during a general field reconnaissance since 1991. Field surveys of the Smith River in 1995 did not reveal any nesting peregrine falcons, even though there were reports of two nesting territories. Both territories turned out to be prairie falcons.

Gray Wolf: The Little Belt Mountains are part of the Yellowstone National Park (YNP) experimental population area for released gray wolves. Although wolves are not being released in or near the Little Belt Mountains, they may expand out from YNP release sites eventually reaching areas like the project area. These wolves would be classified as "nonessential experimental wolves" according to section 10(j) of the Endangered Species Act (ESA) of 1973. Section 10(j) of ESA states that "nonessential experimental animals are not subject to formal consultation of the Act unless they occur on land designated as a national wildlife refuge or national park" (50 CFR Part 17, Fed. Reg. Vol 59, No 224). According to section 7 of ESA, nonessential experimental wolves found outside of national wildlife refuges and national park lands will be treated as if they were only proposed for listing (50 CFR Part 17, Fed. Reg. Vol. 59, No 224). Under section 7, Federal agencies are required to establish conservation programs for the particular species and to informally confer with USFWS on actions that will likely jeopardize the continued existence of the proposed species to be listed as threatened or endangered (50 CFR Part 17, Fed. Reg. Vol 59, No 224).

The Little Belt Mountains support adequate habitat and a wild ungulate preybase to sustain wolves part of the year. When coupled with the surrounding mountain ranges, year-round occupation by wolves is possible. The Little Belt Mountains may serve as occupied wolf habitat or as a habitat linkage to the adjacent mountain ranges.

Sporadic wolf sightings have been reported to area MDFWP game wardens, MDFWP area biologists, and Forest Service personnel for the past few years in the Little Belt Mountains, especially in 1997. No sightings have been undeniably confirmed. However, a snow track survey completed in February 1995 revealed possible tracks of a single wolf, based on track dimensions, in the Little Belt Mountains. These tracks were recorded 20-25 miles south and east of the project area. In 1996, a single wolf from the YNP reintroduction was located in the Crazy and Castle Mountains, south of the Little Belt Mountains. Snow track surveys completed in the TCEF vicinity during the winter of 1997 did not detect any wolf sign.

B. Candidate Species

Swift Fox: Swift fox occupy short-grass prairie habitats. Potential habitat can be found outside of National Forest System Lands surrounding the Little Belt Mountains and other island mountain ranges of the Jefferson Division. No suitable habitat is present in the Little Belt Mountains or project area.

Mountain Plover: Mountain plover occupy short-grass prairie habitats. Favored areas included those which have been heavily grazed by livestock. Mountain plover are known to occupy short-grass benchlands near the southern borders of the Little Belt and Snowy Mountains from Haymaker to Cameron Creeks (Knowles and Knowles 1993). No suitable habitat is present in the Little Belt Mountains or the project area.

Canada Lynx: The lynx was considered as a species that was part of the wildlife issue in the EA. For a discussion on lynx refer to the EA in chapter III.

III. EFFECTS OF IMPLEMENTATION OF THE PREFERRED ALTERNATIVE

A. Threatened and Endangered Species

Direct, Indirect, and Cumulative Effects

No active nest sites or nesting territories for bald eagles or peregrine falcons have been identified in the project area. There is no suitable habitat within the project area; therefore, the proposed action would have no impacts on these avian species or their habitats.

No resident gray wolves have been documented in the Little Belt Mountains. However, individual wolves are believed to periodically "pass through" the mountain range. The project area is part of the experimental population area for wolves released in Yellowstone National Park. Wolves from the experimental population or from natural populations may eventually reside in the Little Belt Mountains.

Potential wolf populations will be managed under the provisions of the Endangered Species Act, "The Reintroduction of Gray Wolves to Yellowstone National Park and Central Idaho EIS", and other applicable laws. The proposed land management activities would not negatively impact wolves or potential habitat. Ungulate populations would not be negatively affected by the proposed action therefore maintaining the potential preybase for wolves.

B. Candidate Species

Direct, Indirect, and Cumulative Effects

No habitat for **swift fox and mountain plover** exists in the project area. Therefore, the proposed action would have no impact on these species.

The effects of the proposed action on the **lynx** was documented in the EA, see chapter III for this discussion.

IV. DETERMINATION OF EFFECTS

A. Threatened and Endangered Species

There are no anticipated effects on **bald eagles or peregrine falcons**, therefore, the implementation of the proposed action would result in a determination of **"no effect"** for these listed species.

There are no known den or rendezvous sites for the **gray wolf** in the project area. There has been no documentation of wolf activity in the TCEF. There are no major impacts predicted to the prey base (elk or deer) in the EA. Therefore, the implementation of the proposed action would result in a determination of **"no effect"** for the gray wolf. This determination of effect was concurred by Ann Vandehey of the USFWS during a phone conversation on December 22, 1997.

V. CONSULTATION/COORDINATION

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APPENDIX B

TENDERFOOT CREEK EXPERIMENTAL FOREST RESEARCH PROJECT

BEST MANAGEMENT PRACTICES

PREPARED BY

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LEWIS AND CLARK NATIONAL FOREST

November 1997

I. BEST MANAGEMENT PRACTICES

INTRODUCTION

The Forest Service is required by law to comply with water quality standards developed under authority of the Clean Water Act. Both the Environmental Protection Agency and the State of Montana are responsible for enforcement of these standards. The Lewis and Clark Forest Plan states (Chapter II, p.50) that the Forest will "utilize adequate soil and water conservation practices to protect soil productivity and to control nonpoint water pollution from project activities, using as a minimum, practices specified in any State developed "Best Management Practices." The use of BMPs is also required in the Memorandum of Understanding (FSM 1500) between the Forest Service and the State of Montana as part of our responsibility as the Designated Water Quality Management Agency on National Forest System lands.

Montana water quality standards regulate nonpoint source pollution from timber management and road construction activities through application of Best Management Practices (BMPs). The BMPs were developed under authority of the Clean Water Act to ensure that Montana waters do not contain pollutants in concentrations which adversely affect water quality or impair a designated use. State recognized BMPs are listed in "Best Management Practices for Forestry in Montana" (1989).

BMP Implementation Process

In cooperation with the State, the USDA Forest Service's primary strategy for the control of nonpoint sources is based on the implementation of BMPs determined necessary for the protection of the identified beneficial uses.

The Forest Service Nonpoint Source Management System consists of:

1. BMP selection and design based on site-specific conditions; technical, economic and institutional feasibility; and the designated beneficial uses of the streams.

2. BMP Application

3. BMP monitoring to ensure that they are being implemented and are effective in protecting designated beneficial uses.

4. Evaluation of BMP monitoring results.

5. Feeding back the results into current/future activities and BMP design.

The District Ranger is responsible for ensuring that this BMP feedback loop is implemented on all projects.

The Practices described herein are tiered to the practices in FSH 2509.22. They were developed as part of the NEPA process, with interdisciplinary involvement, and meet State and Forest water quality objectives.

II. KEY SOIL AND WATER CONSERVATION PRACTICES

The following chart displays the Soil and Water Conservation Practices (Best Management Practices or BMPs) required in Forest Service Handbook 2509.22, along with each unit and alternative that would be affected by the BMP. The chart also references the timber sale contract provision that would respond to the required BMP. Note that not all the BMPs are listed here--only those that require further specificity in the EA are listed. The Forest Service requires adherence to all practices outlined in the handbook. There are standard provisions for compliance in every timber sale contract for BMPs pertaining to timber harvesting (refer to FSM 2509.22 and Timber Sale Contract Provisions available in any Ranger District Office).

BMP	BMP Title	Unit	Contract Provision
11 - WATERSHED MANAGEMENT			
11.05	Wetlands Analysis and Evaluation	All	none
11.07	Oil and Hazardous Substance Spill Contingency Planning	All	C6.341, C6.53
11.11	Petroleum Storage and Delivery Facilities and Management	All	C6.341, C6.53
13 - VEGETATION MANIPULATION			
13.03	Tractor Operation Excluded from Wetlands, Bogs and Wet Meadows	1-4	C6.61
13.04	Revegetation of Surface Disturbed Areas	All	C6.601, C6.623
13.06	Soil Moisture Limitations for Tractor Operation	All	none
14 - TIMBER			
14.02	Timber Harvest Unit Design	All	none
14.03	Use of Sale Area Maps for Designating Soil and Water Protection Needs	All	B1.1, B6.5, C6.51
14.04	Limiting the Operating Period of Timber Sale Activities	All	SPS 204, B6.6
14.06	Riparian Area Designation	3, 4, 13	C6.5, C5.421
14.07	Determining Tractor Loggable Ground	All	C6.4
14.08	Tractor Skidding Design	All	B6.422
14.10	Log Landing Location and Design	All	B6.422
14.11	Log Landing Erosion Prevention and Control	All	B6.422, B6.64
14.12	Erosion Prevention and Control Measures During Timber Sale Operations	All	B6.6
14.14	Revegetation of Areas Disturbed by Harvest Activities	All	B6.6, C6.6, C6.601
14.15	Erosion Control on Skid Trails	All	B6.422, B6.6, B6.66,C6.601
14.16	Meadow Protection During Timber Harvesting	All	B6.61
14.17	Stream Channel Protection	Same as 14.06	B6.5, B6.6, C6.5, C6.6, C6.53
14.18	Erosion Control Structure Maintenance	All	B6.6, B6.66, B4.225
14.19	Acceptance of Timber Sale Erosion Control Measures Before Sale Closure	All	B6.6, B6.63, B6.64, B6.65, C6.6
14.20	Slash Treatment in Sensitive Areas	Same as 14.17	FSH 2409.18, FSH 2409.15
14.22	Modification of Timber Sale Contract	All	B8.3, B8.33
14.23	Reforestation Requirement	All	none
15 - ROADS AND TRAILS			
15.02	General Guidelines for Road Location/Design	4-6, 8, 10, 12-16	none
15.03	Road and Trail Erosion Control Plan	4-6, 8, 10, 12-16	none
15.04	Timing of Construction Activities	4-6, 8, 10, 12-16	C6.3, C6.36, B6.31
15.06	Mitigation of Surface Erosion and Stabilization of Slopes	4-6, 8, 10, 12-16	B6.31, B6.6, B6.62, C5.2, C5.4, C6.36
15.07	Control of Permanent Road Drainage	4-6, 8, 10, 12-16	B6.6, B6.66,C6.3, C6.6, C6.601

BMP	BMP Title	Unit	Contract Provision
15.09	Timely Erosion Control Measures on Incomplete Road and Stream Crossing Projects	4-6, 8, 10, 12-16	SPS 204, B6.31, B6.6,C6.6
15.10	Control of Road Construction Excavation & Sidecast Material	4-6, 8, 10, 12-16	C6.221, C5.4
15.11	Servicing and Refueling of Equipment	All	C6.34, C6.341, C6.34
15.21	Maintenance of Roads	All	C5.4 4 d
15.22	Road Surface Treatment to Prevent Loss of Materials	All	FSH 2409.15
15.23	Traffic Control During Wet Periods	All	B5.12, B6.22, C.5.12
15.24	Snow Removal Controls	All	C5.46
15.25	Obliteration of Temporary Roads	1, 3-12	B6.62, B6.5, C6.6, C6.601

III. FORMAT OF THE BMPs

Each Soil and Water Conservation Practice (SWCP) is described as follows:

Title: Includes the sequential number of the SWCP and a brief title

Objective: Describes the SWCP objective(s) and the desired results for protecting water quality.

Effectiveness: Provides a qualitative assessment of expected effectiveness that the implemented BMP will have on preventing or reducing impacts on water quality. The SWCP effectiveness rating is based on: 1) literature & research (must be applicable to area); 2) administrative studies (local or within similar ecosystem); and 3) professional experience (judgment of an expert by education and/or experience). The expected effectiveness of the SWCP is rated either High, Moderate, or Low.

Implementation: This section identifies: (1) the site-specific water quality protection measures to be implemented and (2) how the practices are expected to be applied and incorporated into the Timber Sale Contract.

IV. ITEMS COMMON TO ALL SOIL AND WATER CONSERVATION PRACTICE

Responsibility for Implementation: The District Ranger (through the presale forester) is responsible for insuring the factors identified in the following SWCPs are incorporated into: Timber Sale Contracts through the inclusion of proper B and/or C provisions; or Public Works Contracts through the inclusion of specific contract clauses.

The Contracting Officer, through his/her official representative (Sale administrator and/or Engineering Representatives for timber sale contracts; and Contracting Officers Representative for public works contracts) is responsible for insuring that the provisions are properly administered on the ground.

Monitoring: Implementation and effectiveness of water quality mitigation measures are also monitored annually. This includes routine monitoring by timber sale administrators, road construction inspectors, and resource specialists which is documented in diaries and project files. Basically, water quality monitoring is a review of BMP implementation and a visual evaluation of BMP effectiveness. Any necessary corrective action is taken immediately. Such action may include modification of the BMP, modification of the project, termination of the project, or modification of the State water quality standards.

V. ABBREVIATIONS

TSC = Timber Sale Contract
SAM = Sale Area Map
TSA = Timber Sale Administrator
COR = Contracting Officer Representative
PWC = Public Works Contract

BMP	BMP Title	Unit	Contract Provision
11 - WATERSHED MANAGEMENT			
11.05	Wetlands Analysis and Evaluation	All	none
11.07	Oil and Hazardous Substance Spill Contingency Planning	All	C6.341, C6.53
11.11	Petroleum Storage and Delivery Facilities and Management	All	C6.341, C6.53
13 - VEGETATION MANIPULATION			
13.03	Tractor Operation Excluded from Wetlands, Bogs and Wet Meadows	1-4	C6.61
13.04	Revegetation of Surface Disturbed Areas	All	C6.601, C6.623
13.06	Soil Moisture Limitations for Tractor Operation	All	none
14 - TIMBER			
14.02	Timber Harvest Unit Design	All	none
14.03	Use of Sale Area Maps for Designating Soil and Water Protection Needs	All	B1.1, B6.5, C6.51
14.04	Limiting the Operating Period of Timber Sale Activities	All	SPS 204, B6.6
14.06	Riparian Area Designation	3, 4, 13	C6.5, C5.421
14.07	Determining Tractor Loggable Ground	All	C6.4
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14.10	Log Landing Location and Design	All	B6.422
14.11	Log Landing Erosion Prevention and Control	All	B6.422, B6.64
14.12	Erosion Prevention and Control Measures During Timber Sale Operations	All	B6.6
14.14	Revegetation of Areas Disturbed by Harvest Activities	All	B6.6, C6.6, C6.601
14.15	Erosion Control on Skid Trails	All	B6.422, B6.6, B6.66,C6.601
14.16	Meadow Protection During Timber Harvesting	All	B6.61
14.17	Stream Channel Protection	Same as 14.06	B6.5, B6.6, C6.5, C6.6, C6.53
14.18	Erosion Control Structure Maintenance	All	B6.6, B6.66, B4.225
14.19	Acceptance of Timber Sale Erosion Control Measures Before Sale Closure	All	B6.6, B6.63, B6.64, B6.65, C6.6
14.20	Slash Treatment in Sensitive Areas	Same as 14.17	FSH 2409.18, FSH 2409.15
14.22	Modification of Timber Sale Contract	All	B8.3, B8.33
14.23	Reforestation Requirement	All	none
15 - ROADS AND TRAILS			
15.02	General Guidelines for Road Location/Design	4-6, 8, 10, 12-16	none
15.03	Road and Trail Erosion Control Plan	4-6, 8, 10, 12-16	none
15.04	Timing of Construction Activities	4-6, 8, 10, 12-16	C6.3, C6.36, B6.31
15.06	Mitigation of Surface Erosion and Stabilization of Slopes	4-6, 8, 10, 12-16	B6.31, B6.6, B6.62, C5.2, C5.4, C6.36
15.07	Control of Permanent Road Drainage	4-6, 8, 10, 12-16	B6.6, B6.66,C6.3, C6.6, C6.601

SWCP = Soil and Water Conservation Practices
BMP = Best Management Practice
SMZ = Streamside Management Zone
SPS = Special Project Specification
EPA = Environmental Protection Agency
CFR = Code of Federal Regulations

Best Management Practice Descriptions

PRACTICE 11.05 - Wetlands Analysis and Evaluation;

OBJECTIVE: To delineate wetlands within sale areas in order to prevent damages to facilities or degradation of soil and water resources.

EFFECTIVENESS: High

PRACTICE 13.04 - Revegetation of Surface Disturbed Areas

OBJECTIVE: To protect soil productivity and water quality by minimizing soil erosion.

EFFECTIVENESS: Revegetation can be moderately effective at reducing surface erosion after one growing season following disturbance and highly effective in later years. Effectiveness has been shown to vary from 10% on 3/4:1 slopes to 36% on 1:1 slopes to 97% on 1:1 slopes in later years (King, John G. and E. Burroughs. Reduction of Soil Erosion on Forest Roads. Intermountain Research Station General Technical Report, 1988).

IMPLEMENTATION: All temporary roads, landings, and skid trails in the sale area will be seeded within one year after harvesting is completed. Approved seed mixes and fertilizer specifications will be incorporated into TSC provision C6.601# (Erosion Control Seeding). TSC provision C6.623# (Temporary Road, Skid Trail/Skid Road and Landing Scarification) will identify that scarification/ripping of compacted landings and closed roads will be a minimum of 6 inches, not to exceed 14 inches.

PRACTICE 13.06 - Soil Moisture Limitations for Tractor Operation

OBJECTIVE: To minimize soil compaction, puddling, rutting, and gullying with resultant sediment production and loss of soil productivity by ensuring that activities are done when ground conditions are such that erosion and sedimentation can be controlled.

EFFECTIVENESS: Responsible implementation and enforcement are required for high effectiveness.

IMPLEMENTATION: Tractor operations will be limited to periods when the soil moisture content is sufficiently low that rutting does not occur.

PRACTICE 14.03 - Use of Sale Area Maps for Designating Soil & Water Protection Needs

OBJECTIVE: To delineate the location of protection areas and special treatment areas, to insure their recognition, proper consideration, and protection on the ground.

EFFECTIVENESS: High

IMPLEMENTATION: The following features will be designated on the SAM:

a. Stream courses (perennial and ephemeral) listed below will be designated as Stream Course Protection areas to be protected under TSC B6.5b. Wetlands (meadows, lakes, pot holes, etc.) to be protected per C6.61.

c. Riparian Areas, including riparian areas with planned harvest where logging and site prep will differ from adjoining the unit as identified in TSC provision C6.50# (Riparian Areas).

These features will be reviewed on the ground by the Purchaser and the Sale Administrator prior to harvesting.

PRACTICE 14.04 - Limiting the Operating Period of Timber Sale Activities;

PRACTICE 15.04 - Timing of Construction Activities

OBJECTIVE: To minimize soil erosion, sedimentation and soil productivity loss by insuring activities, including erosion control work, road maintenance, etc., are done: (1) within the time period specified in the TSC; or (2) when ground conditions are such that erosion and sedimentation can be prevented.

EFFECTIVENESS: Moderate PARALLEL STATE BMP: Montana State BMP I.D.4., I.E.6., IV.A.2.

IMPLEMENTATION: Within the sale area, the following specifications relating to operating periods have been identified and recommended:

1. Earthwork shall be postponed during wet periods if, as a result, erodible material would enter streams.

TSC provision B6.31 allows operations to occur outside Normal Operating Season subject to requirements in B6.6, B6.65, and C5.23.

A. The following requirements apply to operations outside the Normal Operating Season (see H-1, 2 for specific winter operations):

1. Drain dips will be built into skid trails and temporary roads at the time of construction, where feasible. Where draindips are not feasible, or are not functioning, trails and temporary roads will be waterbarred and maintained as necessary and/or prior to any prolonged shutdown.

2. Temporary Roads will be seeded immediately following completion of use.

3. All surface erosion and stabilization activities will be placed prior to November 1 of each year.

B. The following requirements apply to winter operations:

1. Skid trails will be constructed with waterbars and/or draindips, and allowed to freeze prior to skidding operations.

2. Prior to spring shutdown, slash and/or cull logs will be placed into skidtrails to approximate waterbars.

3. Breaks will be provided in the snow berm during snowplowing activities. Winter operations will also require the following language in the referenced TSC provisions:

a. All streams and channels within harvest units will be flagged or otherwise identified. (Predesignated under C6.50#).

b. During all snowplowing activities, breaks will be maintained in the snow berm along the outside of roads, particularly in the areas where needed for road drainage (C5.46).

Operations will be discontinued if conditions change and activities are no longer operating on frozen or snow covered ground, the intent of winter logging.

PRACTICE 14.20 - Slash Treatment in Sensitive Areas

OBJECTIVE: To protect water quality by protecting sensitive tributary areas from degradation which would result from using mechanized equipment for slash disposal.

EFFECTIVENESS: Moderate

IMPLEMENTATION: All such sensitive areas, including riparian harvest areas, bogs and meadows will be identified on the sale area map, the slash treatment map, and in the contract. TSC Provision C6.7 will include the following:

(a) Jackpot burning within Streamside Management Zones will be utilized rather than broadcast burning.

(b) Grapple piling of slash will be used in all machine pile units.

PRACTICE 11.07 - Oil and Hazardous Substance Spill Contingency Planning
PRACTICE 11.11 - Petroleum Storage and Delivery Facilities & Management
PRACTICE 15.11 - Servicing and Refueling of Equipment

OBJECTIVE: To prevent contamination of waters from accidental spills of fuels, lubricants, bitumens, raw sewage, wash water, and other harmful materials by prior planning and development of Spill Prevention Control and Countermeasure Plans.

EFFECTIVENESS: Although SPCC Plans cannot eliminate the risk of materials being spilled and escaping into waters, they can if followed be effective at reducing adverse effects to tolerable levels. Depending on the location and quantity of a spill, a properly implemented Plan can provide for up to 100% containment of a spill.

IMPLEMENTATION: TSC provision C6.341 holds the purchaser responsible for taking appropriate preventive measures to insure that any spill of oil or oil products does not enter any stream or other waters of the United States. If the total oil or oil products storage exceeds 1320 gallons or if any single container exceeds a capacity of 660 gallons, the purchaser will prepare a Spill Prevention Control and Countermeasures Plan. The plan shall meet EPA requirements including certification by a registered professional engineer. If necessary, specific requirements for transporting oil to be used in conjunction with the contract will be specified in TSC provision C6.53.

The Contracting Officer Representative will designate the location, size and allowable uses of service and refueling areas. The criteria below will be followed at a minimum:

1. Petroleum product storage containers with capacities of more than 200 gallons, stationary or mobile, will be located no closer than 100 feet from stream, water course, or area of open water. Dikes, berms, or embankments will be constructed to contain the volume of petroleum products stored within the tanks. Diked areas will be sufficiently impervious and of adequate capacity to contain spilled petroleum products.

2. Transferring petroleum products: During fueling operations or petroleum product transfer to other containers, there shall be a person attending such operations at all times.

3. Equipment used for transportation or storage of petroleum products shall be maintained in a leakproof condition. If the Forest Service Representative determines there is evidence of petroleum product leakage or spillage he/she shall have the authority to suspend the further use of such equipment until the deficiency has been corrected.

4. For longer term storage, a sump pond lined with plastic will be constructed equal to the volume of fuel stored on the site.

In the event any leakage or spillage enters any stream, water course or area of open water, the operator will immediately notify the COR who will be required to follow the actions to be taken in case of hazardous spill, as outlined in the Forest Hazardous Substance Spill Contingency Plan.

PRACTICE 13.03 - Tractor Operation Excluded from Wetlands, Bogs, & Wet Meadows

OBJECTIVE: To maintain wetland functions and avoid adverse soil and water resource impacts associated with the destruction or modification of wetlands, bogs and wet meadows.

EFFECTIVENESS: Much of this mitigation consists of avoiding the impact [40 CFR 1508.20(a)]. The Forest Service has near-complete control over construction operations. Effectiveness is expected to be high.

IMPLEMENTATION: At a minimum, the following specific protective requirements for wetlands identified on the SAM will be incorporated into C6.61# (Wetlands Protection):

1. Soil and vegetation along lakes, bogs, swamps, wet meadows, springs, seeps, or other sources where the presence of water is indicated will be protected from disturbance which would cause adverse effects on water quality, quantity, and wildlife and aquatic habitat.

2. An equipment exclusion zone shall extend a minimum of 50 feet from the wetlands, bogs, and wet meadows where they are contiguous with streamside management zones.

PRACTICE 14.02 - Timber Harvest Unit Design;
PRACTICE 14.08 - Tractor Skidding Design;
PRACTICE 14.10 - Log Landing Location and Design

OBJECTIVE: To insure that timber harvest unit design will maintain water quality and soil productivity by locating/designing landings and skidding patterns to best fit the terrain and avoid soil erosion.

EFFECTIVENESS: Restricting tractor skidding to designated skid trails can reduce the aerial extent of soil disturbance from the typical 18-36% to 10% or less. Properly located landings and skid trails produce similar results. Effectiveness is expected to be moderate

IMPLEMENTATION: TSC provision B6.422 (Landings and Skid Trails) requires that the location of all skid trails and landings must be agreed upon before construction. Specific criteria that will be addressed during sale-layout and pre-work with the operator will include:

General:

All new or reconstructed landings, skid trails, and fire trails shall be located on stable areas outside riparian areas. Side-casting will be held to a minimum.

Skid Trails:

a. Skid trails shall be kept to the minimum feasible width and number.

b. Locate skid trails to avoid concentrating runoff and provide breaks in grade and waterbars.

Landings:

1. Landing sizes will be the minimum necessary for safe, economical operation.

2. Landings and log decks will not be located within Riparian Areas.

3. Landings, log decks, and/or burn piles will be located a minimum of 100 feet from streams, far enough away that direct (unfiltered) entry of sediment, bark, or ash and burning products, will not occur.

PRACTICE 14.06 - Riparian Area Designation

OBJECTIVE: To minimize the adverse effects on Riparian Areas with prescriptions that manage nearby logging and related land disturbance activities.

EFFECTIVENESS: Moderate

IMPLEMENTATION: Riparian areas will be protected through the following requirements that will be incorporated into timber sale layout, or into the timber sale contract as identified below:

1. Provide the large organic debris (LOD), shading, soil stabilization, wildlife cover, and water filtering effects of vegetation along perennial or intermittent streams.

2. When cable yarding is necessary, across or inside the riparian areas, logs will be fully suspended when crossing streams and immediately above streambanks. Yarding shall be done in such a manner as to minimize stream bank and channel disturbance.

3. When ground skidding systems are employed, logs will be end-lined out of streamside and Riparian Areas. Equipment is permitted to enter streamside areas only prior Alternative Practices Approval from the DNRC. (C6.316#, Limited Operating Period; C6.4#, Streamside Management Zone and Riparian Area Protection).

4. Tracked or wheeled skidding in or through class I or II streams is permitted only through Alternative Practices Approval from the DNRC. When streams must be crossed, adequate structures to carry stream flow shall be installed. Cross the stream at right angles to its channel if at all possible. Remove all temporary crossings immediately after use and, where applicable, water bar the ends of skid trails [TSC Provision C6.5]

5. Waste resulting from logging operations, such as crankcase oil, filters, grease and fuel containers, shall not be placed inside the Stream Protection Zones [TSC Provision B6.34].

PRACTICE 14.11 - Log Landing Erosion Prevention and Control;
PRACTICE 14.12 - Erosion Prevention & Control During Timber Sale Operations;
PRACTICE 14.15 - Erosion Control on Skid Trails.

OBJECTIVE: To protect water quality by minimizing erosion and subsequent sedimentation derived from log landings and skid trails.

EFFECTIVENESS: Moderate

IMPLEMENTATION: The following criteria will be used in controlling erosion and restoring landings and skid trails so as to minimize erosion:

General:

1. Deposit waste material from construction or maintenance of landings and skid and fire trails in geologically stabilized locations at least 100 feet outside of the appropriate Stream Protection Zone.

2. Skid trails and landings will be seeded with a mix specified in C6.601#.

Landings:

1. During period of use, landings will be maintained in such a manner that debris and sediment are not delivered to any streams.

2. Landings shall be reshaped as needed to facilitate drainage prior to fall and spring runoff. Landings shall be Stabilized by establishing ground cover or by some other means within one year after harvesting is completed.

3. Landings will drain in a direction and manner that will minimize erosion and will preclude sediment delivery to any stream.

4. After landings have served the Purchaser's purpose, the Purchaser shall ditch or slope them to permit the water to drain or spread [TSC Provision B6.63 (Landings)].

Skid Trails: 1. Skid trails and fire trails shall be stabilized whenever they are subject to erosion, by waterbarring, cross draining, outsloping, scarifying, seeding, or other suitable means. This work shall be kept current to prevent erosion prior to fall and spring runoff.

2. Spacing of water bars on skid trails will be designated by the sale administrator and/or watershed specialist.[Reference FSH 7709.56]

PRACTICE 14.14 - Revegetation of Areas Disturbed by Harvest Activities

OBJECTIVE: To establish a vegetative cover on disturbed sites in order to reduce erosion and sedimentation on disturbed areas where normal revegetation methods as outlined in TSC are not adequate.

EFFECTIVENESS: Moderate .

IMPLEMENTATION: Revegetation by seeding and fertilization to control erosion is planned for all temporary roads, skid trails, and landings. If erosion problems still occur on these areas, or other problem areas are discovered or are brought to the attention of the Sale Administrator, KV Plans will be revised to reseed and/or fertilize, or provide for other control measures. If KV Funds are not available, Appropriated Funds will be used.

PRACTICE 14.16 - Meadow Protection During Timber Harvesting

OBJECTIVE: To avoid damage to the ground cover, soil and water in meadows.

EFFECTIVENESS: High

IMPLEMENTATION: Vehicular or skidding equipment shall not be used on meadows except where roads, landings, and tractor roads are approved. In all cases, soil and vegetation will be protected from disturbance which would cause adverse affects on water quality, quantity and aquatic habitat. The TSC Provision B6.61 (Meadow Protection) is a standard provision in all contracts.

Unless otherwise agreed, trees felled into meadows shall be removed by end-lining, and resulting logging slash shall also be removed. Damage to meadows, stream courses, and riparian areas caused by unauthorized Purchaser's operations shall be repaired by the Purchaser in a timely manner to restore and prevent further damage.

PRACTICE 14.17 - Stream Channel Protection (Implementation and Enforcement).

OBJECTIVE: To protect stream beds and streamside vegetation, during and after forest practice operations and road construction, by (1) maintaining unobstructed passage of stormflows; and (2) reducing sediment and other pollutants from entering streams.

EFFECTIVENESS: Much of this mitigation consists of avoiding the impact, minimizing the impact, or rectifying the impact [40 CFR 1508.20 (a-c)]. The Forest Service has near-complete control over construction operations. Effectiveness is expected to be high.

IMPLEMENTATION: To reduce sediment and channel bank degradation at sites disturbed by construction of stream crossing or roadway fill, it may be necessary to incorporate "armoring" in the design of a structure to allow the water course to stabilize after construction. Riprap, gabion structures, and other measures are commonly used to armor stream banks and drainage ways from the erosive forces of flowing water. These measures must be sized and installed in such a way that they effectively resist erosive water velocities. Stone used for riprap should be free from weakly structured rock, soil, organic material and materials of insufficient size, all of which are not resistant to stream flow and would only serve as sediment sources. Outlets for drainage facilities in erodible soils commonly require rip-rapping for energy dissipation (FSH 7709.56B, and Std. FS Spec. 619).

The intent of the regulations and clauses is to protect the integrity of stream channels, and minimize adverse impacts to the channel and downstream resources and beneficial uses. To list all of the regulations that would be implemented to protect and restrict channel alterations, would require a small book. The following items however, highlight some of the principal provisions incorporated into the TSC that will govern channel protection in the sale area.

1. Care shall be taken to cause only the minimum necessary disturbance to the natural appearance of the area. Streambank vegetation shall be protected except where its removal is absolutely necessary for completion of the work [SCPA Rule 9.1(c) and TSC Provisions B6.3 and C6.50].

(a) All streambanks will be avoided by design.

2. If the channel is damaged during construction, it will be restored as nearly as possible to its original configuration without causing additional damage to the channel.

3. Purchaser shall repair all damage to a streamcourse if the Purchaser is negligent in their operations, including damage to banks and channel, to an acceptable condition as agreed to by the certified Sale Administrator and Purchaser's representative.

4. All project debris shall be removed from streamcourse, in an agreed manner that will cause the least disturbance. (B6.5 Streamcourse Protection).
Specifically:

(a)Whenever possible trees shall be felled, bucked, and limbed in such a manner that the tree or any part thereof will fall away from any perennial or intermittent (due to groundwater) streams. Slash that enters these streams as a result of harvesting operations shall be continuously removed, as will other debris that enters these streams whenever there is a potential for stream blockage or if the stream has the ability for transporting such debris. Material removed shall be placed five feet slope distance above the ordinary high water mark. Material to be removed will be all logging debris that is less than six inches in diameter and less than six feet long.

(b) Slash and other debris that enters other gravel or cobble bottomed channels shall be removed whenever there is a potential for stream blockage or if the stream has the ability for transporting the debris.

Material to be removed will be all logging debris that is less than six inches in diameter and less than six feet long.

PRACTICE 14.18 - Erosion Control Structure Maintenance

OBJECTIVE: To insure that constructed erosion control structures are stabilized and working effectively.

EFFECTIVENESS: High

IMPLEMENTATION: TSC provision B6.66 requires that during the period of the contract, the Purchaser shall provide maintenance of soil erosion control structures constructed by the Purchaser until they become stabilized, but not for more than one year after their construction. After 1 year, any erosion control work needed is accomplished through performance bond earmarked for that use. TSC provision C6.6(F) requires the Purchaser to maintain erosion control structures concurrently with his operations under the sale and in any case not later than 15 days after completion of skidding each unit or subdivision.

PRACTICE 14.19 - Acceptance of Timber Sale Erosion Control Measures Before Sale Closure

OBJECTIVE: To assure the adequacy of required timber sale erosion control work.

EFFECTIVENESS: High

IMPLEMENTATION AND RESPONSIBILITY: TSC provision B6.35 requires that upon the Purchaser's written request and assurance that work has been completed the Forest Service shall perform an inspection. One area the Purchaser's might request acceptance for are specific requirements such as logging, slash disposal, erosion control, or snag felling. In evaluating acceptance the following definition will be used by the Forest Service: "Acceptable" erosion control means only minor deviation from established standards, provided no major or lasting impact is caused to soil and water resources. Certified TSAs will not accept as complete erosion control, measures which fail to meet this criteria.

PRACTICE 14.22 - Modification of the Timber Sale Contract

OBJECTIVE: To modify the Timber Sale Contract if new circumstances or conditions indicate that the timber sale will cause irreversible damage to soil, water, or watershed values.

EFFECTIVENESS: High

IMPLEMENTATION: If evidence indicates that unacceptable impacts would occur to soil and water resources if the sale was harvested as planned, the Forest Service Representative will request the Contracting Officer to gain Regional Forester advice and approval to proceed with a resource environmental modification, mutual cancellation, or unilateral cancellation of the Timber Sale Contract as allowed by TSC Provisions B8.3 or B8.33. If the decision is for a resource environmental

modification, once the action is approved by the Regional Forester, the appropriate Line Officer will assign an interdisciplinary team to make recommendations of implementation.

PRACTICE 15.02 - General Guidelines for the Location and Design of Roads and Trails

OBJECTIVE: To locate and design roads and trails with minimal soil and water resource impact while considering all design criteria.

EFFECTIVENESS:

1. Route location ground-truths the results of transportation planning and provides site-specific information on possible problem areas (Gray and Megahan, 1981; Cline et. al., 1981; Megahan and Kidd, 1972; King and Gonsior, 1980).

2. Designed and controlled cut slopes, fill slopes, road width, and road grades effectively reduce sediment production by fitting the roads to the land (Bethalmy and Kidd, 1966; Burroughs, Watts, King, and Hanson, 1985; King, 1979; Megahan, 1978).

IMPLEMENTATION: The following listed items are incorporated in general road location and design guidelines for minimizing impacts on water quality:

Design:

1. Roads shall be planned no wider than necessary to safely accommodate the anticipated use and equipment needs. Cut and fill volumes shall be minimized by designing the road to fit natural terrain features as closely as possible. As much of the excavated material as possible shall be used in fill sections. Minimum cuts and fills shall be planned, particularly near stream channels.

Location:

1. Utilize natural benches, follow contours, avoid long, steep road grades.
Balance cut/fill where possible to avoid waste areas.

2. Embankments and waste shall be designed so that excavated material may be disposed of on geologically stable sites.

3. Avoid slumps and slide-prone areas, and steep sidehills.

4. Road construction shall be minimized within stream protection zones. Areas of vegetation shall be left or re-established between roads and streams [Standard Road Specifications-Special Project Specification 204.01].

5. Where possible, locate turn-outs and turn-arounds at least 200 feet from water bodies or riparian zones. Where placement within 200 feet is necessary due to safety considerations, emphasize erosion control measures to protect water quality; i.e additional windrowing, seeding, etc.

Road drainage: SEE SWCP 15.07

1. Locate and design roads and trails to drain naturally by appropriate use of out-sloping, rolling dips, and grade changes, where possible. Cross drains will be installed in ditched areas to 1) carry intercepted flow across constructed areas; 2) to relieve the length of undrained ditch; and 3) to reduce disruption of normal drainage patterns. Road and trail drainage should be channeled to effective buffer areas, either natural or manmade, to maximize sediment deposition prior to entry into live water.

2. Ditch lines and road grades will be designed to minimize unfiltered flow into streams. A rolling dip, relief culvert or similar structure will be installed as close as practical to crossings to minimize direct sediment and/or water input directly into streams. Route the drainage through SMZ, buffer strips, or other sediment settling structures where possible.

3. Roads shall be planned to drain naturally by out-sloping or in-sloping with cross drainage and by grade changes where possible. Dips, water bars and/or cross drainage will be planned when necessary.

4. Relief culverts and roadside ditches shall be planned whenever reliance upon natural drainage would not protect the running surface, excavation, or embankment. Culvert installations shall be designed to prevent erosion of the fill. Drainage structures shall be planned to achieve minimum direct discharge of sediment into streams.

PRACTICE 15.03 - Road and Trail Erosion Control Plan

OBJECTIVE:

EFFECTIVENESS: Moderate

IMPLEMENTATION: Prior to the start of construction, the Contractor shall submit a schedule for proposed erosion control work as required in the Standard Specifications. The schedule shall include all erosion control items identified in the specifications. Erosion control work to be done by the Contractor will be defined in Standard Specification 204 and/or in the Drawings. The schedule shall consider erosion control work necessary for all phases of the project. The Contractor's construction schedule and plan of operation will be reviewed in conjunction with the erosion control plan by the TSA, district watershed specialist, and engineering to insure their compatibility before any schedules are approved. The Engineer will certify that the Contractors Erosion Control Plan meets the specifications of Std. FS Spec. Section 204.

PRACTICE 15.06 - Mitigation of Surface Erosion and Stabilization of Slopes

OBJECTIVE: To prevent, limit, and mitigate erosion, sedimentation, and resulting water quality degradation prior to the initiation of construction and to minimize erosion from road cutslopes, fillslopes, and travelways during and after construction.

EFFECTIVENESS: Seeding and fertilizing cut slopes, fill slopes, and other disturbed areas reduces erosion from these sources after one growing season.
Effectiveness has been rated at 85% or better once the vegetation has become established (King and Burroughs, 1988).

IMPLEMENTATION: The following erosion control objectives and mitigation measures have been developed by the IDT and will be reflected in contract specifications and provisions:

1. Areas where exposed material is potentially erodible, and where sediment would enter streams, shall be stabilized prior to fall or spring runoff by seeding, compacting, riprapping, benching, mulching, or other suitable means, Timber Sale Contract Clauses C6.6, C6.601, C6.602, and Standard Road Specifications-Special Project Specification 204.01].

(a) These areas are avoided by design.

2. Slumps, slides, and other erosion features causing stream sedimentation shall be stabilized.

(a) These sites have been identified and will be avoided.

3. Slash and debris may be windrowed along the toe of the fill and General Road Specifications-Special Project Specification 201.5].

(a) Measures to reestablish vegetation will be accomplished by November 1 on exposed cut and fill slopes. Various operating seasons on varied units and sales within the FEIS Area will require seeding and fertilization specs to vary. Mulching will be required on erodible slopes where difficulty in re-establishing vegetation is anticipated.

(b) Prompt attention to potential erosion problems, both anticipated and un-anticipated, before they become a water quality issue, will be required. On-site stock piling of straw bales for immediate availability and erosion cloth or a suitable substitute stored off-site but available will also be required.

PRACTICE 15.07 - Control of Permanent Road Drainage

OBJECTIVE: To minimize the erosive effects of concentrated water and the degradation of water quality by proper design and construction of road drainage systems and drainage control structures.

EFFECTIVENESS: Designed and controlled ditches, cross drain spacing, and culvert discharge prevent water from running long distances over exposed ground. Dewatered (dry) culvert installations and special drainage such as rock filter blankets and rock buttresses have been demonstrated effective on the Nez Perce Forest (King and Gonsior, 1980; Rothwell, 1983; Anderson et. al., 1970). Moderate

IMPLEMENTATION: The following items will be included in the timber sale contract provisions or road contract special project specifications.

1. Drainage ways shall be cleared of all debris generated during construction and/or maintenance which potentially interferes with drainage or water quality [Timber Sale Contract Clause C5.4, and Standard Road Specifications-Special Project Specification 204.04].

2. During and following operations on out-sloped roads, out-slope drainage shall be retained and berms shall be removed on the outside edge except those intentionally constructed for protection of road grade fills [Timber Sale Contract Clause C5.4].

3. Cross drains and relief culverts shall be constructed to minimize erosion of embankments. The time between road construction and installation of erosion control devices shall be minimized. Drainage structures or cross drains shall be installed on uncompleted roads which are subject to erosion prior to fall or spring runoff. Relief culverts shall be installed with a minimum grade of 1% [Standard Road Specifications-Special Project Specification 204.1].

4. Cross drains and relief culverts will be installed so as to minimize concentrations of intercepted water (see also Practice 15.02 f.(3)).

PRACTICE 15.09 - Timely Erosion Control Measures on Incomplete Road and Streamcrossing Projects

OBJECTIVE: To minimize erosion of and sedimentation from disturbed ground on incomplete projects.

EFFECTIVENESS: Moderate

IMPLEMENTATION: The following measures will be implemented during projects:

1. Temporary culverts, side drains, flumes, cross drains, diversion ditches, energy dissipaters, dips, sediment basins, berms, debris racks, or other facilities needed to control erosion will be installed as necessary. The removal of temporary culverts, culvert plugs, diversion dams, or elevated streamcrossing causeways will be completed as soon as practical;

2. The removal of debris, obstructions, and spoil material from channels and floodplains;

3. Seeding with native species to minimize erosion.

4. Install drainage structures or cross drain uncompleted roads which are subject to erosion prior to fall or spring runoff. (Std Spec 204)

Erosion control measures must be kept current with ground disturbance, to the extent that the affected area can be rapidly "closed," if weather conditions deteriorate. Areas must not be abandoned for the winter with remedial measures incomplete.

PRACTICE 15.21 - Maintenance of Roads

OBJECTIVE: To conduct regular preventive maintenance operations to avoid deterioration of the roadway surface and minimize disturbance and damage to water quality, and fish habitat.

EFFECTIVENESS: Moderate

IMPLEMENTATION: For roads in active timber sale areas standard TSC provision B5.4 (Road Maintenance) requires the purchaser to perform or pay for road maintenance work commensurate with the purchasers use. Purchaser's maintenance responsibility shall cover the before, during, and after operation period during any year when operations and road use are performed under the terms of the timber sale contract (C5.4 - Road Maintenance). Purchaser shall perform road maintenance work, commensurate with purchaser's use, on roads controlled by Forest Service and used by purchaser in connection with

this sale except for those roads and/or maintenance activities which are identified for required deposits in C5.411# and C5.412#. All maintenance work shall be done concurrently, as necessary, in accordance with T-specifications set forth herein or attached hereto, except for agreed adjustments (TSC C5.4- T301, 310).

1. Sidecast all debris or slide material associated with road maintenance in a manner to prevent their entry into streams [Timber Sale Contract Clause C5.4, and Standard Road Specification-Special Project Specification T108].

2. Repair and stabilize slumps, slides, and other erosion features causing stream sedimentation [Timber Sale Contract Clauses C5.4 and C5.253, and Special Project Specification T108].

3. Active Roads. An active road is a forest road being used for hauling forest products, rock and other road-building materials. The following maintenance shall be conducted on such roads.

(a) Culverts and ditches shall be kept functional.

(b) During and upon completion of seasonal operations, the road surface shall be crowned, out-sloped, in-sloped or water barred, and berms removed from the outside edge except those intentionally constructed for protection of fills.

(c) The road surface shall be maintained as necessary to minimize erosion of the subgrade and to provide proper drainage.

(d) If road oil or other surface stabilizing materials are used, apply them in such a manner as to prevent their entry into streams and Timber Sale Contract Clauses C5.441 and C6.341].

4. Inactive roads. An inactive road is a forest road no longer used for commercial hauling but maintained for access (e.g., for fire control, forest management activities, recreational use, and occasional or incidental use for minor forest products harvesting). The following maintenance shall be conducted on inactive roads.

(a) Following termination of active use, ditches and culverts shall be cleared and the road surface shall be crowned, out-sloped or in-sloped, water barred or otherwise left in a condition to minimize erosion. Drainage structures will be maintained thereafter as needed.

(b) The roads may be permanently or seasonally blocked to vehicular traffic.

(c) Roads will be seeded, and fertilized twice.

(b) The roads may be permanently or seasonally blocked to vehicular traffic.

5. Abandoned Roads. An abandoned road is not intended to be used again. No subsequent maintenance of an abandoned road is required after the following procedures are completed:

(a) The road is left in a condition suitable to control erosion by out-sloping, water barring, seeding, or other suitable methods.

(b) Ditches are cleaned.

(c) The road is blocked to vehicular traffic.

(d) The department may require the removal of bridges and culverts except where the owner elects to maintain the drainage structures as needed.

6. Obliterated Roads: Temporary roads should be obliterated according to guidelines in BMP 15.25.

7. For roads not in an active timber sale area road maintenance must still occur at sufficient frequency to protect the investment in the road as well prevent deterioration of the drainage structure function. This will be accomplished by scheduling periodic inspection and maintenance, including cleaning dips and cross drains; repairing ditches, marking culvert inlets to aid in location, and cleaning debris from ditches and culvert inlets to provide full function during peak runoff events (FSH 7709.15).

PRACTICE 15.22 - Road Surface Treatment to Prevent Loss of Materials

OBJECTIVE: To minimize the erosion of road surface materials and consequently reduce the likelihood of sediment production.

EFFECTIVENESS: Stabilization of road surface and ditch lines over 6% with competent rock (rock that does not rapidly disintegrate) is often over 90% effective (Burroughs, et.al., 1983a, 1983b, 1984, 1985; King and Burroughs, 1988). High

IMPLEMENTATION: On timber sale roads, the Purchaser shall undertake measures to prevent excessive loss of road material if the need for such action has been identified. Road surface treatments may include: watering, applying magnesium chloride, sealing, aggregate surfacing, chip-sealing, or paving.

PRACTICE 15.24 - Snow Removal Controls

OBJECTIVE: To minimize the impact of snow melt on road surfaces and embankments and to reduce the probability of sediment production resulting from snow removal operations.

EFFECTIVENESS: Moderate

IMPLEMENTATION: For Forest roads that will be used throughout the winter, the following measures will be employed:

1. The Purchaser is responsible for snow removal in a manner which will protect roads and adjacent resources.

2. Rocking or other special surfacing and/or drainage measures may be necessary, before the operator is allowed to use the roads.

3. During snow removal operations, banks shall not be undercut nor shall gravel or other selected surfacing material be bladed off the roadway surface. Ditches and culverts shall be kept functional during and following roadway use. If the road surface is damaged, the Purchaser shall replace lost surface material with similar quality material and repair structures damaged in blading operations.

4. Snow berms shall not be left on the road surface or shall be placed to avoid channelization or concentration of melt water on the road or erosive slopes. Berms left on the shoulder of the road shall be removed and/or drainage holes opened at the end of winter operations and before the spring breakup. Drainage holes shall be spaced as required to obtain satisfactory surface drainage without discharge on erodible fills. On insloped roads, drainage holes shall also be provided on the ditch side, but care taken to insure that culverts and culvert inlets are not damaged.

PRACTICE 15.25 - Obliteration of Temporary Roads

OBJECTIVE: To reduce sediment generated from temporary roads by obliterating them at the completion of their intended use.

EFFECTIVENESS: High

IMPLEMENTATION: Effective obliteration is generally achieved through a combination of the following measures: TSC B6.62, C6.622, C6.623#.

APPENDIX C

TENDERFOOT CREEK EXPERIMENTAL FOREST RESEARCH PROJECT

WATER RESOURCES REPORT

PREPARED BY

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December 1997

Analysis Boundary

The TCEF Timber Sale lies within two tributary drainages to Tenderfoot Creek; Sun Creek and Spring Park Creek. The cumulative effects analysis point is at the mouths of those two tributaries, and on Tenderfoot Creek at the mouth of the TCEF watershed, excluding the Lonesome Creek drainage. This analysis area was selected because 1) the most sensitive channel conditions potentially affected exist within these two tributary drainages, and 2) any effects of the proposed activities are expected to be undetectable below the TCEF boundary because of changes in water quality, quantity and stream conditions that exist downstream.

Data Collection and Analysis

The following list summarizes the information that was gathered and compiled to evaluate the water resource characteristics and conditions of the TCEF watershed.

1. Channel Stability Surveys from 1976 and 1997 (Pfankuch, 1978). Channel stability surveys were completed on selected channel reaches within the project area. This information provides a general assessment of the capacity of the stream channels to withstand the erosive forces of streamflow. It also provides information about the capacity of the stream to adjust and recover from potential changes in flow and/or increases in sediment production. Since the channel stability surveys are a subjective approach to evaluating stream conditions, the final rating value can vary between observers. Therefore, it is important to understand that small differences (+/- <10 points) in ratings are probably not significant, but become significant as the differences increase.

2. Channel geometry measurements. This data is gathered to develop stream typing attributes according to the Rosgen stream classification system (Rosgen, 1996). Some of the specific channel measurements include: water gradient, bankfull width, floodprone width, average and maximum bankfull depth. Stream classification is useful to help understand how different streams respond to different natural and human influences.

3. Stream substrate, bank substrate and bank stability observations during 1997.

4. Lewis and Clark National Forest Soil Resource Inventory (USDA-L&C NF, 1981).

5. Water and sediment yield models - WATSED (USDA-FS, 1996) and R1/R4 (USDA-FS, 1987). These models generate a number of variables related to water and sediment yields for both undisturbed (forested) and disturbed (harvest, roads, wildfire) conditions. The variables that will be used in this analysis include average daily streamflow (in cubic feet per second) during the peak flow month, and average annual sediment yield (in tons per square mile per year). Percent increases in peak flow and sediment yield, due to the proposed timber/road/burning activities and historical wildfire conditions, will also be displayed.

Water and sediment yield models simplify extremely complex physical systems. Although specific quantitative values for sediment and water yields are generated, the results must be treated as broad estimates of how real systems may respond. Interpretation of the model results is realistically limited to providing a means of comparison between levels of impact, not an absolute measure against verifiable standards. Therefore, specific "threshold" values will not be identified in this analysis. However, the

modeled results were evaluated in conjunction with field investigations that assessed the ability of the stream systems to handle changes in water or sediment yields. Additionally, the model is currently able to estimate only the increases in sediment due to timber harvesting, site preparation, fire and road activities. It is unable to estimate changes in sediment due to instream erosion, nor is it capable of adequately estimating the effects of grazing (livestock or wildlife) on sediment yield. NOTE: Variables, coefficients and results for this analysis can be found in the project file.

6. Discharge, precipitation and suspended sediment data, and historical fire records within the TCEF (USDA-FS, 1995).

Water Quality and Beneficial Uses

Water quality refers to the physical, chemical and biological composition of a given streamflow and how these components affect beneficial uses. The existing water quality of Tenderfoot Creek is a result of the natural characteristics of the watershed along with the management activities, roads and fire suppression that have occurred there.

The 1996 Montana 303(d) List (MT-DEQ, 1996) identifies one stream near the project area as being water quality limited; the Smith River (MT41J001-1). "Water quality limited" streams either 1) do not fully support their uses and therefore, do not fully meet water quality standards, or 2) are fully supporting their uses, but the uses are threatened. The entire Smith River (98 miles), from its headwaters to the confluence with the Missouri River is listed as water quality limited. The beneficial uses - cold water fishery and aquatic life - are identified as "partially supported". All other uses (drinking water, swimming, agricultural and industrial) are fully supported.

The 303(d) List (refer to Table III-1) suggests that the probable causes of impairment include flow alteration, thermal modification and siltation. The probable sources of impairment include agriculture, resource extraction, silviculture, range land and irrigated crop production. The Smith River currently has a low priority for Total Maximum Daily Load (TMDL) development.

Table III-1
Water Quality Limited Streams

Stream Name	Impaired Use [1]	Cause of Impairment	Source of Impairment	Location
Smith River	Aquatic Life Support (P) Cold Water Fishery - Trout (P)	Flow Alteration Thermal modifications Siltation	Agriculture Resource Extraction Range land Irrigated crop production Silviculture	Headwaters to the Missouri River

[1] P = Partially Supporting

Montana has classified all waters within the project area as B-1 waters. The beneficial uses associated with this classification include; drinking, culinary and food processing purposes, after conventional treatment; bathing, swimming and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply (ARM, 1994).

The Montana Water Quality Act, Nondegradation Rules, and Surface Water Quality Standards require that "land management activities must not generate pollutants in excess of those that are naturally occurring, regardless of the stream's classification". "Naturally occurring" is defined as: "the water quality condition resulting from runoff or percolation over which man has no control or from developed lands where all reasonable land, soil and water conservation practices have been applied". (Note: Reasonable land, soil and water conservation practices are commonly called Best Management Practices (BMPs)). BMPs are considered reasonable only if beneficial uses are protected. They are further described in the Forest Service Handbook- Soil and Water Conservation Practices (FSH 2509.22). Please refer to Appendix B for a list of the BMP's that will be implemented under the Proposed Action. Please also refer to the Monitoring Plan in Chapter II for a description of the monitoring items which would be used to ensure BMP implementation and effectiveness.

APPENDIX D

TENDERFOOT CREEK EXPERIMENTAL FOREST RESEARCH PROJECT

ECONOMIC EFFICIENCY ANALYSIS

PREPARED BY

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December 1997

ECONOMIC EFFICIENCY ANALYSIS

The economic efficiency analysis completed for the Tenderfoot Timber Sale EA developed during NFMA uses updated inputs for TSPAS Version 1.6, Model E974, 7/97 (Timber Sale Planning and Analysis System) for the purpose of conducting economic analysis of timber sales within the Region.

Forest Planning - The objective of the Forest Planning process was to identify the alternative that maximized net public benefits. Each alternative land allocation was analyzed to determine the efficiency-related criteria and economic impact indicators so that the trade-offs between alternatives could be considered. The Forest Plan preferred alternative, Alternative G, was selected because it was judged to maximize net public benefits - a comprehensive measure including present net value and net non-priced effects (Lewis and Clark Forest Plan, 1986). See the Forest Plan EIS, Chapter II, p. 2-105, for a discussion of the determination of net public benefits and pages 2-106 through 2-109, which address the major non-priced resource values from a Forest perspective.

As part of the implementation of the Forest Plan and to meet research objectives, timber harvest practices are being scheduled in the TCEF. Forest Service Handbook 2409.18, Chapter 30, Section 32 describes the economic analysis needed for timber sales. Since both market and non-market effects result from the site-specific management practices being analyzed, a cost efficiency analysis has been completed. This analysis determines the net economic return for those costs and benefits measured in dollar terms and ensures that non-priced cost and benefits are achieved at the least cost.

Local Employment and Income - There are a significant number of individuals in the surrounding areas that derive their livelihoods from the timber industry. Within the White Sulphur Spring area there are at least five major mills actively pursuing Forest Service timber (Brand S Corporation, Livingston; RY Timber, Townsend; Louisiana-Pacific, Belgrade; Pyramid Mountain Lumber, Seeley Lake, and Darby Lumber, Darby) as well as numerous small operators. In FY 1996, the Lewis and Clark National Forest harvested 10.8 MMBF. This harvest provided 400 jobs and $13,390,000 of income to local communities (1996 TSPIRS, Report 3). Based on this information, the TCEF research project will provide about 180 jobs and $602,500 of income to
local communities.

A cost efficiency analysis of the TCEF alternatives was conducted in December 1997. The first part of this analysis is an accounting of the direct benefits and costs of Forest Service activities associated with each timber sale alternative. Direct benefits include estimated timber revenues. Direct costs include Forest Service timber sale preparation and administration, resource specialist and engineering support, and road construction and reconstruction. Timber revenue estimates (expected high bid) Were based on stumpage values predicted by TSPAS, a computerized regression model.

This section explores the economic consequences of implementing the alternatives described in Chapter II. The guiding principle is cost efficiency, or achieving Forest Plan goals and objectives for the area at the least cost.

A. SALE ALTERNATIVE

The values of benefits and costs were determined specifically for this proposal based on the following acres and volumes for each alternative:

The following table is: Harvest Acres and Volume by Alternative

Alternative	Harvest Acres	Cut Volume
1	0	0
2	507*	4800 MBF

* Total harvest acres includes ROW acres but excludes acres within leave islands.

B. RETURNS (TOTAL TIMBER VALUE)

TSPAS estimates the expected high bid based on three years of evidence from past sales on similar sites. TSPAS was used to estimate high bids for the respective sale found within the alternative. TSPAS Equation w9741/f15, the most current version, was used. Lewis and Clark default values were used for road maintenance. All other values were calculated for this analysis. See project file for cost calculations and assumptions.

TSPAS Appraisal Comparison

Expense Factors	**Cost**
Environmental Costs/MBF	$ 11.65
Road Maintenance $/MBF	$ 4.72
Temporary roads $/MBF	$ 3.92
Stumpage rate adj/MBF	$ 52.15**
Specified road cost/MBF	$ 18.65
Essential Regeneration	$ 4.08

** Logging costs were increased due to tight spacing of leave trees and shortened contract time needed to complete sale.

The following is the TSPAS predicted high bid for the timber sale for Alternative 2 based on the above appraisal data:

Alternative	**Predicted High Bid Value**
2	$910,400 (RETURNS)

C. TOTAL COSTS

Net sale values are calculated by alternative after accounting for essential regeneration cost, other KV cost, and Forest Service (FS) costs.

FS COST: $514,700 based on the following:

ANALYSIS/DOCUMENT	29.19/mbf*
SALE PREPARATION	28.59*
HARVEST ADMINISTRATION	16.69*
STAND EXAMS	9.95*
TRANSPORTATION PLAN	9.24*
$/MILE COST	$18.65

*default values based on 3 year averages from TSPIRS for Lewis and Clark NF.

KV COST: Essential Regeneration $17,400 and Other KV $174,700

1) Site Protection-all of the costs related to this mitigation measure will be covered under HARVEST ADMIN.

2) Water-all of the costs related to this mitigation measure will be covered in the road cost estimates assessed in the costs developed for the Transportation Plan and associated BMP's incorporated into the contract prepared for the sale.

3) Road Management-Grass Seeding; Erosion control on skid trails, landings, and other disturbed areas has been covered in TSPAS under ENVIRO PROTEC.

4) Cultural Resources-no additional costs need to be assessed since this is covered under specialist support in TSPAS under SALE PREP and HARVEST ADMIN.

5) Visual/Rec-Signs and Vista costs are under NONHARVEST ACTIVITIES.

6) Noxious Weeds-costs to be covered in TSPAS under NONHARVEST ACTIVITIES.

7) KV Regeneration exams shown in TSPAS under NONHARVEST ACTIVITIES.

8) Underburn and Mixed Burn costs are shown under NONHARVEST ACTIVITIES.

Total costs for each alternative were calculated by TSPAS after being entered under NONHARVEST ACTIVITIES. All costs include overhead. TSPAS incorporates appropriate inflation rates depending on year of activity. Detailed calculations for all values in TSPAS are available in the District's project files along with printouts for all models used in this economic analysis.

D. PNV TIMBER

To determine net sale values, K-V Costs and FS Costs were subtracted from total timber value by TSPAS which then calculated Present Net Value and Benefit Cost Ratio which is displayed in the following table:

ALTERNATIVE	COSTS	RETURNS	PNV	B/C
1	$ 0	0	0	0
2	$ 706,700	$ 910,400	$ 203,700	1.29

This analysis begins in 1997 and runs 2 years into the future (the length of the timber sale contract). All costs and returns were input in 1997 dollars and are discounted at 4.00%. All costs and returns are discounted from the end of the year in which they accrue.

E. Non-Market Benefits and Costs

The major benefit of the TCEF Research Project is the testing of an array of management treatment for regenerating and restoring healthy lodgepole pine forests through the emulation of natural disturbance process, but avoiding catastrophic scale disturbance. Research finding will be used not only on the Lewis and Clark National Forest, but also on lodgepole pine forest throughout the west (see Chapter 1). Other non-market benefits include the reduction of fuels, reduction of risk of catastrophic fires, and local employment. Non-market costs are effects on water, fisheries, old growth, T&E species, and sensitive species. These benefits and costs are discussed throughout this chapter.

APPENDIX E

TENDERFOOT CREEK EXPERIMENTAL FOREST RESEARCH PROJECT

MAPS

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January 1998

APPENDIX E

TENDERFOOT CREEK EXPERIMENTAL FOREST RESEARCH PROJECT

MAPS

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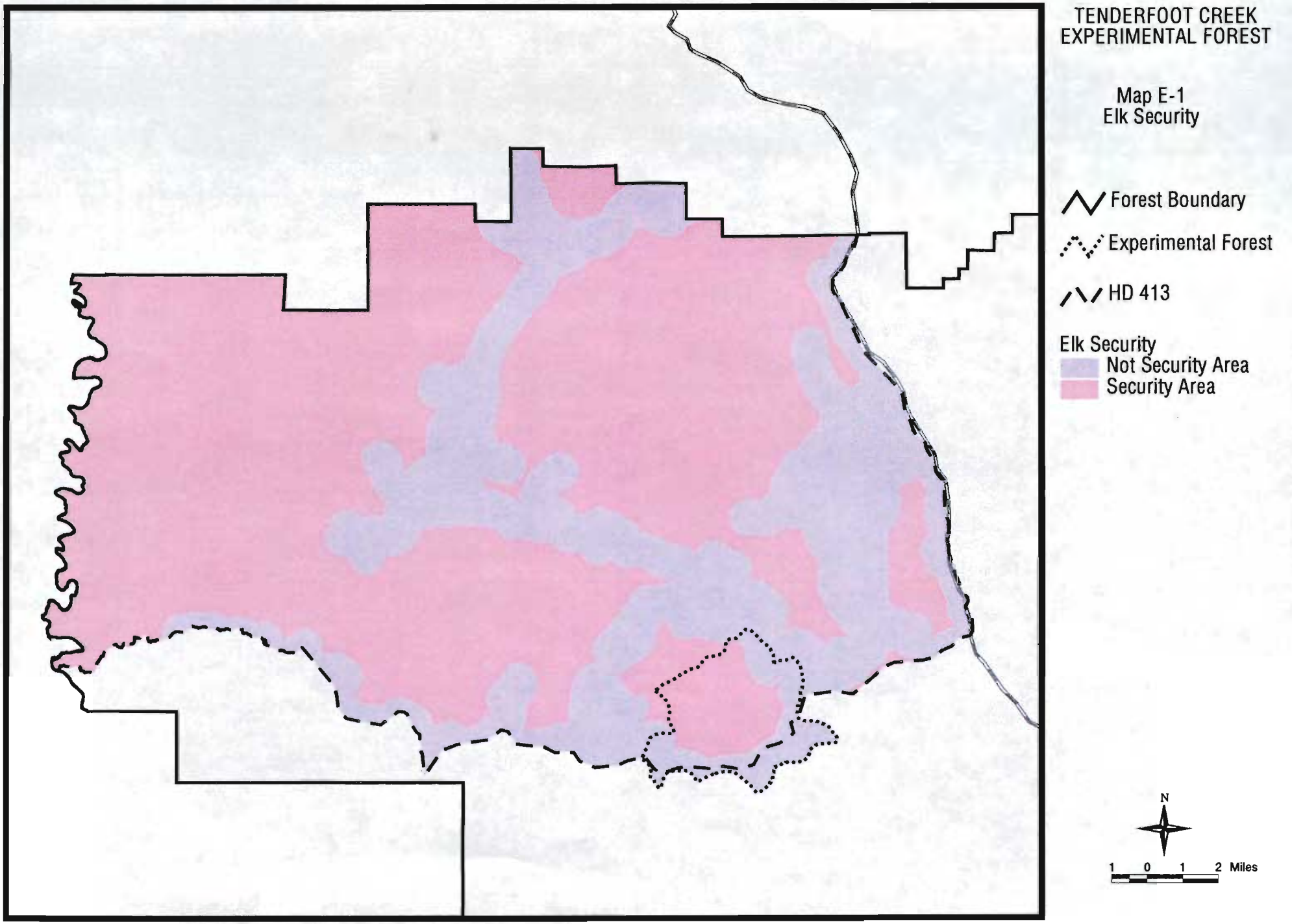
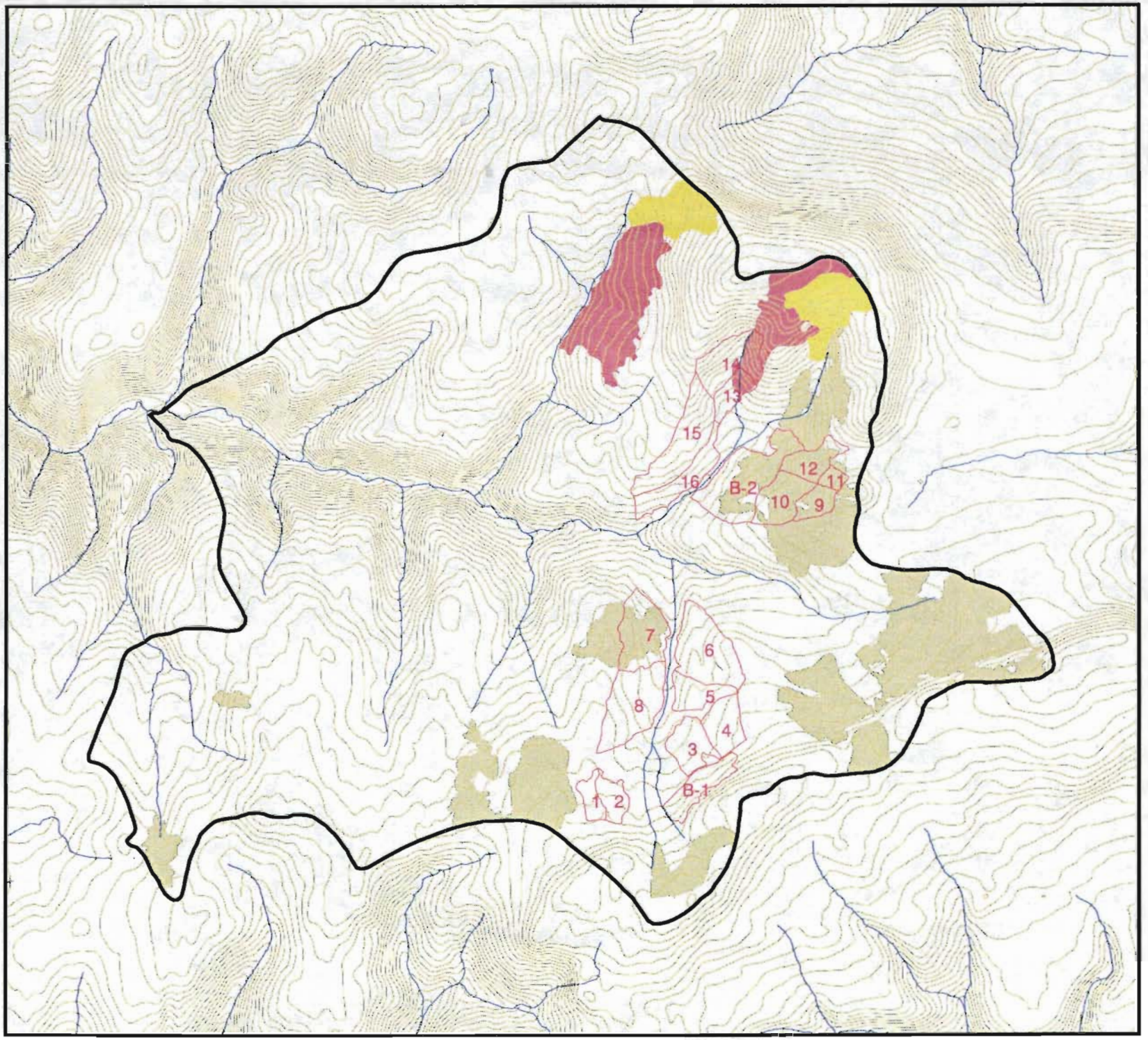
January 1998


TENDERFOOT CREEK
EXPERIMENTAL FOREST
Map E-1
Elk Security
Forest Boundary
Experimental Forest
HD 413
Elk Security
Not Security Area
Security Area
N
1 0 1 2 Miles



TENDERFOOT CREEK
EXPERIMENTAL FOREST

Map E-2
Existing Old Growth

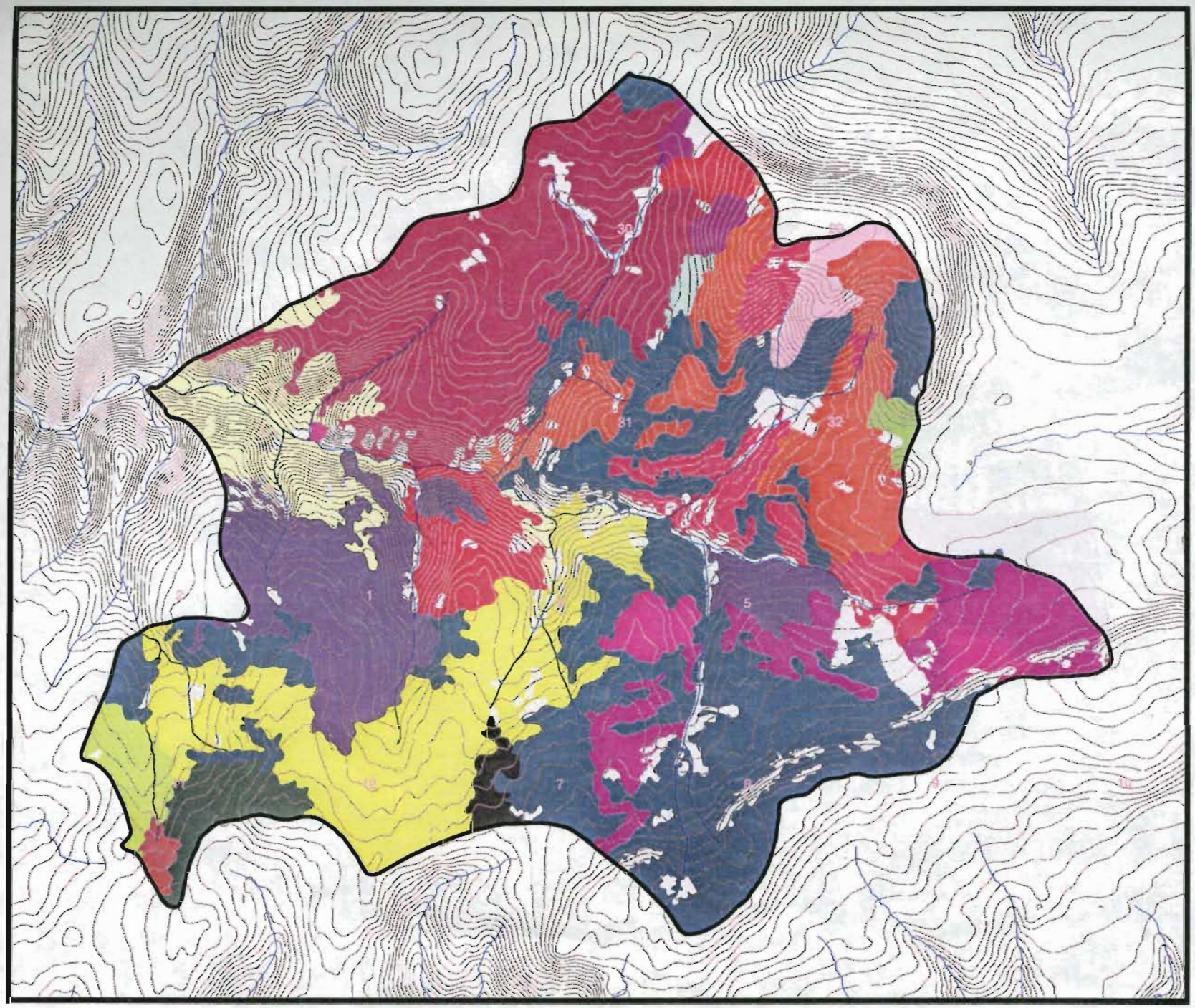
Project Area

Treatment Units

Old Growth
LPOG
WBP/LPOG
WMCOG

N

0.2 0 0.2 0.4 0.6 0.8 Miles



TENDERFOOT CREEK
EXPERIMENTAL FOREST

Map E-3
Fire History

Project Area

Year of Burn
- 1580
- 1580/1873
- 1676/1873
- 1726
- 1726-1765
- 1726-1845
- 1726/1831
- 1726/1873
- 1726/1889
- 1765
- 1765/1845
- 1765/1873
- 1831
- 1845
- 1845/1873
- 1873
- 1873/1902
- 1873/1921
- 1882/1845
- 1845-1873
- 1902
- 1947
- nonforest

N

0.2 0 0.2 0.4 0.6 Mile

I. INTRODUCTION

An environmental analysis has been prepared which describes and evaluates the management alternatives for the timber harvest and burning within the Tenderfoot Creek Experimental Forest (TCEF) project area. The project area lies within the headwaters of the Tenderfoot drainage of the Lewis and Clark National Forest (Map I-1 of EA).

The purpose of this biological assessment is to review the possible effects of the preferred alternative on endangered, threatened, proposed and candidate species and their habitats in order to determine whether or not a "may adversely affect" situation exists.

> *The **preferred alternative (Alternative 2)** will test an array of management treatments for regenerating and restoring healthy lodgepole pine forests through emulation of natural disturbance processes, but avoiding catastrophic scale disturbances. This research project will harvest timber in two treatment sub-watersheds, Spring Park Creek and Sun Creek. These drainages have hydrologically matched sub-watersheds located to the west of each which will be used as control areas for treatment sub-watershed effects. An additional control area will be the headwaters of Tenderfoot Creek which is a Research Natural Area (Onion Park RNA). The silvicultural system used will be shelterwood with reserves using even distribution of single or small groups and uneven distribution and shape of large residual groups. Two site preparation methods are scheduled to be used, burn and no-burn. In addition to site preparation burning, prescribed fire treatments will be applied in each treatment sub-watershed. Two kinds of prescribed fire treatments will be applied, low-intensity broadcast underburn and mixed severity broadcast underburn. Spring Park Creek sub-watershed is approximately 1032 acres and Sun Creek is approximately 859 acres is size. Research will treat approximately 376 acres and 389 acres, respectively. In order to evaluate hydrologic response to ecosystem-based treatments it is necessary to treat a large percentage of each sub-watershed. Silt fences will be installed within each treatment type to evaluate within-treatment sediment productions.*

The Jefferson Division of the Lewis and Clark National Forest includes habitat for three species listed by the USFWS (U.S. Fish and Wildlife Service) as endangered or threatened (wolf, peregrine falcon and the bald eagle). The Forest Plan Standard C-2 instructs the Forest to comply with the Endangered Species Act of 1973, as amended, which obligates the Forest Service to conduct activities and programs which assist in identification and recovery of threatened and endangered plant and wildlife species.

The USFWS published an updated Notice of Review of plant and animal taxa that are candidates for listing as threatened or endangered in the February 28, 1996, Federal Register (61 FR 7596). Beginning with that notice, the Service will recognize as candidates only those plant and animal species for which the Service has sufficient information on biological status and potential threats to propose listing them as endangered or threatened under the Act. Formerly such species were considered Category 1 candidate species. The status of these species will be discussed in this evaluation.

The Lewis and Clark National Forest submitted a letter to the USFWS on March 31, 1997 stating that for any project that is completed on the Forest effects of the project will address the following species :

APPENDIX A

TENDERFOOT CREEK EXPERIMENTAL FOREST RESEARCH PROJECT

BIOLOGICAL ASSESSMENT

PREPARED BY

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December 1997