

APPENDIX A

MONITORING PLAN

INTRODUCTION

The following monitoring matrix describes monitoring associated with the Glacier Loon Project and summarizes the purpose, methods, and expected results and uses of the proposed monitoring activities. The Forest Service is currently seeking opportunities for multi-party monitoring of post treatment conditions.

| TABLE A-1. SUMMARY OF MONITORING ACTIVITIES | | | | | |
|--|------------------------------------|--|---|---|--|
| WHAT | WHERE | WHEN/DURATION | WHY | WHO | EXPECTED RESULTS AND USE |
| WILDLIFE | | | | | |
| Monitor temporary road reclamation and potential post sale use of temporary roads and skid trails. | Units | POST SALE | To determine if roads and skid trails are left in an adequate condition and to see if they are receiving post sale use. | Wildlife Biologist | Determine if temporary road closure expectations are correct. |
| INVASIVE PLANTS | | | | | |
| Monitor the contracted spraying along the haul routes after spraying is completed. | Haul Routes | Post Sale | To ensure proper spraying techniques and compliance with the NIWC DN. | COR or Forest Weed Coordinator | Monitor for noxious weed acres of infestation, effectiveness of control, containment, and prevention measures, and spread and existence of new populations of noxious weeds. |
| FOREST ROADS | | | | | |
| Monitor and oversee temporary road construction. | Temporary roads | Throughout duration of project implementation. | Insure road construction activities comply with contract specifications. | Contracting Officer, Forest Service Representative, and Timber Sale Administrator | Routinely determine compliance with contract specifications. |
| FOREST VEGETATION | | | | | |
| Review and Document tree marking and prescription compliance. | All or a sample of treatment units | During Sale Preparation | Ensure compliance with NEPA and FS policy | Silviculturist | Assure project implementation complies with the NEPA decision |

**TABLE A-1.
SUMMARY OF MONITORING ACTIVITIES**

| WHAT | WHERE | WHEN/DURATION | WHY | WHO | EXPECTED RESULTS AND USE |
|---|------------------------|--|---|--|--|
| Develop NEPA to Implementation crosswalk. | SLRD | Prior to contract development | Ensure layout complies with NEPA decision | Presale Forester | Assure layout complies with NEPA decision |
| Review contract prior to advertisement. | SLRD | Prior to contract advertisement | Ensure contract complies with NEPA decision | TMO, Presale Forester, IDT members, Line Officer, Contracting Officer, TSA, ER | Assure project implementation complies with the NEPA decision |
| Monitor and oversee vegetation treatments. | All treatment units | Throughout project implementation | Ensure treatment activities comply with contract specifications | CO, FSR, TSA, HI, and Silviculturist | Assure compliance with contract specifications. |
| Conduct post treatment surveys to monitor changes in forest structure, composition, and insect and disease conditions and to determine in the silvicultural prescription was met. | All treatment units | Immediately following treatment and periodically thereafter as specified in the silvicultural prescription | Determine how well objectives were met and gather data needed to assess possible follow-up treatments | Silviculturist, Culturist, or designated Representative | Determine the effectiveness of treatments, the need to conduct follow-up treatments, and to make future treatment decisions. |
| Conduct reforestation surveys to determine regeneration success and needs. | All regeneration units | First, third, and fifth year after harvest | Determine regeneration success and needs | Silviculturist, Culturist, or designated Representative | Assure adequate stocking of desired species occurs. |

APPENDIX B

BEST MANAGEMENT PRACTICES

INTRODUCTION

Federal agency compliance with pollution control is addressed through Section 313 of the Clean Water Act, EO 12580 (January 23, 1987), National Nonpoint Source Policy (December 12, 1984), USDA Nonpoint Source Water Quality Policy (December 5, 1986) and the EPA in their guidance "Nonpoint Source Controls and Water Quality Standards" (August 19, 1987). In order to comply with State and local non-point pollution controls, the Forest Service will apply BMPs to all possible non-point sources resulting from management activities proposed in this EA. These BMPs are the Soil and Water Conservation Practices described in the FSH 2509.22.

Best Management Practices are the primary mechanism for achievement of water quality standards (EPA 1987). This appendix describes the Forest Service's BMP process in detail, and lists the key Soil and Water Conservation Practices that have been selected to be used in the action alternatives analyzed in this EA.

Best Management Practices include, but are not limited to, structural, and non-structural controls, operations, and maintenance procedures. Best Management Practices can be applied before, during, or after pollution-producing activities to reduce or eliminate the introduction of pollutants into the receiving watershed (40 CFR 130.2, EPA Water Quality Standards Regulation). Best Management Practices are usually applied as a system of practices rather than a single practice. They are selected based on site-specific conditions that reflect natural background conditions and political, social, economic, and technical feasibility.

The Flathead National Forest emphasizes the application of BMPs "to protect or improve the quality of the water resource" (Forest Plan, page II-40). Practices compiled from the Flathead Drainage 208 Project (May 1980), Flathead National Forest Hydrologic Guidelines (1980), and other sources are listed in the Water and Soils Sections of Chapter II, Forest-Wide Standards portion of the Flathead Forest Plan (pp. II-40 thru II-46). Additional BMPs are listed with the descriptions of individual management areas and in Appendix Q, Landtype Guidelines (pp. Q-1 through Q-9). The Water Standards section further states: "Water quality limits listed in the State Water Quality Standards are coordinated with BMPs" (p. II-40).

ROAD MAINTENANCE ASSOCIATED WITH THE GLACIER LOON PROJECT

Best Management Practices would be applied on **37.7 miles** of haul routes prior to the beginning of logging activities. Completion of BMPs would be required the first season during dry operating conditions. All BMPs required under the Timber Sale Contract would be met following completion of sale activities.

As summarized in the following table, road maintenance (application BMPs) would occur on specified road used for haul of commercial products.

| TABLE B-1. ROAD MAINTENANCE ASSOCIATED WITH THE GLACIER LOON PROJECT | |
|--|-------|
| ROAD NUMBER | MILES |
| 79 | 7.80 |
| 561 | 1.28 |
| 9500 | 0.06 |
| 9552 | 1.00 |
| 9575 | 0.41 |
| 9578 | 4.18 |
| 9579 | 0.69 |
| 9591 | 2.70 |
| 9598 | 0.37 |
| 9773 | 0.64 |
| 9780 | 0.04 |
| 10563 | 0.48 |
| 10566 | 0.22 |
| 10567 | 1.31 |
| 10728 | 1.27 |
| 10732 | 1.81 |
| 10733 | 0.47 |
| 10734 | 0.17 |

| TABLE B-1. ROAD MAINTENANCE ASSOCIATED WITH THE GLACIER LOON PROJECT | |
|--|-------|
| ROAD NUMBER | MILES |
| 10741 | 0.91 |
| 11648 | 0.18 |
| 90240 | 0.74 |
| 90242 | 0.45 |
| 90244 | 1.80 |
| 91239 | 0.71 |
| 91240 | 0.39 |
| 91241 | 1.59 |
| 91242 | 0.46 |
| 91305 | 0.78 |
| 91306 | 0.54 |
| 10157Y | 0.16 |
| 11648B | 0.75 |
| 79A | 0.33 |
| 79C | 0.70 |
| 79L | 0.43 |
| 9579C | 1.90 |
| Total BMPS | 37.7 |

STATE REQUIREMENTS FOR PROTECTION OF WATER QUALITY

Montana State Water Quality Standards require the use of reasonable land, soil, and water conservation practices (similar to BMPs) as the controlling mechanism for non-point pollution. The use of BMPs is also required in the MOU between the Forest Service and the State of Montana as part of the agency's responsibility as the designated water quality management agency on NFS lands.

BEST MANAGEMENT PRACTICES IMPLEMENTATION PROCESS

In cooperation with the State, the Forest Service's primary strategy for the control of non-point sources of pollution is based on the implementation of preventive practices (i.e., BMPs). The BMPs have been designed and selected to protect the identified beneficial uses of the watershed.

The Forest Service non-point source management system consists of the following steps:

BMP SELECTION AND DESIGN

Water quality goals are identified in the Forest Plan. These goals meet or exceed applicable legal requirements including State water quality regulations, the Clean Water Act, and the NEPA. Environmental assessments for projects are tiered to Forest Plans using the NEPA process. The appropriate BMPs are selected for each project by an ID Team. In each new location, there is flexibility to design different BMPs depending on local conditions and values and downstream

beneficial uses of water. The BMP selection and design are dictated by the proposed activity, water quality objectives, soils, topography, geology, vegetation, and climate. Environmental impacts and water quality protection options are evaluated, and alternative mixes of practices are considered. A final collection of practices is selected that not only protect water quality, but also meet other resource needs. These final selected practices constitute the BMPs for the project.

BMP APPLICATION

The BMPs are translated into contract provisions, special use permit requirements, project plan specifications, and so forth. This ensures that the operator or person responsible for applying the BMPs actually is required to do so. Site-specific BMP prescriptions are taken from plan-to-ground by a combination of project layout and Resource Specialists (hydrology, fisheries, soils, etc.). This is when final adjustments to fit BMP prescriptions to the site are made.

BMP MONITORING

When the resource activity begins (e.g., timber harvest or road building), Timber Sale Administrators, Engineering Representatives, Resource Specialists, and others ensure the BMPs are implemented according to plan. Best Management Practices implementation monitoring is done before, during, and after resource activity implementation. This monitoring answers the question: Did we do what we said we were going to do? Once BMPs have been implemented, further monitoring is done to evaluate if the BMPs are effective in meeting management objectives and protecting beneficial uses. If monitoring indicates that water quality standards are not being met or beneficial uses are not being protected, corrective action will consider the following:

1. Is the BMP technically sound? Is it really best or is there a better practice that is technically sound and feasible to implement?
2. Was the BMP applied entirely as designated? Was it only partially implemented? Were personnel, equipment, funds, or training lacking which resulted in inadequate or incomplete implementation?
3. Do the parameters and criteria that constitute water quality standards adequately reflect human-induced changes to water quality and beneficial uses?

FEEDBACK

Feedback on the results of BMP evaluation is both short and long term in nature. Where corrective action is needed, immediate response will be undertaken. This action may include modification of the BMP, modification of the activity, ceasing the activity, or possibly modification of the State Water Quality Standard. Cumulative effects over the long term may also lead to the need for possible corrective actions. Effectiveness of BMPs is based on audit results. Audit results specific to the Swan Lake Ranger District of the Flathead National Forest are on file at the District Office.

BEST MANAGEMENT PRACTICES EFFECTIVENESS

In looking at the effectiveness of BMPs for the Flathead National Forest, it is reasonable to group BMP audit results for the Kootenai and Flathead National Forests together since they have similar soils. Both Forests are dominated by soils formed in the glacial till formed in material weathered from Belt rocks. This material is topped with wind blown volcanic ash from west coast eruptions up to 6000 years ago.

Best Management Practice audits have occurred on the Flathead and Kootenai National Forests since 1988. Audits are done to determine if BMPs were properly applied and, if so, if they were effective at maintaining soil and water quality. Since 1988, individual BMPs have been audited or monitored 2232 times on the Flathead and Kootenai National Forests. They were effective 2211 times.

In order to analyze the results of the BMP audits, they were grouped according to the soil type on which they occurred. The simplest way is to group them by two classes:

1. Residual soils that formed from the underlying bedrock, or
2. Soils formed from glacial till.

Looking at these soil criteria, BMPs were effective when properly applied on glacial soils 1585 times out of 1596 applications. Best Management Practices were effective when properly applied on residual soils 154 out of 156 applications. An additional 480 BMPs were monitored without reference to the soil types on which they are applied. Of these, 472 were effective at protecting soil and water quality.

In summary, BMPs were effective 99.3 percent of the time they were properly applied on glacial till soils. Lumping the entire audit results together regardless of their soil types and including the earliest audits that were not specific to soil type, BMPs were effective 99 percent of the time that they were properly applied on the Flathead and Kootenai National Forests.

ITEMS COMMON TO ALL SOIL AND WATER CONSERVATION PRACTICES

RESPONSIBILITY FOR IMPLEMENTATION

The Swan Lake District Ranger is responsible for ensuring that all applicable SWCPs are applied and implemented. The Timber Management Assistant is responsible for ensuring that the objectives of the SWCPs identified in this appendix are incorporated into the Timber Sale Contract by use of the appropriate Timber Sale Contract CT provisions. The Timber Sale Administrator and Engineering Representative/Contracting Officer's Representative (ER/COR) is responsible for ensuring that contract provisions are properly administered on the ground.

MONITORING

The Timber Sale Administrator, ER/COR, Forest Soil Scientist, and Forest Hydrologist, as needed, will monitor the effectiveness of the applied SWCPs. If the practice is not effective in meeting State or Forest Plan Standards, the practice or project activity will be redesigned, rescheduled, or dropped. Feedback of the results of the site-specific SWCP monitoring to the Forest Soil Scientist will ensure that the best practices are incorporated into all projects impacting water quality. This requirement conforms to the objectives of Practice 11.02 - Soil and Water Resource Monitoring and Evaluation.

SITE-SPECIFIC BEST MANAGEMENT PRACTICES

Description of the soil and water conservation practices from the Forest Service Soil and Water Conservation Handbook (FSH 2509.22) will be applied in all alternatives. The location where the practices will be applied is specified in the table below. For a more detailed description of a specific BMP refer to the Soil and Water Conservation Handbook.

Abbreviations used in this table:

COR = Contracting Officer's Representative
 EA = Environmental Assessment
 ER = Engineering Representative
 FMO = Fire Management Officer
 FNF = Flathead National Forest

IDT = Interdisciplinary Team
 INFISH = Inland Native Fish Strategy
 PSF = Pre Sale Forester
 RHCA = Riparian Habitat Conservation Area
 SAM = Sale Area Map

SMZ = Streamside Management Zone
 SPS = Special Project Specification
 SWCP = Soil and Water Conservation Practice
 TSA = Timber Sale Administrator
 TSC = Timber Sale Contract

| SWCP | MT BMP | SWCP OBJECTIVE | APPLICABLE UNITS/ROADS | RECOMMENDED BEST MANAGEMENT PRACTICES BY IDT/TSA | CONSIDERATIONS FOR BEST MANAGEMENT PRACTICES | PERSON(S) RESPONSIBLE | STANDARD CONTRACT PROVISIONS | STEWARDSHIP CONTRACT PROVISIONS |
|-------|---------|--|------------------------|--|--|-----------------------|------------------------------|---------------------------------|
| 14.01 | IV. A-C | TIMBER SALE PLANNING - To incorporate soil and water resource considerations into Timber Sale Planning | All Activities | 1. Unit design, mitigation, and effects analysis was done by IDT. 2. TSC will be prepared by PSF that will include management constraints and Design Criteria from EA. 3. Use standard interim RHCA widths unless modified through watershed analysis. 4. Use exiting skid trails where feasible. | IDT has evaluated watershed characteristics and estimated response to proposed activities. EA identifies Design Criteria to protect soil and water resources. Timber sale contracts will include provisions to meet water quality, soils, and other resources as directed by the Decision. | IDT, PSF | N/A | N/A |

| SWCP | MT BMP | SWCP OBJECTIVE | APPLICABLE UNITS/ROADS | RECOMMENDED BEST MANAGEMENT PRACTICES BY IDT/TSA | CONSIDERATIONS FOR BEST MANAGEMENT PRACTICES | PERSON(S) RESPONSIBLE | STANDARD CONTRACT PROVISIONS | STEWARDSHIP CONTRACT PROVISIONS |
|-------|--------|---|------------------------|---|---|-----------------------|---|----------------------------------|
| 14.02 | IV. A | TIMBER HARVEST UNIT DESIGN - To insure that timber harvest unit design will secure favorable conditions of water flow, maintain water quality and soil productivity, and reduce soil erosion and sedimentation. | All Activities | <ol style="list-style-type: none"> 1. Cumulative effects analysis and unit design were performed by IDT. 2. The prescriptions and unit design are consistent with direction outlined in the considerations for BMPs. 3. Use standard interim RHCA widths unless modified through watershed analysis. 4. Use exiting skid trails where feasible. | Proposed activities were evaluated to estimate the potential watershed response. Prescriptions will be designed to assure an acceptable level of protection for soil and water resources. Management will protect soil/water values by avoiding sensitive areas, adjusting unit boundaries, adding specific BMPs to meet specific SWCPs, applying mitigation, and applying implementation/effectiveness monitoring. | IDT | N/A | N/A |
| 14.03 | N/A | USE OF SALE AREA MAPS (SAMs) FOR DESIGNATING SOIL AND WATER PROTECTION NEEDS - To delineate the location of protected areas and available water sources and insure their recognition, proper consideration, and protection on the ground. | All Activities | <ol style="list-style-type: none"> 1. Water courses identified and protected using SMZ buffers as a minimum. 2. Skidding on soil when moisture is <18%. 3. Use designated skid trails agreed to by TSA. 4. Use standard interim RHCA widths unless modified through watershed analysis. | The IDT will identify water courses to be protected, unit boundaries, and other features. Ground verification and preparation of SAMs to be included in TSC will be done by PSF. TSA reviews areas of concern with purchaser before operations. | IDT, PSF, TSA | B(T)1.1 B(T)6.5 C(T)6.50# C(T)6.4# | B.1 G.5 K-G.5.0# K-G.4# |

| SWCP | MT BMP | SWCP OBJECTIVE | APPLICABLE UNITS/ROADS | RECOMMENDED BEST MANAGEMENT PRACTICES BY IDT/TSA | CONSIDERATIONS FOR BEST MANAGEMENT PRACTICES | PERSON(S) RESPONSIBLE | STANDARD CONTRACT PROVISIONS | STEWARDSHIP CONTRACT PROVISIONS |
|-------|-------------------------|---|------------------------|--|---|-----------------------|---|--|
| 14.04 | IV. A-2, B-1,2 VI. A | LIMITING THE OPERATION PERIOD OF TIMBER SALE ACTIVITIES - To minimize soil erosion, sedimentation, and a loss in soil productivity by insuring that the purchaser conducts his/her operations in a timely manner. | All Activities | <ol style="list-style-type: none"> Units located on soils sensitive to compaction and/or displacement have been identified. Designate units needing harvest on frozen or snow covered ground. All other ground disturbing activities will occur during dry, frozen, or snow-covered conditions. Be prepared to suspend operations if conditions change rapidly and when the erosion hazard becomes high. Consult with operators experienced with winter logging techniques. In wet unfrozen soil areas, use tractors or skidders to compact the snow for skid road locations only when adequate snow depth exists. Avoid steeper areas where frozen skid trails may be subject to erosion next spring. | If limited operating periods are identified and recommended during the analysis by the IDT, the PSF will prepare a contract that includes appropriate provisions. | IDT, PSF, TSA | B(T)6.31 B(T)6.311 B(T)6.6 C(T)6.6 C(T)6.316# C(T)6.4# | G.3.1 G.3.1.1 G.6 K-G.6 K-G.3.1.6# K-G.4# |
| 14.05 | IV. A-B III A-2-4 | PROTECTION OF UNSTABLE AREAS - To protect unstable areas and avoid triggering mass movements of the soil mantle and resultant erosion and sedimentation. | All Activities | <ol style="list-style-type: none"> Unstable landtypes will be identified during the planning process. Units found to need further protection will use alternative yarding techniques, seasonal restrictions, and/or unit boundary adjustments. | If the NEPA analysis concluded that soils/geology in the area were unstable, BMPs would be designed to prevent irreversible soil and water effects. | IDT, PSF, TSA | C(T)6.316# C(T)6.4# | K-G.3.1.6# K-G.4# |

| SWCP | MT BMP | SWCP OBJECTIVE | APPLICABLE UNITS/ROADS | RECOMMENDED BEST MANAGEMENT PRACTICES BY IDT/TSA | CONSIDERATIONS FOR BEST MANAGEMENT PRACTICES | PERSON(S) RESPONSIBLE | STANDARD CONTRACT PROVISIONS | STEWARDSHIP CONTRACT PROVISIONS |
|-------|----------------|--|------------------------|---|--|-----------------------|---|--|
| 14.06 | II | RIPARIAN AREA DESIGNATION - To minimize the adverse effects on riparian areas with prescriptions that manage nearby logging and related land disturbance activities. | All Activities | <ol style="list-style-type: none"> 1. Identify areas with or adjacent to wet areas. 2. Default RHCA widths will be adhered to unless modified through watershed analysis. SMZ widths will be used as a minimum if modification is proposed. 4. Areas found during sale layout will be reported to the Hydrologist and afforded the same protections as those identified earlier. | All streams and wetlands in the project area will comply with FNF Forest Plan as amended by INFISH. The width of the riparian areas will be decided upon by the IDT. These widths will be included on the SAM, marked on the ground and included in the TSC. | IDT, PSF | B(T)1.1 B(T)6.5, C(T)6.4# C(T)6.41# C(T)6.50# | B.1 G.5 K-G.4# K-G.4.1# K-G.5.0# |
| 14.07 | IV. A-2 B-1 | DETERMINING TRACTOR-LOGGABLE GROUND - To protect water quality from degradation caused by tractor logging ground disturbance. | All Activities | <ol style="list-style-type: none"> 1. Tractor loggable units have been identified during the planning process. 2. Those areas found not to be tractor loggable were designated as alternative logging systems or were dropped from the unit. | IDT has identified tractor-loggable ground (in conjunction with personnel from timber operations) during transportation and timber sale planning process. The results have been used to determine intensity of and restrictions for land disturbance activities. TSC and SAM indicate areas and conditions under which tractors can operate. | IDT, PSF | B(T)1.1 B(T)6.42 C(T)6.4# C(T)6.316# | B.1 G.4.2 K-G.4# K-G.3.1.6# |
| 14.08 | IV. A-B | TRACTOR SKIDDING DESIGN - To minimize erosion and protect soil productivity by designing skidding patterns to best fit the terrain. | All Activities | <ol style="list-style-type: none"> 1. Identify units with designated or dispersed skid trails. 2. TSA and purchaser agree on proposed locations before operation. | IDT has identified sensitive areas during the planning process. The TSA will execute the plan on the ground by locating the skid trails with the timber purchaser or by agreeing to the purchaser's proposed locations prior to operation. | IDT; TSA | B(T)6.422 C(T)6.4# | G.4.2 K-G.4# |

| SWCP | MT BMP | SWCP OBJECTIVE | APPLICABLE UNITS/ROADS | RECOMMENDED BEST MANAGEMENT PRACTICES BY IDT/TSA | CONSIDERATIONS FOR BEST MANAGEMENT PRACTICES | PERSON(S) RESPONSIBLE | STANDARD CONTRACT PROVISIONS | STEWARDSHIP CONTRACT PROVISIONS |
|-------|------------------|---|------------------------|---|--|-----------------------|--|---|
| 14.09 | IV. A-2 | SUSPENDED LOG YARDING IN TIMBER HARVESTING - To protect the soil from excessive disturbance and accelerated erosion and maintain the integrity of the riparian areas and other sensitive areas. | Cable Logging Units | <ol style="list-style-type: none"> Units that have slopes that are unsuitable for or sensitive to ground base skidding will be identified. Units with sustained slopes >35% will be designated cable harvest units. | IDT recognizes the hazards associated with operating on steep and/or rocky slopes. Areas found to be of concern will use appropriate harvest systems that provide for a safe work environment and protect natural resources. | IDT, PSF | B(T)6.42 C(T)6.4# C(T)6.50# | G.4.2 K-G.4# K-G.5.0# |
| 14.10 | IV. A-5,6 B-4 | LOG LANDING LOCATION AND DESIGN - To locate in such a way as to avoid soil erosion and water quality degradation. | All Activities | <ol style="list-style-type: none"> TSA and purchaser agree on landing locations before operation. Use minimum size and least excavation needed. No side-cast material into sensitive areas or waterways. Install proper drainage. | TSA must agree to landing locations proposed by the purchaser. Approved landing locations will meet the criteria of minimal size, least excavation needed, minimum skid roads necessary, no side-cast material into sensitive areas, and have proper drainage. | TSA | B(T)6.422 C(T)6.422 | G.4.2.2 K-G.4.2.2 |
| 14.11 | IV. A-5,6 B-4 | LOG LANDING EROSION PREVENTION AND CONTROL- To reduce erosion and subsequent sedimentation from log landing through the use of mitigating measures. | All Activities | <ol style="list-style-type: none"> Proper drainage will be installed and maintained during operation. Landings will be scarified, seeded, and fertilized upon completion of harvest activities. TSA will assess conditions and take necessary steps to ensure soil and water protection. | PSF and TSA assess what is necessary to prevent erosion from landings and to ensure stabilization. It is up to the TSA to request technical assistance as needed. | PSF, TSA | B(T)6.6 B(T)6.64 C(T)6.6 C(T)6.632# C(T)6.633# | G.6 G.6.4 K-G.6 K-G.6.3.2# K-G.6.3.3# |

| SWCP | MT BMP | SWCP OBJECTIVE | APPLICABLE UNITS/ROADS | RECOMMENDED BEST MANAGEMENT PRACTICES BY IDT/TSA | CONSIDERATIONS FOR BEST MANAGEMENT PRACTICES | PERSON(S) RESPONSIBLE | STANDARD CONTRACT PROVISIONS | STEWARDSHIP CONTRACT PROVISIONS |
|-------|------------|--|------------------------|--|--|-----------------------|---|--|
| 14.12 | IV. A-C | EROSION PREVENTION AND CONTROL MEASURES DURING THE TIMBER SALE OPERATION - To ensure that the purchaser's operations shall be conducted reasonably to minimize soil erosion. | All Activities | <ol style="list-style-type: none"> 1. Designate units with seasonal restrictions. 2. Do not operate during wet periods including spring snowmelt and/or intense or long-duration rain storms. 3. TSA ensures that erosion control is kept current and prevents operation when excessive impacts are possible. | PSF and TSA sets purchaser's responsibility to prevent soil/water resource damage in TSC. TSA ensures that erosion control is kept current and prevents operation when excessive impacts are possible. | PSF, TSA | A16 B(T)6.6 B(T)6.64 C(T)6.6 C(T)6.601# C(T)6.316# | A.16 G.6 G.6.4 K-G.6 K-G.6.6.1 K-G.3.1.6# |
| 14.13 | IV. B-5, 6 | SPECIAL EROSION PREVENTION MEASURES ON AREAS DISTURBED BY HARVEST ACTIVITIES - To prevent erosion and sedimentation on disturbed areas. | All Activities | <ol style="list-style-type: none"> 1. Waterbar, slash, seed, and/or fertilize skid trails and landings. 2. Rehabilitate constructed skid trails and temporary roads. 3. BMPs may be adjusted by the TSA to meet operational requirements. | IDT identifies locations needing special stabilization measures. If any such areas are identified, BMPs may be adjusted by the TSA to meet operational requirements. | IDT, TSA | C(T)6.601# C(T)6.32# C(T)6.633# | K-G.6.0.1# K-G.6.3.2# K-G.6.3.3# |
| 14.14 | IV. B-5 | REVEGETATION OF AREAS DISTURBED BY HARVEST ACTIVITIES - To establish a vegetative cover on disturbed areas to prevent erosion and sedimentation. | All Activities | <ol style="list-style-type: none"> 1. Seed and fertilize areas of exposed soil with FNF approved vegetative and fertilizer mix. | IDT has established vegetation and fertilizer mix to be used in the project area with outlines on the extent to which it should be used. TSA is responsible for seeing that revegetation work required by purchaser is done correctly and in a timely manner. The purchaser will be responsible for revegetation immediately after the completion of harvest. Funds will be collected for the District to do follow-up seeding/fertilizing in years two and three after harvest. | IDT, TSA | C(T)6.01# C(T)6.633# | K-G.6.0.1# K-G.6.3.3# |

| SWCP | MT BMP | SWCP OBJECTIVE | APPLICABLE UNITS/ROADS | RECOMMENDED BEST MANAGEMENT PRACTICES BY IDT/TSA | CONSIDERATIONS FOR BEST MANAGEMENT PRACTICES | PERSON(S) RESPONSIBLE | STANDARD CONTRACT PROVISIONS | STEWARDSHIP CONTRACT PROVISIONS |
|-------|----------------------|--|------------------------|--|---|-----------------------|--|--|
| 14.15 | IV. A-4, 5 B-5, 6 | EROSION CONTROL ON SKID TRAILS - To protect water quality by minimizing erosion and sedimentation derived from skid trails. | All Activities | <ol style="list-style-type: none"> 1. Ensure proper skid trail location. 2. Ensure proper drainage on skid trails. 3. Rehabilitate constructed skid trails and temporary roads. 4. Ensure maintenance of erosion control structures by purchaser. | <p>Erosion control measures may be recommended by the IDT, but site specifically adjusted by the TSA. TSA will ensure erosion control measures are applied prior to expected hydrologic events (spring runoff, high-intensity storms, etc.).</p> <p>Maintenance of erosion control structures by the purchaser may be necessary and requested by the TSA.</p> | TSA | <p>B(T)6.6 B(T)6.65 B(T)6.66 C(T)6.6 C(T)6.633#</p> | <p>G.6 G.6.5 G.6.6 K-G.6 K-G.6.3.3#</p> |
| 14.16 | IV. B-2 | WET MEADOW PROTECTION DURING TIMBER HARVESTING - To avoid damage to the ground cover, soil, and water in meadows. | All Activities | <ol style="list-style-type: none"> 1. Identify units with or adjacent to wet meadows. 2. Units with unmapped wet areas will be reported to Hydrologist and afforded the same protection as those identified during the planning process. 3. Standard interim RHCA widths will be adhered to unless modification is in place. <p>2. SMZ law will be met or exceeded.</p> | <p>IDT has identified areas needing special protection. PSF will verify the areas needing protection and prepare the contract to prevent damage to meadows. The TSA will be responsible for on-the-ground protection of meadows. If meadows are found by the TSA during operations, it is their responsibility to either afford them the proper protection or pursue a contract modification.</p> | IDT, PSF, TSA | <p>B(T)1.1 B(T)6.422 B(T)6.61 C(T)6.4# C(T)6.62#</p> | <p>B.1 G.4.2.2 G.6.1 K-G.4# K-G.6.2#</p> |
| 14.17 | V. A-C | STREAM CHANNEL PROTECTION (IMPLEMENTATION AND ENFORCEMENT) - Protect natural stream flows; provide unobstructed passage of flows; reduce sediment input; and restore flow if diverted by timber sale activity. | All Activities | <ol style="list-style-type: none"> 1. Standard interim RHCA widths will be adhered to unless modification is in place. 2. SMZ widths will be used at a minimum if modification in place. 3. SMZ law will be met or exceeded. | <p>IDT has identified the location of channels in the decision area. PSF will prepare a SAM locating the channels needing protection. Layout crew marks boundaries and trees according to HB-731 and FP guidelines. TSA will see that TSC items are carried out on the ground. Technical assistance will be consulted as needed.</p> | IDT, PSF, TSA | <p>B(T)1.1 B(T)6.5 B(T)6.6 C(T)6.50# C(T)6.6</p> | <p>B.1 G.5 G.6 K-G.5.0# K-G.6</p> |

GLACIER LOON FUELS REDUCTION AND FOREST HEALTH PROJECT

BEST MANAGEMENT PRACTICES

APPENDIX B

| SWCP | MT BMP | SWCP OBJECTIVE | APPLICABLE UNITS/ROADS | RECOMMENDED BEST MANAGEMENT PRACTICES BY IDT/TSA | CONSIDERATIONS FOR BEST MANAGEMENT PRACTICES | PERSON(S) RESPONSIBLE | STANDARD CONTRACT PROVISIONS | STEWARDSHIP CONTRACT PROVISIONS |
|-------|---------|--|------------------------|---|--|-----------------------|---|--|
| 14.18 | IV. A-C | EROSION CONTROL STRUCTURE MAINTENANCE - To insure that constructed erosion control structures are stabilized and working effectively. | All Activities | 1. During the period of the TSC, the purchaser is responsible for maintaining their erosion control features. | During the period of the TSC, the purchaser is responsible for maintaining their erosion control features. If work is needed beyond this time, the District will pursue other sources of funding. | TSA | B(T)6.66 B(T)6.67 | G.6.6 G.6.7 |
| 14.19 | IV. A-C | ACCEPTANCE OF TIMBER SALE EROSION CONTROL MEASURES BEFORE SALE CLOSURE - To assure the adequacy of required erosion control work on timber sales. | All Activities | 1. TSA reviews erosion prevention work before each harvest unit is considered complete. 2. The inspection will determine if the work is acceptable and will meet the objective of the erosion control feature. | A careful review of erosion prevention work will be made by the TSA before each harvest unit is considered complete. The inspection will determine if the work is acceptable and will meet the objective of the erosion control feature. A feature is considered not acceptable if it does not meet standards or is not expected to protect soil/water values. Technical assistance will be used as necessary. | TSA | B(T)6.36 | G.3.6 |
| 14.20 | IV. C | SLASH TREATMENT IN SENSITIVE AREAS - To protect water quality by protecting sensitive tributary areas from degradation that would result from using mechanized equipment for slash disposal. | All Activities | 1. Where harvest is proposed within riparian areas, either slash should be removed with the tree or scattered and not treated. 2. Mechanical fuels treatments should not be used on sensitive land types. | All activities will comply with the FNF Forest Plan as amended by INFISH. Where harvest within riparian areas is proposed, either the slash would be removed with the tree or scattered and not treated. | TSA, FMO | B(T)6.5 B(T)6.7 C(T)6.50# C(T)6.7 C(T)6.71 C(T)6.753 | G.5 G.7 K-G.5.0# K-G.7# K-G.7.1 K-G.7.5.3 |
| 14.22 | N/A | MODIFICATION OF THE TSC - To modify the TSC if new circumstances or conditions indicate the timber sale will cause irreversible damage to soil, water, or watershed values. | All Activities | 1. Environmental modification procedure. | If TSC is not adequate to protect soil/water resources, the TSA and Contracting Officer are responsible for recommending modification of the TSC. | TSA | B(T)8.33 | i.3.3 |

| SWCP | MT BMP | SWCP OBJECTIVE | APPLICABLE UNITS/ROADS | RECOMMENDED BEST MANAGEMENT PRACTICES BY IDT/TSA | CONSIDERATIONS FOR BEST MANAGEMENT PRACTICES | PERSON(S) RESPONSIBLE | STANDARD CONTRACT PROVISIONS | STEWARDSHIP CONTRACT PROVISIONS |
|-------|-------------|--|---------------------------------|--|---|-----------------------|--|---------------------------------------|
| 15.01 | III. A-E | GENERAL GUIDELINES FOR TRANSPORTATION PLANNING - To introduce soil and water resource considerations into transportation planning. | All Roads | <ol style="list-style-type: none"> 1. Complete a roads analysis. 2. Transportation plans include installation and maintaining proper drainage. | The IDT has evaluated watershed characteristics and estimated the response of soil and water resources to proposed transportation alternatives and activities. | IDT, ER | N/A | |
| 15.02 | III. A-B | GENERAL GUIDELINES FOR THE LOCATION AND DESIGN OF ROADS AND TRAILS - To locate and design roads and trails with minimal soil and water impact while considering all Design Criteria. | New Road and Trail Construction | <ol style="list-style-type: none"> 1. Follow INFISH Standards and Guidelines for road management. 2. Identify sensitive land types, riparian areas, and wetlands during planning. 3. Use the minimum amount of roads and trails necessary. | The IDT has insured that the location and design of roads and trails are based on multiple resource objectives. Mitigation measures have been designed to protect the soil and water resources identified in the NEPA process. Contract provisions will be prepared by the ER that meets the soil and water resource protection requirements. | IDT, ER | | |
| 15.03 | III. A-E | ROAD AND TRAIL EROSION CONTROL PLAN - To prevent, limit, and mitigate erosion, sedimentation, and resulting water quality degradation prior to the initiation of construction by timely implementation of erosion control practices. | New Road and Trail Construction | <ol style="list-style-type: none"> 1. Seed and fertilize disturbed areas. 2. Install proper ditching and road slope. 3. Install proper drainage. 4. Incorporate road grade breaks. 5. Use minimum road or trail length/width necessary. 6. Avoid wet areas or areas of sensitive soil types. | IDT has established soil/water conservation objectives and mitigation measures. ER will then prepare a contract that reflects the objectives. ER will see that erosion control measures are approved and completed in a timely manner. IDT reviews projects to check effectiveness of erosion control features. | IDT, ER | B(T)6.31 B(T)6.312 B(T)6.6 C(T)6.601# | G.3.1 G.3.1.2 G.6 K-G.6.0.1# |
| 15.04 | III. D 1, 4 | TIMING OF CONSTRUCTION ACTIVITIES - To minimize erosion by conducting operations during minimal runoff periods. | New Road and Trail Construction | <ol style="list-style-type: none"> 1. Avoid construction during wet periods. | IDT has outlined detailed erosion control measures in NEPA process. ER puts these measures into contract provisions. Compliance is assured by Contracting Officer or ER. | IDT, ER | B(T)6.31 B(T)6.312 B(T)6.6 SPS 204 | G.3.1 G.3.1.2 G.6 |

| SWCP | MT BMP | SWCP OBJECTIVE | APPLICABLE UNITS/ROADS | RECOMMENDED BEST MANAGEMENT PRACTICES BY IDT/TSA | CONSIDERATIONS FOR BEST MANAGEMENT PRACTICES | PERSON(S) RESPONSIBLE | STANDARD CONTRACT PROVISIONS | STEWARDSHIP CONTRACT PROVISIONS |
|-------|----------|---|---------------------------------|---|---|-----------------------|--|--|
| 15.05 | III. A-E | SLOPE STABILIZATION AND PREVENTION OF MASS FAILURES - To reduce sedimentation by minimizing the chances for road-related mass failures, including landslides and embankment slumps. | New Road and Trail Construction | Avoid construction across unstable areas. Construct embankments following approved engineering practices. 3. Use minimum road or trail length/width necessary. | Road and trail construction in mountainous terrain requires cutting and loading natural slopes which may lead to landslides and/or embankment failures. In areas with intrinsic slope stability problems, appropriate technical resource personnel must be involved in an interdisciplinary approach to route location. | IDT,; ER | N/A | |
| 15.06 | III. A-E | MITIGATION OF SURFACE EROSION AND STABILIZATION OF SLOPES - To minimize soil erosion from road cut slopes, fill slopes, and travel ways. | All Haul Roads | 1. Seed and fertilize cut and fill slopes. 2. Install proper ditching and road slope. 3. Install proper drainage. 4. Incorporate road grade breaks. 5. Install ditch relief culverts before/after stream crossings. | IDT has outlined detailed erosion control measures in the NEPA process. Stabilization techniques are included in contract provisions. Compliance is assured by Contracting Officer or ER. | IDT, ER | SPS 203, 204, 206A 210, 412 619, 625, 626 630 B(T) 5.3 B(T)6.6 B(T)6.63 B(T)6.66 B(T)6.312 C(T)5.314# C(T)6.6 C(T)6.601# | F.3 G.6 G.6.3 G.6.6 G.3.1.2 K-F.3.1.4# K-G.6 K-G.6.0.1# |
| 15.07 | III. E-2 | CONTROL OF PERMANENT ROAD DRAINAGE - To minimize the erosive effects of concentrated water and degradation of water quality by proper design and construction of road drainage systems and drainage control structures. | All Haul Roads | 1. Avoid long, steep grades. 2. Maintain adequate surface drainage. 3. Prevent erosion of culvert fills. 4. Maintain ditches. 5. Ditch relief culverts before/after stream crossings. | IDT has identified locations, Design Criteria, drainage control features, and mitigation. Compliance will be assured by the ER/Contracting Officer. | ER | B(T)5.3 B(T)6.6 C(T)5.31# C(T)6.6 | F.3 G.6 K-F.3.1# K-G.6 |

GLACIER LOON FUELS REDUCTION AND FOREST HEALTH PROJECT

| SWCP | MT BMP | SWCP OBJECTIVE | APPLICABLE UNITS/ROADS | RECOMMENDED BEST MANAGEMENT PRACTICES BY IDT/TSA | CONSIDERATIONS FOR BEST MANAGEMENT PRACTICES | PERSON(S) RESPONSIBLE | STANDARD CONTRACT PROVISIONS | STEWARDSHIP CONTRACT PROVISIONS |
|-------|-------------|--|--|---|--|-----------------------|--|---|
| 15.08 | III. D | PIONEER ROAD CONSTRUCTION - To minimize sediment production and mass wasting associated with pioneer road construction. | New Road and Trail Construction | <ol style="list-style-type: none"> 1. Ensure stable slopes during construction. 2. Seed and fertilize exposed soil. 3. Avoid construction during wet periods. 4. Use slash filter windrows. | ER/Contracting Officer will be responsible for enforcing contract specifications. The purchaser is responsible for submitting an operating plan that includes erosion control measures. | ER | B(T)5.23 B(T)6.31 B(T)6.311 B(T)6.312 B(T)6.6 C(T)6.601# SPS 204 | F.2.3 G.3.1 G.3.1.1 G.3.1.2 G.6 K-G.6.0.1# |
| 15.09 | III. E-7,8 | TIMELY EROSION CONTROL MEASURES ON INCOMPLETE ROADS AND STREAM CROSSING PROJECTS - To minimize erosion of and sedimentation from disturbed ground on incomplete projects. | All Road construction, reconstruction, and maintenance | <ol style="list-style-type: none"> 1. Avoid construction during wet periods. 2. Use slash filter windrows or silt fence. 3. Seed and fertilize disturbed areas. | IDT has identified project location and mitigation measures in NEPA process. Protective measures will be kept current on all areas of disturbed, erosion-prone areas. TSA ensures contract compliance. | IDT, TSA | B(T)5.23 B(T)6.31 B(T)6.6 B(T)6.66 C(T)6.6 C(T)6.601# | F.2.3 G.3.1 G.6 G.6.6 K-G.6 K-G.6.0.1# |
| 15.10 | III. D-8 | CONTROL OF ROAD CONSTRUCTION, EXCAVATION, AND SIDE-CAST MATERIAL - To reduce sedimentation from unconsolidated excavated and side-cast material caused by road construction, reconstruction, or maintenance. | All Road construction, reconstruction, and maintenance | <ol style="list-style-type: none"> 1. Do not side-cast into waterways or sensitive areas. 2. Use slash filter windrows or silt fence. | IDT has identified project location and mitigation measures in NEPA process. Protective measures will be kept current on all areas of disturbed, erosion-prone areas. TSA ensures contract compliance. | IDT, TSA | B(T)5.3 C(T)5.31# SPS 203 SPS 204 | F.3 K-F.3.1# |
| 15.11 | VII. A- 1,2 | SERVICING AND REFUELING EQUIPMENT - To prevent contamination of waters from accidental spills of fuels, lubricants, bitumens, and other harmful materials. | All Activities | <ol style="list-style-type: none"> 1. Ensure proper fuel storage and transportation. 2. Keep fuel from streams, wetlands, ponds, and lakes. | ER/TSA/Contracting Officer will designate the location, size, and uses of service refueling areas. All projects will adhere to the FNF Hazardous Substance Spill Plan in case of accidents. | ER, TSA | B(T)6.222 B(T)6.34 B(T)6.341 | G.2.2.2 G.3.4 G.3.4.1 |

| SWCP | MT BMP | SWCP OBJECTIVE | APPLICABLE UNITS/ROADS | RECOMMENDED BEST MANAGEMENT PRACTICES BY IDT/TSA | CONSIDERATIONS FOR BEST MANAGEMENT PRACTICES | PERSON(S) RESPONSIBLE | STANDARD CONTRACT PROVISIONS | STEWARDSHIP CONTRACT PROVISIONS |
|-------|----------|--|--|--|--|-----------------------|---|-----------------------------------|
| 15.12 | III A. 4 | CONTROL OF CONSTRUCTION IN RIPARIAN AREAS - To minimize the adverse effects on riparian areas from roads. | New Road and Temporary Road Construction | <ol style="list-style-type: none"> 1. Follow INFISH Standards and Guidelines for construction within riparian areas. 2. Use slash filter windrows or silt fence. 3. Install ditch relief culverts and surface water deflectors before/after stream crossings. | Proposed new and temporary roads will adhere to guidelines in the Montana Streamside Management Zone Law (HB-731). All road activities will follow INFISH Standards and Guidelines for road management. | ER, TSA | B(T)6.5 B(T)6.62 C(T)6.50# SPS 206 SPS 206A | G.5 G.6.2 K-G.5.0# |
| 15.13 | V. C-1 | CONTROLLING IN-CHANNEL EXCAVATION - To minimize stream channel disturbances and related sediment production. | All Road construction, reconstruction, and maintenance | <ol style="list-style-type: none"> 1. Use silt fence to minimize introduced sediment 2. Use minimum amount of road. 3. Construct minimum number of crossings. | BMP improvements at crossings would adhere to the guidelines in Montana Streamside Management Zone Law (HB-731) and the INFISH Standards and Guidelines for road management. | ER, TSA | B(T)6.5 SPS 204 SPS 206 206A | G.5 |
| 15.14 | V. A, C | DIVERSION OF FLOWS AROUND CONSTRUCTION SITES - To minimize downstream sedimentation by insuring all stream diversions are carefully planned. | All Work at Stream Crossings | <ol style="list-style-type: none"> 1. Divert stream flow around construction. 2. Use silt fence to minimize introduced sediment 3. Construction during low-flow | The IDT has determined, where stream crossings meet multiple resource objectives, the crossings would require a State 124 permit. This would require the State Fish, Wildlife, and Parks to review the adequacy of the proposed mitigation. Compliance with contract provisions would be done by the ER. | IDT, ER | B(T)6.5 B(T)6.31 C(T)6.50# C(T)6.6 | G.5 G.3.1 K-G.5.0# K-G.6 |

| SWCP | MT BMP | SWCP OBJECTIVE | APPLICABLE UNITS/ROADS | RECOMMENDED BEST MANAGEMENT PRACTICES BY IDT/TSA | CONSIDERATIONS FOR BEST MANAGEMENT PRACTICES | PERSON(S) RESPONSIBLE | STANDARD CONTRACT PROVISIONS | STEWARDSHIP CONTRACT PROVISIONS |
|-------|----------|---|--|---|--|-----------------------|--------------------------------|---------------------------------|
| 15.15 | V. A-C | STREAM CROSSINGS ON TEMPORARY ROADS - To keep temporary roads from unduly damaging streams, disturbing channels, or obstructing fish passage. | All Roads | <ol style="list-style-type: none"> 1. Consult Hydrologist on placement of crossing. 2. Use minimum number of stream crossings. 3. Construction during low-flow. 4. Follow INFISH Standards and Guidelines for construction within riparian areas. | The IDT identifies areas in need of a temporary road during the NEPA process. Proposed stream crossings would adhere to the guidelines in Montana Streamside Management Zone Law (HB-731). | PSF, ER, TSA | N/A | |
| 15.16 | V. C 1-7 | BRIDGE AND CULVERT INSTALLATION - To minimize sedimentation and turbidity resulting from excavation for in-channel structures. | All Road construction, reconstruction, and maintenance | <ol style="list-style-type: none"> 1. Installation should be done during periods of low flow. 2. In-stream sediment retention devices should be used throughout implementation. | IDT has identified project location and mitigation measures in NEPA process. Protective measures will be kept current on all areas of disturbed, erosion-prone areas. TSA ensures contract compliance. | IDT, TSA | C(T)5.31# (T-310) B(T)6.312 | K-F.3.1# (T-618) G.3.1.2 |
| 15.17 | III. D-9 | REGULATION OF BORROW PITS, GRAVEL SOURCES, AND QUARRIES - To minimize sediment production from borrow pits, gravel sources, and quarries and limit channel disturbance in those gravel sources suitable for development in floodplains. | N/A | | | ER | B(T)6.5 C(T)6.50# | G.5 K-G.5.0# |

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|-------|----------|---|--|--|---|-----------------------|--|--|
| 15.18 | III. D-8 | DISPOSAL OF RIGHT-OF-WAY AND ROADSIDE DEBRIS - To insure that debris generated during road construction is kept out of streams and prevent slash and debris from subsequently obstructing channels. | All Road construction, reconstruction, and maintenance | 1. Debris and slash generated during road construction should not be side-cast into streams. | Proposed road construction will adhere to the guidelines in the Montana Streamside Management Zone Law (HB-731). | ER | Std Spec 201 SPS 201 | |
| 15.19 | III. A | STREAM BANK PROTECTION – To minimize sediment production from stream banks and structural abutments in natural waterways. | All Road construction, reconstruction, and maintenance | 1. Take precautions to minimize or eliminate disturbance to stream banks. 2. Maintain in-stream structures. | IDT has identified project location and mitigation measures during NEPA process. Protective measures will be kept current on all areas of disturbed soils. TSA and ER ensure contract compliance. | IDT, ER, TSA | Std Spec 619 | |
| 15.20 | N/A | WATER SOURCE DEVELOPMENT CONSISTENT WITH WATER QUALITY PROTECTION - To supply water for road construction and maintenance and fire protection while maintaining water quality. | N/A | | | ER, FMO | Std Spec 207 | |
| 15.21 | III. E | MAINTENANCE OF ROADS - To maintain all roads in a manner that provides for soil and water protection by minimizing rutting, failures, side-cast, and blockage of drainage facilities. | All Road reconstruction and maintenance | 1. Maintain all roads in a manner that provides for soil and water protection. | Road maintenance associated with a timber sale is the responsibility of purchaser. The ER/TSA will ensure that the purchaser maintains roads according to the appropriate maintenance level. | ER, TSA | B(T)5.12 B(T)5.3 B(T)6.6 C(T)6.6 C(T)5.31# | F.1.2 F.3 G.6 K-G.6 K-F.3.1# |

| SWCP | MT BMP | SWCP OBJECTIVE | APPLICABLE UNITS/ROADS | RECOMMENDED BEST MANAGEMENT PRACTICES BY IDT/TSA | CONSIDERATIONS FOR BEST MANAGEMENT PRACTICES | PERSON(S) RESPONSIBLE | STANDARD CONTRACT PROVISIONS | STEWARDSHIP CONTRACT PROVISIONS |
|-------|----------|--|------------------------|---|---|-----------------------|---|--|
| 15.22 | III. E-1 | ROAD SURFACE TREATMENT TO PREVENT LOSS OF MATERIALS - To minimize the erosion of road surface materials and, consequently, reduce the likelihood of sediment production. | All Haul Roads | <ol style="list-style-type: none"> Maintenance of road surface should include proper blading and/or dust abatement. Use crush-gravel where necessary. | Protective measures will be kept current on all areas of disturbed, erosion-prone areas. ER ensures contract compliance. | IDT, ER | B(T)5.3 C(T)5.31# C(T)5.314# | F.3 K-F.3.1# K-F.3.1.4# |
| 15.23 | III. E-6 | TRAFFIC CONTROL DURING WET PERIODS - To reduce the potential for road surface disturbance during wet weather and reduce sedimentation. | All Haul Roads | <ol style="list-style-type: none"> Avoid hauling during wet periods. | Road restrictions and traffic control measures will be implemented on all haul roads when damage would occur during spring breakup. The decision to restrict a road is made by the ER. Hauling restrictions would be controlled by the TSA. | ER, TSA | B(T)6.6 C(T)6.6 C(T)5.316# C(T)5.41# | G.6 K-G.6 K-F.3.1.6# K-F.4.1# |

| SWCP | MT BMP | SWCP OBJECTIVE | APPLICABLE UNITS/ROADS | RECOMMENDED BEST MANAGEMENT PRACTICES BY IDT/TSA | CONSIDERATIONS FOR BEST MANAGEMENT PRACTICES | PERSON(S) RESPONSIBLE | STANDARD CONTRACT PROVISIONS | STEWARDSHIP CONTRACT PROVISIONS |
|-------|--------------------|--|------------------------|--|--|-----------------------|-------------------------------|---------------------------------|
| 15.24 | III.E-4 VI. A-B | SNOW REMOVAL CONTROLS - To minimize the impact of snow melt on road surfaces and embankments and reduce the probability of sediment production resulting from snow removal operations. | All Winter Haul Roads | <ol style="list-style-type: none"> 1. Be careful not to leave snow berm at edge of road. 2. Ensure proper drainage by opening sections of berm to allow water to leave road surface. 3. Ensure no side cast material enters waterways. 4. Consider hauling only during frozen periods. During cold weather, plow any snow cover off the roadway to facilitate deep freezing of the road prior to hauling. 5. Before logging, mark existing culvert locations. During and after logging, make sure that all culverts and ditches are open and functional. 6. Use compacted snow for roadbeds in unroaded, wet or sensitive areas. Construct snow roads for single-entry harvests or for temporary roads. 7. Return the following summer and build erosion barriers on any trails that are steep enough to erode. | Snow removal will be kept current on all roads associated with winter logging operations. The TSA ensures compliance with contract provisions. | IDT, TSA | C(T)5.316# Std Spec 203.09 | K-F.3.1.6# |

| SWCP | MT BMP | SWCP OBJECTIVE | APPLICABLE UNITS/ROADS | RECOMMENDED BEST MANAGEMENT PRACTICES BY IDT/TSA | CONSIDERATIONS FOR BEST MANAGEMENT PRACTICES | PERSON(S) RESPONSIBLE | STANDARD CONTRACT PROVISIONS | STEWARDSHIP CONTRACT PROVISIONS |
|-------|----------------|---|------------------------|--|--|-----------------------|---|--|
| 15.25 | III. E 7, 8 | OBLITERATION OF TEMPORARY ROADS - To reduce sediment generated from temporary roads by obliterating them at the completion of their intended use. | All Temporary Roads | <ol style="list-style-type: none"> 1. Re-contour road fully where feasible. 2. Seed and fertilize exposed soil. 3. Pull slash and woody debris back onto rehabilitated road. | This work will be done on all new temporary roads in the decision area. The work will be done by the purchaser with compliance by the TSA. | TSA | B(T)6.63 C(T)6.6 C(T)6.632# C(T)6.633# C(T)6.601# | G.6.3 K-G.6 K-G.6.3.2# K-G.6.3.3# K-G.6.0.1# |
| 18.03 | IV. C -8 | PROTECTION OF SOIL AND WATER FROM PRESCRIBED BURNING EFFECTS - To maintain soil productivity, minimize erosion, and prevent ash, sediment, nutrients, and debris from entering surface water. | All Prescribed Burning | <ol style="list-style-type: none"> 1. Follow INFISH Standards and Guidelines for burning in RHCAs. 2. Adhere to SMZ Law. 3. Where harvest within riparian areas is proposed, either the slash should be removed with the tree or scattered and not treated. | Prescribed burning adjacent to riparian areas will adhere to guidelines in the Montana Streamside Management Zone Law (HB-731). Prescribed burn plans identify the conditions necessary to prevent soil damage and meet site preparation objectives. | FMO | N/A | |

APPENDIX C

VEGETATION TREATMENTS

WHAT IS A SILVICULTURAL SYSTEM?

A silvicultural system is a planned program of vegetation manipulation treatments during the whole life of a stand to meet specific management direction within the biological and ecological context of the land and landscape.

Included in this appendix are brief descriptions and illustrations of the silvicultural treatments proposed for implementation in the proposed alternatives. Complete documentation of the vegetation analysis and the silvicultural diagnosis and prescription process is included in the project file.

Timber harvest proposed includes a blend of traditional silvicultural treatments. These techniques incorporate even-aged stand management treatments that are characterized by stands comprised of trees that are approximately the same age. Both Regeneration Harvest and Intermediate Harvest Treatments are identified.

The timber harvest and fuels treatments proposed in the action alternatives are designed to meet one or more of the following objectives for vegetation management. All harvest is on lands identified as suitable for timber production in the Forest Plan.

- **Hazardous Fuels Reduction**

- Reduce the associated risk of high-severity landscape wildfire risk within the Wildland Urban Interface as identified in the Seeley Swan Fire Plan.
- Provide for a safer environment for the public and firefighters should a wildfire occur within proposed treatment areas.
- Increase the probability of stopping wildfires on (NFS) lands before they burn onto private lands.

- **Improve Forest health**

- Improve and/or maintain the general health, resiliency, and sustainability of forested stands.
- Reduce the risk of insect epidemics and severe disease infestations within the project area.

- **Provide wood products for local economies**

- Provide forest products to the local timber industry – contributing to short-term forest products and providing for long-term sustainability of timber on NFS lands.

VEGETATION TREATMENT DESCRIPTIONS AND ILLUSTRATIONS

Following are descriptions of proposed treatments. Illustrations depicting approximate pre and post treatment conditions of a representative stand are included as a visual reference for some of the treatments. The actual post-harvest stand conditions will vary from the illustrations presented here due to site-specific conditions.

REGENERATION HARVEST

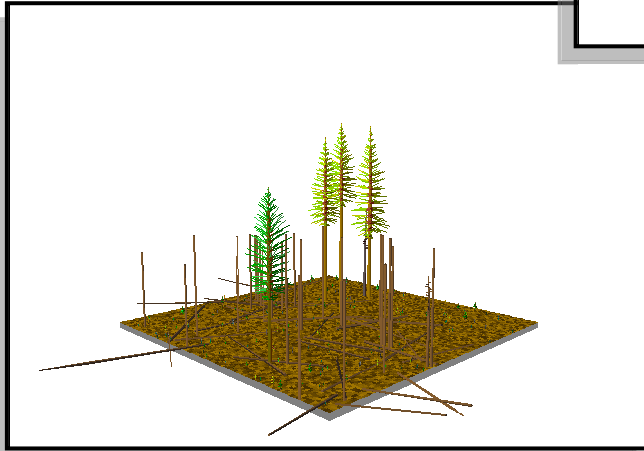
Three regeneration harvests are proposed and described below. These treatments are distinguished by post-harvest residual density and pre-harvest species composition.

CLEARCUT WITH RESERVE TREES

This treatment will remove nearly all trees from the site to facilitate regeneration of a new age class and increase species diversity. Although limited, all long lived, fire resistant, shade intolerant species (western



Pre-Harvest Stand



Post Harvest Clearcut with Reserve Trees

larch, ponderosa pine, western white pine, and occasionally Douglas-fir) will be retained, where feasible and where not acting as an insect or disease vector. Reserve trees will be retained to provide long term structural diversity. These treatment areas consist of primarily even-aged lodgepole pine with little species or structural diversity and are either experiencing mountain pine beetle mortality or are at risk of being affected. Regeneration of trees

would result from natural seeding, planted seedlings, or a combination of both. Mechanical treatments and/or prescribed fire could be used to reduce fuels, recycle nutrients and prepare the site for regeneration.

The National Forest Management Act (NFMA) and Forest Service Handbook (FSH) direction dictate that clearcutting must be justified as the optimum method to meet management objectives when prescribed. Fourteen areas are proposed for clearcutting in this project. Clearcutting was determined to be the optimum regeneration method for meeting management objectives for each of these areas by the Project Silviculturist. Criteria used to make this determination included; species composition relative to management direction and availability of desired species for seed sources, species susceptibility to observed insect agents, presence of disease infections which would be transmitted to the regenerated stand or where non-susceptible species conversion is necessary, and stands subject to windthrow if residual trees were retained.

In the Glacier Loon Project, Clearcut with Reserve Trees is proposed as follows:

Alternative B – 240 acres

Alternative C – 229 acres

Alternative D – 217 acres

SEED TREE WITH RESERVE TREES

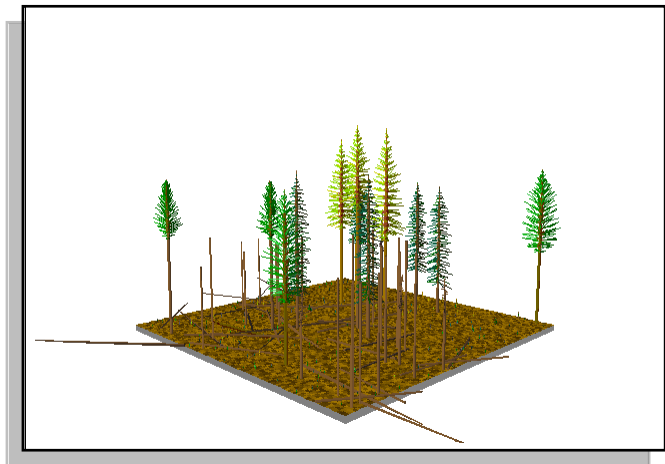
In this treatment, a portion of the existing overstory long lived, fire resistant, shade intolerant species (western larch, ponderosa pine, western white pine, and occasionally Douglas-fir) would be retained and reserved at a density sufficient to facilitate regeneration of these desired species and create a two-aged stand structure (e.g. 5 to 15 trees per acre). This density is designed to provide seed sources and long term structural diversity, while not interfering with the successful regeneration of desired species. The majority of these areas are dominated by lodgepole pine infested with mountain pine beetle or at risk. In addition, some proposed areas are affected by dwarf mistletoe and/or root diseases. Regeneration of trees would result from natural seeding, planted seedlings, or a combination of both. Mechanical treatments and/or prescribed fire could be used to reduce fuels, recycle nutrients and prepare the site for regeneration.

In the Glacier Loon Project, Seed Tree with Reserve Trees is proposed as follows:

Alternative B – 463 acres

Alternative C – 405 acres

Alternative D – 347 acres



Post Harvest Seed Tree with Reserve Trees

SHELTERWOOD WITH RESERVE TREES

A portion of the existing overstory long lived, fire resistant, shade intolerant species (typically; western larch, ponderosa pine, western white pine, and occasionally Douglas-fir) would be retained and reserved at a density sufficient to facilitate regeneration of these desired species and create a two-aged stand structure (e.g. 10 to 30 trees per acre). This density is designed to provide seed sources, long term structural diversity, and provide shelter and a moderated micro-climate favorable for regeneration. Although similar to Seed Tree treatments, the number of trees retained in Shelterwood treatments would be greater. Again, these areas are currently affected by mountain pine beetle, dwarf mistletoe, and/or root diseases. Regeneration of trees would result from natural seeding, planted seedlings, or a combination of both. Mechanical treatments and/or prescribed fire could be used to reduce fuels, recycle nutrients and prepare the site for regeneration.

In the Glacier Loon Project, Shelterwood with Reserve Trees is proposed as follows:

Alternative B – 76 acres

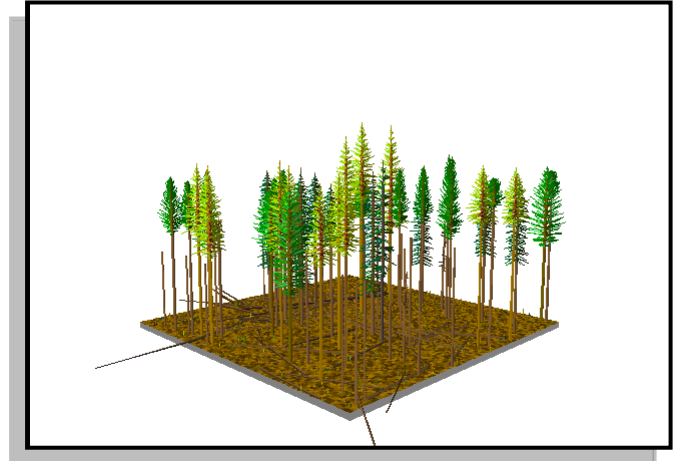
Alternative C – 56 acres

Alternative D – 36 acres

INTERMEDIATE HARVEST

COMMERCIAL THIN AND “MODIFIED” COMMERCIAL THIN

Existing tree density would be reduced from current levels to a target residual density ranging from 60 to 120 square feet of basal area per acre. This equates to approximately 50 to 150 trees per acre depending on tree species and site variables. Long lived, fire resistant, shade intolerant species (typically; western larch, ponderosa pine, western white pine, and occasionally Douglas-fir) would be favored for retention. The purpose of this treatment is to enlarge the growing space of desirable trees and reduce tree competition for limited site resources allowing for improved tree growth, vigor, resilience, and manipulation of fuel continuity. Mechanical treatments and/or prescribed fire would be used to reduce fuels and recycle nutrients. A “Modified” Commercial Thin is proposed in those portions of Units 66 and 67 which are adjacent to and which would directly impact the campground and private lands. The commercial thin treatment will be “modified” so that the primary treatment objectives of fuels reduction and hazard tree mitigation are met while ensuring retention/enhancement of the recreational experience and privacy retention/screening for private lands. Modifications could include, but not limited to, items such as varying residual tree densities near private lands and strategically retaining understory trees for visual/noise screening. During implementation the Project Silviculturist will work closely with the Recreation Staff and private land owners on treatment specifics.



Post Thinning

In the Glacier Loon Project, Commercial Thinning is proposed as follows:

Alternative B – 851 acres

Alternative C – 743 acres (includes 119 acres of “Modified Commercial Thin”)

Alternative D – 361 acres (includes 125 acres of “Modified Commercial Thin”)

IMPROVEMENT CUT

These treatments will be designed to achieve one of two objectives. Where mature ponderosa pine trees exist, the purpose will be to reduce impacts from mountain pine beetle by altering the stand micro-environment and enlarging the growing space of desirable trees. The existing tree density would be reduced from current levels either through thinning (residual densities ranging from 60- 80 square feet of basal area per acre) or “daylighting.” Daylighting treatments are applied on an individual tree basis and involve clearing vegetation within a specified distance (~30 feet) of a target tree. Ponderosa pine and non-susceptible species (e.g. western larch and Douglas-fir) would be favored for retention in all treatments. In addition to the thinning of live trees, dead trees and pine trees currently infested with mountain pine beetle would be salvaged from these areas if encountered. Alternatively, improvement cutting is also proposed in immature stands with high existing tree densities and designed to manipulate fuel continuity and reduce mountain pine beetle hazard. Here, tree density would be reduced from current levels to a target residual density ranging from 50 to 200 trees per acre. The many of the trees to be removed would be smaller than the minimum Forest Service sawlog specifications of 7” inches in diameter at breast height; however larger trees are also likely to be removed. Mechanical treatments would be used to reduce fuels and recycle nutrients.

In the Glacier Loon Project, Improvement Cutting is proposed as follows:

Alternative B – 117 acres

Alternative C – 117 acres

Alternative D – 84 acres

SANITATION/SALVAGE

In these treatment areas the existing stand structure would generally remain intact following treatment. However, these areas would be modified by removal of dead, dying, or damaged trees. Primarily this includes lodgepole pine trees affected by mountain pine beetle. Where concentrations of affected trees exist, stand structure will be more significantly modified. The purpose of this treatment is to improve stand health, recover economic value, and manipulate fuel loadings and continuity. Mechanical treatments would be used to reduce fuels and recycle nutrients.

In the Glacier Loon Project, Sanitation/Salvage is proposed as follows:

Alternative B – 8 acres

Alternative C – 11 acres

Alternative D – 5 acres

POST AND POLE

In these areas (**10 acres** in all action alternatives) permitted individuals will be allowed to harvest live lodgepole pine trees less than 5 inches in diameter at breast height. Areas will be identified on the ground and all specified permit conditions would apply, including limits on material harvested.

PRE-COMMERCIAL THINNING

In this treatment the existing immature tree density would be reduced to a target residual density (e.g. 50 to 300 trees per acre). The primary purpose of this treatment is to reduce fuel continuity, adjust species composition, and concentrate growth on the most desirable trees. This treatment will focus on the removal of sapling and pole sized trees generally not greater than 5 inches in diameter at breast height. Mechanical treatments and/or pile burning would be used to reduce fuels and recycle nutrients. Biomass or other products may or may not be removed from these areas. This treatment is typically accomplished through hand thinning methods or through mechanized chipping/mastication.

In the Glacier Loon Project, Pre-commercial Thinning is proposed as follows:

Alternative B – 343 acres

Alternative C – 343 acres

Alternative D – 95 acres

FUEL TREATMENTS

A number of prescribed treatments are designed to reduce natural and activity generated fuels within the proposed treatment areas. These treatments include mechanical methods and the use of prescribed fire. Mechanical treatments could include a combination of the following; whole tree yarding (or possibly yarding of tops), lop and scatter, masticating, and/or excavator piling. Fuel accumulations at landings would be addressed through burning, chipping/masticating, and/or removal from National Forest lands. Prescribed fire treatments could include broadcast burning, pile burning and/or jackpot burning.

SITE PREPARATION

Depending on existing vegetation and ground conditions, site preparation may be prescribed to help create favorable conditions to help ensure adequate regeneration. These treatments are often prescribed in both artificial and natural regeneration situations and typically address competing vegetation, seed bed preparation, fuel accumulations, and duff reduction. Site preparation can be accomplished through hand, mechanical, or prescribed fire methods. Hand methods usually involve creating favorable conditions at the time of planting using hand tools. Mechanical treatments are often accomplished during harvest operations or shortly afterwards and involve scarification and seed bed preparation through the use of mechanized equipment. Prescribed fire can also be used to recycle nutrients, consume excess fuels, reduce competing vegetation, and create a favorable seedbed.

REFORESTATION

Where regeneration treatments are proposed, a combination of natural and artificial reforestation is planned. Specifically, up to **400 acres** of hand planting of desired species is planned. Where planting occurs, species selection will be based on management direction and site characteristics. Emphasis will be placed on establishing long-lived shade intolerant species such as western larch, ponderosa pine, western white pine, and occasionally Douglas-fir. Natural regeneration is planned in areas where site preparation and seed source proximity and reliability suggest success. Artificial reforestation may be prescribed in these areas if monitoring supports a need. It is expected that some level of natural regeneration will occur in all regeneration units.

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APPENDIX D

BIBLIOGRAPHY AND GLOSSARY

BIBLIOGRAPHY

- Agee, J.K., et al. (2000). The use of shaded fuelbreaks in landscape fire management. *Forest Ecology and Management*, 127, 55-56.
- Agee, J.K., & C.N. Skinner. (2005). Basic principles of forest fuel reduction treatments. *Forest Ecology and Management*, 211, 83-96.
- Albini, F.A. (1976). *Estimating wildfire behavior and effects*. (General Technical Report INT-251). Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station.
- Alexander, M. E., et al. (1998). *The International Crown Fire Modeling Experiment: An Overview and Progress Report*. Paper presented at the In Proceedings of the second symposium on fire and forest meteorology, 1998, Phoenix, AZ.
- Alexander, R. R. (1975). *Partial cutting in old-growth lodgepole pine*. (Research Paper RM-136). Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station.
- Allen, A. (1983). *Habitat Suitability Index Model: Fisher*. Washington, D.C.: USDI Fish and Wildlife Service.
- Amman, G. D., & J. A. Logan. (1998). Silvicultural control of mountain pine beetle: Prescriptions and the influence of microclimate. *American Entomologist*, Fall 1998, 166-177.
- Amman, G. D., et al. (1977). *Guidelines for reducing losses of lodgepole pine to the mountain pine beetle in unmanaged stands in the Rocky Mountains*. (General Technical Report INT-36). Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station.
- Amman, G.D., McGregor, M.D., Cahill, D.B., Klein W.H. . (1977). Guidelines for Reducing Losses of Lodgepole Pine to the Mountain Pine Beetle in Unmanaged Stands in the Rocky Mountains. In F. S. I. F. a. R. E. S. U.S. Department of Agriculture (Ed.), *General Technical Report* (pp. 19). Ogden, UT.
- Anderson, H.E. (1982). *Aids to determining fuel models for estimating fire behavior*. (General Technical Report GTR-INT-122). Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station.
- Apfelbaum, S I. , & C.E. Sams. (1987). Ecology and control of reed canarygrass. *Natural Areas Journal*, 7, 69-74.
- Apps, C. D. (2000). Space-use, diet, demographics, and topographic associations of lynx in the southern Canadian Rocky Mountains: a study. Pages 351–371 in L. F. Ruggiero, K. B. Aubry, S. W. Buskirk, G. M. Koehler, C. J. Krebs, K. S. McKelvey, and J. R. Squires, editors. *Ecology and conservation of lynx in the United States*. University Press of Colorado. Boulder, Colorado, USA.
- Archer, Eric K. , et al. (2004). Testing common stream sampling methods for broad-scale, long-term monitoring *General Technical Report RMRS-122* (pp. 15). Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.
- Arno, S. F. (1980). Forest fire history in the northern Rockies. *Journal of Forestry*, 78(8), 460-465.
- Arno, S. F., et al. (1995). *Age-class structure of old-growth ponderosa pine Douglas-fir stands and its relationship to fire history*. (Research Paper INT-RP-481). Ogden, Utah: USDA Forest Service Intermountain Research Station Retrieved from <Go to ISI>://WOS:A1995RA69500001.
- Arno, S. F., et al. (1997). *Old growth ponderosa pine and western larch stand structures*:

- Influences of pre-1900 fires and fire exclusion.* (Research Paper INT-RP-495). Ogden, Utah: USDA Forest Service Intermountain Research Station Retrieved from <Go to ISI>://WOS:A1997XA09200001.
- Arno, S.F., et al. (1995). Restoring fire-dependent ponderosa pine forests in western Montana. *Restoration and Management Notes*, 13(32-36).
- Arno, S.F., et al. (1985). *Forest succession on four habitat types in western Montana.* (General Technical Report GTR-INT-177). Ogden, Utah: USDA Forest Service, Intermountain Research Station.
- Arno, Stephen F. (1976). *Historical role of fire on the Bitterroot National Forest.*
- Atkins. (2012). *Swan Lake TMDL Planning Area Road Sediment Assessment Results, Lake County Montana.* Condon, MT: Swan Ecosystem Center.
- Aubry, Keith B., et al. (2007). Distribution and broadscale habitat relations of the wolverine in the contiguous United States. *Journal of Wildlife Management*, 71(7), 2147-2158. doi: <http://dx.doi.org/10.2193/2006-548>
- Aubry, K. B., et al. (2012). *Biology and Conservation of Martens, Sables, and Fishers: A New Synthesis.* Ithaca, NY: Cornell University Press.
- Ayres, H.B. (1899). The Flathead Forest Reserve. *The 20th Annual Report of the United States Geological Survey, Part V* (Vol. V, pp. 245-316). Washington, D.C.: Government Printing Office.
- Banci, V. (1994). *Wolverine.* Pp. 99-127 In: Ruggiero, L. F., K. B. Aubry, S. W. Buskirk, L. J. Lyon, and W. J. Zielinski, eds. *The scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine in the western United States.* (General Technical Report GTR RM-254). For Collins, Colorado: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station.
- Barber, J., et al. (2011). *The Region One Existing Vegetation Classification System and its Relationship to Region 1 Inventory Data and Map Products.* (Report 11-10). Missoula, Montana: USDA Forest Service, Northern Region, Forest and Range Management.
- Barnes, B. V., et al. (1998). *Forest Ecology, Fourth Edition.* New York: John Wiley & Sons.
- Barrett, J.W. (1981). *Twenty-year growth of thinned and unthinned ponderosa pine in the Methow Valley of northern Washington.* (Research Paper PNW-286). Portland, Oregon: USDA Forest Service, Pacific Northwest Forest and Range Experiment Station.
- Barrett, S. W. (1998). *Riparian fire history and fire regimes Upper Swan Valley, Flathead National Forest. Upper Swan Valley Fire History Assessment Number One.* (unpublished).
- Barrett, S. W. (2002). *Fire History and Fire Regimes Upper Swan Valley, Flathead National Forest. Upper Swan Valley Fire History Assessment Number Two,* (unpublished).
- Barrett, S. W., & S. F. Arno. (1982). Indian fires as an ecological influence in the northern Rockies. *Journal of Forestry*, 80(10), 647-651.
- Barrett, S. W., et al. (1997). *Fire episodes in the Inland Northwest (1540-1940) based on fire history data.* (General Technical Report GTR-INT-370). Ogden, Utah: USDA Forest Service, Intermountain Research Station.
- Bauer, S.B., & S.C. Ralph. (2001). Strengthening the Use of Aquatic Habitat Indicators in Clear Water Act Programs. *Fisheries*, 26(6), 10.
- Beatty, J.S., et al. (1997). *Larch Dwarf Mistletoe (FIDL).* (Forest Insect & Disease Leaflet 169). Portland, Oregon: USDA Forest Service, Pacific Northwest Research Station.
- Beier, P., & J.E Drennan. (1997). Forest structure and prey abundance in foraging areas of northern goshawks. *Ecological Applications*, 7(2), 564-571.
- Bennett, S. N., & J. L. Kershner. (2009). Levels of Introgression in Westslope Cutthroat Trout Populations Nine Years after Changes to Rainbow Trout Stocking Programs in Southeastern British Columbia. *North American Journal of Fisheries Management*, 29(5), 1271-1282. doi: 10.1577/M08-048.1
- Berg, Nathan D., et al. (2012). Influence of forest structure on the abundance of snowshoe hares in western Wyoming. *The Journal of Wildlife Management*, 76(7), 1480-1488.
- Berg, Nathan Daniel. (2010). *Snowshoe hare and forest structure relationships in western Wyoming.* (Master of Science), Utah State University, Logan, UT.
- Berglund, Doug, et al. (2008). *Region One Vegetation Council Existing Forested Vegetation Classification System and Application to Inventory and Mapping.* Missoula, MT USDA

- Forest Service, Region 1.
- Black, S.H. (2005). Logging to control insects: The science and myths behind managing forest insect "pests". A synthesis of independently reviewed research. Portland, Oregon: The Xerces Society for Invertebrate Conservation.
- Borchers, Jeffrey G, & David A Perry. (1990). Effects of prescribed fire on soil organisms. *Natural and prescribed fire in Pacific Northwest forests*. Oregon State University Press, Corvallis, 143-157.
- Boulanger, John, & Gordon B. Stenhouse. (2014). The impact of roads on the demography of grizzly bears in Alberta. *PLOS One*, 9(12), e115535.
- Bradley, L., et al. (2014). *Montana Gray Wolf Conservation and Management. 2013 Annual Report* (pp. 54). Helena, MT: Montana Department of Fish, Wildlife and Parks.
- Bradley, L., et al. (2013). *Montana Gray Wolf Conservation and Management 2012 Annual Report* (pp. 55). Helena, MT: Montana Department of Fish, Wildlife and Parks.
- Brown, J. K. (2000). *Introduction to Fire Regimes*. (General Technical Report RMRS-GTR-42-vol. 2). Ogden, UT: USDA Forest Service, Rocky Mountain Research Station.
- Brown, J.K., et al. (2003a). Coarse Woody Debris: Managing Benefits and Fire Hazard in the Recovering Forest. *General Technical Report* (pp. 16). Missoula, MT: USDA Forest Service, Rocky Mountain Research Station.
- Brown, James Kerr, et al. (2003b). *Coarse woody debris: managing benefits and fire hazard in the recovering forest*. US Department of Agriculture, Forest Service, Rocky Mountain Research Station.
- Bull, E. L., et al. (1986). *Resource partitioning among woodpeckers in northeastern Oregon*. (Research Note PNW-444). Portland, OR: USDA Forest Service, Pacific Northwest Research Station.
- Bull, E.L. (2002, November 2-4, 1999). *The Value of Coarse Woody Debris to Vertebrates in the Pacific Northwest*. Paper presented at the Symposium on the Ecology and Management of Dead Wood in Western Forests, Reno, Nevada.
- Bull, Evelyn L., & Arlene K. Blumton. (1999). Effect of Fuels Reduction on American Martens and Their Prey. In F. S. U.S. Department of Agriculture (Ed.), *Research Note* (pp. 9). Portland, OR: Pacific Northwest Research Station.
- Bull, Evelyn L., et al. (2005). Short-Term Effects of Fuel Reduction on Pileated Woodpeckers in Northeastern Oregon—a Pilot Study. In R. M. R. S. USDA Forest Service (Ed.), (pp. 17). Portland, OR: Pacific Northwest Research Station.
- Bull, Evelyn L., et al. (1997). Trees and Logs Important to Wildlife in the Interior Columbia River Basin. In P. N. R. Station. (Ed.), *General Technical Report* (pp. 55). Portland, OR: U.S. Department of Agriculture, Forest Service.
- Bulmer, Charles Ernest. (1998). *Forest soil rehabilitation in British Columbia: a problem analysis*: British Columbia, Ministry of Forests Research Program.
- Bunte, K., & S.R. Abt. (2001). *Sampling surface and subsurface particle-size distributions in wadable gravel-and cobble-bed streams for analyses in sediment transport, hydraulics, and streambed monitoring*. (General Technical Report RMRS-GTR-74). Fort Collins, Colorado: USDA Forest Service, Rocky Mountain Research Station.
- Burdett, C. L. (2008). *Hierarchical structure of Canada lynx space use and habitat selection in northeastern Minnesota*. Dissertation, University of Minnesota. Duluth, USA.
- Burns, R. M., & B. H Honkala. (1990). *Silvics of North America, Volume 1: Conifers*. (Agriculture Handbook 654). Washington, D.C.: USDA Forest Service.
- Bush, R., & A. Leach. (2004). *Detailed estimates of old growth and large-snags on the Flathead National Forest*. Missoula, Montana: USDA Forest Service, Northern Region, Inventory and Analysis.
- Busse, Matt D. (1994). Downed bole-wood decomposition in lodgepole pine forests of central Oregon. *Soil Science Society of America Journal*, 58(1), 221-227.
- Castro, Janine, & Frank F Reckendorf. (1995). *Effects of sediment on the aquatic environment: potential NRCS actions to improve aquatic habitat*. US Department of Agriculture, Soil Conservation Service.
- Certini, Giacomo. (2005). Effects of fire on properties of forest soils: a review. *Oecologia*, 143(1), 1-10.

- Chadde, Steve W., et al. (1998). *Peatlands on National Forests of the Northern Rocky Mountains: Ecology and Conservation*. (General Technical Report RMRS-GTR-11). Ogden, UT: USDA Forest Service, Rocky Mountain Research Station.
- Christen, Douglas, & Glenn Matlack. (2006). The role of roadsides in plant invasions: a demographic approach. *Conservation Biology*, 20(2), 7.
- Claar, J. J., et al. (1999). Carnivores. In Committee on Effects of Recreation on Wildlife, G. Joslin, & H. Youmans (Eds.), *Effects of Recreation on Rocky Mountain Wildlife: A Review for Montana* (pp. 7.1-7.63). Bozeman, Montana: Montana Section of The Wildlife Society.
- Cohen, J. (1995). *Structure Ignition Assessment Model (SIAM)*. *The Biswell Symposium: Fire Issues and Solutions in Urban Interface and Wildland Ecosystems*. (General Technical Report PSW-GTR-158). Albany, California: USDA Forest Service, Pacific Southwest Research Station.
- Cohen, J. (1999). *Reducing the Wildland Fire Threat to Homes: Where and How Much?* (General Technical Report PSW-GTR-173). Albany, California: USDA Forest Service, Pacific Southwest Research Station.
- Cohen, J. . (2000a). Why Los Alamos Burned. *Forest Magazine*, 8.
- Cohen, J.D. (2000b). Preventing disaster: home ignitability in the wildland-urban interface. *Journal of Forestry*, 98(3), 15-21.
- Cohen, Jack D, & John E Deeming. (1985). The national fire-danger rating system: basic equations.
- Copeland, J. P., et al. (2010). The bioclimatic envelope of the wolverine (*Gulo gulo*): do climatic constraints limit its geographic distribution? *Canadian Journal of Zoology*, 88, 13.
- Coyner, J. J. . (1980). *Swan Valley Country Landtype Report*. Kalispell, MT: Flathead National Forest.
- Costello, C.M., R.D. Mace, and L. Roberts. 2016. Grizzly bear demographics in the Northern Continental Divide Ecosystem, Montana: research results (2004–2014) and suggested techniques for management of mortality. Montana Department of Fish, Wildlife and Parks. Helena.
- Currim, F. . (1996). *Sensitive Species; Boreal Toad (Bufo boreas boreas)*. Unpublished Report: A compilation of literature citing completed on December 12, 1996, for the Interior Columbia Basin Ecosystem Management Project.
- Czaplewski, R. (2004). *Application of Forest Inventory and Analysis (FIA) data to estimate the amount of old growth forest and snag density in the Northern Region of the National Forest System*. Fort Collins, Colorado: USDA Forest Service, Rocky Mountain Research Station, Natural Resource Assessment, Ecology, and Management Science Research, Research Work Unit RMRS-4852; http://fsweb.r1.fs.fed.us/forest/inv/fia_data/analysis.htm Retrieved from http://fsweb.r1.fs.fed.us/forest/inv/fia_data/analysis.htm.
- Dahms, W.G. (1971). *Fifty-Five Year Old Lodge Pole Pine Responds to Thinning*. (Research Note RN-PNW-141). Portland, Oregon: USDA Forest Service, Pacific Northwest Research Station.
- DeBano, Leonard F, et al. (1998). *Fire effects on ecosystems*: John Wiley & Sons.
- DeHaan, P., et al. (2011). Identification of Population of Origin for Bull Trout Captured in Swan Lake, MT *Report prepared by Abernathy Fish Technology Center* (pp. 54). Longview, Washington.
- DellaSala, Dominick, et al. (1995). Forest Health: Moving Beyond Rhetoric to Restore Healthy Landscapes in the Inland Northwest. *Wildlife Society Bulletin*, 23(3), 346-356.
- Dick, RP, et al. (1988). Microbial biomass and soil enzyme activities in compacted and rehabilitated skid trail soils. *Soil Science Society of America Journal*, 52(2), 512-516.
- Dix, M.E., et al. (2006). The Effectiveness of Vegetation Management Practices for Mitigating the Impacts of Insects on Forest Ecosystems: A Science Synthesis. Executive Summary (pp. 2). Washington, D.C.
- Dixon, R. D. & V. A. Saab. (2000). Black-backed Woodpecker (*Picoides arcticus*). In: A. Poole & F. Gill (Eds.), *The Birds of North America* (Vol. 509, pp. 1-33). Washington, D.C.: The Academy of Natural Sciences and The American Ornithologists' Union.

- Dudley, J. & V. Saab. (2007). Home Range Size of Black-Backed Woodpeckers. *In: Burned Forests of Southwestern Idaho. Western North American Naturalist*, 67(4), 7.
- Dunham, Jason B, et al. (2002). Alien invasions in aquatic ecosystems: toward an understanding of brook trout invasions and potential impacts on inland cutthroat trout in western North America. *Reviews in Fish Biology and Fisheries*, 12(4), 373-391.
- Dunne, T., & L.B. Leopold. (1978). *Water in Environmental Planning*. New York, New York: W. H. Freeman and Company.
- Elliot, W.J., et al. (1995). *Validation of Water Erosion Prediction Project (WEPP) Model for Low-Volume Forest Roads*. Paper presented at the Proceedings Sixth International Conference on Low-Volume Roads, Minneapolis, Minnesota.
- Elliot, William J., et al. (1999). WEPP:Road, WEPP Interface for Predicting Forest Road Runoff, Erosion and Sediment Delivery, Technical Documentation. Fort Collins, CO: Rocky Mountain Research Station and San Dimas Technology and Development Center.
- Ellis, B.K., et al. (1998). Baseline water quality study of Little Bitterroot, Mary Ronan, Ashley, and Lindbergh Lakes, Montana (pp. 118). Polson, Montana: Flathead Lake Biological Station, The University of Montana.
- Ellis, B.K., et al. (1999). Determination of Nutrient and Carbon Loading in the Swan River, Montana (pp. 32). Polson, Montana: Flathead Lake Biological Station, The University of Montana.
- Environmental Protection Agency. (1980). *An Approach to Water Resources Evaluation of Non-Point Silvicultural Sources (A Procedural Handbook)*. Athens, Georgia: Environmental Research Laboratory.
- Everest, F. H., et al. (1987). Fine Sediment and Salmonid Production: A Paradox. In E. O. Salo & T. W. Cundy (Eds.), *Streamside Management: Forestry and Fishery Interactions*. (pp. 98-142). Seattle, WA: University of Washington.
- Fettig, C.J., et al. (2007). The effectiveness of vegetation management practices for prevention and control of bark beetle infestations in coniferous forests of the western and southern United States. *Forest Ecology and Management*, 238, 24-53.
- Fiedler, C.E. (2004). Restoring vigor and reducing hazard in an old growth western larch stand (Montana). *Ecological Restoration*, 22, 2.
- Filip, G.M., et al. (1989). Effects of thinning on volume growth of western larch infected with dwarf mistletoe in northeastern Oregon. *Western Journal of Applied Forestry*, 4(4), 143-145.
- Finch, D. . (1991). *Population ecology, habitat requirements, and conservation of neotropical migratory birds*. (General Technical Report RM-205). Fort Collins, Colorado: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station.
- Fischer, W.C., & A.F Bradley. (1987). *Fire ecology of western Montana forest habitat types*. (General Technical Report INT-223). Ogden, UT: USDA Forest Service, Intermountain Research Station.
- Forest Health Monitoring Program. (2005). *Montana Forest Insect and Disease Conditions and Program Highlights*. (Report 11-1). Missoula, Montana: USDA Forest Service, Region 1, Northern Region.
- Forest Health Protection and State Forestry Organizations. (2004). *In: Forest Insect and Disease Identification and Management Handbook*. USDA Forest Service.
- Freedman, J. D. (1983). *The historical relationship between fire and plant succession within the Swan Valley white-tailed deer winter range, western Montana*. (Ph.D. Dissertation), University of Montana, Missoula, Montana.
- Freedman, J. D., & J. R. Habeck. (1985a). *Fire, logging and whitetailed deer interrelationships in the Swan Valley, western Montana*. *In: Lotan, J. E. and J. K. Brown (compilers), Fire Effects on Wildlife Habitat -Symposium Proceedings; 21 March, 1984, Missoula, MT*. (General Technical Report INT-186). Ogden, UT: USDA Forest Service, Intermountain Research Station.
- Freedman, J.D., & J.R. Habeck. (1985b). *Fire, logging and whitetailed deer interrelationships in the Swan Valley, western Montana*. *In: Lotan, J.E. and J.K. Brown (compilers), Fire Effects on Wildlife Habitat -Symposium Proceedings; 21 March, 1984, Missoula, MT*. (General Technical Report INT-186). Ogden, UT: USDA Forest Service, Intermountain

- Research Station.
- Froehlich, Henry A, & David H McNabb. (1983). *Minimizing soil compaction in Pacific Northwest forests*. Paper presented at the 6. North American Forest Soils Conference. Knoxville (USA). Jun 1983.
- Fuller, A.K., Harrison, D.J., (2010). Foraging paths reveal scale-dependent habitat decisions by Canada lynx. *Journal of Mammal* 91: 1269–1279
- Furniss, Michael J. (2000). Roads Analysis: Informing Decisions About Managing the National Forest Transportation System. *Watershed 2000: Science and Engineering Technology for the New Millennium*.
- Gaines, W. L., et al. (2007). Short-term response of land birds to ponderosa pine restoration. *Restoration Ecology*, 15(4), 670-678.
- Gallant, A., et al. (2003). Vegetation dynamics under fire exclusion and logging in a Rocky Mountain watershed. *Ecological Applications*, 13, 385-403.
- Gardner, B. (2004). Crazy Horse II Monitoring (pp. 4). Bigfork, Montana: Crazy Horse III Fire Salvage Project File J-46. USDA Forest Service, Flathead National Forest.
- Gardner 2016 (The overall condition of residual pool depth was summarized in a 201509 report of all DMRs of the Swan River Valley)
- Garland, John J. (1983). Designated skid trails minimize soil compaction: [Corvallis, Or.]: Oregon State University, Extension Service.
- Garrison, Mariann T, & James A Moore. (1998). Nutrient management: a summary and review. *Intermountain Forest Tree Nutrition Cooperative, University of Idaho, Moscow, Idaho. Suppl. Rep*, 98-95.
- Gibson, K.E. (2004). *Mountain pine beetle management*. (Pp. 4.0-4.16 In Forest Insect and Disease Identification and Management). Missoula, MT: USDA Forest Service, Forest Health Protection and State Forestry Organizations.
- Goldman, Steven J, et al. (1986). *Erosion and sediment control handbook*: McGraw-Hill.
- Gonsior, M.J. (1983). *Forest soil compaction: Where next? A literature review and assessment (unpublished)*. Bozeman, Montana: USDA Forest Service, Intermountain Forest and Range Experiment Station.
- Graham, R .T., et al. (1999). *The effects of thinning and similar stand treatment on fire behavior in western forests*. (General Technical Report PNW-GTR-463). Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station.
- Graham, Russell T, et al. (1994). Managing coarse woody debris in forests of the Rocky Mountains.
- Grant, G. . (1989). *Air Photo Analysis of Swan River Drainage*.
- Graumlich, Lisa J. (1987). Precipitation variation in the Pacific Northwest (1675–1975) as reconstructed from tree rings. *Annals of the Association of American Geographers*, 77(1), 19-29.
- Green, P., et al. (1992). *Old-growth forest types of the Northern Region*. (R-1 SES 4/92 (errata corrected 2011)). Missoula, MT: USDA Forest Service, Northern Region.
- Guscio, C.G. (2007). *Responses of western toads (Bufo boreas) to changes in terrestrial habitat resulting from wildfire*. (Professional paper presented in partial fulfillment of the requirements for the degree of MS Wildlife Biology), The University of Montana, Missoula, Montana.
- Habeck, J. R., & R.W. Mutch. (1973). Fire-dependent forests in the Northern Rocky Mountains. *Quaternary Research*, 3, 408-423.
- Hagle, S.K. (2003). *Root Disease Management*. In: *Forest Insect and Disease Identification and Management Handbook. Chapter 11.0*. Missoula, Montana: USDA Forest Service, Forest Health Protection and State Forestry Organizations.
- Hagle, Sue. (2004). *Management Guide for Root Disease; Consider Root Diseases in your Management Plan*. (11.0). Retrieved from http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5187544.pdf.
- Hammond, C. A. (2008). *A demographic and landscape analysis for common loons in Northwest Montana*. (M.S.), The University of Montana, Missoula, Montana.
- Han, Sang-Kyun. (2006). *Impacts on Soils from Cut-to-Length and Whole Tree Harvesting*. (Master of Science), University of Idaho, Idaho.

- Hann, Wendel J., et al. (1997). Landscape Dynamics of the Basin. In T. M. Quigley & S. J. Arbelbide (Eds.), *An assessment of ecosystem components in the Interior Columbia basin and portions of the Klamath and Great Basins: General Technical Report PNW-GTR-405* (Vol. 2, pp. 338-1055.). Portland, OR: USDA Forest Service, Pacific Northwest Research Station.
- Hanson, K. and R. Moen. (2008). Diet of Canada lynx in Minnesota estimated from scat analysis. Natural Resource Research Institute, NRRI TR-2008/13. University of Minnesota, Duluth, Minnesota, USA.
- Harrington, M.G. (2004). *Benefits of Treating Old-Growth Stands*. (Research Highlights, Fire, Fuels, and Smoke Science Programs). Missoula, Montana: USDA Forest Service, Rocky Mountain Research Station.
- Harrod, R.J., et al. (2009). A User's Guide to Thinning with Mastication Equipment. *US Department of Agriculture, Forest Service, Pacific Northwest Region, Okanogan-Wenatchee National Forest*.
- Harrower, William L., et al. (2010). Movements and Resource Selection of Fledgling Goshawks in Montane Forests of Southeastern British Columbia. *Journal of Wildlife Management*, 74(8), 1768-1775. doi: 10.2193/2009-127
- Hart, M. (1994). Past and present vegetative and wildlife diversity in relation to an existing reserve network: A GIS evaluation of the Seeley-Swan landscape, northwestern Montana.
- Hart, M., & P. Lesica. (1994). *Accuracy of early stand exam age estimates in the Swan Valley of Western Montana*. (Research Note INT-422). Ogden, UT: USDA Forest Service, Intermountain Research Station.
- Hartford, Roberta A, & William H Frandsen. (1992). When it's hot, it's hot... or maybe it's not!(Surface flaming may not portend extensive soil heating). *International Journal of Wildland Fire*, 2(3), 139-144.
- Harvey, Alan E, et al. (1994). Biotic and abiotic processes in eastside ecosystems: the effects of management on soil properties, processes, and productivity.
- Hatchett, B, et al. (2006). Mechanical mastication thins Lake Tahoe forest with few adverse impacts. *California Agriculture*, 60(2), 77-82.
- Hawksworth, F.G. (1977). *The 6-Class Dwarf Mistletoe Rating System*. (General Technical Report RM-48). Fort Collins, Colorado: USDA Forest Service, Rocky Mountain Research Station.
- Hayes, Gerald E, & Jeffrey C Lewis. (2006). *Washington state recovery plan for the fisher: Washington Department of Fish and Wildlife*.
- Hayward, G.D., & R.E. Escano. (1989). Goshawk nest-site characteristics in western Montana and northern Idaho. *Condor*, 91, 476-479.
- Hebel, C.L., et al. (2009). Invasive plant species and soil microbial response to wildfire burn severity in the Cascade Range of Oregon. *Applied Soil Ecology*, 42, 150-159.
- Heinemeyer, K. S. (1993). *Temporal dynamics in the movements, habitat use, activity, and spacing of reintroduced fishers in northwestern Montana. (Masters Degree Thesis), The University of Montana, Missoula, MT.*
- Hejl, S. J., et al. (1995). Effects of Silvicultural Treatments in the Rocky Mountains. In T. E. Martin & D. M. Finch (Eds.), *Ecology and Management of Neotropical Migratory Birds: A Synthesis and Review of Critical Issues* (pp. 220-244). New York: Oxford University Press.
- Hejl, S., et al. (2002). Birds and changing landscape patterns in conifer forests of the north-central Rocky Mountains. *Studies in Avian Biology*, 25, 113-129.
- Helms, J.A. (Ed.). (1998). *The Dictionary of Forestry*. Bethesda, Maryland: Society of American Foresters.
- Hessburg, P. F., & J. K. Agee. (2003). An environmental narrative of Inland Northwest United States forests, 1800-2000. *Forest Ecology and Management*, 178(1-2), 23-59. doi: 10.1016/s0378-1127(03)00052-5
- Hessburg, P. F., et al. (2005). Dry forests and wildland fires of the inland Northwest USA: Contrasting the landscape ecology of the pre-settlement and modern eras. *Forest Ecology and Management*, 211(1-2), 117-139. doi: 10.1016/j.foreco.2005.02.016

- Hildebrand, P.R. (1971). *Biology of white-tailed deer on winter ranges in the Swan Valley, Montana*. (B. Sc. A. Bachelor Thesis), The University of Manitoba, Winnipeg, Manitoba, Canada.
- Hillis, J. M., & B. Kennedy. (2002). Draft – USFS Region One Wolverine Natal Den Assessment. Missoula, Montana: USDA Forest Service, Northern Region, National Fire Plan Cohesive Strategy Team.
- Hillis, J. M., & D. Lockman. (2003). U.S. Forest Service Region One Fisher Assessment (pp. 8). Missoula, Montana: USDA Forest Service, Northern Region.
- Hillis, J. M., et al. (1991, April 10-12, 1991). *Defining Elk Security: The Hillis Paradigm*. Paper presented at the Elk Vulnerability Symposium, Bozeman, MT.
- Hillis, J. Michael, et al. (2003). Potential Changes in Large Diameter Snag Densities, Snag Recruitment Opportunities, and Impacts on Snag-dependent Species in Region One. (pp. 22). Missoula, Montana: USDA Forest Service, Northern Region.
- Hillis, M., et al. (2003). U. S. Forest Service Region One Canada Lynx Assessment. (pp. 24). Missoula, Montana: USDA Forest Service, Northern Region, National Fire Plan Cohesive Strategy Team.
- Hunt, J., & K.W. Krueger. (1962). Decay associated with thinning wounds in young – growth western hemlock and Douglas-fir. *Journal of Forestry*, 60(5), 336-340.
- Hutto, R. L. (2008). The ecological importance of severe wildfires: some like it hot. *Ecological Applications*, 18, 1827-1834.
- Hutto, R. L. (2007). Final Report – Joint Fire Science Program: Understanding the influence of local and landscape conditions on the occurrence and abundance of Black-backed Woodpeckers in burned forest patches. Retrieved at: https://www.firescience.gov/projects/04-2-1-106/project/04-2-1-106_final_report.pdf.
- Inman, Robert M, et al. (2012). Spatial ecology of wolverines at the southern periphery of distribution. *Journal of Wildlife Management*, 76(4), 778-792.
- Interagency Grizzly Bear Committee. (1986). Interagency Grizzly Bear Guidelines. Missoula, Montana: USDA Forest Service.
- Interagency Lynx Biology Team: (2013). *Canada lynx conservation assessment and strategy, 3rd edition Forest Service Publication R1-13-19 (pp. 128)*.
- Jackson, M.B., et al. (2006). *Spread and intensification of western larch dwarf mistletoe following removal of an infected overstory and (or) precommercial thinning: twelve-year remeasurements*. (Report 06-06). Missoula, Montana: USDA Forest Service, Northern Region, Forest Health and Protection.
- Jones, J. L. . (1991). *Habitat Use of Fisher in North Central Idaho*. (M.S. Thesis), The University of Idaho, Moscow, ID.
- Jurgensen, Martin F, et al. (1981). *Effects of prescribed fire on soil nitrogen levels in a cutover Douglas-fir/western larch forest* (Vol. 275): US Dept. of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station.
- Jurgenson, MF, et al. (1977). Effects of timber harvesting on soil biology. *Review Process: Non-Refereed (Other)*.
- Kalabokidis, K. D. , & P. N. Omi. (1998). Reduction of Fire Hazard through Thinning/Residue Disposal in the Urban Interface. *International Journal of Wildland Fire*, 8(1), 7.
- Karl, Thomas R, & Albert J Koscielny. (1982). Drought in the united states: 1895–1981. *Journal of Climatology*, 2(4), 313-329.
- Kasworm, W. F., & T. L. Manley. (1990). Road and trail influences on grizzly bears and black bears in northwest Montana. *Int. Conf. Bear Res. and Manage.*, 8, 79-84.
- Kaufmann, M.R., et al. (2009). *Coexisting with fire: ecosystems, people, and collaboration*. (RMRS-GTR-227). Fort Collins, Colorado: USDA Forest Service, Rocky Mountain Research Station
- Keegan, C.E., et al. (2001). Montana's Forest Products Industry: A Descriptive Analysis, 1969-2000 (pp. 49). Missoula, Montana: The University of Montana, Bureau of Business and Economics Research.
- Kendall, K.C., et al. (2009). Demography and Genetic Structure of a Recovering Grizzly Bear Population. *Journal of Wildlife Management*, 73(1), 16.
- Kendall, K.C., et al. (2008). Grizzly bear density in Glacier National Park, Montana. *Journal of*

- Wildlife Management*, 72(8), 1693-1705.
- Knudson, K. (1994). Water Quality Evaluations of Lindbergh Lake, 1989-1933. *Report prepared for the Lindbergh Lake Homeowners Association* (pp. 22). Helena, MT: Ecological Resource Consulting.
- Koch, P. (1996). *Lodgepole Pine in North America*. Madison, Wisconsin: Forest Products Society.
- Kolbe, J. A., et al. (2007). The effect of snowmobile trails on coyote movements within lynx home ranges. *Journal of Wildlife Management*, 71(15), 1409-1418.
- Kosterman, Megan K. (2014). Correlates of Canada Lynx Reproductive Success in Northwestern Montana.**
- Kunkel, Kyran E. (1997). Predation by wolves and other large carnivores in northwestern Montana and southeastern British Columbia.
- Kuropat, Betty (2009, 2009). [Personal Communication].
- Lamar, S. (2008). *Swan Valley Place Names: a Mosaic of History, Stories and Local Lore*. Condon, Montana: Rumble Peak GeoData.
- Larsen, Isaac J, & Lee H MacDonald. (2007). Predicting postfire sediment yields at the hillslope scale: Testing RUSLE and Disturbed WEPP. *Water Resources Research*, 43(11).
- Laverty, Lyle, & Jerry Williams. (2000). Protecting People and Sustaining Resources in Fire-Adapted Ecosystems. A Cohesive Strategy. The Forest Service Management Response to the General Accounting Office Report GAO/RCED-99-65. Washington, D.C.: USDA Forest Service.
- Lentile, Leigh B, et al. (2007). Post-fire burn severity and vegetation response following eight large wildfires across the western United States.
- Lesica, P. (1997). Spread of *Phalaris arundinacea* adversely impacts the endangered plant *Howellia aquatilis*. *Great Basin Naturalist*, 57, 366-368.
- Lesica, P. . (1990). *Habitat requirements, germination behavior and seed bank dynamics of Howellia aquatilis in the Swan Valley, Montana*. Kalispell, Montana: Unpublished Report submitted to the Flathead National Forest.
- Lewis, C. W., et al. (2011). Influence of stand and landscape features on snowshoe hare abundance in fragmented forests. Journal of Mammalogy, 92(3), 561-567.**
- Lidicker, William Z., & Walter D. Koenig. (1996). Responses of terrestrial vertebrates to habitat edges and corridors. In D. R. McCullough (Ed.), *Metapopulations and wildlife conservation* (pp. 85-109). Washington, D.C.: Island Press.
- Lindenmayer, B D., & R.F. Noss. (2006). Salvage logging, ecosystem processes, and biodiversity conservation. *Conservation Biology*, 20, 949-958.
- Lofroth, Eric C., et al. (2010). *Conservation of fishers (Martes pennanti) in south-central British Columbia, western Washington, western Oregon, and California -Volume 1: Conservation Assessment*. Denver, CO: USDI Bureau of Land Management.
- Long, D.G. (1998). *Mapping historical fire regimes in the Northern Rocky Mountain landscapes*. (M.S. M.S. Thesis), University of Idaho, Moscow, Idaho.
- Lull, Howard William. (1959). *Soil compaction on forest and range lands*: Forest Service, US Department of Agriculture.
- Mace, Richard D. & Timothy L. Manley. (1993). South Fork Flathead River Grizzly Bear Project: Progress Report for 1992. Helena, MT: Montana Department of Fish, Wildlife, and Parks.**
- Mace, R. D., & J. S. Waller. (1997). *Final report: Grizzly bear ecology in the Swan Mountains, Montana*. Missoula, Montana: Montana Fish, Wildlife and Parks.
- Mace, R.D., D.W. Carney, T. Chilton-Radandt, S.A. Courville, M.A. Haroldson, R.B. Harris, J. Jonkel, B. McClelland, M. Madel, T.L. Manley, C.C. Shwartz, C. Servheen, G. Stenhouse, J.S. Waller, E. Wenum. (2011). Grizzly bear population vital rates and trend in the Northern Continental Divide Ecosystem, Montana. *Journal of Wildlife Management*, 9999, 1-10.
- Mace, Richard D. & Lori L. Roberts. (2013). Northern Continental Divide Ecosystem Grizzly Bear Monitoring Team Annual Report, 2012. Kalispell, MT**
- Maletzke, B. T., G. M. Koehler, R. B. Wielgus, and K. B. Aubry. (2008). Habitat conditions associated with lynx hunting behavior during winter in Northern Washington. Journal of Wildlife Management 72:1473–1478.**
- Mantas, Maria. (2000). *Personal observations, unpublished reports, and databases for Howellia*

- aquatilis* by Flathead National Forest Botanist. Flathead National Forest, Kalispell, Montana.
- Mantas, Maria (2012, 2012). [Personal Communication].
- Martinson, A.H., & W.J. Basko. (1983). *Flathead Country: A soil resource inventory and analysis for land-use planning and resource allocation*. Kalispell, Montana: USDA Forest Service, Flathead National Forest.
- Maxell, Bryce A. (2000). Management of Montana's Amphibians. *Wildlife Biology Program, Univ. of Montana & USDA Forest Service, Northern Region. Report (Order Number 43-0343-0224)*.
- McCann, N. P. and R. A. Moen. (2011). Mapping potential core areas for lynx (*Lynx canadensis*) using pellet counts from snowshoe hares (*Lepus americanus*) and satellite imagery. *Canadian Journal of Zoology* 89:509–516.
- McClelland, Riley, & Patricia McClelland. (1999). Pileated woodpecker nest and roost trees in Montana: links with old-growth and forest "health". *Wildlife Society Bulletin*, 27(3), 13.
- McGrath, M.T., et al. (2003). Spatially explicit influences on Northern Goshawk nesting habitat in the interior Pacific Northwest. *Wildlife Monographs*, 154, 1-63.
- McLellan, B. N. & D. M. Shackleton. (1989). Grizzly bears and resource extraction industries: habitat displacement in response to seismic exploration, timber harvesting and road maintenance. *Journal of Applied Ecology*, 26, 371-380.
- McIver, C. P., et al. (2013). Montana's forest products industry and timber harvest, 2009 *Resource Bulletin RMRS-RB-16* (pp. 42). Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station.
- McIver, James D, et al. (2000). Environmental effects of postfire logging: literature review and annotated bibliography: Portland, Or.: US Dept. of Agriculture, Forest Service, Pacific Northwest Research Station.
- McLellan, B. N. & D. M. Shackleton. (1989). Grizzly bears and resource extraction industries: habitat displacement in response to seismic exploration, timber harvesting and road maintenance. *Journal of Applied Ecology*, 26, 371-380.
- McNabb, DH, et al. (2001). Soil wetness and traffic level effects on bulk density and air-filled porosity of compacted boreal forest soils. *Soil Science Society of America Journal*, 65(4), 1238-1247.
- Meko, D., et al. (1993). Spatial Patterns of Tree-Growth Anomalies in the United-States and Southeastern Canada. *Journal of Climate*, 6(9), 1773-1786. doi: Doi 10.1175/1520-0442(1993)006<1773:Spotga>2.0.Co;2
- MFWP. (2004). Montana Statewide Elk Management Plan. from <http://fwp.mt.gov/fishandwildlife/management/>
- MFWP. (2005). Montana's Comprehensive Fish and Wildlife Conservation Strategy. Helena, Montana: Montana Department of Fish, Wildlife & Parks.
- MFWP. (2006). Ecology of white-tailed deer in the Salish Mountains, Northwest Montana (pp. 263). Helena, Montana: Montana Department of Fish, Wildlife & Parks.
- MFWP. (2009). White-tailed deer spring survey in the Swan Valley, HD 130. Helena, Montana: Montana Department of Fish, Wildlife & Parks.
- MFWP. (2010). Elk, mule deer, white-tail deer distribution and population estimates. Helena, Montana: Montana Department of Fish, Wildlife & Parks.
- Mills, L. Scott, et al. (2005). Pellet count indices compared to mark-recapture estimates for evaluating snowshoe hare density. *Journal of Wildlife Management*, 69(3), 1053-1062. doi: 10.2193/0022-541x(2005)069[1053:Pcictm]2.0.Co;2
- Miller, Jennifer J. , et al. (2005). *Canada Lynx Habitat Inventory - Upper Columbia-Salmon Clearwater District, Idaho, Final Report*. Boise, ID.
- Milner, K.S. (1992). Site index and height growth curves for ponderosa pine, western larch lodgepole pine, and Douglas-fir in western Montana. *Western Journal of Applied Forestry*, 7(1), 9-14.
- MNHP-MFWP. Montana Field Guide. <http://fieldguide.mt.gov/default.aspx>
- MNHP. (2014). Montana Natural Heritage Program Species of Concern Report. Retrieved 10/31, 2014, from <http://www.natureserve.org/explorer/servlet/NatureServe?searchName=Howellia%20aqu>

[atilis](#)

- Montana Bald Eagle Working Group. (2010). Montana Bald Eagle Management Guidelines: An Addendum to Montana Bald Eagle Management Plan, 1994. Helena, Montana: Montana Department of Fish, Wildlife and Parks.
- Montana Common Loon Working Group. (2007). 2006 Annual Update (pp. 5).
- Montana Department of Agriculture. (2010). Montana Noxious Weed List. Retrieved May 13, 2011, 2011, from http://montana.plant-life.org/species/arctium_minus.htm
- Montana Department of Water Quality. (2004). Water Quality Protection Plan and TMDLs for the Swan Lake Watershed (pp. 124). Helena, Montana: Montana Department of Water Quality.
- Montana Department of Fish, Wildlife and Parks. (2013). Harvest and Hunting Reports. Helena, MT: Montana Department of Fish, Wildlife and Parks.
- Montana Natural Heritage Program. (2014). Plant Species of Concern. Accessed on 10/31/2014 at: http://fieldguide.mt.gov/detail_PDCAM0A010.aspx
- Morgan, P., et al. (1994). Historical range of variability: a useful tool for evaluating ecosystem change. *Journal of Sustainable Forestry*, 2, 87–111.
- Morgan, T.A., C.E. Keegan III, S.W. Hayes, and C.B. Sorenson. (2011). Montana's Forest Products Industry Current Conditions and 2011 Forecast. Bureau of Business and Economic Research. University of Montana.
- Mowat, G. and B. G. Slough. (2003). Habitat preference of Canada lynx through a cycle in snowshoe hare abundance. *Journal of Zoology* 81:1736–1745.
- Mowat, G., K. G. Poole, and M. O'Donoghue. (2000). Ecology of lynx in northern Canada and Alaska. Pages 265–306 in L. F. Ruggiero, K. B. Aubry, S. W. Buskirk, G. M. Koehler, C. J. Krebs, K. S. McKelvey, and J. R. Squires, editors. *Ecology and conservation of lynx in the United States*. University Press of Colorado. Boulder, Colorado, USA
- Muhlfeld, Clint C, et al. (2009). Hybridization rapidly reduces fitness of a native trout in the wild. *Biology Letters*, rsbl. 2009.0033.
- Mundinger, J.G. (1981). White-tailed Deer Reproductive Biology in the Swan Valley, Montana. *Journal of Wildlife Management*, 45, 135-139.
- Mundinger, J.G. (1982). Biology of the White-tailed Deer in the Coniferous Forests of Northwestern Montana *Progress Report*. Helena, Montana: Montana Department of Fish, Wildlife, and Parks.
- Murphy, K., et al. (2011). Wolverine conservation in Yellowstone National Park (YNP): Final report YCR-2011-02. Yellowstone National Park, WY: USDI National Park Service.
- Naney, R. H., et al. (2012). Conservation of Fishers (*Martes pennanti*) in South-Central British Columbia, Western Washington, Western Oregon, and California—Volume III: Threat Assessment. Denver, CO: USDI Bureau of Land Management.
- Nappi, A. & P. Drapeau. (2009). Reproductive success of the black-backed woodpecker (*Picoides articus*) in burned boreal forests: Are burns source habitats? *Biological Conservation*, 142, 1381-1391.
- National Wildfire Coordinating Group. (2014). Wildland Fire Incident Management Field Guide. (PMS 210). Boise, ID: Retrieved from <http://www.nwcg.gov/pms/pubs/pms210/pms210.pdf>.
- NatureServe. (2014). NatureServe Explorer: an online encyclopedia of life. Retrieved 2014 <http://explorer.natureserve.org/>
- O'Donoghue, M., S. Boutin, D. L. Murray, C. J. Krebs, E. J. Hofer, U. R. S. Breitenmoser, C. Breitenmoser-Wuersten, G. Zuleta, C. Doyle, and V. O. Nams. (2001). Coyotes and Lynx. Pages 275–316 in Krebs, C. J., S. Boutin, and R. Boonstra, *Ecosystem Dynamics of the Boreal Forest: The Kluane Project*, Oxford University Press, New York, New York, USA
- Oliver, C. D. , & B. C. Larson. (1996). *Forest Stand Dynamics, Update Edition*. New York, NY: John Wiley & Sons.
- Olsen, W. K., et al. (1996). Stand characteristics associated with mountain pine beetle infestations in ponderosa pine. *Forest Science*, 42(3), 310-327.
- Omi, P. N. , & E. J. Martinson. (2002). *Effects of Fuels Treatment on Wildfire Severity*. Western Forest Fire Research Center, Colorado State University.
- Overton, C. K., et al. (1997). *R1/R4 (Northern/ Intermountain Regions) Fish and Fish Habitat*

- Standard Inventory Procedures Handbook*. (General Technical Report INT-GTR-3). Ogden, UT: USDA Forest Service, Intermountain Research Station.
- Page-Dumroese, D, et al. (2009). USDA Forest soil disturbance monitoring protocol, Volume 1: Rapid assessment. *FS-WO-82a. Moscow, ID: US Department of Agriculture, Forest Service, Rocky Mountain Research Station*.
- Page-Dumroese, Deborah, et al. (1991). Organic matter function in the western-montane forest soil system. *AE Harvey, and LF Neuenschwander (Compilers), Proceedings Management and Productivity of Western-Montane Forest Soils. USDA For. Serv. Gen. Tech. Rep. INT-280. Ogden, UT, 95-100.*
- Page-Dumroese, Deborah S. (1993). Susceptibility of volcanic ash-influenced soil in northern Idaho to mechanical compaction.
- Parks, C.G., et al. (2005). Natural and land-use history of the Northwest mountain eco-regions (USA) in relation to patterns of plant invasions. *Perspectives in Plant Ecology, Evolution and Systematics*, 7, 137-158.
- Patla, S. M. (1997). *Nesting ecology and habitat of the Northern Goshawk in undisturbed and timber harvest areas on the Targhee National Forest, Greater Yellowstone Ecosystem*. (M.S. Thesis), Idaho State University, Pocatello, ID.
- Pederson, L. . (2006). *R1 Forest Health Hazard Rating System*. USDA Forest Service, Northern Region. Missoula, Montana.
- Perry, DA, et al. (1990). Species migrations and ecosystem stability during climate change: the belowground connection. *Conservation Biology*, 4(3), 266-274.
- Pfister, R.D., et al. (1977). *Forest habitat types of Montana*. (General Technical Report INT-34). Ogden, Utah: USDA Forest Service, Intermountain Forest and Range Experiment Station.
- Porter, Aswea D., et al. (2005). Fine-scale selection by marten during winter in a young deciduous forest. *Canadian Journal of Forestry Research*, 35, 901-909.
- Powell, R. A. , & W. J. Zielinski. (1994). Fisher. In L. F. Ruggiero, K. B. Aubry, S. Buskirk, L. J. Lyon, & W. J. Zielinski (Eds.), *The Scientific Basis for Conserving Forest Carnivores: American Martin, Fisher, Lynx, and Wolverine in the Western United States* (pp. 38-73). Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range and Experiment.
- Powers, Robert F, et al. (2005). The North American long-term soil productivity experiment: findings from the first decade of research. *Forest Ecology and Management*, 220(1), 31-50.
- Prescott, Cindy E, & Raija Laiho. (2002). The nutritional significance of coarse woody debris in three Rocky Mountain coniferous forests. *USDA Forest Service General Technical Reports*, 381-392.
- Quigley, Thomas M., et al. (1996). *Integrated scientific assessment for ecosystem management in the interior Columbia Basin and portions of the Klamath and Great Basins*. (GTR-PNW-382). Portland, OR: USDA Forest Service, Pacific Northwest Research Station Retrieved from http://www.fs.fed.us/pnw/publications/pnw_gtr382/
<http://www.treearch.fs.fed.us/pubs/25384>.
- Raley, C. M., et al. (2012). *Habitat ecology of fishers in western North America: a new synthesis*. In: K. B. Aubry, W. J. Zielinski, M. G. Raphael, G. Proulx, & S. W. Buskirk (Eds.), *Biology and Conservation of Martens, Sables, and Fishers: A New Synthesis* (pp. 231-254). Ithaca, NY: Cornell University Press.
- Reichel, James D, & Stan G Beckstrom. (1993). *Northern Bog Lemming Survey, 1992*: Montana Natural Heritage Program.
- Ritter, S., et al. (2000). *R1 Snag Protocol*. Missoula, Montana: USDA Forest Service, Northern Region, Inventory and Analysis.
- Roper, B. B. , et al. (2003). The value of using permanent sites when evaluating stream attributes at the reach scale. *Journal of Freshwater Ecology*, 18, 585-592.
- Rota, Christopher T., et al. (2014). *The role of wildfire, prescribed fire, and mountain pine beetle infestations on the population dynamics of black-backed woodpeckers in the black hills, South Dakota*. *PLOS One*, 9(4), e94700.
- Rotenberry, J. T., et al. (1995). When and how are populations limited? The Roles of Insect

- Outbreaks, Fire, and Other Natural Perturbations. In T. E. Martin & D. M. Finch (Eds.), *Ecology and Management of Neotropical Migratory Birds: a Synthesis and Review of Critical Issues* (pp. 55-84). Oxford, NY: Oxford University Press.
- Ruggiero, Leonard F., et al. (1994). *The scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine in the western United States*. (General Technical Report RM-GTR-254). Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station.
- Russell, W. H., & C. Jones. (2001). The effects of timber harvesting on the structure and composition of adjacent old-growth coast redwood forest. *Landscape Ecology*, 16, 731-741.
- Ryan, Kevin C., & Nonan Noste. (1983, April 1985). *Evaluating Prescribed Fires*. Paper presented at the Symposium and Workshop on Wilderness Fire, Missoula, MT.
- Ryan, MG, et al. (2009). Fuel Treatments by Mulching-A Synthesis of the Ecological Impacts.
- Saab, V.A., & J. G. Dudley. (1998). *Responses of cavity-nesting birds to stand-replacement fire and salvage logging in ponderosa pine/Douglas-fir forests of southwestern Idaho*. (Research Paper RMRS-RP-11). Ogden, UT: USDA Forest Service, Rocky Mountain Research Station.
- Sala, A. , & R. Callaway. (2004). *Physiological responses of old growth ponderosa pine and western larch to restoration cutting and burning treatments*. (RMRS-99563-RJVA). Unpublished Report: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station.
- Samson, F. (2005). *A Conservation Assessment of the Northern Goshawk, Black-backed Woodpecker, Flammulated Owl, and Pileated Woodpecker in the Northern Region (amended March 6, 2006)*. (Unpublished). Missoula, Montana: USDA Forest Service, Northern Region.
- Samson, Fred. (2006). *Habitat Estimates for Maintaining Viable Populations of the Northern Goshawk, Black-backed Woodpecker, Flammulated Owl, Pileated Woodpecker, American Marten, and Fisher*. Missoula, MT.
- Savage, J. (2008). The Perils of Profit. *Forest Magazine*, Spring, 2008.
- Schmidt, J. A. , & R. L. Barger. (1986, June 30-July 2, 1986). *Effects of wind and snow on residual lodgepole pine following intermediate cuttings*. Paper presented at the Management of Small-Stem Stands of Lodgepole Pine Workshop Proceedings, Fairmont Hot Springs, MT.
- Schmidt, S. K., et al. (2007a). Biogeochemical consequences of rapid microbial turnover and seasonal succession in soil. *Ecology*, 88, 1379-1385.
- Schmidt, S.K., et al. (2007b). Biogeochemical consequences of rapid microbial turnover and seasonal succession in soil. *Ecology*, 88, 1379-1385.
- Schmidt, W. C., et al. (1976). *Ecology and silviculture of western larch forests*. (Technical Bulletin No. 1520). Washington, D.C.: U.S. Department of Agriculture.
- Schwartz, M. K., et al. (2013). *Stand- and landscape-scale selection of large trees by fishers in the Rocky Mountains of Montana and Idaho*. *Forest Ecology Management*, 305, 103-111.
- Schnackenberg, Elizabeth S., & Lee H. MacDonald. (1998). Detecting Cumulative Effects on Headwater Streams in the Routt National Forest, Colorado. *Journal of American Water Resources Association*, 34(5), 15.
- Schwalm, C. R. , & K. S. Milner. (2002). Stand Responses Following Partial Cutting in Western Montana. *Western Journal of Applied Forestry*, 17(1), 37-45.
- Schwartz, M.K., Mills, L.S., McKelvey, K.S., Ruggiero, L.F., Allendorf, F.W., (2002). *DNA reveals high dispersal synchronizing the population dynamics of Canada lynx*. *Nature* 415, 520-522.
- Scott, J.H., & R.E. Burgan. (2005). *Standard fire behavior fuel models: A comprehensive set for use with Rothermel's surface fire spread model*. (General Technical Report RMRS-GTR-153). Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station.
- Scott, Joe H., & Elizabeth D. Reinhardt. (2001). *Assessing crown fire potential by linking models of surface and crown fire behavior*. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station.
- SEC. (2004). Upper Swan Valley Landscape Assessment (pp. 238). Condon, MT: Swan Valley

- Ecosystem Management & Learning Center.
- Sestrich, Clint Michael. (2005). *Changes in native and nonnative fish assemblages and habitat following wildfire in the Bitterroot River Basin, Montana*. MONTANA STATE UNIVERSITY Bozeman.
- Seymour, Geoff, & Aregai Teclé. (2004). Impact of Slash Pile Size and Burning on Ponderosa Pine Forest Soil Physical Characteristics. *Journal of the Arizona-Nevada Academy of Science*, 37(2), 74-82. doi: 10.2181/1533-6085(2004)037<0074:iospsa>2.0.co;2
- Seymour, Geoff, & Aregai Teclé. (2005). Impact of slash pile size and burning on soil chemical characteristics in ponderosa pine forests. *Journal of the Arizona-Nevada Academy of Science*, 38(1), 6-20.
- Shearer, R.C. (1971). Silvicultural Systems in Western Larch Forests. *Journal of Forestry*, 69(10), 732-735.
- Shelly, J. S., , (1994, 1994). [Personal Communication].
- Shelly, J.S. (1988). *Status review of Howellia aquatilis: Region 1, Flathead National Forest*. Helena, Montana: Montana Natural Heritage Program.
- Shore, T.L., & L. Safranyik. (1992). *Susceptibility and risk rating systems for the mountain pine beetle in lodgepole pine stands*. (Report BC-X-336). Victoria, British Columbia: Forestry Canada, Pacific and Yukon Region, Pacific Forestry Centre.
- Shenk, T. M. . (2009). *Wildlife research report: post release monitoring of lynx (Lynx canadensis) reintroduced to Colorado. July 1 2008–August 31, 2009.*, from <http://cpw.state.co.us/Documents/Research/Mammals/Publications/2005-2006WILDLIFERESEARCHREPORT.pdf#page=7>.
- Silveri, Ann, et al. (2001). Logging and edaphic factors in the invasion of an Asian woody vine in a mesic North American forest. *Biological Invasions*, 3, 379-389.
- Sime, C. A., et al. (2010). *Montana gray wolf conservation and management 2009 annual report*. Helena, Montana: Montana Fish, Wildlife & Parks.
- Sime, Carolyn A, et al. (2007). *Montana gray wolf conservation and management 2006 annual report*.
- Skinner, C. N., et al. (2002). *Effects of prescribed fire and thinning on wildfire severity: The Cone Fire, Black's Mountain Experimental Forest*. Paper presented at the 25th Annual Forest Vegetation Management Conference, Redding, California.
- Skinner, C.N. (2002). *Influence of fire on the dynamics of dead woody material in forests of California and southwestern Oregon*. Paper presented at the Proceedings of the Symposium on the Ecology and Management of Dead Wood in Western Forests, Reno, Nevada.
- Smith, D.M., et al. (1997). *The Practice of Silviculture: Applied Forest Ecology, 9th ed*. New York: John Wiley & Sons, Inc.
- Spencer, C.N., & F.R. Hauer. (1991). Phosphorus and nitrogen dynamics during a wildfire. *Journal of the North American Benthological Society*, 10(1), 24-30.
- Spencer, Craig N., et al. (2003). Wildfire effects on stream food webs and nutrient dynamics in Glacier National Park, USA. *Forest Ecology and Management*, 178, 141-153.
- Squires, John R. & Tom Laurion. (2000). *Lynx home range and movements in Montana and Wyoming: preliminary results. Ecology and conservation of lynx in the United States. University Press of Colorado, Boulder, USA, 337-349.*
- Squires, J. R., & P. L. Kennedy. (2006). Northern goshawk ecology: an assessment of current knowledge and information needs for conservation management. *Studies in Avian Biology*, 31, 8-62.
- Squires, J. R., & L. F. Ruggiero. (2007). Winter prey selection of Canada Lynx in Northwestern Montana. *Journal of Wildlife Management*, 71, 310–315.
- Squires, J.R. L.E Olsen, D.L. Turner, N.J. Deceasre, J.A. Kolbe. (2012). Estimating detection probability for Canada lynx Lynx Canadensis using snow-track surveys in the northern Rocky Mountains, Montana, USA. *Wildlife Biology* 18(2):215-224.
- Squires, J. R. , & R. T. Reynolds. (1997). Northern Goshawk (*Accipiter gentilis*). In A. Poole & F. Gill (Eds.), *The Birds of North America, No. 238* (pp. 1-32). Philadelphia, PA and Washington, D.C.: The Academy of Natural Sciences and The American Ornithologist's Union.

- Squires, J. R., & L. F. Ruggiero. (2007). Winter prey selection of Canada Lynx in Northwestern Montana. *Journal of Wildlife Management*, 71, 310–315.
- Squires, John R., et al. (2008). Hierarchical den selection of Canada lynx in western Montana. *Journal of Wildlife Management*, 72(7), 1497-1506. doi: 10.2193/2007-396
- Squires, J.R. 2009. Letter from John Squires to Carly Walker. June 19, (2009). Accessed August 8, 2013. Found at: < <http://ncfp.files.wordpress.com/2012/08/squires-june-29-2009-letter-missoula-county-rural-int-lynx-seeley.pdf>>.
- Squires, John R., et al. (2010). Seasonal resource selection of Canada lynx in managed forests of the northern Rocky Mountains. *Journal of Wildlife Management*, 74(8), 1648-1660. doi: 10.2193/2009-184
- Squires, J.R., N.J. DeCesare, L. E. Olson, J.A. Kolbe c, M.Hebblewhite, S.A. Parks. (2013). Combining resource selection and movement behavior to predict corridors for Canada lynx at their southern range periphery. *Biological Conservation* 157: 187-195.
- Squires, John R., et al. (2006). Lynx ecology in the intermountain West *Research Program Summary, Summer 2006* (pp. 51). Missoula, MT: USDA Forest Service, Rocky Mountain Research Station.
- Stanfield, Les W, & Bruce W Kilgour. (2006). *Effects of percent impervious cover on fish and benthos assemblages and instream habitats in Lake Ontario tributaries*. Paper presented at the American Fisheries Society Symposium.
- Startsev, AD, & DH McNabb. (2001). Skidder traffic effects on water retention, pore-size distribution, and van Genuchten parameters of boreal forest soils. *Soil Science Society of America Journal*, 65(1), 224-231.
- Sturdevant, N. (2010). *Review of FHP projects funded in 2010 and proposed for 2011*. (Report Number MFO-TR-10-32). Missoula, Montana: USDA Forest Service, Forest Health Protection.
- Sturdevant, N. . (2011). *PSR Evaluations on the Flathead National Forest, 2011*. (Report Number MFO-TR-11-26). Missoula, Montana: USDA Forest Service, Forest Health Protection.
- Sugden, B. D. , & S. W. Woods. (2007). Sediment production from forest roads in western Montana. *Journal of the American Water Resources Association*, 43, 193-206.
- Swan Ecosystem Center. (2004). Upper Swan Valley Landscape Assessment (pp. 238). Condon, MT: Swan Valley Ecosystem Management & Learning Center.
- Southwestern Crown Carnivore Monitoring Team. (2015). *Forest Carnivore Monitoring in the Southwestern Crown of the Continent: Progress Report 2012-2014* (pp. 61): Southwestern Crown of the Continent.
- Switalski, T. Adam, & Cara R. Nelson. (2011). Efficacy of road removal for restoring wildlife habitat: Black bear in the Northern Rocky Mountains, USA. *Biological Conservation*, 144(11), 2666-2673. doi: 10.1016/j.biocon.2011.07.026
- The Nature Conservancy, & USDA Forest Service.. (2003). *Weed Risk Assessment: The Nature Conservancy and U.S. Department of Agriculture, Forest Service*.
- Thomas, Jack W, et al. (1979). Snags. *Wildlife habitats in managed forests—the Blue Mountains of Oregon and Washington. Agricultural Handbook*, 553, 60-77.
- Trombulak, Stephen, & Christopher Friessell. (2000). Review of Ecological Effects of Roads on Terrestrial and Aquatic Communities. *Conservation Biology*, 14(1), 13.
- Tysdal, L. M. , et al. (1999). Modeling erosion from insloping low-volume roads with WEPP watershed model. *Transportation Research Record*, 1652, 250-256.
- Tyser, Robin W., & Christopher A. Worley. (1992). Alien flora in grasslands adjacent to road and trail corridors in Glacier National Park, Montana (USA). *Conservation Biology*, 6(2), 253-262. doi: 10.1046/j.1523-1739.1992.620253.x
- USDA. (1973). *Forest Hydrology, Hydrologic Effects of Vegetation Manipulation, Part II*. Missoula, Montana: USDA Forest Service, Northern Region.
- USDA. (1974). *Agriculture Handbook 462, National Forest Landscape Management*. Washington, DC: USDA.
- USDA. (1977). *Agriculture Handbook 483, National Forest Landscape Management*. Washington, DC: USDA.
- USDA. (1985). *Flathead National Forest Land and Resource Management Plan*. Kalispell, Montana: USDA Forest Service, Flathead National Forest.

- USDA. (1994). *Wildlife Landscape Assessment – Swan Valley*. Kalispell, Montana: USDA Forest Service, Flathead National Forest.
- USDA. (1994a). *Biological Assessment Flathead LRMP Amendment #19*. Kalispell, Montana: USDA Forest Service, Flathead National Forest.
- USDA. (1995a). *2000 National Forest Resource Management Amendment No. 2000-95-5*. Washington, DC.
- USDA. (1995b). Amendment 19 to the Flathead National Forest Plan Environmental Impact Statement: allowable sale quantity and objectives and standards for grizzly bear habitat management *Flathead National Forest Plan*. Kalispell, MT: U.S. Department of Agriculture, Forest Service, Flathead National Forest.
- USDA. (1995c). Inland Native Fish Strategy: Environmental Assessment - Decision Notice and Finding of No Significant Impact *Interim strategies for managing fish-producing watersheds in eastern Oregon and Washington, Idaho, western Montana, and portions of Nevada* (pp. 211): U.S. Department of Agriculture, Forest Service, Intermountain, Northern, and Pacific Northwest Regions.
- USDA. (1995d). *Landscape Aesthetics: A Handbook for Scenery Management, Agriculture Handbook No. 701*. Washington, DC: USDA Forest Service.
- USDA. (1998a). *Flathead National Forest Forest Plan Amendment 21 Final Environmental Impact Statement: Management direction related to old growth forests*. Kalispell, Montana: USDA Forest Service, Flathead National Forest.
- USDA. (1998b). *Flathead National Forest Forest Plan Amendment 21, Final Environmental Impact Statement*. Kalispell, Montana: USDA Forest Service, Flathead National Forest.
- USDA. (1999a). *Ecology and Conservation of Lynx in the United States*. (General Technical Report RMRS-GTR-30WWW). Fort Collins, Colorado: USDA Forest Service, Rocky Mountain Research Station.
- USDA. (1999b). *Flathead National Forest Plan Amendment 21: Management Direction Related to Old Growth Forests Decision Notice*. Kalispell, Montana: USDA Forest Service, Flathead National Forest.
- USDA. (2000). Supplemental Draft Environmental Impact Statement, Interior Columbia Basin Ecosystem Management Project. Boise, ID: U. S. Department of Agriculture, Forest Service and U. S. Department of the Interior, Bureau of Land Management.
- USDA. (2001a). Flathead National Forest Land and Resource Management Plan. Kalispell, MT: U.S. Department of Agriculture, Forest Service, Flathead National Forest.
- USDA. (2001b). *Flathead National Forest Land and Resource Management Plan (Amended)*. Kalispell, Montana: USDA Forest Service, Flathead National Forest.
- USDA. (2001c). *Flathead National Forest Noxious and Invasive Weed Control Decision Notice and Finding of No Significant Impact*. Kalispell, Montana: USDA Forest Service, Flathead National Forest.
- USDA. (2001d). Future trends in agricultural trade *Miscellaneous Publication No. 1579* (pp. 8): U.S. Department of Agriculture, Animal and Plant Health Inspection Service.
- USDA. (2001e). *Future Trends in Agricultural Trade*. Washington, D.C.: USDA Animal and Plant Health Inspection Service Retrieved from http://www.aphis.usda.gov/publications/aphis_general/content/printable_version/brotradi.pdf.
- USDA. (2002). *Grizzly bear distribution outside of recovery zones*. Missoula, Montana: The University of Montana, College of Forestry and Conservation, U.S. Fish and Wildlife Service Grizzly Bear Recovery Program.
- USDA. (2003). *Influence of Forest Structure on Wildfire Behavior and the Severity of Its Effects, an Overview*. Washington, D.C.: USDA Forest Service.
- USDA. (2005). *Guidelines for Road Maintenance Levels*. (0577 1205-SDTDC). Washington, DC: USDA Forest Service.
- USDA. (2006). *National Forest evaluation and compliance with National Forest Management Act Requirements to require viability and diversity of animal communities (updated August 2011)*. Kalispell, Montana: USDA Forest Service, Flathead National Forest.
- USDA. (2007). Northern Rockies Lynx Management Direction: Final Environmental Impact Statement (Volumes 1 and 2). Missoula, MT: U.S. Department of Agriculture, Forest

- Service, Northern Region.
- USDA Forest Service. (2013). Geospatial Post-Burn Habitat Analysis - Flathead National Forest, Kalispell, MT USDA Forest Service.
- USDA. (2016). *Flathead National Forest Evaluation and Compliance with National Forest Management Act requirements to Provide for Viability and Diversity of Animal Communities Unpublished report* (pp. 183): Forest Service.
- USDA. (2015). *Flathead National Forest Evaluation and Compliance with National Forest Management Act requirements to Provide for Viability and Diversity of Animal Communities Unpublished report* (pp. 183): Forest Service.
- USDA Forest Service. (1988). *FSH 2509.22 Soil and Water Conservation Practices Handbook*. Washington, DC.
- USDA Forest Service. (1992). *Land and Resource Management Plan Annual Monitoring Report*. Kalispell, MT.
- USDA Forest Service. (1997). *Conservation Strategy for Howellia aquatilis*. (Appendix VV to Flathead Forest Plan). Kalispell, Montana: USDA Forest Service, Flathead National Forest.
- USDA Forest Service. (1998). *Flathead National Forest Forest Plan Amendment 21 Final Environmental Impact Statement: Management direction related to old growth forests*. Kalispell, Montana: USDA Forest Service, Flathead National Forest.
- USDA Forest Service. (1999). *Forest Service Manual 2500 Region 1 Supplement No. 2500-99-1*. Washington, DC: US Department of Agriculture, Forest Service.
- USDA Forest Service. (2001). *Flathead National Forest Land and Resource Management Plan (Amended)*. Kalispell, Montana: USDA Forest Service, Flathead National Forest.
- USDA Forest Service. (2004). *Crazy Horse Fire Salvage Project*. Kalispell, MT Flathead National Forest.
- USDA Forest Service. (2004). *Region 1 timber sale program statistics report*. Missoula, MT.
- USDA Forest Service. (2006a). *Draft Region 1 Aquatic Ecological Unit Technical Guide for Wadeable Streams*. Missoula, MT.
- USDA Forest Service. (2006b). Interagency Grizzly Bear Committee Summer Meeting Notes, June 6-7, 2006. from <http://www.fs.fed.us/r1/wildlife/igbc/>
- USDA Forest Service. (2007a). *Black-backed Woodpecker Northern Region Overview, Key Findings and Project Considerations. Version July 13, 2007*. Missoula, Montana: USDA Forest Service, Northern Region Black-backed Woodpecker Working Group.
- USDA Forest Service. (2007b). *Integrated Restoration and Protection Strategy in the Northern Region: Overview*. Missoula, Montana: USDA Forest Service, Northern Region.
- USDA Forest Service. (2007c). *Northern Rockies Lynx Management Direction Record of Decision*. Missoula, Montana: USDA Forest Service, National Forests in Montana, and parts of Idaho, Wyoming, and Utah.
- USDA Forest Service. (2007d). *Northern Rockies Lynx Management Direction Record of Decision, National Forests in Montana, and parts of Idaho, Wyoming, and Utah* (pp. 71). Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region.
- USDA Forest Service. (2008). *Proposed Directive FSM 2020 - Ecological Restoration and Resilience. Questions and Answers*. Retrieved 4 April, 2014, 2014, from http://www.fs.fed.us/spf/tribalrelations/documents/policy/ecorestoration/Proposed_Directive_QAs_20090709.pdf
- USDA Forest Service. (2010a). *Montana Forest Insect and Disease Conditions and Program Highlights - 2010*. (11-1). Missoula, MT.
- USDA Forest Service. (2010b). *Wildlife Council Meeting Notes. December 8-9, 2010*.
- USDA Forest Service. (2011a). *FSM 2900 - Invasive Species Management*. Washington, DC.
- USDA Forest Service. (2011b). *Region 1 Approach to Soils NEPA Analysis Regarding Detrimental Soil Disturbance in Forested Areas - A Technical Guide*. Missoula, MT USDA Forest Service
- USDA Forest Service. (2012). *Increasing the pace of restoration and job creation on the National Forests*. Washington, D.C.: USDA Forest Service.
- USDA Forest Service. (2013). *Letter from USFS Region 1 to US Fish and Wildlife Service addressing new lynx science. September 13, 2013*.

- USDA Forest Service, et al. (2000). *Canada Lynx Conservation Assessment and Strategy*. (Publication #R1-00-53). Missoula, MT: USDA Forest Service, Northern Region.
- USDA Natural Resources Conservation Service. (1999). *Soil taxonomy, a basic system of soil classification and interpreting soil surveys*. . (Agricultural Handbook Number 436). USDA.
- USDI. (1987). *Northern Rocky Mountain Wolf Recovery Plan*. Denver, Colorado: USDA Fish and Wildlife Service.
- USDI. (1993). *Grizzly Bear Recovery Plan*. Denver, Colorado: USDI Fish and Wildlife Service.
- USDI. (1997). *Amended and restated conservation agreement among Plum Creek Timber Company, L.P. and Montana Department of Natural Resources and Conservation and USDA Forest Service, Flathead National Forest and USDI Fish and Wildlife Service*. Agreement. Plum Creek Timber Company, L.P.; Montana Department of Natural Resources and Conservation; USDA Forest Service, Flathead National Forest; and USDI Fish and Wildlife Service. Kalispell, Montana.
- USDI (2013b). *Endangered and Threatened Wildlife and Plants; Threatened Status for the Distinct Population Segment of the North American Wolverine Occurring in the Contiguous United States; Establishment of a Nonessential Experimental Population of the North American Wolverine in Colorado, Wyoming, and New Mexico; Proposed Rules, 78 C.F.R. (2013b)*.
- USDI. (2007a). *Biological Opinion on the Northern Rockies Lynx Management Direction*. Helena, Montana: USDI Fish and Wildlife Service.
- USDI. (2007b). *Recovery Plan for Silene Spaldingii (Spalding's Catchfly)*. Portland, OR.
- USDI Fish and Wildlife Service. (2010) Federal Register/Vol. 75/No. 239/Tuesday, December 14, 2010/Proposed Rule. 50 CFR Part 17 - Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition to List the North American Wolverine as Endangered or Threatened (2010).
- USDI Fish and Wildlife Service. (2013) Federal Register/Vol. 78/No. 23/Monday, February 4, 2013/Proposed Rules. Endangered and threatened wildlife and plants; threatened status for the distinct population segment of the North American wolverine occurring in the contiguous United States, Pages 7863 - 7890 [FR DOC # 2013-01478].
- USDI Fish and Wildlife Service. (2014a) Federal Register/Vol. 79/No. 177/Friday, September 12, 2014. 36 CFR 17 - Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for the Contiguous United States Distinct Population Segment of the Canada Lynx and Revised Distinct Population Segment Boundary; Final Rule. (2014). <https://federalregister.gov/a/2014-21013>
- USDI. (2014b). Federal Register, Vol. 79, No. 156/Wednesday, August 13, 2014, Proposed Rules: 50 CFR Part 17 Endangered and Threatened Wildlife and Plants; Threatened Status for the Distinct Population Segment of the North American Wolverine Occurring in the Contiguous United States; Establishment of a Nonessential Experimental Population of the North American Wolverine in Colorado, Wyoming, and New Mexico; Proposed Rule. Federal Register, 79(156), 47522-47545.
- 50 CFT part 17 Federal Register, Vol. 63, No. 125, Montana, June 29, 1998. Endangered and Threatened Wildlife and Plants; Notice of 12-Month Finding on a Petition To List the Northern Goshawk in the Contiguous United States West of the 100th Meridian; Proposed Rule, 63 C.F.R. (1998).
- 50 CFR Part 17 - Federal Register / Vol. 74, No. 36 / Wednesday, February 25, 2009 / Rules and Regulations, Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for the Contiguous United States Distinct Population Segment of the Canada Lynx; Final Rule. Pages 8615 - 8702 [FR DOC # E9-3512] (2009).
- 50 CFR Part 17, Federal Register, Vol. 75, No. 239, Tuesday, December 14, 2010, Proposed Rule: Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition to List the North American Wolverine as Endangered or Threatened (2010).
- 50 CFR Part 17 - Federal Register, Vol. 76, No. 126, Thursday, June 30, 2011. Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition To List a Distinct Population Segment of the Fisher in Its United States Northern Rocky Mountain Range as Endangered or Threatened With Critical Habitat: Proposed Rule, 76 C.F.R. (2011a).
- 50 CFR Part 17 - Federal Register /Vol. 76, No. 138 /Tuesday, July 19, 2011 / Proposed Rules /

- Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition To List *Pinus albicaulis* as Endangered or Threatened With Critical Habitat, Pages 42631 - 42654 [FR DOC # 2011-17943] (2011b).
- USDI Fish and Wildlife Service. (2007). *Biological Opinion on the Northern Rockies Lynx Management Direction*. Helena, MT: USDI Fish and Wildlife Service.
- USDI. (2011c). Endangered and Threatened Wildlife and Plants: 12-month Finding on a Petition to List *Pinus albicaulis* as Endangered or Threatened with Critical Habitat. *Federal Register*, 76(138), 24.
- USDI. (2011d). *Grizzly Bear (Ursus arctos horribilis) 5-Year Review: Summary and Evaluation*. Missoula, MT: USDI Fish and Wildlife Service.
- USDI. (2013). *Water howellia (Howellia aquatilis) 5-year review: Summary and Evaluation*. Helena, MT.
- USDI. (2014). *Biological Opinion on the Effects of the Flathead National Forest Plan Amendment 19 Revised Implementation Schedule on Grizzly Bears*. Helena, MT.
- USDI Fish and Wildlife Service. (1996). *Draft Water Howellia (Howellia aquatilis) Recovery Plan*. (Prepared by J.S. Shelly and John Gamon). Washington, D.C.: United States Department of the Interior, Fish and Wildlife Service.
- USDI Fish and Wildlife Service. (2000). Endangered and threatened wildlife and plants; determination of threatened status for the contiguous United States distinct population segment of the Canada lynx and related rule; final rule. *Federal Register*, 65, 16052-16086.
- USDI Fish and Wildlife Service. (2008). Revised Critical Habitat for the Contiguous United States Distinct Population Segment of the Canada Lynx; Proposed Rule. *Federal Register*, 73(40), 10860-10896.
- USDI Fish and Wildlife Service. (2013) *Water howellia (Howellia aquatilis) 5-Year Review : Summary and Evaluation*. Montana Ecological Services Field Office, Helena, MT. Accessed at http://ecos.fws.gov/docs/five_year_review/doc4271.pdf
- U.S. Fish and Wildlife Service. 2014. *Biological Opinion on the Effects of the Flathead National Forest Plan Amendment 19 Revised Implementation Schedule on Grizzly Bears*. Helena, Montana. 157 pp.
- Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for the Contiguous United States Distinct Population Segment of the Canada Lynx; Final Rule., 74 C.F.R. (2009).
- USDI Geological Survey. (2008). A study to estimate the grizzly bear population size in the Northern Continental Divide ecosystem. from http://nrmssc.usgs.gov/news/NCDE_overview.pdf
- Vasemägi, Anti, et al. (2010). Ecological consequences of hybridization between native westslope cutthroat (*Oncorhynchus clarkii lewisi*) and introduced rainbow (*Oncorhynchus mykiss*) trout: effects on life history and habitat use. *Canadian Journal of Fisheries and Aquatic Sciences*, 67(2), 357-370.
- Vigil, A. (2002). *Meadow Smith Environmental Impact Statement, Silvicultural Specialist Report*. Kalispell, MT: Flathead National Forest
- Vinkey, R. S. . (2003). *An evaluation of fisher (Martes pennanti) introductions in Montana*. (M.S. Thesis), The University of Montana, Missoula, Montana.
- Von der Lippe, M., & I. Kowarik. (2007). Long-distance dispersal of plants by vehicles as a driver of plant invasions. *Conservation Biology*, 21(4), 986-996.
- Waller, John S., & Richard D. Mace. (1997). Grizzly bear habitat selection in the Swan Mountains, Montana. *Journal of Wildlife Management*, 61(4), 1032-1039. doi: 10.2307/3802100
- Wallmo, O. C., & and J. W. Schoen. (1980). Response of deer to secondary forest succession in southeast Alaska. *Forest Science*, 26, 448--462.
- Wang, Lizhu, et al. (1997). Influences of Watershed Land Use on Habitat Quality and Biotic Integrity in Wisconsin Streams. *Fisheries*, 22(6), 6-12.
- Watkins, R., et al. (2003). Effects of forest roads on understory plants in a managed hardwood landscape. *Conservation Biology*, 17(2), 411-419.
- Weaver, T. , & J. Fraley. (1991). Fisheries habitat and fish populations in: flathead basin forest

- practices water quality and fisheries cooperative program *Flathead Basin Forest Practices Water Quality and Fisheries Cooperative Program - Final Report* (pp. 53-68). Kalispell, Montana: Flathead Basin Commission.
- Westerling, A. L., et al. (2006). Warming and earlier spring increase western U.S. forest wildfire activity. *Science*, 313(5789), 940-943. doi: 10.1126/science.1128834
- Western Wood Products Association. (2010). New Lumber Forecast Predicts Slow, Steady Recovery for Sawmills. News Release, March 23, 2010. Portland, Oregon.**
- White, C. M., et al. (2011). Integrated Monitoring of Bird Conservation Regions (IMBCR): 2010 Annual Report (pp. 397). Brighton, Colorado: Rocky Mountain Bird Observatory.
- Williamson, JR, & WA Neilsen. (2000). The influence of forest site on rate and extent of soil compaction and profile disturbance of skid trails during ground-based harvesting. *Canadian Journal of Forest Research*, 30(8), 1196-1205.
- Wisdom, Michael J., & Lisa J. Bate. (2008). Snag density varies with intensity of timber harvest and human access. *Forest Ecology and Management*, 255(7), 2085-2093. doi: 10.1016/j.foreco.2007.12.027
- Witmer, G.W., et al. (1998). *Forest carnivore conservation and management in the interior Columbia basin: issues and environmental correlates*. (Geneneral Technical Report PNW-GTR-420). Portland, Oregon: USDA Forest Service, Pacific Northwest Research Station.
- Zielinski, W. J., et al. (2013). An assessment of fisher (*Pekania pennanti*) tolerance to forest management intensity on the landscape. *Forest Ecology and Management*, 310, 821-826.**
- Zouhar, Kristin, et al. (2008). Wildland fire in ecosystems: Fire and nonnative invasive plants *General Technical Report RMRS-42-6* (pp. 355). Fort Collins, CO: U.S. Dept. of Agriculture, Forest Service, Rocky Mountain Research Station.

GLOSSARY

Action Alternative - An alternative that proposes some management action, as contrasted to the No Action Alternative.

Administrative Appeal - A request to a higher authority for review of a decision related to an Environmental Impact Statement, Environmental Analysis, or Categorical Exclusion.

Affected Environment - The biological and physical environment that will or may be changed by actions proposed and the relationship of people to that environment.

Age or Size Class - A distinct group of trees, or portion of growing stock recognized on the basis of age (or size).

Airshed - Basic geographic units in which air quality is managed.

Alternative - A combination of management prescriptions applied in specific amounts and locations to achieve a desired management emphasis. One of the several policies, plans or projects, proposed for decision-making.

Bear Management Area (BMA) – Areas delineated to include important habitat components and to implement standards and guidelines pertaining to grizzly bears. These areas have also been used for evaluating habitat for other wildlife species including big game and old growth indicator species.

Bear Management Subunit – An area approximately the size of an average female home range (about 50 mi²), generally from ridge top to valley bottom, and including all seasonal habitats.

Best Management Practices (BMPs) - Methods, measures or practices to prevent or reduce water pollution, including but not limited to, structural and non-structural controls, operation and maintenance procedures, other requirements, and scheduling and distribution of activities. Usually BMPs are applied as a system of practices rather than a single practice. BMPs are selected on the basis of site-specific conditions that reflect natural background conditions and political, social, economic, and technical feasibility.

Biological Assessment (BA) - A document prepared by a federal agency for the purpose of identifying any endangered species or threatened species, which is likely to be affected by an agency action. This document facilitates compliance with the Endangered Species Act. The federal agency, in consultation with the Secretary of Interior, must insure that any action authorized, funded, or carried out by a federal agency is not likely to jeopardize the continued existence of any endangered or threatened species, or result in the destruction or adverse modification of its habitat.

Biological Evaluation (BE)- A document prepared by the Forest Service to review programs or activities to determine how an action might affect any threatened, endangered, proposed, or sensitive species. This document often focuses only on sensitive species if the Threatened, Endangered, and Proposed Species will be covered in a Biological Assessment.

Biomass (Fuels) - Live and dead accumulations of organic material.

Blowdown (Windthrow) - Uprooting by the wind. Also refers to a tree or trees so uprooted.

Board Foot - A unit of measurement represented by a board one foot square and one inch thick.

Browse - Twigs, leaves, and young shoots of trees and shrubs on which animals feed; in particular, those shrubs which are used by big game animals for food.

Buffer - A land area designated to block or absorb unwanted effects to the area beyond the buffer and to preserve other qualities along or adjacent to roads, trails, watercourses, and recreation sites.

Burn Severity- A relative measure of the degree of change in a watershed that related to the intensity of the fire on soil hydrological function. Burn severity is delineated on topographic maps of polygons. Classes of burn severity are high, moderate, low, and unburned.

Canopy - The forest cover of branches and foliage formed by tree crowns.

Canopy Cover or Crown Closure - The percentage of ground surface that is shaded by the live foliage of plants as seen from above. Used to describe how open or dense a stand of trees is.

Capability - The potential of an area of land and/or water to produce resources, supply goods and services, and allow resource uses under a specified set of management practices and at a given level of management intensity. Capability depends upon current conditions and site conditions such as climate, slope, landform, soils, and geology; as well as the application of management practices, such as silviculture or protection from fires, insects, and disease.

Cavity - A hollow in a tree that is used by birds or mammals for nesting, denning, roosting, etc.

Closed Canopy - The description given to a stand when the crowns of the main level of trees forming the canopy are touching and intermingled so that light cannot reach the forest floor directly.

Coarse Woody Debris (CWD) - Any piece(s) of dead woody material, e.g., dead boles, limbs, and large root masses on the ground or in streams.

Cohort - An age class of trees that is distinctively different from other age classes in a particular forest stand.

Commercial Thinning - A silviculture treatment that “thins” out an overstocked stand by removing trees, which are large enough to be sold as products such as poles or fence posts. It is carried out to improve the health and growth rate of the remaining crop trees.

Composition (Species) - The mix of different species that make up a plant or animal community, and their relative abundance.

Condition Class – A function of the degree of departure from historical fire regimes resulting in alterations of key ecosystem components, such as species composition, structural stage, stand age, and canopy closure. Categorized by three classes as follows: Condition Class 1 – Fire regimes are within or near an historical range; Condition Class 2 – Fire regimes have been moderately altered from their historical range; Condition Class 3 – Fire regimes have been significantly altered from their historical range.

Consultation - A process required by Section 7 of the ESA whereby Federal agencies proposing activities in a listed species habitat confer with the U.S. Fish and Wildlife Service about the impacts of the activity on the species. Consultation may be informal, and thus advisory, or formal, and thus binding.

Corridor - A band of vegetation, usually older forest, which serves to connect distinct patches on the landscape. By providing connectivity, corridors permit the movement of plant and animal species between what would otherwise be isolated patches.

Council on Environmental Quality (CEQ) - An advisory council to the President established by the National Environmental Policy Act of 1969. It reviews Federal programs for their effect on the environment, conducts environmental studies, and advises the President on environmental matters.

Cover/Forage Ratio - The ratio of tree cover (usually conifer types) to foraging areas (natural openings, clearcuts, etc.).

Cover Type - The present vegetation composition of an area, described by the dominant plant species.

Crown - The part of a tree or other woody plant bearing live branches and foliage.

Crown Closure (see Canopy Cover)

Crown Fire - A fire that advances from top-to-top of trees or shrubs more or less independently of the surface fire. Sometimes, crown fires are classed as either running or dependent, to distinguish the degree of independence from the surface fire.

Cultural Resources - The physical remains of human activity (artifacts, ruins, burial mounds, petroglyphs, etc.) and conceptual content or context (as a setting for legendary, historic, or prehistoric events; as a sacred area of native peoples, etc.) of an area of prehistoric or historic occupation.

Cumulative Effect - The impact on the environment, which results from the incremental impact of the action when added to other actions. Cumulative impacts can also result from individually minor but collectively significant actions taking place over a period of time.

Density (Stand) - The number of trees growing in a given area, usually expressed in terms of trees per acre.

Diameter Best Height (DBH) - The diameter of a tree measured four and one-half feet above the ground.

Direct Effect - Effects on the environment that occur at the same time and place as the initial cause or action.

Dispersal - The movement of organisms away from the place of birth or from centers of population density.

Disturbance (Ecosystem) - Refers to events that alter the structure, composition, or function of terrestrial or aquatic habitats. Natural disturbances include, among others, drought, floods, wind, fires, wildlife grazing, and insects and pathogens. Human-caused disturbances include actions such as timber harvest, livestock grazing, roads, and the introduction of exotic species.

Diversity - The distribution and abundance of different plant and animal communities and species.

Duff - The partially decayed organic matter on the forest floor.

Early Seral/Structural Stage - A stage of development of an ecosystem from a disturbed, relatively unvegetated state to a plant community that is up to 30 years old. Stand structure is seedling and sapling sized.

Ecosystem - A functional unit consisting of all the living organisms (plants, animals, and microbes) in a given area, and all the non-living physical and chemical factors of their environment, linked together through nutrient cycling and energy flow. An ecosystem can be of any size--a log, pond, field, forest, or the earth's biosphere--but it always functions as a whole unit. Ecosystems are commonly described according to the major type of vegetation, for example, forest ecosystem, old-growth ecosystem, or range ecosystem.

Endangered Species - Any species, plant, or animal that is in danger of extinction throughout all or a significant portion of its range. In accordance with the 1973 ESA, the Secretary of the Interior identifies endangered species.

Endemic - A species whose natural occurrence is confined to a certain region and whose distribution is relatively limited (vertebrate biology). A population that is at equilibrium or low density (invertebrate biology or pathology).

Escape Route – A means to access a safety zone.

Fire Exclusion - The disruption of a characteristic pattern of fire intensity and occurrence (primarily through fire suppression).

Fire Event (Fire Occurrence, Fire Incidence) - A single fire or series of fires within an area at a particular time.

Fire Frequency – A general term referring to the recurrence of fire in a given area over time.

Fire Hazard - The potential fire behavior for a fuel type, regardless of the fuel type's weather-influenced fuel moisture content or its resistance to fire line construction. Assessment is based on physical fuel characteristics, such as fuel arrangement, fuel load, condition of herbaceous vegetation, and presence of elevated fuels.

Fire Intensity – Based on temperature, flame length, rate of spread, heat of combustion, and total amount and size of fuel consumed. Accounts for convective heat rising into the atmosphere and fire effects to the overstory.

Fire Intolerant (or “intolerant”) - Species of plants that do not grow well or die from the effects of fire. Generally these species are shade-tolerant as well.

Fire Regimes - The ecological effects of frequency, intensity, extent, season, and synergistic interactions with other disturbances, such as insects and disease, classified into generalized levels of fire severity.

Fire Return Interval (Fire Interval) - The number of years between successive fire events in a given area.

Fire Risk - The probability or chance of fire starting determined by the presence and activities of causative agents.

Fire Rotation – The length of time necessary for an area equal in size to the study area to burn.

Fire Severity – A relative measure of the post-fire appearance of vegetation (residual fuels/mortality) as it related to the intensity of the fire and its consumptive effects on vegetation.

Fire Suppression (Fire Control) - All of the work and activities connected with fire extinguishing operations, beginning with discovery and continuing until the fire is completely extinguished.

Fire Tolerant (or “tolerant”) - Species of plants that can withstand certain frequency and intensity of fire. Generally these species are shade-intolerant as well.

Firefighter Safety - A work environment where foreseeable risks have been minimized through the mitigation of known hazards associated with wildlife suppression.

Fish Habitat - The place where a population of fish species lives and its surroundings; includes the provision of life requirements such food and cover.

Fish Passage - Clear access for migrating fish through a potential barrier.

Fishery - The total population of fish in a stream or body of water and the physical, chemical, and biological factors affecting that population.

Forage - All browse and non-woody plants available to livestock or wildlife for feed.

Forb – Any herbaceous (herb-like) plant other than grass or grass-like plants that has little or no wood on it. For example, wildflowers are forbs.

Forest Development Road (FDR) - A road wholly or partly within or adjacent to and serving the National Forest System and which is necessary for the protection, administration, and use of the National Forest System and the use and development of its resources.

Forest Health - (also called forested landscape or forestland) is defined as: the conditions under which the integrity of the soil and ecological processes are sustained resulting in systems that maintain their diversity, resiliency, and productivity with associated sustainable human resource issues.

Forest Plan- The Flathead National Forest Land and Resource Management Plan.. A Forest Plan is a document prepared under the National Forest Management Act by each national forest that generally describes how the resources in the forest will be managed for a 10 to 15 year period.

Forest Structure - The mix and distribution of tree sizes, layers, and ages in a forest. Some stands are mostly one size (single-story), some are two-story, and some are a mix of trees of different ages and sizes (multi-story).

Forest Type - Relates to the tree species (and to generalized understory plant) composition.

Fuels - Includes living plants, dead, woody vegetative materials; and other vegetative materials capable of burning.

Fuel Loading - The oven dry weight of fuels in a given area, usually expressed in tons per acre. Fuel loadings may be referenced to fuel size or time-lag categories; and may include surface fuels or total fuels.

Fuel Management - Manipulation or reduction of flammable matter for the purpose of reducing the intensity or rate of spread of a fire, while preserving and enhancing environmental quality.

Fuel Treatment - The rearrangement or disposal of natural or activity fuels.

Geographic Information System (GIS) - Computer software that provides database and spatial analytic capabilities.

Goal - A concise statement that describes a desired condition to be achieved. It is normally expressed in broad, general terms and is timeless in that it has no specific date that it is to be completed. Goal statements form the principal basis upon which objectives are developed.

Guideline - An indication or outline of policy or conduct dealing with the basic management of the Forest. Forest-wide management standards and guidelines apply to all areas of the Forest regardless of the other management prescriptions applied.

Habitat Type - An aggregation of all land areas potentially capable of producing similar plant communities at climax.

Hazard - A real or potential condition that may result in an undesired event, the cause of risk. Hazard can apply to the probability of tree mortality or damage by an insect or disease and also represents material or fuel that will ignite and burn.

Hiding Cover - *Trees of sufficient size and density to conceal animals from view at 200 feet.*

Historic Range of Variability (HRV) - Conditions which be expected to occur under natural disturbance and succession regimes.

Home Range - An area, from which intruders may or may not be excluded, to which an individual restricts most of its usual activities.

Indirect Effects - Secondary effects which occur in locations other than the initial action or significantly later in time.

Initial Attack - An aggressive suppression action consistent with firefighter and public safety and values to be protected.

Instream Cover - Anything in the water that provides protection to fish from predators (including turbulence, debris, logs, and rocks).

Intensity - Energy release rates; these are physical descriptors of the fire, not its ecological effects. Generally referred to as High, Moderate, or Low intensity.

Interdisciplinary Team (ID Team) - A group of individuals with different training assembled to solve a problem or perform a task. The team is assembled out of recognition that no one scientific discipline is sufficiently broad to adequately solve the problem. Through interaction, participants bring different points of view to bear on the problem.

Intermittent Stream - A stream which flows only at certain times of the year when it receives water from springs or from some surface source such as melting snow.

Invasive Plant - All State and county listed "noxious weeds" are considered invasive plants. Also, other exotic species (not listed by State or counties as noxious weeds) that can successfully out compete and displace native plant communities.

Inventoried Roadless Area - An area identified and classified as roadless. These areas were identified during the second Roadless Area Review and Evaluation (RARE II).

Issue - See Public Issue.

Ladder Fuels - Fuels which provide vertical continuity between the surface fuels and crown fuels in a forest stand, thus contributing to the ease of torching and crowning.

Landscape - The landforms of a region in the aggregate; the land surface and its associated habitats at scales of many acres to many square miles; a spatially heterogeneous area.

Landtype - An inventory map unit with relatively uniform potential for a defined set of land uses. Properties of soils landform, natural vegetation, and bedrock are commonly components of landtype delineation used to evaluate potentials and limitations for land use.

Large Woody Debris - Large logs and stumps in streams and on land that provide habitat for aquatic and terrestrial organisms and affects stream function.

Late Seral/Structural Stage - A stage of development of an ecosystem from approximately 80 to 120 years old. Forested stands are generally 12 to 16 inches average dbh.

Lethal Fire/Lethal Fire Regime - Fire that consumes the entire vegetative community (grasses, shrubs, trees. Also see Stand Replacement Fire.

Linkage (Habitat) - Linkage zones are combinations of landscape structural factors that allow wildlife to move through, and live within, areas influenced by human actions. A linear habitat patch through which a species must travel to reach habitat more suitable for reproduction and other life-sustaining needs.

Low Severity Ground Fire - A fire with low intensity that primarily scorches tree boles, allowing fire tolerant species to survive.

Maintenance Level (ML) – The Maintenance Level of a road indicates the type of traffic it can accommodate.

Management Area (MA) - An aggregation of capability areas that have common management direction and may be dispersed over the Forest. Consists of a grouping of capability areas selected through evaluation procedures and used to locate decisions and resolve issues and concerns.

Management Indicator Species (MIS) - Species identified in a planning process that are used to monitor the effects of planned management activities on viable populations of wildlife and fish including those that are socially or economically important.

Mature Timber - Individual trees or stands of trees that in general are at their maximum rate in terms of the physiological processes expressed as height, diameter, and volume growth.

MBF and MMBF - Thousand board feet and million board feet, respectively.

Mean Fire Return Interval (Mean Fire Interval) – The average of all fire intervals in a given area over a given time period.

Mesic - Moderately moist.

Mid-Seral/Structural Stage - A stage of development of an ecosystem from approximately 30 to 80 years old. Forested stands are generally 5 to 12 inches average dbh. Stand structure is pole- and small sawlog-sized trees.

Mixed-Severity Fire/Mixed Severity Fire Regime - Mixed-severity fire regime areas can experience the full range of fire severities during either a single event or consecutive events. In other words, in a single fire event both low severity (killing few trees) and high severity (killing all trees) in patches of variable sizes. This tends to create complex fine-grained spatial patterns of vegetation conditions across a landscape.

Monitoring and Evaluation- The periodic evaluation on a sample basis of Forest Plan management practices to determine how well objectives have been met and how closely management standards have been applied.

Montane - Of, growing in, or inhabiting mountain areas.

National Environmental Policy Act (NEPA) - An act which encourages productive and enjoyable harmony between man and his environment; promotes efforts to prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; enriches the understanding of the ecological systems and natural resources important to the Nation; and establishes a Council on Environmental Quality.

National Forest Management Act (NFMA) - A law passed in 1976 as amendments to the Forest and Rangeland Renewable Resources Planning Act that requires the preparation of Regional and Forest Plans and the preparation of regulations to guide that development.

National Forest System (NFS) - All national forest lands reserved or withdrawn from the public domain of the United States, all national forests lands acquired through purchase, exchange, donation, or other means, the national grasslands and land utilization projects administered under Title III.

National Wilderness Preservation System - All lands covered by the Wilderness Act and subsequent wilderness designations, irrespective of the department or agency having jurisdiction.

Native Species - Species that are indigenous to a region, as opposed to introduced or exotic species.

Native (Natural) Succession and Disturbance Regimes - The historic patterns (frequency and extent) of fire, insects, wind, landslides, and other natural processes in an area.

Natural Regeneration - Renewal of a tree crop by natural seeding, sprouting, suckering, or layering.

No Action Alternative - The management direction, activities, outputs, and effects most likely to exist in the future if the current plan would continue unchanged.

Non-Lethal Fire/Non-Lethal Fire Regime - Fire that primarily consumes surface fuels causing little mortality to overstory trees. See also Low Severity Fire.

Noxious and Invasive Weed EA (NIWC EA)

Noxious Weed - Any exotic plant species established or that may be introduced in the area which may render land unfit for agriculture, forestry, livestock, wildlife, or other beneficial uses.

Old Growth Habitat - A community of forest vegetation that has reached a late stage of plant succession characterized by a diverse stand structure and composition along with a significant showing of decadence. The stand structure will typically have multi-storied crown heights and variable crown densities. There is a variety of tree sizes and ages ranging from small groups of seedlings and saplings to trees of large diameters exhibiting a wide range of defect and breakage both live and dead, standing and down. The time it takes for a forest stand to develop into old growth condition depends on many local variables such as forest type, habitat type, and climate. Natural chance events involving forces of nature such as weather, insect, disease, fire, and the actions of man also affects the rate of development of old-growth stand conditions.

Open Road – A road with no restrictions on motorized vehicle use.

Overmature Timber - Individual trees or stands of trees that in general are past their maximum rate in terms of the physiological processes expressed as height, diameter, and volume growth.

Overstory - The portion of the trees that form the uppermost canopy layer in a forest of more than one story.

Perennial Streams - Streams that flow continuously throughout most years and whose upper surface generally stands lower than the water table in the region adjoining the stream.

Phloem – The layer of cells under the bark and outside of the cambium layer responsibility for transporting food created by the leaves.

Pole - A tree between a sapling and small timber size at least 5 inches DBG but smaller than 8 inches DBH.

Pool - A portion of the stream with reduced current velocity, often with water deeper than the surrounding areas, and which is usable by fish for resting and cover.

Population - A group of coexisting (conspecific) individuals that interbreed if they are sexually reproductive.

Potential Habitat (Wildlife) - Habitat that is likely to be occupied by a wildlife species or group of species, currently or in the near future.

Potential Vegetation Group (PVG) - Groupings of habitat groups on the basis of similarity of general moisture or temperature environment.

Pre-Commercial Thinning - The selective felling, deadening, or removal of trees in a young stand primarily to accelerate diameter increment on the remaining stems, maintain a specific stocking or stand density range, and improve the vigor and quality of the trees that remain.

Preferred Alternative - The Agency's preferred alternative is the alternative that the agency believes would best fulfill its statutory mission and responsibilities, giving consideration to economic, environmental, technical and other factors, and which meets the purpose and need of the NEPA document.

Prescribed Burning- The controlled use of fire to reduce or eliminate the unincorporated organic matter of the forest floor, or low, undesirable vegetation. A written, approved prescribed fire plan must exist, and NEPA requirements must be met, prior to ignition.

Proposed Action - The proposed action or proposal exists at that stage in the development of an action when an agency subject to the Act (NEPA) has a goal and is actively preparing to make a decision on one or more alternative means of accomplishing that goal and the effects can be meaningfully evaluated.

Public Involvement - A process designed to broaden the information base upon which agency decisions are made by informing the public about Forest Service activities, plans, and decisions, and participation in the planning processes which lead to final decision making.

Public Issue - A subject or question of widespread public interest identified through public participation relating to management of NFS lands.

Ranger District – Administrative subdivision of the Forest supervised by a District Ranger.

Reach - A length of stream channel, lake, or inlet exhibiting, on average, uniform hydraulic properties and morphology.

Rearing Habitat - In the case of juvenile westslope cutthroat trout, this is primarily the pool environment in streams.

Recovery Plan - A plan that details actions or conditions necessary to promote species recovery, that is, improvement in the status of species listed under the ESA to the point at which listing is no longer appropriate. Plans are required for virtually all listed species.

Reforestation - The renewal of forest cover by seeding, planting, and natural means.

Regeneration - The renewal of a forest, whether by natural or artificial means. This term may also refer to a tree crop itself.

Rehabilitation (Road) - The act of maintaining a road and improving drainage features, usually to meet BMP standards.

Release - Freeing a tree or group of trees from more immediate competition by cutting or otherwise eliminating growth that is overtopping or closely surrounding them.

Resident Fish - Non-migratory fish species.

Resilient, Resiliency - The ability of a system to respond to disturbances. Resiliency is one of the properties that enable the system to persist in many different states or successional stages.

Responsible Official - The Forest Service employee who has the authority to select and/or carry out a specific planning action.

Restore, Restoration - The re-creation of a natural or self-sustaining, resilient community or ecosystem, or a movement in that direction.

Restricted Road - A road on which motorized vehicle use is restricted during the entire non-denning period. The road requires physical obstruction and motorized vehicle use in the non-denning period is legally restricted by order.

Riparian Areas - Areas with distinctive resource values and characteristics that are comprised of an aquatic ecosystem and adjacent upland areas that have direct relationships with the aquatic system. This is considered the horizontal distance of approximately 100 feet from the normal high water line of a stream channel, or from the shoreline of a standing body of water.

Riparian Ecosystem - A transition between the aquatic ecosystem and the adjacent upland terrestrial ecosystem. It is identified by soil characteristics and by distinctive vegetative communities that require free or unbounded water.

Riparian Habitat Conservation Area (RHCA) - Portions of watersheds where riparian-dependent resources receive primary emphasis and management activities are subject to specific standards and guidelines. Riparian Habitat Conservation Areas were established as INFISH guidelines.

Riparian Land Type - Integrated map units of the types of riparian habitats based on topography, substrate materials (i.e., clays or boulders), and associated vegetation.

Riparian Wildlife Habitat - Vegetation growing close to a watercourse, lake, swamp, or spring that is generally critical for wildlife cover, fish food organisms, stream nutrients and large organic debris, and for streambank stability.

Risk - The probability of a hazard and/or the consequences of that hazard (hazards are undesirable events).

Road Density – Number of miles in a given area.

Road Management - The combination of both traffic management and maintenance management operations. Traffic management is the continuous process of analyzing, controlling, and regulating uses to accomplish National Forest objectives. Maintenance management is the perpetuation of the transportation facility to serve intended management objectives.

Salvage – Harvest of trees that are dead, dying, or deteriorating due to fire, wind, insect or other damage, or disease.

Sapling - A young tree that is larger than a seedling but smaller than a pole, typically 5 to 25 feet tall.

Scoping Process - An early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to the proposed action. Identifying the significant environmental issues deserving of study and deemphasizing insignificant issues, narrowing the scope of the environmental impact statement accordingly (CEQ regulations, 40 CFR 1501.7).

Security - The protection inherent in any situation that allows a wildlife species to remain in a defined area despite an increase in stress or disturbance, such as that associated with hunting season. The components of security include vegetation, topography, the size of the blocks of vegetation, road density, distance from roads, intensity of the disturbance, and seasonal timing.

Sediment - Solid material, both mineral and organic, that is in suspension, being transported, or has been moved from its site of origin by air, water, gravity, or ice.

Seedling - A young tree that has just germinated but has not yet reached sapling size, typically 1 to 5 feet tall.

Seedling/Sapling - A size category for forest stands in which trees less 5 inches in diameter are the predominant vegetation.

Sensitive Species - Those wildlife and plant species identified by the Regional Forester for which population viability is a concern because of significant current or predicted downward trends in (a) population numbers or density, or (b) habitat capability that would reduce a species' existing distribution.

Seral - A biotic community that is developmental; a transitory stage in an ecologic succession.

Seral Stage (also called successional or structural stage) refers to vegetation structural development; and describes the mix and distribution of tree species, sizes, canopy layers, ages, and general conditions in a forest.

Seral/Structural Stage - A stage of development of an ecosystem from a disturbed, relatively unvegetated state to a complex, mature plant community.

Severity - Refers to the ecological effects of fires, usually on the dominant organisms of the ecosystem, for example a stand dominated by lodgepole pine.

Shade Intolerant - Species of plants that do not grow well or die from the effects of too much shade. Generally, these are fire-tolerant species.

Shade Tolerant - Species of plants that can develop and grow in the shade of other plants. Generally, these are fire-intolerant species.

Silviculture - The theory and practice of controlling the establishment, composition, growth, and quality of forest stands in order to achieve the objectives of management.

Silviculture Diagnosis - The process of compiling, summarizing, analyzing, and recording of stand data.

Silvicultural Prescription - A written document that describes management activities needed to implement silvicultural treatment or treatment sequence. The prescription documents the results of the analysis during the diagnosis phase.

Silvicultural Systems - A management process whereby forests are tended, harvested, and replaced, resulting in a forest of distinctive form. It includes all cultural management practices performed during the life of the stand, such as regeneration cutting, thinning, and use of genetically improved tree seeds and seedlings to achieve multiple resource benefits.

Site Preparation - A general term for a variety of activities that remove competing vegetation, slash, and other debris that may inhibit the reforestation effort.

Site Productivity - Production capability of a specific area of land.

Slash - The residue left on the ground after felling and other silvicultural operations and/or accumulating there as a result of storms, fire, or poisoning trees.

Snag - A standing dead tree usually greater than 5 feet in height and 6 inches DBH.

Soil Productivity - The capacity of a soil to produce a specific crop such as fiber and forage, under defined levels of management. It is generally dependent on available soil moisture and nutrients and length of growing season.

Spatial - Of relating to, involving, or having the nature of space.

Spawning Habitat - Areas of substrate that provide well-oxygenated and suitable sized gravels for fish spawning.

Species - A group of actually or potentially interbreeding populations that are reproductively isolated from all other kinds of organisms.

Specified Road - See Forest Development Road above.

Stagnation - A condition where plant growth is markedly reduced or even arrested through, e.g., competition, state of the soil, or disease.

Stand - A community of trees or other vegetative growth occupying a specific area and sufficiently uniform in composition (species), age, spatial arrangement, and conditions as to be distinguishable from the other growth on adjoining lands, so forming a silvicultural or management entity.

Stand Maintenance Fire (Non-Lethal) - Fire that emphasizes the survival of the living overstory vegetation.

Stand Replacement Fire- Fire that emphasizes the destruction of the living overstory vegetation. See also Lethal fire.

Stand Replacement Fire Regime - Stand-replacement fire regimes typically occur on lands that experience predominantly lethal fires, with less than 10 percent of the forested canopy cover remaining after the fire.

Stand-Replacing Disturbance - An agent such as fire, blowdown, insect or disease epidemic, or timber harvest that kills or removes enough trees to result in an early-seral/structural stage condition.

Standards and Guidelines - An indication or outline of policy or conduct dealing with the basic management of the Forest. Forest-wide management standards and guidelines apply to all areas of the Forest regardless of the other management prescriptions applied.

Stocking - A measure of timber stand density as it relates to the optimum or desired density to achieve a given management objective.

Structure - The various horizontal and vertical physical elements of the forest, including tree size, canopy composition, quantity and quality of deadwood, ephemeral herbaceous species, density of wildlife trees, fungi, age structure, forest height, etc.

Subspecies - Subpopulations or races within a species that are distinguishable by morphological characteristics and, sometimes, by physiological or behavioral characteristics.

Substrate - Mineral and/or organic material that forms the stream bed (stream bottom).

Summer Range - Land used by wildlife species (specifically big game and/or grizzly bear) during the summer months.

Succession - A predictable process of changes in structure and composition of plant and animal communities over time. Conditions of the prior plant community or successional stage create conditions that are favorable for the establishment of the next stage. The different stages in succession are often referred to as "seral stages."

Sustainability is defined as the capacity of forests, ranging from stands to eco-regions, to maintain their health, productivity, diversity, and overall integrity, in the long run, in the context of human activity and use.

System Road - See Forest Development Road, above.

Temporary Road - A road constructed to facilitate forest management activities but is reclaimed soon after the activity is completed.

Territory - Any area defended by one or more individuals against intrusion by others of the same or different species.

Thermal Cover- Cover used by animals to ameliorate the chilling effects of winter weather or the heating effects of summer weather. For elk, a stand of coniferous trees 40 feet or taller with an average crown closure of 70 percent or more.

Threatened Species - Any species, plant or animal, which is likely to become an endangered species within the near future throughout all, or a significant portion, of its range. In accordance with the 1973 ESA, the Secretary of the Interior identifies endangered species.

Tiering - Refers to the elimination of repetitive discussions of the same issue by incorporating by reference the general discussion in an environmental impact statement of broader scope. For example, a project EA could be tiered to the Forest Plan EIS.

Travel Habitat - Habitat used by a wildlife species for daily or periodic movements between areas of higher-quality habitat. For example, for a lynx this would be the forested cover used while traveling between areas used for denning and that used for hunting.

Underburning - A fire that consumes surface fuels but not trees and large shrubs. See also Low Severity Fire and Stand Maintenance Fire.

Understory - The trees and other woody species which grow under a more or less continuous cover of branches and foliage formed collectively by the upper portion of adjacent trees and other woody growth.

Ungulate - A mammal with hooves.

Vegetative Screening - Vegetation (trees, shrubs, etc.) that ameliorates the visual effect of management activities adjacent to viewing areas (i.e. main roads).

Vegetative Succession - A phase in the gradual supplanting of one community of plants by another.

Viability - A viable animal or plant species is defined as consisting of self-sustaining populations that are well distributed throughout the specie's range. Self-sustaining populations are those that are sufficiently large, and have sufficient genetic diversity to display the array of life history strategies and forms that will provide for their persistence and adaptability in the planning area over time.

Visual Resource - The composite of basic terrain, geologic features, water features, vegetative patterns, and land use effects that typify a land unit and influence the visual appeal the unit may have for visitors.

Water Quality- The physical, chemical, and biological properties of water.

Water Yield - The runoff from a watershed, including groundwater outflow.

Watershed - The land area drained by a river system.

Water Erosion Prediction Project (WEPP) –. A computer simulation that predicts soil erosion.

Wetland - Areas that under normal circumstances have hydrophytic vegetation, hydric soils, and wetland hydrology.

Wilderness - Federal land retaining its primeval character and influence without permanent improvements or human habitation as defined under the 1964 Wilderness Act. It is protected and managed so as to preserve its natural conditions, which (1) generally appear to have been affected primarily by forces of nature with the imprint of man's activity substantially unnoticeable; (2) has

outstanding opportunities for solitude or a primitive and confined type of recreation; (3) has at least 5000 acres or is of sufficient size to make practical its preservation, enjoyment, and use in an unimpaired condition, and (4) may contain features of scientific, educational, scenic, or historical value as well as ecologic and geologic interest.

Wildfire - An unwanted wildland fire that requires a suppression response.

Wildland Fire - A non-structure fire, other than prescribed fire, that occurs in the wildland. Any fire originating from an unplanned ignition.

Wildland Urban Interface (WUI) - That line, area, or zone where structures and other human development meet or intermingles with undeveloped wildland or vegetative fuels.

Wind Dominated Fire - The power of the wind is greater than the power of the fire in influencing its behavior.

Windfirm - A tree (live or dead) or species of tree that is relatively resistant to being blown over by the wind.

Windthrow - A tree or stand of trees that have been blown over by the wind.

Winter Range - The areas available to and used by big game during the winter season. Must contain forage or browse to feed big game. Winter range areas tend to have a relatively low amount of snow cover which enables the animals to reach the forage.

ACRONYMS

| | | | |
|--------------|--|--------------|---|
| A19 | Amendment 19 | CSKT | Confederated Salish and Kootenai Tribes |
| ARM | Administrative Rules of Montana | CWPP | Community Wildfire Protection Plan |
| APHIS | Animal and Plant Health Inspection Service | DBH | Diameter at Breast Height |
| ATV | All-Terrain Vehicle | DEQ | MT Department of Environmental Quality |
| BA | Biological Assessment | DMR | Designated Monitoring Reach |
| BBER | Bureau of Business and Economic Research | DN | Decision Notice |
| BCR | Bird Conservation Regions | DNRC | MT Department of Natural Resources and Conservation |
| BE | Biological Evaluation | DSD | Detrimental Soil Disturbance |
| BIA | Bureau of Indian Affairs | EA | Environmental Assessment |
| BLM | Bureau of Land Management | ECA | Equivalent Clearcut Acre |
| BMA | Bear Management Analysis Area | EIS | Environmental Impact Statement |
| BMP | Best Management Practice | EO | Executive Order |
| BMU | Bear Management Unit | EPA | Environmental Protection Agency |
| BO | Biological Opinion | ERC | Energy Release Component |
| CAA | Clean Air Act | ESA | Endangered Species Act |
| CCF | 100 cubic feet | FACTS | Forest Service Activity Tracking System |
| CEQ | Council of Environmental Quality | FEIS | Final Environmental Impact Statement |
| CFLRP | Collaborative Forest Landscape Restoration Program | FHP | Forest Health and Protection |
| CFR | Code of Federal Regulations | | |
| CFS | Cubic Feet per Second | | |

| | | | |
|--------------------|---|----------------|--|
| FIA | Forest Inventory and Analysis | | Strategy |
| FlamMap | Fire Behavior Mapping and Analysis Program | LDM | Larch Dwarf Mistletoe |
| FOFEM | First Order Fire Effects Model | LWCF | Land and Water Conservation Fund |
| FONSI | Finding of No Significant Impact | MA | Management Area |
| Forest Plan | Land and Resource Management Plan | MAFI | Mean Annual Fire Intervals |
| FRCC | Fire Regime Condition Classes | MAPS | Monitoring Avian Productivity and Survivorship |
| FS | Forest Service | MBF | Thousand Board Feet |
| FSH | Forest Service Handbook | MFI | Mean Fire Interval |
| FSM | Forest Service Manual | MIS | Management Indicator Species |
| FSVeg | Field Sampled Vegetation | ML | Maintenance Level |
| FVS | Forest Vegetation Simulator | MMA | Maximum Management Area |
| GIS | Geographic Information System | MMBF | Million Board Feet |
| GTR | General Technical Report | MMW | Mission Mountains Wilderness |
| HRV | Historic Range of Variability | MNHP | Montana Natural Heritage Program |
| ID Team | Interdisciplinary Team | MOU | Memorandum of Understanding |
| IMBCR | Integrated Monitoring in Bird Conservation Regions | MPB | Mountain Pine Beetle |
| INFISH | Inland Native Fish Strategy | MS | Management Situation |
| IMPLAN – | Impact analysis for PLANning | MS | Mixed Severity |
| LANDFIRE | Landscape Fire and Resource Management Planning Tools Project | Mt SHPO | Montana State Historic Protection Office |
| LAU | Lynx Analysis Unit | NAAQS | National Ambient Air Quality Standards |
| LCAS | Lynx Conservation Agreement | NAIP | National Agriculture Imagery |

GLACIER LOON FUELS REDUCTION AND FOREST HEALTH PROJECT

APPENDIX D

BIBLIOGRAPHY AND GLOSSARY

| | Program | | Budget |
|---------------|--|---------------|--|
| NCDE | Northern Continental Divide Ecosystem | ORD | Open Road Density |
| NEPA | National Environmental Policy Act | PCE | Primary Constituent Elements |
| NFDRS | National Fire Danger Rating System | PCTC | Plum Creek Timber Company, LLP |
| NFMA | National Forest Management Act | PM | Particulate Matter |
| NFS | National Forest System | PNV | Present Net Value |
| NIFMID | National Interagency Fire Management Integrated Database | PVG | Potential Vegetation Groups |
| NIWC | Noxious and Invasive Weed Control | RAWS | Remote Access Weather Station |
| NPS | National Park Service | RFSS | Regional Forester's Sensitive Species |
| NR | Not Recorded | RHCA | Riparian Habitat Conservation Area |
| NRCS | Natural Resources Conservation Service | RMO | Road Management Objectives |
| NRIS | Natural Resource Information System | RMRS | Rocky Mountain Research Station |
| NRLMD | Northern Region Lynx Management Direction | ROD | Record of Decision |
| NTMB | Neotropical Migratory Bird | SDMP | Soil Disturbance Monitoring Protocol |
| NWCG | National Wildland Fire Coordinating Group | SEC | Swan Valley Ecosystem Center |
| OHV | Off-Highway Vehicle | SIAM | Structure Ignition Assessment Model |
| OMB | Office of Management and | SMZ | Stream Management Zone |
| | | SOPA | Schedule of Proposed Activities |
| | | SVGBCA | Swan Valley Grizzly Bear Conservation Agreement |
| | | SWCP | Soil and Water Conservation |

| | | | |
|--------------|--|---------------|---|
| | Practices | USFWS | United States Fish and Wildlife Service |
| TES | Threatened and Endangered Species | UV | Ultra Violet |
| TMDL | Total Maximum Daily Load | VMAP | Vector Map |
| TNC | The Nature Conservancy | VQO | Visual Quality Objectives |
| TPA | Tons Per Acre | WATSED | Water Yield and Sediment Model |
| TPL | Trust for Public Land | WEPP | Water Erosion Prediction Project |
| TRD | Total Road Density | WFDSS | Wildland Fire Decision Support System |
| TSMRS | Timber Stand Management Record System | WRA | Weed Risk Assessment |
| USGS | U.S. Geological Survey | WUI | Wildland Urban Interface |
| USC | United States Code | WWPA | Western Woods Products Association |
| USDA | United States Department of Agriculture | | |
| USDI | United States Department of the Interior | | |

APPENDIX E

LIST OF PREPARERS

The following individuals assisted with the development of the Glacier Loon Fuels Reduction and Forest Health Project.

| INTERDISCIPLINARY TEAM MEMBER | TITLE | AREA OF CONTRIBUTION |
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GLACIER LOON FUELS REDUCTION AND FOREST HEALTH PROJECT

LIST OF PREPARERS

APPENDIX E

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