

APPENDIX A—GLOSSARY

GLOSSARY

Abiotic—Non-living.

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

Adaptive Management—A type of natural resource management that implies making decisions as part of an on-going process. Monitoring the results of actions will provide a flow of information that may indicate the need to change a course of action. Scientific findings and the needs of society may also indicate the need to adapt resource management to new information.

Additional Distance Index—An estimate of the relative significance of a potential break in connectivity for wildlife species that prefer to remain within or close to forested cover. It is measured as the additional distance such an animal would have to travel to reach a location just on the other side of a proposed harvest unit.

Adfluvial Fish—Fish that spend part of their lives in lakes, ascend rivers and tributaries to spawn, then as adults return to lakes.

Affected Environment—The natural environment that exists at the present time in an area being analyzed 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.

Anthropogenic—Of, relating to, or resulting from the influence of human beings on nature. (e.g., pollution).

Aspect—Physical position with respect to the points on a compass. Often used conjunction with slope.

Associated Characteristics (Old growth habitat) —In the definitions of Old-growth Forest Types of the Western Montana Zone (Project File Exhibit J-1) there are “associated characteristics” typical of the old growth stands in each types. These include multiple canopy layers and moderate or high levels of downed woody debris.

ATV—Small All Terrain Vehicle, sometimes referred to as a “four-wheeler.” See also Off-Road Vehicle.

Avian—Of, related to, or typical of birds.

Bank Cover—Living streamside vegetation overhanging the water for up to 1 meter above the water surface.

Bark Beetle—An insect that bores through the bark of forest trees to eat the inner bark and lay its eggs.

Bear Management Area—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.

Benefit-Cost Ratio—Measure of economic efficiency, computed by dividing total discounted primary benefits by total discounted economic costs.

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—A document prepared by a federal agency for the purpose of identifying any endangered or threatened species that 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 ensure 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 Diversity (or Biodiversity)—The variety of life and its processes, including bacteria, fungi, plants, insects, birds, fish and mammals, the genes they contain and the ecosystems they form.

Biological Evaluation—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.

Biological Legacies—Features that remain on a site or landscape after a natural disturbance. These legacies include live and dead trees, coarse woody debris, soil organic matter, plants, fungi, microorganisms, and seeds.

Biotic—Living.

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 that is 1 foot square and 1 inch thick.

Browse—Twigs, leaves, and young shoots of trees and shrubs on which animal feed; in particular, those shrubs which are utilized 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.

Buffer Strip—A strip of land (often including undisturbed vegetation) where disturbance is not allowed or is closely monitored to preserve or enhance aesthetic and other qualities along or adjacent to roads, trails, watercourses and recreation sites.

Burn Intensity—Based on temperature, moisture content of duff, fuels lying on the ground, and heat of combustion of conductive and radiant heat that goes down into the soil, affecting soil characteristics.

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

Cable Logging—Logging that involves the transport of logs from stump to collection points by means of suspended steel cables.

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

Canopy Cover—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.

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.

Carnivore—A flesh-eating or predatory organism, as a bird of prey, a bear or wolf, or an insectivorous plant.

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

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

Coarse-Filter Approach—An approach to maintaining biodiversity that involves maintaining a diversity of structures within stands and a diversity of ecosystems across the landscape. The intent is to meet most of the habitat requirements of most of the native species. Compare with fine-filter approach.

Commercial Forest Land (Suitable Timber Land)—Land that is producing, or is capable of producing, crops of industrial wood and (1) has not been withdrawn by Congress, the Secretary of Agriculture, or the Chief of the Forest Service; (2) where existing technology and knowledge is available to ensure timber production without irreversible damage to soils productivity or watershed conditions; and (3) where existing technology and knowledge, as reflected in current research and experience, provides reasonable assurance that adequate restocking can be obtained within 5 years after final harvesting.

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.

Conifer—A tree that produces cones, such as a pine, spruce, or fir tree.

Connectivity—A measure of how well different areas (patches) of a landscape are connected by linkages, such as habitat patches, single or multiple corridors, or stepping stones' of like vegetation. The extent to which conditions among late-seral/structural forest areas provide habitat for breeding, feeding, dispersal and movement of late-seral/structural dependent wildlife species.

Consultation—A process required by Section 7 of the Endangered Species Act whereby federal agencies proposing activities in a listed species habitat confer with the US 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—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 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 Base Height—The vertical distance from the ground to the bottom of the live crown of an individual tree. See also canopy base height.

Crown Bulk Density—The mass of available fuel per unit crown volume. It is a property of an individual tree, not a whole stand. See also canopy bulk density.

Crown Closure—See Canopy Cover.

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 that 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.

Decommission—In terms of this document, this term means to change a road so it no longer functions as a road or trail. This can be accomplished through one or a combination of treatments including: recontouring to original slope, placement of natural

debris, or revegetation with shrubs or trees. Culvert removals and stream restoration would occur where roads to be decommissioned intersect streams.

Dedicated Skid Trail—A trail used repeatedly for hauling logs in order to confine disturbance to that trail only.

Defensible Space—The area between a structure and an oncoming wildfire where the vegetation has been modified to reduce the wildfire threat and to provide an opportunity for firefighters to effectively and safely defend the structure.

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

Developed Recreation—Recreation that occurs where improvements enhance recreation opportunities and accommodate intensive recreation activities in a defined area.

Diameter Breast Height—The diameter of a tree measured 4.5 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.

Dispersed Recreation—The portion of outdoor recreation use that occurs outside of developed sites in the unroaded and roaded forest environment i.e., hunting, backpacking, and berry picking.

Dispersed Skid—Removing logs from a unit where the equipment makes only one or two passes over any given piece of ground to minimize disturbance.

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.

Disturbance Regime—Natural pattern of periodic disturbances, such as fire or flooding.

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

Downed Wood (Debris) Habitat—Logs and stumps used for a variety of functions for wildlife species, especially mammals and amphibians, for feeding, reproduction, resting, and cover.

Downed Wood Recruitment—Trees, live or dead, that will contribute to future downed wood.

Downed Woody Material Habitat—Downed trees and other woody material, such as stumps, bark, and limb piles, that occur on the forest floor and provide diversity in the environment. Downed logs and stumps are required for resting and denning, are vital for hunting below the snow in winter, and are apparently also used as travel cover, particularly in lieu of vegetative cover.

Draft Environmental Impact Statement—The draft form of a formal public document prepared to analyze the impacts on the environment of a proposed project or action and

released for comment and review. Public comments are requested within 45 days after the release of the document and are considered prior to making the final decision and are responded to in the final environmental impact statement.

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.

Ecological Integrity—The quality of a natural unmanaged or managed ecosystem in which the natural ecological processes are sustained, with genetic, species and ecosystem diversity assured for the future 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.

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.

Edge—The outer band of a patch that has an environment significantly different from the interior of the patch.

Edge Effects—Changes in ecological community resulting from the rapid creation of abrupt margins in large patches of previously undisturbed habitat. For old growth habitat, this is where sun, wind, predators, competitors, etc., can penetrate further into what was previously interior forest.

Efficiency, Economic—The usefulness of inputs (costs) to produce outputs (benefits) and effects when all costs and benefits that can be identified and valued are included in the computations. Economic efficiency is usually measured using present net value, though use of benefit-cost ratios and may sometimes be appropriate.

Elk Hiding Cover—Vegetation, primarily trees, capable of hiding 90 percent of an elk seen from a distance of 200 feet or less.

Elk Hunting Season Security Area—Areas of contiguous hiding cover patches over 250 acres in size and more than 1/2 mile from roads or trails that are open to motorized use during the hunting season.

Endangered Species—Any species, plant, or animal that is in danger of extinction throughout all or a significant portion of its range. Endangered species are identified by the Secretary of the Interior in accordance with the 1973 Endangered Species Act.

Environmental Baseline—Past and present effects of all federal, state, or private actions and other human activities in the action area. The current condition.

Escape Route—A means to access a safety zone.

Even-Aged Management—The application of a combination of actions that result in the creation of stands in which trees of essentially the same age grow together. Managed

even-aged forests are characterized by a distribution of the stands of varying ages (and, therefore, tree sizes) throughout the forest area. The difference in ages between trees forming the main canopy level of the stand does not usually exceed 20 percent of the age of the stand at harvest rotation age. Regeneration in a particular stand is obtained during a short period at or near the same time that a stand has reached the desired age or size for regeneration and is harvested. Cutting methods include clearcutting, shelterwood cutting, and seed tree cutting.

Exotic Plants—In most cases, plants not native to North America.

Final Environmental Impact Statement—The final formal public document prepared to analyze the impacts on the environment of a proposed project or action when significant environmental impacts are anticipated.

Fine Filter Approach—An approach to maintaining biodiversity that is directed toward particular habitats or individual species that might fall through the coarse filter. These habitats may be critical in some way and the species threatened or endangered.

Fine Fuels—Woody or herbaceous plants, live or dead, less than 3 inches in diameter.

Fines—Sediment in streams that is less than 0.25 inches or 6 millimeters in diameter.

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

Fire Severity—A relative measure of the post-fire appearance of vegetation (residual fuels/mortality) as it relates 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.

Fire-Intolerant Species—Tree species with thin bark at maturity, such as subalpine fir and spruce.

Fire-Tolerant Species—Tree species with thick bark at maturity, such as western larch and Douglas-fir.

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.

Foliage—Plant leaves as a whole.

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 Health—The condition in which forest ecosystems sustain their complexity, diversity, resiliency, and productivity while providing for human needs and values. It is a useful way to communicate about the current condition of the forest, especially with regard to the ability of the ecosystem to respond to disturbances.

Forest Land—Land at least 10 percent occupied by forest trees of any size or formerly having had such tree cover and not currently developed for non-forest use. Lands developed for non-forest use include areas for crops, improved pasture, residential, or administrative areas, improved constructed roads of any width, and adjoining road clearing and power-line clearing of any width.

Forest Plan—In this document, the *Helena National Forest Land and Resource Management Plan*, April 1986. 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 10–15 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 Supervisor—The official responsible for administering the National Forest System lands in a Forest Service Administrative unit, which may consist of one or more National Forests or all the National Forests within a State.

Forest System Road—A road wholly or partly within or adjacent to and serving the National Forest System and which is necessary for the protection, administration, and utilization of the National Forest System and the use and developments of its resources.

Forest Type—A category of forest usually defined by its vegetation, particularly its dominant vegetation as based on percentage cover of trees, e.g. spruce-subalpine fir; lodgepole.

Fragmentation—The alteration of a large habitat patch to create isolated or tenuously connected patches of the original habitat that are interspersed with an extensive mosaic of other habitat types. This results in the reduction of total area, increased isolation of patches, and reduced connectivity between patches of natural vegetation. This occurs naturally through such agents as fire, landslides, windthrow and insect attack. In managed forests, timber harvesting and related activities have been the dominant disturbance agents.

Fry—The name applied to young fish from the time of hatching and until they have absorbed the yolk sac.

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 Model—A set of surface fuel bed characteristics (load and surface-area-to-volume-ratio by size class, heat content, and depth) organized for input to a fire model. Standard fuel models (Anderson 1982) have been stylized to represent specific fuel conditions.

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

Geographic Information System—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.

Gradient (stream)—The slope of a streambed.

Grizzly Bear Subunit—See subunit.

Ground-Based Logging System—Logging equipment such as a tractor or rubber-tired skidder that operates on the ground and is used to remove trees from a cutting area.

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 over time.

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.

Herbivore—An animal that feeds on plants.

Hiding Cover—Vegetation used by an animal for hiding. The amount and quality of vegetation needed depends on the animal's size, mobility, and reluctance to venture into relatively open areas. For an elk, hiding cover conceals 90% of a standing adult elk from the view of a human at a distance equal to or less than 200 feet. Hiding cover allows elk to use areas for bedding, foraging, thermal relief, wallowing, or other functions, but it does not necessarily provide security during the hunting season.

High-Contrast Edge—High-contrast edge is created when stands adjacent to old growth habitat are converted from late or mid-seral/structural stage to the early seral/structural stage. See “Edge”.

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

Hydrological Unit Code—A Hydrologic Unit Code (HUC) is part of a coding system developed by the U.S. Geological Service to map geographic boundaries of watersheds of various sizes. The HUCs are called (from larger to smaller) first-, second-, third-, and fourth-field HUCs, etc.; smaller HUCs are nested within larger ones. A subbasin represents a fourth-field HUC, or a unit of approximately 800,000 to a million acres. The Interior Columbia Basin Ecosystem Management Project also identified two smaller sizes of HUCs, fifth- (“watersheds”) and sixth-field (“subwatersheds”) HUCs, to aid in analysis and description.

Indirect Effects—Secondary effects that occur in locations other than the initial action or significantly later

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—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.

Interior Columbia River Basin—The parts of the watershed of the Columbia River Basin that lie in eastern Oregon, eastern Washington, Idaho, far western Wyoming, western Montana and small portions of northern Utah and northern Nevada.

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) in 1977.

Irregular Uneven-Aged Structure (Unbalanced)—Stands that have three or more distinct age classes that do not occupy approximately equal areas. Distribution of diameters is unbalanced.

Issue—See PUBLIC ISSUE.

Juvenile Trout—The fingerling or sub-adult stages (not sexually mature).

Key Use Zones (White-tailed deer)—Areas within one quarter mile of a riparian feature.

Land and Resource Management Plan—A strategic integrated resource plan based on the principles of enhanced public involvement, consideration of all resource values, and resource sustainability.

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 Wood 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.

Legacies—In an ecological context, anything handed down from a predisturbance ecosystem, including green trees, surviving propagules and organisms, dead wood, and certain aspects of soil chemistry and structure.

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.

Litter—The uppermost slightly decayed layer of organic matter on the forest floor.

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

Lynx Analysis Unit—An area that approximates the size of an average female lynx home range (25-40 square miles in contiguous habitat, and that contains habitats needed in all seasons. The lynx analysis unit is not the actual home range, but is an area upon which direct, indirect, and cumulative effects analyses are preformed.

Lynx Habitat—Higher-elevation, cool/cold, moist forests. In the western United States, subalpine fir/spruce associations (with lodgepole pine as a seral species) provide the primary habitat.

Major Forested Connectivity Linkage—Areas where forested connectivity appears to be relatively important. If connectivity were to be severed in these areas, wildlife species that prefer to remain within or close to forested cover would have to travel 2.0 miles or further to reach a location just on the other side of a proposed harvest unit. See “Additional Distance Index”.

Management Area—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—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.

Maximum Modification—Under this visual quality objective, management activities may dominate the landscape. However, when viewed as background, the visual characteristic landscape must be those of natural occurrences within the surrounding area or character type. When viewed as foreground or middle ground, they may not appear to completely borrow from naturally established form, line, color, or texture. Alterations may also be out of scale or contain detail, which is incongruent with natural occurrences as seen in the foreground or middle ground.

Mesic—Moderately moist.

Metapopulation—A collection or set of local populations living where discrete patches of the area are habitable and the intervening regions are not; a basic demographic unit composed of a set of populations in different habitat patches linked by the movement of individuals.

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.

Mixing Height—Measured from the surface upward, the height to which relatively vigorous mixing (of smoke) occurs due to convection.

Moist Sites—An important characteristic of elk habitat consisting of wet meadows, ponds, seeps, and springs, and typically located in more remote, upper-drainage perched sites.

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.

Mosaic—A mix of stand structure and composition caused by disturbance. In the case of wildland fire, fire burns with varying severity and intensity with widely varying fire effects.

Multiple Use—The management of public lands and their various resource values so they are used in the combination that best meets the present and future needs of the public.

Mycorrhizal—The symbiotic association of the mycelium of a fungus with the roots of a seed plant.

National Environmental Policy Act—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 Environmental Policy Act Process—An interdisciplinary process, mandated by NEPA, which concentrates decision making around issues, concerns, alternatives, and the effects of the alternatives on the environment.

National Forest Management Act—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—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 Succession and Disturbance Regimes—The historic patterns (frequency and extent) of fire, insects, wind, landslides and other natural processes in an area.

Natural Range of Variability—see Historical Range of Variability

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

Neotropical Migratory Birds—Migratory bird species that nest in North America and winter in Central or South America or the Caribbean.

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.

Non-Lynx Habitat—”Temporary non-lynx” habitat includes sites capable of growing forests but currently in a early-seral/structural stage condition and too young to be of use by lynx. Most “permanent non-lynx habitat” is too rocky or too wet to support forests.

Non-Point Source Pollution—Pollution which is induced by natural processes, including precipitation, seepage, percolation, and runoff; and which is not traceable to any discrete or identifiable facility.

Non-Serotinous—Cones that open when the seeds ripen, rather than staying closed for one or more years. These cones do not necessarily need heat to open them.

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.

Off-Road Vehicle—Any form of mechanized equipment that typically transports an individual that is capable of being operated off an established road or trail, e.g., motorbikes, four-wheel drives, and snowmobiles. Sometimes referred to as ATV.

Old Growth Associated Species—Plants, wildlife, and insects that are dependent at some or all stages of their life cycles upon ecological conditions that are found inside of “old growth” forests.

Old Growth Associated Species—The group of 31 wildlife species that is associated with old-growth forest plant communities on the Flathead National Forest. See Project File Exhibit J-1.

Old Growth Habitat—A community of forest vegetation which 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 Density—The miles of road open to motorized vehicle traffic within a specified area; e.g. a bear management analysis area 5000 to 15,000 acres. The open road density equals miles of open road within a specific area divided by total square miles of a specific area.

Partial Retention—Within this visual quality objective, management activities remain visually subordinate to the characteristic landscape. Management activities borrow and repeat natural line, form, color, common in the characteristic landscape but changes in their qualities, size, amount, intensity, direction, pattern, etc., remain visually subordinate to the characteristic landscape.

Patch—Areas distinguished from their surroundings by environmental discontinuities, such as a patch of early-seral/structural stage forest surrounded by mid- and late-seral structural stage forest.

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.

Pole—A tree between a sapling and small timber size at least five inches in diameter at breast height but smaller than 8 inches diameter at breast height.

Polygon—A closed figure, like a circle or an irregular shape.

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.

Population Viability—An evaluation that determines if a population will continue to persist. This term applies to both local populations and an entire species.

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

Preferred Alternative—The preferred alternative is the action choice that the agency has determined would best fulfill its statutory mission and responsibilities, giving consideration to economic, environmental, technical and other factors, and which also meets the project's purpose and need statement as required by the National Environmental Policy Act process.

Project Area—An area with a defined boundary that encompasses all activities proposed in a particular project.

Proposed Action—The proposed action or proposal exists at that stage in the development of an action when an agency subject to the National Environmental Policy Act 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 National Forest System lands.

Ranger District—Administrative subdivision of the national 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.

Reclaimed—See decommission.

Reclamation (Road)—The act of taking a forest road out of the road system and no longer allowing motorized travel. Some drainage features may be removed and vegetation is allowed to grow on the road surface. The road prism is not altered and the road may be put back into service with usually a small amount of reconditioning.

Record of Decision—A document separate from but associated with an environmental impact statement that publicly and officially discloses the responsible official’s decision on the proposed action.

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 Endangered Species Act to the point at which listing is no longer appropriate. Plans are required for virtually all listed species.

Recreation Visitor Day—One 12-hour period of recreation. It can be one person for 12 hours, 2 people for 6 hours, 12 people for 1 hour, etc.

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

Refugium—An area that remains unchanged while areas surrounding it change markedly; hence the area serves as a refuge for species requiring specific habitats.

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

Regular Uneven-Aged Structure (Balanced)—A stand in which three or more distinct age classes occupy approximate equal areas and provide a balanced distribution of diameter classes.

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 Line Officer—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 route on which motorized vehicle use is not allowed, for instance during the entire wildlife non-denning period. A restricted road usually requires physical obstruction to prevent motorized access during restricted periods.

Retention—This visual quality object provides for management activities, which are not visually evident. Under the Retention, activities may only repeat form, line, color, and texture, which are frequently found in the characteristic landscape.

Riffle—A shallow rapid where the water flows swiftly over completely or partially submerged obstructions (rocks, etc.) to produce surface agitation, but standing waves are absent.

Rip Rap—A loose assembly of broken rock, generally used to stabilize slopes.

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—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 Landtype—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. In this case, it is the number of miles per square mile.

Road Prism—The area of the ground containing the road surface, cut slope and fill slope.

Roadless Area—A National Forest area which (1) is larger than 5000 acres, or if smaller than 5000 acres, contiguous to a designated wilderness or primitive areas; (2) contains no roads; and (3) has been inventoried by the Forest System for possible inclusion in the wilderness preservation system.

Roadless Area Review and Evaluation II—A comprehensive process, instituted in June 1977, to identify roadless and undeveloped land areas in the National Forest System and to develop alternatives for both wilderness and other resource management.

Rotation—The planned number of years between the formation or regeneration of a tree crop or stand and its final cutting at a specified stage of maturity. Can be based on physical, biological, pathological or economic criteria.

Salvage Harvest—The cutting of trees that are dead, dying, or deteriorating (e.g., because they are overmature or materially damaged by fire, wind, insect, fungi, or other injurious agents) to obtain monetary value that would otherwise be lost.

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

Sawtimber—Trees containing at least one 8 foot piece with a 5.6 inch diameter inside bark at the small end and meeting the Regional specifications for freedom from defect. Softwood trees must be at least eight inches in diameter at breast height for all species except lodgepole pine which must be seven inches at breast height.

Scarification—The removal of the surface organic material (duff) to the surface of the underlying mineral soil.

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 (Reg. 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. See “Elk Hunting Season Security Area.”

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.

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

Serotinous—Late in maturing or blooming. Also refers to cones that stay on a tree without opening for one or more years. Generally it takes heat, such as from a fire, to open.

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.

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

Size Class—Intervals of tree diameters used to classify timber. Size classes include: seedling/sapling; pole timber; and sawtimber.

Skidder—A machine that skids felled trees to the roadside or landing.

Skidding—Moving logs or felled trees from the stump to a landing, usually with the forward end supported off the ground.

Skyline—A logging system used to remove trees from steep slopes. Logs are brought upslope on a suspended cable, or skyline. The cable completely or partially supports the weight of the log.

Skyline Corridors—Linear areas cleared of vegetation for a type of cable logging system in which a skyline is stationary and a carriage moves along it carrying logs above the ground, from the felling site to the landing.

Slash—Tree residue, such as limbs, logs, and tops, left on the ground after logging and other silvicultural operations or accumulating there as a result of storms, fire, or other natural events.

Snag—A standing dead tree usually greater than five feet in height and six inches in diameter at least height.

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 Gravel—Small gravels (1/4" - 1.0" diameter) in streams grouped in areas of about one square foot or larger with good water circulation through them.

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.

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% of the forested canopy cover remaining after the fire.

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.

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.

Streamside Management Zone—An area adjacent to the bank of a stream or body of open water where extra precaution is necessary to carry out forest practices in order to protect bank edges and water quality.

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.

Subalpine—A terrestrial community that generally is found in colder, harsher environments than the montane terrestrial community.

Sub-Basin—A drainage area of approximately 800,000

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).

Subunit (related to grizzly bears)—An area approximately the size of an average annual female home range (about 50 mi.² in most of this area), generally from ridge top to valley bottom, and including all seasonal habitats.

Sub-Watershed—A drainage area of approximately 20,000 acres.

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.”

Successional Stage—A stage of development of a plant community as it moves from bare ground to climax. The grass-forb stage of succession precedes the woody-shrub stage.

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

Surface Fuels—Needles, leaves, grass, forbs, dead and down branches and boles, stumps, shrubs, and short trees.

Sustained Yield—The achievement and maintenance in perpetuity of a high-level annual or regular periodic output of the various renewable resources of the National Forest System without impairment of the productivity of the land.

System Road—See Forest System Road.

Take or Taking (for Threatened or Endangered Species)—To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct of a listed species of fish or wildlife without special exemption. Harm is further defined to include significant habitat modification or degradation that results in death or injury to a listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Harass is defined as actions that create the likelihood of injury to listed species by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering.

Temporal—Related to, concerned with, or limited by time.

Temporary Road—A road constructed to facilitate forest management activities but is reclaimed soon after the activity is completed. A temporary road may be reclaimed immediately after timber harvesting is completed or may need to remain in use for up to five years to facilitate reforestation and/or weed control operations.

Terms and Conditions (for Threatened or Endangered Species)—Requirements of the U.S. Fish and Wildlife Service to implement reasonable and prudent measures that

exempt the Forest Service from prohibitions of Section 9 of the Endangered Species Act. Reasonable and prudent measures concerning road access may include regulating the density of open roads, total motorized access routes, maintaining or creating core areas, and public information.

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 ft or taller with an average crown closure of 70 percent or more. Shading and wind breaking

Threatened Species—Any species, plant or animal, which is likely to become an endangered species within the foreseeable future throughout all, or a significant portion, of its range. Threatened species are identified by the Secretary of the Interior in accordance with the 1973 Endangered Species Act.

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 environmental assessment could be tiered to the *Forest Plan EIS*.

Timber Production—The purposeful growing, tending, harvesting, and regeneration of rotational crops of trees to be cut into logs, bolts, or other round sections for industrial or consumer use. For purposes of Forest planning, timber production does not include production of fuelwood or harvest from unsuitable lands.

Timber Stand Improvement—All noncommercial intermediate cuttings and other treatments to improve composition, condition, and volume growth of a timber stand.

Torching Index—The open (6.1-m) windspeed at which crown fire activity can initiate for the specified fire environment.

Trailhead—The parking, signing, and other facilities available at the terminus of a trail.

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.

Treatment—Specific to this project, this term relates to a wide variety of management actions.

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.

Vertical Diversity—The distribution and abundance of different plant and animal communities and species on the vertical plane within an area.

Viability—A viable animal or plant species is defined as consisting of self-sustaining populations that are well distributed throughout the species' 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.

Watershed Response—A qualitative degree and/or modeled measure of how a watershed will respond to precipitation. Parameters include pre-existing soil moisture; amount of soil cover; amount and distribution of impermeable surfaces (rock outcrop, hydrophobic soils); amount and duration of rainfall; lag time between initiation of storm and peak flow runoff; and peak flow discharge and sediment yield. Changes in the characteristics of a watershed brought about by a fire will increase the efficiency with which a watershed yields runoff.

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 5,000 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—That line, area, or zone where structures and other human development meets or intermingles with undeveloped wildland or vegetative fuels.

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.

Yarding—The operation of hauling timber from the stump to a collecting point. This is commonly done using a cable system, dozers, helicopters, or rubber-tired tractors.

APPENDIX B—SNOW TALON CONIFER TREE MORTALITY ESTIMATOR

SNOW TALON CONIFER TREE MORTALITY ESTIMATOR

Introduction

The purpose of this report is to document the analysis and create a general set of guidelines by which tree mortality will be predicted for the Snow Talon Fire Salvage project. Many trees burned completely, which is an obvious sign of mortality; however, the trees that are not completely burned or may die from secondary effects of the fire are more difficult to foresee. Much work has been done by researchers to model mortality caused by fires, and our own vegetation managers have experience with observations from previous large fires including Maudlow-Toston and Cave Gulch. This information will be used to develop the analysis and guidelines for the specific location of the Snow Talon Fire.

Factors Affecting Tree Survival After Fire

Mortality of trees by fire is caused by damage to the living tissue of the tree. Both flaming and smoldering combustion create an environment of elevated temperature, but the duration of that temperature is what is important to the survival of the tree (Stephens and Finney 2002). According to Hare (1961) a temperature of 60° C for a duration of 1 minute is lethal to plant tissues. This is difficult to measure in the event of a wildfire and therefore we have to rely on models based on experience and observations of physical damage to trees.

Trees have developed forms of resistance to fire that vary widely between species. Fire tolerance is defined as a trees level of resistance to fire, and thus ability to tolerate it. Some of the factors that influence resistance to fire include: bark thickness, height and form of the crown, depth of the roots, volatility of the foliage, and the protection of buds. Secondary effects from fire are also responsible for the mortality of the trees, these may include insects, diseases, and wind throw.

Crown Damage

Fires can damage crowns in several ways. One form of damage is the direct consumption of needles by the fire. The remaining live crown would then be assessed for the possibility of survival of the tree. For the purpose of the guidelines presented here 30% live crown will be the cutoff for any chance of survival (Kootenai National Forest 1995). Another form of damage is to the buds. The survival of vegetative buds is necessary for the tree to produce the next year's growth. This damage is difficult to assess since buds are difficult to observe, and the hardiness of the bud varies by species and time of year.

Bole/Root Crown Damage

Bole damage is largely estimated by the percent of the circumference that is scorched. This again varies by species, depending on the thickness of the bark. Douglas fir is capable of surviving up to 50% bole scorch whereas lodgepole pine can only tolerate up

to 25% bole scorch. Root crown damage and damage to the roots is difficult to estimate but observation can be made based on the surface intensity of the fire.

Secondary Effects

Secondary fire effects can affect large amounts of trees that were not killed outright. Such effects can be described as insect or disease outbreaks, as well as wind throw from the loss of adjacent canopies. Insects such as Douglas fir beetle, and mountain pine beetle target trees that have been weakened by fire, then move to adjacent trees unaffected by fire (Forest Health Protection 2000, Rasmussen et al. 1996).

Application to Snow Talon Fire Project

Relating what we know from research and observations from past fires, this report will provide guidelines and criteria for assessing salvage potential among trees that were not completely consumed by the fire. A table derived from the Kootenai National Forest Conifer Tree Mortality Estimator (1995) will be included as a reference for decision based on species, size, and amount of fire damage.

The purpose of the proposed salvage actions in the Snow Talon project is to recover the values of the burned commercial timber products before they decay and have no commercial viability, and to provide economic opportunities for rural communities and to provide a sustained timber yield that is responsive to local industry and national needs. Often trees that succumb to the effects of fire do not appear dead immediately. In order to maximize the purpose of this project this report documents the process of estimating mortality for each species of concern.

Douglas fir is probably the most economically important species within the project area. Because it has thicker bark, Douglas fir is more tolerant to bole scorch and assuming that <50% of the circumference of the bole is deeply charred survival is expected. If the remaining live crown is >30% of the tree height survival will also be anticipated. Another factor when evaluating Douglas fir survival is the surface intensity of the fire because immeasurable root injury may occur as a result of large lateral roots close to the soil surface (Forest Health Protection 2000).

Lodgepole pine exists in abundance within the Snow Talon project area and is perhaps the most susceptible to fire damage. Regardless of crown damage or surface intensity, if 25% or more of the bole is charred mortality expected.

The spruce/sub alpine fir component of the project area is also highly susceptible to fire damage. If the slightest damage is evidenced on the tree then mortality can be expected.

Table B-1. Mortality Estimator for trees with the Snow Talon fire project area.

Crown Severely Damaged by Fire				Partially Green Crown (≥30%)			
				≥50% Soil exposed		<50% Soil exposed	
Species	DBH (in.)	Crown consumed in fire	Remaining live crown <30% of tree ht.	Deep char ≥50% of circumference ≥25% for LP, ES, SAF	Deep char <50% of circumference <25% for LP, ES, SAF	Deep char ≥50% of circumference ≥25% for LP, ES, SAF	Deep char <50% of circumference <25% for LP, ES, SAF
DF	<12	X	X	X	X	X	
	≥12	X	X	X	X	X	
LP	<12	X	X	X	X	X	
	≥12	X	X	X	X	X	X
ES SAF	<12	X	X	X	X	X	X
	≥12	X	X	X	X	X	X

This chart was derived from the Kootenai National Forest conifer tree mortality estimator (1995). On a large scale the observations made by professionals from the Helena National Forest during the Maudlow-Toston and Cave gulch fires find the Kootenai mortality estimator to be acceptable for this application. This guide is intended as a general aid in determining the likelihood of survival for trees and other things that need to be taken into consideration including the health and vigor of the stand, proximity of insect populations, and stand tolerance to fire.

Literature Cited

- Forest Health Protection. 2000. "Survivability and deterioration of fire-injured trees in the northern Rocky Mountains." Forest Health Protection Report 2000-13. U.S. Department of Agriculture, Forest Service, Northern Region, State and Private Forestry. Missoula, Montana. 49 pp.
- Hare, R.C. 1961. "Heat Effects on Living Plants." U.S. Department of Agriculture, Forest Service, Occ., Paper, SO-183.
- Kootenai National Forest. 1995. "Conifer Tree Mortality (Fire Damage) Estimator." Unpublished Document. U.S. Department of Agriculture, Forest Service. Libby, Montana.
- Rasmussen, L.A., G.D. Amman, J.C. Vandygriff, R.D. Oakes, A.S. Munson, and K.E. Gibson. 1996. "Bark beetle and wood borer infestation in the Greater Yellowstone Area during four post-fire years." U.S. Department of Agriculture, Forest Service. Intermountain Research Station. Research Paper INT-RP-487. 9 pp.
- Stephens, S.L., and M.A. Finney. 2001. Prescribed Fire Mortality of Sierra Nevada mixed conifer trees: effects of crown damage and forest floor combustion. *Forest Ecology and Management*. 162(2-3):261–271.

APPENDIX C—SUMMARY OF APPLICABLE WATERSHED BEST MANAGEMENT PRACTICES

SUMMARY OF APPLICABLE WATERSHED BEST MANAGEMENT PRACTICES

Snow Talon Fire Salvage Project

Introduction

Best management practices (BMPs) are the primary mechanism to enable the achievement of soil and water quality standards (Environmental Protection Agency 1987). This appendix describes the Forest Service's BMP process and lists the key Soil and Water Conservation Practices (SWCPs) selected to be used in the alternatives analyzed in this document. Each SWCP will be refined for site-specific conditions during project implementation. These project-level BMPs will conserve site productivity, protect beneficial uses, and meet water quality objectives.

BMPs include, but are not limited to, structural, and nonstructural controls, operations, and maintenance procedures. BMPs can be applied before, during, and after management activities to conserve soil productivity, and reduce or eliminate the introduction of sediment into receiving waters. Usually BMPs are applied as a system 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.

Forest Plan Direction

Forest-wide management directives, in the 1986 *Helena National Forest Land and Resource Management Plan (Forest Plan)*, specify that, "all management activities will be planned to sustain site productivity" (p. II/26). *Forest Plan* forest-wide management direction objectives specify on page II/5 that "water currently meeting state water quality standards will be maintained, by applying soil and water conservation practices that have been developed cooperatively by the State Water Quality agency and the Forest Service and displayed in the Soil and Water Conservation Handbook (FSH 2509.22). To help identify the minimum requirements for projects that could degrade water quality, the effectiveness of state and local BMPs will be identified." The *Forest Plan* also directs that, "During project analysis, ground disturbing activities will be reviewed and needed mitigating actions will be prescribed." The 1986 *Helena National Forest Land and Resource Management Plan Environmental Impact Statement* defines BMPs as, "the set of practices in the Forest Plan which, when applied during implementation of a project, ensures that water related beneficial uses are protected and that State water quality standards are met" (p. VII/2). BMPs and special mitigation measures listed in this appendix comply with direction in the *Helena Forest Plan* by prescribing measures to conserve site productivity and maintain water quality standards in conjunction with salvage harvest activities.

State of Montana Requirements for Protection of Water Quality

Compliance with State requirements for protection of waters of the State of Montana (Administrative Rules of Montana, 16.20.603) means that, “land management activities must not generate pollutants in excess of those that are naturally occurring regardless of the stream’s classification. *Naturally occurring* is defined in the Administrative Rules as that water quality condition resulting from runoff or percolation over which man has no control or from developed land where all *reasonable* land, soil, and water conservation practices have been applied.” The Administrative Rules also state “Best Management Practices are ‘reasonable’ only if beneficial uses are protected” (i.e., fisheries). Land management activities that are in compliance with Montana water quality law and regulations have three elements in common:

- BMPs are applied;
- Beneficial uses are not impaired; and
- Monitoring is in place to test whether BMPs are adequate to protect beneficial uses.

Montana State Water Quality Standards require the use of Reasonable Land, Soil, and Water Conservation Practices (analogous to BMP’s) as the controlling mechanism for nonpoint pollution. Use of BMPs is also required in the Memorandum of Understanding (MOU) between the Forest Service and the State of Montana as part of our responsibility as the Designated Water Quality Management Agency on National Forest System lands.

Format of the BMPs

The BMPs described herein are tiered to the practices in Forest Service Handbook 2509.22 (Soil and Water Conservation Practices Handbook.). They were developed as part of the *National Environmental Policy Act* environmental impact analysis process with interdisciplinary involvement and meet Forest and State water quality objectives. Each SWCP listed below is described as follows:

- BMP Number: Includes the sequential number of the Practice
- BMP Name: Brief title of the Practice.
- Montana BMPs: Includes references for compliance to the State of Montana DNRC’s January 2002 *Best Management Practices (BMPs) For Forestry in Montana*.
- Applicable to Alt 2, 3, and 4: Describes if and how the BMP would be applied under each alternative.
- Notes: Describes site-specific details about implementation of BMPs such as, which harvest units will have specific BMPs applied, or specific slope and seasonal limitations for harvest operations.
- BMP Effectiveness: Provides a qualitative assessment of expected effectiveness that the applied measure will have on preventing or reducing impacts on water quality. The effectiveness rating is based on referenced literature, research, and site-specific administrative studies. Seven references (detailed at bottom of table) are cited as is appropriate.

Table C-1. Soil and water conservation practices identified for the Snow Talon Fire Salvage project.

Soil and Water Conservation Practice Item	Description
BMP Number:	13.02 AND 14.07
BMP Name:	Slope Limitations for Tractor Operation AND Determining Tractor Loggable Ground
Montana BMPs:	IV A 1, 2, 4, 5. IV B 1.
Applicable to Alt. 2:	Yes – Limit <35% slope
Applicable to Alt. 3:	Yes – Limit <35% slope
Applicable to Alt. 4:	Yes – Limit <35% slope
Notes:	Avoid equipment operations and skid trails where small inclusions within units have slopes greater than the specified limit; applicable to all tractor harvest units, including but not limited to Unit Numbers 18, 20, 22, 24, 25, 26, 31, 34, 40, 44, 47, 50, 51, 52, 53, 56, 57, 59, 60, 71, 72, 76, 104, 107, 111, 113, 150, 153, 159, 160, 161, 162
BMP Effectiveness (1-7):	Adequately applied and effective on 100% of sites audited (1)
BMP Number:	13.02 AND 14.07
BMP Name:	Slope Limitations for Tractor Operation AND Determining Tractor Loggable Ground
Montana BMPs:	II, IV A 1, 2, 4, 5. IV B 1.
Applicable to Alt. 2:	Yes – Limit <35% slope
Applicable to Alt. 3:	Yes – Limit <35% slope
Applicable to Alt. 4:	Yes – Limit <35% slope
Notes:	Avoid equipment operations and skid trails where small inclusions within units have slopes greater than the specified limit; applicable to all tractor harvest units, including but not limited to Unit Numbers 18, 20, 22, 24, 25, 26, 31, 34, 40, 44, 47, 50, 51, 52, 53, 56, 57, 59, 60, 71, 72, 76, 104, 107, 111, 113, 150, 153, 159, 160, 161, 162
BMP Effectiveness (1) (2) (3):	Adequately applied and effective on 100% of sites audited (1)
BMP Number:	13.02 AND 14.08
BMP Name:	Slope Limitations for Tractor Operation AND Determining Tractor Loggable Ground
Montana BMPs:	II, IV A 1, 2, 4, 5. IV B 1.
Applicable to Alt. 2:	Yes – Limit <30% slope on unit 15 only
Applicable to Alt. 3:	No - Unit 15 is dropped under this alternative
Applicable to Alt. 4:	Yes – Limit <30% slope on unit 15 only
Notes:	Avoid equipment operations and skid trails where ephemeral drainages occur within this unit (provide for a 100 foot buffer either side of the drainages) and where slopes are greater than the specified limit; applicable only to tractor harvest unit 15
BMP Effectiveness (1-7):	Adequately applied and effective on 100% of sites audited (1)
BMP Number:	13.04
BMP Name:	Revegetation of Surface Disturbed Areas
Montana BMPs:	IV A 5. IV B 4, 6.

Soil and Water Conservation Practice Item	Description
Applicable to Alt. 2:	Yes
Applicable to Alt. 3:	Yes
Applicable to Alt. 4:	Yes
Notes:	Seeding soil disturbed by temporary road construction, log yarding corridors, and log landings; applicable to all harvest units, landings and temporary roads
BMP Effectiveness (1-7):	Adequately applied 98% of sites audited; effective 93% of sites audited (1)
BMP Number:	13.06
BMP Name:	Soil Moisture Limitation for Tractor Ground
Montana BMPs:	IV A 1, 2. IV B 1, 2.
Applicable to Alt. 2:	No, because tractor yarding occurs only under winter conditions with this alternative (i.e., 4 in. frozen ground and/or 6 in. packed snow)
Applicable to Alt. 3:	No, because tractor yarding occurs only under winter conditions with this alternative (i.e., 4 in. frozen ground and/or 6 in. packed snow)
Applicable to Alt. 4:	Yes, when and where tractor yarding occurs during “dry season” conditions
Notes:	Harvest equipment operations are limited when soils are moist or there is surface runoff; also, there is a limited operating period during spring break-up, typically April 15 to June 1; applicable to tractor harvest Unit Numbers 40, 44 (partial), 47, 50, 51 (partial), 52, 56, 71, 104 (partial), 159, 161
BMP Effectiveness (1-7):	Adequately applied and effective on 98% of sites audited (1)
BMP Number:	14.04
BMP Name:	Limiting the Operating Period of Timber Sale Activities
Montana BMPs:	IV A 1, 2. VI A 1, 2, 3. VI B 3, 4. V B 3.
Applicable to Alt. 2:	Yes
Applicable to Alt. 3:	Yes
Applicable to Alt. 4:	Yes
Notes:	Under the timber sale contract, provision B6.6 will be used to control operations because of wet weather, spring break-up or mid-winter thaw; the general winter operating period will be limited to December 1 through April 1 (when spring break-up typically occurs) - contract administrator will suspend or defer harvest and yarding operations during periods when soils are wet, and not covered by at least 6 inches of packed snow or frozen to a depth of at least 4 inches; also, will suspend or defer hauling operations when road surfaces are saturated, and rutting is occurring, and/or surface water runoff is occurring which is eroding road surfaces.
BMP Effectiveness (1-7):	Adequately applied and effective on 98% of sites audited (1) for limiting soil compaction and displacement; adequately applied and effective on 100% of the sites audited (1) for restricting road use when wet (4)
BMP Number:	14.08
BMP Name:	Tractor Skidding Design

Soil and Water Conservation Practice Item	Description
Montana BMPs:	IV A 1, 2, 3, 4, 5.
Applicable to Alt. 2:	Yes
Applicable to Alt. 3:	Yes
Applicable to Alt. 4:	Yes
Notes:	A designated network of skid trails will be generally spaced no closer than 80 feet apart; skid trail layout coordinated w/ soil-hydro; in salvage harvest units which had past harvest activity, re-use existing skid trails if present and/or feasible; standard practices applicable to all tractor harvest units
BMP Effectiveness (1-7):	Adequately applied and effective on 100% of sites audited (1)
BMP Number:	14.09
BMP Name:	Suspended Log Yarding in Timber Harvest
Montana BMPs:	IV B 1.
Applicable to Alt. 2:	Yes
Applicable to Alt. 3:	Yes
Applicable to Alt. 4:	Yes
Notes:	Skyline cable yarding corridors will generally be spaced no closer than 150 feet apart; suspended log yarding will entail full suspension in helicopter harvest units, and front-end log suspension in skyline units; applicable to all helicopter and skyline units
BMP Effectiveness (1-7):	Adequately applied and effective on 100% of sites audited (1) (4) (5) (6)
BMP Number:	14.09
BMP Name:	Suspended Log Yarding in Timber Harvest
Montana BMPs:	IV B 1.
Applicable to Alt. 2:	Yes, applicable to units located in areas at risk for debris flows
Applicable to Alt. 3:	No, because units located in areas at risk for debris flows are dropped from this alternative
Applicable to Alt. 4:	Yes, applicable to units located in areas at risk for debris flows
Notes:	Suspended log yarding will entail full suspension by helicopter yarding for harvest units to prevent soil disturbance located in areas at risk for debris flows; applicable to specified helicopter units, Unit Numbers 7, 38 (and 39, which is combined with 38), 41, 45, 74
BMP Effectiveness (1-7):	Adequately applied and effective for preventing soil disturbance 100% of sites audited (4) (5)
BMP Number:	14.10
BMP Name:	Log Landing Location and Design
Montana BMPs:	IV A 6.
Applicable to Alt. 2:	Yes
Applicable to Alt. 3:	Yes
Applicable to Alt. 4:	Yes
Notes:	Log landing development will average 1 acre of landings for 30

Soil and Water Conservation Practice Item	Description
	acres of harvested area; in salvage harvest units which had past harvest, re-use existing landings where present and feasible; standard practices applicable to all harvest units
BMP Effectiveness (1-7):	Adequately applied and effective on 100% of sites audited (1)
BMP Number:	14.11
BMP Name:	Log Landing Erosion Prevention and Control
Montana BMPs:	IV B 4.
Applicable to Alt. 2:	Yes
Applicable to Alt. 3:	Yes
Applicable to Alt. 4:	Yes
Notes:	Soil scarification and seeding will be implemented; distribute slash for erosion control and nutrient cycling; applicable to all harvest unit landings
BMP Effectiveness (1-7):	Adequately applied and effective on 100% of sites audited (1) (5)
BMP Number:	14.12
BMP Name:	Erosion Prevention and Control Measures During Timber Sale Operations
Montana BMPs:	IV A 1, 5, 6. IV B 4, 5, 6
Applicable to Alt. 2:	Yes
Applicable to Alt. 3:	Yes
Applicable to Alt. 4:	Yes
Notes:	Water bars and mix native seeds with annual cover crop; measures concurrent with harvest operations, and implemented as units are completed; applicable to all harvest units
BMP Effectiveness (1-7):	Adequately applied 98% of sites audited; effective 93% of sites audited (1)
BMP Number:	14.14
BMP Name:	Revegetation of Areas Disturbed by Harvest
Montana BMPs:	IV A 5. IV B 6.
Applicable to Alt. 2:	Yes
Applicable to Alt. 3:	Yes
Applicable to Alt. 4:	Yes
Notes:	Seeding soil disturbed by temporary road construction, log yarding corridors, and log landings; applicable to all harvest units, landings and temporary roads
BMP Effectiveness (1-7):	Adequately applied 98% of sites audited; effective 93% of sites audited (1)
BMP Number:	14.15
BMP Name:	Erosion Control on Skid Trails
Montana BMPs:	IV A 5. IV B 5, 6. V B 4.
Applicable to Alt. 2:	Yes

Soil and Water Conservation Practice Item	Description
Applicable to Alt. 3:	Yes
Applicable to Alt. 4:	Yes
Notes:	Water bars and mix native seeds w/ annual cover crop; measures implemented as tractor skidding is completed; applicable to all tractor harvest units
BMP Effectiveness (1-7):	Adequately applied and effective on 100% of sites audited (1)
BMP Number:	14.15
BMP Name:	Erosion Control on Skyline Yarding Corridors
Montana BMPs:	IV A 1, 2.
Applicable to Alt. 2:	Yes
Applicable to Alt. 3:	Yes
Applicable to Alt. 4:	Yes
Notes:	Implement water bars and seeding with native and annual cover mix on cable yarding corridors, applicable to all skyline units, including Unit Numbers 17, 19, 23, 27, 28, 29, 32, 33, 36, 43, 46, 48, 73, 75, 77
BMP Effectiveness (1-7):	Adequately applied and effective on 100% of sites audited (1)
BMP Number:	14.17
BMP Name:	Stream Channel Protection
Montana BMPs:	II. IV A 1. IV B 4.
Applicable to Alt. 2:	Yes
Applicable to Alt. 3:	Yes
Applicable to Alt. 4:	Yes
Notes:	Follow state SMZ law for salvage harvest; applicable to all harvest units with SMZs
BMP Effectiveness (1-7):	Very high effectiveness on 99% of sites audited (1)
BMP Number:	14.18
BMP Name:	Erosion Control Structure Maintenance
Montana BMPs:	III C, D, and E.
Applicable to Alt. 2:	Yes
Applicable to Alt. 3:	Yes
Applicable to Alt. 4:	Yes
Notes:	Erosion control measures implemented concurrently with operations; applicable to all roads used to access harvest units
BMP Effectiveness (1-7):	Adequately applied 93% of sites audited; effective 95% of sites audited (1)
BMP Number:	14.19
BMP Name:	Acceptance of Sale Erosion Measures Before Sale Closure
Montana BMPs:	Field review for all BMP practices for forestry in Montana.
Applicable to Alt. 2:	Yes

Soil and Water Conservation Practice Item	Description
Applicable to Alt. 3:	Yes
Applicable to Alt. 4:	Yes
Notes:	Field review of erosion control measures to determine effectiveness following rain or snow-melt with monitoring results used to modify ongoing erosion control work or to identify rehabilitation needs; applicable to all roads and harvest units
BMP Effectiveness (1-7):	Adequately applied 93% of sites audited; effective 95% of sites audited (1)
BMP Number:	SPECIAL Mitigation Measures
BMP Name:	Winter Logging Operating Conditions
Montana BMPs:	VI A 1-3. VI B 3, 4.
Applicable to Alt. 2:	Yes, applicable to all tractor and skyline harvest units
Applicable to Alt. 3:	Yes, applicable to all tractor and skyline harvest units
Applicable to Alt. 4:	Yes, applicable only to specified tractor units with ashcap soils
Notes:	Harvest operations will be conducted when there is 6 inches of packed snow and/or 4 inches frozen ground; the general winter operating period will be limited to Dec. 1 through April 1; objective is to avoid detrimental soil displacement and compaction; applicable to all tractor and skyline units under Alternatives 2 and 3, and applicable only to specified tractor harvest units with ash cap soils under Alternative 4 - Unit Numbers 15, 18, 20, 22, 24, 25, 26, 31, 34, 44 (partial), 51 (partial), 53, 57, 59, 60, 72, 76, 104 (partial), 111, 113, 150, 153, 160, 162
BMP Effectiveness (1-7):	Adequately applied and effective on 98% of sites audited (1) (5) (6)
BMP Number:	SPECIAL Mitigation Measures
BMP Name:	Winter Logging Operating Conditions
Montana BMPs:	III C 7. VI A 2. VI B 1,2.
Applicable to Alt. 2:	Yes
Applicable to Alt. 3:	Yes
Applicable to Alt. 4:	Yes
Notes:	Hauling operations will be conducted when soils on native surface roads are frozen or dry; operations will be limited when soil rutting or surface water runoff occurs on native surface roads (including Copper Creek Road #330) or to the critical delivery points identified along Road #330 in Appendix for Road Improvement and Maintenance BMPs. At these specified locations immediate action to ensure sediment laden water that may be running down the road during any melt period, does not reach Copper Creek. This stipulation will likely require equipment to divert sediment laden water off the road through any snow berm that may have formed from plowing and into vegetated areas.; the general winter operating period will be limited to Dec.1 through April 1; applicable to all native surface roads utilized by harvest operations
BMP Effectiveness (1-7):	Adequately applied and effective on 98% of sites audited (1) (4)
BMP Number:	SPECIAL Mitigation Measures

Soil and Water Conservation Practice Item	Description
BMP Name:	Prohibit Harvest and Equipment Operation in RHCA Stream Buffer (with exception of equipment traffic on existing roads)
Montana BMPs:	II.
Applicable to Alt. 2:	Yes
Applicable to Alt. 3:	Yes
Applicable to Alt. 4:	Yes
Notes:	Will meet intent of State SMZ law and the intent of the Inland Native Fish Strategy for all alternatives, but will expand the stream buffer to include the entire width of the floodplain along the upper reaches of Copper Creek, adjacent to units 11 and 14 (RHCA buffer boundary will follow the break in slope between flat valley bottom, and hillslopes where harvest units 11 and 14 are located)
BMP Effectiveness (1-7):	Applied correctly 96% of sites, and very high effectiveness on 99% of sites audited (1)
BMP Number:	SPECIAL Mitigation Measures
BMP Name:	Special Erosion Prevention Measures on Areas Disturbed by Timber Harvest
Applicable to Alt. 2:	No
Montana BMPs:	IV A 5. IV B 5, 6
Applicable to Alt. 3:	No
Applicable to Alt. 4:	Yes
Notes:	Evenly distribute slash on cable corridors, applicable to all skyline units; also, place straw mulch mat or evenly distribute logging slash on skid trails and other concentrated use areas, applicable to all tractor units
BMP Effectiveness (1-7):	Distribution of salvage logging slash effective in increasing post-fire ground cover and reducing erosion following fire (2)
BMP Number:	SPECIAL Mitigation Measures
BMP Name:	Special Erosion Prevention Measures on Areas Disturbed by Timber Harvest
Montana BMPs:	IV A 1. IV C 4.
Applicable to Alt. 2:	Yes, all units
Applicable to Alt. 3:	Yes, all units
Applicable to Alt. 4:	Yes, all units
Notes:	Retain coarse woody material (>3 in. diameter) on site as ground cover for erosion control and biomass for site productivity; amount of material should meet recommendations by researchers for 5–20 tons per acre on warm, dry habitat types, and 10–30 Tons per acre for other types (Graham et al. 1994 and Brown et al. 2003); evenly distribute slash across the harvest units; applicable to all harvest units
BMP Effectiveness (1-7):	Distribution of salvage logging slash effective in increasing post-fire ground cover and reducing erosion following fire (2) (4) (5) (7)
BMP Number:	SPECIAL Mitigation Measures

Soil and Water Conservation Practice Item	Description
BMP Name:	Contour Tree Felling Treatment in Sensitive Areas
Montana BMPs:	IV A 1. IV B 3.
Applicable to Alt. 2:	No
Applicable to Alt. 3:	No
Applicable to Alt. 4:	Yes
Notes:	Contour fell logs where non-merchantable trees are dropped in cable and helicopter yarding corridors, or for safety; applicable to all harvest units
BMP Effectiveness (1-7):	Rated excellent to good 66% of projects surveyed, fair 14% and poor 20% (3)

(1) Source of BMP effectiveness evaluation is the "Montana State Forestry Best Management Practices Monitoring, The 2000 Forestry BMP Audits Report" (Montana Department of Natural Resources and Conservation 2000).

(2) Source of Mitigation Measure effectiveness evaluation is the report "Implementation and Effectiveness Monitoring of Best Management Practices and Soil and Water Conservation Measures in the Foothills Fire Salvage Logging Area 1992-1995" (Maloney, Thorton, and Lesch 1995).

(3) Source of Mitigation Measure effectiveness evaluation is the report "Evaluating the Effectiveness of Post-fire Rehabilitation Treatments" (Robichaud, Beyers, and Neary 2000, page 86).

(4) Source of BMP effectiveness evaluation is USDA Forest Service 2003a. "Maudlow-Toston Salvage Sale Unit Log" documenting a Jan. 8, 2003 field review of BMP and mitigation implementation and effectiveness in helicopter units and sale area haul roads, completed by Soil Scientists Sue Farley and Vince Archer with Biologists Rachel Fiegley and Alicia Kitto. 2 pages. On file at Helena National Forest Supervisors Office.

(5) Source of BMP effectiveness evaluation is USDA Forest Service 2003b. "Maudlow-Toston Salvage Sale, Photos from BMP Effectiveness Monitoring" documenting an Oct. 16, 2003 field review of BMP and mitigation implementation and effectiveness in skyline units (both summer and winter logging) and tractor units that were winter logged, completed by Soil Scientists Sue Farley and Vince Archer. 3 pages. On file at Helena National Forest Supervisors Office.

(6) Source of BMP effectiveness evaluation is USDA Forest Service 2003c. "Maudlow-Toston Salvage Sale Unit Log" documenting an Oct. 16, 2003 field review of BMP and mitigation implementation and effectiveness in skyline units (both summer and winter logging) and tractor units that were winter logged, completed by Soil Scientists Sue Farley and Vince Archer. 5 pages. On file at Helena National Forest Supervisors Office.

(7) Source of BMP effectiveness evaluation is USDA Forest Service 2003d. "Maudlow-Toston Salvage Sale Unit Log" documenting an Oct. 29, 2003 field review of BMP and mitigation implementation and effectiveness in a winter tractor logging unit, completed by Soil Scientists Sue Farley and Vince Archer. 3 pages. On file at Helena National Forest Supervisors Office.

Table compiled by S. Farley with input from S. Scott and L. Burns, Helena National Forest, 3/1/2004, 13:10.

Literature Cited

Department of Natural Resources and Conservation, 2002. *Best Management Practices (BMPs) For Forestry in Montana January 2002*. Montana Department of Natural Resources and Conservation. 10 March. <<http://www.dnrc.state.mt.us/forestry/Temp/BMPs.pdf>>.

U.S. Environmental Protection Agency, 1987. "Nonpoint Source Controls and Water Quality Standards." Washington, D.C.

APPENDIX D—REVEGETATION PLAN

REVEGETATION PLAN

The primary species proposed for revegetation activities associated with the Snow Talon salvage project are presented below. Revegetation would speed up recovery in an area by producing seed within a growing season that would be dispersed to the surrounding area and/or extend roots into the surrounding area, producing more plants to stabilize the site. Plant diversity would be increased over time as the planted species and offsite native plants colonize the area.

These proposed species are for use in both the seed mix and for plug plantings. The plants that were present prior to the Snow Talon fire were adapted to fire and should begin actively growing in the first season following the fire, as long as the root crowns of the shrubs were not killed. Native grasses and forbs would resprout the first growing season following the fire.

Jammer trail recontouring would require 100% disturbance of the soil in the area being recontoured. The recontoured area would be left rough with minimal straight slopes to provide microsites for seeds and rain/snow catchment. Woody debris and rock would be used to stabilize the recontoured areas.

Grass Seed

Bluebunch wheatgrass: 5 lbs/acres

Idaho fescue: 3 lbs/acres

Slender wheatgrass: 5 lbs/acres

Cereal rye: 10 lbs/acres

Area A:

Subalpine fir (*Menzeisia*)

Thimbleberry (*Rubus parviflora*), White spiraea (*Spiraea betulifolia*), Buffaloberry (*Shepherdia canadensis*), Sitka alder (*Alnus sitchensis*), Oregon grape (*Berberis repens*), Twinflower (*Linnaea borealis*), Wintergreen (*Pyrola asarifolia*), Wintergreen (*Pyrola secunda*), Beargrass (*Xerophyllum tenax*).

Subalpine fir/Beargrass

Service berry (*Amelanchier alnifolia*), Pachistima (*Pachistima myrsinites*), White spiraea (*Spiraea betulifolia*), Vagel, Oregon grape (*Berberis repens*), Beargrass (*Xerophyllum tenax*), Sitka alder (*Alnus sitchensis*), Kinnickinnick (*Arctostaphylos uva-ursi*), Wintergreen (*Pyrola asarifolia*), Grouse whortleberry (*Vaccinium scoparium*).

Subalpine fir/Woodrush

Labrador tea (*Ledum glandulosa*), Blue huckleberry (*Vaccinium globulare*), Grouse whortleberry (*Vaccinium scoparium*), Pachistima (*Pachistima myrsinites*), Beargrass (*Xerophyllum tenax*).

Area B:

Subalpine fir (*Menzeisia*)

Thimbleberry (*Rubus parviflora*), White spiraea (*Spiraea betulifolia*), Buffaloberry (*Shepherdia canadensis*), Sitka alder (*Alnus sitchensis*), Oregon grape (*Berberis repens*), Twinflower (*Linnaea borealis*), Wintergreen (*Pyrola asarifolia*). Wintergreen (*Pyrola secunda*), Beargrass (*Xerophyllum tenax*).

Area C:

Subalpine fir (*Menzeisia*)

Thimbleberry (*Rubus parviflora*), White spiraea (*Spiraea betulifolia*), Buffaloberry (*Shepherdia canadensis*), Sitka alder (*Alnus sitchensis*), Oregon grape (*Berberis repens*), Twinflower (*Linnaea borealis*), Wintergreen (*Pyrola asarifolia*), Wintergreen (*Pyrola secunda*), Beargrass (*Xerophyllum tenax*).

Area D:

Douglas-fir/Pinegrass

Twinflower (*Linnaea borealis*), Syal, White spiraea (*Spiraea betulifolia*), Buffaloberry (*Shepherdia canadensis*), Oregon grape (*Berberis repens*), Kinnickinnick (*Arctostaphylos uva-ursi*), Chokecherry (*Prunus virginiana*). Amal, Juco, Ceve.

Area E:

Subalpine fir (*Menzeisia*)

Thimbleberry (*Rubus parviflora*), White spiraea (*Spiraea betulifolia*), Buffaloberry (*Shepherdia canadensis*), Sitka alder (*Alnus sitchensis*), Oregon grape (*Berberis repens*), Twinflower (*Linnaea borealis*), Wintergreen (*Pyrola asarifolia*), Wintergreen (*Pyrola secunda*), Beargrass (*Xerophyllum tenax*).

Area F:

Subalpine fir/Beargrass

Amal, Pachistima (*Pachistima myrsinites*), White spiraea (*Spiraea betulifolia*), Vagl, Oregon grape (*Berberis repens*), Beargrass (*Xerophyllum tenax*), Sitka alder (*Alnus sitchensis*), Kinnickinnick (*Arctostaphylos uva-ursi*), Wintergreen (*Pyrola asarifolia*).

Area G:

Subalpine fir/Woodrush or Caca

Legl (*Phyllodoce empetriflora*), Vagl, Grouse whortleberry (*Vaccinium scoparium*), Pachistima (*Pachistima myrsinites*), Beargrass (*Xerophyllum tenax*).

Area H:

Douglas-fir/Snowberry

Twinflower (*Linnaea borealis*), Syal, White spiraea (*Spiraea betulifolia*), Buffaloberry (*Shepherdia canadensis*), Oregon grape (*Berberis repens*), Kinnickinnick (*Arctostaphylos uva-ursi*), Chokecherry (*Prunus virginiana*), Serviceberry (*Amelanchier alnifolia*), Common juniper (*Juniperus communis*), Ceanothus (*Ceanothus velutinus*).

Area I:

Subalpine fir (*Menzeisia*)

Thimbleberry (*Rubus parviflora*), White spiraea (*Spiraea betulifolia*), Buffaloberry (*Shepherdia canadensis*), Sitka alder (*Alnus sitchensis*), Oregon grape (*Berberis repens*), Twinflower (*Linnaea borealis*), Wintergreen (*Pyrola asarifolia*), Wintergreen (*Pyrola secunda*), Beargrass (*Xerophyllum tenax*).

This revegetation plan by D. Hawkins and L. Olsen, U.S. Department of Agriculture, Forest Service, Helena National Forest, Helena, Montana. 11/13/2003

APPENDIX E—HELENA NATIONAL FOREST SENSITIVE PLANT SPECIES LIST

HELENA NATIONAL FOREST SENSITIVE PLANT SPECIES LIST

The following list of plant species are known or suspected to occur within the Helena National Forest. Presented are a description of the sensitive plant species technical name, elevation, bloom dates, substrate/habitat and associated species. An asterick (*) placed before a plant name indicates that the plant is known to occupy habitat within the Helena National Forest, while all others are suspected to occur. If a “2” follows the plant name, it indicates that the species is in rangewide imperilment; a “3” following the plant name indicates the species is in regional/state imperilment.

Sensitive Plant Species List

Amerorchis rotundifolia/*Orchis rotundifolia* (3): 3350–5920 feet, mid-June to mid-July. Organic soils/wet mossy coniferous forest edges, near peatlands and streams often on limestone, Spruce forest around seeps or along streams, often in soil derived from limestone. *Picea engelmannii*, *Habenaria hyperborea*, *Cypripedium passerinum*, *Listera borealis*, *Pyrola uniflora*.

Aquilegia brevistyla (3): 5000–6200 feet, June through mid-July survey time. Open woods and stream banks at mid-elevations in the montane zone.

Astragalus lackschewitzii (2): 7300–8300 feet, late July to August survey time. Stabilized calcareous scree/alpine and subalpine. *Astragalus bourgovii*, *Dryas octopetala*, *Smelowskia calycina*. (Note: Collect plants in full fruit.)

Botrychium crenulatum (2): 2440–7680 feet, foothills and montane zones, mid-July to mid-August survey time. Stream bottoms, around seeps, on the edges of marshes, and in wet roadside swales, often on soils influenced by reprecipitated calcium. Vegetation dominated by spruce, alders, and dogwood, with high cover and diversity of forbs and graminoids.

**Botrychium paradoxum* (2): 3550–8480 feet, foothills and montane zones, mid-July to mid-August survey time. Moist shrubby meadows, often near lakes. Mesic meadows associated with spruce and lodgepole pine forests in the montane and subalpine zones. *Epilobium angustifolium*, *Fragaria virginiana*, *Penstemon confertus*.

**Carex livida* (3): 2910–6030 feet, late June to early August survey time. Wet, organic soils of fens in the foothill and montane zones [other literature has indicated calcareous parent material]. *Habenaria hyperborea*, *Carex lasiocarpa*, *Betula glandulosa*.

Carex paupercula (3): 2910–6300 feet, montane zone, late June to mid-August survey time. Nutrient-poor bogs and fens, often with sphagnum moss, in the montane zone. *Eleocharis pauciflora*, *Carex aquatilis*, *Drosera rotundifolia*, *Alnus incana*, *Equisetum arvense*.

**Cirsium longistylum* (2): 4680–8170 feet, late June to August survey time. Vernal moist meadows in the montane zone.

**Cypripedium parviflorum* (3): 3000–6200 feet, late May to early July survey time. Fens, organic soils, moist coniferous forests, seepage areas and moist ecotones between

peatlands and upland forest. *Picea engelmannii*, *Betula glandulosa*, *Salix candida*, *Cypripedium passerinum*.

Cypripedium passerinum (3): 3100–5700 feet, late June to early July survey time. Peaty soils, in ecotone between wet mossy coniferous forests and wetlands or streams. Mossy, moist, or seepy places in coniferous forests, often on calcareous substrates.

C. parviflorum, *Picea engelmannii*, *Equisetum arvense*, *Habenaria hyperborea*.

**Drosera anglica* (3): 3100–9000 feet, early July to late July survey time. Peatlands on floating organic mats—undisturbed sphagnum bogs; in wet, organic soils of fens.

D. linearis, *Carex livida*, *Carex interior*.

**Drosera linearis* (3): 4350–6030 feet, early July to late July survey time. Peatlands on floating organic mats—undisturbed sphagnum bogs; wet, organic soil of nutrient-poor fens in the montane zone. *D. anglica*, *Carex livida*, *Carex interior*.

Epipactis gigantea (3): 2900–6200 feet, late June to mid-July survey time. Warm springs and seeps on the edges of peatlands. Stream banks, lake margins, fens with springs and seeps, often near thermal waters. *Habenaria dilatata*, *Rhamnus alnifolia*, *Senecio triangularis*, *Equisetum arvense*. (Note: Any known warm spring area should be checked for this species.)

Goodyera repens (3): 5700–6100, moist limestone slopes of old growth Douglas-fir, montane zone, late July to August survey time, *Pseudotsuga douglassii*.

Grindelia howellii (2): 3320–5960 feet, July–August flowering forest openings, river terraces, and native grasslands. Vernal moist, lightly disturbed soil adjacent to ponds and marshes, as well as similar human-created habitats, such as roadsides and grazed pastures.

**Juncus hallii* (3): 4000–8860 feet, late June through early September survey time, in moist to wet meadows. *Polygonum bistortoides*, *Festuca idahoensis*, *Festuca scabrella*, *Iris missouriensis*, *Potentilla gracilis*.

Oxytropis podocarpa (3): 7300–8200 feet, early July to mid-August. Alpine slopes usually with northern aspects, gravelly ridges and slopes, often on limestone. *O. viscida*, *Dryas octopetala*, *Smelowskia calycina*.

**Phlox kelseyi* var. *missoulensis* (2): 3600–8100 feet, mid-May through early July survey time depending on elevation. Usually gravelly windswept ridges, although sometimes in forb-dominated meadows. Open, exposed, limestone-derived slopes in the foothills and montane zones. *Douglasia montanum*, *Penstemon eriantherus*, *Lomatium cous*, *Geum triflorum*, *Eriogonum ovaliflorum*, *Erigeron compositus*.

**Polygonum douglasii* ssp. *austinae* (3): 4320–8520 feet, early July to mid-August survey time. Open gravelly shale-derived soil of eroding slopes/banks or usually moist barren shale slopes. *Agropyron spicatum*, *Potentilla glandulosa*.

Salix wolfii var. *wolfii* (3): 6540–8400 feet, mid-July through late August survey time. Rocky clay-loam soils/montane to subalpine wet meadows most often riparian; streambanks and wet meadows in the valley, montane and subalpine zones. *Betula glandulosa*, *Geranium richardsonii*, *Heracleum lanatum*. (Note: Catkins are necessary for positive identification.)

Saxifraga tempestiva (2): 7920–9900 feet, mid-July to mid-August survey time. Vernal moist open soil in meadows, rock edges, depressions; krummholz and alpine zones. *Pedicularis pulchella*, *Poa alpina*, *Dodecatheon pulchellum*.

**Scirpus subterminalis* (3): 2890–6000 feet, late June to late August survey time. Often submerged in 1–3 feet of water in quiet ponds and sloughs. Open water and boggy margins of ponds, lakes, and sloughs at 0.1–3 meter depth in the valley, foothill, and montane zones. *Myriophyllum specatum*, *Nuphar variegatum*, *Nymphaea tetragona*, *Potamogeton gramineus*.

Thalictrum alpinum (3): 4855–8280 feet, late June to late July. Hummocks in moist alkaline meadows often beneath low shrubs. *Potentilla fruticosa*, *Salix brachycarpa*, *Dodecatheon pulchellum*, *Juncus balticus*.

Veratrum californicum (3): 6160–7360 feet, July through August survey time. Wet meadows, along streambanks; montane to subalpine zones.

Viola renifolia (3): 2400–6520 feet, late June to early July survey time. Organic soils, swampy spruce woods. *Picea engelmannii*, *Alnus incana*, *Pinus contorta*, *Pyrola asarifolia*, *Mitella nuda*, *Senecio pseud aureus*.

List Changes

Changes from the older, 1994, sensitive species list to the current, 1999, list are as follows:

Dropped from the listing:

- *Agoseris lackschewitzii*
- *Asplenium trichomanes*
- *Eriophorum viridicarinaratum*
- *Saussurea densa*.

Added:

- *Botrychium crenulatum*
- *Cirsium longistylum*
- *Drosera anglica*
- *Grindelia howellii*.

Name changes:

- *Amerorchis rotundifolia* was *Orchis rotundifolia*
- *Astragalus lackschewitzii* was *Astragalus molybdenus*
- *Cypripedium parviflorum* was *Cypripedium calceolus* var. *parviflorum*.

Sensitive Plant Species Habitats on the Helena National Forest

If an “(E)” follows a plant name, these species are usually found ecotonally between wet areas of peat lands, and surrounding coniferous forests. An “(S/A)” following a plant name indicates subalpine and alpine areas, and if an “(A)” follows a plant name, the area is alpine.

Ponds

Scirpus subterminalis

Open Wet Meadows/Peatlands/Fens

Botrychium crenulatum

Carex livida (calcareous)

Carex paupercula

Drosera anglica

Drosera linearis

Epipactis gigantea (thermal springs)

Salix wolfii var. *wolfii*

Coniferous Wet Meadows/Ecotones

Aquilegia brevistyla

Botrychium paradoxum

Cypripedium parviflorum (E)

Cypripedium passerinum (E)

Amerorchis rotundifolia (calcareous)

Veratrum californicum

Viola renifolia (organic soils)

Moist Forb/Grass Meadows

Botrychium crenulatum

Juncus hallii

Thalictrum alpinum (alkaline)

Forblands and Grasslands

Botrychium paradoxum

Cirsium longistylum

Grindelia howellii

Phlox kelseyi var. *missoulensis* (forb/grasslands and scree slopes)

Moist Cliff Crevices and Talus Slopes

Astragalus lackschweztii (S/A) (calcareous)

Polygonum douglasii ssp. *austinae* (barren shale slopes in the montane zone)

Moist Douglas Fir Forests

Goodyera repens (limestone)

Alpine

Oxytropis podocarpa (A) (calcareous)

Saxifraga tempestiva (A)