United States Department of Agriculture

Crystal Cedar

Updated Environmental Assessment

Forest Service
Flathead National Forest
Hungry Horse-Glacier View Ranger District
November 2019

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Introduction

The Hungry Horse-Glacier View Ranger District of the Flathead National Forest is proposing to conduct 3,876 acres of vegetation management and construct approximately 25 miles of trails on National Forest System lands.

We prepared this environmental assessment to determine whether effects of the proposed activities may be significant and require preparation of an environmental impact statement. By preparing this environmental assessment, we are fulfilling agency policy and direction to comply with the National Environmental Policy Act and other relevant Federal and State laws and regulations. The responsible official for this decision will be the Flathead Forest Supervisor Chip Weber.

This environmental assessment includes two appendices. Appendix A describes project design features, which are part of the proposed action. Appendix B provides a summary of past, ongoing, and reasonably foreseeable activities considered in the cumulative effects analyses.

Updates to the November 2019 Environmental Assessment

An updated environmental assessment has been prepared to clarify information and correct errors identified in the June 2019 Crystal Cedar Environmental Assessment. Some of the changes include clarification that prescribed burns would occur at low to moderate intensity. We clarified that 70 percent of the proposed treatment units had stand exams and that all of the proposed units had been visited by a silviculturist and other resource specialists. This document clarifies the potential indirect and cumulative effects of winter harvest to Canada lynx in the project area and that both the No-Action alternative and the Proposed Action maintain habitat components that contribute to sustaining the recovery of the grizzly bear population in the NCDE (FW-DC-TE&V-01). Table 44 was updated to correct an error in the length of national forest system road/trail interaction in Spring Creek (north). Tables 56 and 57 were updated to reflect the detrimental soil effects to unit 119 and 119A from winter logging with an in-woods processor. Table 58 was corrected to discuss FW-DC-WREC-05 and clarify that the project would not foreclose on opportunities to expand winter recreation opportunities in the future. The document clarifies the potential effects of the proposed activities to forest users such as hunters and berry pickers. The document also clarifies what type of recreation events have been permitted in the project area. These corrections did not result in a change to the significance of effects of the proposed activities.

Overview of the Project Area and Background

Proposed Project Location

The project area is approximately 27,249 acres in size and is bounded to the south by the community of Columbia Falls and to the west by the Flathead River (refer to figure 1. vicinity map). This area includes Crystal Creek, Cedar Flats, Spoon Lake, Blankenship Road, and Teakettle Mountain and is located on the Hungry Horse-Glacier View Ranger District.

Ownership within the project area is 33 percent private (8,915 acres), 2 percent State (479 acres), and 65 percent National Forest System lands (17,795 acres). All proposed activities would occur

on National Forest System lands (NFS). Approximately 92 percent (24,987 acres) of the project area is located within the wildland-urban interface.

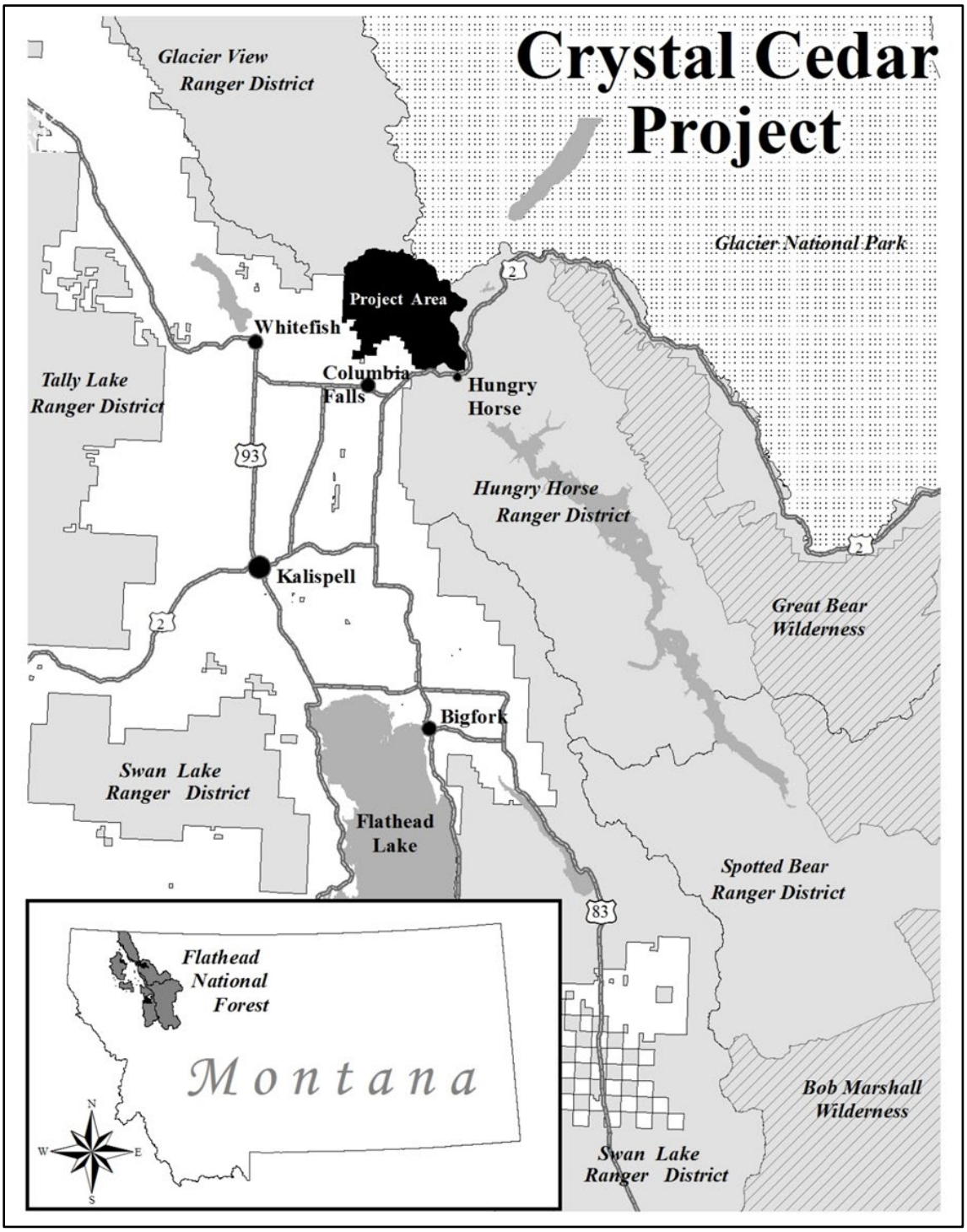


Figure 1. Vicinity map

The Flathead National Forest 2018 Forest Plan

The forest plan (USDA 2018b) provides the management direction for all resources on the Flathead National Forest. The forest plan was developed following the process and requirements set forth in the 2012 National Forest System land management planning rule (36 CFR § 219). The rule requires that forest plans provide for ecological sustainability and contribute to social and economic sustainability, using public input and the best available scientific information to inform plan decisions. The forest plan incorporates an active management strategy that promotes desired vegetation and habitat conditions, contributes economic benefits to local communities through forest management and other activities, and provides for a variety of recreational opportunities. This environmental assessment tiers to the forest plan's final environmental impact statement (FEIS).

Vegetation management and wildlife habitat direction in the forest plan addresses future uncertainties, such as climate change, by focusing on the development of landscapes and forest conditions that are resilient and resistant to disturbances and stressors. See appendix 7 of the FEIS volume 4 for an overview of how climate change is addressed at the forest plan scale.

Coarse-filter/fine-filter analysis approach

As guided by the 2012 planning rule, the forest plan applied a coarse-filter/fine-filter approach to developing management direction for the terrestrial and aquatic resources. The coarse-filter approach seeks to manage a broad range of habitats identified as necessary to maintain the natural diversity of species, ecosystems, and ecosystem processes on the Forest. It is a landscape-level concept and an ecosystem approach that recognizes the interdependence of species and ecosystem processes. Appendix 6 of the FEIS prepared for the forest plan provides a list of Flathead National Forest species and provides the bridge between coarse filter plan components and key ecosystem characteristics they are associated with. The coarse-filter approach accounts for the changing nature of ecosystems over time and space, and permits the blending of social values with environmental values. In contrast, the fine filter approach is a species-specific concept, and seeks to provide specific direction to protect plant or animal species if it was determined through the forest planning process that their needs may not be adequately addressed under the coarse filter approach.

The habitat needs for most plant and animal species on the forest are provided by forest plan direction developed under a coarse-filter approach. The desired conditions, standards, and guidelines in the aquatic ecosystems, watersheds, riparian management zones, and terrestrial ecosystems sections of the plan are primarily coarse-filter plan components that as a whole will provide desired habitat conditions for native wildlife and plant species, as well as contributing benefits and services to people. These coarse-filter plan components relate to forest and ecosystem composition, structure, pattern and function. Plan components in the native plant and wildlife species diversity section of the plan includes additional species-specific management direction.

Management area direction

The forest plan provides an integrated set of management direction that provide for the social, economic, and ecological sustainability and multiple uses of the Flathead National Forest's lands and resources. The forest plan designates management areas; these areas are assigned sets of plan components such as desired conditions, suitable uses, and in some areas either standards or guidelines or both.

The Crystal Cedar project area is divided into the following management areas: 2a (designated wild and scenic rivers), 6a (general forest low-intensity vegetation management), 6b (general forest medium-intensity vegetation management), 6c (general forest high-intensity vegetation management), and 7 (focused recreation areas).

Table 1. Management areas within the Crystal Cedar project area

Management area	Acres (percent of project area)	Management area description
2a. Designated wild and scenic river	939 (3%)	Recreation segments of the congressionally designated wild and scenic river, the North Fork and Middle Fork of the Flathead River are located in the project area.
6a. General forest low-intensity vegetation management	4,699 (17%)	A low intensity of timber harvest is expected. MA 6a is located in areas with a higher level of other resource considerations or site limitations that would restrict active vegetation management compared to MA 6b and MA 6c.
6b. General forest medium-intensity vegetation management	2,546 (9%)	A medium intensity of timber harvest is expected in MA 6b, and these areas will have regularly scheduled timber harvest. MA 6b is located in areas where other resource considerations or site limitations are expected to restrict active management to a lesser degree than in MA 6a but more than in MA 6c.
6c. General forest high-intensity vegetation management	914 (3%)	A higher intensity of timber harvest is expected in MA 6c compared to MA 6a and MA 6b, and these areas will have regularly scheduled timber harvest. MA 6c is located in areas where other resource considerations are expected to restrict active vegetation treatments to a lesser degree than either MA 6a or MA 6b.
7. Focused recreation area	8,691 (32%)	Focused recreation areas recognize a variety of sustainable recreation settings and opportunities. These areas accommodate existing as well as additional recreation growth and are intended to benefit local economies. This MA provides a focal point for not only existing recreation but also for new and enhanced recreation activities. Some areas of MA7 are identified as suitable for timber production, and others are not (forest plan figure B-33).
Lands of other ownership	9,460 (35%)	
Total acres	**27,249**	

Geographic area direction

The forest plan divides the forest into six geographic areas and provides management direction specific to these areas that reflect community values and local conditions in the area. The Crystal Cedar project area is within the North Fork geographic area.

Purpose and Need for Action

The purpose of the Crystal Cedar Project is to move the project area towards the desired conditions defined by the forest plan. The difference between the existing condition and the desired condition creates a need for management action on the ground. The purposes for the Crystal Cedar project are identified below, which compel the need for action.

- Provide sustainable trail-based recreation opportunities close to local communities that are compatible with other resources.
- Reduce tree densities and fuel loadings within the wildland-urban interface to result in less intense fire behavior near communities and facilitate safe wildland fire operations.
- Improve the diversity and resilience of forest vegetative communities and associated wildlife habitat.
- Provide a mix of forest products to contribute to economic sustainability, providing jobs and income to local economies.

Provide sustainable trail-based recreation opportunities close to local communities that are compatible with other resources.

Residents and visitors of the Columbia Falls area have expressed increasing interest to expand trail systems that link local communities to adjacent public lands. The project area currently contains seven miles of motorized trails which are receiving increasing levels of use by pedestrians, equestrians, mountain bikers, cross-country skiers, and other nonmotorized recreationists. Local residents, city government, and local businesses have expressed interest in developing a nonmotorized trail system which provides loop opportunities for recreationists close to the community of Columbia Falls.

The forest plan identifies that the forest trail system should provide a variety of motorized and nonmotorized recreational opportunities during summer and winter, provide linkages from local communities to the Forest, and be compatible with other resources (FW-DC-IFS-08). Furthermore, the forest plan identifies the Forest should partner with local groups to develop and maintain trail systems (FW-DC-P&C-11).

More specifically, the forest plan identifies the Crystal-Cedar Area and Cedar Flats Off-Highway Vehicle Area as management area 7 (focused recreation), where the desired conditions are to provide a diversity of year-round recreation activities close to local communities (GA-NF-MA7-Crystal-Cedar-DC-01) and provide a system of mechanized and motorized trails for mountain biking and off-highway vehicles on designated routes linking local communities to easily accessed recreation opportunities (GA-NF-MA7-Cedar Flats OHV-DC-01).

The Crystal Cedar Project contributes to these desired conditions by proposing a new trail network near Columbia Falls which will create a network of motorized and nonmotorized trails that provide year-round recreational opportunities. The project also proposes to achieve these recreational opportunities through partnerships with local organizations to construct and maintain the trails system.

Reduce tree densities and fuel loadings within the wildland-urban interface to result in less intense fire behavior near communities and facilitate safe wildland fire operations.

The Crystal Cedar project area contains a mixture of private and NFS lands adjacent to the community of Columbia Falls. The Flathead County Community Wildfire Protection Plan (2011) identified neighborhoods within the project area as priority areas for local fire departments. The high level of human use in the project area creates potential for human-caused starts (project file exhibit J-2), combined with a large number of values at risk on private lands interspersed with NFS lands. The project area also receives a large amount of summer recreational traffic and dispersed camping, causing concern among local residents and local fire departments that careless recreationists could start potential wildfires.

Although the ranger district has conducted past management in the area, the highly productive growth sites combined with high level of human use, creates a need to manage and maintain the vegetation conditions in the project area towards less intense fire behavior.

The forest plan desired conditions state that in areas where wildfires on NFS lands pose a threat to communities, wildland fuel is reduced so the expected fire behavior is reduced (FW-DC-FIRE-02) and that lower tree densities occur in the wildland-urban interface (FW-DC-TE&V-13).

The Crystal Cedar Project proposes to use vegetation management to lower tree densities and fuel loadings within the wildland-urban interface adjacent to Columbia Falls. Some of these treatments will result in commercial harvest to reduce canopy density and other treatments will remove small, noncommercial sized understory trees that provide ladder fuels. These treatments are designed to result in less intense fire behavior in the project area where there are numerous residences and forest visitors. This will also facilitate safe wildland fire operations in the event of a wildland fire event.

Improve the diversity and resilience of forest vegetative communities and associated wildlife habitat.

The forest vegetation in the Crystal Cedar project area was heavily influenced by the Half Moon Fire of 1929 (project file exhibit J-2), which burned the majority of the project area, and resulted in areas of mature lodgepole pine, which are vulnerable to future stand replacing fires and insect infestations. This past disturbance and subsequent management has also resulted in very few large trees remaining on the landscape to provide habitat for wildlife species that utilize large trees. The abundance of riparian areas in the project area also provide valuable plant and wildlife habitat and contribute to a productive growing site.

The forest plan desired conditions in the project area identify a desire to increase the percent area of western larch dominance type and the percent area with presence of western larch and western whitepine in the warm-moist potential vegetation type (57 percent of the project area) and an increase in western white pine in the cool-moist potential vegetation type (35 percent of the project area) (FW-DC-TE&V-08). The forest plan also identifies maintaining or increasing hardwood dominance type (FW-DC-TE&V-09), which are spread throughout the project area. Another desired condition is to maintain or increase the percent area of large and very large trees to create habitat that supports a wide variety of wildlife associated with forests in the potential vegetation type (FW-DC-TE&V-11). There is also a desired condition to have forest patterns contribute to connectivity of habitat for wildlife (FW-DC-TE&V-19) and that cover conditions in

riparian management zones contribute to habitat connectivity for a variety of wildlife species (FW-DC-RMZ-06).

The proposed vegetation treatments in the project area are designed to favor more fire-tolerant species such as western larch, Douglas-fir, and western white pine and promote tree growth to increase the percentage of large trees over time. Vegetation treatments will also increase the presence of these desirable tree species on the landscape. Vegetation treatments have been designed to maintain habitat connectivity and cover throughout the project area and would stimulate new growth of hardwoods and browse species that provide wildlife foraging habitat. Treatments occurring in riparian management zones will encourage tree growth to provide a diversity of forest size classes and tree species in the project area.

Provide a mix of forest products to contribute to economic sustainability, providing jobs and income to local economies.

Forest plan desired conditions state that the production of timber should contribute to ecological sustainability and contribute to the achievement of vegetation desired conditions (FW-DC-TIMB-01). The plan also states that the production of timber should contribute to economic sustainability to local economies (FW-DC-TIMB-02). On lands identified as not suitable for timber production, but where timber harvesting is allowed to achieve multiple-use values, timber harvest contributes to achieving desired conditions while providing economic and social services and benefits to people (FW-DC-TIMB-07). Additionally, the forest plan identifies that vegetation management activities should provide opportunities for collecting firewood (FW-DC-OFP-03).

The Crystal Cedar Project includes vegetation treatments that move the project area towards desired conditions for forest stands and fire behavior, while contributing wood products to the local economy. The project identifies firewood opportunities, live birch cutting, while contributing to the desired forest condition. See project file exhibit Q-1 for an overview of the financial efficiency of the Crystal Cedar Project.

Public Involvement

In July 2017, the Cedar Flats Trail Group, a committee of the Gateway to Glacier Trail organization, submitted a draft proposal to establish a trail network for a wide variety of users north of Columbia Falls. Their proposal encompassed input from a variety of users in the community, nongovernmental organizations, and City of Columbia Falls leadership.

The ranger district asked the public for input on management activities in November 2017 when we sent out approximately 700 letters to landowners located within one-half of a mile of the project area and 100 emails to individuals and organizations who said they were interested in the project. We met with individuals and organizations who had questions about the project or wanted to share information about management on National Forest System lands. We received 72 written responses to this request for information.

Considering the trails proposal from the Gateway to Glacier Trail organization and input received from the public, we drafted a proposed action. On October 15, 2018, we sent letters announcing the release of the proposed action to approximately 270 individuals and landowners within one-tenth of a mile of proposed management activities within the project area. Emails were sent to 238 individuals and organizations. Approximately 140 individuals and organizations provided comments on the proposed action.

A public open house to provide additional information and answer questions about the project was held on October 30, 2018. Over 100 individuals attended the open house. Following the open house, various landowners, communities, and homeowners associations requested follow-up meetings with the district. We met with landowners interested in discussing access and management around their property and user groups asking for additional recreational opportunities within the Crystal Cedar project area.

On November 14, 2018, we attended a Meadow Lake Resort homeowners' association meeting to discuss the Crystal Cedar Project and answer residents' questions. Over 20 individuals attended this meeting, and a follow-up field visit was held on November 15, 2018, with a small group of residents interested in discussing trail and trailhead design and access.

On November 26, 2018, a field trip to the Spoon Lake area was held at the request of Spoon Lake residents interested in discussing vegetation management units proposed near their property (units 119 and 119a). Approximately 20 individuals participated in the field trip.

On February 21, 2019, the residents of Barnett Road/Fourth Avenue WN asked if we could come talk to them about management of the road and trailhead on NFS Road 10815. Six residents were in attendance with representatives from the Forest Service and Gateway to Glacier Trail organization.

Changes Made to Proposed Action Based on Public Comment

Public comments received on the proposed action were reviewed by the responsible official to determine how to best address public concerns. Some comments were determined to be outside the scope of the project and some concerns are already addressed by public law, policy, or regulation. Some alternatives to the proposed action were considered but not analyzed in detail; rationale for these decisions is provided below.

Some public comments were addressed by developing design features or modifying the proposed action to reduce effects to resources, these include the following comments:

Concern that trails will facilitate trespass onto private property

Public comments expressed a concern from adjacent landowners that proposed trails would facilitate trespass onto private property. We talked with concerned private property owners and conducted field review to identify actions that could be taken to discourage trespass from trails to private property. Locations of trails TR02 and TR10 were modified to direct users away from private property. In addition, the following design features were added:

To discourage trespassing on private land and provide high quality trail experience, trail TR02 and would be located out of sight of private property lines where feasible. Skid roads crossing TR02 will be rehabilitated for 150 feet on either side of the trail by any site-appropriate combination of the following:

- Scarifying with hand tools or excavator to a depth equal sufficient to ameliorate the presence of detrimental soil compaction (usually between 2 and 12 inches);
- Seeding with the native plant mix as specified by the forest botanist;
- Placing woody material on the template;

- Planting native shrubs, or trees, or both to augment natural vegetation; or
- Placing barrier rock to discourage use.

Concerns about potential effects of units 119A and 119

Public comments expressed a concern for the aesthetic effects of commercial logging in units 119A and 119, as well as the potential effects to weeds, wildlife, summer residents, and road maintenance. The district held a field trip at these units to discuss these concerns with local residents and modified the proposed action to address these concerns:

- Unit 119A and 119 would require winter logging and in-woods processing to reduce ground disturbance, minimize weed spread, and avoid potential seasonal conflicts with local residents and visitors. Fuels piling and treatment could occur during non-winter season.

Interest in building accessible trails for handcycles

DREAM Adaptive Recreation asked the Forest Service to consider designing some of the proposed trails to accommodate handcycles used by athletes with disabilities.

- Trails TR01, TR01A, TR02, TR02A, TR03, and TR04 are proposed to be designed as accessible to handcycles.

Additional areas of treatment next to private land

Unit 145 was added in response to comments received from the public that they wanted additional vegetation treatments adjacent to their property.

Modifying trail locations to improve user experience

Public comment provided site-specific recommendations to improve trail connectivity and recreational experiences. Based on these comments, we made these changes to the proposed action:

- Motorized trail 6301B was added to connect the existing motorized trails 6301 and 6302 to direct recreational users off NFS Road 10815.
- The location of trail TR10 was modified to improve the recreational experience and direct users away from private property.

Alternatives Considered but Not Analyzed in Detail

Changes to Over-the-Snow Use in the Project Area

We received several public comments requesting changes to over-the-snow use in the project area. Some members of the public asked that the district analyze groomed Nordic trails in the project area. Other comments asked for a new designated snowmobile route in the project area. Other public comment requested that groomed fat bike trails be included. The responsible official considered these comments and decided that changes to over-the-snow management was outside

the scope of the Crystal Cedar Project and would not be fully analyzed as an alternative to the proposed action.

We also received comments from residents and recreationists requesting improved winter parking opportunities. The responsible official believes that the existing infrastructure and the proposed trailheads could provide opportunities for winter parking to be maintained through partnership agreements.

Add More Trails in the Project Area

We received public comment requesting more trails be proposed in the project area. Some commenters asked the responsible official to consider construction of a mountain bike-specific downhill trail in the project area. Other commenters wanted a trail constructed to the top of Teakettle Mountain. The responsible official considered these comments and decided the trail system proposed in this EA should be accessible to a wide variety of users, focus recreation opportunities on management area 7 lands close to the community of Columbia Falls, and be designed for successful partnerships to construct and maintain the trail network. Specifically, the responsible official decided that a downhill-specific trail would not meet the focus on trails for a wide variety of users and a trail to the top of Teakettle was located outside of management area 7 lands and would not be fully analyzed as an alternative to the proposed action.

No-Action Alternative

The no-action alternative assumes that no implementation of any elements of the proposed action would take place within the Crystal Cedar project area. This alternative would not respond to the purpose and need for action or concerns identified during scoping for this project. There would be no effort to make progress towards the desired condition for recreation opportunities near Columbia Falls. Fuels reductions would not occur to meet the desired conditions for less intense wildfire behavior and safe wildland firefighting operation. Vegetation management to move towards the desired condition for forest composition would not occur. Ongoing activities, such as recreation, public firewood gathering, fire suppression, and normal road maintenance would continue in this alternative. Ongoing processes, such as the spread of invasive species, and fire would continue to impact the project area over time. The no-action alternative serves as a point of comparison between the existing condition and the potential effects of the proposed action.

Proposed Action

The proposed action is a set of management actions to meet the purpose and need for action as described above. The proposed action was scoped to the public in October 2018 and has been modified to address public comment and forest plan direction.

Table 2 provides a summary of the components of the proposed action.

Table 2. Summary of proposed action components

Proposed trail construction	Miles
Nonmotorized trail	24.3
Motorized trail	0.4
Proposed road management	**Miles**
Temporary roads	6.3
NFS system road construction	0.9
NFS system road reroute	0.2
NFS system road aquatic organism passage structures	1
Proposed vegetation treatments	**Acres**
Commercial thin	1,984
Seed tree	506
Shelterwood	32
Clearcut	13
Overstory removal	46
Total proposed commercial treatment	**2,581**
Estimated sawtimber volume	18,811 CCF (9.4 MMBF)
	Acres
Sapling thin	572
Understory removal	286
Live birch cutting along open roads[a]	280
Prescribed burning (ecosystem burns)	157
Total proposed noncommercial treatment	**1,295**

a. Acres of live birch cutting along open roads overlap with acres of other types of vegetation treatment

Proposed Trails

The Crystal Cedar Project proposes to add a trail network in the project area to the National Forest System for management. The project proposes adding 24.7 miles of trail to the system to create loop opportunities near the community of Columbia Falls to be constructed and maintained by partner organizations to Forest Service standards. The Gateway to Glacier Trail organization has expressed interest in partnering with the Forest Service to construct and maintain trails, and there are opportunities for additional partnerships with interested organizations.

The proposed trail system would include 15 nonmotorized trails and 2 motorized trail segments to create a sustainable trail network available for a wide variety of users to enhance recreation experiences near the community of Columbia Falls. Trails would be located, designed, constructed, and maintained to minimize the risk of user group conflict and human-wildlife conflict. Some trail segments could be constructed in the same location as temporary roadways or areas already exhibiting use, and other trail segments could have new construction.

Trail classes determine design elements including tread width, signing, and the recreational environment and experience. Trail classes are general categories reflecting trail development scale, arranged along a continuum. The trail class identified for a National Forest System trail prescribes its development scale, representing its intended design and management standards.

Trails would be designed according to one designed use, or trail class, but can be managed for a range of users. As displayed in table 3, a trail designed for mountain bike use may be managed for pedestrians and bicycles, and a trail designed for pack and saddle could be used by pedestrians, bicycles, and equestrians. More information on trail classes, managed use, and designed use, including definitions and photo examples, can be found on the Web at: https://www.fs.fed.us/managing-land/trails/trail-management-tools/trail-fundamentals.

Two trails, TR03 and TR11A, are proposed to provide a family-friendly trail experience. Trail TR03 could be a class 4 or 5 accessible loop for hikers and bikers close to Columbia Falls. Trail TR11A is proposed as a pedestrian interpretive trail focusing on wetlands and aquatic ecosystems.

The proposed trail system also includes the addition of two segments class 3 all-terrain vehicle trail. Trails 6400B and 6301B serve as short connector trails to provide a sustainable loop routes between existing motorized trails and NFS Road 1690.

Two new developed trailheads are proposed in the project area. One trailhead is proposed at the junction of Barnett Road and NFS Road 10815, where there is an existing clearing. The trailhead on NFS Road 10815 may be approximately one acre in size to accommodate up to 30 vehicles. The trailhead on NFS Road 1690 could also be constructed up to an acre in size to accommodate up to 30 vehicles. Trailheads would have toilets and informational materials available for day use visitors. The project also proposes to use a portion of the existing Canyon Creek trailhead on NFS Road 316 for summer day use. Overnight use at the proposed trailheads would be prohibited. It is anticipated that these trailheads will not be constructed to their full capacity in the initial stages of trail development but could be expanded to the identified maximum capacity if there is an observed need for more visitor parking. In other segments of the trail network, pullouts may be constructed along open roads to allow for two to three cars to park at various points in the trail network and would not have visitor facilities.

Table 3. Trails proposal

Trail number	Designed use and trail class	Managed use	Miles
6400B	ATV - 3	Pedestrians, bicycles, equestrian, ATV	0.2
6301B	ATV-3	Pedestrians, bicycles, equestrian, ATV	0.2
TR01	Bicycle - 3	Pedestrians, bicycles	3.0
TR01A	Bicycle - 3	Pedestrians, bicycles, equestrian	0.5
TR02	Bicycle - 3	Pedestrians, bicycles, equestrian	2.3
TR02A	Bicycle - 3	Pedestrians, bicycles, equestrian	0.1
TR03	Bicycle- 4-5	Pedestrians, bicycles	1.5
TR03A	Bicycle - 3	Pedestrians, bicycles	0.5
TR04	Bicycle 3	Pedestrians, bicycles, equestrian	1.4
TR05	Pack and saddle - 3	Pedestrians, bicycles, equestrian	1.7
TR06	Pack and saddle - 3	Pedestrians, bicycles, equestrian	0.9
TR07	Pack and saddle - 2	Pedestrians, bicycles, equestrian	6.3
TR08	Bicycle - 3	Pedestrians, bicycles, equestrian	3.2
TR08A	Pack and saddle - 3	Pedestrians, bicycles, equestrian	0.5
TR10	Pack and saddle - 3	Pedestrians, bicycles, equestrian	1.4

Trail number	Designed use and trail class	Managed use	Miles
TR11	Pack and saddle - 3	Pedestrians, bicycles, equestrian	0.9
TR11A	Hiker only - 3	Pedestrian	0.1
		Total miles	**24.7**

Proposed Vegetation Treatments

In order to reduce tree densities and fuel loadings within the wildland-urban interface; improve the diversity and resilience of forest vegetation communities and associated wildlife habitat; and provide a mix of forest products to contribute to economic sustainability of local economies, several different silvicultural prescriptions are proposed:

Commercial thinning is an intermediate treatment that would retain the healthiest trees with large, well-formed crowns. The objective of this treatment is to improve forest growth and health. Leave tree selection would favor fire-tolerant species, including western larch, western white pine, and Douglas-fir. These trees would then have more growing space, light, nutrients, and water to allow them to develop into large trees more rapidly with improved insect, disease, and fire tolerance. Commercially thinned stands would not require reforestation. Three commercial thin units were identified as opportunities to promote aspen growth by removing encroaching conifers from healthy aspen clones. Commercial thinning would also achieve fuels reduction objectives by reducing tree densities and ladder fuels.

Shelterwood, seed tree, and clearcut are regeneration treatments that use timber harvesting to create a new forest stand of fire-tolerant tree species. These silvicultural methods would change the stands from large and medium tree structure classes to the seedling stage. The objective of these treatments is to reduce fuels and regenerate fire-tolerant species including western larch, western white pine, or ponderosa pine. These treatments would mimic a stand replacement fire where more than 75 percent of the overstory would be replaced reducing the potential for future crown fires. All regeneration harvests would have natural regeneration, or planting of desired species, or both.

Overstory removal is a treatment made in a stand with an older, upper canopy layer and a sapling stage understory. The removal of the upper canopy layer would be followed by a sapling thin to improve current and future stand health, growth, species composition, and tree sizes.

Sapling thin is similar to the commercial thin except it occurs in young stands less than 35 years old where trees are small. A portion of the existing trees are removed (trees at least 6 inches or smaller diameter at breast height), leaving a relatively well-stocked forested condition. The primary objective is to maintain or improve current and future stand health, growth, and species composition. Sapling thin would also achieve fuels reduction objectives.

Understory removal is similar to the commercial and sapling thin except the primary objective is fuels reduction. A portion of the existing trees are removed (trees at least 6 inches or smaller diameter at breast height), leaving a relatively well-stocked forested condition. Ladder fuels will be reduced and spacing between trees will be increased. Understory removal would also achieve increased forest growth objectives.

Table 4 describes the tree retention for each type of vegetation treatment.

Table 4. Retention descriptions for vegetation treatments

Vegetation treatment type	Retention description	
	Trees per acre	Canopy cover
Commercial thin	80–150 medium trees per acre	30-70% (average 50%)
Shelterwood	25–35 medium to large trees per acre	20-30%
Seed tree	5–15 medium to large trees per acre	5-10%
Clearcut	5–10 medium to large trees per acre	3-7%
Overstory removal	100–200 small trees per acre	30-50%
Sapling thin	150–250 small trees per acre	30-50%
Understory removal	80–150 medium to large trees per acre	30-70% (average 50%)

Vegetation treatments within riparian management zones (RMZ) will occur in portions of the proposed treatment units to promote growth of large trees and increase the diversity of forest age classes, species composition, and forest density. RMZs are areas adjacent to perennial and intermittent streams, wetlands, ponds, lakes, and reservoirs. The RMZ is divided into two areas: the inner and outer RMZ. Widths of RMZs by category are delineated in forest plan standard (FW-STD-RMZ-01) based on the following categories:

Category 1: fish-bearing streams

Category 2: permanently flowing non-fish-bearing streams

Category 3: seasonally flowing or intermittent streams and lands identified as potentially unstable or landslide prone

Category 4a: ponds, lakes, reservoirs, and wetlands greater than 0.5 acre and all sizes of howellia ponds and fens/peatlands

Category 4b: ponds, lakes, reservoirs, and wetlands less than 0.5 acre (except howellia ponds and fens/peatlands)

See forest plan pp. 19-21 for a description of RMZ categories and management direction.

The forest plan FEIS analysis and modeling incorporated treatments in RMZs. Complying with plan components related to treatments will protect values and maintain habitat conditions for associated plant, animal, and aquatic species. Only hand removal of vegetation will occur within the mapped inner RMZ (FW-STD-RMZ-06) and no treatment would occur within fen RMZs. In areas where an existing road is located within the RMZ, a site-specific determination has been made that the road delineates the inner RMZ from the outer RMZ (FW-STD-RMZ-01). Likewise, for category 3 streams exceptions are allowed if the slope within the 100 foot RMZ decreases to 15 percent or less for a distance of at least 30 feet (forming a bench). The boundary of the inner RMZ may then be located at the toe of the bench. Vegetation treatment will occur within the outer RMZ to promote resiliency of forest vegetation and improve ecosystem integrity (FW-SUIT-RMZ-01).

Table 5 displays the potential types of vegetation treatment that could occur within RMZs.

Table 5. Potential vegetation treatments within RMZs

Vegetation treatment type	Potential treatment acres in outer RMZ[a]
Intermediate treatment[b]	288
Regeneration treatment	35
Prescribed fire	8
	Potential treatment acres in inner RMZ
Sapling thin	6

a. Acreages displayed in table were mapped through GIS and may not reflect the accurate locations or acreages of RMZs identified through layout of treatment units.

b. Intermediate treatments include: commercial thin, sapling thin, understory removal, and birch cutting

Live birch cutting is proposed along NFS Roads 1690, 10815, and 10816 in designated areas, up to 150 feet from the roadway, to provide opportunities for the public to harvest live birch for personal use with a permit.

Prescribed burning would return fire to the project area and reduce the risk and impacts of a relatively large stand replacement fire in the future. Prescribed burns would occur at low to moderate intensity burn severity conditions. Using prescribed fire combined with the other proposed treatments would reduce and break up the continuity of fuels across the project area. Another objective of burning is improving wildlife forage and winter range through stimulation of browse. Implementation of the prescribed burns could extend for several years into the future depending on the occurrences of desirable prescribed burning weather opportunities.

Table 6 provides a listing of the proposed vegetation treatments and map 1 displays the location of these treatments in the project area.

Table 6. Proposed vegetation treatments

Unit	Acres	Prescription	Treatment method	Fuels treatment method	Management area
2	190	Commercial thin	Summer tractor	Excavator pile	7
3	12	Commercial thin	Tractor	Excavator pile	7
4	220	Commercial thin	Tractor	Excavator pile	7
04a	8	Commercial thin	Tractor	-	7
5	39	Commercial thin	Tractor	-	7
6	120	Commercial thin	Summer tractor	Excavator pile	7
7	166	Commercial thin	Tractor	Excavator pile	7
9	37	Seed tree	Tractor	Excavator pile	6b
10	16	Commercial thin	Log forwarder	Excavator pile	7
11	18	Seed tree	Log forwarder or winter tractor	Excavator pile	7
14	63	Commercial thin	Summer tractor	-	7
16	69	Commercial thin	Summer tractor	Excavator pile	7
17	86	Commercial thin	Summer skyline	Excavator pile	7
20	34	Seed tree	Tractor	Excavator pile	6b
23	4	Seed tree	Summer skyline	Excavator pile	7
25	17	Seed tree	Tractor	Excavator pile	7

Unit	Acres	Prescription	Treatment method	Fuels treatment method	Management area
25a	11	Seed tree	Tractor	Excavator pile	7
27	54	Commercial thin	Tractor	-	7
29	7	Seed tree	Tractor	Excavator pile	7
31	12	Seed tree	Tractor	Excavator pile	7
32	22	Seed tree	Tractor	Excavator pile	6b
33	20	Seed tree	Tractor	Excavator pile	7
35	5	Understory removal	Hand	-	7
36	23	Seed tree	Tractor	Excavator pile	7
40	40	Commercial thin for aspen release	Tractor	Excavator pile	6b
42	8	Seed tree	Winter tractor	Excavator pile	6b
43	39	Commercial thin	Tractor	-	7
44	16	Seed tree	Summer skyline	Broadcast burn	7
45	10	Seed tree	Tractor	Excavator pile	6b
46	133	Commercial thin	Summer tractor	-	7
46a	11	Commercial thin	Tractor	-	7
47	22	Commercial thin	Tractor	Excavator pile	7
48	7	Seed tree	Tractor	Excavator pile	6b
49	23	Shelterwood	Tractor	Excavator pile	7
50	12	Commercial thin	Tractor	-	6b
51	86	Commercial thin	Tractor	-	7
53	10	Commercial thin	Tractor	-	6b
54	53	Commercial thin	Winter tractor	Excavator pile	7
54a	8	Commercial thin	Log forwarder or winter tractor	Excavator pile	7
55	16	Commercial thin	Summer skyline	-	7
64	32	Commercial thin	Log forwarder or winter tractor	-	6b
65	13	Seed tree	Tractor	Excavator pile	6b
66a	2	Understory removal	Hand	-	7
67	18	Commercial thin	Tractor	-	7
68	36	Commercial thin for aspen release	Tractor	Excavator pile	6a/7
70	31	Seed tree	Log forwarder or winter tractor	Excavator pile	7
70a	8	Seed tree	Log forwarder or winter tractor	Excavator pile	7
71	34	Commercial thin	Log forwarder	Excavator pile	7
72	5	Seed tree	Summer tractor	Excavator pile	7
73	27	Seed tree	Tractor	Excavator pile	7
74	3	Seed tree	Tractor	Excavator pile	6b
81	3	Seed tree	Winter tractor	Excavator pile	6b

Unit	Acres	Prescription	Treatment method	Fuels treatment method	Management area
82	20	Commercial thin	Tractor	-	7
82a	12	Commercial thin	Tractor	-	7
85	39	Commercial thin	Tractor	-	7
86	41	Seed tree	Tractor	-	7
88	11	Seed tree	Tractor	Excavator pile	6b
92	4	Seed tree	Tractor	-	6b
93	26	Seed tree	Skyline	Broadcast burn	7
96	12	Commercial thin	Summer tractor	Excavator pile	7
96a	2	Commercial thin	Tractor	Excavator pile	7
98	3	Seed tree	Tractor	Excavator pile	7
99	4	Seed tree	Tractor	Excavator pile	6b
101	9	Seed tree	Tractor	Excavator pile	7
102	7	Seed tree	Tractor	Excavator pile	6b
108	9	Shelterwood	Summer skyline	Broadcast burn	7
109	39	Commercial thin	Winter tractor	Excavator pile	7
112	14	Commercial thin for aspen release	Summer tractor	Excavator pile	7
113	20	Commercial thin	Summer skyline	-	7
114	9	Commercial thin	Summer skyline	-	7
119	19	Commercial thin	Log forwarder and winter tractor	Excavator pile	7
119a	6	Commercial thin	Log forwarder and winter tractor	Excavator pile	7
120	10	Seed tree	Log forwarder or winter tractor	Excavator pile	6b
121	13	Clearcut	Tractor	Excavator pile	2a
122	35	Commercial thin for aspen release	Tractor	-	6c
123	77	Commercial thin	Tractor	Excavator pile	2a
126	15	Commercial thin	Tractor	Excavator pile	6b
128	12	Commercial thin	Tractor	Excavator pile	7
129	54	Commercial thin	Tractor	Excavator pile	6b
130	6	Commercial thin	Log forwarder or winter tractor	Excavator pile	2a/6b
131	55	Seed tree	Tractor	Excavator pile	2a/6b
133	24	Understory removal	Hand	-	7
133a	3	Understory removal	Hand	-	7
134	30	Understory removal	Hand	-	7
135	46	Understory removal	Hand	-	7
136	26	Understory removal	Hand	-	7
137	42	Understory removal	Hand	-	7
140	5	Understory removal	Hand	-	6c

Unit	Acres	Prescription	Treatment method	Fuels treatment method	Management area
141	24	Understory removal	Hand	-	7
142	15	Understory removal	Hand	-	7
143	45	Understory removal	Hand	-	7
144	14	Understory removal	Hand	-	6c
145	5	Understory removal	Hand	-	6a
200	4	Sapling thin	Hand	-	6b/7
201	21	Sapling thin	Hand	-	6b
202	10	Sapling thin	Hand	-	6b
203	6	Sapling thin	Hand	-	6b
204	14	Sapling thin	Hand	-	7
205	24	Sapling thin	Hand	-	6b
206	16	Sapling thin	Hand	-	7
208	39	Sapling thin	Hand	-	7
209	2	Sapling thin	Hand	-	6b
210	8	Sapling thin	Hand	-	7
211	4	Sapling thin	Hand	-	7
212	13	Sapling thin	Hand	-	6b
213	27	Sapling thin	Hand	-	7
214	7	Sapling thin	Hand	-	7
215	2	Sapling thin	Hand	-	6a/7
217	9	Sapling thin	Hand	-	6b
220	10	Sapling thin	Hand	-	7
222	15	Sapling thin	Hand	-	6b/7
223	8	Sapling thin	Hand	-	7
224	13	Sapling thin	Hand	-	6b
226	3	Sapling thin	Hand	-	7
227	6	Sapling thin	Hand	-	6b
228	5	Sapling thin	Hand	-	7
229	6	Sapling thin	Hand	-	7
230	10	Sapling thin	Hand	-	6b
231	10	Sapling thin	Hand	-	7
232	19	Sapling thin	Hand	-	7
233	5	Sapling thin	Hand	-	7
234	5	Sapling thin	Hand	-	7
235	37	Sapling thin	Hand	-	6b
236	49	Sapling thin	Hand	-	6b
237	46	Overstory removal with sapling thin	Tractor	-	6c
238	23	Sapling thin	Hand	-	6c
239	20	Sapling thin	Hand	-	6c

Unit	Acres	Prescription	Treatment method	Fuels treatment method	Management area
240	22	Sapling thin	Hand	-	6c
241	17	Sapling thin	Hand	-	2a/6c
242	17	Sapling thin	Hand	-	6c
243	27	Sapling thin	Hand	-	7
244	3	Sapling thin	Hand	-	6b
245	2	Sapling thin	Hand	-	6b
246	3	Sapling thin	Hand	-	6b
247	3	Sapling thin	Hand	-	6b
248	3	Sapling thin	Hand	-	6b
249	4	Sapling thin	Hand	-	6b
250	2	Sapling thin	Hand	-	6b
251	2	Sapling thin	Hand	-	6b
252	4	Sapling thin	Hand	-	6b
253	4	Sapling thin	Hand	-	6b
254	4	Sapling thin	Hand	-	6b
255	3	Sapling thin	Hand	-	6b
256	2	Sapling thin	Hand	-	6b
300	48	Prescribed burn	Hand	-	7
300a	59	Prescribed burn	Hand	-	7
301	50	Prescribed burn	Hand	-	7
NFS Road 1690	140	Personal use live birch cutting	Hand	-	7
NFS Road 10815	105	Personal use live birch cutting	Hand	-	7
NFS Road 10816	35	Personal use live birch cutting	Hand	-	7

Treatment Methods

Commercial harvest methods

Methods of tree removal for units with commercial products would be ground-based mechanized or skyline. Mechanized harvest methods would occur across approximately 2,395 acres, utilizing tracked or rubber-tired equipment. Skyline harvest methods would be used on about 186 acres of steeper ground, utilizing cables to yard woody material up to a landing at the top of a unit.

Noncommercial harvest methods

Thinning in the young sapling units with no commercial products would occur by hand (chainsaws) across approximately 572 acres and include lopping and scattering of the slash and fuels or hand piling material on site. Fuels reduction in the understory removal units would occur by hand and pile burning on 286 acres.

Post-harvest fuels and site preparation methods

Some proposed harvest units would have post-harvest treatments designed to reduce forest fuels that are generated either through harvest activity or is naturally occurring in high amounts. In the case of all regeneration harvest units (seed tree, shelterwood, and clearcut) these post-harvest activities would also prepare the site for reforestation by reducing competing vegetation and creating favorable seed bed conditions. Post-harvest fuels treatment includes excavator piling and broadcast burning, as identified by vegetation treatment unit in table 6. Prior to broadcast burning, fireline would be constructed where needed.

Reforestation methods

Where regeneration harvest treatments are proposed (seed tree, shelterwood, and clearcut), a combination of natural and planting reforestation is planned. Planting would occur where insufficient natural regeneration of desired species is anticipated, due to lack of seed source or where restoring ponderosa pine or rust-resistant western white pine is an objective. Western white pine is an important, but declining species in this area and it would be planted where feasible. In addition to western white pine, other species that might be planted include western larch, Douglas-fir, and ponderosa pine.

Road management

A travel analysis was conducted during the project development stage to assess the current forest transportation system and inform decisions related to the transportation system in the Crystal Cedar project area (project file exhibits P-1 through P-3).

To improve public safety and provide access for resource management and fire suppression activities, approximately 0.9 miles of system road are proposed for construction and 0.2 miles of National Forest System road (Road 10813) would be rerouted. Approximately 6.3 miles of temporary roads would be constructed to the minimum standards necessary for log hauling on NFS roads. Temporary roads would be rehabilitated following timber harvest activities and would cease to function as roads. Approximately 0.5 miles of temporary roads are proposed on existing motorized trails and will be managed again as trail following project activities.

NFS roads used as haul routes would receive road maintenance in accordance with best management practices (BMPs) prior to log hauling. The objectives of road maintenance would be to reduce the concentration of subsurface and surface water runoff, minimize road surface erosion, filter ditch water before entering streams, and decrease the risk of culvert failures during peak runoff events. Maintenance work could include culvert installation, replacement of existing culverts with larger culverts, installation of drainage dips and surface water deflectors, placement of rip-rap to armor drainage structures, aggregate surface replacement, aggregate placement to reinforce wet surface areas, ditch construction and cleaning where needed, and surface blading to restore drainage efficiency of the road surface. These actions would bring the roads up to current BMP standards, better accommodate traffic, and reduce deferred maintenance.

A need for an aquatic organism passage structure has been identified on NFS Road 1690 for an unnamed fishbearing stream within the Spring Creek subwatershed. The existing undersized culverts will be replaced with a culvert or structure large enough to accommodate a 100-year flood and provide aquatic organism passage in the stream.

Environmental Impacts of the Alternatives

Effects to Terrestrial Ecosystems and Vegetation

Summary of Findings

Implementation of the proposed action would improve the diversity and resilience of forest vegetative communities and associated wildlife habitat. Treatments will also reduce forest density, contributing to the fuels reduction objective of the project. Through planting and natural regeneration of regeneration harvest units, species composition will be improved and diversified. Intermediate treatments will also contribute to improved species composition through preferred leave tree selection. Reduction in forest density through intermediate and regeneration harvest will also contribute to increased growth. Trees in treated units will have more growing space and will be able to grow into larger trees faster.

Methodology

Analysis area

The project area, at 27,249 acres, provides a well-defined region where meaningful evaluation of trends, patterns and ecological functioning of the forest vegetation can occur. This area is large enough to contain all the projects activities and potential effects, but small enough to not obscure the effects of alternatives. It is made up of many forest stands, which are contiguous groups of trees of relatively uniform age classes, structure, and composition. Lands within the project area are primarily National Forest System lands but some are privately or state owned. Within the project area, 479 acres are owned by the state and 8,915 acres are privately owned. In general, these private lands are adjacent to town and have developments (homes, outbuildings, etc.) with conifer dominated forest intermixed.

The timeframe of analysis is both for short-term and long-term effects. This is because of the long lives and persistent nature of forest vegetation. The short-term effects are the conditions post-treatment. The long-term effects are displayed at 50 years into the future. This is because tree growth and composition are not immediate changes with the action alternative. It takes time for trees to respond to increased growing space, and planted trees to become dominant.

Information sources

Approximately 22 percent of the national forest system land in the project area had a common stand exam, which resulted in stand exams for approximately 70 percent of the proposed treatment units. These exams provide valuable site-specific information on forest conditions, such as tree species composition, density, age and size classes, insect and disease presence, and habitat types. Exam information was used to build the existing forest vegetation conditions database, used for this forest vegetation analysis, as well as for many of the wildlife analyses. The boundary for this layer was based on the Crystal Cedar project area with a one-half mile buffer around it (see the wildlife species section of this environmental assessment for a discussion on the one-half mile buffer). The layer was developed using a combination of sources of information (see project file exhibit H-1 for a detailed description of how the vegetation layer was created).

In addition to the forest vegetation database, all the treatment units in the proposed action have been visited in the field within the past two years by a certified silviculturist to provide the up-to-date, site-specific information necessary for determining the proposed treatment prescription and conducting this environmental analysis.

Indicators

The following indicators were used to evaluate each alternative's ability to address the purpose and needs related to forest vegetation and wildlife habitat:

Table 7. Terrestrial ecosystems and vegetation indicators

Purpose and need	Applicable forest plan direction	Vegetation objective	Resource indicator	Measurement
Improve the diversity and resilience of forest vegetative communities and associated wildlife habitat.	FW-DC-TE&V-07 FW-DC-TE&V-08	Increase western larch dominance type	% western larch	Acres
		Increase western white pine dominance type	% western white pine	Acres
	FW-DC-TE&V-09	Maintain or increase hardwood dominance type	% hardwoods	Acres
	FW-DC-TE&V-10 FW-DC-TE&V-11 FW-DC-TE&V-12	Decrease in small and medium forest size classes	% small/medium size classes	Acres
		Increase in large and very large forest size classes	% of large/very large size classes	Acres
Reduce tree densities and fuel loadings within the wildland-urban interface to result in less intense fire behavior near communities and facilitate safe wildland fire operations.	FW-DC-TE&V-13	Reduce moderate and high density forest conditions with focus in the wildland-urban interface	Canopy cover %	Acres

Percentage of western larch and western white pine cover types. The forest plan indicates a need to increase these cover types forestwide (table 7). These cover types contain species expected to be more resilient to insect, disease, and fire disturbance agents considering climate change (G. Scott et al. 2013). These forest types contain species that are also expected to eventually produce very large trees as well as large snags of species valuable to wildlife.

Percentage of hardwoods. The forest plan indicates a need to maintain or increase the hardwood cover type forestwide (table 7). Although hardwood communities are not common on the Forest, they are considered an important component of the overall vegetation diversity and they also provide habitat for a wide variety of birds and other wildlife species (FEIS, volume 1, p. 208). Increasing or maintaining hardwoods is desired particularly in the warm-moist potential vegetation type, which is the majority of the Crystal Cedar project area.

Acres of small, medium, large, and very large tree size classes. These indicators are inversely correlated. The forest plan indicates a need to decrease the proportion of small and medium tree sizes and increase the proportion of large and very large trees sizes (table 7). Natural disturbance (primarily wildfire) has been the historical limitation to the amount of large and very large size classes in this ecosystem (FEIS, volume 1, p. 221). The majority of the project area burned in the Half Moon Fire of 1929. Forests in this area have only recently reached the point where some may be close to transitioning to the large or very large size class.

Acres of canopy cover. The forest plan indicates a need to reduce moderate and high density forest within the wildland-urban interface (table 7). Moderate and high density forest, as defined for the forest plan, is forest with canopy cover greater than 40 percent. The majority of the Crystal Cedar project area falls within the wildland-urban interface. It is desired to increase the proportion of very low to low density forest (canopy cover less than or equal to 40 percent) and decrease the proportion of moderate and high density forest (canopy cover greater than 40 percent).

Affected environment

Potential vegetation type

The Crystal Cedar project area has been grouped into areas of similar biophysical characteristics. These groupings are referred to as potential vegetation type. They are a coarse grouping of the Northern Region habitat type groups, which in turn are groupings of individual habitat types (Pfister et al. 1977). Habitat types are an aggregation of ecological sites of like biophysical environments (such as climate, aspect, soil characteristics) that produce plant communities of similar composition, structure, and function. The vegetation communities that would develop over time given no major natural or human disturbances (i.e., the climax plant community) would be similar within a particular potential vegetation type.

Potential vegetation types provide an understanding of the potential vegetation conditions that might occur over time on a particular site. In contrast, the existing vegetation condition describes what currently exists on a particular site. The characteristics of existing plant communities can be highly variable over time and space at any one particular point in time or within a particular potential vegetation type. The existing conditions reflect each site's unique history, forest character, pattern of disturbances, and point in time along the successional pathway.

The warm-moist potential vegetation type includes moist sites that are relatively warm and are largely limited to lower-elevation sites and wider valley bottoms with relatively productive, deep ash-capped soils. All western red cedar and western hemlock habitat types are within this type, as well as the moist grand fir habitat types. The warm-moist potential vegetation type occupies only 4 percent of the Flathead National Forest. It is the least abundant potential vegetation type on the forest, yet 58 percent of the Crystal Cedar project area is occupied by this potential vegetation type. Cool-moist is the second most dominate potential vegetation type representing 28 percent of the project area. The cool-moist potential vegetation type is dominated by the subalpine fir habitat types. Spruce habitat types make up most of the remainder. This type occurs on low- to mid-elevation sites across all aspects. Understanding potential vegetation type location and abundance is important because the forest plan describes vegetation management direction according to potential vegetation type. See project file exhibit H-2, map 1 for a map of potential vegetation types in the project area.

Key ecosystem components

Riparian

In this analysis, riparian refers to the area within riparian management zone. Riparian composition includes all types of vegetation including conifer, hardwood, herb/forb/shrub, and non-forest (water, sparse vegetation). Approximately 6,530 acres, or 24 percent, of the analysis area is within a mapped riparian management zone. Riparian management zones fall across different ownership within the analysis area, with approximately 53 percent of riparian on National Forest System lands, 45 percent privately owned, and 2 percent is managed by the state. Tables 8-10 display the composition, size class, and density of the forest within the riparian management zone. See project file exhibit H-2 map 2 for the location and type of riparian management zones within the project area.

Table 8. Riparian management zone (RMZ) vegetation composition

Dominant species	Acres	Percent of RMZ
Douglas-fir (DF)	938	14%
Lodgepole pine (LP)	1396	21%
Intolerant mix (IMIX)[a]	756	12%
Western larch (WL)	683	10%
Subalpine fir (AF)	215	3%
Engelmann spruce (ES)	307	5%
Tolerant mix (TMIX)[b]	206	3%
Hardwoods	862	13%
Herb	107	2%
Shrub	276	4%
Sparse vegetation	320	5%
Water	359	5%

a. IMIX is a mix of DF, LP, WL, WP

b. TMIX is a mix of AF, ES, WRC, GF

Table 9. RMZ size class

Dominant forest size class	Acres in analysis area	Percent of RMZ
Seedling and sapling 0-4.9” d.b.h.	294	5%
Small tree 5-9.9” d.b.h.	2376	36%
Medium tree 10-14.9” d.b.h.	1469	22%
Large tree 15-19.9” d.b.h.	395	6%
Very large tree ≥20” d.b.h.	66	1%
Non-forest (herb, water, shrub, etc.)	1929	30%

Table 10. RMZ forest density

Tree canopy cover	Acres[a]	Forest density	Acres	Percent of RMZ
10-25% canopy cover	310	Very Low/low	1160	18%
26-40% canopy cover	850			
41-59% canopy cover	2267	Moderate/high	3434	53%
≥60% canopy cover	1167			

a. 30% of the project area is non-forest or hardwood dominated.

Hardwood

The hardwood dominance type tends to occur as small patches and stringers scattered amongst the coniferous types. It also occurs as a transitory vegetation type in early successional stages of coniferous forest development (FEIS, volume 1, p. 215). Hardwood abundance is difficult to accurately estimate, as hardwood species regularly occur within conifer dominated forest and riparian areas. Within the analysis area there is approximately 1,817 acres (7 percent of the analysis area) where hardwoods are the dominant species (they occupy greater than 60 percent of the stand). There is an additional 2,562 acres of stands where hardwoods are co-dominant (they occupy 40 to 60 percent of the stand). Hardwoods in the project area include cottonwood, quaking aspen, and paper birch. Paper birch is particularly plentiful in the south portion of the project area (in the Cedar Flats vicinity) where it was released from past harvest. Aspen is present in many stands, but is not the dominant species for any notable acreage. Cottonwood is present primarily in riparian or wetland areas where water is more plentiful. See project file exhibit H-2, map 4 for a location of hardwood species.

Persistent grass/forb/shrub

Similar to hardwood types, most grass/forb/shrub dominated communities are transitional, present only in the early successional stages of coniferous forest succession. Seven percent (1,861 acres) of the analysis area is persistent forb/grass/shrub. Most of this form of cover type occurs on developed private land where lands are managed to be non-forest. Outside of private land, persistent grass/forb/shrub land is located on south and west facing slopes and has substantial conifer encroachment. See project file exhibit H-2, map 5 for a location of grass/forb/shrub.

Coniferous forest

Composition

Nearly all stands are composed of more than one tree species in many different proportions. To facilitate the analysis process, forest cover types reflect only the more dominant species or vegetation type within the stand. See project file exhibit H-1 for a description of how these species types are defined and summarized. Table 11 displays the cover types on National Forest System lands within the analysis area. See project file exhibit H-2, map 3 for a map of these cover types.

Table 11. Coniferous forest composition

Dominant species	Acres within each PVT (NFS lands only)[a]			
	Warm-dry	Warm-moist	Cool-moist	Cold
Grand fir (GF)	1	91	-	-
Douglas-fir (DF)	951	2794	1188	120

Dominant species	Acres within each PVT (NFS lands only)[a]			
	Warm-dry	Warm-moist	Cool-moist	Cold
Lodgepole pine (LP)	218	2566	610	5
Intolerant mix (IMIX)[b]	54	1606	840	18
Western larch (WL)	24	1312	440	-
Subalpine fir (AF)	8	237	584	52
Engelmann spruce (ES)	38	160	379	16
Tolerant mix (TMIX)[c]	30	291	410	21
Western red cedar (WRC)	-	55	96	-
Ponderosa pine (PP)	28	34	18	-

a. Acreage is total conifer composition (includes RMZs)
b. IMIX is a mix of DF, LP, WL, WP
c. TMIX is a mix of AF, ES, WRC, GF

Size class

Age and size of trees are closely interconnected; as trees get older they also grow larger in height and diameter. However it is not always a tight correlation. Height is influenced primarily by site and soil productivity, but diameter growth is more strongly affected by stand density and degree of competition for limited water, nutrients, and light. Very old trees (i.e. greater than 170 years old) may be small diameter (i.e. less than 9 inch d.b.h.) if they have been growing in high density stand conditions for much of their life. In contrast, trees may reach large sizes at relatively young ages if they are on productive sites and have low level of competition with other trees for available water, nutrients, and sunlight. Despite this, a general association of size classes and forest successional stages can be made. Seedling and sapling sized trees are in the early successional stage of development. Small and medium tree sizes are in the mid successional stage. The large size trees are usually classified as mid successional however some stands are old enough to be classified late successional. The very large sized tree class are considered late successional. See project file exhibit H-2, map 6 for a display of tree size classes in the project area.

Table 12. Coniferous forest size class

Size class	Acres within each potential vegetation type (NFS lands only)[a]			
	Warm-dry	Warm-moist	Cool-moist	Cold
Seedling and sapling 0-4.9” d.b.h.	19	691	404	35
Small tree 5-9.9” d.b.h.	860	4680	2063	100
Medium tree 10-14.9” d.b.h.	439	3492	1191	79
Large tree 15-19.9” d.b.h.	31	368	584	12
Very large tree ≥20” d.b.h.	6	7	368	6

a. Acreage is total conifer size class, includes area within RMZs

Very large live trees

The very large sized tree class represents the older forest stands. This is the size class that would correlate most closely to old-growth forest. There are only 387 acres of very large trees in the analysis area. See table 12 for acreage within each potential vegetation type.

Forest density

Forest density is a measure of the area occupied by trees. Tree density influences the growth and vigor of individual trees within the stand. Tree canopy cover is used as a means to assess forest density. Tree canopy cover is defined as the percentage of ground covered by a vertical projection of the outermost perimeter of the tree crowns, considering trees of all heights. Forest with canopy covers of less than or equal to 40 percent are considered to have a low density, canopy covers greater than 40 percent have moderate or high density. Table 13 and project file exhibit H-2, map 7 display the forest density in the analysis area.

Table 13. Coniferous forest density

	Acres within each PVT (NFS lands only)[a]			
Tree canopy cover	Warm-dry	Warm-moist	Cool-moist	Cold
10-25% canopy cover	64	557	760	59
26-40% canopy cover	210	1774	962	19
41-59% canopy cover	511	3820	1489	72
>60% canopy cover	571	3052	1365	80

a. Acreage is total conifer density (includes area within RMZ

Old growth

This section summarizes the old growth analysis conducted specifically for the Crystal Cedar Project to provide updated, project level, site specificity. Forest level abundance and trends can be found in the FEIS, volume 1, p. 238.

Table 14. Old-growth forest

	Acres within each PVT (NFS lands only)			
Old growth[a]	Warm-dry	Warm-moist	Cool-moist	Cold
1593	-	592	949	52

a. Acreage is total old growth, includes area within RMZs

Old-growth forest is defined as a community of forest vegetation that is distinguished by sufficient numbers of large, old trees and by stand densities and related structural attributes occurring at levels that meet the definitions established for the Northern Region of the Forest Service in Green et al. (2011). Old-growth forest conditions are not limited just to the stands that are classified as very large tree size class. They also occur in the medium and large forest size class categories. A site-specific analysis was completed evaluating location of old growth at the project scale using field exams, common stand exams, National Agriculture Imagery Program, and Vegetation Mapping Program (see project file exhibit H-5 for description of the analysis process).

An estimated 1,593 acres (6 percent) of the analysis area has been determined to be in an old growth forest condition. The old growth occurs in 15 different patches ranging in size from 9 to

361 acres (with a mean patch size of 106 acres). The majority of this old growth occurs in the northwest corner of the project area outside of the wildland-urban interface. This is expected and preferred because one of the primary old growth attributes, multiple canopy layers, is not a desirable attribute of stands within the wildland-urban interface. See project file exhibit H-2, maps 8 and 9 for a location and patch size of old growth in the project area.

Snags and downed wood

Dead wood, both snags (standing dead trees) and downed woody material, is an important structural component of the forest, contributing to the biodiversity of forest life by being part of the life cycle of many animals, providing habitat for feeding, reproduction, and shelter. Because of the wide variation in snag conditions both spatially and temporally, evaluating and managing for desired snag densities and other conditions, is best considered at a broad scale such as a watershed rather than a small scale such as a specific forest stand (FEIS, volume 1, p. 250). Downed wood is derived directly from snags as well as from live trees or parts of trees that fall due to wind, fire, or other factors. Thus, the variability in abundance, distribution, size and other characteristics of the downed wood component is similar to the analysis scale of snags described above. See table 15 for estimated levels of snag and downed wood in the project area.

Table 15. Estimated levels of snag and downed wood in the project area

Area	Snag and dead/downed wood – estimated abundance[a], existing, and future potential			
Early successional (includes past regeneration harvest units)	3,551 acres	Minimal dead/downed wood and snags, existing or short-term future potential, due to harvest activity, post-harvest slash treatment and young age of current stands. Note: Does not include area adjacent to open roads.		
Non-forest	2,093 acres	Minimal dead/downed wood and snags, existing or future potential, due to lack of canopy cover.		
Within 200 feet of open road	1,575 acres	Minimal dead/downed wood and snags, or future potential, especially larger material and Douglas-fir, western larch, lodgepole pine, due to firewood cutting.		
No public road access and not within past regeneration harvest areas	20,100 acres	Late successional	1,696 acres	Moderate to high amount of snags/dead downed wood of all sizes, existing and potential, particularly larger diameter material (>12” diameter) and Douglas-fir, western larch, and western white pine.
		Mid successional >80 years old	14,776 acres	Low to moderate amount of snags/dead downed wood, primarily smaller size (<12” diameter). Increasing abundance over time. Note: Includes hardwoods
		Mature lodgepole pine stands	3,628 acres	Moderate to high amount of snags/dead downed wood, existing and into the future, due to past and continuing mountain pine beetle mortality. Localized areas of very heavy concentrations. Mostly smaller sizes, <10” diameter.

a. Numeric values associated with the qualitative terms for snag abundance: Minimal = less than 1 snag per acre; low = 1-3 snags per acre; moderate = 4-8 snags per acre; high = greater than 8 snags per acre

The vast majority of the stands in the Crystal Cedar project area have low to moderate snags and downed wood densities. Lower snags levels are expected due to the incidence of past harvest within the project area. See project file exhibit H-2 map 11 for the location of past harvest. Lower

downed wood levels are also expected and preferred because the project occurs primarily in the wildland-urban interface where low fuel loading is desirable.

Landscape pattern and connectivity

The spatial pattern of forest conditions across the landscape can affect ecological processes, including wildlife and plant habitat and dispersal and disturbance risk, spread, and size. Forest patterns are influenced by a number of factors, including physical site conditions, forest characteristics, and disturbance (FEIS, volume 1, p. 272).

See project file exhibit H-10 for a map of the landscape pattern in the Crystal Cedar project area. The largest patch sizes in the project area are in the mid seral size classes. This is the result of the majority of the project area being burned in the Half Moon Fire of 1929 (see project file exhibit J-2 for the location of historical fires). The largest patch occurs in the unmanaged, previously burned (in 1929) stands on Teakettle Mountain. The large diameter patches all occur outside of the 1929 burn perimeter in the northwest portion of the project area where fire has not burned in recorded history. The smallest patches of all sizes, occur in the developed areas (private) and along road systems where there is recent past management.

Table 16. Patch sizes within the analysis area

Coniferous size class	Count	Minimum (acres)	Maximum (acres)	Mean (acres)
0-4.9” d.b.h.	88	5	304	27
5-9.9” d.b.h.	102	5	3814	121
10-14.9” d.b.h.	122	5	2082	58
15-19.9” d.b.h.	26	5	286	55
≥20” d.b.h.	6	8	163	65
Non-coniferous forest class	**Count**	**Minimum (acres)**	**Maximum (acres)**	**Mean (acres)**
Non-forest	111	5	75	16
Deciduous forest	80	5	185	23

Alternatives

No-action alternative

Direct, indirect, and cumulative effects

Vegetation objectives would not be met with the no-action alternative.

Since there would be no treatments that alter forest conditions, the no-action alternative would not add cumulatively to the changes in forest type, size class, or forest density. Forest successional processes would continue without human interference. Fire would be allowed to play its historical role as a primary agent of change in this forest landscape – altering forest age, size classes, densities, species mixes, or removing diseased trees and enabling the forest to “start over.”

Coniferous forest

Size class

There would not be improved forest growth and subsequently no accelerated increase in tree sizes. Forests would continue to develop under their natural trajectory. In all stands, increasing tree density would increase competition among individual trees for light and moisture. Increasing stand densities would continue to cause stress and mortality in affected species. Increasing mortality would add to the current snag and downed woody material, which would benefit some wildlife species but would also increase the expected severity of a fire should it occur in the future.

The cumulative effect would be a reduction in growth rates and tree and stand vigor over time. Under the high densities that will exist in these stands, tree crowns would diminish in size, reducing the growth rate of the tree and its capacity to respond to thinning treatments that might occur in the future. Reduced growth of trees would result in higher mortality and smaller tree sizes in the future forest.

Composition

Species diversity would not be altered with the no-action alternative. There would be no opportunity to increase the percentage of western larch, western white pine, or hardwoods. In the western white pine stands, pine would continue to decrease in proportion as it dies from white pine blister rust and mountain pine beetle, and subalpine fir/spruce would increase as it responds to the increased growing space with elimination of the pine (see project file exhibit H-13 for more information on white pine blister rust and its effect on western white pine). Other species, such as western larch, would be unable to establish on these sites. Lack of thinning in the young western white pine planted stands would result in the improved western white pine being overtopped and crowded by the naturally regenerating shade tolerant species, reducing their growth and vigor.

Forest density

With the absence of management or wildfire, forest density within the project area would remain high. The majority of the project area would continue to have crown canopies greater than 40 percent. Those stands with less than or equal to 40 percent would continue to grow increasing their canopy density over time. Cumulatively, the project area would have increasing forest density over time with associated increasing high fuel hazard.

Persistent grass/forb/shrub

With the no-action alternative the proportion of persistent grass/forb/shrub cover type would decline over time due to succession. Conifers would continue to encroach within non-forested areas and shade out the understory. Shrub condition in non-forest areas would decline, as would the associated quality of forage. Shrubs within general forest would not be slashed and would remain in poor condition, above browse height, or grow above browse height over time.

Hardwoods

Because hardwood species are relatively shade intolerant, they grow best in openings. With the no-action alternative, conifers would shade-out the hardwoods as they compete for resources. Without the disturbance of vegetation treatment, the hardwoods would stagnate and possibly succumb to disease and/or they would not be able to establish on new sites and increase in abundance.

Riparian

Species composition, size class, and density would remain unaltered in the riparian areas. Effects of the no-action alternative would be the same for riparian areas as is described in coniferous forest effects above.

Old growth and very large live trees

No old growth or late successional forest would be harvested, nor would stands adjacent to old growth. Existing conditions for these components, as described under the existing condition section, would not be changed. There would be no harvest related blow down within the old growth edge.

In some of these forests, death of the larger overstory trees to disease or insects would continue at increasing rates. This would add to the snag and large downed woody components in the stand which could improve the late successional or old growth values for associated wildlife species. In most of the stands currently classified as late successional or old-growth forest, as the existing larger diameter overstory trees die, there are fewer trees that would be able to replace them. Over time this would reduce the amount and quality of old growth and late successional forests in the project area. Mid seral forests would continue to progress towards large tree size, but at a decreased rate than with intermediate harvest; due to competition these stands may never achieve a large or very large size class. It is likely late successional forests would decline in old growth value as they lose the old overstory trees to disease or insects and have no potential replacement trees. Stands currently at high densities, particularly the sapling stands, would have a small chance of ever developing the necessary tree sizes and complex stand structures of an old-growth stand.

Snags and downed wood

Large, live, overstory trees would remain at their current densities, with risk of loss limited to wildfire, insect or disease factors but not harvest activities. Also with the no-action alternative, increasing numbers of snags of all sizes would occur as trees succumb to insect and disease. With this mortality, abundant downed woody material would also exist. Firewood cutting would continue along open roads, keeping snags and downed wood density lower in these areas.

Landscape pattern and forested connectivity

With no vegetation treatments, existing stand and landscape structural diversity would remain. Patch size and density would be unaltered. No increase in the proportion of young seedling or sapling stands would occur (assuming no wildfires occur), which would cause no further fragmentation of this landscape.

The growth of the young stands into a mid-successional stage would increase the size of these mid successional forest patches. High levels of mortality in many stands would increase within-stand structural diversity. However, these changes come at the cost of a landscape increasingly vulnerable to large-scale and high-intensity wildfire, and increasing loss of trees to insect and disease. Stressed trees would also be less resilient in the face of drought and other unforeseen weather and climate changes in the local area.

Proposed action

Direct and indirect effects

Riparian

Treatment within the riparian management zone will promote desired conditions that maintain or improve ecosystem integrity and promote resilience of vegetation. In many areas, diverse structure in riparian management zones is promoted through natural ecosystem processes such as wildfire, insects, or disease. In the Crystal Cedar project area however, which lies mostly within the wildland-urban interface, fire and other natural processes are not likely to occur or be encouraged. In lieu of natural disturbance, vegetation management activities will be used to meet desired conditions. These treatments address not only stand-level conditions but also landscape-level desired conditions, by adding to a pattern of forest conditions and structures across the broader landscape that contribute to altering potential future fire behavior and increasing the diversity of forest age classes, species composition, and forest density.

Regeneration harvest in the riparian management zone is prescribed to alter species composition. In regeneration units the species composition is either exclusively one species (lodgepole pine) or is a mix of species considered undesirable (subalpine fir, grand fir, or Engelmann spruce). Following harvest, regeneration units will be planted or regenerate naturally with long-lived fire tolerant species (western larch, western white pine, and Douglas-fir). These species will create large, high-quality snags in the future that will eventually contribute to downed woody material.

Intermediate treatments in the riparian management zone are prescribed to alter tree size. In intermediate treatment units, trees are dense and slow growing. Without treatment, growth will slow, and stands would stagnate, with diameters staying small. With thinning there will be an increase in growing space, allowing trees more access to water, light, and nutrients. Trees in intermediate treatment units would grow faster than untreated units and have a higher likelihood of increasing to very large trees size. Very large trees are desirable in the riparian management zone for wildlife habitat and future contribution to snag and downed wood material.

It is also desirable to reduce fuels in the riparian management zone. In the event of a wildfire, the riparian management zone vegetation would have a higher likelihood of surviving if forest density was altered. In both regeneration and intermediate treatment, forest density would be reduced. Treated stands are of moderate and high density currently (greater than 40 percent canopy cover), but would be converted to very low to low density forest (less than or equal to 40 percent canopy cover).

Table 17 displays total acres of treatment within riparian management zones by prescription.

Table 17. Acres of potential treatment within riparian management zones by prescription

	Prescription	Outer RMZ treatment acres	Potential treatment acres in RMZ
Intermediate treatment	Birch cutting	82	288
	Commercial thin	147	
	Sapling thin	34	
	Understory removal	25	
Regeneration treatment	Clearcut	7	35
	Seed tree	27	
	Shelterwood	1	
Prescribed fire	Broadcast burn	8	8
		Inner RMZ treatment acres	
Intermediate treatment	Sapling thin	6	6

Hardwoods

Firewood birch cutting may temporarily reduce percentage of birch in some areas, however it will only be along open roads. Smaller diameter birch (stems less than 4 inches d.b.h.) would not likely be cut. Leaving these hardwood saplings will increase their abundance over time as they have more available growing space. Also, where birch are removed, new trees will sprout from the stumps. Overall abundance of birch would not change with firewood cutting, however the presence of birch would change to a younger age class.

No hardwood trees would be targeted for removal with commercial harvest, sapling thinning, understory removal, or prescribed burning. This would at a minimum maintain the abundance of hardwoods within the project area. Harvest, however, would have some incidence of non-targeted removal (yarding and skid trails, for example). This impact would stimulate sprouting and subsequently improve the abundance and quality of hardwoods. Because hardwoods are considered a shade intolerant, shorter-lived species, increased light and/or younger age classes are necessary to encourage growth. Without increased growing space, the hardwoods would be outcompeted over time by the conifers within the stand.

At least two units (68 and 122) will transition from conifer dominance to an aspen dominated stand. This would increase overall hardwood dominance by 71 acres. Aspen is a type of species that needs fire for its continued well-being on most sites. For that reason, management in aspen stands in this project area is important due to the absence of fire in the wildland-urban interface. Fire, if it functioned naturally in aspen stands, would reduce the overstory, stimulate the shoots to sprout, and kill the invading conifers, thus perpetuating aspens presence. Without fire or management in these aspen stands, aspen would be outcompeted by conifers and slowly die out of the ecosystem.

Harvest stands where birch is present, particularly in the Cedar Flats area, will have an increased proportion of birch as some of the conifers are removed. Birch is highly responsive to removal of conifers and will respond with an increase in vigor and dominance. Cottonwoods would not be cut.

Persistent grass/forb/shrub

Current density of grass/forbs/shrubs will be maintained or slightly increased by the use of fire to eliminate conifer encroachment. Applying fire to the burn units dominated by grass/forbs/shrub, will increase the quality of forage as plants respond to the stimulation/regrowth after fire.

Shrubs are plentiful throughout the project area. Due to lack of fire on most of the landscape (since 1929), these shrubs are decadent, tall, and material that would be edible for big game species is above browse height. Slashing is prescribed in many units (project file exhibit H-14) to rejuvenate these shrubs. Commercial harvest in these areas will further promote shrub development as removal of conifers will allow more available resources for shrub/grass/forb growth.

Coniferous forest

Table 18. Change in species composition

		Unit acreage		
Vegetation objective	**Indicator**	**Before treatment presence**	**Short-term presence[a]**	**Long-term presence[b]**
Increase in the percent area of western larch dominance type	% of western larch	291	1162	1162
Increase in the percent area of western white pine dominance type	% western white pine	0	175	175

a. Short-term presence is displayed as post-treatment condition.

b. Long-term presence is displayed at 50 years into the future.

Composition

Composition in all treated stands would be altered and improved with the proposed action. In the thinned stands (sapling and commercial) this will be accomplished by favoring the preferred species for leave at the time of treatment. Preferable species include ponderosa pine, western white pine, western larch, and Douglas-fir. These species are preferred because they are fire tolerant and longer lived. When these trees eventually die they would persist on the landscape longer as quality snags and downed woody materials.

In the regeneration harvest units, planting or natural regeneration will be used to achieve desired species. In stands suitable for the growth of western white pine (moist potential vegetation types) improved western white pine will be planted. Western larch may also be planted in these stands. Where lodgepole pine currently dominates, western larch will be planted to increase species diversity. Some units have adequate seed trees of western larch and Douglas-fir species, so planting is not necessary. See project file exhibit H-3 for a selection of modeling results.

Size classes

Tree size would not be immediately impacted by treatment, so for the short term, size class presence would remain relatively similar to the existing condition. In the long term however, due to increased growing space, trees and stands will grow into the next size class. It is anticipated all stands will increase in one size class within the 50 year analysis period. See project file exhibit H-3 for a selection of modeling results.

Regenerated stands would be seedlings post treatment, however with 50 years of growth they would become small sized trees (5-9.9" d.b.h.). If these stands received a sapling thinning in 20 years after harvest, they would increase in size at an even quicker rate.

The medium size class will increase as trees grow out of smaller classes with increased growing space from the commercial thinning. Very large size class would not immediately increase but would over time as trees grew. Treatment would put the stands on a trajectory to grow into the very large size class within 100 years of harvest.

In the understory removal units the ingrowth (seedlings and saplings) would be slashed. This would remove the undesirable shade tolerant species, reducing competition for the desirable overstory. With less understory competition the overstory will be free to grow eventually becoming large or very large trees faster.

Thinning at a young age reduces competitive pressure for limited light, nutrients, and water. The sapling thinning allows the trees to develop healthy full crowns, maintain vigorous growth rates, and eventually produce large trees faster than without treatment. Sapling thinning would increase these stand sizes from saplings or small trees to small or medium size classes in the long term.

Table 19. Change in size class

Vegetation objective	Indicator	Before treatment presence	Short-term presence[a]	Long-term presence[b]
Decrease in percent area of small and medium forest size classes	% of small size classes	2335	1979	1027
	% of medium size classes	796	444	1968
Increase in percent area of large and very large forest size classes	% of large/very large size classes	0	0	444

a. Short-term presence is displayed as post-treatment condition.

b. Long-term presence is displayed at 50 years into the future.

Forest density and canopy cover

Forest density would be greatly reduced, particularly in the wildland-urban interface where it is desired for fuels reduction. The reduction in density allows remaining trees more available growing space, improving their access to light, water, and nutrients. This increase in vigor would produce larger trees faster than in the no-action alternative. The reduction in density would be most effective for 15-20 years, but the benefit of lower density forests would last for decades. This condition will not persist because over time, forests will grow and regenerate. In order to maintain lower tree densities particularly in the small trees sizes, future treatments would be needed. In 15-20 years thinned stands would need to be slashed again to maintain lower small tree densities. In regenerated stands, a pre-commercial thinning would need to occur in approximately twenty years to decrease those tree densities. This long-term maintenance is not part of the proposed action and would have to be analyzed as a separate future action.

Table 20. Change in forest density

Vegetation objective	Indicator	Canopy cover percent	Before treatment presence	Short-term presence	Long-term presence
Reduce moderate and high density forest conditions with focus in the wildland-urban interface.	Canopy cover percent	Shrubs	0	157	157
		10-25%	339	576	45
		25-40%	632	2863	3395
		41-59%	1928	0	0
		≥60%	698	0	0

Old growth and very large live tree

No old growth would be treated with the proposed action, however there is old growth adjacent to proposed vegetation treatment units. Two regeneration units (65 and 101) are directly adjacent to old-growth forest. See project file exhibit H-4 for old growth edge effect discussion. In these stands blowdown risk within the old-growth stand edge is increased. It is not likely that blowdown associated with harvest will change the character, quality, or characterization of the old-growth stand(s).

In addition to old growth adjacent to units 65 and 101, regeneration units 36, 70, and 73 are within 300 feet of an old-growth stand. In these five units all live trees greater than 17 inches d.b.h. of western larch, western white pine, and Douglas-fir would be left. Additionally, all large downed wood greater than 9 inches diameter and snags greater than 15 inches d.b.h. would be left. Retaining these structural and composition components would promote the development of old-growth forest in the future in these treated stands (FW-GDL-TE&V-06). See project file exhibit H-2, map 8 for the location of old growth and adjacent units.

The commercial thin units have the highest likelihood of developing into large and very large sized trees. The increase in growing space will increase the pace at which these stands would grow. It is not the objective of this project to increase the percentage of old growth (as defined by Green et al.) in the majority of the project area. This is because the majority of the project area is within the wildland-urban interface. In the wildland-urban interface it is desired to limit ladder fuels, or the small tree component (seedlings, saplings, and small trees), whereas multiple canopy layers is a desired old growth trait. Although thinned stands will not be defined as old growth, they will have a substantial very large live tree component in the future that will be beneficial for some wildlife species.

Snags and downed wood

The highest quality snags and downed wood are those that are largest in size and of a long lasting species such as western larch, western white pine, or Douglas-fir. Because the proposed action both increases trees sizes and increases presence of western larch and western white pine, snags and downed wood abundance and condition would be improved (FW-DC-TE&V-15 and GA-NF-STD-01).

After regeneration harvest, those stands would be planted or naturally regenerated to western larch or western white pine. In time, those stands would be dominated by those species.

Over time, thinned stands would create larger trees at an increased rate due to increasing growing space. These trees will grow and die over time providing higher quality snags into the future. As they die, downed woody debris increase.

The desired condition for downed woody debris is different within the wildland-urban interface than outside. In the wildland-urban interface fires would not be allowed to burn so forest fuels would not be regulated naturally. Because of the desire to have low fuel loading, lower downed wood densities are needed. Through yarding and piling of downed material lower fuel loading would be maintained in the wildland-urban interface portion of the project area.

Landscape pattern and forest connectivity

In the short term the number and patch size of seedling and sapling trees increases. This is expected due to the regeneration harvest. As those trees regenerate, in the long term (in the absence of fire), the seedling and sapling class will grow increasing the number and maximum patch size of the small tree class.

All other size classes have an increase in number of patches and maximum patch size, as smaller class sizes grow into bigger classes.

When the existing condition is compared to the long-term effects of treatment the very large size class patch size is static. This is because it takes time for trees to grow. With more time (about100 years) and growth, trees in treated units would mature from the 15-19.9 inches d.b.h. size class to the very large size class. This would increase the number of very large tree patches. The large class patch size increases in number of patches and maximum size of patch but the mean is slightly decreased. Medium tree class does not increase in count, but it does increase in mean patch size which is what we would like to see; bigger patches are desired rather than more patches. Seedling and sapling size class is reduced in both count and mean, but the maximum patch size is increased.

Table 21. Comparison of number and size of patches

	Coniferous size class	Number of patches	Minimum (acres)	Maximum (acres)	Mean (acres)
Existing condition	0-4.9” d.b.h.	88	5	304	27
Short term		90	5	530	33
Long term		77	5	388	26
Existing condition	5-9.9” d.b.h.	102	5	3814	121
Short term		91	5	3919	134
Long term		107	5	4786	105
Existing condition	10-14.9” d.b.h.	122	5	2082	58
Short term		108	5	2097	63
Long term		102	5	2311	81
Existing condition	15-19.9” d.b.h.	26	5	286	55
Short term		26	5	286	55
Long term		39	5	376	48
Existing condition	greater than 20” d.b.h.	6	8	163	65
Short term		6	8	163	65
Long term		6	8	163	65

	Non-coniferous forest class	Number of patches	Minimum (acres)	Maximum (acres)	Mean (acres)
Existing condition	Non-forest	111	5	75	16
Short term		104	5	111	18
Long term		104	5	111	18
Existing condition	Deciduous forest	80	5	185	23
Short term		69	5	251	24
Long term		69	5	251	24

Temporary road construction would occur with the proposed action. Temporary roads on existing (historical) templates result in essentially no new change to the existing forest vegetation (the change occurred in the past, when the road was originally built). The main effect would be the removal of shrubs, small trees and other vegetation that may be growing within the road template, with little to no additional disturbance of soils and adjacent vegetation. Temporary roads that are newly constructed as part of the proposed action would result in removal of existing trees and other forest vegetation, and disturbance of soil surface layers and plant roots within the road template. This would be a temporary impact, and these roads would be rehabilitated after use, restoring the natural contour of the land and allowing native vegetation to re-establish.

Cumulative effects

The proposed action would add cumulatively to the change in forest species type, size, and forest density, from past harvesting and thinning actions within the analysis area. Regeneration harvest would convert mature forest stands currently in a mid or late successional stage of development into an early successional young forest dominated by seedlings, as well as alter forest species compositions. Thinning would lower tree densities and in some stands change species compositions, but have relatively little immediate impact on forest size or successional and structural stage.

The proposed action moves the Crystal Cedar landscape more towards the desired condition, which is where stands are more diverse and resilient in the face of inevitable future change. There will be an increase in the western white pine and western larch species types and overcrowding will be reduced. Improvement in stand growth, and subsequent short- and long-term stand health and vigor, would occur.

Under the proposed action, wildfire in this landscape would not likely be allowed to burn naturally. The treatments proposed are designed to address the exclusion of fire, by reducing fuels mechanically. The changed stand conditions that would result from the treatments would improve the ability of the stands to survive future disturbances, such as insects and disease or wildfire should one occur.

The proposed activities would have some cumulative impact on the amount of snags and dead and downed woody material on this landscape. This impact would be a small increase in quantity and quality of snags in the long term. No roads are proposed to be re-opened, so there would be no increased removal of snags to firewood cutting.

In all regeneration harvest units, the live (and dead) leave trees are not planned for removal in any future entry and thus would remain on the site indefinitely. They would increase the structural diversity in the stand and across the landscape over the long term. They would provide a

continuous source of seed for potential regeneration of a new generation of trees now and in future years. They would continue to grow, persisting in the stand, with many potentially becoming large, old legacy trees themselves. Eventually they would die and become large snags and ultimately large downed wood. At all these stages, they provide a number of benefits to the ecosystem and resources, such as habitat for wildlife, contributions to soil productivity, and attractive visual appearance.

Forest products gathering is expected to continue in the project area at current levels. This includes firewood cutting, as well as Christmas trees, boughs, post and pole and other miscellaneous material. Firewood cutting will continue to limit snags and downed woody material along open roads, and would generally be limited to areas within 200 feet of open roads. Christmas tree and bough harvesting will continue to thin young forests adjacent to open roads

Effects to Wildlife Species

Introduction

The coarse-filter/fine-filter approach of the 2012 planning rule and the forest plan maintains the natural diversity of species, ecosystems, and ecosystem processes and thus provides for most of the conditions needed for wildlife species on the Flathead National Forest (see the overview of the project area and background section of this environmental assessment for an explanation of the coarse-filter/fine-filter analysis approach). Most of the potential effects of the proposed action on wildlife species are addressed in the analyses for terrestrial and aquatic ecosystems and their key characteristics and their needs are met through this project's consistency with all forest plan components for those habitats (project file exhibits R-1 and G-1). Also see FEIS appendix 6, including table 6-3 which lists habitat associates and status for wildlife species on the Flathead National Forest (USDA 2018a).

This species-specific section of the wildlife analysis is focused on threatened and proposed wildlife species and other species that may be affected by the Crystal Cedar proposed action and that have desired conditions, standards, or guidelines in the forest plan that are relevant to the proposed project. Wildlife species are not included in the environmental assessment if the species or its habitat would not be affected by proposed project activities (see project file folder G for more information).

Canada Lynx (Threatened Species)

Summary of Findings

The Crystal Cedar project area lies entirely within the Teakettle lynx analysis unit (LAU). Only 26 percent of this LAU is mapped as Canada lynx habitat. Most of the Teakettle LAU is located within the wildland-urban interface, as are most of the proposed vegetation management activities, except units 27, 70, 70a, 228. Existing lynx feeding habitat would not be affected by vegetation management included in the proposed action, therefore no exception acres would be used to complete proposed activities. Proposed vegetation treatment would convert 153 acres of "other" habitat (potential denning habitat) to the early stand initiation structural stage. The proposed action would retain a mosaic of forest habitats for lynx to travel and forage throughout lynx habitat in the Teakettle LAU. Vegetation management, road construction, trail and trailhead construction, and associated activities could disturb or displace Canada lynx during

implementation. Consultation with the U.S. Fish and Wildlife Service for Canada lynx will be completed on proposed activities before the decision is finalized for the Crystal Cedar Project.

Methodology

Analysis area

The analysis area for effects on Canada lynx is the Teakettle LAU (project file exhibit G-3). The Crystal Cedar project area lies entirely within the Teakettle LAU. Lynx analysis units are large enough to include the home ranges of one female lynx and numerous snowshoe hares, and to represent the effects of timber harvest, fuel reduction, road and trail construction, and firewood cutting across the landscape. As described in the Lynx Conservation Assessment and Strategy, LAUs may also contain areas of non-habitat such as dry forest or open meadows, especially in mountainous regions (ILBT 2013). The forest plan FEIS, biological assessment (project file exhibit R-6), and biological opinion (project file exhibit R-7) include information about LAUs across the landscape at multiple scales.

The length of time for the proposed activities associated with the Crystal Cedar Project is approximately five years. This is based on the probable contract length for the proposed project, and the timeframes for related activities. The temporal scale of the effects analysis extends 100 years into the future, enough time for dense forest conditions and mature multistory stands to develop and for some trees to die or fall to create denning habitat.

Indicators

To evaluate compliance with forest plan vegetation standards and guidelines for Canada lynx (USDA 2018b, appendix A), the following indicators were used:

- Acres of potential Canada lynx habitat by structural stage affected by vegetation management
- Length of road and trail construction through potential Canada lynx habitat

Data sources

Habitat data were collected during walk-through surveys of the project area (project file exhibit G-2). These data were used along with the project vegetation layer (see terrestrial ecosystems and vegetation section of this environmental assessment and project file exhibit H-1) to characterize potential lynx habitat in the Teakettle LAU. In order to compare alternatives and assess compliance with vegetation standards VEGS1, VEGS2, VEGS5, and VEGS6, lynx habitat in the Teakettle LAU was classified based upon structural definitions in the forest plan (USDA 2018b, appendix A). These vegetation standards apply to lynx habitat identified in the forest plan and FEIS. Recent science by Holbrook et al. (2018; 2017; 2016), Kosterman et al. (2018), and Vanbianchi (2017) was considered in the analysis of effects on Canada lynx for the Crystal Cedar Project (project file exhibit G-5).

Alternatives

Most of the habitat needs of the Canada lynx are ensured through consistency with coarse-filter forest plan components for terrestrial ecosystem and vegetation and riparian management zones (project file exhibits R-1 and G-1). Several desired conditions, standards, and guidelines in the forest plan are relevant to Canada lynx in the project area. Through standard FW-STD-WL-04, the Northern Rockies Lynx Management Direction (NRLMD), as modified by the final record of

decision for the forest plan, was incorporated into the forest plan. The forest plan incorporates standards and guidelines as well as desired conditions. For example, desired condition FW-DC-TE&V-08 describes cool-moist and cold coniferous conditions that contribute to lynx habitat. Other desired conditions for Canada lynx habitat include FW-DC-TE&V-12, which describes forest vegetation conditions that maintain or increase the density and distribution of very large live trees across the landscape. FW-DC-TE&V-13 describes a range of forest densities in a diverse pattern across the landscape providing cover and foraging conditions for wildlife. Desired condition FW-DC-TE&V-17 describes downed wood across the matrix of forested lands, contributing to forest structural diversity and habitat. FW-DC-TE&V-19 describes forest patterns which contribute to connectivity of habitat for movement within and between home ranges, and dispersal between populations and FW-DC-RMZ-06 describes cover conditions in riparian management zones that contribute to habitat connectivity for a variety of wildlife species including Canada lynx.

No-action alternative

Direct, indirect, and cumulative effects

The habitat needs of Canada lynx (*Lynx canadensis*) and Canada lynx population information are detailed in the forest plan FEIS. The no-action alternative provides a baseline for comparison of effects from the proposed action. The effects of the no-action alternative represent potential natural changes over time. Table 22 displays the current situation of potential habitat for lynx in the Teakettle LAU (project file exhibit G-3). Denning habitat is well distributed throughout lynx habitat in the LAU and most areas of denning habitat have feeding habitat nearby and most are moist types that are likely to support alternate prey, such as red squirrels.

Table 22. Estimated existing condition of potential lynx habitat by structural stage in the affected lynx analysis unit (project file exhibit G-3)

Lynx analysis unit	Total acres	Lynx habitat acres (% of total)	Early stand initiation[a] acres (% of lynx habitat)	Stand initiation[b] acres (% of lynx habitat)	Multistory[c] acres (% of lynx habitat)	Other[d] acres (% of lynx habitat)	Percent regenerated in 10 years
Teakettle	31,177	8,132 (26.1%)	510 (6.3%)	739 (9.1%)	1,879 (23.1%)	5,005 (61.5%)	0

a. Stand initiation structural stage where trees have not grown tall enough to protrude above the snow in winter.

b. Stand initiation structural stage that currently provides winter snowshoe hare habitat.

c. Multistory structural stage with many age classes and vegetation layers that provide snowshoe hare habitat.

d. Other (stem exclusion) structural stage with closed canopy and limited understory; does not provide snowshoe hare habitat.

No additional actions, such as timber harvest, fuel reduction, prescribed burns, road construction, or trail construction are proposed with this alternative. The no-action alternative would maintain higher tree densities in the cool moist potential vegetation type, providing cover and foraging conditions for Canada lynx. Continued forest succession would result in denser stands comprised of more shade-tolerant tree species. The availability of denning and hiding sites would gradually increase, as would habitat used by numerous species preyed on by Canada lynx. In lieu of wildland fire or other stand-replacing disturbance, feeding habitat would gradually increase and then diminish in quality and quantity. The fuel loading in many stands would increase the chance

of large stand replacing wildland fires in adjacent areas, which could have mixed results for lynx habitat. Stand-replacement disturbances are more likely to occur under this alternative, which would have the greatest and longest negative effect on potential denning habitat.

Currently, approximately six percent of lynx habitat in the Teakettle LAU is in the early stand initiation structural stage, and therefore the LAU does not exceed the VEGS1 standard of 30 percent (FW-STD-WL-04). Stands in this stage only provide summer forage for lynx (because vegetation is too short to protrude above the snow in winter), but would be expected to continue to grow, becoming good winter hare habitat (i.e. stand initiation) in approximately 20 years. Nine percent of lynx habitat in the Teakettle LAU is estimated to provide stand initiation winter hare feeding habitat. Twenty-three percent of lynx habitat is estimated to provide multistoried mature feeding habitat for lynx. There would be no direct effects to lynx as a result of implementing this alternative; there would be no change in the amount or quality of multistory mature or stand initiation forage habitat or cover due to timber harvest.

Current forest patterns contribute to connectivity of habitat for lynx movement within and between home ranges, and dispersal between populations (FW-DC-TE&V-19). Current cover conditions in riparian management zones also contribute to habitat connectivity for lynx (FW-DC-RMZ-06). The Haskill Basin connectivity area provides habitat connectivity for wide-ranging species moving north-south between the Swan and Whitefish Ranges (GA-NF-DC-06).

Proposed action

Direct and indirect effects

Vegetation management included in the proposed action would affect 508 acres of mapped Canada lynx habitat in the "other" structural stage, which does not provide snowshoe hare habitat. Most of the lynx habitat that would be affected by proposed vegetation management is located within the wildland-urban interface, with only 99 acres of "other" lynx habitat proposed for treatment outside the wildland-urban interface. No lynx feeding habitat is proposed for treatment. A summary of the estimated changes to lynx habitat due to vegetation management is displayed in table 23. The proposed action would increase early stand initiation lynx habitat by approximately 153 acres due to regeneration treatment of "other" lynx habitat, which does not currently have a dense understory providing hare habitat. The intermediate treatment of 355 acres of "other" habitat would not alter the structural stage of lynx habitat. No vegetation management is proposed in multistory lynx habitat.

Table 23. Summary of estimated changes to potential lynx habitat by structural stage through proposed vegetation management in the affected lynx analysis unit, shown in increases and decreases in acres (project file exhibit G-4)

Lynx analysis unit	Early stand initiation[a] acres	Stand initiation[b] acres	Multistory[c] acres	Other[d] acres
Teakettle	+153	0	0	-153

a. Stand initiation structural stage where trees have not grown tall enough to protrude above the snow in winter.

b. Stand initiation structural stage that currently provides winter snowshoe hare habitat.

c. Multistory structural stage with many age classes and vegetation layers that provide snowshoe hare habitat.

d. Other (stem exclusion) structural stage with closed canopy and limited understory; does not provide snowshoe hare habitat.

The proposed action complies with standard VEGS1 because the amount of early stand initiation hare habitat would not exceed 30 percent. The proposed action also complies with standard VEGS2 because regeneration treatments would not occur on more than 15 percent of lynx habitat on National Forest System lands within the Teakettle LAU in a ten-year period (FW-STD-WL-04). Only 14 percent of the vegetation management in the proposed action would occur in stands identified as some type of lynx habitat (project file exhibit G-4). Table 24 shows the estimated post-project condition of potential lynx habitat in the affected LAU.

Vegetation management included in the proposed action would reduce forest densities on a total of 508 acres of lynx habitat, with 257 acres of this occurring in the cool-moist potential vegetation type. These effects would be short term and densities may increase over the long term due to reduced canopy cover (FW-DC-TE&V-13). It would take approximately 20 years for this long-term effect. The loss of potential denning habitat would be partially balanced in that the removal of fuels would reduce the probability of fire spreading to remaining denning habitat of higher quality.

Table 24. Estimated post-project condition of potential lynx habitat by structural stage in the affected lynx analysis unit, in acres and percent of lynx habitat (project file exhibit G-4)

Lynx analysis unit	Total acres	Lynx habitat acres (% of total)	Early stand initiation[a] acres (% of lynx habitat)	Stand initiation[b] acres (% of lynx habitat)	Multistory[c] acres (% of lynx habitat)	Other[d] acres (% of lynx habitat)	Percent regenerated in 10 years
Teakettle	31,177	8,132 (26.1%)	663 (8.2%)	739 (9.1%)	1,879 (23.1%)	4,852 (59.7%)	1.6%

a. Stand initiation structural stage where trees have not grown tall enough to protrude above the snow in winter.

b. Stand initiation structural stage that currently provides winter snowshoe hare habitat.

c. Multistory structural stage with many age classes and vegetation layers that provide snowshoe hare habitat.

d. Other (stem exclusion) structural stage with closed canopy and limited understory; does not provide snowshoe hare habitat.

Road construction and use would have effects on lynx and lynx habitat in the Teakettle LAU (table 25). In the proposed action, most of the proposed road construction (6.48 miles) would pass through areas of non-habitat for lynx (project file exhibit G-4). Temporary roads would be rehabilitated following completion of project activities. New system roads would have year-long closures with gates. All new roads and restricted roads used for project activities would be closed to motorized public access during and after implementation of the project. Canada lynx could be disturbed or displaced by proposed road construction and new system roads could facilitate non-motorized access for trapping of other furbearer species.

Table 25. Estimated length of roads proposed for construction through potential lynx habitat by structural stage in the Teakettle LAU, shown in miles (project file exhibit G-4)

Type of road	Template	Other[a]	Non-habitat
Temporary	Existing	0.74	3.98
Temporary	New	0.30	1.41
System	New	0	1.09

a. Other (stem exclusion) structural stage with closed canopy and limited understory; does not provide snowshoe hare habitat.

Trail construction and use would also have effects on lynx and lynx habitat (table 26). In the proposed action, most of the proposed trail construction (19.24 miles) would pass through areas of non-habitat for lynx (project file exhibit G-4). Trail construction would affect vegetation in the direct vicinity of the trail but would not change the overall function of the habitat patch. Canada lynx could be disturbed or displaced by trail construction activities. Under the proposed action, two trailheads would be constructed in the project area, however, these would be located outside of mapped lynx habitat.

Forest patterns will continue to contribute to connectivity of habitat for lynx movement within and between home ranges, and dispersal between populations (FW-DC-TE&V-19) and cover conditions in riparian management zones would continue to contribute to habitat connectivity for lynx (FW-DC-RMZ-06). Forested cover would not be severed by proposed vegetation treatments and the Haskill Basin connectivity area would continue to provide habitat connectivity for wide-ranging species moving north-south between the Swan and Whitefish Ranges (GA-NF-DC-06).

Table 26. Estimated length of trails proposed for construction through potential lynx habitat by structural stage in the Teakettle LAU, shown in miles (project file exhibit G-4)

Managed use	Early stand initiation[a]	Stand initiation[b]	Multistory[c]	Other[d]	Non-habitat
Nonmotorized	0.10	0.76	1.51	3.65	18.81
Motorized	0	0	0	0	0.43

a. Stand initiation structural stage where trees have not grown tall enough to protrude above the snow in winter.

b. Stand initiation structural stage that currently provides winter snowshoe hare habitat.

c. Multistory structural stage with many age classes and vegetation layers that provide snowshoe hare habitat.

d. Other (stem exclusion) structural stage with closed canopy and limited understory; does not provide snowshoe hare habitat.

Indirectly, winter logging, snow plowing, and use and grooming of access roads may facilitate movement of competitors that prey on snowshoe hares (such as bobcat, wolf, and coyote), although research on this is inconclusive at this time. Some proposed timber harvest units may be logged in winter, requiring snow plowing on roads. All units proposed for winter harvest in mapped lynx habitat are located within a designated over-the-snow vehicle area and roads proposed for access to these units are open seasonally (from December 1 to March 31) to oversnow vehicle use.

Cumulative effects

Vegetation management has occurred in the Teakettle LAU in the past and is expected to continue into the future. Timber harvest, precommercial thinning, and fuel reduction across National Forest System lands, state, and private lands has removed or altered lynx habitat, typically leaving few smaller trees, low limbs, snags, or large downed wood (project file exhibit G-11). Such areas can still function as lynx habitat but at reduced quality for a period of time. Past fire suppression may have contributed to this, as well as low levels of sapling feeding habitat.

Past timber harvest occurred on approximately 6,719 acres of National Forest System land in the project area from the 1940s through the 2000s and has been included as part of the existing condition of structural stages. The most recent of these were the Flathead National Forest Pre-Commercial Thinning Project, which treated 114 acres, the Blankenship Fuel Reduction Project, which included 830 acres of mechanical fuels reduction, and the Cedar Spoon Project, which included 940 acres of mechanical fuels reduction. Other vegetation management activities include weed spraying; prescribed burning; and hazard tree and blowdown removal at trailheads and along open roads. Personal use firewood cutting, Christmas tree harvesting, and bough and cone collection have also affected vegetation in the Teakettle LAU. All of these activities are expected to continue into the future in the Teakettle LAU. The last large wildfire to occur in the project area was the Half Moon Fire of 1929, which affected approximately 21,241 acres. In addition, the Robert Fire of 2003 affected 464 acres in the northernmost portion of the Teakettle LAU and then the Glacier Rim Fire of 2015 reburned 95 acres of the same area.

Roads constructed across the Teakettle LAU facilitate access for firewood cutting, hunting, trapping, and other activities. Firewood cutting along open roads has decreased downed logs, which are particularly important for lynx and their prey. Brushing of saplings along National Forest System roads in lynx habitat has reduced their value to snowshoe hares. Open and closed roads facilitate human access, contributing to the risk of mortality or displacement of lynx. Roads can also cause some collision-related injuries or mortalities. The proposed action would construct approximately one mile of new temporary road and seven miles of National Forest System trails in mapped lynx habitat.

All human activities in the Teakettle LAU have the potential to disturb or displace Canada lynx. These include numerous recreational activities such as sightseeing; hiking; camping; rafting; mountain biking; huckleberry picking; fishing; hunting; snowmobiling; cross-country skiing; motorcycle and ATV riding; dispersed recreation; and other miscellaneous forest product gathering. Timber harvest; wildland fire suppression; fuels reduction; prescribed burns; road construction, maintenance, and BMPs; trail construction and maintenance; and noxious weed control could similarly disturb or displace lynx.

Hunting, trapping, and predator control may have had the greatest impact on Canada lynx in the past. Human access and available cover largely determine mortality risk to lynx. The lynx trapping season is currently closed in Montana. This project is not expected to have a cumulative impact to mortality risk due to the trapping season closure.

Snowmobile access can provide easy winter access for trappers and possibly competitors. Snowmobile routes and play areas exist in the Teakettle LAU from December 1 to March 31, conditions permitting. No additional grooming for public snowmobiling is proposed. Possible winter timber harvest for the proposed Crystal Cedar project is not expected to have negative effects to lynx when combined with existing motorized winter travel.

Canada Lynx Critical Habitat

Summary of Findings

The Crystal Cedar project area lies entirely within the Teakettle LAU. Only 27 percent of this LAU is designated as Canada lynx critical habitat. Existing lynx feeding habitat would not be affected by activities included in the proposed action. Proposed vegetation treatment would result in a 153-acre reduction in potential denning habitat (PCE1c) and a 153 acre increase in potential feeding habitat (PCE1a). The proposed action would retain a mosaic of forest habitats for lynx to travel and forage throughout the Teakettle LAU. Consultation with the U.S. Fish and Wildlife Service for Canada lynx critical habitat will be completed on the proposed activities before the decision for the Crystal Cedar Project is finalized.

Methodology

Analysis area

The analysis area for effects on Canada lynx critical habitat is the Teakettle LAU (project file exhibit G-3). The Crystal Cedar project area lies entirely within the Teakettle LAU. Lynx analysis units are large enough to include the home ranges of one female lynx and numerous snowshoe hares, and to represent the effects of timber harvest, fuel reduction, road/trail construction, and firewood cutting across the landscape. LAUs may also contain areas of non-habitat such as dry forest or open meadows, especially in mountainous regions (USDA 2013; ILBT 2013). The forest plan FEIS, biological assessment (project file exhibit R-6), and biological opinion (project file exhibit R-7) include information about LAUs across the landscape at multiple scales.

The length of time for the proposed activities is approximately five years. This is based on the probable contract length for the proposed project, and the timeframes for related activities. The temporal scale of the effects analysis extends 100 years into the future, enough time for dense forest conditions and mature multistory stands to develop and for some trees to die or fall to create denning habitat.

Indicators

To evaluate compliance with forest plan standards and guidelines for Canada lynx critical habitat (USDA 2018b), the following indicators were used:

- Acres of Canada lynx critical habitat by primary constituent element affected by vegetation management
- Length of road and trail construction through Canada lynx critical habitat

Data sources

The analysis for Canada lynx critical habitat (USFWS 2014) is separate from that applied above to lynx habitat, although the scientific basis of the analysis is essentially the same (project file exhibit G-4). The assessment of lynx habitat completed for the Canada lynx analysis was also used for the Canada lynx critical habitat analysis. Structural stages of lynx habitat were grouped by primary constituent element (PCE) for this analysis. By definition, critical habitat for Canada lynx contains the physical and biological features essential to conservation of the lynx, and is comprised of the PCE in an appropriate quantity and spatial arrangement (USDI Fish and Wildlife Service 2008; USFWS 2014). Based on the current knowledge of the life history, biology, and ecology of the lynx, the PCE and its four components for Canada lynx critical habitat (USFWS

2014) are boreal forest landscapes supporting a mosaic of differing successional forest stages and containing:

- Snowshoe hares and their preferred habitat conditions which include dense understories of young trees, shrubs or overhanging boughs that protrude above the snow and mature multistoried stands with conifer boughs touching the snow surface (PCE 1a);
- Winter snow conditions that are generally deep and fluffy for extended periods of time (PCE 1b);
- Sites for denning that have abundant coarse woody debris, such as downed trees and root wads (PCE 1c); and
- Matrix habitat (e.g., hardwood forest, dry forest, non-forest, or other habitat types that do not support snowshoe hares) that occurs between patches of boreal forest in close juxtaposition (at the scale of a lynx home range) such that lynx are likely to travel through such habitat while accessing patches of boreal forest within a home range (PCE 1d).

Alternatives

In addition to forest plan desired conditions, standards, and guidelines listed in the Canada lynx section above, FW-DC-WL-05 applies specifically to Canada lynx critical habitat mapped by the U.S. Fish and Wildlife Service. This desired condition states that boreal forest landscapes support a mosaic of differing forest successional stages, providing the physical or biological features essential to the conservation and recovery of the Canada lynx population.

No-action alternative

Direct, indirect, and cumulative effects

The no-action alternative provides a baseline for comparison of effects from the proposed action. The effects of the no-action alternative represent potential natural changes over time. Approximately 27 percent of the Teakettle LAU is designated as critical habitat for Canada lynx (USFWS 2014) and project file exhibit G-3). As of the 2014 revision by the U.S. Fish and Wildlife Service, there are approximately 2,273,340 acres of designated critical habitat for lynx on the Flathead National Forest, which is entirely within the 9,783 square mile critical habitat unit 3. See table 27 for a summary of Canada lynx critical habitat PCE across critical habitat in the Teakettle LAU (project file exhibit G-3). Denning habitat (PCE1c) is well distributed throughout the LAU and most areas of denning habitat have feeding habitat nearby and most are moist types that are likely to support alternate prey, such as red squirrels.

Table 27. Estimated existing condition of critical habitat by PCE in the affected lynx analysis unit, in acres and percent of critical habitat (project file exhibit G-3)

Lynx analysis unit	Total acres	Critical habitat acres (% of total)	PCE1a (feeding)[a] acres (% of CH)	PCE1c (denning)[b] acres (% of CH)	Other[c] (stem exclusion) acres (% of CH)	PCE1d (matrix)[d] acres (% of CH)
Teakettle	31,177	8,518 (27.3%)	3,093 (36.3%)	6,568 (77.1%)	4,711 (55.3%)	713 (8.4%)

a. PCE1a (feeding) includes early stand initiation, stand initiation, and multistory structural stages.

b. PCE1c (denning) includes multistory and other structural stages.

c. Other (stem exclusion) structural stage with closed canopy and limited understory; does not provide snowshoe hare habitat.

d. PCE1d (matrix) includes areas of non-habitat for lynx.

No additional actions, such as timber harvest, fuel reduction, prescribed burns, road construction, or trail construction are proposed with this alternative. The no-action alternative would maintain higher tree densities in the cool moist potential vegetation type, providing cover and foraging conditions for Canada lynx. Continued forest succession would result in denser stands comprised of more shade-tolerant tree species. The availability of denning and hiding sites would gradually increase, as would habitat used by numerous species preyed on by Canada lynx. In lieu of wildland fire or other stand-replacing disturbance, feeding habitat would gradually increase and then diminish in quality and quantity. The fuel loading in many stands would increase the chance of large wildland fires in adjacent areas, which could have mixed results for lynx habitat. Stand-replacement disturbances are more likely to occur under this alternative, which would have the greatest and longest negative effect on potential denning habitat.

Proposed action

Direct and indirect effects

A summary of the estimated changes to Canada lynx critical habitat due to vegetation management is displayed in table 28. The proposed action would increase PCE1a (feeding) habitat by approximately 153 acres due to treatment of "other" lynx habitat, which does not have a dense understory providing hare habitat. The reduction in "other" habitat is also reflected in PCE1c (denning) habitat.

Table 28. Summary of estimated changes to Canada lynx critical habitat by PCE through proposed vegetation management in the affected lynx analysis unit, shown in increases and decreases in acres (project file exhibit G-4)

Lynx analysis unit	PCE1a (feeding)[a] acres	PCE1c (denning)[b] acres	Other (stem exclusion)[c] acres	PCE1d (matrix)[d] acres
Teakettle	+153	-153	-153	0

a. PCE1a (feeding) includes early stand initiation, stand initiation, and multistory structural stages.

b. PCE1c (denning) includes multistory and other structural stages.

c. Other (stem exclusion) structural stage with closed canopy and limited understory; does not provide snowshoe hare habitat.

d. PCE1d (matrix) includes areas of non-habitat for lynx.

Fourteen percent of the vegetation management in the proposed action would occur in Canada lynx critical habitat (project file exhibit G-4). Table 29 shows the estimated post-project condition of Canada lynx critical habitat lynx in the Teakettle LAU.

Table 29. Estimated post-project condition of Canada lynx critical habitat by PCE in the affected lynx analysis unit, in acres and percent of critical habitat (project file exhibit G-4)

Lynx analysis unit	Total acres	Critical habitat acres (% of total)	PCE1a (feeding)[a] acres (% of CH)	PCE1c (denning)[b] acres (% of CH)	Other (stem exclusion)[c] acres (% of CH)	PCE1d (matrix)[d] acres (% of CH)
Teakettle	31,177	8,518 (27.3%)	3,246 (38.1%)	6,415 (75.3%)	4,558 (53.5%)	713 (8.4%)

a. PCE1a (feeding) includes early stand initiation, stand initiation, and multistory structural stages.

b. PCE1c (denning) includes multistory and other structural stages.

c. Other (stem exclusion) structural stage with closed canopy and limited understory; does not provide snowshoe hare habitat.

d. PCE1d (matrix) includes areas of non-habitat for lynx.

Vegetation management included in the proposed action would reduce forest densities on a total of 509 acres of lynx critical habitat, with 258 acres of this in the cool-moist potential vegetation type. These effects would be short term and densities may increase over the long term due to reduced canopy cover (FW-DC-TE&V-13). It would take approximately 20 years for this long-term effect. In the proposed action, the loss of denning habitat (PCE1c) would be partially balanced in that the removal of fuels would reduce the probability of fire spreading to remaining denning habitat of higher quality.

Road construction would have effects on Canada lynx critical habitat in the Teakettle LAU (table 30). In the proposed action, most of the road construction proposed in Canada lynx critical habitat (1.04 miles) would pass through "other" habitat which is included in PCE1c (denning) (project file exhibit G-4). Temporary roads would be rehabilitated following completion of project activities.

Table 30. Estimated length of roads proposed for construction through Canada lynx critical habitat by PCE in the Teakettle LAU, shown in miles (project file exhibit G-4)

Type of road	Template	PCE1c (denning)[a]	Other (stem exclusion)[b]
Temporary	Existing	0.74	0.74
Temporary	New	0.30	0.30

a. PCE1c (denning) includes multistory and other structural stages.

b. Other (stem exclusion) structural stage with closed canopy and limited understory; does not provide snowshoe hare habitat.

Trail construction would also have effects on Canada lynx critical habitat in the Teakettle LAU (table 31). Only two trails proposed for construction in the proposed action would pass through Canada lynx critical habitat (Trails TR07 and TR08) (project file exhibit G-4). Trail construction would affect vegetation in the direct vicinity of the trail, but would not change the overall

function of the habitat patch. Under the proposed action, two trailheads would be constructed in the project area, however, these would be located outside of designated Canada lynx critical habitat.

Table 31. Estimated length of trails proposed for construction through Canada lynx critical habitat by PCE in the Teakettle LAU, shown in miles (project file exhibit G-4)

Trail type	PCE1a (feeding)[a]	PCE1c (denning)[b]	Other (stem exclusion)[c]
Nonmotorized	2.38	5.16	3.65

a. PCE1a (feeding) includes early stand initiation, stand initiation, and multistory structural stages.

b. PCE1c (denning) includes multistory and other structural stages.

c. Other (stem exclusion) structural stage with closed canopy and limited understory; does not provide snowshoe hare habitat.

Cumulative effects

Vegetation management has occurred in the Teakettle LAU in the past and is expected to continue into the future. Timber harvest, precommercial thinning, and fuel reduction across national forest, state, and private lands has altered Canada lynx critical habitat, typically leaving few smaller trees, low limbs, snags, or large downed wood (project file exhibit G-11). Past fire suppression may have contributed to this, as well as low levels of stand initiation feeding habitat.

Past timber harvest occurred on approximately 6,719 acres of National Forest System land in the project area from the 1940s through the 2000s. The most recent of these were the Flathead National Forest Pre-Commercial Thinning Project, which treated 114 acres, the Blankenship Fuel Reduction Project, which included 830 acres of mechanical fuels reduction, and the Cedar Spoon Project, which included 940 acres of mechanical fuels reduction. Other vegetation management activities include weed spraying; prescribed burning; and hazard tree and blowdown removal at trailheads and along open roads. Personal use firewood cutting, Christmas tree harvesting, and bough and cone collection have also affected vegetation in the Teakettle LAU. All of these activities are expected to continue into the future in the Teakettle LAU. The last large wildfire to occur in the project area was the Half Moon Fire of 1929, which affected approximately 21,241 acres. In addition, the Robert Fire of 2003 affected 464 acres in the northernmost portion of the Teakettle LAU and then the Glacier Rim Fire of 2015 reburned 95 acres of the same area.

Open roads across the Teakettle LAU facilitate access for firewood cutting. This activity has decreased the amount of downed wood, which is particularly important for lynx and their prey. Brushing of saplings along National Forest System roads in lynx habitat has reduced their value to snowshoe hares. Considering these effects, the proposed action would still retain a mosaic of forest habitats for lynx to travel and forage throughout the Teakettle LAU.

Grizzly Bear (Threatened Species)

Summary of Findings

The Crystal Cedar project area lies entirely within the Cedar Teakettle bear management subunit. Only 59 percent of this subunit is located on National Forest System lands. No project activities are proposed in or near mapped grizzly bear denning habitat. Currently, 79 percent of the Cedar Teakettle subunit provides hiding cover for grizzly bears. Proposed vegetation treatment would

reduce hiding cover by 534 acres or 2 percent. All activities included in the proposed action would occur in spring habitat for grizzly bears; therefore, implementation of most activities would occur outside the spring period. There would be temporary changes to access conditions during implementation of proposed activities, including a 9 percent increase in open motorized route density (OMRD) and a 2 percent increase in total motorized route density (TMRD), if all roads were being used to implement activities at the same time. Access conditions would be restored to pre-project levels within one year after completion of the project in order to reduce the duration of grizzly bear displacement or disturbance (FW-GDL-IFS-01). The proposed action would retain a mosaic of forest habitats for grizzly bears to travel and forage throughout the subunit. Vegetation management, road construction, trail and trailhead construction, and associated activities could disturb or displace grizzly bears during implementation and into the future resulting from increased human activity in the subunit due to trails proposed for construction. The new trailheads and parking would not be designed or managed for overnight use, so they would not count as an increase above the baseline. Consultation with the U.S. Fish and Wildlife Service for grizzly bear will be completed on the proposed activities before the decision is finalized for the Crystal Cedar Project.

The Crystal Cedar Project would reduce the risk of detrimental effects to bears by limiting activities in spring habitat during the spring period, maintaining road closures to the public during project activities, ensuring cover is well distributed throughout the Cedar Teakettle subunit, and designing harvest units to minimize distance to cover where openings would be created through vegetation management. No project activities would occur in or near secure core. Prescribed upland burns and some vegetative treatments would enhance grizzly bear forage in the subunit. Recreational improvements are proposed in areas known to receive seasonal use by bears due to high quality forage, therefore the likelihood of a human-bear conflict is moderate. Project design features for maintaining sight distances along trails, educational signage at trailheads, and design of the trails would contribute to decreasing the potential for human-bear conflict and associated grizzly bear mortality.

Methodology

Analysis area

The analysis area for effects on grizzly bears is the Cedar Teakettle bear management subunit (project file exhibit G-6). The Crystal Cedar Project is located in the primary conservation area (PCA) of the Northern Continental Divide Ecosystem (NCDE). The PCA has been divided into bear management subunits. These subunits approximate the size of a female grizzly bear's home range. The Crystal Cedar project area lies entirely within the Cedar Teakettle subunit (31,739 acres). Land ownership within the affected subunit is shown below in table 32. This subunit was used to analyze direct, indirect, and cumulative effects to the grizzly bear and has been determined as the appropriate scale to analyze effects to grizzly bears by the Interagency Grizzly Bear Committee (IGBC). Conservation measures for the grizzly bear, including standards and guidelines, have been addressed at the subunit scale (USDA 2018b).

The length of time for the proposed activities associated with the Crystal Cedar project that would temporarily affect access management conditions is approximately five years. This is based on the probable contract length for the proposed project, and the timeframes for related activities. The temporal scale of the effects analysis extends 100 years into the future.

Table 32. Land ownership in the affected bear management subunit (project file exhibit G-6)

Bear management subunit	Total acres	National Forest System lands	Private	Montana Department of Natural Resources and Conservation
Cedar Teakettle	31,739	59.0%	39.2%	1.5%

Indicators

To evaluate compliance with forest plan standards and guidelines for grizzly bears, the following indicators were used:

- Motorized access (OMRD, TMRD, CORE) in affected bear management subunit
- Acres of hiding cover affected by vegetation management
- Acres of vegetation management in seasonal grizzly bear habitats
- Length of road and trail construction in seasonal grizzly bear habitats

Data sources

Habitat data were collected during walk-through surveys of the project area (project file exhibit G-2). These data were used along with the project vegetation layer (see terrestrial ecosystems and vegetation section and project file exhibit H-1) to characterize potential grizzly bear habitat. Additional data used for analysis included grizzly bear telemetry data, past grizzly bear mortality information, grizzly bear denning habitat model, and review of the best available science.

Denning habitat was modeled for the forest plan based upon Rick Mace's assessment of the distribution of 252 verified grizzly bear dens in the NCDE (see FEIS, volume 2, pp. 150-153). The average elevation of 252 grizzly bear dens in the NCDE ranged from 6,427 to 6,906 feet. Hiding cover was estimated using data collected during field surveys and forest vegetation data. Potential spring habitat was modeled based upon elevation. Effects of vegetation management, road construction, and trail construction were determined by overlaying coverages of grizzly bear habitats with proposed unit, road, and trail locations (project file exhibit G-7).

Alternatives

Most of the habitat needs of the grizzly bear are ensured through consistency with coarse-filter forest plan components for terrestrial ecosystems and vegetation and riparian management zones (project file exhibits R-1 and G-1). Many desired conditions, standards, and guidelines in the forest plan are relevant to grizzly bears in the project area. Relevant forestwide desired conditions related to grizzly bear habitat include FW-DC-TE&V-01 and FW-DC-TE&V-02, which guide management to provide the amount, type, and distribution of vegetation for habitat components in a mosaic of successional stages for grizzly bear habitat needs over the long term. Desired condition FW-DC-WL-02 promotes grizzly bear habitat to sustain the recovery of the grizzly bear population in the NCDE and to contribute to connectivity with neighboring grizzly bear recovery zones. Habitat-related guidelines include FW-GDL-TE&V-02, which promotes the design of vegetation management activities to avoid detrimental effects on the grizzly bear population and to include one or more measures to protect, maintain, increase, or improve grizzly habitat quantity or quality, and FW-GDL-TE&V-03, which supports measures to retain cover (where present) along a portion of grass/forb/shrub openings, riparian wildlife habitat, or wetlands. Guideline FW-GDL-TE&V-01 supports the inclusion of measures into project design to reduce

the risk of disturbance to the grizzly bear population, such as restricting activities in spring habitat during the spring time period or providing areas with low levels of human activity adjacent to areas with high levels of disturbance. To further reduce the potential of grizzly bears being disturbed or displaced, guideline FW-GDL-IFS-01 states that projects should be designed so that on-the-ground implementation does not exceed 5 years.

Forestwide desired condition FW-DC-IFS-01 applies to the NCDE PCA and provides open motorized route density (OMRD), total motorized route density (TMRD), and secure core (CORE) levels that contribute to sustaining the recovery of the grizzly bear population in the NCDE. Forestwide standards associated with motorized access management include FW-STD-WL-03, which requires calculation of temporary changes in OMRD, TMRD, and CORE for roads used for projects during the non-denning season. Calculations will include estimated changes for each year of the anticipated duration of the project and will be incorporated into the 10-year running average required by standard FW-STD-IFS-03. Further, standard FW-STD-IFS-02 requires no net decrease to the baseline for CORE and no net increase to the baseline OMRD or TMRD during the non-denning season and guideline FW-GDL-IFS-02 suggests that these be restored to pre-project levels within one year after completion of the project in order to reduce the duration of grizzly bear displacement or disturbance due to project-related activities.

Forestwide desired conditions were designed to reduce the risk of grizzly bear-human conflicts through proper storage of bear attractants (FW-DC-WL-01), through information, education, and design features or criteria for management activities (FW-DC-WL-03), through proper food and garbage storage (FW-DC-REC-06), and through trailhead and web-based education and information on recreating in bear country (FW-DC-REC-06). Further, forestwide standard FW-STD-WL-02 requires that the food/wildlife attractant storage special order applies to all NFS lands within the NCDE primary conservation area and zone 1. In addition, several forestwide guidelines are intended to reduce the risk of grizzly bear-human conflicts amongst contractors, permittees, lessees, operators, and their employees. These include FW-GDL-TE&V-04, requiring a provision providing for modification, cancellation, suspension, or temporary cessation of activities to resolve grizzly bear-human conflict situations, FW-GDL-WL-01, requiring exchange of information on procedures for safely working and recreating in grizzly bear country and of food/wildlife attractant storage special order(s), and FW-GDL-WL-02, requiring evaluation and written authorization prior to establishment of camps on NFS lands other than in a developed recreation site.

To limit the risk of bear-human conflicts along trails, forestwide guideline FW-GDL-IFS-015 requires site-specific measures when designing, constructing, or reconstructing system trails and requires that information on how to avoid and respond to bear-human encounters be posted at trailheads.

No-action alternative

Direct, indirect, and cumulative effects

Grizzly bear populations, habitat, and habitat connectivity were discussed in detail in the forest plan FEIS. Extensive data have been collected on the status of the NCDE population. These data indicate that the demographic and distribution criteria, as outlined in the Revised Grizzly Bear Recovery Plan (USFWS 1993), have been surpassed (USFWS 2013, 34). Grizzly bears and their sign have been recorded in and near the project area. NCDE monitoring data confirms use of the project area by both male and female grizzly bears, including females with cubs, throughout the non-denning season. High densities of berry-producing shrubs attract grizzly bears to the project

area from June through October. In the past 20 years, there have been three documented grizzly bear mortalities in the affected subunit. All three mortalities occurred on private land and were human-caused, including a train strike, defense of life, and mistaken identity.

Grizzly bears use a mosaic of habitats that vary throughout the year. The affected subunit provides potential foraging habitat for grizzly bears throughout the spring, summer, and fall. The spring period (see den emergence time period in forest plan glossary) is a key time for grizzly bears because they are coming out of their winter dens, possibly with young cubs or yearlings, and it is the breeding season. Grizzly bear use of habitat is restricted by snow in the early spring so many grizzly bears move to lower elevations. In summer and fall, abundant habitat is available for grizzly bears. Denning habitat is characterized by a combination of elevation, aspect, slope, and vegetation. The analysis area supports only 161 acres of modeled grizzly bear denning habitat (project file exhibit G-6). Denning season in this area is considered to be December 1 to March 31. The availability of denning habitat is likely a limiting factor for grizzly bears in the affected subunit. Availability of cover may affect grizzly bear habitat security and is well distributed throughout the area (project file exhibit G-6). Table 33 displays the acreage and percentage of these important habitat components in the affected subunit.

Table 33. Estimated existing condition of seasonal grizzly bear habitat and hiding cover in the affected bear management subunit (project file exhibit G-6)

Bear management subunit	Total acres	Potential denning habitat acres (% of subunit)	Hiding cover acres (% of subunit)	Potential spring habitat acres (% of subunit)
Cedar Teakettle	31,739	161 (0.5%)	24,931 (78.5%)	29,953 (94.4%)

The no-action alternative provides a baseline for comparison of effects from the proposed action. The effects of the no-action alternative represent potential natural changes over time. Since there would be no vegetation treatments or road and trail construction proposed under the no-action alternative, there would be no direct effects to grizzly bears as a result of implementing the no-action alternative; there would be no loss of cover, no temporary decrease in available forage, no decrease in security, and no displacement due to management activities. This alternative would maintain habitat components that contribute to sustaining the recovery of the grizzly bear population in the NCDE (FW-DC-TE&V-01), a mosaic of successional stages to provide for grizzly bear habitat needs over the long term (FW-DC-TE&V-02), and habitat connectivity with neighboring grizzly bear recovery zones (FW-DC-WL-02).

Under the no-action alternative, no roads would be added to the road system and there would be no temporary changes to access parameters for project activities. Access conditions would continue to contribute to sustaining the recovery of the grizzly bear population in the NCDE (FW-DC-IFS-01). Table 34 displays the baseline open motorized route density (OMRD), total motorized route density (TMRD), and secure core (CORE) percentages for the affected subunit (project file exhibit G-8). Access conditions in the affected subunit do not currently meet research benchmarks (project file exhibit R-7. Route densities greater than those known to adversely affect grizzly bears (19 percent for OMRD and TMRD), or percentage of CORE less than the threshold also known to adversely affect grizzly bears (at least 68%) continue to contribute adverse effects to individual grizzly bears. This results in incidental take for this species, but is within the level of take exempted by the forest plan biological opinion (project file exhibit R-7).

Table 34. Baseline access conditions in affected bear management subunit (project file exhibit G-8)

Bear management subunit	Access density parameter		
	OMRD (> 1 mi/mi^2)	TMRD (> 2 mi/mi2)	CORE
Cedar Teakettle	35%	36%	24%

Public motorized use would still occur on roads and trails open to motorized use within the affected subunit. Administrative use of roads with public restrictions would also continue, but would not exceed either six trips (three round trips) per week or one 30-day unlimited use period during the non-denning season (FW-STD-IFS-01). A food storage order would still exist on NFS lands requiring appropriate storage of bear attractants to minimize risk of human-bear conflict (FW-DC-WL-01). Not implementing the proposed vegetative treatments could increase the risk of a wildfire burning more intensely in the project area, which could result in a change in available forage and cover for grizzly bears over the short and long term. Fires have historically produced both positive and negative effects for grizzly bears. Loss of hiding cover would be a potential negative effect. On the positive side, forage habitat could potentially increase. Under the no-action alternative, potential wildfire may burn to a more intense and severe degree than under natural conditions. Larger, more severe wildfire may increase the interval for return of grizzly bear forage.

Proposed action

Direct and indirect effects

Denning habitat

No project activities are proposed in mapped grizzly bear denning habitat in the affected subunit. The closest vegetation management unit is located over a kilometer from the nearest patch of potential denning habitat. Therefore, the proposed action would have no direct or indirect effects on potential denning habitat for grizzly bears.

Hiding cover

Proposed vegetation management activities would affect hiding cover in the affected subunit. Most treatments, including commercial thin, sapling thin, overstory removal, and understory removal, are assumed to continue to provide hiding cover after project implementation. Shelterwood, seed tree, and clearcut treatment units would not continue to provide hiding cover. Upland prescribed burns are expected to maintain hiding cover where it exists in the forested portions of the burn units. Fire would be implemented to achieve moderate burning conditions, which are assumed to result in mortality to small diameter trees and tall shrubs, but retain the majority of large trees. Tree boles, snags, and burned vegetation would still provide some visual obstruction for cover. Under the proposed action, vegetation management activities would decrease hiding cover on approximately 534 acres in the affected subunit (project file exhibit G-7). Harvest units were designed to minimize distance to cover. Hiding cover could take up to 20 years to return after treatment, depending on stand conditions. Hiding cover is not a limiting factor for grizzly bears in the affected subunit, and over 75 percent of the affected subunit would still provide hiding cover after completion of proposed activities.

Table 35. Estimated hiding cover affected by proposed vegetation management in the affected bear management subunit, in acres and percent of hiding cover (project file exhibit G-7)

Bear management subunit	Total acres	Hiding cover acres	Hiding cover affected acres	Percent of hiding cover affected
Cedar Teakettle	31,739	24,931	534	2.1%

Foraging habitat

Vegetation management in the proposed action would decrease the amount of available forage due to ground disturbance in vegetation treatment units. The decrease would be temporary and foraging conditions could return in treatment units within five years of project completion. Forage production would increase following vegetation treatment, as a greater amount of sunlight and moisture reach the forest floor. All activities included in the proposed action would occur in potential spring habitat for grizzly bears and therefore are subject to timing restrictions during the spring time period (April 1 to June 30), see design features in appendix A. This would reduce displacement of bears foraging on spring foods located in the lower elevations (while snow may still cover the higher elevations) of the affected subunit. Riparian areas provide high-quality forage for grizzly bears. The Crystal Cedar project area includes over 6,500 acres of mapped riparian management zones that provide potential riparian foraging habitat for grizzly bears. Vegetation management would temporarily decrease foraging habitat on 337 acres within riparian management zones. Forage conditions could return more quickly in these highly productive areas and levels of production would increase following vegetation treatments.

Displacement, habitat security, and mortality risk

Human activity levels could negatively affect grizzly bears by causing disturbance or displacement from preferred habitats. Grizzly bears are highly dependent upon learned habitat; disturbance or displacement into unknown territory may lead to sub-marginal nutrition, reduced reproduction, or greater exposure to adult predatory bears or human food sources, which can lead to human-caused mortality (Mace and Waller 1997; Kuennen, Van Eimeren, and Trechsel 2017; USFWS 2017). Forest plan standard FW-STD-IFS-03 and guideline FW-GDL-IFS-01 limit disturbance due to project activities. Human and mechanical activity would displace bears from the areas in/near proposed vegetation treatment units, road and trail construction, haul routes, aquatic improvement, and other project activities.

Disturbance during vegetation management in the project may occur due to mechanical or motorized activity and crew activities, although this would be limited by project design features which limit the duration of the proposed project activities, consistent with the forest plan standard and guideline. Specific amounts of disturbance to grizzly bears is difficult to predict from vegetation management activities, as motorized use and human activity may occur intermittently localized in one unit or another, then relaxed as activity and disturbance shift to implement proposed activities elsewhere. This is also true of road and trail construction activities.

While forest plan standard FW-STD-IFS-03 allows temporary changes to access conditions for projects in bear management subunits within the NCDE, standard FW-STD-IFS-02 requires that there be no net increase in open motorized route density (OMRD) or total motorized route density (TMRD), and no net decrease in secure core (CORE) compared to the baseline. To meet standard FW-STD-IFS-02, upon completion of project activities within the NCDE primary conservation area, all temporary roads (6.3 miles) would be rehabilitated and new National Forest System roads (1.1 miles) would have year-long closures with gates and would be included in calculations

of TMRD; however, these roads would not increase the TMRD percentage for the affected subunit due to their proximity to other roads. All new roads and restricted roads used for project activities would be closed to motorized public access during and after implementation of the project. The new motorized connector trails would be included in both OMRD and TMRD calculations, but would not increase these percentages for the affected subunit due to proximity to other roads and motorized trails. Nonmotorized trails would be closed to motorized use and are not counted in OMRD or TMRD calculations.

On-the-ground implementation of project activities would not exceed five years to reduce the potential for disturbance or displacement of grizzly bears (FW-GDL-IFS-01) and access conditions would be restored to pre-project levels within one year after completion of the project in order to reduce the duration of grizzly bear displacement or disturbance (FW-GDL-IFS-02). Access conditions in the affected subunit does not currently, and will not at project completion, meet research benchmarks. Route densities greater than those known to adversely affect grizzly bears (19 percent for OMRD and TMRD), or percentage of secure core less than the threshold also known to adversely affect grizzly bears (at least 68 percent) continue to contribute adverse effects to individual grizzly bears. This results in incidental take for this species, but is within the level of take exempted by the forest plan biological opinion (project file exhibit R-7). Access conditions in affected subunit before, during, and after project activities are displayed in table 36.

No vegetation management activities are proposed in secure core as defined by the forest plan. No road construction, road use, or trail construction would occur in, or within 500 meters, of existing secure core.

Table 36. Temporary changes to access conditions in affected bear management subunit (project file exhibit G-8)

Bear management subunit	Moving window analysis run	Access density parameter		
		OMRD (> 1 mi/mi^2)	TMRD (> 2 mi/mi2)	CORE
Cedar Teakettle	Before	35%	36%	24%
	During	44%	38%	24%
	After	35%	36%	24%

Recreation improvements proposed include 24.3 miles of new nonmotorized trails, 0.4 miles of motorized connector trails, and two new trailheads. Grizzly bears would be displaced from these areas during construction. It is likely that the trail system would receive a high level of use soon after construction, as it is close to the town of Columbia Falls (see recreation section of this environmental assessment for a discussion on population growth and recreation demand).

Human recreation in grizzly bear habitat increases the likelihood of grizzly bear-human conflict. Grizzly bear response to human disturbance may differ depending upon the season, type of habitat, or the bear's location in relation to the trail. Fortin et al. (2016) reported that most defensive attacks by grizzly bears result from surprise encounters and Herrero (1985) noted that most surprise encounters involve bear mothers, with females and cubs of the year being most dangerous. Further, most attacks are the result of sudden encounters between hikers and grizzly bears that react defensively to protect young or a food source (Herrero 1985; MacHutchon 2014).

Grizzly bears may already be avoiding the areas within 500 meters of open roads (Mace and Waller 1997), where most new trail construction is proposed (table 37). As trails are constructed and recreation use begins, grizzly bears may adopt temporal patterns of use to avoid human activity, decreasing the potential for conflict. However, many of the trails are proposed in areas known to receive seasonal use by bears due to high quality forage. The risk of a human-bear conflict is greater along trails that pass through foraging areas such as huckleberry patches or riparian habitats, as well as trails that cross or run parallel to loud streams. Avoidance of riparian habitat was a major consideration during development of the trails proposal (table 37). Berry-producing shrubs are common throughout most of the project area, including proposed trail locations. Project design features for maintaining sight distances along trails, educational signage at trailheads, and design of the trails would contribute to decreasing the potential for human-bear conflict and associated grizzly bear mortality, consistent with forest plan guideline FW-GDL-IFS-15. See appendix A of this environmental assessment for design features.

The proposed action has the potential for disturbing or displacing grizzly bears both during implementation of proposed activities and into the future resulting from increased human activity in the project area due to the trails proposed for construction. The new trailheads and parking would not be designed or managed for overnight use, so they would not count as an increase above the baseline (FW-STD-REC-01, see forest plan glossary for the NCDE definition of baseline).

Table 37. Proposed trail construction and grizzly bear concerns in the Cedar Teakettle subunit, shown in miles (project file exhibit G-7)

Trail type	Total miles	Trail in RMZs	Trail outside RMZs	Trail >500m from open roads	Trail within 500m of open roads
Nonmotorized	24.42	2.21	22.21	4.34	20.08
Motorized	0.40	0.24	0.16	0	0.40
Total	**24.82**	**2.45**	**22.37**	**4.34**	**20.48**

The proposed action would maintain habitat components that contribute to sustaining the recovery of the grizzly bear population in the NCDE (FW-DC-TE&V-01), a mosaic of successional stages to provide for grizzly bear habitat needs over the long term (FW-DC-TE&V-02), and habitat connectivity with neighboring grizzly bear recovery zones (FW-DC-WL-02).

Cumulative effects

Vegetation management has occurred in the Cedar Teakettle bear management subunit in the past. Timber harvest, precommercial thinning, and fuel reduction across National Forest System lands, state, and private lands has altered grizzly bear habitat (project file exhibit G-11). Past timber harvest occurred on approximately 6,719 acres of National Forest System land in the project area from the 1940s through the 2000s. The most recent of these were the Flathead National Forest Pre-Commercial Thinning Project, which treated 114 acres, the Blankenship Fuel Reduction Project, which included 830 acres of mechanical fuels reduction, and the Cedar Spoon Project, which included 940 acres of mechanical fuels reduction. Other vegetation management activities

include weed spraying, prescribed burning, and hazard tree/blowdown removal at trailheads and along open roads. Personal use firewood cutting, Christmas tree harvesting, and bough and cone collection have also affected vegetation in the subunit. All of these activities are expected to continue into the future. Past and future vegetation management and prescribed burns may increase grizzly bear forage in the affected subunit.

The last large wildfire to occur in the project area was the Half Moon Fire of 1929, which affected approximately 21,241 acres. In addition, the Robert Fire of 2003 affected 1,005 acres in the northernmost portion of the Cedar Teakettle subunit and then the Glacier Rim Fire of 2015 reburned 96 acres of the same area.

Roads constructed across the Cedar Teakettle subunit facilitate access for firewood cutting, hunting, trapping, and other activities. Open and closed roads, along with both motorized and non-motorized trails, facilitate human access, contributing to the risk of mortality or displacement of grizzly bears. Roads can also cause some collision-related injuries or mortalities.

All human activities in the Cedar Teakettle subunit have the potential to disturb or displace grizzly bears. These include numerous recreational activities such as sightseeing, hiking, camping, rafting, mountain biking, huckleberry picking, fishing, hunting, motorcycle and ATV riding, dispersed recreation, and other miscellaneous forest product gathering. These activities increase the chance of conflict with bears and thus the chance for grizzly bear mortality. Human development in the Columbia Falls area on private property has increased grizzly bear-human conflict due to increased presence of human attractants to bears. Special Food Storage Orders on the Flathead National Forest have contributed to improved conditions for grizzly bears. These orders require all users of National Forest System lands to store food, garbage, and other bear attractants in a bear-resistant manner. Contractors and others implementing the Crystal Cedar Project would be required to comply with these conditions. Timber harvest; wildland fire suppression; fuels reduction; prescribed burns; road construction, maintenance, BMPs; trail construction and maintenance; and noxious weed control could similarly disturb or displace grizzly bears.

Hunting, trapping, and predator control may have had the greatest impact on grizzly bears in the past. Human access, available cover, and public attitudes largely determine mortality risk to grizzly bears.

Wolverine (Proposed Species)

Summary of Findings

The analysis area for effects to wolverine in the Crystal Cedar Project contains 196 acres of modeled wolverine denning habitat and 2,874 acres of modeled primary wolverine habitat. No activities included in the proposed action would occur within modeled wolverine maternal denning habitat. Proposed vegetation management would remove cover on 33 acres in modelled primary wolverine habitat, however, connectivity of forested cover would not be severed.

Methodology

Analysis area

Copeland and Yates (2006) estimated that adult female wolverines have home ranges averaging 55 square miles and adult males ranged over an even larger area, with home ranges that averaged

193 square miles. The spatial extent of analysis of effects for wolverines is the project area plus a one-half mile buffer. At 42,674 acres (67 square miles), it is large enough to include one female wolverine home range, but is not so large as to obscure the effects of alternatives (project file exhibit G-9). It is representative of the effects of wildland fire, natural tree mortality, timber harvest, roads, road management, recreation activities, and other effects factors across the landscape.

The length of time for the proposed activities associated with the Crystal Cedar Project is approximately five years. This is based on the probable contract length for the proposed project, and the timeframes for related activities. The temporal scale of the effects analysis extends 100 years into the future.

Indicators

To evaluate compliance with forest plan standards and guidelines for wolverine, the following indicators were used:

- Acres of vegetation management in maternal denning and primary wolverine habitats
- Miles of road and trail construction in maternal denning and primary wolverine habitats

Data sources

Data used for analysis included the following wolverine habitat models. Denning habitat was modeled for the forest plan based upon two models, Copeland et al. (2010) and Inman et al. (2013) (project file exhibit G-9). The model of primary wolverine habitat (suitable for survival and use by resident adults) from (Inman et al. 2013) was used to assess effects to wolverine habitat. The model by Copeland et al. (2010) was used to assess effects to maternal and natal denning habitat, including areas providing persistent spring snow at least five years out of seven (on average), herein referred to as “maternal denning habitat.”

Alternatives

Most of the habitat needs of the wolverine are ensured through consistency with coarse-filter forest plan components for terrestrial ecosystem and vegetation and riparian management zones (project file exhibits R-1 and G-1). The wolverine was proposed for listing as threatened on February 4, 2013 (USDI 2013), but on August 13, 2014, the U.S. Fish and Wildlife Service withdrew its proposal to list the wolverine as a threatened species (USDI 2014). On May 24, 2016, the U.S. Fish and Wildlife Service again listed wolverine as a proposed species on the Flathead National Forest (project file exhibit G-14) pending status review. In 2017, the U.S. Fish and Wildlife Service concurred with the conclusion of no-jeopardy for the 2018 forest plan due to plan components that maintain, improve, and restore ecological conditions within the plan area to contribute to conservation of the wolverine by reducing the risk of future threats, including consideration of potential future changes in climate. See the forest plan FEIS, biological assessment (project file exhibit R-6), and the 2017 U.S. Fish and Wildlife Service biological opinion (project file exhibit R-7) for more information about this species and its habitat at various scales. Forest plan geographic area desired condition GA-NF-DC-06 is relevant to wolverine in the analysis area. This desired condition indicates the Haskill Basin connectivity area, which encompasses most of the project area, provides habitat connectivity for wide-ranging species, such as wolverine, moving north-south between the Swan and Whitefish Ranges.

No-action alternative

Direct, indirect, and cumulative effects

Wolverine populations, habitat, and habitat connectivity were discussed in detail in the forest plan FEIS (USDA FS 2018a). Wolverines are occasionally reported in the analysis area (project file exhibit G-9). There have been several confirmed sightings over the past five years in the drainages of the North and Middle Forks of the Flathead River in Glacier National Park, upper Grave Creek, and Ten Lakes area (project file exhibit G-9).

The analysis area contains 196 acres of modeled wolverine denning habitat. The Inman 2013 model approach, which is based on snowpack but also incorporates other habitat variables such as terrain ruggedness and some aspects of human development, identifies 2,874 acres of primary wolverine habitat suitable for survival and use by resident adults. The analysis area has no barriers to movement between habitat patches for dispersing wolverines and approximately 73 percent of the area currently functions as cover for wolverine (project file exhibit G-9). Most of the analysis area for wolverine and all of the modelled wolverine habitat within the analysis area is located within the Haskill Basin connectivity area. Forested cover in the analysis area currently provides for movement of wolverines in this important connectivity area (project file exhibit G-9).

The no-action alternative provides a baseline for comparison of effects from the proposed action. The effects of the no-action alternative represent potential natural changes over time. Since there would be no vegetation treatment or road and trail construction proposed under the no-action alternative, there would be no direct effects to wolverine as a result of implementing the no-action alternative; there would be no loss of cover and no displacement due to management activities. Overall, availability of carrion and other food sources would not be measurably affected and the availability of hiding sites used by wolverines during dispersal would gradually increase. The fuel loading in many stands would increase the chance of large intense wildland fires in adjacent areas, which could have both positive and negative effects on wolverine.

Proposed action

Direct and indirect effects

No activities included in the proposed action would occur within modeled wolverine maternal denning habitat. The proposed action does include some vegetation management in modelled primary wolverine habitat. This includes 30 acres of sapling thinning, 40 acres of commercial thinning, and 33 acres of regeneration treatment (project file exhibit G-10). Since intermediate treatments are expected to retain cover conditions, only 33 acres of cover would be affected in primary wolverine habitat. Once these areas become revegetated with grasses/forbs/shrubs they would provide foraging habitat for mammals that wolverines are known to feed upon. Across the analysis area, the proposed action would affect a relatively small amount of cover, although the probability of large stand-replacing wildland fires would be reduced. Considering the large scale of wolverine home ranges and dispersal, these effects would not be measurable, nor would availability of carrion and other food sources be measurably affected. Disturbance and temporary displacement of individual wolverines could occur as a result of activities associated with vegetation management.

The proposed action also includes construction of 1.71 miles of new nonmotorized trail in modelled primary wolverine habitat. Wolverines could be disturbed or temporarily displaced from

habitat during construction of trails. Disturbance and displacement related to trail use would be long term. No road construction would occur in modelled primary wolverine or maternal denning habitat. Connectivity of forested cover for movement of wolverines would not be severed through implementation of activities included in the proposed action.

Cumulative effects

Vegetation management has occurred in the analysis area in the past. Timber harvest, precommercial thinning, and fuel reduction across National Forest System lands, state, and private lands has altered wolverine habitat (project file exhibit G-11). Past timber harvest occurred on approximately 6,719 acres of National Forest System land in the project area from the 1940s through the 2000s. The most recent of these were the Flathead National Forest Pre-Commercial Thinning Project, which treated 114 acres, the Blankenship Fuel Reduction Project, which included 830 acres of mechanical fuels reduction, and the Cedar Spoon Project, which included 940 acres of mechanical fuels reduction. Other vegetation management activities include weed spraying, prescribed burning, and hazard tree/blowdown removal at trailheads and along open roads. Personal use firewood cutting, Christmas tree harvesting, and bough and cone collection have also affected vegetation in the subunit. All of these activities are expected to continue into the future. Past and future vegetation management and prescribed burns may increase forage for species wolverine feed upon.

The last large wildfire to occur in the project area was the Half Moon Fire of 1929, which affected approximately 21,241 acres. In addition, the Robert Fire of 2003 affected 3,287 acres in the northernmost portion of the analysis area and then the Glacier Rim Fire of 2015 reburned 96 acres of the same area.

Roads constructed across the analysis area facilitate access for firewood cutting, hunting, trapping, and other activities. Open and closed roads, along with both motorized and nonmotorized trails, facilitate human access, contributing to the risk of mortality or displacement of wolverine. Roads can also cause some collision-related injuries or mortalities.

The analysis area is within wolverine management unit 1 (northwest Montana), which had a trapping quota of three wolverines (with a maximum of one female) in 2010 and has had a quota of zero since then. In December 2012, a state district court judge in Helena granted a temporary restraining order that blocked the opening of Montana's 2012-2013 wolverine trapping season, and it has remained closed since then. With respect to connectivity and highways, there are no high-elevation paved highways in the analysis area.

Other Wildlife Species

Introduction

The following species may be affected by the Crystal Cedar Project and have forest plan desired conditions, standards, or guidelines relevant to the proposed activities. The life history, habitats, and effects to these species were assessed in the forest plan FEIS.

Methodology

Analysis area

The analysis area for all wildlife species and habitats other than Canada lynx, grizzly bear, and wolverine is the Crystal Cedar project area. At approximately 43 square miles (27,249 acres), it is

large enough to include home ranges of these species and to represent the effects of wildland fire, natural tree mortality, timber harvest, prescribed fire, fuel reduction, firewood cutting, and recreation across the landscape. All habitat attributes used by these species are distributed across this area within the bounds of natural physiographic variation. It is large enough to evaluate the ability of the habitat to support populations of these species, but small enough to not obscure the effects of the alternatives. All of the proposed activities that could directly or indirectly affect these species are contained within this area. The temporal span of the effects analysis for wildlife varies by species, up to 100 years for species like black-backed woodpeckers and fisher that are affected until late-seral forests and snag and downed wood habitat return to treated areas. Larger-scale assessments were included in the forest plan FEIS section 3.7 and appendix 6.

Indicators

To evaluate compliance with forest plan standards and guidelines for each species, the following indicators were used:

- Acres of species-specific habitat components affected by vegetation management
- Miles of road and trail construction in species-specific habitat components

Data sources

Habitat data were collected during walk-through surveys of the project area (project file exhibit G-2). These data were used along with the project vegetation layer (see terrestrial ecosystems and vegetation section and project file exhibit H-1) to characterize habitat in the wildlife analysis area. Additional data used for analysis include Montana Natural Heritage Program observation and monitoring data, Montana Fish, Wildlife, and Parks species distribution data, and a review of relevant science. Effects of vegetation management, road construction, and trail construction were determined by overlaying coverages of species-specific habitat components with proposed unit, road, and trail locations.

Bald Eagle

Most of the habitat needs of the bald eagle are ensured through consistency with coarse-filter forest plan components for terrestrial ecosystem and vegetation and riparian management zones (project file exhibits R-1 and G-1). These include desired condition FW-DC-TE&V-09, which describes the occurrence of persistent cottonwood communities across the forest providing habitat for a wide variety of wildlife species, including nesting bald eagles. FW-DC-WL DIV-01 describes the availability of very large diameter trees (greater than 20 inches d.b.h., especially black cottonwoods) within 1/2 mile of rivers and 40-acre or larger waterbodies in order to provide nesting and roosting habitat for bald eagles. Bald eagles should not be harassed or displaced from nesting due to human activities and fish are available to provide food. Standard FW-STD-TE&V-03 describes the retention of snags or live snag replacement trees within timber harvest areas to provide nesting habitat for bald eagles and guideline FW-GDL-TE&V-10 describes the retention of live ponderosa pine, western larch, or black cottonwood trees greater than or equal to 20 inches d.b.h. in vegetation treatment units within 1/2 mile of rivers or waterbodies larger than 40 acres suitable for bald eagle to provide nesting and roosting habitat. To reduce the risk of disturbance to nesting bald eagles, FW-GDL-WL DIV-05 limits activities within 1/4 mile of very large trees used as active nests from February 1 to August 15 and guideline FW-GDL-WL DIV-02 describes the retention or enhancement of visual buffers within 0.25 mile surrounding active and alternate bald eagle nest sites.

The Flathead River corridor provides breeding habitat for bald eagles and runs along the eastern boundary of the analysis area (project file exhibit G-15). One active nest is located in the southeast corner of the analysis area, just over 0.25 mile from vegetation management unit 123, therefore, no timing restrictions would apply to activities in this unit. The topography of the area along with the forested condition provide visual screening between the nest and the vegetation management unit, therefore there would be no effects to nesting bald eagles. Although bald eagles have been observed at Spoon Lake, nesting has not been documented in this location. Vegetation treatment units 121, 123, 130, and 131 are located within one-half of a mile of the Flathead River and vegetation treatment units 42, 48, 65, 74, 81, 99, 119, 119a, 141, 202, 205, 209, and 217 are located within 1/2 mile of Spoon Lake. In these units, live ponderosa pine, western larch, or black cottonwood trees greater than or equal to 20 inches d.b.h. would be retained where they exist to provide bald eagle nesting and roosting habitat. No other project activities would occur within 1/2 mile of rivers or 40-acre or larger waterbodies.

Black-backed Woodpecker

The habitat needs of black-backed woodpeckers are largely addressed by coarse-filter plan components for terrestrial ecosystems and vegetation and wildlife diversity (project file exhibits R-1 and G-1). These include desired condition FW-DC-TE&V-16, which describes snag retention to contribute to cavity habitat distribution. FW-DC-TE&V-25 describes the importance of periodic planned and unplanned ignitions to create recently burned forest conditions for species associated with burned forest and FW-DC-WL DIV-01 describes forests burned with a mix of low, moderate, and high severity to provide burned trees for nesting and feeding habitat and some trees that die gradually to provide habitat for up to a decade following wildfire. The three types of forested habitat that are important for this species include areas that have burned in the past six years, areas with wide spread tree mortality from insect or disease, and areas of smaller disturbance throughout the forest.

No large scale wildfire has occurred in the analysis area since the Half Moon Fire of 1929. There have been approximately 50 small fires throughout the area over the past 30 years that have created small patches of habitat for black-backed woodpeckers (project file exhibit G-16). The Robert Fire of 2003 burned a large area to the north of the analysis area, but is no longer providing important habitat for this species. Most of the analysis area is located within the wildland-urban interface where fuels reduction projects have occurred periodically, further limiting available habitat through removal of snags. Indirectly, taking no action to reduce fuels in the analysis area would increase the potential for stand-replacing fires to occur, which could result in large areas of highly suitable habitat for this species. The proposed action would reduce the likelihood of recently burned habitat but would not preclude achieving desired conditions for black-backed woodpeckers as described in FW-DC-WL DIV-01 and FW-DC-TE&V-25 over the long term. Due to the lack of recent post-fire habitat in any of the proposed units, the proposed action would not remove any current potential feeding or nesting habitat for black-backed woodpeckers. Timber harvest; fuel treatments; and road, trail, and trailhead construction would remove some potential future nesting and feeding trees. However, other areas that support their prey would be left intact and prescribed burning is likely to create some new habitat.

Common Loon

Most habitat needs of common loons are ensured through consistency with coarse-filter forest plan components for terrestrial ecosystems and vegetation and wildlife diversity (project file exhibits R-1 and G-1). These include desired condition FW-DC-WL DIV-01, stating that on lakes

greater than 13 acres, common loons are not harassed or displaced from nesting due to human activities and that lakes and ponds with potential for nesting have shoreline or island sites with overhead cover as well as small fish available for food. To reduce the risk of disturbance to nesting loons, FW-GDL-WL DIV-05 sets a timing restriction for project activities occurring within 150 yards of active common loon nesting/nursery sites from April 1 to August 1.

Three lakes in the analysis area are surveyed each year in May for nesting pairs and in July for nesting pairs with chicks (project file exhibit G-17). Both Spoon Lake and Cedar Creek Reservoir are territorial lakes where loons have nested in the past five years. Bailey Lake is not a territorial or potential breeding lake likely due to high levels of human disturbance. Spoon Lake also receives high levels of recreational use but consistently produces young. Once the nest is located each year on Spoon Lake, floating signs are installed to promote successful common loon reproduction (FW-OBJ-WL DIV-01).

To reduce the risk of disturbance to nesting common loons on Spoon Lake and Cedar Creek Reservoir, vegetation treatments would not occur from April 1 to August 1 within 150 yards of active nesting and nursery sites. This restriction would apply to units 119, 119a, 82, and 82a, depending on the location of nesting and nursery sites. No other project activities included in the proposed action would occur close enough to these lakes to cause disturbance to nesting loons. Vegetation along shorelines would not be affected by the proposed action.

Fisher

Most of the habitat needs of the fisher are ensured through consistency with coarse-filter forest plan components for terrestrial ecosystem and vegetation and riparian management zones (project file exhibits R-1 and G-1). These include FW-DC-RMZ-06 and FW-DC-TE&V-19 (connectivity), FW-DC-TE&V-15 through FW-DC-TE&V-17 (snags and downed wood); FW-DC-TE&V-12, FW-STD-TE&V-01, and FW-GDL-TE&V-06 (old growth habitat and very large trees), and FW-STD-RMZ-02 through 06 and guidelines FW-GDL-RMZ-01 through 15 (riparian habitats).

The forest plan identified key ecosystem, or ecosystem characteristics, or both for fisher as coniferous forests in the warm-moist potential vegetation type including western larch, white pine, cedar, or hemlock (excluding mixed ponderosa pine/Douglas-fir forest), and forests in riparian management zones (FW-DC-WL DIV-01). Old-growth forest, with very large snags, down logs, and live trees with heart rot, arranged in connected, complex shapes with few isolated patches provide habitat for travel and predator avoidance. Large mean patch size of old-growth forest and a mosaic of diverse forest conditions providing habitat for prey species both exist at a scale that provides a potential home range for fisher. See forest plan FEIS section on fisher for more information (section 3.7, pp. 109-116 and appendix 6).

In the Flathead National Forest, potential habitat occurs in the portion of the warm-moist potential vegetation type composed of very large western red cedar, western hemlock, western larch, western white pine, Douglas-fir, and grand-fir mixed with other size classes (USDA 2018a). Contiguous blocks of this potential vegetation type occur in the southern end of the North Fork geographic area, where the Crystal Cedar project is located. Approximately 15,762 acres of the analysis area is in the warm-moist potential vegetation type (project file exhibit G-18). This, along with additional NFS lands in this potential vegetation type surrounding the analysis area, has the potential to provide a home range for fisher. Currently, approximately 10,192 acres of forested areas in the warm-moist potential vegetation type is in a condition that provides the moderate to high density cover required for habitat connectivity and about 1,449 acres of this could provide habitat for denning and resting. Open areas and hardwood forest are generally

avoided by fisher and occur on over 2,000 acres of the warm-moist potential vegetation type in the analysis area. Forested cover for fisher habitat connectivity within potential habitat in the analysis area is highly fragmented.

Riparian areas are also an important habitat component for fisher, providing movement corridors between habitat patches. Approximately 6,530 acres of the analysis area is located within riparian management zones with approximately 3,434 acres with moderate to high density cover and about 1,930 acres with medium to large trees for denning and resting sites.

Approximately 1,593 acres of the analysis area is in an old-growth forest condition, with about 592 acres of this occurring in the warm-moist potential vegetation type in isolated patches. Most of the old-growth forest in the analysis area is located in the northwest corner of the analysis area, outside of the wildland-urban interface. Vegetation management for fuel reduction within the wildland-urban interface reduces the occurrence of old-growth forest attributes important to fisher, including multiple canopy layers, snags, and downed wood. It is important to note that approximately 99 percent of the portion of the analysis area in the warm-moist potential vegetation type is also located within the wildland-urban interface and is therefore unlikely to provide old-growth habitat for fisher in the future. See terrestrial ecosystems and vegetation section for more information on very large live trees, old-growth forest, and snags and downed wood in the project area.

Under the no-action alternative, the availability of habitat components important to fisher would generally increase; however, the potential for wildfire burning more intensely in the project area would also increase. This could result in a loss of potential habitat for fisher over the short and long term. There would be no direct effect to cover on National Forest System lands and all potential resting and denning habitat would be maintained.

Under the proposed action, forest density would be reduced, especially in the wildland-urban interface where it is desired for fuels reduction. Regeneration treatment would remove moderate to high density cover on approximately 342 acres of potential fisher habitat, including 42 acres of potential denning and resting habitat. Open areas created by regeneration treatment would be avoided by fisher. This would affect some forested connections, but alternate routes would persist. Intermediate harvest would reduce the effectiveness of cover on approximately 1,345 acres of potential fisher habitat, including 41 acres of potential denning/resting habitat. Intermediate treatments would give remaining trees more growing space, which would produce larger trees faster than in the no-action alternative. Some vegetation management is proposed in riparian management zones. This could include 35 acres of regeneration treatment and 288 acres of intermediate treatment in the outer riparian management zone and six acres of intermediate treatment in the inner riparian management zone. No riparian corridors would be severed by proposed activities.

Vegetation management would create a mosaic of successional stages and promote development of very large live trees. Snags and downed wood would be retained to contribute to the complex structure that provides high-quality fisher habitat where this would not interfere with fuels reduction within the wildland-urban interface.

Road and trail construction would occur through potential fisher habitat. Fisher movement is not known to be influenced by human activity, but motorized access can indirectly affect fisher by providing access for trapping and firewood gathering. Temporary roads would be rehabilitated following completion of project activities. New system roads would have year-long closures with

gates. All new roads and restricted roads used for project activities would be closed to motorized public access during and after implementation of the project.

Forest Ungulates

Forest ungulates include elk, mule deer, white-tailed deer, and moose. They are also known as big game species because they are hunted in accordance with State regulations. Most of the habitat needs for forest ungulates are ensured through consistency with coarse-filter forest plan components for terrestrial ecosystems and vegetation and wildlife diversity (project file exhibits R-1 and G-1). In addition, several species-specific plan components are relevant for connectivity of habitat, winter range, and security. Forest plan components relevant to forest ungulates in the analysis area include FW-DC-TE&V-19, which describes forest patterns with areas of cover interspersed with more open areas to provide spring, summer, and fall forage for species such as elk and mule deer in warm-moist potential vegetation type and for moose, elk, and mule deer in the cool-moist potential vegetation type. Guideline FW-GDL-WL DIV-01 describes the retention of an overstory canopy for snow intercept cover in key winter big game habitats. In the grizzly bear recovery zone/primary conservation area, standards FW-STD-IFS-02 and GA-SM-STD-01 for motorized access indirectly benefit ungulates by providing security habitat. Location of key winter habitats for forest ungulates were verified through consultation with Montana Fish, Wildlife, and Parks (project file exhibit G-20).

Forest ungulate populations, habitat, and habitat connectivity were discussed in detail in the forest plan FEIS. Approximately 84 percent of the analysis area currently functions as hiding cover for forest ungulate species, all well-distributed and connected, while only 15 percent is open and more likely to provide forage (project file exhibit G-19). Additional forage is found in the understory of forested areas and in riparian habitat.

The analysis area includes approximately 2,463 acres of mapped elk winter range and 1,918 acres of mule deer winter range mapped by MFWP (project file exhibit G-19). All mapped mule deer winter range in the analysis area is located within mapped elk winter range. Winter range for white-tailed deer is distinct from these other forest ungulates. There is no mapped white-tailed deer winter range within the project area, however, Montana Fish, Wildlife, and Parks identified the area surrounding Cedar Lake as winter concentration for white-tailed deer during winter and for other ungulate species during tough winters (project file exhibit G-20). All of these areas were considered during project design and for this analysis. Thermal cover is a subset of hiding cover acres and represents forested stands with the potential to intercept snow and provide winter protection for deer or elk (table 38).

Table 38. Estimated existing condition of mapped forest ungulate habitat in the project area, in acres and percent of total (project file exhibit G-19)

Area	Total	Forage (% of total)	Hiding cover (% of total)	Thermal cover (% of total)
Analysis area	27,249	4,075 (15.0%)	22,814 (83.7%)	17,521 (64.3%)
Elk winter range	2,463	608 (24.7%)	1,855 (75.3%)	1,545 (62.7%)
Mule deer winter range	1,918	469 (24.4%)	1,449 (75.6%)	1,253 (65.3%)

If no further timber harvest or wildland fire occurs over the next five years, the amount of cover would increase and the availability of high-quality grazing and browse forage would decrease slightly. Without treatment, the probability of intense wildland fire would continue to increase in some areas, resulting in the loss of extensive areas of cover and an increase in forage over the short term.

Regeneration treatments in the proposed action would reduce hiding cover by approximately 533 acres in the project area. This includes 449 acres of habitat currently providing thermal cover. These treatments would stimulate forage production over the short term, improving conditions for forest ungulates in the project area. Intermediate treatments would reduce the effectiveness of hiding cover on 2,683 acres, but would increase forage production following vegetation treatment, as a greater amount of sunlight and moisture reach the forest floor. Regeneration treatment in the proposed action would affect forested connections, although alternate routes would persist. Possible shrub slashing would enhance big game forage throughout the project area.

Within mapped elk and mule deer winter range, regeneration treatments would reduce hiding cover by approximately 32 acres. This includes 20 acres of thermal cover, however, full-crowned trees (primarily Douglas-fir) would be retained where present in the overstory to provide snow intercept cover and Douglas-fir would be favored for retention over western larch in these units (FW-GDL-WL DIV-01). Intermediate treatments would reduce the effectiveness of hiding cover on 294 acres in mapped elk winter range and on 239 acres of mapped mule deer winter range, but would increase forage production in these areas over the short term. Douglas-fir would also be favored in intermediate treatment units adjacent to the Cedar Lake area to provide snow intercept cover for white-tailed deer during winter.

Motorized and nonmotorized access can affect forest ungulates through direct disturbance or increased access for hunting. Road construction in the proposed action would be near roads currently open to public motorized use yearlong so they should not create additional displacement. Upon completion of project activities, all temporary roads would be rehabilitated and new system roads would have year-long closures with gates. All new roads and restricted roads used for project activities would be closed to motorized public access during and after implementation of the project.

Gray Wolf

Most habitat needs of gray wolves are ensured through consistency with coarse-filter forest plan components for terrestrial ecosystems and vegetation and wildlife diversity (project file exhibits R-1 and G-1). To reduce the risk of disturbance to gray wolves, FW-GDL-WL DIV-05 sets a timing restriction for project activities within 0.25 mile of known, active den or rendezvous sites from April 1 to July 1. Denning and rendezvous sites are often located at low elevations, in flat terrain, and near water. There are no known denning or rendezvous sites located in the project area. The primary prey species for gray wolves are forest ungulates and ungulate winter ranges are key to wolf survival. Forest plan components ensuring the habitat needs of forest ungulates also support gray wolves (see forest ungulate section).

Much of the analysis area has the potential to provide denning habitat for wolves (project file exhibit G-21). If an active wolf denning or rendezvous site is discovered within 0.25 mile of any vegetation management unit, or road and trail construction location, activities would temporarily stop and operations would be modified to avoid disturbance to breeding wolves. Under the no-action alternative, the lack of new openings and canopy thinning could mean less forage available

for prey eaten by wolves and taking no action to reduce fuels would increase the potential for stand-replacing fires to occur, which could result in large areas of decreased suitability or temporarily unsuitable habitat. As discussed above, vegetation management and road/trail construction in the proposed action would affect cover, forage, and security for forest ungulates.

Great Blue Heron

Most habitat needs of great blue herons are ensured through consistency with coarse-filter forest plan components for terrestrial ecosystems and vegetation and wildlife diversity (project file exhibits R-1 and G-1). These include desired condition FW-DC-TE&V-09, which describes the occurrence of persistent cottonwood communities across the forest providing habitat for a wide variety of wildlife species, including nesting colonies of great blue herons. FW-DC-WL DIV-01 describes the availability of very large diameter trees (greater than 20 inches d.b.h., especially black cottonwoods) within one-half of a mile of rivers and 40-acre or larger waterbodies in order to provide nesting and roosting habitat for great blue herons. Great blue herons should not be harassed or displaced from nesting due to human activities and fish are available to provide food. To reduce the risk of disturbance to nesting colonies of great blue herons, FW-GDL-WL DIV-05 limits activities within 0.2 mile of very large cottonwood trees used as active nesting rookeries from March 15 to August 1.

The Flathead River corridor provides habitat for nesting colonies of great blue herons and runs along the eastern boundary of the analysis area. Great blue herons have been observed along this stretch of the Flathead River, however, no active nesting rookeries are known to occur in the analysis area, therefore no timing restrictions would apply to activities included in the proposed action (project file exhibit G-22). Vegetation treatment units 121, 123, 130, and 131 are located within 1/2 mile of the Flathead River and vegetation treatment units 42, 48, 65, 74, 81, 99, 119, 119a, 141, 202, 205, 209, and 217 are located within 1/2 mile of Spoon Lake. In these units, live ponderosa pine, western larch, or black cottonwood trees greater than 20 inches d.b.h. would be retained where they exist to provide great blue heron nesting and roosting habitat.

Northern Goshawk

Habitat needs of the northern goshawk are ensured through consistency with coarse-filter forest plan components for terrestrial ecosystems and vegetation, particularly those for old-growth forest and a variety of seral stages of coniferous forest (project file exhibits R-1 and G-1). Under the no-action alternative, the availability of old-growth habitat components important to northern goshawks would generally increase and no potential nest trees would be removed. The potential for wildfire burning more intensely in the project area would increase under this alternative and could lead to loss of old-growth habitat and large trees for nesting.

The proposed action would remove some potential nest trees and areas of mature forest, but would retain existing old-growth forest and numerous potential home ranges for goshawks, which are heterogeneous and include forest openings, mature forest, and early seral forest. Intermediate treatments for fuel reduction could benefit goshawks by reducing forest densities and improving hunting conditions. The potential for intense wildfire would also be reduced under this alternative, protecting potential nest trees and existing old-growth forest in the analysis area.

FW-GDL-WL DIV-05 includes measures to reduce the risk of disturbing goshawks during nesting season. There are no known goshawk nest sites in the project area; however, there have been observations and indirect evidence of breeding (project file exhibit G-23). If an active northern

goshawk nest is discovered in the project area, project activities would be restricted from March 1 to August 15 in the greater than 40-acre forest stand identified as the nest site.

Townsend's Big-eared Bat

Most habitat needs of Townsend's big-eared bats are ensured through consistency with coarse-filter forest plan components for their roosting and feeding habitats (project file exhibits R-1 and G-1). These include FW-STD-RMZ-01 (category 4a) and standards for snags and downed wood that provide for roosting habitat. FW-GDL-WL DIV-01 also provides for ecological conditions that specifically support Townsend's big-eared bats, including maternity roosts and hibernacula and diverse structure in riparian management zones.

There are no known maternity roosts or hibernacula in the analysis area but individuals have been observed in a cave adjacent to the analysis area (project file exhibit G-24). Approximately 6,530 acres of the analysis area is located within riparian management zones, providing habitat for insects preyed upon by bats. The no-action alternative would maintain current conditions in riparian habitats across the analysis area. The potential for wildfire burning more intensely in the project area would increase under this alternative, resulting in areas of less suitable or unsuitable habitat for Townsend's big-eared bats. The proposed action alternative would include vegetation treatment and road/trail construction in riparian management zones. These activities could reduce potential feeding habitat over the short term by removing vegetation near lakes and streams. Over the long term, this species would benefit from the reduced potential for intense wildfire.

Western (Boreal) Toad

Habitat needs of the boreal toad are ensured through consistency with coarse-filter forest plan components for terrestrial ecosystems and vegetation, aquatic ecosystems, and wildlife diversity (project file exhibits R-1 and G-1). These include FW-STD-RMZ-01 and standards for snags and downed wood that would provide for boreal toads in upland habitats. Standards FW-STD-IFS-01 through -05 and guideline FW-GDL-IFS-02 indirectly reduce the risk of mortality of boreal toads as they move from aquatic to upland habitats. FW-DC-WL DIV-01 also provides for ecological conditions that specifically support boreal toad breeding, feeding, and metamorphosis.

Western toads use a wide variety of aquatic habitats for breeding and use upland habitats up to a mile from these areas outside the breeding season. All land in the analysis area is close enough to potential breeding habitat to be potential upland habitat for western toads (project file exhibit G-25). The no-action alternative would maintain current conditions in riparian and upland habitats across the analysis area. The potential for wildfire burning more intensely in the project area would increase under this alternative. This could lead to some direct mortality, but the resulting burned habitat is desirable for this species. The proposed action would include vegetation treatment and road and trail construction in upland habitats as well as riparian management zones. All of these activities have the potential to cause mortality to individual adult and juvenile boreal toads, however this would not have a measureable effect at the population level.

Effects to Aquatic Resources

Summary of Findings

Implementation of the proposed action (or no-action alternative) either individually or cumulatively would not alter the current finding for watershed condition framework (class 1-

functioning properly), would not impair water quality beneficial uses, and has no effect on listed or proposed threatened and endangered species or their habitats (see project file exhibit L-15).

Methodology

Analysis area

The project area is primarily situated within the Abbot Creek (west), Cedar Creek, and Spring Creek (north) subwatersheds (hydrologic unit code (HUC) 12) as illustrated on map 1 in project file exhibit L-10. The project area also overlaps a small portion of the Deep Creek-North Fork Flathead River and Flathead River-Goodwich Bayou subwatersheds. However, proposed activities in the Deep Creek-North Fork Flathead River and Flathead River-Goodwich Bayou subwatersheds are limited in scale, or intensity, or both, have no interaction with stream channels or riparian areas, and are therefore excluded from further analysis (project file exhibit L-1).

Table 39 presents principal waterbodies within each analysis area, highlights existing water quality impairments, if any, and watershed condition framework ratings. Map 2 in project file exhibit L-11 displays designated bull trout critical habitat, which is limited to the Flathead River, and gives spatial reference to these attributes relative to proposed activities and scale of associated effects analysis.

Table 39. Principal streams, notable ratings, and water quality impairments within affected subwatersheds

HUC12	Area (acres)	Principal streams/waterbodies within the analysis area	Watershed condition framework rating[a, b]	Water quality impairment
Abbot Creek (west)	21,182	Flathead River	Class 1	none
		Spoon Lake		
		Bailey Lake		
Cedar Creek	12,089	Cedar Creek		
		Crystal Creek		
Spring Creek (north)	18,673	Trumbull Creek		
		Garnier Creek		

a. As detailed in the Watershed Condition Classification Technical Guide (Potyondy and Geier 2011), a watershed in good condition functions in a manner similar to natural wildland conditions. A watershed is considered to be functioning properly if the physical attributes are adequate to maintain or improve biological integrity. This consideration implies that a class 1 watershed that is functioning properly has minimal undesirable human impact on its natural, physical, or biological processes, and it is resilient and able to recover to the desired condition when disturbed by large natural disturbances or land management activities.

b. Watershed condition framework rating determinations are displayed in project file exhibit L-8.

The spatial bounds of analysis areas are variable, depending on which component of aquatic resource is analyzed. Each component of the analysis describes the scale at which the direct and indirect effects are being predicted.

Temporal bounds for aquatic resources range between short term (project initiation to approximately 3 years post completion of stream crossing construction) and long term (more than 3 years post completion), depending on the type and scale of effects. Each component of the analysis describes the temporal nature of predicted effects.

Indicators

Table 40 presents indicators and measures derived from the forest plan (USDA 2018b) for specific aquatic resource elements where scoping and public comment suggest relevant issues exist (project file exhibit L-1). The supporting paragraphs detail methods and assumptions used to generate measures for analysis.

Table 40. Resource indicators and measures for assessing effects

Resource element	Resource indicator	Measure (quantify if possible)	Used to address: relevant issue[b]?
Watersheds water quantity)	Road/trail interaction with riparian areas (includes trailheads and parking areas)	1. Miles of road/trail interaction with riparian areas and wetlands.	Yes
Watersheds (water quality)	Sediment delivery/nutrient loading	2. Sediment delivery (tons) associated with roads/trails.	Yes
		3. Number of high risk[a] road/trail stream crossings.	
Riparian areas (aquatic habitat/stream morphology) and aquatic species	Sediment delivery/nutrient loading, road/trail interaction with riparian areas.	4. Number of high aquatic consequence stream crossings.	Yes
		Measures 1-4 are used collectively to quantify possible effects to these resource indicators.	

a. Methodology for determining level of risk is based on field evaluation and presented in project file exhibit L-4
b. Relevant issues were identified through scoping, or public comment, or both (project file exhibit L-1)

Watersheds (water quantity): The number or road and trail miles within 50 feet of lotic (flowing waters) riparian habitats or 10 meters of lentic (still waters) riparian habitats was used as a measure of possible effects to stream flow and recharge. A 50 feet minimum was used for lotic habitats to be consistent with minimum stream management zone widths as defined by the State of Montana (MTDNRC 2006), while a 10 meter minimum distance from lentic habitats follows guidance from (Kahklen and Moll 1999). In general, less disturbance within these areas equates to less potential effect.

Watersheds (water quality), riparian areas (aquatic habitat/stream morphology), and aquatic species: Increased sediment delivery is used as a surrogate for total suspended sediment and nutrient (specifically phosphorus) concentrations in this analysis. Similarly, sediment delivery rates are utilized as surrogates for analyzing potential effects on riparian areas and ultimately aquatic species.

Sediment delivery estimates associated with roads are based on a 50 year climate simulation using the water erosion prediction program (WEPP) road batch interface. Therefore, estimated sediment delivery represents the average of what could potentially occur over a 50 year period. Sediment delivery generated through road grading and BMP application, other than culvert removal or installation, are incorporated in the WEPP model outputs under the general assumption these increases, or potential reductions, fall within predicted error for model outputs (plus or minus 50 percent). Roads previously rehabilitated are assumed to be zero because they are disconnected from stream channels. Sediment delivery from new proposed roads, both temporary roads and National Forest System roads, follows methodology outlined in project file exhibit L-2 while delivery associated with culvert replacement follows guidance outlined in project file exhibit L-3. The analysis assumes all proposed activities would be completed in one

year to overlap potential effects in time and space (although effects are more likely to be distributed over a 3 to 5 year period). Detailed information about the WEPP model is available at: http://forest.moscowfsl.wsu.edu/fswepp/.

Furthermore, roads have been identified as the primary source of anthropogenic sediment delivery to streams (Sugden and Woods 2007). More specifically, road-stream crossings are estimated to account for 74 percent of all road sediment delivery to streams (Cissel et al. 2013). Therefore, this analysis also utilizes the number of high risk road-stream crossings as a measure for potential water quality effects. In general, fewer high risk stream crossings equate to less potential effect to water quality, aquatic habitat, channel morphology, and aquatic species. Methodology for determining level of risk is based on field evaluation and presented in project file exhibit L-4. It is important to also note that the level of risk assigned to a particular stream crossing is not necessarily commensurate to the potential consequence that may occur if the culvert were to fail. Thus, each site has also been rated high, moderate, or low for aquatic consequence. This rating process utilized field data collected on site along with spatial relationship to perennial and fish bearing stream reaches (project file exhibit L-11).

Data sources

Information for this analysis was gathered from a variety of sources including those incorporated in the forest plan (USDA 2018b). Other information includes field data recently collected on the ground within or near the project area. These data include: Forest Service field evaluation of stream channel conditions, photo points (project file exhibit L-5), WEPP road and culvert surveys (project file exhibit L-9), and Montana Department of Environmental Quality reports (Montana Department of Environmental Quality 2012, 2014).

Alternatives

No-action alternative

Direct, indirect, and cumulative effects

Watersheds (water quantity): The proximity of roads and trails to riparian areas within affected subwatersheds is displayed in table 41. These values are further divided by land ownership illustrating the distribution of effects across management boundaries.

Table 41. GIS estimated lengths for road and trail interaction with riparian areas (measure #1)

HUC12	Land ownership	Approximate length of road/trail interaction (mi.)		
		Lotic	Lentic	Total
Abbot Creek (west)	NFS lands	1.2	0.3	3.4
	State/county/private	1.3	0.6	
Cedar Creek	NFS lands	1.5	0.0	2.8
	State/county/private	1	0.3	
Spring Creek (north)	NFS lands	0.7	0.0	3.2
	State/county/private	2.1	0.4	

Under the no-action alternative no change in the length of road and trail interaction with riparian areas would occur (table 41). Likewise, road BMP work would not be implemented as scheduled leaving potential high risk stream crossings and other potential road drainage issues untreated.

Leaving these culverts in place and not applying necessary BMP work to area roads may alter hydrologic processes from existing conditions at the hillslope scale which include modification of surface run-off and groundwater recharge patters. Changes to run-off and/or recharge characteristics beyond the hillslope scale are not anticipated to be measurable primarily due to high infiltration capacity of local geology and topographic setting within the project area.

Watersheds (water quality): Surface waters in the Flathead River portions of both Abbot Creek (west) and Cedar Creek subwatersheds as well as Spring Creek in the Spring Creek subwatersheds are beneficial use classified as B-1[1] (project file exhibit L-7). Additionally, the State has assigned individual waterbodies unique water quality assessment categories. Spring Creek has been assigned water quality category 1 meaning all applicable beneficial uses have been assessed and all uses are determined to be fully supported. The Flathead River portion of both Abbot Creek (west) and Cedar Creek subwatersheds has been assigned water quality category 3 meaning there is insufficient data to assess the use-support of any applicable beneficial use and therefore no use-support determinations have been made. The primary water quality contaminants generated from forest lands and relevant to the proposed activities are fine sediment and nutrients (bound to soil particles) produced from hillslopes, National Forest System roads, and stream banks. No streams within any of the affected subwatersheds are identified by Montana Department of Environmental Quality as impaired (project file exhibit L-7).

Table 42 quantifies estimates for anthropogenic sediment sources from National Forest System roads at the subwatershed scale. These estimates are presented only for comparison relative to other WEPP outputs for sediment delivery.

Table 42. Sediment delivery estimates for existing conditions on the forest (measure #2)

HUC12	Background erosion[a] (tons)	Anthropogenic sediment delivery (tons)		Catchment area (acres)
		NFS road[b]	% of Background	
Abbot Creek (west)	622	0.3	0.05	21182
Cedar Creek	355	0.2	0.07	12089
Spring Creek (north)	548	0.2	0.03	18673

a. Background estimates for sediment delivery follow guidance presented in (Elliot 2013) and utilize catchment areas as displayed in project file exhibit L-10.

b. WEPP road field data and model results available in project file exhibit L-9

Because road-stream crossings are the primary anthropogenic disturbances influencing water quality, the number of high risk road-stream crossings are also utilized as a measure of potential effects to these elements. Current conditions are presented in table 43 for each subwatershed.

[1] B-1 are waters classified as suitable for drinking, culinary, and food processing purposes after conventional treatment; bathing, swimming and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.

Table 43. Risk ratings for National Forest System road stream crossings on National Forest System lands (measures #3 and #4)

HUC12	Risk rating for stream aligned culverts on NFS lands (aquatic consequence rating)[a]		
	High	Moderate	Low
Abbot Creek (west)	4 (3)	4 (2)	3 (6)
Cedar Creek	7 (6)	3 (1)	2 (5)
Spring Creek (north)	5 (3)	0 (2)	3 (3)

a. Risk rating based on methods outlined in project file exhibit L-12. Aquatic consequence rating based on proximity to fish habitat and evaluation of field culvert data and are included in parenthesis.

Under the no-action alternative, sediment delivery associated with the existing transportation system would remain unchanged from the existing condition (table 42). However, 16 existing high risk stream crossings would not be removed or maintained through implementation of road BMPs (project file exhibit L-11, table 43). Leaving these high risk culverts in place maintains potential risk of failure and associated water quality effects (sediment and nutrient delivery) to area streams (USDA 2018a, 116). Under the culvert failure scenario, potential water quality effects would be a temporary exceedance of State water quality standards for turbidity and total suspended sediment (Montana Department of Environmental Quality 2012, 2014); however, changes to existing beneficial use classifications or water quality categories would not be anticipated. Water quality changes resulting from potential culvert failure are not anticipated to extend beyond the reach scale and would not reach the Flathead River due to hydrologic sinks at Spoon Lake, Schafer Springs, and interruption of perennial flow in upper Garnier Creek. Based on monitoring results of culvert failure and removals as presented in (Shapiro 2010) temporal distribution of possible water quality effects would be short term (less than 3 years).

Riparian areas (aquatic habitat/stream morphology), and aquatic species: Watershed condition framework ratings for aquatic habitat condition in each of the affected subwatersheds is listed as good (project file exhibit L-08) (Potyondy and Geier 2011). Water erosion prediction program (WEPP) modeling estimates for anthropogenic sources of sediment delivery support this determination in that delivery from National Forest System roads represents just 0.12 percent of background (table 42). However, channel instability and risk to aquatic habitat values are increasingly at risk when positioned downstream from high risk or high aquatic consequence stream crossings. Currently, the project area contains 16 high risk stream crossings of which 12 are rated as high aquatic consequence (table 43, project file exhibit L-11).

Fish bearing stream reaches are displayed in project file exhibit L-10. Other than Crystal Creek and Cedar Creek, tributary streams within the project area have little fisheries value and lack connectivity to the Flathead River due to a combination of downstream activities on private lands and geology. Crystal Creek above Road 316 (desirable fish barrier) contains genetically pure westslope cutthroat trout (Montana Fish Wildlife and Parks 2019) while the Flathead River and Middle Fork Flathead River are designated bull trout critical habitat (project file exhibit L-11). Cedar Creek, Trumbull Creek and Garnier Creek support non-native brook trout. Spoon Lake and Bailey Lake support brook trout as well as hybrid cutthroat/rainbow trout (Montana Fish Wildlife and Parks 2019). Bull trout critical habitat (Flathead River) is limited to foraging/migratory/over wintering habitats, and no spawning or rearing habitats exist within or are approximate to the analysis area.

Under the no-action alternative indicator measures #1 through #4 would remain unchanged and the current condition would persist as detailed in tables 41, 42, and 43. However, the level of risk associated with culvert failure at 16 existing high risk stream crossings (12 high aquatic consequence crossings, table 43) would also remain because implementation of road BMPs would not occur as scheduled under the proposed action. In the absence of BMP application, potential sediment delivery associated with culvert failure at high risk sites would be elevated and would temporarily reduce quality of downstream aquatic habitat and channel morphologic stability which could affect fish bearing reaches of Crystal Creek, Cedar Creek, Trumbull Creek, Garnier Creek, and tributaries to Spoon Lake. The severity of effects would be variable depending on climate and stream flow conditions following disturbance but primarily limited spatially to the stream reach immediately below the affected crossings (Foltz, Yanosek, and Brown 2008) and temporally to the time period of 1 to 3 years following failure as suggested by (Shapiro 2010). Consequences of effects would not extend to mapped critical habitat in the Flathead River. Project file exhibit L-11 gives spatial context to potential impacts on fish bearing stream reaches, stream reaches containing pure strain westslope cutthroat trout, bull trout and designated bull trout critical habitat. No change to current watershed condition framework rating would result under the no-action alternative.

Cumulative effects

The type and scale of potential cumulative effects to watersheds, riparian areas, and aquatic species would be the same as described above for direct and indirect effects of the no-action alternative. Potential cumulative actions on National Forest System lands and lands of other ownership such as road maintenance, residential development, and timber harvest would also be limited to the hillslope or reach scale. However, effects from these ongoing or future actions would only be cumulatively additive when effects overlap spatially. Because these effects are anticipated to be measurable only at the hillslope or reach scale, measurable effects at the larger subwatershed scale would not occur. Cumulative effects would not result in any changes to existing watershed condition framework ratings, water quality beneficial use determinations, or have any effect on proposed or listed threatened and endangered species or their habitats.

Proposed action

Direct and indirect effects

Watersheds (water quantity): Under the proposed action, the length of road/trail interaction with riparian areas would change as presented in table 44 and displayed in project file exhibit L-27. Effects from these changes would be difficult to quantify even at the hillslope scale but may include modification of surface water runoff and ground water recharge patterns relative to undisturbed conditions (USDA 2018a, 114-115).

Table 44. National Forest System road/trail and riparian area interaction under the proposed action (measure #1)

HUC12	Land ownership[a]	Approx. length of National Forest System road/trail interaction (mi)[b]				
		Lotic	Change from existing condition	Lentic	Change from existing condition	Total
Abbot Creek (west)	National Forest System lands	1.2	0.00	0.3	0.00	3.4
	State/county/private[b]	1.3	0.00	0.6	0.00	
Cedar Creek	National Forest System lands	1.7	0.22	0.01	0.01	3.2
	State/county/private[b]	1.0	0.00	0.3	0.00	
Spring Creek (north)	National Forest System lands	1.1	0.27	0.0	0.00	4.0
	State/county/private[b]	2.1	0.00	0.4	0.00	

a. Values for riparian area interaction with roads and trails on private lands are largely unknown.

b. Data computed from spatial dataset using methods and assumptions detailed above in the methodology section of this report.

Application of BMPs to new proposed roads and trails as well as existing roads and trails would further mitigate potential for measurable effects to hydrologic processes by ensuring proper road drainage and replacing or providing necessary maintenance to 16 high risk stream crossings displayed in table 43.

Watersheds (water quality): Management activities identified under the proposed action would increase sediment delivery to area streams relative to current conditions (table 45, project file exhibit L-14). The principal mechanism for sediment delivery is short term (less than 3 years) heavy use of existing native and gravel surfaced roads, use and construction of new temporary and specified roads, and upgrading one aquatic organism passage (AOP) to meet State BMP and FW-STD-RMZ-02.

Table 45. Spatial and temporal distribution of anthropogenic sediment delivery by disturbance mechanism under the proposed action (measure #2)

HUC12	Background erosion[b]	Anthropogenic sediment delivery (tons)[a]												
		Existing road system	Principal waterbody affected	Existing NFS road system (high traffic level)[c]	Proposed NFS road (high traffic level)[c]	Year 1				Years 2-3			Years 4-5	
						Temp road[c]	AOP replacement[d]	Total (change +/-)[a]	Total % of background	Temp Road[c]	Total (change +/-)[a]	Total % of background	Total (change +/-)[a]	Total % of background
Abbot Creek (west)	756	0.3	Spoon Lake (exhibit L-14)	0.3	0	0	0	0.3 (0)	0.04	0	0.3 (0)	0.04	0.3 (0)	0.04
Cedar Creek	432	0.2	Crystal Creek & Cedar Creek (exhibit L-14)	0.7	0.9	0	0	1.6 (+1.4)	0.37	0	1.6 (+1.4)	0.37	1.6 (+1.4)	0.37
Spring Creek (north)	667	0.2	Garnier Creek & Trumbull Creek (exhibit L-14)	0.4	0	1.3	0.9	2.6 (+2.4)	0.39	1.3	1.7 (+1.5)	0.25	0.4 (+0.2)	0.06

a. Actual values may vary over time. Temporary roads are anticipated to be rehabilitated within 3 years of construction, haul is assumed to be completed within 5 years, and replacement of the AOP is assumed to occur in year 1.

b. Background estimates for sediment delivery reflect estimates for undisturbed forests as presented in (Elliot 2013).

c. WEPP road field data and model results available in project file exhibit L-9. Values are held constant for the analysis period (years 1 through 5).

d. Sediment delivery associated with AOP replacement follow guidance from project file exhibit L-3.

Increased sediment delivery associated with AOP replacement, new road construction, increased traffic levels during haul, and BMP application are anticipated to be short term (less than 3 years). Where existing high risk culverts are replaced or maintained through application of BMPs (project file exhibit L-14, table 43), these efforts would reduce long-term risk (greater than 3 years) of sediment delivery and stream turbidity associated with potential culvert failure (USDA 2018a, 121) at 16 sites (note: the AOP is included in the total number of high risk culverts). Water quality effects would be limited to the reach scale and may include temporary exceedance of state water quality standards for turbidity and total suspended sediment (Montana Department of Environmental Quality 2014, 2012) during construction, although changes to existing beneficial use classifications or water quality categories would not be anticipated. Water quality reductions or measurable increases in sediment delivery, and associated nutrients, would not reach the Flathead River system due to the spatial distribution of potential sediment sources, scale of predicted sediment delivery, and local hydro-geologic setting (e.g. hydrologic sinks, high permeability surface geology, discontinuous nature of surface water features).

Vegetation treatments proposed in riparian management zones (FW-STD-RMZ-01) would not have measurable effects to sediment delivery (project file exhibit L-16).

Riparian areas (aquatic habitat/stream morphology): Sediment delivery is the principal measure affecting water quality, aquatic habitat, and channel morphology. Table 45 quantifies sediment delivery by source type while project file exhibit L-14 gives spatial reference to potential sediment sources relative to designated bull trout critical habitat, and known fish bearing stream reaches. Upgrading an AOP, replacing or maintaining stream culverts through BMP implementation, and construction of new temporary and National Forest System roads may affect aquatic habitat and channel morphology directly at stream crossings when stream channel and banks are modified. Additionally, increases in sediment delivery (table 45) would potentially alter downstream channel habitat conditions by increasing percent pool tail fines, reducing median substrate particle size, and decreasing residual pool depths. Potential measurable effects would be variable depending on climate and stream flow conditions following disturbance but primarily limited spatially to the stream reach immediately below the affected crossings, approximately 810 meters (Foltz, Yanosek, and Brown 2008). These effects would not reach designated critical bull trout habitat in the Flathead River system.

Aquatic species: Effects to aquatic species draws inference from effects analysis associated with watersheds and riparian areas. Effects to these elements as quantified through selected measurement indicators are assumed to impact aquatic species when they overlap spatially. As displayed in project file exhibit L-14, sediment sources associated with the proposed action may measurably affect fish bearing stream reaches in Garnier Creek, Trumbull Creek, Crystal Creek, Cedar Creek, and the unnamed perennial tributary to Spoon Lake. However, due to the nature and scale of possible effects, impacts on aquatic species would be limited to temporary displacement of individuals during construction periods. Effects to westslope cutthroat trout in Crystal Creek during the spawning season would not occur as timing limitations outlined in design features of the proposed action would be fully implemented to avoid this critical time. Because measurable effects to water quality, aquatic habitat, and channel morphology are not anticipated in designated bull trout critical habitat in the Flathead River, and bull trout are not present in affected stream reaches, effects to bull trout or bull trout critical habitat are not anticipated (project file exhibit L-15). The barrier culvert on Road 316 (Crystal Creek) will be retained to protect the genetic purity of westslope cutthroat trout above the barrier and prevent brook trout invasion upstream. No changes to the watershed condition framework rating would result through implementation of the proposed action.

Cumulative effects

Transportation infrastructure associated with vegetation management, motorized recreation, utility lines and rights of ways resulting from past projects continue to alter hydrologic processes and contribute sediment to streams within affected subwatersheds. On National Forest System lands, these effects are represented in the no-action alternative through measurement indicators 1, 2, 3, and 4 presented above in table 41 through table 43. The proposed action would incrementally add to these measurement indicators as displayed in table 44 and table 45. However, these effects are anticipated to also be limited spatially to the hillslope and reach scale and measurable effects at the larger subwatershed scale would not be anticipated. Furthermore, the level of cumulative increase is not expected to alter watershed condition framework ratings, water quality beneficial use determinations, or pose any measurable effect to proposed or listed threatened and endangered species.

Similarly, much of the analysis area subwatersheds consist of private property which is likely to see some level of increased development in the future. Effects from development on private land may also alter hydrologic processes and increase sediment delivery to area streams. However, because effects from the proposed action are anticipated to be short term (less than 3 years) and limited to the reach scale, they are not anticipated to overlap in time or space with effects from private land development to the degree resource impacts could be measurable. Furthermore, development of private lands would also be subject to applicable local, state and federal regulation geared towards minimizing effects to water quality and riparian areas.

Effects to Plant Species of Conservation Concern

Summary of Findings

Several rare plant populations occur in the Crystal Cedar project area in the following habitat groups: fens habitat group; wetland/riparian habitat group; and mesic montane/disturbance habitat group. Because the project follows forest plan direction, it will protect documented plant species of conservation concern[2] populations, and project design features will protect documented species of concern and potential species of concern populations, which overlap with species of conservation concern populations.

Proposed vegetation management activities would not impact fen suitable habitat. Trail TR11A has the potential to increase the risk of damage and weed invasion to the fen and plant species of conservation concern slender cottongrass (*Eriophorum gracile*) by improving access to the site.

The wetland/riparian habitat group would have short-term impacts from ground disturbing activities in the RMZs until vegetation recovers. Road construction, reconstruction, and maintenance have the potential of weed introduction and spread into the wetland/riparian habitat group. Trail and trailhead construction would have the same effects as roads, on a smaller scale.

The mesic montane/disturbance habitat group would have short-term impacts from ground disturbing activities. Long-term impacts, such as the regrowth of the canopy, would impact the suitable conditions in the understory vegetation. Effects from roads, trails, and trailheads in mesic montane/disturbance habitat group are similar to wetland/riparian habitat group. Trail TR11A passes through the habitat surrounding a population of crested woodfern. Specific design features would be implemented to avoid this population.

[2] Species of conservation concern are identified by the Regional Forester; more information is available at http://bit.ly/NorthernRegion-SCC.

Methodology

Analysis area

The analysis area for this project is based on the area of the project's impacts on known occurrences or suitable habitat for plant species of conservation concern. The analysis area is confined to the project area and includes all treatment units and road systems with activities related to this proposed project.

The temporal bounds may be up to 100 years after project implementation (Kuropat 2009a). The recovery of individual plants and populations after a disturbance event is species-specific and may depend on the disturbance type and its effects to the microsite, the tolerance of the species to disturbance, and the species methods of reproduction (i.e. rhizomes, taproots, bulbs, and corms). Following project implementation, vegetation conditions may be suitable for some plant species of conservation concern to become established immediately while other species may take between 50 and 100 years to return to the tree and shrub canopy cover conditions that provide suitable habitat.

Indicators

Presence or absence of plant species of conservation concern, state species of concern, or potential species of concern populations, and presence of each habitat group for acres treated, are used as indicators for analysis.

Data sources

Data sources used in this analysis include field surveys, the Montana Natural Heritage Program's (MNHP) Element Occurrence Database, and the Forest Service Natural Resource Management (NRM) database. Surveys were conducted in the summer field seasons of 2017 and 2018.

For more information about methodology, analysis process, information sources, incomplete information and unavailable information, refer to the forest plan FEIS volume 1, page 335.

Alternatives

No-action alternative

The USFWS Montana Field Office currently lists two species as threatened for the Flathead National Forest: water howellia (*Howellia aquatilis*) and Spalding's catchfly (*Silene spaldingii*) (USFWS 2018). There are no documented occurrences for water howellia or Spalding's catchfly on the Glacier View Ranger District in either the Montana Natural Heritage Program (MNHP) rare plants database or the NRM database. As a result, these species will not be analyzed. See project file exhibit I-1 and forest plan FEIS volume 1, pp. 312-322 for more information.

There are 26 plant species of conservation concern listed for the Flathead National Forest in five main habitat groups (forest plan FEIS volume 1, pp. 336-338, 340-342). Several populations of plant species of conservation concern, as well as state species of concern and potential species of concern, are documented in the project area (tables 46 and 47). See project file exhibit I-2 for species descriptions and the MNHP state list of species (Montana Natural Heritage Program 2019) for more information about state listed plant species.

Table 46. Species of conservation concern in the project area

Species name	Common name	Habitat group	Number of populations in project area
Botrychium paradoxum	peculiar moonwort	mesic montane/disturbance	1
Dryopteris cristata	crested woodfern	mesic montane/disturbance	3
Epipactis gigantea	giant helleborine	wetland/riparian	5
Eriophorum gracile	slender cottongrass	fen	2
Meesia triquetra	meesia moss	fen	1
Trichophorum cespitosum	tufted club-rush	fen	2

Table 47. State species of concern (SOC) or potential species of concern in the project area

Species name	Common name	Habitat group	Number of populations in project area
Botrychium crenulatum (SOC)	wavy moonwort	mesic montane/ disturbance	1
Botrychium hesperium (SOC)	Western moonwort	mesic montane/ disturbance	1
Cypripedium parviflorum (PSOC)	small yellow lady's slipper	fen	1
Drosera rotundifolia (PSOC)	roundleaf sundew	fen	1
Gaultheria ovatifolia (PSOC)	slender wintergreen	wetland/riparian	1
Lobelia kalmia (SOC)	Kalm's lobelia	fen	1
Ophioglossum pusillum (SOC)	adder's tongue	wetland/riparian	1
Scheuchzeria palustris (SOC)	rannoch-rush	fen	2

The forest plan uses a coarse-filter approach in management area direction to maintain ecological conditions of many habitat groups across the scale of the forest to meet the needs of most plant species. Other habitat groups are not commonly managed for vegetation treatment or recreation opportunities, such as formerly listed rare plant species, and some of those habitat groups have forestwide plan direction protecting those areas. The vegetation management proposed in this project follows the forest plan and management area direction. The focus of this analysis will be those species occurring in habitat groups identified in the forest plan: fen; wetland/riparian; and mesic montane/disturbance habitat groups.

Direct, indirect, and cumulative effects

Under the no-action alternative there would not be any vegetation management in the project area. Ecological succession would continue in areas such as fen; wetland/riparian; and mesic montane/disturbance habitat groups. Natural disturbances such as wind events and wildland fire would continue to occur on the landscape, creating habitat for those species requiring disturbance to germinate and reproduce. Past vegetation management has also provided ample disturbance for those species, as well as altered suitable habitat for species found in mesic montane and riparian habitat groups.

Additional trails would not be created in the project area, which would maintain those native plant habitats, but would not address the issue of social trails and the resulting weed infestations in the project area, which currently impacts native vegetation and plant species of conservation concern. However, the Forest invasive plant program already focuses on these existing National Forest System trails and infested areas for weed treatment with the knowledge of documented plant species of conservation concern populations.

There are a few fens and many wetlands in the project area, on National Forest System lands and on lands of other ownership. Currently, many fens occupied by plant species of conservation concern or state listed species are not impacted by recreation. A couple fens and wetlands have roads or trails adjacent to them or nearby. There are no trails through fens or wetlands with documented plant species of conservation concern.

Proposed action

See forest plan FEIS volume 1 pp. 345-346 for effects from vegetation management, recreation, and road access to plant species of conservation concern and suitable habitat. Project design features prevent impacts to these populations through avoidance measures.

Impacts to fen habitat group, including documented populations

Direct and indirect effects

Forest plan standard FW-STD-RMZ-05 applies to the fens in the project area, which states that "ground-disturbing vegetation treatments in the riparian management zone for peatlands, fens, and bogs shall only occur in order to restore or enhance aquatic and riparian-associated resources." This standard applies to the entire riparian management zone for peatlands, fens, and bogs within category 4a and protects those populations that occur within peatland/fen habitat groups that are categorized as 4a. No vegetation treatment is proposed within fen RMZs.

An interpretive trail and boardwalk (trail TR11A) are proposed to a fen in the project area that supports slender cottongrass and roundleaf sundew. Design features for the trail and boardwalk construction avoid impacts to the slender cottongrass and roundleaf sundew populations as well as to minimize impacts to the fen. The boardwalk would be designed to discourage visitors from trampling in the fen. Interpretive signs would describe the ecological process of fen development and its fragility. Effects of constructing a trail to rare plant populations include increased human interaction, which leads to increased risk of trampling, removal, or collection of plants, and possible degradation of habitat by disturbance and the increased risk of introducing invasive plant species. A benefit of an interpretive trail is the education of the public of fen habitats and the plants that inhabit them.

Impacts to wetland/riparian habitat group, including documented populations

Direct and indirect effects

The wetland/riparian habitat group for plant species of conservation concern falls under the definition in forest plan standard FW-STD-RMZ-01 for all riparian management zones. The project will meet FW-STD-RMZ-02 and 06 which provide protections to this habitat group for this project.

Wetland/riparian-dependent species can also occur in fens, such as giant helleborine and adder's tongue. Documented populations in wetland/riparian habitat that occur in RMZs would be excluded from vegetation treatment during layout (such as units 43 and birch unit along Road 1690) to avoid ground disturbing impacts to plants at those sites (FW-GDL-PLANT-DIV-02) (see design features).

There are no proposed roads near documented wetland/riparian habitat group species of conservation concern populations. There are roads proposed for vegetation management purposes crossing RMZs and the wetland/riparian habitat group. Many of the proposed temporary roads are on existing road templates, which means that they have not been providing suitable habitat for wetland/riparian habitat group species of conservation concern. Maintaining or reconstructing them to standards would cause soil disturbance and remove what vegetation has grown back on the road surface. Weeds also exist on these templates, providing seed sources that can move into the adjacent wetland/riparian habitat, impacting suitable habitat.

The project's adherence to FW-GDL-RMZ-01, 08-12, 14 and 15 would reduce effects to wetland/riparian habitat and any undocumented rare plant populations. However, there are several units proposed for activities in the riparian habitat group. These activities could change conditions on the ground from suitable habitat to unsuitable for plant species of conservation concern by altering light, temperature, and humidity.

Impacts to mesic montane/disturbance habitat group, including documented populations

Direct and indirect effects

Vegetation treatments do not overlap the documented populations in the mesic montane/disturbance habitat group and would not impact them (FW-GDL-PLANT DIV-02). There are no roads or trails proposed directly over documented populations. Trail TR11A is proposed near the habitat of a population of crested woodfern. That trail would be designed around the population to avoid impacts.

The effects described in the forest plan FEIS (volume 1, pp. 345-346) from recreation, vegetation management, and road management apply to the mesic montane/disturbance habitat group. This habitat group would be more impacted than the fens and wetland/riparian habitat groups as there are more activities proposed in the mesic montane habitat of the project area. Suitable habitat would be impacted by trails, roads, and vegetation management due to ground disturbance, canopy removal, and weed introduction and spread.

However, there are species that could benefit from soil disturbance and canopy removal, such as the moonworts (*Botrychium* sp.). They are often found in old road beds and trail edges in the disturbance habitat group. The proposed trails and roads in this project would provide suitable habitat in the long term.

Cumulative effects

Past, present, and reasonably foreseeable activities in the project area affecting fens; wetland/riparian; and mesic montane/disturbance habitat group plant populations and suitable habitat include vegetation management, recreation, land development, and roads.

Vegetation management

Past vegetation management has manipulated mesic montane habitat, and created disturbance habitat, in the project area since the 1940s (project file exhibit I-4). Between vegetation management, wildland fire, and fire suppression, much of the habitat in the project area has been maintained as mesic montane with mixed conifers and a shrub-dominated understory. The proposed activities would continue that trend with an emphasis on fuels reduction. Reforestation that occurred following past regeneration harvest has reduced the timeline for increasing canopy cover and providing ongoing suitable habitat for plant species of conservation concern in the mesic montane habitat group.

Roads

Road management is a past, present, and reasonably foreseeable activity in the project area. Similar to the effects from the proposed action, road construction has removed suitable habitat from the landscape permanently and has changed adjacent habitat by edge effects (changed light, temperature, and humidity), which also allows weeds to encroach into native plant communities, further altering suitable habitat (forest plan FEIS, volume 1, pp. 345-346). Due to the large amount of private lands in this project area and the adjacency to an urban area, there are many miles of roads on the landscape.

Roads have been constructed near and adjacent to fens in the project area in the past and continue to exist on the landscape. Roads provide corridors for vehicles, recreationists, and weeds which can have negative effects to fens.

Roads effects are more predominant in the wetland/riparian habitat group than in the fen habitat group due to road construction following stream courses as well as the abundance of riparian areas in the project area. The presence of roads has led to weed infestations along roads and then to the treatment of those infestations, near wetlands and in riparian areas. This project would add one National Forest System road that potentially crosses riparian areas. Temporary roads would be rehabilitated and seeded following project activities. No additional roads would be open to public use in the project area. The existing motorized trails in the landscape have a similar effect to plant species of conservation concern as roads, and the addition of the nonmotorized trails system to the project area would add to the potential edge effects to suitable habitat. Disturbance from roads would add suitable habitat for disturbance-dependent species.

Land development

Land development is extensive in the project area. There are nearly 9,000 acres of private property in the project area. Some of that development has likely occurred in wetlands and riparian corridors, and while those areas are not National Forest System lands, the impacts can move up and downstream in the form of invasive species. Reed canarygrass and Canada thistle are two species that can negatively impact wetland and riparian habitats, altering conditions so that native species cannot thrive. There are a few locations in the project area where these species are along stream corridors on private lands, with the potential to move onto National Forest System lands, and vice versa.

Recreation

Recreation is a dominant activity on National Forest System lands in the project area. As referenced in the forest plan FEIS volume 1, p. 345, activities such as trails and trailheads used by hikers, stock, wheeled users, and even snowmobile trailheads and trail maintenance, impact suitable habitat and potential plant species of conservation concern populations. Recreation will continue to occur in the project area. The proposed action would increase recreation opportunities in the project area, which would impact suitable habitat for mesic montane/disturbance habitat group species.

Weed management is a past, present, and reasonably foreseeable activity in the project area. It is connected to many of the other activities discussed in this section. Managing weeds is a large part of recreation and road management, since these activities provide vectors for the introduction and spread for weeds. Weed infestations impact suitable habitat and require control by chemical, biological, mechanical or manual means. The weed program is required to avoid impacting documented plant species of conservation concern populations. However, weed management can impact undocumented plant species of conservation concern populations.

Effects to Non-Native Invasive Plants/Noxious Weeds

Summary of Findings

The no-action alternative would not increase risk of introduction, spread, establishment, or persistence of non-native invasive plants.

The proposed action would have a limited risk of introducing new weed species into the project area. However, it would have a high risk of spread throughout the project area due to the number of existing weed infestations in the project area, the amount of potential soil disturbance, the existing roads, the proposed recreation, the amount of private land, the timing of activities, and the use of equipment in those areas moving from site to site without cleaning between sites.

The risk of establishment would be moderate considering hand methods are proposed on nearly a third of the proposed vegetation treatment, haul routes would be treated pre- and post-haul, disturbed sites would be seeded, and temporary road rehabilitation would occur.

The risk of persistence would be high in the areas such as regeneration harvests, roads, trails, and other areas with canopy cover removal. If weeds were to establish in those sites, the lack of canopy would allow those weeds to maintain their infestations until treated or out-competed by native vegetation. Other vegetation treatment types, such as commercial thins, sapling thins, and understory removal would create a moderate risk of persistence.

The design features would help prevent introduction, spread, and establishment of weeds, which in turn would help prevent the persistence of weeds.

Methodology

Analysis area

The analysis area is the project area and nearby lands of other ownership that provide access to the project area, as shown in proposed action map 1. The spatial bounds of the non-native invasive plants analysis area are based on the project area, which is the area of influence for risk of introduction, spread, and establishment of invasive species.

Project activities leading to soil disturbance and increased light would increase the risk of invasive plant introduction, spread, establishment, and persistence. Some shade-tolerant species, such as hawkweed, may persist indefinitely even after the canopy closes. The risk of invasive plant introduction and spread can begin with project implementation and last until 5 to 10 years (average seed viability) after activities cease. The risk of invasive plant establishment and persistence may occur up to 50 years after implementation is complete, depending on native vegetation recovery. After 50 years, in the longest example, the overstory and understory canopy cover conditions would shade the ground and greatly reduce the risk of establishment and persistence by most invasive species (Kuropat 2009b).

It is assumed after project completion, the risk of introduction and spread due to project activities would be low. It is also assumed after the canopy closes the risk of establishment and persistence would be low.

Indicators

Measurement indicators for weeds quantify how weeds can possibly move across and remain on the landscape. They also provide the amount of risk an activity might create to allow weeds to fill a resource

element (table 48). Not all activities can be measured or will have an effect to weeds. See project file exhibit I-5 for more information on methodology.

Table 48. Resource indicators and measures

Resource element	Resource indicator	Measure
Weed introduction and spread	Proximity to known infestations	Documented infestations in and adjacent to project area
Weed establishment	Soil disturbance	Acres of soil disturbance
Weed persistence	Light availability	Acres of canopy cover reduction

Data sources

Data sources used in this analysis include field surveys and the Forest Service Natural Resource Management (NRM) database. Surveys were conducted in the summer field seasons of 2017 and 2018.

For more about information sources, incomplete information, and unavailable information, refer to the forest plan FEIS volume 1, pp. 348-351.

Alternatives

No-action alternative

There are approximately 470 infested acres documented in the project area (table 49). These infestations primarily infest roadsides and previously disturbed areas in the project area. There are infested areas off road as well. The most commonly documented species are St. John's wort, the hawkweed complex, oxeye daisy, and spotted knapweed. Notably, leafy spurge, Dalmatian toadflax, hoary alyssum, and tansy ragwort occur in this project area. These species require special attention from the weeds program due to their relative low infestation rates on the forest, or their noxious priority, or both (Montana Department of Agriculture 2017). See project file exhibit I-6 for information on species biology.

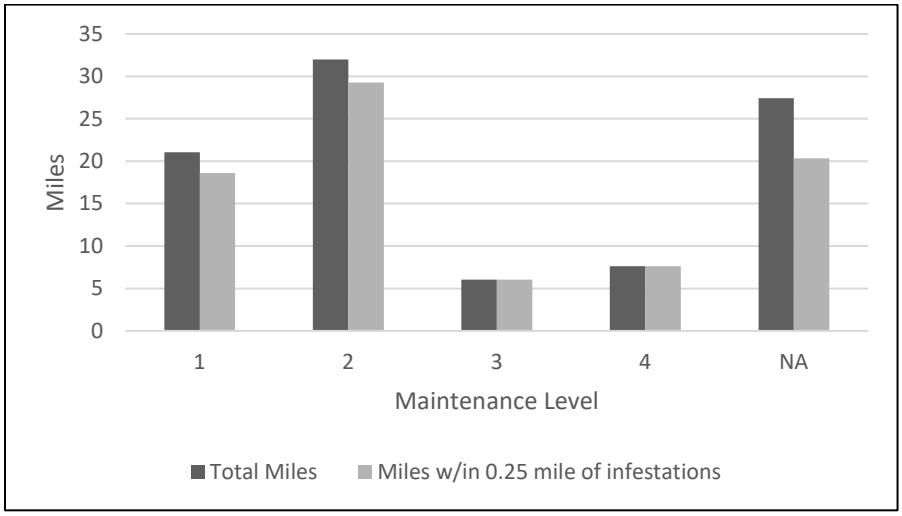
The majority of roads existing in the project area are infested or within a quarter mile of an infestation (figure 1, project file exhibit I-7). The existing motorized trails in the project area are all infested (project file exhibit I-7).

Table 49. Documented infestations in the Crystal Cedar project area

Latin name	Common name	Infested acres
Achillea nobilis	noble yarrow	0.53
Artemisia absinthium	wormwood; absinthe	0.25
Berteroa incana	hoary alyssum	0.03
Bromus tectorum	cheatgrass	0.07
Campanula rapunculoides	creeping bellflower	0.06
Centaurea stoebe ssp. micranthos	spotted knapweed	68.10
Cirsium arvense	Canada thistle	17.12
Cirsium vulgare	bull thistle	0.25
Cynoglossum officinale	houndstongue	33.15
Euphorbia esula	leafy spurge	2.15

Latin name	Common name	Infested acres
Hieracium sp.*, H. aurantiacum, H. floribundum*	hawkweed complex	105.35
Hypericum perforatum	St. John's wort	131.13
Leucanthemum vulgare	oxeye daisy	70.80
Linaria dalmatica	Dalmatian toadflax	Trace, less than 0.01 acre.
Linaria vulgaris	common toadflax	8.73
Phalaris arundinacea	reed canarygrass	2.50
Potentilla argentea	silver cinquefoil	0.01
Potentilla recta	sulfur cinquefoil	0.74
Senecio jacobaea	tansy ragwort	Trace, less than 0.01 acre.
Tanacetum vulgare	common tansy	26.34
	Total	**467.28**

Figure 2. Total miles of existing roads within 0.25 miles of an existing infestation within the Crystal Cedar project area



Maintenance level: 1 – basic custodial care (closed); 2 – high clearance vehicles; 3 – suitable for passenger cars; 4 – moderate degree of user comfort; NA – not applicable (historical, decommissioned, or private roads not assigned a maintenance level)

Direct, indirect, and cumulative effects

There would be no ground disturbing activities under the no-action alternative, which would prevent creating more suitable conditions for weed establishment as a result of project activities. Equipment related to project activities would not enter the project area, eliminating the risk of introducing and spreading new weeds. There would also not be a risk of persistence from timber harvest since canopy cover would remain the same, as well as the increase of canopy cover over time.

Ecological succession would continue, where vegetated areas would continue to increase canopy cover except in areas of current land use (developed land, roads, trails, etc.), and in the event of wildland fire. Weeds would continue to move across the landscape at similar rates to now, by wind, people, animals, vehicles, etc. Treatment of weeds will continue as funds allow, unrelated to this project.

Proposed action

Direct and indirect effects

Weed introduction and spread

Introduction of weeds into the project area would be low risk because of weed washing requirements in the timber contract for equipment used. Because project activities would be implemented with equipment moving through the infestations within the project area the risk of spread remains high. Figure 2 compares total miles of all existing roads on National Forest System lands to the miles of roads within a quarter mile of documented weed infestations. Many of these roads are directly infested with weeds, while others are within skidding distance of weeds (figure 2). The proposed roads, both temporary and National Forest System roads, are all infested or within a quarter mile of an infestation.

The proposed vegetation treatment units are all within a quarter mile of an infestation as well. However, surveys showed that 505 acres of proposed vegetation treatment acres do not currently have weeds (project file exhibit I-7). Several other units only have weeds inventoried along roads bordering the units. These units are at the greatest risk of weeds being introduced and spread throughout from the adjacent roadside infestations.

As with the proposed roads in the project area, all of the proposed trails are within a quarter mile of an infestation, and there are a few sections of trail proposed in areas already infested.

To address bringing in weeds from off-forest, equipment would be washed prior to work on-forest, which would make the risk of introducing new weed species into the project area low (FW-DC-NNIP-02). The risk of spreading weeds through the project area would be high due to amount of weeds in the project area, timing of activity during flowering and seed set, proximity of nearby infestations within the project area and routes to get to activity areas, and the use of equipment in those areas moving from site-to-site without cleaning between sites. Areas of hand treatment (1,295 acres) are at a low to moderate risk of introducing and spreading seed due to the same timing and proximity factors discussed above, however, since individual people can avoid walking directly through weed infestations, this would avoid spreading weeds directly through the project area. Treatment of haul route pre- and post-hauling would reduce weed spread during operational periods but will not eliminate the risk of spread within the project area.

Weed establishment

Weeds establish in disturbed soil, whether it is new seed in freshly disturbed soil or dormant seed banked in the soil that has been exposed by any disturbance. See the soils section for detrimental disturbance in this project area. It is any soil disturbance that creates suitable conditions for weed seed to germinate and grow (project file exhibit I-5). The proposed action could disturb up to 2,739 acres from harvesting (vegetation treatments including burns minus hand treatments), approximately 27 acres from road construction, plus approximately 11 acres of trails in the project, and approximately 2 acres of trailhead construction, which is ten percent of the project area. This means that within approximately 2,779 acres, there would be soil disturbance (non-detrimental and detrimental) interspersed through that acreage, providing suitable conditions for the establishment of weeds. Activities in the project that would cause soil disturbance include trail and road construction, mechanical vegetation management activities, and prescribed burning.

Not every site of disturbance would be immediately infested with weeds; it only increases the suitable conditions of those areas until the native vegetation recovers. Project design features include rehabilitation measures such as seeding sites of disturbance with native grass seed, which would reduce the risk of establishment of weed seed and germination in those rehabilitated areas (FW-GDL-NNIP-01). The risk of establishment would be moderate considering hand methods are proposed on nearly a third of

the proposed vegetation treatment, haul routes would be treated pre- and post-haul, disturbed sites would be seeded, and temporary road rehabilitation would occur.

Weed persistence
How long weed infestations exist on the landscape, or their persistence, depends on the surrounding habitat, specifically those resources that would limit their survival. Many non-native plant species are impacted by light or the lack of, depending on the species (project file exhibits I-5 and I-6). The proposed action would increase the light available to weeds by opening up the canopy through vegetation treatments, roads, and trails. The risk of persistence would be high in the areas such as regeneration harvests, roads, trails, and other areas with majority canopy cover removal. If weeds were to establish in those sites, the lack of canopy would allow those weeds to maintain their infestations until treated or out-competed by native vegetation. Other vegetation treatments, such as commercial thins, sapling thins, and understory removal would have a moderate risk of persistence. Design features address weed issues prior to persistence of infestations (FW-DC-NNIP-03). Once there is an established infestation, the Flathead National Forest weeds program incorporates it into the existing condition of the forest and prioritizes it using an adaptive strategy (FW-DC-NNIP-04, FW-OBJ-NNIP-01).

Table 50. Resource indicators and measures for the proposed action

Resource element	Resource indicator	Measure	Proposed action[a]
Weed introduction and spread	Proximity to infestations	Documented infestations within 0.25 mile of proposed activities	452 infested acres
Weed establishment	Soil disturbance	Acres of soil disturbance from proposed activities	2,779 acres, see soils section
Weed persistence	Light availability	Acres of canopy cover reduction from proposed activities	3337 acres of canopy cover removal (harvests, roads, burns)

a. Methodology for non-native invasive plant analysis can be found in project file exhibit I-5.

Cumulative effects

Past activities influencing the introduction and spread of weeds into the project area include vegetation management, weed control, revegetation, recreation, road construction and management, prescribed burning and wildland fire, special use permits, forest products use, and land development. See project file exhibit I-8 for a list of past and current actions in the project area.

Weed introduction and spread
Timber harvest has occurred in the project area since the 1940s and since then weeds have likely been introduced to the landscape with each subsequent entry. Recent projects such as Cedar Spoon and Blankenship Fuels Reduction Stewardship projects have incorporated weed prevention design features. Crystal Cedar and future projects also incorporate weed prevention design features.

Private lands provide weed seed sources for new infestations or spread of infestations throughout the project area. Land development (building and road construction, infrastructure, etc.) brings in outside equipment that has likely been used on other projects in other parts of the Flathead Valley, the state of Montana, or from out of state. Vectors include, but are not limited to, wind, animals, humans, equipment, and vehicles. In the Crystal Cedar project area, there is a lot of National Forest System lands/lands of other ownership interface where weeds can spread easily from one side of a boundary to the other. There is a high risk of future introduction and spread from adjacent lands.

Roads provide corridors for the movement of weeds into and throughout the project area, on public lands and private lands. Road maintenance includes graveling and blading, which requires the addition of gravel

from an off-site source to the road bed and equipment to scrape along the road, along with vegetation, moving that gravel a long distance along the road surface. These activities introduce and spread foreign material that often contains weed seed. Brushing roadsides, depending on the time of year, can clip seed heads and move them along the roadside as well. These activities are continuous and foreseeable, but because many of these roads will be treated prior to use for log hauling, it will provide an additional opportunity to treat existing infestations.

Recreation activities such as hiking, biking, OHV use, stock use, and other recreation activities that bring people, animals and vehicles into the project area and through it are also vectors for the introduction and spread of weed seed. These activities are continuous and foreseeable and will expand with the construction of the new trail network.

Other actions in the project area which can introduce or spread weeds either into the project area or through it include forest product gathering and certain special use permits. Individuals enter the project area and have the risk of carrying invasive plant seeds on their persons or vehicles.

Weed establishment
Past activities included ground disturbance such as timber harvest activities, trail and road construction, road maintenance (blading), prescribed burning, fire suppression activities, and private land development and some special use permits allow for the risk of establishment of non-native invasive plants. Common practice project design features in recent projects include seeding disturbed sites to prevent weeds from establishing.

Weed persistence
The project area has several areas lacking canopy cover, such as developed lands, roads, trails, special use permit sites, and naturally occurring habitats like open meadows, rocky outcrops, river banks, and forest openings. In addition to roads and trails, there are a few of these forest openings that are infested (project file exhibit I-7). Tree planting has occurred and will likely occur again in the project area, which increases the canopy cover quicker in the planted area than if the area was left to naturally regenerate. The proposed action would contribute to more forest openings on the landscape and persistent openings via new roads and trails.

Persistent infestations require control and treatment, which has been occurring in the project area since 2001 and will continue to occur into the foreseeable future. The addition of roads and trails from the proposed action would likely increase the amount of weed control needed from the Flathead National Forest weeds program.

Effects to Fire and Fuels

Summary of Findings

Reducing forest density in the project area through vegetation management activities will have beneficial effects for the fire and fuels resource. The hazardous fuels treatments in the wildland-urban interface enhance the success of fire suppression activities, minimize crown fire likelihood, and decrease flame length. Minimizing risk and loss of life to the public and firefighters while protecting private property and other values at risk will be benefited by the proposed action.

Methodology

Analysis area

The project area is directly north of Columbia Falls, Montana, mainly within the wildland-urban interface. Wildland-urban interface is an area within or adjacent to an at-risk community. An at-risk community is defined as a community within the wildland-urban interface listed in the Federal Register notice, Wildland Urban Interface Communities within the Vicinity of Federal Lands that are at High Risk from Wildfire (66 FR 751). Columbia Falls is identified within the Federal Register notice as a community within the vicinity of Federal lands that is at high risk from wildfire (project file exhibit J-11). The wildland-urban interface is based upon locally produced community wildfire protection plans, as stipulated and defined in the Healthy Forests Restoration Act of 2003. For the Crystal Cedar Project, wildland-urban interface is mapped through the Flathead County Community Wildfire Protection Plan (project file exhibit J-1). Approximately 92 percent of the project area falls within the wildland-urban interface and lands directly adjacent to the project area are composed primarily of private lands with residences and corporate timber land

The project area is the analysis area for the fire and fuels resource, because it is where the effects of implementing the proposed activities would occur.

Indicators

The following indicators were used to compare the effects of alternatives against each other.

Table 51. Fire and fuels resource indicators

Purpose and need	Applicable forest plan direction	Project objective	Resource indicator	Measure
Reduce tree densities and fuel loadings within the wildland-urban interface to result in less intense fire behavior near communities and facilitate safe wildland fire operations.	FW-DC-FIRE-02 FW-DC-TE&V-13	Reduce wildland fuel so that expected fire behavior is reduced.	Fire type	Crown fire or surface fire
			Flame length	Feet
		Reduce high density forest conditions with focus in the wildland-urban interface.	Canopy cover	Acres

Acres of canopy cover

The forest plan indicates a need to reduce moderate and high density forest within the wildland-urban interface. Sixty percent of the project area is considered moderate or high density forest. It is desired to increase the proportion of low density forest (canopy cover less than or equal to 40 percent) and decrease the proportion of moderate and high density forest (canopy cover greater than 40 percent), especially in the wildland-urban interface. The majority of the Crystal Cedar Project falls within the wildland-urban interface.

In general, the denser the forest the greater the likelihood that fuel characteristics could support a fast-moving, intense crown fire. “The proposed activities will modify fire behavior and fuel conditions, which may improve opportunities for fire suppression, but the vegetation treatments by themselves will not prevent fires from burning or spreading” (Finney and Cohen 2003).

Canopy cover is typically low when the stand is in the earliest stage of succession, when grass, forbs, and shrubs dominate the site and trees are in the seedling size class. As trees grow, crowns expand to fill up the growing space, and canopy cover gradually becomes greater. The growth of understory trees over time also adds to the canopy cover on many sites, especially as the forest grows into the later successional stages. Site productivity also affects canopy cover, with more productive, moist sites tending to support higher canopy cover and harsh sites with poor soils supporting lower canopy cover.

Flame length

The forest plan guidelines indicate a desire to reduce negative impacts of wildfires or improve fire control opportunities through treatments that result in at least one of the following outcomes: reduced flame length, rate of spread, or torching and crowning indices (FW-GDL-FIRE-05). To determine existing condition flame lengths and the potential to reduce flame lengths through vegetation treatment, units were classified according to fuel models (J.H. Scott and Burgan 2005) and run through BehavePlus 5.05 fire modeling program to predict changes in fire behavior and type under given parameters for fuel moisture, weather, and terrain (project file exhibit J-7).

Fire type

Fire can be classified as one of four types shown in table 52 with associated fire behavior.

Table 52. Fire types and associated fire behavior

Fire type	Fire behavior
Surface	understory fire
Torching	surface fire with occasional torching trees
Conditional crown	crown fire possible if the fire transitions to the overstory
Crowning	fire spreading through the overstory crowns

Active crown fire spread is sustained through dense canopy cover (Agee and Skinner 2005). Thus, the purpose of fuel treatment is to change fire behavior when it enters a treated area to reduce the effects of the fire by reducing flame lengths and modifying the type of fire (Stratton 2004). Once a wildfire moves from the crown of trees to the ground, wildland firefighters are better situated to manage the fire and in a safer environment.

Alternatives

No-action alternative

Direct, indirect, and cumulative effects

The Half Moon Fire of 1929 burned the majority of the project area (project file exhibit J-2). Fire suppression and development of private lands in the project area since the Half Moon Fire have resulted in hazardous fuels conditions that pose substantial risks to residences and private property within the wildland-urban interface. Past projects such as Cedar Spoon (2004) and Blankenship Fuels (2006) (project file exhibit J-3) have treated fuels in portions of the project area, but local fire departments and the Forest Service recognize there is a need for more hazardous fuels reduction work to be done within the project area, given its close proximity to the at-risk community of Columbia Falls.

Currently, the majority of the project area consists of forests that are greater than 40 percent canopy cover which is considered moderate to high density forests with closed forest canopies. With the absence of

vegetation treatment, forest density within the project area would remain moderate to high. Those stands with less than or equal to 40 percent canopy would continue to grow, increasing their canopy density over time. With more closed forest canopies, ladder fuels become more prevalent and this can contribute to severe stand replacing fires, which is especially concerning within the wildland-urban interface.

The project area is an area with high levels of human use for dispersed recreation and motorized trails, which contribute to the potential for human-caused fire starts (project file exhibit J-2).

Table 53. Existing forest density within the Crystal Cedar project area

Tree canopy cover	Acres	Forest density	Percent of project area[a]
10-25% canopy cover	2113	Very low/low	25%
26-40% canopy cover	4735		
41-59% canopy cover	9721	Moderate/high	60%
≥ 60% canopy cover	6567		

a. 15 percent of the project area is land with less than 10 percent canopy cover.

Under the no-action alternative, large-diameter Douglas-fir and western larch, would continue to lose vigor due to competition from dense understories of shade-tolerant tree species. This would perpetuate a denser understory. This understory also would serve as ladder fuel that would permit a surface fire to expand into the canopy, thereby killing many of the existing large-diameter trees that would have otherwise survived a surface fire. Under the no-action alternative, without vegetation treatments, fire types would remain unchanged and anticipated flame lengths would not be reduced.

Without prescribed fire, natural openings would continue to grow in with conifer encroachment and shrubs would continue to lose vigor and remain decadent.

Access for firefighters to respond to a wildfire and or manage a wildfire would remain the same because no trails would be built or roads improved with no action. Limited access increases response time and decreases firefighter effectiveness.

Proposed action

Direct and indirect effects

The focus of fuels management since 2001 has been on modifying the fuel conditions to meet various objectives to reduce threats to values at risk by increasing suppression success by minimizing crown fire likelihood, decreasing fire intensity, or decreasing rate of spread. The vegetation treatments proposed will result in a change in the amount, configuration, and spacing of live and dead vegetation to create more manageable fire and reduced severity during a wildfire event (FEIS, volume 2, p. 281).

Vegetation treatments are designed to reduce fire line intensity by converting fire type from crown fire to surface fire and reduce flame length to less than 8 feet, and ideally less than 4 feet, by reducing canopy density, surface, and ground fuels and increasing canopy base height. Although future fire intensity will be reduced in vegetation management units, rate of spread can increase in the post-treatment environment due to a reduction in shading from the sun and sheltering from the wind. Fast moving, lower intensity surface fires has more desirable fire effects than a slow moving intense fire due to the fact that fire adapted, resistant tree species are more likely to survive and create more resilient forest. Treatments

would also reduce the risk and severity of a large scale stand-replacing fire by breaking up the continuity of heavy fuel across the landscape and prevent the spread of wildland fires to neighboring property (FW-DC-FIRE-05).

As shown in table 54 vegetation treatment would change forest density, as shown through canopy cover acreages, within the project area. Reducing moderate to high density canopy cover decreases the possibility of crown fires which benefits firefighting efforts.

Table 54. Forest density within proposed vegetation treatment units under the proposed action

Tree canopy cover	Existing condition (acres)	Post-implementation of proposed action (acres)
10-25% canopy cover	339	576
26-40% canopy cover	632	2863
41-59% canopy cover	1928	0
≥ 60% canopy cover	698	0

a. Post-treatment, 157 acres would have less than 10 percent canopy cover.

The proposed action would effectively reduce the acres of moderate and high density canopy cover on a landscape level reducing expected fire behavior and increasing firefighter safety in the event of a wildfire. Moderate and high density forest conditions within the wildland-urban interface would be diminished. Lower tree densities and fuel loadings would occur in the project area and wildland-urban interface which helps to prevent spread of wildland fire to neighboring private property and provides a safer environment for wildland firefighters and the public.

While much fire research has been done to inform the debate over whether fuels or weather are more influential factors on fire severity, a study conducted by Parks et.al (2018) concluded that “fuel is on average the most influential factor driving high-severity fire in forests of the western US,” but that weather also has a substantial influence on fire severity.

Vegetation treatment units show a decrease in flame length for all types of treatments except sapling thinning (project file exhibit J-8). Sapling thins show an initial increase in flame length which generally lasts from 5 to 7 years before fuels conditions naturally improve (project file exhibit J-8).

Fire type will be moved from crowning/conditional crowning to a surface fire in all treatment types except for sapling thinning where an initial torching type of fire occurs (project file exhibit J-9). This torching is not carried through the crowns of the stand.

Access for firefighters to respond to a wildfire or manage a wildfire would improve because of the constructed trail network, providing improved access to areas of the project not accessed by roads.

Prescribed fires would occur through hand lighting, most likely in September or October; however, there is a chance of a spring burn on some of the more exposed sites. These entries would most likely take place in a single year or over a few years due to air quality constraints, potential for escape, high fire danger, or too much precipitation. Prescribed fire ignitions will not take place in the inner RMZ but fire would be allowed to back or flank into the inner RMZ as listed in design features. Spill containment would be utilized for all pumps utilized for prescribed burning. Burn plan(s) and complexity analysis would be completed prior to prescribed fire implementation.

The Forest Service participates in the Montana-Idaho Airshed Group, which regulates prescribed burns within the state of Montana (project file exhibit J-4). See FEIS, volume 2, pp. 305–307 for a discussion on the Montana-Idaho Airshed Group and smoke management procedures. Air quality would be addressed in the individual prescribed fire plan. Project file exhibits J-5 and J-6 display the expected prescribed fire smoke dispersion and amounts of particulate matter expected to be released into the air.

Cumulative effects

The proposed action would treat fuels and reintroduce fire, designed to mimic natural fire, into the project area. The proposed activities will build upon the fuels reduction activities initiated in Blankenship Fuels and Cedar Spoon and the prescribed fires from 1995 (project file exhibit J-12) to continue the reduction of ladder fuels and high-density forests in the wildland-urban interface. Without future entries into these stands, over time the understory will regrow and create ladder fuels in the wildland-urban interface.

Because of the high values at risk and close proximity to residences and private property, it is likely that fires will continue to be suppressed in the project area. Private development will likely continue within and around the project area, increasing the values potentially at risk from wildfire.

Past treatments combined with the proposed treatments will continue moving the fire and fuels resource toward the desired conditions for fuel management by treating forest vegetation and reducing fire impacts to private property and National Forest System infrastructure, with an emphasis on the wildland-urban interface (FW-OBJ-FIRE-01).

Effects to Soil

Summary of Findings

The soil analysis indicates that both alternatives would meet all forest plan management direction for soils. Soil function and long-term productivity would be maintained by minimizing cumulative detrimental soil conditions in proposed activity areas.

Methodology

Analysis area

The analysis area forms the boundary for the assessment of direct, indirect, and cumulative effects to the soil resource. This area consists of the proposed treatment units and temporary roads for the project. This area was selected because it is where the effects of implementing the proposed activities would occur. The effects on soils would not extend beyond the units proposed for treatment. Effects would range temporally from one to 70 years (Gonsior 1983; Ryan and Noste 1985).

Indicators

Table 55. Resource indicator and measures for assessing effects

Resource element	Resource indicator	Measure	Relevant issue
Soil quality	Detrimental soil conditions	Activity areas with predicted cumulative detrimental soil conditions not exceeding 15 percent	Conserve soil function and long-term productivity

Data sources

Forest Service Manual (FSM) Section 2500-Chapter 2550 and the Region 1 Supplement 2500-2014-1 provide direction for maintaining soil quality (project file exhibit K-1). Establishment of existing condition for proposed mechanical treatment units followed the approach outlined in the Region 1 Soil National Environmental Policy Act technical guide (project file exhibit K-1). Where initial field observations showed potential for existing detrimental soil disturbance to be in excess of two percent of the activity area, the Forest Soil Disturbance Monitoring Protocol (SDMP) was utilized (Page-Dumroese, Abbott, and Rice 2009a, 2009b). This protocol provides a method for systematically quantifying soil conditions based on visual indicators.

All SDMP surveys were conducted using an 80 percent confidence level (Page-Dumroese, Abbott, and Rice 2009b). The margin of error around each estimate is ± 5 percent. Sample size is determined automatically on the electronic SDMP field form. SDMP field data collection spreadsheets and activity area documentation forms are located in project file exhibit K-3.

A study of soil moisture trends on the Flathead National Forest (project file exhibit K-4) demonstrates the average annual period when soils are sufficiently dry to reduce detrimental soil disturbance. Literature cited documents the effectiveness of proposed design features to reduce disturbance from project activities. In addition, monitoring reports for activities on soils similar to those in the project area (project file exhibits K-5-14) were used to estimate the effects of the proposed activities. Information gathered in field investigations was used to determine cumulative effects (project file exhibit K-15).

The soils in the project area are described in the updated landtype report and soil survey for the Flathead National Forest (Martinson and Basko 1983, 1988).

Predicted detrimental soil disturbance from proposed temporary roads are calculated based on average clearing width. Temporary road prisms are part of the productive land base as defined by National Forest Management Act Sections 4-7, and therefore, predictions of potential impacts on soil productivity are required. All temporary roads are estimated to average 22 feet in width of total disturbance resulting in 2.7 acres of detrimental disturbance per mile. All associated impacts from temporary road construction and rehabilitation are assigned to the related vegetation treatment units.

Alternatives

No-action alternative

Direct, indirect, and cumulative effects

Field investigations were conducted to determine if and how existing soil condition was affected by past management activities, or dispersed activities, or both. Areas with existing soil disturbance were surveyed to quantify detrimental soil condition (table 56). In addition, proposed vegetation treatment units that would require design features to address conditions such as sensitive soils and landslide-prone areas were evaluated.

Soil quality in the project area is stable to trending upward. Literature indicates that disturbed soils improve by means of plant growth, bioturbation, freeze-thaw cycles, wet-dry cycles, and organic matter additions, all of which naturally occur in the project area. These natural processes effectively ameliorate compacted soils over time (Lull 1959). Compaction recovery rates are highly variable with an expected range of 10 to 70 years (Gonsior 1983). Most disturbed soils have abundant organic matter and roots throughout the upper soil layers. In addition, pre-harvest surveys of proposed units show that many old disturbances are no longer detrimental; indicating they are recovering and soil quality is trending upward.

Dominant productivity ratings of the landtypes in the project area is moderate to high. All soils within the proposed units, with the exception of small, shallow, rocky inclusions and bedrock outcrops, support forest vegetation.

The erosion risk rating for the landtypes in the project area is moderate. These landtypes are characterized by soils with high infiltration rates. The high rock fragment content of most subsurface horizons also promotes water movement through the soils. Runoff from these soils is uncommon.

Sensitive soils contain an excess of soil moisture or have soil textures with increased susceptibility to disturbance from mechanical harvesting activities. Disturbance on sensitive soils can lead to loss of soil productivity. Areas of sensitive soils typically require design criteria for protection. Units 10, 54, 54A, 64, 70, 70A, 120, 130, and 133A have soil textures that require summer cut-to-length/log forwarder or winter logging to minimize detrimental soil disturbance to sensitive soils.

The dominant mass failure hazard rating for the project area is low. The proposed units exhibited no signs of increased mass failure risk during field reconnaissance.

This alternative would not cause short-term effects on the soil resource over and above existing condition. No additional road building, timber harvest, prescribed burning, or fuels reduction would disrupt natural soil processes.

Proposed action

Direct and indirect effects

The following sections are based on the intent to maintain soil function and long-term productivity (FW-DC-SOIL) by designing skid trails and landings so they occupy less than 15 percent of each activity area and use of site preparation methods that minimize detrimental disturbance.

Physical soil characteristics

Ground-based harvest

These activities would result in direct and indirect effects on physical soil properties within the boundaries of proposed activity areas. Most detrimental effects would be concentrated on the skid trails, landings, and temporary roads within or associated with vegetation management units. Minimizing the area occupied by landings and skid trails to reduce the detrimental effects on soil productivity from changes in physical soil properties is recommended (Garland 1983; Page-Dumroese 1993; Williamson and Neilsen 2000).

Skid trails and landings would be laid out to occupy less than 15 percent of the activity unit (FW-STD-SOIL-01). Calculations demonstrate that spacing skid trails 75 and 100 feet apart limit disturbance to less than 15 percent of the activity area (project file exhibit K-18). Designated skid trails with 100 foot spacing impact 11 percent of the harvest area (Garland 1983). Post-harvest monitoring on the Flathead National Forest consistently shows less than 15 percent detrimental soil disturbance from ground-based operations that use designated skid trails (project file exhibits K-5-14).

In addition to using designated skid trails and landings, there is potential to reduce soil impacts further by limiting equipment operation, to the extent possible, when soils are drier than field capacity (McNabb, Startsev, and Nguyen 2001; Startsev and McNabb 2001). Rutting is most often associated with logging on wet soils (Williamson and Neilsen 2000). Soil moisture monitoring on the Flathead National Forest showed that soils are drier than field capacity during the summer dry period which begins in July and often lasts well into October (project file exhibit K- 4). Most summer logging would occur when soils are

drier than field capacity. By operating on low soil moisture conditions we have the potential to reduce the amount of detrimental soil disturbance from skidding operations.

Heavy slash (about 40 kg/m^2) has proven effective for buffering the effect of equipment operation on mineral soil (S.-K. Han 2006). Cut-to-length/log forwarder systems paired with heavy slash mats on skid trails can reduce detrimental soil disturbance over traditional ground-based logging systems. These harvesting systems, which stay on designated skid trails, create soil disturbance on about 10 percent of the harvested area (S.-K. Han 2006). Logging when soils are drier than field moisture capacity reduces the amount of compaction associated with cut-to-length logging (H.-S. Han et al. 2006). Monitoring on timber sales showed that 15 units logged using a cut-to-length/log forwarder system all met soil quality objectives (project file exhibits K-8-10).

Skyline harvest

Skyline operations would result in direct and indirect effects on physical soil properties within the boundaries of the proposed activity areas. Effects will be less than those from ground-based operations. Skyline yarding disturbs 2 to 8 percent of the soil in a unit (McIver and Starr 2000). Monitoring results on the Flathead National Forest show skyline yarding had levels of detrimental disturbance far below 15 percent of an activity area.

Excavator piling

All mechanical piling would be accomplished with excavators. This method reduces the extent of detrimental soil impacts from the site preparation activities (project file exhibit K-17).

Sapling thin and understory removal

No detrimental soil disturbance would result from the hand cutting of saplings or the hand piling of cut saplings. No significant effects to soil bulk density, infiltration capacity or soil moisture content are expected (Seymour and Tecle 2004).

Organic matter

All proposed treatments would leave varying amounts of organic matter on the site (FW-GDL-SOIL-04). The total amount of nutrients on a site would likely be reduced where organic matter would be removed or displaced. However, plant available nutrients mineralized from organic matter would increase due to increased incoming solar radiation and soil moisture. These conditions accelerate the decomposition of the remaining organic matter and the release of plant-available nutrients in the treated stands (Harvey et al. 1994).

After project implementation, competition between trees would be reduced because fewer trees would remain on the sites. This situation could result in more available nutrients and water for the remaining trees, potentially conferring greater growth, vigor, and disease resistance (Powers et al. 2005).

It is important to note that nutrients in soil and organic matter are not the only nutrients available to the forest vegetation. In logging followed by low-severity broadcast burning there would be no long-term depletion of nitrogen reserves because lost nitrogen would be more than replenished by inputs from precipitation and by biological nitrogen fixation over a rotation of 100 to 150 years (Jurgensen, Harvey, and Larsen 1981).

Regeneration harvest

These treatments would remove the most overstory vegetation and have the potential to remove more amounts of organic matter than intermediate harvests. Whole tree yarding would remove tops and branches of harvested trees from the stand to the landing for disposal by pile burning,

chipping/masticating, and/or removal. Units proposed for excavator pile burning or broadcast burning would leave nutrients associated with the slash on the site to be used by the remaining forest vegetation.

All harvest prescriptions would leave a portion of the existing stand on the site. Remaining living trees and vegetation in stands will serve as potential nutrient sources on the site.

Intermediate harvest

These treatments would leave a large portion of the existing stand on site, which would maintain more organic matter on the site than regeneration harvests.

Excavator piling and burning

This post-harvest treatment will be used for mechanical site preparation work. The proposed site preparation activities would reduce organic material on sites while reducing hazardous fuel loads. A variety of organic material would remain on the site after project implementation.

Prescribed burning

The effect of fire on soil is described as burn severity, which depends on the duration of burning and intensity (Certini 2005). Prescribed fire activities that result in dominantly low to moderate burn severities would best preserve soil productivity. The amount of nutrients available to plants would increase as a result of the burning. Proposed burn conditions would allow many plants to quickly return to the burned sites from unburned roots and seeds in the soil. Post-fire vegetation response would utilize available nutrients, reducing nutrient leaching. Native forest vegetation would remain on the site, including some of the existing trees. The ultimate goal of this effort is to maximize the intended vegetative response while minimizing resource impacts.

Sapling thin and understory removal

Lop and scatter treatment units will be treated by hand and have slash dispersed throughout the unit. Organic matter will not be removed and there will be no measureable effects to the forest floor.

Soil erosion

Where there is a risk of soil erosion, it would be minimized by implementing the following management practices:

- Reducing the area where equipment operates
- Locating landings on relatively flat ground that can be properly drained
- Locating skid trails on slopes less than 40 percent that have soils with a low or moderate erosion hazard (FW-GDL-SOIL-01)
- Using erosion control features such as water bars, seeding, replanting, and placing slash on disturbed soils (FW-GDL-SOIL-03)

Sediment from the permanent transportation system is not a component of the soil quality assessment process. These effects are evaluated in the aquatics section.

Vegetation treatment

Management activities that leave organic matter on the soil surface minimize soil erosion. Watershed Erosion Prediction Project (WEPP) model results show no potential for post-treatment erosion in units proposed for mechanical treatment (project file exhibit L-16).

Sapling thin and understory removal

Maintenance of infiltration rates and effective ground cover of soils is necessary to prevent erosion. The lack of biomass removal would maintain effective ground cover and the lack of increase in soil bulk

density would result in no reduction in infiltration rates over the existing soil. No soil erosion is anticipated from this treatment.

Prescribed burning

With a 25 year return period analysis there is a zero to 14 percent probability of erosion following implementation of prescribed burns (project file exhibit L-16). WEPP model results estimate the amount of erosion in this scenario at 0.02 tons per acre (project file exhibit L-16).

Post-fire vegetative response will be rapid, regardless of burn severity and areas that burn intensely will have sufficient organic material and vegetative response to reduce risks to soil erosion (Lentile et al. 2007). Soil erosion rates would decrease as vegetation and effective ground cover are re-established.

Temporary road construction

Re-contouring activities identified in design features would not ameliorate the long-term impacts to soil productivity immediately, but would improve soil conditions compared to those of an existing or abandoned road (FW-STD-SOIL-02). The establishment of vegetation and associated additions of organic matter would encourage recovery over time. Re-contouring would provide a suitable seed bed for native forest vegetation while increasing soil hydraulic conductivity, organic matter, total carbon, and total nitrogen (Lloyd, Lohse, and Ferré 2013). These conditions would likely accelerate the recovery of the soil productivity.

Erosion is expected from temporary roads when native surfaces are exposed to rainfall impact and overland flow. WEPP model results estimate the potential amount of soil erosion from these uses at a maximum of 1.4 tons per acre per year over the three year sale contract period. This figure represents erosion from all temporary road segments for the anticipated duration of use (project file exhibit L-16). Erosion rates would decrease as roads are rehabilitated following use. By way of comparison, the average annual erosion on Montana cropland in 2007 was 6.4 tons per acre per year. A ton of soil spread across an acre would be as thick as a dime.

National Forest System road construction

Although impacts on soils from system road designation and construction fall outside of the analysis area, they are discussed and reviewed for potential soil stability concerns. New National Forest System roads are considered dedicated lands removed from the productive land base and thus are not included in soil quality objectives. Permanent road construction would consist of a maximum of 1.1 miles of new National Forest System road resulting in a removal of approximately 1.9 acres from the forest's productive land base.

National Forest System trail construction

New National Forest System trails are considered dedicated lands removed from the productive land base and thus are not included in analysis area. These designations would consist of a maximum of 24.7 miles of new system trails within the project area and would result in a maximum removal of approximately 10.9 acres from the forest's productive land base.

Other recreation proposals

Although impacts on soils in designated recreation areas fall outside of the analysis areas, they are discussed and reviewed for potential issues. Construction of two designated trailheads and potential construction of vehicle turnouts along open roads would result in some short-term erosion and displacement during the construction phase. Construction would consist of a maximum removal of 2 acres from the forest's productive land base.

Cumulative effects

The risks of cumulative effects were assessed within each proposed activity area. Cumulative effects consist of the direct and indirect effects from all past, present, future and proposed activities overlapping in time and space with the proposed project area. Units proposed for mechanical treatment were reviewed on the ground to quantify the effects from past activities and determine if existing levels of detrimental disturbance exceed the Region 1 soil quality objectives.

The estimated cumulative effects for each activity area from implementation of the action alternatives are displayed in table 56. Units listed in this table are limited to those which will have predicted increases in detrimental soil condition. Hand treatment units (e.g. understory removal, sapling thin) will not result in cumulative increases in detrimental soil condition and are not included in this table. Predicted cumulative detrimental soil condition values are based on implementation of all required design features for soils.

Table 56. Proposed action cumulative effects summary

Unit	Existing detrimental soil condition %	Proposed treatment detrimental soil condition %	Proposed temporary road detrimental soil condition %	Cumulative detrimental soil condition %
2	3.3	8.0	0.2	11.5
3	0.0	8.0	0.0	8.0
4	5.6	8.0	0.0	13.6
5	0.0	6.0	0.0	6.0
6	2.8	8.0	0.0	10.8
7	3.3	8.0	0.0	11.3
9	0.0	10.0	0.0	10.0
10	2.8	6.0	0.0	8.8
11	5.6	8.0	0.0	13.6
14	3.3	6.0	2.2	11.5
16	5.6	8.0	1.2	14.8
17	3.3	5.0	2.6	10.9
20	0.0	10.0	0.0	10.0
23	3.3	5.0	0.0	8.3
25	3.3	10.0	0.0	13.3
25A	3.3	10.0	0.0	13.3
27	5.6	6.0	0.0	11.6
29	0.0	10.0	0.0	10.0
31	0.0	10.0	0.0	10.0
32	0.0	10.0	1.9	11.9
33	0.0	10.0	0.0	10.0
36	5.6	8.0	0.0	13.6
40	3.3	8.0	1.0	12.3
42	0.0	6.0	7.4	13.4
43	0.0	6.0	0.0	6.0
44	0.0	7.0	0.0	7.0
45	0.0	10.0	0.0	10.0

Unit	Existing detrimental soil condition %	Proposed treatment detrimental soil condition %	Proposed temporary road detrimental soil condition %	Cumulative detrimental soil condition %
46	0.0	6.0	0.7	6.7
46A	2.8	6.0	0.0	8.8
47	2.8	8.0	0.0	10.8
48	0.0	10.0	0.0	10.0
49	3.3	10.0	0.8	14.1
50	3.3	6.0	0.0	9.3
51	0.0	6.0	1.0	7.0
53	0.0	6.0	1.0	7.0
54	8.3	4.0	1.2	13.5
54A	8.3	6.0	0.0	14.3
55	5.6	2.0	0.0	7.6
64	0.0	3.0	1.8	4.8
65	0.0	10.0	0.0	10.0
67	3.3	6.0	0.0	9.3
68	0.0	8.0	0.0	8.0
70	0.0	8.0	0.0	8.0
70A	0.0	8.0	0.0	8.0
71	0.0	8.0	0.0	8.0
72	0.0	10.0	0.0	10.0
73	0.0	10.0	0.0	10.0
74	0.0	10.0	0.0	10.0
81	0.0	6.0	8.6	14.6
82	0.0	6.0	0.0	6.0
82A	0.0	6.0	0.0	6.0
85	6.5	6.0	0.0	12.5
86	2.3	8.0	1.6	11.9
88	0.0	10.0	0.0	10.0
92	0.0	8.0	1.0	9.0
93	7.6	7.0	0.0	14.6
96	5.6	8.0	0.0	13.6
96A	5.6	8.0	0.0	13.6
98	2.0	10.0	0.0	12.0
99	0.0	10.0	0.0	10.0
101	3.3	10.0	0.0	13.3
102	0.0	10.0	0.0	10.0
108	3.3	7.0	0.0	10.3
109	8.3	4.0	1.2	13.5
112	3.3	8.0	0.0	11.3
113	5.6	2.0	2.0	13.5
114	5.6	2.0	0.0	7.6

Unit	Existing detrimental soil condition %	Proposed treatment detrimental soil condition %	Proposed temporary road detrimental soil condition %	Cumulative detrimental soil condition %
119	3.3	3.0	0.0	6.3
119A	0.0	3.0	0.0	3.0
120	0.0	8.0	0.0	8.0
121	1.2	10.0	0.0	11.2
122	8.6	6.0	0.0	14.6
123	0.0	8.0	0.0	8.0
126	5.6	8.0	0.0	13.6
128	0.0	8.0	0.0	8.0
129	0.0	8.0	0.0	8.0
130	3.3	6.0	0.0	9.3
131	0.0	10.0	0.0	8.0
237	5.6	6.0	0.0	11.6
300	1.5	5.0	0.0	6.5
300A	1.2	5.0	0.0	6.2
301	0.0	5.0	0.0	5.0

Table 57 displays the total acres of predicted detrimental soil disturbance and soil erosion from the proposed activities by alternative. Alternatives are designed to minimize detrimental soil disturbance by implementing design features.

Table 57. Detrimental soil condition and soil erosion by alternative

Description	No-action	Proposed action
Detrimental soil condition from proposed activities (acres)	0	263
Cumulative detrimental soil condition (acres)	23	285
Predicted soil erosion (tons)	0	65

Contrasting effects of proposed action with past actions

The estimated level of detrimental disturbance from this proposed project is less than that associated with harvest activities that occurred earlier than 1990. During the past three decades the level of concern for maintaining soil quality has greatly increased. This increase has been accompanied with implementation of management practices that protect the soil. These changes include:

- The use of excavators instead of bulldozers for mechanical site preparation
- Use of designated skid trails
- Operating when soils are dry or when winter conditions would protect soil
- Use of cut-to length/log forwarder systems
- Use of slash layers to reduce effects on skid trails
- Full rehabilitation of temporary roads

In addition, timber sales are audited for compliance with state and national BMPs and are monitored as specified in the environmental analysis document, both of which contribute to better results.

Duration of effects

Displacement and erosion, the loss of topsoil, is a long term and perhaps a permanent loss of soil productivity. However, management practices outlined in the design features would reduce the occurrence of displacement and erosion to within the Region 1 soil quality objectives.

Compaction may last from 10 to 70 years (Gonsior 1983). Monitoring of 40 year old activities within this project area averaged between three and eight percent detrimental soil condition, indicating significant recovery of compacted soils has occurred.

Reductions in organic matter content reverse quickly as vegetation is established. Organic debris accumulates on the surface and roots grow, die, and are decomposed in the soil. These organic materials release nutrients and improve the quality of the soil by improving its structure and reducing compaction and other disturbances. Loss of organic matter is a short term change lasting about 10 years once vegetation returns to the soil.

Light and moderate severity burned areas have minor effects well within the natural range of variability for wildfire. Areas burned under conditions that produce light or moderate burn severity would vegetate quickly due to viable seeds or roots that could produce more plants and the complement of microorganisms and nutrients remaining on site (Ryan and Noste 1985).

Changes in soil microorganisms are not permanent. Recovery would occur as soon as organic matter is present in the soil, which could be immediately after the proposed management is carried out.

Soil erosion will be controlled through the use of erosion control measures. In addition, bare soils would naturally recover or be revegetated with native seed. Any erosion that occurs would be short-lived, most likely occurring during the time between the soil disturbance and the implementation of erosion control measures.

Effects of ongoing and reasonably foreseeable activities

Most ongoing and foreseeable activities would not overlap with the proposed actin in both time and space. Specifically, their effects do not overlap in space as they occur outside of the proposed activity areas.

Combined effects from past, proposed, ongoing and foreseeable activities

Several proposed units in the proposed action would have cumulative effects from the combination of past and proposed activities. These effects are displayed in table 56. All proposed activities associated with the proposed action would meet FW-DC-SOIL-01 with the implementation of the design features.

Effects to Recreation

Summary of Findings

National Forest System lands in the project area currently offer a variety of frontcountry summer and winter recreational opportunities, including, but not limited to, dispersed camping, hiking, mountain biking, snowshoeing, motorized trail riding, snowmobiling, and Nordic skiing.

These lands would continue to provide a variety of recreation opportunities under the no-action alternative, but would likely not meet increasing public demand for recreation experiences. Under the no-action alternative, the mix of recreation opportunities would remain limited to a 7-mile motorized trail system and dispersed recreation. As use of the area increases due to population growth and increased

tourism, the creation and use of non-National Forest System trails as well as conflicts between motorized and nonmotorized users will likely increase.

The proposed action would add a variety of nonmotorized trails to the project area, moving the two focused recreation areas, Crystal-Cedar and Cedar Flats Off-Highway Vehicle Area, closer to desired conditions outlined in the forest plan. The proposed action accomplishes the purpose and need of the project without substantially altering current motorized and dispersed use of the area.

Methodology

The impact analysis for recreation resources evaluates effects of the alternatives with regard to:

- Consistency with desired conditions associated with recreation opportunity spectrum (ROS) settings and management areas in the forest plan;
- Comparing recreation resource indicators among the alternatives (see table 59); and
- Potential for user conflicts.

Analysis area

The analysis area for effects to recreation resources from the proposed action and no-action alternative will be the project area. Neither alternative will have measurable effects on recreation resources outside of these boundaries.

Recreation opportunity spectrum settings and management areas

ROS is a classification tool that provides a framework for defining the types of outdoor recreation opportunities the public might desire and identifies which portion of the spectrum a given national forest area might be able to provide. Establishing a variety of ROS settings enables land managers to plan for a variety of settings in which the public can recreate, each with their own characteristics and opportunities. The forest plan established ROS settings and associated plan components for every acre on Flathead National Forest. These settings range from primitive settings within Great Bear Wilderness to a rural setting in and around Whitefish Mountain Resort. More information on ROS and the range of settings on the Forest can be found in the FEIS volume 2 (pp. 316-338) and forest plan (pp. 55-58)

Management area direction in the forest plan provides finer-scale direction for recreation resources than the ROS settings. The effects analysis compares how each alternative does or does not contribute to achieving desired conditions for both ROS settings and management areas in the project area.

Indicators

Table 58 presents indicators and measures derived from the forest plan for specific recreation resource elements. These indicators allow for a quantitative assessment of differences between the two alternatives and how each alternative contributes to the project's purpose and need and forest plan desired conditions.

Table 58. Indicators and measures for analyzing effects to recreation

Purpose and need	Applicable forest plan direction	Project objective	Resource indicator	Measure
Provide sustainable trail-based recreation	FW-DC-IFS-08 FW-DC-P&C-11	Construct trails for a wide variety of users close to Columbia Falls	Number of bicycle trails constructed in the Whitefish Range vicinity	Number of trails

Purpose and need	Applicable forest plan direction	Project objective	Resource indicator	Measure
opportunities close to local communities that are compatible with other resources.	GA-NF-MA7-Crystal-Cedar-DC-01 GA-NF-MA7-Cedar Flats-OHV-DC-01 FW-DC-SREC-06 FW-DC-WREC-05	Provide additional nonmotorized, trail-based recreation opportunities within the Cedar Flats and Crystal Cedar MA7s	Management actions or activities that move toward desired recreation opportunity spectrum class characteristics	Number of management actions
			Miles of motorized and nonmotorized summer trails	Miles
			Miles of new nonmotorized trails constructed	Miles
	FW-DC-IFS-08 FW-DC-P&C-11 GA-NF-MA7-Cedar Flats-OHV-DC-01 FW-DC-SREC-06 FW-DC-WREC-05	Improve safety and loop opportunities within the existing Cedar Flats motorized trail system	Miles of new motorized trails constructed	Miles
	FW-DC-S&E-02 FW-DC-S&E-03		Levels of recreational visits, as measured through day visits, night visits, local and non-local visits	Number of visits

Data sources

Much of the recreation data used to assess existing recreation resources in the analysis area comes from the Forest Service infrastructure database. This Forest-level database is a collection of Web-based data entry forms, reporting tools, and mapping tools. Use of the geographic information system allows Forest staff to visualize, analyze, interpret, and understand data to reveal relationships and patterns.

Alternatives

No-action alternative

Direct, indirect, and cumulative effects

Recreational use

Apart from the designated motorized trails in the Cedar Flats focused recreation area and the Canyon Creek snowmobile trail, recreational use in the analysis area is currently dispersed and informal. See FEIS volume 2 pp. 337-338 for a discussion on human population growth in the area and increased demand for a variety of recreation settings.

Landowners with property adjacent to the analysis area frequently report concerns about undesirable activities in the project area. These activities include trash and carcass dumping, irresponsible target shooting, late night parties, trespassing, and illegal motorized use. Under the no-action alternative, these activities are likely to continue or increase commensurate with population growth while the Forest Service does not anticipate an increase in resources for education, law enforcement, and clean up.

Summer trails

Over the past few decades, running, hiking, and mountain biking on nonmotorized trails in the Flathead Valley has grown substantially. This growth has coincided with public support for the development of a variety of trail systems close to communities on public lands. For example, Lone Pine State Park and Foys Lake County Park provide trail-based recreation opportunities within minutes of downtown Kalispell. The Whitefish Legacy trails system connects directly to the city of Whitefish. Columbia Falls is the only incorporated municipality in Flathead County without a nonmotorized trail network that is easily accessible from town.

There are currently 7.1 miles of National Forest System trails within the project area, all of which are open to motorized use (ATV and motorcycle) seasonally June 1 through November 30. This trail system overlays largely on old roads and skid trails with a few small sections of recently constructed trail. The designed use for these class 3 trails are for all-terrain vehicles and have a designed width of 60 inches wide. They provide an easy trail experience for motorized uses as well as a variety of nonmotorized users, particularly hikers, dog walkers, mountain bikers, and equestrian users. Use of these trails is light to moderate as evidenced by grass and other vegetation that grows in the trail tread. There are currently no designated nonmotorized trails in the project area or trails that provide a more challenging trail experience.

Under the no-action alternative, no new trails would be constructed in the Whitefish Range vicinity (IND-REC-07, IND-IFS-14, IND-IFS-15) and existing miles of trails would remain the same (IND-IFS-09) in the project area. Increasing use may result in increased conflict among motorized and nonmotorized user groups within the analysis area on existing motorized trails. No management actions would be taken to move the focused recreation areas within the analysis area toward desired conditions for providing nonmotorized trail experiences that link communities to National Forest System lands (GA-NF-MA7-Crystal-Cedar-DC-01, GA-NF-MA7-Cedar Flats OHV-DC-01).

Developed recreation sites

The Canyon Creek Trailhead is the only developed recreation site in the project area (USDA 2018b, 177). It is a winter-only snowmobile trailhead including a large parking area suitable for snowmobile trailers, an information kiosk, a vault toilet, and a storage facility for grooming equipment. Flathead Snowmobile Association operates and maintains this site in partnership with the Forest Service and with additional funding support from Montana Fish, Wildlife, and Parks. The no-action alternative would have no effect on this site.

Dispersed recreation

Dispersed recreation occurs within the entire project area. These activities include sightseeing, camping, picnicking, hunting and fishing, target shooting, hiking and backpacking, horseback riding, mountain and road biking, berry picking, and firewood gathering.

Dispersed camping is permitted along roads within the project area from NFS Roads 1690 north to the project area boundary. This area is less attractive for dispersed camping due limited availability of dispersed campsites and a lack of attractions such as lakes, streams, or high-quality views near to roads. Forest Service personnel have observed this area is only occasionally used for dispersed camping. South of Road 1690 in the Cedar Flats focused recreation area, dispersed camping beside roads is not permitted. This use pattern is not expected to change under the no-action alternative.

In the absence of nonmotorized trails, activities associated with dispersed recreation have, over time, established a number of social trails throughout the analysis area and particularly in the Cedar Flats area.

Use of social trails by dispersed recreationists could potentially continue and intensify under the no-action alternative.

Road use

Driving for pleasure is one of the most popular recreation activities occurring on the Flathead National Forest and within the project area. Wheeled motorized access on National Forest System roads provides user access for hiking, bicycling, firewood gathering, hunting, fishing, camping, huckleberry picking, ATV/motorcycle riding, wildlife viewing, stock use, and appreciating the forest from a vehicle. The Cedar Flats Road 10815 and NFS Road 1690 receive heavy local use. Recreational road use is expected to increase commensurate to recreational use.

Winter use

The Cedar Flats focused recreation area is popular in the winter for dispersed cross-country skiing, dog walking, snowshoeing, and snowmobiling. Much of the project area south of the Crystal Creek drainage and Spoon Lake is open to over-snow vehicle use, conditions permitting. In addition, National Forest System Roads 10815, 10816, 10880, 1690, 1659, 316G, and 116A are designated (ungroomed) routes for snowmobile use. See Glacier View Ranger District Over Snow Vehicle Use Map (project file exhibit M-1). Motorized and nonmotorized winter use of the area is likely to increase commensurate with population growth under the no-action alternative. No other direct effects are anticipated.

The Canyon Creek groomed snowmobile trail (NFS Trail 99701) begins at the Canyon Creek Trailhead. This trail is maintained and operated in partnership. The no-action alternative would have no effects on this snowmobile trail.

Recreation special uses

There are two snowmobile outfitters operating in the project area. Each outfitter has been permitted 1,000 service days of snowmobiling on the Canyon Creek groomed snowmobile trails. There have been multi-sport recreational events permitted in the project area. The no-action alternative would have no direct effects on these operations.

Proposed action

Direct and indirect effects

Recreational use

An increase in recreational use throughout the project area is expected to occur under both the no-action and proposed action, but use is anticipated to increase more under the proposed action. The proposed action anticipates this growth and takes steps to ensure recreation experiences meet desired conditions for ROS settings and management areas in the project area. Development and management actions under the proposed action alternative would accommodate anticipated increased interest in trail based recreation opportunities close to communities with managed trailheads.

Development of formal trailheads and trail systems will likely reduce undesirable and illegal activities in the project area, as has been observed at other developed trailheads. Partnerships with local community groups may result increased resources for education, clean up, and enforcement.

Summer trails

Under the proposed action, 11 new trails managed for bicycle use would be constructed in the Whitefish Range vicinity (IND-REC-07). There would be 24.3 miles of nonmotorized trails (IND-IFS-15) and 0.4

miles of motorized connector trails (IND-IFS-14) constructed in partnership with a community organization. The proposed trail system would create nonmotorized trails that enhance recreation experiences, are designed for safety, environmental protection, and operational efficiency. This trail system emphasizes a series of loop trails that provide opportunity for progressively longer and more challenging excursions.

The proposed trail system is located entirely within two focused recreation areas designated in the forest plan: the Cedar Flats Off-Highway Vehicle Area and the Crystal-Cedar Area. The proposed action will move both areas toward meeting their respective desired conditions in the forest plan (pp.128-129) and the project purpose and need "provide trail-based recreation opportunities close to local communities that are compatible with other resources."

Proposed development in the Cedar Flats Off-Highway Vehicle Area expands the existing system to include nonmotorized single track trail opportunities that better link this area to Columbia Falls (GA-NF-MA7-Cedar Flats OHV-DC-01). Motorized loop opportunities would also be improved under this alternative (project file exhibit M-10). The potential for crowding is reduced by developing two additional trailheads, multiple access points where trails cross roads, and multiple loop options that help disperse users throughout the trails system. These developments and associated increases in use are consistent with the roaded natural summer ROS settings for both focused recreation areas, which supports trail experiences with higher concentrations of use, user comfort, and social interactions.

Public comments expressed a concern about conflicts between different types of recreationists and potential conflicts between recreationists and wildlife. This desire to reduce user conflict in the project area would be addressed through trail design that increases sight distance on trails and incorporating trail design techniques that can slow down user groups to reduce the opportunities for high-speed encounters between different types of recreationists and between recreationists and wildlife. Where appropriate, barriers would be constructed to restrict motorized use of nonmotorized trails, with an emphasis on places were motorized and nonmotorized trails intersect. Barrier types would be selected based on the managed uses of the intersecting trails (see design features and project file exhibit M-9). Trail development would also include signage and educational materials about how people can reduce user conflicts and avoid wildlife conflicts while using trails (see design features).

Forest Service trail design parameters and construction standards provide guidance for building sustainable trails. In this context, sustainable trails means "trails that withstand the wear and tear of normal traffic and reasonable user behavior during the managed season of use and that have minimal negative effects on adjacent resources" (FSH 2309.18, 20.2, project file exhibit M-2).

The designed use of a trail reflects the managed use that requires the most demanding design, construction, and maintenance parameters and that, in conjunction with the applicable trails class, determines which design parameters will apply to the trail. While there can only be one design standard for a trail, there can be more than one managed use per trail or trail segment.

> "The Managed Uses for a trail are usually a small subset of all the allowed uses on the trail, that is, uses that are allowed unless specifically prohibited. For example, on a trail that is closed to all motorized use but open to all nonmotorized use, the Managed Uses could be Hiker/Pedestrian and Pack and Saddle. The allowed uses, however, would also include bicycles and all other nonmotorized uses" (FSH 2309.18, Chapter 10, 14.3.3).

Trails within the project area would be managed for their assigned managed uses in a manner designed to minimize user conflict and the future creation of additional, unapproved trails.

The trails system and associated infrastructure would be constructed primarily in partnership with local organizations. Strong partnerships with local community organizations will be key to ensuring that the proposed trail system is socially and financially sustainable (FSM 2353.03) in addition to operational and environmental sustainability. Under the proposed action, partner groups will be responsible for raising funds and building community support (i.e. recruiting volunteers and building coalitions of community organizations) for the construction, operation, and maintenance of the proposed trail system. Partnerships for trail development and maintenance are specifically identified as desirable in the forest plan (FW-DC-P&C-11). The Forest Service would retain oversight of the trail system, ensuring that the trails and associated facilities meet Forest Service design, construction, operation, and maintenance standards.

Developed recreation sites

Under the proposed action, Canyon Creek Trailhead, which is currently only used during the winter, would be improved to accommodate summer use. This would entail working with partners to ensure the parking surface is adequate for year-round traffic and security concerns for the storage facilities are adequately addressed.

Two additional developed trailheads would be constructed under the proposed action for day use only. These trailheads would include moderate site modifications including a vault toilet and a visitor kiosk at each site. These developments would contribute the roaded natural desired summer ROS setting for both focused recreation areas, which supports higher concentrations of use, user comfort, and social interactions within a well-defined road system.

Dispersed recreation

There would be no direct effects to dispersed camping under the proposed action. Dispersed camping would continue to be prohibited within the Cedar Flats focused recreation area and allowed along most roads elsewhere in the project area. Vegetation management may indirectly create additional dispersed camping opportunities such as landings near open roads. Rehabilitation of landings to a natural appearing condition (see design features) would likely minimize the attractiveness of these sites for camping and limit the size of areas impacted by camping.

Dispersed recreational activities would shift largely to formal trails under the proposed action. Establishing a system of designated nonmotorized trails would discourage the use of social trails. The proposed trails would provide a higher quality, formalized trail experience with clearly marked links to a variety of loop opportunities. In addition, design features require that skid roads that cross new system trails and lead to private land would be rehabilitated, reducing the attractiveness for users to leave system trails.

The proposed action would have no direct effects other dispersed recreational activities such as hunting and berry picking. However, there may be indirect effects to some of these activities. The new nonmotorized trail system would provide additional and easier access for hunters and berry pickers. As use patterns change in the area to include additional trails and trailheads, these developments may also indirectly affect forest users such as hunters and berry pickers if recreational use of the area increases along trails. These effects to dispersed use are consistent with the roaded natural summer ROS settings for both focused recreation areas, which supports dispersed recreational experiences with higher concentrations of use, user comfort, and social interactions.

Road use

The proposed action would have no direct effects on driving for pleasure in the analysis area. All roads currently open for use year round and seasonally would remain so. With the development of a

nonmotorized trail system, road use along NFS roads 10815 and 1690 is likely to increase at a higher rate under the proposed action than the no-action alternative. These indirect effects to recreation-related road use are consistent with the roaded natural summer ROS settings for both focused recreation areas, which supports higher concentrations of use and social interactions.

Winter use

No changes to over-the-snow use are proposed. The existing motorized and nonmotorized uses are likely to increase with population growth, similarly to the no-action alternative. Vegetation management activities could have indirect effects by opening up areas that were previously difficult to access in the winter. Proposed trailheads could create infrastructure that can accommodate plowed winter parking through partnership agreements in the Cedar Flats area. The project area would not foreclose on future opportunities to expand winter facilities in accordance with FW-DC-WREC-05.

Recreation special uses

The proposed action alternative would have no direct or indirect effects on the snowmobile outfitter and guide operations in the project area.

Table 59. Comparison of alternatives

Forest plan indicators	Description	No-action alternative	Proposed action
IND-REC-07	Number of bicycle trails constructed in the Whitefish Range vicinity.	0	11
IND-REC-12	Management actions or activities that move toward desired recreation opportunity spectrum class characteristics	0	2 (motorized and nonmotorized)
IND-IFS-09	Miles of motorized and nonmotorized summer trails	Motorized: 7.1 miles Nonmotorized: 0 miles	Motorized: 7.5 miles Nonmotorized: 24.3 miles
IND-IFS-14	Miles of new motorized trails constructed.	0	0.4
IND-IFS-15	Miles of new nonmotorized trails constructed	0	24.3
IND-S&E-01	Levels of production of recreational visits, (as measured through day visits, night visits, local and non-local visits)	Modestly increased local day visits associated with population growth of immediate community	Greater increase in local day visits and modest increases in non-local day visits associated with increased recreation opportunities

Designated wild and scenic river

There are four vegetation management units (units 121, 123, 130 and 131) proposed within the North Fork and Middle Fork Flathead River recreation river segments to reduce fuels, diversify vegetation, and reduce discernable edges between land ownerships (MA2a-SUIT-02). Proposed management activities will have no effect to the outstandingly remarkable values identified for these segments of river (project file exhibit M-6). See pp. 90-92 of the forest plan for management direction related to wild and scenic river management and pp. 395-400 of the FEIS for a discussion on effects at the Forest level.

Cumulative effects

The analysis area for cumulative effects to recreation resources is the project area. Aside from the Canyon Creek Snowmobile Trail, all existing and proposed recreation resources are physically confined to the westernmost third of the project area and do not connect to any other trail systems. Neither the no-action

alternative, proposed action, nor related actions will have direct or indirect effects on this snowmobile trail and associated special uses.

Past and future vegetation management is not likely to substantially increase the amount of dispersed recreation in the analysis area. Minor shifts in where dispersed use is concentrated is likely to occur due to vegetation management.

The ongoing preparation of the Comprehensive River Management Plan for the Three Forks of the Flathead Wild and Scenic River will not have cumulative effects to recreation resources in the project area when combined with the proposed action because the planning effort is confined to the wild and scenic river corridor and does not overlap with the proposed recreation management in this project.

Effects to Scenery

Summary of Findings

The scenery analysis indicates that the no-action alternative and proposed action would meet forest plan direction and the scenic character of the project area would be retained.

Methodology

Analysis area

The scenery resource existing condition includes the project area, as well as viewing platforms outside of the project area that have visibility into the project area. While these viewing platforms are not the only locations where the project is visible; they do provide a range of viewpoints that may be affected by the management activities proposed in this project. It is expected that a viewer at these locations may experience a different aesthetic post project. These viewing platforms are all associated with concern level 1 travel-ways (roads, trails, and waterways) and concern level 1 locations (recreation sites and urban areas). Concern levels are defined and explained in Forest Service Handbook 701, Landscape Aesthetics: A Handbook for Scenery Management (SMS) (USDA 1995). The North Fork Road (Road 486), Highway 2, and Flathead River[3] (designated Wild and Scenic River) are all concern level 1 travel-ways, where viewers' reason(s) for being there include to enjoy the scenery. The towns of Whitefish, Columbia Falls, and Hungry Horse are all concern level 2 locations where the reason for being in the location does not necessarily include enjoyment of the scenery but the density of population and the economic value of activities related to the scenery justify a high concern for the scenery resource. In addition, these points capture multiple distance zones (where different features become apparent to viewers). It is for these reasons that these viewing platforms are deemed adequate to measure the extent and magnitude of possible effects.

Table 60. Summary of viewing platforms (inside and outside the project area) and their distance zones to project units, and concern levels

Viewing Platform	Distance	Concern
Eastside of Whitefish	Background	2; Regional and local visitation; moderate to long duration of view
Northside of Columbia Falls	Middleground	2; National, regional and local visitation; moderate to long duration of view

[3] The project area includes two segments of the wild and scenic river, the North Fork recreation segment and the Middle Fork recreation segment. The North Fork recreation segment does not have an outstandingly remarkable value (ORV) associated with the scenic resource, but the Middle Fork recreation segment does.

Viewing Platform	Distance	Concern
Hwy 2 (Hungry Horse and Coram)	Middleground	1; National, regional and local visitation; moderate to long duration of view
North Fork Road	Foreground, middleground	1; National, International and regional visitation; moderate to long duration of view
Flathead River (WSR)	Foreground, middleground	2; National, International and regional visitation; moderate duration of view

a. Explanations of distance zones, concern levels etc. can be found within the SMS handbook.

b. See project file exhibit O-4_ViewingPlatforms and project file exhibit O-5_Visibility for map of locations and visibility.

Indicator

Analysis for scenery focuses on retention of, or progress towards retention of, the scenic character of landscapes described in the forest plan. Effects to the scenic character are measured by scenic integrity objectives (SIOs) as defined in the handbook guidance for SMS and mapped across the Flathead National Forest in the forest plan. SIOs establish the maximum acceptable degree of alteration to the scenic character. A very high SIO translates to no tolerance for scenic character alteration, except those induced by ecological changes. A low SIO allows a high level of alteration of the scenic character, including dominance of the scenic character by management actions. The following table outlines how the scenic character serves as an indicator measured by the effects to acres of each SIO within the project area.

Table 61. Scenery resource indicators and measures for assessing scenery effects

Resource element	Indicator	Measure
Scenic character	Management activity deviations from SIO	Acres that meet or exceed SIO

The effects to scenery are measured in three time periods: project completion (immediate), 5 years (short term), and more than 5 years (long term). Cumulative effects are analyzed for a 25-year period, which is the approximate time necessary for sufficient vegetation regrowth to be non-discernable by the general viewer. Effects that are eliminated by the natural course of a single growing season are not considered effects because they are so short lived.

Data sources

Evaluation of the effects of the Crystal Cedar project to the scenery resource is directed by the forest plan in conjunction with methodological and management policy described in Forest Service Handbook 701, Landscape Aesthetics: A Handbook for Scenery Management (USDA 1995).

Alternatives

No-action alternative

Direct, indirect, and cumulative effects

The existing condition of the project area, existing scenic integrity (ESI),—as seen from the aforementioned viewing platforms—ranges from low to high because at the landscape scale since overall the scenic character of the North Fork geographic area is intact and deviations are not evident. Geographic area based scenic character descriptions can be found in appendix F of the forest plan and a map of the ESI can be found in project file exhibit O-2.

There are three SIOs assigned to the Crystal Cedar project area, low, moderate, and high. The following table indicates the ESI of about 87 percent of proposed unit acres meet or exceed their SIO. The

remaining 13 percent do not meet their SIOs. These acres have discernible evidence of past management actions (most recently, Cedar Spoon Fuels Stewardship Project in 2004 as well as others in the 1980s and 1990s) which are incongruent with the scenic character of the area. All of the acres not meeting are within the foreground or middleground of either the wild and scenic river or the North Fork Road. While these areas do not currently meet or exceed their SIOs, in the long term they should meet their SIOs due to regrowth of harvested vegetation. A map of the SIOs within the project area can be found in project file exhibit O-3.

The project area includes many boundaries with lands of other ownership including many private land developments and associated infrastructure (powerlines, telephone lines etc.) which all create discernible impacts to the scenic landscape. These developments and facilities do not dominate the scenic character but management actions on National Forest System lands could be taken to reduce the discernibility of lands of other ownership actions and/or reduce the contrast between the Forest and lands of other ownership actions.

Table 62. Scenery resource indicator and measure of the project area existing condition

Indicator	Measure	Existing condition
Management activity deviations from the SIO	Acres that meet or exceed SIO	3382 of 3877 acres meet or exceed their assigned SIOs. 495 acres do not: • 54 acres high • 441 acres moderate

If no action is taken, the ESI should be retained for most of the project area in the short term and the long term. Those acres not currently meeting or exceeding their SIO should continue not to meet or exceed in both the short term and the long term. There are no other direct effects from the no-action alternative on the scenery resource in the short term or long term.

The no-action alternative could result in indirect effects to the scenic resource as overstocked forest stands continue to be under ever greater stress from insects, disease, and fuel loading. These conditions should continue to degrade the scenic stability and in the event of a stand replacement fire or insect or disease epidemic the scenic integrity should likely be greatly reduced by results outside of the historic range of variability and scenic character of the project area. These large scale alterations to the scenic landscape should most likely be long-term deviations from the scenic character as it should take years for the evidence of a stand replacing fire or insect or disease infestation to diminish and be replaced by new vegetation growth.

There are numerous previous timber harvests, a commercial thinning project, a pre-commercial thinning project, two fuels reduction projects (Blankenship Fuels and Cedar Spoon) and prescribed burning and wildfires which have all influenced the scenic landscape within the project area and the viewing area of the project. Past activities from the Cedar Spoon Stewardship Project have resulted in some of the acres that are not currently meeting their SIOs along the North Fork Road. Other timber harvests from the 1980s and 1990s have created discernible contrasts compared to the natural landscape. These acres should meet or exceed their SIOs in the long term due to regrowth of vegetation. The Three Forks of the Flathead comprehensive river management plan may change management processes and monitoring of this portion of the project area. However it is not expected that the management changes should affect the scenery resource. Lastly, other ongoing activities within the project area and viewing area such as hazard tree removal, forest product gathering should not affect the scenery resource to the extent that the SIOs are not met or the scenic character is dominated by the activities. There are no other known management action

projects within the area that should cumulatively affect the scenery resource within the Crystal Cedar project area.

There are boundaries between National Forest System lands and lands of other ownership that are currently discernible due to linear edge effects created by differing management actions on either side of the boundary. They do not cumulatively effect the scenery resource such that the scenic character is not dominant, but actions could be taken to reduce their discernibility in the short term, creating a more sustainable scenic character in a shorter timeframe. In the long term these areas may become less discernible, due to natural vegetation growth. There are no known management activities proposed by other landowners, so the cumulative effects are based on the assumption that the current vegetation composition on non-Forest lands will be maintained, and landowners will not take actions to reduce the discernibility of the edge effects. Therefore the cumulative effects from the no action alternative should be retention of the scenic character in both the short term and the long term, but also retention of a potentially unsustainable scenic character without any potential to create a sustainable scenic character.

Proposed action

Direct, indirect, and cumulative effects

The proposed action should not cause significant direct or indirect effects to the scenery resource because of project design to reduce the scenic contrast between the management activities and the scenic character of the area. Project file exhibit O-1 discusses specifically how those units with acres where the ESI does not meet or exceed the SIO should meet or exceed their SIOs through management activity and project design. All of those acres will not meet the SIO in the short term but in the long term the vegetation diversity in structure, form and texture should increase the scenic variety and create a more stable scenic composition and meet or exceed the SIO. Likewise there are a number of activity units that have both an ESI and SIO of high (project file exhibit O-1). In these units, activities may diminish retention of high integrity in the short term. In the long term these units should meet or exceed the high SIO and become more scenically stable by reducing the risk of a large-scale alteration to the scenic landscape which could diminish the scenic character.

The proposed trails all fall within the moderate SIO and should meet this SIO. Those portions of trails that intersect unit acres where the ESI does not currently meet or exceed the SIO should not move these acres farther from meeting or exceeding. Likewise, the proposed new roads should not adversely affect the scenery resource beyond that of the units. The two new National Forest System roads are mostly not visible from the North Fork Road (with the exception of where the reroute of Road 10813 meets the North Fork Road) and should meet the moderate SIO.

The proposed action should directly benefit the scenic character because the scenic stability of the area should be increased by moving an additional 495 acres toward meeting or exceeding SIOs in the long term. Reducing overstocked stands and reducing the fire risk within the wildland-urban interface should indirectly benefit the scenic stability of the project area including those acres not treated by reducing the risk of a large scale alteration to the scenic landscape by a stand replacing fire or insect or disease infestation.

The cumulative effects to the proposed action are the same as those of the no-action alternative. In the long term all acres should meet their SIOs. The one exception to this is the boundaries that are discernable between National Forest System lands and lands of other ownership. Proposed actions to reduce this discernibility should create a more sustainable scenic character sooner in the short term as well as the long term by reducing the linear and edge effects at these boundaries. There are no other reasonably foreseeable actions that cumulatively effect the scenery resource.

Table 63. Summary comparison of environmental effects to the scenery resource

Indicator	Measure	No-action alternative	Proposed action
Management activity deviations from the SIO	Acres that meet or exceed SIO	3382 of 3877 acres meet or exceed their SIO in both the short term and long term.	3382 acres of 3877 acres meet in the short term and are moving toward meeting or exceeding their SIO in the long term.

Effects to Cultural Resources

Cultural resource staff conducted a cultural resource inventory of the area of potential effect to locate, record, and evaluate the historical significance of any identified cultural resource. A pre-survey files search for information on previously recorded cultural sites in the proposed project area was also conducted. Cultural resources are typically location specific and are analyzed as to what resources the proposed activity can potentially impact. The inventory completed for this project, to date, has located several historic logging related sites and these will be avoided by all project activity.

As a result of the discovery of cultural resources during the pedestrian inventory required for the area of potential effect of the proposed action, there is the potential for the forest plan cultural resources desired conditions (FW-DC-CR-01 and 06) to move in a positive direction. Cultural resources having scientific, cultural, or social values would be preserved and protected for their cultural importance and sites identified under the National Historic Preservation Act would be inventoried, protected, and, if warranted, nominated to the National Register of Historic Places (FW-STD-CR-01).

All proposed ground disturbing activities can pose a potential threat to cultural resources. However, with the implementation of design freatures, the proposed action will result in no negative impacts to cultural resource values. Cultural resource inventories increase the collective knowledge of resources on the landscape that can then be properly evaluated and managed. An expanded analysis of effects to cultural resources is located in the project file (project file exhibit N-4).

Agencies and Persons Consulted

The Forest Service engaged in discussions with the following organizations and agencies during the development of this environmental assessment:

Federal, State, and Local Agencies

U.S. Fish and Wildlife Service
Montana Department of Transportation
Montana Fish, Wildlife, and Parks
State Historic Preservation Office
Flathead County Fire Service Area
Blankenship Rural Fire District
City of Columbia Falls
Bonneville Power Administration

Tribes

Confederated Salish and Kootenai Tribes
Blackfeet Nation

Others

Gateway to Glacier Trail
DREAM Adaptive Recreation
Meadow Lake Resort Homeowners' Association

See the public involvement section of this environmental assessment for an overview of outreach efforts to local landowners, neighborhoods, and interested parties.

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Appendix A. Design Features

Introduction

These design features are an integral part of the proposed action and are considered requirements should the proposed action be selected. Many concerns expressed during the public involvement processes were addressed through development of design features to avoid or reduce potential environmental impacts.

Forest Service directives (manual and handbook), forest plan standards and guidelines, and all other laws, regulations, and policies that relate to managing National Forest System lands apply to the proposed activities and are repeated here only if clarification is required.

Aquatics

01 Other than trees that are determined to be a hazard at developed recreation sites and administrative sites, vegetation management (including ignition of prescribed fire) would not be permitted within inner RMZs. Exceptions also include prescribed fire which would be allowed to back through inner RMZs, pile burning consistent with accepted practices detailed in the Montana Guide to the Streamside Management Zone Law and Rules (MTDNRC 2006), and non-mechanical treatments such as sapling thinning and hand fuels reduction treatments, that do not impair the function or condition of aquatic and riparian resources. Broadcast burning would not occur within 50 ft of any waterbody. Unit layout would follow guidance detailed in FW-STD-RMZ-01.

02 At developed recreation sites, trees within the riparian management zone that are determined to be a hazard would be felled to provide for public safety, in consultation with a Forest aquatics specialist. Felled downed trees would be left on-site as needed to meet large wood desired conditions, where it is safe and practical to do so (FW-GDL-RMZ-07).

03 Application of site appropriate BMPs for water quality and forestry management would follow guidance detailed in volume 1 of the National Core BMP Technical Guide (USDA 2012) and associated Forest Service manual and handbook direction, Montana Guide to the Streamside Management Zone Law & Rules (MTDNRC 2006), and Montana Forestry BMPs (Ziesak et al. 2015) (FW-STD-RMZ-02).

04 No mechanical treatment would occur within 150 ft of Duck Lake or the unnamed perennial stream in proposed unit 119a. Mechanical treatment would be limited to the slope break, where appropriate, adjacent to Duck Lake or 150 ft in unit 119. Hand treatment would occur between 150 ft and 50 ft (above the existing road). The Forest hydrologist or aquatics specialist would be onsite to delineate appropriate RMZ for these two units prior to treatment.

05 In-stream activities (e.g. road or trail crossings) in the Crystal Creek drainage would be subject to timing limitations to protect westslope cutthroat trout (no activity May 1-July 15).To maintain free-flowing streams, new, replacement, and reconstructed stream crossing sites (culverts, bridges, and other stream crossings) would accommodate at least the 100-year flow, including associated bedload and debris.

06 Equipment storage, storage of fuels and toxicants, maintenance or refueling (other than for portable pumps associated with prescribed fire) would not be permitted within the RMZ.

07 Best management practices for protecting water resources from prescribed fire activities would follow guidance detailed in volume 1 of the National Core BMP Technical Guide (USDA 2012, 52-59). Ground disturbing fireline construction within RMZs should be avoided when practicable to do so. Any fireline constructed within RMZs would be fully rehabilitated (USDA 2012). All fireline constructed outside of RMZs would be stabilized with suitable water and erosion control measures. Water bar spacing for fireline stabilization would adhere to the following spacing guidelines:

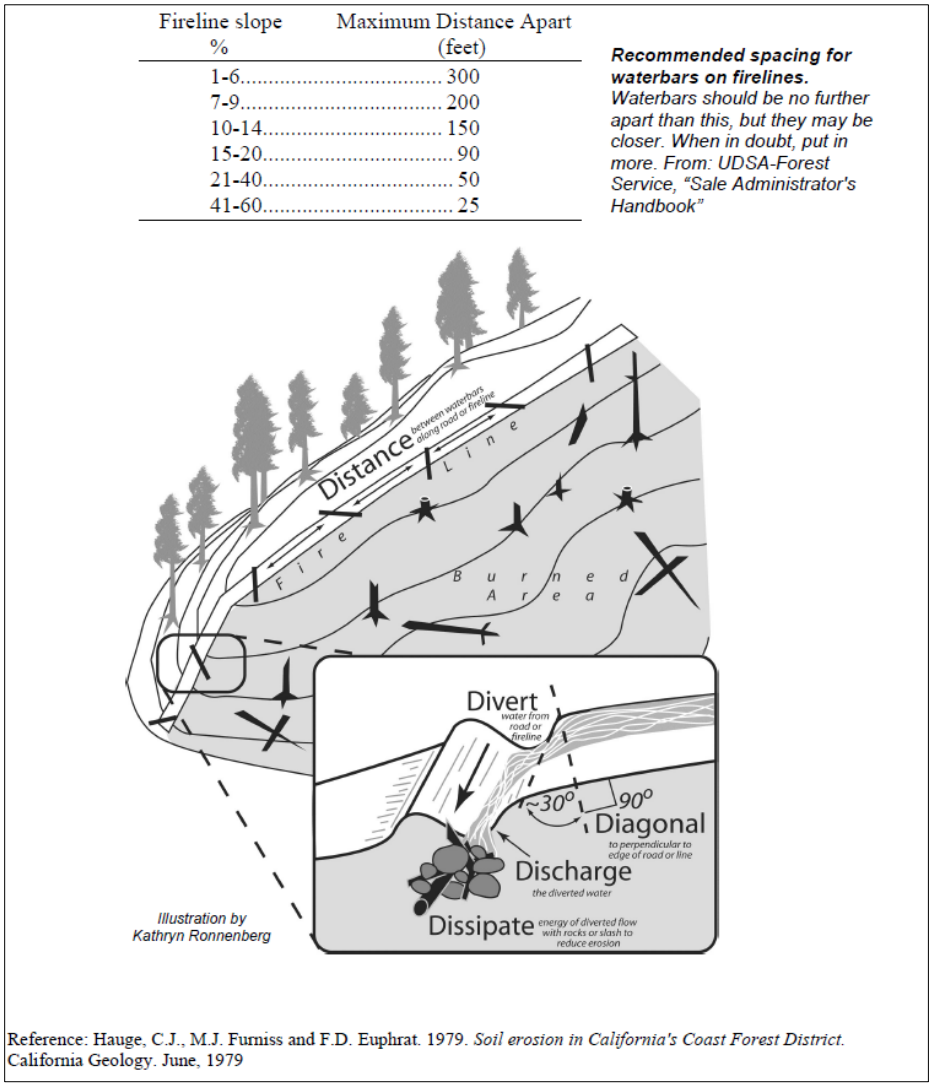

Figure 3. Water bar spacing for fireline stabilization

08 Portable pumps, and associated fuel, utilized for prescribed fire would be fitted with spill containment kits adequately sized and installed per manufacturer's recommendations.

09 All drafting hoses would be fitted with a minimum ¼-inch screen to prevent intake of fish and other aquatic species. No drafting will occur from ponds or fens.

Cultural resources

10 National Historic Preservation Act Section 106 reporting and consultation is required to be completed prior to any expenditure of federal funds to implement the selected alternative. Adherence to the regulations for implementing the National Historic Preservation Act insures that significant heritage resources are identified prior to project implementation.

11 To protect cultural resources, provisions shall be included in applicable contracts, agreements, and special-use permits for properties that are unevaluated, eligible for, or listed in the National Register of Historic Places (FW-STD-CR-01).

12 Identified cultural or archaeological sites will be flagged and avoided. Maps with site locations will be provided to the sale administrator and fuels specialist to ensure sites will be avoided.

13 Should cultural resources be identified during the course of project implementation, operations would cease and the heritage staff notified to complete resource documentation and evaluation of eligibility.

14 Trail locations will be surveyed for cultural resources prior to construction and relocated to avoid identified resources.

Non-native invasive plant species/noxious weeds

15 Off-road equipment would be power scrubbed or steam cleaned on the undercarriage and chassis before transport to the project area. Off-road equipment includes all logging and construction machinery for vegetation treatments and recreation development, except for log trucks, chip vans, service vehicles, water trucks, pickup trucks, cars, and similar vehicles. This cleaning shall remove all soil, plant parts, seeds, vegetative matter, or other debris that could contain or hold seeds. All subsequent entries of equipment from outside the project area back to the project area shall be treated in the same manner as the initial entry.

16 Herbicides would be sprayed within the road prism along designated haul routes before log hauling begins and after all purchaser activities are completed. Treatments would only occur during the periods from June 1 to July 15 or September 1 to September 30. Treatment of invasive plants would be consistent with the strategy outlined in the Noxious and Invasive Weed Control Environmental Assessment and Finding of No Significant Impact (USDA 2001). Specific roads and mileage would be prepared in consultation with the Forest weeds coordinator.

17 To reduce the probability of establishment of new non-native invasive plant populations, areas where soils are disturbed by construction activities (e.g. road construction, landings, and skid trails) conducted or authorized by the U.S. Forest Service should be reseeded as soon as practical, during the appropriate time of year, using certified weed-free seed mixes (FW-GDL-NNIP-01).

18 Unit 133 would be hand treated and require additional equipment and gear cleaning when leaving the unit due to infestations of hoary alyssum and toadflax, and leafy spurge both

in the unit and on the access road Parker Hill (NFS road 60111). All dirt and plant parts must be brushed off of gear and clothing prior to leaving the unit (and before entering vehicles) after operations. When approaching the unit, if using Parker Hill Road, all vehicles and gear must remain on the road when driving through the leafy spurge infestation, and not pull off to the side of the road until outside the infestation boundary. If there is to be burning, it shall only be in burn piles and not broadcast burning. All equipment and personnel shall avoid walking through the hoary alyssum infestation. No piles would be built in the hoary alyssum and toadflax infestations, nor would there be any trees or vegetation dragged through the infestations. The hoary alyssum and leafy spurge infestations would be monitored by the forest's weed or botany staff.

19 Unit 10 and 71 would be specified for in-woods processing with log forwarder operation, operating on slash mat to minimize the spread of leafy spurge in the unit. Equipment would be washed before moving to other units in the project area to prevent the spread of leafy spurge.

Plant species of conservation concern

20 Trail TR11A will be designed to avoid a species of conservation concern (SCC) population of crested woodfern along the trail route as well to avoid a SCC population of cottongrass in the fen at the trail destination, as well as designed to not impact the fen or the state listed species of concern inhabiting the fen.

21 Units 43 and the birch cutting units along Road 1690 would be designed to avoid SCC populations that extend outside the RMZs (FW-GDL-PLANT DIV-02).

22 Trail locations will be surveyed for SCC plants prior to construction and relocated to avoid identified SCC plants.

23 If populations of any other SCC plants are found prior to or during implementation, they would be evaluated and protected as necessary to retain population viability.

Recreation

24 Overnight use would be prohibited by special order at the proposed trailheads on NFS Roads 316, 1690, and 10815.

25 Trail design and construction would follow Forest Service handbook direction for trails management (FSH 2309.18) according to the assigned designed use and adhere to applicable best management practices detailed in volume 1 of the National Core BMP Technical Guide (USDA 2012, 87-102).

26 Where appropriate, barriers would be constructed to restrict motorized use of nonmotorized trails, with an emphasis on places were motorized and nonmotorized trails intersect. Barrier types would be selected based on the managed uses of the intersecting trails. Barrier types may include, but are not limited to barrier rock placement, "V" gates, chicanes, and timber kissing gates (project file exhibit M-9).

27 To discourage trespassing on private land and provide high-quality trail experience, trail TR02 and would be located out of sight of private property lines where feasible. Skid

roads crossing trail TR02 will be rehabilitated for 150 ft on either side of the trail by any site-appropriate combination of the following:

- Scarifying with hand tools or excavator to a depth equal sufficient to ameliorate the presence of detrimental soil compaction (usually between 2 and 12 inches);
- Seeding with the native plant mix as specified by the Forest botanist;
- Placing woody material on the template;
- Planting native shrubs or trees to augment natural vegetation; or
- Placing barrier rock to discourage use.

28 The following trails would accommodate adaptive cycle technology such as handcycles: TR01, TR02, TR03, and TR04.

29 Any damage that occurs to National Forest System trails during logging or associated post-harvest fuels or site preparation will be repaired.

30 To protect the safety of the public using the area, contractors will be required to post signs warning the public of activities and traffic associated with the treatments.

31 If skid trails within thinning units do not currently fall on an existing off-road motorized trail, then these skid routes will be closed in a manner that does not encourage future off-road motorized use. Adequate signing and barriers will be a part of this effort.

Soils

32 Units 11, 54A, 64, 70, 70A, 120, and 130 would be summer logged with an in-woods processing, log forwarder system or winter logged with rubber tired skidders to minimize potential detrimental soil disturbance. These units will be monitored for soil disturbance. Other units may be selected at random for soil disturbance monitoring.

33 Units 42, 54, 81, and 109 would be winter logged with rubber tired skidders to minimize potential detrimental soil disturbance.

34 Ground cover and forest floor depth monitoring will occur in units 9, 25, 32, 36, 70, 72, 88, 98, 102, and 131 after all activities are complete.

35 All mechanized units that remove commercial products would be logged using designated skid trails. Equipment would occasionally leave the trails to access trees or accomplish other activities.

36 Skid trail spacing width must average at least 75 ft in all tractor harvest units. The goal is to occupy less than 15 percent of the treatment area including soil disturbance from skid trails, temporary roads, and landings associated with past and proposed activities (FW-STD-SOIL-01).

37 Implementation monitoring will occur on all temporary road segments after restoration activities are complete.

38 All existing roads and skid trails would be reused to the extent feasible unless doing so would adversely affect soil, water, or other resources. If roads or trails cannot be reused, their extent and location must be considered when laying out additional skid trails.

39 Logging would occur when soils are dry as determined by the hand feel method (project file exhibit K-18).

40 Sale administrators will monitor soil moisture conditions prior to allowing equipment to begin operations in summer. This monitoring must be documented in the Timber Sale Daily Report.

41 All temporary roads constructed for this project will be rehabilitated by any site-appropriate combination of the following (FW-STD-SOIL-03):

- Removing any installed culverts or temporary bridges;
- Recontouring the entire template to natural ground contour (figure 4);
- Where recontouring is unnecessary due to lack of slope, scarifying with excavator to a depth equal sufficient to ameliorate the presence of detrimental soil compaction (usually between 2 and 12 inches);
- Seeding with the native plant mix as specified by the Forest botanist;
- Placing woody material on the template; or
- Planting native shrubs or trees to augment natural vegetation.

42 Winter logging will be restricted to frozen or snow cover conditions. Winter logging requires that there be enough snow to prevent muddy water from mixing into the snow where equipment operates. This will require about ten inches of snow. The depth of snow varies with the snow conditions. It takes more dry powder snow than wet dense snow to protect the soil surface. Soils must be frozen enough to prevent deformation of the soil surface where equipment operates.

43 All mechanical fuel reduction will be accomplished with excavators. Excavators will, to the extent feasible, remain on skid trails.

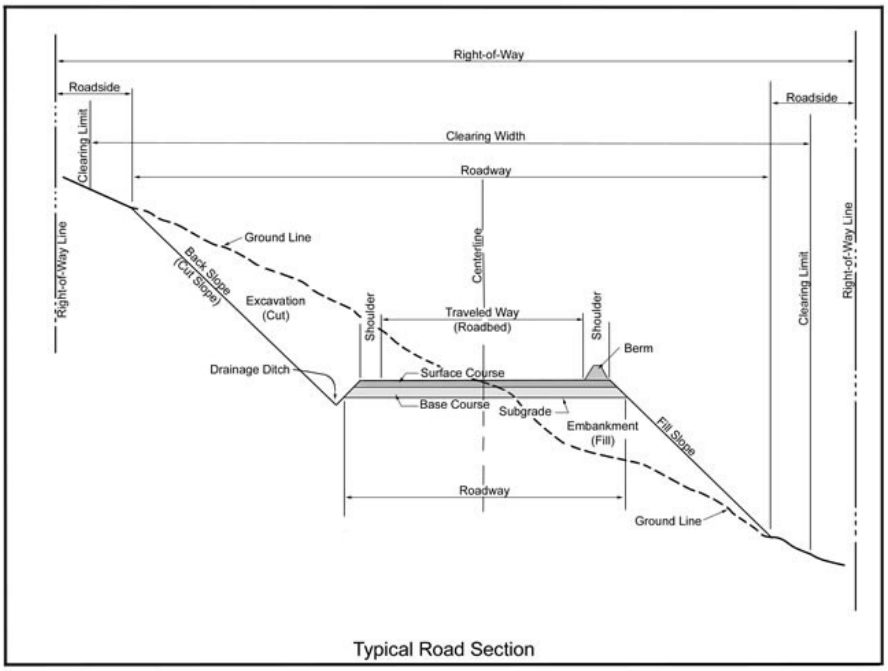

Figure 4. Road cross-section showing location of original ground line

Terrestrial ecosystems and vegetation

44 All snags of western larch, ponderosa pine, and black cottonwood trees greater than 20 inches d.b.h. shall be retained in vegetation treatment areas (FW-GDL-TE&V-06).

45 In units 36, 65, 70, 73 and 101 leave all live western larch, western white pine, and Douglas-fir trees greater than 17 inches d.b.h., large downed wood (greater than 9 inches diameter), and snags and decayed, decadent trees greater than 15 inches d.b.h (FW-GDL-TE&V-06).

46 Within timber harvest areas, snags, or live replacement trees shall be retained at or above the minimum levels displayed in table 64 (GA-NF-STD-01).

Table 64. Minimum average number of snags or live replacement trees per acre greater than 10 feet tall to retain within timber harvest areas

Forest dominance type	Potential vegetation type	Total minimum number of snags or live replacement trees per acres of the largest d.b.h. present (greater than 15" d.b.h.)	Minimum number of snags or live replacement trees per acre (greater than or equal to 20" d.b.h.)
All except lodgepole pine	Warm-moist	7	2
All except lodgepole pine	Cool-moist	5	2
Lodgepole pine	All	2	1

47 Regeneration harvest units should retain a minimum of three live reserve trees per acre of suitable western larch or ponderosa pine trees greater than 17 inches d.b.h., where present (FW-GDL-TE&V-09).

48 Downed woody debris of 12 tons per acre or less where it exists, is the desired amount of material to be retained in treatment units within the wildland-urban interface. A maximum of 15 tons per acre of downed woody material should be retained in treatment units within the wildland-urban interface.

49 Desired downed woody debris for RMZ vegetation treatment areas and units outside the wildland-urban interface is 22 tons per acre for warm-moist potential vegetation type (PVT) and 25 tons/acre for cool-moist PVT.

50 Retain (where it exists) downed woody debris which includes the longest material available (e.g., 16 feet long or longer) and the largest diameters available (e.g., greater than or equal to 15 inches d.b.h.), sufficient to achieve the tons per acre.

51 Excluding live birch cutting units, hardwood trees would not be targeted for removal and would be left intact to the extent possible, considering operational feasibility (FW-DC-TE&V-09).

Scenery

52 Shape individual units, to the extent feasible (economically and technically), to create a natural-appearing unit. Vegetation treatment units should avoid symmetrical shapes,

straight lines and angles, disproportionate (to surrounding untreated units) opening and cluster sizes, and artificial lines and patterns. Additionally, treatments should follow natural topographic breaks and changes in vegetation, treat the entire landform and along roadways vary unit sizes, widths, shapes and distances from center lines as much as possible (FW-GDL-SCN-03).

53 In units bordering within the wild and scenic river corridor or North Fork Road, stumps should be cut to 8 inches or less in height. Slash, root wads, and other debris will be removed, buried, burned, chipped or lopped and scattered to a height no greater than two feet within 150 ft or until topography makes unit not visible (whichever is less distance) in these sensitive viewsheds (MA2-STD-02, FW-GDL-SCN-03).

54 Mask (black out) any painted boundary trees or leave tree marking that is clearly visible from the wild and scenic river or the North Fork Road. It is not necessary to extend this treatment further than 150 ft or until topography makes unit not visible (whichever is less distance) from the viewing locations. Other options to mitigate this visual impact include: use cut tree marking or using removable tags to designate leave or boundary trees (MA2-STD-02, FW-GDL-SCN-03).

55 In units along private land boundaries, use irregular clumping and blending of unit edges to avoid introducing dominating lines that could result from introducing unnatural appearing edges (FW-GDL-SCN-03).

56 When using cable logging systems, keep cable/skyline corridors as narrow as possible to reduce contrasting linear effects. Use irregular clumping to create mosaic landscape character on edges of corridors, use open areas adjacent to corridors. (FW-GDL-SCN-03).

57 In unit 121 retain Flathead river-side vegetative screening where it exists within 100 ft of the river edge. Saplings, brush and other vegetation within 100 ft of the river are often the most effective screening to soften visual impacts of harvest openings (MA2-STD-02).

Wildlife

Ungulate habitat

58 In vegetation treatment units within elk or mule deer winter range (units 2, 14, 16, 17, 23, 44, 72, 96, 108, 112, 113, and 114) and white-tailed deer winter range (units 6, 46, 55, and 109), maintain, where present, full-crowned trees (primarily Douglas-fir) in the overstory to provide snow intercept cover (FW-GDL-WL DIV-01). Douglas-fir should be favored over western larch in these units.

59 If funding is available, in regeneration units 9, 11, 23, 29, 31, 42, 48, 49, 70, 70a, 74, 81, 86, 92, 93, 99, and 101, decadent shrubs (primarily maple and willow) should be hand slashed throughout the units to improve forage conditions for forest ungulates.

60 If funding is available, in commercial thin units 2, 3, 4, 5, 6, 7, 10, 14, 16, 17, 27, 40, 46, 46a, 47, 50, 51, 53, 54, 54a, 55, 68, 71, 82, 85, 96, 109, 112, 114, 119, and 126, decadent shrubs (primarily maple and willow) should be hand slashed throughout the units to improve forage conditions for forest ungulates.

Riparian habitat

61 Where new openings would be created in riparian management zones through even-aged regeneration harvest (units 9, 20, 25, 25a, 29, 31, 32, 33, 42, 44, 65, 70, 70a, 73, 74, 86, 88, 101, 102, 108, 121, and 131), each created opening's distance to cover would not exceed 350 ft to provide wildlife habitat structural diversity, connectivity, and cover (FW-GDL-RMZ-09). Where the distance to cover would be greater than 350 ft, intermediate treatments would be used within the RMZ portion of the regeneration unit to maintain connectivity for wildlife (FW-GDL-RMZ-09).

62 Where vegetation treatment would occur within riparian management zones, all snags greater than or equal to 12 inches d.b.h. would be retained within the harvest area to contribute towards more diverse forest structure and desired habitat conditions by providing higher snag and downed wood densities (once the snags fall) as compared to areas outside riparian management zones (FW-GDL-RMZ-10).

63 In vegetation treatment units within one-half of a mile of Flathead River (121, 123, 130, and 131) and Spoon Lake (42, 48, 65, 74, 81, 99, 119, 119a, 141, 202, 205, 209, and 217), live ponderosa pine, western larch, or black cottonwood trees greater than or equal to 20 inches d.b.h should be retained where they exist to provide bald eagle nesting and roosting habitat (FW-GDL-TE&V-10).

64 In the birch firewood cutting area, some of the largest birch trees (approximately six trees per linear mile of road) will be marked for retention as wildlife trees to provide future snags for nesting and foraging (FW-DC-TE&V-09).

65 Birch cutting within the RMZ will only occur in designated areas approved by wildlife, botany, and aquatic specialists. Birch cutting will not occur within the inner RMZ (FW-STD-RMZ-06).

Timing restrictions

66 To reduce the risk of disturbance to the grizzly bear population, project activities would not occur in spring habitat during the spring time period (April 1 to June 30). For any excepted activities, the duration of the activity and use of restricted roads may be limited (FW-GDL-TE&V-01). Project activities occurring along open roads would not be subject to this timing restriction.

67 To reduce the risk of disturbance to nesting common loons on Spoon Lake and Cedar Creek Reservoir, vegetation treatments would not occur from April 1 to August 1 within 150 yards of active nesting and nursery sites. This restriction would apply to units 119, 119a, 82, and 82a (FW-GDL-WL DIV-05).

68 If it is determined that wolf denning is occurring in the project area, no vegetation activities would occur within 0.25 mile of active den or rendezvous sites from April 1 to July 1 (FW-GDL-WL DIV-05).

69 If an active northern goshawk nest is located in or adjacent to a vegetation treatment unit, project activities would not occur within 0.25 mile of the nest from March 1 to August 15 (FW-GDL-WL DIV-05).

Access management

70 Project would be designed so that on-the-ground implementation of project activities affecting access management conditions (e.g. activities requiring use of temporary or restricted roads) would not exceed 5 years to reduce the potential of grizzly bears being disturbed or displaced (FW-GDL-IFS-01). Exceptions may be made where necessary, however, if an extension is required, reasons would be documented in writing prior to authorization of the extension.

71 There would be no net decrease to the baseline for secure core and no net increase to the baseline open motorized route density or total motorized route density in the affected bear management subunit (FW-STD-IFS-02) and access management conditions should be restored to pre-project levels within one year after completion of the project in order to reduce the duration of grizzly bear displacement or disturbance due to project-related activities (FW-GDL-IFS-02). This includes rehabilitation of temporary roads, returning restricted roads used as haul routes to administrative access only (10810, 10810A, 10811, and 10813), and replacing the berm on 10877.

72 The 10-year running average for temporary changes to access management conditions in the affected bear management subunit would not exceed 5 percent increase in open motorized route density, 3 percent increase in total motorized route density in each subunit, and 2 percent decrease in secure core (FW-STD-IFS-03).

73 Newly constructed firelines should be located away from public access points to prevent their use as motorized travel routes (FW-GDL-FIRE-03). Where fireline must be constructed near public access points, fireline should be treated in a manner to make inaccessible to wheeled motorized vehicles during the non-denning season.

Grizzly bear-human conflict

74 Trails should be constructed to limit the risk of bear-human conflict by avoiding areas of dense vegetation, such as that found in riparian habitat, maintaining sight distances, and limiting speed of travel. In addition, information on how to avoid and respond to bear-human encounters should be posted at trailheads (FW-GDL-IFS-015).

75 Contractors, operators, and their employees should be informed of procedures for safely working and recreating in grizzly bear country and of food and wildlife attractant storage special order prior to beginning work and annually thereafter, in order to reduce the risk of grizzly bear-human conflicts (FW-GDL-WL-01).

Fire and fuels

76 Implementation of the prescribed burns may extend for several years into the future depending on desirable burning weather opportunities. Prescribed burns would be ignited using hand ignition and could occur in the spring (with coordination with wildlife biologist), summer, or fall when suitable burn and air quality conditions exist. Prior to broadcast burning, fireline would be constructed where needed.

77 Prescribed burning prescriptions would be prepared and implemented to not exceed moderate burn severity conditions and would target the treatment of the existing shrub/grass dominated openings. Prescribed burns should be implemented in a way to maintain, where present, patches of full-crowned trees (primarily Douglas-fir) in the

overstory to provide snow intercept cover within the burn unit boundaries (FW-GDL-WL DIV-01).

78 Prior to implementing prescribed burns in units 300 and 300a, measures should be taken to prevent negative impacts to full-crowned trees (primarily Douglas-fir) retained in the overstory of regeneration units 44, 72, and 108 to provide snow intercept cover (FW-GDL-WL DIV-01).

Air quality

79 On the Flathead National Forest, prescribed burning is generally accomplished when dilution, dispersal, and mixing conditions are considered fair to excellent. Prescribed burning requires a permit from the Montana/Idaho Airshed Group and the burn must be implemented within the regulatory framework. This includes daily approval from the Flathead County Air Quality hotline and the Montana/Idaho Airshed Group

Duration and timing of activities

80 Unit 119A and 119 will require winter logging and in-woods processing to reduce ground disturbance, minimize weed spread, and avoid potential seasonal conflicts with local residents and visitors. Fuels piling and treatment could occur during non-winter season.

Appendix B. Past, Ongoing, and Reasonably Foreseeable Activities

This appendix provides a summary of the actions considered in the cumulative effects analyses for the Crystal Cedar Project. Each action was evaluated by the appropriate resource specialist to determine whether it would have a cumulative impact on the resource. These determinations are documented in cumulative effect worksheets found in the project file. All actions that were determined to have a cumulative impact are disclosed throughout this environmental assessment within each resource section. In order to have cumulative effects, the effects of activities must overlap in space and time; therefore, each resource may have a different set of past, present, and reasonably foreseeable actions associated with it.

Table 65. Past, ongoing, and reasonably foreseeable activities

Activity	Past	Ongoing	Reasonably foreseeable
Timber harvest	Timber harvest: 1940s = 497 acres 1950s = 1,426 acres 1960s = 1,314 acres 1970s = 503 acres 1980s = 769 acres 1990s = 412 acres 2000s = 1,798 acres Since 2010 = 0 acres Total acres = 6,719 acres Recent sales completed: Cedar Spoon Fuels Stewardship and Blankenship Fuels Stewardship harvest activities were completed in 2008		
Flathead National Forest Pre-Commercial Thinning Project	Decision included 114 acres of pre-commercial thinning in the Teakettle Lynx Analysis Unit		
Blankenship Fuels Reduction Project (Decision Memo March 2006)	The decision covered approximately 830 acres of mechanical fuels reduction activities on National Forest System lands near Blankenship Road and Teakettle Mountain.		
Cedar Spoon (Decision Memo May 2004)	The decision approved approximately 940 acres of mechanical fuels reduction activities on National Forest System lands between Columbia Falls and Spoon Lake.		
Non-native invasive plant species/noxious weeds	Weed spraying has been ongoing in the project area. Spraying is expected to continue in these areas and others as needed in the foreseeable future.		
Hazard tree and blowdown removal	Ongoing at trailheads and along open roads.		
Forest products gathering	Personal use firewood cutting, Christmas tree harvesting, bough and cone collection, and huckleberry picking are all past, current and reasonable foreseeable activities in the project area.		

Activity	Past		Ongoing	Reasonably foreseeable
Tree planting	Tree planting occurred on approximately 1,604 acres in the project area from the years 1940 through 2010. Activities planned after 1999, are listed as part of the Blankenship and Cedar Spoon Projects.			
Sapling thinning (precommercial thinning)	Precommercial thinning occurred on approximately 2,582 acres between 1963 and 2014. Activities planned after 1999, are listed as part of the Blankenship and Cedar Spoon Projects.			
Prescribed Burning (e.g. for wildlife habitat, or other ecosystem objectives)	Prescribed burning occurred on approximately 435 acres between 1995 and 1998.			
Wildfire history	(*Within project boundary*) The Half Moon Fire of 1929 was the last large wildfire recorded and affected approximately 21,241 acres. Since 1987, one 20 acre fire and about 50 small fires (<2 acres) have been reported. *(Outside project boundary)* A large wildfire called the Robert Fire occurred in 2003 to the north of the project area. In 2015 a portion of this area reburned as the Glacier Rim fire.			
Public recreation	Sightseeing, hiking, camping, rafting, hunting, biking, fishing, snowmobiling, cross country skiing, huckleberry picking, and dispersed recreation take place in the project area. The Glacier Rim, Blankenship Bridge, and House of Mystery boat launches are located adjacent to the project area. The Canyon Creek snowmobile parking area has averaged between 20-24 vehicles each day over the season and includes a grooming shelter.			
Recreation special uses	There are two snowmobile outfitters operating in the project area. Each outfitter has been permitted 1,000 service days of snowmobiling for at the Canyon Creek groomed snowmobile trails. A multi-sport recreation event was issued permits in 2017 and 2018 to bicycle on NFS road 316.			
CHR Motorized Route and Area Designation Project (March 2010)	The decision authorized the construction of 7 miles of motorized routes less than or equal to 50 inches wide in the Cedar Flats area. It also authorized the seasonal use of NFS Road 10815 from June 1 through November 30. It also included the prohibition of overnight use, target (recreational) shooting, and campfires.			

Activity	Past	Ongoing	Reasonably foreseeable
Comprehensive River Management Plan	A planning process for ongoing river management planning is occurring for the three forks of the Flathead River with a decision expected in 2020.		
Road improvement	In 2008, NFS Road 316 was paved from milepost 36.5-37.2 to facilitate winter road maintenance activities.		
Road maintenance	Road maintenance is a past, current, and reasonably foreseeable activity in the project area. Road maintenance and repair work has occurred on NFS Road 316 in the last three years to repair damage from a May 2016 rain event.		
Non-recreation special use permits on NFS land	Special use permits have been issued for the project area for the following types of activities: telephone line, fiber optic cables, powerline, BNSF Railway activities, communications towers, driveway and road use, water pipelines, stream gauging station, silt impoundment, fish hatchery, commercial photography and filming, and other non-ground disturbing activities. A list of special use permits can be found in the project file (project file exhibit M-3). Potential effects to resources from these permitted activities will be discussed in the analysis for each resource.		
North Valley Sportsman Club	The North Valley Sportsman Club operates an outdoor shooting range on land managed by the DNRC within the project area on Parker Hill Road.		
Fish stocking	Spoon Lake is stocked with westslope cutthroat trout annually by MFWP. Bailey Lake was last stocked with westslope cutthroat trout in 2009.		
Private land development	Approximately 8,915 acres of private property are located in the project area (33% of the project area). The county estimates that there are approximately 358 structures in the project area as of December 2018. It is expected that private land development will continue in the project area.		