

Canada Lynx Habitat and Critical Habitat

Existing Condition, Effects Analysis, Forest Plan Consistency, Cumulative Effects

1. Background

A. Habitat

Canada lynx distribution is closely tied to that of snowshoe hares and boreal forests (McKelvey et al., 1999) and hares are the primary winter prey of lynx in Montana (Squires & Ruggiero, 2007). Research and noninvasive sampling techniques have been used to study and detect lynx in many parts of the Forest. Across their range, lynx typically occur in boreal and subalpine coniferous forests dominated by subalpine fir and spruce in landscapes with gentle topography (Squires et al., 2013). On the Flathead National Forest, the cool-moist and cold potential vegetation types are capable of growing subalpine fir and Engelmann spruce, but the dominance type changes over time due to factors such as fire, insects and disease, vegetation management, and forest succession. Forests with a subalpine fir/spruce dominance type currently occur on an estimated 43% of all Flathead NFS lands. Historically, fire, insects, and disease have been the primary processes that have affected forest vegetation in lynx habitat, reverting the vegetation to an early stage of succession or creating openings within the forest canopy. Immediately after a disturbance, forest areas are not yet able to support snowshoe hares and lynx because of the lack of live trees and shrubs, so these areas are in a temporarily unsuitable condition.

B. Winter recreation

Ski resorts may have detrimental effects on lynx (Olson et al. 2018). Winter activity associated with ski resorts, including skiing, ski-lift operation, and grooming of ski runs, may cause disturbance or displacement of individual lynx and may also affect prey availability. About 3,100 acres of the Lakalaho lynx analysis unit is in the Whitefish Mountain Resort permit area. Since 2007, the Forest has consulted on the effects of projects within the Whitefish Mountain Resort, including consultation for Canada lynx critical habitat.

Some researchers have speculated that compacted trails could indirectly affect Canada lynx by serving as travel routes that might enable competing predators (e.g., coyotes) to access snowshoe hare prey in lynx habitat (Murray & Boutin, 1991; Murray et al., 1994; Ruggiero et al., 1999). However, in its remanded determination, the USFWS (2003) found no evidence of competition between lynx and other predators such as coyotes or, if competition exists, there is no evidence that it exerts a population-level impact on lynx. Therefore, the USFWS did not consider compacted trails to be a threat to lynx. Additionally, Kolbe et al. (2007) completed a study of the effect of snowmobile trails on coyote movements in lynx habitat in northwest Montana. They reported that coyotes did not forage closer to compacted snowmobile trails than random expectation, and the overall influence of snowmobile trails on coyote movements and foraging success appeared to be minimal. Key findings of more recent research (i.e. Olson et al., 2017, Olson et al., 2018, and Squires et al., 2019) include:

- Lynx and skiers both prefer steeper slopes, dense canopy, and patchy forest cover.

- Lynx do not appear to be as sensitive to low and moderate levels of skiing and snowmobiling as originally thought; instead, lynx modify their behavior to avoid some types of recreation but appear to be fairly tolerant of non-motorized (skiing) types of recreation.
- High intensities of winter recreation, such as at developed ski areas, may represent a threshold above which lynx have a difficult time coexisting.
- It is difficult to distinguish between impacts of winter recreation and apparent segregation between lynx and recreationists due to differences in habitat choice.
- Patterns of segregation between lynx and winter recreationists appear to be a function of resource-use decisions rather than a “landscape of fear”.
- Lynx decreased movement speeds and increased time spent stationary in areas of highest intensity of backcountry skiing and snowmobiling, although they exhibited little behavioral response to backcountry ski trails and a neutral or a slight proclivity to use roaded areas.
- Management actions “that modify forest canopy cover through tree removal in recreation areas, whether for silviculture or fire/fuels management, could increase the spatial footprint of motorized winter recreation and decrease critical habitat for Canada lynx, especially in mid-elevation forests located on north-facing slopes....”

Kolbe, J. A., Squires, J. R., Pletscher, D. H., & Ruggiero, L. F. (2007). The effect of snowmobile trails on coyote movements within lynx home ranges. *Journal of Wildlife Management*, 71(5), 1409-1418. Retrieved from <http://www.bioone.org/doi/abs/10.2193/2005-682>, <http://dx.doi.org/10.2193/2005-682>.

McKelvey, K. S., Aubry, K. B., & Ortega, Y. K. (1999). History and distribution of lynx in the contiguous United States. In L. F. Ruggiero, K. B. Aubry, S. W. Buskirk, G. M. Koehler, C. J. Krebs, K. S. McKelvey, & J. R. Squires (Eds.), *Ecology and conservation of lynx in the United States. General Technical Report RMRS-30WWW* (pp. 207-264). Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. Retrieved from <https://www.treesearch.fs.fed.us/pubs/4546>, https://www.fs.fed.us/rm/pubs/rmrs_gtr030.pdf.

Murray, D. L., & Boutin, S. (1991). The influence of snow on lynx and coyote movements: Does morphology affect behavior? *Oecologia*, 88(4), 463-469. Retrieved from <Go to ISI>://WOS:A1991GU19000002, <http://link.springer.com/article/10.1007%2FBF00317707>.

Murray, D. L., Boutin, S., & O'Donoghue, M. (1994). Winter habitat selection by lynx and coyotes in relation to snowshoe hare abundance. *Canadian Journal of Zoology-Revue Canadienne De Zoologie*, 72(8), 1444-1451. doi:10.1139/z94-191. Retrieved from <Go to ISI>://WOS:A1994PV94000012, <http://www.nrcresearchpress.com/doi/pdf/10.1139/z94-191>.

Olson, L.E.; Squires, J.R.; Roberts, E.K.; Miller, A.D.; Ivan, J.S.; Hebblewhite, M. (2017). Modeling large-scale winter recreation terrain selection with implications for recreation management and wildlife. *Applied Geography*. 86: 66–91. www.fs.fed.us/rmrs/publications/modeling-large-scale-winter-recreation-terrainselection-implications-recreation

Olson, L.E.; Squires, J.R.; Roberts, E.K.; Ivan, J.S.; Hebblewhite, M. (2018). Sharing the same slope: Behavioral responses of Canada lynx to winter recreation. *Ecology and Evolution*. 1-18. www.fs.fed.us/rmrs/publications/sharing-same-slope-behavioral-responses-threatened-mesocarnivore-motorized-and-non

Ruggiero, L. F., Aubry, K. B., Buskirk, S. W., Koehler, G. M., Krebs, C. J., McKelvey, K. S., & Squires, J. R. (1999). Ecology and conservation of lynx in the United States. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. Retrieved from <https://www.fs.usda.gov/treesearch/pubs/4546>.

Squires, J.R., Olson, L.E., Roberts, E.K., Ivan, J.S., and Hebblewhite, M. (2019). Winter recreation and Canada lynx: reducing conflict through niche partitioning. *Ecosphere*, 10(10): e02876. Retrieved from <https://esajournals.onlinelibrary.wiley.com/doi/full/10.1002/ecs2.2876>.

Squires, J. R., DeCesare, N. J., Olson, L. E., Kolbe, J. A., Hebblewhite, M., & Parks, S. A. (2013). Combining resource selection and movement behavior to predict corridors for Canada lynx at their southern range periphery. *Biological Conservation*, 157, 187-195. doi:10.1016/j.biocon.2012.07.018. Retrieved from <Go to ISI>://WOS:000316651200022, <http://www.sciencedirect.com/science/article/pii/S0006320712003382>.

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USFWS. (2003). Endangered and threatened wildlife and plants; notice of remanded determination of status for the contiguous United States distinct population segment of the Canada lynx; Clarification of findings; Final rule. Federal Register. Retrieved from <https://ecos.fws.gov/ecp0/profile/speciesProfile?scode=A073>.

2. Habitat Analysis Methodology

A. Initial Data Source -- Taylor Hellroaring Project (THR) lynx GIS layer.

This project started with the Lakalaho LAU part of the lynx GIS layer developed for the Taylor Hellroaring Project, because it:

- Had been updated for the 2018 LRMP lynx GIS layer. Flathead National Forest updated its site-specific map of lynx habitat with the signing of the 2018 LRMP revision Record of decision. The updated map of lynx habitat includes lands capable of providing the physical and biological features to support the conservation and recovery of Canada lynx, consistent with the amended Lynx Conservation Agreement (USFWS, 2006) and the Canada Lynx Conservation Assessment and Strategy (ILBT, 2013). See Taylor Hellroaring Project File Exhibit Rt-8.
- Incorporated all of the post-project changes from implementing the Taylor Hellroaring project. See Taylor Hellroaring Project File Exhibit Rt-15.
- Included columns with information for considering recent lynx science (i.e. Kosterman and Holbrook papers). See Appendix 2 below.

B. Update to nonlynx/matrix habitat in Hellroaring Basin, existing conditions.

32.5 acres of **existing** permanent ski runs and clearing for ski lifts were updated to non-lynx habitat/matrix. This change will be tracked in Flathead National Forest GIS data. *(The 43 acres of project-generated non-lynx habitat discussed below are in addition to these 32 acres.)*

Value in 2018 LRMP lynx GIS layer	Acres
Multistory to non-lynx	6.2
Other Mature to non-lynx	9.2
Stem Exclusion Other to non-lynx	11.5
Stand Initiation to non-lynx	5.7
Total	32.5

C. Update for summer 2018 field survey data and photos.

Reviewed data sheets and viewed georeferenced photos from wildlife, silviculture, and hydro field visits that were done for the Hellroaring Basin Improvements Project. Used this information to update the lynx habitat values for 186 acres.

Updates to EC for new FIELD survey info	Acres
FIELD Multistory Feeding to Stem Exclusion/Other	11.3
FIELD Multistory Feeding to Other Mature	42.9
FIELD Mature to Multistory Feeding	17.9
FIELD Stem Exclusion/Other to Early Stand Initiation	13.8
FIELD Stem Exclusion/Other to Other Mature	6.7
FIELD Stand Initiation to Multistory Feeding	18.0
FIELD Stand Initiation to Other Mature	75.4
Total	186.0

3. Existing Condition across the Lakalaho LAU with a Comparison with Taylor Hellroaring Project Data

The following table uses the habitat classifications as used in FNF's 2018 LRMP Appendix A, which is the same as those used by the Northern Rockies Lynx Management Direction.

	Total Acres	Lynx Habitat Acres (% of LAU)	Stand Initiation ¹ Acres (% of lynx habitat)	Early Stand Initiation ² Acres (% of lynx habitat)	Multistory ³ Acres (% of lynx habitat)	Other ⁴ Acres (% of lynx habitat)	% Regenerated in 10 years
Taylor Hellroaring post-implementation	22,456	21,135 (94.1%)	1,936 (9.2%)	1,732 (8.2%)	9,414 (44.5%)	8,053 (38.1%)	1.7%
Existing Condition for current project	22,456	21,103 (94.0%)	1,836 (8.7%)	1,744 (8.3%)	9,391 (44.5%)	8,132 (38.5%)	1.7%

¹ Stand initiation structural stage *that currently provides* snowshoe hare habitat.

² Stand initiation structural stage *that currently does not provide* winter snowshoe hare habitat because trees have not yet grown tall enough to protrude above the snow in winter.

³ Forested multi-storied structural stage with many age classes and vegetation layers *that appears to currently provide* winter snowshoe hare habitat (VEGS6).

⁴ Forested conditions that do not fit Categories 1 through 4. Stem Exclusion Structural Stage – Closed canopy with understory limited; does not provide snowshoe hare habitat.

The following summarizes an additional consideration of recent lynx science by Holbrook et al. and Kosterman et al. regarding the existing condition (see Appendix 2 below). This “Mature” habitat is well distributed and connected (Figure 5), and even more so when one adds sapling hare habitat and stem exclusion forests.

	Lynx Habitat Acres (% of LAU)	Multistory Acres (% of lynx habitat)	Other Acres (% of lynx habitat)	Subset of “Other ⁴ ” that meets definition of “Mature” Acres (% of lynx habitat)	Total that meet the description of “Mature” Acres (% of lynx habitat)
Taylor Hellroaring post-implementation	21,135 (94.1%)	9,414 (44.5%)	8,053 (38.1%)	5,311 (25.1%)	14,743 (69.8%)
Existing Condition for current project	21,103 (94.0%)	9,391 (44.5%)	8,132 (38.5%)	5,398 (25.6%)	14,789 (70.1%)

The entire LAU is designated critical habitat for Canada lynx. Critical habitat acres by structural stage are shown in the following table, in existing critical habitat acres by structural stage, in acres (and % of critical habitat), as updated for this project. All PCE components, including deep fluffy snows and connectivity, are abundant and well-distributed across this area.

	Lakalaho LAU
Total	22,456
Stand Initiation ¹	1,836 acres (8.2%)
Early Stand Initiation ²	1,744 acres (7.8%)
Multistory ³	9,391 acres (41.8%)
Other ⁴ (stem exclusion)	8,132 ac (36.2%)
Matrix Habitat ⁵	1,353 acres (6.0%)

¹Stand initiation structural stage that currently provides winter snowshoe hare habitat because the trees have grown tall enough to protrude above the snow in winter – relates to PCE1a.

²Early stand initiation structural stage does not yet provide winter snowshoe hare habitat because the trees have not grown tall enough to protrude above the snow in winter; early stand initiation is a component of the boreal forest CH mosaic of successional stages – relates to PCE1a.

³Multistory structural stage with many age classes and vegetation layers that provide snowshoe hare habitat, dense horizontal cover – relates to both PCE1a - and PCE1c.

⁴Stem exclusion structural stage - closed overstory canopy with limited understory vegetation; multistory structural stage with many age classes and vegetation layers that do not provide snowshoe hare habitat because they do not provide enough dense horizontal cover – likely relates to PCE1c.

⁵Matrix habitat includes dry forest habitat types, rock outcrops, sites dominated by dry grass/forb/shrubs, low elevations – PCE1d.

4. Hellroaring Basin Improvements Project Effects

A. Method

First added Hellroaring Basin Improvements Project Proposed Action and Lynx Results to GIS Layer. For Proposed Action, first made a union of the 5 shapefiles (ski runs, gladed areas, feathered areas, terrain modifications, and chairlift clearing) to make “PolysUnion2”. Unioned PolysUnion2 with the lynx habitat layer, ran the Multipart-to-Singlepart ArcGIS tool, and renamed the feature class Lynx-WithPA_single. Used Calculate Geometry to recalculate acres. The proposed action polygons were reviewed so that only actual impacts would be assessed and existing vegetation clearing was not included. In addition, the most impactful action was assessed. For example, proposed glading that overlaps with an existing ski lift clearing was dismissed. The actions are listed in order of decreasing impact in the following table. The 2 new service roads and the cat track will be too narrow to make a difference for habitat at the 30-meter grain (see below).

Action (See PA description in EA for full information)	Data	How Evaluated
4 terrain modifications. These areas would be cleared and recontoured.	Field “TerrainMod” value is “TerrainMod” and the “Mod_Code” field identifies which one.	Outside ski runs (2.3 ac), these were considered new temporary clearings. Inside ski runs (1.4 ac), these were considered same as existing permanent clearing/non-lynx habitat.
8 new ski runs and clearings for 2 new lift line locations. These areas would be cleared of trees and groomed. Both lift lines would have 50-foot wide clearing.	Field “Ski_Run_No” has ski run #, “Buffer_Wid” column provides width. Field “Chairlift” has the chairlift #.	Unless already cleared, these were considered new permanent openings and thus non-lynx/matrix habitat (43.1 ac total). Where they overlapped with Taylor Hellroaring fuel reduction units (2.8 ac), these were also considered continued/permanent clearing of what had been authorized as a temporary thinning.
New Glading. Selective tree removal. Expected to retain 75 to 125 trees per acre with an average tree spacing of 20 feet between trees.	Field “Glading” is “GA” and the # for the gladed area is in the “Item_No” field.	Unless already open, these were considered new permanent thinnings (59.2 ac total) changing multistory feeding, other mature forest, and sapling stands to stem exclusion other. If overlapped with Taylor Hellroaring fuel reduction units (3.6 ac), these were also considered

Action (See PA description in EA for full information)	Data	How Evaluated
		continued thinning of what had been authorized as a temporary thinning.
4 areas of new edge feathering. Selective tree removal with increasing cover next to open areas.	Field "FID_Feathered_Gladed-Areas" has a value other than -1 and "NewID" field has the number for each area.	As these are all currently closed canopy, these were considered new permanent thinnings changes multistory feeding, other mature forest, and sapling stands to stem exclusion other (1.9 ac).
Abandonment (Chair 8 and Hellfire run below Grand Junction). Areas would be allowed to revegetate.	Field "Name" has "Hellfire to be Rehab".	Used previous lynx habitat layer to see that the entire area has potential to again provide lynx habitat and changed all areas from non-lynx to early stand initiation (ESI).

Added a new field LynxPA_Chg for habitat changes due to the proposed action. Added new field LynxPA and used the Field Calculator to copy the values from the UpdatedEC field into it, then updated values based on values in the LynxPA_Chg field.

B. Project Effects on Habitat and Post Project Situation

Changes to habitat were very small at the LAU scale, as shown in the following table and Figures 2 and 3.

	Total Acres	Non-Lynx Habitat Acres (% of LAU)	Lynx Habitat Acres (% of LAU)	Stand Initiation Acres (% of lynx habitat)	Early Stand Initiation Acres (% of lynx habitat)	Multistory Acres (% of lynx habitat)	Other Acres (% of lynx habitat)	% Regenerated in 10 years
Existing Condition	22,456	1,353 (6.0%)	21,103 (94.0%)	1,836 (8.7%)	1,744 (8.3%)	9,391 (44.5%)	8,132 (38.5%)	1.7%
Changes	0	+ 43 acres - 0 acres	+ 0 acres - 43 acres	+ 0 acres - 7 acres	+ 2 acres - 4 acres	+ 0 acres - 42 acres	+ 30 acres - 23 acres	+ 0.3%
Net Change	0	+ 43 acres	- 43 acres	- 7 acres	- 2 acres	- 42 acres	+ 7 acres	+ 0.3%
Post-project implementation	22,456	1,396 (6.2%)	21,060 (93.8%)	1,829 (8.7%)	1,742 (8.3%)	9,349 (44.4%)	8,139 (38.6%)	2.0%

Terrain modification outside existing ski runs would change 1 acre of multistory forage and 1 acre of "other" to early stand initiation. Partial vegetation removal for glading and edge feathering would change 26 acres of multistory forage and 4 acres of stand initiation to "other". Clearing for ski runs and ski lifts would change 4 acres of early stand initiation, 3 acres of stand initiation, 21 acres of "other", and 15 acres of multistory forage to no longer provide lynx habitat.

For Canada lynx critical habitat, estimated amount of lynx habitat and matrix habitat proposed for vegetation treatment is displayed in Tables 9 through 11 below. Note that vegetation clearing would permanently convert some lynx habitat to additional matrix, and that vegetation removal for gladed areas and edge feathering would permanently convert some foraging habitat to stem exclusion.

The following table shows estimated acres of lynx critical habitat proposed to be treated.

Total Acres of Critical Habitat	Acres Treated			
	PCE1a – Stand Initiation, Early Stand Initiation, and Multistory	PCE1c – Denning Habitat	Stem Exclusion, Non-foraging	PCE1d – Matrix Habitat
22,456	49	64	22	35

The next table provides a summary of estimated changes to critical habitat, shown in increases and decreases in acres. (Note that some acres are shown in more than one column, i.e. Multistory PCE1a also provides PCE1c denning habitat).

LAU	Total Acres of Critical Habitat	PCE1a – Stand Initiation, Early Stand Initiation, and Multistory	PCE1c – Denning Habitat	Stem Exclusion, Non-foraging	PCE1d – Matrix Habitat
Lakalaho	22,456	+ 0 acres - 49 acres	+ 30 acres - 65 acres	+ 30 acres - 23 acres	+ 43 acres - 0 acres
Total	22,456	- 49 acres	- 35 acres	+ 7 acres	+ 43 acres

Explanations are needed for the previous table. Partial vegetation removal for glading and edge feathering would change 26 acres of multistory forage and 4 acres of stand initiation forage to “other” habitat. This 30 acres accounts for the addition in the PCE1c column and the “stem exclusion” column. Clearing for ski runs and ski lifts would change 4 acres of early stand initiation, 3 acres of stand initiation forage, 21 acres of “other”, and 15 acres of multistory forage to matrix habitat. This accounts for the addition of 43 acres in the PCE1d column.

See Appendix 1 below for cumulative effects.

C. Consideration of Recent Science

For an additional consideration of recent lynx science by Holbrook et al. and Kosterman et al. regarding the existing condition (based on Taylor Hellroaring Project Exhibit Rt-28) see the following table and Figure 6. Across the LAU, this “Mature” habitat is well distributed and well connected, although less so inside the small part that is the project area. See the attached consideration of new Canada Lynx Science done for the Taylor Hellroaring Project (Appendix 2 below).

	Lynx Habitat Acres (% of LAU)	Multistory Acres (% of lynx habitat)	Other Acres (% of lynx habitat)	Subset of “Other” that meets definition of “Mature” Acres (% of lynx habitat)	Total that meet the description of “Mature” Acres (% of lynx habitat)
Existing Condition	21,103 (94.0%)	9,391 (44.5%)	8,132 (38.5%)	5,398 (25.6%)	14,789 (70.1%)
Change	+ 0 acres - 43 acres	+ 0 acres - 42 acres	+ 30 acres - 23 acres	+ 0 acres - 49 acres	+ 0 acres - 92 acres
Net Change	- 43 acres	- 42 acres	+ 7 acres	- 49 ac	- 92 ac
Post-project implementation	21,060 (93.8%)	9,349 (44.4%)	8,139 (38.6%)	5,349 (25.4%)	14,697 (69.8%)

D. Inter-trail Islands

Used the Project Area to evaluate the availability of inter-trail Islands in and near the Hellroaring Drainage. Considered dense sapling, multistory feeding, stem exclusion, and other mature stands to provide diurnal security cover. The following table and Figure 7 display the existing and post-implementation situations. Although the proposed action would break almost all of the existing islands into smaller pieces, the ski runs were carefully shaped to maximize availability and proximity of these diurnal security habitats. In addition, abandonment of the Purgatory Run and the lower half of the Hell Fire Run dramatically increase the availability of diurnal security in the lower part of the drainage.

	# of Inter-trail islands	Smallest	Largest	Mean	Total
Existing Condition	8	14 ac	222 ac	98 ac	781 ac
Post-project implementation	21	2 ac	269 ac	32 ac	672 ac

E. Overall Winter Diurnal Security

Evaluated the availability of relatively secure and quiet area in and near the Hellroaring Drainage. The upper portion of the Hellroaring and a small part of the Big Creek drainage to the northeast, totaling approximately 430 acres, would join an approximately 1,300-acre area of Forest Service land that receives relatively high levels of recreation use by downhill skiers throughout the winter (Figure 8). This is partially balanced by approximately 330 acres that currently get low-to-moderate levels of use but that would receive very little winter use due to ski run and chairlift abandonment (blue on Figure 8). An additional and adjacent 100 acres in the project area are likely to continue to receive very low levels of human use (green on Figure 8).

F. Road and Cat Track Construction

Linear feet of construction crossing the kinds of lynx habitat is shown below. See also Figure 9.

	Early Stand Initiation	Multi. Feeding	SE/Other	SE/Other Mature	Total
Road to Grand Junction	0	2,097	530	382	3,722
Road to Hellroaring Peak	979	308	0	1,450	3,097
(Service Roads Total)	(979)	(2,405)	(530)	(1,833)	(6,819)
Cat Track	0	0	2,940	0	0
Grand Total	979	2,405	3,470	1,833	6,819

G. Habitat and Effects Analysis Maps

Figure 1. Existing Condition, Lynx Habitat across Lakalaho LAU.

Figure 2. Existing Condition, Lynx Habitat in and near Project Area Boundary.

Figure 3. Post Implementation of Hellroaring Basin Improvements Projects, Lynx Habitat

in and near Project Area Boundary.

Figure 4. Proposed Action that Changes to Lynx Habitat and Post Implementation of Hellroaring Basin Improvements Projects, Lynx Habitat in and near Project Area Boundary.

Figure 5. Existing distribution and connectivity of “mature” stands across the LAU.

Figure 6. Post-project distribution and connectivity of “mature” stands across the LAU.

Figure 7. Comparison of Pre- and Post-project Inter-trail Islands in the Project Area.

Figure 8. Winter recreation expansion in context of current high-use area, with area that would receive less winter use due to ski run and chairlift abandonment.

Figure 9. Service Roads and Cat Track crossing lynx habitats.

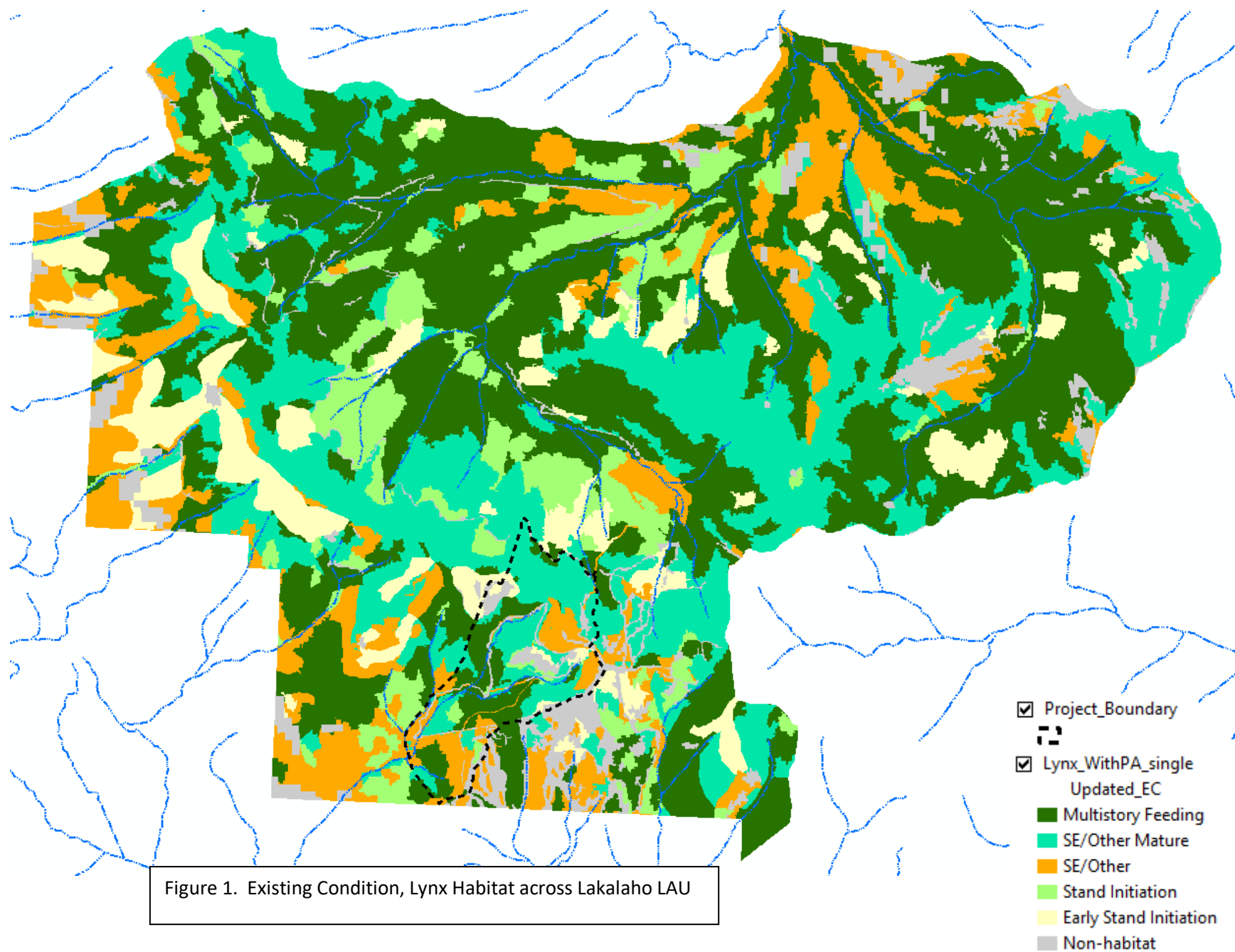
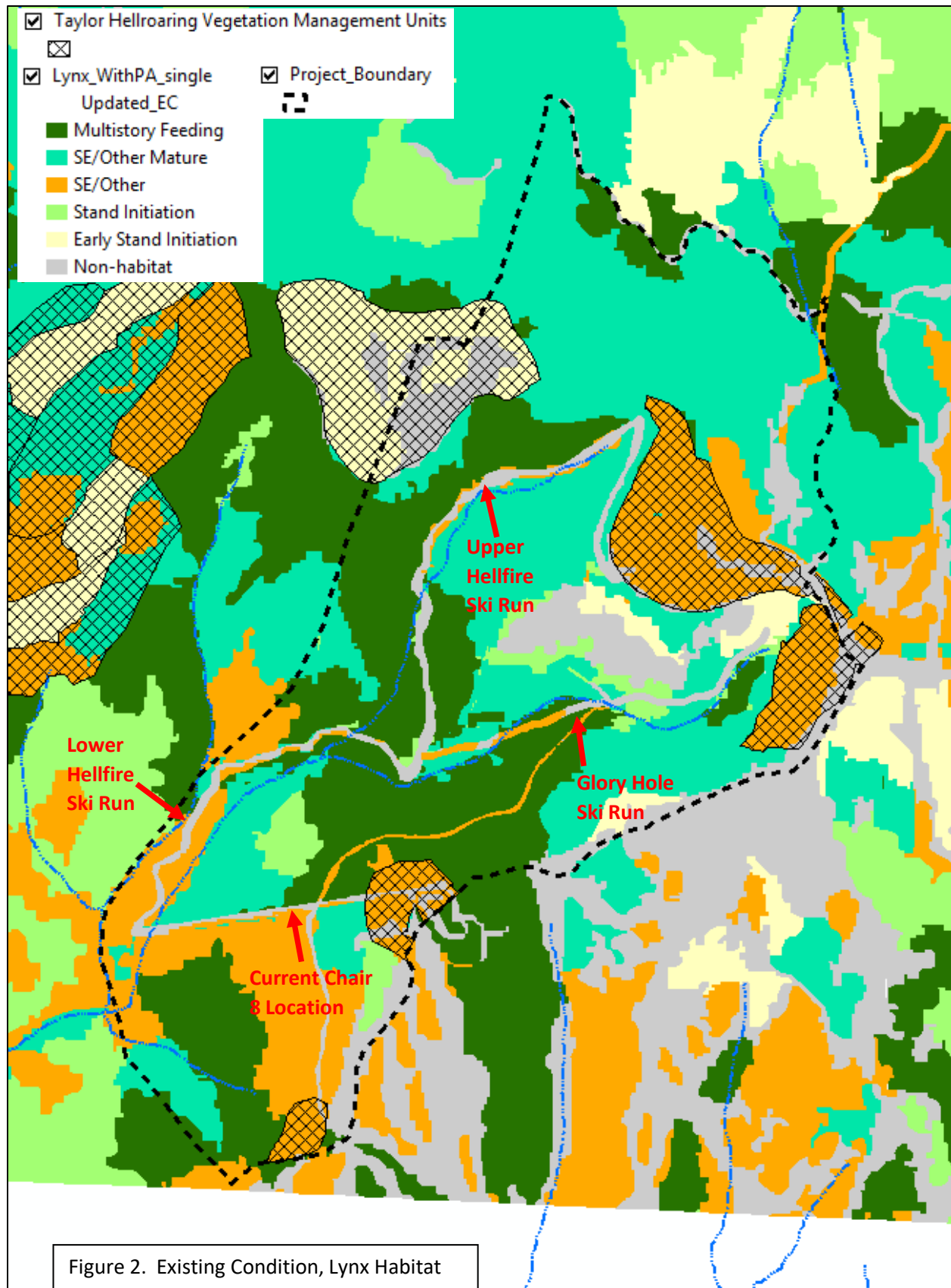


Figure 1. Existing Condition, Lynx Habitat across Lakalaho LAU



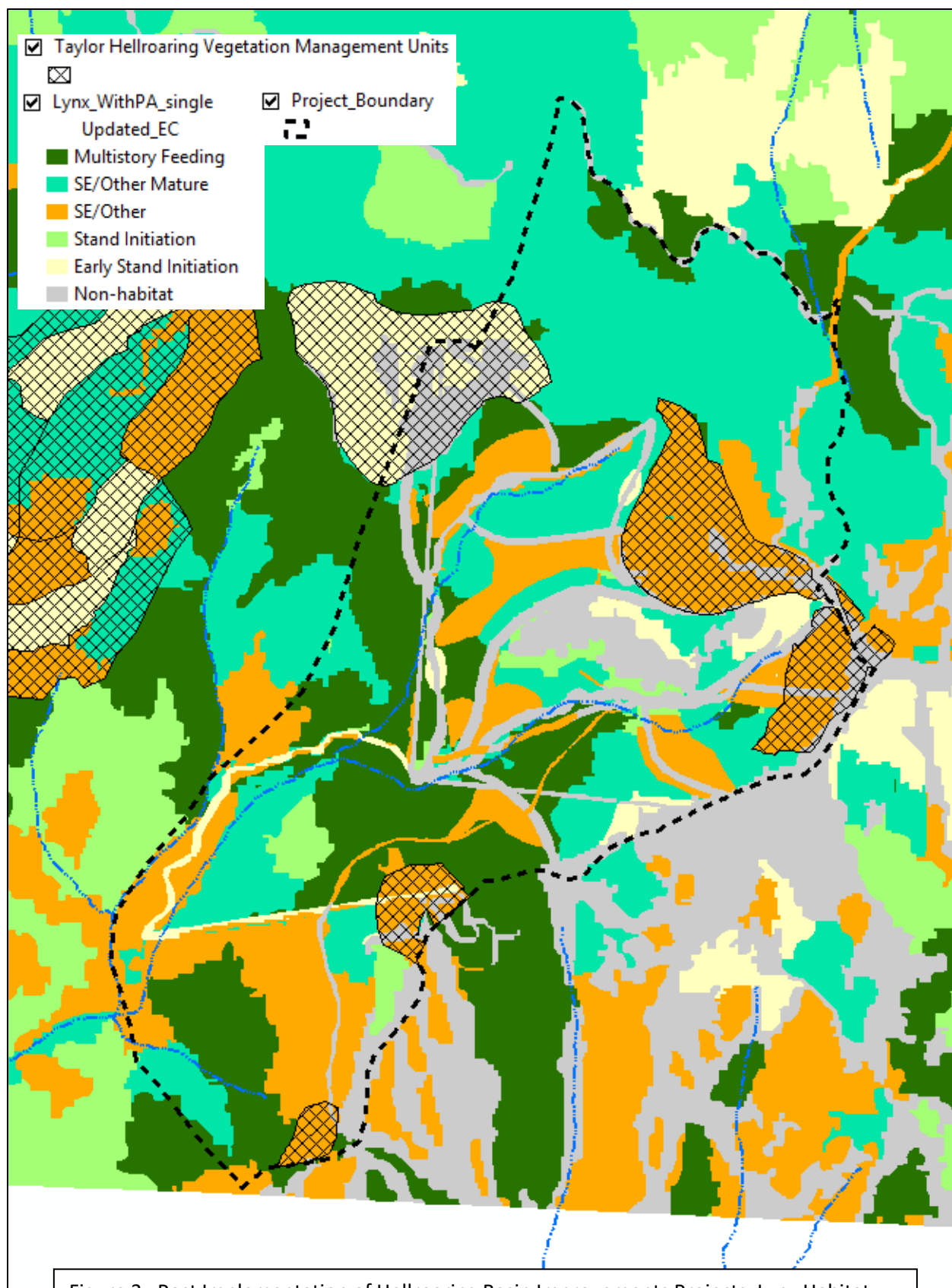


Figure 3. Post Implementation of Hellroaring Basin Improvements Projects, Lynx Habitat in and near Project Area Boundary

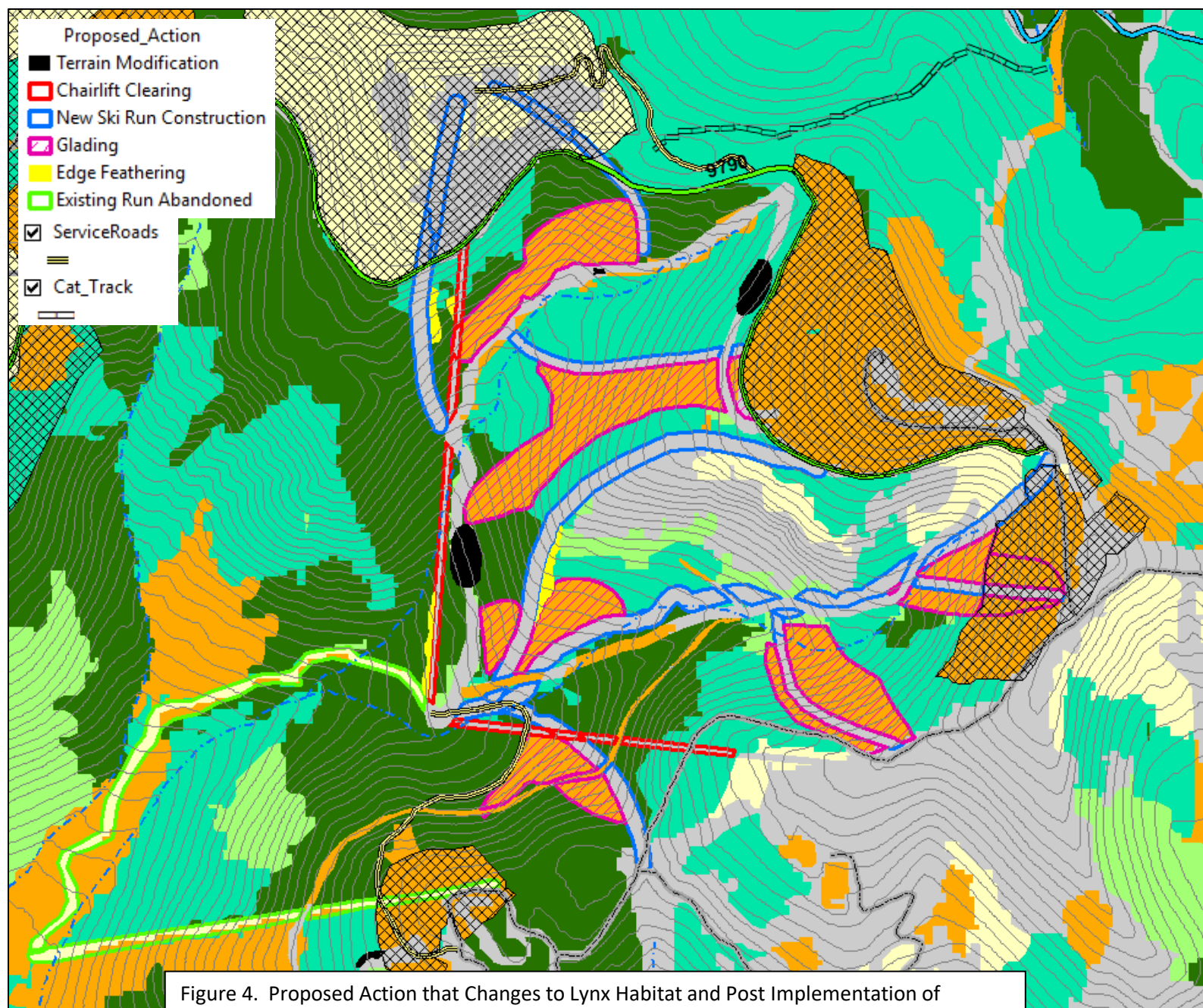


Figure 4. Proposed Action that Changes to Lynx Habitat and Post Implementation of Hellroaring Basin Improvements Projects, Lynx Habitat in and near Project Area Boundary

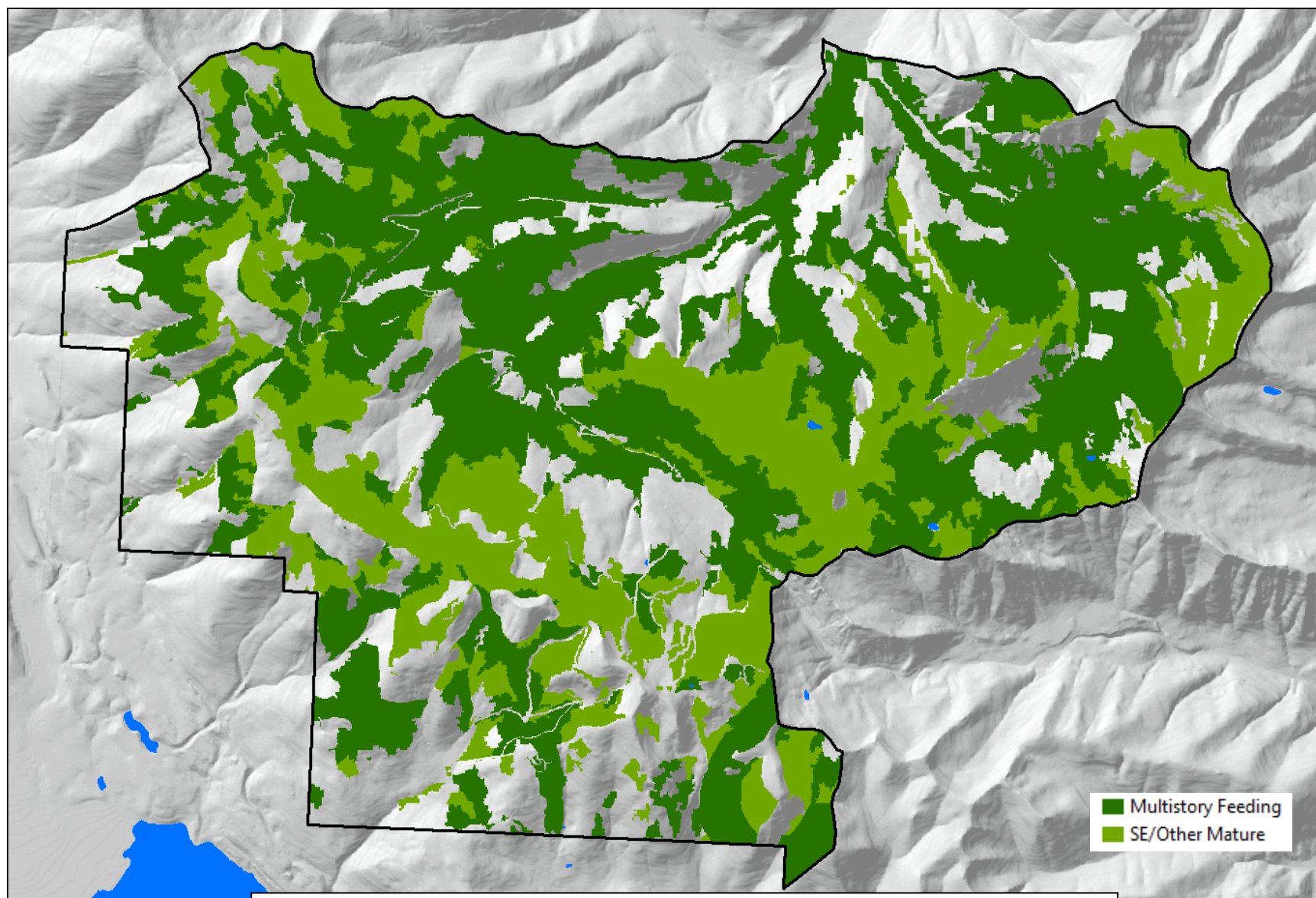


Figure 5. Existing distribution and connectivity of "mature" stands across the LAU

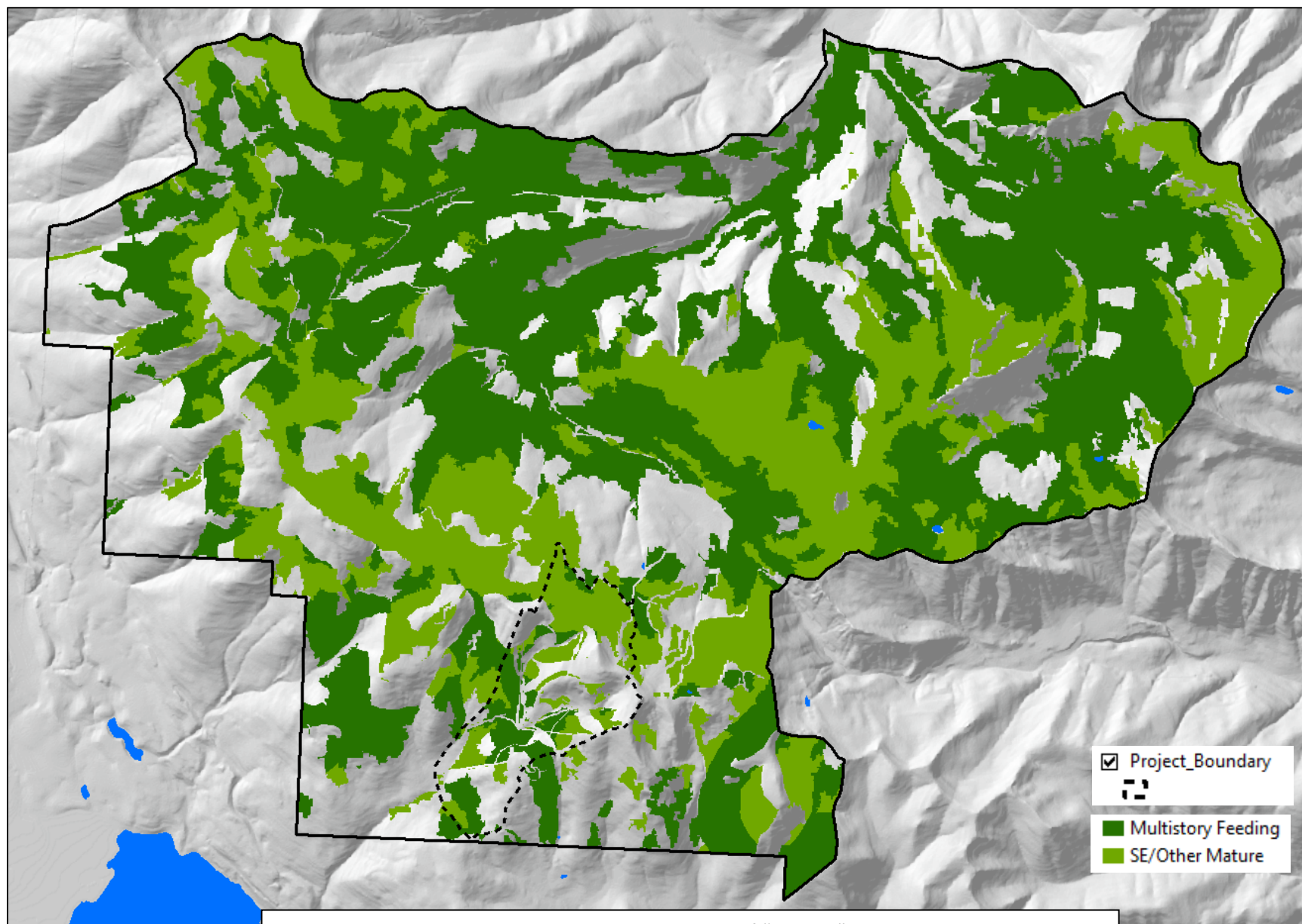


Figure 6. Post-project distribution and connectivity of "mature" stands across the LAU

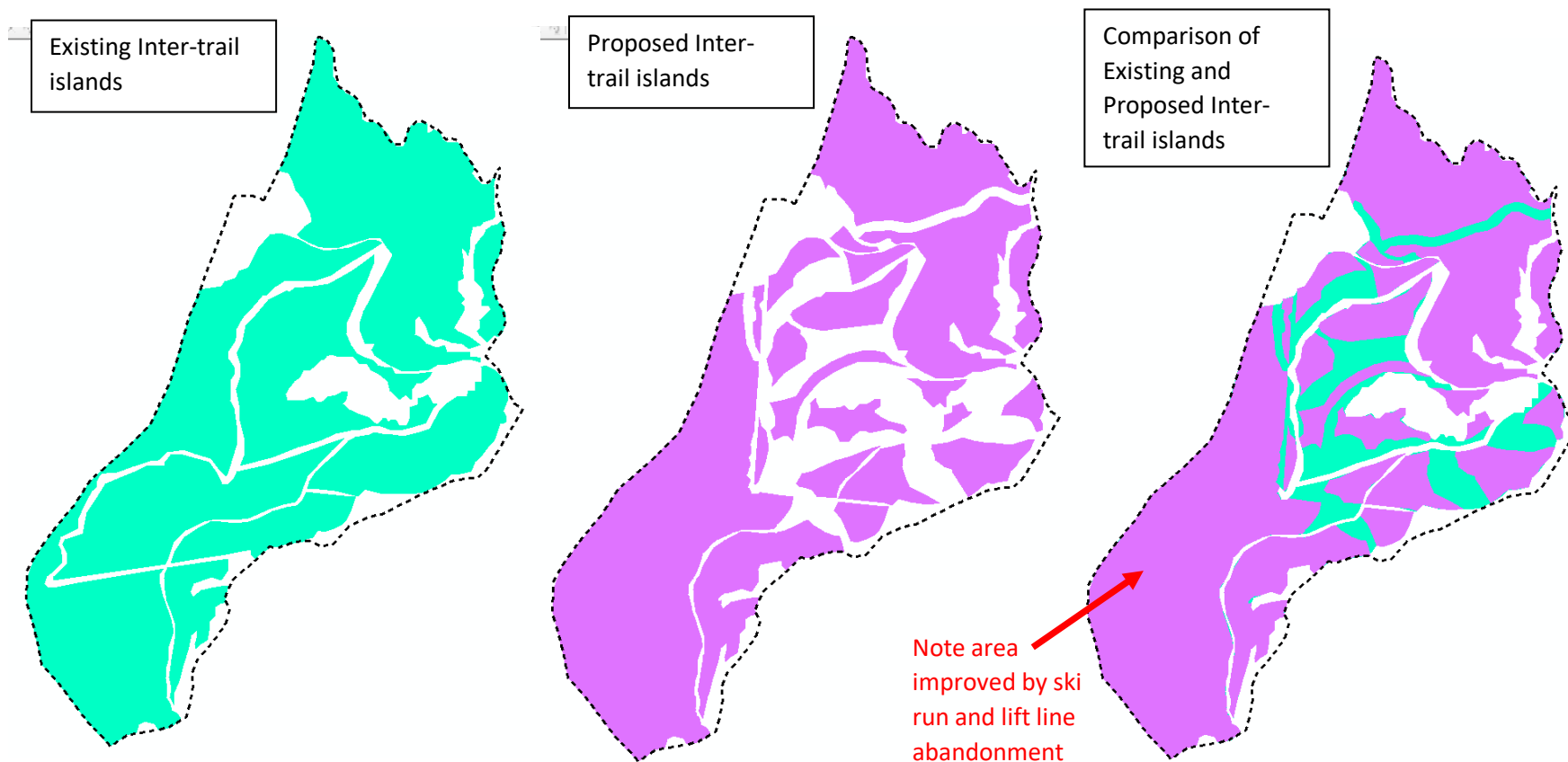


Figure 7. Comparison of Pre- and Post-project Inter-trail Islands in the Project Area

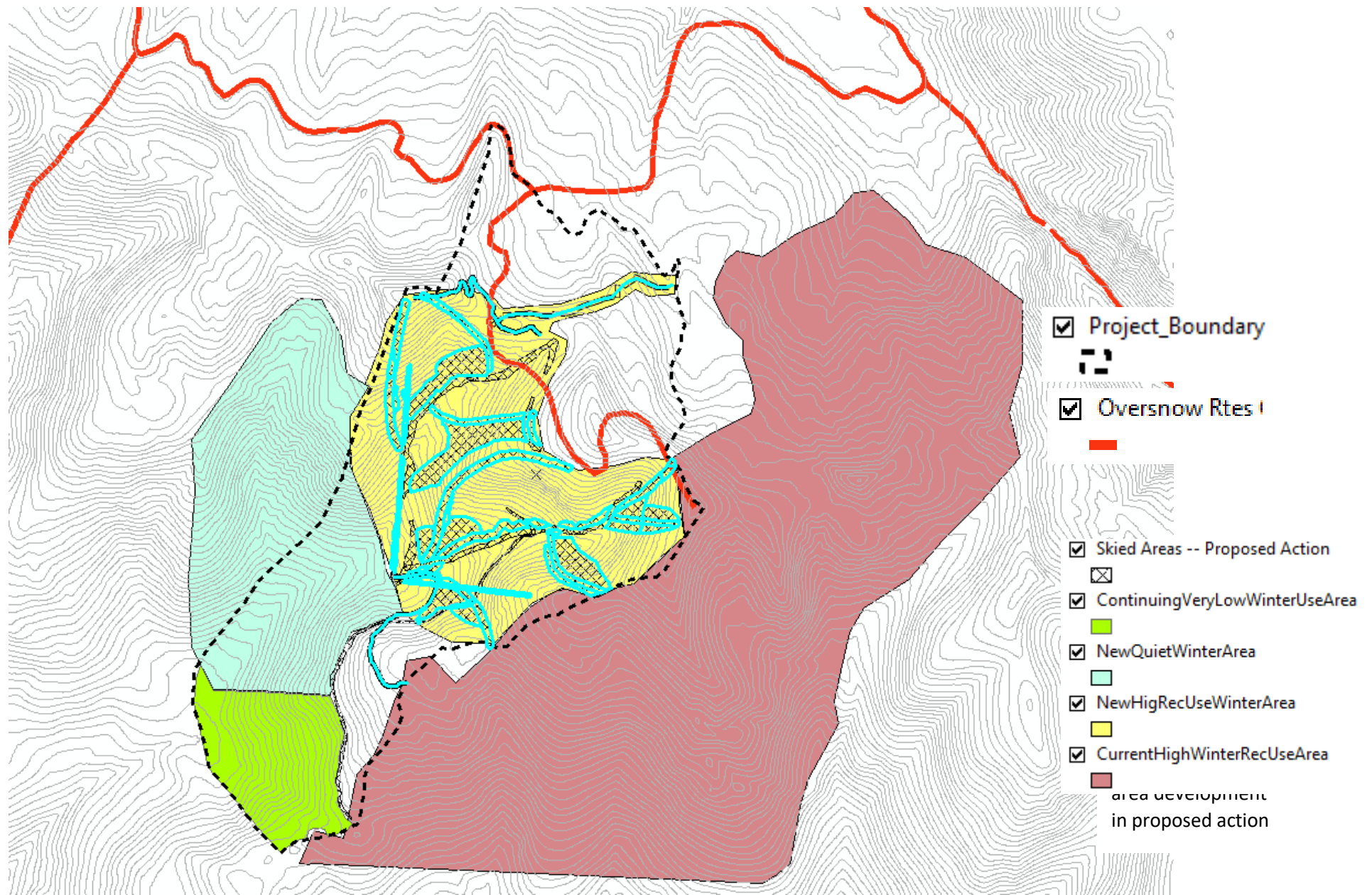


Figure 8. Winter recreation expansion in context of current high-use area, with area that would receive less winter use due to ski run and chairlift abandonment.

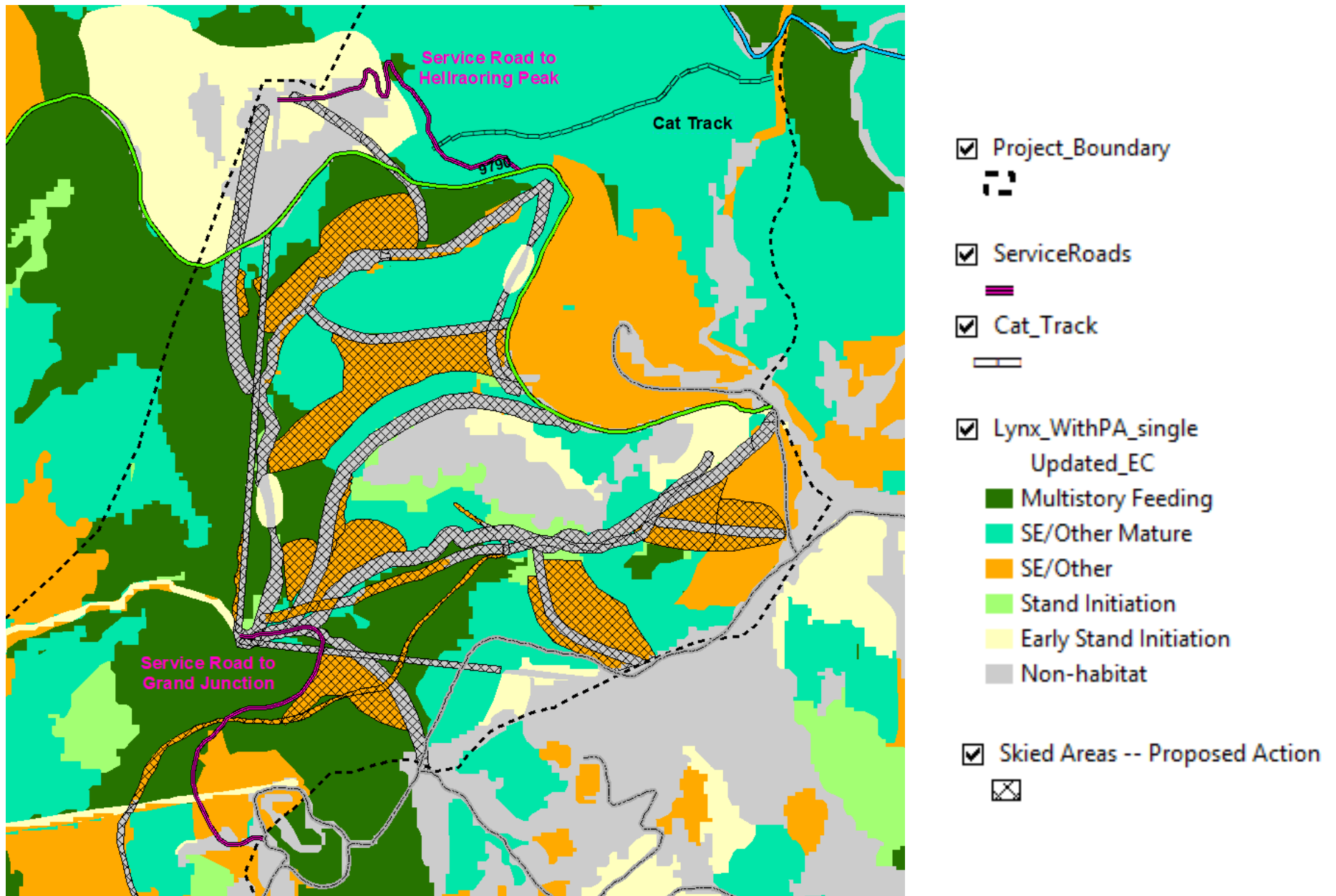


Figure 9. Service Roads and Cat Track crossing lynx habitats

5. Hellroaring Basin Improvements Project Consistency with 2018 Flathead National Forest Land Management Plan

All 2018 Flathead National Forest's Forest standards, guidelines, and desired conditions that mention Canada Lynx are included in the tables below, although many of these plan components are related only indirectly or nominally, and many are not relevant to this project.

Identifier	Plan Component for CANADA LYNX	Project Consistency
FW-STD-TE&V-02	Standard VEG S6 (as modified by the Forest, indicated in bold type below), see appendix A. The standard states: Vegetation management projects that reduce snowshoe hare habitat in mature multistory forests may occur only 1. Within 200 feet of administrative sites, dwellings, outbuildings, recreation sites, and special-use permit improvements, including infrastructure within permitted ski area boundaries; or 2. For research studies or genetic tree tests evaluating genetically improved reforestation stock; or 3. For incidental removal during salvage harvest (e.g., removal due to location of skid trails); or 4. For noncommercial felling of trees larger than sapling size within 200 feet of whitebark pine trees (in stands that contain trees identified for cone/scion/pollen collection) to make whitebark pine more likely to survive wildfires, more resistant to mountain pine beetle attack, and more likely to persist in future environments. <i>Exceptions 2, 3, and 4 shall only be utilized in lynx analysis units where standard VEG S1 is met.</i> Note: Timber harvest is allowed in areas that have potential to improve winter snowshoe hare habitat but presently have poorly developed understories that lack dense horizontal cover (e.g., uneven-aged or even-aged management systems could be used to create openings in coniferous forests in the stem exclusion structural stage where there is little understory so that new forage can grow). Where and to what this applies: Lynx habitat within lynx analysis units and to all vegetation management projects except for fuel treatment projects within the wildland-urban interface as defined by Healthy Forest Restoration Act, subject to the following limitation: Fuel treatment projects within the wildland-urban interface that do not meet standards VEG S1, VEG S2, VEG S5, and VEG S6 shall occur on no more than 6 percent (cumulatively) of lynx habitat on each administrative unit (an administrative unit is a national forest). For fuel treatment projects within the wildland-urban interface, see guideline VEG G10 in appendix A. Exceptions to standard: This standard does not apply to wildfire suppression, wildland fire use, or removal of vegetation for permanent developments such as mineral operations, ski runs, or roads. This standard does not apply to linkage areas (standard VEG S6).	The proposed project would not cause there to be regeneration treatment on more than 15% of lynx habitat on NFS lands within any LAU in a ten-year period. The Taylor Hellroaring project would regenerate less than 2% of the Lakalaho LAU. This standard does not apply to removal of vegetation for permanent developments such as ski runs.
NRLMD Standards VEGS1, VEGS2, VEGS5, and VEGS6	For standards VEG S1 S2, S5, and S 6 the 2017 BO on FNF revised forest plan includes the following terms and conditions which are mandatory, as stated in the draft ROD. BO T&Cs for FNF's Revised LRMP -- The following terms and conditions implement reasonable and prudent measure #1: The Forest Service shall ensure that new or future projects conducted under the exemptions from standards VEG S1, S2, S5, and S6 on the Flathead National Forest: 1. Do not occur in greater than 93,723 acres in the wildland-urban interface.	The proposed project would be consistent with these Terms and Conditions. This standard does not apply to removal of vegetation for permanent developments such as ski runs.

Identifier	Plan Component for CANADA LYNX	Project Consistency
	2. Do not result in more than three adjacent lynx analysis units that do not meet the standard VEG S1 of no more than 30 percent of a lynx analysis unit that is not yet snowshoe hare habitat. 3. Projects allowed per the exemptions or exceptions to VEG S5 and S6 shall not occur in any lynx analysis unit exceeding VEG S1, except for protection of structures. The following term and conditions implement reasonable and prudent measure #2: The Forest Service shall ensure that vegetation management projects conducted under exceptions to VEG S5 and S6 on the Flathead National Forest adhere to the following: 4. Timber management projects (as defined in BO appendix 5) shall not regenerate more than 15 percent of lynx habitat on Forest lands within a lynx analysis unit in a 10-year period. 5. Do not occur in greater than 15,460 acres. The following term and conditions implement reasonable and prudent measure #3: 6. In support of the monitoring and reporting requirements of the NRLMD, the Flathead National Forest shall provide to the USFWS and the USDA Forest Service Northern Region (Region 1) Office in Missoula summaries of the reporting requirements listed below. The summaries shall be submitted to the USFWS Montana Ecological Services Office in Helena, Montana, by April 1 of each year or other date through mutual agreement. The summaries shall document the following information related to fuel treatment and vegetation management projects occurring in lynx habitat: a. Individual fuels treatment and vegetation management projects conducted in lynx habitat under the exemptions and exceptions to the vegetation standards VEG S1, S2, S5, and S6 may reduce the quality or quantity of snowshoe hare habitat. Some projects are likely to result in detectable and measurable effects to lynx (the USFWS biological opinion's analysis found that this may rise to the level of take), while other projects will not result in a detectable, measurable effect to lynx (i.e., may affect, but not likely to adversely affect). The acreages of all projects will be tracked and aggregated to ensure that over the life of the revised forest plan, the number of acres impacted does not exceed the acres projected to be treated and the effects analyzed in the biological opinion. This approach to tracking and monitoring ensures that the proposed action is implemented as proposed and is consistent with the USFWS analysis. In addition, given the long time span of the proposed action, this process provides information that can help determine whether consultation reinitiation ever becomes necessary. If the level of take exempted under the biological opinion for the revised forest plan would be exceeded, re-initiation of consultation or project-specific consultation would be required (as appropriate).	
FW-STD-WL-04	The Northern Rockies Lynx Management Direction in appendix A, as modified by the Flathead National Forest's forest plan record of decision, shall be applied.	See the Table B in Appendix 6 in the Terrestrial BA for this project (Exhibit 12-03) for project consistency with LMP Appendix A.
FW-GDL-REC-03	To provide ecological conditions to support Canada lynx on NFS lands at a forestwide scale, there should be no net increase in miles of designated routes for motorized over-snow vehicle use, groomed routes, or areas where motorized	This project would not cause a net increase in in miles of designated routes for motorized over-snow vehicle use, groomed

Identifier	Plan Component for CANADA LYNX	Project Consistency
	over-snow vehicle use is identified as suitable. The “no net increase” is in comparison to the suitability displayed in figure B-11. This guideline does not apply inside permitted ski area boundaries, to winter logging, to rerouting trails for public safety, to accessing private inholdings, or to access regulated by guideline HU G12 (see appendix A).	routes, or areas where motorized over-snow vehicle use is identified as suitable. This guideline does not apply inside permitted ski areas.
FW-DC-WL-05	Within Canada lynx critical habitat mapped by the USFWS, 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.	Boreal forest landscapes would continue to support features essential to lynx conservation and recovery.

Identifier	Plan Component for CONNECTIVITY AND HABITAT PATCHES	Project Consistency
FW-DC-TE&V-19	Forest patterns contribute to connectivity of habitat for wildlife (e.g., Canada lynx, marten), movement within and between home ranges, and dispersal between populations. Desired conditions related to forest patterns across the landscape and within potential vegetation types are described below. [See additional text in the Forest Plan.]	Across the project area, project analysis area, and Flathead NF, forest patterns continue to contribute to connectivity and disturbances suitable for lynx.
GA-NF-DC-07	The North Fork and North Whitefish Range connectivity areas (see figure B-30) provide habitat connectivity for wide-ranging wildlife species (e.g., grizzly bear, Canada lynx, wolverine) moving between Glacier National Park and the Whitefish Range.	Not applicable. The project is not in this or any other connectivity area listed in the LMP.

Identifier	Plan Component for RIPARIAN WILDLIFE HABITATS	Project Consistency
FW-DC-RMZ-06	Cover conditions in riparian management zones contribute to habitat connectivity for a variety of wildlife species (e.g., Canada lynx, grizzly bear, marten, fisher).	Riparian cover would be interrupted by some of the ski runs, but across the project area, project analysis area, and Flathead NF, cover in riparian areas would continue to contribute to connectivity.

Identifier	Plan Component for SNAG AND DOWNED WOOD HABITAT	Project Consistency
FW-DC-TE&V-17	Downed wood, especially the larger material (9 inches or larger in diameter), is present across the matrix of forested lands, contributing to forest structural diversity, soil ecological function, and habitat for wildlife species associated with downed wood for feeding, denning, resting, and cover such as pollinators, Canada lynx, grizzly bears, pileated woodpeckers, marten, and fisher. The desired condition for downed wood is displayed in table 11, which is expressed as a forestwide minimum average amount across all forested acres within each potential vegetation type. Downed wood is highly variable in amount, sizes, species, and stages of decay, both across the landscape and over time. Specific stands or sites may have much lower or higher amounts of	Downed wood would be retained where practical and safe, as detailed in this project's design features.

Identifier	Plan Component for SNAG AND DOWNED WOOD HABITAT	Project Consistency										
	downed wood per acre, depending upon the unique conditions, site-specific management objectives, and disturbance history. Lowest amounts of downed wood (e.g., less than 10 tons per acre) are found in areas where concern for fire hazard is elevated, such as in portions of the wildland-urban interface and in areas within 200 feet of open roads accessible to firewood cutting. Highest amounts are generally found in areas that have experienced fire or insect and disease infestations more than 10 years previously and in riparian management zones. Table 11. Desired minimum for average total tons per acre downed wood, as measured across all forested acres within each potential vegetation type on the Forest <table><tr><th>Potential vegetation type</th><th>Desired minimum in total tons per acre as a forestwide average</th></tr><tr><td>Warm-dry</td><td>14</td></tr><tr><td>Warm-moist</td><td>22</td></tr><tr><td>Cool-moist</td><td>25</td></tr><tr><td>Cold</td><td>15</td></tr></table>	Potential vegetation type	Desired minimum in total tons per acre as a forestwide average	Warm-dry	14	Warm-moist	22	Cool-moist	25	Cold	15	
	Potential vegetation type	Desired minimum in total tons per acre as a forestwide average										
	Warm-dry	14										
	Warm-moist	22										
	Cool-moist	25										
	Cold	15										

Identifier	Plan Component for GENERAL FOREST HABITAT	Project Consistency												
FW-DC-TE&V-12	Very large live trees (greater than 20 inches d.b.h.) are present not only in the very large forest size class (see FW-DC-TE&V-10 and 11) but are also distributed throughout other forest size classes across the matrix of Forest lands, including areas where timber harvest activities occur. Forest vegetation conditions support maintaining or increasing the density and distribution of very large live trees across the landscape. Desired species are listed in table 8. Very large live trees contribute to forest structural diversity, to long-term forest resilience, and to recovery after disturbances (such as fire). Very large trees contribute to future snag habitat in the late successional and old-growth forest, providing for long-term recruitment of large rotten trees, broken-top trees, and snags that are important habitat for species such as pileated woodpeckers, flammulated owls, lynx, fisher, and others. Very large trees contribute to scenic quality and to the economic value of forest products in areas suitable for timber production.	Across the project area, project analysis area, and Flathead NF, very large trees continue to contribute to habitat conditions suitable for lynx.												
	Table 1. Desired species of very large live trees (≥ 20 inches d.b.h.) by area.													
	<table><tr><th>Area</th><th>Desired conifer species in very large size classes</th></tr><tr><td>Warm-dry PVT</td><td>Ponderosa pine, western larch on suitable sites</td></tr><tr><td>Warm-moist PVT</td><td>Western larch, western white pine, Douglas-fir, ponderosa pine, western red cedar, western hemlock</td></tr><tr><td>Cool-moist PVT</td><td>Western larch, Douglas-fir, western white pine on suitable sites</td></tr><tr><td>Cold PVT</td><td>Engelmann spruce, whitebark pine</td></tr><tr><td>Riparian management zones</td><td>Black cottonwood and the species listed for the PVT associated with the riparian area</td></tr></table>		Area	Desired conifer species in very large size classes	Warm-dry PVT	Ponderosa pine, western larch on suitable sites	Warm-moist PVT	Western larch, western white pine, Douglas-fir, ponderosa pine, western red cedar, western hemlock	Cool-moist PVT	Western larch, Douglas-fir, western white pine on suitable sites	Cold PVT	Engelmann spruce, whitebark pine	Riparian management zones	Black cottonwood and the species listed for the PVT associated with the riparian area
	Area		Desired conifer species in very large size classes											
	Warm-dry PVT		Ponderosa pine, western larch on suitable sites											
	Warm-moist PVT		Western larch, western white pine, Douglas-fir, ponderosa pine, western red cedar, western hemlock											
	Cool-moist PVT		Western larch, Douglas-fir, western white pine on suitable sites											
Cold PVT	Engelmann spruce, whitebark pine													
Riparian management zones	Black cottonwood and the species listed for the PVT associated with the riparian area													
FW-DC-TE&V-13	Forest densities range from very low to very high and occur in a diverse pattern across the landscape. Moderate and high tree densities (i.e., greater than or equal to 40 percent canopy cover) occur on 50 to 75 percent of the forested area and most commonly located in the cool-moist and warm-moist potential vegetation types. Forests at lower densities (i.e., less than 40 percent canopy cover) occur on up to 50 percent of the forested area and are most commonly located in the warm-dry potential vegetation type; on the drier and colder sites within the cool-	Across the project area, project analysis area, and Flathead NF, forest densities continue to contribute to												

Identifier	Plan Component for GENERAL FOREST HABITAT	Project Consistency						
	moist and cold potential vegetation types; and in the wildland-urban interface. Forests at lowest densities also occur in seedling/sapling forest size classes. Forest densities contribute to ecological, social, and economic desired conditions at the stand and landscape scale, including: Wildlife habitat, e.g., providing cover and foraging conditions for many species including Canada lynx and flammulated owl, and facilitating tree growth for development of very large trees and future old-growth habitat. Forest resilience, e.g., reducing competition, improving tree vigor and growth, and reducing forest fuels in areas of the wildland-urban interface. Timber productivity on lands suitable for timber production, e.g., maintaining adequate tree growth rates and stocking levels	habitat conditions suitable for lynx.						
FW-DC-TE&V-08	Presence of tree species within each potential vegetation type meets or trends towards desired conditions, as described in table 4. The distribution of tree species provide desired habitat conditions for associated wildlife species and contribute to diverse and resilient forest conditions, as described in table 4. See appendix D for a description of potential vegetation types. Table 2. Current and desired conditions by potential vegetation type for tree species presence (percentage of Forest within the potential vegetation type where particular species are present) <i>[Only portions of the table that are directly relevant to wildlife are extracted here. See the complete Table 4 in the Forest Plan.]</i> <table><tr><th>PVT</th><th>Desired trends and conditions</th></tr><tr><td>Cool-moist coniferous forest</td><td>These conditions contribute to habitat for key species such as Canada lynx, and provide high-quality habitat for cavity nesting/denning species.</td></tr><tr><td>Cold coniferous forest</td><td>These conditions contribute to habitat for key species such as Canada lynx and Clark’s nutcracker.</td></tr></table>	PVT	Desired trends and conditions	Cool-moist coniferous forest	These conditions contribute to habitat for key species such as Canada lynx, and provide high-quality habitat for cavity nesting/denning species.	Cold coniferous forest	These conditions contribute to habitat for key species such as Canada lynx and Clark’s nutcracker.	Across the project area, project analysis area, and Flathead NF, tree species composition continues to contribute to habitat conditions suitable for lynx.
PVT	Desired trends and conditions							
Cool-moist coniferous forest	These conditions contribute to habitat for key species such as Canada lynx, and provide high-quality habitat for cavity nesting/denning species.							
Cold coniferous forest	These conditions contribute to habitat for key species such as Canada lynx and Clark’s nutcracker.							

Note. Forest Plan Appendix A's Objective HU O1 discourages the expansion of snow compacting activities outside baseline areas evaluated between 1998 and 2000. The Resort's existing permit boundary, which the proposed action does not change nor go beyond, was included in this baseline. Consistent with Objective HU O3, all proposed activities would occur inside the Resort's existing permit area, which concentrates activities in existing developed areas. See below for analysis documents from the NRLMD.

Appendix 1. Cumulative Effects for Canada Lynx and Canada Lynx Critical Habitat across the Lakalaho Lynx Analysis Area

	Past	Present	Reasonably Foreseeable	Does it Contribute?
Wildfires and Wildland Fire Suppression	There is evidence of wildland fire in and near the analysis area over the last several hundred years. Most fires have been less than one acre and were suppressed using hand crews, but there have been large fires in recent years. In the Upper Big LAU, the 2006 Werner Peak Fire burned 18 acres, the 2001 Werner Fire burned about 859 acres, the 2001 Moose Fire burned nearly 3800 acres, and an unnamed 1994 fire burned 35 acres. Since about 1930, wildland fires have been actively suppressed by the Forest Service and other agencies and wildland fires will continue to be suppressed.			Yes
Hunting, Trapping, and Predator Control	These activities have been and continue to be popular uses of National Forest System land and other ownerships. Popular hunted species include white-tailed deer, mule deer, elk, moose, and gray wolf. Some species that are now currently listed as threatened, such as grizzly bears and Canada lynx, were hunted and trapped in the past. Some predator populations, such as gray wolves and coyotes, were reduced in numbers from the analysis area in the early part of the last century.			Yes
Fishing	Fishing within the analysis area is not a common activity.			No
Firewood and Other Miscellaneous Forest Product Gathering	Firewood gathering has occurred and will continue in the future. Recent higher than historic energy costs may increase the public's desire to obtain firewood but air quality concerns may also reduce reliance on this source of fuel in the future. Other products gathered in small quantities in the area include posts and poles, mushrooms, berries, and Christmas trees.			Yes
Snowmobiling	Snowmobiling is allowed on designated roads, NFS trails, and areas as identified on the Tally Lake and HH/GV Over Snow Maps (https://www.fs.usda.gov/main/flathead/maps-pubs). Groomed routes include Upper Whitefish Lake road on DNRC lands, NFSR 9790 which access the back side of WMR and NFSR 316 in Canyon Creek which is a designated groomed over snow trail. The Lakalaho Snow Park and Warming Hut are in the upper reaches of the Big Creek drainage.			Yes
Camping	The developed Moose Lake Campground is up the Big Creek drainage and numerous dispersed sites occur in the Big Creek drainage. On USFS lands, dispersed camping is allowed within 300 feet of open roads.			Yes
Other Developed Recreation Sites or Areas	Whitefish Mountain Resort has an array of ski runs, ski lifts, trailheads, and buildings, which includes the Summit House Restaurant. DNRC has a lookout cabin on Werner Peak which is accessed by the Taylor Road NFSR 9790.			Yes
Driving	Driving, sightseeing, and wildlife viewing on open Forest, State, and private roads will continue.			Yes
Hiking, Mountain Biking, and Horseback Riding	These activities occur on roads and trails throughout the analysis area, with numerous formal trailheads. The highest density of trails are in the Whitefish Mountain Resort (WMR) permit area and have increased in popularity. Dispersed, hiking, hunting, biking, and ORV activities are expected to increase in popularity on adjacent lands in the area. A proposed			Yes
	Past	Present (Fall 2016 – Fall 2017)	Reasonably Foreseeable	Does it Contribute?
	trail addition to the Whitefish Trails system will occur with a trailhead in the Haskill Basin area which could eventually link to FS lands.			
Motorcycle and ATV Riding	There are no trails available for motorcycle or ATV (Four-wheeler) use on NFS lands other than on roads open to regular vehicle traffic. This activity occurs on and off roads on other ownerships.			Yes

	Past	Present	Reasonably Foreseeable	Does it Contribute?
Road Construction	The analysis area has approximately 61.0 miles of USFS system roads. Most were built since 1960. In 2014, The Forest Service authorized an easement to the DNRC allowing for construction of two segments of permanent road through NFS lands totaling .84 miles.	See table below for the ongoing Whitefish Municipal Watershed Project. Contribution of the Taylor Hellroaring Project's road construction to cumulative effects is discussed above.		Yes
Road Maintenance, BMPs, and road use	Roads on all ownerships will be maintained for use either by all users or for individual landowners. Roads used for the transport of forest products are generally maintained to meet Montana Best Management Practices (BMP). Road work to improve surface drainage, stabilize slopes, and reduce erosion and stream sedimentation has occurred on roads used by the Forest Service. Roads designated for motorized use by the public are maintained with safety as a high priority. This primarily involves repairing drainage features and clearing of live and down vegetation. Some roads have been closed and are maintained at a lower level. There are currently approximately 61.0 miles of road under USFS jurisdiction within the project area; of which 12.8 miles are open year-long, 25.9 miles are open seasonally, and 22.2 miles are closed yearlong. Contribution of the Taylor Hellroaring Project's road maintenance actions to cumulative effects is discussed above.			Yes
Road Decommissioning	Roads have been removed from the transportation system and rendered undrivable to improve wildlife security, landscape hydrologic function, and reduce maintenance costs.		Contribution of the Taylor Hellroaring Project's road actions to cumulative effects is discussed above.	Yes
Beaver Control	Trapping of beavers and destruction of beaver dams occurred up to the 1990s on a variety of ownerships.	This activity may continue to take place on private property.		Yes
Timber Harvest	See tables below for harvest history on USFS lands.	See tables below, including a table for the ongoing Whitefish Municipal Watershed Project. Timber harvesting on private property is currently unknown. Lands owned by DNRC are expected to continue to have resource management in the currently and in the foreseeable future. Contribution of the Taylor Hellroaring Project's vegetation management actions to cumulative effects is discussed above.		Yes
Thinning for Hazardous Fuels Reduction	See table below.	See tables below, including a table for the ongoing Whitefish Municipal Watershed Project. Contribution of the Taylor Hellroaring Project's vegetation management actions to cumulative effects is discussed above.		Yes
Prescribed Burning	Prescribed fire will continue to be used in the future as a management tool.			Yes
Precommercial Thinning		The amount of pre-commercial thinning to reduce the density of sapling sized stands		Yes

	Past	Present	Reasonably Foreseeable	Does it Contribute?
	Past	Present (Fall 2016 – Fall 2017)	Reasonably Foreseeable	Does it Contribute?
		and decrease wildland fire intensity in the WUI adjacent to private lands is unknown. It is expected that it has occurred and would continue to occur in the future.		
Special Use Permits	Communications towers and Winter Sports Incorporated operations and facilities are mentioned above and the Knights of Columbus have a permit for a religious statue nearby.			
Trail Construction / Maintenance	On USFS lands central to the analysis area, the Ralph Thayer Memorial NFS Trail 26, or the Whitefish Divide trail, is a National Recreation Trail and the Smokey Range NFS Trail 270 is nearby. Both trails have been maintained in recent years. Miles of other system and user-created trails occur across the area, with far fewer in the higher elevations.	Contribution of the Taylor Hellroaring Project’s trail construction actions to cumulative effects is discussed above.		Yes
Noxious Weed Control	Noxious weed control as outlined in the 2001 Flathead National Forest Noxious and Invasive Weed Control Environmental Assessment and Decision Notice will continue to take place in the analysis area and is expected to increase in the future. Individual landowners will continue to control weeds with primarily spot applications on their property.			Yes
Comm. Towers, Utilities, Transmission Lines	Communications towers occur west of Whitefish Mountain Resort, with an underground powerline coming from the east. A sewer line reaches from the Whitefish Mountain Summit Area to private land to the south.			Yes

Past Forest Service Vegetation Treatments, in Acres, Across the Lynx Analysis Area (based on 11/2017 query of the FACTS database)

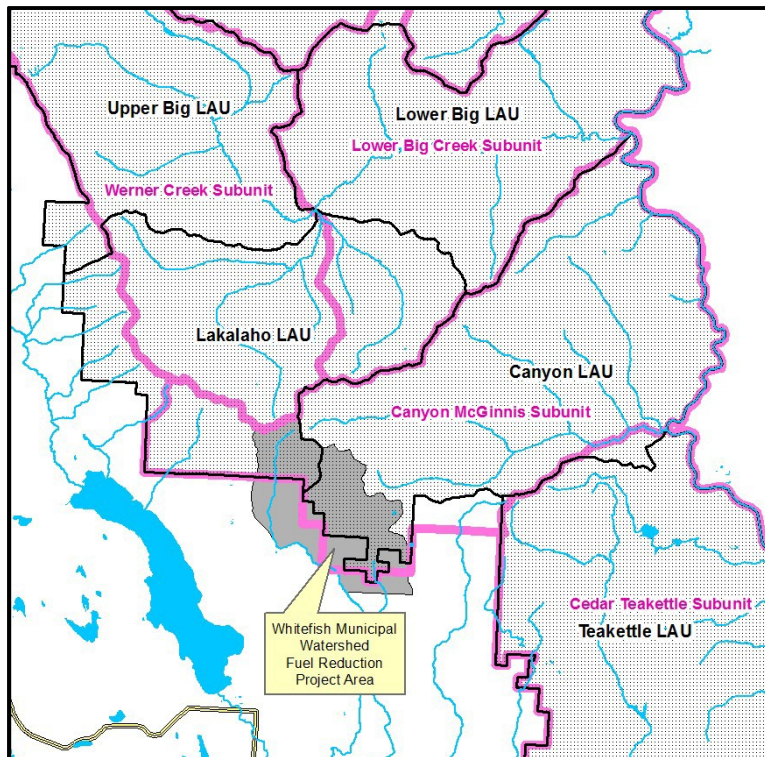
Timber Harvest Activities	60s	70s	80s	90s	00s	10s	Total
Liberation Cut	301	0	0	0	0	0	301
Salvage Cut (intermediate treatment)	311	0	0	0	0	0	311
Shelterwood Removal Cut (EA/NRH/FH)	18	0	0	0	0	0	18
Single-tree Selection Cut (UA/RH/FH)	598	0	0	0	0	0	598
Stand Clearcut (EA/RH/FH)	2672	0	0	0	0	0	2672
Two-aged Shelterwood Establishment and Removal Cut (w/ res) (2A/RH/FH)	27	0	0	0	0	0	27
Total Harvest	3,927	0	0	0	0	0	3,927

Past Forest Service Timber Sales across the Lynx Analysis Area.

Sale Name	Year Accomplished	Acres in Lynx Analysis Area
Upper Big Creek	1960-69	3,927
Total:		3,927

Whitefish Municipal Watershed Project activities:

COMMERCIAL AND NONCOMMERCIAL HARVEST TREATMENT ACRES	
Seed Tree with Reserves	196
Commercial Thin	58
Understory Removal	103
Fuel Break	1
Total Treatment Acres	358
LOGGING SYSTEM ACRES	
Tractor (Ground-based)	144
Skyline	110
Total Logging System Acres	254
PRESCRIBED BURN ACRES	
Prescribed Burn Units within the Wildland Urban Interface	756
ROAD MANAGEMENT MILES	
Haul Routes (BMPs to be applied to meet Timber Sale Requirements)	10
Temporary Roads(2.06 on NFS Lands and 0.49 on Private and State Lands)	2.55



Appendix 2. Consideration of New Canada Lynx Habitat Science done for the Taylor Hellroaring Project

Recent science by Holbrook et al. and Kosterman et al. was considered in the analysis of effects on Canada lynx for the Taylor Hellroaring Project. The following analysis is not to be interpreted as setting any precedent for how this new science should be applied or interpreted, nor is any new management direction implied. (See elsewhere in this exhibit for a consideration of new science on recreation effects on lynx).

There is uncertainty regarding the management application of new science because forest structure characteristics used to define habitat relationships in these publications are not the same as those used to establish vegetation management standards for lynx in the Flathead National Forest Plan, which were adopted from the NRLMD (USDA FS 2007). Forest Service Region 1 biologists and researchers at the Rocky Mountain Research Station are working together to better understand these relationships and their management application, which may result in improved interpretations and analysis methods in the future. Thus, the analyses below consider new science, but should not be interpreted as setting any precedent for how this new science should be applied, nor is any new management direction implied.

Holbrook and others (2016) refined previous science about the positive effect of horizontal cover on snowshoe hares by evaluating occupancy and intensity of use. Their research found a positive, yet parabolic effect of snow depth on snowshoe hare occupancy, meaning occupancy was highest at moderate snow depths. Their publication describes snowshoe hare habitat using metrics such as quadratic mean diameter, trees/hectare, canopy cover, and basal area (Table 2 and Table A1 in Holbrook et al. 2016). The authors reported that both occupancy and intensity of use by snowshoe hares increased as horizontal cover increased. Forest structure in areas with high snowshoe hare use and high horizontal cover was characterized as multistoried with dense canopy cover and at least medium-sized trees (e.g., 5" to 9" dbh). They found that intensity of use by snowshoe hares increased as the proportion of subalpine fir and spruce increased. Intensity of use by hares also increased with increased proportion of lodgepole pine within a mixed conifer context. Intensity of use by snowshoe hares decreased as presence of Douglas fir increased.

Holbrook and others (2017) refined previous science about lynx in northwest Montana using a multi-scale approach to evaluate habitat use and selection. They assessed functional responses in lynx habitat use to characterize habitat relationships, predicted lynx habitat use at different scales, and assessed behavioral differences with changing environmental conditions within the existing, suspected distribution of Canada lynx in the Northern Rockies. They developed resource selection function models for Canada lynx that apply to different scales; at the landscape scale (2nd order model) and the home range scale (3rd order model).

Holbrook and others (2017) reported that intermediate snow depths and the distribution of snowshoe hares were the strongest predictors of where lynx selected their home ranges. Forest structural conditions within home ranges determined seasonal habitat use by male and female lynx. The authors defined four forest structure classes, sparse, stand initiation, advanced regeneration, and mature.

The "stand initiation" class described by Holbrook and others (2017) includes forest that lacks dense horizontal cover in winter. This forest structure class has few trees, an open canopy, and is a result of recent (e.g., ≤5 years) disturbance (e.g. forest harvest or severe fire). Within their home ranges, lynx avoided stand initiation habitats.

The "sparse" class is described as mixed-conifer stands that are sparsely stocked (naturally) or mechanically thinned, which tend to be younger (i.e., ~10–20 year old) but can occur at any age.

The advanced regeneration class is described as early–mid-seral stands of age ~25–40 years with a mixed species composition, but spruce-fir tends to occur the most frequently. Advanced regenerating forest was strongly selected by lynx across scales and seasons. Lynx increasingly used "advanced regeneration" as this stage became

available (up to a maximum availability of 40%). The authors stated “the affinity of lynx to advanced regenerating forest within a home range, coupled with the high use of mature forest, suggests lynx spend a significant amount of time at the interface between mature and advanced regenerating forest. This is consistent with the mechanism that advanced regeneration likely produces the highest snow-shoe hare densities, but the mature structure class is where hares are most accessible for lynx.

The authors stated, “mature forest structures were used in proportion to availability, although 66% of female home ranges contained >50% mature forest.” Mature forest was described by Holbrook and others (2017) as “mid-seral stands of age ≥ 40 years arranged in a multistoried structure with a mixed species composition, but spruce-fir tends to occur twice as much as other species”. The authors reported that the range of stand conditions described for the mature class (e.g. tree size, stem density, canopy closure) is quite broad, indicating a variety of overstory and understory conditions. Thus, the value of the mature forest component as foraging habitat within lynx home ranges is likely highly variable and dependent on existing horizontal cover values at the local scale. More than any other cover type, lynx selected for forest canopies of spruce and subalpine fir, while canopies dominated by western larch were used least by lynx. High horizontal cover was also positively related to relative probability of lynx use. These authors reported that Canada lynx in the Northern Rockies use a gradient of forest structures and compositions, but they use more mature, spruce-fir forest than any other structural stage or species.

For practical application for forest managers, the researchers provided an example showing that advanced regeneration forest could be created through timber harvest or fire, recognizing that achieving this structural stage (and its value for lynx habitat) meant short-term negative effects following stand regeneration. Holbrook and others (2018) evaluated different forest silvicultural treatments and their relative influence on available lynx foraging habitat. The research found that lynx used past silvicultural treatments (regeneration, thinning and selection cut harvests); however lynx use of these treatment areas was low for at least 10 years following harvest. Cumulative use by lynx (in both summer and winter) occurred sooner following thinning treatments than either regeneration or selection harvest treatments; thinning treatments required ~ 20 years post treatment to reach 50% lynx use, while regeneration harvest and selection harvest treatments required 34 years and 39 years respectively. Lynx appeared to use regeneration and selection cuts similarly over time, suggesting that the difference in vegetation impact between these treatment methods make little difference relative to potential impacts to lynx over the long-term. The authors reported that the landscape context of vegetation treatments is also important. In areas with low amounts of mature forest in the neighborhood, lynx use of recovering silvicultural treatments was higher than in treatments surrounded by an abundance of mature forest.

Kosterman and others (2018) focused on reproductive success relative to structural conditions within female lynx core use areas. A female core use area is smaller than a female home range and encompasses relatively high quality habitat. This study focused on forest structure within 50% core use areas because they were more strongly related to female lynx demographic responses than home ranges were. Forest characteristics that defined high reproductive success within the core use areas of female lynx home ranges included 1) abundant and connected mature forest and 2) intermediate amounts of small-diameter regenerating forest.

The mature forest class described in Kosterman et al. 2018 (Table 1) is “multistoried stands with substantial understory and horizontal cover”. In female lynx core use areas with high connectivity of mature forest, the probability of producing a litter increased significantly as the proportion of small-diameter regenerating forest increased from $\sim 5\%$ to $\sim 10\%$ and remained consistently high in core use areas with up to $\sim 20\%$ of small-diameter regenerating forest. Kosterman found that female lynx exhibited decreasing use of stand initiation forest structure, up to a maximum availability of 25% within their core use area. Stand initiation forest structure is defined in Table 2 of this paper as very young stands (generally 5 years old and younger) with very few trees and open canopies resulting from recent disturbances such as timber harvest and/or severe fire (similar to the “stand initiation” class described by Holbrook and others in their 2017 publication). Similar to Holbrook and others (2018), the study also

indicated that the amount of small-diameter regenerating forest that is optimal for female lynx is dependent on the landscape context. The optimal quantity broadens as mature forest becomes more connected.

Researchers at the Rocky Mountain Research Station recently completed an assessment that further addresses habitat mosaics relative to probability of producing litters within core use and home range areas of female lynx, and summarized their findings in a manuscript that has been submitted for publication. The manuscript addresses relative values of mature and young regenerating forest (referred to as advanced regeneration in the manuscript), and their conclusions are consistent with those in Kosterman et al. (2018) relative to the importance of connected mature forest structure. Connected mature forest is also relevant at landscape and home range scales (Squires, personal comm. to Gary Hanvey, USFS R1 wildlife biologist).

Because the forest structure and composition layers developed by Holbrook and others (2017) reflect one point in time, they do not discern between areas that are temporarily in a sparse vegetation condition due to a recent disturbance (such as wildfire or timber harvest) and those in a sparse vegetation condition because they have natural limitations (e.g. steep, shallow soils, dry vegetation types, low elevations lacking in deep, fluffy snow). To be able to discern these differences, the analyses of forest structure were applied to lynx habitat mapped by the Forest, because it does not include areas of permanent rock, dry habitat types, or low elevations lacking in deep fluffy snow.

It should be noted that there is a difference in nomenclature for forest structural stages between Holbrook et al. (2017) and those used in the NRLMD (adopted in Flathead National Forest Plan Appendix A). The portion of their “sparse” class resulting from thinning, as well as their stand initiation class, would most closely compare to the “early stand initiation” stage or “lynx habitat in an unsuitable condition” defined in the NRLMD. Looking over the definitions in Holbrook et al. (2018 pg. 7), the “advanced regeneration” class most closely compares with the “stand initiation” structural stage in the NRLMD. These two classes are similarly defined as early to mid-seral aged stands generally over 20 years post-disturbance with mixed conifers, but with spruce and subalpine-fir occurring most frequently. As a result of forest succession, these stands have advanced enough from past disturbance to contain high horizontal cover, with branches of trees above the snow surface during the winter months. These stands may have high tree densities ranging from several hundred trees per acre over 5” DBH and more than 1,000 trees per acre less than 5” DBH.

The forest structural classes described in these papers are not consistent with structural classes used to define and develop objectives, standards, and guidelines in the Northern Rockies Lynx Amendment (NRLMD). In particular, these papers describe a “Mature” class as:

“A multistoried or uneven-aged stand with a median DBH of 26 cm (10 inches). This DBH is reflective of the multistoried nature of the structure class, but despite this DBH, there was a comparatively high proportion (i.e., 22%) of large trees (≥ 38 cm in DBH). Common attributes in this class were substantial understory (e.g., seedlings and saplings) and horizontal cover, continuous canopy, and no evidence of recent disturbance” (Kosterman et al. 2018)

“Mid-seral stands of age ≥ 40 yr arranged in a multi-storied structure with a mixed species composition, but spruce-fir tends to occur twice as much as any other species (Appendix S1). Mature exhibited a median basal area-weighted dbh of 10 inches or 25 cm (IQR = 7–14 inches or 18–35 cm). However, of the 194 plots examined 45% were classified at size classes between 5 and 10 inches (12.7–25.4 cm), 25% at size classes between 10 and 15 inches (25.4–38 cm), and 21% of them were classified at size classes between 15 and 25 inches (38–64 cm). Mature exhibited median canopy cover of 56% (IQR = 40–70%), median tree height of 65 ft or 20 m (IQR = 53–88 ft or 16–27 m), and median basal area of 140 ft²/acre or 32 m²/ha (IQR = 91–209 ft²/acre or 21–48 m²/ha). Tree density for trees larger than 5 inches (12.7 cm) was 217 trees/acre or 535 trees/ha (IQR = 144–331 trees/acre or 357–818 trees/ha). Tree density for trees <5 inches (12.7 cm) was

1500 trees/acre or 3705 trees/ha (IQR = 300–4200 trees/acre or 741–10,374 trees/ha)” (Holbrook et al. 2017).

The NRLMD uses Lynx Analysis Units (LAUs), which approximate “the size of a female lynx home range”. As stated in the Lynx Conservation Assessment and Strategy (LCAS 2000 and ILBT 2013), an LAU should be from about 25 to 50 square miles, and “Since the LAU represents a hypothetical female home range, and is the basis for analysis, it can be larger and contain more lynx habitat than an actual home range.” Holbrook et al. 2017 used a median home range of 21.2 square miles and reported that “Mature forest was used in proportion to its availability (~16-75%; Fig. 5, Table 5), although 66% of female home ranges contained ≥50% mature forest.” Holbrook et al. 2017 reported that lynx in their study (28 females and 48 males) exhibited decreasing habitat use with increasing proportions of stand initiation habitat. This was particularly true of female lynx. Kosterman et al. 2018 identified “50% annual home ranges (hereafter, core areas) for 36 female lynx using the fixed-kernel density method” because “they were more strongly related to demographic responses than were 90% home ranges”. LAUs were used in the analysis below because they approximate the size of female lynx home range in the Northern Rockies, because they provide the basis for analyzing effects to lynx habitat relative to management guidance in the NRLMD, and because specific core use areas within home ranges and LAUs are not known.

1. Method

Revisited the Canada lynx habitat GIS mapping done for the Taylor Hellroaring Project (Exhibit Rt-08) to identify stands that meet the description of “Mature” in Kosterman et al. 2018 & Holbrook et al. 2017. “Mature” forest as described in these papers includes stands identified in the original analysis for the project as ***multistory forage habitat (see below) plus additional stands with more than one forest story not previously considered as foraging for lynx.***

- A. Building on the GIS analysis done for this project, these additional stands are a subset of the catchall “Other” class (stem exclusion and multistory non-feeding) that is dominated by trees 5” and larger and that are also dominated by Engelmann spruce and subalpine fir. QUERY = ["Lynx_Final" = 'SE/Other' AND ("TREESIZE" = '5-9.9' OR "TREESIZE" = '10-14.9' OR "TREESIZE" = '15-19.9') AND ("R1_CoverTy" = 'Spruce/fir')]. Added field “Mature” to attribute table and entered value of ‘Mature’ for all stands captured by this query. Then added field “Mature2” to attribute table and filled with values from field “Mature”. Queried stands within the SE/Other category that were field-verified as stem exclusion and removed value from “Mature2” field. Added field “Mature_Forest” to attribute table. Queried all values of ‘Mature’ from “Mature2” field and entered value of ‘Other Mature’ in “Mature_Forest” field. Queried all values of Multistory Feeding in “Lynx_Final” field and added value of ‘Multistory Mature’ in “Mature_forest” field. This final subset of acres is a minimum estimation of “Mature” acres as described in Kosterman et al. 2018 and Holbrook et al. 2017. Based on personal knowledge of habitat conditions in these LAUs, it is likely that more acres in each LAU also meet this description, but this analysis is intentionally conservative rather than inclusive.
- B. Reviewed proposed vegetation management in these additional “Mature” stands to derive post-implementation acres. Vegetation management planned in these other “Mature” areas is shown in Table 1.

Table 1. Estimated acres that meet description of “Mature Forest” in Kosterman et al. 2018 and Holbrook et al. 2017, and proposed vegetation management in these areas.

Lynx Analysis Unit (LAU)	“Mature” Acres	No Vegetation Management Acres	Regeneration Harvest Acres	Commercial Thin Acres	Hazard Fuel Reduction Acres	Prescribed Burn Acres	Vegetation Management in “Mature” Acres
Upper Big	11,435	11,426	6.4	2.5	0	0	8.9
Lakalaho	15,189	14,609	134.3	0.6	172.1	273.2	580.2

2. Results and Conclusion

Table 2 shows the resultant existing and post-implementation acres and percentages for stands in the project LAUs meeting the description of “Mature” in Kosterman et al. 2018 & Holbrook et al. 2017. Figures 1 and 2 below show the existing and post-project distribution and connectivity of these stands in the project LAUs and within the proposed vegetation management units.

Table 2. Existing and Post Project Areas that meet the description of “Mature Forest” in Kosterman et al. 2018 and Holbrook et al. 2017.

Lynx Analysis Unit (LAU)	LAU Total Acres	Lynx Habitat Acres	Early Stand Initiation ¹ (not providing winter forage) Acres (% of lynx habitat)	Stand Initiation ² (winter forage) Acres (% of lynx habitat)	Multistory ³ (forage) Acres (% of lynx habitat)	Other ⁴ (non-feeding) Acres (% of lynx habitat)	Subset of “Other ⁴ ” that meet definition of “Mature” Acres (% of lynx habitat)	Total that meet the description of “Mature” Acres (% of lynx habitat)
Upper Big Existing	19,611	18,322	4,045 (22.1%)	818 (4.5%)	7,021 (38.3%)	6,438 (35.1%)	4,414 (24.1%)	11,435 (62.4%)
Upper Big Post Project			4,064 (22.2%)	818 (4.5%)	7,021 (38.3%)	6,419 (35.0%)	4,407 (24.1%)	11,428 (62.4%)
Lakalaho Existing	22,456	21,135	905 (4.3%)	1,936 (9.2%)	9,489 (44.9%)	8,806 (41.7%)	5,701 (27.0%)	15,189 (71.9%)
Lakalaho Post Project			1,732 (8.2%)	1,936 (9.2%)	9,414 (44.5%)	8,053 (38.1%)	5,311 (25.1%)	14,743 (69.8%)

¹Stand initiation structural stage where the trees have not grown tall enough to protrude above the snow in winter. May provide summer foraging habitat.

²Stand initiation structural stage that currently provides winter lynx foraging conditions.

³Multistory structural stage with many age classes and vegetation layers with sufficient density to provide winter lynx foraging conditions. This stage may contain denning habitat.

⁴Other (stem exclusion) structural stage – Closed canopy with understory limited; Multistory structural stage with many age classes and vegetation layers that do not provide snowshoe hare habitat. This stage may contain denning habitat.

The total acres that meet the description of “Mature” exceed 50% in both LAUs before and after vegetation management and this habitat would remain well distributed and connected. In addition, both LAUs would continue to have less than 30% in an early stand-initiation condition. Therefore, no further analysis was needed to demonstrate consideration of this new lynx science. There is no need to change the analysis conclusions nor Endangered Species Act determinations for the Taylor Hellroaring Project.

Holbrook, J.D., et al. 2016. Multiscale habitat relationships of snowshoe hares (*Lepus americanus*) in the mixed conifer landscape of the Northern Rockies, USA: Cross-scale effects of horizontal cover with implications for forest management. *Ecology and Evolution* 7(1):125-144.

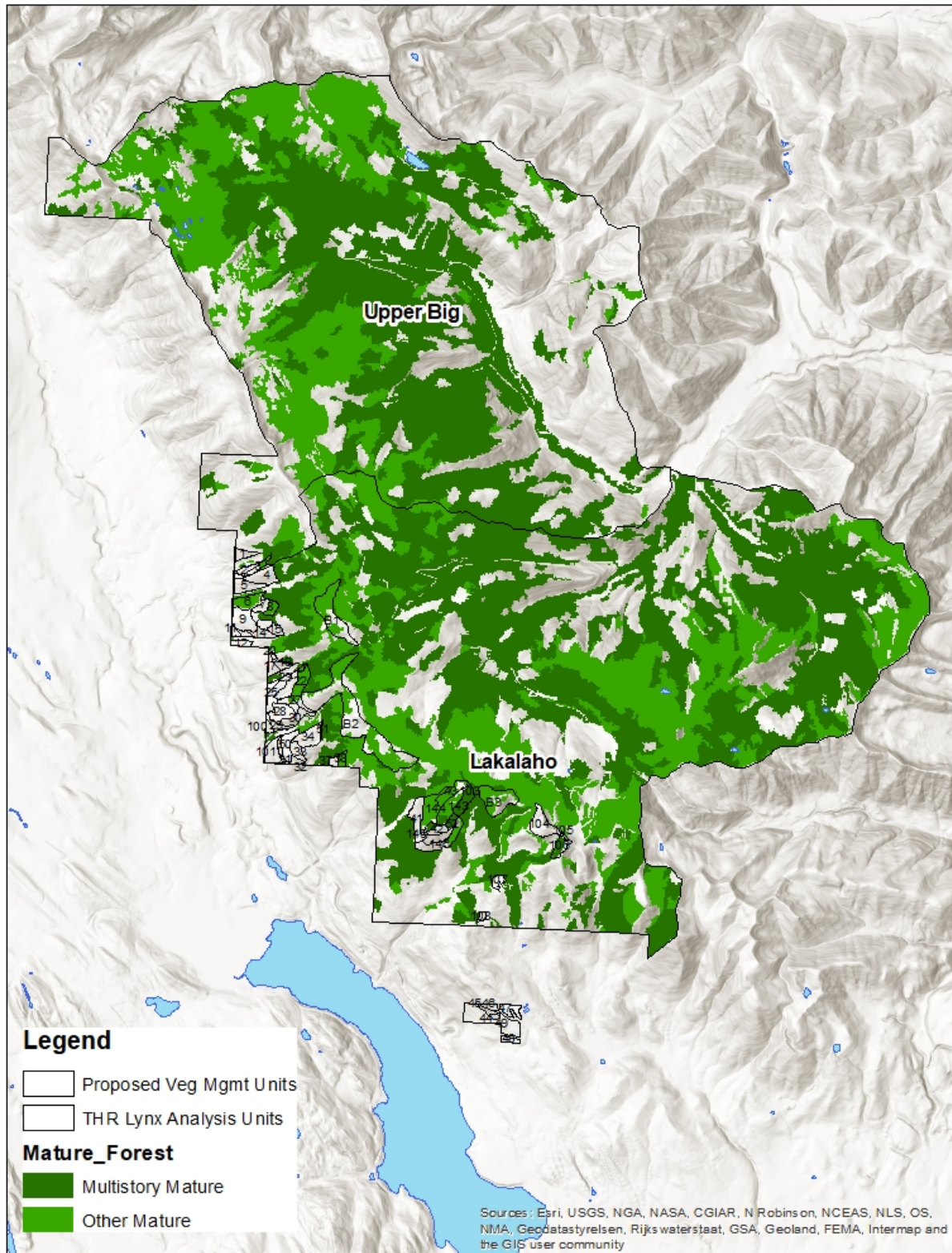
Holbrook, J.D., et al. 2017. Understanding and predicting habitat for wildlife conservation: the case of Canada lynx at the range periphery. *Ecosphere* 8(9)1-25, with appendices.

Holbrook, J.D., et al. 2018. Spatio-temporal responses of Canada lynx (*Lynx canadensis*) to silvicultural treatments in the Northern Rockies, *Forest Ecology and Management* 422(2018):114-124.

Kosterman, M., et al. 2018. Forest structure provides the income for reproductive success in a southern population of Canada lynx. *Ecological Applications* 28(4):1032-1043.

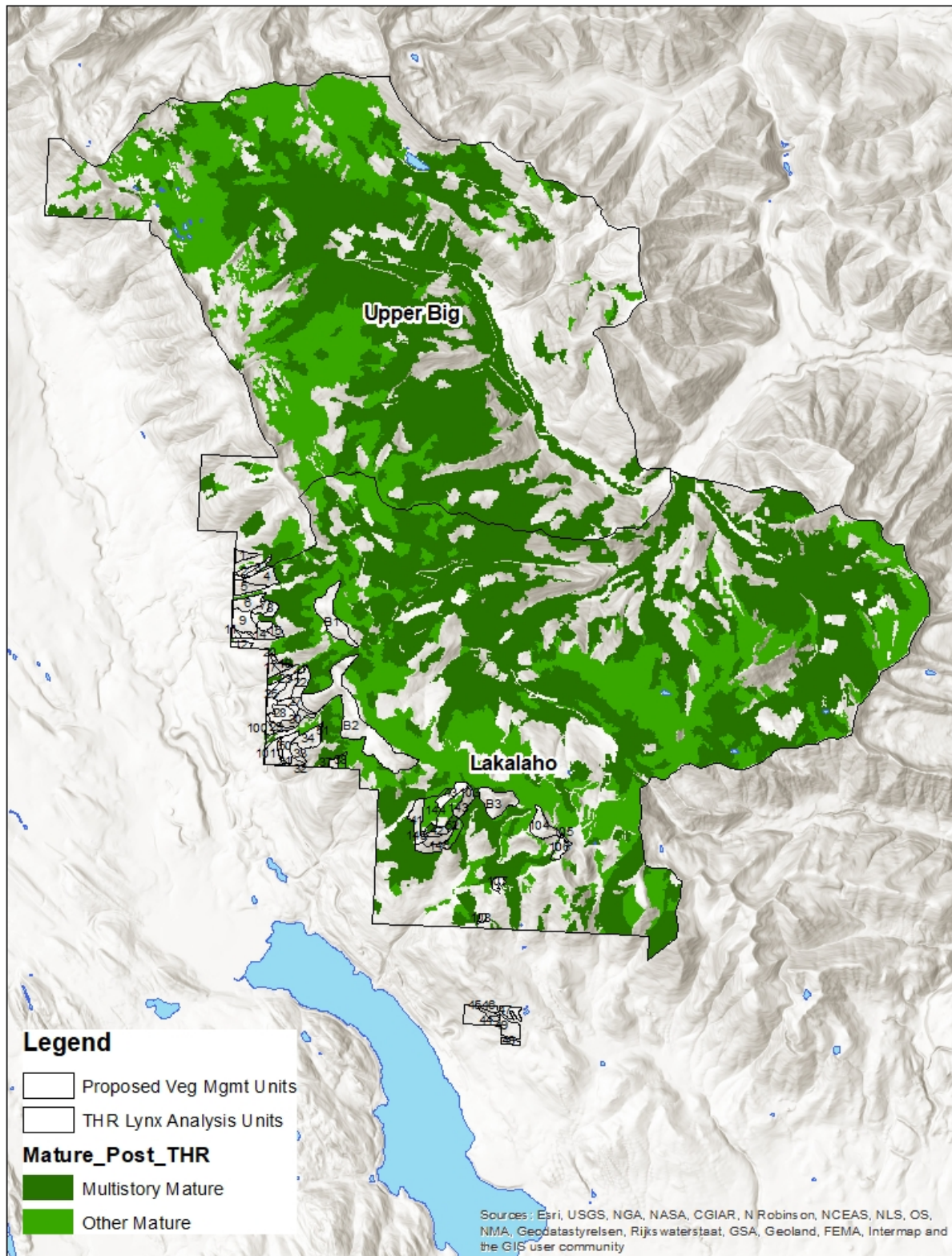
Interagency Lynx Biology Team. 2013. Canada lynx conservation assessment and strategy. 3rd edition. USDA Forest Service, USDI Fish and Wildlife Service, USDI Bureau of Land Management, and USDI National Park Service. Forest Service Publication R1-13-19, Missoula, MT. 128 pp.

Vanbianchi, C.M et al. 2017. Canada lynx use of burned areas: Conservation implications of changing fire regimes. *Ecology and Evolution*. 2017;1–13.



Figure

1. Existing distribution and connectivity of these stands in the project LAUs and within the proposed vegetation management units.



Figure

2. Post-project distribution and connectivity of these stands in the project LAUs and within the proposed vegetation management units.

Canada Lynx - A Review of Recently Published Papers Relative to Canada Lynx Research in North West Montana

September 10, 2018

This document reviews recently published information on Canada lynx in relation to research conducted in North West Montana. The Northern Rockies Lynx Management Direction (NRLMD) was adopted by 18 National Forests in the Northern, Intermountain and Rocky Mountain Regions of the US Forest Service in March, 2007, and provides comprehensive Forest Service management direction consisting of goals, objectives, standards and guidelines designed to contribute to the conservation and recovery of Canada lynx in the Northern Rockies ecosystem. The direction was based on the best scientific information available at the time the NRLMD Record of Decision (ROD) was signed, and applies to mapped lynx habitat on National Forest System land considered “occupied” by Canada lynx.

Since the adoption of the NRLMD in 2007, a review of new, additional information and published papers related to Canada lynx in the Northern Rockies was conducted by staff in the Northern Region in 2013. This document provides a review of **four new papers** published from 2016 to 2018, and an assessment of how they relate to management direction provided in the NRLMD. Scientists at the Rocky Mountain Research Station assisted in this review.

Holbrook et al. 2016 *Multi-scale habitat relationships of snowshoe hares (*Lepus americanus*) in the mixed conifer landscape of the Northern Rockies, USA: cross-scale effects of horizontal cover with implications for forest management. Ecology and Evolution 7, 125–144.*

The objective of this study was to assess habitat relationships of snowshoe hares within a 3.6 million ha study area in NW Montana using a multiscale and gradient-based framework to provide a more complete characterization of snowshoe hare habitat at local and landscape scales that could be used by forest managers. Specifically, the study (1) assessed the relationship between horizontal cover and snowshoe hares at multiple scales, (2) estimated how forest metrics vary across the gradient of snowshoe hare use and horizontal cover, and (3) modeled and mapped predicted snowshoe hare occupancy and intensity of use at the landscape scale (study area).

At the landscape scale, the study considered and utilized a suite of vegetative, topographic, and climatic covariates known or suspected to influence snowshoe hare occupancy and intensity of use. At the plot scale, the study randomly distributed and sampled >1000 plots within mixed conifer forest types throughout accessible locations within the study area during summer 2013 to measure vegetation components (tree species, compositions and densities, canopy cover, horizontal cover, ect...) and snowshoe hare occupancy and intensity of use (pellet counts).

The most significant findings in Holbrook et al. 2016 and how they may or may not relate to current management direction provided in the NRLMD are summarized below:

1) Study results indicated consistent patterns across scales and **emphasized the importance of horizontal cover, subalpine fir, Engelmann spruce, and lodgepole pine** as indicators of hare habitat within mixed conifer forest types in the Northern Rockies. Each of these habitat components are addressed below.

- **The relationship between horizontal cover and snowshoe hare density was relatively strong;** both occupancy and intensity of use by snowshoe hares increased as horizontal cover increased. Forest structures in areas with high snowshoe hare use and high horizontal cover was characterized as multistoried with dense canopy cover and medium-sized trees (e.g., 5" to 9" dbh). Study results in Holbrook et al. (2016) support conclusions similar to those in previous studies in that disturbing (e.g., cutting or burning) multistoried forests with high stem densities (particularly in the understory) would likely have a negative effect on snowshoe hares in the short term, but may provide benefits them in the longer term.
- **This study indicated that the horizontal cover attribute and its influence on habitat for snowshoe hares is associated with forests that have a substantial subalpine fir and Engelmann spruce component** (relative to those without a spruce-fir component), and that the only species to increase in abundance with horizontal cover was Engelmann spruce and subalpine fir. This study concluded that preserving the horizontal cover that subalpine fir and Engelmann spruce trees provide within mixed conifer forests of the Northern Rockies will likely be important for the conservation of snowshoe hare and lynx.
- **This study also indicated a positive effect of lodgepole pine on both occupancy and use by snowshoe hares,** which the authors attributed mostly to nutritional mechanisms. Ellsworth et al. (2013) discovered that lodgepole pine produced higher levels of digestible protein than other common conifers in the Northern Rockies (e.g., Douglas-fir, subalpine fir, Engelmann spruce, western larch) and that overwinter depletion of biomass and browsing by snowshoe hares was most associated with lodgepole pine. Although data in the Holbrook et al. 2016 study indicated that areas with high use by snowshoe hares are indeed highly mixed conifer forests, forest managers within the study area could use lodgepole pine as well as spruce-fir, or more specifically horizontal cover, as initial indicators of potential snowshoe hare habitat.

Conclusions in Holbrook et al. 2016 relative to the importance of horizontal cover, subalpine fir, Engelmann spruce, and lodgepole pine as indicators of hare habitat are consistent with those identified by Ruggiero et al. (1999) and Ruediger et al. (2000), both of which provided the foundation for vegetation management guidance in the NRLMD. **Guideline VEG G1** in the NRLMD emphasizes recruitment of high densities of conifers, hardwoods and shrubs that promote dense horizontal cover for snowshoe hare during vegetation management planning. **Standard VEG S6** in the NRLMD limits vegetation management actions that would reduce snowshoe hare habitat in multistoried forests to fuel treatment projects within the WUI (the WUI exemption) and vegetation management projects for other resource benefit (exceptions for treatments surrounding administrative sites, research sites, and incidental removal during salvage harvest). These treatment exemptions and exceptions were acknowledged and addressed in the NRLMD planning process and US Fish and Wildlife Serviced Biological Opinion. Although Ruggiero et al. (1999), Ruediger et al. (2000) and the NRLMD FEIS acknowledge the importance of the spruce-fir and lodgepole pine components to snowshoe hare and lynx habitat, **Holbrook et al. 2016 provides additional insight on the relative contributions of these species' to snowshoe hare**

occupancy and intensity of use that should be considered by biologists and forest managers when developing vegetation management projects.

2) This study also predicted, modeled, and mapped snowshoe hare habitat within their study area in NW Montana, and demonstrated that quality snowshoe hare habitat is patchily distributed at a coarse scale (Figure 11 in Holbrook et al. 2016). The authors specifically noted the importance of predicted probability of snowshoe hare occupancy and intensity of use on multiple-use lands (e.g., national forests, state-managed lands), and their contribution to the conservation of snowshoe hare habitat at the landscape scale; simply focusing on wilderness areas or national parks for conservation of snowshoe hares would likely result in ineffective strategies. Figure 11 in Holbrook et al. 2016 provides maps of predicted probability of snowshoe hare occupancy and intensity of use within their study area in NW Montana; although these maps depict existing snowshoe hare habitat conditions based on available data at the time of their development for this publication (~2014), **they may be used to inform vegetation management planning at the project level.**

3) The study provided explicit forest structural condition information concerning snowshoe hare habitat within the mixed conifer forests of the Northern Rockies that can be directly implemented by forest managers. The structure of forests with high use by snowshoe hares was characterized as dense (particularly in the understory), relatively closed, and multistoried, which was described using metrics such as quadratic mean diameter, trees/ha, canopy cover, and basal area (Table 2 and Table A1 in Appendix A, in Holbrook et al. 2016). These stand characteristics can arise in nearly all successional stages and are presumably realized following disturbance agents (e.g., wildfire, insect damage, root disease, or cutting) of intermediate severity that allow patches of light to reach the forest floor.

The findings indicated in Holbrook et al. 2016 underscore the importance of dense horizontal cover to achieve high use by, and likely high densities of, snowshoe hares. And, although the conclusions in Holbrook et al. 2016, summarized above, do not contradict specific management direction provided by standards and guidelines in the NRLMD, **their findings do highlight the need to consider the indicated vegetation compositions and arrangements that provide for snowshoe hare occupancy and high intensity of use at both the local and landscape scales when developing and analyzing vegetation management actions at the project level.**

Holbrook et al. 2017 *Understanding and predicting habitat for wildlife conservation: the case of Canada lynx at the range periphery*. Ecosphere 8(9):e01939.10.1002/ecs2.1939

This paper assessed functional responses in lynx habitat use to characterize habitat relationships, predicted lynx habitat, and assessed behavioral differences with changing environmental conditions within the existing, suspected distribution of Canada lynx in the Northern Rockies. Through use of resource selection function (RSF) analyses of 86 unique individual lynx (38 females and 48 males) in the study area, this paper developed multi-scale predictions of lynx habitat and lynx habitat conditions within NW Montana. By assessing functional responses and habitat selection across scales and seasons, the study indicated that:

- **Canada lynx used more mature, spruce-fir forest than any other structural class or species.** This determination was also indicated in Squires et al. 2010, the science which provided the impetus and rationale for Standard VEG S6 in the Northern Rockies Lynx Management Direction (NRLMD). (See Science Review in USDA 2013)
- **Intermediate snow depths and the distribution of snowshoe hares were the strongest predictors of where lynx selected their home ranges.**
- **Young regenerating forests generally provided the most abundant snowshoe hares, while mature forest is where lynx appear to hunt efficiently.** NRLMD standards VEG S5 and VEG S6 emphasize retention of young regenerating stands and multistoried mature stands (respectively) that provide habitat for snowshoe hares.
- **Within their home ranges, female and male lynx increasingly used young regenerating forest structures as they became more available (up to a maximum availability of 40%).** NRLMD standard VEG S5 emphasizes retention of young regenerating stands and prohibits any stand modifications that reduce snowshoe hare habitat until trees “self-prune” and no longer provide habitat for snowshoe hares during winter.
- **Vegetation management actions may be used to promote development of young regenerating forests that provide habitat for snowshoe hare (e.g., regeneration harvest treatments);** however, because young regenerating forest conditions initiate from the early seral stand initiation structural stage, such management actions will result in lower quality snowshoe hare habitat for twenty or more years post treatment.
- **Female lynx exhibited decreasing use of stand initiation structures (up to a maximum availability of 25%).** Stand initiation structures as defined in this paper (Table 2) include very young stands (generally 5 years old and younger) with very few trees and open canopies resulting from recent disturbances such as timber harvest and/or severe fire. NRLMD standard VEG S1 limits disturbances from timber harvest or fire that results in the stand initiation (SI) structural stage not yet providing snowshoe hare habitat during winter to no more than 30% of mapped lynx habitat within a Lynx Analysis Unit (LAU). However, SI structures as defined in this paper (Table 2) and the SI structural stage defined in the NRLMD are not the same; stands in the SI structural stage as defined in the NRLMD (and that apply to standard VEG S1) approach 20 – 25+ years of age before moving to young regenerating stands that provide snowshoe hare habitat during winter. Thus, the SI structure class defined in this paper is but a subset of the SI structural conditions used in NRLMD standard VEG S1 to establish the 30% SI condition threshold.
- **Mature forest structures were used in proportion to availability, although 66% of female home ranges contained ≥50% mature forest (pa 13).** Through the use of resource selection function (RSF) modeling, researchers determined that lynx within their study area used more mature spruce-fir forest than any other structure class or species, and increasingly used advanced regeneration forest structures as they became more available within their home ranges. The study concluded that advanced regeneration generally provides the most abundant snowshoe

hares, while mature forest is where lynx appear to hunt efficiently. These findings were based on lynx habitat use of four forest structural classes derived from satellite imagery, and include sparse forest, stand initiation, advanced regeneration, and mature forest. All four classes are described in Table 2 of the paper using metrics from the USDA Forest Service Forest Inventory and Analysis (FIA) program. Although the **definition for mature forest in Table 2 is mid-seral stands ≥ 40 years of age arranged in a multi-storied structure** with a mixed species composition, the range of stand conditions described for the mature class (ie...tree sizes, stem densities, and canopy closures, etc...) is quite broad, indicating a variety of overstory and understory stand conditions, a range of structural conditions as defined in Oliver and Larson (1996) (including the young forest and understory re-initiation multistoried structural stages), and a mix of high and low horizontal cover values capable of supporting varying degrees of habitat quality for snowshoe hares. Thus, the value of the mature forest component as foraging habitat for lynx (within home ranges in this study) is likely highly variable and dependent on existing horizontal cover values at the local scale.

The structural classes and RSF modeling processes used in the Kosterman Thesis (2014) and in Kosterman et al. (2018) to describe habitat use by lynx are very similar to those used in this paper, and the findings in all three papers are similar as a result. However, forest structural classes described in those two papers, and the classes described in this Holbrook et al. 2017 paper (sparse, stand initiation, advanced regeneration, and mature in Table 2) are not the same as those structural classes used to define and develop objectives, standards and guidelines in the Northern Rockies Lynx Amendment (NRLMD). Forest structural classes used in the NRLMD are based on structural stages defined by Oliver and Larson (1996), and do not “crosswalk” well with structural classes used in this study, or those in the Kosterman Thesis (2014) or Kosterman et al. (2018). Staff in the R1 Regional office are working with research scientists at RMRS to better interpret structure classes used in these studies and how they compare with those used in the NRLMD.

Standard VEG S6 in the NRLMD prohibits vegetation management actions that reduce snowshoe hare habitat within **existing multistoried mature forest structures**; but the standard does allow an exemption for treatments within the Wildland Urban Interface (WUI) and provides for a limited amount of exceptions to benefit other resources. However, the standard only provides for existing levels of multistoried snowshoe hare habitat within LAUs, and does not require retention of mature forest structures with potential to develop into multistoried snowshoe hare habitat in the future; nor does it provide guidance or recommendations for the amount of multistoried snowshoe hare habitat necessary to support a lynx home range. **Thus, in addition to retaining existing multistoried forest structures with dense understories that provide snowshoe hare habitat within LAUs (per VEG S6), vegetation management planning should consider retention or intermediate silvicultural treatments of multistoried forest structures currently lacking dense horizontal cover to promote multistoried snowshoe hare habitat in the future where such habitat is currently limited to less than 50% of existing lynx habitat within the LAU.**

Guideline VEG G1 in the NRLMD promotes vegetation management treatments that recruit high densities of conifers, hardwoods, and shrubs where such habitat is scarce or not available; priority for treatment should be given to stem exclusion and closed canopy structural stage stands to promote development of multistoried structures with high horizontal cover for snowshoe hares. **Implementation**

of this guideline would be most beneficial in LAUs where less than 50% of lynx habitat is in the multistoried structural stage that provides habitat for snowshoe hares.

This paper also predicted lynx habitat within the suspected distribution of Canada lynx in the Northern Rockies; based on RSF and satellite imagery modeling processes described previously and a set of appropriately scaled covariates (Table 4), Holbrook et al. (2017) developed lynx habitat maps that predict probability of use for lynx in western Montana. Because these maps are based on habitat selected by lynx in the study area, they reflect current habitat conditions and provide an informed measure of current lynx habitat quality in western Montana. These maps were derived by assessing lynx habitat use within all land areas within their home ranges; and thus, the resulting predictive probability maps do not coincide with lynx habitat maps developed by Forests as directed in the LCAS and NRLMD. Regardless, these maps provide a science based map of current habitat quality, and a valuable tool for planning and assessing effects at the project level.

Holbrook et al. 2018 *Spatio-temporal responses of Canada lynx (*Lynx Canadensis*) to silvicultural treatments in the Northern Rockies, U.S.* Forest Ecology and Management 422:114-739 124.

The objective of this study was to evaluate the spatial and temporal responses of Canada lynx to differing silvicultural treatments. The study utilized an extensive GPS dataset that included 66 Canada lynx (i.e., 164,593 locations) collected during 2004–2015 in NW Montana. The Forest Service FACTS database was used to identify 1,293 vegetation treatments that occurred within the lynx home ranges identified in a previous study by Holbrook et al. (2017) over a temporal gradient of 1–67 years following treatment. The study identified three different silvicultural treatment groups that included 25 unique silvicultural activity types (Appendix A: Table A.1); the three treatment groups included: (1) **regeneration cuts** (combined regeneration cut with natural regeneration and regeneration cut with plantings; n=791), (2) **selection cuts** (combined group selection and liberation cut; n=71), and (3) **thinnings** (combined improvement cut and precommercial thinning; n=431). By assessing functional responses and habitat selection across scales and seasons, the study indicated that:

- **Lynx used silvicultural treatments (regeneration, thinning and selection cut harvests) post-harvest, but there was little use by lynx during the first 10 years following treatments;** thus, there is a ~10 year cost of implementing any treatment (thinning, selection, or regeneration harvest) relative to resource selection by lynx. This temporal cost is associated with lynx preferring advanced regenerating and mature structural stages and is consistent with previous work (Squires et al., 2010; Holbrook et al., 2017) demonstrating a negative effect of precommercial thinning on snowshoe hare densities for ~10 years following treatment.
- **Cumulative use by lynx (in both summer and winter) occurred sooner following thinning treatments than either regeneration or selection harvest treatments;** thinning treatments required ~20 years post treatment to reach 50% lynx use, while regeneration harvest and selection harvest treatments required 34 years and 39 years respectively.

- **Lynx appeared to use regeneration and selection cuts similarly over time, suggesting that the difference in vegetation impact between these treatment methods make little difference relative to potential impacts to lynx.**
- **In areas of past vegetation management actions assessed in this study, both the vegetation recovery time following silvicultural treatments and existing forest structures (presence or absence of lynx foraging stands) interacted to influence lynx behavior.** Lynx tended to avoid silviculturally treated stands (regardless of time since treatment) when preferred structural stages (e.g., mature multi-storied forest or advanced regeneration) were abundant in the adjacent, surrounding landscape; in areas with low amounts of mature forest in the neighborhood, lynx use of recovering silvicultural treatments was higher than in treatments surrounded by an abundance of mature forest.

The findings in Holbrook et al. 2018 emphasize that spatial arrangements and compositions, as well as recovery times following vegetation treatments, are important to balancing silvicultural actions and Canada lynx conservation. Although the conclusions in Holbrook et al. 2018 (as summarized above) do not directly address or contradict management direction provided by the NRLMD (Standards and Guidelines), **their findings do highlight the need to consider landscape-level compositions and arrangements, as well as recovery times post treatment, when developing and analyzing vegetation management actions at the project level**, especially within landscapes composed of lower quality habitat.

Kosterman et al. 2018. *Forest structure provides the income for reproductive success in a southern population of Canada lynx.* Ecological Applications, 28(4), 2018, pp. 1032-143.

This publication investigated the relationship between reproduction success and forest structural compositions and arrangements within the annual core use areas of 36 radio collared female lynx on the Kootenai and Lolo National Forests previously studied and described in the Kosterman Thesis (2014). Kosterman et al. (2018) found a relationship between forest structure and reproductive success in Canada lynx consistent with an income breeding strategy, where forest structure supplied the income important for successful reproduction. The forest characteristics that defined high reproduction success within the core use areas of female lynx home ranges included (1) abundant and connected mature forest and (2) intermediate amounts of small-diameter regenerating forest. This study focused on forest structures within 50% core use areas because they were more strongly related to demographic responses than were 90% home ranges; fixed-kernel density methods were used to estimate core and home range areas.

Analysis methods and the most significant findings in this paper are discussed below in relationship to how they relate to current management direction provided in the NRLMD.

- **Structural Classes.** The structural classes used by Kosterman et al. (2018) to describe habitat use by lynx are similar to those used in the 2014 Kosterman Thesis and in Holbrook et al. 2017, and the findings in all three papers are not the same as structural classes used to define and develop

objectives, standards and guidelines in the Northern Rockies Lynx Management Direction (NRLMD). Forest structural classes used in the NRLMD are based on structural stages defined by Oliver and Larson (1996), and do not “crosswalk” well with structural classes defined in the Kosterman Thesis (2014), in Holbrook et al. 2017, or in Kosterman et al. 2018. Thus, direct comparisons are difficult. Staff in the R1 Regional office are working with research scientists at RMRS to better interpret structure classes used in these studies and how they compare with those used in the NRLMD.

- **Core Use Areas, Home Ranges and Lynx Analysis Units.** Forest structure and reproduction success relationships addressed in Kosterman et al. 2018 are based on core use areas selected by female lynx in the study area, and represent those portions of their total home range area that provided relatively high quality habitat when the home range was occupied. The **mean values** of structural conditions within **core use areas** of the 36 female lynx included in their study were:

- Mature forest => 49% +/- 13% SD
- Med-dia forest => 24% +/- 18% SD
- Small-dia forest => 13% +/- 6% SD
- Sparse forest => 10% +/- 7% SD
- Open forest => 4% +/- 4% SD

Structural conditions described above are defined in Table 1 of Kosterman et.al. 2018.

The NRLMD directs development and use of Lynx Analysis Units (LAUs) that represent a theoretical female lynx home range for implementing Standards and Guidelines in the NRLMD. LAUs approximate the size of a female lynx home range in the Northern Rockies (25 to 50 sq miles) and contain at least 10 sq miles of lynx habitat on AF/ES habitat types (Ruediger et. al. 2000; NRLMD 2007). Since LAUs represent female lynx home ranges and are not the same as core use areas identified in this study, **structural conditions that support reproduction success within core use areas are not directly comparable to structural conditions within LAUs used to address management guidance in the NRLMD**. Staff in the R1 Regional office are working closely with research scientists at RMRS to better interpret, understand, and identify desirable structural conditions that support reproduction success within female lynx **home ranges**, which would be more comparable to habitat conditions at the LAU scale.

- **Forest characteristics that defined high reproduction success within the core use areas of female lynx home ranges included 1) abundant and connected mature forest and 2) intermediate amounts of small-diameter regenerating forest.** This study concluded that reproduction success was largely associated with forest structure and configuration, and that “mature forest in a connected configuration creates an energetically efficient context for lynx to acquire snowshoe hares and successfully reproduce”. In core areas with high connectivity of mature forest, the probability of producing a litter increased significantly as the proportion of small-diameter regenerating forest increased from ~5% to ~10%; litter production probability remained consistently high in core use areas with up to ~20% of small-diameter regenerating forest, and then declined when amounts of small diameter regenerating forest exceeded 20%.

The probability of producing a litter was highest for females in core-use areas with ~12-20% of small diameter regenerating forest and increased with increasing connectivity of mature forest. However the study also indicated that the amount of small-diameter regenerating forest that is optimal for female lynx is dependent on the landscape context; that is, the optimal quantity broadens as mature forest becomes more connected. But, despite the mature to small diameter forest relationship, mature forest in a connected configuration is particularly important for core use areas of lynx, which aligns with landscape-level habitat selection described in Squires et al. (2013) and Holbrook et al. (2017).

Although Kosterman et al. (2018) focuses on reproductive success relative to structural conditions within female lynx core use areas, connected mature forest is also relevant at landscape and home range scales (Squires, personal com). RMRS researchers recently completed an assessment that further addresses habitat mosaics relative to probability of producing litters **within core use and home range areas** of female lynx, and summarized their findings in a manuscript that has been submitted for publication. The manuscript addresses relative values of mature and young regenerating forest (referred to as advanced regeneration in the manuscript), and their conclusions are consistent with those in Kosterman et al. (2018) relative to the importance of connected mature forest structures.

Objective ALL O1 and Standard ALL S1 in the NRLMD provide management guidance for maintaining connectivity between and within LAUs. However, the purpose of connectivity guidance in the NRLMD is to provide cover to accommodate day to day travel movements within LAUs and longer migratory movements between LAUs. It does not address mature forest connectivity in the context of reproductive success. **Thus, in addition to addressing ALL O1 and ALL S1 at the project level, vegetation management planning should consider maintaining and/or improving connectivity of mature, multistoried habitat within the LAU.** The mature forest class described in Kosterman et al. 2018 (Table 1) is “multistoried stands with substantial understory and horizontal cover”, which is comparable to the multi-storied conditions addressed by Standard VEG S6.

Standard VEG S1 in the NRLMD limits the amount of mapped lynx habitat within a LAU in a stand initiation structural stage that does not yet provide winter snowshoe hare habitat to 30%; the NRLMD also defines this stage as lynx habitat in an unsuitable condition and includes a range of conditions from new openings resulting from timber harvest or stand replacement fire, to young regenerating forests not tall and/or dense enough to provide snowshoe hare habitat during winter. Of the five structure classes used to define habitat conditions in Kosterman et al. 2018, the open, sparse and small diameter regeneration forest classes (as described in Table 1) are most likely to meet the unsuitable habitat conditions that define the 30% threshold in Standard VEG S1. Mean values within female lynx core use areas determined by Kosterman et al. (2018) for the open, sparse and small diameter classes were 4%, 10% and 13% respectively, and collectively would equal ~27%. Per structural class definitions in Table 1 of Kosterman et al. 2018, the open and sparse structural classes lack horizontal cover and do not provide habitat for snowshoe hare; thus, both classes meet the unsuitable definition described in Standard VEG S1. But, it is unclear if the same is true for the small diameter class defined by Kosterman et al. (2018); per Table 1, this class provides dense horizontal cover for snowshoe hares, but it is not known if this class includes young trees tall and dense enough to provide habitat during winter.

In addition, structural habitat conditions described in Kosterman et al. 2018 occurred within known female lynx core use areas; such conditions may not be the same within the larger home range or LAUs used in the NRLMD to approximate home ranges. Thus, because of the habitat differences and uncertainties described, it is unclear how (or if) the conclusion in Kosterman et al. 2018 (e.g...that the probability of producing a litter was highest for females that had core-use areas with ~12-20% of small diameter regenerating forest) relates to the 30% stand initiation structural stage threshold described in NRLMD Standard VEG S1. As stated previously, staff in the R1 Regional office are working closely with research scientists at RMRS to better interpret, understand, and crosswalk structural conditions described in research papers with those used to define management direction provided in the NRLMD.

Review Summary prepared by:

Gary Hanvey
Canada Lynx Biologist
Northern Region, USFS
Missoula, MT.

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(Note: References in bold type are the subject papers addressed in this Review Summary)



File Code: 1920-2-1

Date: December 20, 2001

Subject: Data Request for Northern Rockies Lynx Amendment

To: Region 1 Forest Supervisors, Shoshone Forest Supervisor, Bighorn Forest Supervisor, Salmon-Challis Forest Supervisor, Caribou-Targhee Forest Supervisor, Ashley Forest Supervisor, Bridger-Teton Forest Supervisor, Idaho BLM, and Martha Hahn (State Director for Idaho BLM)

REPLY DUE JANUARY 22, 2002

Portions of Regions 1, 2 and 4, the Bureau of Land Management in Idaho, and in northern Utah are amending plans in the Northern Rockies Geographic Area of the Canada lynx to incorporate the conservation measures, or their equivalent, recommended in the Canada Lynx Conservation Assessment and Strategy. We initiated the amendment process September 11 and now are in the process of collecting information for the analysis and evaluating the no action and proposed action alternatives.

I have asked the Northern Rockies Lynx Amendment Team to have the environmental analysis process completed this fiscal year so we do not have to tap additional money or resources from the field units. To accomplish this task the team intends to publish an environmental document for review and comment by June 2002. However, to meet this timeline the team needs assistance from Forest and BLM staff to obtain vital information that will help characterize the affected environment, and provide information on the environmental consequences of the no action, and proposed action alternatives. This evaluation, in addition to comments received during scoping, will help develop alternatives to the proposed action.

Timely completion of the amendment requires that we receive responses by the reply due date. If you cannot meet this date please contact Jon Haber immediately to explain your specific situation to see if we can provide assistance. The team has scheduled a **conference call** with the Forest and BLM field coordinators for **January 8, 2002, 2:00 pm MST**. The call in number is 9-1-877-891-6970, passcode 28450, leader Jon Haber. The purpose of the call is to review the data request and answer any questions.

Please submit the following information by January 16, 2002, to Joan Dickerson, jdickerson@fs.fed.us. Electronic versions are preferred.

- Tables/spreadsheets completed for consultation on lynx for "ongoing" activities.
- Attachment 1 filled out.

If you have questions regarding this request contact the specialist below.

- Wildlife: Tim Bertram, R1 Regional Office (406) 329-3611
- Plants: Susan Rinehart, R1 Regional Office (406) 329-3669
- Recreation: Cliff Mitchell, Clearwater National Forest, (208) 476-4541
- Range: Terry Nevius, Humboldt-Toiyabe (775) 964-2671



- Transportation: Carl Cain, R1 Regional Office (406) 329-3220
- Social: Rick Anderson, R1 Regional Office (406) 329-3647
- Minerals: Joe Gurrieri, Beaverhead-Deerlodge National Forest, (406) 494-0230
- Silviculture: Bill Terrill, Idaho Panhandle National Forest (208) 265-6627

If you cannot reach the resource contact you may call Joan Dickerson (406) 329-3314 or Jon Haber (406) 329-3399 for assistance. I expect this to constitute most of the information we will need from the field. However, some follow-up requests are possible as well as additional requests related to alternatives that may be developed.

Thank you again for your support.

BRADLEY E. POWELL
Regional Forester

enclosure

Forest or BLM Unit	Flathead National Forest
Prepared By	Dale Luhman
Date	January 15, 2002

Over-Snow Routes or Play Areas

(For questions contact: Cliff Mitchell, Clearwater NF (208) 476-4541 cmitchell@fs.fed.us)

Total Miles of Groomed or Designated over-the snow routes*	186
Estimated Miles of groomed or designated over-the-snow routes in lynx habitat	172
Average total snowmobile trail miles groomed each year (determine the average for the past 2-5 years using available data) whole forest	123
Average snowmobile trail miles groomed each year (determine the average for the past 2-5 years using available data) in lynx habitat .	118
Average total cross-country ski trail miles groomed each year (determine the average for the past 2-5 years using available data) whole forest	63
Average cross-country ski trail miles groomed each year (determine the average for the past 2-5 years using available data) in lynx habitat .	54
Number of designated snowmobile play areas within lynx habitat **	0
Estimated acreage of designated snowmobile play areas within lynx habitat	0

***Groomed or designated over-the-snow routes include the following:** designated winter route, groomed winter route, authorized winter route/use area.

Designated winter route: are routes or trails (linear travel way) that are managed by the Forest Service, by any agency or organization under agreement with the Forest Service or by special use permittee, and that is identifiable to the visitor as a result of on-the-ground signing, road corridors, blue or orange diamonds, bamboo wands, blazes, or difficulty markers, or is shown on maps, brochures, recreation opportunity guides, or electronic media produced or approved by the Forest Service.

Groomed winter route (regardless of grooming frequency). A route or trail, usually intended for snowmobile, dogsled, snowcat, or cross-country skiing, on which the snow surface is packed, leveled and scarified, with or without "set tracks", usually by means of equipment towed behind a snowmobile or snowcat. Most such routes or travelways are maintained through agreements with snowmobile clubs, permittees, event holders, and others for varying periods of time during the winter months. Snow roads maintained by permitted snowcat tours are "groomed" under this definition.

Authorized winter route/use area: any other route/area, not identified above, that is specified in an outfitter guide permit or special use permit, for over the snow recreation purposes or other such activities (such as private land access, snowtel sites, and avalanche control areas). This item does not include downhill or cross country ski areas.

****Snowmobile play areas** specifically identified by written text or mapping where designated snowmobile use is encouraged or promoted. Designation refers to a decision in the Forest Plan or other NEPA decision document; it also includes any travel maps, maps or pamphlets distributed to the public. Dispersed use areas or areas identified as winter semi-primitive motorized (ROS categorization) are not automatically a designated snowmobile play area. These specific areas must be identified by a decision or displayed in materials distributed to the public.

Note: Groomed or designated over-the-snow routes do not include plowed roads, or roads or trails marked as open for use, but not meeting any of the above criteria.

Winter Recreation Use Levels

Do you have information (including just knowledge) regarding the level of winter recreation use on your unit? If so provide a summary of the information including type of use, level of use, and source of information.

Type of Use	Level of Use	Data Source
snowmobile	23000 visits (use in ungroomed area might add 10-20%) to these numbers	Informal vehicle counts
Cross-country ski	11000 visits	Informal vehicle counts
Downhill ski areas	302,700 visits	Average ticket sales

Ski Areas (For questions contact: Cliff Mitchell, Clearwater NF (208) 476-4541)

Total number of downhill and cross country ski areas whole forest or unit	6
Number and acres (permit acres) of downhill and cross country ski areas in lynx habitat (list each area and associated acres)	5 areas, total 3749 acres downhill Big Mountain 2650 acres Blacktail Mountain 1020 acres Cross country Essex 27 acres Glacier Wilderness Ranch 18 acres Blacktail X-C 34 acres
Number of planned ski areas in lynx habitat (identify which ones).	0
Number of existing downhill or cross-country ski areas, within lynx habitat that have planned expansions in the next 10 yrs	1—Big Mountain

Table K-10. Cross-country and downhill ski areas operating under special use permit

	Ski areas	Inside lynx habitat			
		Number	Acres	Planning expansion	New areas planned
NATIONAL FOREST					
Idaho					
Clearwater	0	0	0	0	0
Idaho Panhandle †	2	0	0	1	0
Nez Perce	1	0	0	0	0
Salmon-Challis ‡	1	1	1,401	1	0
Targhee	2	2	974	1	0
Montana					
Beaverhead-Deerlodge	2	2	1,999	1	0
Bitterroot ‡	0	0	0	0	0
Custer	1	1	1,288	1	0
Flathead	6	5	3,749	1	0
Gallatin	2	2	956	1	0
Helena	3	2	320	0	0
Kootenai	3	1	2,640	1	1
Lewis & Clark	3	3	1,498	1	0
Lolo †	3	2	1,412	1	0
Wyoming					
Bighorn	6	1	400	0	0
Bridger-Teton	5	5	4,620	0	0
Shoshone	10	1	2	0	0
Utah					
Ashley	0	0	0	0	0
TOTAL	50	28	21,259	10	1

† The Idaho Panhandle and Lolo National Forests both have parts of the Lookout Pass ski area within their administrative boundaries. On this table it is listed under the Lolo in Montana.

‡ The Salmon-Challis and Bitterroot National Forests both have parts of the Lost Trail ski area within their administrative boundaries. On this table it is listed under the Salmon-Challis NF in Idaho.

Figure 3-7. Ski areas in the planning area

[From NRLMD FEIS]

