User's Guide – Fisher Habitat Spatial Data

Thank you for downloading the Fisher Habitat Spatial Data (April 2017 release) from the BC Fisher Habitat Working Group.

This Fisher Habitat Spatial Data was generated to provide quantitative guidance to help forest planners incorporate habitat needs of fishers into their forest planning decisions. When successfully integrated into the planning process, the Spatial Data will help planners make informed decisions of where and what to harvest (or avoid), while providing options to help maintain the habitats that fishers need within harvested stands and across landscapes.

The Spatial Data is designed to help forest licensees incorporate fisher habitat into their operations by providing 2 key pieces of information. First, the Spatial Data helps forest planners identify habitats that fishers need for denning and resting at stand and landscape scales. Second, it recommends specific targets for each habitat need for: 1) retaining key structures within harvested cutblocks, and 2) the amount of habitat within the landscape. The Spatial Data and guidance within is intended to inform resource professionals when planning and implementing forest development operations; however, it is not to be interpreted as direction nor is it legally binding. This Spatial Data is designed to be used in concert with the Fisher Habitat Management Decision Tables and other background information that can be found at http://www.bcfisherhabitat.ca/habitat-tools/.

For more information about Fisher Habitat spatial data, other habitat management tools, or the BC Fisher Habitat Working Group, please visit www.BCFisherHabitat.ca.

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About The Data

Across the range of fishers in BC, fishers occur in 4 different Habitat Zones: Boreal, Sub-Boreal (moist subzones), Sub-Boreal (dry subzones), and Dry Forest zones. Each Habitat Zone has different forest ecologies that affect how fishers use habitat. To account for these differences, the Spatial Data used

empirical data from 4 fisher research studies completed within each Habitat Zone, and distills the information down to habitat conditions and targets that forest professionals can readily identify and incorporate it into forest planning decisions.

Fishers need forests that provide habitat for 4 very distinct habitat needs: denning, resting, moving, and foraging. We developed the Spatial Data specific to each Habitat Zone using measurements of the habitats used by radiotagged fishers for these habitat needs. To date, Spatial Data has been generated for denning and resting habitat because these are currently considered to be the most limiting habitats for fishers. Subsequent analyses may identify spatial data for moving and foraging at a future date. Please be aware of the limitations of this data (see Limitations of Use, below). Depending on the Fisher Habitat Zone, spatial data layers for denning and up to 3 types of resting habitat are available (Table 1). Within each layer, attribute data are arranged by specific habitat needs. Attribute data (Table 1. Spatial data layers available within each Fisher Habitat Zone.Table 1-3) for each polygon provide the stand and landscape condition of that polygon, notify if habitat is limited in the local landscape, and provide retention target guidance.

Table 1. Spatial data layers available within each Fisher Habitat Zone.

	Habitat need			
Fisher Habitat Zone	Denning[1]	Resting in trees with rust brooms[2]	Resting in tree cavities[3]	Resting in or under CWD[4]
Boreal	X	X		X
Sub-Boreal (moist subzones)	X	X		X
Sub-Boreal (dry subzones)	X	X	X	X
Dry Forest	X	X		X

[1] Denning habitats provide secure den sites for birthing and rearing young from April – June.
[2] Broom resting habitats provide secure resting sites on rust brooms in spruce trees.
[3] Cavity resting habitats provide secure resting sites in tree cavities (Sub-Boreal moist subzones only).
[4] CWD resting habitats provide thermal cover under large logs or in coarse woody debris piles.

Table 2. Attribute descriptors associated with each polygon.

Attribute	Definition
Stand condition	Identifies whether the stand is Type I (i.e., shown to be used 75% of the time by radiotagged fishers for the specified habitat need) or Type II (i.e., shown to be used by fishers 25% of the time for this habitat need).
Landscape condition	Identifies whether the density of Type I stands for this habitat need within a typical female fisher home range centred on this point is Above, Near, or Below that which has been shown to support 75% of radiotagged fishers.
Landscape warning	Identifies if harvesting this stand will further reduce the supply of Type I stands in a landscape below the density that has been shown to support 75% of radiotagged fishers.
Retention target	If forest harvest is to proceed, identifies specific targets (structures/ha) for identified structures to retain within proposed harvest units for this habitat need.
Structural attributes	Describes the dimensional characteristics of identified structures for this habitat need that should be retained at the above-noted Retention target.

Table 3. Data dictionary for Fisher Habitat Spatial Data. Each polygon in the feature class has the following attribute data associated with it.

|	Field name	Alias	Details
Denning	Den_stand	Denning: Stand condition	"Type I" or "Type II"
	Den_landsc	Denning: Landscape condition	"Above", "Near", "Below" target density of Type I stands within fisher home range.
	Den_warn	Denning: Landscape warning	A warning message of "Reconsider Harvest" is suggested if proposed harvest is of a Type I stand in a landscape "Near" or "Below" target density.
	Den_target	Denning: Retention target	Specified retention target for trees suitable for denning within proposed cutblock.
	Den_attr	Denning: Structural attributes	Describes suitable denning trees for retention.
Broom resting	Broom_stand	Broom resting: Stand condition	"Type I" or "Type II"
	Broom_landsc	Broom resting: Landscape condition	"Above", "Near", "Below" target density of Type I stands within fisher home range.
	Broom_warn	Broom resting: Landscape warning	A warning message of "Reconsider Harvest" is suggested if proposed harvest is of a Type I stand in a landscape "Near" or "Below" target density.
	Broom_target	Broom resting: Retention target	Specified retention target for trees suitable for broom resting within proposed cutblock.
	Broom_attr	Broom resting: Structural attributes	Describes suitable broom resting trees for retention.
Cavity resting	Cavity_stand	Cavity resting: Stand condition	"Type I" or "Type II"
	Cavity_landsc	Cavity resting: Landscape condition	"Above", "Near", "Below" target density of Type I stands within fisher home range.
	Cavity_warn	Cavity resting: Landscape warning	A warning message of "Reconsider Harvest" is suggested if proposed harvest is of a Type I stand in a landscape "Near" or "Below" target density.
	Cavity_target	Cavity resting: Retention target	Specified retention target for trees suitable for cavity resting within proposed cutblock.
	Cavity_attr	Cavity resting: Structural attributes	Describes suitable cavity resting trees for retention.
CWD resting	CWD_stand	CWD resting: Stand condition	"Type I" or "Type II"
	CWD_landsc	CWD resting: Landscape condition	"Above", "Near", "Below" target density of Type I stands within fisher home range.
	CWD_warn	CWD resting: Landscape warning	A warning message of "Reconsider Harvest" is suggested if proposed harvest is of a Type I stand in a landscape "Near" or "Below" target density.
	CWD_target	CWD resting: Retention target - Single piece CWD	Specified retention target for single pieces of CWD suitable for resting within proposed cutblock.
	CWD_attr	CWD resting: Structural attributes - Single piece CWD	Describes suitable resting CWD pieces for retention.
	CWD_pile	CWD resting: Retention target - CWD piles	Specified retention target and dimensions for CWD piles within proposed cutblock.
	Version	Version date	Date that spatial data was compiled.

Using the Data in Forest Planning

1. Download the **[Fisher_habitat_spatial_data_Apr_2017.gdb]** geodatabase from www.BCFisherHabitat.ca and load the Spatial Data specific to your Fisher Habitat Zone into ArcGIS. This Spatial Data is designed to be used in concert with the Fisher Habitat Management Decision Tables and other background information that can be found at http://www.bcfisherhabitat.ca/habitat-tools/.
2. Clip the Spatial Data with your proposed cutblock spatial data to identify Fisher Habitat polygons occurring within the proposed cutblock.
3. Review the "Landscape warning" field for each habitat need (e.g., denning, broom resting, cavity resting, CWD resting) to identify if any portions of the cutblock should be considered for removal from the block.
   a. These "Landscape warning" fields provide guidance to help planners consider fisher habitat at the landscape scale.
   b. Where the spatial data identifies that the density of these Type I stands in the landscape is below the level normally supporting fishers, harvest of this stand type would be expected to have a disproportionately negative effect on the ability of the area to support fishers. Selecting Type II stands elsewhere to meet timber volume objectives is suggested.
   c. Where the spatial data identifies no warning, harvest of this stand is not expected to further reduce the supply of Type I stands in the landscape below that which has been shown to support 75% of radio-tagged fishers.
4. If harvest is to proceed, review the "Retention target" field for each habitat need to determine the minimum density of important habitat structures that should be retained within the harvested cutblock.
5. Note that the retention target values are specific for stems that are of the appropriate tree species and meet the minimum diameter (as described in the "Structural attribute" field).
   a. These "Retention targets" provide guidance to help planners retain habitats within harvested cutblocks.
   b. Possible strategies for achieving the retention target for each habitat need may include single- or multiple-tree retention of specified structures within harvested areas or by identifying patches of suitable retention trees to be included within wildlife tree patches or wildlife tree retention areas.
   c. Note that there are 2 targets for CWD within blocks: 1) retaining single pieces of CWD, and 2) creating CWD piles within cutblocks.
6. Outputs from the spatial query should be used to develop retention strategies that can be incorporated into site plans for proposed cutblocks.

Proposed 72-ha cutblock (red outline) in the Boreal forest zone near the Murray River in northeastern BC:
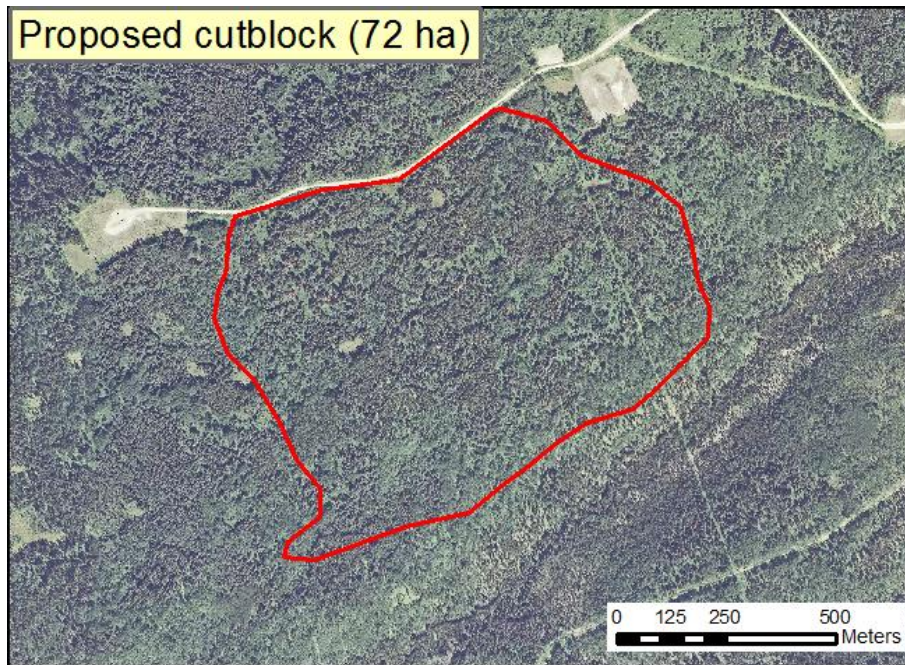
1) Load the **[Boreal_fisher_habitat_spatial_data_170413]** feature class from the Fisher_habitat_spatial_data_Apr_2017.gdb geodatabase (white dashed outline). This is the Fisher Habitat Spatial Data that you will use to identify warnings and determine retention targets.
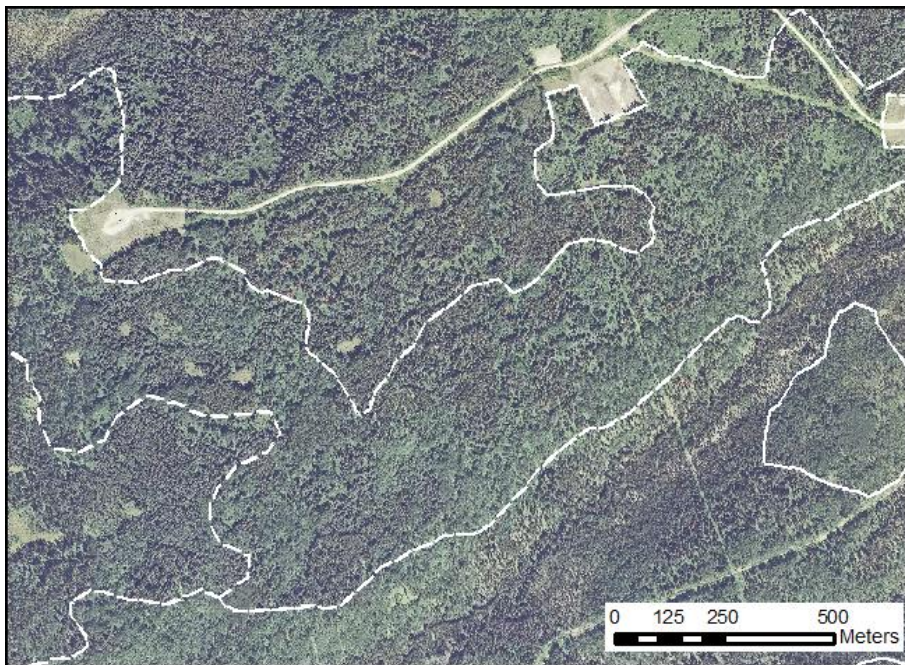
2) Load your proposed cutblock boundary.

Proposed cutblock (72 ha)
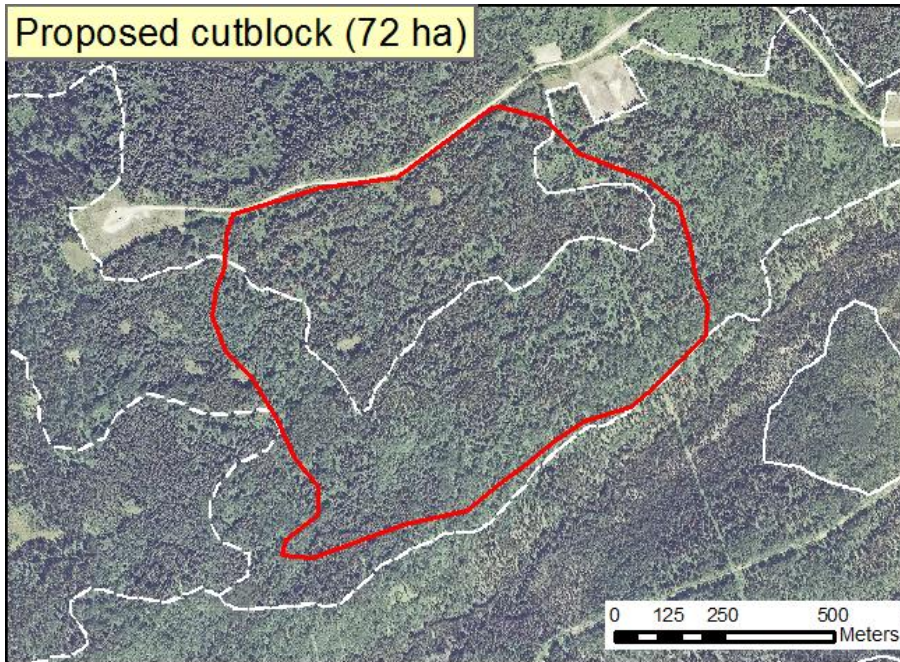
3) Intersect the proposed cutblock boundary with the Fisher Habitat Spatial Data and update the area for the resulting polygons. Make sure that the output layer is saved as a feature class in a file geodatabase (i.e., not a stand-alone shapefile) or else the field aliases will be lost. In this example, the proposed cutblock is comprised of 2 polygons from the Fisher Habitat Spatial Data, which we have labelled Unit "A" and "B".

Proposed cutblock (72 ha)
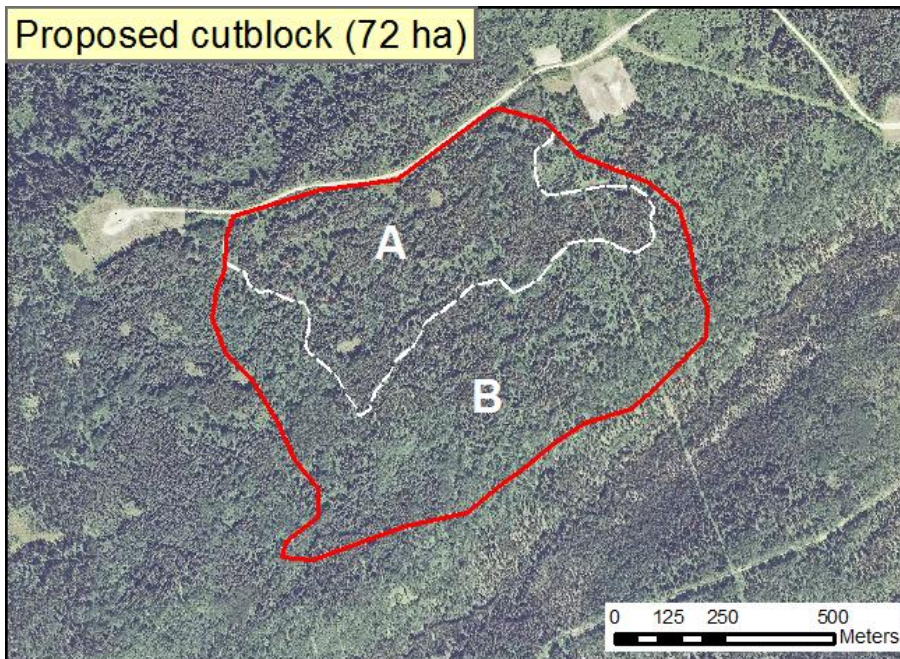
4) Examine the resulting attribute table to identify warnings and determine retention targets for the proposed block. Consider exporting the attribute data to Excel for ease of compilation using the Table to Excel (Conversion) tool, making sure the "Use field alias as column header" is selected. We have transposed the output into the following attribute table for these 2 units within the proposed cutblock:

	Attribute	Unit A	Unit B
	Area (ha)	29	43
Denning	Denning: Stand condition	Type II	Type I
	Denning: Landscape condition	Below	Below
	Denning: Landscape warning	none	RECONSIDER HARVEST - supply of Type I stands in landscape is below target
	Denning: Retention target	Retain 1.6 potential den trees (i.e., Acb >52 cm dbh or At >40 cm dbh)/ha	If harvest must proceed, retain 10.0 potential den trees (i.e., Acb >52 cm dbh or At >40 cm dbh)/ha
	Denning: Structural attributes	Acb >52 cm dbh or At >40 cm dbh	
Broom resting	Broom resting: Stand condition	Type II	Type I
	Broom resting: Landscape condition	Above	Above
	Broom resting: Landscape warning	none	none
	Broom resting: Retention target	Retain 0.05 potential rest trees (i.e., Sw >31 cm dbh or Sb >17 cm dbh with rust brooms)/ha	Retain 2.0 potential rest trees (i.e., Sw >31 cm dbh or Sb >17 cm dbh with rust brooms)/ha
	Broom resting: Structural attributes	Sw >31 cm dbh or Sb >17 cm dbh with rust brooms	
CWD resting	CWD resting: Stand condition	Type II	Type II
	CWD resting: Landscape condition	Below	Below
	CWD resting: Landscape warning	None	none
	CWD resting: Retention target - Single piece CWD	Retain 0.4 potential CWD rest logs (i.e., Hard logs >30 cm diameter, >11 m in length, and elevated 25-50 cm above ground)/ha	Retain 0.4 potential CWD rest logs (i.e., Hard logs >30 cm diameter, >11 m in length, and elevated 25-50 cm above ground)/ha
	CWD resting: Structural attributes - Single piece CWD	Hard logs >30 cm diameter, >11 m in length, and elevated 25-50 cm above ground	
	CWD resting: Retention target - CWD piles	Create 0.25 CWD piles/ha that are >3 m x 5 m x 2 m high, with >30% of pieces >20 cm diameter and >3 m long	Create 0.25 CWD piles/ha that are >3 m x 5 m x 2 m high, with >30% of pieces >20 cm diameter and >3 m long

5) From this analysis, a planning forester should first note that Unit B is a **Type I** stand for **Denning** in a landscape where the density of these stands is **Below** that which is expected to support a fisher (yellow cell in table). Thus, it would be prudent to reconsider harvest of this unit by securing volume in Type II stands elsewhere in this area, as the effect of harvesting the Type I Unit B would be to further reduce the supply of this habitat in the landscape and possibly making that area unable to support fishers in the short- and mid-term.

6) The next step is for the planning forester to calculate the total number of each type of structure that should be targeted for retention within the proposed cutblock. This is achieved by multiplying the retention target (# stems/ha) by the total area (ha) of each unit in the cutblock. For the proposed cutblock above, this converts to following retention table:

Total retention target	Unit A	Unit B
Denning: Total number of trees to retain in unit	46 stems	430 stems
Denning: Structural attributes to retain	Acb >52 cm dbh or At >40 cm dbh	
Broom resting: Total number of trees to retain in unit	2 stems	86 stems
Broom resting: Structural attributes to retain	Sw >31 cm dbh or Sb >17 cm dbh with rust brooms	
CWD resting: Total number of single pieces to retain in unit	12 pieces	17 pieces
CWD resting: Structural attributes of single pieces of CWD	Hard logs >30 cm diameter, >11 m in length, and elevated 25-50 cm above ground	
CWD resting: Total number of CWD piles to create in unit	7 piles	11 piles
CWD resting: Retention target - CWD piles	CWD piles/ha that are >3 m x 5 m x 2 m high, with >30% of pieces >20 cm diameter and >3 m long	

7) This information can then be incorporated into site plans or as direction to layout crews to plan the block layout to achieve these cutblock-specific targets.

Limitations of Use

This spatial data contains specific information on habitat use of fishers in British Columbia based on research conducted in the province over the past 25 years. The information represents the best available information to conserve fisher habitat during forest management operations in B.C. Any guidance is intended to inform resources professionals and is not to be interpreted as direction nor is it legally binding.

By using this data, you acknowledge that:

- The sole intent of this spatial data is to identify retention targets for fisher habitats in forestry operations.
- This data is not a predictive model and does not predict habitat suitability, capability, or importance and therefore is not appropriate for analyzing the effects of developments on fishers or their habitats.
- The model uses VRI, RESULTS, consolidated cutblock, and permitted harvest unit spatial data to characterize fisher habitat and, therefore, is subject to the strengths and limitations inherent with these data sets, including inaccuracies and imprecision which may be considerable in some areas.
- The model is imperfect. Stands identified as Type I fisher habitat may or may not include the habitat features that fishers necessarily need for the specified life activity. Ground-truthing is required to confirm habitat conditions.
- This spatial data is subject to change as additional data becomes available.
- To ensure spatial data is up-to-date and to find additional information and forest management planning tools please visit www.BCfisherhabitat.ca.

How the Spatial Data Was Generated

The spatial data is generated using data from radiotagged fishers and Rank 1 polygons in the provincial Vegetation Resources Inventory (VRI) spatial data. VRI data was updated with forest harvesting data available within the Reporting Silviculture Updates and Land Status Tracking System (RESULTS), Harvested Areas of BC (Consolidated Cutblocks), and permitted harvest units available within Forest Tenure Harvesting Authority data available on DataBC.

Spatial Data Compilation Process

1. **IDENTIFY CHARCTERISTICS OF TYPE I STANDS FROM EMPIRCAL DATA**. Within each Fisher Habitat Zone, we identified stands that accounted for 75% of radiolocations of fishers for each habitat need. We then recorded attributes that were consistently available in the VRI data (e.g., species composition of canopy, quadratic mean diameter, canopy closure) to identify *Type I* stands. That is, Type I stands are expected to account for 75% of the use by fishers for each specified habitat need.

2. **ESTIMATE DENSITY OF TYPE I STANDS NEEDED TO SUPPORT FISHERS FROM EMPIRICAL DATA**. We calculated the density of Type I stands for each habitat need that occurred in the home ranges of radiotagged fishers (females only). The *Target Density* was determined by identifying the density of Type I stands for each habitat need that was found in at least 75% of the home ranges.

3. **IDENTIFY TYPE I STANDS IN FISHER HABITAT ZONES**. The attributes of Type I stands (for each habitat need; identified in Step 1) were applied to VRI spatial data to identify Type I stands within each Fisher Habitat Zone. All stands not identified as Type I are identified as *Type II*. This is the "stand condition" for each polygon in the VRI.

4. **REMOVE HARVESTED AREAS (NEW AND PERMITTED) FROM TYPE I STANDS**. To update new forest harvest information in the VRI data, we converted to Type II stands those Type I polygons that were recently harvested (clearcut only; RESULTS, Consolidated Cutblock) or are currently permitted cutblocks (Harvest Authorizations).

5. **CALCULATE THE DENSITY OF TYPE I STANDS IN FISHER HABITAT ZONES**. The density of Type I stands (for each habitat need) that occurs within a home-range radius of each point (1 ha pixel) in the landscape was calculated for the entire Fisher Habitat Zone. Using the target density identified in Step 2, the current "Landscape condition" was determined to be: *Above* when density was ≥85th percentile of empirical data, *Near* when density was 75th-85th percentile of empirical data, or *Below* when density was <75th percentile of empirical data.

6. **COMBINE STAND CONDITION AND LANDSCAPE CONDITION DATA INTO ONE LAYER**. Union the Stand condition dataset (Steps 3-4) with the Landscape condition dataset (Step 5) into one layer that has both attributes associated with polygon data. Possible outcomes for each resulting polygon are found in the matrix below:

Landscape condition	Stand condition	
	Type I	Type II
Above target density		
Near target density	W	
Below target density	W	

7. **FLAG TYPE I STANDS IN LANDSCAPES WHERE THEIR DENSITY IS NEAR OR BELOW TARGET**. In landscapes where the density of Type I stands was below or near the Target Density, identify a warning to inform data users that these stands are rare on the landscape and harvest of these stands would diminish the supply of this habitat below that which has been shown to support fishers. This information is relayed in the "Landscape warnings" field in the spatial data. These are the data identified as "W" in the matrix in Step 6.

8. **USE EMPIRICAL DATA TO IDENTIFY RETENTION TARGETS FOR SPECIFIED STRUCTURES WITHIN PROPOSED HARVEST UNITS.** We conducted field evaluations at random locations within Type I and forested Type II stands for each Fisher Habitat Zone to estimate the normal density (stems/ha) of identified structures for each habitat need (e.g., trees suitable as reproductive dens) in undisturbed stands. Different retention targets were identified for each habitat need.

Retention targets for each combination of stand and landscape condition were generated using the following approach:

Landscape condition	Stand condition	
	Type I	Type II
Above target density	25% of normal density in undisturbed Type I stands	25% of normal density in forested Type II stands
Near target density	75% of normal density in undisturbed Type I stands	75% of normal density in forested Type II stands
Below target density	100% of normal density in undisturbed Type I stands	100% of normal density in forested Type II stands

For example, if a proposed cutblock has a Type I stand condition and a landscape condition that is above the target density for a specific habitat need, then the retention target for the specified structural attribute (e.g., den-sized trees) for that habitat need would be 25% of the density of that attribute that is normally found in an undisturbed Type I stand.

Note that Retention targets are identified for both single pieces of CWD and CWD piles in planned cutblocks.