Hinton Wood Products
*A division of West Fraser Mills Ltd.*

Edson Forest Products
A division of West Fraser Mills Ltd.

# Grizzly Bear
# Habitat Conservation Strategy

**Version 4**
**October 24, 2014**

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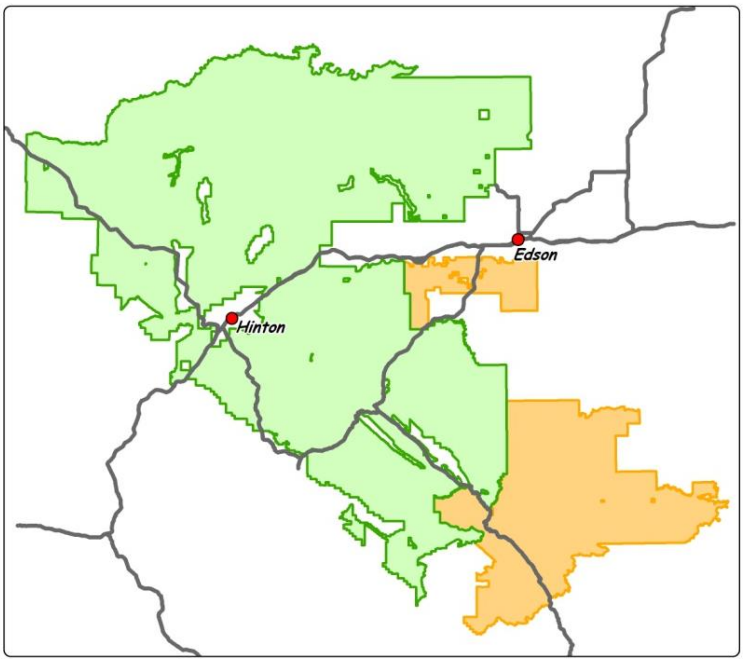
# PREFACE

Hinton Wood Products and Edson Forest Products are Divisions of West Fraser Mills Ltd. Hinton Wood Products manages Forest Management Agreement 8800025 and Edson Forest Products manages Forest Management Agreement 9700032. The Forest Management Areas (FMA) associated with the Agreements border each other in west central Alberta. Each has a separate Forest Management Plan. A single Woodlands Department (hereafter, West Fraser) representing Hinton Wood Products and Edson Forest Products manages both FMA.

West Fraser is certified to the Sustainable Forestry Initiative[1] Standard, which requires signatories to have biodiversity conservation programs, especially for species at risk designated by relevant governments. The West Fraser Species at Risk (SAR) Guide (West Fraser 2014) describes species and ecological communities that are mandatory content to meet SFI requirements, plus additional species and communities that West Fraser includes as voluntary good practice. The SAR Guide is a document that provides identification and basic forest management direction for each species or community. The SAR Guide references a more detailed Species Conservation Strategy, which contains additional information about West Fraser habitat management to direct forest management and conservation.




*Hinton Wood Products (green) and Edson Forest Products (yellow) Forest Management Areas.*

West Fraser has one target related to Species Conservation Strategies:

1. Target #1 – Complete species conservation strategies for all species at risk (SARA and Alberta designations) within 6 months of designation, update strategies at least every 2 years and report on results of strategies annually.

Species conservation strategies are developed by West Fraser and reviewed, endorsed, and approved as a cooperative program between West Fraser and Alberta Environment and Sustainable Resource Development.

[1] http://www.sfiprogram.org/

## SUMMARY

The grizzly bear (*Ursus arctos*) is the larger of 2 FMA bear species. Global grizzly bear[2] distribution declined by more than 50% during the 1800s and a large part of currently occupied North American range is in western Canada (COSEWIC 2012). Historic declines in grizzly bear distribution and numbers were related to large scale landscape alterations (e.g. agriculture and settlement) and widespread killing by humans. Grizzly bears were killed because they were considered a threat to human safety and competitors for resources humans wanted. Today human-caused habitat changes and human-caused mortality are the still the primary factors affecting grizzly bear distribution and populations.

The Canadian grizzly bear population was estimated at 26,000 (year of estimate not provided) with no evidence of a decline in the overall population size during the past 20 years (COSEWIC 2012). Over that period there was some evidence of ongoing range expansion and contraction in local areas. The Alberta grizzly bear population size was estimated at 691 grizzly bears based on a series of estimates collected from 2004-2009 (ASRD and ACA 2010). The estimates for Bear Management Unit 2 (Grande Cache) and 3 (Yellowhead) were 39 (2004: 95% CI 36-55) and 271 (2008: 95% CI 288-516) respectively. The FMA is contained within these two BMUs. FMA-specific population estimates have not been estimated.

The Alberta population of the grizzly bear was designated in the Alberta Wildlife Act as Threatened in 2010. The western population of the grizzly bear was assessed as Special Concern in May 2012 (COSEWIC 2012).

Grizzly bears are carnivores with an omnivore diet. They eat many different foods including green vegetation, berries, fruits, roots, insects and other arthropods, and a wide variety of other animals and food sources. Grizzly bears are also apex predators capable of killing the largest animals that they have access to. Food is obtained from a wide variety of habitats that grizzly bears use selectively according to seasonal food availability. Generally green vegetation is important early in the season and fruits are important later. Grizzly bears eat animal protein in all seasons when opportunity arises. Grizzly bears can be described as both habitat and food generalists. Grizzly bears are active throughout the day during spring, summer, and fall, with periods of activity interspersed with rest periods. They are often active at night as well. They enter winter hibernation dens in [November] and emerge in [March].

Grizzly bears are found throughout the FMA but are most abundant in western areas. Individual bears have large home ranges.

Grizzly bears opportunistically use habitats in relation to food availability but also as resting areas and areas to provide security, especially to avoid human disturbance. Recently disturbed and other early seral habitats often have abundant preferred food resources. These habitats include cutblocks, burned areas, natural and anthropogenic openings and non-forested areas, and sites with local food sources such as agricultural areas and human waste.

Application of ecosystem-based management (EBM) will provide abundant food resources interspersed with cover for grizzly bears over the long term. West Fraser will contribute to reducing human-caused mortality by managing West Fraser access (primarily roads) using the life cycle approach and cooperating with others including the energy sector and governments to develop and implement Regional Access Plans to manage the overall surface footprint on the FMA. This will combine with human use management directed by the Government of Alberta toward minimizing human-caused mortality.

[2] The brown bear is known as the grizzly bear in North America and the brown bear in the rest of the world.


*Radio-collared grizzly bear foraging on succulent grass seeded on a road right-of-way. Grizzly bears are attracted to food sources such as this but their use of habitats close to human activity increases the risk of human-caused mortality.*

## INTRODUCTION

The brown bear (*Ursus arctos*) occurs in North America and Europe. By convention brown bears are called grizzly bears in North America. Historic and present distribution in North America is shown in Figure 1 and Figure 2. Both grizzly bears and black bears (*Ursus americanus*) occur throughout the FMA. Adult grizzly bear males weigh 200-300 kg and adult females weigh 100-200 kg (ESRD 2008). Grizzly bears have a distinctive shoulder hump and a dished facial profile whereas black bears have no shoulder hump and a straight facial profile. Coat colour is variable in both species. Grizzly bears usually have brown to grey or black coats and the hairs are often lighter at the tips, creating a 'grizzled' appearance.

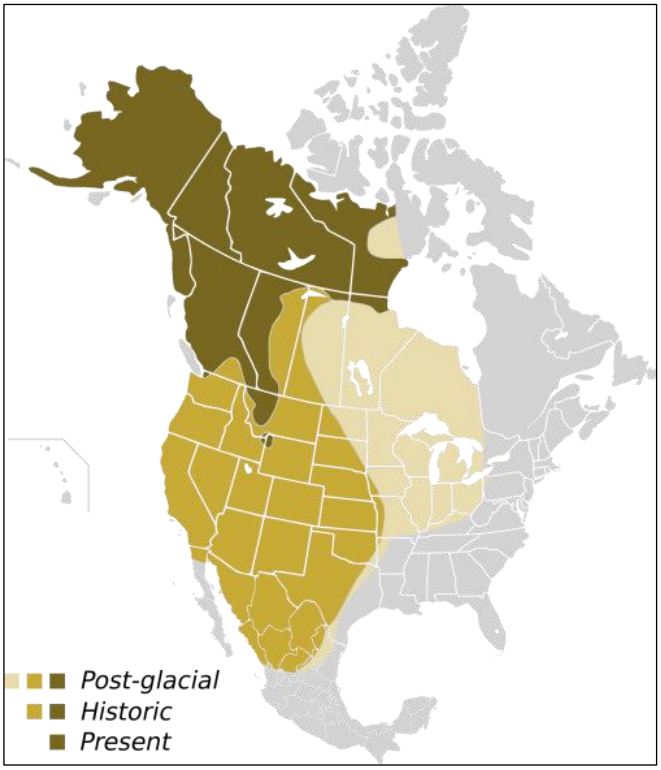



**Figure 1** – *Post-glacial, historic, and present North America range of the grizzly bear (Wikipedia)*

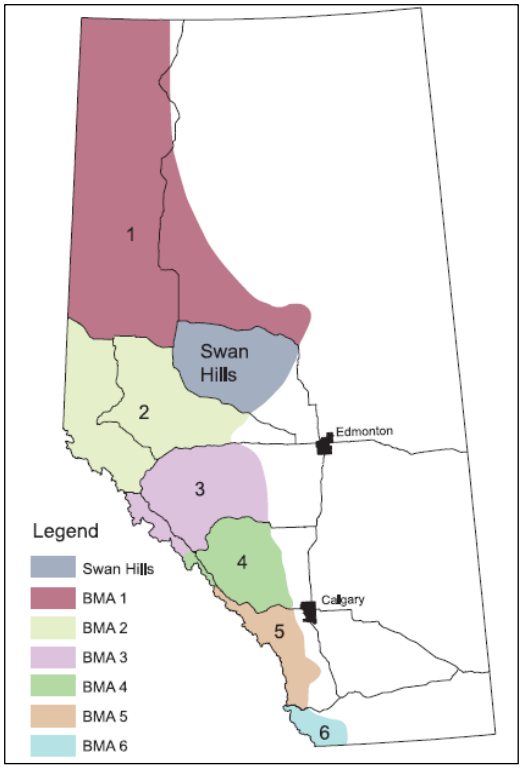



**Figure 2** – *Grizzly bear "Bear Management Areas" in Alberta, Canada (AESRD 2013)*

The grizzly bear is a habitat generalist that uses many habitats to obtain life requisites. Food-producing habitats are the most important for general needs. More specialized needs include habitats used for resting (e.g. day beds) and winter dens. Secure habitats are defined as areas where bears can obtain life requisites away from human influence.

Grizzly bear females first breed between 4 and 8 years of age (Herrero 1978, Garshelis et al. 2003) and have 1-3 cubs per litter. Cubs stay with their mother for up to 2 years (reference). The average reproductive rate in Alberta is 0.2 cubs/adult female per year (Boulanger and Stenhouse 2009).

Grizzly bears hibernate during winter months in dens that are either natural features or excavated by the bears. On the FMA grizzly bears emerge from dens March to April and enter dens from October to November.

## CONSERVATION STATUS

The IUCN Red List of Threatened Species ranked the brown (grizzly) bear as Least Concern in 2013 (IUCN 2014). The western population of the grizzly bear in Canada was assessed as Special Concern in 2012 (COSEWIC [2012]. The grizzly bear was designated as Threatened in Alberta in 2010. See Table 1.

**Table 1** – *Conservation status of the grizzly bear*

| Year | IUCN | Year | COSEWIC/SARA | Year | Alberta Wildlife Act |
|---|---|---|---|---|---|
| 2008 | Least Concern | 2012 | Special Concern | 2010 | Threatened |

## POPULATION STATUS

Grizzly bear range and population size in North America declined from historic levels during the European settlement period but have remained at more stable levels in recent decades (reference). Settlement-era declines in grizzly bear distribution and numbers were related to large scale landscape conversions (e.g. agriculture and settlement) and widespread killing by humans (reference). Grizzly bears were killed because they were considered a threat to human safety and competitors for resources humans wanted. Today human-caused habitat changes and human-caused mortality are the still the primary factors affecting grizzly bear range and populations.

The estimated world population in 2008 was about 200,000 with 33,000 in the United States and 25,000 in Canada (McLellan et al. 2008). The Canadian grizzly bear population was estimated at 26,000 (year of estimate not provided) with no evidence of a decline in the overall population size during the past 20 years (COSEWIC 2012). Over that period there was some evidence of ongoing range expansion and contraction in local areas (COSEWIC 2012).

The Alberta grizzly bear population size was estimated at 691 grizzly bears (no confidence estimate) based on a series of estimates collected from 2004-2009 (ASRD and ACA 2010). The provincial estimates excluded portions of Banff and Jasper National Parks. The estimates for Bear Management Unit 2 (Grande Cache) and 3 (Yellowhead) were 39 (2004: 95% CI 36-55) and 271 (2008: 95% CI 288-516) respectively. The FMA is contained within these two BMUs (Figure 2). FMA-specific population estimates have not been completed.

## FMA OBSERVATIONS

Grizzly bears are found throughout the FMA but are most abundant in western areas. Individual bears have large home ranges. Grizzly bear telemetry locations from 2004-2013 (Foothills Research Institute (fFI) 2014) are shown in Figure 3 (map provided by fRI).

West Fraser reports grizzly bear sightings to the fRI which in turn updates the Government of Alberta Fisheries and Wildlife Management Information System (FWMIS: AESRD 2014).

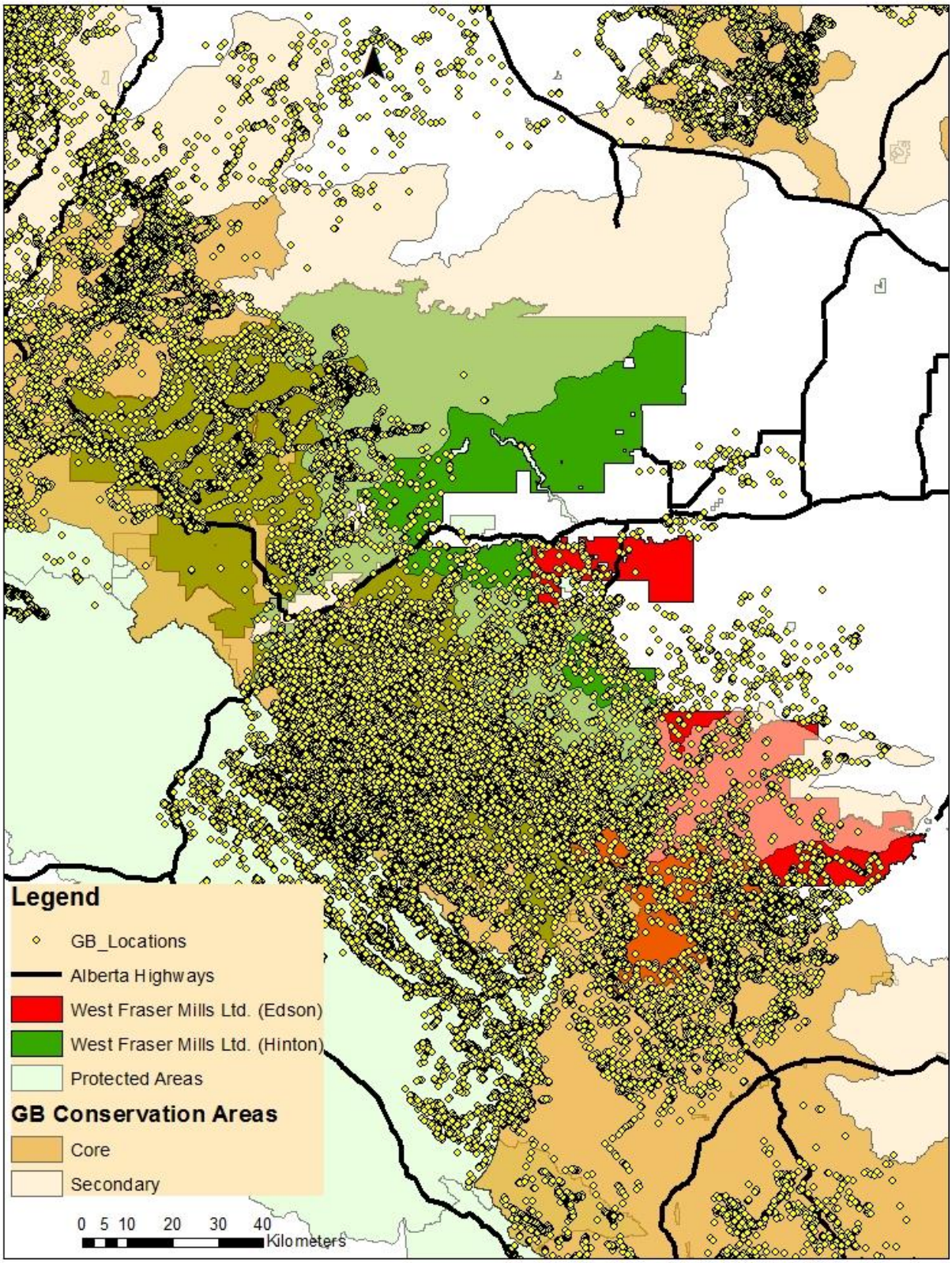



**Figure 3** – *Grizzly bear management zones in FMA region and grizzly bear telemetry locations*

## LIMITING FACTORS

There are a number of limiting factors to maintaining or increasing grizzly bear populations. These limiting factors include the following:

### A. Habitat Loss and Alteration

Grizzly bears are considered to be habitat generalists that use many habitats in relation to seasonal food availability (AESRD and ACA 2010). Habitat loss for grizzly bears usually means conversion of food-producing habitat to non-producing habitat and includes loss related to settlements, reservoirs, and vegetation removal (e.g. roads and surface mines). These kinds of habitat loss may be permanent (e.g. reservoir, permanent road) or temporary (e.g. surface mine, temporary road). Permanent habitat loss due to roads on the FMA is low (<2% to date).

Effective habitat loss occurs where grizzly bears are either excluded from or behaviourally reduce use of otherwise suitable habitat in relation to human factors. These could include areas with high levels of human activity (e.g. heavy motorized traffic, settlements) and areas where humans do not support bear presence, resulting in bear mortalities or translocations. Known areas like this on or near the FMA include settlements (Hinton, Robb, Cadomin, and Edson) and the Highway 16 corridor.

Grizzly bear habitat constantly changes in response to both natural and anthropogenic disturbances and habitat succession following disturbance. Habitat suitability for grizzly bears changes concurrently. Habitat alteration for grizzly bears means any alteration of a habitat that could change bear behaviour or survival, or changes resources that bears need. Alterations that cumulatively remove or reduce bear habitat or bear use of habitat could be considered limiting factors. These include alteration of habitats that reduce food production over the short term if that reduction cumulatively limits bear population size over the same time period. Forest management that approximates the natural disturbance regime (mainly forest fires) should provide a continuing supply of suitable grizzly bear habitat over time.

Alterations could also include high levels of human activity which some bears may avoid, and increases in human activity that could increase risk of human-caused mortality. Mortality risk is covered in a separate section.

### B. Food Supply

The grizzly bear has an omnivore diet and eats many different types of food. Many food items are only seasonally available and there is considerable annual variation in some major food sources, especially berry crops. In years where key food resources (usually berry crops) are limited grizzly bears wander widely in search of food.

Adequate quantities or high quality food are necessary on an annual basis for each bear to put on enough fat reserves to last through hibernation. Bears that enter dens with insufficient fat may not survive. For successful reproduction females must enter dens with enough fat to complete their pregnancy and nurse cubs. Cubs are born while the female is still in hibernation in the den.

### C. Predation

Grizzly bears are at the top of the food chain and predation by other species is not a significant limiting factor. Adult males sometimes kill cubs (McLellan 2005). Wolves may rarely kill grizzly bears (Gunther and Smith 2004).

### D. Human-caused Mortality

Most known grizzly bear mortalities are directly related to human causes. Over a 10 year period from 2004-2013 165 of 186 (89%) known grizzly bear deaths in Alberta were attributed to human causes (ESRD 2014). Of these, 62 (38%) human-caused bear deaths were related to bears that died during hunting

seasons when large numbers of hunters use grizzly bear range. The next most important factor was illegal killing at 43 (26%) of human-caused bear deaths.

Human-caused mortality was closely linked to the nearness of roads to grizzly bears – where road densities were high, there was a greater chance that humans would come into contact with grizzly bears; and more human encounters with grizzly bears represented a higher mortality risk for the bears. The 2008 Alberta Grizzly Bear Recovery Plan (ASRD 2008) proposed interim targets for open route density[3] of 0.6 km/km$^2$ in core grizzly bear habitat and 1.2 km/km$^2$ in secondary grizzly bear habitat. These targets were to be replaced with more comprehensive mortality risk targets as they were developed. The Government of Alberta modified the open route determination to include only open roads[4] and developed maps showing core and secondary grizzly bear range. However the Government did not develop processes to apply the recommended targets as part of access management. Recent research determined that thresholds of 0.6 km/km$^2$ and 0.85 km/km$^2$ open road densities in individual Bear Management Units were correlated with higher levels of mortality risk in Alberta.

Mortality risk is an enhancement to open route or open road density because it includes additional factors that influence grizzly bear mortality risk. The fRI developed a mortality risk model that incorporates visibility from roads and other corridors and produces a "risk surface" map. However the model does not presently incorporate the level or type of human use, which would improve mortality risk estimates.

## E. Security and Safe Harbour

Secure areas are essentially the inverse of road density. They represent areas where grizzly bears are away from human presence (roads) and are able to securely use habitat with reduced risk of human contact or human-caused mortality. Safe harbours are areas with low mortality risk with high RSF values.

## F. Other Factors

There is no good information on the role of accidents, parasites and diseases, weather, etc. in relation to the grizzly bear. These factors are generally not considered to be major limiting factors.

The Foothills Research Institute (fRI) has developed several tools to evaluate grizzly bear habitat and its limiting factors, which include the following:

1. Resource Selection Function

According to the fRI's Grizzly Bear Program User Guide (May 31, 2014), resource availability is represented by the Resource Selection Function (RSF) model (Nielsen, 2002), which predicts relative probability of bear occurrence, classified into 10 ordinal bins. Bear occurrence, or occupancy, is used in this model as a surrogate for the abundance and distribution of various habitat resources including food, water, denning sites, and thermal cover. Models have been developed for three seasons (spring, summer and fall), and for six population units (Livingstone, Castle, Clearwater, Yellowhead, Grande Cache, and Swan Hills), based on differences in resource use seasonally and between regional population groups. (The Livingstone and Castle RSFs have been combined due to their similarity and size). The models are based on regression analysis of at least 2 years of grizzly bear location data collected by GPS radio collars, combined with six basic landscape variables: land cover type (eight broad vegetation classes (McDermid, 2005)), canopy cover, conifer/deciduous mix, streams, regenerating forest mask, and Compound Topographic Index (CTI), a measure of soil wetness.

Figure 4 shows RSF for the mountains and Foothills area of central Alberta, including HWP's FMA area (outlined in black on the map).

[3] Open route density is the density of all routes that can be used by a motorized vehicle and are open to unrestricted motorized use.
[4] Open road density is the density of all roads ≥ 1.7 m wide that can be used by a motorized on-highway (generally, a 4x4) vehicle and are open to unrestricted motorized use.

2. Mortality Risk

According to the fRI's Grizzly Bear Program User Guide (May 31, 2014), habitat security is represented by the mortality risk model (Nielsen 2004), which predicts the relative probability of human-caused mortality as a function of landscape variables including terrain, proximity to roads and trails, and regional land-use. The model is based on multivariate logistic regression analysis of 297 anthropogenic grizzly bear mortalities that occurred within the Central Rockies Ecosystem (CRE) between 1971 and 2002. The model is derived from six base inputs: land cover, terrain ruggedness (TRI), and proximity to roads and trails, White Zone (agricultural areas), streams, and protected areas.

Figure 5 shows mortality risk for the mountains and Foothills area of central Alberta, including HWP's FMA area (outlined in black on the map).

3. Habitat Model: Food

According to the fRI's Grizzly Bear Program User Guide (May 31, 2014), the suite of food models includes absolute probability (scaled 0 to 1) and binary (presence/absence) surfaces for 20 forage species or food groups, as well as composite models for 10 semi-monthly periods (May to September) based on seasonal changes in diet (Nielsen, 2003; Munro et al, 2003). The food models cover the Clearwater, Yellowhead, Grande Cache, Swan Hills, and Alberta North population units. A version of GBtools can update the food models within the Yellowhead and Grande Cache core and secondary conservation areas to predict the effect of forest harvesting on grizzly bear food supply.

Figure 6 shows potential food value for the mountains and Foothills area of central Alberta, including HWP's FMA area (outlined in black on the map).

4. Safe Harbour Index

The concept of safe harbour is an area within a watershed or population unit where there is high quality grizzly bear habitat (high RSF scores) combined in both space and time with low levels of grizzly bear mortality risk. These safe harbours therefore contain both food and security for grizzly bears. Safe harbours are expected to move over time, along with forest succession and the management of access life spans, across the landscape.

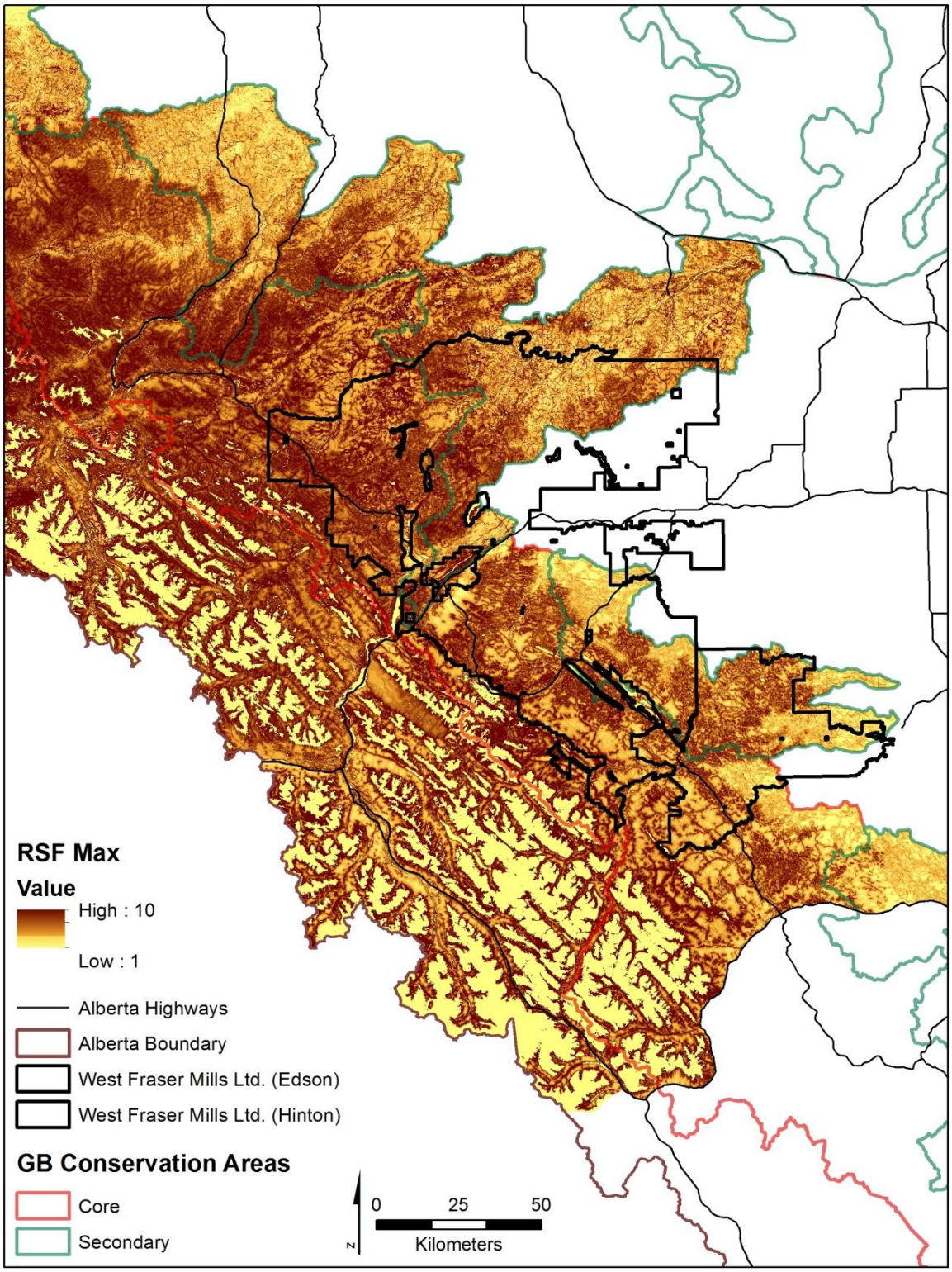



**Figure 4** – *Resource Selection Function for grizzly bear in the mountains and foothills of central Alberta*

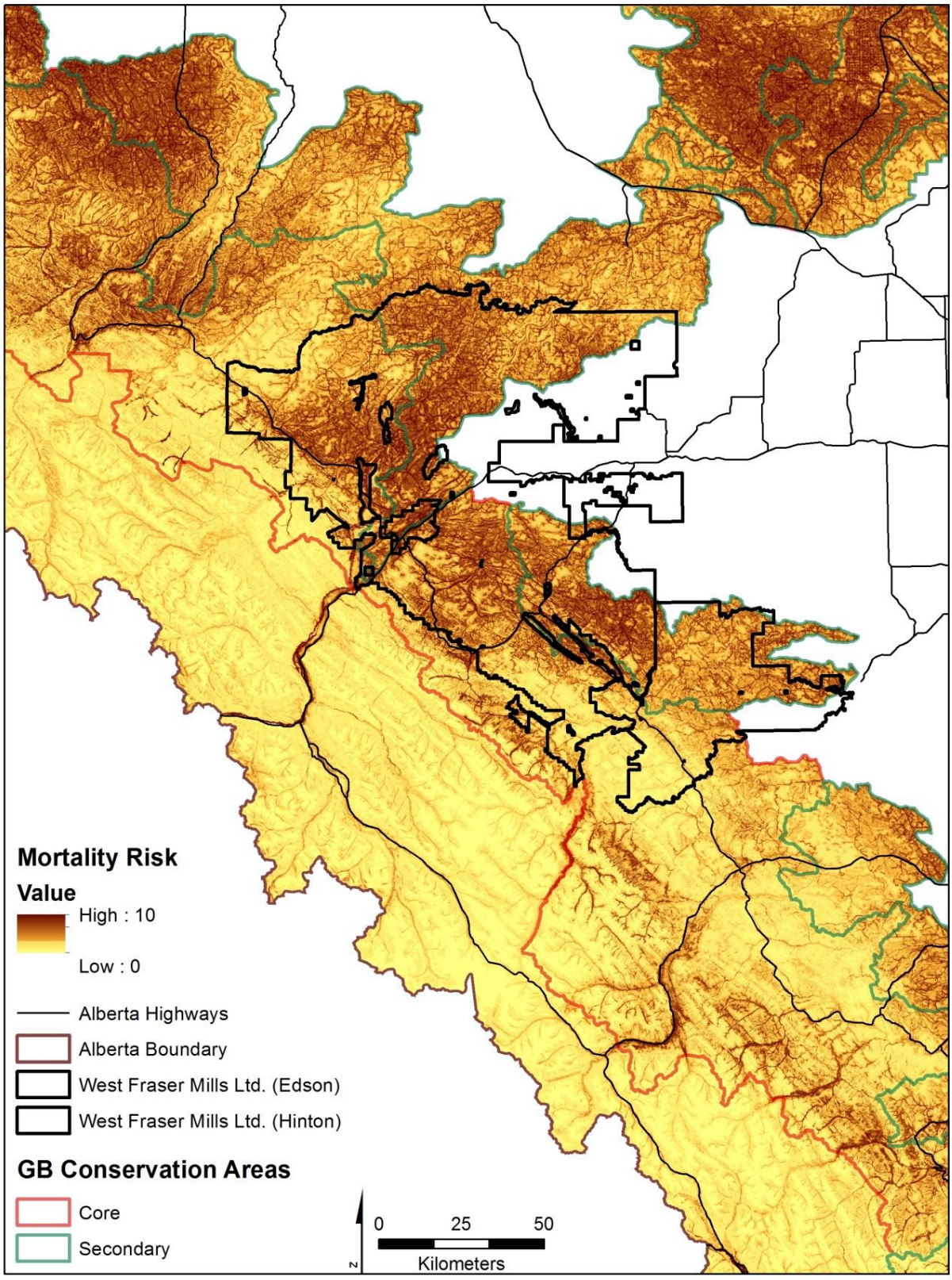



**Figure 5** – *Mortality risk for grizzly bear in the mountains and foothills of central Alberta*

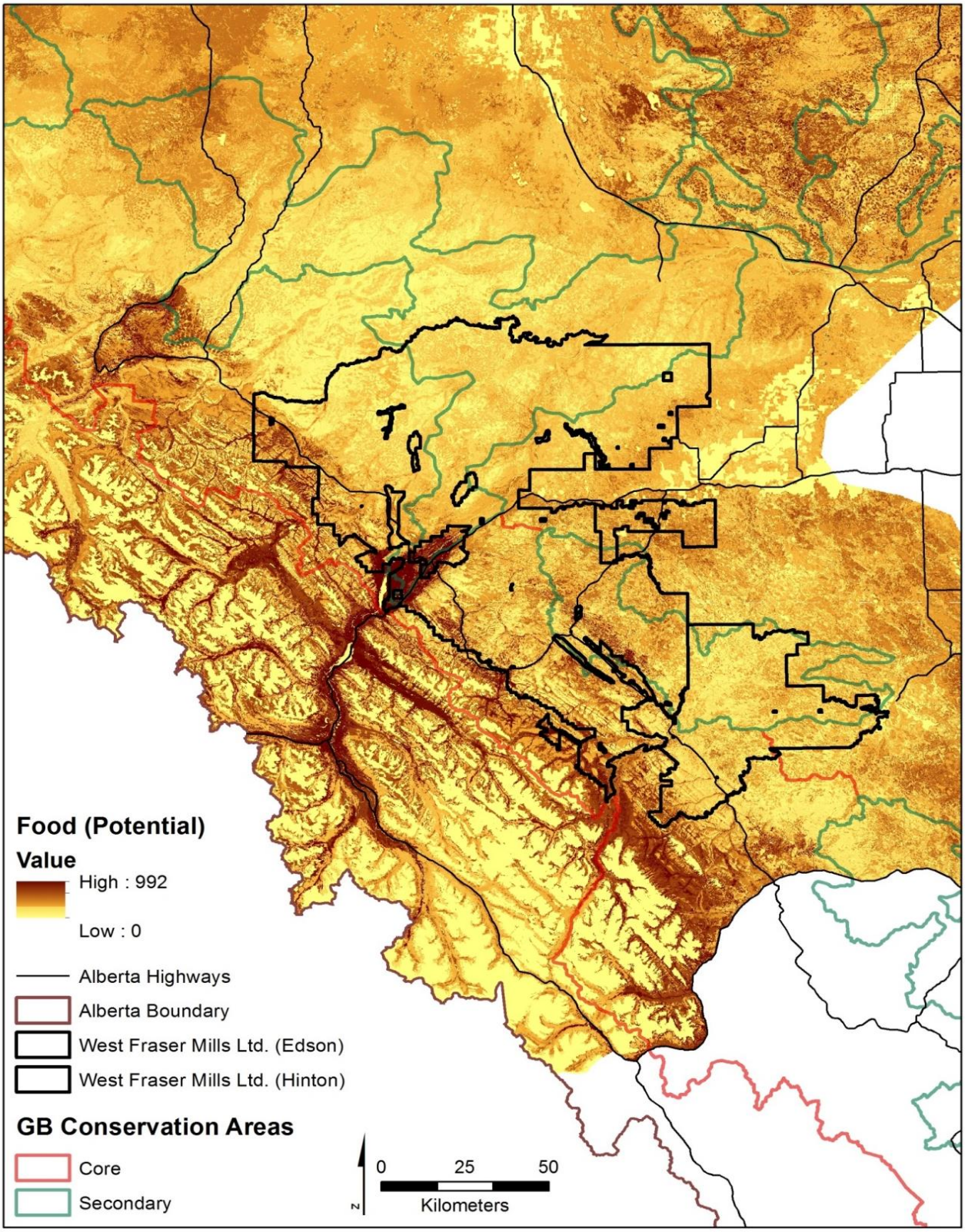



**Figure 6** – *Food (potential) value for grizzly bear in the mountains and foothills of Alberta*

## HABITAT MODELING RESULTS FOR THE HINTON FMA

Modelling of a number of key limiting factors to grizzly bear habitat was run for the Hinton FMA area. The results of this modeling are described in the following sections:

### A. Open Route Density

Open route densities are used as a surrogate measure to quantify the reduction of grizzly bear survival rates that can occur in habitats with open access features. It is important to recognize that at low population levels increased human caused mortality may exceed the capacity of grizzly bear population levels to be sustained.

These densities are part of the thresholds identified for the management of the Core and Secondary grizzly bear conservation areas. In Core Areas the open route density threshold is 0.6 km/km2, while the open route density threshold in Secondary GBWUs is 1.2 km/km2. Open Route Densities are defined as the total length of all open routes divided by the area of each grizzly bear watershed unit. Only access routes accessible to a motorized vehicle with an overall width of 1.65 m (65”), typically a 4-wheel drive truck, were classified. The open route data has been used to calculate a baseline "open route density" for Core and Secondary grizzly bear conservation areas. Only the portions of GBWU that overlap the FMA are included. Open roads include all existing LOC roads in the West Fraser database that have not been deactivated or reclaimed. Roads that have barriers were considered to be open.

Open road densities for HWP roads and all roads for Grizzly Bear Watershed Units that overlap the Hinton FMA are presented in Table 2. Calculations for the Edson FMA have not been completed. Table 2 also outlines the difference between HWP owned roads and roads owned by other users.

In both Core and Secondary GBWUs the objective is to maintain or reduce current levels of open route density. These objectives are most likely to be met through Integrated Land Management and HWP’s Long Term Access Plans (see Appendix 13 in the 2014 DFMP).

West Fraser participated in the development of the Berland Smoky Regional Access Development Plan, which is an Integrated Land Management access planning initiative initiated by the Foothills Landscape Management Forum in partnership with the Government of Alberta. One of the objectives was to assess open road density for the planning area. This demonstrated the value of a collaboration to develop access footprint innovation.

### B. Resource Selection Function

Resource selection function models (RSF) are used as a surrogate measure of grizzly bear habitat supply and quality. The model outputs are spatially explicit and are a probability surface to indicate the probability of grizzly bears occurring on the landscape. Research shows a relationship between high RSF values and the current presence and distribution of grizzly bears as determined by DNA population inventory work. These RSF models incorporate both grizzly bear habitat use and human use of the landscape.

At the present time we do not fully understand the relationship(s) between population size and habitat supply as measured by RSF scores. However maintaining or increasing RSF scores, in both space and time, in grizzly bear conservation areas is a focus of management actions.

In Core GBWUs, the objective is to maintain or increase the current maximum RSF values; while in Secondary GBWUs, the objective is to increase current maximum RSF values.

**Table 2** – *Road Densities in Core and Secondary Grizzly Bear Watershed Units – Gross FMA Landbase*

| Grizzly Bear Population Unit | Grizzly Bear Watershed Unit | Habitat Type | HWP Open All-Weather Forestry Roads | | | All Other Open All-Weather Non-HWP Roads | | | Total Road Density all open roads Year 0 (2012) |
|---|---|---|---|---|---|---|---|---|---|
| | | | Year 0 (2012) | | | Year 0 (2012) | | | |
| | | | Road Length | Area (km sq) | Rd. Density (km/km sq) | Road Length | Area (km sq) | Rd. Density (km/km sq) | |
| Grande Cache | G38 | Core | 84.95 | 454.1 | 0.187 | 35.19 | 454.1 | 0.077 | 0.265 |
| | G42 | Core | 222.95 | 537.6 | 0.415 | 112.93 | 537.6 | 0.210 | 0.625 |
| | G44 | Core | 216.42 | 728.6 | 0.297 | 98.7 | 728.6 | 0.135 | 0.433 |
| | G46 | Core | 18.37 | 229.1 | 0.080 | 44.28 | 229.1 | 0.193 | 0.273 |
| | G50 | Core | 80.06 | 232.2 | 0.345 | 49.6 | 232.2 | 0.214 | 0.558 |
| | G58 | Core | 29.64 | 107.1 | 0.277 | 10.57 | 107.1 | 0.099 | 0.375 |
| | | ***Core Totals*** | 652.39 | 2288.7 | ***0.285*** | 351.28 | 2288.7 | ***0.153*** | ***0.439*** |
| | G28 | Secondary | 3.03 | 58.0 | 0.052 | 24.3 | 58.0 | 0.418 | 0.471 |
| | G31 | Secondary | 40.01 | 204.2 | 0.196 | 147.2 | 204.2 | 0.721 | 0.917 |
| | G36 | Secondary | 175.69 | 376.7 | 0.466 | 218.1 | 376.7 | 0.579 | 1.045 |
| | G37 | Secondary | 159.61 | 477.8 | 0.334 | 413.3 | 477.8 | 0.865 | 1.199 |
| | G40 | Secondary | 132.36 | 540.0 | 0.245 | 360.7 | 540.0 | 0.668 | 0.913 |
| | G47 | Secondary | 210.31 | 475.7 | 0.442 | 118.0 | 475.7 | 0.248 | 0.690 |
| | G51 | Secondary | 92.30 | 289.7 | 0.319 | 91.0 | 289.7 | 0.314 | 0.633 |
| | | ***Secondary Totals*** | 813.31 | 2422.1 | ***0.336*** | 1372.7 | 2422.1 | ***0.567*** | ***0.903*** |
| | | | | | | | | | |
| Yellowhead | Y53 | Core | 61.62 | 230.6 | 0.267 | 50.2 | 230.6 | 0.218 | 0.485 |
| | Y56 | Core | 292.29 | 691.7 | 0.423 | 95.6 | 691.7 | 0.138 | 0.561 |
| | Y61 | Core | 180.53 | 624.5 | 0.289 | 70.5 | 624.5 | 0.113 | 0.402 |
| | Y69 | Core | 14.44 | 138.2 | 0.104 | 18.4 | 138.2 | 0.133 | 0.238 |
| | Y70 | Core | 88.16 | 343.5 | 0.257 | 99.3 | 343.5 | 0.289 | 0.546 |
| | Y77 | Core | 35.89 | 283.2 | 0.127 | 48.8 | 283.2 | 0.172 | 0.299 |
| | | ***Core Totals*** | 372.93 | 2311.6 | ***0.291*** | 682.7 | 2311.6 | ***0.295*** | ***0.457*** |
| | Y57 | Secondary | 214.35 | 641.6 | 0.334 | 184.5 | 641.6 | 0.288 | 0.622 |
| | Y63 | Secondary | 218.12 | 495.0 | 0.441 | 123.4 | 495 | 0.249 | 0.690 |
| | Y65 | Secondary | 9.48 | 28.2 | 0.336 | 9.6 | 28.2 | 0.339 | 0.676 |
| | | ***Secondary Totals*** | 441.97 | 1164.9 | ***0.379*** | 317.4 | 1164.9 | ***0.273*** | ***0.652*** |

*Road density could not be forecast for Year 10 for non-HWP owned roads, due to HWP's inability to forecast road construction from other users

Table 3 describes the results of RSF modelling on the Hinton FMA area for Year 0(2012), Year 10, and the difference in RSF values at year 10. Figure 7, Figure 8, and Figure 9, show the same results spatially. These results were calculated and provided to HWP by ESRD.

**Table 3** – *RSF Modelling Results for Hinton FMA Area*

| Grizzly Bear Population Unit | Grizzly Bear Watershed Unit | Habitat Type | Current Mean | Future Mean | Difference +/- | Change % |
|---|---|---|---|---|---|---|
| Grande Cache | G38 | Core | 7.562255859 | 7.608356953 | 0.046101 | 0.006096 |
| | G42 | Core | 7.574120522 | 7.558651447 | -0.01547 | -0.00204 |
| | G44 | Core | 8.145310402 | 8.123931885 | -0.02138 | -0.00262 |
| | G46 | Core | 8.590817451 | 8.671406746 | 0.080589 | 0.009381 |
| | G50 | Core | 8.08297348 | 8.202280998 | 0.119308 | 0.01476 |
| | G58 | Core | 7.67948246 | 7.799995422 | 0.120513 | 0.015693 |
| | | | | | | |
| | G28 | Secondary | 6.848968983 | 7.949656 | 1.100688 | 0.160708 |
| | G31 | Secondary | 6.828778744 | 7.826237 | 0.997458 | 0.146067 |
| | G36 | Secondary | 7.326024055 | 7.263687 | -0.06234 | -0.00851 |
| | G37 | Secondary | 6.390334129 | 6.61183 | 0.221496 | 0.034661 |
| | G40 | Secondary | 5.812765598 | 5.817437 | 0.004671 | 0.000804 |
| | G47 | Secondary | 8.001955032 | 7.836529 | -0.16543 | -0.02067 |
| | G51 | Secondary | 6.56155777 | 6.573123 | 0.011565 | 0.001762 |
| | | | | | | |
| | | | | | | |
| Yellowhead | Y53 | Core | 5.49806118 | 5.423967 | -0.07409 | -0.01348 |
| | Y56 | Core | 7.476673126 | 7.230921 | -0.24575 | -0.03287 |
| | Y61 | Core | 7.230071068 | 7.279918 | 0.049847 | 0.006894 |
| | Y69 | Core | 6.965517044 | 6.965517 | 0 | 0 |
| | Y70 | Core | 7.191256046 | 7.305375 | 0.114119 | 0.015869 |
| | Y77 | Core | 6.676618576 | 6.731141 | 0.054522 | 0.008166 |
| | Y79 | Core | 5.292452812 | 4.981132 | -0.31132 | -0.05882 |
| | Y85 | Core | 7.42483902 | 7.424839 | 0 | 0 |
| | | | | | | |
| | Y57 | Secondary | 4.862499237 | 4.948865 | 0.086366 | 0.017762 |
| | Y63 | Secondary | 6.482876301 | 6.819076 | 0.3362 | 0.05186 |
| | Y65 | Secondary | 7.825617313 | 7.574096 | -0.25152 | -0.03214 |
| | | | | | | |

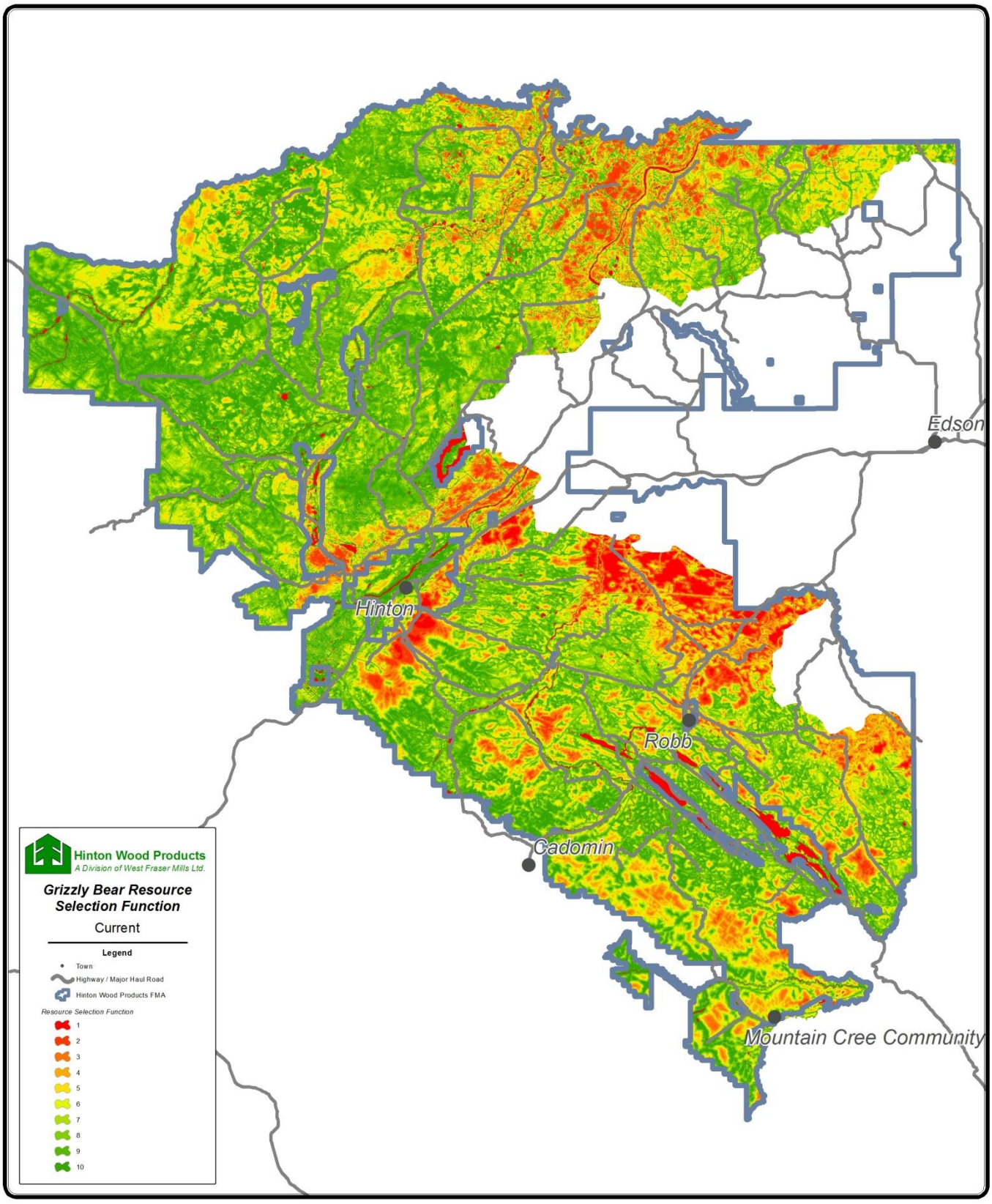



**Figure 7** – *RSF Modelling Hinton FMA area Year 0 (2012)*

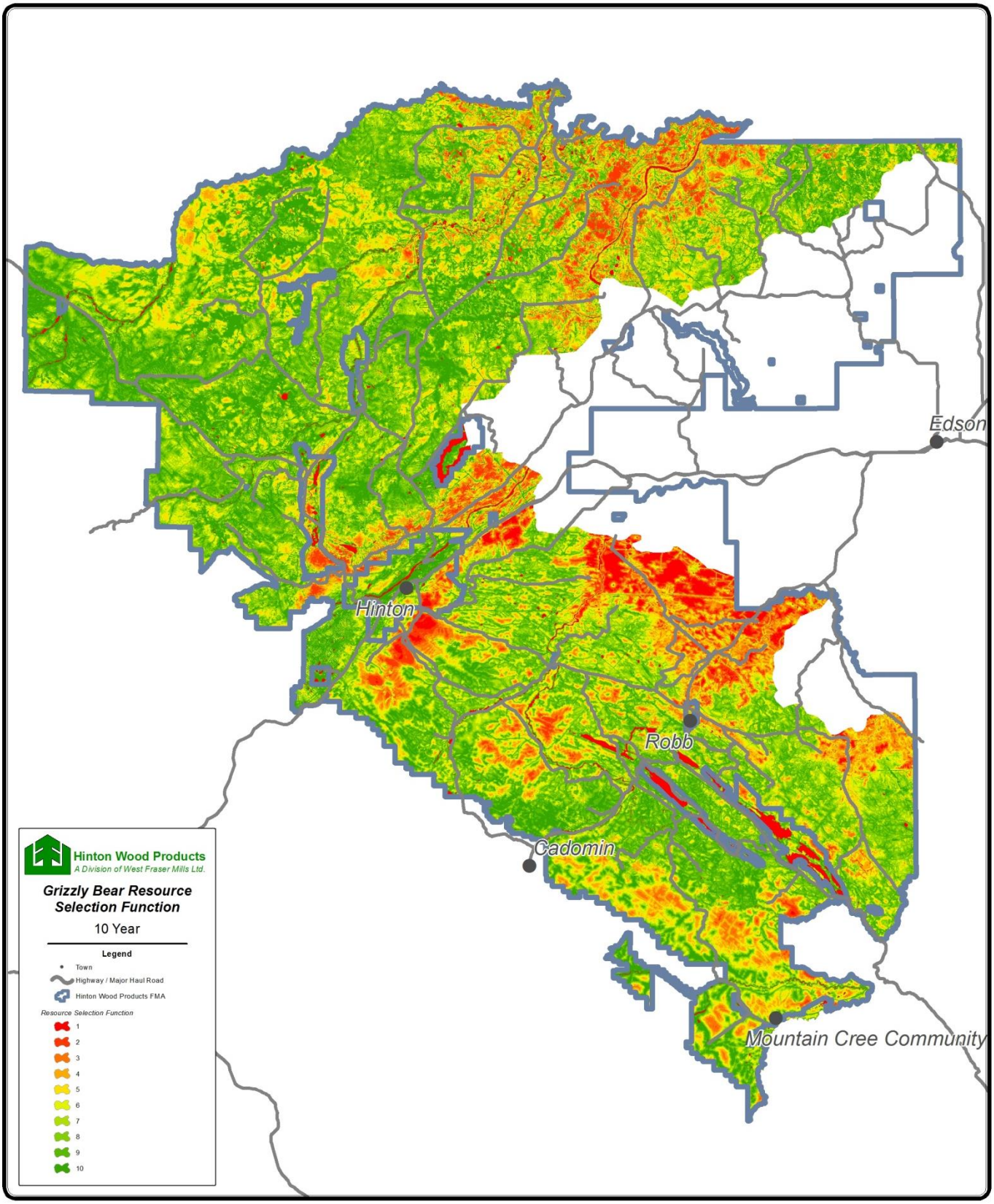



**Figure 8** – *RSF Modelling Hinton FMA area Year 10*

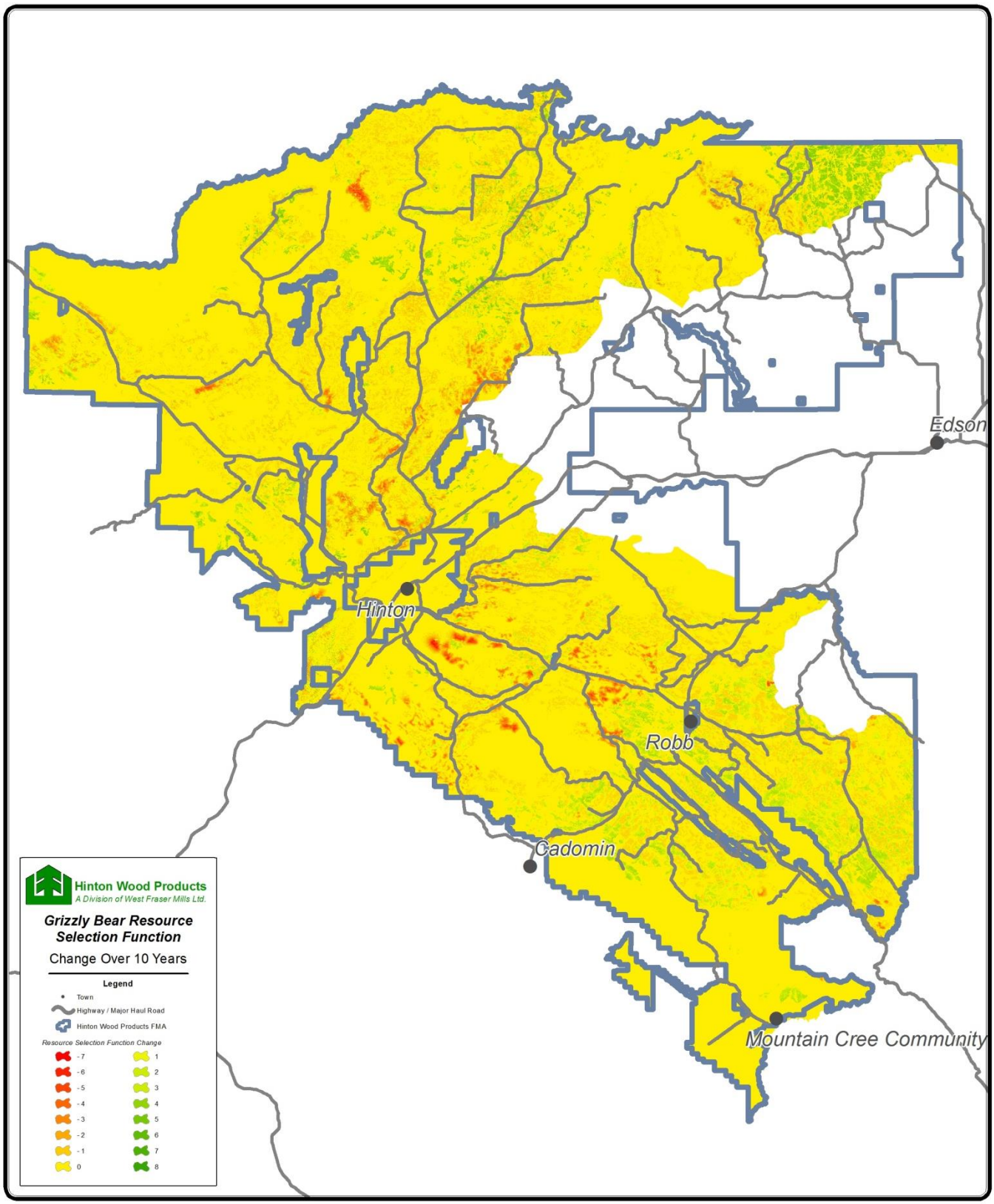



**Figure 9** – *RSF Modelling Hinton FMA area – Change of 10 years*

## C. Mortality Risk

The grizzly bear mortality risk model has been used to understand the spatial configuration of mortality risk for grizzly bears in any given land area (both population unit and GBWU). The mortality risk surface is used in conjunction with the open route density information to understand how access and habitat variables interact to impact grizzly bear survival rates. Currently the mortality risk model output cannot be used to predict either grizzly bear population size or trend. However, relationships have been found, with research data showing that there is a low occupancy rate as mortality risk increases. This may reflect both short and long term effects of human caused mortality on resident bear population distribution and abundance.

In Core GBWUs the objective is to maintain or reduce current levels of mean mortality risk as determined through the mortality risk model. In Secondary GBWUs the objective is to reduce current levels of mean mortality risk.

Table 4 describes the results of mortality risk modelling on the Hinton FMA area for Year 0(2012), Year 10, and the difference in mortality risk values at year 10. Figure 10, Figure 11, and Figure 12, show the same results spatially. These results were calculated and provided to HWP by ESRD.

**Table 4**– *Mortality Risk Modelling Results for Hinton FMA Area*

| Grizzly Bear Population Unit | Grizzly Bear Watershed Unit | Habitat Type | Current Mean | Future Mean | Difference +/- | Change % |
|---|---|---|---|---|---|---|
| Grande Cache | G38 | Core | 3.942401886 | 3.965671 | 0.023269 | 0.6% |
| | G42 | Core | 6.904892445 | 6.788165 | -0.11673 | -1.7% |
| | G44 | Core | 6.075432301 | 6.020454 | -0.05498 | -0.9% |
| | G46 | Core | 4.286509514 | 4.184931 | -0.10158 | -2.4% |
| | G50 | Core | 3.806949615 | 3.810596 | 0.003646 | 0.1% |
| | G58 | Core | 5.302616119 | 5.21821 | -0.08441 | -1.6% |
| | | | | | | |
| | G28 | Secondary | 3.890213 | 3.849687 | -0.04053 | -1.0% |
| | G31 | Secondary | 5.866905 | 5.79378 | -0.07313 | -1.2% |
| | G36 | Secondary | 6.841262 | 6.858177 | 0.016915 | 0.2% |
| | G37 | Secondary | 6.812062 | 6.838634 | 0.026573 | 0.4% |
| | G40 | Secondary | 5.676953 | 5.613452 | -0.0635 | -1.1% |
| | G47 | Secondary | 7.677071 | 7.422623 | -0.25445 | -3.3% |
| | G51 | Secondary | 6.855086 | 6.767314 | -0.08777 | -1.3% |
| | | | | | | |
| | | | | | | |
| Yellowhead | Y53 | Core | 5.698501 | 5.644076 | -0.05443 | -1.0% |
| | Y56 | Core | 6.713414 | 6.421138 | -0.29228 | -4.4% |
| | Y61 | Core | 5.875336 | 5.789101 | -0.08624 | -1.5% |
| | Y69 | Core | 6.845842 | 6.845842 | 0 | 0.0% |
| | Y70 | Core | 4.156453 | 4.136649 | -0.0198 | -0.5% |
| | Y77 | Core | 4.610684 | 4.594462 | -0.01622 | -0.4% |
| | Y79 | Core | 2.769194 | 2.767424 | -0.00177 | -0.1% |
| | Y85 | Core | 1.113208 | 1.113208 | 0 | 0.0% |
| | | | | | | |
| | Y57 | Secondary | 6.355721 | 6.341451 | -0.01427 | -0.2% |
| | Y63 | Secondary | 7.139946 | 7.090779 | -0.04917 | -0.7% |
| | Y65 | Secondary | 5.841071 | 5.78923 | -0.05184 | -0.9% |
| | | | | | | |

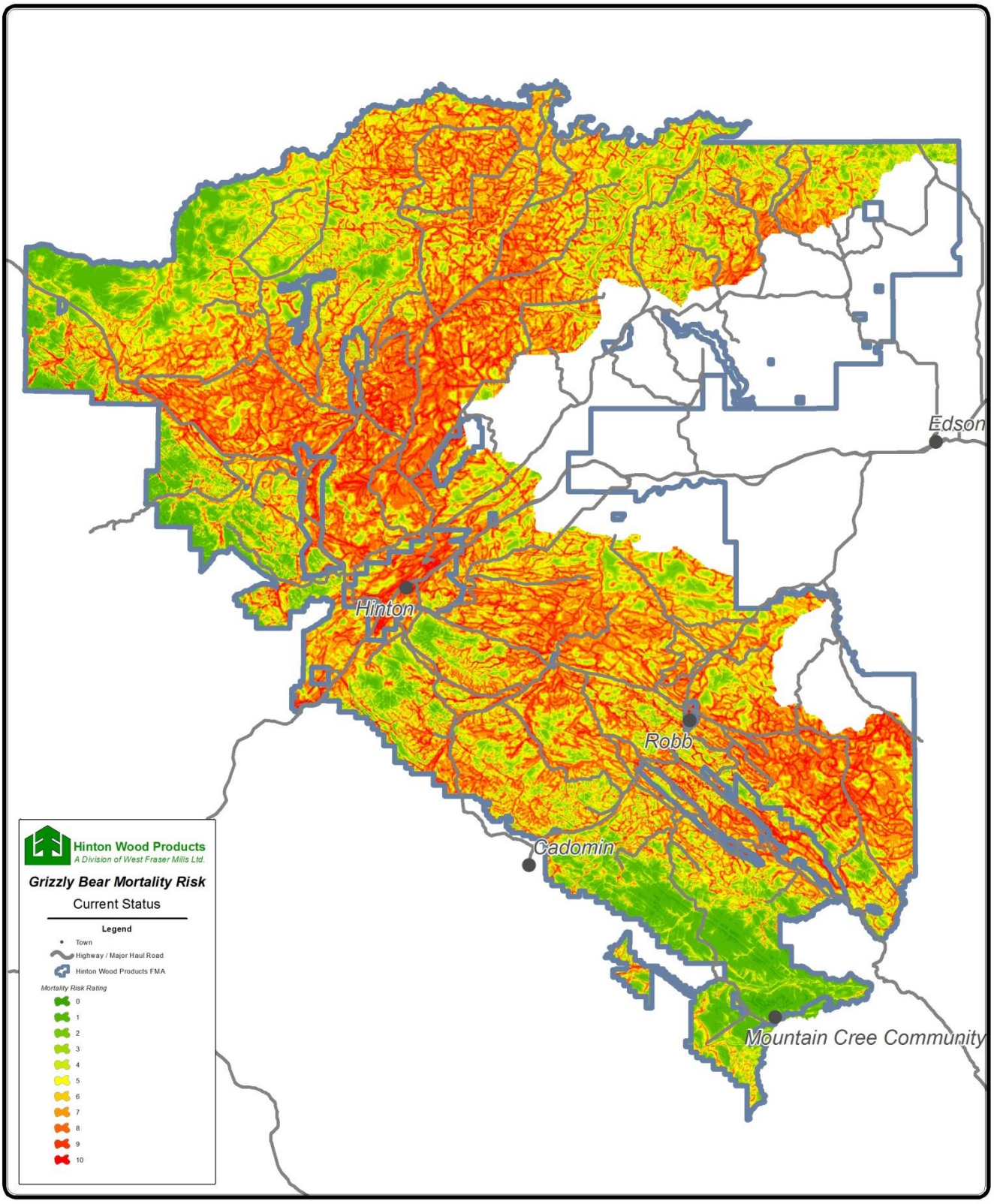



**Figure 10** – *Mortality Risk Modelling for Hinton FMA area Year 0 (2012)*

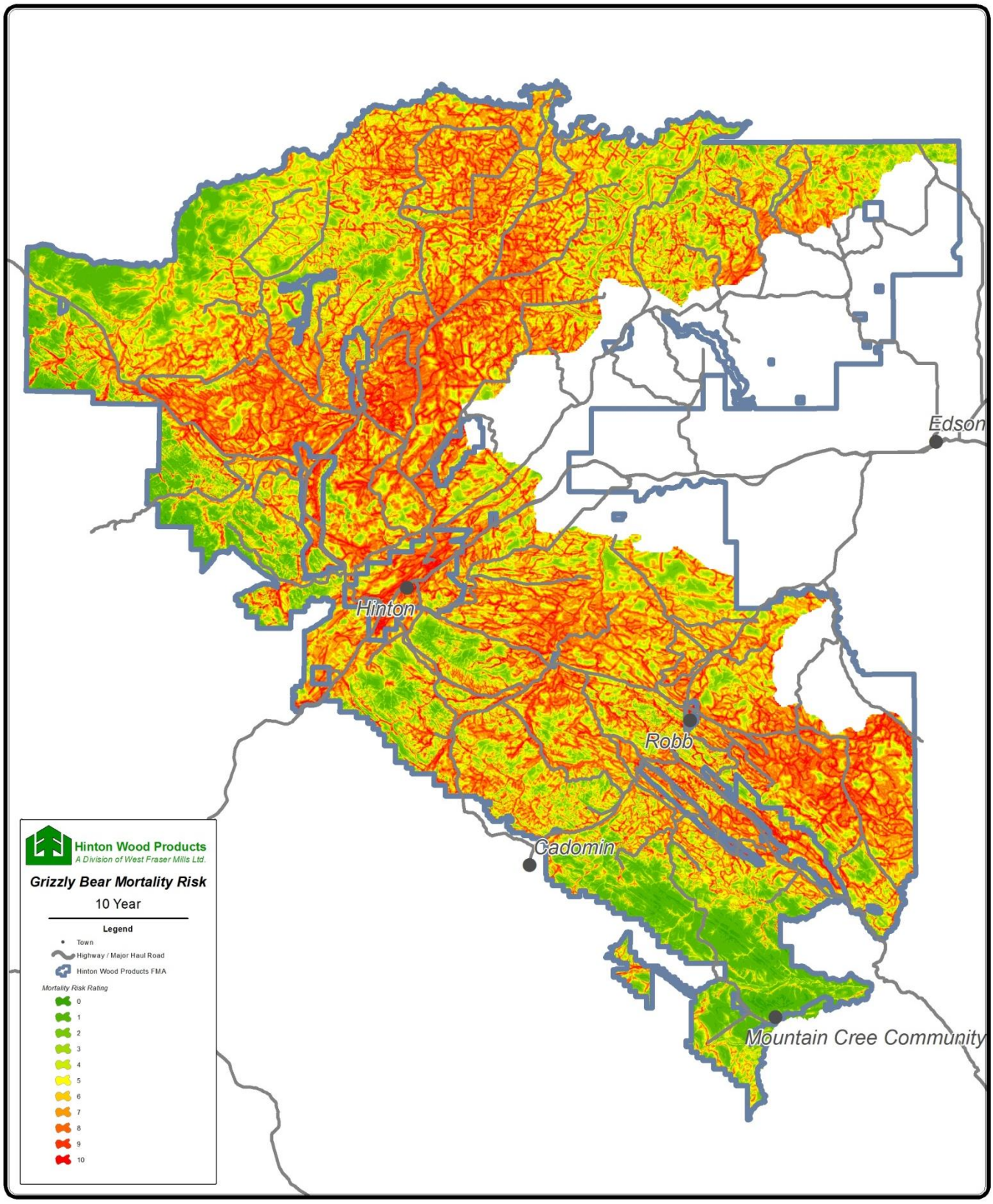



**Figure 11** – *Mortality Risk Modelling for Hinton FMA area Year 10*

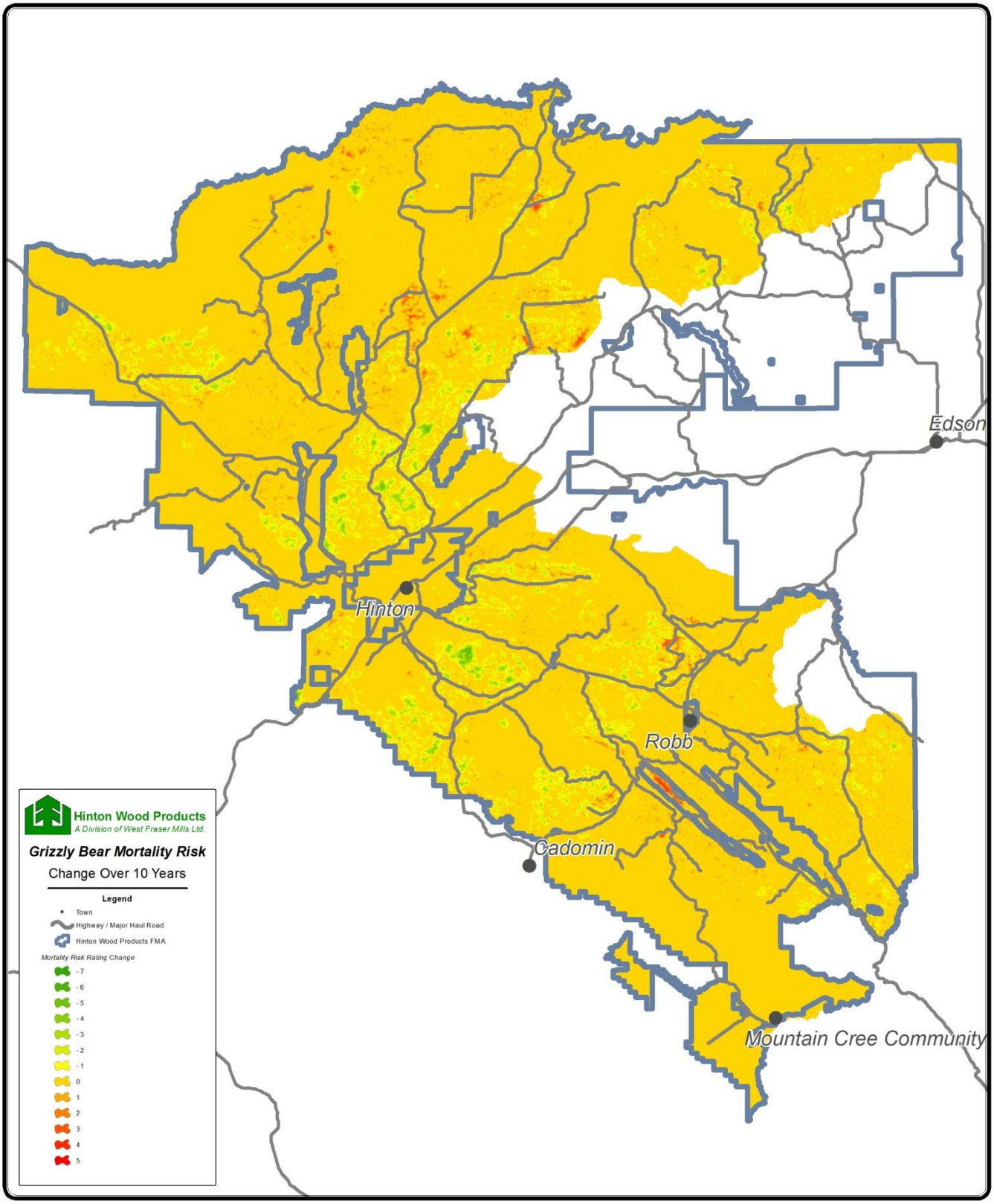



**Figure 12** – *Mortality Risk Modelling Hinton FMA area – Change of 10 years*

## D. Safe Harbour Index

Safe Harbour combines the RSF model (representing occupancy, or habitat quality) with the mortality risk model (representing habitat security) to distinguish areas of population sink (good-quality but high-risk habitat) from good-quality, low-risk areas that serve as a population source (Fig. 3). The relative proportion of population sources and sinks within a defined area can serve as a baseline measure of overall habitat quality.

In all Core GBWUs the objective is to maintain or increase both the quantity (area) and quality (mean safe harbour value) that is currently present. In Secondary GBWUs the objective is to increase current values of safe harbour quantity and quality.

Table 5 describes the results of safe harbour modelling on the Hinton FMA area for Year 0(2012), Year 10, and the difference in safe harbour values at year 10. Figure 13, Figure 14, and Figure 15 show the same results spatially. These results were calculated and provided to HWP by ESRD.

**Table 5**– *Safe Harbour Modelling Results for Hinton FMA Area*

| Grizzly Bear Population Unit | Grizzly Bear Watershed Unit | Habitat Type | Current Mean | Future Mean | Difference +/- | Change % |
|---|---|---|---|---|---|---|
| Grande Cache | G38 | Core | 43.92889 | 44.01265 | 0.0837631 | 0.2% |
| | G42 | Core | 21.83161 | 22.81303 | 0.9814224 | 4.5% |
| | G44 | Core | 29.81747 | 30.37894 | 0.5614738 | 1.9% |
| | G46 | Core | 47.4645 | 49.02509 | 1.5605888 | 3.3% |
| | G50 | Core | 48.20862 | 49.15791 | 0.9492874 | 2.0% |
| | G58 | Core | | | | |
| | | | | | | |
| | G28 | Secondary | 40.51656 | 47.86048 | 7.3439178 | 18.1% |
| | G31 | Secondary | 25.80104 | 31.48551 | 5.6844673 | 22.0% |
| | G36 | Secondary | 22.15162 | 21.77612 | -0.3754978 | -1.7% |
| | G37 | Secondary | 18.46493 | 19.0402 | 0.5752678 | 3.1% |
| | G40 | Secondary | 22.73471 | 23.20714 | 0.4724350 | 2.1% |
| | G47 | Secondary | 17.55998 | 19.0181 | 1.4581203 | 8.3% |
| | G51 | Secondary | 18.16313 | 18.67415 | 0.5110245 | 2.8% |
| | | | | | | |
| | | | | | | |
| Yellowhead | Y53 | Core | 19.62393 | 19.60532 | -0.0186100 | -0.1% |
| | Y56 | Core | 23.29287 | 24.52107 | 1.2282028 | 5.3% |
| | Y61 | Core | 27.48172 | 28.79197 | 1.3102474 | 4.8% |
| | Y69 | Core | 18.54767 | 18.54767 | 0.0000000 | 0.0% |
| | Y70 | Core | 38.72123 | 39.55753 | 0.8363037 | 2.2% |
| | Y77 | Core | 33.05059 | 33.54166 | 0.4910660 | 1.5% |
| | Y79 | Core | 49.10529 | 49.41412 | 0.3088226 | 0.6% |
| | Y85 | Core | 47.00943 | 44.20755 | -2.8018875 | -6.0% |
| | | | | | | |
| | Y57 | Secondary | 15.05 | 15.68094 | 0.6309452 | 4.2% |
| | Y63 | Secondary | 16.90363 | 18.63333 | 1.7297039 | 10.2% |
| | Y65 | Secondary | 31.42629 | 30.51757 | -0.9087143 | -2.9% |
| | | | | | | |

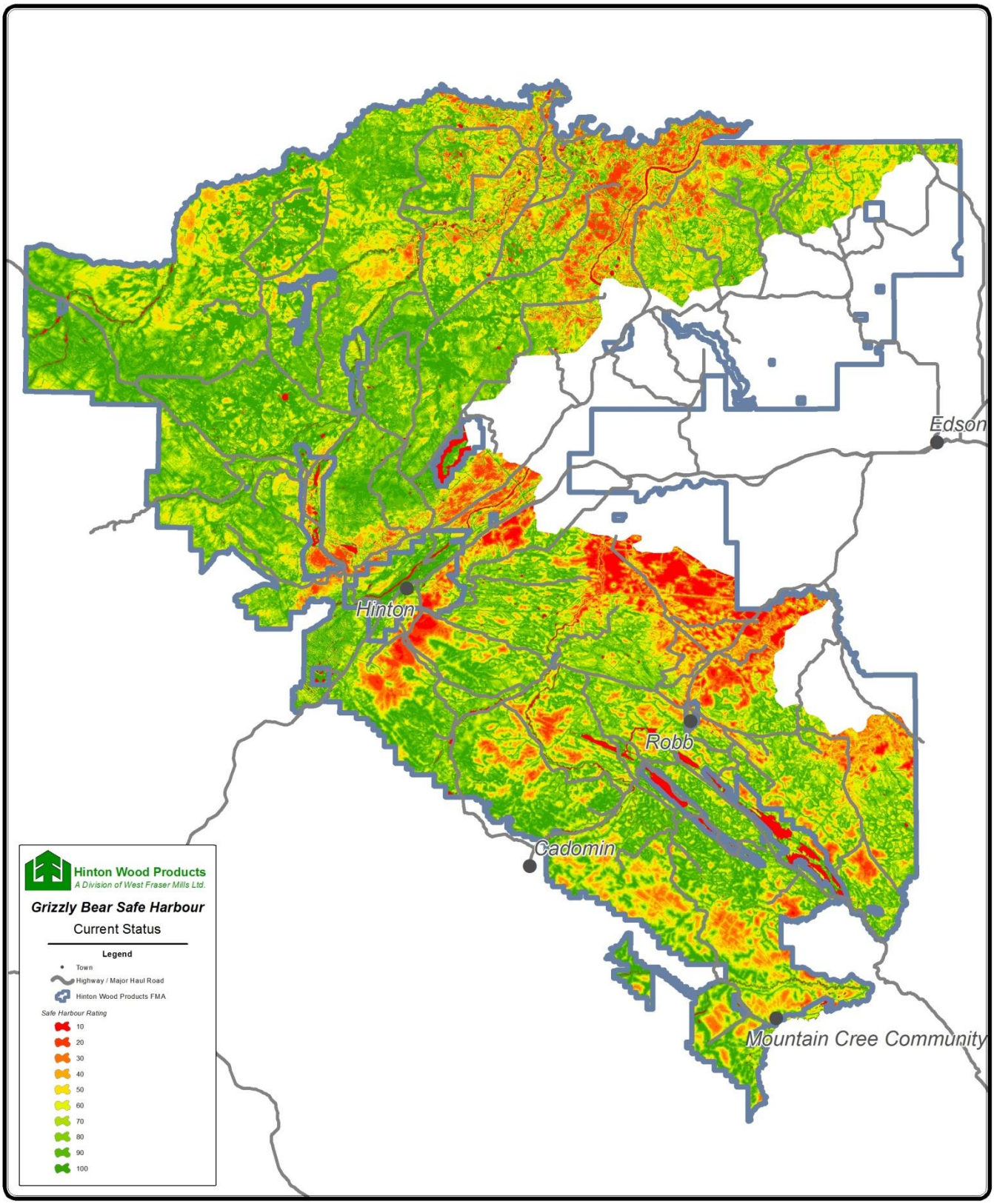



**Figure 13** – *Safe Harbour Modelling for Hinton FMA area Year 0 (2012)*

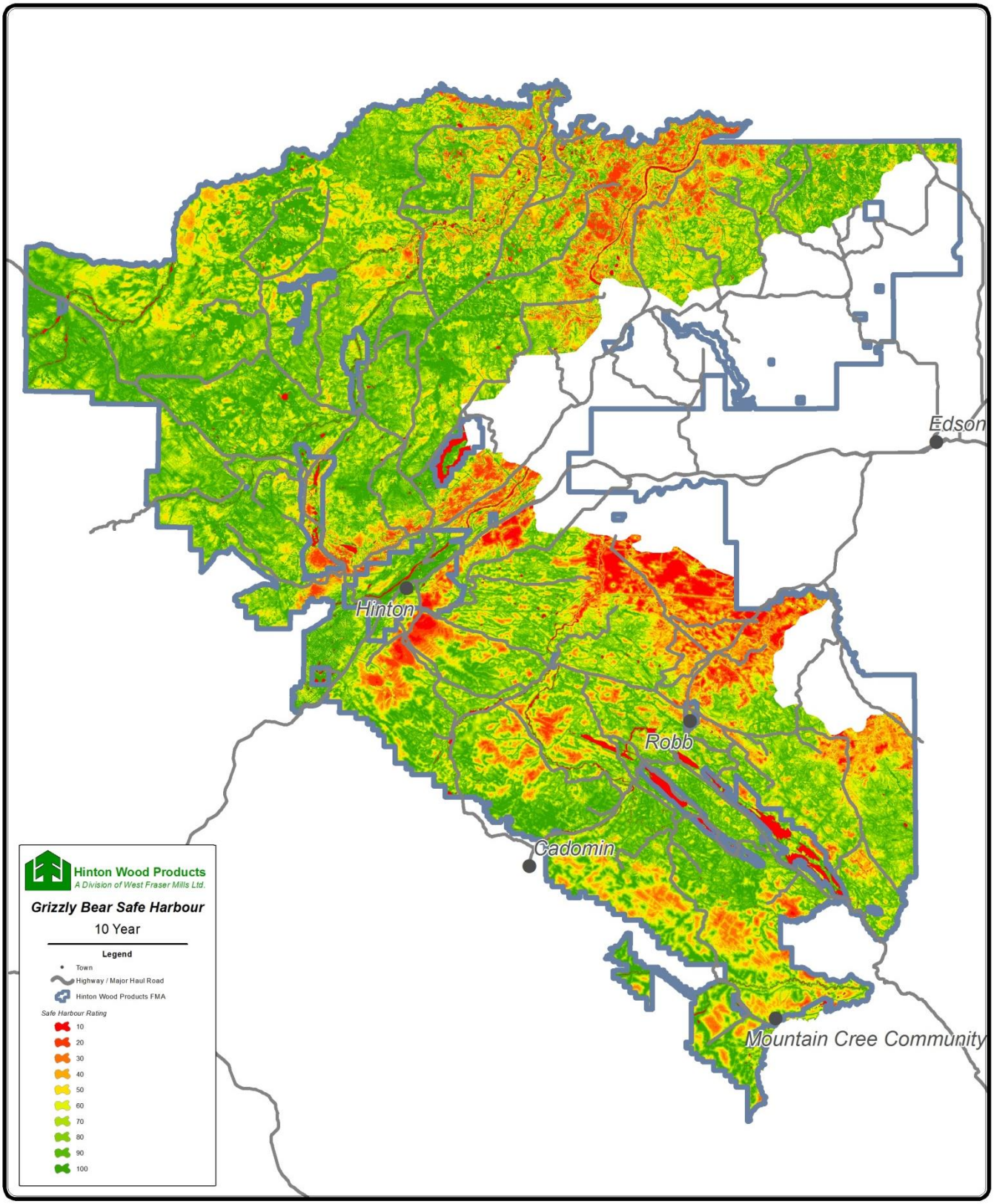



**Figure 14** – *Safe Harbour Modelling for Hinton FMA area Year 10)*

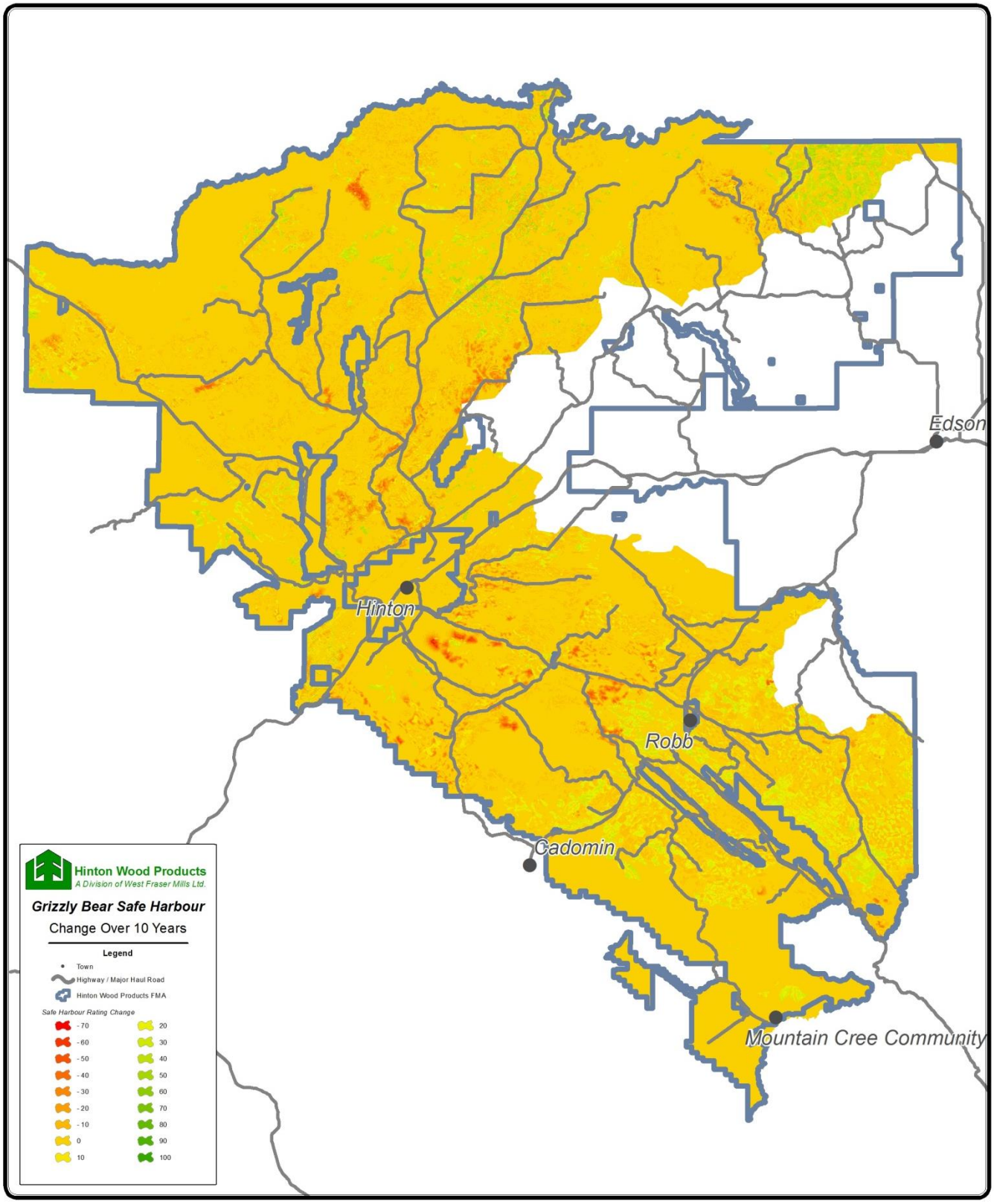



**Figure 15** – *Mortality Risk Modelling Hinton FMA area – Change of 10 years*

# HABITAT CONSERVATION STRATEGY

## A. Roles and Responsibilities

West Fraser has no responsibility for grizzly bear population management. Commitments made in this document relate specifically and only to West Fraser management of the Hinton FMA[5] and potential associated impacts on grizzly bear conservation. Other factors that may affect conservation of the grizzly bear are beyond the responsibility of West Fraser. As part of the West Fraser stewardship commitment West Fraser will consider and may partner with Alberta and others in their conservation programs.

West Fraser and Alberta are jointly responsible for developing, implementing, monitoring, and improving this Habitat Conservation Strategy (HCS). Periodic revisions will be endorsed by the parties and the most current version of the HCS will be approved as part of FMP revisions.

West Fraser and Alberta will work together to implement a monitoring program and related investigations that may be commenced if conservation objectives are not being met. For this HCS, West Fraser monitoring responsibility solely relates to habitat produced by West Fraser harvest and other vegetation management activities, and to West Fraser roads and other access. West Fraser is not responsible for monitoring related to grizzly bear populations or habitat use or monitoring related to the actions of others.

## B. Goal

The West Fraser goal is to contribute to long-term conservation of grizzly bear by applying ecosystem-based management on the FMA based on the principle of approximating natural disturbance patterns (see Appendix 2 in HWP's 2014 DFMP). This will provide a continual supply of suitable grizzly bear habitat over the long term. West Fraser will also manage West Fraser roads and other access based on the life cycle approach to manage West Fraser roads, and work with others to manage roads and other footprint owned and managed by others. The HCS will be reviewed and revised as new information is acquired.

## C. Detailed Forest Management Plan

Grizzly bears are mainly associated with recently disturbed and early seral habitats, especially after disturbances and near edges and openings. This type of habitat is produced after forest fires and harvesting, as well as in other natural areas (e.g. wet meadows, riparian areas) and anthropogenic areas (e.g. road and pipeline right-of-ways).

Natural disturbance based management will be applied to manage a continuing supply of suitable habitat over time. West Fraser does not see any reason to alter the harvest level or pattern over time for grizzly bear. Therefore there are no special considerations needed for grizzly bear that would affect the AAC or Spatial Harvest Sequence (SHS).

**Landbase Designation**

Grizzly bear habitat management does not require adjustments to the DFMP landbase designation.

**DFMP Management Strategy**

The DFMP Management Strategy includes the following considerations for grizzly bear habitat:

Active Landbase

- Apply ecosystem-based management including the natural pattern approximation approach to develop the Annual Allowable Cut and Spatial Harvest Sequence.

[5] Present knowledge and state of implementation is most advanced for the Hinton FMA. West Fraser intends to manage the Edson FMA in the same way. Work to bring the Edson FMA up to the desired level is in progress.

Passive Landbase

- Cooperate with any government-led activities to disturb the passive Landbase.

Natural Disturbance Salvage

- The cumulative total area of unsalvaged natural stand replacing disturbances will be at least 25% of area disturbed based on a 20 year rolling average.
- Apply ecosystem-based management procedures and practices to ensure retention of un-salvaged trees and patches at the salvage planning and operations stages.

Roads

- Manage the West Fraser road network following the life cycle approach to minimize the physical road network over the long term (see Long Terms Access Plans in the Appendix 13 of the 2014 DFMP).
- Minimize use of palatable plant species for erosion control on right-of-ways.
- Manage West Fraser human use activities to ensure West Fraser does not contribute to human-caused mortality.
- Cooperate with collaborative initiatives to manage roads and other access footprint owned and managed by others (e.g. Foothills Landscape Management Forum, Regional Access Plans).
- Cooperate with government-led initiatives to manage human use to reduce human-caused mortality risk.

Other

- Manage West Fraser camps and other facilities to ensure they comply with the Bear Smart approach.

Habitat Risk Assessment

Possible grizzly bear habitat conservation issues include:

1. Total rates of disturbance may be insufficient to approximate natural disturbance regimes, especially in habitat types that will be protected from fire and harvest.
2. Harvest-origin and other anthropogenic-origin habitat may not have appropriate food plants for grizzly bears.
3. Harvest-origin and other anthropogenic-origin habitat may not have similar quantities of food plants for grizzly bears when compared to similar fire-origin habitats.
4. Harvest-origin and other anthropogenic-origin habitat may attract grizzly bears to areas where mortality risk is higher and result in increased rates of human-caused mortality.
5. Total mortality risk associated with West Fraser roads and other activities may exceed levels needed to keep human-caused mortality at acceptable levels.

The conservation risks of the identified issues are discussed individually in this HCS and a risk assessment matrix is included in Appendix 1.

Harvest Design and Schedule

Grizzly bear habitat management does not require adjustments to the Spatial Harvest Sequence harvest design and schedule.

## D. Access Management

Human-caused mortality of grizzly bears is influenced by encounter rates between grizzly bears and humans and the type of human use. Open road access density is a factor in the relationship because road access is used by humans to access grizzly bear range, increasing encounter rates. For business purposes

West Fraser requires a network of permanent roads that are maintained for year around use. These are generally class (see definitions) 2 and 3 roads that access multiple compartments. Additional permanent roads are needed for periodic use and are maintained during periods of use. These are generally class 3 and 4 roads that provide access within compartments. West Fraser also requires a network of temporary roads that include AOP roads and block roads. These are generally class 4, 5, and 6 roads.

The West Fraser road network connects to roads owned by others, primarily the Alberta government and the energy industry. West Fraser has no responsibility for these roads but attempts to work with others to minimize and manage the overall road network.

Life Cycle Approach

As the long term industrial tenure holder on the FMA West Fraser has an interest in the long term road footprint and plays a lead role in access development and management. West Fraser developed the Life Cycle Approach (LCA) to manage both West Fraser roads and roads and other footprint owned by others. Using this Life Cycle approach, HWP developed Long Term Access Plan for each of the five working circles on the FMA area.

As part of these LTAP's HWP reviewed all roads and associated footprint on the FMA and conducted an assessment from the perspective of long term West Fraser access needs. Within each working circle LTAP the following information was provided:

1. An overview map showing:
   - The LTAP area with base map features
   - Compartment boundaries
   - Existing and proposed roads and stream crossings
   - Existing and proposed access control locations

2. An ortho map showing:
   - The LTAP area
   - Existing and proposed roads and stream crossings

3. A brief description of the area

4. A brief description of the status of existing roads

5. A description of major resource value issues.

6. A table that lists the major road corridors used for hauling within the LTAP area.

7. A table that lists all existing Class 1, 2, 3 and 4a roads within a given Working Circle (In appendices). Included in this table is:
   - Length of the road with the WC
   - Owner of the road (HWP or External)
   - Road class
   - Compartments accessed by given road
   - Number of culverts and/or bridges over intermittent or permanent stream. Please note that for externally owned roads, the list may be incomplete. There may be more than reported on any given road.
   - A strategy for each road (Maintain, Deactivate or Reclaim). The existence of an LTAP strategy on a road does not necessarily mean it will be completed within any given time frame, but rather when the opportunity presents itself (e.g., oilfield road disposition offered to HWP, HWP has equipment in the area, HWP budgets allow for some deactivation work, external funding comes available, etc.), the strategy can be put into action.

8. A table that lists proposed new permanent roads.

These LTAPs can be found in Appendix 13 of HWP's 2014 DFMP.

Deactivation

West Fraser will deactivate West Fraser roads that are identified as permanent periodic when they are not being used by either West Fraser or others. West Fraser will participate in Regional Access Plan processes to identify access needs of others before implementing large scale deactivation. Some West Fraser roads have already been deactivated and West Fraser will continue with ad hoc deactivation while Regional Access Plans are being developed.

Reclamation

West Fraser will reclaim West Fraser roads that are identified as no longer needed for West Fraser use or use by others. This will generally apply to roads held under disposition. Roads held under AOP approval will be reclaimed if the road was constructed after 2010. AOP roads that were constructed in 2010 or earlier will be reclaimed on a voluntary basis if reclamation is identified in Regional Access Plans. West Fraser will participate in Regional Access Plan processes to identify access needs of others before implementing large scale reclamation. Some West Fraser roads have already been reclaimed and West Fraser will continue with ad hoc reclamation while Regional Access Plans are being developed.

West Fraser routinely reclaims and reforests block roads in conjunction with completion of harvesting, haul, and reforestation activities, except where a need for keeping open access has been identified (e.g. trapper access, silviculture access). This practice will continue.

West Fraser will request reclamation on completion of intended use for all roads and other footprint owned by others that have been designated for reclamation by West Fraser. West Fraser will accept disposition transfers from others if the road is designated to become part of the long term West Fraser road network.

Regional Access Plans

West Fraser is a member of the Foothills Landscape Management Forum and participated in the development of the Berland Smoky Regional Access Development Plan. West Fraser will continue to participate in Regional Access Plan processes and will implement those portions of approved RAP that apply to West Fraser.

Human Use Management

Human use management is the responsibility of the Government of Alberta. West Fraser will ensure that West Fraser activities in the area of human use support grizzly bear conservation. West Fraser will comply with regulatory requirements for physical access controls. However West Fraser believes that physical access controls are generally not the best way to manage human use and will continue to advocate for other approaches.

Grizzly Bear Mortality Risk

WF strongly supports adding more capability to current mortality risk estimator, which only looks at roads and visibility from roads. HWP believe the model needs to take into account the amount and type of human use. Roads that get a lot of non-risky human use (e.g. no guns) would actually come out as less risky than roads that don't get a lot of human use but what use there is higher risk (e.g. hunting traffic in fall).]

### E. Final Harvest Plans

Grizzly bear habitat management does not require adjustments to Final Harvest Plans.

### F. Harvest Planning and Operating Ground Rules

Grizzly bear habitat conservation does not require changes to the Harvest Planning and Operating Ground Rules, which will be applied with site-specific judgment.

## MONITORING

West Fraser will monitor all aspects of the forest management system including harvest and access. West Fraser staff will report FMA grizzly bear sightings to the fRI.

## RESEARCH AND CONTINUAL IMPROVEMENT

Knowledge needs include:

- Improve mortality risk assessments by adding information about level and type of human use.
- Evaluate actions intended to reduce human-caused mortality risk.

New information related to these and other questions will be regularly reviewed and incorporated into revisions of the grizzly bear conservation strategy.

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## **Appendix 1** – *Grizzly bear risk assessment matrix*

| Activity | Aspect | Impact | Probability | Severity | Risk | Strategy |
|---|---|---|---|---|---|---|
| Harvesting and site preparation | Insufficient retention to provide security cover | Reduced use of recently harvested areas | Improbable – most cutblocks have retention patches or are mostly located close to edges | Low – EBM approach should leave adequate cover | D | Continue normal practices |
| Harvesting and site preparation | | | Unknown – no information | Low – CONI are very uncommon | D | Continue normal practices |
| Fire suppression | Less burned forest over time | Reduced availability of fire specialist food plants | Probable – Fire occurrence is reduced compared to natural range of variation | Low – food plant availability is not likely to limit population size | D | Replace burned forest with harvested forest |
| West Fraser roads | Increased road footprint | Increased mortality risk | Probable – overall road footprint is increasing | Medium – Manage human use to mitigate | A | Apply life cycle approach |
| Other roads and footprint | Increased roads and other footprint | Increased mortality risk | Probable – overall footprint is increasing | Medium – manage human use to mitigate | A | Participate in Regional Access Plans |
| West Fraser human use | Increased human use | Increased mortality risk | Improbable – no known mortalities related to West Fraser use | Low – apply mitigation practices | D | Continue human use practices designed to minimize impacts |
| Other human use | | | | | | |

**Activity** – an activity that may result in a negative effect on conservation.
**Aspect** – the presumed result of the activity.
**Impact** – the negative conservation effect.
**Probability** – the frequency that the impact may occur. Nil: Activity not currently undertaken; Improbable: Likely to never happen; Remote: Less than once a year; Occasional: Monthly to yearly; Probable: Weekly to monthly; Frequent: Daily to weekly.
**Severity** – the level of severity that the impact could cause. Each of 5 severity aspects is rated on a scale of 1 – 3, with 1 = low, 2 = medium, and 3 = high. Aspects are: size of the impact, duration of the impact, cost of changing the impact, likelihood of recovery after the impact occurs, and length of time for recovery to occur. Each aspect is scored, and the total Severity score is Negligible 0 – 6; Minor 7 – 9; Major 10 – 12, and Catastrophic 13 – 15.
**Risk** – a combination of Probability and Severity according to the Risk table:

**Risk evaluation table**

| Probability of impact | Severity of impact | | | |
|---|---|---|---|---|
| | Catastrophic | Major | Minor | Negligible |
| Frequent | A | A | A | C |
| Probable | A | A | B | C |
| Occasional | A | A | B | D |
| Remote | A | B | C | D |
| Improbable | B | C | C | D |