BLACK BEAR DEN FIELD SURVEYS (JUNE 11, 2015) ON DAKOTA RIDGE RE PROPOSED BC TIMBER SALES (BCTS) CUTBLOCKS A87126 - DK042 & DK044 & COMMENTS ON IMPACTS, INCLUDING ON OTHER CAVITY-USING VERTEBRATES

RESULTS OF GIS MAP MODEL OF HIGH VALUE BLACK BEAR DEN HABITATS FOR CHAPMAN-HOWE LANDSCAPE UNITS (LUs), BC SUNSHINE COAST

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Report for Elphinstone Logging Focus
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Cover photo: Active black bear den (#2) in live redcedar located in proposed BCTS cutblock DK042 on Dakota Ridge. Photo: W. McCrory

DISCLAIMER

As the study area is within the traditional territory of the Squamish (Sḵwx̱wú7mesh) First Nations, who have signed no treaties, the land is recognised as subject to traditional and legal interpretation of First Nations aboriginal rights and land title, especially in light of the June 26, 2014 Supreme Court of Canada (SCC) ruling on aboriginal title (Tsilhqot'in Nation *v* British Columbia). The Squamish (Sḵwx̱wú7mesh) First Nations are currently engaged in the BC Treaty process and are also involved in other government-to-government (G2G) discussions associated with land and resource use in their traditional territories outside the treaty process. *Nothing in this report shall abrogate or derogate from any aboriginal title or aboriginal rights of the Sḵwx̱wú7mesh First Nations or any Sḵwx̱wú7mesh members.*

The findings and recommendations expressed herein are entirely my own and have not been subject to outside peer review. I take full professional responsibility for any errors, omissions or errors in interpretation of data from the scientific literature. All GIS computations have been double-checked by myself and GIS analyst Baden Cross. I take no responsibility for errors in data used from outside sources such as Ministry forest cover maps. Where possible I identify where I have relied on my professional judgement and opinion.

While the best efforts have been made to ensure the validity of this review, no liability is assumed with respect to the use or application of the information contained herein.

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1.0 SUMMARY & RECOMMENDATIONS

Black bear dens & impacts of BCTS proposed logging

Coastal black bears are dependent on old-growth structures for winter dens.

June 11, 2015 field surveys of two of four cutblocks (DK042 and DK044) proposed by BC Timber Sales (BCTS) on Dakota Ridge in Howe Sound identified five active-appearing black bear dens in old-growth trees. Two more dens were located in old-growth forest between the cutblocks.

Of the seven den trees, four were located in old redcedars and were trunk cavities with entrances between 2-4 m above the ground. All were live cedars. Two other dens were of the basal cavity/root bole type under live yellow cedar trees; these were dug under root structures at the base of each tree. The other den was a basal cavity/root bole den site in a large western hemlock. One den had an artificial entrance created by early hand loggers using a faller's axe to make a test hole. Another den had the entrance made by a bear digging a fairly large hole in the dirt bank to establish access into the root basal cavity.

Elevations of den sites ranged between 700 and 920 m with a very large average Diameter at Breast Height (DBH) of 2.15 m (215 cm). The redcedars had the highest DBHs.

A crude estimate of total active dens extrapolated from the sample areas of the two cutblocks would be 12 for DK042 (8.48 ha) and 16 for DK044 (45.74 ha), for a total of 26 dens or an average of **0.48 dens/ha**. Extrapolating the 64 ha total area of the cutblocks and the 2 ha of new access road (through old-growth den habitat only), **approximately 32 active dens were predicted to be impacted by this particular BCTS logging operation**. Due to the abundance of very old and large trees, the area also has good potential for recruitment of new den sites over a long term time frame as is typical of static old-growth coastal forests.

Projected black bear den site density/ha was very high when compared to one other coastal study. This may reflect the low sample size, but I am of the opinion that black bear den activity may be more concentrated on Dakota Ridge not just due to old-growth structural availability but due to the extensive loss of similar habitat in the surrounding region from clearcut logging.

Red- and blue-listed site series plant communities on Dakota Ridge

No red-listed site series plant communities were found in the BCTS cutblocks, but about 10.2 ha of blue-listed site series was located in DK044 and DK043. The blue-listed site series in DK044 overlaps with the two active black bear dens located, as well as a recognized yellow cedar Culturally Modified Tree (CMT) area. As noted in McCrory (2015), guidelines are being developed on the central and north coast to protect some 70% of blue-listed site series and this should also be considered for the Sunshine Coast.

Figure 1. Old hemlock on Dakota Ridge in DK044, with black bear den entrance in root structure. Den #6. (W. McCrory)

GIS black bear den habitat model

Results of our field surveys were used to validate and adjust a GIS coastal black bear den habitat model previously developed for the central BC coast. Our findings of seven black bear dens on Dakota Ridge corresponded well with the highest value black bear den habitats identified by the GIS model. Although there was a low sample size, the results were considered useful for predicting where the highest value black bear den areas would occur on the Sunshine Coast.

Dakota Ridge dens were found at higher elevations that expected for black bears. This may be because grizzly bears, which den at higher elevations than black bears, have been extirpated from the area, and den trees elsewhere are in short supply due to extensive clearcutting. We adjusted our GIS coastal den habitat model to evaluate only the highest potential den areas using slope data (10-30 degrees), elevation (250-1,000 m), and old-growth (age class 9). Parameters for low-moderate den habitat potential (developed for our 2010 model) were excluded from our analysis for purposes of simplicity. Some black bears would still be expected to den in other areas, such as old-growth structures left over in previously cutover lands and in old-growth structures in places like the Elphinstone park expansion study area (McCrory 2015). **However, in my professional opinion, none of these peripheral winter den areas would match the very high quality old-growth den habitat identified on Dakota Ridge.**

Loss of high quality den habitat in Dakota Ridge study area

Using the predictive GIS black bear den model for the 2,616 ha Dakota Ridge study area we determined that in historic times an estimated 942 ha would have been available as high quality den habitat in old-growth forest. Today some 74% (693 ha) of the highest potential den habitat for black bears (assumed to have been old-growth previously) has already been clearcut. Some 249 ha is still intact as old-growth. The proposed BCTS logging would remove another 54 ha, or 22%, of high quality den habitat remaining in the Dakota Ridge den study area, reducing what is left on Dakota Ridge to 195 ha. When such old-growth bear den attrition is viewed in both the local and regional context such a loss becomes significant from a cumulative effects perspective.

Historic loss of high quality den habitat in Chapman-Howe Landscape Units (LUs)

Overall, our GIS den model showed that in historic times prior to logging, there was about 13,500 ha of the highest value black bear den habitat in the Chapman-Howe LUs. We estimate some 11,500 ha, or 85%, of high potential black bear den habitat has been lost to clearcut logging. The GIS model determined there is now only 2,000 ha of the high quality black bear den habitat left in both LUs. In other words, there is only 15 % of the original old-growth black bear den habitat left in the LUs, representing 2.9% of the terrestrial landscape. Of this, the 249 ha of high value old-growth black bear den habitat in the Dakota Ridge study area represents over 10% of the high value den habitat left in the whole region (or LUs). This is considered significant from a benchmark black bear old-growth den habitat perspective.

Review of current guidelines to protect black bear den sites

Currently, there are no established guidelines in BC and Alaska to protect den trees or bears, but after years of efforts by researchers and conservation groups, some are now being developed in both areas. I would concur with the recommendations in the Davis et al. (2011) study of bear dens on Vancouver Island of not attempting to protect known den sites through protection of single trees, but instead retaining dens in contiguous forest or patches. I also concur with their recommendations of retaining some older forest for recruitment of new dens. For wildlife tree patches, Davis et al. (2011) recommend patches >1 ha around dens. For Prince of Wales Island, Alaska, protection now being proposed to the US Forest Service by biologists is for a no-log reserve for 100 m around a known black bear den. For Haida Gwaii Ecosystem Based Management (EBM), Coastal Order 20 is recommending a 20 m reserve around a black bear den with an additional tree-length buffer beyond. For the north and central coast, EBM Coastal Order 19 is only for a tree-length buffer around black bears dens.

While these recommendations are a very positive step forward, based on our den analysis of Dakota Ridge and Chapman-Howe LUs, I believe stronger protection measures need to be applied in these areas.

CONCLUSIONS AND RECOMMENDATIONS

To my knowledge, none of the existing black bear den researchers and guideline proponents have looked at what den protection measures are needed in a coastal landscape that has a

significant loss of old-growth den supply, such as we have documented for the Sunshine Coast, in consideration of the amount of surviving old-growth den supply and sites where recruitment of new dens could occur. While perhaps the recent guidelines being put forth by different researchers and others would have merit where very little den loss has occurred, I am hesitant to endorse any of them for landscapes that have already lost so much of their old-growth den habitat. Windthrow is also a significant threat to small patch protection for standing tree den sites. In these instances of historically degraded landscapes, such as our modeling has demonstrated for high value black bear den habitat on the Sunshine Coast, it would be more important to protect all remaining old-growth forest to help balance off the large and growing imbalance of plantation forest versus old-growth forest and the growing list of old-growth dependent species at risk. This is not just true for the old-growth denning needs of black bears (which are not considered at risk in the area) but for the importance of old-growth forests to a whole host of cavity-using vertebrates, some of them in sensitive or at-risk categories. In this regard, the report by Bunnell (2013) is instructive, particularly his conclusion that in order to protect all of the cavity-using species, some portion of the landscape should be left "unmanaged," and that as more and more old-growth is removed, the list of species at risk only grows.

From this perspective, my professional opinion would be to recommend that Dakota Ridge not be logged but be protected as a benchmark area for high value black bear den habitat and other cavity-using vertebrates.

2.0 APPROACH

Five approaches were used in my analysis. All GIS analysis/mapping was done by Baden Cross:

- Background review of coastal black bear denning ecology and review of other cavity users of old-growth forests.
- Partial surveys of black bear den sites in old-growth in proposed BCTS cutblocks A79517 - DK042 & DK044 on Dakota Ridge on June 11, 2015. Discussion and maps.
- GIS review of red- and blue-listed site series plant communities in relation to BCTS proposed cutblocks
- GIS analysis of old-growth high value den habitat in Dakota Ridge study area, including an estimate of what has already been logged.
- GIS model of old-growth high value den habitat for black bears remaining in Chapman-Howe Landscape Units (LUs), including an estimate of what has already been logged.

For the June 11, 2015 field survey, identification of black bear den sites in old trees was explained to Ross Muirhead and Hans Penner so that the study team could fan out and check out different trees. If a potential den was located, it was then verified by myself. This approach allowed us to increase the size of the sample area.

A more or less random search was made for currently active den cavity structures in older trees as well as potential den cavities. Criteria used to identify "active" dens included opening size, DBH (diameter at breast height) of tree, and evidence of bear use (nesting material, claw scratch marks at entrance to cavity, presence of hair, and other features). "Active" dens were considered

to be those that showed some sign of bear activity in the past even though bears may not have used the cavity in recent years; i.e., without actual winter surveys of use, "real" use could not realistically be determined with certainty.

In discussions with several scientists who have studied black bear use of dens, there appears to be some differences of opinion as to what defines an active den. I more or less followed the definition of the Haida Gwaii Land Use Objectives Order (Consolidated Version, p. 3): *"Black Bear den" means a cavity within a tree, a snag, a stump or a log, greater than 0.80 meters in diameter which shows evidence of use by Black Bears for winter hibernation.* (http://www.haidagwaiimanagementcouncil.ca/documents/HGLUOO%20Consolidated%20Order%20FINAL%20Signed%202014040245.pdf) For each "active" den site, type, size of entrance, DBH, GPS location, and other parameters were recorded.

Working with GIS analyst Baden Cross, we modified our coastal black bear den habitat model for the central and north BC coast (McCrory et al. 2010 *In Press*) and focused on parameters that would allow us to identify the best or highest value den habitat only. Based on the elevations of the higher dens located on Dakota Ridge, we used elevations from 250-1,000 m. Slope values of 10-30 degrees and only old-growth (age class 9) were used. We did not attempt to model for low-moderate den habitat potential, as was done in McCrory et al. (2010) for the BC central coast. The government database used for Dakota Ridge, including forest cover types and red- and blue-listed site series, is described in greater detail in McCrory (2015 *In Press*).

3.0 RESULTS & DISCUSSION

3.1. Background review of coastal black bear denning ecology and review of other cavity users of old-growth forests and implications of clearcut logging

Black bears

To summarize, coastal black bears are dependent on old-growth trees and downed structures for winter hibernation and birthing and early rearing of young. According to an extensive review by McCrory et al. (2010 *In Press*):

> *Our background review showed clearly that both species of coastal bears (grizzly and black bears) are old-growth-dependent for one-half of each year, the hibernation period. As noted in an ecological review of forest management on MacMillan Bloedel's forest tenure in coastal BC (Bunnell et al. 1998), all of the 150 black bear dens reported in different studies in the Pacific Northwest were in large trees or wooden structures derived from trees (logs, root wads, stumps). None of the observed dens were in rock cavities or excavated in soil. Dens are not only used for winter hibernation but also for natality and as nursery sites. Pregnant females of both species give birth to their young mid-winter in the security of dens. Since the young are born tiny and naked, the dens provide the shelter for the young to develop the first 2-4 months of their lives, growing rapidly on their mother's rich milk.*

A number of researchers have identified negative consequences to black bear survival from shortages of den sites caused by clearcutting of old-growth areas that once supported old-growth den structures; i.e., competition for den areas by bears can lead to conflict and mortality,

and lack of security of den sites can lead to increased predation on black bears by their own kind or other predators such as wolves.

Pearson (1975) reported the death of a grizzly bear from conflict with another bear for a den site. According to a black bear den study in the heavily clearcut Nimpkish Valley on Vancouver Island (Davis 1996):

> *Security of den sites is an important factor that may influence timing of denning, types of dens used, and den location. Disturbance of denned bears can be detrimental because bears are trying to minimize energy expenditures during this period. Denning mortalities appear to be related to security of the den site. Den-related mortality can occur either by natural causes, hunting, cannibalism or predation. Bears in dens may be preyed upon by other black bears (Davis and Harestad 1996) or, where they occur, by grizzly bears (Ross et al. 1988). It is likely that females with cubs that are too small to climb trees are safer inside dens.*

In the Nimpkish Valley, a high rate of cannibalism was found on denned bears, non-denned bears, and cubs (Davis and Harestad 1996). Davis (1996) felt that in areas with a high risk of cannibalistic attacks by bears on other bears: *security of the den sites may be more critical in selection of den sites.*

According to Davis et al. (2011):

> *Conversion of late-successional forests to younger even-aged stands is detrimental to the supply of dens for black bears in coastal British Columbia. Conservation of adequate dens and denning habitat in forest management plans is appropriate because individual den sites are important structural legacies to black bear populations and a lack of suitable den sites may lead to decreased black bear populations because of increased cannibalism (Alt and Gruttadauria 1984, Davis and Harestad 1996), predation by wolves (Horejsi et al. 1984), or deaths due to increased energetic costs from using less thermally advantageous dens (e.g., dens prone to inundation; Alt 1984).*

<u>Old-growth forests are important to a host of cavity-using vertebrate species</u>

In a recent comprehensive review of forest management and the issue of sustaining cavity-using species in the Pacific Northwest (including British Columbia), Bunnell (2013) points out that of the 67 vertebrate species commonly using cavities in the region, 20 species, or 30% of the total, are designated *at risk* or *potentially at risk*; most of this is related to the emphasis of past forestry activities on removing old and dying trees as a matter of economic efficiency. Where forestry has been practiced longer, the proportion of designated *at-risk* forest-dwelling vertebrate species that use cavities is higher. Bunnell (2013) also points out that leaving some dead and dying trees in forestry operations has some value, particularly trees 50 cm dbh or larger. While pointing out that this approach can accommodate most bird species in less productive inland forest types, this silvicultural approach may not be adequate for some bird species, including four designated as *at risk.* He also points out that a likewise situation occurs for some mammal species. His review shows that six mammal taxa select trees or snags > 50 cm in diameter and use downed wood

from 50-150 cm in diameter and are listed as *sensitive* or *at risk* in the Pacific Northwest. These include several bat species (Keen's myotis and northern myotis), black bear (subspecies *Kermodei*), grizzly bear, fisher, and American marten. Others, such as the northern flying squirrel, are also mentioned but, according to his review, are not included in the at-risk category.

Bunnell points out that: *a major implication is that stands managed intensively for fibre production often will not retain all cavity users. That implies some portion of the landscape should be left unmanaged. There is no unequivocal estimate of how much*.

3.2 Black bear dens on Dakota Ridge – Results of June 11, 2015 field survey

Following is a preliminary assessment of my field survey of black bear dens and associated habitat on Dakota Ridge on June 11, 2015.

We first hiked for approximately 200 m through second-growth logged forest (age class 4) to proposed cutblock DK042. As with second-growth forest along the access road, I saw very little evidence of old-growth structures that might be used for winter dens by black bears. The whole area appears to have been logged fairly clean. It was obvious from the size of several large diameter redcedar stumps cut by shakeblockers that this site had once been old-growth, age class 9.

DK042 was determined by timber cutting boundary survey tapes and road C/L survey tapes. Some of these were located for reference. This was all old-growth age class 9, and in contrast to the second-growth forest, was rich in an abundance of old-growth structures.

At the first cutblock we also documented other old-growth structures that might serve as potential den sites for recruitment in the future, but were not considered active black bear dens at this time. We numbered each of these trees and recorded species, type (live or dead), and measured the DBH. However, due to time constraints, this was discontinued along the route between the lower and upper cutblock as well as in upper cutblock DK044.

Proposed cutblock DK042 - den survey results

A GIS analysis of forest cover age classes indicated that this proposed BCTS cutblock is about 8.48 ha in size and is all old-growth forest (age class 9). The GIS high quality den habitat model showed that not all of this is high value den habitat.

We surveyed 14 potential den trees in the middle and west sector of the cutblock and measured the DBH. The average diameter was 2.3 m or 232 cm. Most of these were redcedars, some dead snags with broken off or partially broken off tops. There appeared to have been a powerful windstorm event at some point in the history of the area to have broken off the tops of so many snags about 20 or more metres up. This cutblock also had some evidence of early salvage of western redcedar for roof shakes.

Three black bear dens were located (Table 1) in the central portion, all within about 125 m of each other, on moderate slopes. All were within the cutting area and/or proximal to the flagged road location.

All three dens found were tree cavity dens in large, live western redcedar trees, with entranceways 2-4 m up in the tree. One of the dens involved an artificial entrance created by a test hole axed into the hollow centre by early salvage loggers.

Figure 2. Black bear den (#3) in old-growth redcedar in DK042 that had artificial entrance created by test hole axed by early logging. Axe cut at top of entrance. (W. McCrory)

Transect on access route between DK042 & DK044

This transect distance was approximately 400 m, with searches being made for dens in old trees up to 30-40 m from the access route. Again, this was age class 9. Two black bear dens were located on moderate slopes (Table 1).

Proposed cutblock DK044 - den survey results

GIS showed this was all age class 9, and 45.74 ha in size. The BCTS map shows four wildlife tree reserve areas (WTRAs). The westernmost one did not include the two dens we located in the vicinity nor, for that matter, an extensive CMT site previously identified by an archeological survey for ELF. Two of the WTRAs involve riparian leave areas.

Approximately 2.5 hours were spent checking about 100 old-growth trees for den structures, starting around the road location/junction, station DK3-2. Approximately 1/8 of the proposed cutblock was surveyed. Two black bear dens were found. Based on this sample size, I would estimate a minimum of 16 active dens in this cutblock, should similar homogenous old-growth continue within the proposed cutblock boundaries.

Figure 3. Den #7 in base of large yellow-cedar in DK044. Cavity was at least 2m in length and up to 1m wide. (W. McCrory)

Summary of black bear den inventory on Dakota Ridge

Seven dens were found that were considered to be viable or active (Table 1). Potential back bear den trees also occur for future use as den sites as the trees age further, as existing small entrances to cavities are enlarged by animals or forces of nature to create access.

Not only was the evidence of active black bear dens considered to be high, but the potential for new ones over long periods of time was also considered high due to the old-growth age of most of the trees, especially western redcedar, which mostly have the largest and most consistent heart rot inner cavities.

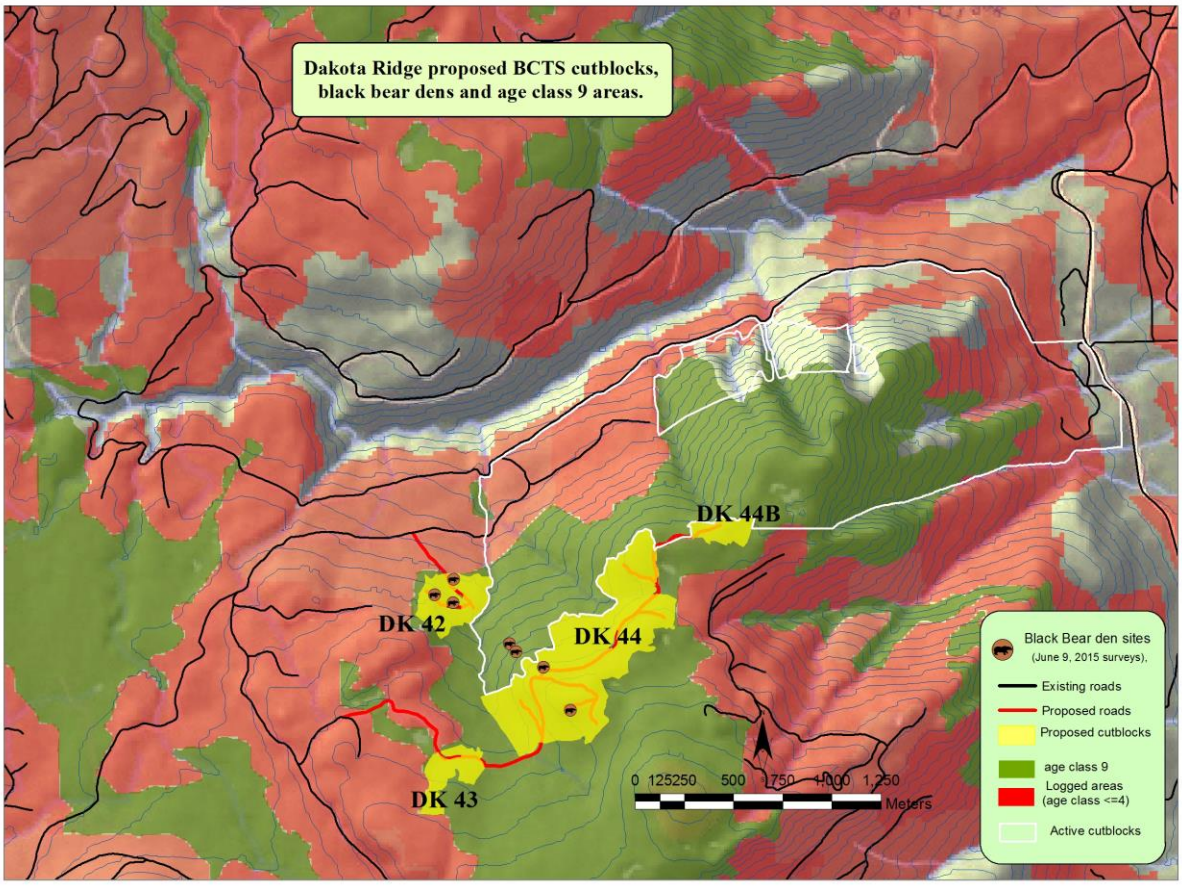
Of the seven den trees, four were located in old redcedars and were trunk cavities with entrances between 2-4 m above the ground. All were live cedars. Two others were basal cavity/root bole den sites in live yellow cedar trees dug under root structures at the base of each tree. The other den was a basal cavity/root bole den site in a large western hemlock. As noted, one den had an artificial entrance created by early hand-loggers creating a test hole in the tree with an axe. At another den a bear had made a fairly large excavation of an adjacent dirt bank to establish access into the root basal cavity.

Elevations ranged between 700 and 920 m with an average DBH of 2.15 m (215 cm). The redcedars had the highest DBHs.

Total number of active dens estimated to be impacted by Dakota Ridge proposed logging

Approximately 1/4 of proposed block DK042 and 1/8 of DK044 were surveyed and indicated that more dens would occur in the cutting area. A crude estimate of total active dens extrapolated to both cutblocks would be 12 for DK042 (8.48 ha) and 16 for DK044 (45.74 ha), for a total of 26 dens or an average of **0.48 dens/ha**. Extrapolating for the 64 ha total area of the cutblocks and the 2 ha of new access road that would be built through old-growth forests, **approximately 32 active dens would be predicted to be impacted by this particular BCTS logging operation**.

Despite the small sample size and area, the density of active den trees on Dakota Ridge would appear to be quite high. By comparison, in a telemetry study of black bears on Mitkof Island, Alaska, Hanson (1988) found an average of 0.056 dens/ha across the island landscape, mostly in old hemlock trees in upland areas. Twice as many dens (0.11/ha) occurred in old forests of commercial value for logging. The researcher estimated that 500 black bear den trees were lost when 4,575 ha was roaded and clearcut. Given that most den trees are centuries old, such losses must be considered permanent and largely irreversible.



Map 1. Dakota Ridge study area showing black bear den sites located in proposed BCTS cutblocks DK042 and DK044. Five active den sites were found in old-growth structures within the two cutblocks and extrapolation of the field survey sample size areas to the other two cutblocks and new road location (in old-growth sections only) indicated that an estimated 32 active black bear dens would be impacted by logging.

Table 1. Dakota Ridge Black bear dens from June 11, 2015 surveys. BCTS cutblocks A79517 DK042 & DK044 & between cutblocks. Wayne McCrory, RPBio. For ELF.

Den & Tree #	Location	Tree Species & desn.	DBH* (cm)	Den type & entrance	Elevn.	Avg. slope from DEM**	Comments
Den-1(#3)	DK042, Lower block, 10 m e.? of R/Way	Redcedar, live	202	Trunk cavity Entrance 2 m up. Small, 33 cm diam.	700 m	24 deg.	Entrance face n. Wood debris for bear. 2 hairs coll. Not used last year?
Den-2(#9)	DK042, Lower. W. spur near end, Stn 677, 5 m off r/way	Redcedar, Snag – 1 live top	273	Trunk cavity Entrance 4 m up. Face south	750 m GPS?)	24 deg.	One – 1 wk. green vegn. scat nearby. Bear widened entrance to 40 cm. Scratch marks. 1.5 m cavity inside
Den-3(#12)	DK042, Lower, Near r/way	Redcedar, live	250 est.	Trunk cavity Entrance 2 m up. Face North	750 m	24	Small entrance 45 cm across. Enough for small bear. Claw marks below. Could not see inside
Den-4(#16)	Access trail: ½ way between DK042-DK044 cutblocks	Yellow cedar, live	171	Root bole Bear had excavated dirt bank to widen access 2 m down. 2/3 m diam. entrance	800 m	24	1.5 m cavity in side, under roots. Bit of moisture. Entrance S., uphill side.
Den-5(#17)	Access trail: ½ way between DK042-DK044 cutblocks N49 29.229 W 123 32.525***	Redcedar, Live. 4 tops	276	Trunk, cavity. Den entrance m up	840 m (820 GPS)	24	Hamilton? Entrance E. side. Smaller hole but looks like worked by bear.
Den-6(#18)	DK044, Lower n. side, access trail. Rd R/Way 40 m above. Stn. 3-115	Lge. West. Hemlock, live	171	Basal cavity		24	Den entrance 18 x 55 cm, suited for small bear. The up over root to large cavity. N.W. side entrance. Hair collected.
Den-7(#19)	DK044, S.w.side ridge, CMT area	Yellow cedar, live, solid	164	Basal cavity	920	14	50 m below ridge. Entrance on s.w. side. 30 x 40 x cm, another smaller. Cavity at back. Used. (T. Hamilton?)

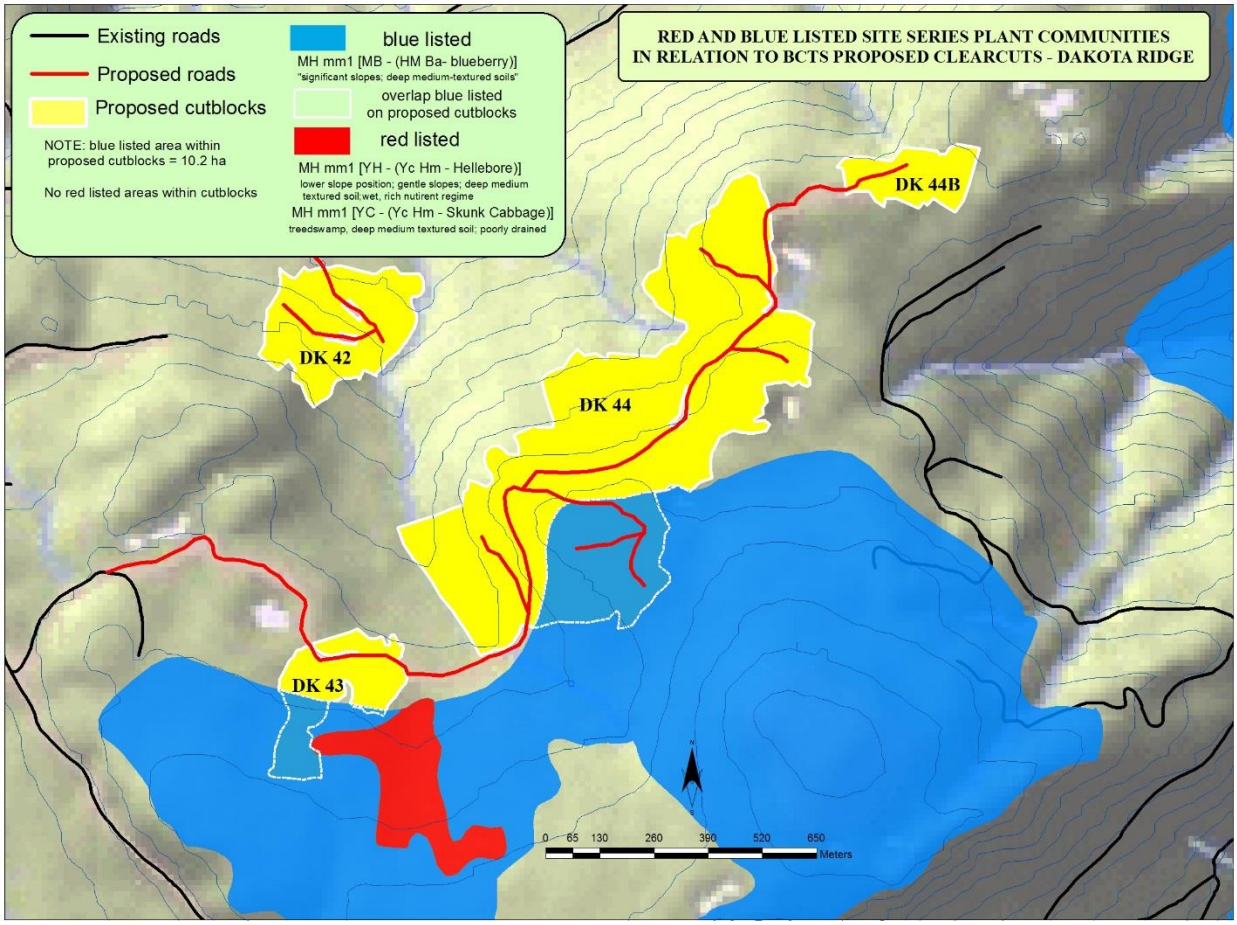
***DEM refers to Digital Elevation Model. GIS was used to compute slope average for the whole area, as slopes were not measured at each den location**

****DBH refers to Diameter at Breast Height. All measurements were taken with a diameter tape. However, due to the large flares of some of the butts, DBH was considered a crude estimate.**

*****GPS readings could only be obtained at some of the den sites due to the difficulty in getting satellite connections.**

3.3 Red- and blue-listed site series plant communities on Dakota Ridge

No red-listed site series were found in the BCTS cutblocks, but about 10.2 ha of blue-listed site series are located mostly in DK044. The blue-listed site series in DK044 overlaps with the two active black bear dens located, as well as a recognized yellow cedar CMT area. As noted in McCrory (2015), guidelines are being developed on the central and north coast to protect some 70% of blue-listed site series.



Map 2. Dakota Ridge study area showing red and blue listed site series in relation to BCTS proposed cutblocks. No red-listed site series were found in the proposed cubtlocks or road locations, but about 10.2 ha of blue-listed site series are located mostly in DK044.

3.4 Use of field work results to test and adapt coastal black bear GIS habitat model

We used the results of our field surveys to validate and adapt the coastal black bear den habitat model developed for the central BC coast from a literature review of coastal black bear den attributes, including forest age, slope, and elevation in which algorithms were applied (McCrory et al. 2010 *In Press*). Basically, the previous GIS model was validated by the field surveys on Dakota Ridge except that dens were found at higher elevations that expected for black bears. This may be because grizzly bears, which den at higher elevations than black bears, have been extirpated from the area, and den trees are in shorter supply at lower elevations due to extensive

clearcutting. For purposes of simplifying our analysis, we used the same slope data (10-30 degrees) from our earlier model for black bears, but modified the elevation to a higher level to reflect local conditions (250-1,000 m). We also focused on only the highest value potential habitat involving old-growth (age class 9). Parameters for low-moderate den habitat potential, developed for our 2010 model, were excluded from our analysis for purposes of simplicity. We did not include lower value areas, such as the Elphinstone park expansion study area where low black bear denning habitat values were recently identified in relation to scattered, relict old-growth trees, including live and downed structures (McCrory 2015).

Our findings of seven black bear dens on Dakota Ridge corresponded well with the highest value black bear den habitats identified by the GIS model, and although a low sample size, was considered fairly representative of predicting where the highest value areas would occur for black bear winter dens on the Sunshine Coast.

We then ran the GIS model for the four proposed cutblocks on Dakota Ridge (63 ha) and, although all is in age class 9, some 52 ha (82.5%) was determined from slope and elevation parameters to be of high black bear denning habitat capability. Another 2 ha would be impacted by new logging roads for a total of 54 ha.

3.5 GIS model analysis of current and logged high value den habitat in Dakota Ridge study area

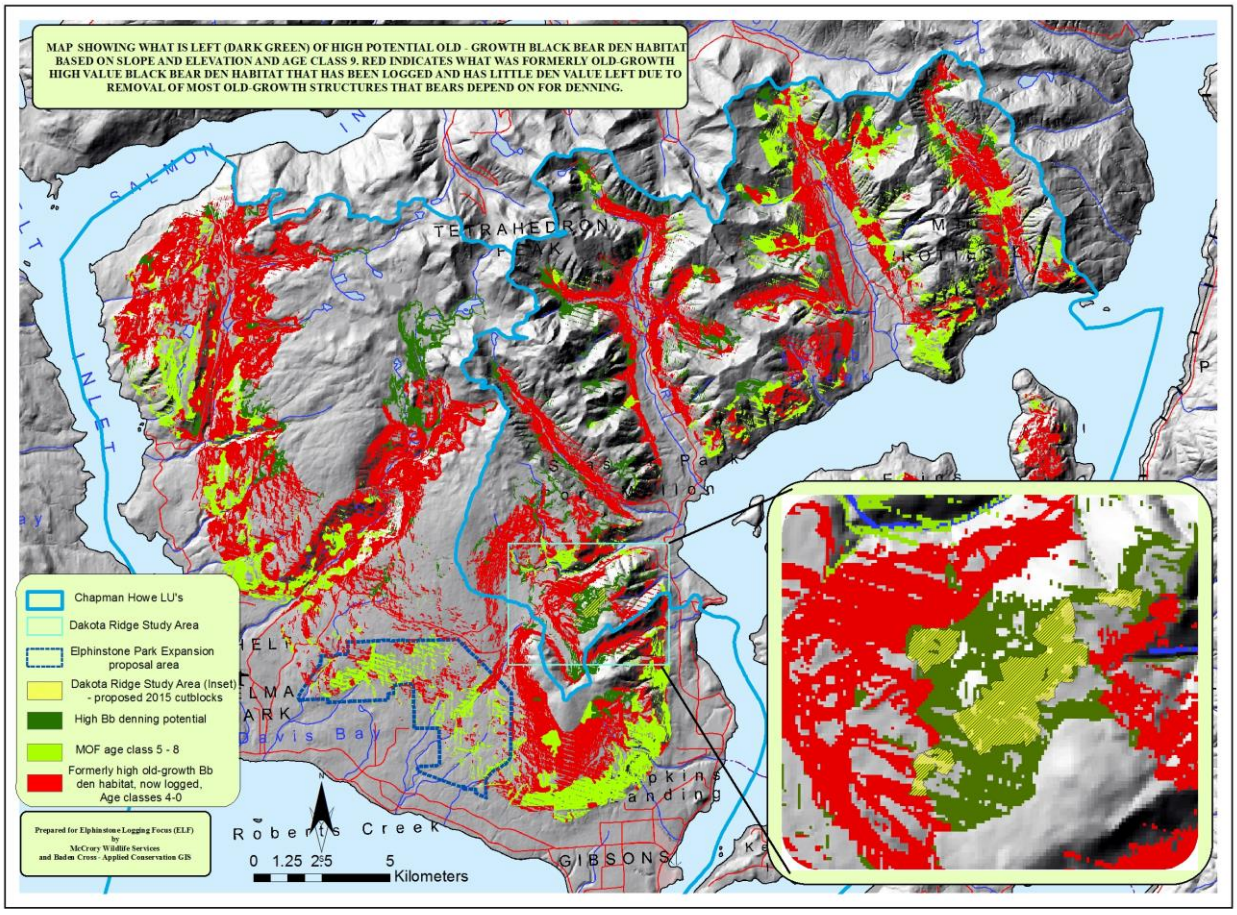
The 2,616 ha Dakota Ridge study area was defined by the boundaries shown on Map 2. These were arbitrary boundaries for the purposes of comparing existing and logged high potential black bear den habitat in a surrounding but not regional context for the proposed BCTS Dakota Ridge cutting area. (See also next section for a regional analysis).

We first ran the predictive GIS black bear habitat den model for the 2,616 ha Dakota Ridge study area using only the high value GIS slope and elevation parameters. Some 693 ha of this highest potential den habitat, assumed to be formerly age class 9, was then determined to have been clearcut and now was in class 4 or less with, of course, much diminished black bear den habitat values due to loss of most old-growth structures. Using the same GIS model parameters for slope and elevation, some 249 ha was found to still occur as old-growth age class 9 as the highest den values (existing age classes 5-8 were excluded although they would have some lower den habitat values). All total, considering that our age Class 9 assumption for logged areas is accurate for the time of original clearcutting, a total of 942 ha of highest value den habitat once existed for black bears, but now only 249 ha (26%) remains in our Dakota Ridge study area. Some 74% is already gone. The proposed BCTS logging would mean another 54 ha or 22% of high quality den habitat would be lost, reducing what is left on Dakota Ridge to 195 ha.

3.6 GIS model analysis of current and logged high black bear den habitats in Howe and Chapman Landscape Units (LUs)

We again used the updated GIS model for high black bear den habitat areas to analyze how much high value old-growth (age class 9) den habitat remains in the Howe and Chapman LUs, and approximately how much has been lost. We assumed all of the logged areas were formerly old-

growth (age class 9) while recognizing some may have been age class 8 and lower. Age classes 0-4 were all assumed to be logged, although some age class 5 might also have been logged in the past. Again, for purposes of simplicity, we excluded age classes 5-8 from our analysis. At best, our results are to be considered a crude approximation only.



Map 3. Shows the small amount of highest value black bear den habitat (dark green) still in an old-growth state in the region, reflecting low-moderately steep slopes (10-30 degrees) and elevations between 250 – 1,000 m used in our GIS model. Using the same model and assuming all logged areas (age classes 0 – 4) were formerly old-growth coastal forest (age class 9) it was determined that most of the highest value black bear den habitat in the region has already been lost due to clearcutting. It is recognized that studies have shown that some black coastal bears do use remaining old-growth structures left in clearcut areas but the overall values are greatly diminished. We did not attempt to determine how much of the high remaining old-growth den habitat is in protected areas (e.g. Tetrahedron provincial park), old-growth management areas (OGMAs) or wildlife tree patches or reserves.

For our analysis we used only the terrestrial, not marine, component of the total area of the Chapman-Howe LUs, which is 68,600 ha. Overall, our GIS den model showed that originally there was some 13,500 ha of the highest value black bear den habitat in both LUs (red and dark green on Map 3). Some 11,500 ha shown as red on Map 3 (age classes 0-4), assumed when originally logged to be old-growth age class 9, has been lost to clearcut logging. By running the GIS model for slope and elevation, and filtering out only old-growth age class 9, it was determined there is some 2,000 ha of the high quality black bear den habitat left in both LUs. In other words, there is only 14.7% of original old-growth black bear den habitat left in the LUs,

representing 2.9% of the terrestrial landscape. Of this, the 249 ha of high value old-growth black bear den habitat in the Dakota Ridge study area represents about 10% of the high value den habitat left in the whole region (or LUs).

Again, I wish to reiterate that there is still an unquantified amount of lower quality denning habitat left in the LUs, including the old-growth structures in the Elphinstone park expansion study area (McCrory 2015). As well, some black bear denning would occur in second-growth clearcuts, such as in old stumps and residual old-growth trees, either standing or down.

However, **none of these lower value den areas match the very high quality old-growth den habitat identified on Dakota Ridge and the various dens identified. Simply put, it is very important to retain such areas unlogged as benchmark areas not only for black bear den habitat representative of the old coastal forests, but for the host of cavity-using vertebrates that still exist in the area.**

In terms of overall impacts of logging on high quality black bear den habitat, of the 64 ha proposed for clearcutting, the den model shows that 52 ha would be in high quality den habitat and another 2 ha would be impacted by new logging roads. Thus, if the logging proposed by BCTS on Dakota Ridge is approved, it will mean that 22% (54 ha) of the remaining old-growth high quality den habitat for black bears in the Dakota Ridge black bear den study area will be lost forever. This also would reduce the 2,000 ha remaining in the two LUs by another 2.7%, contributing to the attrition of suitable habitat and adding to the ecologically negative cumulative impacts on old-growth-dependent cavity-using vertebrates in the region.

3.7 Current black bear den habitat protection guidelines

Currently, no guidelines have been adopted by the province to protect black bear dens and their den habitat, despite a number of scientific studies, some published, recommending that such be implemented, particularly for coastal bears that are dependent exclusively on old-growth structures for the hibernation, birthing, and early rearing requirements of their life history. TimberWest on Vancouver Island has taken some private initiative to protect black bear dens in their logging operations.

Following are some of the recommendations and proposed guidelines for protecting black bear den sites and their habitat associations.

1. In the absence of a field inventory of den sites for the spirit bear and grizzly bear in Western Forest Product's (WFP) logging plans on the BC central coast, McCrory et al. (2010 *In Press*) developed a GIS habitat den model and tested it on the central coast on Roderick-Pooley Islands and elsewhere. They found that 20% of the high potential black bear den habitat on Roderick-Pooley (one of four known "Kermode" islands) had already been logged by WFP. A review of proposed Ecosystem-Based Management (EBM) concluded that guidelines for bears did not include adequate provision for protection of old-growth den sites. Some subsequent testing of the habitat model for Pooley Island showed that more ground-testing was needed to verify actual den sites so that the draft model could be refined. In the absence of a field inventory, the authors recommended that the model be used to identify the

most important potential denning areas and that adequate provisions be included in any guidelines to protect den areas. Helen Davis (pers. comm.) has tried using predictive den habitat models but did not find their accuracy that reliable.

2. According to Davis et al. (2011):

   Conversion of late-successional forests to younger even-aged stands is detrimental to the supply of dens for black bears in coastal British Columbia. Conservation of adequate dens and denning habitat in forest management plans is appropriate because individual den sites are important structural legacies to black bear populations and a lack of suitable den sites may lead to decreased black bear populations because of increased cannibalism (Alt and Gruttadauria 1984, Davis and Harestad 1996), predation by wolves (Horejsi et al. 1984), or deaths due to increased energetic costs from using less thermally advantageous dens (e.g., dens prone to inundation; Alt 1984).

   Davis et al. (2011) recommended the following:

   If maintaining current population levels is a management goal, then conservation and recruitment of adequate numbers of safe winter den sites across the landscape needs to be included in forest management plans. Our findings suggest that the most effective method for retaining highly persistent, hollow tree dens is to retain these important structures within contiguous forests or patches of trees rather than as single trees. In other forest types, researchers have found that retention patches >1 ha in size, placed in topographically sheltered locations, with minimized edge exposure to prevailing winds, are more windfirm (Steventon 2011). Further research on the longevity of wildlife tree patches is required in coastal forests to determine the most effective management prescriptions for long-term retention of individual den trees. However, managing habitat for black bears must include not only retention of current den structures but also recruitment of new den structures

3. After a 2-3 year study of winter den use by coastal black bears on Prince of Wales Island, Alaska, protection guidelines are currently being proposed to the U.S. Forest Service for the revisions of the Tongass Forest Management Plan. Currently it is being proposed that there be a 100 m no-log buffer around all known dens. The den report summary is still being written (Boyd Porter email to McCrory Wildlife Services, June 29, 2015).

4. Haida black bear den guidelines under Consolidated Order 20 (http://www.haidagwaiimanagementcouncil.ca/documents/HGLUOO%20Consolidated%20Order%20FINAL%20Signed%202014040245.pdf):

   Objectives for Black Bear dens

   (1) Protect all Black Bear dens within a reserve zone, measuring at least 20 meters in width, around the Black Bear den.

   (2) Despite subsection (1), alteration or removal of a Black Bear den or its reserve zone, or both, may occur, provided that:

   (a) an intergovernmental process is completed;

(b) the alteration or removal is required for road access or to address a safety concern; and

(c) the alteration or removal does not occur during the winter hibernation season.

(3) Adjacent to any reserve zone required in subsection (1), maintain a management zone with an average width equal to 1.0 tree length, measured from the outer edge of the reserve zone, to protect the integrity of the reserve zone.

(4) Where practicable, maintain suitable western redcedar and yellow-cedar in management zones for long term Black Bear den recruitment.

(5) Within the management zone required under subsection (3), alteration or removal of trees may occur, outside of the winter hibernation season, to:

(a) accommodate operational requirements for road and bridge construction, where no practicable alternative exists;

(b) accommodate road maintenance and deactivation, the removal of danger trees, and brushing and clearing within the right-of-way, for safety purposes, on any existing road under active tenure; or,

(c) mitigate the impact of windthrow.

(6) All existing and newly discovered Black Bear dens must be documented and submitted to the Council of the Haida Nation and the Province of British Columbia at the end of each calendar year.

(7) Where practicable, include trees, snags, stumps and logs that are greater than 0.80 meters in diameter within stand level retention, for the recruitment of future denning habitat.

5. **North and central coast black bear den guidelines under Consolidated Order 19** (Jens Weiting pers. comm.). Apparently, these are also being proposed for the south coast but only for LUs where coastal ecosystem-based guidelines are being developed:

Objectives for grizzly and black bear dens

A. Protect grizzly bear dens and black bear dens.

B. Adjacent to grizzly bear dens, maintain a reserve zone with a minimum width of 50 meters.

C. Despite subsections (1) and (2), alteration or removal of:

1. a black bear den; or

2. a grizzly bear den or its reserve zone, or both, may occur, provided that:

i. there has been First Nation engagement with applicable First Nations;

ii. the alteration or removal is required for road access or to address a safety concern and there is no reasonably practicable alternative; and

iii. the alteration or removal does not occur during the winter hibernation season.

D. In addition to subsections 1 and 2 above, adjacent to any reserve zone required in subsection 2, maintain a management zone with an average width equal to 1.0 tree length, measured from the outer edge of the reserve zone, to protect the integrity of the

reserve zone.

E. *Within the management zone required under subsection (4), alteration or removal of trees may occur, outside of the winter hibernation season, to:*
   1. *accommodate operational requirements for road and bridge construction, where no practicable alternative exists;*
   2. *accommodate road maintenance and deactivation, the removal of danger trees, and brushing and clearing within the right-of-way, for safety purposes, on any existing road under active tenure; or,*
   3. *mitigate the impact of windthrow.*

F. *All found bear dens must be documented and submitted to the applicable First Nations and the Province of British Columbia at the end of each calendar year*

3.8 Implications of proposed Dakota Ridge cutblocks to other cavity-using vertebrate species

During historic occupation by grizzly bears, this same high elevation old-growth forest would have been preferred by grizzly bears for winter denning. The nearest grizzly bears today are found just to the north in the Elaho Valley within the Howe LU.

In a recent comprehensive review of forest management and sustaining cavity-using species in the Pacific Northwest (including British Columbia) Bunnell (2013) points out that of the 67 vertebrate species commonly using cavities in the region 20 (30%) are designated *at risk* or *potentially at risk*; most of this related to the emphasis of past forestry activities on removing old and dying trees as a matter of economic efficiency. Where forestry has been practiced longer, the proportion of forest-dwelling vertebrate species that use cavities designated *at risk* is higher. Bunnell (2013) also points out that leaving some dead and dying trees in forestry operations has some value, particularly trees 50 cm dbh or larger. While pointing out this approach can accommodate most bird species in less productive, inland forest types this silvicultural approach may not be adequate for some bird species including four designated *at risk.* He also points out likewise for some mammal species. He points out that six mammal taxa select trees or snags > 50 cm in diameter and use down wood from 50-150 cm in diameter are listed as *sensitive* or *at risk* in the Pacific North West including Keen's myotis, northern myotis, black bear (subspecies *Kermodei*), grizzly bear, fisher, and American marten. Others such as the northern flying squirrel are also mentioned but not considered at risk.

Bunnell points out *a major implication is that stands managed intensively for fibre production often will not retain all cavity users. That implies some portion of the landscape should be left unmanaged. There is no unequivocal estimate of how much*.

3.9 Comments on Ministry report to SCRD on black bear dens on Dakota Ridge

According to Ross Muirhead, provincial carnivore biologist Anthony Hamilton flew in by helicopter approximately a year ago and met Mr. Muirhead and Mr. Penner on Dakota Ridge to carry out some field surveys in response to their concerns about the impacts of proposed BCTS logging on black bear den sites in old-growth trees. Apparently, Mr. Hamilton located two active

black bear dens, both of which Muirhead and Penner claim to have found for me within cutblock DK044 and which constituted part of my survey results. Apparently, Hamilton has not yet produced his report. Until such time as I obtain a copy of his survey results I have no comment.

However, the following information was recently obtained by my client group from the website of the Sunshine Coast Regional District (SCRD) planning and development committee :

> *Cutblock G043DK044 – After the community had reported presence of bear dens in this area, a senior carnivore specialist from the Ministry of Environment reviewed these cut blocks and discovered two dens outside of the planned harvest areas during the on-site examination. Although no active dens were noted in the cut-blocks, the stand of timber proposed for harvesting does have attributes that would provide denning opportunities. When considered in the context of denning potential that exists across the landscape, it was determined by the Ministry that the planned harvesting of the Dakota cut-blocks will have an inconsequential impact on denning opportunities for black bears.* **(**http://www.scrd.ca/files/File/Administration/Agendas/2015/2015-July-9%20PDC%20Agenda%20Package%20PART%201.pdf)

Detailed and specific survey data is missing in the Ministry's summary comment and professional opinion, but should be requested by ELF from SCRD or the Ministry of Environment. It appears that no attempt was made by the Ministry to estimate the number of active black bear dens in the proposed Dakota Ridge cutblocks. (It should be noted that my survey results showed that there are at least five dens located in two of the proposed cutblocks and a total of 32 active dens estimated to be impacted in the four BCTS cutblocks and road location.

Additionally, until I see the Ministry's data quantifying the denning habitat potential across the landscape, it is difficult to comment on their statement that loss of black bear dens on Dakota Ridge would *have an inconsequential impact on denning opportunities for bears;* other than our den habitat model suggesting that much of the original old-growth forest in the region that would have provided a den supply for black bears has been largely replaced with second-growth plantation forests such that black bear dens may be in short supply; not to mention as noted elsewhere in this report that logging also causes a loss of old-growth structures for a host of other vertebrate species. Obviously, the author of the alleged Ministry statement has not done their homework on the extensive logging of old-growth that has already gone on in the Sunshine Coast and what cumulative effects logging of old-growth on Dakota Ridge would have on old-growth-dependent species such as black bears.

4.0 CONCLUSIONS AND RECOMMENDATIONS

To my knowledge, none of the existing black bear den researchers and guideline proponents have looked at what den protection measures would be needed within the context of coastal landscape with an overall significant loss of old-growth den supply, such as we have documented for the Sunshine Coast, in comparison to the amount of surviving old-growth den supply and sites where recruitment of new dens could occur. While perhaps the guidelines would have merit where very little den loss has occurred I am hesitant to endorse any of them for landscapes that

have already lost so much of their old-growth den habitat.

Windthrow is also a significant threat to small patch protection for standing tree den sites. In these instances of historically degraded landscapes, such as our modeling has demonstrated for high value black bear den habitat on the Sunshine Coast, it would be more important to protect all remaining old-growth forest to help balance off the large and growing imbalance of plantation forest versus old-growth forest and the growing list of old-growth dependent species at risk. This is not just true for the old-growth denning needs of black bears (which are not considered at risk in the area) but for the importance of old-growth forests to a whole host of cavity-using vertebrates, some of them sensitive or at risk. In this regards, the report by Bunnell (2013) is instructive, particularly his conclusion that in order to protect all of the cavity-using species, some portion of the landscape should be left "unmanaged," and that as more and more old-growth is removed, the list of species at risk only increases.

From this perspective, my professional opinion would be to recommend that all old-growth within the 2,616 ha Dakota Ridge black bear den study area not be further logged but be set aside as a benchmark area for its very high value for black bear den habitat and for other old-growth cavity-using vertebrates.

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