

Preliminary Modeling of Deer Winter Range in Heiltsuk Territory on the Central Coast of British Columbia

Summary reference document to accompany maps

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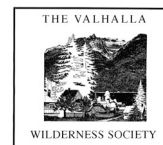
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Abstract

Sitka black-tailed deer (*Odocoileus hemionus sitkensis*) is an important resource for top predators and human hunters on the Central Coast of British Columbia. Severe winter weather is infrequent but may have significant regative consequences for coastal deer populations. During deep snow, deer require old, high-volume forests on gentle to moderate slopes at low elevations. Often, these same forest characteristics are targeted by industrial forestry. Once converted to tree plantations and entered into rotation schedules, these landscapes will likely never regain important structural characteristics for deer. Thus, it is important to identify important winter habitat for deer that may be non-renewable under current forestry models.

We applied a Geographic Information System (GIS) to identify deer winter range in Heiltsuk Territory. Over the same area, we also used GIS to estimate the Timber Harvest Land Base (THLB), which contains the areas most likely targeted for timber removal. Deer winter range and the THLB covered small proportions of Heiltsuk Territory (8 and 11% respectively). Notably, there was considerable convergence between winter habitat for deer and the THLB. Nearly 50% of modeled winter range occurs in the THLB and is thus potentially targeted for removal. These areas should be given special consideration in conservation planning. Moreover, planners, government, and industry must acknowledge that the impact of forestry on wildlife populations can be disproportionately larger than the percent area affected by logging. The output of this model can be applied in land-use planning.

Scope and Limitations of Model

The model applied herein was developed for the Spirit Bear Study Area on British Columbia's (BC) Central Coast by McCrory *et al.* (in press). It represents the best of preliminary efforts to model winter range of Sitka black-tailed deer (*Odocoileus hemionus sitkensis*) on the central coast of British Columbia. The model was developed to identify habitat that would be of highest importance to deer during severe winters. The model does not address the majority of life history requirements of coastal deer (i.e. general foraging habitat in areas and during periods without snow). Furthermore, the output is binomial or

categorical: areas are defined as those providing deer winter range, and those that do not. Deer, however, may use areas not identified in the model, and densities likely differ among areas across the landscape during periods of snow accumulation.

Our results are preliminary as the model was developed using data from ecologically similar areas (McCrary *et al.* in press). Considerable field verification is necessary to test this model and develop future models, which should rank polygons for winter habitat (and general foraging habitat) potential on a continuous scale.

Winter survival is a crucial factor, but not the only one in maintaining viable and well-distributed populations of deer in Pacific Northwest forests. Available evidence suggests that large-scale clearcut logging will reduce forage quality and quantity throughout the landscape, reducing the carrying capacity for deer (Wallmo and Schoen 1980; Alaback 1982; Van Horne *et al.* 1988; Hanley *et al.* 1989; Happe *et al.* 1990; Schoen *et al.* 1998). Piecemeal protection of a limited number of deer winter ranges likely will not sufficiently mitigate long-term declines if timber harvest continues by current methods and at current rates.

Geographic Information Systems in Coastal Planning

Geographic Information Systems are extremely useful to planners concerned with defining an adequate balance between resource extraction and conservation of biological diversity. Timely decisions can be approached through spatial analysis techniques that provide visual overlays of areas of concern and statistical database functions that help in reviewing potential impacts before they occur. For stakeholders that are unfamiliar with GIS techniques, three dimensional landscape renditions provide a powerful tool to visualize the area with which they are often familiar on the ground, particularly the 'overall' impacts that may occur from planned resource extraction.

Deer Winter Range in Coastal Forests

Winter is stressful for deer and old forests provide important shelter and food resources, especially during periods of snow. Deep and persistent snow can lead to significant mortality in coastal deer populations (Wallmo and Schoen 1980; Fenger & Harcombe 1992). On Admiralty Island, southeast Alaska, 39% of adult radio-collared deer died during one severe winter (Schoen *et al.* 1985). The authors estimated total mortality (including fawns) probably exceeded 60%. During periods of deep snow in southeast Alaska, high volume old-growth stands received disproportionately high use by deer (Schoen and Kirchhoff 1990), likely because this forest type is most effective at intercepting snowfall (Kirchhoff and Schoen 1987). Schoen and Kirchhoff (1990) showed that deer concentrated their activities in the highest volume old-growth within their home ranges when snow depth reached as little as 15-cm in southeast Alaska. Moreover, Harestad *et al.* (1982) demonstrated that energy requirements of deer during winter are best met in old-growth forests. Also, old forests provide an abundance of winter foods for deer, such as shrubs, lichens, and a species-rich litterfall from a complex plant community canopy (Wallmo and Schoen 1980, Kirchhoff and Schoen 1987).

In contrast, second-growth forests provide poor winter habitat for deer. Forage in clearcuts may be unavailable or may require significant energy to access (Schoen and Kirchhoff 1985; Harestad *et al.* 1982). More notably, closed canopies that form after the regeneration of clearcuts severely limit forage. If no additional harvesting occurs, these conditions may persist for 150 to 200 years. However, under short-rotation, even-aged management, some understory plant species may never regenerate (Wallmo and Schoen 1980; Alaback 1982; Schoen *et al.* 1988). This loss in structure and function can be considered permanent. To this situation, Schoen *et al.* (1988) applied the term “nonrenewable old-growth (deer) habitat”.

Convergence between Winter Habitat for Deer and Areas Targeted for Logging

Areas important to wildlife are often the same as those selected for resource extraction. Schoen *et al.* (1985) predicted the effect in Hawk Inlet on Admiralty Island, southeast Alaska, where logging will remove more than 75% of commercially viable forests over 100 years. The investigators predicted that deer would be reduced to 20% of the 1985 level. Similarly, Bergdahl *et al.* (2000) assessed the impacts of road building and clearcutting within the Spirit Bear Conservancy Proposal using company forest development plans and current harvest rates. These authors predicted the loss of approximately 23% of suitable deer winter range in the next 20 years and over 90% after 100 years.

Winter Climatic Conditions in Heiltsuk Territory

Climatic conditions in Heiltsuk Territory are generally mild, but can vary among areas and years. Thirty-year average annual snowfall varies from 86-cm (Bella Bella) to 155-cm (Ocean Falls) (Figure 1; Environment Canada 1991). Snowfall and probability of accumulation are much greater in the inland portions of the study area but no weather data are available. Southeast Alaska and coastal BC can periodically experience very heavy snowfalls. For example, Person (1997) used long-term weather data for Prince of Wales Island, southeast Alaska, to predict that approximately 6 winters per century may result in significant declines in deer numbers (ca. once every 17 years).

Objectives of Modeling

The objectives of this modeling effort are:

1. To identify potential deer winter range areas in Heiltsuk Territory (~16,650-km²). Output maps use the same scale and layout as the Heiltsuk Land Use Atlas. Planners can use the associated maps as a layer in decision-making and;
2. To identify areas and estimate overlap between deer winter range and areas likely targeted for timber removal. This information can better inform decision-makers about the potential impact of forestry on winter habitat for deer.

Models and Methodology

We used a deer winter range model developed by McCrory *et al.* (in press) for application in a Geographic Information System (GIS). The model included the following geographic data: biogeoclimatic subzones, B.C. Ministry of Forest cover, and a Digital Elevation Model (DEM) generated from 1:20,000 TRIM maps. For details on the variables, criteria, and rationale used in the model, see McCrory *et al.* (in press). Briefly, the model included areas meeting the following criteria:

1. **Elevation.** Between sea level and 500-m.
2. **Forest Type.** Western hemlock (*Tsuga heterophylla*)-dominated biogeoclimatic subzone variants CWH vm1 and CWH vh2.
3. **Age classes.** 121-140 years to >500 years
4. **Volume Classes.** 150-200 m³/ha to 850 m³/ha.
5. **Slope Steepness.** <40°

Aspect is often considered important in deer winter ranges. The model applied herein, however, omits aspect for several important reasons. First, it was highly correlated with forest type. Second, in steep terrain such as the topographically complex mainland of Heiltsuk Territory, aspect may not be a good predictor of sun exposure given the low angle of winter sun at this latitude. Schoen & Kirchhoff (1990) found that deer increased their use of southerly aspects on Admiralty Island during severe winter conditions, and used northern exposures less than their abundance in both a mild and severe winter. These authors suggested, however, that elevation and characteristics of the forest canopy were much more important variables for identifying deer winter ranges than aspect.

We also used a GIS model to estimate the Timber Harvest Land Base (THLB; see Travers *et al.* 1999; McCrory *et al.* in press). Briefly, BC Ministry of Forests defines the THLB as the land remaining after removing areas unsuitable or unavailable for timber removal (e.g. steep or protected areas, areas identified as providing important wildlife habitat, or stands of low commercial value). Modifications may vary among regions after negotiation among local First Nations, company foresters, the Ministry of Forests, and government habitat biologists (R. Travers personal communication).

Results and Discussion

Modeled winter range comprises a small proportion of Heiltsuk Territory. Likewise, the THLB covers a relatively small area. Notably, however, there is considerable convergence between deer winter range and areas most likely targeted for timber removal.

Approximately 8% of Heiltsuk Territory provides deer winter range as defined by the model (*Figures 1-3*). Winter range occurs in a mosaic of small pockets throughout the landscape, and is more abundant on inner islands and adjacent mainland (*Figures 1-3*).

Eleven percent of land falls within the Timber Harvest Land Base, some of which has already been converted to tree plantations (*Figures 1-3*). Similar to modeled habitat for deer, these areas occur primarily on the mainland and inner islands (*Figures 2, 3*).

Notably, considerable convergence occurs between modeled winter habitat for deer and areas likely targeted for timber removal. Approximately 48% of deer winter range falls within the THLB (*Figures 1-3*). In the mainland area where snowfall frequency, duration, and severity are greatest, this overlap is 51%. The degree of conflict was particularly evident in the mainland area near Namu (*Figure 4*).

From our preliminary modeling effort we conclude the following:

1. The proportion of Heiltsuk Territory that likely provides critical deer winter range habitat is small (~8%). These areas should be given special consideration in conservation planning. Although deep snow may be infrequent, loss of this relatively rare forest type may have significant negative impact on deer populations.
2. Planners, government, and industry must acknowledge that the impact of forestry on wildlife populations is often disproportionately larger than the percent area affected by logging. In this case, although the THLB affects only 11% of the land base, the conflict with predicted deer winter range is roughly 5 times that area (48%).

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