A Management Plan for Roosevelt Elk in British Columbia

September 2015

Executive Summary

Roosevelt elk (*Cervus canadensis roosevelti*) serve an important ecological role in coastal ecosystems of British Columbia (BC). They are prey for top predators and they influence plant phenology and successional pathways in their preferred habitats. Roosevelt elk are also important in First Nations culture and provide resident and guided hunting and viewing opportunities. Economic benefits generated by these uses benefit communities, regions and the province.

This plan presents a synopsis of current management objectives and strategies for Roosevelt elk that will direct management from 2015-2025 according to provincial wildlife policy and ongoing consultation and engagement with First Nations and stakeholders.

Roosevelt elk are on the Provincial Blue List and are subject to a conservative, limited-entry hunt in the West Coast and South Coast Regions. Although their global distribution is smaller and more fragmented than pre-1900, the BC population is growing, particularly in the South Coast Region where translocations have re-established Roosevelt elk into portions of their historic range.

Roosevelt elk are managed by Elk Population Units (EPUs). Population size and trend, harvest rate and habitat suitability have been estimated for all EPUs. Indicators are monitored according to conservation priorities and available funding.

Given the conservation status of Roosevelt elk and the high demand for cultural, subsistence, recreational and commercial uses, the Ministry of Forests, Lands and Natural Resource Operations (FLNR) has management goals of increasing the population, expanding its distribution and mitigating threats, such that the subspecies could be removed from the Provincial Blue List within the 2015-2025 time period.

It is acknowledged that delivering these goals, while addressing conservation concerns, has potential implications for other sectors like transportation, forestry and agriculture which also must be considered. Therefore, to meet these management goals, the following objectives are planned:

- Obj. 1. Maintain self-sustaining populations of Roosevelt elk throughout their current range in the West Coast and South Coast Regions.
- Obj. 2. Re-establish Roosevelt elk in historic but unoccupied ranges where ecological conditions are suitable.
- Obj. 3. Maintain or restore the contribution of Roosevelt elk to natural biodiversity and ecosystem function.
- Obj. 4. Within the ecological limits of the species, provide opportunities for consumptive and non-consumptive use.
- Obj. 5. Mitigate public safety risk of vehicle collisions.

Obj. 6. Mitigate crop depredation impacts on agricultural crops and market gardens.

Obj. 7. Mitigate conflicts with forest management objectives.

Strategies to meet these objectives are presented, although the intensity, duration and extent of different management strategies will need to be developed and implemented based on site-specific circumstances and consultation with First Nations and stakeholders.

Table of Contents

List of Figures

List of Tables

Disclaimer

This management plan has been prepared by the Ministry of Forests, Lands and Natural Resource Operations as advice to the responsible jurisdiction and organizations that may be involved in managing Roosevelt elk in British Columbia.

Management actions to achieve the management goals and objectives identified herein are subject to the priorities and budgetary constraints of participatory agencies and organizations.

Recommendations provided in the plan will be used by the Ministry of Forests, Lands and Natural Resource Operations to guide the development of new, or modification of existing, provincial policies and procedures. While the recommendations herein are based on the best available science and expert judgment of the writers and reviewers, policy considerations may result in the modification of these recommendations, while respecting their intent, to address social and economic objectives in Roosevelt elk management. The mangement goals, objectives, and management actions may be modified in the future to accommodate new objectives and findings.

Success in the conservation of this species depends on the commitment and cooperation of many different constituencies that may be involved in implementing the directions set out in this management plan.

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Timberlands Limited Partnership, Northwest Hardwoods Inc., Powell River Regional District, TimberWest Forest Corp., and Western Forest Products Inc.

Introduction

Roosevelt elk (*Cervus canadensis roosevelti*) are the largest subspecies of North American elk and range in BC throughout Vancouver Island and portions of the South Coast Region (Shackleton 1999). As the largest ungulate in their range, Roosevelt elk serve an important ecological role as prey for top predators such as gray wolves (*Canis lupus*) and cougars (*Puma concolor*), and as large browsers that influence plant phenology and successional pathways in their habitats. Roosevelt elk are important to First Nations, who are keenly interested in expanding their traditional use of the species. Resident hunters submit more than 15,000 applications annually for approximately 300 hunting opportunities. Guided hunts for non-resident hunters are in high demand and provide a high return to guide-outfitters. Roosevelt elk are also highly sought after for wildlife viewing. These uses generate direct and indirect revenue to the Crown as well as economic benefits to communities, regions and the province.

This plan presents a synopsis of current management objectives and strategies for a Roosevelt elk management plan, based on input from FLNR. This plan is intended to direct management of Roosevelt elk for the next 10 years according to provincial wildlife policy, following consultation with First Nations and stakeholders. For the purposes of Roosevelt elk management, consultation is defined as a process which allows for reaction and response by First Nations and stakeholders to wildlife management issues.

Conservation

Roosevelt elk are ranked by the Conservation Data Centre (2015) as S3S4 (*Vulnerable* to *Apparently Secure*) and are on the Provincial Blue List (*Special Concern*). The BC Conservation Data Centre of the Ministry of Environment collects and disseminates information relating to distribution, trends and threats to species and ecosystems that are at risk in BC. Like other blue listed species, Roosevelt elk are considered at risk and have characteristics that make them particularly sensitive or vulnerable to human activities and natural events. The Ministry of Environment's (2009) Conservation Framework outlines 3 goals for at risk species and ranks the priority of each goal by species. The goals of red or blue listing species are:

- to contribute to global efforts for species and ecosystem conservation;
- prevent species and ecosystems from becoming at risk; and
- to maintain the diversity of native species and ecosystems.

Of these goals, preventing the species from becoming at risk is considered the highest priority for Roosevelt elk. The framework provides broad management action recommendations for Roosevelt elk such as monitoring population trends, species and population management, and habitat protection.

This plan seeks to outline the tools that are available to wildlife managers to address conservation concerns, including concerns regarding distribution, trends, and threats for Roosevelt elk in BC. While these three metrics are intertwined, the distribution and trends can be significantly impacted by threats depending on their scope and severity.

Elk are large bodied animals and have significant habitat requirements in terms of both space and food (see Natural History, page 3). As mentioned above, Roosevelt elk populations can be particularly sensitive to human activities or natural events. Human activities such as resource extraction, development, and road constructions can threaten habitat suitability and increase access to habitats for predators and hunters. Other human activities such as over-harvesting threaten to impact elk populations as well (Nyberg and Janz 1990).

Natural events such as extreme winter weather can significantly impact elk populations by increasing minimum energy requirements and reducing the available forage and cover habitat (Brunt 1990, Quayle and Brunt 2003). These conditions will be amplified if inadequate critical winter ranges are available. Predation can also negatively impact conservation objectives, especially in small populations and where avoidance of deep snow is challenging.

First Nations

The province recognizes that many First Nations have asserted or proven aboriginal rights (Aboriginal Interests) or may have treaty rights to harvest wildlife for sustenance (food, social and ceremonial purposes) in their traditional areas. Further, the province has a legal obligation to consult when proposed wildlife management decisions have the potential to negatively impact Aboriginal Interests or treaty rights to harvest wildlife.

In many areas of Roosevelt elk range, demand for ceremonial, cultural and subsistence use exceeds sustainable harvesting opportunities. A number of First Nations, whose traditional territories include Roosevelt elk range, have expressed strong support for increasing both the size and extent of the elk population.

Economic Benefit

Hunting, trapping and wildlife viewing is responsible for approximately 2.5% of BC's gross domestic product (2003 data; Service BC 2005). Athough specific data for Roosevelt elk hunting are not available, studies from other jurisdictions suggest that resident and non-resident elk hunters spend $440 and $1,800 respectively, per trip in local communities (nominal 2012 US dollars; Koontz and Loomis [2005]). This spending does not include direct licence revenue, guide-outfitter fees, indirect economic benefits or regional impacts.

Roosevelt elk populations can also generate direct economic losses, primarily through damage to agricultural crops and impacts to establishing forest stands.

These costs are difficult to assess and have not been comprehensively estimated in BC or elsewhere. Wildlife managers work to mitigate conflicts with traffic safety, agricultural crop depredation and forest managment where conflicts are identified and practicable opportunities to mitigate exist.

Natural History

Brunt (1990), Quayle and Brunt (2003) and Shackleton (1999) provided detailed narratives of Roosevelt elk life history in BC. The following is a brief overview:

Feeding Ecology and Habitat Use

Roosevelt elk are generalist herbivores and browse or graze on a wide variety of shrubs, forbs, grasses, sedges and trees, depending on availability (Brunt 1990 Shackleton 1999, Cook 2002). Elk focus their habitat use in forested habitats, particularly along forest edges, riparian areas and recently burned forest stands or clearcuts (Witmer and deCalesta 1983). Security cover is also a major factor in Roosevelt elk habitat use (Brunt 1990, Quayle and Brunt 2003). Dense forests provide security and snow interception cover, and habitat that can provide both abundant food and dense cover in close proximity are considered highly suitable for Roosevelt elk (e.g., mature-old forest edges and riparian areas).

Seasonal habitat use patterns are variable; with some Roosevelt elk moving seasonally to high-elevation summer ranges, others moving between low-elevation seasonal ranges, and still others remaining in year-round ranges (Brunt 1990, Shackleton 1999). Snow depth is an important determinant of winter habitat use, with Roosevelt elk moving into mature and old forest to seek snow interception cover when snow in more open areas becomes deep enough (>30 cm; Brunt 1990) to cover low-growing plants.

Social Organization and Reproduction

Elk are social ungulates that congregate primarily in maternal groups comprised of adult females, young of the year (calves), and other juveniles (<2.5 years old) of both sexes. Adult males are typically solitary or are found in small bachelor groups except during the breeding season (September-October) when dominant males defend harems of females and calves from rival males (Franklin et al. 1975, Shackleton 1999, Geist 2002).

Females usually breed for the first time when 2.5 years old (Shackleton 1999) and bear a single calf (twins have never been confirmed on Vancouver Island; Quayle and Brunt 2003) in late May or early June. During the first few weeks of the newborn calf's life, cows and their calves typically remain apart from other elk, and calves will often remain hidden in dense cover as an anti-predator tactic while the cow remains close by. After calves become more mobile, cows and their new calves re-join the main herd.

Population Size and Distribution

The global distribution of Roosevelt elk extends from northern California to southwestern BC (Shackleton 1999, O'Gara and Dundas 2002). In BC they are currently distributed throughout most of Vancouver Island, on the mainland coast in the watersheds north of the Fraser Valley (Figure 1). The current mainland populations are largely a result of translocations from Vancouver Island (Spalding 1992, Quayle and Brunt 2003). Available evidence suggests that Roosevelt elk were formally distributed more extensively throughout the south coast of BC but were largely extirpated from the region by the 1880s as a result of an expanding human population and market hunting (Spalding 1992, O'Gara and Dundas 2002, Quayle and Brunt 2003).

Range descriptions, archeological evidence and traditional items fashioned from elk antlers, bones and hides highlight the importance of elk to First Nations pre-European contact. Based on traditional ecological knowledge (TEK), Roosevelt elk were widespread and abundant throughout the lower Fraser Valley, the 'north shore' watersheds of greater Vancouver and on Vancouver Island.

Evidence for the distribution and abundance of Roosevelt elk in the Coast Area of BC is provided by Aboriginal traditional knowledge. In the South Coast Region, words for elk exist in coastal languages, including *Shxwiya'xkel* among the Sts'ailes of the Upper Fraser valley (K. Charlie, *pers. comm.*), *Kayi7ch* in Skwxwu7mesh snichim, the language of the Squamish Nation (Chief I. Campbell, *pers. comm.*), and *qeyiyec* among the Tsleil-Waututh (B. Doyle, *pers. comm.*).

While the distribution of elk on Vancouver Island was not impacted by historical settlement, farming and market hunting to the same extent as populations on the mainland coast, evidence of distribution is also available through TEK and is reflected in First Nations languages, including T'ła̲wa̲l's in the Kwawala language of the Kwakwa̲ka̲'wakw people (H. Alfred, *pers. comm.*) and ƛ'udup in the Nuu-chah-nulth dialect spoken by people of the Pacheedaht First Nation (H. Jones, *pers. comm.*).

Translocations to the Sechelt Peninsula during the 1980s and near Powell River in the 1990s were followed by releases into the 'north shore' watersheds from the growing Sunshine Coast population during the 2000s (Appendix II). Although elk are found farther southeast in the Cascade Mountains, they are likely Rocky Mountain elk (*Cervus canadensis nelsoni*; Shackleton 1999) descended from translocations into Washington State (Washington Department of Fish and Wildlife 2000).

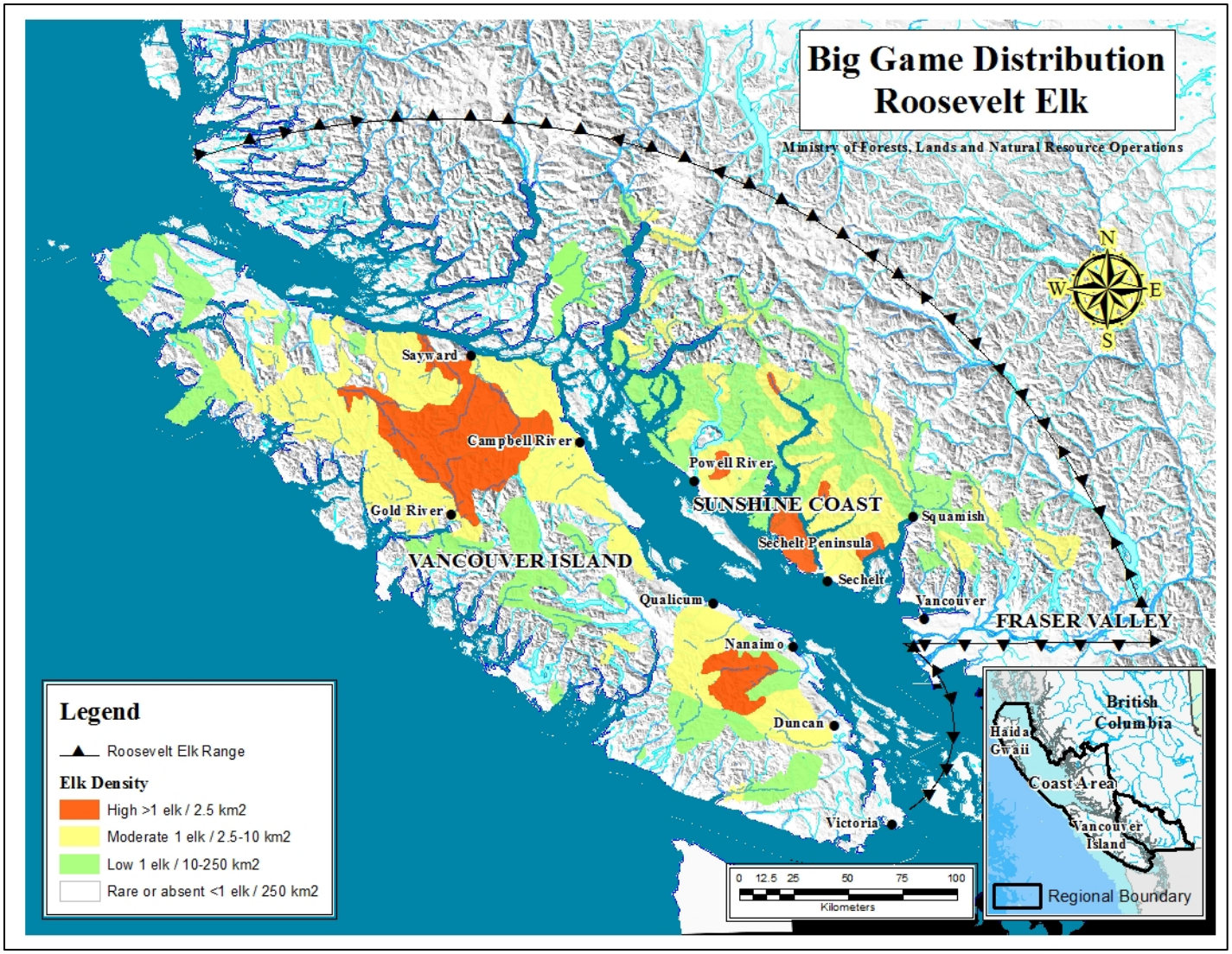

Figure 1. Estimated distribution and population density of Roosevelt elk in British Columbia.

The Roosevelt elk population has experienced an overall increase in BC (Table 1). The increase is most evident in the South Coast Region (Figure 2) where translocated populations are increasing rapidly.

Table 1. Estimated population size of Roosevelt elk in British Columbia, by Region.

Year	West Coast Region	South Coast Region	BC (approximate)
1986	2500	<50	2550
2001	3400	<400	3800
2014	5500	1600	6900

Management

Monitoring Population Size and Trend

Elk Population Units (EPUs) are the spatial management units by which Roosevelt elk are assessed and managed (Figure 2). EPUs generally follow the boundaries of major watersheds but are modified to account for known elk distribution, habitat use and movements. Roosevelt elk are usually inventoried by aerial surveys conducted in late winter or early spring (Simpson 1997). Methods follow accepted provincial standards (Resources Information Standards Committee (RISC) (2002)). Only portions of the EPUs are typically surveyed in any given year. The size of the area flown is funding dependent and priority areas for surveying are those:

1. with the largest hunted populations;
2. where a new hunt is anticipated;
3. where populations have been recently translocated;
4. of particular interest to First Nations; and/or,
5. where high levels of illegal or unregulated hunting are known to be occur.

Surveys are focused primarily on estimating population size, determining calf:100 cow and bull:100 cow ratios and the age class distribution of bulls. These indicators are used to evaluate population status and the effects of hunting (where authorized). Bull:100 cow ratios of 20-25 and calf:100 cow ratios of 30-40 are considered indicative of a stable population (Bender and Miller 1999, Oregon Department of Fish and Wildlife 2003, Montana Department of Fish, Wildlife, and Parks 2004, Arizona Game and Fish Department 2007, BC Ministry of Environment 2010, Ontario Ministry of Natural Resources 2011). Bull and calf ratios have generally fallen within these ranges over the last 18 years suggesting that overall, management actions are resulting in stable populations.

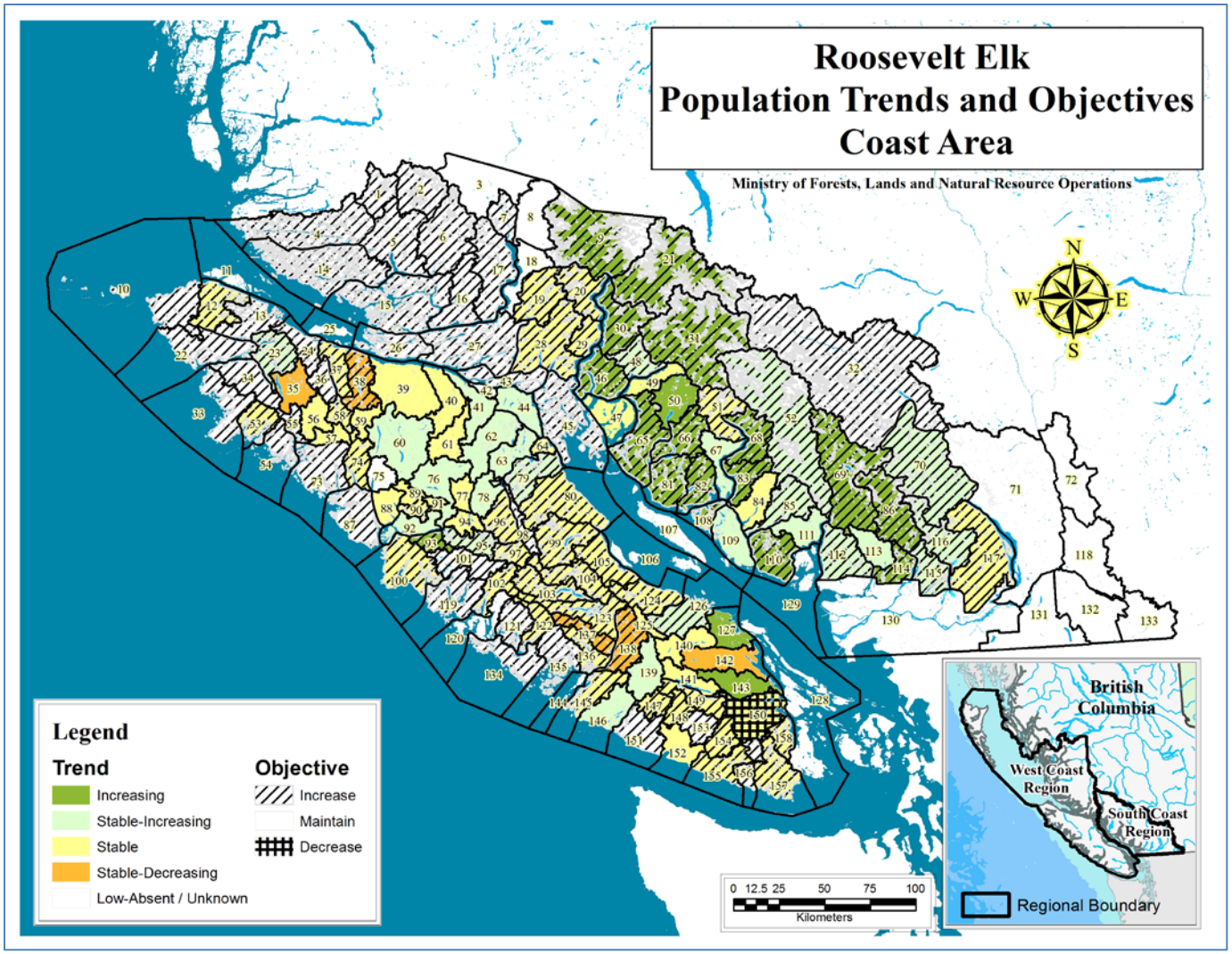

Figure 2. Roosevelt elk population units (EPUs) in the South Coast and West Coast Regions. Detailed information on each EPU is referenced in Appendix I. Also illustrated is the estimated population trend and objective for each EPU.

The total population of Roosevelt elk in an EPU can also be estimated in part from aerial surveys, after correcting for sightability. Sightability of elk in west coast forested habitats is generally 0.33-0.5 (Simpson 1997, Gilbert and Moeller 2008). Sightability corrections are applied based on a subjective assessment of the following factors:

1. weather – effect of fog, snow and rain on visibility;
2. habitat – canopy cover conditions where elk occur in the area;
3. ground snow conditions – relative abundance and location of tracks following a recent snowfall relative to the number of groups counted on surveys;
4. proportion of the range likely to be occupied that was surveyed;
5. time of day – use of open habitats is more likely within 2 h of sunrise or sunset; and
6. group size (typically a reflection of elk density) – larger groups are more likely to be sighted.

A sightability of *very low* to *very high* is assigned to each survey and elk counts are inflated accordingly to generate population estimates (Table 2).

Table 2. Sightability classes for Roosevelt elk surveys in BC , estimated proportion of the population visible and multiplication factors used to estimate population size from aerial inventory data.

Sightability	Estimated proportion of population visible on surveys	Multiplication Factor
Very low	<30%	>3.3
Low	30-45%	2.2-3.3
Moderate	45-55%	1.8-2.2
High	55-70%	1.4-1.8
Very high	70-95%	1.05-1.4

Roosevelt elk numbers and composition data are also collected during spring (April-May) and summer (August) using ground-based inventories. These data can be used to contribute to population size estimates and performance indicators.

Consumptive Use Management

Harvest Objectives

Harvest is closely regulated by *Limited Entry Hunting* (LEH) and monitored throughout the West Coast and South Coast Regions (Figure 3). Roosevelt elk are vulnerable to hunting because they are highly visible and in some areas relatively easy to hunt. Demand for hunting opportunities is high (i.e., approximately 15,000 applications from resident hunters for approximately 300 LEH permits, and high demand for guided hunts that provide a high return to guide-outfitters; K. Brunt,

pers. comm.) because elk provide a high reward value to hunters in terms of both meat and trophies.

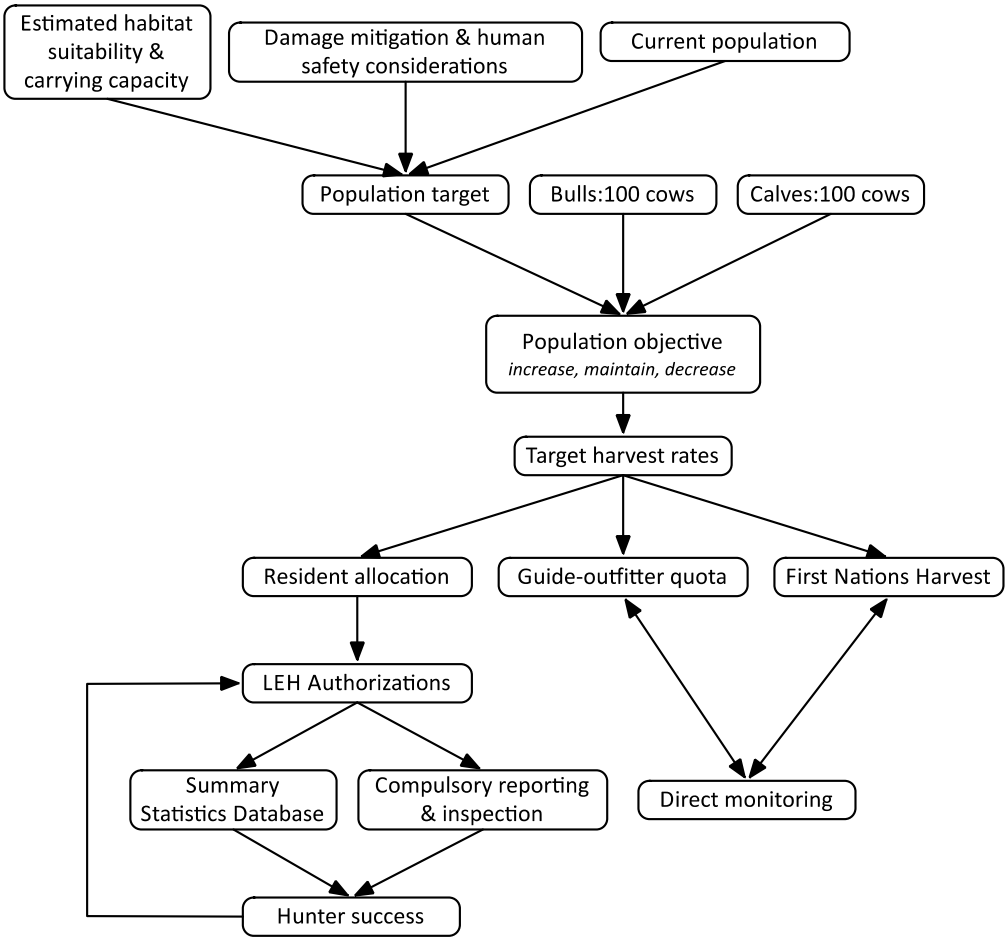

Figure 3. Consumptive use management of Roosevelt elk in British Columbia.

Consumptive use opportunities are provided where indicators of population size and status relative to population targets (see *Conservation* and *Sustainable Use* objectives, pages 15-17) indicate that the EPU can support a sustainable harvest. Harvest objectives are set conservatively based on these indicators and targets, considering factors such as predation and unregulated harvest.

Under arrangements with the province, First Nations typically harvest up to 50% of the annual allowable harvest of Roosevelt elk in BC. Allocation among licensed resident and guided hunters follows a Ministry Allocation policy (BC Ministry of Environment 2007; Table 3).

Table 3. 2015 Current FLNR harvest allocation for Roosevelt elk (applied after First Nations harvest arrangements).

Region	Roosevelt elk	Resident (%)	Non-resident (%)
West Coast	Bull	85	15
West Coast	Any sex (archery)	85	15
South Coast	Bull	80	20

Access to hunting opportunities for resident hunters is granted via LEH, which is BC's method of managing the harvest by resident hunters for particular wildlife species. Allocation is implemented where hunting demand is high relative to the available harvest and where the species or class of animal is particularly vulnerable to over-harvest. LEH controls harvest by limiting the number of resident hunters who are provided an opportunity to hunt Roosevelt elk. An alternative to LEH are *General Open Seasons* (GOS) which regulate the hunt by bag limits and limiting the length of time that species can be hunted. LEH, rather than GOS is used to manage Roosevelt elk harvests as it results in a more predictable harvest than GOS, and thus reduces the chance for overharvest.

LEH authorizations are distributed via a lottery among resident hunters who apply. The number of authorizations issued depends on the success rates of hunters from previous years. Where hunter success is low, a larger number of authorizations are issued to achieve a target harvest compared to areas or species where hunter success is high. Note that issuing a large number of authorizations where the target harvest is small carries the risk that circumstances not under management control might allow hunters to over-achieve (e.g., unexpectedly favourable hunting conditions) and hence exceed the target harvest. In addition, safety and quality of the hunting experience may be compromised if too many authorizations are issued. To control for these risks, the number of authorizations issued is conservative and may be adjusted based on harvest monitoring information that is collected.

Harvest Monitoring

Because the number of LEH authorizations issued to hunters regulates harvest of Roosevelt elk by licensed residents, and because the number of authorizations issued is based on hunter success, determining hunter success is critical to managing a sustainable harvest.

First Nations and guide-outfitters report their harvest directly to the Ministry, and the Ministry acquires information regarding the success of resident hunters granted LEH authorizations via annual questionnaires. By analyzing the success of hunters who return questionnaires, the Ministry can estimate the hunting success of the entire population of resident hunters who held authorizations. However, relatively few authorizations are issued for Roosevelt elk and not all questionnaires are returned. As a result, analyses are prone to sampling errors because few Roosevelt elk harvest events are reported each year. This can lead to imprecise estimates of hunter success.

To address the analytical limitations of hunter surveys, compulsory reporting and compulsory inspection programs are used. Under these programs, hunters are required to either report ("compulsory reporting") or present for inspection their harvest ("compulsory inspection"). Compliance with compulsory inspection programs is considered to be higher than with compulsory reporting, but both programs provide more accurate harvest information than analyses of the LEH or hunter questionnaires. Compulsory inspection and compulsory reporting are in place in the South Coast and West Coast Regions, respectively.

Habitat Management

The capability of habitats to support Roosevelt elk ultimately determines carrying capacity and, consequently, population targets, objectives, and opportunities for consumptive and non-consumptive use. As a result, managing habitat is an important component of Roosevelt elk management.

The distribution of capable and suitable elk habitat has been estimated at a regional scale through *Broad Ecosystem Unit* mapping and associated wildlife habitat ratings (RISC 1998). Although useful at a regional scale, the mapping is not suitable for identifying the abundance and distribution of Roosevelt elk habitat at finer scales. This requires more detailed modelling based on Terrestrial Ecosystem Mapping or Predictive Ecosystem Mapping (RISC 1999), alternative methods based on available terrain and vegetation information (e.g. Brunt 1991, Appendix III), or qualitative assessments based on field reconnaissance. Of these, field reconnaissance has been used most frequently to assess the capability and suitability of Roosevelt elk habitat.

Legal protection of Roosevelt elk habitat is provided by Parks and Protected Areas (to the extent they comprise suitable habitat) and areas designated as Ungulate Winter Range (UWR) under the *Forest and Range Practices Act*. Protection is focused on winter habitat because winter is the most limiting season for ungulates; they are most likely to face energetic stresses in winter because forage is more limited and of poorer quality than during other seasons, and animals expend more energy to maintain stasis in cold weather (Brunt 1990). As large-bodied ungulates subsisting in a relatively mild climate, the value of UWR is most evident during severe winter conditions.

UWRs for Roosevelt elk and black-tailed deer (*Odocoileus hemionus columbianus*) have been established throughout the West Coast Region but not in the South Coast Region. UWRs capture areas of crown land with the highest current habitat suitability. In establishing UWR under the Government Action Regulation of the *FRPA*, impacts to the forest industry are considered in the decision making process. Because UWR and other habitat designations represent a balance of critical habitat needs and minimizing impacts to the timber harvesting land base, the current distribution and abundance of UWR may not be optimal to support current or future Roosevelt elk populations under severe winter conditions. An assessment of winter range is part of the risk assessment conducted prior to implementing management changes that are aimed at significantly changing the population of elk in an EPU (see Recommendations, page 21). In EPUs where the availability of critical winter ranges

are assessed to be insufficient for populations objectives which are otherwise supported by the habitat, work should be undertaken to increasing the available winter range through habitat management options listed below.

The total Crown land base protected as UWRs on Vancouver Island in the West Coast Region for both Roosevelt elk and black-tailed deer is 45,437 ha. Of this 10,227 ha are designated specifically for elk and 33,090 ha for deer. The remaining 2,120 ha are designated for the protection of winter range for a combination of both deer and elk.

Parks and Protected Areas and UWRs capture only a small proportion of suitable Roosevelt elk habitat in BC. On crown forest outside UWRs, Roosevelt elk habitat is managed in general by the forest industry through professional reliance and forest certification obligations. Under the *Foresters Act*, professional foresters are required to uphold the principles of stewardship of forests, forest lands, forest resources and forest ecosystems. First Nations and stakeholders also participate in elk habitat management though projects funded by the Habitat Conservation Trust Foundation, BC Hydro's Fish and Wildlife Compensation Program, and other sources.

Habitat management can be stratified into three general categories:

1. Retaining currently suitable habitat – this corresponds to management in Parks and Protected Areas and UWRs where natural succession and other ecological processes dominate.
2. Integrated management planning with industrial forestry – this involves implementing forest harvest planning and silviculture strategies, predominantly based on a stewardship approach, to retain and enhance Roosevelt elk habitat characteristics throughout the forest rotation (Becker et al. 1990). Suitable prescriptions vary by habitat type (e.g., snow zone, deciduous versus coniferous stands, etc.).
3. Habitat enhancement – techniques aimed at increasing the carrying capacity of currently suitable habitats, such as controlled burning (Janz 2005) and other activities to enhance forage availability and/or snow interception capability of habitats.

The first phase of UWR designation in the West Coast Region is mostly complete. Because most South Coast Region populations have resulted from relatively recent translocations, there has been no formal land base budget established for Roosevelt elk UWRs in the Region. Although, this budget is not established, designation of UWR in the South Coast Region is not precluded where biological rationale for such habitat protection exists. Assessments of the availability of UWR for elk are ongoing and new information will be considered as it becomes available.

Habitat enhancement generally treats small areas and is relatively expensive, so its application has and will be limited in scope and dependent on available funding (e.g., Materi 2006). As a result, UWR management and integrated management

planning with the forest industry will continue to dominate habitat management activities related to Roosevelt elk on crown forest land.

Human Safety, Damage Prevention and Mitigation

Like other populations of wildlife, Roosevelt elk can conflict with other land uses. Specifically, elk pose a risk to human safety when using habitats adjacent to highways and roads, and can cause damage to agricultural crops, ornamental gardens, golf courses and impact young forests. Because elk are large-bodied and gregarious, damage can sometimes be severe.

Reducing Risk of Vehicle Collisions

The BC Ministry of Transportation and Infrastructure collects information on wildlife mortalities on highways in the province and applies the information to profile risk and to develop policies, strategies and mitigation actions (BC Ministry of Transportation and Infrastructure 2010).

Accidents involving Roosevelt elk are relatively infrequent, with only a few (<10) reported each year in the South Coast and West Coast Regions combined. Accidents are most frequent in summer and early fall (BC Ministry of Transportation and Infrastructure 2010).

Strategies to mitigate the risk of accidents involving Roosevelt elk include: habitat management on rights-of-way (i.e., plantings that do not attract wildlife), signage, reflectors, over/underpasses, exclusion fencing, repellents and hazing, liberal hunting seasons near highways and Roosevelt elk translocations (BC Ministry of Transportation and Infrastructure 2010).

To date the most common strategies employed have been liberalized hunting seasons (to harass Roosevelt elk as well as to reduce populations), translocating Roosevelt elk away from problem areas, fencing on portions of Highway 19 on Vancouver Island, and road signage.

Agricultural Conflicts

As generalist browser-grazers a variety of commercial agricultural crops can be attractive to elk and lead to economic losses. Strategies to deal with conflicts can involve harvest strategies to reduce populations (e.g., liberal antlerless hunts) and increase harassment (e.g., long or split hunting seasons). Exclusion fencing is effective but expensive to construct and maintain. Electric fencing is less costly and has been used effectively to deter elk use of farmlands in the Sayward area on Vancouver Island.

Extended and split hunting seasons, as well as translocations have been used to address chronic agriculture conflicts.

Forestry Concerns

The relationship between Roosevelt elk and industrial forestry is complex. Forest harvesting can increase the abundance of suitable forage for elk until a forest overstorey is re-established, but then poor forage conditions can persist for decades

(Wallmo and Shoen 1980, Alaback 1984, Jenkins and Starkey 1993). Despite temporary increases in forage abundance, the concurrent removal of cover can reduce security when accessing forage resulting in increased vulnerability to both predators and hunters (Nyberg and Janz 1990). Logging activity also removes the snow-intercepting forest canopy and associated arboreal lichens, which reduces habitat suitability for elk during severe winter conditions by restricting mobility and reducing available forage (Brunt 1990). Reduced mobility in snow results in increased energy expenditures, threat of predation and reduced fitness.

As large herbivores, elk play an important role in ecosystems by influencing plant phenology and succession (Marquis 2010). In some cases these influences may conflict with forestry interests, often on productive growing sites in valley bottoms (Henigman et al. 2005). Elk behaviours such as browsing and trampling young trees, and rubbing against saplings may result in a variety of short and long-term costs:

- some stands are replanted several times before legal obligations to achieve free-to-grow status are met;
- seedling protection may be required to reduce impacts of browse;
- there may be long-term timber supply impacts due to lower timber quality and quantity caused by elk use when stands were young; and,
- the mix of species being replanted in some areas is being altered to reduce palatability to elk; this could have impacts on the long-term supply of some species, such as western redcedar.

Concerns with forestry objectives may increase as elk populations expand in size and range, and in some cases concerns may be mitigated by adjusting proposed target populations and management strategies for specific EPUs (see Proposed Goals, Objectives and Strategies, page 15). However, it is recognized that mitigating impacts of elk population changes will not be possible in all circumstances.

A detailed plan to address these concerns in each EPU is beyond the scope of this elk management plan; however, Nyberg and Janz (1990) provided comprehensive management strategies and Henigman et al. (2005) developed a decision tool highlighting risks and considerations. More recently, the Coast FRPA Implementation Team (2010) reviewed planning, silviculture, policy and legislative options to mitigate Roosevelt elk impacts on reforestation and as a result of this review it was determined that policy tools are in place to address silviculture obligations that may not be met as a result of elk browse issues. These tools will assist licensees and resource managers in addressing the specific impacts of elk on forest management on a case by case basis.

Objectives and Strategies

This section provides a list of objectives and strategies to guide Roosevelt elk management in BC between now and 2025. The Ministry is committed to ongoing engagement and consultation with First Nations and stakeholders, continued monitoring of Roosevelt elk populations as well as the benefits and costs of management policies and actions, and may adjust objectives and strategies where warranted.

Conservation Objectives

Given the conservation status of Roosevelt elk and the high demand for cultural, subsistence, recreational and commercial uses, FLNR is proposing the following conservation objectives with the goal that the subspecies could be removed from the Provincial Blue List by 2025:

Obj. 1. Maintain self-sustaining populations of Roosevelt elk throughout their current range in the West Coast and South Coast Regions.

Obj. 2. Re-establish Roosevelt elk in historic range where ecological conditions are suitable.

Obj. 3. Maintain or restore the contribution of Roosevelt elk to natural biodiversity and ecosystem function.

Progress on achieving conservation objectives will be measured by assessing the current elk population against a target population for each EPU of interest. The target population sizes were derived from the estimated carrying capacities of each EPU. Carrying capacity was defined as the estimated maximum population size of Roosevelt elk that can be sustained indefinitely, given the current suitability of habitat in an EPU. Habitat suitability for elk is estimated for each EPU based on an expert assessment of habitat conditions over the entire unit (Table 4). An expert assessment is used because the performance of currently available habitat models is inadequate (see Recommendations, page 21).

Table 4. Roosevelt elk habitat suitability classes and associated estimated carrying capacity.

Estimated Roosevelt elk habitat suitability	Estimated carrying capacity of Roosevelt elk/km^2
Very low	0.005 - 0.050
Low	0.150
Low-moderate	0.225
Moderate	0.300
Moderate-high	0.375
High	0.450
High-very high	0.575
Very high	0.700+

Both habitat suitability and carrying capacity are ecological concepts that are difficult to measure with precision. As a result, expert assessments of these

parameters are necessarily coarse and are used as guidance in setting management strategies.

The target population sizes and associated population objectives (Appendix 1) were derived from the carrying capacity based on the following rule set:

1. where the current population estimate was >60% of the estimated carrying capacity, the proposed target population size was set to the current population estimate, unless (4) applied;
2. where the current population estimate was <60% of the estimated carrying capacity, the proposed target population size was set to 60% of the estimated carrying capacity, unless (4) applied;
3. where the current population estimate was >100% of the estimated carrying capacity, the proposed target population size was set to 100% of the estimated carrying capacity, unless (4) applied;
4. where the target population size based on (1), (2) or (3) was judged to result in unacceptable conflicts with public safety in combination with other land uses (e.g., highways, agriculture, forestry), the target population was reduced to 40% of the estimated carrying capacity;
5. a target population size of zero (0) was applied where habitat is currently unoccupied and re-establishing a population is not an objective because:
    a. supply of suitable habitat is insufficient;
    b. conflicts with public safety is currently too high;
    c. little interest among First Nations or stakeholders; or,
    d. presence of Rocky Mountain elk; and
6. a population objective of *Increase* or *Decrease* was applied where the target population size differed from the current population estimate by >20%.

The rule set was applied to each EPU based on information available to the Ministry and on feedback received from First Nations and stakeholders. Further refinement may be considered as a result of ongoing engagement and consultation (see Recommendations, page 21).

Proposed management strategies to achieve population objectives are similar for most EPUs given the very high interests from First Nations and stakeholders (Appendix I). These strategies are detailed further below (see Management Strategies, page 18) and take into account the conservation, First Nations and/or stakeholder interests with an understanding that although target population sizes and population objectives are provided for each EPU, management actions are not anticipated for every unit. In many cases additional development work and consultation will be required before strategies are implemented. Additionally, population estimates and objectives may change as additional data are collected and analyzed.

Sustainable Use Objective

Obj. 4. Within the ecological limits of the species, provide opportunities for long-term consumptive and non-consumptive use.

Consumptive use opportunities (i.e., First Nations', licensed resident and guided hunting) are typically considered only in EPUs where Roosevelt elk populations are:

- >50 animals;
- >20 bulls:100 cows; and
- >30% of bulls are branch-antlered.

There may be exceptional circumstances where hunting will be considered when these conditions are not met (e.g., goal is to severely reduce the population or where the proportion of branch-antlered bulls cannot be reliably estimated). Opportunities are provided in a manner consistent with Ministry policy (BC Ministry of Environment, Lands and Parks 1996).

Decisions regarding harvest are made in the context of an EPU's population objective. Whether the EPU population objective is to *maintain, decrease,* or *increase* depends on whether the conditions listed above are met and on the EPU's calf:cow ratio and target population size.

Low bull:100 cow ratios can result from over-harvest, severe winters or predation (primarily wolf or cougar). Low calf:100 cow ratios could result from severe winters, predation, or populations exceeding carrying capacity.

Calf: 100 cow ratios are cross-referenced with population size relative to the population target to indicate a population objective for an EPU (Table 5). The harvest regime is guided by the population objectives (Table 6).

Table 5. Population objectives for Elk Population Units as a function of current population size and target population size and observed calf:100 cow ratios.

	Calves:100 cow		
Current population size relative to target	**<25**	**25-35**	**>35**
<75%	Increase	Increase	Maintain
75-100%	Increase	Maintain	Decrease
>100%	Maintain	Decrease	Decrease

Table 6. Harvest regime (expressed as percentages of the total population) for Roosevelt elk, depending on population objectives for Elk Population Units.

	Percentage of the population estimate in the EPU		
Population objective	**Antlered harvest rate (%)**	**Antlerless harvest rate (%)**	**Either sex (archery) harvest rate (%)**
Increase	5	0-2	3
Maintain	7.5	4	6
Decrease	10	6	10-20

Damage Prevention and Mitigation Objectives

Obj. 5. Mitigate public safety risk of vehicle collisions.

Obj. 6. Mitigate crop depredation impacts on agricultural crops and market gardens.

Obj. 7. Mitigate conflicts with forest management objectives.

An integrated approach to human safety and damage prevention and mitigation will continue to be an important focus of Roosevelt elk management. Issues are site-specific and often complex, and strategies will vary.

Preferred strategies are those that improve human safety or mitigate impacts while still achieving Roosevelt elk population objectives. These include:

- translocations from areas where Roosevelt elk populations are near or exceed EPU population targets;
- installations and actions designed to exclude Roosevelt elk from areas where damage problems are chronic (e.g., fencing, reflectors, repellents);
- habitat management to discourage use of, or divert use away from, high impact areas (e.g., appropriate seed-mix planting on rights-of-way, forest harvest and regeneration planning strategies that integrate Roosevelt elk habitat use and requirements, etc.);
- revising forestry planning, harvest and reforestation activities to address Roosevelt elk habitat use and requirements; and
- changing human behaviour to mitigate risk (e.g., signage, controlling vehicle speeds) or increase hazing of Roosevelt elk (extending or splitting hunting seasons).

If for some reason the ministry is considering significant changes to population objectives, First Nations and stakeholders will be engaged.

Management Strategies

A range of management strategies are available to wildlife managers in order to achieve all types of management objectives. While managers strive to maintain consistency in management regimes among EPUs, individual conservation objectives will guide the suite of strategies that is appropriate in a given situation with consideration given to sustainable use and mitigation objectives. Management strategies are discussed in detail above (see Management, page 6) and are closely linked to whether the objective is to decrease, maintain or increase a population.

Before management strategies are implemented in EPUs with population objectives of either *Increase* or *Decrease*, a risk analysis will be conducted to assess and balance the following factors:

a. positive or negative impact on conservation objectives;

b. demand for consumptive or non-consumptive uses by First Nations and stakeholders;

c. likelihood of conflicts with other land uses; and

d. suitability of available habitat to meet Roosevelt elk life requisites.

Monitoring Population Size and Trend

Part of the management strategies includes monitoring trends, planning, and reviewing the use of Roosevelt elk. Depending on budgetary constraints, regular monitoring of EPUs to determine population parameters and performance (every 1-2 years) is typically undertaken on larger, more intensively managed populations while less frequent monitoring schedules (every 3-5 years) are used in other population units (see Monitoring Population Size and Trend, page 6). Analysis of survey results will inform whether population targets are being met and if objectives are stable or changing. Results will also indicate if changes to management strategies should be considered to achieve objectives.

Consumptive Use Management

In more established populations with greater than 50 animals, hunting is the most commonly used management tool for regulating Roosevelt elk populations in BC in order to achieve or maintain population targets. Hunting levels can be adjusted from year to year depending on the population objective to either enhance or reduce populations although adjustments on this scale are typically small to maintain sustainable opportunities. Hunting is the most widely supported tool across consumptive user groups although, within the constraints of conservation and safety objectives, hunting is not preferred for making large-scale, site-specific changes to populations over short periods (see Translocation, page 20).

When new hunting opportunities are established, these are typically focused on the male component of the population as the removal of a small number of antlered animals is least likely to have an impact on the stability of the population. Provided that the bull to cow ratios are maintained within acceptable limits, future recruitment will not be limited by the number of bulls. New hunts are monitored closely and if the population is able to support increased hunting pressure, these increases will be incremental and small to allow time for monitoring and to ensure appropriate harvest rates, seasons and bag limits.

Harvest of the female component of the population can have the greatest effect on the size of the population and hence this harvest must be managed more conservatively. As the population can easily be impacted by overharvest of female elk, where mixed harvest strategies are used, antlerless harvest rates are maintained at relatively low levels. Antlerless harvest rates are typically maintained at very low levels (0-2%) until population objectives are achieved. Once a population target is met and the population objective changes, it may be appropriate

to increase the antlerless harvest opportunities following analysis of conservation objectives and review of any new information.

In rare cases, Roosevelt elk management is required where there are higher risks to public safety and impacts to industry, such as in human populated areas, agricultural land, and adjacent to highway corridors. Elk management in these areas can be complex as the conservation and public safety values in the areas are both of great concern. Given this complexity, managers often use a variety of strategies, including hunts using archery equipment to mitigate public safety risks while increasing the density of hunters, mixed harvest strategies with relatively high antlerless harvest rates, and in some cases translocation of elk to areas where conservation objectives and population objectives can be supported.

Translocation

Elk translocation is a tool that has been shown to be effective in making larger changes to populations in short periods and is typically used to address management objectives of mitigating a particular risk in a source EPU while addressing an objective to increase the population in another EPU. Where herds in EPUs become hazards, increasing risk to human safety, where impacts to industry become a concern and where hunting is a less effective management tool, translocation is often considered and used.

Source herds can be targeted from EPUs with objectives to increase the population where particular herds are creating a safety hazard in specific areas such as near highways. While removing these animals may delay achievement of a population target in the immediate term, this strategy may be considered in order to mitigate specific risks with the understanding the population overall is likely to rebound in the short term.

Translocation necessitates both a suitable source herd and a suitable EPU for population recovery/augmentation. Population recovery/augmentation using translocation as a strategy will be considered in areas where the habitat can support additional animals and where the current population is below the minimum number for a harvestable population and the target population.

Prior to translocation being undertaken First Nations in both the source and receiving areas will be consulted. Stakeholders will be notified prior to translocations projects taking place. Staff will endeavour to cooperate with private land owners regarding translocations and access to private land as necessary.

Habitat Management

One strategy that has been used effectively to address discrete conflicts arising from elk overlapping with areas of higher human densities is to directly reduce elk access to key areas. The use of exclusion fencing adjacent to highway corridors or near agricultural operation has been undertaken and has been effective in some cases. Exclusion fencing is expensive to install and maintain and as such is likely only to be considered in specific geographic areas that are likely to present ongoing risks.

Other management tools are used as available, such as habitat enhancement, for example through seeding, prescribed burning or thinning and spacing projects. Habitat enhancement through prescribed burning for example can be effective in increasing habitat suitability when manipulating foraging areas, particularly adjacent to winter ranges.

Habitat enhancement using thinning and spacing in recruitment areas for ungulate winter ranges is also a consideration although, as indicated above, this strategy can be cost prohibitive. This type of enhancement would be done to address a need for habitat in a specific EPU through a project with dedicated funding

It is also possible to manipulate habitat through modification of forestry activities to either increase or decrease the suitability of areas for elk use. Strategies such as amending block harvest timing in an area to maintain forage availability over time, or changing block size or shape can be used to affect elk use.

Data Limitations

The analyses and proposed strategies presented in this plan are necessarily limited by available data. The following are limitations that may affect the accuracy and/or precision of population or harvest estimates and, hence, warrant a conservative approach to Roosevelt elk management:

- harvest reporting errors – not all hunters respond to harvest questionnaires, which could result in sampling errors and biases in harvest rate estimates;
- inventory errors – adult females can be mistaken for calves on surveys, leading to inflated calf counts; differential sightability among age-sex classes; and
- resource limitations – funding and staff capacity restricts the extent and intensity of inventory (i.e., air- or ground-based population and habitat surveys) and harvest assessments (i.e., compulsory inspection), which limits the confidence of estimates and increases the number of years required to establish reliable trends.

Recommendations

1. Where required, revise proposed EPU population targets, objectives and strategies based on First Nations and stakeholder consultation.
2. Refine habitat modelling techniques to inform carrying capacity estimates.
3. Secure funding for inventory and monitoring programs.
4. Conduct analyses by EPU to determine if adequate critical winter ranges are designated and if currently inadequate, work towards protecting additional habitat where gaps exist.

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Approval is sought for the Management Plan for Roosevelt Elk in in British Columbia:

Director – Fish and Wildlife Branch

Resource Stewardship Division

Reviewed by:

Date: September 10, 2015

Signature:

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Appendix I – Roosevelt Elk Population Units

Table 7. Possible management strategies to achieve Roosevelt elk population targets. Codes are cross-referenced by elk population unit (EPU) in Table 8 below.

Code	Management Strategy
A	Inventory population regularly (i.e. every 1-2 years)
B	Inventory population less frequently (i.e. every 3-5 years)
C	Consumptive use management
D	Herd translocation (population enhancement)
E	Habitat management
F	Directly reduce elk access to key areas (e.g. use exclusion fencing adjacent to highways or agricultural operations)

Table 8. Estimated current habitat suitability and estimated carrying capacity, as well as current and target populations for Roosevelt elk in British Columbia. ID number is referenced in Figure 2. Proposed management strategies to meet target populations are listed for each unit. Where the current population is within 20% of the target, the objective is to maintain the population. Key management objectives 1 – 7 (referenced below) and proposed management strategies to achieve elk population targets (table 7) are cross-referenced by elk population unit.

1. **Maintain self-sustaining populations of Roosevelt elk throughout their current range in the West Coast and South Coast Regions.**
2. **Re-establish Roosevelt elk in historic but unoccupied ranges where ecological conditions are suitable.**
3. **Maintain or restore the contribution of Roosevelt elk to natural biodiversity and ecosystem function.**
4. **Within the ecological limits of the species, provide opportunities for consumptive and non-consumptive use.**
5. **Mitigate public safety risk of vehicle collisions.**
6. **Mitigate crop depredation impacts on agricultural crops and market gardens.**
7. **Mitigate conflicts with forest management objectives.**

ID	Elk population unit	Current population estimate	Trend (Stable/ Increasing/ Decreasing	Estimated habitat suitability (Low/Mod / High)	Estimated carrying capacity (K)	Target population (60% of K)*	Population objective (Increase/ Maintain/ Decrease)	Key MGMT Objectives (2-7)**	Proposed MGMT Strategies	Notes
	Vancouver Island Subpopulation									
40	Adam	182	S	VH	315	189	M	3,4,7	A, C	
44	Amor	95	S-I	H	146	95	M	3,4	A, C, E	Consider additional winter range protection.

ID	Elk population unit	Current population estimate	Trend (Stable/ Increasing/ Decreasing	Estimated habitat suitability (Low/Mod / High)	Estimated carrying capacity (K)	Target population (60% of K)*	Population objective (Increase/ Maintain/ Decrease)	Key MGMT Objectives (2-7)**	Proposed MGMT Strategies	Notes
57	Artlish	70	S	VH	110	70	M	3,4	B, C, E	Consider additional winter range protection.
104	Ash	15	S	H	212	85	I	3,4,7	B, C, D	High interest in establishing a huntable population. Potential release site for augmentation via translocation.
58	Atluck	20	S	M	48	29	I	3,4	-	
102	Bedwell	15	S	M-H	108	65	I	3,4	-	Significant habitat is located in Strathcona Park
4	Belize	0	N/A	L	158	95	I	2,4	-	
35	Benson	65	S-D	M	114	68	M	3,4	B, C	
38	Bonanza	110	S-D	H	192	115	I	3,4	B, C	
120	Bulson	0	N/A	L	38	0		2,4	-	Insufficient quality habitat
95	Burman	20	S-I	M-H	111	67	I	3,4	B, C	Significant portion of habitat in the Strathcona Park
125	Cameron	30	S	H	50	30	M	3,4	B, C	
42	Camp Point	5	UNKNOWN	L	9	5	M	3,4	-	
64	Campbell River	62	S	VH	55	55	M	3,4	A, C	
151	Carmannah/ Walbran	0	N/A	L	64	38	I	2,4	-	
147	Caycuse	5	S	M	58	35	I	2,4	B	
143	Chemainus	82	I	M	123	82	M	3,4	A, C	Limited Entry Hunting planning for 2016 underway.
121	Clayoquot	0	N/A	L	47	28	I	2,4	-	
24	Cluxewe/	10	UNKNOWN	M	88	53	I	3,4	B	

ID	Elk population unit	Current population estimate	Trend (Stable/ Increasing/ Decreasing	Estimated habitat suitability (Low/Mod / High)	Estimated carrying capacity (K)	Target population (60% of K)*	Population objective (Increase/ Maintain/ Decrease)	Key MGMT Objectives (2-7)**	Proposed MGMT Strategies	Notes
	Keogh									
99	Comox	60	S	M	182	73	I	3,4,5,6	B, C, F	*target set at 40% of K. Highways, Agriculture and Human settlement conflicts eliminate some of the area as suitable habitat.
89	Conuma	60	S	VH	88	60	M	3,4,7	B, C	
144	Deer Group	0	N/A	VL	1	0			-	Insufficient quality habitat
98	East Buttle	0	N/A	L	24	14	I	2	-	
18	East Knight	0	N/A	VL	2	0			-	Insufficient quality habitat
135	Effingham	0	N/A	M-H	149	89	I	2,4	C , D	Potential release site for recovery via translocation. Some overlap with Pacific Rim National Park Reserve
78	Elk	70	S-I	H	125	75	M	3,4	B	Good summer range and winter range. Almost completely within Strathcona Park.
126	Englishman River	60	S-I	M	141	85	I	3,4,5,6	B, C	Highways, Agriculture and human settlement issues eliminate part of the area as suitable habitat.
73	Espinosa	20	UNKNOWN	L-M	130	78	I	3,4	E	Consider additional winter range protection.
39	Eve/Tsitika	202	S	H	386	232	M	3,4,7	A, C	
8	Franklin (Mainland)	0	N/A	VL	2	0			-	Insufficient quality habitat
138	Franklin (V. Island)	30	S-D	M-H	174	104	I	3,4	B, C	Unregulated elk harvest is a concern in this area.

ID	Elk population unit	Current population estimate	Trend (Stable/ Increasing/ Decreasing	Estimated habitat suitability (Low/Mod / High)	Estimated carrying capacity (K)	Target population (60% of K)*	Population objective (Increase/ Maintain/ Decrease)	Key MGMT Objectives (2-7)**	Proposed MGMT Strategies	Notes
15	Gilford/ Broughton	0	N/A	L	147	88	I		D	Potential release site for recovery via translocation.
76	Gold/ Muchalat	348	S-I	VH	551	348	M	3,4,7	A, C, D	Potential source for translocations.
103	Great Central	10	S	L	57	34	I	3,4	B	
63	Greenstone	225	S-I	VH	339	225	M	3,4,7	A, C, E	Consider additional winter range protection.
43	Hardwicke - Thurlow	0	N/A	L-M	59	35	I	2	-	
77	Heber	75	S	H-VH	108	75	M	3,4,7	A, C, E	Consider additional winter range protection.
136	Henderson	5	S	M-H	93	56	I	2,4	B, C	
119	Herbert Inlet	0	N/A	L-M	104	62	I	2	-	
100	Hesquiat	10	S	L-M	132	79	I	3,7	-	
27	Heydon	5	N/A	L-M	220	132	I	2,4	D	Potential release site for augmentation via translocation.
14	Huaskin	0	N/A	L	152	91	I	2,7	-	
93	Jacklah/ Houston	30	I	H	73	44	I	3,4,7	B,D, E	Potential release site for augmentation via translocation. Consider additional winter range protection.
155	Jordan	5	S	M	103	62	I	2,4	B	
16	Kakweiken	0	N/A	L	84	50	I		-	
55	Kauwinch	10	UNKNOWN	H	66	40	I	2,4	E	Consider additional winter range protection.

ID	Elk population unit	Current population estimate	Trend (Stable/ Increasing/ Decreasing	Estimated habitat suitability (Low/Mod / High)	Estimated carrying capacity (K)	Target population (60% of K)*	Population objective (Increase/ Maintain/ Decrease)	Key MGMT Objectives (2-7)**	Proposed MGMT Strategies	Notes
122	Kennedy	10	S	M	77	46	I	2,4	-	
36	Kilpala	10	UNKNOWN	M	61	37	I	2,4	-	
6	Kingcome	0	N/A	L-M	202	121	I	2,4	B,D	
146	Klanawa	80	S-I	M-H	147	88	M	3,4,7	A, C,	Limited Entry Hunting planning for 2016 underway. Some overlap with Pacific Rim National Park Reserve.
33	Klaskish	10	UNKNOWN	L-M	108	65	I	2,4	-	
22	Koprino	15	UNKNOWN	L	88	53	I	3,4	-	
54	Kyuquot	10	UNKNOWN	L	33	20	I	3,4	-	
153	Lens/Harris	0	N/A	M	81	49	I	2,4	-	
134	Long Beach	0	N/A	L-M	82	49	I	2,4	-	Significant overlap with Pacific Rim National Park Reserve
150	Lower Cowichan	87	S	M	199	79	D	3,4,5,6,7	A,C,D,F	*target set at 40% of K. Significant conflicts with highways, agriculture, golf courses and forestry. Consider highway fencing and potential elk source for translocations. Allow natural recovery to occur in adjacent EPUs
7	Lower Klinaklini	0	N/A	M	79	47	I	2,4	D	
59	Lower Nimpkish	54	S	H	81	54	M	3,4	B, F	
41	Lower	231	S-I	VH	361	231	M	3,4,5,6,7	A,C,D,E,F	Potential elk source for

ID	Elk population unit	Current population estimate	Trend (Stable/ Increasing/ Decreasing	Estimated habitat suitability (Low/Mod / High)	Estimated carrying capacity (K)	Target population (60% of K)*	Population objective (Increase/ Maintain/ Decrease)	Key MGMT Objectives (2-7)**	Proposed MGMT Strategies	Notes
	Salmon									translocations. Consider additional winter range protection.
34	Mahatta	34	UNKNOWN	L-M	106	64	I	3,4	B	
25	Malcolm	0	N/A	L	14	0			-	Insufficient quality habitat
92	McCurdy	70	S-I	H	108	70	M	3,4	B,D	Consider augmentation of Kleeptee
101	Moyeha/ Megin	0	N/A	L-M	96	58	I	2	-	
156	Muir/Leech	0	N/A	L-M	52	31	I	2	-	
137	Nahmint	32	S-D	H	105	70	I	3,4	B, C	
12	Nahwitti	55	S	M	146	88	I	3,4	B, C	
127	Nanaimo	63	I	M-H	116	70	M	3,4,5	A	Highways, and Human settlement conflicts eliminate much of the area as suitable habitat.
140	Nanaimo Lakes	228	S	VH	347	228	M	3,4,7	A, C	
11	Nigei	0	N/A	L	19	0			-	Insufficient quality habitat
139	Nitnat	90	I	M-H	167	100	M	3,4,7	A, C	Limited Entry Hunting planning for 2016 underway
87	Nootka	5	UNKNOWN	L-M	118	71	I	2,4,7	-	High interest in establishing a huntable population
141	North Shore Cowichan Lk.	275	S	VH	448	275	M	3,4,5,7	A, C	Potential elk source for translocations.
106	Northern Gulf Islands	0	N/A	L	23	0		5,6	-	Agriculture and Human settlement conflicts

ID	Elk population unit	Current population estimate	Trend (Stable/ Increasing/ Decreasing	Estimated habitat suitability (Low/Mod / High)	Estimated carrying capacity (K)	Target population (60% of K)*	Population objective (Increase/ Maintain/ Decrease)	Key MGMT Objectives (2-7)**	Proposed MGMT Strategies	Notes
										eliminate much of the area as suitable habitat.
80	Oyster/ Tsolum	50	S	M	249	100	I	3,4,5,6	A, C	*target set at 40% of K. Highways, Agriculture and human settlement conflicts eliminate significant part of the area as suitable habitat.
28	Phillips	15	S	M	274	174	I	3,4	B, C, D	SHARED EPU WITH SOUTH COAST REGION (Moh): One of only 2 remnant Roosevelt elk populations on the mainland coast. Potential release site for augmentation via translocation.
96	Phillips/ Wolf	15	S	L-M	77	46	I	3,4	B	Good summer range but winter range is limited. Completely within Strathcona Park.
26	Port Neville	0	N/A	L-M	68	41	I			
53	Power	30	S	M-H	108	65	I	3,4	B,D	
45	Quadra	0	N/A	M	213	85	I	2,7	-	*target set at 40% of K. Significant conflicts likely to occur if population established.
124	Qualicum	20	S	M	128	51	I	3,4,5,6	H	*target set at 40% of K. Highways, Agriculture and human settlement conflicts eliminate much of the area as suitable habitat.

ID	Elk population unit	Current population estimate	Trend (Stable/ Increasing/ Decreasing	Estimated habitat suitability (Low/Mod / High)	Estimated carrying capacity (K)	Target population (60% of K)*	Population objective (Increase/ Maintain/ Decrease)	Key MGMT Objectives (2-7)**	Proposed MGMT Strategies	Notes
13	Quatse	5	UNKNOWN	L	67	40	I	2		
79	Quinsam	60	S-I	M-H	168	101	I	3,4	A, C, E	Consider additional winter range protection.
128	Saanich Peninsula/ Southern Gulf Islands	0	N/A	N/A	0	0		5,6	-	Excessive human development and/or agricultural activity preclude suitability of area for establishment of elk population.
152	San Juan/ Lower Gordon	116	S	H-VH	190	116	M	3,4	A, C	
145	Sarita/ Pachena	10	S	H	162	97	I	3,4	B,D	Potential release site for augmentation via translocation.
1	Seymour	0	N/A	L-M	75	45	I	2	-	
158	Shawnigan Lake	10	S	M	55	22	I	3,5,6	-	*target set at 40% of K. Agriculture, highway and human settlement conflicts likely if population expands.
157	Sooke/ Metchosin	10	S	H	217	87	I	3,5,6	-	*target set at 40% of K. Expansion beyond the Sooke watershed would be problematic due to high human densities.
142	South Fork/Haslam	115	S-D	M-H	194	116	M	3,4	A, C	
149	South Shore Cowichan	20	S	M	87	52	I	3,4,7	B,	

ID	Elk population unit	Current population estimate	Trend (Stable/ Increasing/ Decreasing	Estimated habitat suitability (Low/Mod / High)	Estimated carrying capacity (K)	Target population (60% of K)*	Population objective (Increase/ Maintain/ Decrease)	Key MGMT Objectives (2-7)**	Proposed MGMT Strategies	Notes
	Lk.									
123	Sproat	20	S	L-M	116	46	I	3,4,5,6	-	*target set at 40% of K. Highways, Agriculture and Human settlement conflicts eliminate highest capability part of the area as suitable habitat.
19	Stafford/ Apple	10	S	M	167	100	I	2,4	B	
10	Stranby	15	UNKNOWN	L	80	48	I	2,4	B	
88	Sucwoa	60	S	H	102	61	M	3,4	B, C	
75	Tahsis	40	UNKNOWN	M	65	40	M	3,4	B	
56	Tahsish	50	S	M	87	52	M	3,4	B, C	
97	Thelwood	15	S	M	61	37	I	3,4	B	Completely within Strathcona Park
90	Tlupana	30	S	H-VH	70	42	I	3,4,7	B	
105	Tsable	60	S	M	129	77	I	3,4,5,6	A, C, F	Highways, and Human settlement conflicts eliminate part of the area as suitable habitat.
37	Tsulton	60	S	H	126	76	I	3,4	B, F	
94	Ucona	71	S	H-VH	106	71	M	3,4	A, C, E	Consider additional winter range protection.
91	Upana	30	S	H	28	28	M	3,4,7	B	
148	Upper Gordon	20	S	M	55	33	I	2,4	B	
2	Upper Kingcome/	0	N/A	VL	25	15	I	2	-	

ID	Elk population unit	Current population estimate	Trend (Stable/ Increasing/ Decreasing	Estimated habitat suitability (Low/Mod / High)	Estimated carrying capacity (K)	Target population (60% of K)*	Population objective (Increase/ Maintain/ Decrease)	Key MGMT Objectives (2-7)**	Proposed MGMT Strategies	Notes
	Wakeman									
3	Upper Klinaklini	0	N/A	VL	3	0		2	-	Insufficient quality habitat
60	Upper Nimpkish	365	S-I	VH	649	389	M	3,4,7	A, C	
62	Upper Salmon	443	S-I	VH	670	443	M	3,4,5,6,7	A, C, E	Consider additional winter range protection.
154	Upper San Juan/Fleet	20	S	M	82	49	I	3,4,7	B, C	
5	Wakeman	0	N/A	L-M	192	115	I	2	B, D	Potential release site for recovery via translocation.
23	Waukwaas	40	S-I	M	131	98	I	3,4	B	
17	West Knight	0	N/A	L	115	69	I	2	-	
61	White	241	S	VH	340	241	M	3,4,7	A, C	
74	Zeballos	40	S	M	98	59	I	3,4	B, C, E	Consider additional winter range protection.
	Total West Coast Region	**5,476**			**15,031**	**8,926**				
	South Coast Region									
115	Alouette	5	S-I	M	105	63	I	2, 4	D, A	BC Hydro Watershed, possible research opportunity for elk habitat & enhancement study. Translocation plan to release elk in 2014 to 2017
20	Bear	3	S	L	58	35	I	1		
48	Brem	25	S-I	L-M	69	42	I	3, 4	B	
67	Brittain	50	S-I	M	93	56	M	3, 4	A, C	

ID	Elk population unit	Current population estimate	Trend (Stable/ Increasing/ Decreasing	Estimated habitat suitability (Low/Mod / High)	Estimated carrying capacity (K)	Target population (60% of K)*	Population objective (Increase/ Maintain/ Decrease)	Key MGMT Objectives (2-7)**	Proposed MGMT Strategies	Notes
112	Cap-Seymour	5	S-I	L	85	51	I			Consult GVRD
117	Chehalis	49	I	M	351	211	I	2, 3, 4	D, A, C	
85	Clowhom	60	S-I	M	146	88	I	4	A, C	BC Hydro Watershed, Possible research opportunities for elk habitat, enhancement study
114	Coquitlam	5	I	L-M	59	35	I			Consult GVRD, Hydro,
68	Deserted	75	I	H-VH	236	141	I	3, 4	A, C	
66	Eldred	10	I	L-M	100	60	I	3, 4	D, B, C	Natural recovery is very slow, consider augmentation via translocations in 2015-17
81	Haslam (Stillwater)	100	I	VH	312	187	I	3, 4, 7	B, C	
49	Hat	0	S	L	32	19				Low suitable habitat
9	Homathko	50	I	M-H	422	253	I	3, 4	A, C	LEH planned for 2016
113	Indian	50	S-I	M	94	56	M	3, 4	A, C	Encourage dispersal to adjacent areas, i.e Seymour and Coquitlam
82	Lois	10	I	VH	247	148	I	3, 4	A, C, D	Natural recovery from adjacent units is slow, consider augmentation via translocations in 2015-2017
70	Lower Lillooet	35	I	L-M	364	219	I	2, 4	D, A, C	Translocation Plan to release 20-30 elk near Tipella in 2014 – 2015.

ID	Elk population unit	Current population estimate	Trend (Stable/ Increasing/ Decreasing	Estimated habitat suitability (Low/Mod / High)	Estimated carrying capacity (K)	Target population (60% of K)*	Population objective (Increase/ Maintain/ Decrease)	Key MGMT Objectives (2-7)**	Proposed MGMT Strategies	Notes
69	Mamquam	15	I	VL-L	137	55	I	3, 4	B, D, F	*target set at 40% of K to manage and control elk along highway. Consider highway fencing and potential elk source for translocations. Allow natural recovery occurring from adjacent EPUs
111	McNab	100	S-I	H	150	90	M	3, 4	A, C	
29	Moh	2	S	L-M	53	32	I	2	D	SHARED EPU WITH WEST COAST REGION (Phillips): One of only 2 remnant Roosevelt elk populations on the mainland coast. Potential release site for augmentation via translocation 2015- 2017
84	Narrows	70	S	H	163	98	M	3, 4	A, C	
108	Nelson	3	I	VH	74	45	I			
30	Orford	65	I	M-H	194	116	I	3, 4	A, C	
86	Pitt	70	I	M-H	280	168	I	3, 4, 7	A, C	
50	Powell-Daniels	61	I	L-M	102	61	M	3, 4	A, C	
46	Quatam	30	I	M-H	132	79	I	3, 4	A, C	
110	Rainy-Gray	90	I	H	223	134	I	3, 4, 5, 6	B, C, D	Potential need to control elk at urban fringe and source population for translocations

ID	Elk population unit	Current population estimate	Trend (Stable/ Increasing/ Decreasing	Estimated habitat suitability (Low/Mod / High)	Estimated carrying capacity (K)	Target population (60% of K)*	Population objective (Increase/ Maintain/ Decrease)	Key MGMT Objectives (2-7)**	Proposed MGMT Strategies	Notes
47	Redonda Islands	6	S	VL-L	14	9		1		
109	Sechelt Peninsula	200	S-I	VH	333	200	M	3, 4, 5, 6, 7	A, C, D, F	Primary source population for translocations. Need to control elk along highway, and urban fringe.
51	Skwawka	55	S	M	134	81	I	3, 4	A, C	
21	Southgate	40	I	L	191	114	I	3, 4	A, C	
52	Squamish	50	S-I	L-M	429	172	I	3, 4 , 5, 6	A, C, F	*target set at 40% of K to manage and control elk along highway and potential conflicts with moose objectives in Elaho River. Unregulated elk harvest is a concern in this area.
116	Stave	54	S-I	L	90	54	I	3, 4, 7	A, C	
107	Texada	0			0	0				
65	Theo	50	I	H-VH	305	183	I	3, 4	A, C	
31	Toba	41	I	M	463	278	I	3, 4	B, C	LEH planned for 2016
32	Upper Lillooet	3		VL	211	85	I	1, 6		*target set at 40% of K. This area has significant agricultural interest, major highways and potential conflicts with moose objectives.
83	Vancouver River	65	I	M-H	121	72	I	3, 4	A, C	
133	Manning	0		VL	33	20	I	3		Assumed to be Rocky

ID	Elk population unit	Current population estimate	Trend (Stable/ Increasing/ Decreasing	Estimated habitat suitability (Low/Mod / High)	Estimated carrying capacity (K)	Target population (60% of K)*	Population objective (Increase/ Maintain/ Decrease)	Key MGMT Objectives (2-7)**	Proposed MGMT Strategies	Notes
										Mountain Elk or hybrid
118	Coquihalla	0		L	144	86	I	3		Rocky Mountain Elk
130	Greater Van	0		nil	0	0				Metro Vancouver / Fraser Valley farmland area not suitable for elk recovery
71	East Harrison	5		L	508	305	I	3		Assumed to be hybrid elk area
131	Chilliwack	5		L	159	64	I	3		Assumed to be hybrid elk area. *target set at 40% of K.
132	Skagit	3		L-M	146	88	I	3		Assumed to be hybrid elk area, potential for SEEK research and enhancement.
72	Fraser	0		L	14	8	I	3		Rocky Mountain elk area
	Total South Coast Region	**1,615**			**7,576**	**4,361**				
	Total BC	**7,091**			**22,607**	**13,287**				

* Carrying capacity estimates are based on the best available information. The target population is set at 60 % of K to balance consumptive use opportunities and mitigation objectives due to public safety, agriculture and forestry. In some cases the target population has been set as low as 40% of K due to concerns of public safety and other resource management interests. Where the current population is greater than but within 20% of the calculated 60% of the estimated carrying capacity, the current population estimate is used as the target population.

** Management Objectives 1 is the key management objective throughout the historic range of Roosevelt elk in BC.

Appendix II – Roosevelt Elk Translocation History

History of Roosevelt elk translocations in British Columbia, 1933-2015.

Year	Trap location	Release location	Elk translocated
1933	Vancouver	McNab	5
1978	Upper Heber	N/A	1
1979	Upper Heber	Constitution Hill	13
1982	Nanaimo River	N/A	14
1983	Nanaimo Lake	N/A	1
1984	Nanaimo Lake	San Juan River	7
1985	Campbell River	Trent River	7
1986	Campbell River	Trent River	12
1987	Campbell River	Sechelt Peninsula	7
1988	Campbell River	Sechelt Peninsula	6
1989	Qualicum	Nahmint River	3
1989	Qualicum	Sechelt Peninsula	11
1989	White River	Nahmint	13
1991	Nahwitti River	N/A	5
1992	Elk River	N/A	11
1993	Haslam Ck.	San Juan River	16
1994	Fanny Bay	Powell River	5
1996	Sechelt Peninsula	Powell River	20
1997	Takla Rd.	Jordan Meadows	6
1997	Takla Rd.	Nanaimo Lakes	2
2000	Union Bay	Lower Klanawa	10
2001	Duncan	Caycuse	1
2001	Sechelt Peninsula	McNab	25
2001	Sechelt Peninsula	Rainy River	6
2001	Sechelt Peninsula	Skwawka River	12
2002	Haslam	Tzoonie River	7
2002	Sechelt Peninsula	McNab	1
2002	Sechelt Peninsula	Skwawka River	7
2002	Sechelt Peninsula	Tzoonie River	4
2003	Haslam	Narrows	9
2003	Haslam	Rainy River	3
2003	Sechelt Peninsula	Clowhom River	5
2003	Sechelt Peninsula	Narrows	2
2003	Sechelt Peninsula	Rainy River	2
2004	Haslam	Clowhom River	7
2004	Sechelt Peninsula	Clowhom River	8
2004	Sechelt Peninsula	Rainy River	2
2004	Sechelt Peninsula	Stakawus Creek	13
2005	Duncan	Lower Nitinat River	9
2005	Sechelt Peninsula	Brittain River	20
2005	Sechelt Peninsula	Stakawus Creek	7
2005	Sechelt Peninsula	Upper Pitt River	23
2006	Duncan	Waterloo Mt.	9
2006	Haslam	Salmon Inlet	8

Year	Trap location	Release location	Elk translocated
2006	Haslam	Vancouver River	11
2006	Sechelt Peninsula	Indian River	20
2006	Sechelt Peninsula	Vancouver River	10
2007	Campbell River	Waukwaas River	16
2007	Haslam	Squamish River	26
2007	Powell River	Quatum River	12
2007	Sechelt Peninsula	Upper Stave River	19
2008	Haslam	Quatam River	6
2008	Sechelt Peninsula	Powell/Daniels	17
2008	Sechelt Peninsula	Quatam River	1
2008	Sechelt Peninsula	Stave River	1
2008	Sechelt Peninsula	Theo	3
2009	Haslam	Homathko River	2
2009	Haslam	Orford River	19
2009	Sechelt Peninsula	Brem River	14
2009	Sechelt Peninsula	Homathko River	18
2009	Sechelt Peninsula	Orford River	1
2009	Sechelt Peninsula	Toba River	10
2010	Haslam	Theo	3
2010	Sechelt Peninsula	Daniels River	7
2010	Sechelt Peninsula	Toba River	10
2011	Sechelt Peninsula	Mamquam	8
2011	Sechelt Peninsula	Rainy River	5
2011	Sechelt Peninsula	Southgate	20
2011	Sechelt Peninsula	Theo	13
2012	Gold River	Houston River	22
2012	Sechelt Peninsula	Brem River	10
2012	Sechelt Peninsula	Rainy	8
2013	Sechelt Peninsula	West Harrison	16
2013	Sechelt Peninsula	Lower Lillooet	14
2014	Sechelt Peninsula	Chehalis	24
2014	Gold River	Houston River	9
2015	Sechelt	West Harrison	5
2015	Sechelt	Lower Lillooet	14
2015	Sechelt	Chehalis	10
2015	Sayward	Mahatta River	24

Appendix III – Vancouver Island Roosevelt Elk Winter Range Assessment Variables

Variables used to assess the suitability of Roosevelt elk winter range (K. Brunt, *pers. comm.*).

VARIABLE	VALUE	RANK	COMMENTS
% SLOPE	70+ 50-70 0-50	LOW MOD HIGH	Flat to moderate slopes preferred
ASPECT	NW-NE NE-SSE; WSW-NW Flat; SSE-WSW	LOW MOD HIGH	Generally south aspect slopes preferred; west usually better than east
ELEVATION (m)	>1000 <200; 700-1000 200-700	LOW MOD HIGH	Winter severity, snow depth and duration are significant factors
OVERSTORY COMPOSITION	LOW *HIGH* MOD *MOD* HIGH *LOW*	LOW MOD HIGH	Non-italicized=Relative amounts of Douglas-fir and hemlock to other areas within watershed *Italicized=Relative amounts of cedar (red or yellow) and balsam to other areas within watershed*
STAND VOLUME	LOW MOD HIGH	LOW MOD HIGH	Relative to average stand volumes within the watershed
% CANOPY CLOSURE	<50; >90 50-60; 80-90 60-80	LOW MOD HIGH	Important for snow interception in relation to 'overstory composition' and 'understory abundance'
LICHEN LOAD	LOW MOD HIGH	LOW MOD HIGH	Relative to amounts within the watershed
UNDERSTORY COMPOSITION	LOW MOD HIGH	LOW MOD HIGH	Rank relative amounts of sword fern, skunk cabbage, deer fern and salmonberry to other sites within the watershed. They are associated with rich, moist sites which produce the best forage for elk.
UNDERSTORY ABUNDANCE	LOW MOD HIGH	LOW MOD HIGH	Relative to amounts within the watershed
OTHER FACTORS:	***The following factors are not currently quantified during EWR assessments but they can significantly influence the overall ability of an area to satisfy EWR requirements***		
TOPOGRAPHIC SHADING	The amount of shading from adjacent hillsides is a critical factor influencing winter range suitability (the more shaded, the less valuable the area).		

	Preferably shaded for less than 2 hours per day.
HETEROGENEITY	Topographic heterogeneity ("benchiness") is preferable to a uniform slope. Overstory heterogeneity (variations in canopy closure) provides enhanced forage production and thickets for hiding in open canopy areas, and greater snow interception in areas of more closed canopy. Gullies, wetlands, and hummocky terrain also increase value of elk winter range.
ROCK OUTCROPS	Rock outcrops provide topographic security cover (vantage points), favourable thermal conditions on sunny days, and areas that lose snow more readily during snow ablation periods.
RELATIVE ELK USE	Pellet groups, tracks, trails, sightings, beds, rubs and shed antlers all indicate relative amounts of use. Shed antlers conclusively indicate late winter/spring use; rubs indicate late summer or early fall use. Current elk population levels in the area need to be known before the relative level of use can be determined (i.e. what is heavy use during a period of low elk population levels may only be considered moderate or low use during high elk density periods).
LANDSCAPE FACTORS	Important landscape level considerations affecting the relative value of an area as a elk winter range include the following: a) position in the watershed (low, mod, or high snowfall area - EWR more critical in areas of higher snowfall); b) distance to other winter ranges (greater distances between winter ranges increases their individual importance); c) adjacency to high quality spring and summer range; d) the capability of adjacent areas to satisfy elk habitat requirements; and e) factors affecting local climatic conditions such as exposure to dominant winds or marine influences.