

Stads K'un Habitat Restoration Scoping Assessment

Managing For Old Growth Structural Attributes



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Habitat Restoration on Haida Gwaii

“The Haida Nation is the rightful heir to Haida Gwaii. Our culture is born of respect; and intimacy with the land and sea and the air around us. Like the forests, the roots of our people are intertwined such that the greatest troubles cannot overcome us. We owe our existence to Haida Gwaii. The living generation accepts the responsibility to ensure that our heritage is passed on to following generations. On these islands our ancestors lived and died and here too, we will make our homes until called away to join them in the great beyond.

– from the Constitution of the Haida Nation 2018-10

The Haida Nation have stewarded Haida Gwaii since time immemorial. Therefore, restoration work conducted on Haida Gwaii must support Haida Laws, such as yah'guudang *respect* and gina 'waadluxan gud ad kwaagid *everything depends on everything else*. The Council of the Haida Nation seeks to support restoration projects that prioritize Haida values and the interconnectedness of all things.

Overview

The majority of known Stads K'un nests on Haida Gwaii are located in old growth forest, but clearcut second growth plantations are now a dominant part of the Haida Gwaii and BC landscape. These plantations are focused on tree production and were not designed to support wildlife and wildlife values. In areas where we are focused on maintaining or increasing specific wildlife values or overall biodiversity – in this case Stads K'un foraging and nesting habitat requirements, how do we use the forestry tools available to restore these values?

At their most basic plantations are structurally different from forests in several key aspects. Over the 100's-1000's of years it naturally takes to create a forest, the forest differs from plantations in that it has a range in: tree sizes, tree ages, tree densities, tree species, snags, canopy patch openings, patch – disturbance sizes and coarse woody debris (overview presentation Doyle 2023).

In the following background material, we outline the traditional forestry tools available through harvest and silvicultural activities (Objective 1), followed by an exploration of some of the additional approaches and tools that maybe useful as we try to restore forest structural attributes that may otherwise take those 100's and 1000's of years to create. In Objective 2, we outline the criteria and information required to reassess historical silvicultural - restoration trial sites on Haida Gwaii that may inform future restoration. In Objective 3, we outline the selection criteria for future restoration sites, and the monitoring approaches required to continue to learn from these Stads K'un old-growth attribute focused sites.

A consistent theme of this overview of tools and approaches available is that there is no easy fix here, and restoration cannot easily recover the attributes and diversity of old growth forests. There is no cookie cutter template, this will take a concerted effort, core funding, long-term monitoring and an adaptive management framework and TIME.

Old Growth Forest in all its attributes and functional roles is not a renewable resource.

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Objective 1. Overview of Traditional Silvicultural Treatments that may assist Restoration.

There are a variety of silviculture systems used to harvest and manage old growth and second growth stands on Haida Gwaii. The earlier days of industrial timber harvesting consisted of large progressive clearcuts of old growth timber. The more recent past has seen a shift from harvesting old growth with large clearcuts to harvesting less old growth with smaller openings, whether they are clearcuts, patch cuts or retention systems. With the second growth becoming merchantable there has also been a shift towards logging more second growth.

The second growth has historically been managed for future timber values. This timber focus has diminished the habitat for some species. Forestry systems and silviculture treatments can potentially be used to restore some of this habitat loss. The following is a summary of some of the more recent silviculture systems and silviculture treatments implemented on the Haida Gwaii for discussion purposes, on how we can manage the second growth going forward to hopefully help the goshawks sooner rather than later.

Examples of silviculture systems and treatment options have been provided from imagery (iMap) from sites on Haida Gwaii, along with photos from the Terrace Community Forest for visualization purposes. The Terrace Community Forest also has large tracts of second growth stands that it is managing, allowing us to explore both stand level – stewardship objectives and the larger landscape level site selection of blocks-areas for treatment.

Silviculture System

Retention System

The Retention Silviculture System has been a common silviculture system used in the most recent years in old growth and second growth harvesting. The retention of groups of trees and/or individual trees are retained for a rotation to aid in creating structural diversity and large coarse woody debris and snag recruitment for the future.



Picture 1. Overview imagery (iMap) of a Retention system on the Terrace Community Forest in a second growth stand.

Openings can range in size, and under this system the influence from adjacent standing timber is greater than 50%, allowing for some localized differences in microclimates for various tree and vegetation species.



Picture 2: Ground view of Retention system on the Terrace Community Forest in a second growth stand

The use of this system is straightforward and can be used also to protect a variety of values including riparian areas, large trees, snags, and open non-forested areas.

- From a wildlife perspective, in the short term (~20 years) this system could allow for shrub – herb growth to support grouse, hunting accessibility for foraging Stads K'un. Though time it is unknown how these sites will develop for Stads K'un foraging and for both Stads K'un and Marbled Murrelet nesting requirements (canopy access and creation of suitable nest platforms).
- No pre or post-harvest wildlife assessments have been conducted within this specific silviculture treatment on Haida Gwaii. However, Hudson (2015), did conduct Stads K'un, Marbled Murrelet and Northern Saw-whet owl assessments of retention areas post-harvest, and concluded that they lacked the structural complexity required by Stads K'un and murrelets.

- The number and location of similar site types will need to be identified (licensee – government review – ortho imagery and/or through local forester discussions)

The retention system can also be used to mitigate windthrow events. The “herringbone” design technique has been used on Haida Gwaii to mitigate against the damaging southeastern winds that can occur yearly. Openings are orientated perpendicular to the winds and kept narrow, thereby not allowing the wind to drop below the canopy and cause windthrow.



Picture 3: “Herringbone” approach for managing for windthrow from damaging south-easterly winds (Haida Gwaii Location iMap UTM Zone 8 690733 59478452) Nr. Port Clements

- From a wildlife perspective, if this system was designed such sufficient light¹ reached the forest floor to allow for shrub – herb growth to support grouse, hunting accessibility for foraging Stads K'un and through time provide for Marbled Murrelet canopy access and nest sites.

¹ See attached graph from Doyle 2006, showing the relationship between herb-shrub growth and light on Haida Gwaii.

- No pre or post-harvest wildlife assessments have been conducted within this specific silviculture treatment (pre- commercial or commercial) on Haida Gwaii. The above sites are located near Port Clements.
- The number and location of similar site types will need to be identified (licensee – government review and/or through local forester discussions)

Patch Clearcut

Small openings can be created, whether clearcut (> 1ha) or small patch cuts (<1ha), to provide a range of opening sizes across the landscape. The clearcut silviculture system is used to manage the next rotation as an even-aged stand. Reserves are normally associated with the harvest area and can consist of groups and/or single trees. The reserves often include important resource values such as riparian areas, bird nesting areas and bear dens.



Picture 4: Example of small patches of varying sizes recently harvested on Haida Gwaii (iMap UTM zone 8 306917 5902139). Nr Sandspit.

Once a stand is harvested, the area is restocked with planted trees and/or natural regeneration. This early seral stage lasts around 20 years till the crowns close. This early seral stage usually consists of many herbaceous and woody species and provides habitat and food for those species that rely on them. After this time the tree crowns eventually shade out the herbaceous and woody species. This unmanaged stage, with lack of diversity, can last for decades and can be considered a troubled forest type for many reasons, both from an ecological and forest timber management perspective.

- From a wildlife perspective, on Haida Gwaii without silvicultural treatment (spacing, thinning, and pruning), these stands will have low – nil Stads K'un foraging or Stads K'un and Marbled Murrelet nesting suitability until >100 years.
- We have conducted murrelet and Stads K'un suitability assessments within this stand type and multiple sites on Haida Gwaii (Doyle 2006), and Savard et al. 2000 conducted avian diversity assessments.
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Picture 5: Unmanaged Trouble Forest Type on the Terrace Community Forest

Stand Tending

Tree Spacing

Tree spacing is a silviculture treatment tool used to remove smaller-diameter stems to allow the larger-diameter stems to maintain tree growth at a preferred density. This treatment can increase the diameter of the residual crop trees over time as compared to a crop tree in an unmanaged

dense stand. Stand tending can also extend the timeframe for which the herbaceous and woody vegetation is present on site.



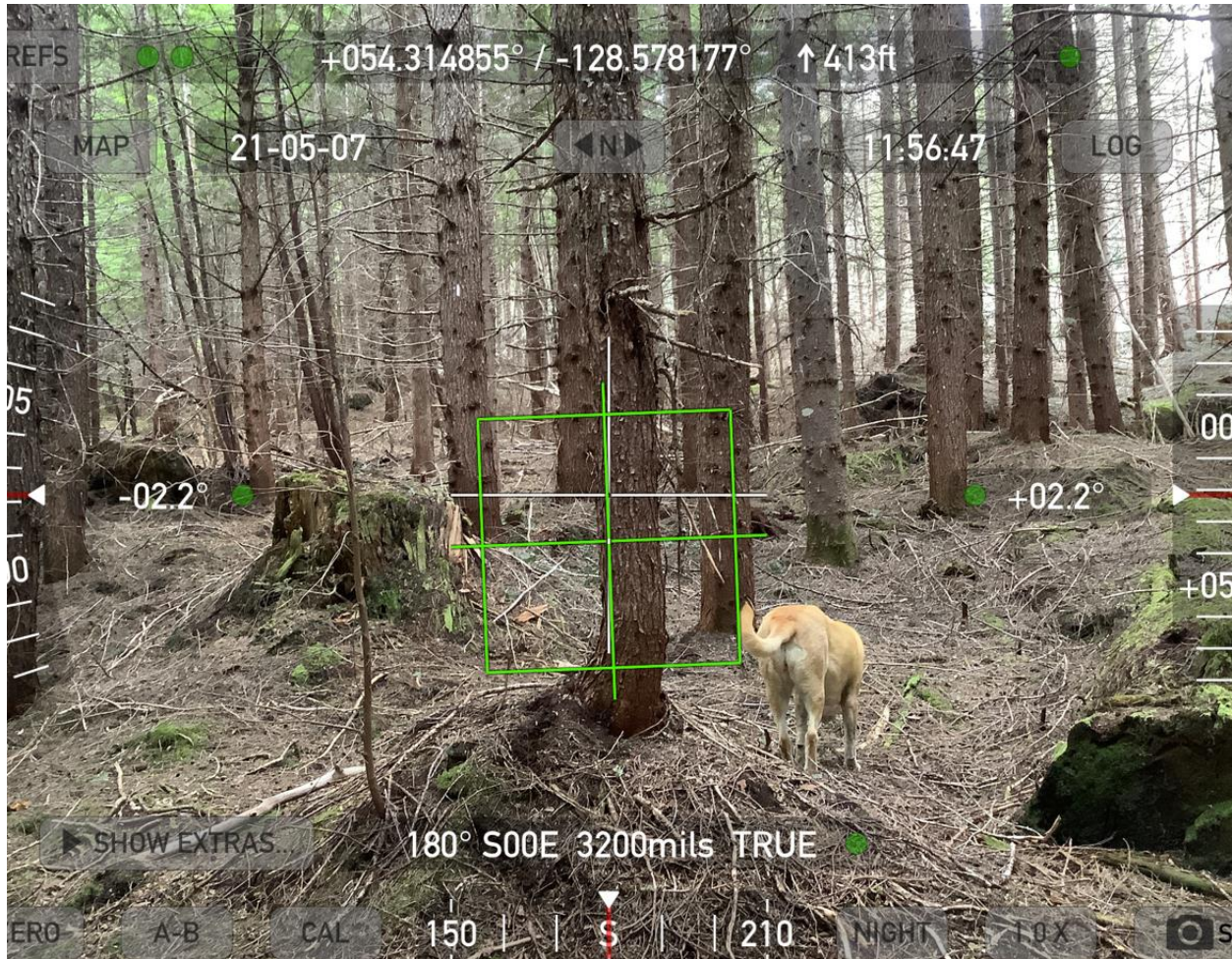
Picture 6: A tree spacer cutting a smaller diameter tree directly adjacent to a larger preferred crop tree.

Many second growth stands on Haida Gwaii have been spaced over the years. The figure below shows a block that was recently spaced in 2022.



Picture 7: iMap image of block spaced in 2022 on Haida Gwaii (UTM zone 8 674423 5919280).

Over time the crowns close and shade out the understory vegetation. Only a few moss species can survive under these conditions.



Picture 8: Spaced stand (mid-1990s) on the Terrace Community Forest. 45 years old at 1200 stem per hectare

Spacing and brushing treatments are also used in watershed restoration treatments. These treatments are generally located adjacent to riparian areas that have been damaged by past harvesting practices. Many areas on Haida Gwaii have been the focus of these riparian restoration treatments, and their locations have been documented in this report.



Picture 9: Spacing and/or Brushing treatment in a riparian area (iMap UTM zone 8 685685 5932058). Yakoun River.

- From a wildlife perspective there are both pre and post focal wildlife assessments for Stads K'un and Marbled Murrelets, and this spacing does increase suitability and the time at which a stand reaches suitability for Stads K'un Foraging (Doyle 2006, Boyer 2020, Savard et al. 2000, vanderBink 1992)
- We have conducted murrelet and Stads K'un suitability assessments within thinned and un-thinned stands at multiple sites on Haida Gwaii.
 - In the short term the key element from a Stads K'un perspective was an increase in light reaching the forest floor, which in turn supported an increase in herb and shrub cover (see Appendix 1. Doyle 2006, Table 7b and 7c), which we anticipate will support increased flower and berry production both of which are important food sources for the endemic Sooty Grouse, a focal Stads K'un prey (Doyle 2005).
 - In the longer-term an increase in light reaching the forest floor across all stand ages and types is associated with an increase in forest floor shrub cover, which again it is anticipated will support higher grouse densities (Zwickle and Bendell 2004).
- In addition, thinning results in an increase in lateral branching, which provides both for hunting perches and for potential nest sites in older stands (Doyle 2006).

Pruning

Pruning treatments are usually carried out on stands that have been spaced. One removes the branches by pruning shears and saws. A single lift prune treatment is 3 meters up the bole of a tree and a second lift pruning treatment is 6 meters. This is an expensive treatment to carry out. Pruning treatments have also been carried out on Haida Gwaii over the years.



Picture 10: Location of pruning treatments on Haida Gwaii (iMap UTM zone 8 678706 5916003) Rennell Mainline just west of QCI Main.

The photo below is from the Terrace Community Forest showing a pruning treatment on a stand that was spaced to 1200 stems per hectare in the mid-1990s and subsequently pruned.

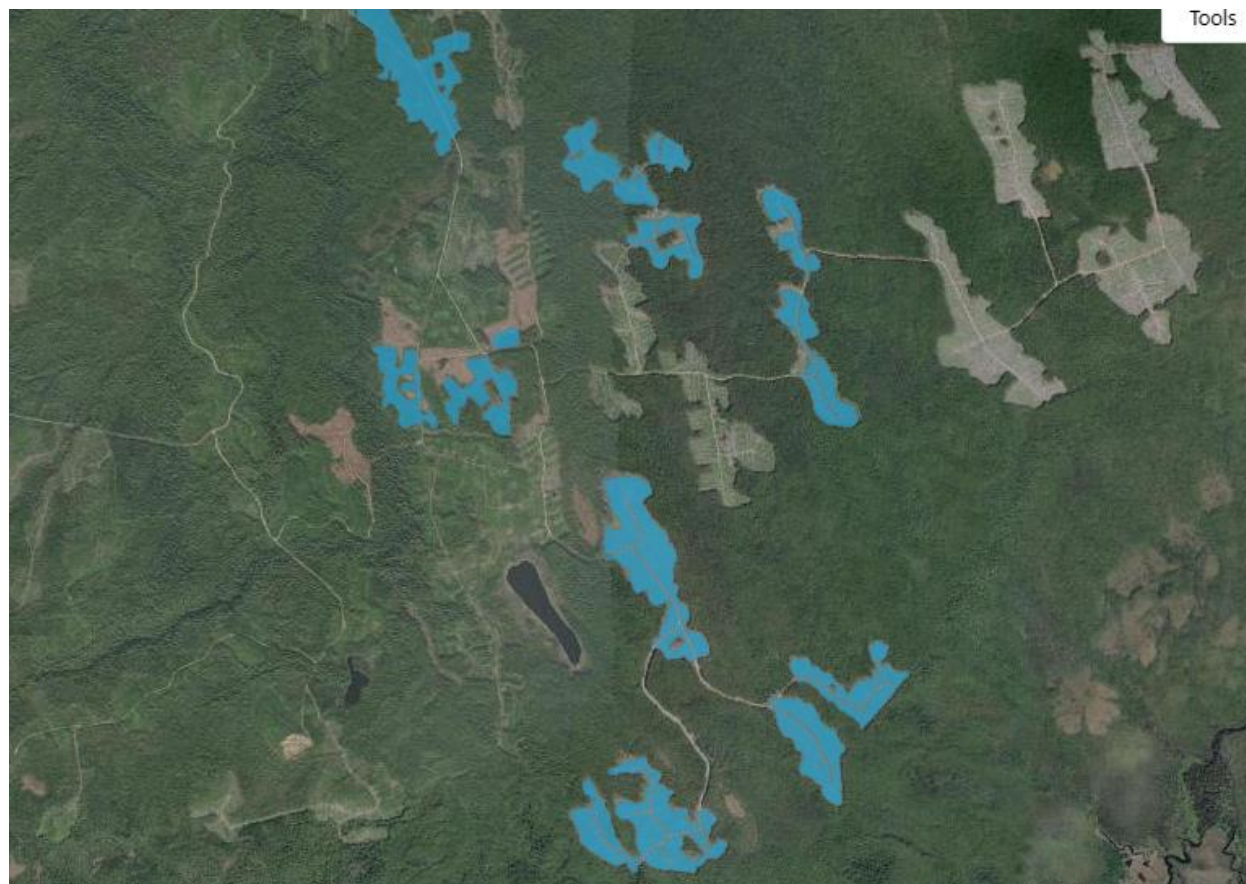


Picture 11: Spaced Western hemlock stand pruned to 3 meters in height.

- From a wildlife perspective, on Haida Gwaii without further silvicultural treatment these stands will have low – nil Stads K'un foraging or Stads K'un and Marbled Murrelet nesting suitability until >100 years.
- We have conducted murrelet and Stads K'un suitability assessments within this stand type and multiple sites on Haida Gwaii (Doyle 2006), and Savard et al. 2000 has conducted avian diversity assessments.

Fertilization

Fertilization is also a stand enhancement treatment used to increase the growth of crop trees. Fertilization can be used to help the trees outcompete brush species as well as sequester carbon. On Haida Gwaii many areas have recently been fertilized.



Picture 12: Location of some stands fertilized on Haida Gwaii (iMap UTM zone 8 689081 5929270) south of Port Clements.

The Terrace Community Forest established a fertilization trial last fall that will study the effects of fertilization on Western hemlock. The photo below shows a stand that was spaced in the mid-1990s and commercially thinned in 2017. The trial will monitor the effect of the fertilization treatment for 10 years.



Picture 13: Terrace Community Forest Western hemlock fertilization trial in a stand that was spaced and commercially thinned.

- From a wildlife perspective, on Haida Gwaii without further silvicultural treatment these stands will predictably have low – nil Stads K'un foraging or Stads K'un and Marbled Murrelet nesting suitability until >100 years.
 - However, does this application allow for higher \$\$ value and shorter harvest window that will support jobs while at the same time allowing for investment in stewardship values in other areas?

- In addition, as a site-specific stewardship treatment how does fertilization impact tree growth characteristics such as greater and stronger later branching, one of the attributes that in combination with thinning may support suitability for both Stads K'un and Marbled Murrelets?
- No studies on Haida Gwaii have specifically looked at wildlife values pre and post fertilization.

Tree Spacing for Habitat Values

Tree spacing can be used as a tool to help manage other values such as wildlife. The photo below is from the Terrace Community Forest where the prescription identified areas to reduce crop tree densities to very low numbers to allow for other non-crop deciduous and berry species to occupy the site. This site was anchored adjacent to an old growth forest with snags along the edge with a sunny aspect.



Picture 14: Terrace Community Forest wildlife enhancement project in the Deep Creek operating areas with funding from SNCIRE through SERNbc.

As a working example of the balance of stewardship and commercial values the Terrace Community Forest has established permanent sample plots in all its commercially thinned blocks to monitor the stand and understory development. The photo below is from its first commercially thinned block in 2015 with stem densities ~ 450 per/ha. The permanent sample plots are measured every five years. Tree heights, diameter and live crown are measured. The understory tree regeneration and other vegetation layers are also inventoried.

Live trees are of course integral to long term forest restoration objectives. If the goal is to completely restore the old growth forest attributes, then during restoration planning site specific targets for tree density and species distribution, that are comparable to typical equivalent old growth located in the same site type, should be identified and managed. Live trees as they age, are the lungs and heart of the old growth forest ecosystems providing an untold number of ecosystem and cultural services. Specific to Stads K'un this would include nest sites, prey and access to those prey. As an example of old growth stem densities on Haida Gwaii, Boyer (2020) recorded an average of ~ 250 stems per hectare in three riparian sites. How you achieve these targets will likely be site specific dependent on the risk of blowdown, the timing of treatment, pre commercial and commercial thinning opportunities, etc.

The photo below is from the Terrace Community Forest. The unmanaged stand on the left has a density of over 5000 stems per hectare and is the same age as the stand on the right. The stand on the right was spaced in the mid-1990s to 1200 stems per hectare and commercially thinned in 2017 to approximately 450 stems per hectare.



Picture 15: Terrace Community Forest shows an unmanaged stand on the left compared to a managed stand on the right.



Picture 16: Terrace Community Forest immediately after commercial thinning – Fall 2015.



Picture 17: Terrace Community Forest five years after commercial thinning. Regeneration and vegetation are starting to develop.

After nine growing seasons there has been good seedling and vegetation development in the understory and the remaining crop trees on site have been released (diameter increased substantially).



Picture 18: Terrace Community Forest block nine years after commercial thinning.

- From a wildlife perspective we have no information on Haida Gwaii specific treatments but work on Vancouver Island indicates that this is increasing Stads K'un nesting and foraging suitability (Shatford and Heckford 2019), although they highlight **“To integrate the simultaneous production of timber and wildlife values will require longer rotations and allowances for leave trees and snag creation.”**
- We have not conducted murrelet and Stads K'un suitability assessments within this stand type on Haida Gwaii.

A review in iMap shows an area south of Sandspit that appears to have been commercially thinned or some variation of a partial cut harvesting.

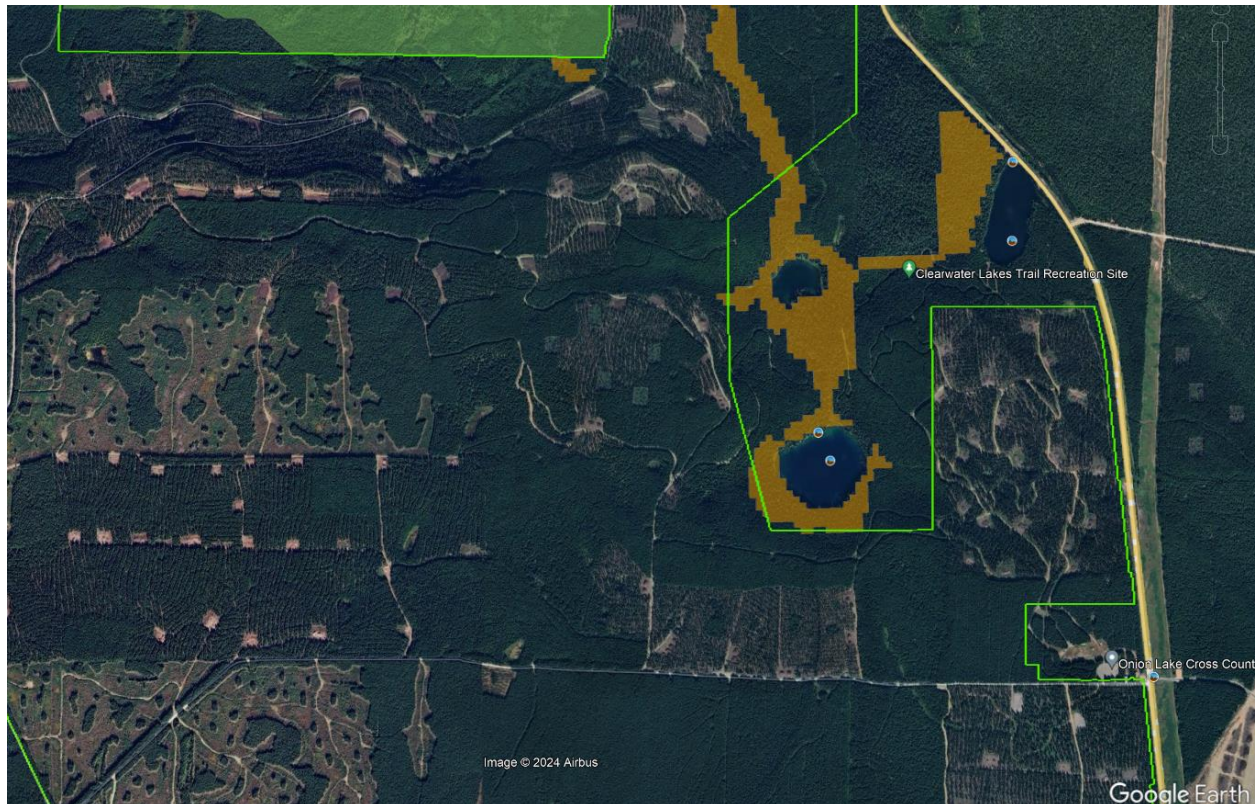


Picture 19: Haida Gwaii commercially thinned or partial cut harvesting (iMap Zone 9 310642 5900017) Nr Sandspit

Stewardship – Silviculture-Harvest/Restoration Landscape Perspective

Mosaic of treatments in the Terrace Community Forest.

As an example of the approach and design in the Terrace Community Forest, stand entries (harvest-silviculture blocks) within the community forest include retention silviculture with reserves and commercial thinning to different residual densities. The green line is the community forest boundary, and the orange is an Old Growth Management Area.



Picture 20: Terrace Community Forest Kitimat Operating Area showing a mosaic of treatments in second growth stands.

The challenge of commercial thinning has always been economics. Without a good timber market to sell logs with smaller diameters has always been a challenge, as the costs to thin and forward the trees to the roadside, processing and hauling, costs more per cubic meter compared to a conventional clearcut harvest method.

As all foresters know, the treatment and approach (timing, type of treatment – investment) is a difficult balance and a gamble based on future markets. In the context of wildlife stewardship, there is an opportunity to balance these objectives, but these opportunities and the approach are predictably very site-specific (timber type, topography, soils, access, roads, distance to the market, forestry rules and regulations, etc).

Diversity of Silvicultural Treatments at a Landscape Scale

In addition to specific silviculture treatments, we are also working closely with the knowledge that to restore biodiversity and manage for goshawks (Stads K'un), then you are working with a wide range of prey species that all require specific habitats and attributes, and therefore no one silviculture system or approach will likely provide for all these species. In the context of the Terrace Community Forest, we are therefore implementing a range of silviculture – stewardship treatments to provide for that diversity of species, and again looking to support that work through silviculture options that support the creation of these attributes. This includes a wide range of patch sizes, thinning treatments, uneven spacing treatments (clumping – small openings), habitat connectivity corridors, and a range of stem densities and tree species. It's a lot of work and we are not maximizing profits, but we are balancing a range of values specific to a community forest approach.

To provide a stand the opportunity to be commercially thinned the stand must be spaced in the first place. Unmanaged stands are generally too dense and consist of smaller diameter trees with poor height to diameter ratios and live crowns that if commercially thinned the residuals will be more susceptible to windthrow, snow press and respond poorly to the treatment.

Good commercial thinning ground consists of previously spaced stands with flat terrain, good soils (not fine textured), good existing road access and short distance to market.

Spacing and future commercial thinning activities can be anchored to goshawk nesting and conservancy areas to help create goshawk habitat. This landscape level approach can help tie current and future goshawk habitats together.

Snags and Coarse Woody Debris

Very specifically and in line with the highlighted comments on page 18, we are looking at ways to ensure a long-term supply of Snags and CWD, attributes and structures that cannot be created using the traditional harvest tools – approaches.

Snags and associated tree cavities are critical to so many species (Bunnell et al. 1998), and we are therefore looking at ways of integrating high quality Snag recruitment (large trees >35cm) into our system. On Haida Gwaii and there are approximately 32 snags/ha (SD 19, N = 75) with an associated ~15 cavities/ha (Doyle [Haida Gwaii.]: unpublished data).

Please see the attached reports for a summary of the techniques that we are exploring (Doyle, Saimoto and Coosemans 2015 (Picture 21 and 22 below), but there are other techniques that may be more practical or effective (Dodson et al. 2013, Lampe 2014), including fungal inoculation to create cavities (Manning 2003). In any scenario, within our plantation landscapes we will have to look at more than one intervention to create snags as it will likely be hundreds of years before this will occur through natural thinning and tree mortality. This really highlights just how tough it is to restore “old forest” attributes.



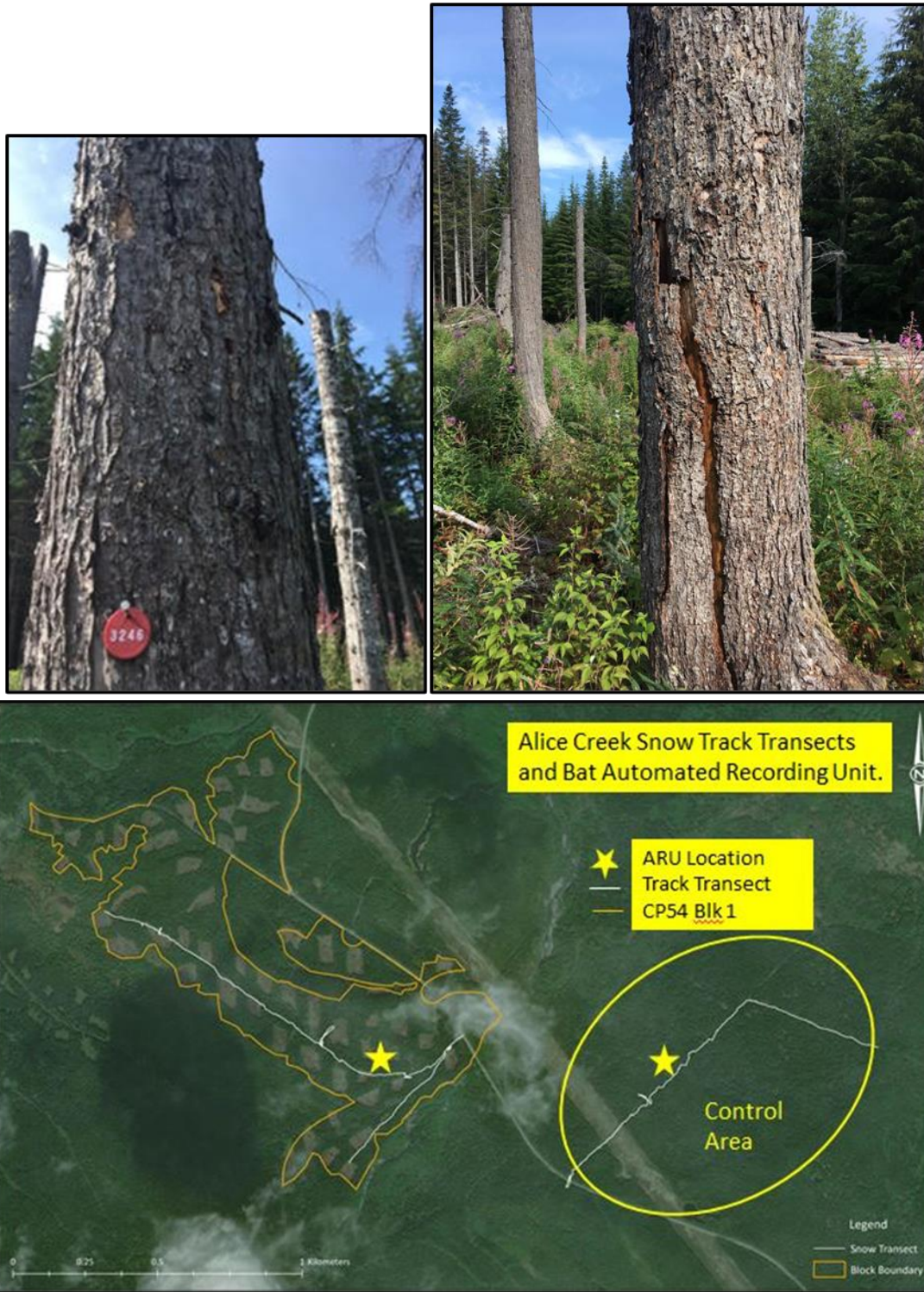
Picture 21. Wildlife Tree patch in Terrace Community Forest (50 year old trees girdled).



Picture 22 a & b. Maternity Bat Boxes and CWD Piles for Small Mammals, squirrels, etc

These same approaches have been integrated at a commercial scale within the second growth harvest of 50-year-old stands but the Kitsumkalum First Nation in a landscape area just north of Terrace (Coosemans and Doyle 2021). Here small patch (<1ha), snag creation and CWD piles were used to emulate old growth attributes (Pictures 23 a-c). The preliminary results (4 years post-

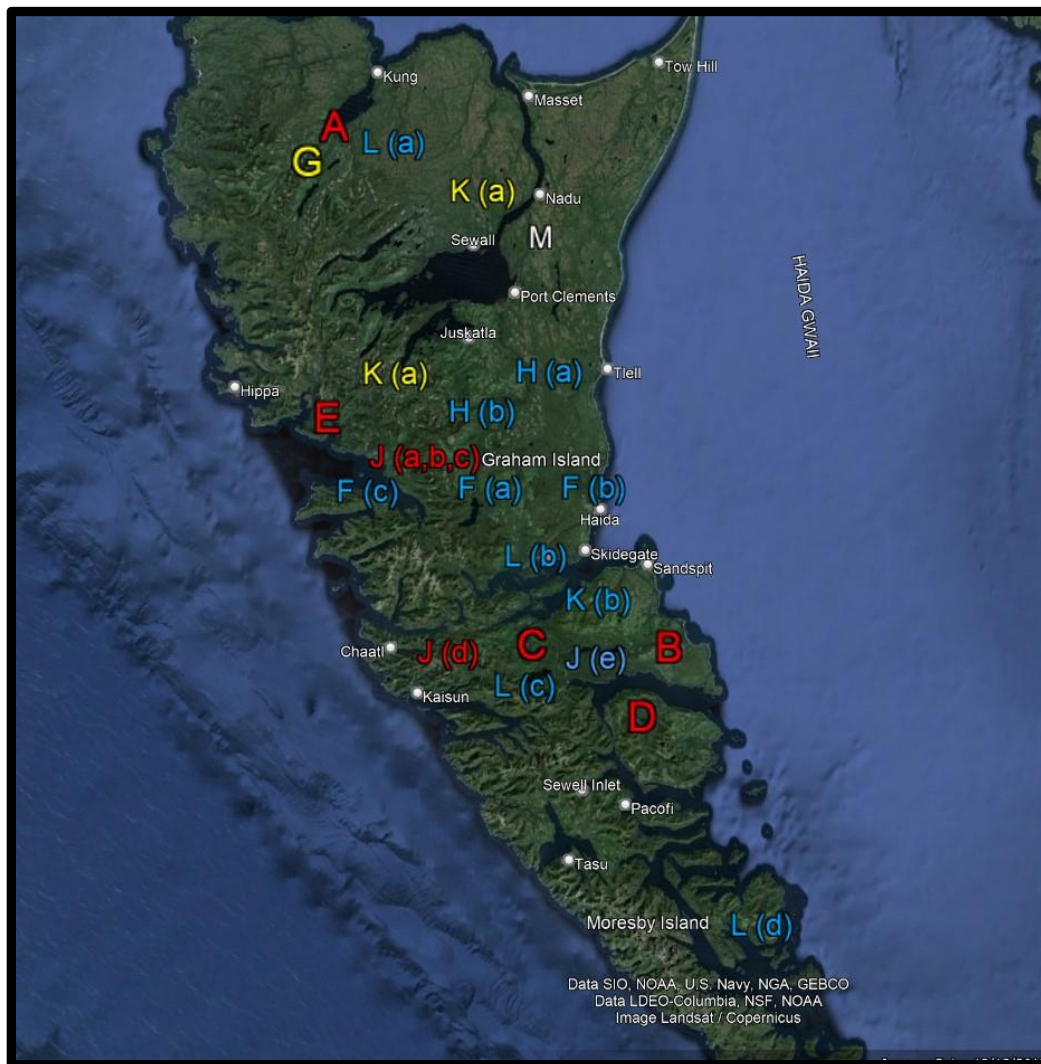
harvest) showing an increase in both old growth bird species and the diversity of bat species compared to controls, and an increase in goshawk foraging suitability relative to controls.



Picture 22a-c. Kitsumkalum (Alice Creek), example restoration – stewardship second growth forestry – habitat attributes and landscape-block design.

Riparian Restoration Areas on Haida Gwaii – Snags and CWD

Specific to habitat restoration – creation on Haida Gwaii, there are 5 or more specific projects (and additional work within Gwaii Haanas), that have focused on second growth Riparian habitat restoration including coarse woody debris and Snag recruitment for wildlife and for future fish habitat (see Reference Database). These activities took place some 23-25 years ago and are located across Haida Gwaii (see RED Labels Map's 1) and have not been reassessed from a focal Stads K'un or other wildlife perspective. Reassessment of at least a few of these sites may therefore provide a valuable insight into the success of the habitat attributes – in relation to the project objectives.



Map 1. Overview Map showing the Location of specific Second growth Wildlife Inventory, Riparian Restoration and Old Growth control sites on Haida Gwaii. RED = Riparian Restoration, BLUE = Second growth thinning and wildlife inventory, YELLOW = Old growth wildlife inventory and alternate stewardship harvest strategies.) See Reference dbase (Appendix 2. Sheet 2) for specific letter trial - project link.

Live Tree Retention

Within and along the edge of the Enhancement Sites, our goal is to promote the growth of the remaining live stems. This enhanced growth of select stems provides two functions: 1) it potentially offsets the commercial impact of loss of live stems through the increased volume (and thus value) in growth of these stems (Bailey and Tappeiner 1998); and, 2) it provides future wildlife trees within the Enhancement Sites, as these well-spaced trees will respond with increased lateral growth (Figure 13) that will provide for a larger crown with potential nest sites for raptors and other birds (Bailey Tappeiner 1998), and will also have improved cone production that will support squirrels, small mammals and seed-eating birds (Reukema 1982).



Figure 1. Spruce showing strong lateral branching.

Methodology for retaining live trees within Enhancement Site

- Leave 20% live trees ≥ 20 cm dbh (girdle or cut the largest dbh trees):
 - Around the perimeter, separate each live tree with a girdled tree.
 - An additional 15 live trees should be retained within the outer edges of the Enhancement Site, evenly distributed throughout the area that is 5-10 m from the edge. These trees should be well separated from one another by girdled and cut stems (as per “Enhancement Site Clearing Design” Section 3.5.3 above).

Restoration and Invasive and Introduced Species

The island archipelago of Haida Gwaii is not only home to many unique and threatened species but unfortunately also must contend with a large number of introduced and invasive species. The impact of some of these species has been well documented, including research and approaches applied to mitigate their impact – see the below link to restoration resources (RGIS).

Within this context all restoration – stewardship activities should ensure no further harm. All planned restoration activities need to ensure that the approach does not undermine the intent by bringing new invasive species into an area. Prior to restoration it is therefore recommended that you should contact the “BC Invasive Species Council” (see Restoration Resources below), to get the latest information and reporting requirements. Specifically, to reduce the risk of introducing invasive plants, clean machinery prior to accessing restoration specific sites, clean work boots, and a follow up check of landing sites etc for invasive plants in the year or two post activities.

Silviculture Activities – During the earlier assessment of wildlife suitability in second growth on Haida Gwaii (Doyle 2006), was the observation that the recently thinned – pruned material potentially prevented access to areas by the deer, and these areas appeared to have a higher abundance of herbs and shrubs. This in turn was consistent with research on deer and how they avoided areas with heavy debris >50cm above the ground (From Nyberg et al. 1989, pre-commercial thinning and pruning not only increased canopy openness, but also increased dense network of overlaying branches and trunks, and this likely reduced the impact of deer browsing on the plants of the forest floor). These observations were further supported by Parker et al. (1984) who in the same forest type, saw a significant reduction in deer browse with >25 pieces of this debris per 100m, when pieces of debris were >30cm off the ground.”

Timing of Restoration – From a weed seed perspective IF it is practical, restoration focused activities that result in soil disturbance should take place in winter or spring, prior to seeding in species such as thistle, hawkweeds, ragweed, etc,. Thus, reducing the risk of weeds becoming incorporated within the disturbed soils within the restoration focused areas.

Objective 2. Historical silviculture treatments:

2a. Summary of Existing Information.

Existing Literature and Studies

The attached dbase (Appendix 1 Stads K'un Restoration Summary 2024) provides a broad summary of the work specific to Northern Goshawk – Stads K'un habitat suitability and creation, wildlife inventories, alternative silviculture methods and how they affect wildlife, and riparian restoration for Haida Gwaii. The master list is split into tabs indicating Haida Gwaii specific research, other relevant coastal research, alternative approaches to silviculture and harvesting in BC, research pertaining to wildlife in similar areas, and other references that were reviewed. There were 16 notable documents found for research specific to Haida Gwaii, though there is likely other information which can be added.

(Data Base Structure: The master list has columns indicating the types of projects the documents are, if they are specific to Haida Gwaii, and their objectives and results. There are additional columns categorizing documents as pertaining to wildlife, second or old growth, if they indicate habitat creation, maintenance, or suitability, whether wildlife inventories were done, if they suggest alternative silviculture or harvesting methods, and other key topics. There were 16 notable documents found for research specific to Haida Gwaii, though there is likely other information which can be added.)

This data set is notable as it highlights the relative lack of knowledge as to what harvest and silviculture treatments will with certainty provide for Stads K'un foraging and habitat needs, and the specifics of that approach on Haida Gwaii, with its additional impact from introduced species, and the low number of Stads K'un that remain.

Haida Gwaii Specific Restoration – Second Growth wildlife inventory in relation to silviculture

Across Haida Gwaii there have been a range of silviculture treatments, resulting in a range in stem densities and age classes, in a range of habitat types as per Table 1.

Specific to active restoration activities these have been focused on the Riparian Habitats and there has been no long-term terrestrial follow up as per the effectiveness of these restoration activities.

Table 1. Restoration and Second Growth Inventory – Suitability Studies on Haida Gwaii. *1992 sites resurveyed in 2004-5.

Project Name	Date	Key Map	Riparian	Second Growth	Old Growth	Inventory	Habitat suitability	Habitat Creation	Has there been follow
General Wildlife Inventories for Proposed BC Ministry of Forests SBFEF Cutblocks, Queen Charlotte Islands/Haida Gwaii	2001	Island Wide	No	Yes	Yes	Yes	Yes	No	No
Avian diversity in relation to logging in the coastal rainforests of British Columbia	2000	F (a, b, c, d, e)	No	Yes	Yes	Yes	No	No	No
The Use of Alternative Silvicultural Systems and Alternative Harvesting Practices in the Vancouver Forest Region	1994	M	No	Yes	Yes	No	No	Yes	No
Mathers Creek Watershed: Riparian Assessments and Stand Management Prescriptions for Mathers, Fukwa, and Clew Creeks	2000	E	Yes	Yes	No	No	No	Yes	No
Deena River Watershed: Riparian Assessments and Stand Management Prescriptions for Lower Deena River and Tributaries	2000	C	Yes	Yes	No	No	No	Yes	No
1997 Watershed Restoration Program. Copper River. Site Level Riparian Assessment and Stand Management Prescriptions	1997	B	Yes	Yes	No	No	No	Yes	No
1998 Watershed Restoration Program Davidson Creek and Naden River Riparian Rehabilitation Project: Results of Restoration Project	2001	A	Yes	Yes	No	No	No	Yes	No
Watershed Restoration Program Canyon Creek - Tartu Inlet Riparian Rehabilitation Project: Results of Restoration Project	2001	E	Yes	Yes	No	No	No	Yes	No
Winter Wildlife Use of Riparian Habitats of the Queen Charlotte Lowlands and the Queen Charlotte Ranges Ecoregions	1992	I (a, b, c, d, e)	Yes	?	?	Yes	No	No	Yes* (2004-5)
An Assessment of Habitat Suitability in Old Growth and Second Growth Retention Area's On Haida Gwaii	2015		No	Yes	Yes	No	Yes	No	No
When do naturally regenerating and pre-commercially thinned second growth forests attain attributes that will support Northern Goshawks (laingi subspecies) and Marbled Murrelets on Haida Gwaii? Doyle, F.I. 2006. Cascadia Forest Products Ltd. Gwaii Haanas National Park Reserve and Haida Heritage Site.		L (a,b,c,d)	No	Yes	Yes	No	Yes	No	Yes*
Wildlife Inventory	1994-1996	Island Wide	No	No	Yes	Yes	Yes	No	No
Forest Restoration on Haida Gwaii: Implications for Goshawk Habitat	2020	H (a) and H (b)	No	Yes	No	Yes	Yes	Yes	No
Pre and post harvest habitat impacts of Husby heli- select harvesting on forest structure and focal wildlife species on Haida Gwaii/Queen Charlotte Islands	2004	G	No	Yes	Yes	Yes	Yes	No	Yes (2006)
Maintenance of habitat suitability for Northern Goshawks (Accipiter gentilis laingi) and Marbled Murrelets using Heli-select harvesting on Haida Gwaii: Years 2-3 Post Harvest	2006	G	No	Yes	Yes	Yes	Yes	No	No

As per the Stads K'un ecosystem "restoration" potential impact of different stem densities, tree species, age classes and additional pruning activities there has been some follow up through avian (Savard et al. 2000) and ecosystem inventory surveys (Doyle 2006). Specifically, the work in 2006 showed a relative increase in Stads K'un Nest and Foraging suitability as a result of pre commercial thinning activities. However, in all cases it is at least 20 years since these surveys were conducted, and prior to initiating further "restoration" activities it will be valuable to look at these sites from both an ecosystem and economic perspectives. If these activities increase suitability for Stads K'un, is this suitability increasing through time, is there potential to access these stands from an economic perspective to further enhance old growth specific stand attributes (light gaps, CWD, Snags) that support foraging and nesting (see attached 2023 (Doyle) presentation overview of required attributes and silvicultural approaches).

2b. Propose Criteria to select 10 historic sites for further evaluation.

The below selection criteria are driven by a need to quickly and effectively initiate restoration activities that will start to create habitat attribute that will support Stads K'un foraging habitat suitability (prey and access to that prey). At the outset the criteria include a range of factors ranging from forest condition and type to accessibility, Partnerships, Funding opportunities and Location (Table 2).

For site selection of historic sites this will be driven by selection based on A and B below. Based on the review of silviculture treatment options (Objective 1), site selection should include the Riparian Enhancement sites (CWD, Snags), a range of stand densities, (predictably focused on sites with a low stem density <400 per/ha for Stads K'un nesting suitability (Shatford and Heckford 2019, Terrace Comm For (Doyle and Bennett pers obs)). This selection should be across a range age classes (second growth stand development in relation to old-growth attributes – Stads K'un suitability, economics, and Haida Cultural Values).

Further site selection should focus on sites that have the opportunity of adjacent paired sampling plots with no prior enhancement. As there are so many site-specific variables outside of A. below (slope, elevation, patch size, aspect, stand adjacency, etc), it is also recommended, that on review of past trials, that selection focuses on areas that are "as much as possible" the same in many respects as possible. Such that these other in situ and adjacency variables have a minimal or possibly equal impact on the observed inventory and suitability results.

In addition, outside of the previously identified trial sites (Map 1), areas with silvicultural treatments in the old burn landscape (NE Haida Gwaii), may provide insights into potential effective second growth silviculture – commercial thin opportunities as per "herringbone" (e.g Nr Port Clements. Page 5 picture 3 Overview Section) or potentially in landscapes with high stem removal in commercial spaced stands (e.g. Moresby. Page 20 picture 19). Prioritizing sites with the opportunity for paired control plots in adjacent stands that have not been harvested.

Ideally, we should visit at least 10 sites that allow for paired and control plots, or have pre and post structural and inventory data, but this as seen as a minimum and should be under constant

assessment. At this stage we are looking for direction to lead a more rigorous sampling design and identification of useful treatment options that will drive effective and implementable approaches to restoration (again with a view at this initial stage to potential stewardship treatments that can be funded by the silviculture/harvest activities). If we can standardize across age and tree species classes and site types, then we should be looking to survey 3-4 sites in each of the trial types (Riparian Restoration, and commercial thinning and Herringbone site types).

Critically, the Haida have been stewards of the forests for millennia, and restoration activities and site selection need to incorporate that knowledge, such that those traditional cultural values are supported through any planned activities. All historic and planned restoration treatments and site selection activities should therefore be chosen in collaboration with these knowledge keepers (Haida Forest Guardians).

Table 2. Overall Historic and New Silviculture Trial Selection Criteria (Not Ranked)

A. Trial in Situ Selection Criteria

- Stand Age
- Stand Density
- Dominant Species
- Site Type
- Stand Treatment
 - Pruning
 - Thinning
 - Riparian Enhancement
 - Herringbone
 - Patch
 - Fertilization
 - Alder treatment

B. Trial Accessibility Selection Criteria

- Accessibility
 - Mainline
 - In block roads present
 - Distance to office – (drive time for surveys)
 - Boat access required?

C. Trial Location in Relation to Overall Objectives

- Location in relation to landscape condition
- Location in relation to Stads K'un (goshawk) territories
- Location in relation to Communities – support and representation

D. Trial Location in Relation to Economics

- Funding Support
 - Commercial Stands
 - Pre-Commercial Stads
 - Distance to log sort
 - Other: Riparian enhancement?
 - Other forest stewardship funding sources?
- Partnerships:
 - CHN – cultural knowledge linkage
 - Parks (BC Parks and Federal Parks)
 - Licensee and BCTS,
 - SERNbc
 - University – academic or other
- **Trial location and Restoration approach in Relation to Haida Cultural and other Values**

Ensure site selection and approach are consistent with supporting Haida Cultural values and the other value components of the forest.

2 c. Field Survey Methodology

For sites with no sampling (structural or wildlife Inventory) history paired plot design (control and treatment) should be a priority for most site selection within second growth thinned sites.

For sites with sampling history a within stand assessment of structural attributes (BC Ministry of Forests and Range and BC Ministry of Environment 2010), in addition to Stads K'un and Marbled Murrelet suitability ratings conducted at least 3 representative sites per treatment type and per control (if applicable).

Focal attribute data include:

1. CWD: inc, number length, width and decay class
2. SNAGS: inc, number and Decay Classes
3. Tree species composition,
4. Tree Height,
5. Canopy Closure,
6. Canopy Heterogeneity
7. Stem Density,
8. Age Class,
9. Mult-layered canopy,
10. Shrub cover – species.

Lidar: Specifically, as an additional asset to site identification – comparison of pre and post treatments and paid plots designs, Lidar can be an effective tool to determine canopy closure – heterogeneity, tree heights and canopy evenness.

Haida Cultural Values

Determine if the past restoration – silvicultural treatments were appropriate and identify values (for monitoring) and restoration approaches and areas that will support cultural values for millennia.

Timber Value (RPF partnership)

In addition to the above, it is anticipated that there may be specific objectives related to stand condition and development that may be related to crop trees, pests and pathogens, if and where there is a goal to support multiple objectives within a restoration first context. This could therefore see the incorporation of standard timber attribute information related to growth and yield and timber quality. This should be conducted by RPF on island partnerships.

Wildlife Data Collection:

As per DEIF. In addition: as per pre-existing island wide data collection (details in Doyle 2006) a 200 x 30m habitat and wildlife inventory transect. This will allow direct comparison with 188 existing data transects across all site types and age classes (harvest – old growth) across Haida Gwaii.

1. ARU data collection (control and treatment) through June-July (main prey consumption by Stads K'un chicks and fledged young (Doyle, MS thesis). Avian species and squirrels.
2. Cavities per snag, cavity size class and evidence of use.
3. Stads K'un foraging and Marbled Murrelet and Stads K'un nesting suitability ranking. In addition, suitability ranking for sooty grouse (cover and forage plants. Unpub data – In Draft for publication)



2012 Stads K'un Nestling on the Demon FSR

(Area no longer supporting breeding).

Baseline and monitoring data collection forms

The primary tool for monitoring the structural changes with the Enhancement Sites will be the Field Manual for Describing Terrestrial Ecosystems, Handbook 25 (MoFR and MoE 2010), and specifically the forms listed below:

- Site Visit FS1333 SIVI
- Vegetation FS882(3) VEG
- Mensuration FS882(4) MENS
- Wildlife Habitat Assessment FS882(5) WHA
- Tree Attributes for Wildlife FS882(6) TAW
- Coarse Woody Debris FS882(7) CWD.

In addition, several other forms will be utilized: 1) the FREP SDM form FS1357 will be completed (in part) to document forest damage caused by pests or pathogens.

Objective 3. Site Selection Criteria Untreated Sites

3a. Site Selection Criteria

Sites for future restoration will be selected in part based on information collected as part of the historical site assessment (Objective 2: site attributes, economic stewardship opportunity, and territory scale Stads K'un suitability). Which historical approaches allow for the most effective and implementable (economic) restoration initiative as quickly as possible across focal landscapes areas. Avoid only one solution as there is still lots to learn and a wide range of habitat niches are needed to support a biodiverse – rich ecosystem.

As per Objective. Area selection could additionally be guided by the Haida, specific to areas where their cultural values would be supported through planned restoration activities.

In addition, both at the landscape scale and stand scale, areas selection for restoration would predictably benefit from a location where hunter – trappers can support restoration activities, in particular - through deer harvest. This can be achieved, through the selection of community accessible sites, and restoration activities that provide for hunter-trapper access throughout the restoration area.

Finally, forest restoration will take a very long time and it will involve potentially generations or focus and support from the people of Haida Gwaii. To achieve this goal area selection will predictably therefore benefit from sites that can be accessed by the people from all communities (school groups to elders), so that they see what is going on, and potentially add to and benefit from the restoration (cultural activities, nature walks, berries harvest, wildlife viewing, interpretive support, etc, etc.).

Landscape Selection

Known and Suitable Territories

Within the above context, focus first on the landscape locations that allow for the best opportunity to provide suitable habitat for Stads K'un. Prioritise older second growth landscapes adjacent to large conservancy – park – riparian areas, where the attributes and conditions are present that are most likely (through restoration) to provide for predicted Stads K'un Territory needs. E.g. Tlell Watershed, Yakoun Lake, etc. This will need a scoping exercise of existing silvicultural treatments that are archived both by the BC Government and licensees. Activity within these areas or any known and predicted territory areas, as per below should therefore be conducted within the context of an island wide population plan – work that is ongoing through the Stads K'un Working Group

For all known territories, including the Second Growth dominated landscapes (Aero North (Ts'ii Kun), K'aasda Gandlaay (Copper Creek), Jakes Landing (Channel)), we need to be careful about how to proceed as some of these territories may still be suitable – even though no breeding was observed this year. At this stage we anticipate – but we can't say for sure that the planned restoration activities will enhance suitability. Activity within territory areas or any known and predicted territory areas, should therefore be conducted within the context of an island wide population plan – work that is ongoing through the Stads K'un Working Group.

Landscapes Outside of Known and Suitable Territories

- Site selection, particularly in area outside of known and suitable territory areas should look for an opportunity to partner with any ongoing silvicultural activities planned within the landscape, such that projects can be integrated within existing programs, both for financial and logistic support.
- Select sites for restoration as per above (site selection in Known and Suitable Territory Areas). Again, with a focus on taking advantage of existing suitable landscape features that may already be providing for Stads K'un prey home range needs, or connectivity from with prey can readily populate the restored habitats (see Tongass Report on island habitat impacts to species abundance and distribution (Smith and Flaherty. 2023)).
- Restoration area design for suitable territory areas should also include territory scale planning that identifies a "Breeding Area" central to an existing suitable Breeding Area or a second growth stand that can be restored specifically to attain attributes that support nest requirements. (>200ha embedded and central to the foraging habitat McClaren et al 2015).
- Select restoration areas that are not unique with a landscape context, such that restoration activities can rapidly implemented over a large area.
- Parks – Conservancies: Preventing the extirpation of Stads K'un from Haida Gwaii needs an island wide population – territory management plan. Many Stads K'un territories were historically in areas that are now Parks and Conservancies, and many of these territory areas were also historically harvested. Habitat restoration activities within these second growth landscapes, can support multiple species and habitat values, including Stads K'un suitability. This and the potential access to additional funding – logistic resources should integrate within an island wide population-based restoration plan.

Stand Selection

Again, as per overall landscape selection above, target restoration specific sites (blocks) to areas where a variety of landscape habitat attributes align with the in-stand opportunity to increase habitat suitability for Stads K'un. Stand Selection criteria should again focus on sites with the highest potential for successful restoration of Stads K'un suitability available attributes, economic stewardship opportunity. As per Table 2 (from Objective 2).

Table 2. New Silviculture Treatments Selection Criteria (Not Ranked)

A. Trial in Situ Selection Criteria

- Stand Age
- Stand Density
- Dominant Species
- Site Type
- Stand Treatment
 - Pruning
 - Thinning
 - Riparian Enhancement
 - Herringbone
 - Patch
 - Fertilization
 - Alder treatment

B. Trial Accessibility Selection Criteria

- Accessibility
 - Mainline
 - In block roads present
 - Distance to office – (drive time for surveys)
 - Boat access required?

C. Trial Location in Relation to Overall Objectives

- Location in relation to landscape condition
- Location in relation to Stads K'un (goshawk) territories
- Location in relation to Communities – support and representation

D. Trial Location in Relation to Economics

- Funding Support
 - Commercial Stands
 - Pre-Commercial Stads
 - Distance to log sort.
 - Other: Riparian enhancement?
 - Other forest stewardship funding sources?

- Partnerships:
 - CHN
 - Parks (BC Parks and Federal Parks)
 - Licensee and BCTS,
 - SERNbc
 - University – academic or other

E. Trial location and Restoration approach in Relation to Haida Cultural and other Values

Ensure site selection and approach are consistent with supporting Haida Cultural values and the other value components of the forest.

3b. Field Survey Methodology

Structure and Prey. – At a within stand and at a Stads K'un territory scale we need ensure that we are being successful in our objective of restoring habitat at the stand scale, such that it increases Stads K'un suitability (prey and access to that prey). In addition, we need to know if our approach is increasing the overall suitability of a landscape – territory scale such that our activities support an occupied Stads K'un territory, including breeding success of that territory.

At the within stand scale this will include a pre and post prey inventory and inventory of the structural old growth attributes that support those prey and access to that prey (see Objective 2). In addition, this will include a paired sample plot design, that includes the treatment, and an adjacent control stands, as we need to determine how successful we are at restoring compared to untreated sites.

Stads K'un. – At the territory scale we need to ensure that these restoration landscape areas are monitored for Stads K'un occupancy, breeding, and breeding success. This will be conducted through integration within the Working Group annual Stads K'un monitoring program. This will be conducted through field surveys, augmented, or facilitated through the use of ARU's (Autonomous Recording Units) to determine if known breeding areas are occupied, or if the location is unknown through a grid pattern of monitoring ARU's that allow us to locate any areas supporting breeding activity.

Silviculture Objective Monitoring. – In addition to the above, it is anticipated that there may be specific objectives related to stand condition and development that may be related to crop trees, pests and pathogens, if and where there is a goal to support multiple objectives within a restoration first context. This could therefore see the incorporation of standard timber attribute information related to growth and yield and timber quality. This should be conducted by RPF on island partnerships.

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Restoration Resources

- Date Creek Research Forest (MoF) <https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/silviculture/silviculture-research/silvicultural-systems-research/date-creeel-research-forest>
- Invasive Species Council of BC <https://bcinvasives.ca/>
- The Research Group on Introduced Species (RGIS) <https://rgis.cefe.cnrs.fr/Publications.html>
- Society for Ecosystem Restoration in Northern BC (SERNbc) <https://sernbc.ca/restoration>
- Terrace Community Forest <https://terracecommunityforest.com/>

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This scoping document and attached data base (Summary of available Restoration and Stand thinning Studies and Supporting Literature), is indebted to the enthusiasm and hard work of team of professionals who all saw the need here, and enthusiastically gave their time such that we can quickly start restoration activities. A big thank you to Alvin Cober for assembling and storing many of the manuscripts, and the reports and data from sites on Haida Gwaii - and thank you to Alison Grover (BC Gov), and Sam Helmer (CHN) for helping to sort and catalogue that collection.

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Appendix 1. Shrub and Herb Cover, Canopy Closure and Thinning

From Doyle 2006. Page 14.

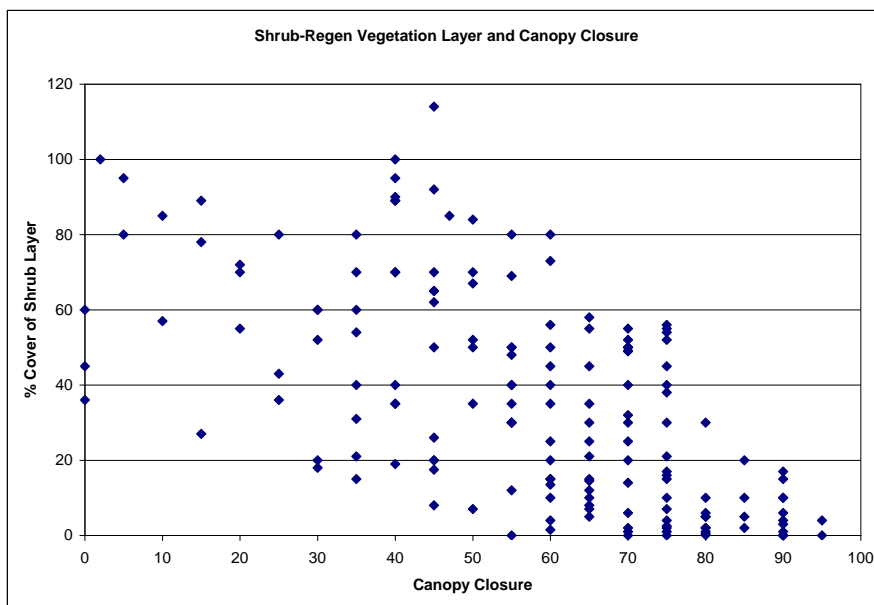
Table 7b. Percentage cover per survey transect, for the differing vegetation layers stands that were both thinned and pruned compared to stands that were only thinned. Stands 40-60 years of age. (B = Shrubs, C = Herbs – flowering plants, D = Moss)

	Thinned and Pruned (n = 5)		Thinned Only (n = 10)	
% Cover	Mean	SD	Mean	SD
B Layer	8.87	7.00	6.07	4.89
C Layer	43.65	39.94	20.80	31.70
D Layer	47.40	15.46	52.45	21.50

Table 7c. Percentage shrub cover per survey transect, for stands that were thinned and pruned compared to comparable transects that were not thinned. Stands 25-80 years of age.

	% Shrub Cover		
Treatment	Mean	SD	n
Not Thinned	4.81	8.05	12
Thinned	27.74	30.32	8
Thinned and Pruned	31.72	30.18	5

Figure 6. Influence of Canopy Closure on Shrub Growth. (N = 133)



Appendix 2. Summary of available Restoration and Stand thinning Studies and Supporting Literature

See Attachments