COUNCIL OF THE HAIDA NATION – EBM TECHNCIAL SERIES NUMBER 1

1 Hlgiid Western yew Taxus brevifolia

Ecosystem-based Management Effectiveness Monitoring Report

MAY 2016

COUNCIL of the HAIDA NATION
hlgiid – Western yew – Taxus brevifolia Effectiveness Monitoring Report
Ecosystem Based Management Technical Series – 1

Heritage and Natural Resource Department 2016
Reynolds, N.A.

ACKNOWLEDGMENT

This study was made possible from the help of field crew;
Tyler Bellis, David Vanderhoop, Aline Lachapelle, Sean Muise,
Ginelle Taylor and Alan Geraghty.

Thanks also to information and resource support from
Jeff Mosher (Taan Forest Products Ltd.) and
Jon Fane (Husby Forest Products Ltd.).

This study and report was supported by the Council of the Haida Nation's
Heritage and Natural Resource Committee – Percy Crosby,
Allan Davidson and Shawn Cowpar – with review by Sean Muise,
Ministry of Forests, Lands and Natural Resource Operations.

HAIDA NATION

BRITISH COLUMBIA

Design: Council of the Haida Nation – Communications 2016

1

Hlgiid
Western yew
Taxus brevifolia

Ecosystem-based Management Effectiveness Monitoring Report

GLOSSARY

EBM	Ecosystem-based Management
ECM	Ectomycorrhizal fungus
FREP	Forest and Range Evaluation Program
FRPA	Forest and Range Practices Act
HGLUOO	Haida Gwaii Land Use Objectives Order
HGMC	Haida Gwaii Management Council
HGNRD	Haida Gwaii Natural Resource District
HTFF	Haida Traditionl Forest Feature
RMA	Riparian Management Area
SLR	Stand Level Retention

CONTENTS

Figures

Photos

Tables

Council of the Haida Nation

EXECUTIVE SUMMARY

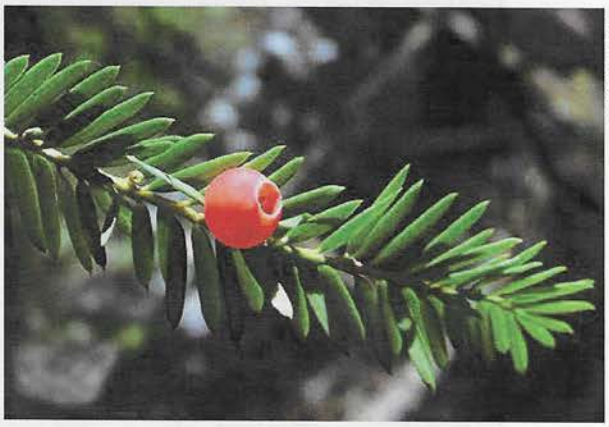
In the fall of 2014, the Council of the Haida Nation (CHN) and the Haida Gwaii Natural Resource District (HGNRD) conducted effectiveness monitoring surveys for yew trees, a cultural value identified under the Haida Gwaii Land Use Objectives Order (HGLUOO). The main goal was to sample forest cutblocks that were designed using an Ecosystem Based Management (EBM) system, to determine if Forest Stewardship Plan strategies for protecting yew trees were effective.

A total of 17 blocks were surveyed, with 213 trees being evaluated. One hundred per cent of patches were in stand level retention (SLR) areas and were minimally impacted from logging; however only 30% of all the trees were in a patch, as defined by the HGLUOO.

Overall, 74% of trees were in SLR. Of the trees outside of SLR, 6% were single stems in the open and 20% were dead, most of which having been stumped. Single trees that were closer to the harvest edge were less impacted compared to trees in the open, but had a 50/50 chance to be highly impacted from logging.

There were minimal impacts to trees in SLR, which were on average 20m away from an edge with 79% of residual trees within a management area retained. Sixty-six per cent of the live observations were co-located with other forest management values. Approximately 16% of all trees outside of SLR did not have operational limitations, lending to a discussion on communication and interpretation of how the term 'practicable' applies to the management of yew trees on Haida Gwaii.

Information gathered during the study is intended to inform operational strategies for licensees as well as policy development through the Haida Gwaii Management Council.



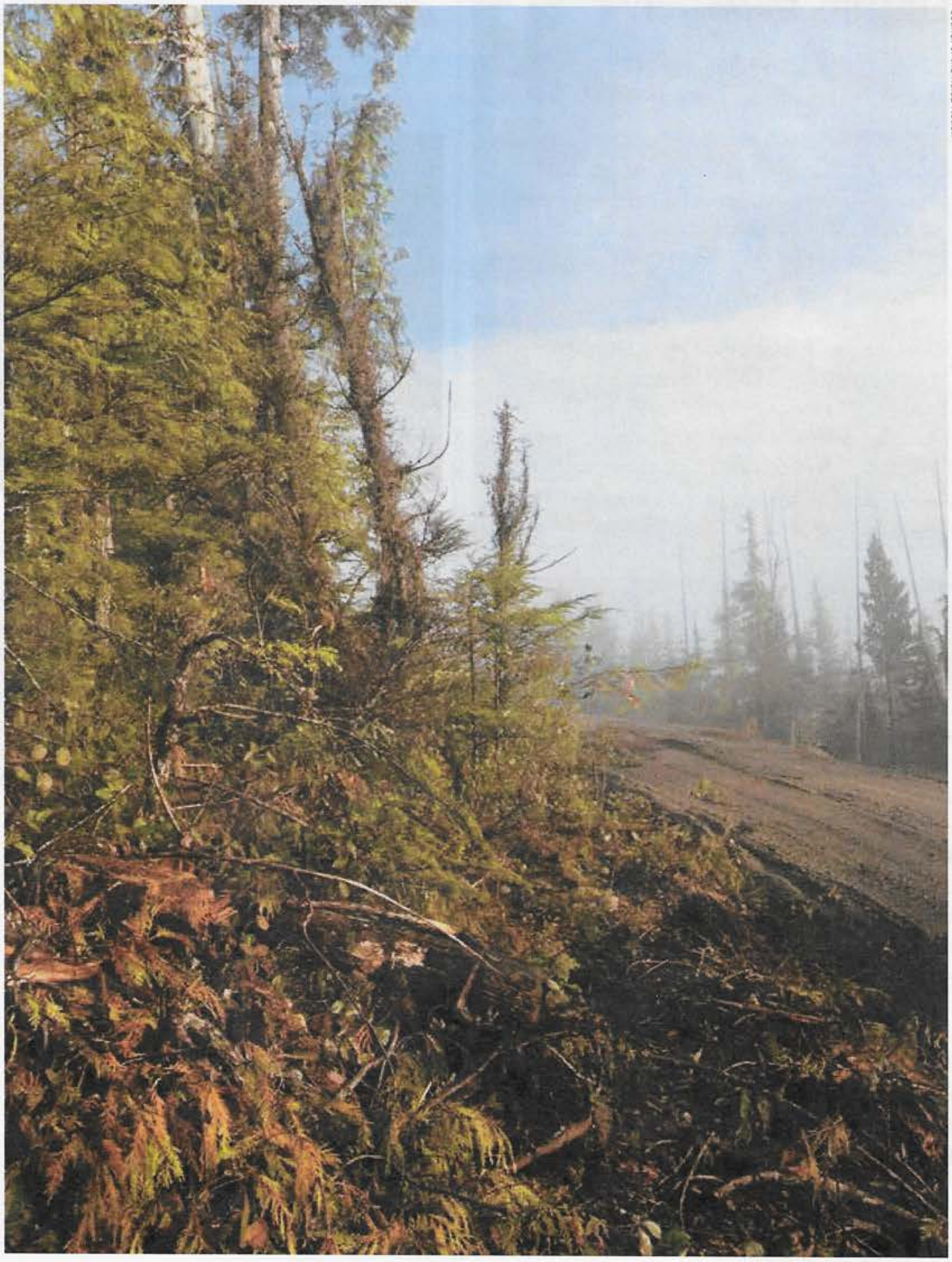
W. P. Armstrong 2003

hlgiid

The objective to protect hlgiid or Western yew, was written into the Haida Gwaii Strategic Land Use Agreement in 2007.

In 2010 the Haida Gwaii Land Use Objectives Order protected 100% of yew patches in stand level retention (SLR), and individual yew trees in SLR where practicable.

Monitoring is a major part of adaptive management, which is an important principle of EBM. The CHN and HGNRD are part of an ongoing initiative in effectiveness monitoring that examines EBM strategies on Haida Gwaii.



Council of the Haida Nation

INTRODUCTION

In the fall of 2014, the Heritage and Natural Resource Department, with assistance from the Haida Gwaii Natural Resource District, initiated implementation and effectiveness monitoring for yew trees.

The key research questions that were asked as part of this project were:

- Are licensees following FSP/HGLUOO strategies and objectives in relation to yew management?
- Are there patterns associated with the interpretation of practicability when managing individual yew trees?
- Are the strategies employed effective at maintaining the integrity of yew trees?

Effectiveness and Implementation Monitoring

Monitoring the results of forest management strategies has been considered an important element to Ecosystem Based Management (EBM) (Cardinall, 2004).

The concept of tracking results and having those results inform policy changes was written into the Haida Gwaii Strategic Land Use Agreement as a tenet of EBM (CHN & BC, 2007). Similarly monitoring is a major part of the provincial governments plan for overseeing the *Forest and Range Practices Act.*

To help achieve this, the Forest and Range Evaluation Program (FREP) was established in 2005 to provide a measure of quality assurance and continuous improvement to industry strategies and Provincial policy development.

Given the commitment to monitoring by both the Council of the Haida Nation and the Province of BC (HGMC, 2011), both governments began the task of developing a monitoring framework that could be applied to multiple objectives, is complimentary to FREP, and can transparently inform licensees and governments alike.

Haida Gwaii has the unique distinction through the Kunst'aa Guu – Kunst'Aayah Reconciliation Protocol of having statutory authority over amendments to the Haida Gwaii Land Use Objectives Order through the Haida Gwaii Management Council (HGMC). The council is made up of two Haida and two Provincial representatives and a neutral chair. The HGMC provides a link between policy change and development, that in turn, facilitates the exchange of information between knowledge holders, resource specialists and decision makers.

Implementation monitoring is written into the management plan to ask and answer the question: "Did we do what we said we would?", in regard to Forest Stewardship Plan strategies and the Land Use Objectives Order.

Effectiveness monitoring evaluates whether the strategy meets the intended goal or objective (Bunnell & Dunsworth).

Silvics of Western yew

Western or Pacific yew is a small tree that grows to 15 metres in height with diametres up to 50 cm on Haida Gwaii. This is relatively small when compared to 142 cm dbh, which is the largest on record in western North America (Bolsinger & A, 1990).

This small tree is unique in many ways. It is mostly dioecious, having both male and female reproductive organs on separate individuals. Although rare, one individual can change reproductive sexes in a lifetime (DiFazio, Vance, & Wilson, 1996). The tree has the capacity for vegetative propagation (Mitchell, 1997), or epicormic/adventitious rooting, whereby if a branch touches the ground it can re-root and become a separate, albeit genetically identical tree.

Trees have also been known to re-sprout or coppice after being cut down , with increases in sprouting correlating with increases in stump height and bark retention (Minore & Weatheryl, 1996). Of less significance to Haida Gwaii, but testimony to the trees resilience, sprouts have been observed sprouting from a base of burned stumps (Hartzell & Rust, 1983).

The chemical compound called paclitaxel ($C_{47}H_{51}NO_{14}$), also known as taxol, was discovered in Pacific yew in 1967 and chemically synthesized in the early 1990's (Wall & Wani, 1995). The drug was found

to be an effective medication to treat various forms of cancer.

The tree is known to be the slowest growing tree species on the Pacific coast (Bolsinger & A, 1990), a characteristic somewhat expected of a tree considered the most shade tolerant in BC (Klinka, Worral, Skoda, & Varga, 2000). Possibly as a result of its slow growth, it is the heaviest wood of all conifers in the U.S (Bolsinger & A, 1990).

Provincially, Pacific yew occurs across seven major biogeoclimatic zones, with decreasing occurrences of the tree when there are increases in latitude and elevation (Klinkenberg, 2014). It grows in a range of slope gradients (up to 150%) and all aspects.

On Haida Gwaii it grows in the submontane regions on sites with fresh to moist moisture regimes and medium soil nutrient regimes. They typically grow in CwHw Salal-Deer fern and HwSs Lanky moss ecological communities (mesic sites), but are occasionally found in dryer sites of CwHw Salal-Oregon beaked moss (sites described in Banner et. al (2014)).

While regionally they are quite rare, they can be locally abundant. Of 217 forestry development areas on Haida Gwaii observed between December 2011 and Auguest 2014, only 26% of them had yew trees (Richardson, Muise, & Reynolds, 2014).

On average, in blocks with yew, there were 37 trees per development area (which are on average approximately 50 hectares in size). The average elevation of yew in this dataset of 217 development areas is 108 m, however the frequency of occurrences spike between 70 – 110 m even though the elevation distribution of all the development areas during the same period cover a much broader range. (See Figure 1) While there have been development areas with as many as 70 stems per hectare[1], or over 700 trees in the development, fewer than five per cent of development areas contain more than 100 yew trees (ibid.)

Yew trees are often covered with mosses and hepatics, notably more than other conifers in any given stand. The significant epiphytic growth could be associated with their persistence in the understory and morphologies that support light interception (King, 1991). A study in the Cascade Range (Peck, 1997) found that yew had nearly the highest mean surface

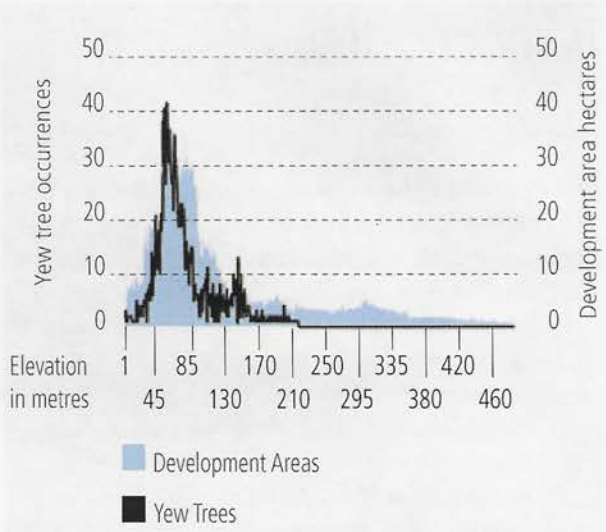


Figure 1. Histogram of the frequency of occurrence in elevation for yew relative to elevation of blocks. Data collected across 217 blocks (2011-2014).

area of epiphytic growth and epiphyte mat mass, second only to Big leaf maple (Acer macrophyllum).

The Haida recognize the yew tree as important for supporting biodiversity and serving a crucial role as an indicator for a healthy and diverse old ecosystem[2]. As has been confirmed through four years of Cultural Feature Identification surveys, no yew trees have been found in second growth blocks. This corresponds directly with the Haida concern that, unless they are actively managed for, yew will be greatly reduced in numbers as the last old forests outside of protected areas are harvested.

[1] 741 yew stems in 10.6 ha development of COL771

[2] Guujaaw, personal communication

Yew wood use

Yew wood density, strength and rot resistance translate into a very high cultural value for tools, as well as food and medicine. The Haida have used the wood for tools such as bows, spoons, masks and fishing hooks. The fleshy seed covering was also eaten, though only in small quantities (Turner, 2010). For a comprehensive description of Haida use see Turner 2010.

Yew wood management on Haida Gwaii

The protection of yew is a distinct objective within the HGLUOO (2010). Patches (five or more yew within five metres of one another) are to be included in SLR, except to accommodate road or bridges where no practicable alternative exists (CHN & BC, 2010). For yew trees that do not meet the definition of a patch, the individual trees are to be included in SLR where practicable.

Prior to the HGLUO the Haida Gwaii Natural Resource District (HGNRD) had adopted a Standard Operating Procedure policy in 2001 for yew wood. The policy outlined best management strategies, including engineering out yew areas into Wildlife Tree Patches, leaving them standing where safe to do so, leaving stumps >30 cm high if cut, or bringing harvested trees to the roadside for local use.

Generally, the policy was set out to "ensure that yew is managed in a sustainable manner and that yew wood is made available to interested parties".

The HGNRD and CHN are in the process of developing a new set of 'Best Management Practices' that will take into account the results of this study.

STUDY METHODS

All blocks are post-HGLUOO and were randomly chosen from the Cultural Features Identification database. All 'observations' within the blocks were randomly chosen prior to field work. A total of 17 blocks[3] were sampled, with a replacement block in the event that a block was not harvested, or inaccessible (terrain, weather etc.). Where the numbers supported it, a minimum of five observations (yew features) were completed per block. The licensee block distribution was BCTS (four blocks), Husby (five blocks) and Taan (eight blocks).

[3]ABFAM300; ALN003; AWN05; AWN06; BER01; BER03; COL726; COL753; COL755;COL756; COL759; COW002; DEL005; FEATH01; FLO002; FLO003; MartinROW

Field methodology

Information gathered as part of the monitoring was based upon a stand level evaluation as well as a feature level evaluation. Information for point features, like a tree or small group of trees, were based on variable radii around the feature.

Features in SLR were identified using the definition from the 2010 LUO: "small intact patches of trees and understory vegetation that are located in a development area to assist in meeting the land use objectives in this Order". These retention areas were synonymous with the variable radius around a feature used in the study. The one tree length variable radius, considered the 'management area' for the purpose of this study, was to represent a zone of influence from edge effects (ex. an area impacted from tree fall from harvesting or windthrow).

For each random observation within the block, the data gathered contained information about the site, including stand level descriptions, and other information specific to the feature itself (tree vigour, damage types etc.).

Each observation was cross-referenced spatially, and numerically identified within Cultural Feature Identification reports. Note that the survey crew calibrated tree vigour classification with the known tendencies for survival (re: vegetative layering and physiological resilience).

Generally, the information collected describe the management area or what the feature contributed to the final ranking of how harvesting affected the management area and feature's integrity. Appendix 1 contains the descriptive references to the standards and data attributes that were collected for each observation.

A patch and individual stems were both considered an observation. For example there would be one description of a management zone for one patch. However the numbers of trees in patches were tallied and used in some statistical summaries.

'Operational limitation' was evaluated in the field based upon the following criteria:

- A road was considered an operational limitation
- Directional falling of the surrounding stems (suggestive of safety)
- The proximity of the yew feature to a merchantable stem (safety)
- Hoe-chuck trails where the terrain was steep (considered for safety)
- Yarding from behind a feature in steeper terrain or when limited by block layout (access to isolated in-block timber)
- other legal requirements for retention

When an operational limitation could not be determined, 'unknown' was recorded.

RESULTS

A total of 115 observations were recorded over 17 sampled development areas. (figure 2) There were a total of 213 trees evaluated during the study when patches were evaluated as a single observation and individual trees were included with with other trees in stand level retention, single stem retention or dead trees,.

Nearly half of the management areas (47%) of all the observations were either moderately to highly impacted by logging. The term highly impacted applied to areas where the majority (more than 75%) of all the trees around the feature were cut or down. However, impact to the management zone did not translate into impacts on each observation. While 38% of the management zones were highly impacted, only 30% of the observations were highly impacted. Sixty-six per cent of all observations were immediately adjacent or next to some other value managed in forestry.

Other values included riparian management areas (RMA)[4], monumental cedar, Haida Traditional Forest Features (HTFF) or other yew trees. HTFF's had the greatest co-location with 22% (SE± 0.085) of observations sharing a management area with Pacific crabapple (Malus fusca) and Indian hellebore (Veratrum viride). RMA's had a co-location frequency of 20% (SE± 0.068) of observations within riparian areas. Monumental cedar had the lowest level of co-location, where management areas only overlapped in 4% (SE± 0.025) of observations.

The majority of all observations (68%, SE± 0.084) were in some form of stand level retention. Eight per cent (SE± 0.084) of all observations were single/ individual stems outside of any retention, and the remainder were dead trees (24%, SE± 0.074).

When counting individual trees within patches the total number of trees (n=213) changes the proportional distribution of these three management types (stand

Figure 2. Map of sample locations.

[4] RMA's measured as default requiremets for fish bearing streams under the HG LUO and default RMA within the Forest Planning and Practices Regulation for non-ffish bearing streams.

level retention, single tree, dead tree). In this case the total number of trees in stand level retention would increase to 73.8% (SE± 0.082), the total number of single stems would be 5.6% (SE± 0.022), and the total number of dead trees would be 20.6% (SE± 0.073). (figure 3)

Of all the observations that were living, 87% have good to excellent vigour. Of those trees that were dead, the majority were cut down or impacted by machine. (Uprooted/pushed down – See Fgure 4)

Of the trees that were dead (n=38), on average 52% (SE± 0.13) of them had some form of operational limitations. Operational limitations also affected living trees, where on average 36% of the observations were somehow constrained. However part of this may correspond with other legal requirements for retention (ex. RMAs of HTFF's). Of the observations that were simply outside of stand level retention, 41% (SE± 0.10) of them had some form of operational limitation (photo 1).

While data on the harvest method was collected, all of the samples were ground-based – hoe-chucked and hand fallen – except for four samples in which feller-bunchers were used. There were no observed management implication trends based on the different harvest methods.

Observations in Stand Level Retention

In this section observations in stand level retention include those classified as legal 'patches' as well as individual stems unless otherwise specified. (photo 2)

All of the trees within legally defined patches were in stand level retention. Patches however only constituted 18% (SE± 0.082) of all observations. Conversely, when counting the total number of trees within the study (n=213) across 17 samples, on average 30% (SE± 0.097) of them appear in patches. Counting only patches, 93% of the features had either low or no impact from logging.

On average 79% of the management area around SLR observations were retained, with an average of 45% crown closure, an average distance to the opening edge of 20 metres, and an average fetch of 0 – 2 tree lengths (See photo 2). Within all SLR areas 83% of the observations had feature integrity of either low to no

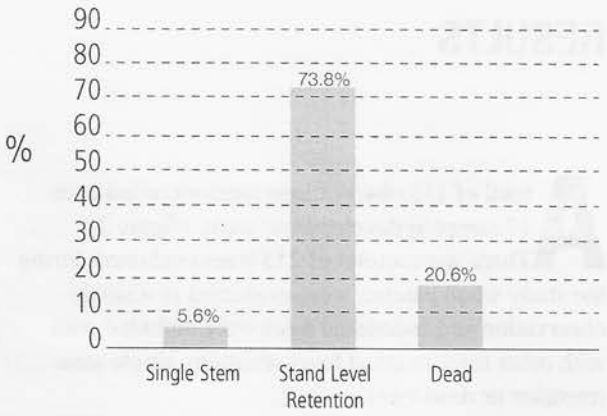


Figure 3. Proportion of trees in relation to management strategies.

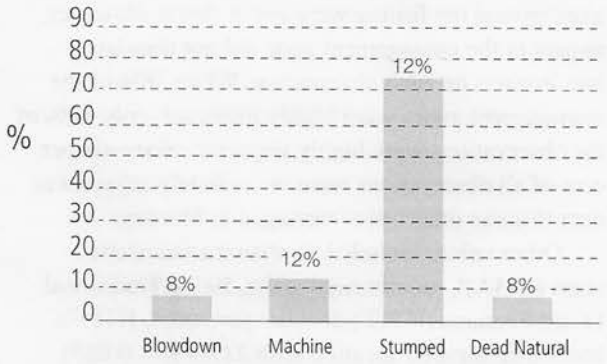


Figure 4. Causes of dead trees within the study area.

Photo 1. Example of a yew tree (foreground) stumped due to safety in COL755.

impact from logging, and 14% had high impact from logging. (figure 5).

Those stems with moderate to high impact in SLR tended to be close to the edge of the opening (avg.2.5m), with low canopy closure (15%) and open to a relatively large fetch from predominate winds (average 2 – 5 tree lengths).

Observations of Single Individual Stems

Eight percent of all observations were single stems (six per cent of trees in the study). Fifty per cent of these observations had moderate to high impact from logging, and 50% had low to no impact from logging. (photo 3)

Individual stems, standing and healthy (vigour fair to excellent), tended to be closer to the harvested edge (avg. 22m from treeline). Conversely, dead trees or trees with poor vigour tended to be farther from the treed edge (avg. 37m).

DISCUSSION

The results show that the legal requirement for keeping yew trees in SLR was followed on average 74% of the time across all blocks in the study.

It confirmed that 100% of stems that were in legally defined patches were retained in SLR, reflecting an adherence to the strict legal requirement. It also showed that trees within patches were on average less impacted from logging.

When assessing all trees in SLR there is evidence that the trees do not need a full radial buffer around them or a particularly high crown closure for them to be relatively healthy. Part of this is likely due to many of the stands being naturally open with low crown closure or trees acclimatized to an opening over the course of its life.

However it is clear that SLR trees that were closer to the edge, with lower crown closure (<20%) and subject to larger fetches in the harvest openings were most prone to being impacted from harvesting. Edge effects included very site-specific sensitivity to aspect and crown closure which in some cases led to significant sun scalding or 'burning'.

This corresponds to findings cited in Bolsinger and Jaramillo (1990) where trees were exposed to heat, frost and wind after logging. (see photo 3).

Photo 2. Typical Stand Level Retention (SLR) in FEA003

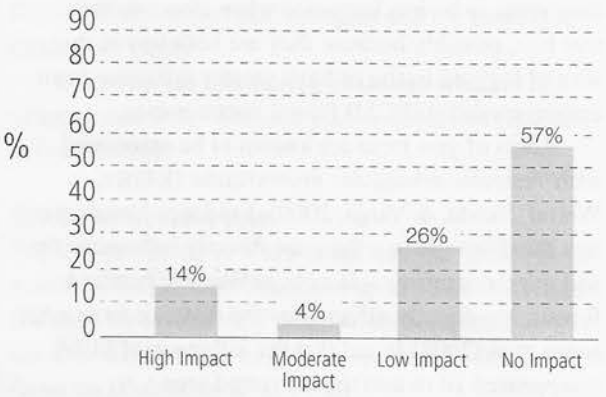


Figure 5. Logging impacts to trees in Stand Level Retention.

Photo 3. A typical single stem, AWN06

Yew trees being healthier in SLR are included in a Haida knowledge-base which knows that trees directly around a yew tree make up its home and this zone of influence directly affects the health of the yew tree .

The six per cent of trees that were not in SLR, but were left alive and standing, presumably had some operational limitation that restricted the ability to retain other trees and vegetation around them. While this is no doubt better than cutting the tree down, the results suggest that individual stems in the open, have a 50/50 chance of highly impacting the tree, (ie. leaving little chance of recovery), however the sample size particular to single stems could be improved.

When these individual trees were left standing they seem to be less impacted when closer to the tree line, possibly because they are both less in the way of logging traffic or have greater influence from ectomycorrhizal (ECM) fungal communities.

Roots of yew trees are known to be associated with vesicular-arbuscular mycorrhizae (Klinka, Worral, Skoda, & Varga, 2000). Evidence has shown that the rhizosphere – the zone directly influenced by soil microorganisms – in coastal Western hemlock forests, are directly affected by the distance to an edge. Jones et.al (2008) found that the influence of ECM disappeared 10 m into the harvested area.

Overall the majority of observations were well co-located with other values that were being managed for, which highlights the licensee's interest in optimizing the timber harvesting landscape. It shows that Western yew often shares similar ecological amplitudes as *V.veratrum* and *M.fusca*. The limited overlap with monumental cedar, typically found on slightly wetter than mesic, or on mesic sites, (Reynolds, 2008) likely reflects the fact that there are fewer monumental cedar than there are yew trees.

The legal use of the word 'practicable', which means the ability for something to be carried out in practice, is of particular importance to the overall results, particularly for trees that are not found in patches.

Interpretations of the word practicable within the *Forest and Range Practices Act* (FRPA) have been extensively explored, and include definitions intending to balance social, economic and environmental factors.

The inclusion of "reasonable commercial

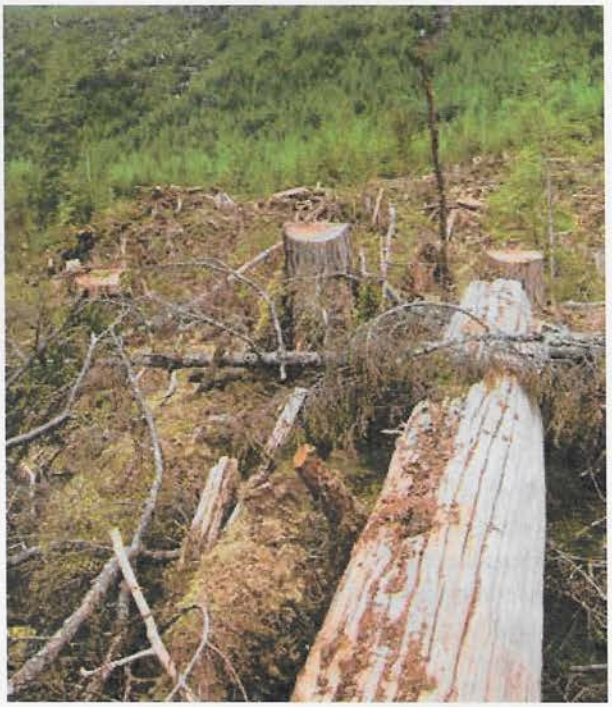


Photo 4. Example of a stumped yew tree due to diretional falling (safety), WN05.

considerations" (BC, 2005) can mean more flexibility than simply considering operator safety or the construction of road or infrastructure.

In this study, 52% of the dead trees were constrained by some kind of operational limitation (as described in the field methodology section). In total, 27% of all the trees were not in SLR (six per cent single stems, 21% dead trees) and only 41% of those had some sort of operational limitation. By this calculation, approximately 16% of all trees were not in SLR and did not have any operational limitation. (photo 4)

There may be several reasons for this relatively high number of features not being protected in SLR:

- A broad interpretation of 'practicability' that includes block profitability as decision criteria for harvesting single stems;
- Mistakes by operators that lead to falling the trees or damaging them with a machine;
- A lack of communication from forest planners to operators about an objective to retain yew trees in SLR.

In reality, it is likely a mix of all three of these factors. A brief review of harvest instruction maps for 12 of the study samples/blocks show that 75% of them had yew trees in the harvest opening (see table 1). But only one block had the yew trees identified on the map and had harvest instructions to the fallers to leave the trees where possible (with no mention of stand level retention). Otherwise six out of the nine maps that had yew trees in the harvest openings had the yew trees on the map.

Block Name	Yew on map	Yew in opening	Harvest Instructions
AWN05	No	Yes	No
AWN06	No	Yes	No
BER01	No	Yes	No
COL726	Yes	Yes	Yes
COL753	Yes	Yes	No
COL755	Yes	No	No
COL756	Yes	No	No
COL759	Yes	Yes	No
COW01	Yes	No	No
FEA001	Yes	Yes	No
FLO002	Yes	Yes	No
FLO003	Yes	Yes	No

Table 1. Results from a review of harvest instruction maps

CONCLUSION

The HGLUO objective of maintaining legally defined patches of yew trees in SLR is being followed, however the legal definition of a patch only applies to 30% of trees. The natural sporadic distribution of stems means that overall, trees are being maintained in SLR 74% of the time, with approximately six per cent of trees being left without retention in the openings and approximately 21% of trees dying, mostly as a result of being cut down.

Overall approximately 16% of all trees are not in SLR and do not have any operational limitation, which speaks to either operator error, poor communication and/or an intention to harvest individual stems to balance an opportunity cost for block profitability.

Trees in SLR did not need a full radial buffer around them in order to maintain the integrity of the tree, but were still, on average, 20m away from a harvest edge. (photo 5) Trees closer to the edge of SLR were most susceptible to harvesting impacts. Sixty-six per cent of occurrences (all in SLR) had some level of co-location with other managed values. Trees in the open fared better when closer to the treeline edge, but overall single stems were highly impacted 50% of the time.

Photo 5. Stand Level Retention for a patch at Collison Point.

APPENDIX 1: Data attributes for effectiveness monitoring point features (yew)

Development area	The name of the block
Date	
Surveyors	
Harvest method type 1	Ground Base-Hand Fallen (GB:HF); Ground Based- Feller Buncher (GB:FB);Rubber Tire Skidder (RTS); Hoe Chuck (HC); Cable based; Aerial yarded
Harvest method type 2	(ex. site is hand fallan and hoe chucked)
Aspect	Degrees
Slope	Percent
Retention type	Stand Level Retention (SL); Individual stem (IS); n/a
Retention sub-type	Treed edge (TE); Aggregate retention (AR). Applies only to trees in Stand Level Retention, to differentiate between features within an opening (AR) or on the block edge (TE)
Distance to opening	In meters (for features in retention- measured from the feature to the opening)
Distance to treed edge	In meters (for features not in retention/ in the open- measured from the feature to the treed edge)
Penetration distance	In meters (for features in retention, measured winthrow penetration into the edge)
Stems standing	Number of trees >17.5cm DBH standing within the management area. (~1 in situ tree length).
(see edge to reserve ratio)	Used to calculate what proportion of the management area is intact.
Stems down	Number of trees >17.5cm DBH down within the management area. (~1 in situ tree length). Used
(see edge to reserve ratio)	to calculate what proportion of the management area is intact.
Edge to reserve ratio	An alternative to stems standing (used to calculate what proportion of the management area is intact.) The angle (degrees) from the feature to the edge of the opening within the management area, divided by 360.Gives a ratio of forest edge to opening (see image on page 10).
Boundary orientation	Windward, windward diagonal, Lee, Lee diagonal, Parallel (see image on page 10)
Wind Exposure Index	From 1- 9 (Rollerson, Beese, & Peters, 2002) see image on page 11
Canopy Structure	Single storied; two-storied; multistoried; open (Province of BC, 2010)
Fetch	>2 tree lengths; 2-5 tree lengths; <5 tree lengths (Zielke, Bancroft, Byrne, & Mitchell, 2010)
Value Adjacency	Yes; No (includes Yew; Riparian Management Area; Haida Traditional Forest Features; CMTs; Monumental; Bear Den; Other)
Value Adjacency comment	Relevant comment about adjacent values.
Has the integrity of the management area been impacted	No impact; Low impact; Moderate impact; High Impact
Management area disturbance type	Wind; forest harvest; biotic; soil/terrain; water
Management area disturbance sub-type	Blown down; machine impact; stumped; cut-pruned
Operational limitations	Yes; No; Unknown (includes falling direction; safety; sensitive soil for machinery; road or hoe trail; deflection line; forest pest control; other FRPA/LUO values.)
CULTURAL FEATURE ID NUMBER	
Patch	Yes; No (Legal LUO definition)
Patch size number	Number of trees within the patch
Patch size area	Approximate square meters (m x m)
Patch standing	Proportion of Yew trees within the patch standing
Foliage cover avg	Average foliage cover, assuming vertical projecting of the crowns to the ground over a 400m2 (20m x 20m) area (Province of BC, 2010)
Health (vigour)	0 (species dead); 1 (vigour poor); 2 (vigour fair); 3 (Vigour good); 4 (vigour excellent). (Luttmerding, Demarchi, Lea, Meidinger, & Vold, 1990) This should account for size; apparent rate of growth; size of leaves; chlorotic; necrotic; stem damage; root damage; path presence.
Feature impact	No impact; Low impact; Moderate impact; High impact
Feature Disturbance type	Wind; forest harvest; biotic; soil/terrain; water
Feature Disturbance sub-type	Blown down; machine impact; stumped; cut-pruned; sun scald

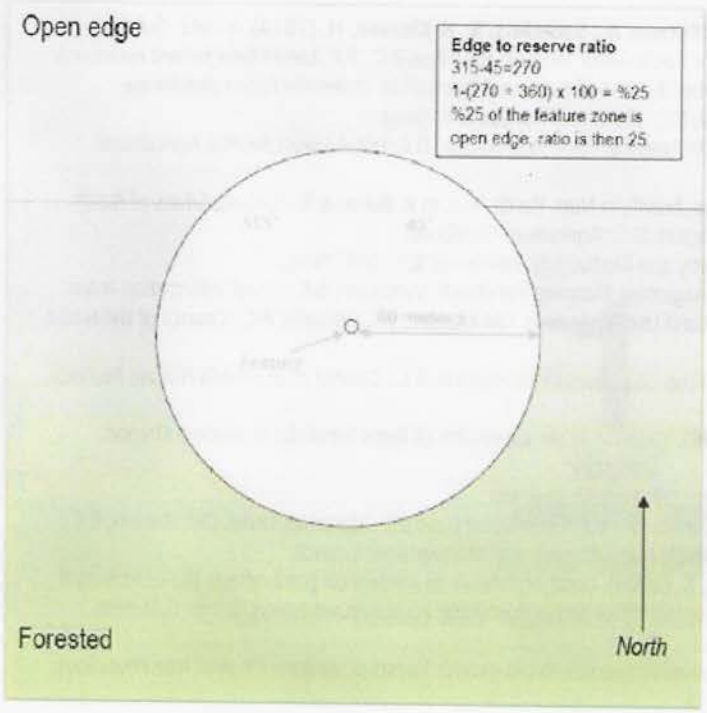
Wind exposure index diagram

	Boundary exposure 2	Lee	Lee diagonal	Parallel	Windward diagonal	Windward
		1	2	3	4	5
Boundary exposure 1						
Lee	1		**3**	**4**	**5**	**6**
Lee diagonal	2	**3**	**4**	**5**	**6**	**7**
Parallel	3	**4**	**5**	**6**	**7**	**8**
Windward diagonal	4	**5**	**6**	**7**	**8**	**9**
Windward	5	**6**	**7**	**8**	**9**	

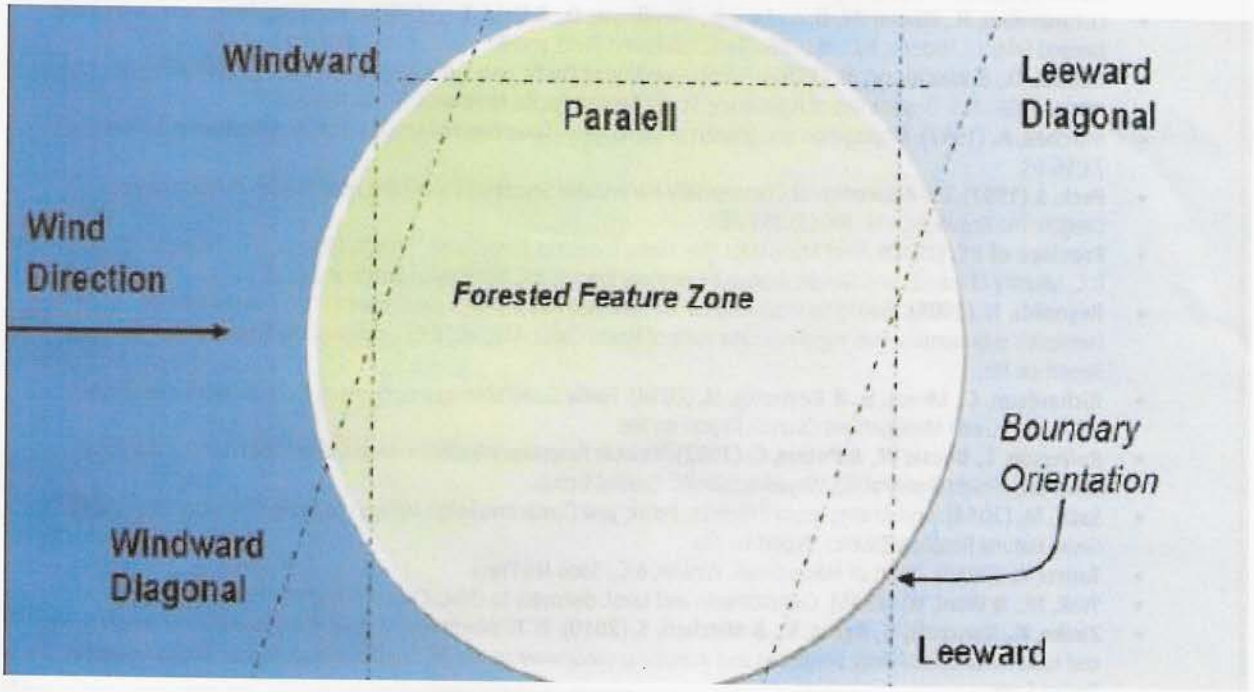
Note: Wind Exposure Index = (Boundary exposure 1 rank) + (Boundary exposure 2 rank)

Wind Exposure Index (sum of ranks)	Wind Exposure Class	Wind Exposure Class number
0	Very low	1
1-2	Low	2
3-4	Moderate	3
5-6	High	4
7-10	Very high	5

Edge to reserve ration diagram



Boundary orientation diagram



REFERENCES

- **Banner, A., MacKenzie, W., Pojar, J., MacKinnon, A., Saunders, S., & Klassen, H. (2014)**. A Field Guide to Ecosystem Classification and Identification for Haida Gwaii. Victoria, B.C.: Prov.B.C., B.C. Land Management Handbook 68 BC, P. (2005). FRPA General Bulletin Number 3 – Use of the Term "Practicable' Under the Forest and Range Practices Act (FRPA) and Regulations. Victoria, B.C.: Ministry of Forests and Range.
- **Bolsinger, C., & A, J. (1990)**. Silvics of North America, Vol.1. Washington, D.C: USDA Forest Service, Agricultural Handbook 654.
- **Bolsinger, C., & Jaramillo, A. (1990)**. Taxus brevifolia Nutt. Pacific Yew. In R. Burns, & B. Honkala, Silvics of North America. Volume 1. Conifers (p. 654). Washington, D.C.: Agriculture Handbook.
- **Bunnell, F., & Dunsworth, G. (n.d.)**. Forestry and Biodiversity. Vancouver, B.C.: UBC Press.
- **Cardinall, D. (2004)**. Ecosystem-Based Management Planning Handbook. Vancouver, B.C.: Coast Information Team.
- **CHN, & BC. (2007)**. Haida Gwaii Strategic Land Use Agreement. Old Massett, B.C.; Victoria, B.C.: Council of the Haida Nation; Province of B.C.
- **CHN, & BC, P. o. (2010)**. Haida Gwaii Land Use Objectives Order. Victoria, B.C.: Counicl of the Haida Nation; Province of BC.
- **DiFazio, S., Vance, N., & Wilson, M. (1996)**. Variation in sex expression of Taxus brevifolia in western Oregon. Canadian Journal of Botany, 74: 1943-1946.
- **Hartzell, H., & Rust, J. (1983)**. Yew. Eugene, OR: Hartzell and Rust.
- **HGMC. (2011)**. Background and Intent Document for the Haida Gwaii Land Use Objectives Order. Old Massett, B.C.: HG Strategic Land Use Agreement Joint Technical Team. Haida Gwaii Management Council.
- **Jones, M., Twieg, B., Durall, D., & Berch, S. (2008)**. Location relative to a retention patch affects the ECM fungal community more than patch size in the first season after timber harvesting on Vancouver Island, British Columbia. Forest Ecology and Management, 1342-1352.
- **King, D. (1991)**. Tree allometry, leaf size and adult tree size in old-growth forests of western Oregon. Tree Physiology, 9:369-381.
- **Klinka, K., Worral, J., Skoda, L., & Varga, P. (2000)**. The distriThe distribution and synopsis of ecological and silvical characteristics of tree species of British Columbia's forests. Canadian Cartographics Ltd., 180 p.
- **Klinkenberg, B. (2014)**. E-FLora of BC: Electronic Altas of the Plants of British Columbia. . Vancouver, B.C. : Lab for Advanced Spatial Analysis, Department of Georgraphy, University of British Columbia.
- **Luttmerding, H., Demarchi, D. A., Lea, E., Meidinger, D., & Vold, T. (. (1990)**. Describing Ecosystems in the Field (second Edition). Victoria, B.C.: B.C. Min. Env., Lands and Parks and B.C. Min. of For., MOE Manual 11.
- **Minore, D., & Weatheryl, H. (1996)**. Stump sprouting of Pacific yew. General technical report, PNW-GTR-378. Portland, OR.: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.
- **Mitchell, A. (1997)**. Propagation and growth of Pacific yew (Taxus brevifolia Nutt.) cuttings. . Northwest Science, 71:56-63.
- **Peck, J. (1997)**. The Association of Commercially Harvestable Bryophytes and Their Host Species in Northwestern Oregon. The Bryologist, Vol. 100 (3):383-393.
- **Province of BC. (2010)**. Field Manual for Describing Terrestrial Ecosystems- 2nd ed. Victoria, B.C.: Research Branch, B.C. Ministry of Forests and Range; Resource Inventory Branch, B.C. Ministry of Environment.
- **Reynolds, N. (2008)**. Ecological modelling for Western Red Cedar (Thuja plicata) within the Coastal Western Hemlock's sub-montane wet hypermaritime zone of Haida Gwaii. Massett, B.C: Council of the Haida Nation. Report on file.
- **Richardson, C., Muise, S., & Reynolds, N. (2014)**. Haida Gwaii Management Council Decision Note. Old Massett, B.C.: Haida Gwaii Management Council. Report on file.
- **Rollerson, T., Beese, W., & Peters, C. (2002)**. Variable Retention Windthrow monitoring Pilot Project 2001-2002. Vancouver: Forest Renewal BC, Weyerhaeuser BC Coastal Group.
- **Salzl, M. (2014)**. Best Management Practices: Pacific yew (Taxus brevifolia). Village of Queen Charlotte, B.C. : Haida Gwaii Natural Resource District. Report on file.
- **Turner, N. (2010)**. Plants of Haida Gwaii. Winlaw, B.C.: Sono Nis Press.
- **Wall, M., & Wani, W. (1995)**. Camptothecin and taxol: discovery to clinic. Cancer Research, 55 (4): 753-60.
- **Zielke, K., Bancroft, B., Byrne, K., & Mitchell, S. (2010)**. BCTS Windthrow Manual: A compendium of information and tools for understanding, predicting and managing windthrow on the BC Coast. Chilliwack, B.C.: British Columbia Timber Sales.