WOODLOT LICENCE # W1677

WOODLOT LICENCE PLAN #1

Term
2005 to 2015

Headquarters Creek Woodlot Ltd.
Harold Macy and Judy Racher
6380 Headquarters Rd
Courtenay, BC, V9J 1M9

E-mail: **hqcreek@axion.net**
Phone: **(250) 337-5332**

Authorized Licensee Signature: **Harold Macy**

[Signature]

[Date]

DISCLAIMER

- Recognizing the special nature of management on a woodlot licence, this disclaimer forms part of the Woodlot Licence Plan (WLP) for Woodlot Licence Number W1677 and advises that:
- the decision to operate under one or more of the Default Performance Requirements (DPR) provided in the Woodlot Licence Planning and Practices Regulation (WLPPR) is the sole responsibility of the woodlot licence holder, and involved no detailed oversight or advice from the prescribing registered professional forester. This disclaimer is signed on the explicit understanding and information provided by government that, the use and achievement of a Default Performance Requirement, meets the expectations of government with respect to the management of woodlot licences;
- the undersigned Registered Professional Forester has been retained to provide advice on the practice of professional forestry with regard to items such as alternative performance requirements, applicable results and strategies and other required measures that do not have a default performance requirement provided in the WLPPR.

Signed _____

Name (Print) _____

RPF # _____ Contact phone number _____

Email _____ Seal: Document and Map

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I. MANDATORY CONTENT FOR A WOODLOT LICENCE PLAN (WLP)

PLAN AREA

☒ This plan covers the entire area of the Woodlot Licence.

The Crown portion of the woodlot consists of 385.0* ha located north of the Mount Washington highway turn-off at Dove Creek Road. The woodlot is bisected by BC Hydro's high-voltage powerlines, Farnham Road, the Inland Island Highway and a local road / trail known as the 'Firetrail.' Additionally, a principal channel and tributary to Headquarters Creek runs parallel to the 'right of ways' and flows north from a wetland complex in the southern portion of the woodlot.

Two lots are identified in the private land contribution of 1.21 ha. The lots are located approximately 3 km to the east of the Crown portion on Headquarters road. Property details are as follows:

Lot 1, District Lot 200, Comox District Plan 30731, and

Lot 2, District Lot 200, Comox District Plan 30731

The private portion consists of advanced immature stands of Douglas-fir and mixed alder/cottonwood. A map is provided in Appendix 2.

MAP AND INFORMATION

Forest practices on the woodlot are intended to intensively manage the licence area for its timber, water, and ecological and recreational values on a sustainable basis and to increase the quality of such values. Present harvesting activities generally use partial cut systems via single-stem selection (thinning) and small patch openings to treat root disease pockets or damaged stands. The Headquarters Creek Woodlot Licence integrates education, extension and research into management activities. The licensees host tours and classes from elementary schools, home school groups, and adult education classes. For the alternate Sandwick School in School District 71 the woodlot provides opportunities for work experiences and forestry education. Other activities underway include operational research examining the growth of broadleaf maple at various densities. Other interests of the licensee are non-timber forest crops such as medicinal and edible plants.

* A new Exhibit 'A' was issued during the development of this plan that reflects that actual location of the New Island Highway.

The development of this WLP is intended to identify areas in which harvesting activities will be avoided or modified to:

- protect resource features;
- address the interests of private property owners;
- manage resource values including the specific retention in riparian zones;
- address areas with other special interest or sensitive areas.

The areas noted above are located, identified and discussed within the following text and attached woodlot licence plan maps. All remaining areas will be managed to meet the goals and objectives of the licensee while providing for and enhancing resource values and facilitating community activities, education and recreation.

In the opinion of the authors, this WLP is consistent with the Ministry of Forests objectives as per "Objectives Matrix" (http://www.for.gov.bc.ca/dcr/Stewardship.htm). The existing management plan for W1677 identifies three additional objectives emphasised by the Ministry of Forests not covered within the present objective matrix. The licensees choose to maintain their management direction in establishing a demonstration forest in concept and implementation; to explore alternate harvesting systems, and to manage within the context of local conditions.

There are no legally established higher level plan covering the licence area. The Vancouver Island Commission on Resources and Environment (CORE) planning process placed no designation on the isolated Crown parcel on which the woodlot is established. A 'General Forestry Zone' designation has been adopted for this planning process.

The woodlot is within the Coastal Western Hemlock Very Dry Maritime Variant (CWHxm1) biogeoclimatic zone where the average rainfall can range from 1100 to 2721 mm/year. Much of the woodlot's forests were burnt in the southern extent of the1938 Sayward fire resulting in continuous areas of even aged Douglas-fir or fir with minor hemlock and cedar components. The terrain of the woodlot is subdued with slopes often below 10% except for those slopes in the western portion of the woodlot. A large wetland complex occupies the middle of the woodlot and is dominated by broadleaf species.

The Ministry of Forests recreation inventory information pertaining to the WLP area is summarized in the following table and the polygons numbers are shown on the WLP map.

Table 1: Recreational Resource Inventory for W1677.

Mapsheet / Polygon	Prominent Feature	Significance *	Mgmt. Class**	Impact Management
92F 075 / 13030	Large Gravel Pit - man made feature	D	2	Licensee has completed rehabilitation work – decompaction, planting, spacing.
92F 075 / 13031	Unmanaged trails, small surface waters, wetland vegetation, hiking, camping, picnicking, potential mountain biking.	C	1	Impact on trails is minimal due to nature of past and planned operations. Residual trees mitigate visual impacts.
92F 075 / 13032	Hydro right-of-way	D	2	Presently under Christmas Tree licence.
92F 075 / 13033	Transitional and coniferous vegetation. Unmanaged trails	D	2	Impact on trails is minimal due to nature of past and planned operations. Residual trees mitigate visual impacts.
92F 075/ 13034	Large swamp	D	1	No operations are planned.
92F 075 / 13005	Coniferous forest. Isolated crown portion	D	2	None planned.

* A = Very High capability to attract recreational, educational or scientific use, provincial significance
B = High capability to attract recreational use, regional significance
C = Moderate ability to attract recreational use, local significance (i.e. feature common in region)
D = Low ability to attract recreational use, features common locally and throughout region

** 1 = Area requires special management considerations to protect or maintain the recreational values
2 = Normal forest management practices are adequate to maintain recreational values.

Present recreational activities in the area include mainly horse back riding, motorized recreation, hunting and the collection of non-timber forest products throughout the woodlot area.

Other than the main public access routes through the woodlot licence area, such as the Vancouver Island Inland Highway and Farnham Road, there is no vehicle access for the public. After construction of access roads, the entries will be gated or blocked to reduce operational safety issues, motorized traffic, garbage dumping and firewood theft. The existing gates or barriers are shown on the WLP map.

The main Vancouver Island hydro transmission lines runs through the Crown portion of the woodlot licence area, preventing the option of growing trees for timber production in this corridor. The Christmas tree farm licence under the power line has been issued to a third party. Other than using the power line corridor for access to the woodlot licence portions, there will be no activities.

The following resources are **not known to exist** on the woodlot license area:

- Wildlife habitat areas,
- Ungulate winter ranges,
- Community watersheds or fisheries sensitive watersheds,
- Community and domestic water supply intakes
- Contiguous areas of sensitive soils,
- Resource features other than wildlife habitat features, archaeological sites, and domestic water supply intakes licensed under the *Water Act*,

All other features and resource values relevant to the management of the woodlot not mentioned specifically in the text of this plan are indicated on the attached maps (See Appendix 1).

AREAS WHERE TIMBER HARVESTING WILL BE AVOIDED

There are no areas in this woodlot licence where timber harvesting will be strictly avoided.

AREAS WHERE TIMBER HARVESTING WILL BE MODIFIED

Areas in this Woodlot Licence where timber harvesting will be modified to protect and manage resource are shown on the map by shading, hatching or lines.

- Riparian reserve zones (RRZs) and wildlife tree patches (WTPs) are not planned for regular harvesting other than those specified by regulation, such as tree removal for the purpose of creating trails or for carrying out a sanitation treatment. These areas include generally zones allocated to streams and wetlands and those areas designated or projected as WTPs. RRZs, including WTPs are denoted in light red shading on the map.

- Riparian Management Zones (RMZs)
  Table 2 below outlines how timber harvesting will be modified based on the stream and wetland classification. Depending of the present stand structure, terrain, windthrow risk and block configuration the retention level will be uniform, grouped or spatially distinct. In general, understory and unmerchantable cedar and other conifers of good form and vigour will be maintained as much as possible to provide cover and bank stability.

Table 2: Modification of harvesting in RMZs by riparian classification.

RIPARIAN CLASS	INTENT OF MANAGEMENT	SPECIES TO RETAIN	RETENTION LEVEL POST HARVEST (stems/ha)
S2 and S3 (Fish bearing S2 =5.0 - 15.0m, S3 =1.5 - 5.0m)	• Maintain the integrity of the RRZ • Assist in maintaining wildlife attributes within the RMA, such as wildlife tree cover, nesting and perching habitat and diversity of vertical forest structure.	**Fd, Cw, Hw, Pw, Dr and Ac**	**25 - 100%**
S4 / FSZ (Fish bearing up to 1.5m)	• Maintain stream bank integrity • Provide shaded cover, LWD and litter		**25 - 100%**
S6 (non-fish =3m)	• Minimize debris transport to lower reaches of stream		**0 - 100%**
W1, W2 & W5 (Wetlands)	• Maintain the integrity of the RRZ • Assist in maintaining wildlife attributes within the RMA, such as wildlife tree cover, nesting and perching habitat and diversity of vertical forest structure.		**25 - 100%**

Fd = Douglas fir, Cw = western red cedar, Hw = western hemlock, Pw = western white pine, Dr = red alder, Ac = cottonwood

PROTECTING AND CONSERVING CULTURAL HERITAGE RESOURCES

The woodlot lies within the traditional territories of six First Nations. A list of these First Nations and their contact information is provided within Part II - Review and Comment. In addition to the information sharing process that is implemented for the approval of this plan, First Nations and other interested parties will be welcome during the term of this plan to review planned developments upon their own initiative. Documentation of all consultation with affected First Nations is included within the supplemental information (Part II) of the plan.

An Archaeological Overview Assessment (AOA) has been completed for the area of the woodlot in 1996. The review noted a low possibility of identifying sites and recommended no further archeological work.

If the licensee or any personnel connected with the Woodlot Licence operation finds evidence of tradition use or cultural heritage values, the Ministry of Forests Aboriginal Liaison Officer will be notified and all work will cease within the immediate (30 m) area. The licensee will cooperate fully, as requested by the Ministry of Forests Aboriginal Liaison Officer.

The following results and strategies (Table 3) for managing cultural heritage values will apply. These are based on known cultural heritage issues of interest to First Nations in the Campbell River Forest District. No specific issues were identified or provided by First Nations during the WLP consultation process.

Table 3: Results and Strategies for Cultural Heritage Resources

Cultural Heritage Value	***Results & Strategies***
Cedar:	***Result:*** • Enable continued access to red cedar for traditional use by local First Nations.
	Strategies: • Based on availability of stock and ecological suitability (e.g. Cw listed as preferred species), a component of Cedar will continue to be planted in the woodlot to ensure a long-term supply. • Naturally occurring young cedar trees (including poles) will be retained where operationally feasible.
Traditionally Used Plants:	***Result:*** • Enable continued access to traditionally used plants for traditional use by local First Nations.
	Strategies: • When local First Nations have indicated specific interest in traditional use plants, the licensee will identify the presence of such plants in planned harvest areas and communicate this to the interested First Nations prior to cutting permit submission. This is to allow for review by the local First Nations and that any collections of traditional use plants can be initiated by the local First Nations prior to harvest. • A no-pesticide use policy is implemented in this Woodlot Licence. Manual brushing and early planting of large stock is the preferred method to overcome brush problems.
Cultural Heritage Resources	***Result:*** • Harvest plans will consider identified cultural heritage resources.
	Strategies: • The Licensee will share information with local First Nations upon request and be available for field reviews.

In addition to First Nations use the Headquarters area has a long history of logging and western settlement. Although there are no features within the woodlot several exist within the vicinity, such as the old dam and flume for the Headquarters village site and the walls of the steam plant for the sawmill.

WILDLIFE TREE RETENTION STRATEGY

Note: The proportion of the Woodlot Licence area that is occupied by wildlife tree retention areas is specified in the "PERFORMANCE REQUIREMENTS" section of this woodlot licence plan. Additionally, the licensee is a certified Wildlife Danger Tree assessor with the Logging/Silviculture and Parks/Recreation modules.

INDIVIDUAL WILDLIFE TREES

a) Species and Characteristics:

Desired species are (in order of preference): Fd, Hw, Dr, Mb with a minimum dbh of 50 cm.
The following table describes the species and characteristics of individual trees that will guide the selection of wildlife tree to be retained from harvesting.

Table 4: Wildlife tree value and characteristics

CHARACTERISTICS	HIGH (at least two of the listed characteristics)	MEDIUM	LOW
	• Internal decay (heartrot or natural/excavated cavities present) • Crevices present (loose bark or cracks suitable for bats) • Large brooms present • Active or recent wildlife use • Current insect infestations • Tree structure suitable for wildlife use (e.g. large nest, hunting perch, bear den, etc.) • Largest tree on site (height and/or diameter) and/or veterans Locally important wildlife tree species	• Large, stable trees that will likely develop two or more of the characteristics listed under HIGH	• Trees not covered by HIGH or MEDIUM categories

From: Wildlife Tree Committee recommendations available at - http://www.for.gov.bc.ca/hfp/wlt/wlt-policy-02.htm

Given the nature of the historic logging and the thrifty second-growth stands present on the woodlot few trees in a given stand may presently have 'high' value attributes. As such, a minimum of 1 (One) tree per hectare will be used as a minimum threshold for retention where the highest value attained is medium. Trees may be left as dispersed individuals or as groups internal to harvest areas.

Additionally, mature cottonwood will be retained when worker safety permits.

b) Conditions under which Individual Wildlife Trees may be Removed:

Specific conditions that influence the decision of where individual wildlife trees may be removed include:

- ☑ worker safety (Danger Tree Assessment);
- ☑ the significance of forest health risk to surrounding stands;
- ☑ the ability to retain other wildlife trees to perform as suitable wildlife habitat; and
- ☑ the availability of wildlife trees and CWD in adjacent areas.

All workers involved with the removal of potential wildlife trees will be informed of developed standards prior to fieldwork to help mitigate unnecessary removals.

c) Replacement of Individual Wildlife Trees:

Individual trees will be replaced if they are of 'high' wildlife values and if there are less than 2 high value wildlife trees within a radius of 200 metres. Replacement trees will be selected using criteria outlined above with a preference for selecting trees that have two or more high wildlife tree value characteristics.

WILDLIFE TREE RETENTION AREAS

a) Forest Cover Attributes:

Wildlife tree patches (WTPs) are planned preferably in fully constrained areas for long-term retention and all riparian reserve zones are included as WTPs. The presently allocated WTPs (all productive forest) for W1677 are shown on the 1:5000 WLP maps and occupy **30.85** ha or **8%** of the woodlot area. Given the shape of the woodlot and the presence of the natural features the distribution and characteristics of the wildlife tree patches follows the FPC biodiversity guidebook recommendations (Sept 1995) and the Ecological Guiding Principles proposed by the Wildlife Tree Committee. The WTPs include some representative larger trees (DBH > average operational cruise) with moderate to high value to wildlife and regenerating stands with future wildlife potential. Presently allocated WTPs and their attributes are shown on the 1:5000 WLP map.

Table 5: Forest cover attributes of existing wildlife tree patches and riparian reserve zones as related to specific areas shown on the WLP map.

Wildlife tree patch ID	Size (ha) % Productive	Forest Cover Attributes	Comments:
W-1	1.46 (0.4%)	72 DH(F) 3305-26	30m RRZ around Headquarters Creek. Steep side slopes. Transitional to dry forest cover to the North. Several large Fd present within reserve. Root rot spot infections.
W-2	3.72 (1.0%)	101 FH(D) 4408-25 102 FD(H) 4305-26 104 SR-/32 91 FCH 4404-28 100 NPBr	Reserve anchored by Wetland 1 (treed swamp). High species and structural diversity. Small area to the West in 20 year old Fd/Ba regeneration.
C-1	7.78 (2.0%)	18 D(MbH) 3308-26 2 NPBr	Larger reserve defined by lower portions of Headquarters Creek. Several beaver dams and broad meandering channel. Noticeable ungulate usage.
C-2	3.96 (1.0%)	18 D(MbH) 3308-26 17 D(HMb) 3307-28 16 SR-/30	Middle portions of Headquarters Creek and side channels. Productive cedar component not captured in forest cover label. Very high CWD remaining. Southern portions of reserve in20 year old Fd Ba regeneration.
C-3	0.76 (0.2%)	118 F(H) 4405-32	Healthy conifer stand adjacent to large wetland, streams and portions of pure alder stands
E-1	0.69 (0.2%)	21 D(MbH) 3308-26	Mixed species stand. Some larger conifers likely to develop high wildlife values with decadent deciduous currently providing feeding and cavity sites. Engineered WTP.
E-2	0.86 (0.2%)	44 F(HC) 1100-33 54 FH (CD) 4506-35 55 D 3308-24 56 FC 3302-22	Reserve anchored by Wetland 2, Creek 27 and W/L boundary. Area includes conifer regen., semi-mature alder and healthy second-growth Douglas-fir.
RRZ	11.62 (3.0%)	Generally mixed woods. Large diameters trees and snags.	Riparian reserve zones established around wetland and/or creeks. Diverse species composition and structure. Presence and location of natural drainage features will dictate exact location of reserve areas.
	30.85 (8.0%)		

The size, shape and location of the presently shown WTPs is subject to change upon further engineering work in adjacent areas. Final mapping and location of WTPs adjacent to cutblocks will be shown with the submission of pre-harvest mapping required by Section 33 of the *Woodlot Licence Planning and Practices Regulation* (WLPPR).

Through on-going observation, there will be potential for identifying and locating nesting trees, other important habitat trees for retention and additional wildlife tree patches. No nesting sites or bear dens requiring specific habitat or tree retention have been identified to date.

The minimum proportion of the woodlot licence area for long-term WTPs retention is 30.8 ha (8%) as per S.52(1) of the WLPPR. At any given time there will be at least this amount of Wildlife Tree Retention Area in the Woodlot Licence with equal or better wildlife habitat attributes as shown in Table 5.

b) Conditions Under which Trees may be Removed from Wildlife Tree Retention Areas:

Stand-specific issues that influence the decision of where salvage may be appropriate for WTPs include:

- ☑ worker safety;
- ☑ the significance of forest health risk to surrounding stands;
- ☑ the ability of the retained wildlife trees to perform as suitable wildlife habitat; and
- ☑ the availability of wildlife trees and CWD in adjacent harvest areas.

Salvage of windthrown timber is permitted within WTPs where they are not within RRZ and where windthrow impacts 25% to 50% of the dominant or co-dominant trees. Salvage of windthrown timber and harvesting of remaining standing stems is permitted within WTPs where windthrow exceeds 50% of the dominant or co-dominant stems; or where forest health issues pose a significant threat to areas outside the WTP.

Individual trees may be felled but **not removed** if considered a safety hazard. Unsafe wildlife trees will be only protected by no-work zones or re-design of cutblock configuration, if they exhibit exceptional high wildlife tree values combining the following characteristics: wildlife tree value category HIGH applicable, DBH > 50 cm, wildlife tree class 2 – 8, > 20 m high, conks or decay present, wildlife use present (nesting, cavities, recent feeding, denning), species Fd, Cw, Hw, Ba, Ss, Ac or Dr.

c) Replacement of Trees Removed from Wildlife Tree Retention Areas:

Given the nature of the adjacent stands and existing WTPs, the felling of danger trees within a distance from harvest edges defined in the specific cutting authority will not be a common occurrence or threaten the long-term integrity and usefulness of the WTPs. As such, no strategy for the specific replacement of individual trees within WTPs is presented.

Where salvage/harvesting is planned and authorized within a non RRZ wildlife tree patch, a suitable replacement WTP of at least equivalent quality will be identified concurrently to achieve the retention target. Where all or part of a WTP is salvaged, the salvaged area should be replaced with other suitable habitat in the nearest possible location. If a WTP suffers blowdown, but is not salvaged, it will not be replaced. Replacement areas must have equal or better wildlife values. For non-riparian WTPs, attempts will be made to incorporate important features such as snags, marking, perch and nesting trees, dens, and other significant wildlife features.

MEASURES TO PREVENT INTRODUCTION OR SPREAD OF INVASIVE PLANTS

The introduction or spread of invasive plants, specifically Scotch Broom (*Cytisus scoparius*), into the woodlot licence area through the use of standard practices is possible given the location and easy access to the woodlot by a multitude of users. It should be noted that in several areas of the woodlot serious Broom problems already exist and have been inherited by or beyond the influence of the licensee. These areas are as follows:

- ☑ BC Hydro Right of Way
- ☑ New Island Highway
- ☑ Areas of and around Blk S1 in the SW corner of the woodlot (rehabilitated gravel pit)
- ☑ Portions of Farnham road

The licensee has already been taking a proactive approach to invasive plant management through initiatives such as the rehabilitation of 8.11 ha in Block S1.

Except for the above listed areas: in the event that Broom becomes established as a result of licensee activities it will be brushed repeatedly and the area grass seeded and monitored. Vehicle access will be restricted via gates or berms as shown on the WLP maps. Where it is know or reasonably expected that machinery is to be transported from a contaminated site, on or off the woodlot, cleaning of tires, tracks, bucket, undercarriage, etcetera will be completed prior to transportation. All newly constructed roads will be seeded if Broom establishment becomes a concern. Seed mixtures used for the above purposes or for those under S.29 of the WLPPR will be assessed to ensure that their use does not introduce other invasive species. Additional species listed in the Invasive Plants Regulation (reg. 18/2004) if identified and located on the woodlot will be managed accordingly.

MEASURES TO MITIGATE EFFECT OF REMOVING NATURAL RANGE BARRIERS

No measures or activities are proposed. There are no rangelands or natural range barriers present on the woodlot. Adjacent residential properties that keep livestock are required by legislation to maintain facilities that prevents unauthorised access and forage on Crown land. The licensee may use livestock for the purpose of intensive silviculture as described in the management plan.

STOCKING INFORMATION FOR SPECIFIED AREAS

☒ The stocking standards for specified areas are found in Appendix 3 – Alternative Stocking Standards.

Specified areas include:

- areas subject to commercial thinning,
- the removal of individual trees, or
- areas subject to single/group tree selection or
- other types of intermediate cutting and /or
- areas subject to the harvest of special forest products.

For the purposes of this plan, commercial thinning, the removal of individual trees, single/group selection, intermediate cutting or the harvest of special forest products may take place anywhere within the woodlot except in designated areas where harvesting will be avoided. The delineation of specific areas will be conducted in conjunction with the pre-harvest mapping as per Section 33 of the WLPPR.

PERFORMANCE REQUIREMENTS

SOIL DISTURBANCE LIMITS

☒ Alternative:

- 8% of Net Area to be Reforested ***except***

  a) up to a maximum of 30% in localised areas (standard unit basis) dominated by heavy salal or salmonberry where light soil raking using an excavator mounted brush rake will be prescribed to disturb and stir up the salal / salmonberry roots to create planting spots to facilitate seedling establishment and achieve early brush control. While this treatment may create dispersed wide to very wide scalps (thus the increased limit), the objective is a mixed substrate of soil and forest floor and not a complete removal of the forest floor.

  b) up to a maximum of 15% in wet site units with fluctuating water tables or prolonged periods of standing water in the winter (CWHxm 12, 13, 14, 15). In these areas 400-600 mounds per ha may be created (where prescribed) using an excavator bucket to create suitable micro sites. This will result in dispersed deep gouges.

  Rationale: these are site preparation treatments but would be conducted concurrent with or immediately following harvesting resulting in soil disturbance that may meet the assessment criteria for scalps and gouges. The increased limits are maximums only and are included to increase flexibility on these sites. These site conditions will normally constitute a small proportion of an average harvest area. Prescription and application of these treatments will consider critical site factors including soil sensitivity and erosion potential.

PERMANENT ACCESS STRUCTURES

☒ Default: WLPPR s.25

- the maximum area occupied by permanent access structures is as follows:
  - Cutblocks ≥ 5 ha – 7% of cutblock area
  - Cutblocks < 5 ha – 10% of cutblock area
  - Total Woodlot Area – 7% of Woodlot Licence area

USE OF SEED

☒ Default: WLPPR s.32

- Adoption of Chief Forester's Standards for Seed Use

STOCKING STANDARDS

☒ Alternative: Stocking Standards are provided in Appendix 3. Clarification and rational is provided in the supplementary information included with the plan. See Section II - 4.

WIDTH OF STREAM RIPARIAN AREAS

☒ Default: as specified in Section 36(4) of the WLPPR.

WIDTH OF WETLAND RIPARIAN AREAS

☒ Default: as specified in Section 37(3) of the WLPPR.

WIDTH OF LAKE RIPARIAN AREAS

☒ Default: as specified in Section 38(2) of the WLPPR.

RESTRICTIONS IN A RIPARIAN RESERVE ZONE

☒ Alternative: WLPPR s.39

- Cutting, modifying or removing trees in a riparian reserve zone is limited to the purposes described in Section 39(1) of the WLPPR and the establishment of the road right of way of Road C210 along Joshua Creek
- For the purpose of Section 39(2.1) of the WLPPR, the following roads may be constructed in a riparian reserve zone:
  Road C200 across Joshua Creek,
  Road C210 along Joshua Creek,
  unspecified road across Creek 27.

RESTRICTIONS IN A RIPARIAN MANAGEMENT ZONE

☒ Alternative: WLPPR s.40

- Construction of a road in a riparian management zone is limited to the conditions described is Section 40(1) of the WLPPR.
- For the purpose of Section 40(1)(a) of the WLPPR, roads may be constructed in a riparian management zone if a road grade previously existed in this location and it is more practicable to re-establish the road on the old grade.
- Restrictions and conditions on road construction, maintenance and deactivation activities, and on cutting, modifying or removing trees in a riparian management zone are as described in Section 40.

WILDLIFE TREE RETENTION

☒ Default: WLPPR s.52(1)

- The proportion of the Woodlot Licence area that is occupied by wildlife tree retention areas is no less than the least of the following:
  - The proportion specified for the area in a land use objective, or
  - The proportion specified in the WLP, or
  - 8%

Note: The proportion of the woodlot licence area that is presently occupied by mapped Riparian Reserve Zones and WTPs that contribute to overall retention is currently at 8.0%.

COARSE WOODY DEBRIS

☒ Default: WLPPR s.54(1)

- Area on Coast – minimum retention of 4 logs per ha = 5 m in length and =30 cm in diameter at one end.
- Area in Interior – minimum retention of 4 logs per ha = 2 m in length and = 7.5 cm in diameter at one end.

RESOURCE FEATURES

☒ Default: WLPPR s.56(1)

- ensure that forest practices do not damage or render ineffective a resource feature.

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Note: Only the performance requirements in Part 3 (Practice Requirements) of the WLPPR for which an alternative can be proposed are shown in this Woodlot Licence Plan. The remaining performance requirements in Part 3 are not shown, nor are the performance requirements in Part 4 (Roads).

APPENDICES

Appendix 1: Map of Crown portion (Schedule B) of Woodlot Licence W1677

Appendix 2: Map of private portion (Schedule A) of Woodlot Licence W1677

Appendix 3: Alternative Stocking Standards for Woodlot Licence W1677

Appendix 4: Silvics, Management and Wood Applications of Garry Oak

MAP 1 of 2

Woodlot Licence W 1677 Headquarters Creek

Woodlot Licence Plan Map

Crown Portion

Ministry of Forests
Campbelll River District

Licencee:	Headquarters Creek Woodlot Ltd.
Reference Map:	092F075
Datum:	NAD 83
UTM Zone:	10
UTM:	E347600 N5512000
TSA:	37 Strathcona
TSB:	A Sayward
FIZ:	B
P.S.Y.U.:	235
Inv. Reg.:	7
Comp.:	6B
Drafted:	August 26, 2005
By:	ECON consulting

Decl.: 20° 6'
Ann. Change: 6.6'

50 0 50 100 150 200 Meters
1:5000

- x Falling Corner
- l Landing, permanent
- v Landing, temporary
- y Station
- Y Culvert
- ú Bridge
- Ý Wildlife Tree
- É Swamp
- o Plot Location
- d RP
- t Legal Post
- (Snag
- s Leave Tree
- A Water Intake
- â Viewpoint
- E Quarry
- Φ Gate
- FS Campground
- Picnic Area
- x Opening
- ¤ Beaver Dam

- Block Boundary
- Treatment Unit
- Main Road
- Road (existing)
- Perm. Trail (existing)
- Old Railroad Grade
- Foot Trail
- S1-S4 Fish Creek
- S5-S6 Creek
- NCD non-classified Drainage
- Not classified Creek
- Bluff
- Powerline
- Gasline
- 10m Contour Lines

- Lake
- Wetland

- Areas where harvesting will be avoided
- Areas where harvesting will be modified

- NSR, not sufficient restocked, Recreation Management Unit

- Blocks, completed
- Woodlot Area

Signature / Seal

Date

econ
250-337-5588

Woodlot Licence
W 1677
Headquarters Creek

Woodlot Licence Plan Map

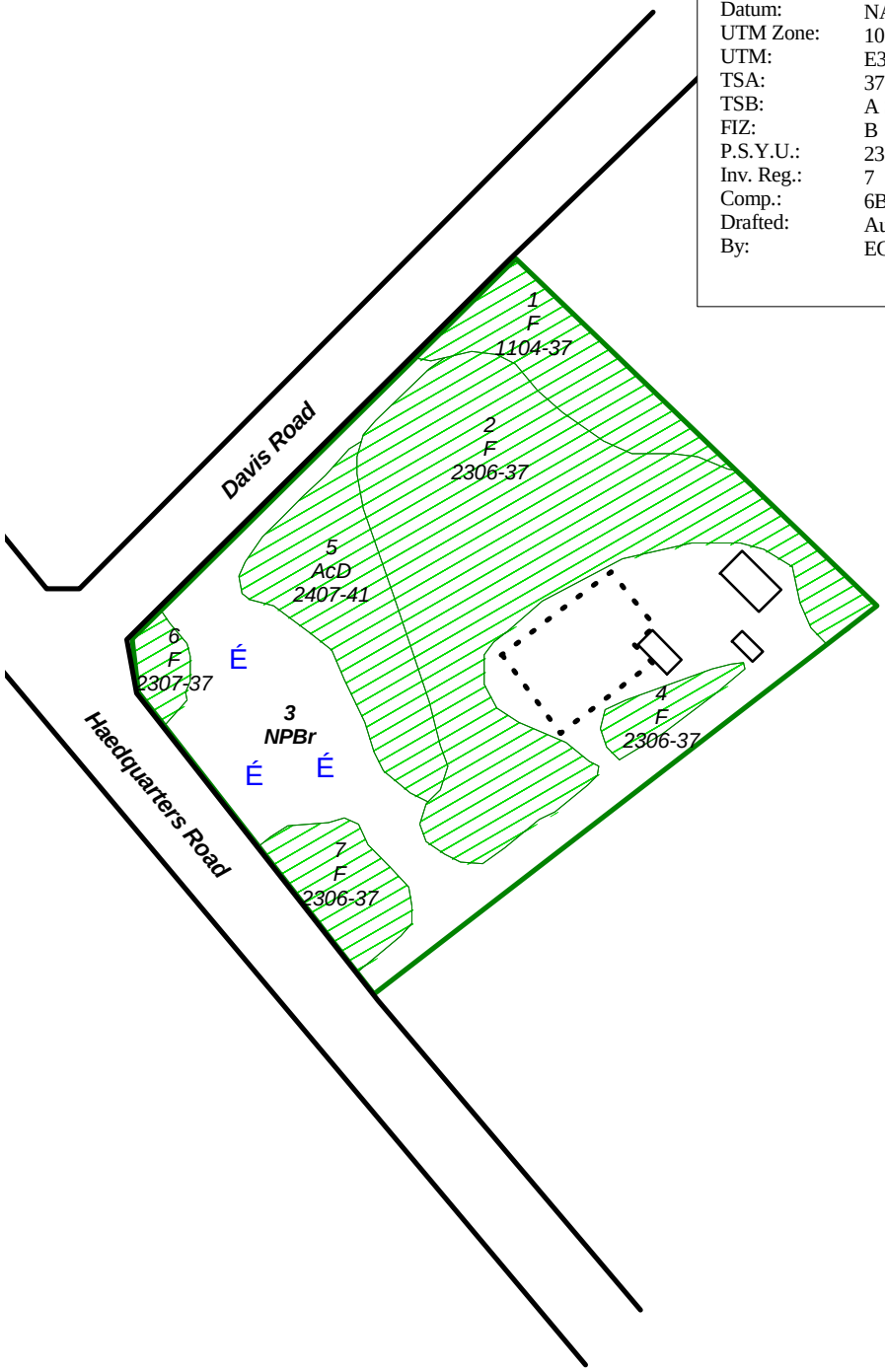
Private Portion

Ministry of Forests
Campbelll River District

Licencee:	Headquarters Creek Woodlot Ltd.
Reference Map:	092F075
Datum:	NAD 83
UTM Zone:	10
UTM:	E351 150 N5514 550
TSA:	37 Strathcona
TSB:	A Sayward
FIZ:	B
P.S.Y.U.:	235
Inv. Reg.:	7
Comp.:	6B
Drafted:	August 18, 2005
By:	ECON consulting

Decl.: 20° 6'
Ann. Change: 6.6'

10 0 10 20 Meters
1:2000



Garden
House
Road
Property Boundary

Contributed Forest
Residence and NP area

econ
250-337-5588

APPENDIX 3: ALTERNATIVE STOCKING STANDARDS

Table: A

ADMINISTRATION			
Vancouver Forest Region	**Campbell River Forest District**	**Licensee: Headquarters Creek Woodlot Ltd.**	**Woodlot Licence #W1677**	**June 20, 2005**

ID #	BEC		Preferred Species						Acceptable Species								Stocking (w/s)			Min Inter Tree Dist (m)	Regen Delay	FG Date	Tree Ht > Brush (min %)	Post Spacing Density		Comments:
	Zone & variant	Site Series	1	Ht (min)	2	Ht (min)	3	Ht (min)	1	Ht (min)	2	Ht (min)	3	Ht (min)	4	Ht (min)	Target P&A (sph)	Min P&A (sph)	Min P (sph)	MITD (m)	Max (yrs)	Late (yrs)		Min	Max	
A	CWHxm	01/04	Fd	3.0					Pw[5]	2.5	Hw[8]	2.0	Cw	1.5			900	500	400	2.0	3	12	150	500	1500	None – Zonal site
B	CWHxm	02	Fd	2.0					Pl	1.25	Pw[5]	2.5	Lw[8]	1.5			400	200	200	2.0	3	12	150	200	800	Avoid logging – xeric site, shallow soils
C	CWHxm	03	Fd	2.0					Cw	1.0	Pw[5]	2.5	Lw[8]	1.5	Pl[6]	1.25	800	400	400	2.0	3	12	150	400	1200	None
D	CWHxm	05/07	Cw	2.0	Fd	4.0			Bg	3.5	Pw[5]	2.5					900	500	400	2.0	3	12	150	500	1500	None
E	CWHxm	06	Fd	3.0	Cw	1.5	Hw	2.0	Bg	3.0	Pw[5]						900	500	400	2.0	6	14	150	500	1500	None
F	CWHxm	08/09[1]	Cw	2.0	Bg	3.5			Ss[7]	4.0							900	500	400	1.5	3	12	150	500	1500	Floodplain - medium/high bench
G	CWHxm	10	Act	4.0	Dr[4]	4.0	Mb[4]	4.0									800	400	400	1.5	3	12	150	400	1200	Floodplain - low bench
H	CWHxm	11[1]	Cw	1.0					Pl[1]	1.25							400	200	200	1.5	3	12	150	200	800	Avoid logging – wet and very poor
I	CWHxm	12[1]	Cw	1.0					Hw[4]	1.5	Pw[5]	2.5	Ss[7]	1.5			800	400	400	1.5	3	12	150	400	1200	Organic soils - avoid ground based equipment
J	CWHxm	13/14[1,2]	Bg	3.5	Cw	2.0	Fd[1]	4.0	Ss[7, 9]								900	500	400	1.5	3	12	150	500	1500	Fluctuating water table
K	CWHxm	15[1,2]	Cw	2.0					Ss[7, 9]								800	400	400	1.5	3	12	150	400	1200	Fluctuating water table
L	CWHxm	01/06	Dr[4]	3.0	Mb	3.0											1200	1000	800	1.5	3	12	150	800	1500	High density deciduous management
M	CWHxm	05/07/08/ 09[1]/02/13/ 14[1,2]/15[1,2]	Act	4.0	Dr[4]	4.0	Mb	4.0									1200	1000	800	1.5	3	12	150	800	1500	High density deciduous management
N[10]	CWHxm	01/02/03/ 04/05/06/ 07	Qg	1.5													800	400	400	2.0	3	12	150	400	1200	Special species management
O	CWHxm	01/04/06	Cw	1.5	Pw[5]	2.5			Fd[3]	3.0	Hw[3, 8]	2.0					900	500	400	2.0	3	12	150	500	1500	Alternate species root rot treatment
P	CWHxm	03	Cw	1.0	Pw[5]	2.5			Fd[3]	2.0	Pl[3]	1.25	Lw[8]	1.5			800	400	400	2.0	3	12	150	400	1200	Alternate species root rot treatment
Q	CWHxm	02	Pw[5]	2.5					Pl[3,6]	1.25	Fd[3]	2.0	Lw[8]	1.5			400	200	200	2.0	3	12	150	200	800	Avoid logging – xeric site, shallow soils
R	CWHxm	05/07	Cw	2.0	Pw[5]	2.5			Fd[3]	4.0	Bg[3]	3.5					900	500	400	2.0	3	12	150	500	1500	Alternate species root rot treatment
S	CWHxm	08/09	Cw	2.0					Bg[3]	3.5	Ss[3, 7]	4.0					900	500	400	1.5	3	12	150	500	1500	Alternate species root rot treatment
T	CWHxm	11	Cw	1.0					Pl[3,6]	1.25							400	200	200	1.5	3	12	150	200	800	Alternate species root rot treatment
U	CWHxm	12	Cw	1.0	Pw[5]	2.5			Hw[3]	1.5	Ss[3, 7]	1.5					800	400	400	1.5	3	12	150	400	1200	Alternate species root rot treatment
V	CWHxm	13/14[2]	Cw	2.0					Bg[3]	3.5	Fd[3]	4.0	Ss[3,7,9]				900	500	400	1.5	3	12	150	500	1500	Alternate species root rot treatment

Foot Notes

1 Elevated microsites are preferred
2 These sites represent areas with strongly fluctuating water tables. They are often found as mosaics in combination with other sites. Elevated microsites are preferred, either mechanical or natural
3 Trees are not acceptable within 10 m of second growth stumps, except Cw, Pw, Lw and deciduous species.
4 Avoid gleyed soils and in frost pockets
5 Pw must be free of blister rust within 10 cm of the stem and be pruned as per ministry guidelines or be blister rust resistant stock (≥ 50% resistance)
6 Restricted to nutrient-very-poor sites
7 Risk of weevil damage, use resistant stock where possible. Ss will not exceed 20% of the free growing stand on 08 & 12 site series or 5% of the free growing stand on 09, 13, 14, & 15 site series on a dispersed basis. Clumps not to exceed 0.1ha in size.
8 Hw is not acceptable on site series 04. The proportion of the free-growing stand comprised of Hw, Lw if established will not exceed 20%. Lw will not exceed 5% of the free growing stand on site series 02.
9 May be planted on prepared mounds
10 Allowable maximum combined area of this SU is 1% of the woodlot licence area

Stocking Standards - General Comments

This table has been developed from the *Reference Guide for FDP Stocking Standards* dated December 11, 2002 and the standards established in the Woodlot Licence Forest Management Regulations (January 31, 2004) Division 2 of Part 6, Schedule A, Table A as well as the correlated guidelines and site interpretation for the Vancouver Forest Region (VFR). Where site series have similar stocking standards, they have been combined. Sections A-K are the general stocking standards. Sections L& M are the deciduous stocking standards. Sections N-U apply to sites affected by root rot.

'Biogeoclimatic unit' or 'BEC' means the zone, subzone, variant and site series described in the most recent field guide published by the Ministry of Forests for the identification and interpretation of ecosystems, as applicable to a harvested area.

Site series with the comment of 'avoid logging'; floodplain site series or sites with strongly fluctuating water tables have been included. However, management on these sites will be limited and will generally be included within a mosaic of better sites. In some cases where there are fluctuating water tables, mounding may be prescribed to create better microsites.

Where standards units (SUs) are comprised of an un-mappable mosaic of site series, the practice will be to manage for the stocking standards, noted by the ID#, of the dominant site series provided that the tree species are suitable in all site series contained within the SU.

A limited number of scattered deciduous trees will be tolerated on all conifer plantations: to provide a nurse crop, promote nutrient cycling or for general biodiversity objectives. Allow up to 50 spha as ghost trees during surveys on all sites. No deciduous tree within 10m of each other will be accepted for dispersed single stems due to increased competitive density effects.

The minimum inter-tree spacing is generally reduced to 1.5 m under the following site-specific conditions: frequent bedrock, large blocky colluvium, hygric sites, and disturbed

roadside areas amongst slash accumulations (up to 10 m from the travelled portion of the road). On machine mounded sites the minimum inter-tree spacing is reduced to 1.0 m.

Deciduous Management

Recommended Regime: The product objective is to manage for high quality knot-free sawlogs on a 40 - 50 year rotation. Establish stand with high densities (1500 sph) is required to achieve a target of 1200 stems/ha at free-growing. At approximately age 10 but not before stand height 12 to 16 m space to 900 stems/ha. Dead branch prune the crop trees early and continue density regulation treatments approx. every 10 years to maintain good crown forms and eliminate low quality stems.

The establishment of a second crop conifer layer (Cw, Ss) before or after density treatment is optional. If a cedar or Sitka spruce understory is planted in addition, then the natural pruning of the alder would be enhanced. The removal of the alder at harvest age is operationally possible, while leaving a fully stocked, semi-mature conifer pole stand behind.

Where conifers are established underneath a designated deciduous stand, the stand's regeneration and free to grow status will be measured using the deciduous standards only. The minimum free growing height criterion for deciduous species is based on the tallest conifer standard for each site series. Damage criteria for deciduous species have not been formally established. General free-growing criteria will be adopted, such that well spaced stems will be of good form, health and vigour.

Stocking Standards – Specified Areas

For salvage of scattered windthrow or root rot mortality, openings of up to 0.1 ha in size are acceptable, not requiring regeneration.

Table: B

Target from Table A standards	Layer*	Stocking**		
		Target pa	MIN pa	MIN p
(stems/ha)		(well-spaced/ha)		
900 - 1200	1	400	200	200
	2	500	300	250
	3	700	400	300
	4	900	500	400
800	1	300	150	150
	2	400	200	200
	3	600	300	300
	4	800	400	400

*Stand Layer definition

Tree Layer 1	Mature	trees >= 12.5 cm dbh
Tree Layer 2	Pole	trees 7.5 cm to 12.4 cm dbh
Tree Layer 3	Sapling	trees >= 1.3 m height to 7.4 cm dbh
Tree Layer 4	Regeneration	trees < 1.3 m height

** pa - preferred and acceptable species p - preferred species
Preferred and acceptable species and "Target from Table A standards' are as specified in Table A by biogeoclimatic ecosystem classification (BEC) site series

APPENDIX 4

Silvics, Management and Wood Applications of Garry Oak

Quercus garryana Dougl. ex Hook.

Oregon White Oak

Fagaceae -- Beech family

William I. Stein

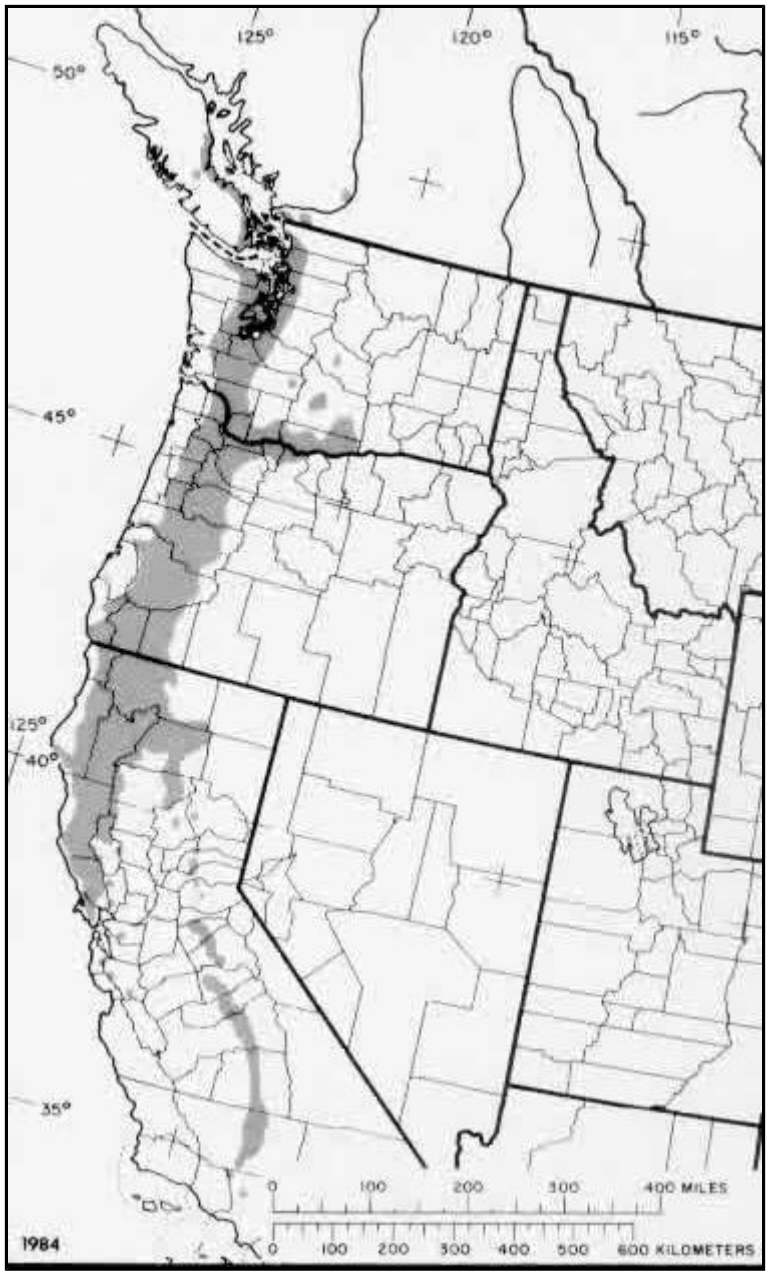
Oregon white oak *(Quercus garryana),* a broadleaved deciduous hardwood common inland along the Pacific Coast, has the longest north-south distribution among western oaks-from Vancouver Island, British Columbia, to southern California. It is the only native oak in British Columbia and Washington and the principal one in Oregon. Though commonly known as Garry oak in British Columbia, elsewhere it is usually called white oak, post oak, Oregon oak, Brewer oak, or shin oak. Its scientific name was chosen by David Douglas to honor Nicholas Garry, secretary and later deputy governor of the Hudson Bay Company.

Habitat

Native Range

The range of Oregon white oak spans more than 15° of latitude from just below the 50th parallel on Vancouver Island in Canada south nearly to latitude 34° N. in Los Angeles County, CA. South of Courtenay, BC, Oregon white oak is common in the eastern and southernmost parts of Vancouver Island and on adjacent smaller islands from near sea level up to 200 m (660 ft) or more (47). It is not found on the British Columbia mainland except for two disjunct stands in the Fraser River Valley (28). In Washington, it is abundant on islands in Puget Sound and distributed east and west of the Sound and then south and east to the Columbia River at elevations up to 1160 m (3,800 ft) (68). Oregon white oak is widespread at lower elevations in most of the Willamette, Umpqua, and Rogue River Valleys of western Oregon (67,68). It is also common in the Klamath Mountains and on inland slopes of the northern Coast Ranges in California to San Francisco Bay but infrequent from there southward to Santa Clara County (29).

In small tree and shrub sizes, Oregon white oak extends inland to just east of the Cascade Range, mainly in the Columbia River and Pit River drainages (29,50,67,68,71). It has a scattered distribution the entire length of the western Sierra Nevada south to the Tehachapi Mountains in Kern and northern Los Angeles Counties where it forms extensive brush fields at elevations up to 2290 m (7,500 ft) (29,76).



-The native range of Oregon white oak.

Climate

Oregon white oak grows in diverse climates, ranging from the cool, humid conditions near the coast to the hot, dry environments in inland valleys and foothill woodlands. Records from 48 climatic observation stations within or bordering its range indicate that Oregon white oak has endured temperature extremes of -34° to 47° C (-30° to 116° F) (45,47,53,77). Average annual temperatures range from 8° to 18° C (46° to 64° F); average temperatures in January, from -11° to 10° C (13° to 50° F); and in July, from 16° to 29° C (60° to 84° F).

Average annual precipitation ranges from 170 mm (6.7 in) at Ellensburg, WA, east of the Cascades to 2630 mm (103.5 in) at Cougar, WA, west of the Cascades. Precipitation at the southern end of the range of Oregon white oak (Tehachapi) averages 270 mm (10.6 in), similar to that at northerly locations east of the Cascades-Ellensburg, Yakima, and Goldendale in Washington and The Dalles and Dufur in Oregon. Average annual snowfall ranges from little, if any, at several locations to 417 cm (164 in) at Mineral in Tehama County, CA. Average

precipitation in the growing season (April through September) ranges from 30 mm (1.2 in) at Tehachapi, CA, and Ellensburg, WA, to 630 mm (24.8 in) at Cougar, WA. Length of average frost-free season (above 0° C; 32° F) ranges from 63 days at Burney in Shasta County, CA, to 282 days at Victoria, BC.

Soils and Topography

Oregon white oak can grow on a wide variety of sites, but on good sites it is often crowded out by species that grow faster and taller. Hence, Oregon white oak is most common on sites that are too exposed or droughty for other tree species during at least part of the year, including inland valleys and foothills, south slopes, unglaciated and glaciated rocky ridges, and a narrow transition zone east of the Cascades between conifer forest and treeless, dissected plateau. Although usually considered a xeric species, Oregon white oak also commonly occurs in very moist locations-on flood plains, on heavy clay soils, and on river terraces. These locations appear to have two common characteristics-standing water or a shallow water table during a lengthy wet season and gravelly or heavy clay surface soils that probably are droughty during the extended dry season. The distribution of Oregon white oak gives evidence that it can withstand both lengthy flooding and drought.

Oregon white oak grows on soils of at least four orders: Alfisols, Inceptisols, Mollisols, and Ultisols. Specific soil series include Hugo and McMahon in coastal northern California and Goulding near Santa Rosa (75,78). In Oregon's Willamette Valley, Oregon white oak is found on soils derived from alluvial deposits (poorly drained gray brown Amity and Dayton series), sedimentary rocks (deep, welldrained brown Steiwer, Carlton, Peavine, Bellpine, Melbourne, and Willakenzie series), and basic igneous rocks (brown or reddish, moderately deep, well-drained Nekia, Dixonville, and Olympic series) (22,38,67,73). A subsurface clay layer that restricts water penetration is characteristic of soils in most of these series. White oak stands near Dufur in eastern Oregon grow in soils derived from basalt and andesite (32); in southern Oregon, they grow in soils derived from andesite, granite, and serpentine (79). On the southeastern tip of Vancouver Island, BC, seven soils supporting a vegetational sequence of grass, Oregon white oak, and Douglas-fir were gravelly loams or gravelly sandy loams that developed on young, nonhomogeneous parent materials (11).

Soils under Oregon white oak stands are generally acidic, ranging in pH from 4.8 to 5.9 (11,75,78). Bulk densities ranging from 0.61 to 1.45 have been measured (73,78). Many white oak stands grow on gentle topography; only one-fourth of those examined in the Willamette Valley were on slopes greater than 30 percent (73).

Associated Forest Cover

Oregon white oak is found in pure, closed-canopy stands; in mixture with conifers or broad-leaved trees; and as scattered single trees or groves on farmlands, woodlands, and prairies. It grows to large sizes but is also found extensively as scrub forest. The best stands are in western Oregon and Washington-in the Cowlitz, Lewis, and Willamette River drainages-but stands or trees with substantial volume are found from British Columbia to central California. Dense dwarf or shrub stands of Oregon white oak, earlier identified as *Quercus garryana* var. *breweri,* and other stands previously identified as Q. *garryana* var. *semota,* form dense thickets over large areas in California (29,35,57,76,81). Similar dwarf or shrub forms grow to a more limited extent on severe sites in the rest of its range (57,79).

Oregon white oak is recognized as a distinct forest cover type (Society of American Foresters Type 233) and is listed as an associated species in at least eight other forest cover types (20): Pacific Douglas-Fir (Type 229), Port Orford-Cedar (Type 231), Redwood (Type 232), Douglas-

Fir-Tanoak-Pacific Madrone (Type 234), Pacific Ponderosa Pine (Type 245), California Black Oak (Type 246), Knobcone Pine (Type 248), and Blue Oak-Digger Pine (Type 250). Its prominence and occurrence in these types, as well as in several others for which it is not specifically listed, vary widely.

Plant communities have been identified in parts of the Oregon white oak type. A Garry oak community of two types (oak parkland and scrub oak-rock outcrop), a Garry oak-arbutus, and an arbutus-Garry oak community have been defined in the Victoria, BC, metropolitan area (42). Four communities, ranked in order from wettest to driest, have been identified in white oak forests of the Willamette Valley: Oregon white oak/California hazel/western swordfern, Oregon white oak/sweet cherry/common snowberry, Oregon white oak/Saskatoon serviceberry/common snowberry, and Oregon white oak/Pacific poison-oak (73). These communities are floristically similar, being differentiated primarily by the relative coverage and frequency of a few shrub species. Five Oregon white oak communities identified in the North Umpqua Valley of Oregon were similar to the xeric Oregon white oak/Pacific poison-oak association of the Willamette Valley; a sixth was a riparian association dominated by Oregon white oak and Oregon ash *(Fraxinus latifolia)* (62). In California, four communities dominated by Oregon white oak were found in the Bald Hills woodlands of Redwood National Park (70) and three communities dominated by Oregon white oak or related hybrids were identified in a limited area on Bennett Mountain (75). The shin oak brush association, largely composed of Oregon white oak, is a distinctive plant community in Kern and Los Angeles Counties (76).

The composition of Oregon white oak communities varies greatly because of differences in soil, topography, and climate, and in fire and grazing histories. Because of proximity to farmlands, many communities include introduced forbs and grasses. Pacific poison-oak *(Rhus diuersiloba)* and common snowberry *(Symphoricarpos albus)* are probably the most widespread and characteristic shrub associates.

Species often found with Oregon white oak are listed in table 1. The listing is not exhaustive; it just indicates the great variety of common associates. Species associated with Oregon white oak in chaparral communities and on serpentine soils are listed in other sources (15,16,79).

Table 1- Trees, shrubs, and herbs associated with Oregon white oak in different parts of its range[1]

Trees	Shrubs	Herbs
Abies grandis	*Amorpha californica*	*Agropyron spicatum*
Acer circinatum	*Arctostaphylos columbiana*	*Agrostis* spp.
Acer glabrum	*Arctostaphylos manzanita*	*Allium* spp.
Acer macrophyllum	*Arctostaphylos media*	*Athysanus pusillus*
Aesculus californica	*Arctostaphylos uva-ursi*	*Avena barbata*
Alnus rubra	*Berberis aquifolium*	*Balsamorhiza deltoides*
Amelanchier alnifolia	*Berberis nervosa*	*Brodiaea* spp.
Arbutus menziesii	*Ceanothus cuneatus*	*Bromus* spp.
	Ceanothus	

Betula occidentalis	*integerrimus*	*Camassia* spp.
Castanopsis chrysophylla	*Ceanothus velutinus*	*Carduus pycnocephalus*
Cercocarpus betuloides	*Cornus stolonifera*	*Carex* spp.
Cornus nuttallii	*Crataegus oxyacantha*	*Chlorogalum pomeridianum*
Corylus cornuta	*Cytisus scoparius*	*Collinsia* spp.
Crataegus douglasii	*Gaultheria shallon*	*Crocidium multicaule*
Fraxinus latifolia	*Hedera helix*	*Cynosurus echinatus*
Heteromeles arbutifolia	*Holodiscus discolor*	*Dactylis glomerata*
Juniperus scopulorum	*Osmaronia cerasiformis*	*Danthonia californica*
Libocedrus decurrens	*Philadelphus lewisii*	*Delphinium menziesii*
Lithocarpus densiflorus	*Physocarpus capitatus*	*Dentaria californica*
Pinus contorta	*Purshia tridentata*	*Dodecatheon hendersonii*
Pinus monticola	*Rhus diversiloba*	*Dryopteris arguta*
Pinus ponderosa	*Ribes sanguineum*	*Elymus glaucus*
Pinus sabiniana	*Rosa eglanteria*	*Eriogonum nudum*
Populus tremuloides	*Rosa gymnocarpa*	*Eriophyllum lanatum*
Populus trichocarpa	*Rosa nutkana*	*Erythronium oregonum*
Prunus avium	*Rubus laciniatus*	*Festuca* spp.
Prunus emarginata	*Rubus parviflorus*	*Fritillaria lanceolata*
Prunus virginiana	*Rubus procerus*	*Galium* spp.
Pseudotsuga menziesii	*Rubus ursinus*	*Holcus lanatus*
Pyrus communis	*Spiraea betulifolia*	*Hypericum perforatum*
Pyrus fusca	*Spiraea douglasii*	*Lathyrus* spp.
Pyrus malus	*Symphoricarpos albus*	*Lomatium utriculatum*
Quercus agrifolia	*Symphoricarpos mollis*	*Lonicera ciliosa*
Quercus chrysolepis	*Symphoricarpos rivularis*	*Lotus micranthus*
Quercus douglasii	*Vaccinium ovatum*	*Lupinus* spp.
Quercus kelloggii	*Vaccinium parvifolium*	*Melica geyeri*
Rhamnus purshiana	*Viburnum ellipticum*	*Mimulus* spp.
Salix spp.		*Montia* spp.
Sambucus cerulea		*Nemophila heterophylla*
Taxus brevifolia		*Osmorhiza* spp.
Thuja plicata		*Phacelia linearis*
		Platyspermum

Tsuga heterophylla	*scapigera*
Umbellularia californica	*Plectritis* spp.
	Poa pratensis
	Polystichum munitum
	Pteridium aquilinum
	Ranunculus spp.
	Sanicula crassicaulis
	Sedum spathulifolium
	Sherardia arvensis
	Silene californica
	Sisyrinchium douglasii
	Stipa spp.
	Thysanocarpus curvipes
	Trifolium tridentatum
	Vicia americana
	Viola ocellata
	Zigadenus venenosus

[1] Sources:
4,10,11,13,20,22,24,28,31,32,35,42,47,54,62,63,67,69,70,71,72,73,75,78

Life History

Reproduction and Early Growth

Flowering and Fruiting- Oregon white oak flowers somewhat later in the spring than many of its associates. Flowering has been noted in March, April, May, and June (72,74), but the seasonal span is probably greater over the wide range of latitudes and elevations where this species occurs. Flowers appear concurrently with new leaves and extension of twig growth.

The species is monoecious, bearing slim, staminate flowers (catkins) that emerge from buds on existing twigs and also appear on the basal end of developing twigs (64). Some catkins associated with new twig growth just originate from the same bud; others are located as much as 5 mm (0.2 in) from the base on new growth. Catkins are pale yellow tinged with green. Fully extended catkins vary greatly in length-in one collection, from 3 to 10 cm (1.2 to 3.9 in). Catkins of the same twig and cluster are in various stages of development-some are fading before others reach full size. The faded dry catkin is light brown and fragile.

The closed pistillate flowers are small, deep red, and covered with whitish hairs (64). They appear in axils of developing leaves, either single and sessile or as many as five or six on a short stalk up to 2 cm (0.8 in) long. Two flowers are often located at the base of the stalk and several along and at its tip. Basal flowers may be open while others on the stalk are still tiny and tightly closed. Flower openings are narrow; the interior elements are greenish to yellowish. Flowers were found on new growth that had extended only 1 cm (0.4 in) or up to 12 cm (4.7 in); most flowers were on new growth 4 to 7 cm (1.6 to 2.8 in) long. Flowering appears at its fullest when the first leaves are about half size; when leaves approach full size, catkins are

withered. On a single tree, flowering seems to be a short event, perhaps a week long, as leaves develop quickly once growth starts.

Individual trees are known to flower abundantly, but observations are needed on the regularity of flowering and on the variability within and between stands and locations.

Seed Production and Dissemination- Seed crops may be heavy but are considered irregular. The large acorns, typically about 3 em (1.2 in) long and half as wide, mature in one season and ripen from late August to November. The age when a tree first bears fruit, the age of maximum production, and the average quantity produced have not been determined. In one collecting effort, about 18 kg (40 lb) of acorns per hour could be hand-picked from the ground under woodland trees between Redding and Weaverville, CA. The yield was estimated to be 5 to 9 kg (10 to 20 lb) each for trees 3 to 9 in (10 to 30 ft) tall and 15 to 30 cm (6 to 12 in) in diameter; production for this fair crop was about 560 kg/ha (500 lb/acre) (81). Northeast of Mount Shasta, a fair crop the same year yielded about 23 kg (50 lb) of acorns from a single tree 8 in (25 ft) in height and crown spread. In the Willamette Valley, acorns were dispersed from September to November, and three crops ranged from failure to 1737 kg/ha (1,550 lb/acre) ovendry-weight basis (12). Large crops of acorns are also produced by shrubby forms of Oregon white oak, but density of the stands can make collection difficult.

The heavy seeds disseminate by gravity only short distances from the tree crowns, except on steep slopes. Local transport is attributed primarily to the food-gathering activities of animals. In the past, Indians-and also pigeons-may have been responsible for long-distance colonization of Oregon white oak (28,71).

Seedling Development- Acorns of Oregon white oak must be kept moist until they germinate. In nature, moisture is maintained by a layer of leaves or through shallow insertion into soil from impact, rodent activity, animal trampling, or other soil disturbances. A moisture content of 30 percent or more must be maintained in cool regulated storage to maintain seed viability. Storage conditions have not been determined specifically for Oregon white oak; several methods recommended for keeping seeds moist should be suitable (46,65).

The acorns are large and heavy, averaging about 5 g each (85/lb). Viability has been better than 75 percent in the few samples tested (46), but the usual quality of the seeds is unknown. The seeds are not dormant; they will germinate soon after dispersal if subjected to warm, moist conditions. They will also germinate prematurely in low-temperature stratification. Normally, seeds retain viability only until the next growing season; chances of extending the viability period have not been determined.

Seedlings of Oregon white oak generally appear in the spring. Germination is hypogeal, and the rapid development of a deep taproot is believed responsible for their ability to establish in grass. Shoot development is relatively slow but can be greatly accelerated with long photoperiods (43). Seedlings are not produced now for forest plantings, but raising them in containers is readily possible. Direct seeding of acorns should also prove successful if seeds and young seedlings are protected from rodents and other predators. In at least some circumstances, natural reproduction from seed seems to occur readily (13,28,35).

Vegetative Reproduction- Oregon white oak sprouts abundantly from dormant buds on cut stumps, root collars, and along exposed trunks. Sprouts provide the most certain way to obtain natural regeneration. In 3 years, stump sprouts in 49 clumps in northwestern California averaged 10 per clump; height of the tallest sprout averaged 2.8 in (9.2 ft) and crown diameter per clump 2.5 in (8.2 ft) (52). Larger stumps produced more sprouts, larger clumps, and faster growing shoots. The spread of Oregon white oak by root sprouts has been noted in widely

separated instances (28,68,69,70,71,74). In general, the rooting or layering of oak cuttings is difficult, and there is no reason to believe that Oregon white oak would be easier to reproduce by these methods than other oaks.

Sapling and Pole Stages to Maturity

Growth and Yield- Under favorable conditions, mature Oregon white oak trees are 15 to 27 in (50 to 90 ft) tall and 60 to 100 cm (24 to 40 in) in d.b.h. (34,48,72,73). A maximum height of 36.6 m (120 ft), crown spread of 38.4 in (126 ft), and diameter of 246 cm (97 in) at d.b.h. are on record (2,35). Typically, open-grown trees have short holes bearing very large, crooked branches that form dense, rounded crowns (fig. 3). Such trees occupy much space but do not produce much volume for commercial use, except for fuel. In contrast, forest-grown trees 70 to 90 years old have slim, straight holes, fine side branches, and narrow crowns (60). Trees measured in northwestern California had average form classes of 63 and 68 (34). Branchwood of trees over 60 cm (24 in) in d.b.h. averaged 24 percent of total cubic volume. Trees of better form are probably developing now because young stands are more even aged and better stocked than those in the past, but such stands are limited in extent and widely scattered.

Resource inventories of various intensities indicate that the Oregon white oak type occurs on at least 361 400 ha (893,000 acres) in California, Oregon, and Washington and, as a species, comprises 26.2 million in' (926 million ft') or more of growing stock (7,8,9,10,21,25,26,27). As a component of woodland and other vegetation types, Oregon white oak is found on an additional 299 100 ha (739,000 acres) in California and in sizeable, undefined areas in Oregon and Washington. In California, the mean stand growing-stock volume in the type was 76.9 m^3/ha (1,099 ft^3/acre), and the maximum found was 314.7 m^3/ha (4,498 ft^3/acre).

Oregon white oak generally grows slowly in both height and diameter, but there are exceptions. Limited data from widely separated locations indicate that six to eight rings per centimeter (16 to 20/in) is a common rate for slower growing Oregon white oaks (28,68,72,75). For example, trees in a full stand 47 to 70 years old on deep Willakenzie soil at Corvallis, OR, averaged 14 in (46 ft) in height, 15 cm (6.0 in) in d.b.h., and eight rings per centimeter (20/in) in radial growth (38). Oregon white oak has the capability, however, of growing faster than five rings per centimeter (13/in) (31,48,72,80). In the Cowlitz River Valley, the fastest rate shown on large stumps was 1.9/cm (4.9/in); in the Willamette Valley, the rate averaged 4.6/cm (11.8/in) for four forest-grown trees 95 to 135 years old that averaged 24 in (80 ft) tall and 48 cm (19 in) in d.b.h.

Basal area of Oregon white oak stands has ranged from 8.0 to 60.8 m^2 /ha (35 to 265 ft^2/acre), with up to 19.3 m^2/ha (84 ft^2/acre) additional basal area of other species present. In these and other stands averaging 10 cm (4 in) or more in d.b.h., number of oak stems ranged from 10 to 2,800/ha (4 to 1,133/acre) (1,4,31, 62,69,70,72,75). Volumes for stands on different sites and of different ages are not known. One 80-year-old stand that averaged 160 trees 9 cm (3.6 in) and larger in d.b.h. would yield about 94.5 m^3/ha (15 cords/acre) (60).

Rooting Habit- Oregon white oak has a deep taproot and a well-developed lateral system; it is very windfirm even in wet areas. Fast taproot extension and sparse development of laterals are shown by seedlings in the first few weeks of growth. Despite formation of a deep taproot, a high percentage of oak roots are found in upper soil layers. Only 11 percent of the total number of oak roots were found below 76 cm (30 in) in deep Willakenzie soil (38). In contrast, 28 percent of the total Douglas-fir roots in the same soil were found below 76 cm (30 in).

Reaction to Competition- Oregon white oak has been classed as intermediate in tolerance, intolerant, and very intolerant of shade (47). Perhaps such a range of tolerance best describes its

status in different situations. Clearly, it is not tolerant of over-topping by Douglas-fir and associated conifers. Dead oaks often found beneath Douglas-fir canopies bear witness that they could not endure the shade (40,72). In some locations and situations, Oregon white oak perpetuates itself, indicating that it can reproduce adequately in its own shade. Branch development on open-grown trees may be very dense. Sparse development of side branches in closed stands provides evidence, however, that it should be classed as intolerant of shade.

Oregon white oak functions as both a seral and a climax species. It is long lived, reproduces from both seeds and sprouts, forms nearly pure stands, and can endure great adversities. In fact, it rates as a climax species because it has greater ability than other species to establish itself and persist where yearly or seasonal precipitation is sparse, where soils are shallow or droughty, or where fire is a repeated natural occurrence.

Geologic and floristic evidence indicates that Oregon white oak associations have evolved through successive eras as components of relatively and pine-oak forests, have repeatedly advanced northward from a locus in the southwestern United States and northwestern Mexico, and have repeatedly retreated as North American climates warmed and cooled (16). The most recent northward advance ended about 6,000 years ago; the more and vegetation types, including oak woodlands, are now being replaced by conifer forest favored by the climatic trend toward cooler and moister conditions.

The seral role of Oregon white oak is illustrated by major changes occurring in the Willamette Valley. Open oak woodlands, savannas dotted with oaks, and grasslands were prominent and widespread before the territory was settled; fires-natural as well as those set by Indians-maintained these open conditions (30,31,36,44,61). Post-settlement exclusion of fire permitted development of closed-canopy white oak stands that are typically of two ages-large spreading trees, now 270 to 330 years old, are scattered among smaller trees of narrow form, 60 to 150 years old (73). Where not restricted by agricultural practices, young oaks continue to encroach into grassland. But, in turn, many oak stands are being invaded and superseded by bigleaf maples or conifers, mainly Douglas-fir (fig. 4). A similar sequence of events is occurring in the northern oak woodland, a distinctive Oregon white oak type in California (5,51,69). Unless steps are taken to reverse present trends, the Oregon white oak type will continue to become a less prominent part of the western flora. A reduction in species diversity will also occur, for open-canopy communities have a more varied composition than closed conifer communities (13).

Damaging Agents- Because of their attractiveness as food, seed crops of Oregon white oak are often decimated quickly (12). Larvae of the filbertworm *(Melissopus latiferreanus)* and the filbert weevil *(Curculio occidentalis)* damage crops even before acorns ripen (23). Maturing or ripe acorns are consumed by woodpeckers, pigeons, doves, jays, wood ducks, mice, chipmunks, squirrels, pocket gophers, woodrats, deer, bear, and other wildlife, as well as by domestic animals.

Wind, wet snow, and freezing rain damage Oregon white oak less than associated hardwoods, but in tests it showed only moderate resistance to cold. Dormant buds collected northwest of Corvallis, OR, withstood -15° C (5° F) and twigs -20° C (-40 F) without injury (55).

Large Oregon white oaks are obviously fire resistant; they have withstood annual or periodic fires for years. But small oaks may be killed or badly damaged by fire, as evidenced by the increased density and spread of oak stands since the advent of fire control.

More than 110 pathogens have been found on the leaves, twigs, trunk, or roots of Oregon white oak (59). Most are of minor consequence; many are saprophytes. Leaf-spot, mildew, and

anthracnose fungi sometimes attack the foliage, but control methods have been suggested for only one-an anthracnose disease *(Gnomonia quercina).* In 1968, this fungus caused moderate to severe dying of leaves and possibly death of oak trees in southern Pierce County, WA (14). Premature browning of foliage is occasionally widespread in the Willamette Valley, but the causes and effects have received only incidental attention. The hairy mistletoe is common on Oregon white oak in Oregon and California, forming conspicuous, rounded growths in the upper crown. Its effect on growth and vigor of this host is undetermined. The white pocket root and butt rot (Polyporus dryophilus) and the shoestring root rot *(Armillaria mellea)* are probably the most damaging rots found in Oregon white oak. Its heartwood is generally very durable; stumps and even relatively small stems may remain intact for years.

Although Oregon white oak is host to hundreds of insect species (19), damage is usually not severe, and loss of trees to insect attack is uncommon. The western oak looper *(Lambdina fiscellaria somniaria)* is probably the most damaging insect on white oak from Oregon north to British Columbia. In some years, oaks over large areas in the Willamette Valley are defoliated (23). The damage is temporary since the trees leaf out the next year and outbreaks are not sustained. The western tent caterpillar *(Malacosoma californicum)* and the Pacific tent caterpillar *(M. constrictum)* are widely distributed defoliators with a preference for oaks. Several species of aphid, particularly *Teberculatus columbiae,* feed on the underside of oak leaves; the snowy tree cricket *(Oecanthus fultoni)* lives in open-grown oaks and associated species; and several leafrollers *(Abebaea cervella* and *Pandemis cerasana)* are found on Oregon white oak. Oregon white oak is the principal host for *R. cerasana,* an introduced leafroller causing sporadic defoliation that is now maintaining a relatively high population and slowly extending its range around Victoria, BC (17). Many gall wasps are found on oaks; those prominent on Oregon white oak include *Andricus californicus,* which forms large, persistent, applelike galls on twigs; *Bassettia ligni,* which causes seedlike galls under the bark of branches that often girdle and kill the branch; *Besbicus mirabilis,* which forms mottled, spherical galls on the underside of leaves; and *Neuroterus saltatorius,* which forms mustard-seed-like galls on lower leaf surfaces that drop in the fall and jump around like Mexican jumping beans caused by activity of the enclosed larvae (18,23).

Only incidental damage by animals has been noted on vegetative parts of Oregon white oak. Douglas squirrels and western gray squirrels sometimes debark small branches infested by gall wasp larvae (64). Damage is scattered and may involve as much as one-fourth of a tree's crown. Gophers and other burrowing animals, which are abundant on forest borders, damage some roots. Livestock inflict some trampling and feeding damage on young oaks.

Special Uses

The wood of Oregon white oak is dense, with specific gravity ranging from 0.52 to 0.88 when ovendry (66), has moderate strength in static bending tests, but does not absorb shocks well (47). It rates high in compression and shear strength and is outstanding among 20 northwestern woods in tension and side hardness tests (47). The heartwood is at least as durable as that of white oak *(Quercus alba)* (58). Pallets made from Oregon white oak compare favorably in strength with those made from other species (66) and are higher in withdrawal resistance for nails or staples (41).

Specialty items, fenceposts, and fuel are now the primary uses of Oregon white oak. The wood is considered one of the best fuels for home heating and commands top prices. It has been used for flooring, interior finish, furniture, cooperage staves, cabinet stock, insulator pins, woodenware, novelties, baskets, handle stock, felling wedges, agricultural implements, vehicles, and ship construction (60). Consumption of Oregon white oak totaled 12 454 m^3 (2,185,000 fbm) exclusive of fuel in 1910 but has since declined (60).

Although Oregon white oak is not grown commercially for landscape purposes, scattered native trees, groves, and open stands are highly valued scenic assets in wildland, farm, park, and urban areas (35,42,49,56). Mistletoe is a scenic growth on Oregon white oaks that is collected and sold as a decorative and festive minor product.

Until recent times, meal or mush made from acorns of many oaks (including Oregon white oak) was a common Indian food (35,71,81). When crops were heavy, white oak acorns were also gathered and stored by local ranchers for feed, mainly for hogs. Livestock forage for acorns and prefer those of white oaks to black oaks (81). The leaves have a protein content of 5 to 14 percent (35,56), and Oregon white oak is rated as good to fair browse for deer but poor for domestic livestock.

Oregon white oak woodlands and forests provide favorable habitat for wildlife (6) and also produce substantial amounts of forage for sheep and cattle (33). Infrequently, cattle are poisoned by foraging on oak; one instance involving Oregon white oak has been documented (37).

Oak-dominated forests in the western part of the Willamette Valley in Oregon have a higher diversity of birds in all seasons than adjacent conifer forests (3). Oregon white oak and ponderosa pine-Oregon white oak associations are preferred brood habitats for Merriam's wild turkey in south-central Washington (39).

Greenhouse experiments have shown that Oregon white oak is a good host for the gourmet truffle, *Tuber melanosporum* (43). The feasibility of managing Oregon white oak stands for truffle production, as many oak stands are managed in Europe, is being investigated.

Genetics

Though Oregon white oak populations in Washington are disjunct and scattered, the chemical and morphological characteristics of their foliage are similar (71). Genetic differences appear so minor that seed distribution from a common source by Indians has been postulated. Ecotypic variation was observed in top and root growth of young seedlings from seed collections made from Corvallis, OR, southward (43). First-year seedlings from northern sources were taller and heavier.

Quercus garryana hybridizes naturally with four other oaks. *Quercus x subconvexa* Tucker *(Q. durata x garryana),* a small tree found in Santa Clara and Marin Counties, CA, is noteworthy because of its morphologically dissimilar parents-*Q. garryana* is a deciduous tree, *Q. durata* an evergreen shrub, and the hybrid is tardily deciduous (74). *Quercus* x *howellii* Tucker *(Q. dumosa* x *garryana)* is also a small tree found in Marin County and a hybrid between a deciduous tree and an evergreen or tardily deciduous shrub or tree. *Quercus* x *eplingii* C. H. Muller *(Q. douglasii* x *garryana),* a tree with deciduous leaves, is found in Lake and Sonoma Counties, CA (75). Hybrids between *Q. garryana* and *Q. lobata* are also found in Sonoma County (4).

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Introductory

SPECIES: Quercus garryana

ABBREVIATION :
QUEGAR
QUEGARB
QUEGARG

SYNONYMS :
NO-ENTRY

SCS PLANT CODE :
QUGA4
QUGAB

COMMON NAMES :
Oregon white oak
Brewer oak
Garry oak
shin oak
Oregon oak
white oak
post oak

TAXONOMY :
The currently accepted scientific name of Oregon white oak is Quercus garryana Dougl. ex Hook. [32,52]. Recognized varieties are as follows:

Quercus garryana var. garryana
Quercus garryana var. breweri (Engelm.) Jeps. (Brewer oak) [10,37,52]
Quercus garryana var. semota Jeps. [10,38]

Varieties breweri and semota are scrub forms of Oregon white oak. The variety semota is not recognized by some authorities, who claim there are no distinguishing morphological differences between it and the variety breweri [13,51]. The main focus of this paper will be upon Quercus garryana variety garryana. Brewer oak will be discussed where relevant information is available. Following the classification scheme of Tucker [51], the varieties breweri and semota will be treated as synonyms for Brewer oak.

Oregon white oak hybridizes with the following species:

x Q. dumosa (California scrub oak): Q. X howellii Tucker [32,51]
x Q. durata (leather oak): Q. X subconvexa Tucker [32,51]
x Q. douglasii (blue oak): Q. X eplingii C. H. Muller [6,32,51]
x Q. lobata (valley oak) [51]

Brewer oak hybridizes with Q. sadleriana (Sadler oak) [51].

LIFE FORM :
Tree, Shrub

FEDERAL LEGAL STATUS :
No special status

OTHER STATUS :
NO-ENTRY

COMPILED BY AND DATE :
Janet L. Howard, July 1992

LAST REVISED BY AND DATE :
NO-ENTRY

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Rocky Mountain Research Station, Fire Sciences Laboratory (Producer).
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Species Index
FEIS Home

DISTRIBUTION AND OCCURRENCE

SPECIES: Quercus garryana

GENERAL DISTRIBUTION :
Oregon white oak is distributed along the Pacific Coast from southwestern British Columbia, including Vancouver Island, south through western Washington and Oregon to the Coast Ranges and the Sierra Nevada in southern California [4,32,38].

Brewer oak occurs in the higher elevations of the Coastal, Klamath, Cascade, and Transverse Ranges, and the Sierra Nevada [38,51].

ECOSYSTEMS :
FRES20 Douglas-fir
FRES21 Ponderosa pine
FRES22 Western white pine
FRES23 Fir - spruce
FRES24 Hemlock - Sitka spruce
FRES27 Redwood
FRES28 Western hardwoods
FRES34 Chaparral - mountain shrub
FRES35 Pinyon - juniper
FRES42 Annual grasslands

STATES :
CA OR WA BC

ADMINISTRATIVE UNITS :
CRLA MORA REDW SAJH WHIS YOSE

BLM PHYSIOGRAPHIC REGIONS :

1 Northern Pacific Border
2 Cascade Mountains
3 Southern Pacific Border
4 Sierra Mountains

KUCHLER PLANT ASSOCIATIONS :

K001 Spruce - cedar - hemlock forest
K002 Cedar - hemlock - Douglas-fir forest
K003 Silver fir - Douglas-fir forest
K004 Fir - hemlock forest
K005 Mixed conifer forest
K006 Redwood forest
K009 Pine - cypress forest
K010 Ponderosa shrub forest
K011 Western ponderosa forest
K012 Douglas-fir forest
K013 Cedar - hemlock - pine forest
K020 Spruce - fir - Douglas-fir forest
K023 Juniper - pinyon woodland
K026 Oregon oakwoods
K028 Mosaic of K002 and K026
K029 California mixed evergreen forest
K030 California oakwoods
K033 Chaparral
K034 Montane chaparral
K048 California steppe

SAF COVER TYPES :

205 Mountain hemlock
211 White fir
213 Grand fir
215 Western white pine
220 Rocky Mountain juniper
221 Red alder
224 Western hemlock
226 Coastal true fir - hemlock
227 Western redcedar - western hemlock
228 Western redcedar
229 Pacific Douglas-fir
230 Douglas-fir - western hemlock
231 Port-Orford-cedar
232 Redwood
233 Oregon white oak
234 Douglas-fir - tanoak - Pacific madrone
238 Western juniper
241 Western live oak
243 Sierra Nevada mixed conifer
244 Pacific ponderosa pine - Douglas-fir
245 Pacific ponderosa pine
246 California black oak
248 Knobcone pine
249 Canyon live oak
250 Blue oak - Digger pine
255 California coast live oak

SRM (RANGELAND) COVER TYPES :

NO-ENTRY

HABITAT TYPES AND PLANT COMMUNITIES :

Oregon white oak occurs in open savannas or in monospecific closed-canopy stands. It is also found in mixed stands with conifers or other broad-leaved trees [13]. The following classifications list Oregon white oak as a dominant species:

Preliminary plant associations of the southern Oregon Cascade Mountain Province [5]
Association types in the North Coast Ranges of California [15]
Oak woodland [24]
Foothill oak woodlands of the interior valleys of southwestern Oregon [42]
Mixed evergreen forest [45]
Plant associations within the interior valleys of the Umpqua River Basin, Oregon [46]
Vegetation of the bald hills oak woodlands, Redwood National Park, California [48]
The Quercus garryana forests of the Willamette Valley, Oregon [50]
The redwood forest and associated North Coast forests [55]

Brewer oak forms dense, extensive pure stands. The "shin oak" communities of southern California are dominated by this variety [15,30]. The following classifications list Brewer oak as a dominant species:

Terrestrial natural communities of California [30]
Association types in the North Coast Ranges of California [15]

MANAGEMENT CONSIDERATIONS

SPECIES: Quercus garryana

WOOD PRODUCTS VALUE :
Oregon white oak has no current use except as fuelwood. It is highly prized for this purpose. The heat output of Oregon white oak is rated as high; it produces few sparks and has moderate ease of splitting [29].

IMPORTANCE TO LIVESTOCK AND WILDLIFE :
Oregon white oak woodlands are important for livestock and wildlife. The oaks are a critical food and nesting source for acorn woodpeckers living in the Oregon white oak cover type [12]. This cover type provides excellent hunting opportuniy for raptors [5]. The acorns are eaten by black-tailed deer, pig, black bear, and various rodents, small nongame birds, and gamebirds [13,23]. Gamebirds consuming the acorns include wood duck, Merriam's wild turkey, pigeon, dove, and valley and mountain quail [13,34]. Acorns are also consumed by sheep and cattle [13,18]. Oregon white oak is browsed by black-tailed deer and all classes of livestock [13,18]. Sprouts are preferred over other growth [44].

Brewer oak is heavily to moderately browsed by black-tailed deer. It is the primary summer diet item of deer in Glenn County, California [44].

PALATABILITY :
New shoots are highly palatable to deer and all classes of livestock. The palatablity of mature Oregon white oak browse in California has been given the following rating [44]:

deer:	good to fair
cattle:	poor to useless
sheep:	poor to useless
goats:	poor to useless
horses:	useless

NUTRITIONAL VALUE :
Protein levels of Oregon white oak leaves in California vary from 5.2 percent in November to 11.6 percent in October [9,44].

COVER VALUE :
Oregon white oak is the preferred forage and nesting cover of the black-capped chickadee, white-breasted nuthatch, Bewick's wren, bushtit, and orange-crowned, MacGillivray's, and Wilson's warblers [2]. Oregon white oak and Oregon white oak-ponderosa pine (Pinus ponderosa) associations are preferred brood habitats for the Merriam's wild turkey in south-central Washington [35].

VALUE FOR REHABILITATION OF DISTURBED SITES :
Oregon white oak is useful for watershed and wildlife habitat restoration. Its deep, extensive root system helps stabilize steep slopes in watershed areas [13]. It has been used in western Washington for restoration of degraded grassland habitat [3]. Trees are generally established from fall acorn plantings. Collection and cultivation methods have been detailed [14,39].

Brewer oak often produces large masts, but acorns are difficult to collect due to the dense, brushy stands formed by this variety [13].

OTHER USES AND VALUES :
Oregon white oak is a highly valued ornamental [13].

Native Americans used Oregon white oak acorns for making acorn meal [13].

OTHER MANAGEMENT CONSIDERATIONS :
Oregon white oak is in decline throughout its range [7,16,27,49]. This species is regenerating poorly, and many Oregon white oak woodlands are being invaded by conifers [2,6,13,28]. In the Willamette Valley, Oregon, where Oregon white oak has historically shown its best growth, the total cover provided by this tree has been reduced from 50 percent in 1850 to 24 percent in 1955 [26]. Saplings there are stunted and under insect attack [16]. Unless steps are taken to reduce present trends, Oregon white oak will continue to become a less prominent member of the western flora. Increasing Oregon white oak populations necessitates removal of competing conifers by burning (see Fire Management Considerations) or other methods. Invading conifers in the bald hills of Redwood National Park, California, were cut or girdled in order to reclaim Oregon white oak woodland [41].

Damaging agents: The white pocket root and butt rot (Polyporus dryophilus) and the shoestring root rot (Armillaria mellea) are the most

damaging fungi infecting Oregon white oak. With the exception of acorn-feeding insects, insect damage is usually not severe in this species. The larvae of the filbert worm (Melissopus latiferreanus) and the filbert weevil (Curculio occidentalis) sometimes destroy a considerable portion of a year's mast before acorns ripen. Oregon white oak is frequently infested with mistletoe (Phoradendron flavescens) [13].

Timber production: Conifer seedlings planted under or near Oregon white oak often show poor establishment; the mychorrhizal fungi associated with Oregon white oak are believed to be incompatible with conifers [1]. Conifer seedlings established in Oregon oak woodlands through natural regeneration usually flourish, however, possibly because the coniferassociated mychorrhizal fungi invade the woodlands simultaneuosly with their conifer hosts.

Softwood logging in the Willamette Valley has favored Douglas-fir seedling recruitment over seedlings of Oregon white oak [16].

BOTANICAL AND ECOLOGICAL CHARACTERISTICS

SPECIES: Quercus garryana

GENERAL BOTANICAL CHARACTERISTICS :
Oregon white oak is a drought-resistant, flood-tolerant, native, monoecious, deciduous tree ranging from 25 to 90 feet (7.6-27 m) high, and 24 to 40 inches (60-100 cm) in d.b.h. Acorns are from 0.8 to 1.0 inch (0.6-2.5 cm) long. Typically, the trunk supports stout, spreading branches and a rounded crown. The bark is thin and scaly. The root system consists of a deep taproot and a well-developed lateral system, making trees windfirm even in wet areas. Oregon white oaks may live to 500 years of age [4,20,44,54].

Brewer oak grows from 3 to 16 feet (1-5 m) in height [30].

RAUNKIAER LIFE FORM :
Phanerophyte

REGENERATION PROCESSES :
Sexual: Oregon white oak is wind pollinated. Acorns develop in 1 year. Masts may be heavy but are irregular. The age of sexual maturity, the age of maximum production, and the average number of acorns produced have not been reported. Acorns are disseminated by gravity or animals. Migrating band-tailed pigeons may disseminate acorns over great distances [13]. Acorn predation is high; often the entire mast is consumed [4]. Some acorns are buried by seed-caching scrub jays, magpies, and various rodents. The viability of fresh acorns has been tested at 75 percent [39]. Fresh acorns germinate immediately under warm, moist conditions. Germination is hypogeal, with initial growth concentrated on development of a taproot. Shoot development is relatively slow; seedlings take 10 years or more to attain 3.3 feet (1

m) in height [13,48]. Seedling survival is low in sod or heavy duff [4]. It is speculated that exotic annual grasses outcompete Oregon oak seedlings for water and light, but experimental results to date are inconclusive [7]. Many seedlings are killed by browsing livestock, deer, or rodents. Pocket gopher frequently destroy young roots [13].

Vegetative: Oregon white oak sprouts from the trunk and root crown following cutting or burning. Some sprouts that arise after burning resemble rhizomes in appearance and growth habit. They originate from the root crown and extend several meters before emerging from the humus [41]. Sprouts grow rapidly; 3-year-old sprouts in Humbolt and Trinity Counties, California, averaged 9.2 feet (2.8 m) in height [36]. The sprouting ability of Oregon white oak declines with age. Mature oaks may be weak sprouters or fail to sprout altogether [25].

SITE CHARACTERISTICS :

Soils and topography: Oregon white oak can grow on a wide variety of sites but is usually outcompeted on better sites. It typically occurs on poor, exposed or droughty locations such as inland valleys and foothills or rocky ridges. It also occurs on poorly drained areas with a shallow water table or with standing water for part of the year. Soil texture is characteristically clay, but the oak grows in gravelly or sandy loam as well. Soil pH ranges from 4.8 to 5.9. Slopes may be steep but are typically gentle (less than 30 percent) [13].

Elevation: Oregon white oak grows from sea level to 5,000 feet (1,524 m) in elevation [13,37].

Brewer oak grows from 3,000 to 7,500 feet (914-2,286 m) in elevation [13,30].

Climate: Oregon white oak grows in diverse climates, ranging from the cool, humid conditions near the coast to the hot, dry environment of inland valleys and foothill woodlands. The species can endure temperature extremes from -30 to 166 degrees Fahrenheit (-34 to 47 deg C). Average annual precipitation ranges from 103.5 inches (262 cm) at Cougar, Washington to 10.6 inches (30 cm) in the Tehachapi Mountains of California [13].

Plant associates: Overstory associates not listed under DISTRIBUTION AND OCCURRENCE include grand fir (Abies grandis), Pacific yew (Taxus brevifolia), incense-cedar (Libocedrus decurrens), western redcedar (Thuja plicata), California bay (Umbellularia californica), bigleaf maple (Acer macrophyllum), river birch (Betula occidentalis), and tanoak (Lithocarpus densiflorus) [11,13,50].

Shrub associates include over 50 species. Some of these are manzanita (Arctostaphylos spp.), buckbrush (Ceanothus cuneatus), English ivy (Hedera helix), poison-oak (Toxicodendron diversilobum), thimbleberry (Rubus parviflorus), California huckleberry (Vaccinium ovatum), and tall Oregon-grape (Mahonia aquifolium) [13].

Ground cover associates are numerous. They include bluebunch wheatgrass (Pseudoroegneria spicata), springgold (Crocidium multicaule), California toothwort (Dentaria californica), blue wildrye (Elymus glaucus), threadleaf phacelia (Phacelia linearis), and Kentucky bluegrass (Poa pratensis) [13].

SUCCESSIONAL STATUS :

Oregon white oak is somewhat shade tolerant. It can reproduce adequately under its own shade but is intolerant of overtopping by

conifers [13]. Oregon white oakwoods are fire climax and are seral to Douglas-fir (Pseudotsuga menziesii), grand fir, or redwood (Sequoia sempervirens) forests in the absence of fire [16,27,28,49]. On xeric sites unfavorable to conifers, Oregon white oak is considered a climax species [20].

SEASONAL DEVELOPMENT :
The following seasonal development was reported for Oregon white oak in the Willamette Valley, Oregon [13]:

catkins emerge:	March - June
leaves emerge:	March - June
stems lengthen:	March - June
acorns ripen:	August - November
acorns dispersed:	September - November

FIRE ECOLOGY

SPECIES: Quercus garryana

FIRE ECOLOGY OR ADAPTATIONS :
Fire ecology: Historically, Oregon white oak was subjected to a fire regime of low-severity surface fires occurring every few years. A study in the Oregon white oak woodlands of Humbolt Redwoods State Park, California, revealed a history of fire every 7.5 to 13.3 years during the presettlement era [47]. Frequent fire resulted in the open savannas typical of presettlement times in the Willamette Valley, Oregon, and the bald hills of California [49]. Dead woody fuels were scant, but flashy fuels (grasses) were abundant and dry early in summer. The fire spread rate was moderated by the gentle topography typical of this cover type. Fire seldom spread into adjacent coniferous forests [5].

Plant adaptations: Oregon white oak has adapted to low- to moderate-severity fire by sprouting from the bole, root crown, and roots [25,36,48]. Sprouts of this species grow far more rapidly than do seedlings. Young trees not subjected to periodic top-kill by fire followed by sprouting often do not attain sexual maturity before they succumb to herbivory [48]. Initial establishment of seedlings is somewhat dependent on fire also. Although this species does not require a bare mineral seedbed, seedling recruitment is greatly enhanced when the litter layer has been removed by fire [4].

POSTFIRE REGENERATION STRATEGY :
Tree with adventitious-bud rootcrown/ soboliferous species root sucker
Ground residual colonizer (onsite, initial community)
Secondary colonizer - offsite seed

FIRE EFFECTS

SPECIES: Quercus garryana

IMMEDIATE FIRE EFFECT ON PLANT :
Crown fire generally kills this species. Moderate-severity surface fire rarely kills large trees, but smaller oaks may be killed or suffer severe cambium damage [13]. Low-severity surface fire rarely harms mature trees, but seedlings and saplings are commonly top-killed. Animal-buried acorns are usually not affected by fire [41,49].

DISCUSSION AND QUALIFICATION OF FIRE EFFECT :
NO-ENTRY

PLANT RESPONSE TO FIRE :
Most researchers report vigorous sprouting of top-killed Oregon white oak [17,36,41,43,53], although at least one researcher [25] has classified this species as a weak sprouter. Sugihara and Reed [48] report more vigorous sprouting in 40-year-old than in 70-year-old oaks. Studies conducted on young, even-aged stands show good postfire recovery of these trees. Oregon white oak top-killed by fall prescribed burning in Shasta and Tehema Counties, California, exhibited vigorous sprouting during the first postfire growing season [53]. In Humbolt and Trinity Counties, California, three-year-old sprouts had grown above the browse line [36].

In the absence of further fire, these sprout clumps form dense, even-aged stands. Most Oregon white oak woodlands of today are of this type due to fire supression. When subjected to further fire, however, weaker meristematic tissue is killed, and individual root crowns produce fewer sprouts per clump with each fire. Continued periodic fire ultimately results in an open savanna with widely scattered, large oaks [27].

Fire research on Brewer oak is extremely limited. One study followed the postfire recovery of this variety for 3 years after the Three Creeks Burn in Humbolt County, California. This "intense" wildfire top-killed most oak shrubs. At the end of postfire year 1, sprouts varied in height from 4.4 to 11.2 feet (1.3-3.4 m), with an average of 18 sprouts per clump. At postfire year 3, many of the weaker sprouts had died, and sprouts were reduced to an average of 10 sprouts per clump. Sprout height at postfire year 3 was not recorded [43].

DISCUSSION AND QUALIFICATION OF PLANT RESPONSE :
NO-ENTRY

FIRE MANAGEMENT CONSIDERATIONS :
Fire appears to be the dominant controlling factor involved in converting invading coniferous forests back to Oregon white oak

woodland. If a conifer forest is the objective, managers can simply allow young invading conifers to grow. In order to halt conifer establishment and facilitate oak regeneration, a minimum frequency of prescribed burning every 5 years is recommended. Ideally, prescribed fire should be set annually. When existing conifers are 10 feet (3 m) or more in height, oak woodlands can be restored by removing conifers by cutting or girdling. A program of prescribed burning is then necessary for long-term maintenance [48].

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SPECIES: Quercus garryana

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II. SUPPLEMENTAL INFORMATION REQUIRED TO BE SUBMITTED IN SUPPORT OF THE PROPOSED WOODLOT LICENCE PLAN

1. REVIEW AND COMMENT

ADVERTISING

A copy of the advertisement placed in the Campbell River Mirror and the Comox Valley Record on July 1st, 2005 is included in this supplemental information section.

REFERRALS

This plan has been referred to the following agencies and/or groups either directly or via the Ministry of Forests:

Campbell River First Nation
1400 Weiwaikum Road
Campbell River, BC, V9W 5W8
Ph: 286-6949, Fax: 287-8838

Cape Mudge First Nation
PO Box 220
Quathiaski Cove, BC, V0P 1N0
Ph: 285-3316, Fax: 285-2400

Comox First Nation
3320 Comox Road
Courtenay, BC, V9N 3P8
Ph: 339-4545, Fax: 339-7053

Sliammon First Nation
RR2, Sliammon Road
Powell River, BC, V8A 4Z3
Ph: (604) 483-9646
Fax: (604) 483-9769

Qualicum First Nation
5850 River Road
Qualicum Beach, BC, V9K 1Z5
Ph: 757-9337, Fax: 757-9898

Homalco First Nation
1218 Bute Crescent
Campbell River, BC, V9H 1G5
Ph: 923-4979, Fax: 923-4987

Hamatla Treaty Society
1441-A Island Highway
Campbell River, B.C. V9W 2E3
Ph: 287-9460, Fax: 287-9469

Ministry of Water, Land and Air Protection
Karen Morrison (Nanaimo)
Ph: 751-3216
Re: Guide-Outfitter certificate holder #100572

COPY OF WRITTEN COMMENTS RECIEVED

All comments have been reviewed by the licensee, Dave Brown RPF and Wolfram Wollenheit RPF. The written comments received are included in this supplemental information section.

REVISIONS MADE AS A RESULT OF COMMENTS RECIEVED

All revisions made in this final submission have been listed in the accompanying cover letter.

2. EFFORTS MADE TO MEET WITH FIRST NATIONS

Included in this supplemental information section is a copy of the 'First Nations Information Sharing Checklist' an external consultation checklist provided by the Campbell River forest district. Included with the checklist for are all letters, minutes and correspondence.

3. EXEMPTIONS

N/A

4. RATIONALE IN SUPPORT OF PROPOSED ALTERNATIVE PERFORMANCE REQUIREMENTS

STOCKING STANDARDS

Alternatives stocking standards are proposed given the location and the licensee's full intent to manage the woodlot as a demonstration forest, to facilitate intensive forest management and to improve site productivity and species/product diversity. Additionally, existing standards in respect to the use of broadleaf species lack measurable and enforceable standards for implementation and are therefore defined further within the alternative stocking standards. Full details and listing of the stocking standards are provided in Appendix 3.

All areas of harvest will undergo pre-harvest mapping as per Section 33 of the Woodlot Licence Planning and Practices Regulation. At that stage the fundamental decision will be made if either conifer or a broadleaf standard will apply and the Standard Unit ID will be assigned.

Forest health concerns raises additional issues as to the appropriateness of the defaults in areas where root rot (e.g. *Phellinus weirii)* impacts the regeneration and long-term health and productivity of the preferred species. The proposed alternative stocking standards promote healthy stands that protect adjacent resources and values For example on infected zonal sites (01) adjacent to a S4 creek or recreational trail where stumping is not appropriate to control sediment or to maintain visual appearance. In these cases the establishment of Douglas-fir (preferred) may prove difficult and unsuited in the long-term due to re-infection.

The Chief Foresters stocking standards indicate black cottonwood (Act), red alder (Dr) and bigleaf maple (Mb) as being productive, reliable and feasible regeneration option on several site series within the CWHxm1. The attached Alternative Stocking Standards will be used and includes the standards for both pure broadleaf stands and mixed woods regeneration. The use of broadleaf is proposed in consideration of the Chief Foresters

memorandum dated August 22nd, 2000 and the supporting note 'Common Principles for the Management of Red Alder within the Coast Forest Region' dated August, 2004. The management for broadleaf species is proposed on a limited scale and is consistent with the management assumptions adopted in the last Annual Allowable Cut (AAC) calculation.

The broadleaf standards are also supported by the following research literature:

- Hibbs *et al.* The Biology and Management of Red Alder (1994),
- E.B. Petersons *et al.* FRDA Report 250 – Black Cottonwood and Balsam poplar manager's handbook for British Columbia (1996).
- L. Sigurdson *et al.* 2nd draft report on Weyerhaeuser's Red Alder Management Practices (1998),
- P.J. Courting *et al.* Forest Research Extension Note 016 - Red Alder management trials in the Vancouver Forest Region (2002).

The minimum density post-spacing shown corresponds to the values recommended in the Establishment to Free-growing Guidebook for the VFR– i.e. the same as the minimum-stocking standard for conifer stands.

Higher stocking is noted for the deciduous stands to ensure self-pruning and may include a conifer component. The maximum density post-spacing has been increased to allow for two stage spacing entries in order to manage snow press, blow down risks and provide the opportunity to capture the small-diameter resource.

The minimum height criterion is based on the tallest conifer standard of the particular site series since the listed hardwoods are at least as rapid growing as their conifer counterpart. If a cedar or Sitka spruce understory is planted in addition to the full hardwood stocking, then the natural pruning of the alder would be enhanced. However, the stand's status will only be measured using the broadleaf standards. The removal of the alder at harvest age is operationally possible, while leaving a fully stocked, semi-mature conifer pole stand behind.

Damage criteria for broadleaf species have not been established. No significant insect or disease outbreaks have been recorded for existing alder trials to date. General free-growing criteria will be adopted and damaged assessed by the survey technician at the time of the survey. Well-spaced stems will be of good form, health and vigour. Species specific damage criteria will be used upon development.

For a maximum combined area of 1% of the woodlot licence area the management of Garry Oak as native species is feasible. Consistent with the management objectives of the woodlot licence, the planting and sowing of a small amount of Garry is intended to increase the species and product diversity as well as to function as a gene resource. The woodlot is within the northern distribution limit of this species and its occurrence has been reduced due to the encroachment of Douglas-fir forest types as a result of the historic logging and management activities. Since there is currently no active regeneration effort in British Columbia for this species, the long-term presence of Garry Oak in this area is at risk.

As demonstration woodlot one goal is to showcase the cultivation of Garry Oak for timber production. The seed will be collected from high quality northern proveniences,

such as the Garry Oaks on Oak Ridge Farms. In terms of silvics, management and wood applications, please refer to the excerpts of the USDA (Forest Service) Handbook 654, “Silvics of North America” and other publications (Appendix 4)

The stocking standards take into account that it is reported that Garry Oak occurs on very dry to moist sites with a nutrient supply from poor to rich. As on of the slow growing species, the minimum height requirement has been set to 1.5 m, which is above the 1.25 m for Lodgepole Pine on very dry sites. It needs to be grown in pure stands, to avoid competition from faster growing species. Being shade intolerant and susceptible to frost damage at young age, considerations should be given to patch size, light regime and radiation cover. Browse protection is certainly required, as it would be selected by deer as a ‘rare species’ diet.

The stocking standards for specified areas are consistent with the default but for one exception. In the case of deciduous stands established under this WLP where initial stocking densities will be 1000-1200 sph (see appendix 3 alternative stocking standards), and where these stands may be in the future subject to commercial thinning, the target stocking for standards will be as follows:

These represent a reduction in the targets and minimums for tree layer 1 as compared to the default standards. The reason for this is that the default standards have been developed for conifer stands, which have different crown characteristics from deciduous species. Under deciduous management regimes, while initial densities will be higher to promote self-pruning and encourage stem development, lower target thinning densities in managed stands may be applied during later stages of the rotation.