Acoustic Velocity Sampling of Western Hemlock on Vancouver Island

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Prepared for

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Summary

Phase I

Phase I of this project involved record acoustic velocity (AV) data from a variety of mature second growth western hemlock (Hw) stands on Vancouver Island to begin to develop an understanding of the range and variability of western hemlock AV values as they relate to associated stand and site information (site index, stand density, slope, aspect, elevation, etc.)

Seventy-two mature second growth western hemlock stands were identified as potential candidates for sampling (twenty-three stands near Campbell River, twenty-two stands near Jordan River, and twenty-seven stands west of Port Alberni).

Plots were subsequently established in ten of these stands and AV readings were obtained using the ST300 device for fifty-one trees in each plot. Stand and site characteristics were also recorded for each stand.

Vehicular access to the remaining potential sample sites was also determined and is summarized in Appendix 1.

Phase II

Phase II of this project involved using the ST300 device to record AV data from a single site immediately prior to harvest and then having staff from FPInnovations sample the same trees (as logs on the ground) using the HM200 AV device.

Four plots (fifty-one trees per plot) were established in a cut-block in the Lower Adam operating area of Western Forest Products' Mid Island forest operation prior to harvesting. Acoustic velocity was measured on 204 standing trees within these plots using the ST300 device. Since then personnel from FPInnovations have measured AV from some of the same trees (logs) after they are cut using the HM200 device. Their ultimate objective is to attempt to determine if relationships exist between AV data obtained by the ST300 and HM200 devices and final characteristics of wood strength and stiffness (MoE, MoR for example).

Acoustic velocity and diameter at breast height (DBH) were recorded for each tree sampled in both study phases. Overall descriptive statistics are as follows: AV readings ranged from 3.5 to 5.7 with an average value of 4.6. Tree diameters (DBH) ranged from 13.2 cm to 84.1 cm with an average diameter of 35.8 cm. Further analysis of this data as it relates to stand and site characteristics and strength and stiffness is being performed by staff at the Canadian Wood Fibre Centre (Canadian Forest Service) and FPInnovations respectively.

Objectives

Phase I

1. Use a geographic information system (GIS) to locate and identify potential western hemlock-leading mature second growth stands on Vancouver Island suitable for performing standing tree Acoustic Velocity (AV) sampling using the ST300 device.
2. Establish (3) field plots (50 trees per plot) and record AV data, diameter at breast height (DBH) for each (western hemlock) tree within those plots. Record ecological information for each plot to assist in subsequent stratification and analysis.
3. Determine logistical access and opportunities for field sampling using the ST300 device at the remaining sites.

Phase II

Work together with FPInnovations personnel to locate a site (near harvest) where standing western hemlock trees could first be sampled with the ST300 device and then sampled again on the ground with the HM200 device. FPInnovations personnel will then attempt to follow the same logs throughout the milling process with the intent of performing machine stress rating (MSR) testing on the finished dimensional lumber products at their facility n Vancouver.

Methods and Results

Phase I

A GIS analysis was performed to identify potential stands in the following three geographic areas: Jordan River, Campbell River, and Port Alberni. Stands with western hemlock as the leading species were first identified and then filtered to create maps of potential stands in the following two age classes: 61 – 70 years and 71 – 80 years. Potential sites were selected from these maps based on suitable size and proximity to primary roads. Sites which were too small or too narrow were not selected to minimize edge effects. Selected sites were numbered sequentially within each geographic area and labelled with an area abbreviation code and plot number (Table 1).

Table 1. Number of Potential Stands Identified by GIS Query

Geographic Area	Abbreviation	Sites Identified	Sample Labelling
Jordan River	JR	22	JR-001, JR-002, etc.
Campbell River	CR	23	CR-001, CR-002, etc.
Port Alberni	PA	27	PA-001, PA-002, etc.

A complete list of sites is included in Appendix 1.

Once potential sites were identified on the maps a field reconnaissance was done to locate 3-4 candidate stands in each geographic area in which to perform the field data collection. It quickly became apparent that in order to be able to access sites by vehicle, that sites had to be located on either a main line, primary branch road, or along a route where road recent upgrades to road

surface and vegetation had recently occurred. The following information was recorded for each plot:

1. 1:20,000 map sheet reference
2. Road name (closest road for access)
3. Access
4. Species composition of stand (from forest cover maps and inventory data)
5. Leading coniferous species
6. Percent western hemlock (if available). Note that the GIS queries were structured to identify stands with western hemlock (Hw) as the leading species.
7. UTM zone (NAD83)
8. UTM easting and northing (measured with a Garmin 60CSx GPS receiver);
9. Elevation (measured with a Garmin 60CSx GPS receiver);
10. BEC variant
11. Age class (61-70 years or 71-80 years)
12. Date sampled
13. Slope (%)
14. Stand Height (height of representative co-dominant tree measured with Vertex sonar measuring device +/- 1m);
15. Aspect (degrees);
16. Plot density was determined by tallying the number of live trees in 500m2 plot to provide an estimate of stand density;
17. Site index from WFP forest inventory data
18. Representative photos were taken of each plot;
19. Notes on access, associated stand information, and predominant ground vegetation species were also recorded for most plots.

Three plots were established in the Jordan River Area, four plots were established in the Campbell River area, and three plots were established in the Port Alberni area (Table 2).

Table 2. Plots sampled for acoustic velocity by general area and map sheet.

General Area	Plot	20K Map Sheet
Jordan River	JR-002	92C.050
Jordan River	JR-011	92C.050
Jordan River	JR-021	92B.041
Campbell River[1]	CR-007	92K.022
Campbell River	CR-008	92K.022
Campbell River	CR-012	92K.022
Campbell River	CR-023	92K.012
Port Alberni	PA-002	92F.017
Port Alberni	PA-003	92F.007
Port Alberni	PA-017	92C.097

[1] Note that all Campbell River plots are located on a single overview map not delineated by map sheet.

Most plots were located at least two tree-lengths from the road to minimize potential edge effects except in cases where stand shape was limiting (long, narrow stands between two roads). Plots were never located less than one tree-length from the road. The first tree in each plot was selected at random and then fifty-one western hemlock trees were systematically sampled in 4-5 adjacent rows of approximately ten trees per row. It was found useful to tie a piece of flagging tape around each tree as it was sampled to see the location of plot trees already sampled. The flagging tape was removed from all trees prior to leaving the site. A double band of pink research flagging tape was tied around most plot centre trees to assist in future re-location if necessary.

A standardized approach was made to attempt to sample each plot tree similarly. On sloped sites the uphill side of each tree was generally sampled unless an abundance of knots, branches, or defects occurred on this side of the tree in which case we sampled a "clearer" section of the bole of the selected tree. Trees with very poor form and/or major defect were rejected altogether. The ST300 transmitter was inserted ("tapped") into the sample tree at 45 degrees as instructed approximately 50-60 above ground level to avoid butt swell and flaring. The receiver prong was inserted ("tapped") into the sample tree as close to 1m above the transmitter as possible using ocular estimation (Photo 1). Distances between transmitter and receiver were always between 90 cm and 110 cm. The transmitter and receiver were then aligned and the distance reading between both devices was recorded. The transmitter was then tapped eight times as directed to obtain the AV reading.

The following parameters were recorded for each tree sampled:

1. Tree Number
2. Distance (cm) between ST300 transmitter and receiver;
3. Averaged AV reading from ST300 receiver (2 decimal places);
4. Tree diameter (cm) at 1.3 m above ground (DBH). Minimum diameter threshold was 12.5 cm;
5. Outside tree temperature (degrees C) was recorded at DBH for the first and every 10th subsequent tree sampled within a plot.

Photo 1. ST300 transmitter and receiver.

Descriptive Statistics

Table 3. Descriptive statistics for DBH and ST300 AV reading by plot.

		DBH			AV				Temp
Plot	n	Min.	Avg.	Max.	Min.	Avg.	Median	Max	C
JR-002	51	17.9	37.6	65.6	3.77	4.49	4.50	5.18	7.3
JR-011	51	18.2	42.5	84.1	3.81	4.53	4.58	5.03	4.3
JR-021	51	14.9	38.2	67.8	3.65	4.37	4.47	4.92	5.5
CR-007	51	16.6	34.0	50.6	3.52	4.48	4.53	5.16	3.1
CR-008	51	14.7	33.0	46.7	3.52	4.40	4.43	5.08	5.6
CR-012	51	17.9	36.9	77.2	3.83	4.51	4.50	5.06	3.6
CR-023	51	16.9	27.4	54.1	3.62	4.56	4.60	5.13	4.1
PA-002	51	13.6	28.1	44.4	3.73	4.66	4.75	5.04	9.1
PA-003	51	13.2	28.3	46.9	3.81	4.66	4.70	5.24	7.9
PA-017	51	18.9	33.3	46.1	3.82	4.60	4.64	5.10	2.1

A field review of all potential sites subsequently determined that of the seventy-two potential sites initially identified, that access is good and the following numbers of stands could easily be accessed for future sampling: Campbell River (6), Jordan River (7), and Port Alberni (20). These sites are listed and classified accordingly in Appendix 1 and marked on the associated maps.

Phase II

With the assistance of Western Forest Products' staff, a mature second growth western hemlock-dominated site was located in the Lower Adam area of that operation that was suitable for sampling standing trees with the ST300 and subsequent AV testing with the HM200. Western's operational designation of this bock was OP 49797.

Four, fifty-one tree plots were established at this site on January 15-16, 2010. Tree marking paint was used to mark each tree with an identification number, a continuous band around the stem to assist in re-location post-harvest, and a dot near ground level to identify stumps post-harvest if required. Acoustic velocity was measured and recorded using the ST300 for each of the 204 standing trees along with DBH and outside bark temperature. Plots were labelled LA49797A-D consecutively.

FPInnovations subsequently sampled as many of these same stems after harvest at roadside using the HM200 device. They were able to obtain HM200 AV data from 134 logs before they were sent to the mill. The mill study component of their work is scheduled for Thursday, April 15th. It will consist of running three batches through the mill, collecting specific lumber dimensions (2x4 and 2x6) and then taking these boards to their machine stress rating (MSR) testing facility in Vancouver. They will also collect woodchips from each of the three batches for other types of analysis.

Final Deliverables

The following deliverables have been provided:

1. PDF maps for each geographic area showing location of all potential and sampled stands. Map of plot locations at Lower Adam Phase II site;
2. Excel data file of plot data (DBH, AV values etc.) for all sites (Phase I and II);
3. List of sites (Appendix 1) grouped by field work and access status;
4. Reports for each stand (Appendix 2) sampled listing parameters identified above;
5. Photos of plots sampled in Phase I.

Appendix 1 - 2009/10 Acoustic Velocity Sites

Campbell River n= 23

AV Sampling Completed

Site ID	Road	BEC	Map	Access	Remarks
CR-007	BT 1500	CWHxm2	92K.022	Good	Access off spur off BT Main. Plot is just below CWHmm1.
CR-008	Stove Creek Main	CWHxm2	92K.022	Good	Falling boundary ribbon above. Larger Fd on site.
CR-012	Spirit Lake Main	CWHxm2	92K.022	Good	Falling boundary ribbon around plot. Bigger Fd on site. Plot is between Spirit lake main and Jurassic Main.
CR-023	Memekay Main	CWHxm2	92K.012	Good	Many small stems < 12.5 cm. Some big Fd on site. No access to south end of BT600 - deactivated and overgrown.

Field Checked

Site ID	Road	BEC	Map	Access	Remarks
CR-004	TL100	CWHvm1		Good	No access from A Branch (bridge out) but good access from Tlowlis Lake Main. Nice site…
CR-009	Hwy 19	CWHxm2		Good	Adjacent to highway 19.
CR-010	SL50	CWHxm2		Good	On Spirit Lake Main.
CR-011	Spirit Lake Main	CWHxm2		Good	Good access but small stand.
CR-013	LL100	CWHxm2		Good	Small diameter trees. Lots of blowdown in block. Small stand.
CR-017	BT600	CWHxm2		Good	Good access from BT 660.
CR-014	LL100	CWHxm2		Fair	Access at entrance to block overgrown. Requires walk-in to access. Blow-down observed in area.
CR-015	Spirit Lake Main	CWHxm2		Fair	Access from SL101 on south side of block. Cannot drive through stand.
CR-003	SR50	CWHxm2		Poor	Large ditch at road entrance. Scratchy alder.
CR-006	Venus 100	CWHmm1		Poor	Deep X-dithes along Venus 100. Long walk in.
CR-016	146L2E	CWHxm2		Poor	Road overgrow (WFP staff). Long walk in.
CR-021	Mem16A	CWHxm2		Poor	Access doubtful. Overgrown (WFP staff).
CR-022	BT600	CWHxm2		Poor	Small logs blocking road. Would require chain saw to access.
CR-001	M Branch	CWHvm1		No Access	M Branch deactivated. Entrance behind Island Timberlands gate.
CR-005	Can300	CWHxm2		No Access	Windfalls blocking road at Santa Maria Lake. (xm2/vm1 splt).
CR-018	BT662	CWHxm2		No Access	WFP staff.
CR-019	146SP15	CWHxm2		No Access	WFP staff.
CR-020	BT690	CWHxm2		No Access	Overgrown (WFP staff).
CR-002	Stowe Creek Main	CWHxm2		Unknown	Behind Dyer/above Camp. Access appears difficult due to old roads.

Yellow = AV sampled Green = good access Red = no access

Appendix 1 - 2009/10 Acoustic Velocity Sites

Jordan River n= 22

AV Sampling Completed

Site ID	Road	BEC	Map	Access	Remarks
JR-002	Off highway 14	CWHvm1	92C.050	Good	WFP sign on location "Planted 1946". Aspect estimated.
JR-011	North Main	CWHvm1	92C.050	Good	Gentle ridge top, undulating. Check elevations from contours. Raining.
JR-021	F Branch	CWHxm2	92B.041	Good	Rich site, stream nearby. Raining.

Field Checked

Site ID	Road	BEC	Map	Access	Remarks
JR-004	Highway 14	CWHvm1	92C.050	Good	Adjacent to highway 14.
JR-005	W31	CWHvm1	92C.050	Good	Adjacent to highway 14.
JR-012	North Main	CWHvm1	92C.050	Good	Adjacent to North Main.
JR-015	East Main	CWHvm2	92C.050	Good	Adjacent to and above East Main (through hydro R/W) up steep slope. BEC estimated from maps.
JR-016	East Main	CWHvm2	92C.050	Good	Adjacent to East Main. BEC estimated from maps.
JR-019	D3	CWHxm2	92C.050	Good	Private land - behind locked gate.
JR-030	E6	CHWvm2	92C.050	Good	New site picked up during field recce. Small polygon.
JR-010	W11	CWHvm1	92C.050	Fair	Long walk from highway or North Main.
JR-013	North Main	CWHvm1	92C.050	Fair	Easy walk in from gate at junction at North Main.
JR-014	Jordan River Main	CWHvm1	92C.050	Poor	Long walk in from gate at junction with North Main.
JR-001	W3	CWHvm1	92C.050	No Access	Behind old gravel pit between highway and ocean.
JR-003	W43	CWHvm1	92C.050	No Access	Bridge out on W42.
JR-006	W30	CWHvm1	92C.050	No Access	W branch is completely over-grown.
JR-007	W30	CWHvm1	92C.050	No Access	W branch is completely over-grown.
JR-008	W10	CWHvm1	92C.050	No Access	W10 does not exist.
JR-009	W10	CWHvm1	92C.050	No Access	W10 does not exist.
JR-017	E7A	CWHvm2	92C.050	No Access	Very long walk in from end of E7 across 2 streams. BEC estimated from maps.
JR-018	E210B	CWHxm2	92C.050	No Access	E200 does not exist any more.
JR-020	E340	CWHxm2	92B.041	Unknown	Behind locked gate on private land. Suspect access OK once gate key acquired.

Yellow = AV sampled Green = good access Red = no access

Appendix 1 - 2009/10 Acoustic Velocity Sites

Lower Adam (Phase II) n= 4

AV Sampling Completed

Site ID	Road	BEC	Map	Access	Remarks
LA49757-A	LA4A6A	CWHvm1	92L.049	Good	
LA49757-B	LA4A6A	CWHvm1	92L.049	Good	
LA49757-C	LA4A6A	CWHvm1	92L.049	Good	
LA49757-D	LA4A6A	CWHvm1	92L.049	Good	

Yellow = AV sampled Green = good access Red = no access

Appendix 1 - 2009/10 Acoustic Velocity Sites

Port Alberni n= 27

AV Sampling Completed

Site ID	Road	BEC	Map	Access	Remarks
PA-002	Bamfield Main	CWHxm2	92F.017	Good	On Bamfield Main near 12 km marker. Plot on small crest (convex). Larger Fd and small Cw on site. Elev from GIS.
PA-003	Corrigan Main	CWHxm2	92F.007	Good	77 years. Beside Corrigan Main. Plot is narrow strip between 2 roads (min. 1 tree length from edge). Trees are stunted by hemlock mistletoe. Elev from GIS.
PA-017	Harrison Creek Main	CWHvm1	92C.097	Good	Stand has been thinned about 20 years ago. Minor Fd and small Ba. Elev from GIS.

Field Checked

Site ID	Road	BEC	Map	Access	Remarks
PA-001	Underwood Cove Main	CWHxm2	92F.017	Good	Near 9 km. Scruffy looking timber (fair site).
PA-002B	Thomas Main	CWHxm2	92F.017	Good	Good access off Thomas Main. Between 11-12 km.
PA-004	Bamfield Main	CWHvm1	92F.007	Good	Near 18 km. on Bamfield Main.
PA-005	Hawthron Main	CWHvm1	92F.007	Good	Near Hawthorn Lake
PA-006	Hawthorn Main	CWHvm1	92F.007	Good	Hw/Fd mix, nice above road, steep below road.
PA-007	Bamfield Main	CWHvm1	92F.007	Good	Near 24 km. on Bamfield Main.
PA-008	Bamfield Main	CWHvm1	92C.097	Good	Steep access off mainline between 31-32 km.
PA-009	Carmanah Main	CWHvm1	92C.097	Good	Very small polygon (61 yrs.) near Camp "B".
PA-012	Carmanah Main	CWHvm1	92C.097	Good	Moderately steep and bluffy up from mainline.
PA-013	CR200	CWHvm1	92C.097	Good	
PA-014	Bamfield Main	CWHvm1	92C.097	Good	Down off mainline, thru DR and creek.
PA-015	Bamfield Main	CWHvm1	92C.097	Good	Nice access and stand above road.
PA-016	Harrison Creek Main	CWHvm1	92C.097	Good	
PA-018	Bamfield Main	CWHvm1	92C.096	Good	On Bamfield Mainline.
PA-019	Coleman Road	CWHvm1	92C.096	Good	Nice site.
PA-020	Bamfield Main	CWHvm1	92C. 096	Good	On Bamfield Mainline.
PA-021	Bamfield Main	CWHvm1	92C.096	Good	On Bamfield Mainline.
PA-024	Carmanah Main	CWHvm1	92C.087	Good	
PA-025	Caycuse Main	CWHvm1	92C.087	Good	
PA-026	North Fork Main	CWHvm1	92C.076	Good	Near Klanawa River. Long drive.
PA-022	Harrison Creek Main	CWHvm1	92C.097	Fair	Access currently blocked by small blow-down on road. Good road surface. Take small chain saw.
PA-023	Carmanah Main	CWHvm1	92C.087	Poor	CA700 aldered-in. Walk in to access stand.
PA-010	Francis Main	CWHvm1	92C.097	No Access	Washout on Fancis Main - long walk in.
PA-011	Francis Main	CWHvm1	92C.097	No Access	Washout on Fancis Main - long walk in.

Yellow = AV sampled Green = good access Red = no access

Appendix 2 - Acoustic Velocity Sample Plots

Operating Area:	Campbell River	AVID	CR-007

20K Map Sheet	92K.022	UTM Zone	10
Road	BT 1500	East	304,050
Access	Good	North	5,572,206
Species Comp		Elev (m)	404
Leading Species	Hw	BEC Variant	CWHxm2
Percent Hw		Age Class	71-80

Plot Information

Date Sampled	27-Nov-09	Aspect (degrees)	250
Slope (%)	15%	Density (per ha)	720
Codom Height (m)	34	Site Index	25

Tree Information

Temperature (C) 3.1 n 51 Species Hw

Diameter

Minimum	16.6
Average	34.0
Maximum	50.6

Acoustic Velocity

Minimum	3.52
Average	4.48
Median	4.53
Maximum	5.16
SD	0.36

Photos 0762-0765

Remarks Spur off BT Main. Plot is just below CWHmm1.

Vegetation Mahoner.

Appendix 2 - Acoustic Velocity Sample Plots

Operating Area:	Campbell River	AVID	CR-008

20K Map Sheet	92K.022	UTM Zone	10
Road	Stove Creek Main	East	307,478
Access	Good	North	5,571,059
Species Comp		Elev (m)	170
Leading Species	Hw	BEC Variant	CWHxm2
Percent Hw		Age Class	71-80

Plot Information

Date Sampled	28-Nov-09	Aspect (degrees)	210
Slope (%)	10%	Density (per ha)	600
Codom Height (m)	34	Site Index	27

Tree Information

Temperature (C) 5.6 n 51 Species Hw

Diameter

Minimum	14.7
Average	33.0
Maximum	46.7

Acoustic Velocity

Minimum	3.52
Average	4.40
Median	4.43
Maximum	4.43
SD	0.38

Photos 0769-0772

Remarks Falling boundary ribbon above. Larger Fd on site.

Vegetation Polymun, Hylospl, Mahoner.

Appendix 2 - Acoustic Velocity Sample Plots

Operating Area:	Campbell River	AVID	CR-012

20K Map Sheet	92K.022	UTM Zone	10
Road	Spirit Lake Main	East	306,494
Access	Good	North	5,569,317
Species Comp		Elev (m)	161
Leading Species	Hw	BEC Variant	CWHxm2
Percent Hw		Age Class	61-70

Plot Information

Date Sampled	27-Nov-09	Aspect (degrees)	200
Slope (%)	5%	Density (per ha)	660
Codom Height (m)	37	Site Index	35

Tree Information

Temperature (C) 3.6 n 51 Species Hw

Diameter

Minimum	17.9
Average	36.9
Maximum	77.2

Acoustic Velocity

Minimum	3.83
Average	4.51
Median	4.50
Maximum	5.06
SD	0.25

Photos 0766-0768

Remarks Falling boundary ribbon around plot. Bigger Fd on site. Plot is between Spirit lake main and Jurassic Main.

Vegetation Polymun

Appendix 2 - Acoustic Velocity Sample Plots

Operating Area:	Campbell River	AVID	CR-023

20K Map Sheet	92K.012	UTM Zone	10
Road	Memekay Main	East	305,442
Access	Good	North	5,561,651
Species Comp		Elev (m)	192
Leading Species	Hw	BEC Variant	CWHxm2
Percent Hw		Age Class	61-70

Plot Information

Date Sampled	28-Nov-09	Aspect (degrees)	
Slope (%)	0%	Density (per ha)	680
Codom Height (m)	28	Site Index	25

Tree Information

Temperature (C) 4.1 n 51 Species Hw

Diameter

Minimum	16.9
Average	27.4
Maximum	54.1

Acoustic Velocity

Minimum	3.62
Average	4.56
Median	4.60
Maximum	5.13
SD	0.33

Photos 0773-0779

Remarks Many small stems < 12.5 cm. Some big Fd on site. No access to south end of BT600 - deactivated and overgrown.

Vegetation Hylospl, Mahoner.

Appendix 2 - Acoustic Velocity Sample Plots

Operating Area:	Jordan River	AVID	JR-002

20K Map Sheet	92C.050	UTM Zone	10
Road	Off highway 14	East	415,818
Access	Good	North	5,366,967
Species Comp	H6C2F2	Elev (m)	203
Leading Species	Hw	BEC Variant	CWHvm1
Percent Hw	60%	Age Class	61-70

Plot Information

Date Sampled	20-Nov-09	Aspect (degrees)	200
Slope (%)	20%	Density (per ha)	960
Codom Height (m)	32	Site Index	33

Tree Information

Temperature (C) 7.3 n 51 Species Hw

Diameter

Minimum	17.9
Average	37.6
Maximum	65.6

Acoustic Velocity

Minimum	3.77
Average	4.49
Median	4.50
Maximum	5.18
SD	0.29

Photos 0736-0747

Remarks WFP sign on location "Planted 1946". Aspect estimated.

Vegetation

Appendix 2 - Acoustic Velocity Sample Plots

Operating Area:	Jordan River	AVID	JR-011

20K Map Sheet	92C.050	UTM Zone	10
Road	North Main	East	421,073
Access	Good	North	5,366,449
Species Comp	H6F2S2	Elev (m)	300
Leading Species	Hw	BEC Variant	CWHvm1
Percent Hw	60%	Age Class	61-70

Plot Information

Date Sampled	21-Nov-09	Aspect (degrees)	160
Slope (%)	10%	Density (per ha)	760
Codom Height (m)	37	Site Index	37

Tree Information

Temperature (C) 4.3 n 51 Species Hw

Diameter

Minimum	18.2
Average	42.5
Maximum	84.1

Acoustic Velocity

Minimum	3.81
Average	4.53
Median	4.58
Maximum	5.03
SD	0.32

Photos 0753-0757

Remarks Gentle ridge top, undulating. Check elevations from contours. Raining.

Vegetation

Appendix 2 - Acoustic Velocity Sample Plots

Operating Area:	Jordan River	AVID	JR-021

20K Map Sheet	92B.041	UTM Zone	10
Road	F Branch	East	427,131
Access	Good	North	5,362,579
Species Comp	H6F3D1	Elev (m)	175
Leading Species	Hw	BEC Variant	CWHxm2
Percent Hw	60%	Age Class	71-80

Plot Information

Date Sampled	21-Nov-09	Aspect (degrees)	170
Slope (%)	10%	Density (per ha)	700
Codom Height (m)	39	Site Index	36

Tree Information

Temperature (C) 5.5 n 51 Species Hw

Diameter

Minimum	14.9
Average	38.2
Maximum	67.8

Acoustic Velocity

Minimum	3.65
Average	4.37
Median	4.47
Maximum	4.92
SD	0.37

Photos 0758-0761

Remarks Rich site, stream nearby. Raining.

Vegetation Polymun.

Appendix 2 - Acoustic Velocity Sample Plots

Operating Area:	Port Alberni	AVID	PA-002

20K Map Sheet	92F.017	UTM Zone	10
Road	Bamfield Main	East	370,723
Access	Good	North	5,440,548
Species Comp		Elev (m)	120
Leading Species	Hw	BEC Variant	CWHxm2
Percent Hw		Age Class	61-70

Plot Information

Date Sampled	30-Nov-09	Aspect (degrees)	290
Slope (%)	10%	Density (per ha)	700
Codom Height (m)	37	Site Index	30

Tree Information

Temperature (C) 9.1 n 51 Species Hw

Diameter

Minimum	13.6
Average	28.1
Maximum	44.4

Acoustic Velocity

Minimum	3.73
Average	4.66
Median	4.75
Maximum	5.04
SD	0.30

Photos 0783-0786

Remarks On Bamfield Main near 12 km marker. Plot on small crest (convex). Larger Fd and small Cw on site. Elev from GIS.

Vegetation Mahoner, Polymun, Gash
Kindore, Hylospl

Appendix 2 - Acoustic Velocity Sample Plots

Operating Area:	Port Alberni	AVID	PA-003

20K Map Sheet	92F.007	UTM Zone	10
Road	Corrigan Main	East	373,982
Access	Good	North	5,435,348
Species Comp		Elev (m)	315
Leading Species	Hw	BEC Variant	CWHxm2
Percent Hw		Age Class	71-80

Plot Information

Date Sampled	30-Nov-09	Aspect (degrees)	280
Slope (%)	10%	Density (per ha)	620
Codom Height (m)	27	Site Index	27

Tree Information

Temperature (C) 7.9 n 51 Species Hw

Diameter

Minimum	13.2
Average	28.3
Maximum	46.9

Acoustic Velocity

Minimum	3.81
Average	4.66
Median	4.70
Maximum	5.24
SD	0.28

Photos 0787 - 0793

Remarks 77 years. Beside Corrigan Main. Plot is narrow strip between 2 roads (min. 1 tree length from edge). Trees are stunted by hemlock mistletoe. Elev from GIS.

Vegetation

Appendix 2 - Acoustic Velocity Sample Plots

Operating Area:	Port Alberni	AVID	PA-017

20K Map Sheet	92C.097	UTM Zone	10
Road	Harrison Creek Main	East	370,270
Access	Good	North	5,421,841
Species Comp		Elev (m)	345
Leading Species	Hw	BEC Variant	CWHvm1
Percent Hw		Age Class	71-80

Plot Information

Date Sampled	01-Dec-09	Aspect (degrees)	310
Slope (%)	15%	Density (per ha)	560
Codom Height (m)	35	Site Index	21

Tree Information

Temperature (C) 2.1 n 51 Species Hw

Diameter

Minimum	18.9
Average	33.3
Maximum	46.1

Acoustic Velocity

Minimum	3.82
Average	4.60
Median	4.64
Maximum	5.10
SD	0.28

Photos 0794-0801

Remarks Stand has been thinned about 20 years ago. Minor Fd and small Ba. Elev from GIS.

Vegetation Minor Hylospl, Gash, Polymun.