



# An Assessment of the Research and Technical Information Needs of Forestry Operators in British Columbia

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## **EXECUTIVE SUMMARY**

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In 2003, the Forest Engineering Research Institute of Canada (FERIC) and FORREX conducted interviews with key forestry operators from industry, First Nations organizations, British Columbia Ministry of Forests staff, and community forest organizations to identify their current sources of research and technical information, their preferences for receiving this information, and the challenges and limitations of the forest industry. The interviews revealed that the key information needs of forestry operators are related to increasing the efficiency of harvesting and silvicultural operations. The need for information about managing environmental issues was also frequently cited.

## **ACKNOWLEDGEMENTS**

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## **QUALIFIER**

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The intent of the survey was to interview a representative sample of forestry operators within each geographic region of British Columbia. However, the outcomes reflect the ideas and needs of those interviewed and not necessarily the viewpoints of all forestry operators in British Columbia.

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## INTRODUCTION

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In 2002, FORREX was contracted by Forestry Innovation Investment Ltd. (FII) to provide extension services to programs funded by FII throughout British Columbia. That portion of FORREX's extension program related specifically to forestry operations was delivered in partnership with the Forest Engineering Research Institute of Canada (FERIC). A needs assessment was conducted, through one-on-one interviews, to characterize forestry operations, to identify key information gaps and constraints of operators, and to identify current and preferred methods of receiving information about topics relevant to forestry operations. The outcomes of the interviews will guide FERIC and FORREX in planning for educational and information programs that will help forestry operators in British Columbia address operational issues and challenges.

## SURVEY METHODS

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### Description of Respondents

From January to April 2003, FERIC extension staff conducted in-person interviews with 124 forestry operators involved in harvesting, road building, and silvicultural operations in Coastal, Southern Interior, and Northern Interior British Columbia (Table 1). The respondents represented forest companies, First Nations organizations, British Columbia Ministry of Forests, and community forest organizations. Respondents were selected from candidates considered to be "key informants", i.e., people with significant knowledge of the forest industry and operational forest practices.

Fifty-nine forestry operators in Coastal British Columbia were interviewed by Ed Proteau between February and April 2003. Thirty-six, or 61%, of the respondents reported that they are members of FERIC.

Thirty-one forestry operators in the Southern Interior were interviewed by Darcy Moshenko between January and April 2003. Twenty respondents, or 65%, reported that they are members of FERIC.

The survey of 34 forestry operators in the Northern Interior was conducted by Albie Thomson between February and April 2003. Eighteen respondents, or 53%, said that their companies are members of FERIC.

**TABLE 1** *Distribution of respondents*

Type of organization	Coastal		Southern Interior		Northern Interior	
	Respondents (no.)	Proportion of group (%)	Respondents (no.)	Proportion of group (%)	Respondents (no.)	Proportion of group (%)
Research forest	1	2	0	0	0	0
Community forest	2	3	1	3	0	0
B.C. Ministry of Forests	4	7	3	10	0	0
First Nations	5	8	0	0	0	0
Forest industry	47	80	27	87	34	100
<b>Total</b>	<b>59</b>	<b>100</b>	<b>31</b>	<b>100</b>	<b>34</b>	<b>100</b>

## **Interview Questions**

The interview questions addressed:

- characteristics of the respondents' forestry operations,
- the respondents' current sources of research-based forestry operations information,
- by what mode respondents receive forestry operations information,
- whether or not respondents receive information applicable to their forestry operations,
- in what form respondents prefer to receive forestry operations information,
- whether or not respondents receive forestry operations information from FERIC and FORREX, and
- future information and research needs related to forestry operations.

A copy of the interview form appears in Appendix 1.

## **Analysis**

Quantitative interview data were analyzed using software called Statistical Package for Social Sciences (SPSS). The identities of the individual respondents remained anonymous as the results were summarized and compiled.

## **Cross Tabulation**

A cross tabulation was performed to determine if any pattern occurred between type of organization and preference for format of information (printed or electronic). For example, do industry members prefer electronic means while community forests do not?

## **RESPONSES**

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### **Annual Harvest Volumes**

In terms of total annual harvest, respondents in Coastal British Columbia said their operations are moderately evenly distributed among three categories: 20 000–100 000 m<sup>3</sup>/yr (23%), 101 000–500 000 m<sup>3</sup>/yr (29%), and 501 000–1 000 000 m<sup>3</sup>/yr (33%) (Table 2). In the Southern Interior, the greater proportion of respondents (62%) said that their harvest falls into the category of 101 000–500 000 m<sup>3</sup>/yr. However, in the Northern Interior, the greater proportion of respondents (47%) said that their harvest falls into the next highest category, 500 000–1 000 000 m<sup>3</sup>/yr.

### **Harvesting Methods**

#### *Helicopter Methods*

Relatively large percentages of respondents in the Southern Interior and Northern Interior said they do not use helicopters for harvesting, at 55 and 62% respectively, while only 19% of respondents in Coastal British Columbia said that they do not use helicopters (Table 3).

At 49%, the greater proportion of Coastal respondents said that 11–25% of their volume is harvested by helicopter methods, but 15% said that 1–10% of their volume is harvested by helicopter. A mere 10% of respondents in the Southern Interior said that 11–25% of their volume is harvested by helicopter, but 31% said that 1–10% of their volume is harvested by helicopter methods. In the Northern Interior, 25% said that 1–10% of their volume is harvested by helicopter methods.

**TABLE 2** Distribution of annual harvest volume

Category of annual harvest volume (m <sup>3</sup> /yr)	Coastal			Southern Interior			Northern Interior					
	Forestry operations (no.)	Proportion of participants (%)	Valid percent <sup>a</sup> (%)	Cumulative percent <sup>b</sup> (%)	Forestry operations (no.)	Proportion of participants (%)	Valid percent <sup>a</sup> (%)	Cumulative percent <sup>b</sup> (%)	Forestry operations (no.)	Proportion of participants (%)	Valid percent <sup>a</sup> (%)	Cumulative percent <sup>b</sup> (%)
20 000–100 000	11	19	23	23	6	19	21	21	1	3	3	3
101 000–500 000	14	24	29	52	18	58	62	83	11	32	37	40
501 000–1 000 000	16	27	33	85	4	13	14	97	14	41	47	87
>1 000 000	7	12	15	100	1	3	3	100	4	12	13	100
Sub-total: Respondents	48	81	100		29	94	100		30	88	100	
Unknown <sup>c</sup>	11	19			2	6			4	12		-
<b>Total participants</b>	<b>59</b>	<b>100</b>			<b>31</b>	<b>100</b>			<b>34</b>	<b>100</b>		

<sup>a</sup> “Valid percent” refers to the percentage in each category after the missing data points are removed.

<sup>b</sup> “Cumulative percent” refers to the percentage that accumulates ordinally down the column (for example, it can be said that 52% of respondents harvest 500 000 m<sup>3</sup>/yr).

<sup>c</sup> Some survey participants did not provide annual harvest data for their operations.

**TABLE 3** Distribution of helicopter harvesting

Extent to which helicopter harvesting methods are used:	Coastal			Southern Interior			Northern Interior		
	Forestry operations (no.)	Proportion of group (%)	Valid percent <sup>a</sup> (%)	Forestry operations (no.)	Proportion of group (%)	Valid percent <sup>a</sup> (%)	Forestry operations (no.)	Proportion of group (%)	Valid percent <sup>a</sup> (%)
No helicopter use	9	15	19	17	55	59	21	62	75
1–10%	7	12	15	9	29	31	7	21	25
11–25%	23	39	49	3	10	10	0	0	0
25–50%	6	11	13	0	0	0	0	0	0
51–75%	2	3	4	0	0	0	0	0	0
Unknown <sup>b</sup>	12	20	-	2	6	-	6	17	-
<b>Total</b>	<b>59</b>	<b>100</b>	<b>100</b>	<b>31</b>	<b>100</b>	<b>100</b>	<b>34</b>	<b>100</b>	<b>100</b>

<sup>a</sup> “Valid percent” refers to the percentage in each category after the missing data points are removed.

<sup>b</sup> Some survey participants did not answer this question.

## Cable Methods

A significant proportion of the volume in Coastal British Columbia is harvested by cable methods: 72% of respondents said that they use cable harvesting for 25–75% of their volume. All Coastal respondents said that they use cable harvesting for at least some of their volume, and one respondent said that 100% of their volume is harvested by cable methods. However, in the Southern Interior and Northern Interior respectively, 14 and 46% of respondents said they do not use cable harvesting at all, and 24 and 29% said that they use cable methods to harvest 1–10% of their volume. In the Southern Interior, the greater proportion of respondents (28%) said that they use cable methods to harvest 25–50% of their volume.

**TABLE 4** *Distribution of cable harvesting*

Extent to which cable harvesting methods are used: category, by proportion of harvest volume	Coastal			Southern Interior			Northern Interior		
	Forestry operations (no.)	Proportion of group (%)	Valid percent <sup>a</sup> (%)	Forestry operations (no.)	Proportion of group (%)	Valid percent <sup>a</sup> (%)	Forestry operations (no.)	Proportion of group (%)	Valid percent <sup>a</sup> (%)
No cable use	-	-	-	4	13	14	13	38	46
1–10%	1	2	2	7	23	24	8	23	29
11–25%	7	12	15	5	16	17	3	9	11
25–50%	16	27	34	8	26	28	3	9	11
51–75%	18	31	38	3	10	10	1	3	4
76–99%	4	7	9	2	6	7	0	0	0
100%	1	2	2	0	0	0	0	0	0
Unknown <sup>b</sup>	12	19	-	2	6	-	6	18	-
<b>Total</b>	<b>59</b>	<b>100</b>	<b>100</b>	<b>31</b>	<b>100</b>	<b>100</b>	<b>34</b>	<b>100</b>	<b>100</b>

<sup>a</sup> “Valid percent” refers to the percentage in each category after the missing data points are removed.

<sup>b</sup> Some survey participants did not answer this question.

## Ground-Based (Conventional) Methods

In Coastal British Columbia, 39% of respondents indicated they use ground-based methods for harvesting for 11–25% of their volume (Table 5). Hoe chucking is the specific method used, except one respondent’s organization uses mechanized ground-based systems (i.e., mechanical falling and skidding).

All of the respondents in the Southern Interior and the Northern Interior indicated that their operations use ground-based methods for some portion of their volume. In the Southern Interior, the greater proportion said that its organizations use conventional harvesting for 76–99% of their volume, at 38%, while in the Northern Interior, 43% said they used conventional harvesting for 100% of their volume.

## Sources of Research-Based Forestry Operations Information

FERIC was the most frequently mentioned source of research-based information: FERIC in general was cited by 54% of Coastal respondents, while FERIC reports were cited by 61% of Southern Interior respondents and 26% of Northern Interior respondents (Table 6). FERIC staff were also cited frequently, i.e., by 48% of Southern Interior respondents and 21% of Northern Interior respondents.

**TABLE 5** *Distribution of ground-based harvesting methods*

Extent to which ground-based harvesting methods are used: category, by proportion of harvest volume	Coastal			Southern Interior			Northern Interior		
	Forestry operations (no.)	Proportion of group (%)	Valid percent <sup>a</sup> (%)	Forestry operations (no.)	Proportion of group (%)	Valid percent <sup>a</sup> (%)	Forestry operations (no.)	Proportion of group (%)	Valid percent <sup>a</sup> (%)
No ground-based use	1	2	2	0	0	0	0	0	0
1–10%	6	10	13	0	0	0	1	3	3
11–25%	23	39	49	1	3	3	0	0	0
25–50%	9	15	19	9	29	31	2	6	7
51–75%	6	10	13	5	16	17	3	9	11
76–99%	2	4	4	11	36	38	10	29	36
100%	0	0	0	3	10	11	12	35	43
Unknown <sup>b</sup>	12	20	-	2	6	-	6	18	-
<b>Total</b>	<b>59</b>	<b>100</b>	<b>100</b>	<b>31</b>	<b>100</b>	<b>100</b>	<b>34</b>	<b>100</b>	<b>100</b>

<sup>a</sup> “Valid percent” refers to the percentage in each category after the missing data points are removed.

<sup>b</sup> Some survey participants did not answer this question.

**TABLE 6** *Sources of research-based forestry information used by forestry operators*

Sources	Coastal		Southern Interior		Northern Interior	
	Times mentioned by respondents (no.)	Proportion of respondents mentioning source (%)	Times mentioned by respondents (no.)	Proportion of respondents mentioning source (%)	Times mentioned by respondents (no.)	Proportion of respondents mentioning source (%)
Academic institutions	5	9	0	0	3	9
Books/library	2	3	0	0	0	0
B.C. Ministry of Forests	6	10	7	23	3	9
Canadian Forest Service	2	3	1	3	1	3
Coast Forest and Lumber Association	2	3	0	0	0	0
Company's own information	2	3	6	19	0	0
Conferences	4	7	3	10	0	0
Consultants	3	5	1	3	0	0
Contractors	1	2	0	0	0	0
Don't get information anywhere	2	3	1	3	0	0
FERIC reports	32 <sup>a</sup>	54 <sup>a</sup>	19	61	9	26
FERIC staff			15	48	7	21
Forestry Continuing Studies Network	3	5	3	10	0	0
FORREX	6	10	4	13	4	12
General publications	6	10	1	3	0	0
Internet	10	17	7	23	1	3
Journals/trade magazines	18	31	5	16	2	6
Model forests	0	0	0	0	1	3
Northern Forest Products Association	0	0	0	0	1	3
Other forestry operators	13	22	7	23	1	3
Private Forest Landowners Association	1	2	0	0	0	0
Suppliers/manufacturers	13	22	2	7	0	0
Word of mouth	3	5	8	26	0	0

<sup>a</sup> Coastal respondents did not specify whether they meant FERIC reports or staff.

Journals and trade magazines (31%), suppliers (22%), and other forestry operators (22%) were mentioned relatively frequently by Coastal respondents, while 26% of Southern Interior respondents cited word of mouth. No Southern and Northern Interior respondents mentioned academic institutions as sources of information. Neither did Southern Interior respondents mention books/libraries (other than in-house). In the Northern Interior, academic institutions and journals were mentioned by only two and three respondents, respectively, and the Internet was mentioned by only one respondent.

### Means by Which Forestry Operations Receive Research-Based Information

At 95 and 87% respectively, a significant proportion of Coastal and Southern Interior respondents said that research-based information comes to them in printed form, while only 23% of Northern Interior respondents said this (Table 7). About three-quarters of the Southern Interior respondents, and slightly more than half of the Coastal respondents, said they receive information verbally but this was true for very few of the Northern Interior respondents. A relatively large proportion of Coastal and Southern Interior respondents said they receive research-based information electronically, at 48 and 58% respectively, but only 23% of Northern Interior respondents say they receive it electronically.

### Applicability of Information

Regarding the applicability of the forestry operations information they receive, 50% of the Coastal respondents and 48% of Southern Interior respondents said that they receive applicable information (Table 8). Some Coastal and Southern Interior respondents said that they sometimes receive applicable information, at 48 and 31% respectively. At 21%, a relatively large proportion of Southern Interior respondents said they do not receive applicable information. Only 2% of Coastal respondents said they do not receive applicable information.

**TABLE 7** Means by which respondents receive research-based information

Means of communication	Coastal		Southern Interior		Northern Interior	
	Respondents (no.)	Proportion of group (%)	Respondents (no.)	Proportion of group (%)	Respondents (no.)	Proportion of group (%)
Printed	56	95	27	87	8	23
Verbal	34	58	24	77	3	9
Electronic	28	48	18	58	8	23

**TABLE 8** Applicability of information received

Receiving applicable information?	Coastal			Southern Interior			Northern Interior		
	Forestry operations (no.)	Proportion of group (%)	Valid percent <sup>a</sup> (%)	Forestry operations (no.)	Proportion of group (%)	Valid percent <sup>a</sup> (%)	Forestry operations (no.)	Proportion of group (%)	Valid percent <sup>a</sup> (%)
Yes	28	47	50	14	45	48	8	24	66
No	1	2	2	6	19	21	2	6	17
Sometimes	27	46	48	9	29	31	2	6	17
Unknown <sup>b</sup>	3	5	-	2	7	-	22	64	-
<b>Total</b>	<b>59</b>	<b>100</b>	<b>100</b>	<b>31</b>	<b>100</b>	<b>100</b>	<b>34</b>	<b>100</b>	<b>100</b>

<sup>a</sup> "Valid percent" refers to the percentage in each category after the missing data points are removed.

<sup>b</sup> Some survey participants did not answer this question.

In the Northern Interior, only 35% of the survey participants responded to the question regarding the applicability of information received. Two-thirds of these said they receive applicable information, while 17% said they do not and 17% said they sometimes do.

### **Preferred Format for Receiving Research-Based Information**

In Coastal British Columbia and the Southern Interior respectively, 95 and 96% of respondents said they prefer to receive research-based information electronically, but only 38% of Northern Interior respondents prefer this format. Some respondents said they prefer to receive information in printed format, at 32, 50, and 32% for Coastal, Southern Interior, and Northern Interior respondents respectively. A preference for receiving information verbally was not mentioned.

### **Receiving Research Articles from FORREX**

A very high proportion of respondents said they would like to receive research articles from FORREX, at 96, 100, and 96% of Coastal, Southern Interior, and Northern Interior respondents respectively. Most Southern Interior respondents said they would like to continue receiving *LINK* and *BC Journal of Ecosystems and Management*, and most said they ask to receive these electronically. Many said they ask for hard copies of *LINK* to be sent to their offices, and for electronic copies to be sent to them individually. One respondent in Coastal British Columbia and one in the Northern Interior said they do not want to receive research articles from FORREX. One Coastal respondent was not familiar with FORREX.

### **Cross Tabulation**

The cross tabulation for the Coastal data revealed a strong interest across all types of organizations for receiving information by electronic means, particularly on the part of industry and the B.C. Ministry of Forests. Industry listed “written” (i.e., printed) almost as frequently as electronic forms. No other patterns occurred between organization type and preferences for receiving information. Electronic seems to be the most preferred among all organizations in Coastal British Columbia.

The Southern Interior data show an interest among all three types of organizations for electronic forms of receiving information (although only one participant was a community forest representative). Slightly more than half of industry respondents want information in printed format, and all but one industry representative mentioned a desire to receive information electronically. The B.C. Ministry of Forests participants did not mention a desire to receive information in printed format.

A cross tabulation was not calculated for interviews in the Northern Interior because all respondents were from the forest industry.

### **Future Needs: Challenges and Limitations**

#### ***Information gaps identified by Coastal respondents***

##### **Variable retention (VR) and windthrow management**

- Blowdown in second-growth hemlock stands—problem in variable retention areas
- Steeper windthrow-prone areas—variable retention (cable strip retention)
- Managing blowdown in second growth harvested by variable retention
- Costs of variable retention
- Hemlock windthrow
- Variable retention and forest health (mistletoe)
- Impacts of variable retention harvesting
- Substitute for equivalent clearcut area (ECA) as an indicator of watershed health (variable retention effects)

## **Stumpage information**

### **Cost effectiveness of processes**

### **Cutblock size and forest health**

### **Roads and culverts**

- Build good road cheaply (mentioned eight times)
- Road design, construction, maintenance, deactivation
- Culverts—tracking for month-end on digital maps
- Culvert sizing guide
- Graded road maintenance with GPS
- Arched fibreglass culverts
- Different method of culvert design (possibly smaller)—we use California method now
- Road deactivation
- Road maintenance issues
- Road maintenance efficiencies (Forest Service Roads)
- Liabilities on road maintenance/code change
- Efficiencies in rock work—blasting technology
- Risk management, over building
- Road maintenance, reduce ballast costs
- Rehabilitation of old roads
- Alternatives for end hauling (keying in rock)
- Use of bonding agents (road maintenance)
- Information on the Nordberg crusher

### **Silviculture**

- Is it worth fertilizing, pruning, thinning?
- Piling/stumping/planting, stand establishment
- Looking at big picture in silviculture and not at specific blocks like we do now
- Effectiveness of manual pruning
- Site preparation for drainage
- Browse protection
- Better slash disposal methods—roadside
- Research on managing forests 25–50 years of age—stand dynamics
- Taper equations—has any work been done on relevancy of today's taper equations?
- Problem with plantability—shortage of soil

### **Engineering**

- Cheaper engineering costs, GPS, and accuracy through old growth
- Cheaper traversing with GPS, downloading directly in tabular form for log cribs so area engineer uses as a guide
- GPS technology to enable accurate road engineering—Bluetooth (wireless) could eliminate connections cable for GPS and laser

### **Harvesting**

- Cost reduction (mentioned eight times)
- Information for new contractors on new harvesting methods
- Information on new methods for harvest design
- Getting lower costs, primarily in combination of harvesting and road building—use of more mechanized harvesting on the Coast
- Using silviculture to mitigate damage from lower cost harvesting systems, by improving productivity of remaining land
- Single-stem selection (mentioned four times)
- Information about second-growth harvesting
- Improving log quality (breakage)

- Information about skyline systems
- Rocks in logs
- Second growth on steep slopes
- Coastal harvesting efficiencies and information
- Any new harvesting systems
- Corridor harvesting—cost studies
- Second-growth harvesting
- Cable yarding with small piece size
- Productivity model with piece size (and hauling distance)
- Productivities for falling/bucking and yarding configurations

#### **Wood sorting**

- Sorting efficiencies
- Wood sorting
- Paint marking—log sorting with processors (clogging heads, painting)
- Banding cedar to improve recovery (mentioned twice)
- Value recovery on cedar, defining what it should look like
- Rocks in cedar (where picking up rock)
- Accountability with the results-based forest practices code
- Bush sorting—impact on harvesting and slash disposal
- Managing for visual values

#### **Equipment**

- Rock drilling equipment
- Powder technology (blasting)
- Productivity on grapple yarders/hoe chuckers with bunched wood
- Machine productivities for hoe-chucking and processing
- Hoe-forwarding sled
- Machine rates and productivity
- Lighting for night shift machines
- Engineering equipment (GPS, laser, and other high tech)
- Painting systems for processors
- Walking machine instead of excavator for harvesting
- Machine productivities
- Swing yarders designed for highway moving
- Bunching for grapple yarder
- MultiDat datalogger (mentioned three times)
- Log breakage
- Electronic tablet, for prescriptions and mapping

#### **Ground-based/mechanized systems**

- Hoe chucking, full length
- Ground based in karst areas—bearing capacity in karst terrain
- Second growth (mentioned twice)
- Productivity of ground-based equipment
- Efficiencies
- Skidding combinations
- Feller bunchers/ hoe chuckers
- Information on the Morgan skidder
- JD 660 skidder with floatation tires
- Feller-processor productivity and cost
- Trans-Gesco forwarder

Mechanization in second growth  
Any information on steep slopes ground-based systems

### **Helicopter**

Single-stem helicopter harvesting  
Helicopter harvesting trials in second growth  
Appraisal allowance for helicopters (rising fuel costs)  
Single tree helicopter yarding (mentioned twice)  
Helicopter yarding of blowdown  
Accurate determination of wood density

### **Hauling**

Highway trucking  
Cost efficiencies (mentioned three times)  
Hauling on per ton basis vs. paid by volume  
Steep grade and switchback hauling  
GPS tracking for hauling  
Constant reduced air pressure results  
Central tire inflation system in coastal conditions

### **Slope stability**

How much timber can be removed without destabilizing slope  
Rainfall intensity on open slopes (slides)

### **Streams**

Over spraying dry S5-6 streams—prove that it is not getting into water (need research to prove)  
Monitoring peak flows

### **Marketing**

Alder markets  
Hemlock products and markets

### **Certification**

Smartwood and Forest Stewardship Council

### **Nurseries**

Mitigating major losses

### **Dryland sort and dumping**

Effective methods of A-framing—small scale  
Recycling of bundling wire (mentioned twice)  
Reduction of bark into water at dumpsites (BCMOE/DFO)  
Electronic scaling

### **Socio-economics**

Basic business education—First Nations, (forestry, fishing, tourism)—assist with business plans  
Community based forestry—social economics—First Nations  
Non-timber forest products production  
Value-added manufacturing information  
Log marketing and product manufacturing

### **Wildlife**

Deer browse (shelters not standing up because of rocky ground)  
Goats, eagles, goshawk, moose  
Spotted owl, marbled murrelet  
Protection of regeneration from elk browse—shelters and repellent (blood mix)  
Endangered species

## ***Information gaps identified by Southern Interior respondents***

### **General**

Natural science research is not linked to harvesting issues (mentioned twice)

### **Log supply**

Need to take away uncertainty around inventory—would enable an increase in harvest volume

### **Forest health**

Root rot

White pine blister rust research is needed

### **Silviculture**

Structure retention—need to do right amount of brushing

Partial cutting in the Rocky Mountain trench—environmental and visual aspects of operating in the trench

### **Partial cutting**

Lower volume stands—how to manage and plan for these stands

Free to grow—would like to keep deciduous component in stand rather than clear in order to avoid slash or damage to conifer regeneration

Managing competing vegetation with and without herbicides

Herbicide use for brushing/weeding—techniques to use in specific situations

What to do with decadent hemlock stands

Software to evaluate stand value based on cruise data (Internet linked)

What systems are available and what can be expected for harvesting costs in specific stand/terrain conditions

Decisions regarding conducting site preparation versus not conducting site preparation

Productivity studies—interested in whole system studies

Planting techniques around management of cattle

### **Roads**

Soil mixing (lime etc.) for road stabilization

Need to make surface stay hard so road does not break up when it gets wet

End hauling information/cost analysis/temporary roads

Engineering structures—alternatives to end-hauling/stabilization of cut slopes

Key indicators for roads (increased responsibility for roads)

Inexpensive rock-crushing methods for surfacing

Specialized blasting techniques

Reduce road construction costs (roads overbuilt in past)

Anything new to help reduce costs in steep ground—road building and alternatives to roads

Cost-effective forwarding methods to minimize road building and to access otherwise inaccessible timber (rehabilitate trails)

Better tool for doing cost estimates—roads and bridges

### **Harvesting**

Sorting and log optimization in bush—sending right log to right mill

Efficiencies of mechanized systems

Long-line harvesting and relation to appraisal system (efficiencies, cost information—it is cheaper to build road or use helicopter, but cannot always build a road and it may not be worth using a helicopter for small areas)

Phase harvesting, roadside harvesting

Cable harvesting—techniques and efficiencies

Would like to see smarter machines that make their own decisions

Cut to length or merchandizing in bush

Need a comprehensive and defensible database for machine productivity for specific areas  
(needed for contract negotiations and methodology for industry to use on their own)  
Refine equipment rates—information on repair and maintenance  
Log damage  
Log quality—want equipment that can do a better job, better technology to do a better job  
Extend season—central tire inflation did not work, decking wood in spring, seasonal harvesting  
Wet weather operations—to extend the season  
Operations in marginal stands (beetle kill too)—how to harvest efficiently, how to utilize the  
most fibre, how to extract the most peelers  
Environmental issues—geotechnical issues  
Selective helicopter harvesting—methods and cost reduction, hemlock looper problem/retain  
more for caribou

### **Operations in steep terrain**

Will a re-load system work for bringing wood off steep slopes?  
Steep-slope harvesting (mentioned frequently)  
Working in challenging terrain—road building  
Cable—carriages that allow thinning between rows/roads and that fit to existing equipment, to  
be used in larger diameter wood  
Avalanche management  
Steep-slope harvesting and ground-based equipment—how to harvest blocks efficiently and cost  
effectively  
Diverse terrain—versatile machines that can work in all areas and stay efficient—road building  
in difficult coast-like terrain

### **Transportation**

Axle configurations on harvesting trucks  
Efficient hauling/transportation system for cut-to-length logs  
Hauling—truck configurations/fuel consumption/truck rates

### **Short wood**

Short-wood hauling  
How short wood can be applied to more difficult terrain and longer wood and make it more  
cost efficient

### **Safety**

Operational woods/bush safety, interested in philosophy/program that division can utilize and  
buy into  
Want information on safety and training

### **Policies**

Simplify policy

### **Management**

Ways to be more hands-off in managing contractors to allow contractors to operate without  
supervision  
Better information to better manage under results-based forest practices code  
Need contact list for other companies and their personnel

### **Salvage**

Benefits of small-scale salvage to forest health and forest productivity—mostly bark beetle

### **Water and riparian**

Cost-effective fish crossing  
Stream crossings—Are we over-designing? Can we use cheaper projects but get same results  
(fisheries?)?  
Rip rap methodology/placement information, balancing risk with rip rap verses biology and  
need for shade

Stream temperature/impact of timber removal from stream edges  
Managing cattle in riparian areas to protect plantation  
Fish-bearing stream crossing—innovations  
Create a model watershed—operational research area  
Standard operating procedure for in-stream work (government falls back on stream crossing guidebook)  
Fish-friendly crossing

#### **Marketing**

Log procurement  
Marketing specialty products  
Hemlock pulp is a major constraint—need a market

#### **Certification and monitoring**

Monitoring phase of sustainable forest management—how to manage the monitoring aspect of criteria and indicators—can FORREX develop a system to manage this?

#### **Sorting and utilization**

Small wood sorting/handling/chipping  
Increased fibre utilization  
Log quality—enhanced bucking  
Fibre quality  
Look at conversion to short logs to get maximum value

#### **Social and economic issues, wildlife, non-timber values, and land-use planning**

Aboriginal issues—dealing with land claims  
Sortyard costs  
Visuals, patch size distribution, wildlife  
Increased efficiency, reduced costs—in all areas  
Managing around the forest practices code for biodiversity—landscape/visuals/caribou  
Accessing volume (crown) for First Nations participants  
Would like to operate in areas set aside for water quality, visuals

#### **Information management**

Hand-held technology for tracking/processing data

### ***Information gaps identified by Northern Interior respondents***

#### **Forest health**

Lodgepole pine fungus  
Spruce leader weevil  
Forest health in old growth (beetle management vs. old-growth management)  
Stem rusts (western gall) and effects on timber supply

#### **Silviculture**

Effectiveness of regeneration and leave-tree retention for riparian management objectives vs. additional harvesting costs  
Timing and number of brushing treatments in lodgepole plantations to meet free-growing standards  
Herbicides—application rates and effectiveness on different vegetation species  
Any current machine production information  
Reduce site-preparation costs by minimizing amount of treatment and combining with harvesting phase  
Maximum density issues for lodgepole stands  
High-elevation balsam stands are showing more decay than cruise factors (if balsam trees are left as leave trees, this creates other silvicultural issues)

Stand management practices in poor-site lodgepole pine stands (cost of removing aspen for “free to grow” goals when species dies naturally prior to lodgepole attaining harvesting size)  
Information about effects of branch size on wood quality in lodgepole regeneration  
Information from pilot project on partial cutting to meet visuals in constrained areas  
Equipment costing and productivity  
Growth and yield information on fertilized stands

#### **Mountain pine beetle**

Beetle management information for TSA  
Timing of beetle slash burns  
More local studies for beetle issues  
Most effective direction to harvest beetle wood—green attack vs. salvage of dead and dying  
How to reduce top shatter while processing beetle-killed wood  
Water absorption properties of beetle-infected logs, effects on drying ability  
Processing issues in dry wood  
Change in characteristics of beetle-infested wood as it affects log-to-lumber recovery (spiral vs. straight check)  
How to treat winter-harvested beetle slash (still green for burning prior to flight)  
Administration of permits for small patch harvesting (beetle removal)  
Truck configurations and other options for carrying light weight beetle wood  
Reduced safety on haul roads due to volumes of beetle wood moved from concentrated area  
Inefficiencies in administration and processing of beetle permit applications

#### **Roads**

Need for innovative construction methods to produce high grade roads—maintenance of roads through compaction, application of binder such as cement powder  
Use of sealants in road maintenance  
Productivity and cost of road construction equipment (drill rigs, excavators, trucks)  
Road construction standards (minimum standard for cost effectiveness)  
Erosion of road edge along lakeside (wave action against fill)  
Production data for tracked machines doing road/ditch maintenance  
Road maintenance indicators (Opti-grade)  
Road maintenance—truck speed vs. grading techniques  
Road construction/maintenance—effects on cycle times

#### **Harvesting**

Cost-effective harvesting methods for Engelmann Spruce–Subalpine Fir (ESSF) strip harvesting and irregular shelterwood  
Any equipment updates (specific to forwarding on steep slopes and multi-tasking bunchers)  
Costing studies for cut-to-length, particularly for new equipment  
Cable-harvesting productivity  
Cost effectiveness of forwarding with/without return trails  
Cut-to-length information  
Handling of waste from processing at the stump  
Productivity and cost of cable operations  
Harvesting equipment information—maintenance costs, productivity figures  
Harvesting efficiencies  
Partial cutting with cable operations  
Harvesting systems that protect regeneration  
Precision bucking for mill usage  
New equipment (Advantage Reports) for harvesting  
Equipment productivity/quality output (especially processors)  
Cut-to-length for steep ground (especially adverse)

## **Transportation**

- Efficiencies in log hauling
- Trucking information—fuel consumption, maintenance costs, tri-axle configuration for truck and trailer (payload and safety)
- Updates on central-tire-inflation systems
- Truck-operating costs
- Unmanned scales to reduce cost and allow for long haul days
- Log-truck maintenance costs
- Maximize truck hauling between mills
- Transportation issues and harvesting productivity—updates
- Cost-effective harvesting and trucking systems for small-patch harvesting
- Transportation issues across Françoise Lake
- Truck configuration—stability with wider (off-highway) bunks—lighter beetle wood allows for more volume
- Trucking—fleet trucks for ideal shift hauling

## **Short/small wood**

- Sorting of balsam prior to hauling of short logs
- Updates on any small-wood harvesting
- Small-wood harvesting and transportation issues
- Information on short-log harvesting studies

## **Safety**

- Truck configuration information for cut-to-length hauling (safety)

## **Management**

- Expediting small business sales
- Develop a working relationship/understanding with ministries
- Partnering within industry to reduce supervision and contractors
- “Manage to the objective” overall planning from strategic level to operations
- Training for private contractors/small business operators in sustainable forest management

## **Water crossings and Riparian Zones**

- Cost-effective stream crossing structures for in-block roads (S3s are typical)
- Soil disturbance levels should be tied to past performance and reflected in allowable cut
- Proper classification of all streams
- Stream crossings and related issues when forced to move roads off valley bottoms and up steep hillsides (can be more detrimental to fish)
- Not enough tolerance (cleaning beyond natural occurrences) for woody debris in fish streams
- Cost of crossings for high gradient (low-value) fish streams
- Cost of cleaning debris (what level?) from non-fish streams because they feed directly into fish-bearing streams
- Riparian management measured by basal area retention—is it always applicable?—should it be more flexible?
- Stream crossings—cost vs. environmental payback, available structures
- “Overkill” with crossings on fish habitat streams
- Stream crossings—in-stream works issues, default to fish stream even if unlikely, added costs for fish stream structures
- Restrictions on harvesting of stream reserves resulting in blow down
- Composite materials for bridge decking

## **Sorting and utilization**

- Innovations in bush sort yards
- Log yard design and operation (e.g., use of portal crane)
- Log checking while stored in millyard

Maximize log manufacturing in woods (cut-to-length)  
Co-ordinate wood flow between mills in area to maximize product quality and output while minimizing haul costs  
Increased utilization  
How to maximize quality from marginal fibre logs (balsam and deformed growth)  
Tracking of log yard inventories (scale data/load data management)  
End checking of logs during storage (including bush decks)  
Beetle management in log yard  
Direction/information to have “right log in right mill”  
Improve processor accuracy without losing productivity—new innovations  
Bush/roadside processing costs for short logs

**Social and economic issues, wildlife, non-timber values, and land-use planning**

Visual quality objectives have too much emphasis  
Clarity re: “negotiation and consultation” with First Nations  
Visual quality objectives conflict with biodiversity issues  
Added costs for public consultation not reflective in appraisal system  
Updates for production costs during harvesting and transport phases  
Appraisal not reflecting true costs

**Information management**

Inventory data management (delivery to contractor payment)

**Deciduous**

Aspen chipping in bush (use of same contractor to produce chips and eight-foot bolts)  
Growth and yield tables—decay waste and breakage information, log storage information

**Other**

Machine fuel consumption information  
Collecting local harvesting history (river drives, skyline system across Fraser River)  
Accuracy of throughput measurement of processors  
Training of heavy-duty machine operators  
Spills from hydraulic hose failure  
Spill-control systems for machines  
Environmentally friendly oils and lubricants  
Recycling of planting boxes/other uses  
Site preparation behind “processing at the stump” systems  
Machine fuel efficiencies  
Log-breakage studies—cost to implement new systems vs. gain in wood values  
Currently using information from local contractors for rates—any additional information?  
Any research on reserve trees/stands as to long-term (5+years) losses from windthrow

## SUMMARY

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### Harvesting Methods

In Coastal British Columbia, cable yarding and hoe chucking are the most commonly used methods of harvesting. Although cable harvesting is the predominant system, increasingly, operators are using helicopter harvesting on the steeper slopes; the use of helicopter harvesting was reported by 81% of respondents. The use of mechanized ground-based harvesting systems is emerging as the proportion of harvesting in second-growth stands increases.

In the Southern Interior, ground-based harvesting is the most commonly used method. However, 86% of respondents said they employ cable harvesting in their operations to some extent, while 41% said they do some helicopter harvesting. The latter two techniques are used on the steeper, more sensitive sites.

The Northern Interior of British Columbia uses primarily ground-based harvesting methods. A small volume is harvested by cable methods, and almost no helicopter harvesting is used. Large road-side operations (>200 000 m<sup>3</sup>/yr) are common due to an increasing requirement for cut-to-length logs.

### Communication of Research Results

Although FERIC publications and staff were the most commonly cited sources of research-based information, 40% or more of respondents did not cite these sources. Many other sources were also mentioned, but at relatively low rates. The respondents in the Northern Interior identified the least number of sources. Fewer Northern Interior respondents listed sources compared with respondents in Coastal British Columbia and the Southern Interior.

In Coastal British Columbia, 50% of respondents said they are receiving applicable information, while the amount is 48% in the Southern Interior. Respectively, 98 and 79% of Coastal and Southern Interior respondents said they are receiving applicable information either when, or sometimes when, they need it. In the Northern Interior, the response rate to this question was low, although 66% of respondents said they receive applicable information.

Most information is received in printed form, although 58 and 77% of respondents say they receive information verbally, in Coastal British Columbia and the Southern Interior, respectively. Electronic communication is received by 48 and 58% of respondents for these regions, respectively. In the Northern Interior, the response rate on the question was either low, or respondents said no communication of research-based forestry operations information was occurring.

Nearly all of the respondents in Coastal British Columbia and in the Southern Interior prefer to receive information electronically, while 32 and 50% want to receive printed information. An examination of the responses from forest industry representatives in Coastal British Columbia shows that they have an equal preference for receiving information in printed and electronic forms; however, B.C. Ministry of Forests representatives preferred electronic material. In the Northern Interior, respondents cited electronic and printed information equally as often.

In all three regions, 96% of respondents want to receive information from FORREX.

## Future Needs

The research needs identified by the respondents are far ranging and cover every aspect of forestry operations. However, several themes are common to the three regions. Increasing the efficiency of harvesting and silvicultural operations—and thereby reducing costs—were rated as important by all respondents. Environmental issues were also mentioned frequently, as related to meeting the requirements for conserving non-timber values while maintaining an economically viable harvesting operation.

Following are some of the specific research and technical information needs identified by the respondents per title of report.

- Reducing road construction and maintenance costs (e.g., through improved efficiencies in road design and rock work, rock crushing for ballasting, timing of grading, ditch maintenance, compaction techniques, and surface stabilizers) (all regions, but particularly Coastal British Columbia)
- Improve water crossings (e.g., appropriate culvert sizes and types, in-block water crossing structures, and cost-effective structures—i.e., avoid over-design) (all regions)
- Reduce harvesting costs (e.g., better information about machine productivities, harvesting systems, new equipment, improved techniques, machine costing, and extending the harvesting season) (all regions)
- Implement mechanized harvesting in second-growth stands (Coastal British Columbia)
- Reduce harvesting costs on steep slopes (Southern Interior)
- Improve cost effectiveness of helicopter harvesting by reducing costs and improving log value (Coastal British Columbia)
- Reduce cost of harvesting mountain pine-beetle-attacked wood and improve manufacturing of this wood (Northern Interior)
- Improve payload of log trucks (all regions)
- Implement cut-to-length systems (Interior)
- Improve log-hauling configurations for cut-to-length logs (Southern Interior)
- Implement central tire inflation (Northern Interior)
- Implement variable retention/partial cutting operations with reduced cost and windthrow (Coastal British Columbia)
- Implement harvesting in riparian areas (Northern Interior)
- Improve log value (e.g., improve sorting in the bush, log allocation to appropriate mills, precision log lengths, and reduced log damage) (all regions)
- Develop techniques to reduce harvesting and silviculture costs and to improve utilization of marginal timber types (e.g., decadent, low-quality, and low-volume wood) and beetle-killed stands (Northern Interior)
- Implement cost-effective silvicultural treatments (e.g., cost/benefit of intensive stand tending and site preparation, browse protection, and managing competing vegetation) (all regions)
- Meet non-timber objectives while retaining ability to harvest cost effectively (e.g., wildlife species and visuals) (all regions)

## **RECOMMENDATIONS**

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The availability of all types and sources of research-based forestry operations information, and the awareness of forestry operators regarding this information need to be improved, especially in the Northern Interior. A priority of the FERIC/FORREX's forestry operations extension program is to ensure forestry operators know where and how to access research information, from all sources.

The desire for information in electronic form is high. However, many respondents, particularly forest industry respondents, want printed information as well, and this form of communication needs to continue. As time passes, however, this situation may change, and continued monitoring of the preferred mode of communication is recommended.

Despite the low ranking of verbal communication as a preferred mode of communication, the feedback from forestry operators regarding one-on-one contact and workshops is positive, and their continued use is recommended. A priority of the FERIC/FORREX forestry operations extension program is to meet with individual users of research information to facilitate the two-way communication of research needs and results.

Activities in each of the regions should reflect the interests and priorities of the respondents. The list of future needs is extensive. Topics for workshops, field days, and presentations will therefore need to be further developed and focused. As well, the survey sheets should be reviewed periodically to determine if new information is available to meet individual needs; if so, follow-up contact should be made.

**APPENDIX 1** Needs Assesment Interview Form

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Company: \_\_\_\_\_

Division: \_\_\_\_\_

FERIC member: Y N

Contact name: \_\_\_\_\_

Title: \_\_\_\_\_

E-mail: \_\_\_\_\_

Address: \_\_\_\_\_

Phone(s): \_\_\_\_\_

Fax: \_\_\_\_\_

**Operations:**

Annual cut: \_\_\_\_\_

Summary of mills: \_\_\_\_\_

Summary of contractors \_\_\_\_\_

\_\_\_\_\_

Heli % \_\_\_\_\_ Cable % \_\_\_\_\_ Ground-based % \_\_\_\_\_ Other: \_\_\_\_\_

**Questions:**

Where do you currently get new research information, or whom do you ask when you have a question?

\_\_\_\_\_

In what form is this information?

\_\_\_\_\_

Is this information applicable to your operations?

\_\_\_\_\_

Within your company, who has access to the information?

\_\_\_\_\_

In what form of communication would you prefer to receive new research information?

\_\_\_\_\_

Would you like to receive research articles from FORREX?

\_\_\_\_\_

**Future needs (Challanges and Limitations):**

Harvesting, Road/Bridges, Transportation, Silviculture Operations, etc.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_