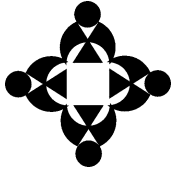




FILE REPORT 01-7

Root Rot Information Needs Assessment:

Summary Report

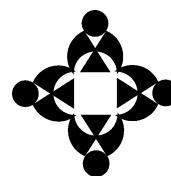


Southern Interior
Forest Extension and
Research Partnership

Root Rot Information Needs Assessment:

Summary Report

Alan M. Wiensczyk



Southern Interior
Forest Extension and
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ABSTRACT

Forest health issues in British Columbia are of considerable concern and include both insect pests and diseases of forest trees. In June 1999, the B.C. Ministry of Forests in the Nelson Forest Region asked SIFERP to help conduct an information needs assessment for partial cutting. During this needs assessment, information pertaining to forest health issues, such as root rot and its effect on the development of residual and second-growth stands, was considered critical. With the current public pressure to continue with partial cutting in all jurisdictions and forest regions, it appears that more information will be needed to help provide possible mitigation opportunities for the operational community.

To address this information need, Partnership extension specialists and staff developed and conducted a telephone survey of key people in the Ministry of Forests (branch, district, and regional level), as well as federal government and university researchers, and the forest industry. The purpose of the telephone survey was to determine the extent of the problem and the unresolved areas, and to identify the type of programming preferred. This report summarizes the results of the survey.

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INTRODUCTION

Forest health issues in British Columbia are of considerable concern and include both insect pests and diseases of forest trees. Based on “extent and severity” criteria, root rot in forest plantations is a major concern to land and resource managers in the southern Interior of the province. In the client needs survey completed for the Southern Interior Forest Extension and Research Partnership (SIFERP) in 1998, information on root rot and pest-management practices was requested “occasionally and often” by approximately 70% of the licensees and by 40% of provincial operations and policy staff and researchers surveyed. This area was also identified by SIFERP’s Ecosystem Management and Forest Practices working group as an information need and priority.

In June 1999, the B.C. Ministry of Forests in the Nelson Forest Region asked SIFERP to help conduct an information needs assessment for partial cutting. During this needs assessment, information pertaining to forest health issues, such as root rot and its effect on the development of residual and second-growth stands, was considered critical. With the current public pressure to continue with partial cutting in all jurisdictions and forest regions, it appears that more information will be needed to help provide possible mitigation opportunities for the operational community.

To address this information need, Partnership extension specialists and staff developed and conducted a telephone survey of key people in the Ministry of Forests (branch, district, and regional level), as well as federal government and university researchers, and the forest industry. The purpose of the telephone survey was to determine the extent of the problem and the unresolved areas, and to identify the type of programming preferred. The objective of this report is to summarize the results of the survey.

METHODS AND SAMPLE SIZE

A series of eight questions was developed and e-mailed or faxed to the recipients before the telephone call (Appendix 1). This was done so that the respondents could have some time to think about the questions and formulate a response before contact by telephone. Appendix 2 contains a listing of people contacted and their affiliation.

The questions addressed:

- current root rot management strategies,
- knowledge gaps and needs,
- availability and usefulness of current information, and
- direction of future root rot programming by the Partnership.

The survey was conducted in September and October, 2000.

Some respondents preferred to e-mail their response and several sent in their responses via fax. Some also supplied additional information about projects on which they were currently working.

A Microsoft Access® database was developed that included the survey results and information about the respondents’ affiliation (Industry, Government: Research, Government: Operations, Academia).

TABLE 1. Number of respondents by affiliation

	Affiliation					Industry
	Academia ^a	Federal government ^a	Provincial government			
			District	Region ^a	Provincial	
No. of respondents	1	5	12	3	1	13

^a Considered “researchers.”

Of the 56 people initially contacted, 35 responded to the survey. The number of respondents by affiliation is shown in Table 1. Not all respondents answered every question: two respondents answered only question 8 and one provided general comments on root rot issues. One acknowledged that root rot was not an issue within their operating area. A few of those contacted (4) recommended other people in their organization who would be better able to talk about root rot issues. One person answered the survey and also recommended another knowledgeable contact.

SURVEY RESPONSES

QUESTION 1. WHAT IS YOUR GENERAL FEELING ABOUT HOW FORESTS ARE BEING MANAGED FOR ROOT DISEASE?

The majority of the respondents (22 out of 31) believed that forests were being managed poorly for root rot. The issues raised were divided into three broad areas: policy or management issues, biological or technical issues, and information issues.

Policy or Management Issues

Respondents believed that no long-term commitment to root disease management was evident. One respondent stated that forest managers seem to expect immediate devastation from the disease. Root rot, however, is a long-term problem that is largely hidden; therefore, the supposed devastation does not occur and no treatments are prescribed.

Concerns were also expressed about:

- the accuracy of the B.C. Ministry of Forests’ Inventory Branch estimates on the amount of root rot, and the techniques used to estimate the incidence of the disease;
- the effect of growth losses to root rot in second-growth forests and the magnitude of those losses;
- the potential negative effects of losses on the long-term timber supply;
- the implications of root rot on a stand’s free growing status; and
- the lack of penalties for ignoring the root rot problem.

One respondent commented that Section 13b of the *Operational Planning Regulation* removes any accountability for doing a forest health assessment from the licensee and puts it in the hands of the District Manager. They felt that if the District Manager did not direct a licensee to conduct a forest health assessment, then one was usually not done.

Biological or Technical Issues

Biological or technical issues raised included the lack of data on the impact of root rot on all of the other forest management objectives (e.g., aesthetics, watersheds, wildlife). As an example, managing for scenic views requires partial cutting in some areas, yet little information is available on the effects of partial cutting on the incidence and spread of the disease. Several respondents felt that too much partial cutting was being done in stands infested with root rot.

Stumping cutblocks has been the standard treatment for dealing with root rot infested stands; however, some respondents mentioned the cost of this treatment and questioned its effectiveness. The conflict between this type of treatment and the soil disturbance limits in the regulations was also highlighted. Some respondents felt that modifications to stumping methods and the soil disturbance guidelines were required. Concerns about the public's perception of the stumping treatment and its unsightly appearance were also noted.

Another option for dealing with root rot is to plant alternative species resistant to the disease. This has been attempted, but some respondents cited examples in which supposedly "resistant" species were found infested and dying from root rot.

Many respondents felt that more studies were required to expand our repertoire of treatment options for stands infested with root rot. Some stated that susceptibility or risk mapping would be a beneficial management tool.

Information Issues

Numerous information issues were mentioned during the survey. Several respondents indicated that more extension on root rot was required. A concern was raised that root disease was being missed in stand surveys and respondents felt that more training was needed for contractors and other field personal in the identification of the disease. The latest information on root rot should also be communicated to industry and government staff, and some respondents felt that the *Root Rot Management Guidebook* requires updating. Respondents also indicated that a lot of confusion existed about treatment options because of differences in opinion among the experts.

Other information issues cited included the lack of data on:

- the risks of disease,
- the magnitude of impact,
- the efficacy of treatments, and
- the long-term implications of root disease on growth and yield.

Several respondents stated that root rot was either not an issue in their operating areas or that it was present, but the effects were minimal. Questions were raised by other respondents about the validity of these assumptions. Root rot is possibly not present in these areas, or it may be present, but is being missed or confused for something else.

**QUESTION 2. IN YOUR OPINION, WHICH ROOT DISEASE PRESENTS THE BIGGEST MANAGEMENT CHALLENGE IN THE SOUTHERN INTERIOR OF BRITISH COLUMBIA, AND WHY?
(I.E., ARMILLARIA, PHELLINUS [LAMINATED ROOT ROT], BLACK STAIN, ANNOSUS)**

Armillaria ostoyae was cited by all respondents as the root disease that presents the biggest management challenge in the southern Interior. *Phellinus weirii* presented the second biggest challenge. However, one respondent felt that *Phellinus* can go unrecognized as it may sometimes

be hidden by *Armillaria*; *Phellinus* often weakens the tree, allowing *Armillaria* to infect and eventually kill it. Excavated roots show signs of *Armillaria*, and so the diagnosis may stop there. *Inonotus tomentosus* was mentioned by a few respondents as a challenge, but this disease occurs mostly in the Sub-Boreal Spruce biogeoclimatic zone.

Respondents felt that *Armillaria* was the biggest management challenge in the southern Interior of the province because it is very widespread and occurs at endemic levels everywhere. It is relatively long-lived, occurs across a broad range of ecosystem types, and attacks several tree species. It is an excellent saprophyte in gathering up food reserves; infection centres can initiate expansion quickly under the proper conditions. *Armillaria* causes growth loss and reduces plant vigour, leading to greater mortality. The disease, therefore, has a potentially larger impact on the Annual Allowable Cut than other root diseases. It is difficult to detect because above-ground surveys can not discover the full extent of the disease. Very few management options exist for dealing with *Armillaria*, and it tends to be exacerbated by current harvesting, partial cutting, and thinning practices.

QUESTION 3. DOES YOUR WORK FOCUS ON ROOT DISEASE? EXPLAIN. WHICH ROOT DISEASE?

Answers to this question varied by position and affiliation. The majority of researchers were studying *Armillaria ostoyae*, although *Phellinus weirii* and *Inonotus tomentosus* were also being studied. One respondent was developing a mathematical model to predict root disease spread.

Operations-level respondents generally felt that their work did not focus on root disease. From the provincial government perspective, managing for bark beetles was the main priority and the workload focus for most operational respondents. One respondent was working on building a root rot inventory for their forest district based on pixel surveys. Most of the forest industry respondents noted that root disease issues were dealt with on a stand-by-stand basis when encountered. Root rot was rarely identified, or treatments for it prescribed, during the Silviculture Prescription development phase (pre-harvest). Root disease was usually encountered and dealt with after the sites were harvested and planted.

QUESTION 4. DO YOU THINK THAT PLANNERS AND OPERATIONAL STAFF HAVE THE TOOLS TO MAKE THE BEST MANAGEMENT DECISIONS FOR ROOT ROT? IF NOT, WHAT IS MISSING?

Four respondents believed that tools were available and that no more were needed. Some had concerns that information was available, but was not reaching the people who needed it. One of the four questioned whether staff were properly trained in the use of the existing tools. Another respondent felt that the tools were available, but that some managers just weren't using them. Whether this was an information extension or a training issue was not known. The majority of respondents (23), however, said that the tools were not available. More information or tools were needed in seven broad areas:

1. biology of the disease,
2. inventory,
3. impacts of the disease,
4. planning,
5. prediction models,
6. survey methodology and surveyors, and
7. treatments.

A couple of the other needs that were mentioned did not fit in these categories and were classified as “other.”

Biology of the Disease

While it is generally known how root diseases like *Armillaria* function and develop, respondents felt that more basic information was needed to appreciate the overall picture of the diseases and their life cycles. Many believed that the validity of existing assumptions needed testing. In addition, more information was necessary on tree species’ susceptibility to the various root diseases (*Inonotus tomentosus* was mentioned specifically). More information or research was also required to update the *Root Disease Management Guidebook*.

Inventory

Respondents felt that an inventory was required of areas infected with root disease.

Impacts of the Disease

More information is necessary on the effects of root disease on forest stand species composition, growth and yield, and the ecosystem, and the relationship of these effects to biogeoclimatic site type (zone/subzone), as well as whether these impacts are going to be significant. Additional information is required on the mortality levels associated with root diseases. Respondents felt that the current disagreement among pathologists about this needs to be resolved. Information on the effects of root diseases at the forest products level is also needed. Resolving questions about the effect of disease on wood quality, value, piece size and dimensions, and the ratio of heartwood to sapwood, will enable the industry to determine the impact of these diseases on the “bottom line.”

A better method for incorporating these impacts into the Timber Supply Review is also required.

Planning

Respondents noted that more root disease management planning is required at the landscape level. Current management usually takes place on a cutblock-by-cutblock basis. Root rot needs to be designated as a priority issue in higher level plans. One respondent felt that forest management involved many conflicting values and that root disease management always seemed to be the lowest priority.

Prediction Models

Determining the relationship between site conditions and root disease was identified by most respondents as a major information need. Permanent Sample Plots in immature stands (both managed and unmanaged) are needed to help chart the course of the disease and its impacts, as well as other stand attributes. Models are needed to assess root disease hazard, or to predict the risk, simulate the rate of disease spread, and ascertain the expected damage to the stand and landscape. According to one respondent, parts of such a model are already available.

An intervention matrix or decision-making key also needs to be developed to help forest managers determine whether treatment is required.

Survey Methodology and Surveyors

A better and simpler survey method for assessing root rot infection levels in the field is necessary. One respondent felt that the accuracy of the current pixel survey was not high enough to obtain the required level of detail and to determine the various trigger points (low vs. medium vs. high infestation level). The need for more staff (contractors and employees) training was also identified in order to quantify the amount of the disease in an area and to determine treatment requirements.

Treatments

Respondents felt that current management practices should be reviewed, and that information was necessary on best management strategies, the different treatment options, and the conditions under which these treatments should be applied. This information should be conveyed to field workers. The following information on root rot treatments is also necessary:

- Cost/benefit analysis of treatment options
- Impacts of treatments with respect to site disturbance guidelines
- Effectiveness of the new and existing treatments
- Alternative treatments to stumping (e.g., non-invasive biological treatments)

Training on the use of the existing management tools was also identified as essential. In addition, a review of the appraisal system was required to incorporate the work already done on controlling root disease through root removal.

Other

Respondents also identified the need for more extension on current research projects.

QUESTION 5. NAME FIVE AREAS PERTAINING TO ROOT DISEASE WHERE YOU FEEL MORE INFORMATION IS NEEDED. EXAMPLES: (1) UNDERSTANDING THE BIOLOGY OF THE DISEASE AS PART OF THE ECOSYSTEM; (2) LONG-TERM IMPLICATIONS IN TERMS OF GROWTH AND YIELD; (3) WHAT MANAGEMENT STRATEGIES WORK BEST; (4) EFFICACY OF TREATMENTS; (5) ROLE OF HARDWOODS; AND (6) IMPACTS OF PARTIAL CUTTING.

Understanding the biology of the disease as part of the ecosystem was ranked as the most important information need by the majority of respondents (Table 2). Information on what management strategies worked best and the long-term implications of root rot for growth and yield were also seen as important.

Other information needs were also suggested by respondents. Several respondents felt that more information was required on the economics of root disease control or management strategies, including the effects of disease on wood quality and the end products produced. The need to explore the relationships between root disease and other factors, such as bark beetles and fire, was also identified by several respondents. Additional information needs identified by respondents are included in Appendix 3.

TABLE 2. Ranking of examples of information needs (number of respondents)

Rank ^a	Example no.					
	1	2	3	4	5	6
1	14	7	6	7	4	8
2	4	10	9	5	8	7
3	1	3	1	1	1	3
4			3	1	1	
5	1					
6						

a If the respondent said that all were important, but that number x was most important, then number x was ranked first and all others were given a second rank.

QUESTION 6. IN YOUR OPINION IS THE CURRENT INFORMATION (A) AVAILABLE FOR USE, AND (B) USER-FRIENDLY? IF NOT, WHY? (I.E., LANGUAGE, OR FORMAT AND DELIVERY PROBLEMS)

Response to this question was varied and did not seem to be related to affiliation or organization. Sixteen respondents said that current information is available for use, while four said that it wasn't available or wasn't readily available. Nine respondents said that the information was user-friendly; four thought that it was not.

Some respondents believed that data interpretation was a problem and that some strong differences of opinion existed among the experts. They stressed that reaching a provincial consensus was important.

Concerns were expressed about the occasional occurrence of too much information and that no middle ground existed between general guidelines and specific research information. Lack of time to read new information was also mentioned.

One respondent stated that scattered information was available, but that it needed to be pulled together, with highlights summarized. A difficulty in knowing where to look for information was also noted. Another respondent thought that it was difficult to remain up-to-date as current information or knowledge was constantly changing. Several respondents felt that extension and technology transfer of root rot information had been weak and that more extension was needed. One respondent suggested that a Web site would be beneficial. To address some of these needs, the Canadian Forest Service is currently working on a pathology Web site aimed at field workers. This will allow the user to obtain as much detail as they require. The Canadian Forest Service also has listings of current publications that can be ordered on-line. Most are available at no cost. Some respondents said they were more comfortable obtaining information from their local regional specialist or pathologist. A caution was expressed by one respondent that any software tools or models developed needed to be district-specific and based on district data in order to be useful.

QUESTION 7. WHICH OF THE FOLLOWING ACTIVITIES WOULD BE MOST EFFECTIVE IN DEALING WITH THE ROOT ROT ISSUE? (A) IDENTIFYING THE KEY GAPS IN OUR KNOWLEDGE ABOUT ROOT ROT (“KNOWLEDGE GAPS”); (B) GETTING EXISTING TECHNICAL AND RESEARCH INFORMATION ON ROOT ROT OUT TO PLANNERS AND FIELD OPERATIONS PEOPLE IN A USEABLE FORMAT (EXTENSION); (C) IMPLEMENTING RESEARCH TO FILL INFORMATION GAPS THAT HAVE ALREADY BEEN IDENTIFIED; (D) SECURING FUNDING OR DEVELOPING PARTNERSHIPS TO IMPLEMENT THE IDENTIFIED RESEARCH; (E) DEVELOPING OR REVISING FORESTRY STANDARDS OR POLICIES TO BETTER FIT THE NATURE AND BIOLOGY OF ROOT ROT.

The most effective activities to deal with the root rot issue were identified as getting the existing technical and research information on root rot out to planners and field operations people in a useable format and developing or revising forestry standards or policies to better fit the nature and biology of root rot (Table 3). Seven respondents felt that all of the activities were important, although five of them identified an activity that was the most important. Responses to this question varied by affiliation. Researchers (academia, federal government and regional government staff) felt that activities C and D would be most effective. Provincial government operational staff (districts and Victoria) responded that activity B would be most effective, while activity E was identified by industry respondents as being the most effective in dealing with the root rot issue.

TABLE 3. Ranking of activities that would be most effective in dealing with the root rot issue (number of respondents)

Rank ^a	Activity				
	A	B	C	D	E
1	8	11	8	7	12
2	5	1	7	2	4
3	1	3	3	2	2
4				2	
5		1			

^a If a respondent said “all of them,” then all areas were ranked first. If they said “all of them,” but x was most important, then x was ranked as first and all others were given a second rank. If a respondent said that two or more were important with no thoughts on rank, then all were ranked as first.

Some respondents added other activities to the list, which they thought would be effective in managing for root rot. One respondent believed that obtaining a consensus among pathologists on the interpretation of the data by site and area was very important. He recognized that this may be difficult given the different areas and the pathologist’s area of expertise. He also stated that baseline information was required to make comparisons between plantations. Another respondent suggested that incorporating the effects of root rot into the Timber Supply Review process was critical. The beneficial effects of treatments, especially in intensively managed forest management zones, also need to be tested and incorporated into the timber supply models. A third respondent felt that a comprehensive economic cost/benefit analysis of treatments would be an effective activity.

Additional comments received from individual respondents are presented in Appendix 4.

QUESTION 8. DO YOU FEEL IT WOULD BE CONSTRUCTIVE TO HOLD A PROVINCE-WIDE MEETING OR WORKSHOP OF PEOPLE WITH VARIOUS AREAS OF EXPERTISE IN ROOT ROT (I.E., OPERATIONS, POLICY, RESEARCH) TO DISCUSS THESE PRIORITY ACTIVITIES AND ATTEMPT TO DEVELOP A PLAN TO IMPLEMENT THE SELECTED ACTIVITIES? IF YES, HOW LONG SHOULD IT BE? WHAT TIME OF YEAR? WHAT KIND OF PRODUCT WOULD YOU EXPECT FROM A MEETING LIKE THIS? CAN YOU SUGGEST OTHERS WHO SHOULD ATTEND? (NOTE THAT OUR UPPER LIMITS WOULD BE AROUND 35 PEOPLE.) IF A PROVINCE-WIDE MEETING DOES NOT STRIKE YOU AS THE BEST STARTING POINT, CAN YOU SUGGEST AN ALTERNATIVE?

The majority (20 of 29) of respondents said that a province-wide meeting would be beneficial. Of those who said that a province-wide meeting would not be beneficial, the majority (6 of 9) felt that a meeting at a regional level would be a better alternative. Their reasoning for not holding a province-wide meeting is outlined below.

- Too much variability in root disease species causing problems (*Armillaria* in the south, *Tomentosus* in the North, *Phellinus* on the Coast).
- Better to look at root diseases at an ecosystem level.
- Lots of subtle differences in the disease from area to area and there aren't consistent ways of treating the disease.

Suggested alternatives to a province-wide meeting included:

- Hold a smaller meeting at a regional level.
- Have an outside expert, or committee of experts, come in to do an evaluation or assessment of British Columbia's root rot control and research program and make recommendations.
- Organize an international Root Rot Symposium and then follow-up with a province-wide meeting to develop terms of reference for a management committee.
- Audit operations where root rot problems are prevalent, and report on the effectiveness of the management strategies and the long-term implications of the findings. A cost/benefit analysis and impact on productivity should also be included.
- Hold a meeting of researchers to pull all information together and then travel to different regions/districts to present the information and answer questions.
- Hold round-table meetings (at least 3) with licensees, district staff, and researchers.
- Have two meetings. The first would develop strategies and a business plan. This would be followed by a second meeting with government and industry managers to obtain funding and support to move forward with the project.
- Wait until more information available.

Several respondents stated that some very clear objectives and expectations would be required for the meeting.

The majority of respondents felt that a 1–2 day meeting would be sufficient. A few suggested that a longer 3–5 day symposium should be organized.

In general, a winter meeting (January to March) seemed to meet most of respondent's needs, although one respondent said that winter was a bad time for forest district staff because of time constraints related to district bark beetle management programs.

The products expected from a root disease management meeting were related to the type of meeting suggested by the respondents. These products included:

- White paper.
- Published proceedings (4) (have them available at start of meeting [1]).
- Plan to establish Permanent Sample Plots for managed and unmanaged stands. Will need provincial government buy-in (Treasury Branch, Inventory, Pathologists, Entomologists).
- List of proposals/recommendations on what we should be doing prepared by a steering committee and distributed before meeting for review; would revise following meeting, depending on discussion.
- Document disagreements among the experts and the reasons for them, then determine research needs to address these disagreements.
- Report on goals and direction for root disease management.
- Plan to revise some of the policies on root disease management.
- Summary of latest research findings and list of contacts or experts, with a profile of the things that they are working on.
- Statement of needs, proposed activities (general plans), and priorities of various user groups (list and tabulate priorities from different expert or user groups, preferably individuals).
- Report on research priorities and agreement amongst experts as to the best way to deal with the issue.

APPENDIX 1 Root Rot Telephone Survey Questions

Root rot was identified in the Southern Interior Forest Extension and Research Partnership's Needs Survey as a serious and ongoing problem both for Industry and Ministry staff. Before we begin any programming in root rot, we want to consult with you, the experts, to get a clearer understanding of the nature of the problem. We will do that by asking you a series of questions.

1. What is your general feeling about how forests are being managed for root disease?
2. In your opinion, which root disease presents the biggest management challenge in the Southern Interior of BC and why? (i.e., *Armillaria*, *Phellinus* [laminated root rot], black stain, *Annosus*)
3. Does your work focus on root disease? Explain. Which root disease?
4. Do you think that planners and operational staff have the tools to make the best management decisions for root rot? If not, what is missing?
5. Name five areas pertaining to root disease where you feel more information is needed.
Examples:
 - understanding the biology of the disease as part of ecosystem,
 - long-term implications in terms of G&Y,
 - what management strategies work best,
 - efficacy of treatments,
 - role of hardwoods,
 - impacts of partial cutting.
6. In your opinion is the current information a) available for use, and b) user-friendly? If not, why? (i.e. language or format/delivery problems).
7. Which of the following activities, in your mind, would be the most effective in dealing with the root rot issue?
 - a. Identifying the key gaps in our knowledge about root rots ("knowledge gaps").
 - b. Getting existing technical and research information on root rot out to planners and field operational people in a usable format (extension).
 - c. Implementing research to fill information gaps that have already been identified.
 - d. Securing funding and/or developing partnerships to implement the identified research.
 - e. Developing or revising forestry standards/policies to better fit the nature and biology of root rot.
8. Do you feel it would be constructive to hold a province-wide meeting/workshop of people with various areas of expertise in root rot (i.e. operations, policy, research) to discuss these priority activities and attempt the development of a plan to implement the selected activities?
 - i. If yes, how long should it be?
 - ii. What time of year?
 - iii. What kind of product would you expect from a meeting like this?
 - iv. Can you suggest names of others who should attend? (Note that our upper limit would be around 35 people.)
 - v. If a province-wide meeting does not strike you as the best starting point, can you suggest an alternative?

APPENDIX 2 Root Rot Survey Contacts

Name	Position	Affiliation	Response
Don Norris	Regional Pathologist	Nelson Forest Region	Yes
Emile Begin	Forest Health Officer	Invermere District	Yes
Julie Castonguay	Forest Health Officer	Kootenay Lake District	Yes
Hadrian Merler	Regional Pathologist	Kamloops Regional	Yes, question 8 only
Gerry Chapman	Silvicultural Officer	Williams Lake District	Yes
Von Vickers	Forest Health Technician	Williams Lake District	No
Michael Pelchat	Silviculture Officer	Quesnel District	No, forwarded to district staff
Grant Johannesen	Forest Health Technician	Quesnel District	No
Gerry Mooney	Silviculture Officer	Horsefly District	No
Ron Godlonton	FOS	Horsefly District	No
Don Wright	Forest Health Technician	100 Mile House District	Yes
Rob Haley	Forest Health Technician	Chilcotin District	No
Doug Harris	Former Silviculture Officer	Chilcotin District	No
Wayne Anshelm	Forest Health Technician	Salmon Arm District	Yes, question 8 only
Pat Byrne	Forest Health Specialist	Merritt District	Yes, general comment only
Ross Elliott	Forest Health Officer	Boundary District	No
Liz Goyette	Forest Health Officer	Cranbrook District	Yes
Margot Hollinger	Forest Health Officer	Penticton District	Yes
Dave Piggin	Forest Health Forester	Kamloops District	Yes
Stewart Pyper	Forest Health Technician	Clearwater District	Yes
Dan Reibin	Forest Health Technician	Arrow Forest District	Yes
Ed Senger	Forest Health Officer	Lillooet District	Yes
Rick Specht	Forest Health Officer	Vernon District	No
Pat Wadey	Zone Forester	Revelstoke District	No
Russ Cozens	Forest Health Officer	Forest Practices Branch	No, recommended Muir
John Muir	Prov. Forest Health Officer	Forest Practices Branch	Yes
Bill Chapman	Soil Scientist	Cariboo Forest Region	Yes
Robert Wright	Silviculturist	Slocan Forest Products	No, recommended Cutts
Pat Cutts		Slocan Forest Products	Yes
Dave Basaraba	Silviculturist	Crestbrook Forest Ind.	Yes
Shane Browne-Clayton		Riverside Forest Products	No, recommended Coulter
Bill Coulter		Riverside Forest Products	Yes
Jerry Canuel		Aspen Planers	No
Ron Ozanne		Atco Lumber Ltd.	Yes, recommended Bekker
Bob Johnson		Riverside: Armstrong	No

APPENDIX 2 *Root Rot Survey Contacts (Concluded)*

Name	Position	Affiliation	Response
Kim Peel	Silviculturist	Lignum Ltd.	Yes
Art Lacouciere		Weldwood	No
Charles Von Hahn	Was Silviculturist	Slocan: Quesnel	Yes
Guy Burdikin	Silviculturist	West Fraser: Williams Lake	Yes
George White	Silviculturist	Riverside: Horsefly	Yes
Tim Harding	Silviculturist	Riverside: Williams Lake	Yes
Rob Cochrane	Silviculturist	West Fraser(TFL): Quesnel	No
Mark Hopkins	Silviculturist	Ainsworth	No, recommended Brown
Don Brown		Ainsworth	Yes
Dan Roberts		Ainsworth	No
Wayne Nuyens	Silviculturist	Ainsworth: 100 Mile	Yes
Grant Glessing	Silviculturist	Tolko Industries Ltd.	No
Duncan Morrison	<i>Armillaria</i>	CFS	Yes
Rona Sturrock	<i>Phellinus</i>	CFS	Yes
Mike Cruickshank	<i>Armillaria</i>	CFS	Yes
Bart Van der Kamp		UBC	Yes
Dan Livingston	Silviculture Forester	Weyerhaeuser: Lumby	Yes
Fred Elsaesser	Silviculture Forester	Weyerhaeuser: Merritt	No
Rich Hunt	<i>Tomentosus</i>	CFS	Yes
Fred Peet	Root Rot model	CFS	Yes
Geoff Bekker	Woodlands Manager	Pope and Talbot	Yes

APPENDIX 3 Individual Comments on Information Needs: Question Five

Numbers in brackets indicate that the need was identified by more than one respondent.

- Economics: effects of disease on growth and yield, wood quality, and end-product from mills
- Economics of root disease control or management strategies (2)
- Rate of root growth for British Columbia species
- Rate of fungus growth along a root for British Columbia species
- Probability of fungus transfer when a healthy root crosses a diseased root
- Occurrence of natural resistance
- Host–pathogen interaction (2)
- Management of root disease in young stands: fill plant or start over
- Relationship between bark beetles and root disease
- Information on relationship between fire and *Armillaria*
- Impacts on free growing: are stocking targets realistic?
- Disease interactions with younger stands that weren't treated
- Impact on the ecosystem of using alternative species such as larch in re-establishing root disease areas
- Research and development on potential machine configurations that could be used to treat root diseases in all silviculture systems
- Continue and expand support for Canadian Forestry Service scientific research on root diseases, particularly for *Armillaria* in southern interior British Columbia. This research has provided major benefits and insights and has been one of the “best-buys” in recent years. On-going support is essential. Additional technical support is needed.
- Organize and make available current information to evaluate risks and impacts
- Calibrate and facilitate training on root disease model via PROGNOSIS BC model
- Establish and re-measure extensive growth-and–yield trials to acquire data on disease impacts and treatment (practices) effects
- Establish an innovative treatment program to provide short-term, limited (e.g., \$20 000 or less) funding for ad hoc or impromptu research trials
- Develop and provide an update training session for foresters and technicians to improve professional competency and promote implementation of efficacious practices

APPENDIX 4 Individual Comments: Question Seven

- Government needs to work with licensees to solve the problem
- Get information from other regions as they have more root rot problems than here in the Cariboo
- Would like to see an appraisal allowance for stumping: enticement to licensees
- Difference in opinion among researchers on the interpretation of the science
- Need to determine and communicate the impacts of root disease to licensees. May result in higher ranking for information
- We have studied root rot to death: know all we need to know
- Review revenue side of picture in terms of beneficial forest health-related activities and licensee incentives
- Need to discuss and determine extent of problem in the Cariboo first
- Need to take a retrospective look at standards or policies. Look back at what we've been doing and what we now know. Will lead to definition of knowledge gaps
- Urgent need for change in attitude towards root disease among senior (ADM) managers and managers in Ministry of Forests and their counterparts in industry
- Ministry of Forests needs to implement policies and probably regulations regarding root disease management
- Too narrowly focused at stand level for control activities: costly. Need to look at a higher level and assess risk
- Don't want 'E' at all: don't have a lot of SOP's in their district (SOP = Standard Operating Procedure)
- Convincing people about the impacts of root disease and that sometimes partial cutting doesn't make sense from an ecological point of view in terms of root disease incidence and severity
- Need some well-done surveys to try to predict how the disease will act. Keep information from these surveys in a central location