Welcome to

Forest Health

for Silviculture Surveyors

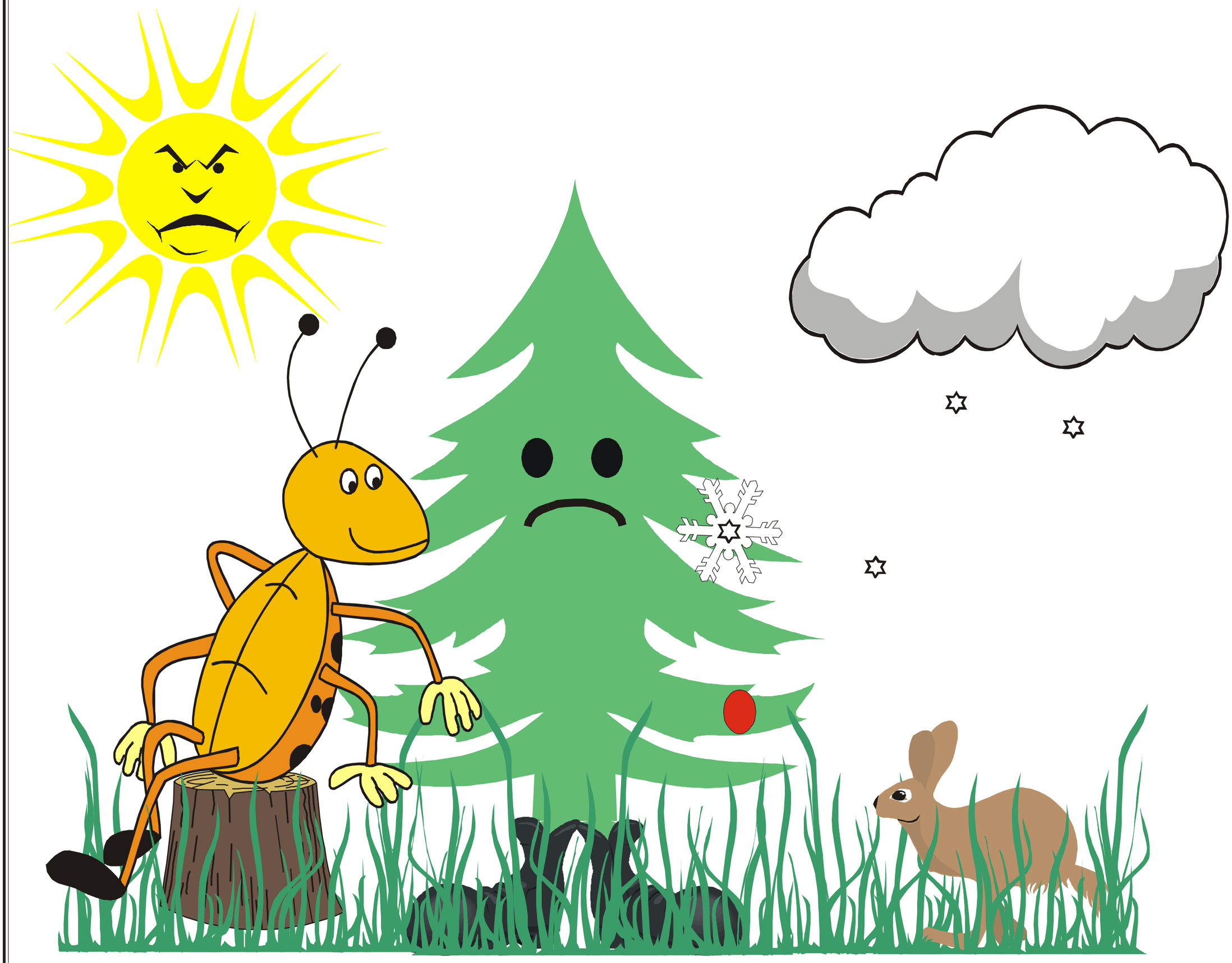




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Acknowledgements

The Forest Health for Silviculture Surveyors Course was originally developed and produced by Larry McCulloch and the staff at Laing and McCulloch of Smithers, in 1995. The course was presented on numerous occasions over the following few years. As time progressed, the knowledge of forest health issues grew, making the format and content of the original course less valuable.

In January of 2000, an initiative directed by John Muir, RPF, of the Ministry of Forests, was undertaken to bring these materials up to date. The intent was to bring the course content up to the present day's level of forest health understanding. Course materials were revised based on the collection of new ideas presented by the participants and the instructors.

In addition, the format of this course was modified so the content could be easily updated as the knowledge of forest health issues increases in the future.

The successful restructuring of this course was possible only through the involvement of John Wallis (Wallis Environmental Consultants), and Joan Holt (Entopath Management Ltd.). This version of the course was developed by Allen & Sue Schaad and the team at Prifor Management Ltd., of Williams Lake.

Purpose

The primary purpose of this course is to provide silviculture surveyors with an opportunity to become more aware of:

- the importance of forest health issues
- methods employed in identifying major causes of mortality, growth and wood quality reduction
- the host(s), symptoms and impacts of forest pests
- the use of common reference material
- the approved methods for collecting forest health data
- how to apply the Free Growing Damage Criteria to silviculture surveys
- common treatment methods and the creation of treatment recommendations
- preparing for the forest portion of the Silviculture Survey Accreditation Examination

The course itself only provides an opportunity for participants to learn the methods of forest health identification and the options for treatment recommendations. It is expected that the participants will need to combine the knowledge gained in the course with their personal silviculture and forest health experience through field application over time to become fully proficient in the subject.



How to Use This Guide

This guide was designed to help facilitators prepare for and deliver an informative and entertaining training course. The facilitator's guide itself is designed to provide the facilitator with a framework for delivery. While the course could be presented in a "word-for-word" basis, it will be more enjoyable for you and for the participants, to apply your own personality within the framework provided. Facilitators will have their own personal preference of presentation style. They will also have their own history of personal forest health and silviculture experience. In addition, each group of participants and each delivery location will have their own particular characteristics. For all of these reasons you are encouraged to "make this course your own". Examples, techniques and methods described in this document should be considered suggestions. Feel free to add your own examples that suit the general learning objectives.

It is true that the best learning experience can be provided through a course being delivered by several people - an experienced facilitator/instructor and/or local Ministry of Forests representatives and/or specialists. This is rarely the reality of the delivery situation. A single instructor/facilitator is more common. The facilitator/instructor must therefore have considerable knowledge and experience in the fields of silviculture and forest health surveys and treatments. 'Local' knowledge is good, but a provincial scope is better.

An ability to apply the principles of adult learning and "learner-centred" training approaches is definitely an asset.

For those with extensive silviculture and forest health experience, but limited instructional or facilitation experience, we recommend:

How to Teach Adults in One Hour - by William A. Draves

How Adults Learn - A series of workshops offered through the BC Forestry Continuing Studies Network by John Baker

The success of any training depends upon how well the session facilitator selects and organizes activities to communicate the purpose and objectives of the session to the participants. The care and thoroughness with which you plan and prepare each session will make the difference between a mediocre and a successful event. Please review these materials carefully, select the activities that meet the needs of your audience, and have fun being a part of the learning process.



Background

This course was originally developed in 1994 and 1995 by the Ministry of Forests, Silviculture Practices Branch, under contract with Laing and McCulloch Ltd. of Smithers. The process of course development was mixed with facilitation sessions to develop the Free Growing Damage criteria.

This version of the course and the associated materials were revised in the beginning of 2000 by Allen Schaad, RPF of Prifor Management Ltd. in Williams Lake.

Since our understanding of the individual forest pests is constantly changing, this makes it very difficult to develop a training package that is constantly up-to-date. As soon as materials are prepared, they require revision because we have learned some new facet of one or more of the pests. In addition, to the credit of the forest health professionals in the province, research is constantly increasing our understanding of treatment options and effectiveness.

Further, the collective philosophy of the forest health community is broad. There are so many 'unknowns' that a great deal of the forest health decisions are based on professional scientific judgement. The mix of quantitative and qualitative observations, combined with personalities, results in a very active forest health community.

This course is therefore designed to accommodate the ongoing growth of our understanding of forest health issues. The details and specifications are intentionally restricted to the Appendix section of the materials. As a result, lively discussion and active revision of such essential documents as the Free Growing Damage Criteria can continue as needed. As the results of these discussions are formulated into new criteria, the new document can simply replace the old one in the appendix. A date is also located on each page of the materials to assist with tracking these changes.

Introduction to the Facilitator's Guide

Target Audience
This module is one of a series that is intended to provide individuals with an opportunity to learn technical aspects necessary to conduct silviculture surveys in BC. This Module, as its name describes, contains the methods required to successfully perform the forest health components of the silviculture survey process.

This course is best suited to those with some basic understanding of silviculture survey procedures. The module entitled Basic Silviculture Surveys is a suggested prerequisite, along with some related field experience. For those individuals who have very little forest health and/or surveying experience, this course is suitable as an introductory course. Significant follow-up practice is essential.

While this course does not in itself result in becoming an accredited surveyor, the material presented is directly linked to the Silviculture Survey Accreditation Exam.

Class Size
The recommended maximum class size is 15. Above this number, an assistant or co-instructor is essential to maximize the participant's opportunity to receive personal attention.

This binder of materials has been prepared with the following sections:

Presentation Notes
Each page contains a miniature version of the overhead transparency. In addition, reference is made to the corresponding '**Overhead Number**', and the '**Participant's Workbook Page Number**'. '**Instructional Objectives**' are listed for each to assist with guiding the intent of the discussion. Finally, '**Key Points, Concepts, Examples & Facilitator's Notes**' is also intended as a reference for the instructor. It contains examples, reference material and alternate methods of presentation. Instructors may wish to highlight key words within this section to create their own personalized presentation notes.

Overhead Transparencies
A full set of overhead transparencies is contained within each Facilitator's Guide. Multiple versions of some have been prepared to allow the facilitator to select the method he/she prefers. As well, regionally specific examples have been produced.

Slides
The Facilitator's Guide contains a set of slides showing common samples of various forest health factors. Instructors may wish to add their own locally relevant subset of slides to this collection.

Appendices
Included in this section are such things as the forest health-related Forest Practices Code Guidebooks, and the compact disc containing these materials.



Course Objectives

The subject of forest health is broad, and can be studied in great depth. This course is much more of an introduction or overview of the subject. The experts in the field may find it even cursory. The goal in preparing this course is to provide a working level of training for the intended target audience: silviculture surveyors. It is intended to provide an opportunity to learn the technical methods expected of a silviculture surveyor. The course objectives are outlined as follows:

Learn the **importance of forest health** information,

Develop a **foundation** of terms, definitions and concepts

Be introduced to the **identification, hosts and impacts** of the major causes of tree mortality and growth reduction,

Use common **reference material** to learn more about forest health factors,

Learn **data collection** methods

Apply **free growing damage criteria**,

Become familiar with some of the common **treatments** and **recommendations**.

Much can be added to the content by an experienced facilitator through the use of relevant local examples. However, there is little that can be eliminated.



Facilitator Preparation

Field Sites

While the classroom component of this course is important, the field portion is crucial. Many participants learn best from 'hands on' use of the skills they have been introduced to in the classroom. The role of the facilitator/instructor is to 'act as tour guide'. This is a fine balance between 'teaching' and presenting the opportunity to learn. The facilitator's obligation is to locate sites that provide the greatest opportunity for the participants to learn.

The success of Day 2 is dependant on good field site selection and organization.

Principles to consider when selecting field sites:

Travel distance - This must be kept to a minimum. The participants did not attend the course to sit in a vehicle for hours to travel to the "perfect" field site. One may have to accept a marginal site that is close, rather than endure great travel distances. Since root disease is the most difficult to recreate at a suitable demonstration site, this should be the primary criteria. Other samples are more easily collected and transported to a common spot.

Travel Logistics - Consider the need for four wheel drive, radio communications, heavy industrial vehicle traffic and parking. We suggest the lead and trailing vehicles monitor a common radio frequency in the event of some access difficulty.

Multiple Spots - Two separate locations have been successfully used in previous delivery sessions. This allows the participants to see different forest health factors under different conditions. Moving from the first to the second site provides a break, and allows some time for individual discussion. Under severe weather conditions, it also allow participants a convenient period to "warm up/cool down". Where more than two spots are selected, travel time should be considered.

Where the pre-selected field sites lack certain forest health factors, extra effort should be employed to gather these absent forest health factors from other sites. These can make great samples that can be used in the classroom component. In addition, samples can be brought to a central location at one of the field sites for examination by the participants.

Plot Establishment - To ensure the smooth flow of the field day and the desired results are achieved, the stocking and or free growing survey plots that will be tallied by the participants should be previously established. Intentionally position the plots in locations that have forest health factors. Time permitting, tally these plots yourself so you know the result to expect when the participants tally them. Locate the plots within easy walking distance and within sight of one another. Mark the plots for easy locating by the participants when you return. Number the plots in a logical method. Mentally plan the route from the transportation vehicles, to the walk-through and on to the plots. You may wish to demonstrate a plot as well. A plot card blown up to 400% makes a good visual impact to record the result of your demonstration plot.



Sample Collection

Fresh samples will be required during the classroom practice session when using the reference books . The number of separate forest health factors will be dependant on the speed at which the participants are able to confirm their identification. We recommend two to four different forest health factors. There should be at least two samples of each forest health factor, and even more samples when the class size is larger than ten.

Suggestions:

Select samples from different general types of forest health factors:

- animal damage
- abiotic injuries
- diseases
  - root disease
  - stem disease
  - mistletoe
  - foliage
- insects
  - bark beetle
  - weevil
    - leader
    - root collar
  - defoliator
- treatment damage
- vegetation damage

Supplies

The facilitator will have to confirm the production of a sufficient quantity of participant's workbooks. There is a file on the CD that contains this information.

A supply of field cards will be required. 1 - FS 747, 1 - FS 657, 2 - FS 658 and 2 - FS 659 per participant should be sufficient. These are frequently updated, so ensure you have the most current versions.

A copy of the Free Growing Damage Criteria is also provided in the appendix. Again, ensure you have the most up-to-date version.

Additional copies of the reference books will be an asset.



Facilitator's Check List

TWO WEEKS (or more) BEFORE THE SCHEDULED DELIVERY DATE, CONFIRM WITH THE COURSE ORGANIZING BODY:

- ❑ course location, (fax a map if required)
- ❑ course date and start time, (request a copy of the materials the participants were sent)
- ❑ facility - time available for your use
- ❑ number of participants
- ❑ desired seating arrangement
- ❑ procedures for late registrants
- ❑ preparation and delivery of the Participant's Workbooks
- ❑ determine who will supply audio/visual equipment
- ❑ miscellaneous, "local logistics".....

PREPARE YOURSELF

- ❑ organize your facilitator's guide since the last time it was used
- ❑ research field sites based on the delivery location
- ❑ visit the field site to confirm access and local issues
- ❑ review the damage agent most common to the course location
- ❑ consult with local experts for recent techniques and local examples
- ❑ collect samples for classroom and field use
- ❑ copy the hand out materials (one of each for each participant and extras)
- ❑ assemble reference material
- ❑ review the facilitator's guide
- ❑ miscellaneous supplies
- ❑ organize slides, ensure availability of slide projector, screen extension cord(s)

MORNING OF DELIVERY

- ❑ arrive early
- ❑ confirm classroom layout and organization
- ❑ distribute participant's workbooks
- ❑ lay out reference materials
- ❑ test the audio/visual equipment
- ❑ set the videos to the correct start location
- ❑ find and test the lighting adjustments (lights and curtains)
- ❑ identify the location for adjusting the heat in the room
- ❑ identify the facility representative to call in case of a problem during the session
- ❑ confirm the location of the restroom facilities
- ❑ confirm arrangements for refreshments (if provided)

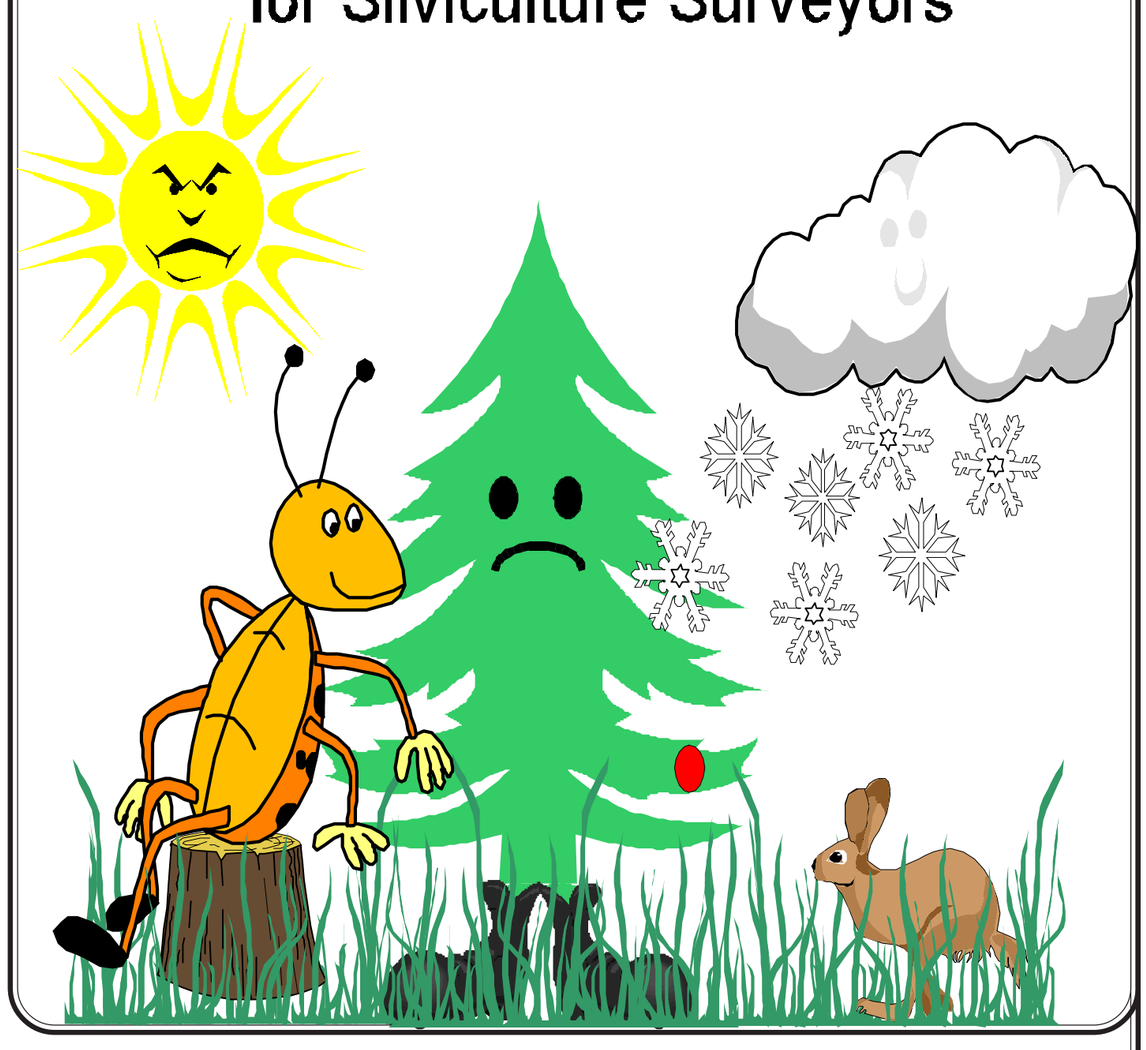


Participant's Workbook Page Reference: 1

Overhead Number: 1

Lesson Number: 1

Title: Introduction



Instructional Objectives:

- Introduction to the Instructor(s)
- Awareness of the facility

Key Points, Concepts, Examples & Facilitator's Notes:

- Take the time to introduce yourself. The intent is for the participants to feel comfortable that "you are worth listening to". You have been selected as an instructor based on your knowledge and your experience in the field of forest health. In addition, you need to convey to the participants that you are friendly, and approachable. Make them comfortable and ready to learn.

Suggestions for information to include:

- Your name and company affiliation
- Your education and employment history
- Special knowledge of the subjects of silviculture and forest health
- Personal information/short amusing story (remind them you are human too)



General "Housekeeping" Information

In an effort to make the participants comfortable in the facility, the instructor should pass on information to assist them. Subjects to consider:

- The location of the washrooms
- The location of the telephone
- Any methods to deal with messages received throughout the day
- Room temperature
- Any other information to assist the participants in feeling comfortable and to allow the course to proceed smoothly.
- The participant's workbook has been provided. It contains each of the overheads, and space for the participants to write notes.

Participant's Workbook Page Reference: 3

Overhead Number: 2

Lesson Number: 1

Title: Introduction

Agenda

Today

Introduction

Importance of Forest Health



Foundation

Identification

Application

Free Growing Damage Criteria

Treatment Recommendations



Tomorrow

Field Practice

Instructional Objectives:

- To make the participants aware of the plans for the duration of the course
- Wherever possible, plant the "seed of excitement" that there are 'good things to come'

Key Points, Concepts, Examples & Facilitator's Notes:

- Introduce the agenda as "The Plan". This is a general framework to the training session. There are no times provided for the individual lessons. Time allocated to individual topics can be adjusted to meet the level of participation, discussion, questions and the prior level of understanding the participants bring with them. However, keep in mind those with limited knowledge may slow the progress of the group, as will those with extensive experience. A balance is the key. Tactfully "moving on" to the next topic may have to be required.
- The timing of breaks and general start and stop time should be followed by the instructor.

Instructional Hint:
As the group begins a break, indicate a time to return, rather than the length of the break. "We'll begin again at 10:15", rather than, "Let's take a 15 minute break". You will find the group will often reconvene with little encouragement by you. This will assist with keeping the group motivated and moving ahead through the subject matter.

Participant's Workbook Page Reference: n/a

Overhead Number: 3

Lesson Number: 1

Title: Introduction



Instructional Objectives:

- Introduce themselves to the others attending
- Become aware of the range of experience of their co-participants

Key Points, Concepts, Examples & Facilitator's Notes:

- This is often an awkward point for many participants.
- Since this is a relatively short course, the introductions should also be short. Total time to complete, for an average class, should be between 5 to 10 minutes.
- Some instructors may wish to add a 'game' to these introductions. Three optional overheads have been prepared. Any one of them may be used to guide the introduction of the students. You may also choose to refrain from using any of these overheads in favour of using one of your own.
- Some groups and some instructors do not like the game concept. They often find it embarrassing or 'juvenile'. When it works, it is a great set up for the day. This must be determined by the individual instructor.

Participant's Workbook Page Reference: n/a

Overhead Number: 4

Lesson Number: 1

Title: Introduction



On the "tent" cards,

Print your Name

and

forest

Draw Your Favorite Pest.



Participant's Workbook Page Reference: n/a

Overhead Number: 5

Lesson Number: 1

Title: Introduction



Participant's Workbook Page Reference: 3

Overhead Number: 6

Lesson Number: 1

Title: Introduction

Principal Learning Objectives

Through this course participants will have the opportunity to.....

Learn the **importance of forest health** information,

Develop a foundation of terms, definitions and concepts,

Be introduced to the **identification, hosts and impacts** of the major causes of tree mortality and growth reduction,

Use common **reference material** to learn more about forest health factors,

Learn **data collection** methods and apply **free growing damage criteria**,

Become familiar with some of the common **treatments** and **recommendations**.



Instructional Objectives:

- Provide an overview of the course objectives

Key Points, Concepts, Examples & Facilitator's Notes:

- Remind the participants of the breadth and depth of the subject of forest health.
- This is a course on techniques, methods and process. You will not become a forest health expert in the next two days. True understanding and proficiency in the subject comes with field application, and continued learning.
- You will be introduced to the methods necessary to become competent over time.



Participant's Workbook Page Reference: 4

Overhead Number: 7

Lesson Number: 1

Title: Introduction

Silviculture Survey Accreditation Exam...

2000 Performance Objectives;

1. Understand current legal requirements as they relate to silviculture surveys and **how to stay current**.
4. List the reasons (criteria) for **stratification**, and describe why good stratification is important for a silviculture survey.
5. Choose the survey, **timing of the survey**, the type of data to collect and the sampling method to effectively address on-site critical factors.
10. Understand the purpose of the **walk-through**.
17. Identify **critical factors** and explain how they affect the establishment, growth and development of the future stand and the achievement of stand objectives. This will include site limiting factors and management limiting factors such as:

- Frost
- Soil nutrients
- Soil moisture
- **Forest health factors**
- Soil conservation hazards and sensitivities
- Soil temperature
- Non-timber management issues

Instructional Objectives:

- A conceptual understanding of how the content of this course is related to the performance objectives of the Silviculture Survey Accreditation process.

Key Points, Concepts, Examples & Facilitator's Notes:

- These points may be briefly discussed. The facilitator may suggest methods for staying current, such as visiting surveys-related web sites, attending work shops and training such as this.
- This is intended to be a brief topic.



Participant's Workbook Page Reference: 4

Overhead Number: 8

Lesson Number: 1

Title: Introduction

Silviculture Survey Accreditation Exam...

23. Collect and **record data** on MOF field form FS 657 and 658.

26. **Summarize data** on MOF forms FS 659 and FS 1138A.

27. **Use** information from **data** analysis on FS 659 and FS 1138A to make appropriate administrative recommendations (i.e., establish more plots, label as NSR, FG, etc.)

30. ***Identify forest health damage, along with the major regional pest species (biotic and abiotic).***

31. ***Describe potential impacts of major regional forest health factors on the future stand.***

Instructional Objectives:

- continued

Key Points, Concepts, Examples & Facilitator's Notes:

- As on the previous page, the goal is to give an understanding that this course is the source for developing the skills required for these Silviculture Survey Accreditation performance objectives. Performance objective 30 and 31 are the most specifically linked of them all. The 2000 version of the performance objectives identifies forest health damage to a level of 80% accuracy.
- There are 8 samples to be identified during the examination. (This is reviewed annually.) There are forest health issues to be dealt with during the written, case study and field data collection portions of the examination.
- A frequently asked question is, "If I do not get 80% on this single performance objective, do I fail the exam?". The quick answer is, "Yes". However, the examiner has some discretion in the application of the final recommendation for accreditation. Where a person fails only a single performance objective, exceptions can be made with justification by the examiner.

Participant's Workbook Page Reference: 5

Overhead Number: 9

Lesson Number: 1

Title: Introduction

Forest Health Legislation

Forest Practices Code of BC Act

Silviculture Practices Regulation

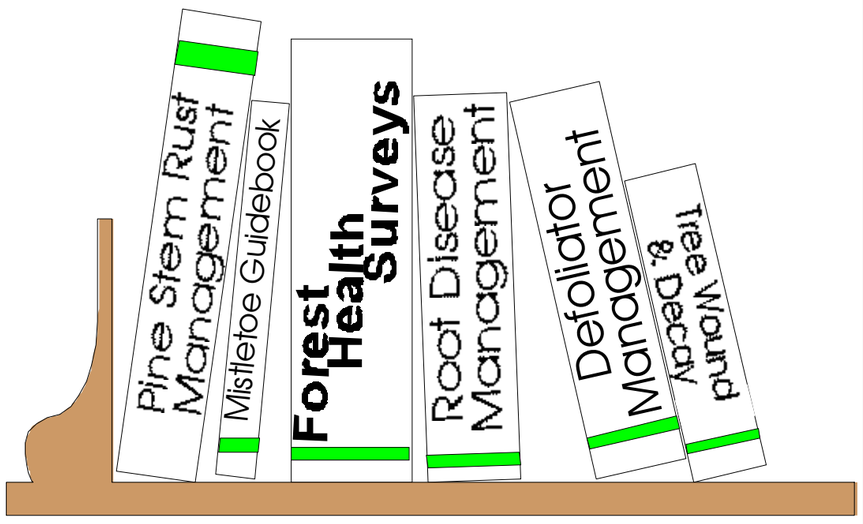
Operational Planning Regulation

Administrative Remedies Regulation

and....

although not legislation, but considered "best current practices"

8 forest health related Guidebooks



Guidebooks available at;
HTTP://www.for.gov.bc.ca/tasb/legsregs/fpc/FPCGUIDE/Guidetoc.htm

Instructional Objectives:

- Awareness of the availability of the various guidebooks to assist with developing an understanding of forest health.
- Awareness of the availability of guidebooks to be used as reference when you identify a certain forest health factor in a area being surveyed.

Key Points, Concepts, Examples & Facilitator's Notes:

- It is important to evaluate forest health data because it is required by law. Sections 25. (b) (v) and 26. (b) (iii) of the Silviculture Practices Regulation requires that the incidence of damage by forest health factors be reported.
- Accurate identification of forest health factors during a stocking survey is important because it is a precursor to what to expect during the subsequent free growing survey.
- Accurate detection of forest health factors at the time of the free growing survey is important since there are no formally scheduled surveys after this survey. If a forest health factor is missed during the free growing survey, you may be stuck with it until the next harvest.
- Inquire if anyone knows the basic legislative requirements for collecting forest health information.

CAUTION: The Act and regulations are subject to change therefore the section numbers indicated may also change.



Key Points, Concepts, Examples & Facilitator's Notes:

• The guidebooks are no longer being distributed free of charge. They are available from the Ministry of Forests web site: www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/guidetoc.htm.

The forest health guidebooks are:

- Bark Beetle Management
- Dwarf Mistletoe Management
- Management of Terminal Weevils in BC
- Root Disease Management
- Defoliator Management
- Tree Wounding and Decay
- Pine Stem Rust Management
- Forest Health Surveys

Other guidebooks that contain forest health related information are:

- Silviculture Prescriptions
- Silviculture Surveys
- Stand Management Prescriptions
- Establishment to Free Growing (May 2000)
  (6 - one for each Forest Region)
- Pruning

Participant's Workbook Page Reference: 6

Overhead Number: 10

Lesson Number: 2

Title: Importance

Annual Losses to Forest Pests....

Based on the 1994/95 Ministry of Forests Annual report table C-2p;

	Bark Beetles	Defoliators	Dwarf Mistletoes	Root	Total Diseases
Cariboo Region	439	471	350	221	1,481
Total of All Regions	2,459	1,679	1,640	1,367	7,145

That is about 10% of the total volume harvested

EACH YEAR!

Expresses in '000m^3

Instructional Objectives:

- A brief introduction to the level of impact forest health factors have on the amount of wood volume produced in BC.

Key Points, Concepts, Examples & Facilitator's Notes:

- Select the page that is most appropriate for the region in which the course is being presented. All six regions are included in the participant's workbook.
- The 94/95 Ministry of Forests annual report was the last year containing these figures; more recent values are not yet available. The 96/97 Annual Report is available but contains less detailed data and only lists three of the six forest regions. Data may be available later in 2000 for the 98/99 fiscal year. The facilitator may wish to produce a replacement table when more recent data is available. The 94/95 data, although quite dated, is still the most informative.
- There may be variation in the interpretation of these values. Some of the volume indicated in the table may be from salvage harvesting.
- Figures vary greatly from year to year. Defoliators, for example, are known to be cyclic. Mistletoe, however, is rather stable on a yearly basis, but should be declining over time with the application of management practices that reduce the impact.
- The values indicated are prior to salvage operations.

Participant's Workbook Page Reference: 6

Overhead Number: 11

Lesson Number: 2

Title: Importance

Annual Losses to Forest Pests....

Based on the 1994/95 Ministry of Forests Annual report table C-2p;

	Bark Beetles	Defoliators	Dwarf Mistletoes	Root	Total Diseases
Kamloops Region	165	143	260	224	792
Total of All Regions	2,459	1,679	1,640	1,367	7,145

That is about 10% of the total volume harvested

EACH YEAR!

Expresses in '000m^3

Annual Losses to Forest Pests....

Based on the 1994/95 Ministry of Forests Annual report table C-2p;

	Bark Beetles	Defoliators	Dwarf Mistletoes	Root	Total Diseases
Nelson Region	57	32	98	58	245
Total of All Regions	2,459	1,679	1,640	1,367	7,145

That is about 10% of the total volume harvested

EACH YEAR!

Expresses in '000m^3

Participant's Workbook Page Reference: 7

Overhead Number: 12

Lesson Number: 2

Title: Importance

Participant's Workbook Page Reference: 7

Overhead Number: 13

Lesson Number: 2

Title: Importance

Annual Losses to Forest Pests....

Based on the 1994/95 Ministry of Forests Annual report table C-2p;

	Bark Beetles	Defoliators	Dwarf Mistletoes	Root	Total Diseases
Prince George Region	1,595	1,025	262	529	3,411
Total of All Regions	2,459	1,679	1,640	1,367	7,145

That is about 10% of the total volume harvested

EACH YEAR!

Expresses in '000m^3

Annual Losses to Forest Pests....

Based on the 1994/95 Ministry of Forests Annual report table C-2p;

	Bark Beetles	Defoliators	Dwarf Mistletoes	Root	Total Diseases
Prince Rupert Region	162	0	315	73	550
Total of All Regions	2,459	1,679	1,640	1,367	7,145

That is about 10% of the total volume harvested

EACH YEAR!

Expresses in '000m^3

Participant's Workbook Page Reference: 8

Overhead Number: 14

Lesson Number: 2

Title: Importance



Participant's Workbook Page Reference: 8

Overhead Number: 15

Lesson Number: 2

Title: Importance

Annual Losses to Forest Pests....

Based on the 1994/95 Ministry of Forests Annual report table C-2p;

	Bark Beetles	Defoliators	Dwarf Mistletoes	Root	Total Diseases
Vancouver Region	41	8	355	262	666
Total of All Regions	2,459	1,679	1,640	1,367	7,145

That is about 10% of the total volume harvested

EACH YEAR!

Expresses in '000m^3

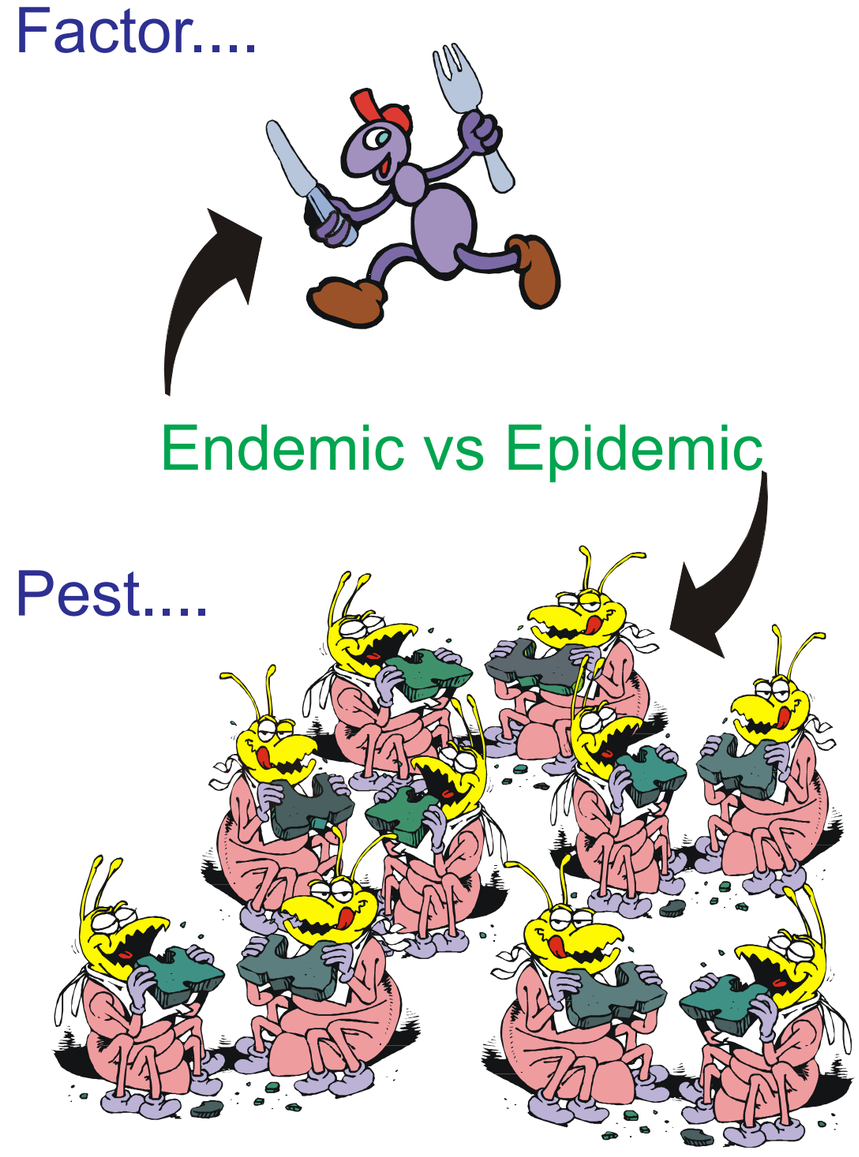


Participant's Workbook Page Reference: 9

Overhead Number: 16

Lesson Number: 2

Title: Importance



Instructional Objectives:

- An understanding of the terminology.

Key Points, Concepts, Examples & Facilitator's Notes:

- The terminology employed within forest health continues to evolve.
- A forest health factor is anything that can damage, slow the growth of, or kill, trees.
- These are present in every forest. They are an essential, naturally occurring component of a healthy forest ecosystem. At low levels, they are considered endemic.
- When their population or level of damage has a detrimental impact on the intended use of the forest, we refer to them as pests.
- When the damage resulting from the activities of a forest health factor put our intended management objectives at risk, they are considered at epidemic levels.
- Add a local example such as *Ips spp*. being present in most forests at endemic levels, versus the spruce bark beetle epidemic in the Bowron valley.



Participant's Workbook Page Reference: 9

Overhead Number: 17

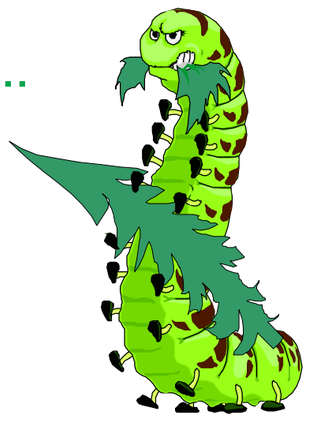
Lesson Number: 3

Title: Foundation

Types of Forest Health Factors



Animal
deer, rabbits, squirrels...
Abiotic = 'nonliving'
sun, wind, snow...
Diseases
root disease, stem disease, mistletoe...
Insects
aphids, defoliators, weevils...
Treatments
logging, planting, thinning...
Vegetation
herbs, shrubs, trees...



Instructional Objectives:

- Continued development of the terminology.

Key Points, Concepts, Examples & Facilitator's Notes:

- The forest health factors have been grouped into 6 general types. These groupings are used in the organization of the abbreviation system we use.
- The facilitator may wish to ask the group to suggest additional examples of each type.
- A discussion of the damage each of these groups cause could be encouraged.



Participant's Workbook Page Reference: 10, 11

Overhead Number: 18

Lesson Number: 3

Title: Foundation

Forest Health Abbreviation System

General to Specific

Disease **R**oot **A**rmillaria

General Damage Type | Type of Damage | Specific Species

The more common 160 are found on the FS 747

At last count there is a total of,

213

The complete list can be found in the appendix and at;

http://www.for.gov.bc.ca/isb/isis/user_guide/append_c/a_c_14.htm#f

Instructional Objectives:

- Introduction to the three letter abbreviation system employed in BC.

Key Points, Concepts, Examples & Facilitator's Notes:

- There is no need to intentionally memorize these. The FS 747 is your field reference.
- As you work with them, the common ones you use will "stick" in your memory.
- 213 of them may be intimidating, but you will utilize a much smaller subset in your daily use.
- There are three letters, and three positions, from general to specific. There is a logical method to the naming system. The first letter is very general. It is the general group or damage type of forest health factor: D for disease, I for insect, T for treatment etc. The second letter is more specific. It tells us more about the location of the damage: R for root, S for stem and F for foliage. It can also describe the kind of damage: M for mistletoe, T for tree competition and H for Harvesting. The third letter signifies the particular species.
- Some of the codes have only two letters, for example AC = cattle
- More abbreviations may be "complicated", but "try writing the Latin name of any one of these into the tiny little boxes on the survey field cards....."
- Remind the participants that these codes change repeatedly. You may wish to use the example that "A" for animal was changed from "A" to "W" (for wildlife) and back to "A" in two years during the late 1990's.
- Surveyors should begin each field season by finding the most current version of the FS 747.
- Suggest that this is a good item to add to a prework conference checklist.
- CAUTION: These web site addresses change frequently.

DAMAGE AGENT AND CONDITION CODES

FIELD CODES	DESCRIPTION
A	**ANIMAL DAMAGE**
AB	BEAR
AC	CATTLE
AD	DEER
AE	ELK
AH	HARE OR RABBIT
AM	MOOSE
AP	PORCUPINE
AS	SQUIRREL
AV	VOLE
AX	BIRDS
AZ	BEAVER
N	**ABIOTIC INJURIES**
NB	FIRE
ND	DROUGHT
NF	FLOODING
NG	FROST
NGC	frost crack
NGH	frost-heaved
NGK	shoot / bud frost kill
NH	HAIL
NK	FUMEKILL
NL	LIGHTNING
NN	ROAD SALT
NR	REDBELT
NS	SLIDE
NW	WINDTHROW
NWS	windthrow-soil failure
NWT	windthrow-treatment or harvest related
NX	WOUNDING / RUBBING
NY	SNOW, ICE, SNOW PRESS
NZ	SUNSCALD
D	**DISEASE**
DB	BROOM RUST
DBF	fir broom rust *Melampsorella caryophyllacearum*
DBS	spruce broom rust *Chrysomyxa arctostaphyli*
DD	STEM DECAYS
DDB	birch trunk rot *Fomes fomentarius*
DDD	sulfur fungus *Laetiporus sulphureus*
DDE	rust-red stringy rot *Echinodontium tinctorium*
DDF	brown crumbly rot *Fomitopsis pinicola*
DDH	hardwood trunk rot *Phellinus ignarius*
DDO	cedar brown pocket rot *Poria sericeomollis*
DDP	red ring rot *Phellinus pini*
DDQ	quinine conk rot *Fomitopsis officinalis*
DDS	Schweinitz butt rot *Phaeolus schweinitzii*
DDT	aspen trunk rot *Phellinus tremulae*

FIELD CODES	DESCRIPTION
DF	FOLIAGE DISEASES
DFA	western pine aster rust *Coleosporium asterum*
DFC	large-spored spruce-labrador tea rust *Chrysomyxa ledicola*
DFD	spruce needle cast *Lirula macrospora*
DFE	elytroderma disease *Elytroderma deformans*
DFH	larch needle cast *Hypodermella laricis*
DFL	pine needle cast *Lophodermella concolor*
DFM	larch needle blight *Meria laricis*
DFP	fir-fireweed rust *Pucciniastrum epilobii*
DFR	Douglas-fir needle cast *Rhabdocline pseudotsugae*
DFS	red band needle blight *Mycosphaerella(Scirrhia)pini*
PSS	sirococcus tip blight *Sirococcus strobilinus*
PDT	cedar leaf blight *Didymascella thujina*
DL	LEADER OR BRANCH DIEBACKS
DLD	dermea canker *Dermea pseudotsugae*
DLF	red flag disease *Potebniamyces balsamicola*
DLP	phomopsis canker *Phomopsis lokoyae*
DLS	sydowia tip dieback *Sclerophoma pithyophila*
DLV	aspen-poplar twig blight *Venturia spp.*
DM	DWARF MISTLETOES
DMF	Douglas-fir dwarf mistletoe *Arceuthobium douglasii*
DMH	hemlock dwarf mistletoe *Arceuthobium tsugense*
DML	larch dwarf mistletoe *Arceuthobium laricis*
DMP	lodgepole pine dwarf mistletoe *Arceuthobium americanum*
DR	ROOT DISEASES
DRA	armillaria root disease *Armillaria ostoyae*
DRB	blackstain root disease *Ceratocystis wageneri*
DRC	laminated root rot (cedar) *Phellinus weirii*
DRL	laminated root rot *Inonotus sulphurascens(Phellinus weirii)*
DRN	annosus root disease *Heterobasidion annosum*
DRR	rhizina root disease *Rhizina undulata*
DRS	schweinitzii butt rot *Phaeolus schweinitzii*
DRT	tomentosus root rot *Inonotus tomentosus*
DS	STEM DISEASE (CANKER OR RUST)
DSA	atropellis canker *Atropellis piniphila*
DSB	white pine blister rust *Cronartium ribicola*
DSC	comandra blister rust *Cronartium comandrae*

FS 747 HSP 99/1

FIELD CODES	DESCRIPTION
DSE	sooty bark canker *Encoelia pruinosa*
DSG	western gall rust *Endocronartium harknessii*
DSH	hypoxylon canker *Hypoxylon mammatum*
DSP	cryptosphaeria canker *Cryptosphaeria populina*
DSR	ceratocystic canker *Nectria galligena*
DSS	stalactiform blister rust *Cronartium coleosporioides*
DST	target canker *Nectria galligena*
DSY	cytospora canker *Cytospora chrysosperma*
I	**INSECTS**
IA	APHIDS *OR ADELGIDS*
IAB	balsam woolly adelgid *Adelges piceae*
IAC	giant conifer aphid *Cinara spp*
IAG	Cooley spruce gall adelgid *Adelges cooleyi*
IAL	larch cone woolly aphid *Adelges lariciatus*
IAS	spruce aphid *Elatobium abietinum*
IB	BARK BEETLES
IBB	western balsam bark beetle *Dryocoetes confusus*
IBD	Douglas-fir beetle *Dendroctonus pseudotsugae*
IBI	engraver beetles *Ips*
IBM	mountain pine beetle *Dendroctonus ponderosae*
IBP	twig beetles *Pityogenes, Pityophthorus spp*
IBS	spruce beetle *Dendroctonus rufipennis*
IBT	red turpentine beetle *Dendroctonus valens*
IBW	western pine beetle *Dendroctonus brevicomis*
ID	DEFOLIATING INSECTS
IDA	black army cutworm *Actebia fennica*
IDB	two-year budworm *Choristoneura biennis*
IDC	larch casebearer *Coleophora laricella*
IDD	western winter moth *Erannis vancouverensis*
IDE	spruce budworm *Choristoneura fumiferana*
IDF	forest tent caterpillar *Malacosoma disstria*
IDG	greenstriped forest looper *Melanolphila imatata*
IDH	western blackheaded budworm *Acleris gloverana*
IDI	pine needle sheath miner *Zelleria haimbachi*
IDL	western hemlock looper *Lambdina fiscellaria lugubrosa*
IDM	gypsy moth *Lymantria dispar*
IDN	birch leaf miner *Fenusa pusilla*
IDP	larch sawfly *Pristiphora erichsonii*
IDR	alder sawfly *Eriocampa ovata*

FIELD CODES	DESCRIPTION
IDS	conifer sawflies *Neodiprion spp.*
IDT	Douglas-fir tussock moth *Orgyia pseudotsugata*
IDU	satin moth *Leucoma salicis*
IDV	variegated cutworm *Peridroma saucia*
IDW	western spruce budworm *Choristoneura occidentalis*
IDX	large aspen tortrix *Choristoneura conflictana*
IDZ	western false hemlock looper *Nepytia freemani*
IS	SHOOT INSECTS
ISB	western cedar borer *Trachykele blondeli*
ISE	European pine shoot moth *Rhyaconia buoliana*
ISG	gouty pitch midge *Cecidomyia piniinopsis*
ISP	pitch nodule moths *Petrova spp.*
ISS	western pine shoot borer *Eucosma sonomana*
ISQ	Sequoia pitch moth *Synanthedon sequoiae*
IW	WEEVILS
IWC	conifer seedling weevil *Steremnius carinatus*
IWM	Magdalis sp.
IWP	lodgepole pine terminal weevil *Pissodes terminalis*
IWS	white pine weevil (on spruce) *Pissodes strobi*
IWW	Warren's root collar weevil *Hylobius warreni*
IWY	cylindrocopturus weevil *Cylindrocopturus spp.*
IWZ	Yosemite bark weevil *Pissodes schwartzii*
M	**MITE DAMAGE (TRISETACUS SPECIES)**
T	**TREATMENT INJURIES**
TC	CHEMICAL
TH	HARVESTED
TL	LOGGING
TM	OTHER MECHANICAL DAMAGE (NON-LOGGING)
TP	PLANTING
TPM	planting — poor microsite
TR	PRUNING
TT	THINNING OR SPACING
V	**VEGETATION PROBLEMS**
VH	HERBACEOUS COMPETITION
VP	VEGETATION PRESS
VS	SHRUB COMPETITION
VT	TREE COMPETITION

Participant's Workbook Page Reference: 12

Overhead Number: 20

Lesson Number: 3

Title: Foundation

TOP TEN

Most Important Forest Health Factors



...but which ten?

Instructional Objectives:

- Concentrate the learning on the most important forest health factors.

Key Points, Concepts, Examples & Facilitator's Notes:

- The premise of using the David Letterman Top Ten list may seem unusual; however, it is reasonably well known. It keeps a "light/fun" atmosphere and is a reasonable lead-in to the next concept. It is the concept that some forest health factors are more important than others. There is a wide range of damage resulting from the various forest health factors.
- For example, the pitch twig midge (ISG) causes a right-angle deformation of the young branches on lodgepole pine. A small amount of nutrients are "stolen" from the branch by the little insect. On the other hand, root diseases "KILL" trees and make the soil "infected" for many years.
- The "Top Ten" are the forest health factors that must not be mis-identified. They also must be recorded in a plot, without fail. "You must get these right." It is never acceptable to ignore these.
- There may be more or less than ten. (The number is not important.) There is usually a small handful of very important forest health factors in a particular area.
- The list varies for each forest region, and for each biogeoclimatic subzone.
- The list changes over time. Many individual forest health factors affect trees of only certain ages.
- Some Forest Districts have made lists of their version of the "Top Ten".



Participant's Workbook Page Reference: 12

Overhead Number: 21

Lesson Number: 3

Title: Foundation

Hints...

Establishment to Free Growing Guidebook (2000)

Forest Health Guidebooks

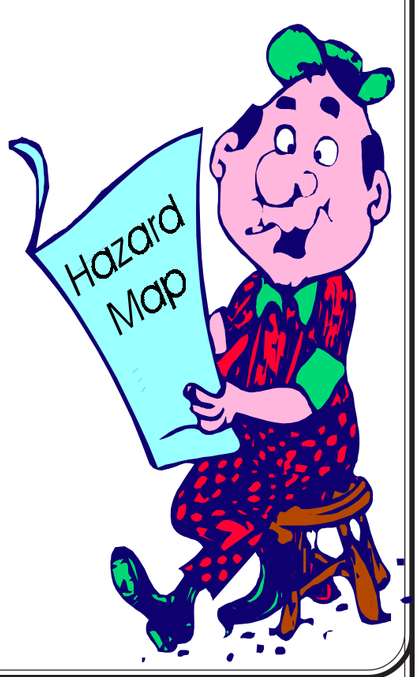
Regional BEC Books

Hazard Maps

Silviculture Prescription

District & Region Staff

Co-workers



Instructional Objectives:
- Introduction to some resources.

Key Points, Concepts, Examples & Facilitator's Notes:
- Some participants may still be overwhelmed with their new level of responsibility to identify and record up to 213 forest health factors. The goal is to give them some reassurance that there are some hints and reference materials to assist them with what forest health factors to expect in an area.
- The most useful of the listed materials is the Establishment to Free Growing Guidebook (1995) for each Forest Region. It contains detailed tables of the forest health factors you would expect to encounter in each of the biogeoclimatic subzones within the Forest Region. An example is found on the next page.

Participant's Workbook Page Reference: 13

Overhead Number: 22

Lesson Number: 3

Title: Foundation

What about the others?

All forest health factors present

on All trees in

All plots are recorded.

Missing one of the "TOP TEN" is a serious error.

Instructional Objectives:

- When and where to tally which forest health factors.

Key Points, Concepts, Examples & Facilitator's Notes:

- This is often a misunderstood concept. Many believe (have been misinformed), that only trees that exceed some level of infection, or some percentage of damage, are recorded. THIS IS WRONG. All trees in every plot are assessed for the presence of any forest health factor.
- Some Forest Districts may establish their version of the "Top Ten" and instruct surveyors to disregard others if they are at endemic levels. This is acceptable only if the Forest District has developed such a list. This list may also be included in your contract.

Participant's Workbook Page Reference: 13

Overhead Number: 23

Lesson Number: 3

Title: Foundation



Hazard: the degree to which the characteristics of the sampling entity (usually a tree or a stand) make it vulnerable to damage. It is equivalent to susceptibility.

Hazard vs Risk

Risk: the probability and expected severity of sampling entity damage. It is a function of numerous components including sampling entity, hazard, sampling unit conditions, proximity to damaging agents and the incidence of those agents.

Instructional Objectives:
- Clarify the definition of these terms

Key Points, Concepts, Examples & Facilitator's Notes:
- The two terms are often misused. While this issue is a small portion of the overall course objectives, it is reasonable to take a moment to clarify the definition of these two words.

- The definitions found in the graphic were copied from the glossary section of the Forest Health Surveys Guidebook.

- Dictionary definitions are not that helpful;

Hazard: risk; danger; peril: The life of an explorer is full of hazards.; chance
Risk: a chance of harm or loss; danger, chance of loss

It may be more descriptive to use an example;
broken glass on the floor is a hazard,
since you are wearing shoes there is little risk of injury.

A stand of pine may be located in an area with a high Warren's root collar weevil hazard zone.
A 40 year old stand of pine in this area is at no risk of loss to the weevil.

Participant's Workbook Page Reference: 14

Overhead Number: 24

Lesson Number: 3

Title: Foundation

Full Size Version on the Next Page

Instructional Objectives:

- An awareness of Hazard maps and their use.

Key Points, Concepts, Examples & Facilitator's Notes:

- This is a very brief topic. The objective is to make the participants aware of the presence of such maps, what they look like, and how they might be used.
- Hazard maps are the graphical representation of the risk of a forest health factor in a geographic area. They are often cross referenced to biogeoclimatic classification.
- Hazard information is also found in the forest health guidebooks.
- Hazard maps are not available for all pests in all regions of the province.
- Contact individual Forest Districts for availability.
- The sample map provided indicates a high risk to the spruce leader weevil attach in the orange and pink areas. The two different colours represent two different biogeoclimatic subzones.

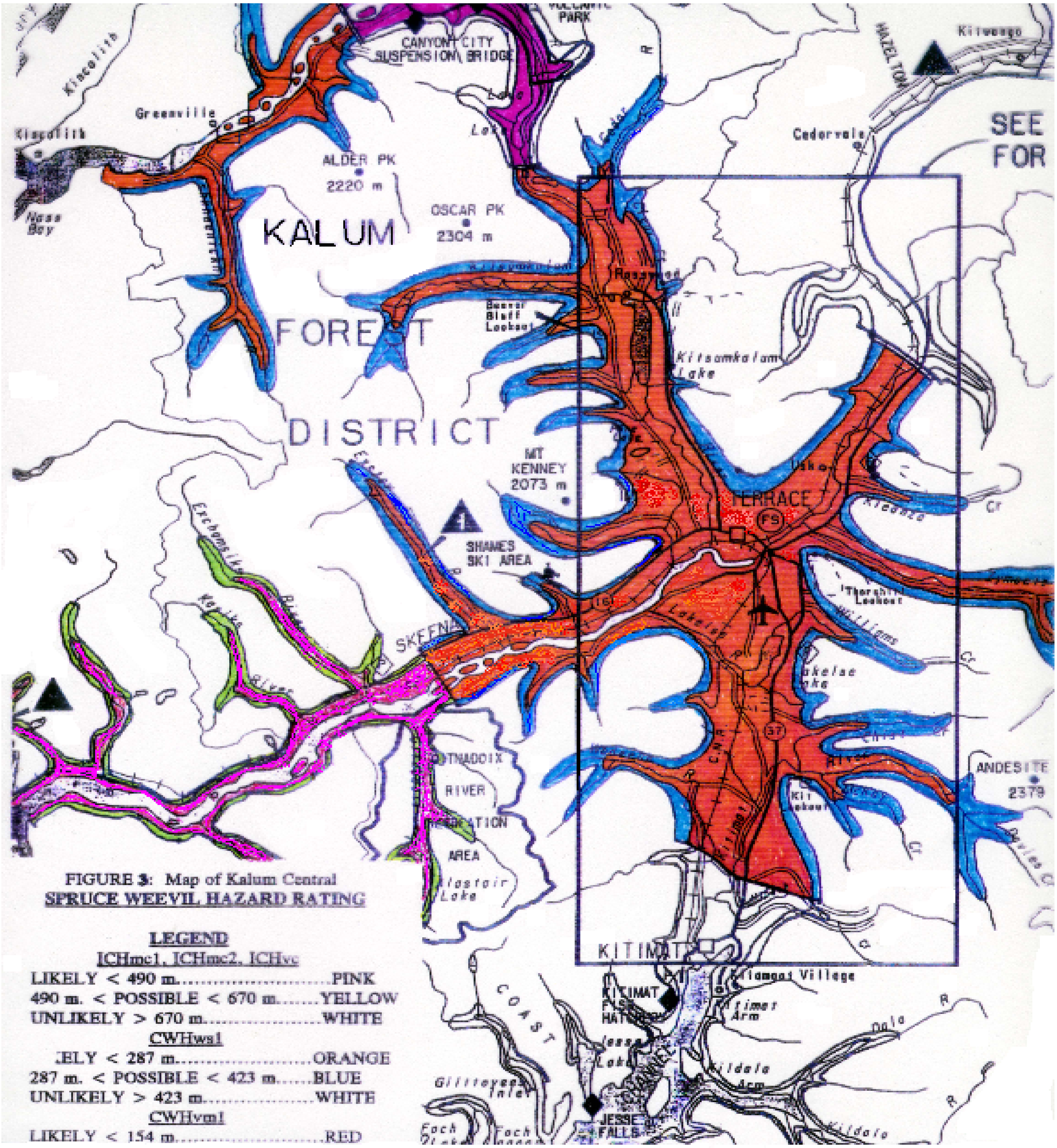


FIGURE 3: Map of Kalum Central
SPRUCE WEEVIL HAZARD RATING

LEGEND

ICHmc1, ICHmc2, ICHvc

LIKELY < 490 m. .... PINK
490 m. < POSSIBLE < 670 m. .... YELLOW
UNLIKELY > 670 m. .... WHITE

CWHws1

.ELY < 287 m. .... ORANGE
287 m. < POSSIBLE < 423 m. ..... BLUE
UNLIKELY > 423 m. .... WHITE

CWHvm1

LIKELY < 154 m. .... RED

Participant's Workbook Page Reference: 15

Overhead Number: 25

Lesson Number: 3

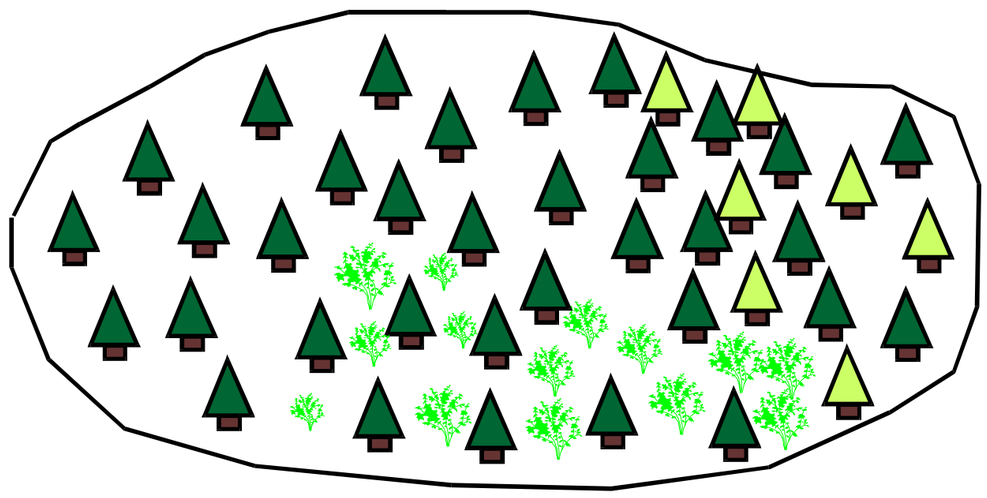
Title: Foundation

Stratification =

Separation of Different

and

Grouping of Similar



Instructional Objectives:

- Introduce stratification as it relates to forest health factors.

Key Points, Concepts, Examples & Facilitator's Notes:

- One of the criteria for stratification specified in the Surveys Guidebook is changes in forest health factors present.
- The goal of stratification is to separate portions of the survey area into "like populations".
- You can think of stratification as identifying portions of the survey area that are "different" than other portions.
- For example, the east side of a particular block has a high (30%) incidence of mistletoe, while the west side of the same block has no incidence of mistletoe. This would indicate that there are at least two strata.
- Where forest health factors such as root disease were identified during the preparation of the silviculture prescription, separate standards unit or treatment units may already be identified.

Participant's Workbook Page Reference: 16

Overhead Number: 26

Lesson Number: 4

Title: Identification

The #1 Key to effective forest health identification....



Observational Skills!

Instructional Objectives:

- As the overhead indicates, the importance of observational skills.

Key Points, Concepts, Examples & Facilitator's Notes:

- What else can we say here. "If you don't see it, you can't record it." The key is in strengthening the personal 'mental linkage' between one's eyes and the forest health database in one's brain. There is a very important distinction between "looking" and "SEEING"; observing, recognizing and identifying.
- You may wish to pass on a short story similar to this one. A young man taking the surveys accreditation exam says to the examiner, "I don't think I did very well on the forest health section of the exam. I've never seen any of those things before. You see we don't have any forest health in _____." The point is, forest health factors are everywhere. Beginners, like the person in the story, often overlook them. Or, may not be making the link from seeing them to recognizing their significance.
- A walk-through is the perfect time to practise this. Walk over to every funny looking, odd coloured tree you see. Chances are there is some forest health factor present.
- You may even be so bold as to issue a challenge. Offer a reward to anyone who can find a block with no forest health factors present.
- Our forests have more forest health factors than we often "SEE".

Participant's Workbook Page Reference: 16

Overhead Number: 27

Lesson Number: 4

Title: Identification

sign

Sign: visible portion of a fungus or insect, such as conk or frass, seen on, in or around the host

Sign vs Symptom

Symptom: visible reaction of a host to abiotic injury or disease; for example chlorosis

Reproduced from; *Field Guide to Forest Damage in British Columbia*

Instructional Objectives:

- Recognize the difference between the two terms; sign and symptom..

Key Points, Concepts, Examples & Facilitator's Notes:

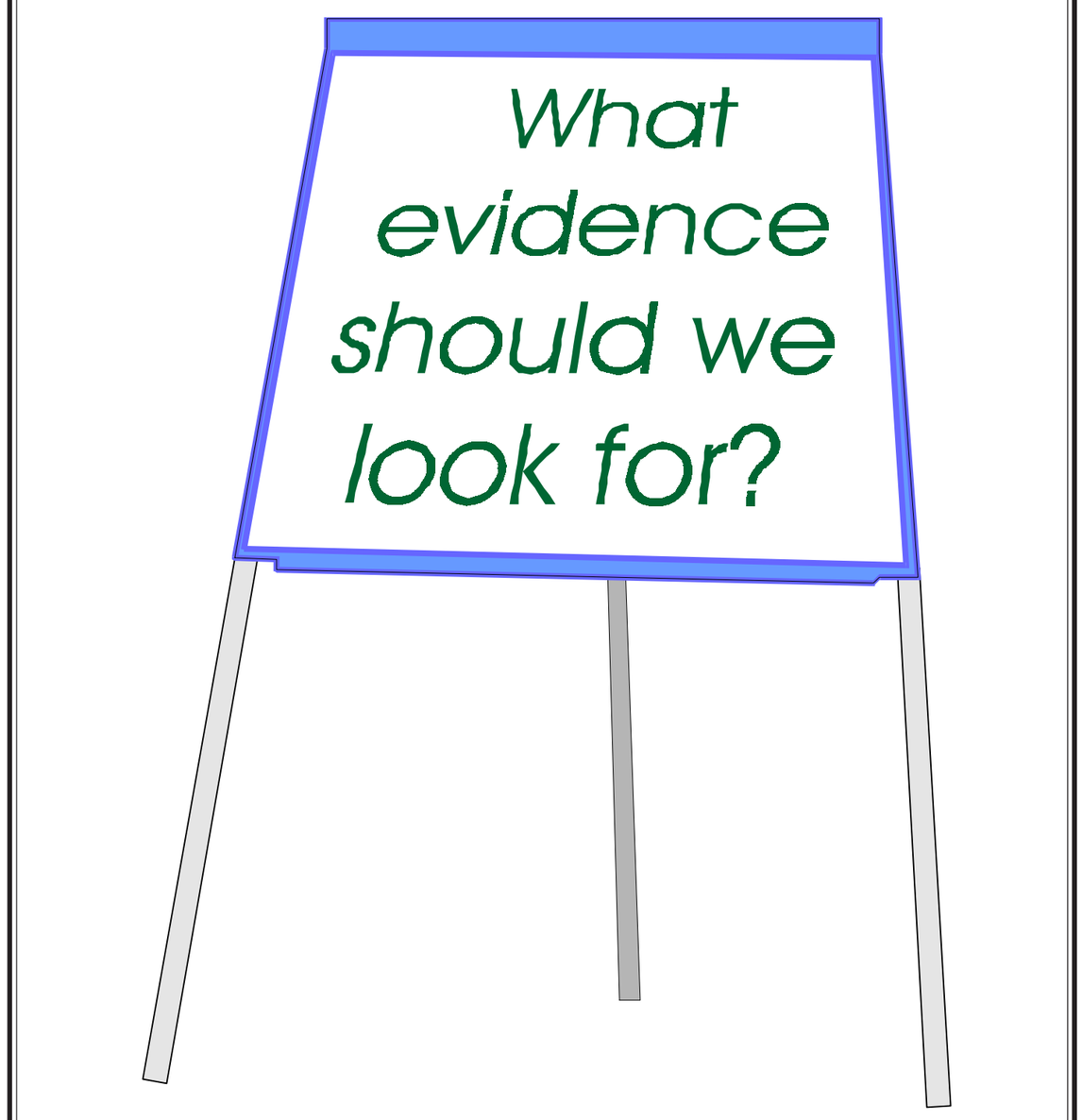
- The two terms are defined in Field Guide to Forest Damage in British Columbia.
- The essence of the difference between these two terms is;
- A sign is more definitive "proof" of the presence of a forest health factor.
- A symptom is the visible expression of the affects of a pest.
- Chlorosis is a classic example. Chlorosis is a symptom that may be caused by many things. Fan shaped mycelium under th bark of a Douglas fir is a definitive sign of Armillaria root disease.

Participant's Workbook Page Reference: 17

Overhead Number: 28

Lesson Number: 4

Title: Identification



Instructional Objectives:

- Develop a familiarity with the evidence, (signs and symptoms), of forest health factors.

Key Points, Concepts, Examples & Facilitator's Notes:

- To encourage group participation, pose the question, "What evidence should we look for?" As answers are offered, write them on a flip chart or white board.
- You may also wish to ask the person offering to provide a description of the term. For example, someone will suggest frass is evidence of insect attack. You may want to ask them "What is frass?", "Where will we find it?", "How is it produced?", "What does it indicate?". Participants should be encouraged to record these in their workbook.
- You may wish to organize the suggestions by requesting evidence in relation to the groups of forest health factors.

Some of the evidence are discussed on the next page....



Participant's Workbook Page Reference: 17

Overhead Number: 29

Lesson Number: 4

Title: Identification

	Sign	Symptom
Animal Damage	teeth marks droppings multiple vertical scratches hairs stuck in resin tunnels at ground level large sections of bark removed high on the tree	nipped off foliage and branchlets
Abiotic Injuries	mechanical slitting of bark at a young age	wide spread damage results evident early in the spring results evident following a major weather occurrence
Diseases	basal resinosis fruiting bodies	discoloration of foliage distress cone crop swelling shrinkage
Insects	frass entrance or exit holes black stain/blue stain	chlorosis mortality
Treatment Injuries	saw marks scars from machinery	open wound
Vegetation Problems	young trees crushed by grass and herbs foliage battered	poor vigour

Instructional Objectives:

- Identify examples of the two terms.

Key Points, Concepts, Examples & Facilitator's Notes:

- This is a minor component of the course. Keep this issue to a limited amount of time.
- This list is clearly not complete. The value may be in requesting the participants suggest examples.



Participant's Workbook Page Reference: 18

Overhead Number: 30

Lesson Number: 4

Title: Identification

Survey Timing

AGENT	HOST	STAGE EVIDENT*	SEASON EVIDENT**	DURATION EVIDENT
ANIMALS				
Hare	All	up to 6 cm dbh	◆	several years (clipped seedlings evident ~1 yr)
Squirrel	Pl (others)		◆ caused in spring & summer	several years
Vole	All		◆ caused in fall or winter	2 years with mortality several years without
Porcupine	Pl, Spruce, Lw (Hw)		◆	several years
Ungulates	All (Ss)		◆	1 to several years
DISEASES				
Rusts	Pl (other pines)		◆ gall rust, other rusts	several years (stem rusts most easily seen in June)
Mistletoes	Hw, Pl, Fd, Lw			several years to several decades
Root Rots - annosus - armillaria - black stain - phellinus - tomentosus	Hw (True Firs, Ss) All Fd, Pl (Hw) Fd, True Firs, (Lw) Sx (Pl)	armillaria = all	when snow free	several years to several decades

* STAGES: Seedling 0 - 2 Yrs; Regen. 3 - 10 Yrs; Sapling 11 - 20 Yrs; Pole 21 - 80 Yrs; Mature 80+ Yrs; All Ages

** SEASONS: Spring; Summer; Fall; Winter; All

Instructional Objectives:

- Introduction to the Survey Timing Table

Key Points, Concepts, Examples & Facilitator's Notes:

- This table is found on page 18 and 19 of the Silviculture Survey Guidebook.
- It is intended to assist with the scheduling of surveys where forest health factors are known to be present. If the surveyor knows the time of year when the best evidence for the forest health factor is most evident, they can then collect the most accurate information about the presence of that factor.
- It is also beneficial to know the best time of year to see the forest health factors for scheduling treatments such as stem disease eradication treatments or leader pruning treatments.
- It also assists with developing the understanding that certain forest health factors affect trees within specific age classes.
- Survey timing is especially important with defoliators, since the damage increases over the summer, and may be more difficult to detect by the following spring.

Participant's Workbook Page Reference: 18

Overhead Number: 31

Lesson Number: 4

Title: Identification

Survey Timing

AGENT	HOST	STAGE EVIDENT*	SEASON EVIDENT**	DURATION EVIDENT
INSECTS				
Balsam Wooly Adelgid	True Firs		◆	1 year to several years
Warren's Root Collar Weevil	Sx, Pl		◆	several years
Lodgepole Pine Terminal Weevil	Pl		◆ most obvious in summer & fall of year attacked	several years
White Pine Weevil	Ss, Sx		◆ most obvious in summer & fall of year attacked	several years
ABIOTIC				
Frost	All			1 to 2 years
Snow	All		◆	several years to several decades

* STAGES

Seedling 0 - 2 Yrs; Regen. 3 - 10 Yrs; Sapling 11 - 20 Yrs; Pole 21 - 80 Yrs; Mature 80+ Yrs; All Ages

** SEASONS

Spring; Summer; Fall; Winter; All

Instructional Objectives:

- continued

Key Points, Concepts, Examples & Facilitator's Notes:



Participant's Workbook Page Reference: 19

Overhead Number: 32

Lesson Number: 4

Title: Identification

Let's try one...

Field Guide to Forest Damage in BC

or

Field Guide to Pests of Managed Forests in BC

replaced in 1999 by above publication

Instructional Objectives:
•Application of the Reference material.

Key Points, Concepts, Examples & Facilitator's Notes:
• The class will now have an opportunity to put some of the new concepts into practice.
•Break the participants into groups of three to five people.
•Issue each group a forest health sample. Ask them to use the reference books to determine the common name, the pest code and the list of hosts for the sample.

•This concept can be continued with the slides and additional fresh samples, as time permits.
•Option: Turn it into a game.
•Write the group's answer on a scrap piece of paper and place it into the "hat" (box, bowl or other).
•This process can be repeated as many times as desired, given the time allocation.
•Prizes may be given to the group with the correct answer.
•The wrong answers can be useful in the form of a question back to the class, "Why is this sample not".
•Some individuals have expressed an interest in providing these reference material to the participants.
•The reference book entitled Common Tree Diseases of British Columbia are available for free from the Canadian Forestry Service, 250-363-0600.

Participant's Workbook Page Reference: 19

Overhead Number: 33

Lesson Number: 4

Title: Identification



Did you say slide show?



Instructional Objectives:

•Provide an opportunity to view some common forest health factors in a slide show format.

•Give participants the opportunity to view forest health factors which they otherwise may not have the opportunity to see in the field.

Key Points, Concepts, Examples & Facilitator's Notes:

• The Facilitator's Guide contains a collection of over 100 slides from all over the province. These slides show different forest health factors as they appear in the field.

• The facilitator should create a locally relevant subset of slides. You may choose to provide fresh samples in addition to the ones shown on the slides.

• The slide presentations have been know to put people to sleep, so be creative, and keep it as short and as exciting as you can. We suggest a few slides, followed by a fresh sample; more slides, then a break.



Participant's Workbook Page Reference: 20

Overhead Number: 34

Lesson Number: 4

Title: Identification

Other sources of help...

Co-workers

Supervisors

Internet

A few good ones are:

http://www.fcmr.forestry.ca/fhn/ma/insect_e.htm

http://www.pfc.forestry.ca/nursery/

Ministry of Forests District Staff

Ministry of Forests Region Staff

Universities and Colleges

Canadian Forestry Service

Instructional Objectives:

- Point out other sources of identification assistance.

Key Points, Concepts, Examples & Facilitator's Notes:

- When you find a forest health factor and you are having difficulty identifying it, start with local sources. Ask your co-workers and supervisor. It can be a positive learning experience for the entire crew/company.



Participant's Workbook Page Reference: 20, 21, 22

Overhead Number: 35, 36, 37

Lesson Number: 4

Title: Identification

Hints for sending a specimen to Canadian Forestry Service

Read the instructions on the back of the form.

Include good, clear photographs from various angles.

Package moist samples in paper rather than plastic.

Whole samples are better than fragments (where practical).

Film containers with a tissue are good for insect samples.

Animal droppings and debris from suspected animal damage is also useful.

Ship the samples as soon as they are collected.

Expect three weeks or more for a reply.

A sample form is located in the Appendix.



Instructional Objectives:

- There is expert help available.
- These experts have a preferred format for delivery of the samples.

Key Points, Concepts, Examples & Facilitator's Notes:

- Canadian Forest Service offers a forest health identification service. For difficult issues we do have the option to send a sample for professional verification.
- The service is free. But they have restrictions noted on the back of the form.
- Try pointing out a few of the important points within the list of hints such as, packaging moist samples in paper rather than plastic. It arrives mouldy, the accuracy of the identification may be reduced.
- The sample form is included on the next two pages and provided as an overhead transparency.
- The forms may be ordered from Canadian Forest Service at 250-363-0600. This number is also found on the back of the sample form provided.



Canada BRITISH COLUMBIA

FOREST INSECT AND DISEASE COLLECTION AND IDENTIFICATION

FOR SUBMISSION TO THE CANADIAN FOREST SERVICE (see reverse for Procedures.)

A COLLECTION LOCATION *(be specific)*

LATITUDE ° ' "

LONGITUDE ° ' "

UTM Z E N

RESOLUTION IN km ☐10 ☐1 ☐1/10

ELEV. (m)

C COLLECTOR

B COLLECTION DATE Y M D

BGC ZONE

AGENCY

STREET

CITY

POSTAL CODE

PHONE ( )

FAX ( )

E-MAIL

D HOST / SUBSTRATE

LATIN NAME *(preferred)*

COMMON NAME

HOST TYPE

☐ 1. Seedling (nursery) ☐ 2. Transplant (nursery) ☐ 3. Seedling (forest) ☐ 4. Sapling ☐ 5. Young growth ☐ 6. Semi-mature ☐ 7. Mature ☐ 8. Over-mature ☐ 9. Dead standing ☐ 10. Dead fallen ☐ 11. Wood product

NON-PLANT SUBSTRATES: ☐ 12. Duff ☐ 13. Mineral Soil ☐ 14. Insect ☐ 15. Fungus

OBJECT SAMPLED

☐ 1. Flower ☐ 2. Fruit ☐ 3. Buds ☐ 4. Old foliage ☐ 5. New foliage ☐ 6. New shoot ☐ 7. Branch ☐ 8. Stem ☐ 9. Butt ☐ 10. Root ☐ 11. Bark ☐ 12. Whole plant ☐ 13. Trap ☐ 14. Non-plant substrate ☐ 15. Other: _____

E STAND TYPE

☐ 1. Nursery ☐ 2. Ornamental ☐ 3. Plantation (native) ☐ 4. Plantation (exotic) ☐ 5. Shelterbelt ☐ 6. Hedgerow ☐ 7. Woodlot ☐ 8. Nat. forest ☐ 9. Treed swamp ☐ 10. Scattered indiv. ☐ 11. Non-forest ☐ 12. Spaced ☐ 13. Fertilized ☐ 14. Pruned ☐ 15. Comm. thinned ☐ 16. Untreated ☐ 17. Sprayed ☐ 18. Urban

TREE HEIGHT (m)

DBH (cm)

SAMPLING TECHNIQUE

☐ 1. Beating ☐ 2. Hand-picked ☐ 3. Pheromone trap ☐ 4. Other trap *(describe)* _____ ☐ 5. Light trap ☐ 6. Other *(describe)* _____

F DAMAGE INTENSITY / FREQUENCY OF OCCURRENCE *(describe)*

G TENTATIVE IDENTIFICATION / REMARKS

YEAR

REGISTRATION NO.

FOR CANADIAN FOREST SERVICE USE ONLY

☐ INSECT ☐ DISEASE ☐ FUNGUS

FORM OF

SPECIES NO.	FINAL IDENTIFICATION	STATUS	E STAGES	L SYM 1	P SYM 2	A BI	NO. INS.	ID.	D	REMARKS

G TENTATIVE IDENTIFICATION / REMARKS (CONT.)

FS 466 HSP 96/8 33232 18784 **DISTRIBUTION:** **WHITE** - CANADIAN FOREST SERVICE; **CANARY** - REGIONAL FOREST HEALTH SPECIALIST; **PINK** - ORIGINATOR'S FILE



Collection and identification of forest insects and fungi are essential for effective forest management. Legal, scientific and historical benefits of expert identification and archiving include records for quarantine and regulatory issues, substantiation of current outbreaks and previously undetected pests, and documentation of research results.

SPECIMENS ACCEPTED

Please submit only the following types of specimens:
- insects, diseases and fungi from forest habitats or wood products (not from agricultural, garden or ornamental plants, or stored products);
- pests causing new or major outbreaks;
- field identifications by contractors, only by prior arrangement by Ministry regional or district staff;
- materials to document special studies, surveys, research and publications;
- unusually severe damage by known or unknown factors, for future reference.

REPORT INFORMATION

All specimens sent to the Canadian Forest Service (CFS) must include a FS 466 form or equivalent with the following minimum data (letters correspond to those on front of this form):

[A] Geographic location of collection (reference the collection location to a recognized locality on 1:100 000 or 1:250 000 map sheet), and either UTM grid or latitude/longitude.

[B] Date of collection (year-month-day, e.g., 96 06 04).

[C] Name, affiliation, mailing address, telephone and fax numbers, and e-mail address of collector. Give name, affiliation, mailing address, telephone and fax numbers, and e-mail address of individual requesting identification, under "Remarks", if different from "C".

[D] Host/substrate information (host species, age, condition, number of hosts similarly affected, location of damage on host, or type of substrate, if not a plant).

[E] Description of area (e.g., non-forest, natural forest, plantation, bog, urban).

[F] Damage intensity and occurrence.

[G] Note unusual conditions/contributing factors, e.g., heavy frost, drought, chemical applications, proximity to roads, etc. Attach extra sheet if needed for remarks.

SPECIMENS AND SHIPMENT

Special care must be taken to collect an adequate specimen and to prevent deterioration of material in transit. Inadequate or spoiled material cannot be processed. Ship live material by Priority Post or courier, and use crush-resistant containers (e.g., mailing tins). For labels on vials, notes and enclosures, use HB pencil or India ink to ensure permanency. Except for shipping defoliating insects, ***NEVER USE PLASTIC BAGS OR WRAP***, and do not moisten specimens. For fresh disease or fleshy fungi collections, prevent mould contamination by using paper envelopes, paper wrapping and cardboard boxes for shipping.

- **Larvae of defoliators:** Ship 10-20 live larvae in a tied plastic bag with sufficient foliage for 3-5 days of feeding. Ship additional larvae in small screw-top vials containing 70-80% ethanol (preferred) or isopropyl (rubbing) alcohol. Vials must be well sealed and packaged with sufficient absorbent material and a waterproof wrap to prevent contamination or leakage if a container should break.
- **Larvae of bark beetles or woodborers:** Collect borers in small-diameter (<10 cm) stems or shoots. Ship larvae from larger material in alcohol, as above. Enclose a sample of typical damage, packaged separately.
- **Pupae and hard-bodied insects:** Ship live material in small containers with packing to protect during shipping. Place dead adult specimens between layers of tissue paper (no cotton) in a rigid container with sufficient packing to prevent any movement of material within the container.
- **Foliar diseases:** Collect 20 cm-length branches with leaves. Press flat between newsprint or, for bushy specimens, wrap in a paper bag. Include a cutting of healthy foliage (labelled) for comparison, and flowers or fruit of host plant, if identity unknown. For spring collections, include over-wintered, old foliage from ground litter or on tree for possible mature fruiting bodies.
- **Stem and branch diseases:** For small-diameter material, cut a 20 cm-length of affected and adjacent healthy stem material. For larger material, cut a section of at least 10 x 10 cm from the edge of a canker. Include affected and healthy-appearing tissue. Include a section of bark with any apparent fruiting bodies.
- **Decay in wood, root disease and blowdown trees:** Determine tree species. Collect any conk or mushrooms closely associated with decay. At any fungal conks, areas of breakage or suspect decay, including decayed or diseased roots, cut a wood section of at least 15 cm x 15 cm x 15 cm that includes decayed, stained and apparently sound wood. Describe decay. For suspect root disease, select trees that were recently killed, fallen or declining (symptomatic), and avoid trees or roots that have been dead for one or more years. Sample fresh roots with disease features such as pitching, mycellia and/or stain. Package wood samples and conks separately. Label and wrap in newsprint.
- **Fleshy Fungi:** Collect several specimens, especially of varying maturity. For ground specimens, pry as much of the mushroom as possible out of the ground with a knife. For specimens on wood, also collect a specimen of any underlying wood decay, as described above. Dry all fleshy fungi before shipping. Air-dry small fragile specimens in a warm dry place, and for larger fungi, heat-dry at 50°C. Spore prints from fresh collections can be submitted with dried specimens. Package in dry material to protect in transit.

SEND SPECIMENS WITH WHITE COPY OF THIS FORM TO:

CANADIAN FOREST SERVICE
Pacific Forestry Centre
506 West Burnside Road
Victoria, B.C. V8Z 1M5
Attention: Insectary/Herbarium

Tel.: 363-0600 Fax: 363-6005



Participant's Workbook Page Reference: 23

Overhead Number: 38

Lesson Number: 4

Title: Identification

What if I still don't know what it is?

General to Specific

Disease **R**oot **?** Unknown

General Damage Type

Type of Damage

Specific Species

Use this with care.

It tells others about your ability to identify forest health factors.

It can not be entered into computer compilation systems.

It should be used only until you have correctly identified the forest health factors.

Instructional Objectives:

- Coding methods for unknown forest health factors.

Key Points, Concepts, Examples & Facilitator's Notes:

- Even after careful observation of a forest health factor, research using reference material, consultation with co-workers and supervisors, there may still be some uncertainty to the positive identification of the sample.
- Special emphasis should be given to the fact that this is an interim measure. Positive identification is still required.
- You may also wish to point out the "impressions" you will be giving your client and or supervisor. "If all of your pest codes end in a ?, do we really want you doing our surveys?".



Participant's Workbook Page Reference: 23

Overhead Number: 39

Lesson Number: 5

Title: Application

Forest Health Data Collection

When and where does it apply?

Forest health data collection and analysis is an integral part of every silviculture survey.

All the time,
every tree,
in every plot,
for every survey.



Instructional Objectives:

- Introduction to data collection.

Key Points, Concepts, Examples & Facilitator's Notes:

- It is a common misunderstanding that we only record forest health factors when the exceed some threshold level to become pests. This MUST be corrected. There is not damage threshold for the recording of the presence of a forest health factor in a plot.
- The Silviculture Surveys Guidebook (page 17) makes reference to the "forest health survey" being an integral component of every survey.
- Where a single tree has multiple forest health factors, **record all of them**.
- This is a similar misunderstanding to the recording of total tree. "We count ALL of them."
- **This is not the way it is described on page 20 of the Silviculture Surveys Guidebook! That guidebook will be changed in the next printing. Also, it is not that the Silviculture Surveys Guidebook is wrong, the standards changed after the guidebook was published.**



Participant's Workbook Page Reference: 24

Overhead Number: 40

Lesson Number: 5

Title: Application

Survey Plot Card (FS 658)

Province of British Columbia — Ministry of Forests

SILVICULTURE SURVEY PLOT

PAGE

REPORT NO. | SURVEY TYPE | OPENING NO. | STRATUM | POINT OF COMMENCEMENT | LICENCE NO. | C.P. | BLOCK

☐ WELL-SPACED ☐ FREE-GROWING

BEARING & DISTANCE	PLOT NO.	LAYER	TOTAL TREES	TOTAL CONIFERS	COUNT. CONIFERS	COUNT. HEIGHT	PREFERRED AND ACCEPTABLE SPECIES						TO-TAL W	TOTAL FG	TOTAL HEIGHT (m)	AGE (year)	PLANTABLE NUMBER/HA	PREPARABLE NUMBER/HA	COMPETING VEGETATION SPECIES	% COVER	HEIGHT (m)	FOREST HEALTH PEST CODE	AFFECTED LIVE TREES	AFFECTED DEAD TREES
			1	2																		3	4	5

COMMENTS: (prescriptions, snags, watercourses, wildlife, stand damage, etc.) 6

FS 658 95/8 (Prifor) DATA ON THE TOTAL HEIGHT AND AGE OF WELL-SPACED TREES, MAIN COMPETING VEGETATION AND INVENTORY COMPONENT SHOULD BE RECORDED ON THE FIRST PLOT ESTABLISHED IN THE STRATUM, AND EVERY FOURTH PLOT THEREAFTER. PUT INVENTORY COMPONENT ON LINES BETWEEN PLOTS.

Instructional Objectives:

- Introduction to the FS 658 field card.

Key Points, Concepts, Examples & Facilitator's Notes:

- The fields that are directly related to forest health data collection have been noted with field numbers, (1 to 6). Descriptions on the source of the data to be recorded in these fields is found on the following page.
- The data collection techniques for fields 1 and 2 follow standard silviculture survey procedures. Fields 3, 4 and 5 are more specifically related to the forest health aspects. Field 6 is a general comments field.



Participant's Workbook Page Reference: 25

Overhead Number: 41

Lesson Number: 5

Title: Application

Field Descriptions for the FS 658

Field	Description
1	Total trees are recorded as usual. These values will be used in the subsequent calculations.
2	Total conifers are recorded as usual. These values will be used in the subsequent calculations.
3	Record the three letter pest code for each forest health factor found in the plot. Multiple rows will be required for multiple forest health factors in a single plot.
4	Record the number of trees that are alive and affected by the forest health factor.
5	Record the number of trees that are dead as a result of the forest health factor.
6	This space is left for comments related to the general health of the survey area. The comments here are not summarized. The comments are usually qualitative and based on visual observation.

Instructional Objectives:

- Provide a reference to assist with identifying the source for each data item.

Key Points, Concepts, Examples & Facilitator's Notes:

- The individual steps are reasonably simple.
- Emphasis should be given to the point that if positive identification of the cause of a particular forest health factor is critical. The unconfirmed or suspected cause can be signified by using the first one or two letters of the three letter code followed by ?. The collect samples and continued research to identify the specific forest health factor. When the positive identification is confirmed, the ? can be replaced with the correct full three letter pest code.

Participant's Workbook Page Reference: 26

Overhead Number: 42

Lesson Number: 5

Title: Application

FS 658 Silviculture Survey Plot Data

Sample from page 89 of the Silviculture Surveys Guidebook

Province of British Columbia — Ministry of Forests

SILVICULTURE SURVEY PLOT

PAGE

REPORT NO. FG | SURVEY TYPE | 82L056-38 | OPENING NO. | A | STRATUM | POINT OF COMMENCEMENT | LICENCE NO. | C.P. | BLOCK

☐ WELL-SPACED ☒ FREE-GROWING

BEARING & DISTANCE	PLOT NO.	LAYER	TOTAL TREES	TOTAL CONIFERS	COUNT. CONIFERS	COUNT. HEIGHT	PREFERRED AND ACCEPTABLE SPECIES						TOTAL W	TOTAL FG	TOTAL HEIGHT (cm)	AGE (year)	PLANTABLE NUMBER	PREPARABLE MICROSITE	COMPETING VEGETATION SPECIES	% COVER	HEIGHT (cm)	FOREST HEALTH PEST CODE	AFFECTED LIVE TREES	AFFECTED DEAD TREES
							P Fd	P Lw	a Pl	a Sx														
POC																								
N 200m.	1		16	9	8	20	6	1						M	175	9			Epil ang	10	130	AD	2	0
	Fd5Lw3Ac1At1-9-1.8m-10%																		Rubi par	30	120	WS	1	0
N 200m.	2		6	5	4	40	3		1	1				5	230	9	1					WS	1	0
E 200m.	3		11	7	7	20	3		2					5			1							
S 200m.	4		16	11	9	20	6	2						M	180	9			Epil ang	20	120	AD	3	0
	Fd5Lw3Ac1At1-9-2.0m-15%																		Rubi par	40	130			
S 200m.	5		8	4	4	40	1	1		2				4	220	9	2	1						
	Fd6Lw2Ac1At1-8-1.6m-12%																							

COMMENTS: (prescriptions, snags, watercourses, wildlife, stand damage, etc.) deer browse found only on the fir branches

FS 658 95/8 (Prifor) DATA ON THE TOTAL HEIGHT AND AGE OF WELL-SPACED TREES, MAIN COMPETING VEGETATION AND INVENTORY COMPONENT SHOULD BE RECORDED ON THE FIRST PLOT ESTABLISHED IN THE STRATUM, AND EVERY FOURTH PLOT THEREAFTER. PUT INVENTORY COMPONENT ON LINES BETWEEN PLOTS.

Instructional Objectives:

- Provide a sample for participant reference.

Key Points, Concepts, Examples & Facilitator's Notes:

- The sample plot was reproduced from page 89 of the Silviculture Surveys Guidebook. Modifications have been made to make this version of the sample more correct than the one in the Guidebook.

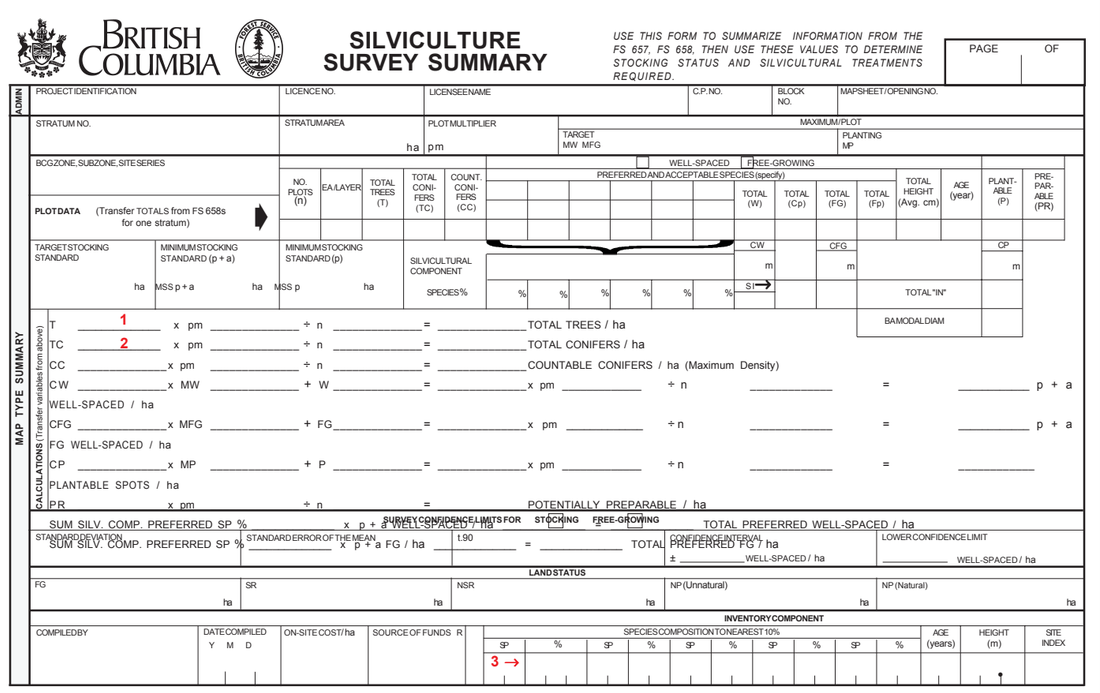
Participant's Workbook Page Reference: 27

Overhead Number: 43

Lesson Number: 5

Title: Application

FS 659 - Front Side



SILVICULTURE SURVEY SUMMARY

USE THIS FORM TO SUMMARIZE INFORMATION FROM THE FS 657, FS 658, THEN USE THESE VALUES TO DETERMINE STOCKING STATUS AND SILVICULTURAL TREATMENTS REQUIRED.

PAGE OF

ADMIN

PROJECT IDENTIFICATION | LICENCE NO. | LICENSEE NAME | C.P. NO. | BLOCK NO. | MAPSHEET/OPENING NO.

STRATUM NO. | STRATUM AREA ha | PLOT MULTIPLIER pm | MAXIMUM/PLOT TARGET MW MFG | PLANTING MP

BCG ZONE, SUBZONE, SITE SERIES | WELL-SPACED ☐ FREE-GROWING ☐

	NO. PLOTS (n)	EA/LAYER	TOTAL TREES (T)	TOTAL CONI-FERS (TC)	COUNT. CONI-FERS (CC)	PREFERRED AND ACCEPTABLE SPECIES (specify)						TOTAL (W)	TOTAL (Cp)	TOTAL (FG)	TOTAL (Fp)	TOTAL HEIGHT (Avg. cm)	AGE (year)	PLANT-ABLE (P)	PRE-PAR-ABLE (PR)
PLOT DATA (Transfer TOTALS from FS 658s for one stratum) →																			

TARGET STOCKING STANDARD ha MSS p + a | MINIMUM STOCKING STANDARD (p + a) ha MSS p + a | MINIMUM STOCKING STANDARD (p) ha MSS p | SILVICULTURAL COMPONENT SPECIES % % % % % % % | CW m | CFG m | CP m | SI → | TOTAL "IN" | BA MODAL DIAM

MAP TYPE SUMMARY

CALCULATIONS (Transfer variables from above)

T ____1____ x pm _____ ÷ n _____ = _____ TOTAL TREES / ha

TC ____2____ x pm _____ ÷ n _____ = _____ TOTAL CONIFERS / ha

CC _____ x pm _____ ÷ n _____ = _____ COUNTABLE CONIFERS / ha (Maximum Density)

CW _____ x MW _____ + W _____ = _____ x pm _____ ÷ n _____ = _____ p + a

WELL-SPACED / ha

CFG _____ x MFG _____ + FG _____ = _____ x pm _____ ÷ n _____ = _____ p + a

FG WELL-SPACED / ha

CP _____ x MP _____ + P _____ = _____ x pm _____ ÷ n _____ = _____

PLANTABLE SPOTS / ha

PR _____ x pm _____ ÷ n _____ = POTENTIALLY PREPARABLE / ha

SUM SILV. COMP. PREFERRED SP % _____ x p + a WELL-SPACED / ha — SURVEY CONFIDENCE LIMITS FOR STOCKING ☐ FREE-GROWING ☐ — TOTAL PREFERRED WELL-SPACED / ha

STANDARD DEVIATION SUM SILV. COMP. PREFERRED SP % _____ | STANDARD ERROR OF THE MEAN _____ x p + a FG / ha | t.90 _____ = _____ TOTAL PREFERRED FG / ha | CONFIDENCE INTERVAL ± _____ WELL-SPACED / ha | LOWER CONFIDENCE LIMIT _____ WELL-SPACED / ha

LAND STATUS

FG ha	SR ha	NSR ha	NP (Unnatural) ha	NP (Natural) ha

INVENTORY COMPONENT

COMPILED BY	DATE COMPILED Y M D	ON-SITE COST/ha	SOURCE OF FUNDS R	SPECIES COMPOSITION TO NEAREST 10% SP	%	SP	%	SP	%	SP	%	SP	%	AGE (years)	HEIGHT (m)	SITE INDEX
				3 →												

FS 659-1 HSP 98/8 (Prifor)

FILE ORIGINAL IN DISTRICT OFFICE ON OPENING FILE.

Instructional Objectives:

- Introduction to the front of the FS 659

Key Points, Concepts, Examples & Facilitator's Notes:

- The purpose of this card is for the manual compilation of the silviculture survey.
- There are no forest health specific components to this field card.
- All of the fields are completed as normal.
- The data found in fields 1, 2 and 3 is used in the calculations found on the back of this card.



Participant's Workbook Page Reference: 28

Overhead Number: 44

Lesson Number: 5

Title: Application

Field Descriptions for the FS 659 - Front Side

Field	Description
1	The total tree value in this field is transferred to column 2 on the back of the FS 659.
2	The total conifer value in this field is transferred to column 3 on the back of the FS 659.
3	The percentages for each forest health factor will be used in column 6 on the back of the FS 659.

Instructional Objectives:

•Provide a reference to assist with identifying the source for each data item.

Key Points, Concepts, Examples & Facilitator's Notes:

• The total trees (T) and total conifers (TC) are marked with numbers 1 and 2. The values in these fields are transferred to fields 1 and 2 on the back of the FS 659.



Participant's Workbook Page Reference: 29

Overhead Number: 45

Lesson Number: 5

Title: Application

FS 659 - Back Side

BRITISH COLUMBIA

SILVICULTURE

USE THIS FORM TO SUMMARIZE PLOT INFORMATION FROM THE FS 658 AND SUMMARIZE SILVICULTURAL

PAGE OF

SUMMARY OF COMPETING VEGETATION — ← CHECK (✓) APPROPRIATE BOXES →

SPECIES (INCLUDE ONLY THE FOUR MAIN COMPETING SPECIES)	ESTIMATED	CURRENT MINIMUM	CURRENT MAXIMUM	CURRENT AVERAGE	HT. INCREMENT	DISTRI- CONTINUOUS	DISTRI- PATCHY	DISTRI- SCATTERED	CURRENT HIGH	CURRENT MEDIUM	CURRENT LOW	CURRENT NIL	POTENTIAL HIGH	POTENTIAL MEDIUM	POTENTIAL LOW	POTENTIAL NIL

RECOMMENDED TREATMENTS

SITE PREPARATION (method, sensitivity, season, year)

REGENERATION METHOD (species, stock type, stock age, season, year)

BRUSHING (method, season, year)

STAND TENDING (method, season, year)

SURVEYS (type, season, year)

PRIMARY TREATMENT RECOMMENDATIONS

PEST INFORMATION SUMMARY

1 PEST	2 TOTAL (sum of Total Trees column)	3 TOTAL (sum of Total Conifers column)	4 LIVE TREES (sum of Live Trees Affected	5 DEAD TREES (sum of Dead Tree	6 HOST SPECIES (from Inventory Label) (expressed	7 %TOTAL TREES [(4+5)÷(2+5)] x 100	8 %CONIFERS [(4+5)÷(3+5)] x 100	9 %HOST TREES [(4÷(2×6)] x 100
1	2	3	4	5	6	7	8	9

PEST MANAGEMENT (eradication, surveys)
10

FISH AND WATER (spawning areas, buffer zones, water quality, potable water)

ALTERNATE TREATMENT RECOMMENDATIONS
11

Instructional Objectives:

- Introduction to the back of the FS 659

Key Points, Concepts, Examples & Facilitator's Notes:

- Time should be taken to point out the source of each of the values to be entered.
- The formula located at the top of columns 7, 8 and 9 may not be clear to all participants. Emphasize, "Take the value from column 4 plus the value from column 5 and add these together, take the value from column 2 plus the value from column 5 and add these together, then divide the first number by the second and multiply the result by 100."
- To practice the methods, coach the participants to use the data found on the sample FS 657 provided.



Participant's Workbook Page Reference: 30

Overhead Number: 46

Lesson Number: 5

Title: Application

Field Descriptions for the FS 659 - Back Side

Field	Description
1	The three letter pest code recorded on the FS 657. One row per forest health factor.
2	The total tree value in this field is transferred from field 1 on the front of the FS 659
3	The total conifer value in this field is transferred from field 2 on the front of the FS 659
4	The total number of live trees affected by that forest health factor from each of the plots in the stratum.
5	The total number of dead trees killed by that forest health factor from each of the plots in the stratum.
6	Based on the inventory label
7	The sum of column 4 plus column 5, divided by the sum of column 2 plus column 5, then multiplied by 100
8	The sum of column 4 plus column 5, divided by the sum of column 3 plus column 5, then multiplied by 100
9	Column 4, divided by column 2 multiplied by column 6, then multiplied by 100
10	Where a treatment is required to reduce the impact of a forest health factor, descriptions should be entered here.
11	Alternate treatments should also be considered.

Instructional Objectives:

- Provide a reference to assist with identifying the source for each data item.

Key Points, Concepts, Examples & Facilitator's Notes:

- Allow the participants time to complete the calculations. Make yourself available for additional personal assistance.

Participant's Workbook Page Reference: 30

Overhead Number: 47

Lesson Number: 5

Title: Application

Incidence =

the proportion (0 to 1) or percentage (0 to 100%) of entities (trees affected by pests within a sample unit.)

Example:

the percentage of trees found with mistletoe

Severity =

the quantity of damage or damaging agents affecting sample entities within a sampling unit. It is a damage rating measure.

Instructional Objectives:

- Confirmation of terminology

Key Points, Concepts, Examples & Facilitator's Notes:

- It may not be clear to everyone the difference between the two terms:
- *Incidence* is a measure of "how many" are affected.
- *Severity* is a measure of "how bad" are they affected.
- Incidence is the value calculated in column 9 on the FS 659 and is the value used most commonly in the guidebooks. This is the same data that is recorded on the MLSIS form C, stores in ISIS and used in the various guidebooks in the discussion of treatment thresholds.



Participant's Workbook Page Reference: 31, 32, 33

Overhead Number: 48, 49, 50

Lesson Number: 6

Title: Free Growing Damage Criteria

Location of damage	Type of damage	Tree being assessed is UNACCEPTABLE if:	Host species	Likely damage agents & damage agent codes	Comments
Stem	**Wound (including sunscald and girdling)**	the tree has any wound which is greater than 33% of the stem circumference, or	All	squirrel AS, beaver AZ, vole AV, porcupine AP, hare AH, Warrens root collar weevil IWW, sequoia pitch moth ISQ, fire NB, windthrow NW, sunscald NZ, logging TL, mechanical TM.	A wound is defined as an injury in which the cambium is dead (e.g., sunscald) or completely removed from the tree exposing the sapwood. Measure the wound across the widest point of the exposed sapwood (or dead cambium when the tree is damaged by sunscald). Healed over wounds (= scars) are acceptable. See Figure 1.
		the tree has a wound which is greater than 20% of the total length of the stem, or			
		the tree has a wound centred on an infection caused by a stem rust, canker, or dwarf mistletoe (See Note under Stem: Infection).			
Stem	**Insect mining at root collar**	the tree is currently attacked by a bark-mining insect such as a weevil or a beetle and exhibits symptoms such as foliage discoloration, thinning, and/or reduced height growth increments	Pl, Sx	[illegible] weevil IWW.	Only trees that are symptomatic should be considered for insect infestation or mining damage. Non-symptomatic trees are presumed to be unaffected by insect mining.
Stem	**Deformation (including crook, sweep, fork, browse, and dead or broken top)**	the pith is horizontally displaced more than 30 cm from the point of defect and originates above 30 cm from the point of germination.	Fd, sweep, all except Cw and Hw	[illegible]ers ID, white pine (spruce) weevil IWS, lodgepole pine terminal weevil IWP, northern pitch twig moth ISP, sequoia pitch moth ISQ, cattle AC, deer AD, elk AE, moose AM, frost NG, hail NH, snow NY, drought ND, logging TL, mechanical TM.	For horizontal displacement see Figure 2.
		the tree leader has been killed three or more times in the last five years (weevil only).	Sx, Ss, Pl	White pine (spruce) weevil IWS, lodgepole pine terminal weevil IWP.	**This criterion applies only for terminal weevil damage.**
		the tree has two or more leaders with no dominance expressed after five years growth and the fork originates above 30 cm from the point of germination.	All	terminal weevils (IWS, IWP), frost NG, animal damage A.	Leader dominance occurs when the tallest leader is at least 5 cm taller than the second tallest leader. See Figure 3.
		the tree has a dead or broken top at a point that is >2 cm (>3 cm for the coast) in diameter.	All		

Full Size Version on the Next Page

Instructional Objectives:

- Introduction to the Free Growing Damage Criteria
- Provide explanation of the individual criteria.

Key Points, Concepts, Examples & Facilitator's Notes:

- The methods and specifications contained in the Free Growing Damage Criteria are in constant flux. Modification to these criteria is the norm rather than the exception. Participants should be encouraged to regularly consult Ministry of Forests staff, employers, clients and co-workers to ensure they have the most current version of this and other survey related materials.
- The free growing damage criteria were formulated and are periodically updated by a group of
- District, Region and Branch forest health specialists.

Regions and Districts have the ability to modify these criteria to better meet local needs.

- This section is included as an appendix in the participant's workbook to assist with the replacement of this version as others are produced.
- Each of the individual criterion are described in detailed graphics on the following pages.
- As time passes and the criteria change this section will also require updates. The CD contained in the facilitator's guide contains a "view and print only" of the materials. An "edit-able" version of the file is stored at Forest Practices Branch as well as a backup copy at Prifor Management Ltd.
- The process is to proceed through each section of the Free Growing Damage Criteria. Participants should be encouraged to remove the Free Growing Damage Criteria from their binder so that it can be seen next to the individual graphics.
- Remind them these two pages will be required in the field for day 2.

Location of damage	Type of damage	Tree being assessed is UNACCEPTABLE if:	Host species	Likely damage agents & damage agent codes	Comments
Stem	**Wound** **(including sunscald and girdling**	the tree has any wound which is greater than 33% of the stem circumference, or the tree has a wound which is greater than 20% of the total length of the stem, or the tree has a wound centred on an infection caused by a stem rust, canker, or dwarf mistletoe (See Note under Stem: Infection).	All	squirrel AS, beaver AZ, vole AV, porcupine AP, hare AH, Warrens root collar weevil IWW, sequoia pitch moth ISQ, fire NB, windthrow NW, sunscald NZ, logging TL, mechanical TM.	A wound is defined as an injury in which the cambium is dead (e.g., sunscald) or completely removed from the tree exposing the sapwood. Measure the wound across the widest point of the exposed sapwood (or dead cambium when the tree is damaged by sunscald). Healed over wounds (= scars) are acceptable. See Figure 1.
Stem	**Insect mining at root collar**	the tree is currently attacked by a bark-mining insect such as a weevil or a beetle and exhibits symptoms such as foliage discoloration, thinning, and/or reduced height growth increments	Pl, Sx	root collar weevil IWW.	Only trees that are symptomatic should be checked for insect infestation or mining damage. Non-symptomatic trees are presumed to be unaffected by insect mining.
Stem	**Deformation** **(including crook, sweep, fork, browse, and dead or broken top)**	the pith is horizontally displaced more than 30 cm from the point of defect and originates above 30 cm from the point of germination.	For sweep, all except Cw and Hw	Defoliators ID, white pine (spruce) weevil IWS, lodgepole pine terminal weevil IWP, northern pitch twig moth ISP, sequoia pitch moth ISQ, cattle AC, deer AD, elk AE, moose AM, frost NG, hail NH, snow NY, drought ND, logging TL, mechanical TM.	For horizontal displacement see Figure 2.
		the tree leader has been killed three or more times in the last five years (weevil only).	Sx, Ss, Pl	White pine (spruce) weevil IWS, lodgepole pine terminal weevil IWP.	This criterion applies only for terminal weevil damage.
		the tree has two or more leaders with no dominance expressed after five years growth and the fork originates above 30 cm from the point of germination.	All	terminal weevils (IWS, IWP), frost NG, animal damage A.	Leader dominance occurs when the tallest leader is at least 5 cm taller than the second tallest leader. See Figure 3.
		the tree has a dead or broken top at a point that is >2 cm (>3 cm for the coast) in diameter.	All		

Location of damage	Type of damage	Tree being assessed is UNACCEPTABLE if:	Host species	Likely damage agents & damage agent codes	Comments
Stem	**Infection** **(including cankers and galls)**	any infection occurs on the stem.	All	comandra blister rust DSC, stalactiform blister rust DSS, white pine blister rust DSB, western gall rust DSG, atropellis canker DSA.	Note: Wounds caused by rodent feeding around rust cankers should have stem rust recorded as the causal agent.
Branch	**Infection** **(cankers)**	an infection occurs on a live branch less than 60 cm from the stem.	Pw, Pl, Py	white pine blister rust DSB, comandra blister rust DSC, stalactiform blister rust DSS.	See Figure 4.
Branch	**Galls**	a gall rust infection occurs on a live branch less than 5 cm from the stem.	Pl, Py	western gall rust DSG.	See Figure 4.
Branch	**Gouting**	any adelgid gouting occurs on a branch	Ba, Bg, Bl	balsam woolly adelgid lAB.	Gouting is defined as excessive swelling of a branch or shoot caused by balsam woolly adelgid, and is often accompanied by misshapen needles and buds. It is most common on branch tips and at nodes near the ends of branches. Consult a recent distribution map to identify the geographic extent of this pest.
Foliage	**Defoliation**	>80% of tree foliage has been removed due to defoliating insects or foliage disease.	All	defoliators lD, foliage diseases DF.	
Stem or Branch	**Dwarf mistletoe infection**	any infection occurs on the stem or a live branch, or a susceptible tree is located within 10 m of an overtopping tree, which is infected with dwarf mistletoe.	Hw, Pl, Lw, Fd	hemlock dwarf mistletoe DMH, lodgepole pine dwarf mistletoe DMP, larch dwarf mistletoe DML, Douglas-fir dwarf mistletoe DMF.	Note: To confirm infection, the surveyor must observe mistletoe aerial shoots or basal cups on regeneration or on live or dead fallen brooms. Overtopping tree is a tree that is three or more times taller than the median height of the trees being assessed.

Location of damage	Type of damage	Tree being assessed is UNACCEPTABLE if:	Host species	Likely damage agents & damage agent codes	Comments
Roots	**Root disease**	sign(s) or a definitive combination of symptoms of root disease are observed.	All	armillaria root disease DRA, laminated root rot DRL, tomentosus root rot DRT, annosus root disease DRN, blackstain root disease DRB.	Signs are direct evidence of the pathogenic fungus including fruiting bodies, distinctive mycelium or rhizomorphs. Symptoms include foliar chlorosis or thinning, pronounced resin flow near the root collar, reduced recent leader growth, a distress cone crop, and wood decay or stain. An individual symptom is not sufficient to identify a root disease.
		infected tree found in plot. See comments for well-spaced tree net down calculation. The multiplier for DRA is two, except in BEC zones PPdh1 and 2, lDFxh1, lDFdm1 and 2, MSdk1, and MSdm1 where the multiplier is one.	All	armillaria root disease DRA.	Note: All conifer species are considered susceptible. Broadleaf species are considered not susceptible for survey purposes only.
		infected conifer found in plot. See comments for well-spaced tree net down calculation. The multiplier for DRL is four.	Fd, Sx, Se Lw, Ba, Bg	laminated root rot DRL.	Note: Bl, Cw, Pl, Pw, Py, and broadleaf species are considered not susceptible for survey purposes only.
		infected conifer or stump found in plot. See comments for well-spaced tree net down calculation. The multiplier for DRT is two.	Se, Sx	tomentosus root rot DRT.	Note: Ba, Bl, Cw, Fd, Pl, Pw, Py and broadleaf species are considered not susceptible for survey purposes only.
		infected conifer found in plot. See comments for well-spaced tree net down calculation. The multiplier for DRN is two.	Ba, Hw, Ss	annosus root rot DRN.	Note: Bg, Bl, Cw, Cy, Fd, Hm, Pl, Pw, Py, Sx and broadleaf species are considered not susceptible for survey purposes only.

Example: How to apply net down for root disease. If root disease-infected trees are found in the plot:

1.
In the first sweep, determine the total number of healthy, well-spaced trees using the prescribed minimum inter-tree distance (MITD) (e.g., 12 trees) ignoring the M-value;

2.
In a second independent sweep, determine the number of well-spaced infected trees (including dead infected trees and for DRT only, infected stumps) using MITD (e.g., one infected tree);

3.
Multiply the number from step 2 by the multiplier for the specific root disease and subtract this number from the number of susceptible healthy well-spaced trees found in step 1 (e.g., for DRA: 12-1(2) = 10). The result is the maximum number of free growing trees tallied for the plot.

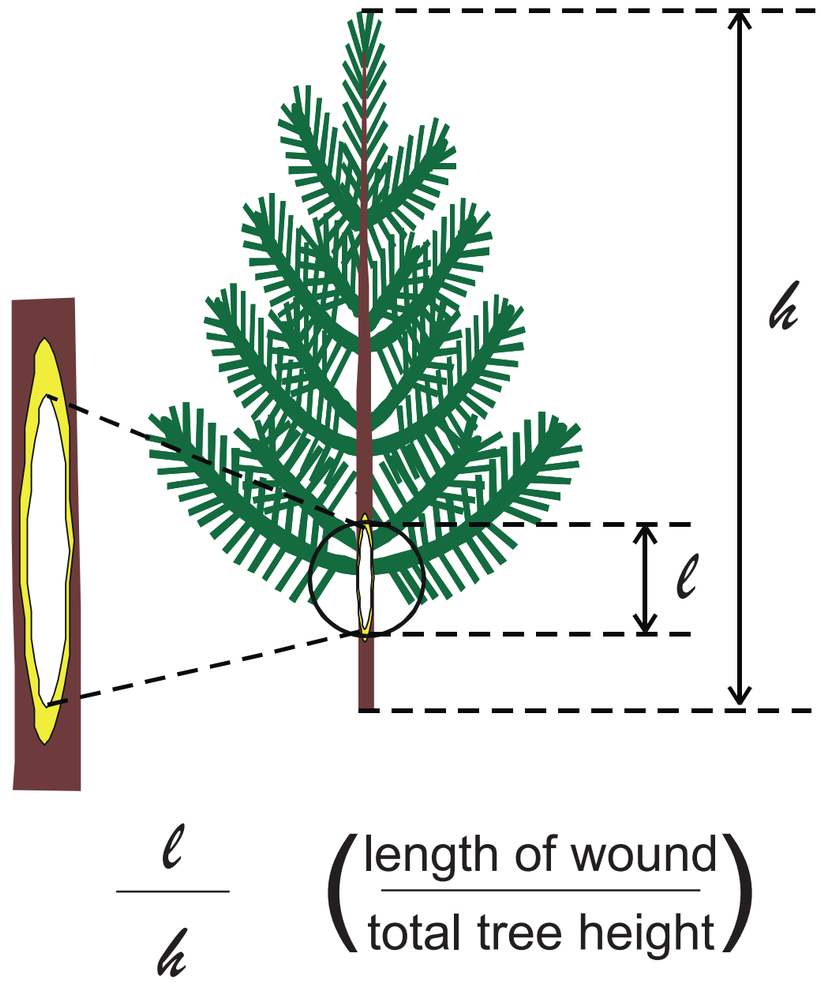
Participant's Workbook Page Reference: 34

Overhead Number: 51

Lesson Number: 6

Title: Free Growing Damage Criteria

Figure 1. Calculation of wound along stem length.



Instructional Objectives:

- Describe the details of wound acceptability

Key Points, Concepts, Examples & Facilitator's Notes:

- The title "Figure 1" refers to the reference in the Free Growing Damage Criteria.
- There are two wound related criteria, one for circumference and the second for wounds along the length of the stem.
- A wound the encircles the stem in excess of the specified amount is unacceptable.
- A wound that stretches along the length of the stem more than the specified amount is unacceptable.
- The procedures for dealing with multiple small wounds that, when combined, exceed the allowable ratio has not been defined. However, it is realistic to assume the wounds should be considered with their combined affect.

Participant's Workbook Page Reference: 34

Overhead Number: 52

Lesson Number: 6

Title: Free Growing Damage Criteria

Stem Deformation

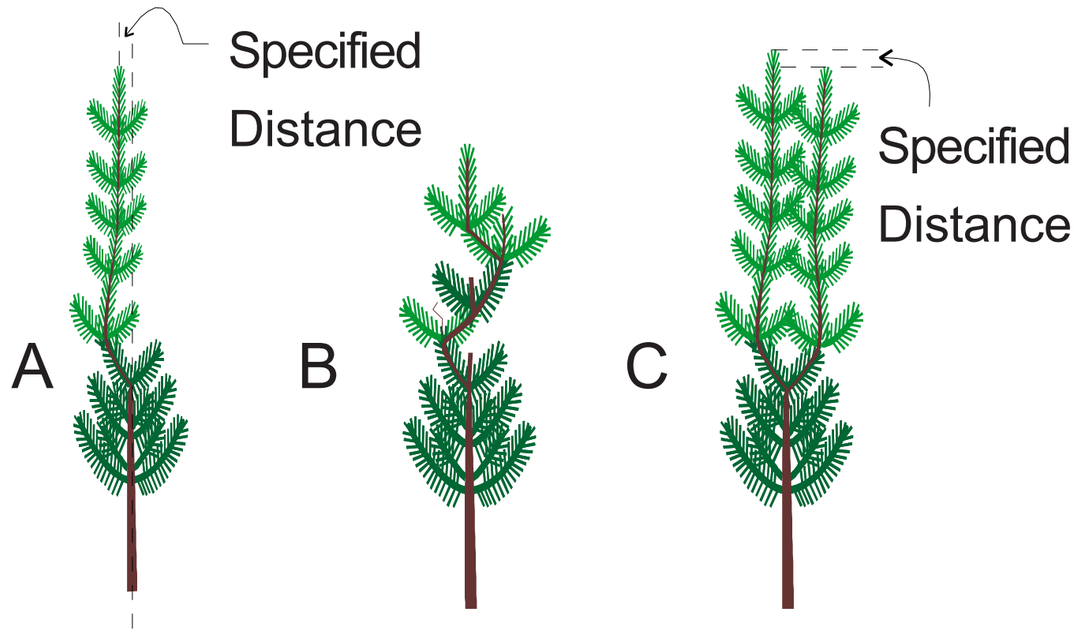
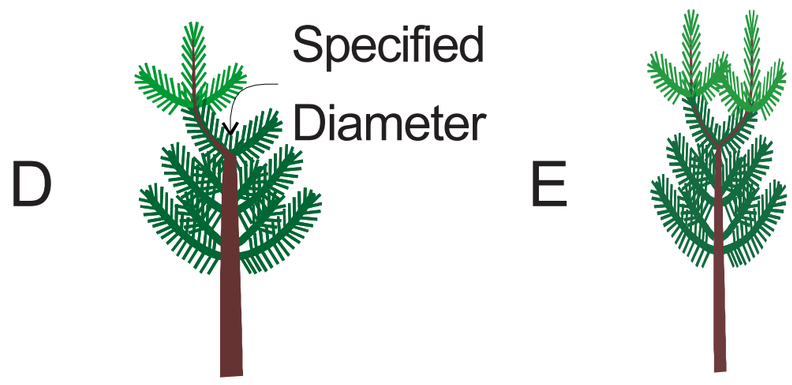


Figure 2.

Figure 3.



Instructional Objectives:

- Describe the details of deformation acceptability

Key Points, Concepts, Examples & Facilitator's Notes:

- "Figure 2" refers to the figure number indicated in the Free Growing Damage Criteria.
- Each of the five sample trees have been affected by some forest health factor. The actual cause is not relative to the criteria being applied.
- The trees are not labelled on the overhead.
- Tree A - the leader has a 'crook' that is displaced more than the specified distance from the centre line of the undamaged portion of the stem. It may have corrected itself since the original damage, in that the new leaders are in alignment. If some portion of the stem has exceeded the specified distance, the tree is unacceptable.
- Following an injury that results in leader damage, we allow the tree a period of 5 years to correct itself. **If less than 5 years has passes since the damage, the tree is considered acceptable.** If more than 5 years has passed, the criteria described on tree B and C are applied.
- Tree B - Where one or more forest health factors have caused a tree to be forked multiple times, the tree is considered unacceptable. The number of forks is defined in the Free Growing Damage Criteria.



•Tree C - Where forest health factors have caused a tree to have more than one leader, we allow the tree 5 years to recover from the damage. After the 5 year period, one of the leaders must be significantly taller than the other. We refer to this as dominance. The Free Growing Damage Criteria defines how much taller one of the leaders must be. **Again, if less than 5 years has passes since the damage, the tree is considered acceptable.**

•Tree D - The breakage or damage has occurred at a relatively thick portion of the stem. As a result it is unlikely that a tree with such significant damage to the stem will grow to produce an acceptable form of tree. This wound is also a centre for infection.

•Tree E - For the purpose of a reminder, **emphasis should be placed on the need for 5 years to pass. This tree is considered acceptable.**

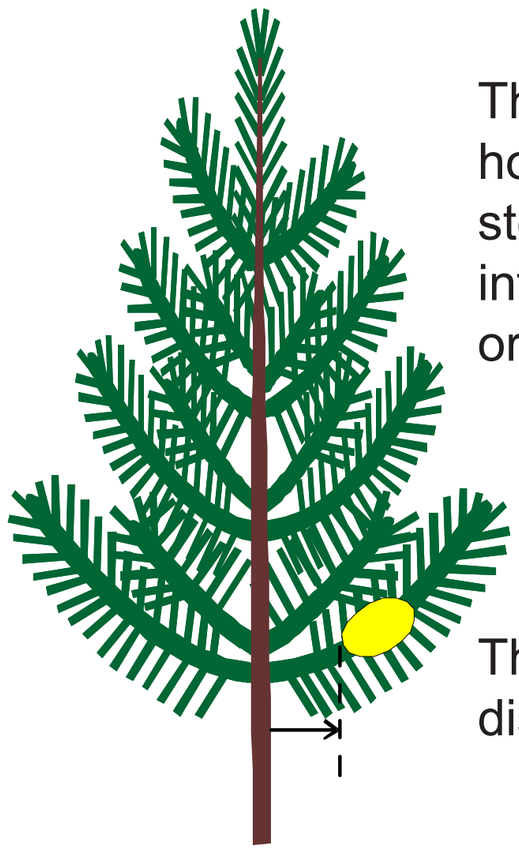
Participant's Workbook Page Reference: 35

Overhead Number: 53

Lesson Number: 6

Title: Free Growing Damage Criteria

Figure 4. Branch Infections



The measured horizontally from the stem to the point of infection by canker or gall.

The specified distance.

***The tree is unacceptable if with an infection anywhere on the stem.**

Instructional Objectives:

- Describe the details of gall and canker acceptability

Key Points, Concepts, Examples & Facilitator's Notes:

- "Figure 3" refers to the figure number indicated in the Free Growing Damage Criteria.
- The Free Growing Damage Criteria apply two separate specifications for the two primary types of stem disease. DSG has a separate specification from the group of DSB, DSC and DSS.
- The criteria for stem diseases is relatively simple. Measure from the stem to the closest visible signs of infection along the branch. Compare this measurement to the specified distance for the particular species of stem disease. If the measurement from the tree to the infection is less than the distance specified in the Free Growing Damage Criteria, the tree is unacceptable.
- Some may question why the measurement is not based on a distance along the branch. The disease grows along the length of the branch and therefore that distance is also potentially valid.

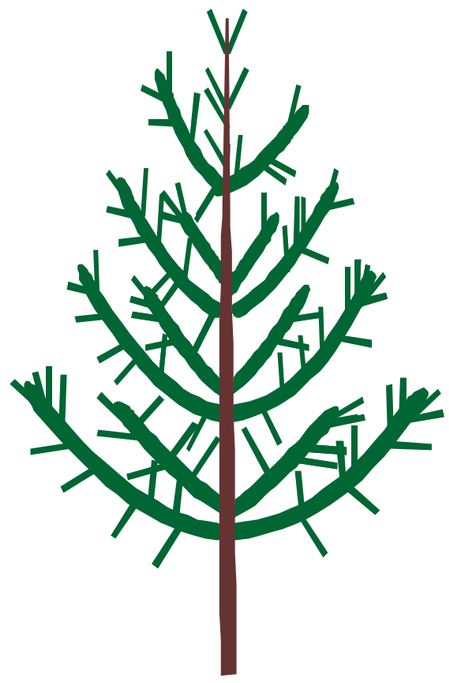
Participant's Workbook Page Reference: 35

Overhead Number: 54

Lesson Number: 6

Title: Free Growing Damage Criteria

Defoliation



χ % of the "normal" foliage is missing.

Instructional Objectives:

- Describe the details of defoliation acceptability

Key Points, Concepts, Examples & Facilitator's Notes:

- With all the effort to be evaluate free growing trees in a quantifiable manner, no one has been able to quickly and simply quantify defoliation levels. The process requires a surveyor to make a visual estimate of the percentage of foliage that is missing. One must consider the volume of foliage that you would expect the tree to have, given the conditions it is growing in. If the tree would normally have 1000 needles, but now has only about 250 left, this tree has been 75% defoliated.

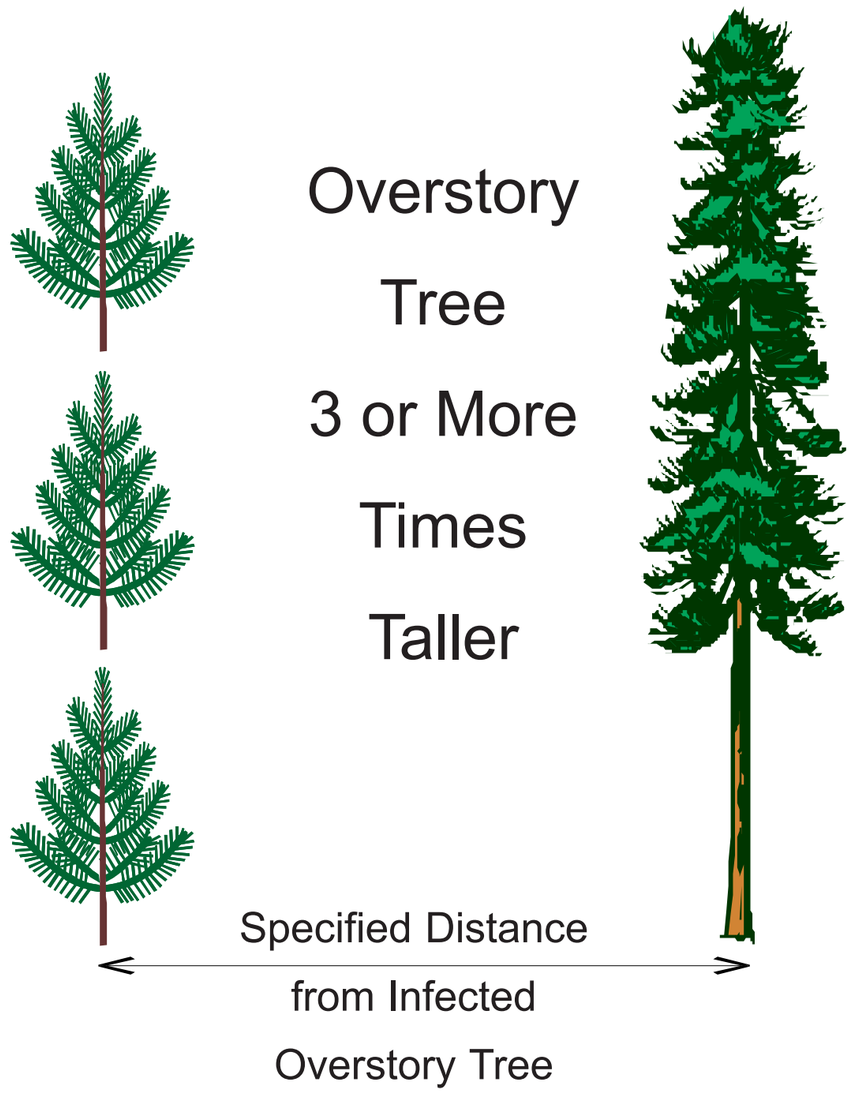
Participant's Workbook Page Reference: 36

Overhead Number: 55

Lesson Number: 6

Title: Free Growing Damage Criteria

Dwarf Mistletoe Infection



Instructional Objectives:

- Describe the details of dwarf mistletoe infection acceptability

Key Points, Concepts, Examples & Facilitator's Notes:

- Mistletoe infection on the branches or the stem results in the tree being unacceptable as a free growing tree.
- Where tall mistletoe infected trees are close to small trees of the same species these small trees are at risk of being infected by the overstory trees. The Free Growing Damage Criteria specifies three criteria:
  - the small trees (trees at risk) are the same species as the overstory trees
  - the overstory tree is more than or equal to three times the height of the small trees
  - trees closer than the specified distance are not acceptable
- The height of the infection on the overstory tree is not considered significant.

Although this course is not intended to cover the forest health implications on multi-storey surveys, is may be added that the infected mature tree, (Layer 1 tree), is considered acceptable since it is currently large enough to be merchantable. The young pine below may not be acceptable.

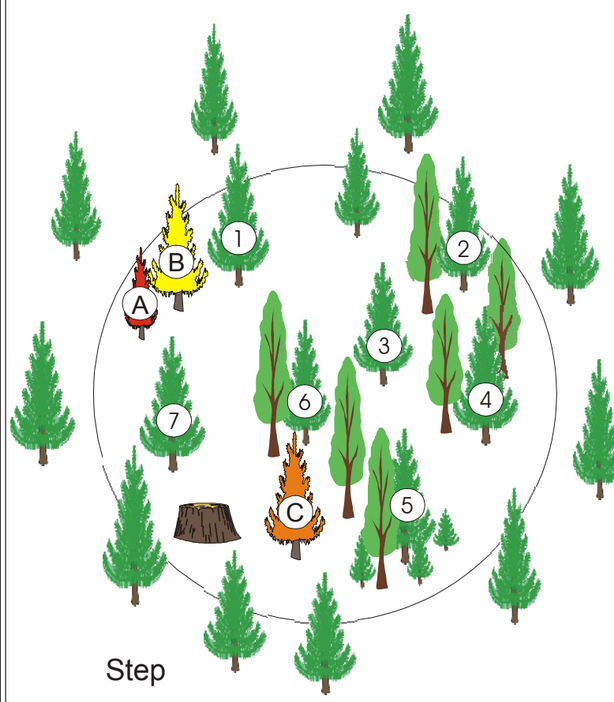
Participant's Workbook Page Reference: 36

Overhead Number: 56

Lesson Number: 6

Title: Free Growing Damage Criteria

Root Disease



2 infected well spaced trees
x 2 root disease multiplier
4

7 well spaced trees
- 4 from the previous Step 2
3

The maximum number of free growing trees that can be accepted in this plot is 3.

Step

1 Tree A, B and C are infected with root disease. However tree A and B are less than the minimum inter tree distance apart.

Count 2 well spaced infected trees.

2 The "root disease multiplier" in this plot is assumed to be 2, therefore 2 infected trees times the root disease multiplier of 2 = 4.

3 Trees 1 to 7 are greater than the minimum inter tree distance from each other.

Count 7 well spaced trees.

4 7 well spaced trees minus 4 from Step 2 = 3. Therefore, we can not accept any more than 3 free growing trees in this plot. These are likely to be tree 1, 7 and maybe 3.

Instructional Objectives:

- Describe the details of root disease acceptability

Key Points, Concepts, Examples & Facilitator's Notes:

- The root disease criteria is the most complex of all the criteria discussed.
- The purpose of this process is to establish a maximum (cap) on the number of free growing trees that can be selected. The process for calculating the maximum recognizes the dynamics of root disease spread.
- You may wish to begin by letting the participants know that this process is only required when a root disease-infected tree is found in a plot. (It also includes stumps infected with Tomentosus.) There is no longer a requirement to search for root disease outside the plot. Only root disease found in the plot is considered in this process.
- It will become apparent that where the level of infection (number of infected trees) is low, the calculation may not be necessary. Also, where conifer densities are high (many well spaced trees to choose from), it may not be necessary.
- The process has four steps. The wording in the Free Growing Damage Criteria may be misleading. It is recommended that participants listen to this description before reading the text.



Participant's Workbook Page Reference: 37

Overhead Number: 57

Lesson Number: 7

Title: Recommendation

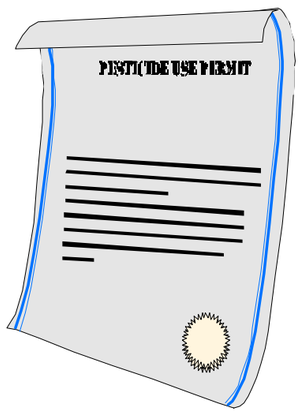
A Good Recommendation MUST...

effectively address deficiencies

be directed toward "Target" not minimum

meet the requirements of the SP where possible and practical

consider the management objectives



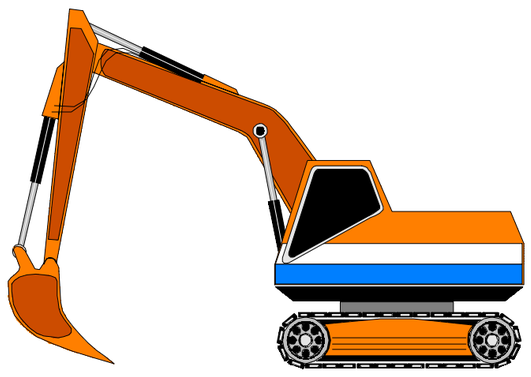


It Would be Nice if the recommendation...

encouraged biodiversity

limited "intrusiveness"

was cost effective



Instructional Objectives:

- Introduction to the process of creating a forest health treatment recommendation

Key Points, Concepts, Examples & Facilitator's Notes:

- While cost is a factor, good biologically based treatments are more important than cost.



Participant's Workbook Page Reference: 37

Overhead Number: 58

Lesson Number: 7

Title: Recommendation

For Good Recommendations you need...

Data -

- Accurately identified and collected
- Accurately compiled

Objectives -

- Local Land use Planning
- Silviculture Prescription
  - Stand Structure Objectives
  - Stocking Standards

Knowledge -

- Reference Material
- Guidebooks
  - Treatment Thresholds
- Treatment Options
- History of similar areas
- Communication with others

Instructional Objectives:

- Introduction to the process of creating a forest health treatment recommendation

Key Points, Concepts, Examples & Facilitator's Notes:

- Good recommendations require the careful consideration of the items listed. Most of all the experience of having seen forest health problems resolved through treatments. Where experience is lacking one can compensate for it, and at the same time gain some experience with a methodical process.

1 Gather the existing base of known information.
2 Compare it to the desired outcome, (usually the silviculture prescription).
3 Identify the problems, issues or shortcomings, (forest health factors).
4 Research these problems, (learn more about the forest health factors).
5 Consult with knowledgeable co-workers and forest health professionals.
6 Formulate a treatment recommendation, or combination of treatments to reduce or overcome the forest health factor.
7 Fine tune the treatment recommendation by adding details like seasons, and methods.



Participant's Workbook Page Reference: 38

Overhead Number: 59

Lesson Number: 7

Title: Recommendation

Silviculture Surveys Guidebook

Table 5-1. Forest health factor, code, incidence, and recommended treatment

Forest health Factor	Code	Incidence	Recommended treatment
Armillaria root disease	DRA	>1 to 5% of host species	Formal root disease survey
		>5% of host species	Intensive control treatment
Phellinus root disease	DRL	>1 to 5% of host species	Formal root disease survey
		>5% of host species	Intensive control treatment
Tomentosus root disease	DRT	any presence	Formal root disease survey
		>15% of host species	Intensive control treatment
Rhizina root disease	DRR	Any incidence and replanting is required	Delay planting 2 growing seasons after the broadcast burn
		Any incidence and replanting not required	Resurvey in year 2-3
Coastal hemlock dwarf mistletoe	DMH	Any	Eradicate infected trees <3 m in height
			Eradicate infected trees that are <10 m from and/or overtopping new regeneration
			Eradicate infected trees >3 m in height on low or poor sites
Interior lodgepole pine, Douglas-fir and larch dwarf mistletoes	DMP DMF DML	Any	Eradicate infected trees >3 m in height where the infection is in the top half of the tree
			Eradicate infected trees that are <15 m from and/or overtopping new regeneration
Comandra blister rust, *Stalactiform* blister rust, and Western gall rust	DSC DSS DSG	<10% all three stem rusts combined	Eradicate infected stems and prescribe a posttreatment target density equal to the target stocking standard
		10-20% all three stem rusts combined	Eradicate infected stems and prescribe a posttreatment target using the formula below
		>20% all three stem rusts combined	Delay spacing 3 to 5 years, resurvey and evaluate using these rules
White pine blister rust	DSB	Any	Eradicate infected stems and those with branch infections closer than 60 cm to the stem, and prune all other infections

* Incidence referred to in the above table is calculated as described in column 9 on the back of the FS 659 card.

Instructional Objectives:

•Introduction to the threshold values found in the Silviculture Surveys Guidebook.

Key Points, Concepts, Examples & Facilitator's Notes:

•Page 84 of the Silviculture Survey Guidebook contains a series of threshold values for many of the common forest health factors. The values are intended as a guide to trigger a thought process.

•A few of the thresholds relevant to the location of the course should be pointed out.

•Additional forest health threshold values are present in the various forest health guidebooks.



Participant's Workbook Page Reference: 39

Overhead Number: 60

Lesson Number: 7

Title: Recommendation

Case Study #1

Description:

SBS dw1 04

clearcut silviculture system

harvested 20 years ago

natural lodgepole pine regeneration was very effective

Survey Results:

Inventory Label: PI10 14-4.7-20-64-10340/0(99)(7)

Silviculture Label: PI100-14-5.8-20-1070(99)(7)

DSG is measured at 17%

Instructional Objectives:

- Case Study #1

Key Points, Concepts, Examples & Facilitator's Notes:

- The high conifer density is suggesting the need for juvenile spacing. The guidebooks suggest that given the high level of DSG, and the current age, post spacing densities should be adjusted to compensate for future damage and mortality. The density should be twice the target stocking standard in this example. DSG requires thin young bark to successfully infect a tree. With consideration for the age and height of this stand, it is unlikely the level of DSG will rise significantly. New branch infections may continue to occur but even their occurrence will slow as the trees grow taller.
- There is no reason to postpone the juvenile spacing treatment any longer. Schedule the treatment for early summer when the spores allow for easy visibility of the infections. Branch infections may be pruned, but the techniques prescribed in the Pruning Guidebook must be considered.
- It may not be operationally practical to conduct all of the juvenile spacing operations on all of the stands with high levels of infection during the peak visibility season. A crew could be used in a "mark-to-cut" strategy. That is, to mark the infected trees when the infected trees are easiest to identify, employing crews that require little training and no power tools. The economic viability is questionable, but it is operationally feasible.
- Spacing to a high density is an option.



Participant's Workbook Page Reference: 39

Overhead Number: 61

Lesson Number: 7

Title: Recommendation

Case Study #2

Description:

ICH mk1 01

clearcut silviculture system

harvested 3 years ago

broadcast burned in the fall of the year harvested

planted with a mix of Douglas fir and spruce 2 years ago

Survey Results:

Inventory Label: NSR-Fd6Sx4-6-0.3-25-1-445/0(99)(7)

Silviculture Label: NSR- Fd6Sx4-6-0.3-25-410(99)(7)

Mortality from DRR measures 25%

35% unknown case of mortality planted seedlings

Weather through the first year following planting was exceptionally good for Seedling development.

Vegetation competition is moderate but increasing.

Instructional Objectives:

- Case Study #2

Key Points, Concepts, Examples & Facilitator's Notes:

- This area has been severely impacted by Rhizina undulata. Rhizina has adapted to take advantage of the conditions resulting from broadcast burning. The ICH is particularly susceptible. It is realistic to suspect that the mortality related to the unknown cause is also from Rhizina since the mortality occurred shortly after planting. The signs of Rhizina are easily visible in the year in which they cause the mortality but the fruiting body, being mostly water, quickly decomposes.
- Rhizina quickly invades the soil causing mortality of all conifer species native to the ICH zone. The root disease is short lived. After 3 years following the broadcast burning, the root disease is dramatically less likely to cause additional mortality.
- Replant the area as soon as possible with the preferred and/or acceptable species specified in the silviculture prescription.
- This ecosystem is prone to high vegetation competition. The longer planting is postponed, the more likely the need for brush control treatments.

Participant's Workbook Page Reference: 40

Overhead Number: 62

Lesson Number: 7

Title: Recommendation

Case Study #3

Description:

CWH xm 04

Clearcut 10 years ago

Broadcast burned the year following the harvest

Planted with Douglas fir 9 years ago with 2 year old stock

A survey 2 years and 4 years after planting indicated an excellent looking new crop.

The late free growing date is 11 years

Fdc is the only preferred or acceptable species listed in the silviculture prescription.

Cw, Lw and Pw are listed as tertiary species in the Establishment to Free Growing Guidebook. Hw is not listed.

Survey Results:

Inventory Label: NSR-Hw7Fdc3-5-0.6-26-16-5850/0(99)(7)

Silviculture Label: NSR-Fdc100-11-4.5-28-257(99)(7)

DRL found to have caused 23% mortality, and an additional 12% have been found infected.

Competing vegetation is surprisingly low.

Instructional Objectives:

- Case Study #3

Key Points, Concepts, Examples & Facilitator's Notes:

- The licensee in this case is in a very serious situation. The block is NSR, heavily infected with DRL and one year away from the end or the free growing assessment period.
- The groups may also discuss "how this could happen". Poor observational skills of the previous surveyor and the 7 year gap without additional surveys.
- Undoubtedly the consideration of an amendment to the silviculture prescription will come up. Any amendments must be biologically appropriate for the site. Some may wish to accept the Hw. The Hw is no less susceptible to the DRL than the Fdc and is growing very slowly. It is not biologically suited to a CWH xm 04.
- One may wish to question the biogeoclimatic classification. This is reasonable, but the completed survey should have already confirmed this.
- Very few options are available. The licensee is likely near the end of the free growing period. The block is NSR. An amendment is required under the Operational Planning Regulation. An administrative penalty is likely.
- The presence of the forest health factor may be important for this stand, but on the landscape level, it may not be critical that all stands be disease and insect free.



Participant's Workbook Page Reference: 40

Overhead Number: 63

Lesson Number: 7

Title: Recommendation

Case Study #4

Description:

IDF dk3 01

Single tree selection harvesting 15 years ago

Survey Results:

Inventory Label: L1-Fdi6Pli4-98-23.0-19-15-260/4(99)(7)
L2-Fdi10-85-14.0-19-6-175/3(99)(7)
L3-Fdi10-35-5.8-19-35-8450/2(99)(7)
L4-Pli10-7-0.4-21-30-6930/1(99)(7)

Silviculture Label: L1-Fdi60Pli40-98-23-19-260(99)(7)
L2-Fdi100-89-16.0-19-45(99)(7)
L3-Fdi100-42-6.7-19-160(99)(7)
L4-Pli100-7-0.4-21-340(99)(7)

The survey indicates the area is sufficiently regenerated.

All of the well spaced trees in layers 1, 2 and 3 meet the free growing criteria. None of the layer 4 trees are free growing.

Vegetation is minimal, restricted to low herbs and grass.

Layer 1 has 18% and layer 4 has 2% DMP

Layer 4 has 7% DSG

Instructional Objectives:

- Case Study #4

Key Points, Concepts, Examples & Facilitator's Notes:

- Although this course is not intended to cover the forest health implications on multi-storey surveys, participants still often wish to discuss the topic. This example attempts to avoid the more complex issues that have not yet been resolved.

- Heavy natural regeneration of Pli on the areas with more historic disturbance and less crown closure is common. It is also worth noting that the layer 4 trees are nearly tall enough to become layer 3. The need for spacing may be is essential, depending on the distribution of that density.
- It is clear that the overtopping DMP infected Pli must be removed. Their presence eliminates the ability to consider the layer 4 Pli as free growing.
- The debate may centre around the cost/benefit analysis and operational considerations to salvaging the layer 1 Pli. Falling the layer 1 Pli will cause some damage to the smaller layers. Salvage harvesting will cause additional damage. Based on the high densities, the stand can likely with stand the higher levels of damage. Juvenile spacing should be schedule two or more years after the salvage harvesting to allow the damaged stems to express their inferiority.
- The low levels of DSG can be reduced during the juvenile spacing.
- The layer 4 trees are not free growing since they do not meet the 0.5 minimum free growing height.

Participant's Workbook Page Reference: 41

Overhead Number: 64

Lesson Number: n/a

Title: Preparation for Day 2

So where are we going?

How are we getting there?

When will we be back?

What are we doing when we get there?

- practice pest identification
- practice the use of the reference material
- practice recording and summarizing data
- collect specimens
- discuss recommendations

Instructional Objectives:

- Provide guidance for the participants to prepare for the field day.

Key Points, Concepts, Examples & Facilitator's Notes:

- Before the participants gather their belongings and proceed home for the evening, the details related to Day 2 must be communicated. The questions posed on the overhead transparency should be anticipated. These and others related to the logistics of the field trip must be pre-planned by the facilitator. You may find it useful to mentally walk through the plans for the day in an effort to foresee issues that can be prepared for.

It is always desirable to share transportation; not just for the reduced cost, but for the additional opportunity to share ideas while travelling to the field sites.

The answers to the questions listed can be written directly on the overhead transparency.

- It may also be necessary to plan a meeting place.
- Participants familiar with the area may choose to meet at the site.
- Be sure to be firm with the planned departure time.



Participant's Workbook Page Reference: 41

Overhead Number: 65

Lesson Number: n/a

Title: Preparation for Day 2

So where are we going?

How are we getting there?

What should we bring?

Lunch
Appropriate clothing for the weather
Sturdy knife
Calculator
Reference books
Reference card (FS 747)
Plot cards (FS 658 and FS 659)
Free Growing Damage Criteria
Shovel/Pulaski/Ax
Small folding saw
Measuring tape
3.99m plot cord
Field note book & pencil

* We will be in small groups so we can share.



Instructional Objectives:

•Provide guidance for the participants to prepare for the field day.

Key Points, Concepts, Examples & Facilitator's Notes:

•Emphasis should be placed on the ability to share equipment since the tasks will be completed in small groups. The lack of any of the listed equipment will not dramatically reduce the value of the learning experience of the field day.



Day 2

There are as many different way to organize the field portion of this training course as there are instructors. There are no right or wrong ways to conduct this portion as long as;

•it is conducted safely

•provides numerous opportunities to practise the skills and techniques described during the classroom session

The following is a suggested agenda,

•Meet at a central location at a specified time.

•Travel to the first site (less than 1 hour, as short as possible is best).

•As a single group, (or two smaller groups where a second facilitator is available), conduct a walk-through of the block. Be sure to encourage observational skills. Encourage the deviation from any pre-planned route for the purpose of conducting a closer inspection of any tree that "doesn't look right". Encourage the use of the reference books to determine the cause of damage. Use the Free Growing Damage Criteria to determine the acceptability of the damaged tree. An hour or more is usually easy to fill. The completion of this segment is a logical time for a break.

•The field site is also a good opportunity to revisit the process of the root disease multiplier. If root disease is not present on the field site, a plot simulating root disease can be created by the instructor. "Plant" a dead and or chlorotic trees to create a situation.

•The next stage is to put out identification skills to more precise application. Divide the participants into manageable sized groups of two to five. Three seems to provide the best group dynamics. Instruct the groups to designate at least one person in each group to record the data for their data on an FS 658. You will have to provide the details that would normally be found in the silviculture prescription. For this purpose it would be acceptable for the facilitator to simply provide the data. It is beneficial to acquire the silviculture prescription for the site but it is not essential where the facilitator has a good knowledge of the Establishment to Free Growing Guidebook, silviculture prescriptions and silviculture surveys. They will need:

- •the preferred and acceptable species
- •minimum inter-tree distance
- •target and minimum stocking standard
- •conifer to brush ratio
- •minimum free growing height



•Encourage the participants to disperse and proceed to the preestablished plots to complete the type of survey appropriate for the age of the block; stocking or free growing. Ask that they complete as many as they can by a specified time, (11:30 is often a logical time to reconvene for a debriefing of results). Suggest that they take "short cuts" for today. Concentrate on the forest health aspects of the plots. Suggest it is OK, for today, to estimate values that are not crucial to the forest health components.

•When the group comes back together, assist them with completing the final stage; to summarize the data. Verbally "walk" the participants through the tasks to determine the three incidence values. All of the values are entered on the back of the FS 659 field card. These steps are:

Field

1 Enter each different three letter pest codes recorded on the FS 657. One row per forest health factor.

2 Add the total number of trees in all of the plots combined and enter this value into column 2.

3 Add the total number of conifers in all of the plots combined and enter this value into column 3.

4 Separately, add the number of live trees affected by each of the forest health factors. Record each of these values in column 4 for each of the pest codes.

5 Separately, add the number of dead trees affected by each of the forest health factors. Record each of these values in column 5 for each of the pest codes.

6 Consider the hosts for each of the forest health factors present. In relation to the inventory label data collected. Where a forest health factor exists on a tree species that is rare on the site, the calculations will result in 0%.

7 Complete the mathematical calculations on the column headings. The sum of column 4 plus column 5, divided by the sum of column 2 plus column 5, then multiplied by 100

8 The sum of column 4 plus column 5, divided by the sum of column 3 plus column 5, then multiplied by 100

9 Column 4, divided by column 2 multiplied by column 6, then multiplied by 100

•The debriefing can proceed with group representatives sharing their results. The discussions that often result may require the entire group to revisit a plot to discuss the acceptability of one or more trees. This should be encouraged.

•The process is repeated on a second site. It is desirable for the second site to have different forest health factors present. A different biogeoclimatic zone and year of harvest will usually accomplish this site diversity. If the first site was at the stocking survey age, the second must be within the free growing survey range.



•A "mock exam" may be offered at the end of the day to those who wish to do so. This may be of more interest to those preparing for the Silviculture Survey Accreditation exam. This can be as simple as a collection of samples with numbered pieces of flagging tied to them. Individuals take a few minutes to assess the samples and record their determination of the correct pest code on a scrap piece of paper or corner of a plot card. Upon completion, the facilitator reviews the correct answers. They participants can be reminded that this is a loose simulation of the accreditation exam. "Did you get more than 80% correct?"

•Before the group disperses, draw the group together for a review. There may also be an evaluation to be completed.

Summary

So what did we learn;

•forest health is an important component of silviculture surveys

•clarified a number of forest health terms, (pest/hazard/risk/sign/symptom)

•the three letter pest code abbreviation system

•availability of reference material

•discussed observation, looking, seeing

•practised identifying a few samples

•introduced to the newest version of the free growing damage criteria

•practised data collection and completing the field cards

•performed forest health calculations

•discussed threshold values and recommendations