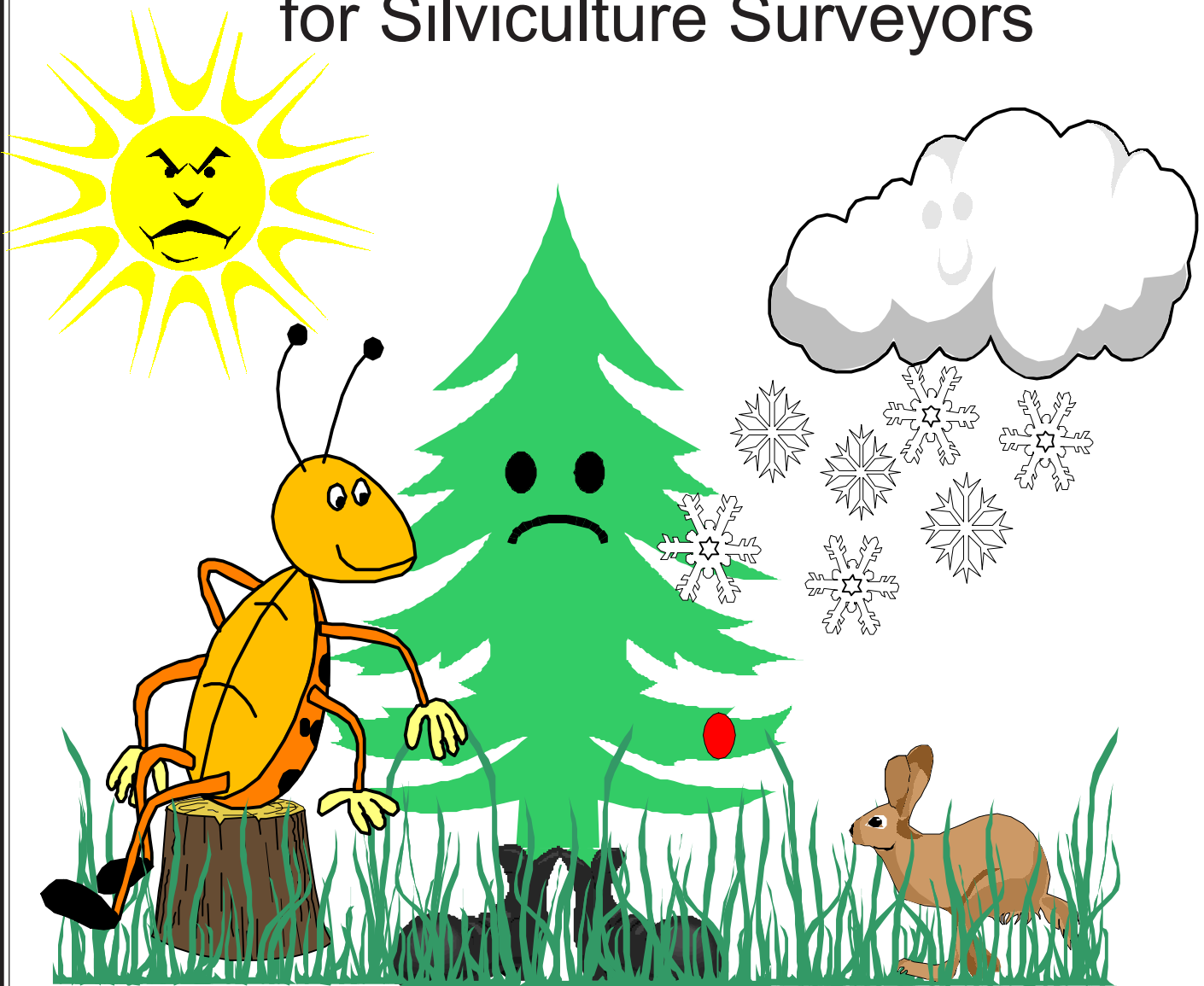




Welcome to

Forest Health

for Silviculture Surveyors





Agenda

Today

Introduction

Importance of Forest Health

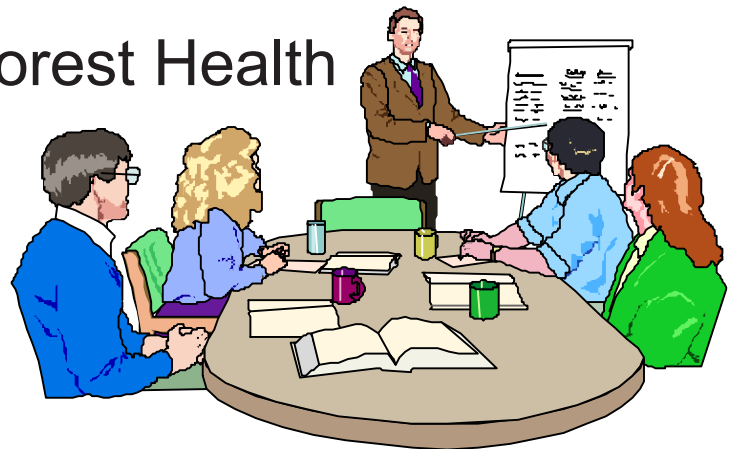
Foundation

Identification

Application

Free Growing Damage Criteria

Treatment Recommendations



Tomorrow

Field Practice of the
concepts learned today





Your Name
Your Employer
Your Favourite
Forest Pest



*Forest
Health*

Your Name
Your Employer
A question you
would like
answered today?



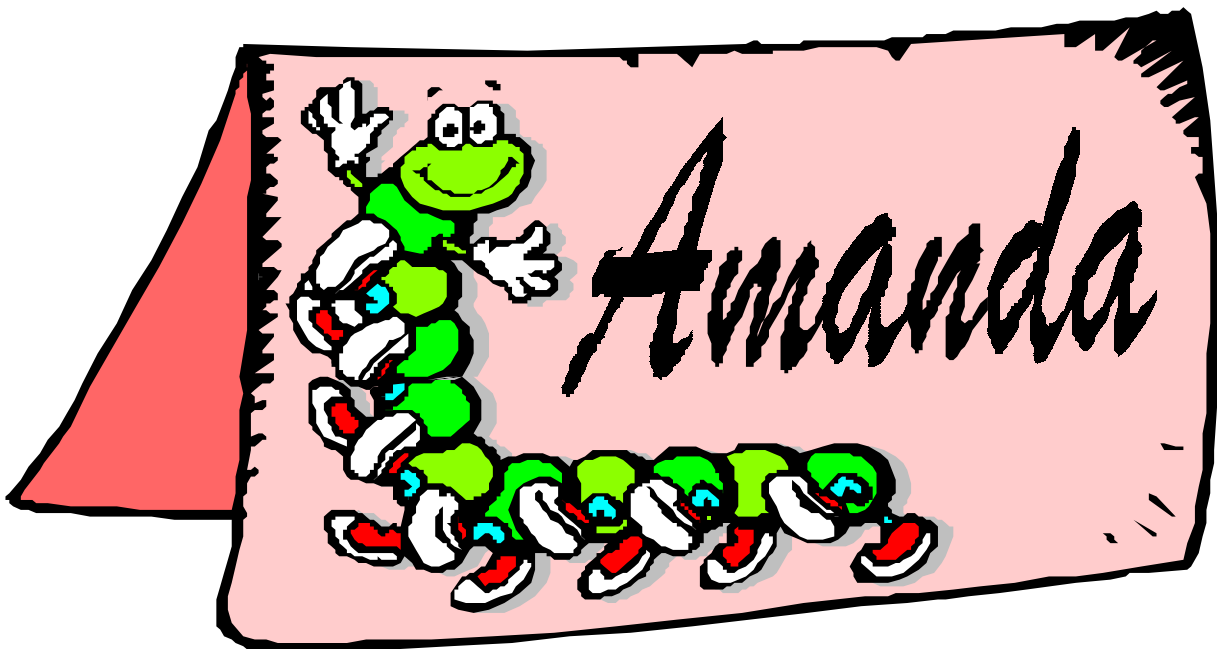
On the “tent” cards,

Print your Name

and

forest

Draw Your Favorite Pest.





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**.





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 **walkthrough**.
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



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.***



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](http://www.for.gov.bc.ca/tasb/legsregs/fpc/FPCGUIDE/Guidetoc.htm)



Annual Losses to Forest Pests....

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

	Bark Beetles	Defoliators	Dwarf Mistletoes	Root Diseases	Total
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 '000m³



Annual Losses to Forest Pests....

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

	Bark Beetles	Defoliators	Dwarf Mistletoes	Root Diseases	Total
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 '000m³



Annual Losses to Forest Pests....

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

	Bark Beetles	Defoliators	Dwarf Mistletoes	Root Diseases	Total
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 '000m³



Annual Losses to Forest Pests....

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

	Bark Beetles	Defoliators	Dwarf Mistletoes	Root Diseases	Total
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 '000m³



Annual Losses to Forest Pests....

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

	Bark Beetles	Defoliators	Dwarf Mistletoes	Root Diseases	Total
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 '000m³



Annual Losses to Forest Pests....

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

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

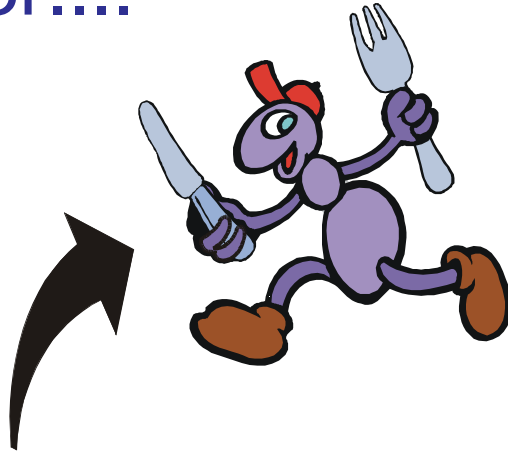
That is about 10% of the total volume harvested

EACH YEAR!

Expresses in '000m³

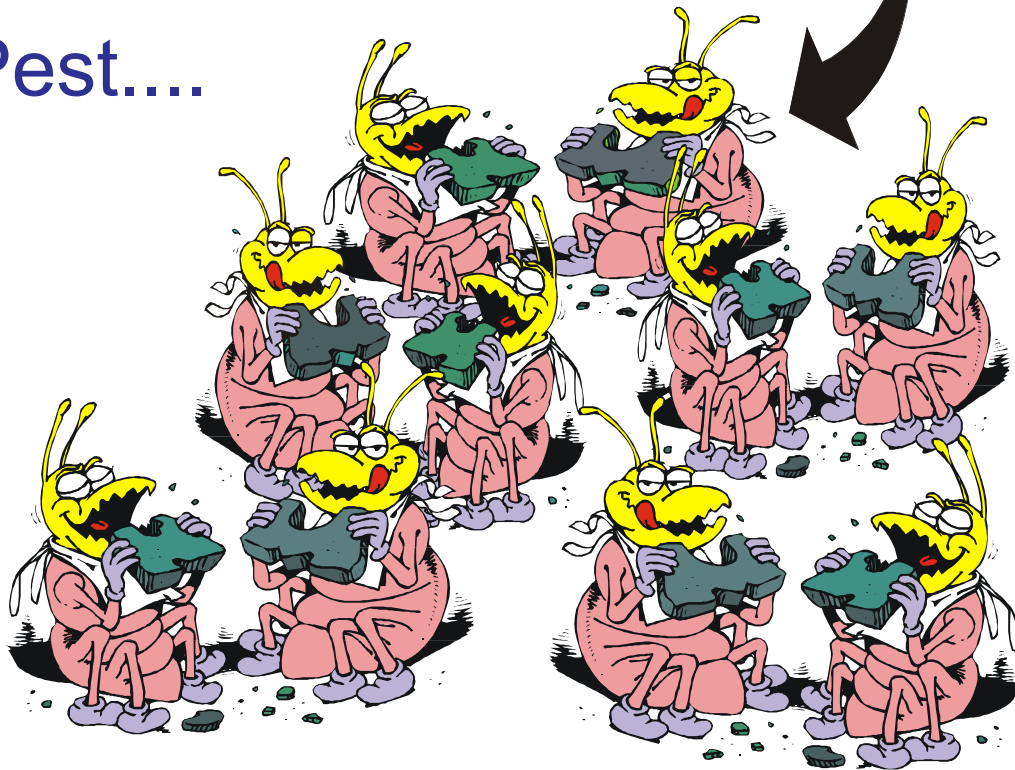


Factor....



Endemic vs Epidemic

Pest....





Types of Forest Health Factors

Animal

deer, rabbits, squirrels...

Abiotic = 'non-living'

sun, wind, snow...

Diseases

root disease, stem disease, mistletoe...

Insects

aphids, defoliators, weevils...

Treatments

logging, planting, thinning...

Vegetation

herbs, shrubs, trees...





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

BRITISH
COLUMBIA

DAMAGE AGENT AND CONDITION CODES

FIELD CODES	DESCRIPTION	FIELD CODES	DESCRIPTION	FIELD CODES	DESCRIPTION
A	ANIMAL DAMAGE			DF	FOLIAGE DISEASES
AB	BEAR	AP	PORCUPINE	DFA	western pine aster rust <i>Coleosporium asterum</i>
AC	CATTLE	AS	SQUIRREL	DFC	large-spored spruce-labrador tea rust <i>Chrysomyxa ledicola</i>
AD	DEER	AV	VOLE	DFD	spruce needle cast <i>Lirula macrospora</i>
AE	ELK	AX	BIRDS	DFE	elytroderma disease <i>Elytroderma deformans</i>
AH	HARE OR RABBIT	AZ	BEAVER	DFH	larch needle cast <i>Hypodermella laricis</i>
AM	MOOSE			DFL	pine needle cast <i>Lophodermella concolor</i>
				DFM	larch needle blight <i>Meria laricis</i>
N	ABIOTIC INJURIES			DFP	fir-fireweed rust <i>Pucciniastrum epilobii</i>
NB	FIRE	NN	ROAD SALT	DFR	Douglas-fir needle cast <i>Rhabdocline pseudotsugae</i>
ND	DROUGHT	NR	REDBELT	DFS	red band needle blight <i>Mycosphaerella(Scirrhia)pini</i>
NF	FLOODING	NS	SLIDE	PSS	sirococcus tip blight <i>Sirococcus strobilinus</i>
NG	FROST	NW	WINDTHROW	PDT	cedar leaf blight <i>Didymascella thujina</i>
NGC	frost crack	NWS	windthrow-soil failure		LEADER OR BRANCH DIEBACKS
NGH	frost-heaved	NWT	windthrow-treatment or harvest related	DLD	dermea canker <i>Dermea pseudotsugae</i>
NGK	shoot / bud frost kill			DLF	red flag disease <i>Potebniamyces balsamicola</i>
NH	HAIL	NX	WOUNDING / RUBBING	DLP	phomopsis canker <i>Phomopsis lokoyae</i>
NK	FUMKILL	NY	SNOW, ICE, SNOW PRESS	DLS	sydowia tip dieback <i>Sclerophoma pithyophila</i>
NL	LIGHTNING	NZ	SUNSCALD	DLV	aspen-poplar twig blight <i>Venturia spp.</i>
				DM	DWARF MISTLETOES
D	DISEASE			DMF	Douglas-fir dwarf mistletoe <i>Arceuthobium douglasii</i>
DB	BROOM RUST			DMH	hemlock dwarf mistletoe <i>Arceuthobium tsugense</i>
DBF	fir broom rust <i>Melampsorella caryophyllacearum</i>			DML	larch dwarf mistletoe <i>Arceuthobium laricis</i>
DBS	spruce broom rust <i>Chrysomyxa arctostaphyli</i>			DMP	lodgepole pine dwarf mistletoe <i>Arceuthobium americanum</i>
DD	STEM DECAYS			DR	ROOT DISEASES
DDB	birch trunk rot <i>Fomes fomentarius</i>			DRA	armillaria root disease <i>Armillaria ostoyae</i>
DDD	sulfur fungus <i>Laetiporus sulphureus</i>			DRB	blackstain root disease <i>Ceratocystis wageneri</i>
DDE	rust-red stringy rot <i>Echinodontium tinctorium</i>			DRC	laminated root rot (cedar) <i>Phellinus weirii</i>
DDF	brown crumbly rot <i>Fomitopsis pinicola</i>			DRL	laminated root rot <i>Inonotus sulphurascens(Phellinus weirii)</i>
DDH	hardwood trunk rot <i>Phellinus ignarius</i>			DRN	annosus root disease <i>Heterobasidion annosum</i>
DDO	cedar brown pocket rot <i>Poria sericeomollis</i>			DRR	rhizina root disease <i>Rhizina undulata</i>
DDP	red ring rot <i>Phellinus pini</i>			DRS	schweinitzii butt rot <i>Phaeolus schweinitzii</i>
DDQ	quinine conk rot <i>Fomitopsis officinalis</i>			DRT	tomentosus root rot <i>Inonotus tomentosus</i>
DDS	Schweinitz butt rot <i>Phaeolus schweinitzii</i>			DS	STEM DISEASE (CANKER OR RUST)
DDT	aspen trunk rot <i>Phellinus tremulae</i>			DSA	atropellis canker <i>Atropellis piniphila</i>
				DSB	white pine blister rust <i>Cronartium ribicola</i>
				DSC	comandra blister rust <i>Cronartium comandrae</i>

FS 747 HSP 99/1

FIELD CODES	DESCRIPTION	FIELD CODES	DESCRIPTION
DSE	sooty bark canker <i>Encoelia pruinosa</i>	IDS	conifer sawflies <i>Neodiprion spp.</i>
DSG	western gall rust <i>Endocronartium harknessii</i>	IDT	Douglas-fir tussock moth <i>Orygia pseudotsugata</i>
DSH	hypoxylon canker <i>Hypoxylon mammatum</i>	IDU	satin moth <i>Leucoma salicis</i>
DSP	cryptosphaeria canker <i>Cryptosphaeria populina</i>	IDV	variegated cutworm <i>Peridroma saucia</i>
DSR	ceratocystic canker <i>Nectria galligena</i>	IDW	western spruce budworm <i>Choristoneura occidentalis</i>
DSS	stalactiform blister rust <i>Cronartium coleosporioides</i>	IDX	large aspen tortrix <i>Choristoneura conflictana</i>
DST	target canker <i>Nectria galligena</i>	IDZ	western false hemlock looper <i>Nepytia freemani</i>
DSY	cytospora canker <i>Cytospora chrysosperma</i>	IS	SHOOT INSECTS
		ISB	western cedar borer <i>Trachykele blondeli</i>
I	INSECTS	ISE	European pine shoot moth <i>Rhyacionia buoliana</i>
IA	APHIDS OR ADELGIDS	ISG	gouty pitch midge <i>Cecidomyia piniinopsis</i>
IAB	balsam woolly adelgid <i>Adelges piceae</i>	ISP	pitch nodule moths <i>Petrova spp.</i>
IAC	giant conifer aphid <i>Cinara spp</i>	ISS	western pine shoot borer <i>Eucosma sonomana</i>
IAG	Cooley spruce gall adelgid <i>Adelges cooleyi</i>	ISQ	Sequoia pitch moth <i>Synanthedon sequoiae</i>
IAL	larch cone woolly aphid <i>Adelges lariciatus</i>	IW	WEEVILS
IAS	spruce aphid <i>Elatobium abietinum</i>	IWC	conifer seedling weevil <i>Steremnius carinatus</i>
IB	BARK BEETLES	IWM	Magdalis sp.
IBB	western balsam bark beetle <i>Dryocoetes confusus</i>	IWP	lodgepole pine terminal weevil <i>Pissodes terminalis</i>
IBD	Douglas-fir beetle <i>Dendroctonus pseudotsugae</i>	IWS	white pine weevil (on spruce) <i>Pissodes strobi</i>
IBI	engraver beetles <i>Ips</i>	IWW	Warren's root collar weevil <i>Hylobius warreni</i>
IBM	mountain pine beetle <i>Dendroctonus ponderosae</i>	IWY	cylindrocopturus weevil <i>Cylindrocopturus spp.</i>
IBP	twig beetles <i>Pityogenes, Pityophthorus spp</i>	IWZ	Yosemite bark weevil <i>Pissodes schwartzii</i>
IBS	spruce beetle <i>Dendroctonus rufipennis</i>		
IBT	red turpentine beetle <i>Dendroctonus valens</i>	M	MITE DAMAGE (TRISETACUS SPECIES)
IBW	western pine beetle <i>Dendroctonus brevicornis</i>		
ID	DEFOLIATING INSECTS	T	TREATMENT INJURIES
IDA	black army cutworm <i>Actebia fennica</i>	TC	CHEMICAL
IDB	two-year budworm <i>Choristoneura biennis</i>	TH	HARVESTED
IDC	larch casebearer <i>Coleophora laricella</i>	TL	LOGGING
IDD	western winter moth <i>Erannis vancouverensis</i>	TM	OTHER MECHANICAL DAMAGE (NON-LOGGING)
IDE	spruce budworm <i>Choristoneura fumiferana</i>	TP	PLANTING
IDF	forest tent caterpillar <i>Malacosoma disstria</i>	TPM	planting — poor microsite
IDG	greenstriped forest looper <i>Melanophila imatata</i>	TR	PRUNING
IDH	western blackheaded budworm <i>Acleris gloverana</i>	TT	THINNING OR SPACING
IDI	pine needle sheath miner <i>Zelleria haimbachi</i>		
IDL	western hemlock looper <i>Lambdina fiscellaria lugubrosa</i>	V	VEGETATION PROBLEMS
IDM	gypsy moth <i>Lymantria dispar</i>	VH	HERBACEOUS COMPETITION
IDN	birch leaf miner <i>Fenusa pusilla</i>	VP	VEGETATION PRESS
IDP	larch sawfly <i>Pristiphora erichsonii</i>	VS	SHRUB COMPETITION
IDR	alder sawfly <i>Eriocampa ovata</i>	VT	TREE COMPETITION



TOP TEN

Most Important Forest Health Factors



...but which ten?



Hints...

Establishment to Free Growing
Guidebook (2000)

Forest Health Guidebooks

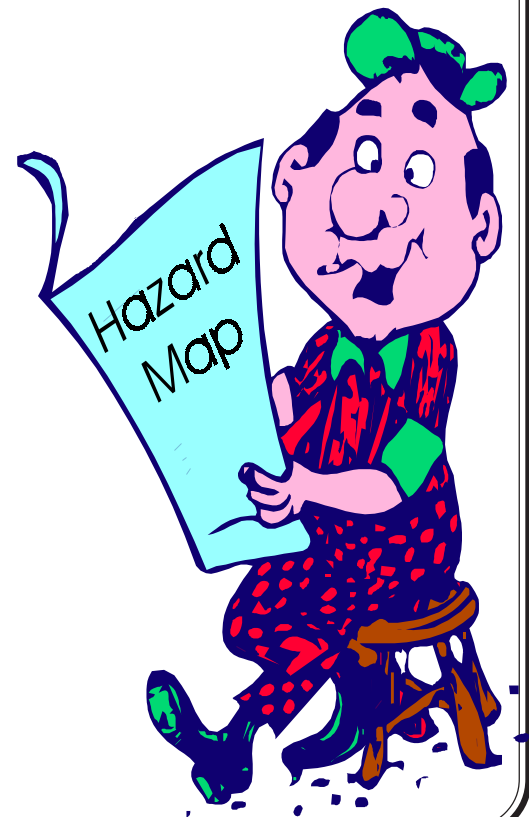
Regional BEC Books

Hazard Maps

Silviculture Prescription

District & Region Staff

Co-workers





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.**



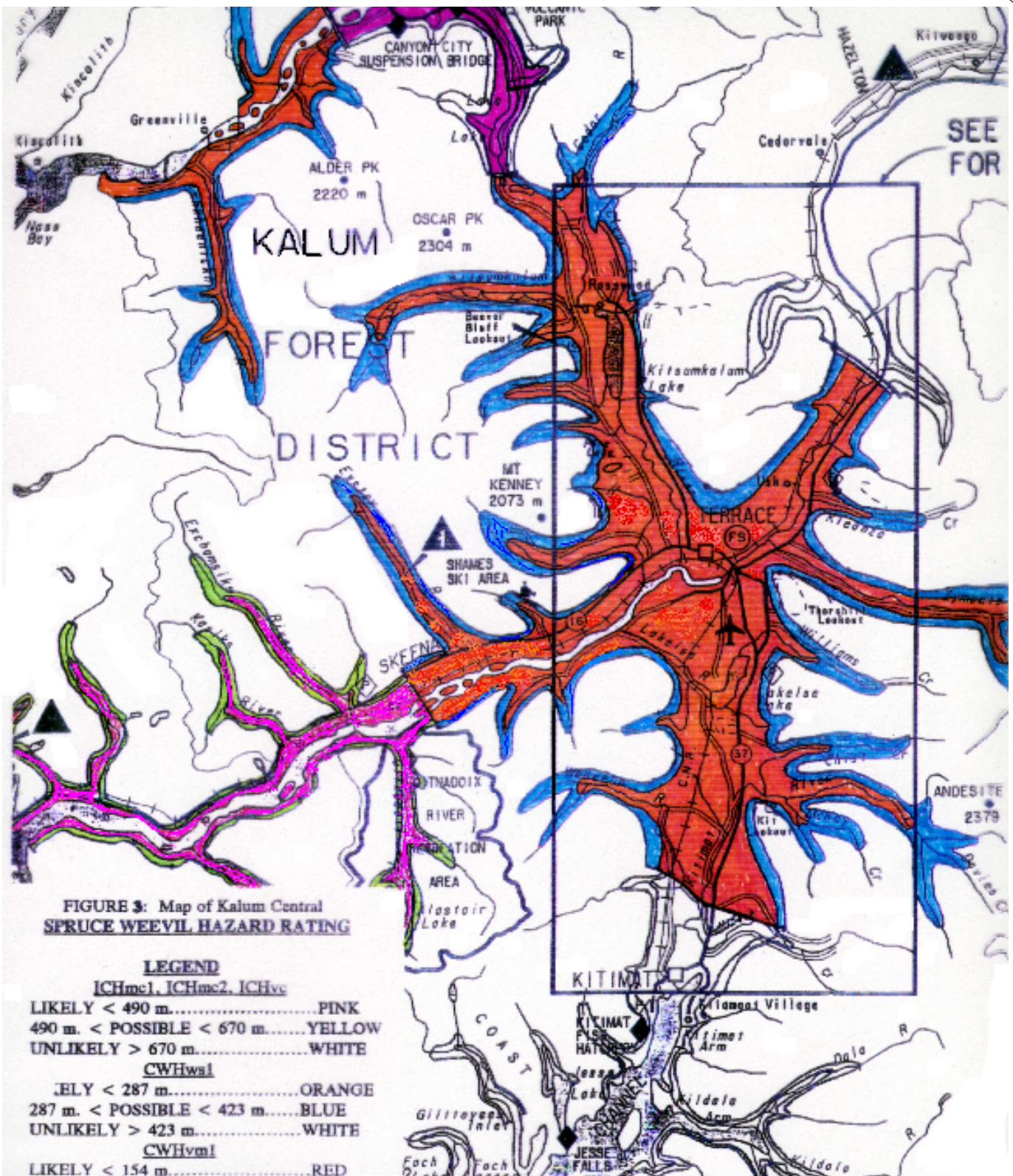
Hazard: the degree to which the characteristics of the sampling entity (usually a tree or a stand) make it vulnerable to damage. It is equivalent to susceptibility.



Hazard vs Risk

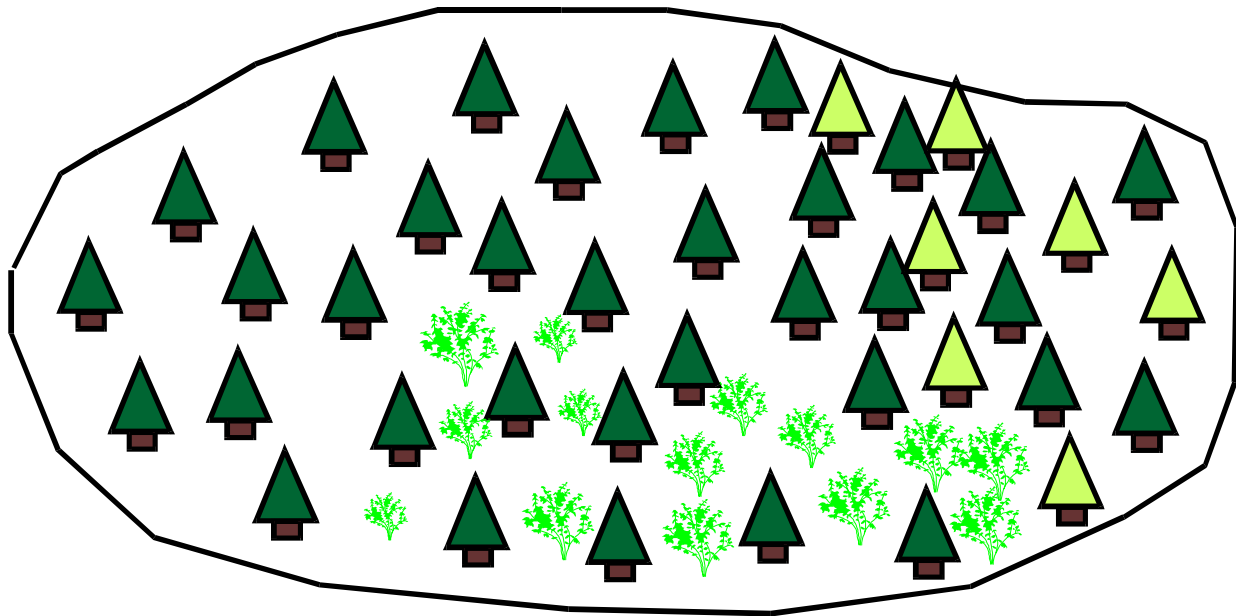
Risk: the probability and expected severity of sampling entity damage. It is a function of numerous components including sampling entity, hazard, sampling unit conditions, proximity to damaging agents and the incidence of those agents.







Stratification = Separation of Different and Grouping of Similar





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



Observational Skills!



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*



*What
evidence
should we
look for?*



	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 berbs foliage battered	poor vigor



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	PI (others)		◆ caused in spring & summer	several years
Vole	All	 	◆ caused in fall or winter	2 years with mortality several years without
Porcupine	PI, Spruce, Lw (Hw)	 	◆	several years
Ungulates	All (Ss)	 	◆	1 to several years
DISEASES				
Rusts	PI (other pines)	  	◆ gall rust  other rusts	several years (stem rusts most easily seen in June)
Mistletoes	Hw, PI, Fd, Lw	  	  	several years to several decades
Root Rots - annosus - armillaria - black stain - phellinus - tomentosus	Hw (True Firs, Ss) All Fd, PI (Hw) Fd, True Firs, (Lw) Sx (PI)	  armillaria = all	   when snow free	several years to several decades

* STAGES

Seedling
0 - 2 YrsRegen.
3 - 10 YrsSapling
11 - 20 YrsPole
21 - 80 YrsMature
80+ YrsAll
Ages

** SEASONS

Spring



Summer



Fall



Winter



All





Survey Timing

AGENT	HOST	STAGE EVIDENT*	SEASON EVIDENT**	DURATION EVIDENT
INSECTS				
Balsam Woolly 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 YrsRegen.
3 - 10 YrsSapling
11 - 20 YrsPole
21 - 80 YrsMature
80+ YrsAll
Ages

** SEASONS

Spring



Summer



Fall



Winter



All





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



Did you say slide show?





Other sources of help...

Co-workers

Supervisors

Internet

Ministry of Forests District Staff

Ministry of Forests Region Staff

Universities, Colleges and

<http://www.forestry.ubc.ca/fetch21/fetch21/FETCH21.html>

Forestry Canada Staff and

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

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



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.





FOREST INSECT AND DISEASE COLLECTION AND IDENTIFICATION

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

[illegible]



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 overwintered, 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



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.



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.**





Survey Plot Card (FS 658)

Province of
British ColumbiaMinistry
of Forests

SILVICULTURE SURVEY PLOT

PAGE

[illegible]

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.



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.



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		82L056-38		A		POINT OF COMMENCEMENT										LICENCE NO.		C.P.		BLOCK					
SURVEY TYPE		OPENING NO.		STRATUM																					
						☐ WELL-SPACED ☒ FREE-GROWING PREFERRED AND ACCEPTABLE SPECIES										☒ PLANTABLE NUMBER "IN"		☒ PREPARABLE MODAL DIA.		COMPETING VEGETATION			FOREST HEALTH		
BEARING & DISTANCE	PLOT NO.	LAYER	TOTAL TREES	TOTAL CONIFERS	COUNT CONIFERS	COUNT HEIGHT	SPECIES						TOTAL W	TOTAL FG	TOTAL HEIGHT (cm)	AGE (year)	SPECIES	% COVER	HEIGHT (cm)	PEST CODE	AFFECTED				
							P	P	A	A															LIVE TREES
POC							Fd	LW	PL	SX															
N 200m	1		16	9	8	20	6	1					M	175	9		Epil ang Rubi par	10	130	AD	2	0			
			Fd5LW3Ac1At1-9-1.8m-10%															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 Rubi par	20	120	AD	3	0			
			Fd5LW3Ac1At1-9-2.0m-15%															40	130						
S 200m	5		8	4	4	40	1	1		2			4	220	9	2	1								
			Fd6LW2Ab1At1-8-1.6m-12%																						

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

deer browse found only on the fir branches

FS 658 95/8 (Prior)

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.



FS 659 - Front Side

BRITISH
COLUMBIASILVICULTURE
SURVEY SUMMARYUSE 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		LICENSE NO.		LICENSEE NAME		C.P. NO.		BLOCK NO.		MAPSHEET / OPENING NO.	
STRATUM NO.		STRATUM AREA		PLOT MULTIPLIER		TARGET MW MFG		MAXIMUM / PLOT		PLANTING MP			
BCG ZONE, SUBZONE, SITE SERIES		NO. PLOTS (n)		EA / LAYER		TOTAL TREES (T)		TOTAL CONIFERS (TC)		COUNT. CONIFERS (CC)		PREFERRED AND ACCEPTABLE SPECIES (specify)	
PLOT DATA (Transfer TOTALS from FS 658s for one stratum)		TOTAL (W)		TOTAL (Cp)		TOTAL (FG)		TOTAL (Fp)		TOTAL HEIGHT (Avg. cm)		AGE (year)	
TARGET STOCKING STANDARD		MINIMUM STOCKING STANDARD (p + a)		MINIMUM STOCKING STANDARD (p)		SILVICULTURAL COMPONENT		CW		CFG		CP	
ha		MSS p + a		ha		MSS p		ha		m		m	
SPECIES %		%		%		%		%		%		%	
T		1		x pm		+ n		=		TOTAL TREES / ha		BA MODAL DIAM	
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		=								TOTAL PREFERRED WELL-SPACED / ha	
SUM SILV. COMP. PREFERRED SP %		x p + a FG / ha		=								TOTAL PREFERRED FG / ha	
SURVEY CONFIDENCE LIMITS FOR ☒ STOCKING ☒ FREE-GROWING													
STANDARD DEVIATION		STANDARD ERROR OF THE MEAN		t.90		CONFIDENCE INTERVAL		LOWER CONFIDENCE LIMIT					
						±		WELL-SPACED / ha				WELL-SPACED / ha	
FG		SR		NSR		NP (Unnatural)		NP (Natural)					
ha		ha		ha		ha		ha					
INVENTORY COMPONENT													
COMPILED BY		DATE COMPILED Y M D		ON-SITE COST / ha		SOURCE OF FUNDS		SPECIES COMPOSITION TO NEAREST 10%		AGE (years)		HEIGHT (m)	
								SP % SP % SP % SP % SP % SP %					
								3 →					

FS 659-1 HSP 98/8 (Prior)

FILE ORIGINAL IN DISTRICT OFFICE ON OPENING FILE.



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.



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												PEST INFORMATION SUMMARY												
SPECIES (INCLUDE ONLY THE FOUR MAIN COMPETING SPECIES)	ESTI- MATED	CURRENT			HT. INCRE- MENT	DISTRI-			CURRENT			POTENTIAL			1	2	3	4	5	6	7	8	9							
		MINIMUM	MAXIMUM	AVERAGE		CONTINUOUS	PATCHY	SCATTERED	HIGH	MEDIUM	LOW	NIL	HIGH	MEDIUM	LOW	NIL	PEST	TOTAL (sum of Total Trees column)	TOTAL (sum of Total Conifers column)	LIVE TREES (sum of Live Trees Affected)	DEAD TREES (sum of Dead Tree)	HOST SPECIES (from Inventory Label) (expressed	% TOTAL TREES $\frac{[(4)+(5)]}{(2)+(5)} \times 100$	% CONIFERS $\frac{[(4)+(5)]}{(3)+(5)} \times 100$	% HOST TREES $\frac{[(4) \div (2) \times (6)]}{(2) \times (6)} \times 100$					
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)																		PEST MANAGEMENT (eradication, surveys) 10												
SURVEYS (type, season, year)																		FISH AND WATER (spawning areas, buffer zones, water quality, potable water)												
PRIMARY TREATMENT RECOMMENDATIONS																		ALTERNATE TREATMENT RECOMMENDATIONS 11												



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.



Incidence =

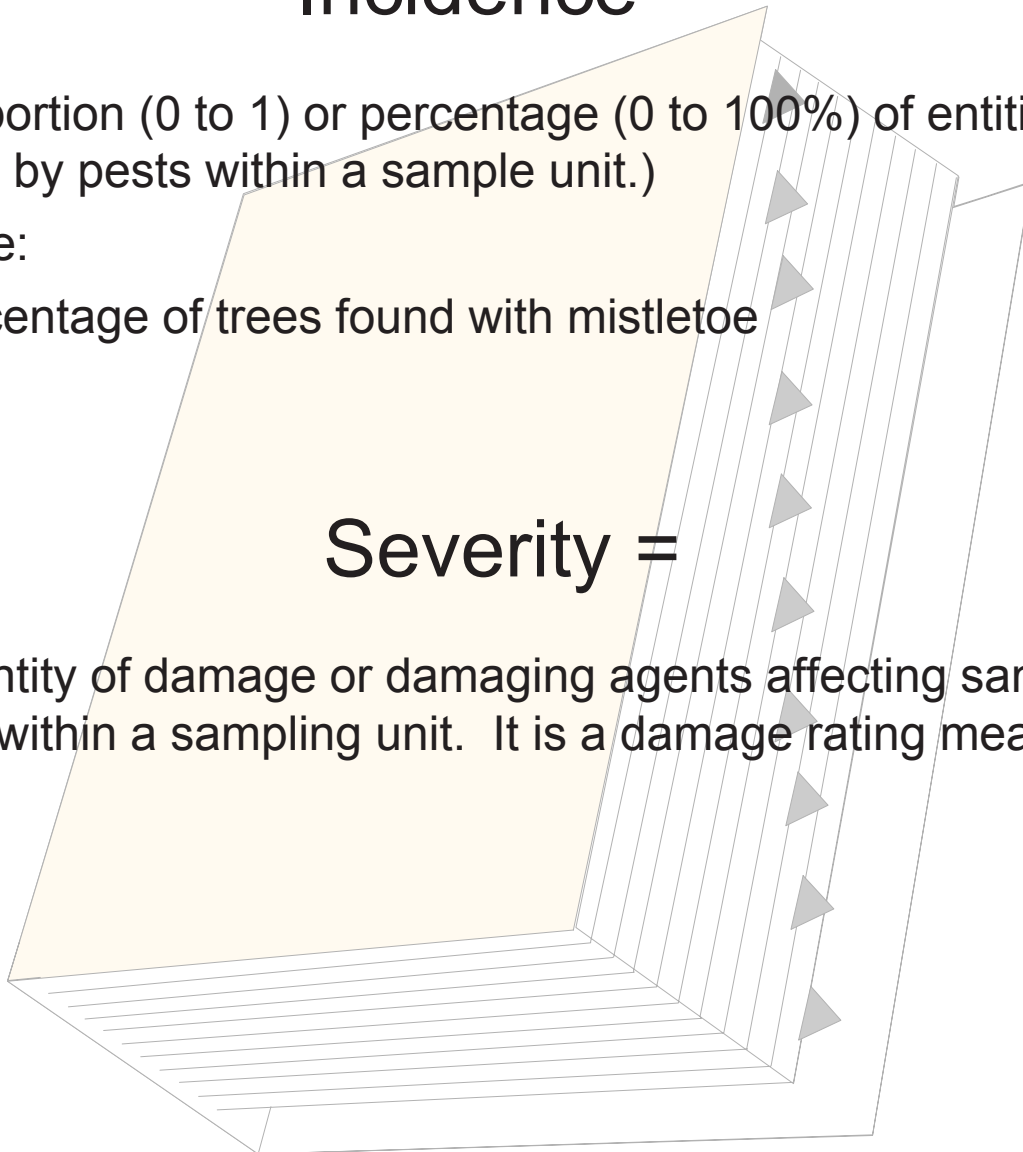
the proportion (0 to 1) or percentage (0 to 100%) of entities (trees affected by pests within a sample unit.)

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.





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	PI, 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, PI	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, atopellis 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 IAB.	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 m
Foliage	Defoliation	>80% of tree foliage has been removed due to defoliating insects or foliage disease.	All	defoliators ID, foliage diseases DF.	
Stem or Branch	Dwarf mistletoe infection	any infection occurs on the stem or a live branch, or	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.
		a susceptible tree is located within 10 m of an overtopping tree, which is infected with dwarf mistletoe.			Overtopping tree is a tree that is three or more times taller than the median height of the trees being assessed.



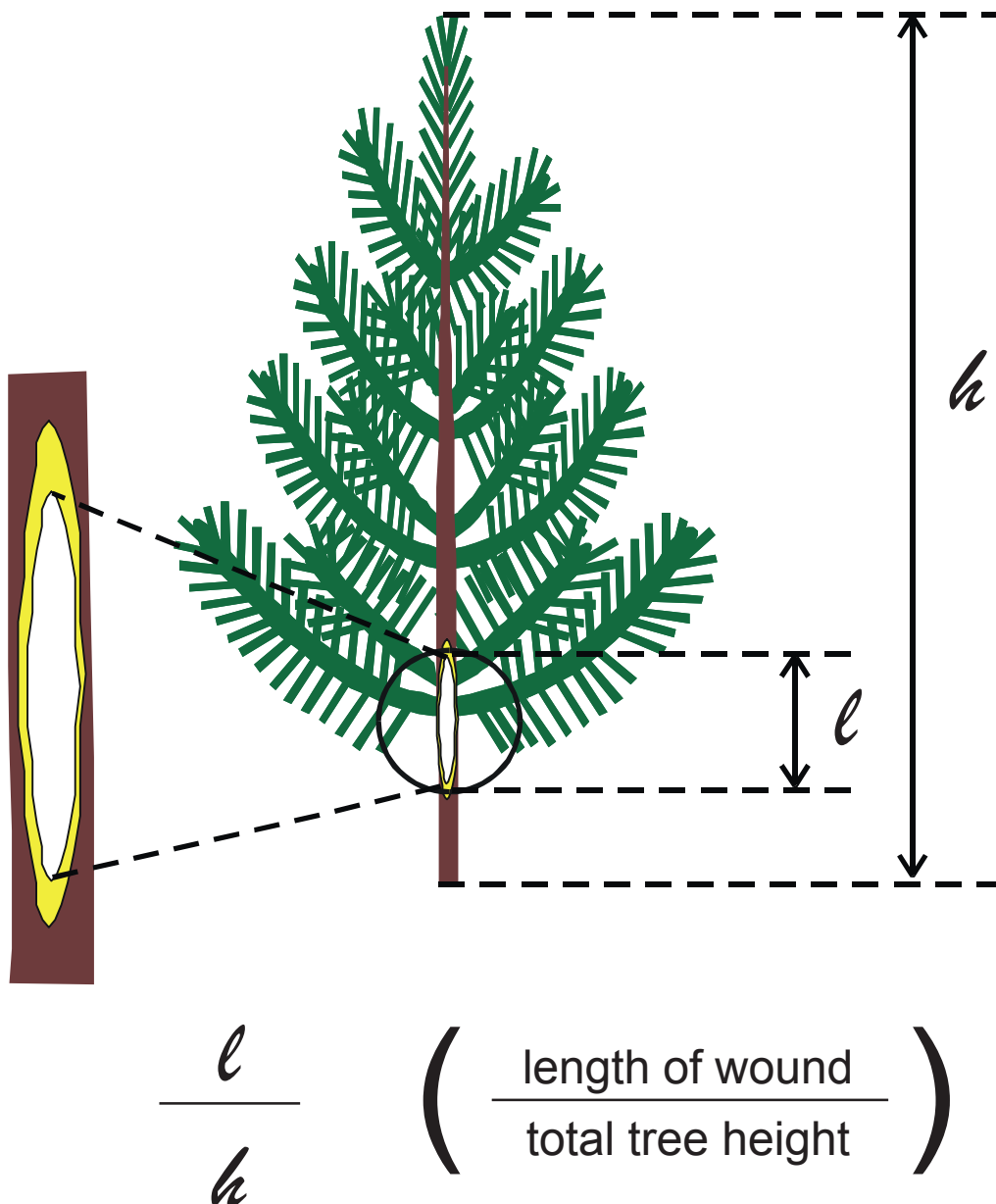
Location of damage	Type of damage	Tree being assessed is UNACCEPTABLE if:	Host species	Likely damage agents & damage agent codes	Comments
Roots	Root disease	sign(s) or a definitive combination of symptoms of root disease are observed.	All	armillaria root disease DRA, laminated root rot DRL, tomentosus 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, IDFxh1, IDFdm1 and 2, MSdk1, and MSdm1 where	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.



Figure 1. Calculation of wound along stem length.





Stem Deformation

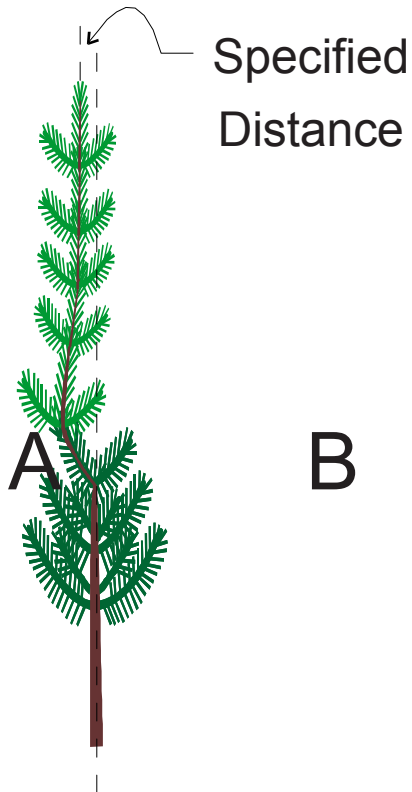


Figure 2.

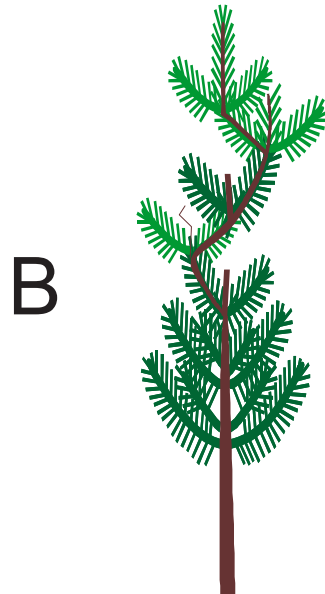
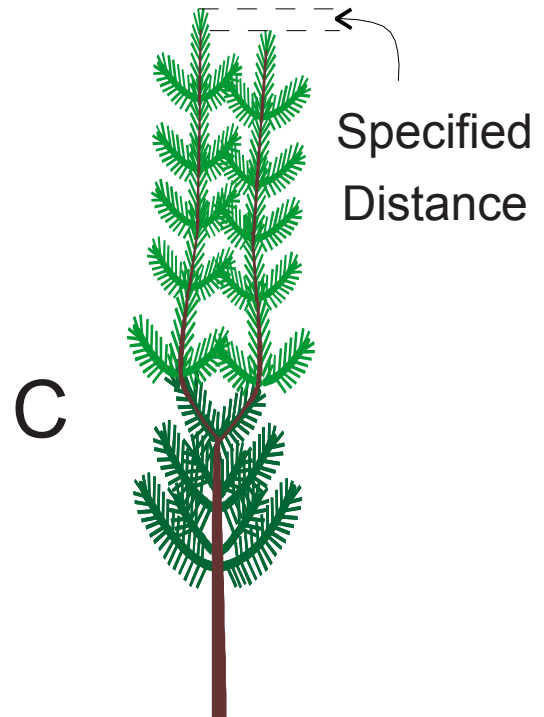


Figure 3.

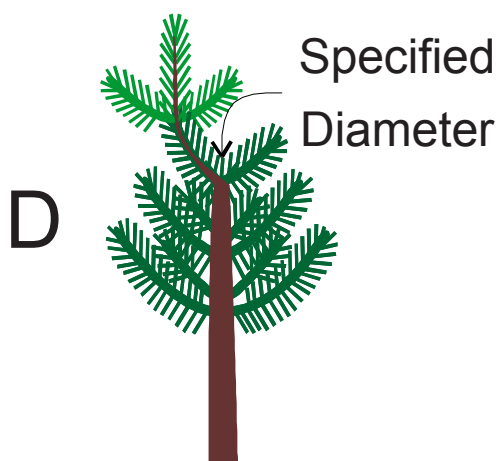
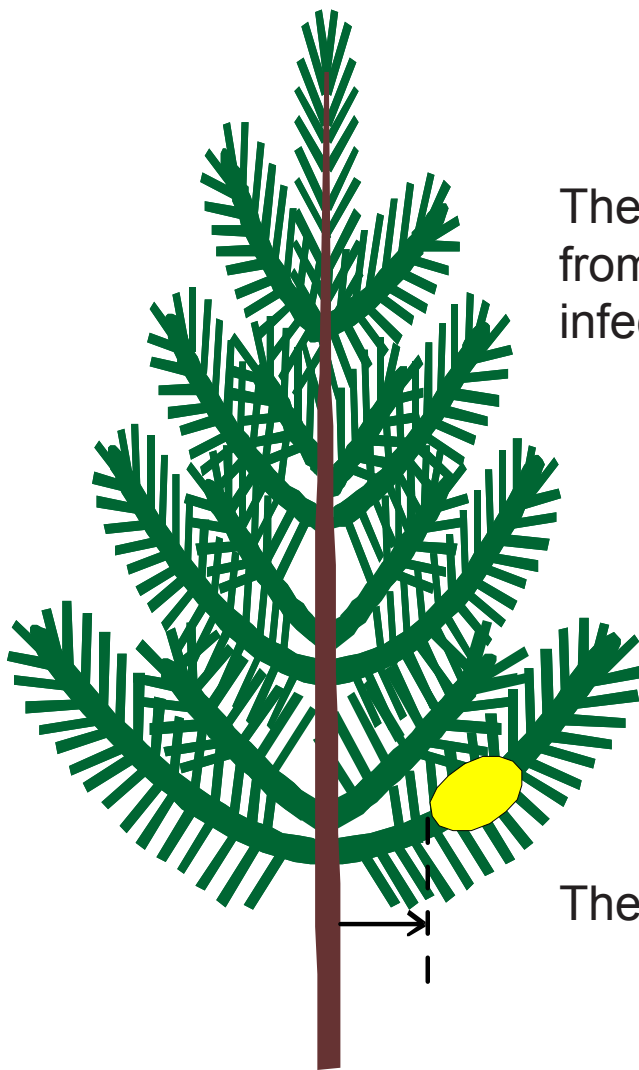




Figure 4. Branch Infections



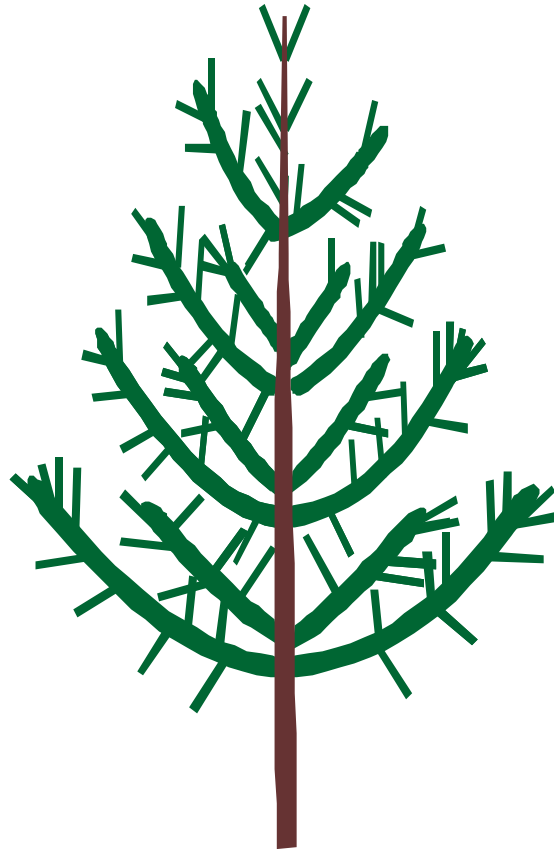
The measured horizontally from the stem to the point of infection by canker or gall.

The specified distance.

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



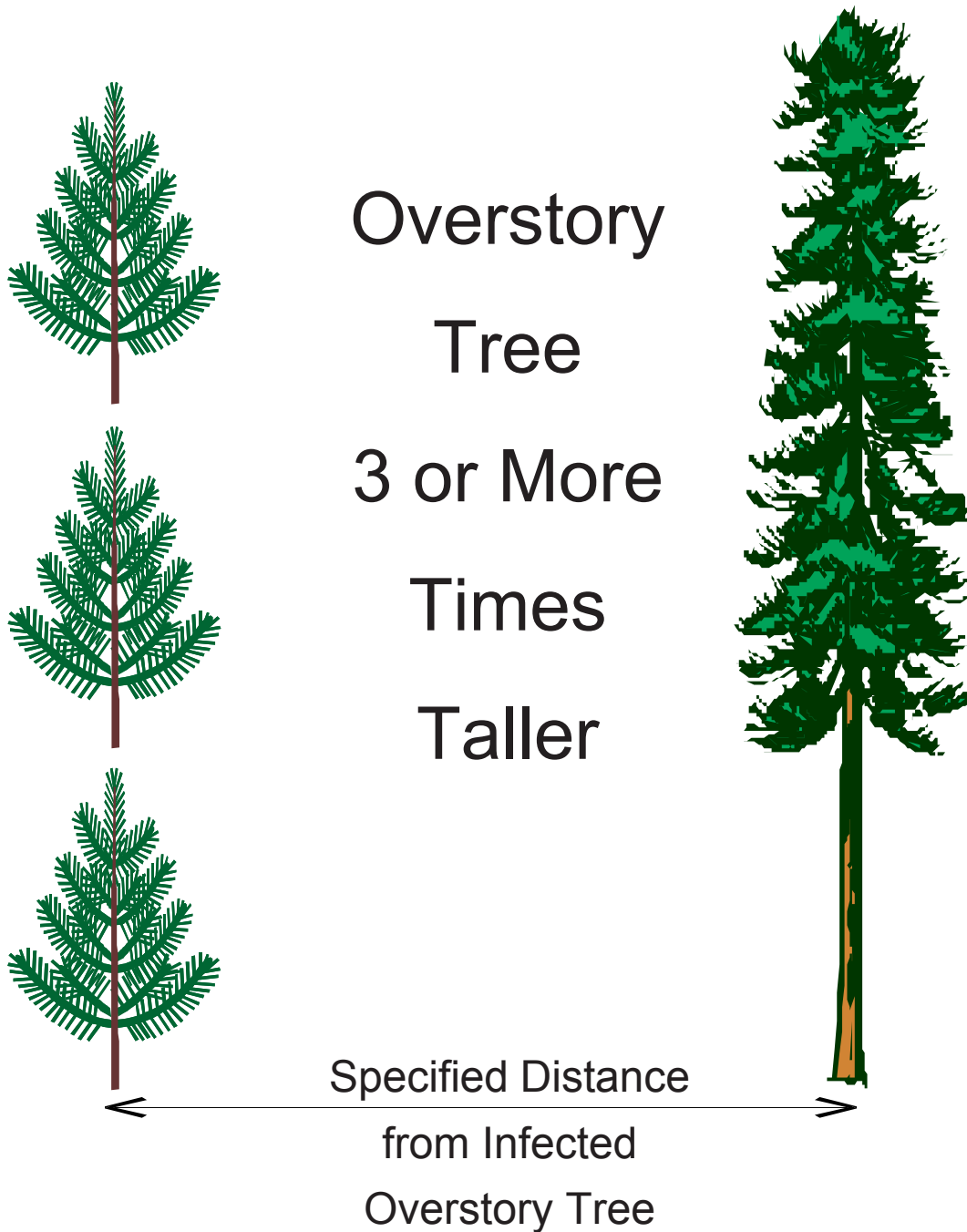
Defoliation



χ % of the “normal” foliage is missing.

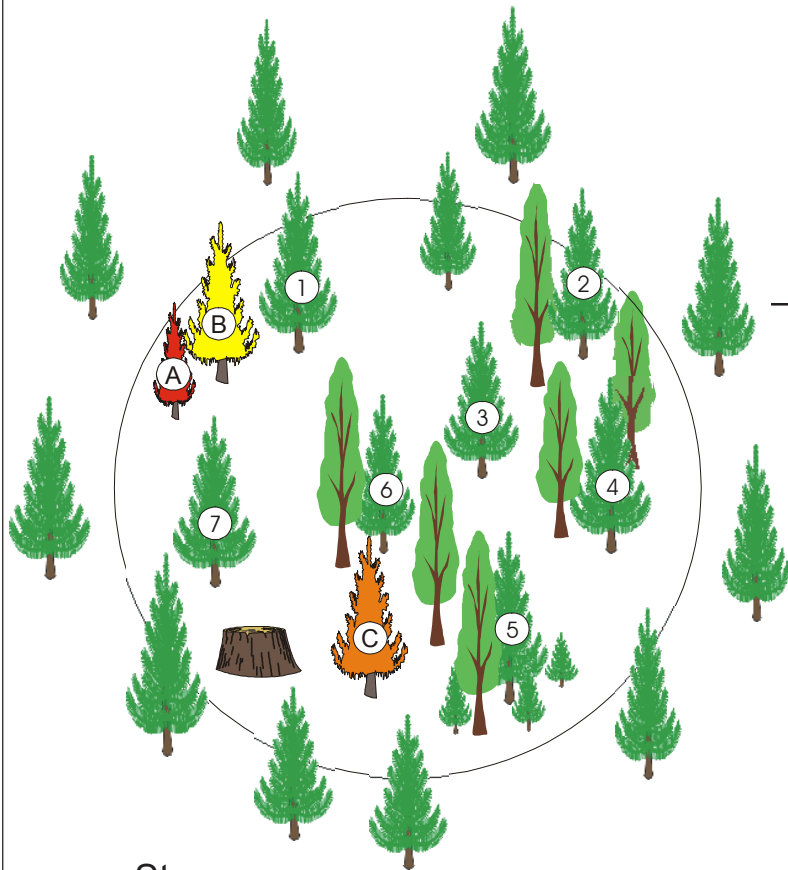


Dwarf Mistletoe Infection





Root Disease



$$\begin{array}{r} 2 \text{ infected well spaced trees} \\ \times 2 \text{ root disease multiplier} \\ \hline 4 \end{array}$$

$$\begin{array}{r} 7 \text{ well spaced trees} \\ - 4 \text{ from the previous Step 2} \\ \hline 3 \end{array}$$

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.



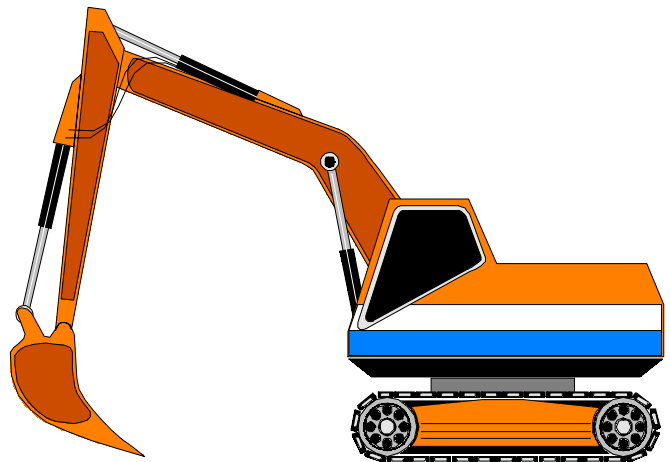
A Good Recommendation MUST...

effectively address deficiencies
be directed toward “Target”, not minimums
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





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



Silviculture Surveys Guidebook

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

Forest health Factor	Code	Incidence	Recommended treatment
<i>Armillaria</i> root disease	DRA	>1 to 5% of host species	Formal root disease survey
		>5% of host species	Intensive control treatment
<i>Phellinus</i> root disease	DRL	>1 to 5% of host species	Formal root disease survey
		>5% of host species	Intensive control treatment
<i>Tomentosus</i> root disease	DRT	any presence	Formal root disease survey
		>15% of host species	Intensive control treatment
<i>Rhizina</i> 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
<i>Comandra</i> blister rust, <i>Stalactiform</i> blister rust, and Western gall rust	DSC DSS DSG	<10% all three stem rusts combined	Eradicate infected stems and prescribe a post-treatment target density equal to the target stocking standard
		10-20% all three stem rusts combined	Eradicate infected stems and prescribe a post-treatment 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.



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%



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 cause of mortality planted seedlings

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

Vegetation competition is moderate but increasing.



Case Study #3

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



Case Study #4

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.



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



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.