Field data acquisition manual
SEPPIR – CFL 1.0 version

Robert A. Allard, Louis Archambault, Gaston Laflamme, and André Lavallée
Quebec Region • Information Report LAU-X-99E

Forestry Canada Forêts Canada

Canada

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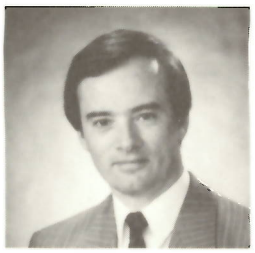

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André Lavallée, Ph. D.

Mr. Lavallée work focuses primarily on the selection of plantation sites, white pine in particular, with a view to heading off the major problems that affect these plantations. Past work centred on many other problems that beset plantations and natural forests. Since 1960, André Lavallée has been part of the LFC team; he obtained his Ph.D. in forest pathology from Université Laval in 1969.

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TABLE OF CONTENTS

Page

LIST OF TABLE AND FIGURES

ABSTRACT

Over the last few years, expert systems have become increasingly important for the solution of complex problems. To a large extent, the success of expert systems hinges on their ability to produce significant results for tasks such as diagnosis and decision-making that were seldom computerized in the past. This document is intended to help potential users collect data for the proper operation of the two software modules of the SEPPIR expert system.

RÉSUMÉ

Depuis quelques années les systèmes experts occupent une place de plus en plus grande dans la solution de problèmes complexes. Leur succès provient en grande partie du fait qu'ils permettent d'aborder avec des résultats significatifs des tâches auparavant très peu informatisées tel le diagnostic et la prise de décision. Le présent document a pour but d'aider les futures utilisateurs à recueillir de façon adéquate toutes les informations nécessaires au bon fonctionnement des deux modules (évaluation du risque et diagnostic) du système expert SEPPIR.

INTRODUCTION

SEPPIR, an acronym taken from **S**ystème **E**xpert pour les **P**lantations de **PI**ns **R**OUGES (Expert System for Red Pine Plantations), is an expert system that deals with problems caused by insects, disease, animals, and abiotic factors in red pine plantations. The first of this system's two modules is used to evaluate the potential hazard represented by one or more pests, diseases, or abiotic factors. The second provides for a diagnosis of factors affecting a plantation. SEPPIR is an adaptation of the PREDICT expert system (*Pinus Resinosa* Expert Diagnostic Consultation Tool) to conditions found in Quebec. PREDICT was developed at Madison University in Wisconsin (USA) (Schmoldt 1987).

This manual is intended to facilitate data collection for the proper operation of this expert system. It covers data acquisition for both software modules and provides the information required to properly complete the questionnaire found in the Appendix.

DEFINITION OF DAMAGE RISKS

The concept of risk used in this expert system refers to the probability of an increase in the populations of insects, diseases, and animals, or the probability of damage resulting from abiotic factors. To simplify the text, the term "forest pest" will be used in collective reference to insects, animals, diseases, and abiotic factors. The complete list of forest pests appears on the following page.

COMPONENTS OF THE QUESTIONNAIRE

This is the most important section of the manual as it shows how to properly complete the questionnaire (see Appendix) using observations made during visits to the plantation. Clear answers should be given to all questions since the individual collecting field data will not necessarily be the one who will interact with the expert system. Consequently, the more precise and relevant the field data collected, the better the diagnosis or hazard assessment will be. In particular, observers must fill out different questionnaires for each tree that seems

LIST OF FOREST PESTS

Insects

European pine needle midge	(*Contarinia baeri* [Prell])
European pine shoot moth	(*Rhyaciona buolina* [D.& S.])
June beetle	(*Phyllophagus* spp.)
Northern pine weevil	(*Pissodes approximatus* Hopk.)
Pales weevil	(*Hylobius pales* [Hbst.])
Bark beetle	(*Ips pini* [Say])
Pine root collar weevil	(*Hylobius radicis* Buch.)
Pit borer	(*Pityophthorus puberulus* Le Conte)
Red headed pine sawfly	(*Neodiprion lecontei* [Fitch])
Red pine needle midge	(*Thecodiplosis piniresinosae* Kearby)
White pine weevil	(*Pissodes strobi* [Peck])

Diseases

Annosus root rot	(*Armillaria mellea* [Vahl ex Fr.])
Fomes root rot	(*Heterobasidion annosum* [Fr.] Bref)
Pine needle rust	(*Coleosporium* spp.)
Scleroderris canker	(*Gremmeniella abietina* [Lagerb.] Morelet)

Animals

Porcupine	(*Erithizon dorsatum* L.)
Small rodents	(*Microtus* spp.)

Abiotic factors

Herbicides

Planting techniques

Snow and freezing rain

Winter drying

to have a special problem. If several of the trees have more or less the same symptoms, replies may be generalized, but this approach is not recommended.

General information

This section of the questionnaire is used to situate the red pine plantation. A basic unit for hazard assessment or diagnosing forest pests is the administrative region. One of nine such regions may be selected (Figure 1). Other questions concerning plantation location (regional county municipality, municipality, township, range, lot) are not used by the expert system but serve to better locate plantations on a map, for future reference.

The owner's name and address are important because they are the only way of contacting him or her if major problems are found on the plantation. Taking corrective measures is the owner's responsibility.

Providing the name of the plantation is optional; it serves only for purposes of classification. However, if the plantation is part of the network formed by Quebec's Ministère des Forêts, it would be better to list it. This number is recorded on a small, bright orange plastic rectangle, which is always easily visible either on a stake set in front of the plantation, or on a fence post near it. Including the observer's name is also optional. However, the date of the survey must be recorded. The last two questions make it possible to very accurately locate the plantation. The entire procedure used to code the UTM grid is described in the manual *Échantillonage des insectes et maladies associés aux arbres en milieu forestier* by Bruno Boulet of the Ministère des Forêts du Québec. The last piece of information, the ecological zone, can be determined by referring to Figure 1. As the second basic unit after the administrative region, it is very important for the hazard assessment module.

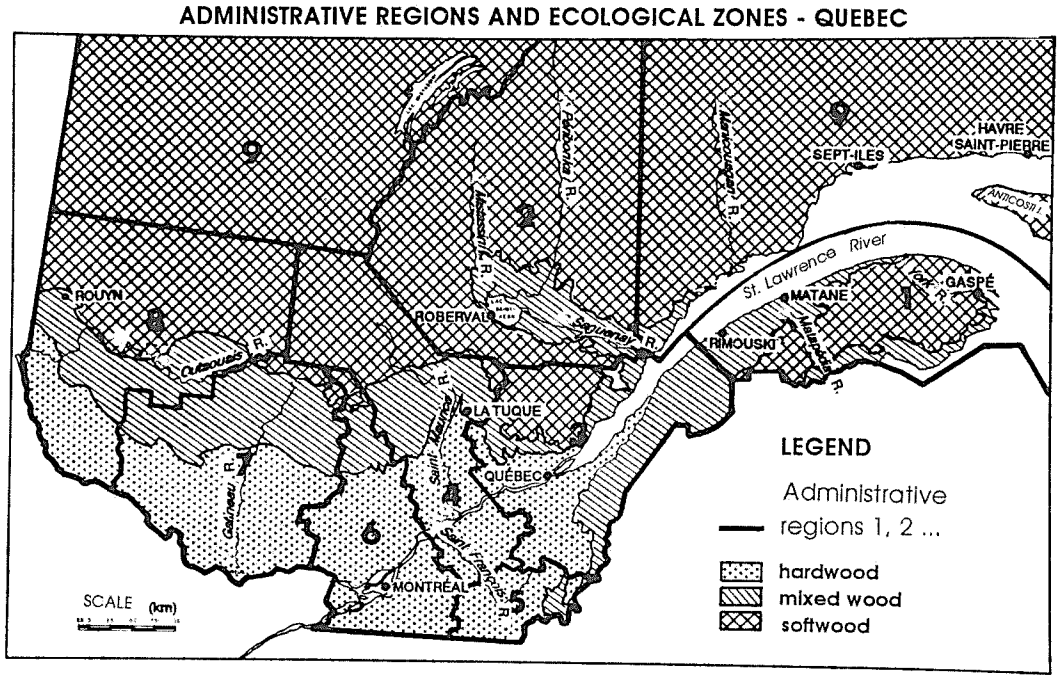

Figure 1. Administrative regions and ecological zones - Quebec.

General observations

This portion of the questionnaire is designed to correspond as closely as possible with the order in which the expert system asks questions, but question order may vary. The selection of responses provided for each question is as wide as possible, but it is unlikely that all potential questions could be provided. CONSEQUENTLY, THE MORE COMMENTS YOU MAKE UNDER THE "COMMENTS" HEADING AT THE END OF THE QUESTIONNAIRE, THE BETTER THE EXPERT SYSTEM'S RESPONSE WILL BE.

You may check or not check the boxes for this set of questions. A check mark means you are sure -- what you have observed or noted totally corresponds with the question asked. Failure to check a box means the opposite. You may, however, note the degree of certainty of your response by giving a figure from 0 to 100 in parentheses.

Various terms that may be unclear to those filling out the questionnaire are explained in greater detail in the following pages.

Definition of terms

TYPES OF DAMAGE OBSERVED

Classifying the types of damage observed within one or more categories will enable the expert system to only consider a portion of the 21 forest pests included in the software. Although you may have difficulty selecting categories of forest pests during the consultation with the expert system, you will have the opportunity to select any of the forest pests included in the expert system. You should, however, be logical in selecting forest pest categories. For example, a tree cannot simultaneously be both partially and entirely discolored, but it may have wounds or damage to its bark along with complete discoloration.

Note that defoliation refers to damage caused by an insect that feeds on the tree's needles, in contrast to needle cast. This difference is very important to the expert system.

EXAMINING THE BARK, THE ROOTS, THE ROOT COLLAR, AND THE SOIL

From among the suggested responses, select the one that best corresponds with your examination of the different parts of the tree or its environment. "Examination" means more than just taking a look; it involves a meticulous inspection of the different parts of the tree.

Inspection of the bark should include its surface, its base, and any cracks in the base. Any discoloration under the bark, the presence of cocoons or larvae, or small holes in the bark, etc. should be noted. If no selection matches your observations, check the box "none of these conditions," and list all relevant information in the COMMENTS section.

To inspect the roots, obviously you must see them. If the tree is relatively small, simply pull it up. Most of the proposed responses deal with young trees or seedlings.

To properly locate the area of the root collar, refer to Figure 2. Once again, a meticulous examination of this part of the tree is required.

Inspection of the soil does not merely involve assessing if it is sandy or not, but determining if other indicators, such as larvae buried in the ground, would suggest the presence of one or more forest pests.

Any other observations should be listed in the COMMENTS section at the end of the questionnaire.

THE INSPECTED TREES ARE HEALTHY

The distribution of damaged trees in a plantation and the type of stem damage can be very significant in making a diagnosis. For example, pine bark beetles cause damage in localized groups of trees. Pine root collar weevils can cause stems to lean or make them unstable in the soil. Consequently, the characteristics that best describe the inspected trees should be selected. In addition, if the affected trees are dead, make sure you enter that as one of your selections.

FLAGGING

We define flagging as follows: all or part of one or more branches is discolored. If any flagging appears on the tree, note the month you believe it first occurred.

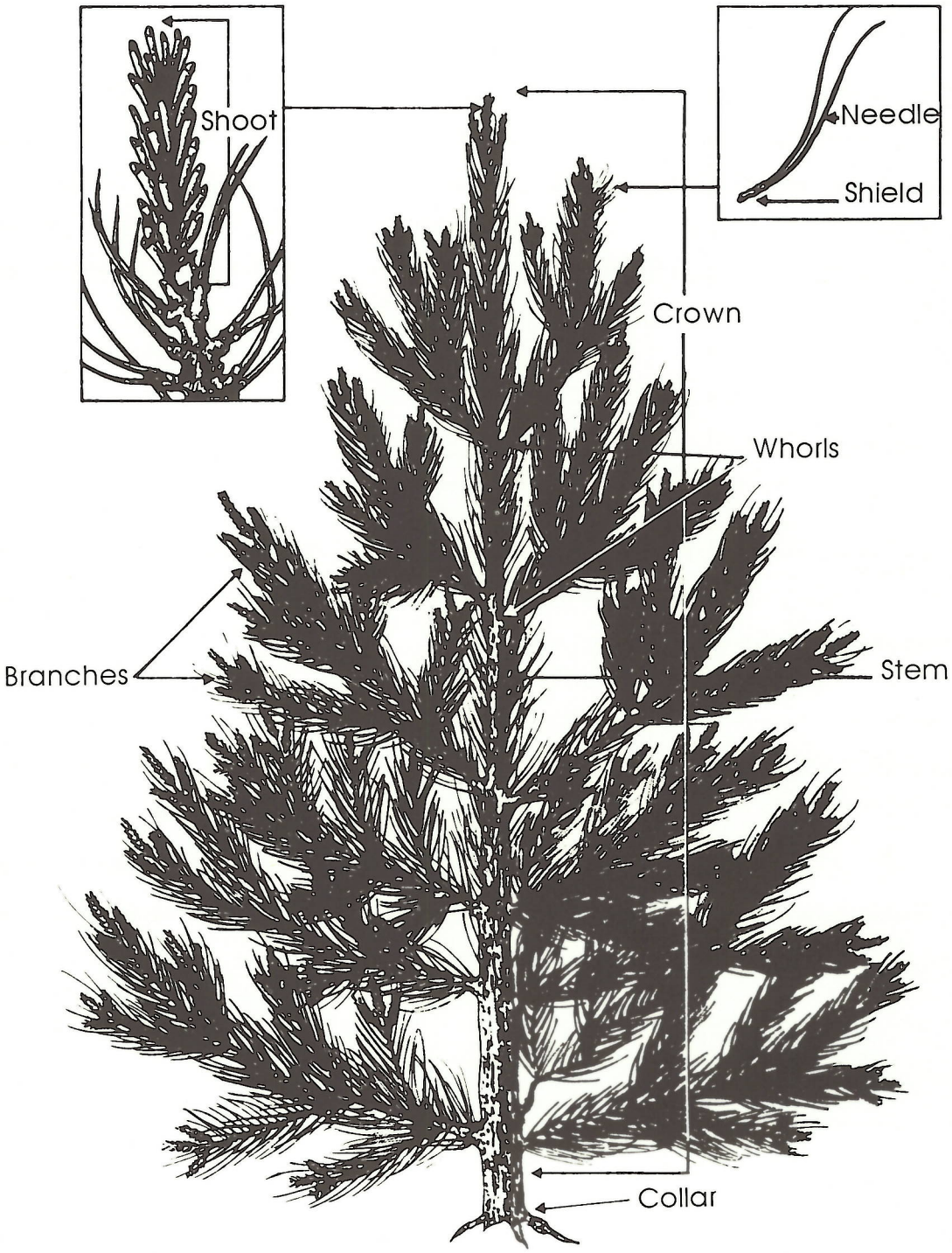

Figure 2. Tree parts.

AFFECTED NEEDLES

This question asks you to indicate which portion of the foliage is affected. The current year's foliage covers the area from the tips of the branches to the first whorl, while the rest of the foliage is known as old foliage. Needles from the previous year appear inside or below the next-to-last whorl on the branch. If it is early in the growing season and new foliage has not yet appeared, the most recent foliage on the tree will be considered the current year's needles. Only one answer may be given to this question.

DISTRIBUTION OF DAMAGE TO THE NEEDLES

You should select those characteristics that best describe the distribution of damage to needles in the affected trees. They may sometimes seem redundant to you, but note those that correspond with your observations nonetheless.

NEEDLE DISCOLORATION

It is often difficult to distinguish between different hues of needle coloring. The most important distinction is between yellow and reddish brown. The expert system considers brown and red to be identical.

NEEDLE INJURIES

Some descriptions of needle conditions are very general, while others are more specific. More detailed descriptions make it possible to recognize particular forest pests. Select the general and/or specific conditions that apply to the tree observed.

DESCRIBING DEFOLIATION

If larvae have abandoned a tree or are difficult to identify, the defoliation model for the entire crown may provide evidence of a particular defoliator. Note the characteristics that best describe the defoliation observed. Make sure needle loss results from insect activity and that needle cast has not resulted from other kinds of needle damage.

AFFECTED SHOOTS

A shoot is the elongated portion of branches from the most recent growing season. Select all listed features that correspond with your observations.

AFFECTED BUDS

The expert system considers only one forest pest that specifically attacks tree buds. Most of the symptoms listed result from its actions.

Signs

This portion of the questionnaire deals specifically with insects. It provides for the collection of specific information on larvae, their feeding habits, their cocoons, and the locations and shapes of their galleries. You must be very careful in making your observations because cocoons, larvae, and galleries are very small. If you raise the bark to make your observations, do so delicately, to avoid destroying or disturbing anything.

CHIP COCOONS

The material used for the construction of pupal coocons, as well as their location on the tree, can provide definitive evidence of the presence of certain forest pests. Observable pupal chambers are those of the white pine weevil, the northern pine weevil, and the pales weevil.

LARVAE

If you have seen any larvae, select the description that best corresponds with your observations. Identification of one or more forest pests depends on your description of the larvae. If none of the descriptions is appropriate, write down your observations under the COMMENTS heading on the last page of the questionnaire. Differentiation between related species may require laboratory examination.

LARVAL FEEDING

In many cases, larval feeding habits, without any other description, can be used to identify an insect. For example, larval colonies from certain types of sawflies feed individually, while other species feed in small groups of six or less.

GALLERIES

A particular type of gallery, containing larvae or insects eggs, may often be very specific to a certain type of pest. Consequently, when observed, they provide very strong evidence of particular forest pests. Some can indicate the presence of pine engravers, pine root collar weevils, or white pine weevils.

Information on the plantation

This portion of the questionnaire applies to both of the expert system's modules (hazard assessment and diagnosis). You may answer "YES" or "NO" to this set of questions. Checking "YES" means you are sure. In other words, what you have seen or observed definitely corresponds with the question asked. A "NO" means the opposite. You may, however, indicate in parentheses, the degree of certainty of your answer (ranging from 0 to 100). This portion of the questionnaire is used to produce an overall picture of the plantation, which is very useful to the expert system. In the following pages, we will consider each of the questions asked and explain the different terms used in them.

BASAL AREA

Basal area can indicate if the plantation is under stress. It is more difficult to calculate the basal area of a plantation than that of a natural forest. To solve this problem, we have calculated basal area tables based on tree spacing and diameter at breast height (Table 1). The following formula is used in our calculations:

$$B.A. = \frac{\pi \times D^2}{4E^2}$$

where

π	=	3.141592654
D^2	=	the diameter of the tree (in centimetres)
E^2	=	the spacing of the trees in the plantation (in metres)

PLEASE NOTE: This formula yields a basal area in square metres per hectare only when the diameter is given in centimetres and spacing between trees is known in metres. If feet and inches are used, they must be converted.

Table 1. Basal area in square metres per hectare

Diameter (cm)	Spacing (m)								
	1.20	1.50	1.60	1.80	2.00	2.10	2.40	2.50	3.00
2	2.18	1.40	1.23	0.97	0.79	0.71	0.55	0.50	0.35
3	4.91	3.14	2.76	2.18	1.77	1.60	1.23	1.13	0.79
4	8.73	5.59	4.91	3.88	3.14	2.85	2.18	2.01	1.40
5	13.64	8.73	7.67	6.06	4.91	4.45	3.41	3.14	2.18
6	19.63	12.57	11.04	8.73	7.07	6.41	4.91	4.52	3.14
7	26.73	17.10	15.03	11.88	9.62	8.73	6.68	6.16	4.28
8	34.91	22.34	19.63	15.51	12.57	11.40	8.73	8.04	5.59
9	44.18	28.27	24.85	19.63	15.90	14.43	11.04	10.18	7.07
10	54.54	34.91	30.68	24.24	19.63	17.81	13.64	12.57	8.73
11	66.00	42.24	37.12	29.33	23.76	21.55	16.50	15.21	10.56
12	78.54	50.27	44.18	34.91	28.27	25.65	19.63	18.10	12.57
13	92.18	58.99	51.85	40.97	33.18	30.10	23.04	21.24	14.75
14	106.90	68.42	60.13	47.51	38.48	34.91	26.73	24.63	17.10
15	122.72	78.54	69.03	54.54	44.18	40.07	30.68	28.27	19.63
16	139.63	89.36	78.54	62.06	50.27	45.59	34.91	32.17	22.34

SITE INDEX

The site index is another indicator of stress in a plantation. Analysis of data on the total average age and total average height of dominant trees will help develop an equation relating age and height (Bolghari 1984). Refer to Figure 3 when determining this value.

RECENT HERBICIDAL TREATMENT

In the question "recently treated with a herbicide," "recently" means within a year of the time of observation. Using this information, it can be determined if the herbicide was applied before or after lignification, which is very significant.

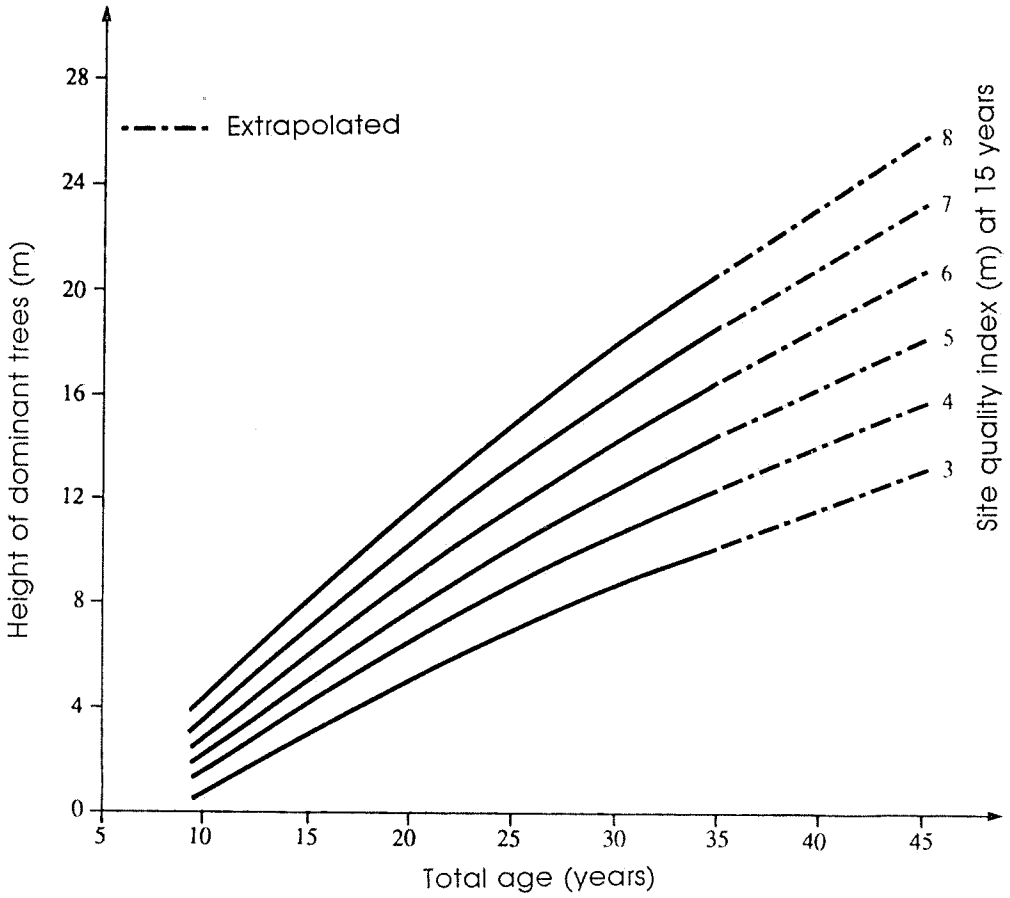

Figure 3. Site quality index curves in red pine plantations (from Bolghari, 1984).

PRESENCE OF COMPETITIVE TREES

This involves determining if the plantation has been invaded by undesirable species of trees such as willows (*Salix* L.), trembling aspens (*Populus tremuloides* Michx.), alders (*Alnus rugosa* [Du Roi] Spreng), etc. Such trees must significantly slow the growth of the plantation to be considered competitive.

PRESENCE OF COMPETITIVE HERBACEOUS VEGETATION

Competition from herbaceous vegetation is most likely to occur in young plantations on abandoned farmland. Owing to soil preparation, grasses are usually absent during planting. However, after two or three years, such vegetation, largely composed of graminaceae, may spring up and become very competitive with the red pines.

A STAND OF MAPLES OR A SUGARBUSH NEARBY

This involves determining if a stand of maples or a sugarbush lies within a maximum radius of 300 metres from the plantation. Such a stand would not have to contain only maples.

DROUGHT CONDITIONS

This factor is another stress indicator and is apparent when soil is sandy and dry. If the grass is turning brown, this is also a good indication that drought is present. Such conditions may, however, be caused by herbicides, so their use must be discounted.

PLANTATION UNDER STRESS

If a plantation is characterized by unhealthy looking trees or trees with diminished growth, these are good indications that it is under stress. Stress may also be caused by too much water in the soil, clayey soil, a thin layer of topsoil over rock, etc. However, if there are other indications that the plantation is under stress, make note of this under the COMMENTS heading at the end of the questionnaire.

PLANTATION AGE

The plantation's age can be calculated in two ways: with an increment borer or by counting whorls on the trees (Figure 2). Two years should generally be added to the age calculated in the latter manner. The age of seedlings is two years.

DIAMETER AT BREAST HEIGHT

The dhb is the tree's diameter, including the bark, measured 1.30 metres above the highest root. The average dhb of a plantation is obtained by measuring 10 red pine stems at the dhb level using a metal tree caliper or a tape that is specially calibrated for this purpose. Figure 4 shows several examples of dhb location. For seedlings, give 0 as the dhb. The system takes them into consideration.

AVERAGE HEIGHT

"Height" means the distance between the foot of the tree and the last living or dead whorl of the crown. In red pines, the whorl is associated with the leader. Average height is determined by measuring 10 stems in the plantation. Various systems may be used to make this measurement: tape measures for short stems, fiberglass poles for medium-sized plantations, or clinometers for very tall plantations. The average height of seedlings should be indicated.

MINIMUM HEIGHT OF FOLIAGE OFF THE GROUND

The "minimum height of foliage off the ground" is the distance between the ground and the first branches of the tree. An exact, rather than an approximate, value should be given.

MAXIMUM HEIGHT OF SNOW COVER FROM THE PREVIOUS WINTER

This value is relatively easy to obtain, depending on the time at which the plantation is visited.

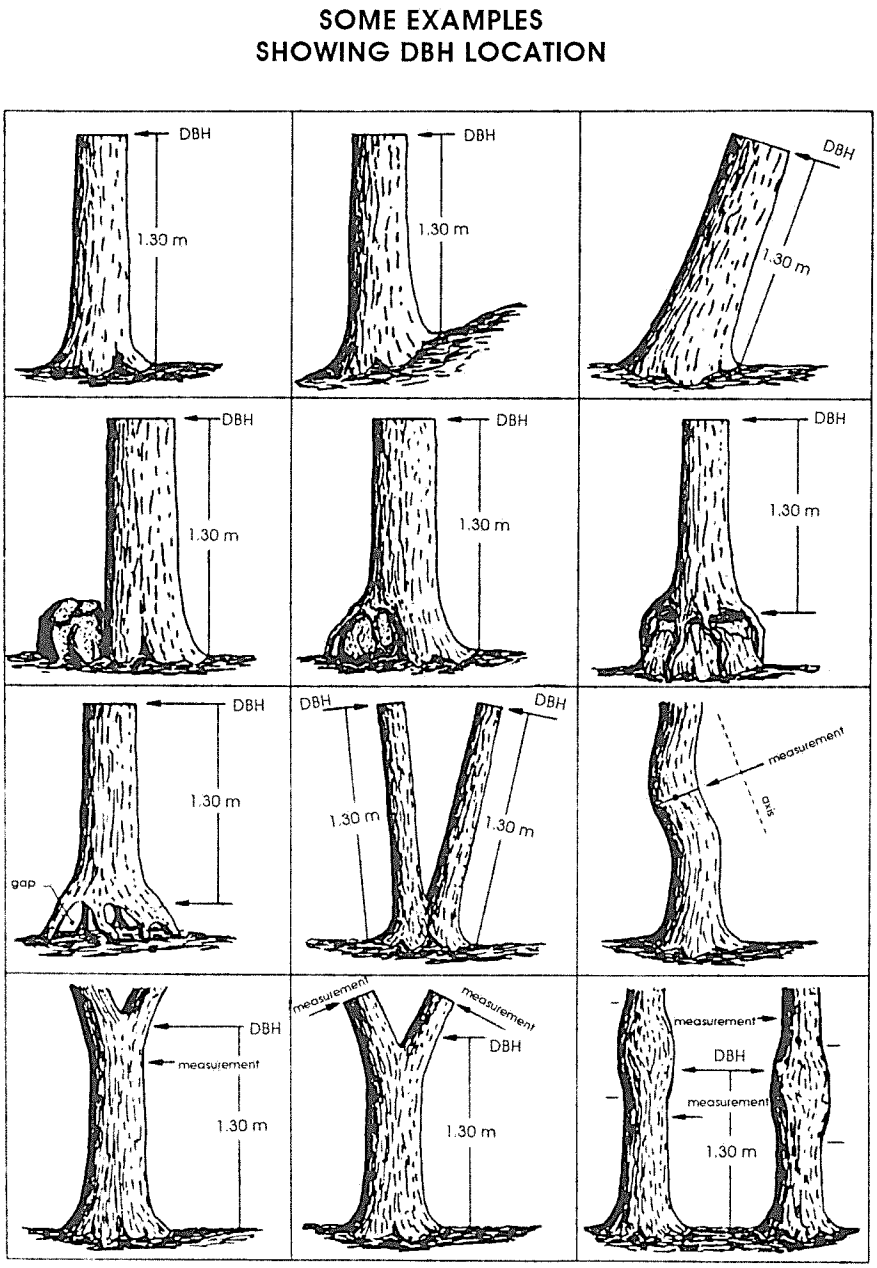

Figure 4. Some examples showing dbh location (from Annon, 1981).

RECENT INJURIES TO TREES

The term "recent" in the question "Recent injuries to trees" means injuries sustained by a tree less than a year before the visit to the plantation. Recent injuries provide easy access for pathogens and insects. However, if these injuries are more than one year old, virtually no risk of problems remains.

LOCATED IN THE PINE DISTRIBUTION AREA

It is important to know if the plantation is within the normal red pine distribution area. If it is outside this area, the likelihood of problems increases substantially. Figure 5 displays the red pine distribution area in Quebec.

RECENT THINNING OF TREES WITHIN THE PLANTATION

A "recent" thinning of trees within a plantation pertains to an event that has occurred less than a year before observation. Recently cut stumps in the plantation can serve as breeding grounds for pales weevils. Moreover, annosus root rot can colonize recently cut stumps and migrate toward the roots of healthy trees, bringing on their death.

PRESENCE OF WINDTHROW OR INJURIES

The presence, in or near the plantation, of windthrow, cut logs on the ground, or leftover wood with diameters greater than 5 cm must be indicated. Such sites are favorable to the development of pine engravers.

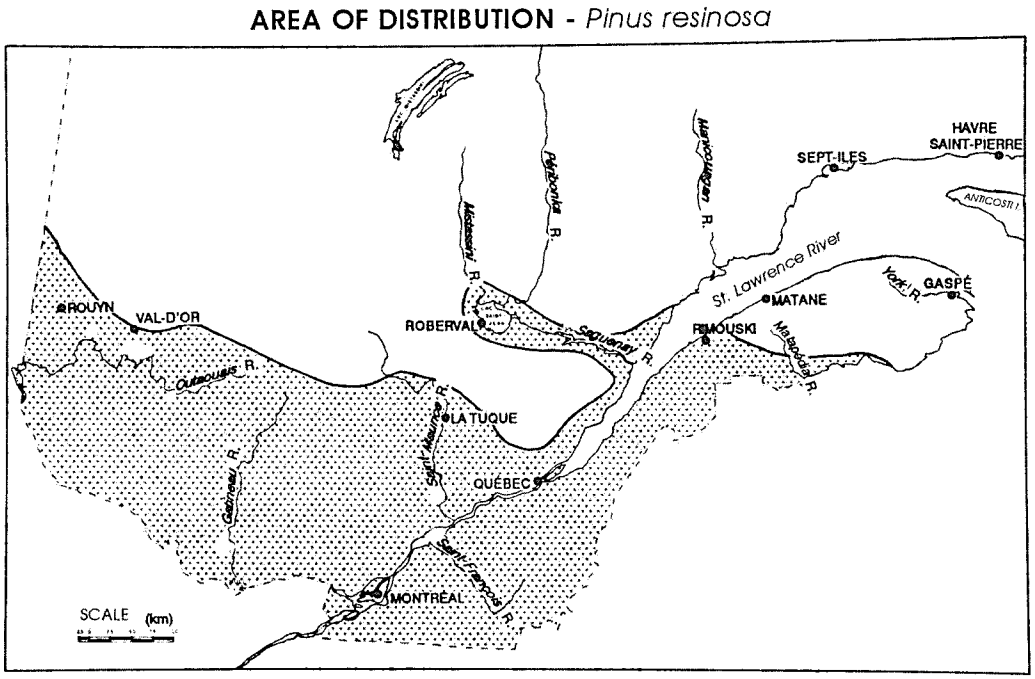

Figure 5. Area of distribution (*Pinus resinosa*) (from Lavallée, 1973).

PRESENCE OF AN OVERSTORY

The overstory is defined as the canopy class in which height exceeds the average height of the rest of the stand, and thus the top and a portion of the crown receive full lighting on all sides. This is particularly relevant to plantations with trees of various ages.

PRESENCE OF DEAD TREES IN OR NEAR THE PLANTATION

You should determine if there are dead red or white pines in or near the plantation. "Near" means within a radius of 300 metres.

THICK GRASS OR WEED COVER FROM THE PREVIOUS YEAR

"Culm" is a very dense cover of dead weeds. Such dense cover encourages the development of small rodents because it provides them with breeding grounds.

PRESENCE OF JACK OR SCOTCH PINES IN OR NEAR THE PLANTATION

These two species are the preferred hosts of pine root collar weevils, pales weevils, and white pine weevils. Their presence increases the risk of attack by such pests. It is therefore important to determine if either of these species exists within or near the plantation. "Near" refers to trees within a radius of 300 metres.

PRESENCE OF LOCAL DEPRESSIONS

"Local depression" means a hollow or basin within the plantation. Scleroderris canker thrives in such locations because the soil is moister, it is colder, and snow cover is deeper. Do not confuse a local depression with the bottom of a slope.

SITE EXPOSED TO WIND

Such sites are usually in the middle or on top of slopes exposed to prevailing winds. Plantations near relatively large rivers or lakes are also considered to be exposed to wind.

LOCATED ON A SITE PREVIOUSLY OCCUPIED BY HARDWOODS

Snags, stumps, and branches indicate whether hardwoods were present on the site prior to planting. The critical period is five years. If hardwoods have occupied the site within the past five years, the risk of attack from armillaria root rot is very high. Armillaria root rot develops on the roots and stumps of hardwoods and then attacks red pine roots. However, if no hardwoods have been present on the site within the past five years, the risk of attack is fairly low.

SIGNS OF SMALL RODENTS

Pathways, nests, or droppings are good indications of the presence of small rodents. Pathways and nests are generally found when grass or weed cover is thick. It is strongly recommended that the base of the stem be examined if tree diameter is less than 2 cm.

PRESENCE OF PLANTS

Goldenrod and aster are intermediate hosts for pine needle rust. Make note if either or both of these plants are present in or near the plantation. Once again, the word "near" means within a radius of 300 metres.

COMMENTS

Place any other observation that seems relevant to you under this heading. The more information we have, the better the risk assessment, or the more accurate the diagnosis.

CONCLUSION

We hope that, after reading this manual, the questionnaire will appear clearer and that field data collected will be valid. This will enable the expert system to identify as closely as possible any forest pests disturbing the plantation and to evaluate the potential damage they may cause.

We should once again emphasize that this expert system only considers 21 possible forest pests afflicting red pines on plantations in Quebec. Your observations may not correspond at all with those suggested in the questionnaire. If so, take some samples and have them examined by forestry experts who are specialists in pathology or entomology. The information collected on the form that appears in the Appendix will prove very useful to the expert you consult.

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APPENDIX

REPORT OF DAMAGE TO RED PINE

GENERAL INFORMATION

Administrative region:_____ Regional county municipality:_____

Municipality:_____ Township:_____ Range:_____ Lot :_____

Owner's name: _____ Address: _____

Plantation name:_____ Observer's name:_____

Date :_____/_____/_____ UTM Grid:_____ Map number:_____
Day Month Year 1/50 000

Ecological zone: Boreal ( ) Mixed ( ) Hardwood ( )

GENERAL OBSERVATIONS

Type of damage observed

( ) partial tree discoloration
( ) whole tree discoloration
( ) bark damage
( ) root or root collar damage
( ) needle defoliation
( ) shoot and bud damage

Examination of the bark

Yes ( ) No ( )
If yes:
( ) normal
( ) patches removed at the base of the tree
( ) loose on the stem in patches
( ) boring dust and/or holes in the bark's cracks
( ) small pits present within 0.5 cm of the ground

Examination of the roots

Yes ( ) No ( )
If yes:
( ) normal
( ) completely removed from dead trees
( ) small roots chewed off
( ) fine roots missing
( ) chew marks present on tap root

( ) tender bark eaten off in patches
( ) patches removed in upper crown
( ) green discoloration beneath bark
( ) none of these conditions

( ) surrounded by black shoe-string-like structures
( ) wound up in itself
( ) shaped like hockey sticks

Examination of root collars

Yes ( ) No ( )
If yes:
( ) normal
( ) girdled
( ) swollen
( ) blackened
( ) resin present on the bark
( ) surrounded by pitch-soaked soil
( ) white mycelium present under the bark
( ) presence beneath the humus of fructifications 8-15 cm in diameter with chocolate-brown coloring and a white edge

Examination of the soil

Yes ( ) No ( )
If yes:
( ) sandy soil

The trees examined are healthy

Yes ( ) No ( )
If no:
( ) dead
( ) dead over a large area
( ) dead in a circle
( ) dead by group
( ) deformed
( ) leaning or loose in the ground
( ) dispersed
( ) curled
( ) infected with a resinous canker on the base of branches that appeared during the month of July and subsequently
( ) wilting of branches less than 2 m above the ground

Flagging

Yes ( ) No ( )

If yes: month: _____

Needles affected

Yes ( ) No ( )

If yes:

( ) both old and new

( ) those from the current year

( ) only old needles

( ) only the past year's needles

( ) only the needles of the past two years

Distribution of needle damage

( ) no damage

( ) lower half

( ) lower than 2 m above the ground

( ) terminal leader

( ) under the snow line

( ) above the snow line

( ) dispersed in the crown

( ) higher than 4.5 m above the ground

( ) near the buds

( ) on dominant trees

( ) on a particular side

( ) mostly near the top

( ) on the lower branches of smaller trees

Abnormal needle coloring

Yes ( ) No ( )

If yes:

( ) yellow

( ) red

( ) brown

Needle injury

Yes ( ) No ( )

If yes:

( ) dead

( ) needle loss, shedding

( ) wilting month: _____

( ) discoloration after wilting

( ) discoloration on the base

( ) cream-colored blisters from May to July

( ) discoloration after bending and drooping

( ) curled

( ) needles bent sharply at the sheath while still green during August and September

( ) totally or partially defoliated month: _____

Describe any defoliation

_____

_____

_____

Shoots affected

Yes ( ) No ( )

If yes:

( ) curved
( ) bent over
( ) dead
( ) discolored brown
( ) resinous coating
( ) curled
( ) mined hollow
( ) dead or bent over on smaller trees
( ) withering of lateral branches after June and
when: _____
( ) resinous cankers on shoots from the current year in July, and subsequently

Buds affected

Yes ( ) No ( )

If yes:

( ) growing at an angle
( ) coated with resin
( ) curved
( ) dead
( ) drop of resin present at the base
( ) dead less than 2 m above the ground
( ) curved growth
( ) curled
( ) flow of resin
month when injuries occurred: _____

INDICATIONS

Chip cocoons

Yes ( ) No ( )

If yes:

( ) on the ground, at the surface of stump wood or damaged trees
( ) in July, under the bark (on the surface of the terminal leader) from current or preceding year
( ) under the bark (on the surface of the wood) of the main stem

Larvae

Yes ( ) No ( )

( ) with reddish-brown heads
( ) with reddish-brown heads, yellow bodies with six segments of small black circles
( ) orange colored and feeding under pairs of needles from May to October
( ) numerous, whitish, like worms, and under the bark of the terminal leader from April to July
( ) numbering from 2 to 5, small, brown, and under a layer of resin at the base of buds from August to March
( ) from 2 to 5, brown, and present on the elongated shoots in May and June
( ) feeding under the bark of primary roots near the collar

Larval feeding patterns

( ) in colonies
( ) alone
( ) in groups of 6 or less

Galleries

Yes ( ) No ( )

If yes: presence
( ) eggs
( ) larvae

description
( ) present in the area of the collar with larvae
( ) present with larvae under the bark of the terminal leader or prior shoots
( ) present in the cambium of the shoots
( ) eggs laid out in a line

INFORMATION CONCERNING THE PLANTATION

Plantation characteristics

- basal area greater than 12 m²/ha	Yes ( ) No ( )
- site index <= 4 m at age 15	Yes ( ) No ( )
- recently treated with a herbicide (within 1 year)	Yes ( ) No ( )
- presence of competitive trees	Yes ( ) No ( )
- presence of competitive herbaceous vegetation	Yes ( ) No ( )
- maple stand nearby (0-300 m)	Yes ( ) No ( )
- presence of drought conditions	Yes ( ) No ( )
- plantation under stress	Yes ( ) No ( )

Age of plantation:_____

Average diameter of trees:_____cm

Average height:_____m and cm

Minimum height of foliage above the ground:_____m and cm

Maximum height of snow cover the previous winter:_____m and cm

- recent tree injuries (within 1 year)	Yes ( ) No ( )
- in the red pine distribution area	Yes ( ) No ( )
- recent thinning of the plantation	Yes ( ) No ( )
- presence of windthrows, wounds of more than 4 cm, or untreated red pine stumps	Yes ( ) No ( )
- presence of an overstory	Yes ( ) No ( )
- presence of dead trees in or near the plantation (white or red pine)	Yes ( ) No ( )
- type of plantation	Windbreak ( ) Christmas trees ( ) Other ( )
- thick grass or weed cover from the previous year	Yes ( ) No ( )
- presence of jack or scotch pines in or near the plantation	Yes ( ) No ( )
- presence of local depressions	Yes ( ) No ( )
- site exposed to the wind	Yes ( ) No ( )
- located on a site previously occupied by hardwoods (within 5 years)	Yes ( ) No ( )
- signs of rodents (fieldmice, mice, etc.)	Yes ( ) No ( )
- types of plants present	Aster ( ) Goldenrod ( ) Not observed ( )

COMMENTS: