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THE SIGNIFICANCE OF DISEASE AND STAINS IN
HARDWOOD MANAGEMENT IN QUEBEC

by

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RESUME

L'aménagement des forêts feuillues de seconde venue vise principalement à améliorer la qualité des billes. Les caries et colorations du bois constituent le principal facteur de dégradation des arbres en croissance. Au Québec, après une première étape en taxonomie des champignons responsables des caries, les études pathologiques sur le bouleau jaune et l'érable à sucre ont porté sur l'évaluation des caries d'après les signes externes et leur progression dans l'arbre vivant. Une classification de la qualité des arbres vivants fut alors développée dans le but d'aider l'aménagiste forestier lors de coupes d'amélioration. Aujourd'hui, un calcul rapide permet de dire qu'environ 30% des arbres semblent de très bonne qualité dans les forêts feuillues du Québec; un autre 33% des tiges donnera une qualité acceptable si on les exploite d'ici 20 ans. D'autre part, près d'un tiers des peuplements feuillus sont de faible qualité à cause des caries qui entraînent une perte de plus \$3,000,000. annuellement.

Si on continue d'avoir les industries et les agences gouvernementales comme principaux clients, les futurs travaux en pathologie devront étudier l'influence des différentes interventions en forêt (élagage, éclaircie, entailles sous vide, etc.) sur le comportement des pathogènes (chancres, caries du tronc et des racines) dans les arbres vivants.

Si d'autre part, on vise l'aménagement des petites superficies boisées ainsi que le soin à apporter aux arbres d'ornement

des propriétés privées ou dans les aires de récréation, on devra évaluer l'importance d'un plus grand nombre de maladies puisque tout devient important sur ces territoires. Le public demande de plus en plus d'informations sur des problèmes très spécifiques et avant de donner plus d'emphase à nos activités dans ce domaine, on devra planifier une augmentation du nombre de pathologistes forestiers. Dans ce domaine d'activité, tout ce qui n'est pas insecte ou feu retombe dans les mains des pathologistes forestiers qui sont actuellement deux fois moins nombreux au Québec qu'il ya a 10 ans.

INTRODUCTION

Deciduous trees can be the object of research and development in two broad fields of activity: (1) Management of hardwood stands on large areas, and (2) studies on individual trees such as ornamentals, in recreational areas, etc. Previous studies in forest pathology were mostly concerned with stand management and improvement. In the coming years, a number of efforts will remain in that field of activity, but restricted groups of trees in forested areas or in plantations will also become a matter of concern because of the increasing interest of the population for green and healthy trees. Therefore, the significance of diseases in hardwood management will increase and, in fact, many questions remain unanswered.

MANAGEMENT OF HARDWOOD FORESTS

In general, decays and stains in second growth hardwood forests are often more extensive and should be considered more seriously than in management of immature softwood forests. This second growth hardwood forest covers large areas of land, mainly in the most accessible parts of Quebec. A major objective in hardwood management

is the improvement of quality. Sawlog, veneer and furniture producers are facing an increasing difficulty in finding high-grade logs for quality products. Among diseases, decay and stain organisms represent the most important group of fungi or bacteria responsible for the degrade of living or felled deciduous trees. Even if forest managers succeed in improving the rate of growth, shape of trees and stand composition, decay and stain must be reduced to a minimum in order to improve quality.

In Quebec, as in other provinces, the first studies dealt with the taxonomy of decay fungi, and with cull. None of these were made in virgin hardwood forests. Thirty years ago, a pathological survey performed in a second growth deciduous forest located at Duchesnay (northern limit of yellow birch and sugar maple) revealed that the presence of decay affected from 6 to 52% of the 3000 trees examined, depending on age classes. Beech, red maple, yellow birch, sugar maple and black ash were the most severely affected, in decreasing order of importance. Also, more than 40% of the sugar maple and yellow birch trees exhibited at least one injury, and an additional 12% of the trees were cankered in each of those two species. Unfortunately, volume data were not published after this first study. A few other dissectional studies were made in the Eastern Townships and Beauce County between 1940 and 1955, but white birch defect was mainly considered to be related to birch dieback.

In 1965, a study of hardwood decays was initiated to evaluate the relative importance of decay in the main hardwood tree species of Quebec. Yellow birch, sugar maple and occasionally red maple were included in dissectional studies at Dudswell and Thurso Experimental Forests. The total amount of information cannot have the weight of Dr. Basham's work since it is based on only 611 trees. However, results permitted one to learn more about the succession of organisms occurring in various infection courts, the significance of external signs of decays and the rate of progress of fungal decay in living trees. Then

a tree quality classification was developed as a tool for hardwood managers in their improvement cuttings. This classification is now used by Dr. Roberge and Mr. Pfalzgraf of the Laurential Forest Research Centre, and other foresters in the Provincial Department of Lands and Forests who feel that such a classification is useful in determining the actual and future pathological condition of a hardwood stand. Variations in frequency and extent of decay exist within the geographical range of a species but the information requested by foresters is often on a 10- to 20-year basis. For example, dealing with decays and stains, a forest manager wants to know if a tree, showing a mechanical injury of a certain size, has a 10% or 80% chance of being completely or partially rotten in 10, 20 or 30 years from now. The pathological studies performed between 1965 and 1968 tried to answer, at least partially, questions of this type.

Based on such a quality classification of yellow birch and sugar maple, about 30% of the trees sampled appeared to be promising and another 33% to have an acceptable value for the coming 20 years; ten per cent were almost complete culls. If the surveys made in Dudswell and Thurso represent most of the second growth hardwood forest, one could count on a loss of more than \$3 million annually because of decays, and we can estimate that almost one-third of these hardwood stands are composed of trees of lower quality which should be removed.

In Quebec, the relative importance of species other than yellow birch and sugar maple in hardwood stands could possibly lead to a need of similar dissectional studies in red maple, white birch and beech. The Provincial Department of Lands and Forests already has a part of the information needed to build up quality classifications of those species, and there is no need for the LFRC to pursue this type of study. If a specific request for such a classification is received in the coming years, it would only be a matter of a few months (with men and money) to duplicate these studies for other hardwood species. The

long-term phase of the dissections is isolation, culturing and identification of organisms involved in decay and stain of each species under study. This part is essential to pathological research for a better understanding of the decay process, but presents few interests for the practising manager.

With the resources available and even with additional forces at the LFRC it would be more appropriate to investigate the influence of management techniques (pruning, thinning, fertilization etc.) on the behavior of pathogens in living trees. If we want to improve the quality of veneer logs, studies are also needed on factors governing high concentrations of trunk cankers on a particular site or after a specific stand treatment. Finally, with an increasing presence of man, or a higher frequency of operations in hardwood forests, there will be a need for information on the behavior of root-rotting organisms in the various second growth stands of Quebec. Sugar maple stands must also be the object of research to evaluate, for example, the influence of vacuum sap collecting on the pathological condition of the trees. How long are those trees going to yield double the amount of maple sap (as compared to traditional trapping) without showing any sign of crown deterioration, or delay in tap closure? Dr. Lachance and I are conducting preliminary studies on these matters but we have to keep the trees under observation in the coming years. Nothing was tried with infrared aerial photography or with the "Shigometer" to detect stain, decay, or other diseases without felling the trees, but these techniques should be explored, particularly in sugar maple stands where every tree represents a productive value each year.

MANAGEMENT OF SMALL FORESTED AREAS AND ORNAMENTALS

In this particular field of activity, forest diseases other than decays and stains must also be included for consideration. In the past, "forest pathology for people" has been practised by a number of

scientists of the LFRC but almost no specific study has been listed in our projects. Extension services providing information to the public on tree care, pest control etc. were established years ago in the USA by universities and government departments, but in Quebec nobody has the responsibility and facilities to answer inquiries on control of tree diseases. Every year, the Forest Insect and Disease Survey Unit of the LFRC provides information on tree diseases of ornamentals to an increasing number of individuals, municipalities and forest protection associations, but the same man is responsible for the survey in all types of forests as well as on all species of ornamentals.

Dutch elm disease has been studied in Quebec since 1940 and this is the exception which confirms the rule, being the only project in forest pathology directed towards ornamentals. Control tests have been performed on a small scale during the last five years, but again with limited equipment. In recent years, the Great Lakes Forest Research Centre has intensified this research on the control of Dutch elm disease.

The significance of diseases such as leaf rusts, spots, anthracnose and mildews on growth and appearance of trees has never been studied under conditions prevailing in Quebec because, in large stands, foresters considered them as secondary. As long as we had forest industries and government agencies as clients, these diseases were not among the priorities. On ornamentals, camping sites, along nature trails and rest areas, the relationship between foliage diseases and climatic factors will have to be established in order to predict their occurrence and to suggest protective measures. Trunk cankers, black knots, shoot blights and frost cracks are all diseases frequently noticed by the general public, affecting and killing trees especially in small forested areas or in forests suddenly opened for recreation purposes. The few treatments with antibiotics did not succeed under Quebec climatic conditions. For example, actidione did not control white pine blister rust in Quebec while it seemed to work on western

white pine. There are probably many other treatments with fungicides providing protective measures for hardwood trees, but the appropriate spraying schedule is not always adapted to the seasons and temperatures prevailing in Quebec. Systemic insecticides, easily applied on the trunk, were developed against a number of insects but here we are just beginning with systemic fungicides. There is a need for communication with representatives of the Chemical Control Institute.

Ornamentals in cities and small private woodlots are also exposed to disturbance of the soil, lowering of the water table, etc. Air pollution is another type of symptom which often has to be recognized by forest pathologists. Which one of our native or exotic hardwood species is the most tolerant, or the most susceptible, to those adverse factors and the common diseases? The answer is not known.

The variety of problems listed in previous statements could be longer but I think that it is sufficient to illustrate the complexity of the task in forest pathology if we decide to become advisors in urban forestry or amenity forestry. On individual trees, small plantations or small woodlots, almost every enemy, outside fire and insects, is called pathogenic. Therefore the needs in "forest pathology for people" are enormous.

There are a number of solutions, or a number of trials reported in the recent literature, but we need personnel to learn these solutions and test them in the various parts of the Province.

SUMMARY AND CONCLUSIONS

In résumé, the significance of diseases in Quebec cannot yet be tabulated in a few figures from an impact study. However, decay reduces significantly the volume of fibre in second growth hardwood stands. Many forest managers are aware of this phenomenon and a

quality classification of trees is often included on their sampling forms. The work performed in the past helped to define such a quality classification of standing trees. If more precision is required, other fundamental research on stain and decay processes will be necessary. In the meantime, forest pathology should devote efforts to following the influence of the various management techniques, presently tested, on the pathological condition of the deciduous forest.

Small forested areas and single trees are of much more concern for the general public. This public requests a number of information leaflets on the particular disease they have on their land. Some of this material is available now in Quebec in addition to that being prepared in Ottawa. If we want to emphasize research and development needs in this field of activity, almost everything is at the initial stage in Quebec and additional man-years will be necessary to improve the situation. Four forest pathologists at the LFRC are actually covering and maintaining studies which were made by nine forest pathologists ten years ago. *The significance of more diversified species of pathogens will increase if we become interested in restricted numbers of trees. This interest will require a great number of short-term studies on life cycles, epidemiology and control measures adapted to various conditions prevailing in Quebec.

DISCUSSION

The many queries concerning identification and treatment of tree diseases received by Insect and Disease Survey staff offer one of the best opportunities for the CFS to deal directly with the public and develop a real "forestry for the people" image. Improvement of this service is considered desirable.