Forest Pest Control Policies and Programs in Québec, New Brunswick and Maine

New England states and eastern Canadian provinces share some common forest pest control problems including the current spruce budworm outbreak. Over the years it has been possible to trace technical developments of the control programs and timber losses suffered by individual provinces and states. Yet the economics and policies surrounding spruce budworm control have not been reported in a way that enables one to observe and understand the degree of coordination between government and industry in Canada and the U.S.A. To promote understanding of this vital subject, the CIF Working Group #8 — Economics and Policy and SAF Working Group on Economics, Policy and Law held a joint meeting at the International Forest Congress at Québec City August, 1984. The objective of the meeting was to examine

the "Economics, investment returns and public policy on forest pest control programs in New England and Canada, including the question: with major forest losses to insects in eastern U.S.A. and Canada, what are the public and private investment strategies at work (state/provincial, federal, private) and what are the results in terms of timber supply?" Two Canadian (J.C. Mercier and D.D. Lockhart) and two American authors (T. Rumpf and G. Williams) presented the following papers and provided an informative panel session.

Patrick Duffy, RPF
Chairman, CIF Working Group #8
Economics and Policy

Protection of the Forest: A Social and Economic Imperative¹

by

Jean-Claude Mercier²

Abstract

The forest products sector is a vital segment of Québec's economy. Until recently this sector was supported by abundant resources. Today, the situation has changed. Resource shortages could soon develop in certain regions. Even if forest management is increased to moderate these shortages, the necessity to protect the forest will not diminish. On the contrary, investments cannot be made without adequate protection programs.

Protection programs are not new. Fire protection was initiated in the early 1950s and has since made considerable progress.

Losses from the current spruce budworm epidemic support the necessity to protect forests from insects. Insect control strategies and techniques have improved and will continue to improve in response to public pressure concerning the use of chemicals in the forest. As foresters, our challenge is not only to protect the forest but to inform the public of the necessity of protection to maintain our economic and social well being.

Résumé

Le secteur des produits forestiers est un segment vital pour l'économie québécoise. Jusqu'à tout récemment, d'abondantes ressources supportaient ce secteur mais des pénuries pourraient bientôt survenir dans certaines régions. Même si ces pénuries ont été tempérées par l'aménagement forestiers, la nécessité de protéger les forêts ne diminuera pas pour autant. Au contraire, des investissements ne peuvent être faits sans des programmes de protection adéquats.

Les programmes de protection ne sont pas récents. La protection contre les feux de forêts a commencé au début des années 50 et a progressé considérablement depuis lors.

Les pertes causées par l'épidémie actuelle de la tordeuse des bourgeons de l'épinette nous oblige à protéger les forêts contre les insectes. Les stratégies et les techniciens de protection se sont améliorées et s'amélioreront davantage afin de répondre aux pressions du public vis-à-vis l'utilisation des insecticides chimiques en milieu forestier. Comme forestiers, notre défi n'est pas seulement de protéger la forêt, mais d'informer le public sur la nécessité de le faire si on désire maintenir notre bien-être social et économique.

¹Paper given at the International Forest Congress held at Québec on August 7, 1984.

²Associate Deputy Minister, Department of Energy and Resources, Québec, Québec. (Mr. Mercier has since become Associate Deputy Minister for the federal Ministry of State (Forestry)).

The harvesting and processing of forest products has been, is, and will continue to be a vital segment of Quebec's economy. Directly and indirectly, this sector accounts for approximately 250 000 jobs and a payroll of \$1.2 billion, and thus is responsible for the sustenance of one person out of every seven in the province. At \$3 billion per year, forest products top the list of Quebec exports. More than 120 municipalities in Quebec look to the forest for their immediate livelihood. In short, Quebec's forests are an important renewable natural resource and contribute importantly to the well-being of every Quebecer.

To ensure that these vital gains are maintained for the economy of Quebec, the resource must continue to be available in sufficient quantity and quality. The ability to offer industry an assured supply of the resource is the basic objective of the good management of our forests.

Until the beginning of the 1950's, the population of Quebec as a whole, and even those responsible for the development of the forest, thought that existing supplies of wood were more than adequate for the needs of industry.

One must remember that at that time, the annual softwood harvest was approximately 15 million m³ per year. This stable pattern of forest development was significantly altered by the post-war industrial revolution and the present day technological advance, which together have substantially increased demands on the resource. These new demands can be explained first by the increase in productivity and the expanded market for forest products, and second, by the simultaneous desire to maintain current employment levels. As a result, the current annual harvest of softwoods from public forests averages about 20 million m³.

In addition to the industrial and technological revolution, there has also been what we in Quebec call the quiet revolution of the 1960's during which the population became aware of this collective heritage and the benefits it could bestow, especially in terms of recreation, fishing and hunting. The various demands made on the resource gave rise to an awareness of the forest's limits and the need to protect it.

There you have a brief overview that provides the context within which the development of Quebec's policy on the protection of the forest took place. In addition I believe a little history would be useful in relating how our policies for the protection of the forest have developed along with this socio-economic situation, both in terms of protection against forest fires and of protection against insects. I also think we must conclude that progress is sometimes achieved as a result of a series of learning experiences.

Protection Against Forest Fires

Without dwelling on the point, it is probably true to say that the need to protect forests against fire was perceived more rapidly because of the spectacular nature of fire; the heavy losses it produces over a short period of time; and the reduced productivity of forest land that frequently follows it.

In Quebec, legislation dealing with protection against forest fires goes back to the last century. At that time, the government initiated specific measures to prevent forest fires including designating protected areas, restricting the use of fire to specific purposes and placing controls on the operations of the railways. However, it wasn't until 1924 that a forest fire protection service was set up. Over the next few years, a

large number of private organizations for protection against forest fire were created in various regions of Quebec. With the new forestry policy of the early 1970's, these organizations were brought together in seven regional conservation agencies.

Much progress has been made since the fire protection services have begun to operate. The number of forest fires has remained relatively stable since the 1950's, averaging about 1 000 per year over a five-year period. The surface area destroyed by fire has averaged some 60 000 ha annually up to 1975. Since then, however, the emphasis has been put on prevention and an initial assault using CL-215 type air tankers, and although the number of fires has remained more or less the same, the area destroyed has dropped to less than 20 000 ha per year. Currently, more than \$25 million are spent annually on protection against forest fire.

Protecting the Forest Against Insects

It was in 1937 that a branch was created specifically for the protection of the forest against insects. At the time, Quebec was experiencing a serious European spruce sawfly epidemic. Prior to this epidemic, the forest in Quebec has been periodically infested by several other insects epidemics. Among others, was an outbreak of spruce budworm in 1748 in the Laurentian reserve. Following a number of relatively minor outbreaks, a major epidemic raged over the entire eastern region of the insect's potential habitat (southern Quebec, Maine and New Brunswick) in 1877. However, it was only with the 1937 outbreak of European spruce sawfly that positive measures were taken to combat the effects of these epidemics. The first step consisted of spreading parasites deadly to this insect throughout the forest. Since it was formed, the Entomology Branch has carried out a number of campaigns against various destructive insects which have a serious impact on the supply of softwoods most in demand by industry. Among others we might mention the battle waged against the Swaine jack pine sawfly from 1963 to 1967 and again in 1972, using phosphamidon, fenitrothion and viruses. The Leconte sawfly, which feeds on red pine, was also fought using viruses from 1966 to 1972. Fenitrothion was used from 1970 to 1973 to combat the jack pine budworm and the hemlock looper. Finally, the first campaign against the spruce budworm was launched during the last epidemic. In 1952, a DDT spray program was begun on an experimental basis using a beaver type aircraft over 3 200 ha of infested forest in the Matapedia Valley. At the height of the epidemic, in 1957, the spray program covered almost half a million hectares. Over the course of the program, from 1952 to 1962, more than 1.7 million hectares were treated with this powerful insecticide. In addition to the aerial spray program, efforts were made to recover damages wood, with the result that several forest harvesting firms transferred the location of their operations.

It was probably at about this time that the advisability of silvicultural methods in fir stands was called into question, given their great vulnerability to budworm epidemics. Nonetheless, the protection of the forests was considered to be a vital part of forest management, and its necessity was never placed in doubt. As soon as the epidemic was over, work in these stands was intensified. Since then, there has been an appreciable increase in the effort devoted to protection, and protection methods have developed quite rapidly.

The current spruce budworm epidemic is considered to be the most serious forestry problem to hit northeastern North America in the last 15 years. The programs aimed at this

epidemic alone have covered a total area of 22.2 million hectares from 1970 to 1984, an average of 1.5 million hectares per year. It is estimated that the program has reached, on an annual basis, less than 10% of the infested area. Efforts have been concentrated on regions with the heaviest infestation or where the potential harvest justifies the activity by taking into account the impact of this epidemic on the short-term supply to the industries.

A Review of Accomplishments

1970 to 1972: Start of Operations

Operations began on a modest scale. Between 1970 and 1972, the area covered by chemical insecticide spraying using single engine airplanes or helicopters with visual guidance systems rose from 11 600 to 800 000 ha annually. DDT was not used during this period. It was replaced with insecticides considered to be less harmful to the environment, such as fenitrothion. However, the scope of the epidemic and of the means required to fight it caused some doubt, for the first time, on whether measures should automatically be taken to protect the infested areas. Issues of an economic nature were also raised in connection with forest protection measures.

It was in this context that treatments using biological insecticides (*Bacillus thuringiensis*) were undertaken on an experimental basis, without achieving complete success. At the same time, chemical spraying using four-engine aircraft equipped with inertia guidance systems made it possible to cover vast areas in a very short time (12 000 ha in 25 minutes). Four-engine aircraft marked the arrival of a new technology in aerial insecticide spraying. It was now up to us to apply this technology most efficiently.

Since the new planes flew at a high altitude (100 metres) than the smaller aircraft, it was necessary to use oil rather than water as a solvent for the insecticide to reduce evaporation during spraying. The new planes were also faster (380 km/h) which improved the dispersal of the mixture into fine droplets, thus allowing a more even coverage and a reduction in the volume of product to be sprayed. The higher altitude and better dispersal produced a wider distribution area: the amount of spray solution reaching the soil was the result of four or five successive passes of the aircraft made at intervals of 1 000 metres.

Finally, a team of researchers under the direction of Dr. Jean-Paul Nadeau of the Research Branch of the Ministère des Terres et Forêts du Québec studied the economic impact of the fight against the latest spruce budworm epidemic in 1972. The study demonstrated that the aerial spraying was profitable in that the funds invested to fight the epidemic were, in the long run, less than the losses that would be incurred if the action was not taken. The study concluded that if such a program were not in effect, the current epidemic in Quebec could lead to a decrease in the potential forest yields of some 5.6 million m³ on an annual basis over a duration of 40 years or more. Implementation such a policy consistent with a notion of sustained yield would lead to annual losses of:

- \$12.6 million in royalties from public forests;
- \$14.9 million in tax revenues;
- \$63.2 million in wages; and
- 17 000 jobs

This study was a first attempt to quantify what has been previously considered a necessity, and confirmed the impor-

tance of protection programs not only in terms of their impact on forestry but also in terms of their economic impact.

1973 to 1976: Large Scale Operations

More extensive aerial spray programs were undertaken in the years following this initial phase. Four-engine aircraft were used to spray areas varying from 2.4 to 3.6 million hectares threatened by the budworm. To carry out these programs, some runways had to be lengthened at some airports, plants had to be set up to mix and load the chemical products.

During this period, studies of the movements of budworm populations and their parasites were undertaken. Techniques were developed to assess the effectiveness of operations. These were used to draw up a chart of forest areas according to mortality risk, which has provided the basis for a more rational protection program.

However, these large-scale spraying programs did not succeed in controlling the budworm epidemic. At most, they made it possible to minimize damage and so reduce the loss of trees in the areas treated. Under the policy that was then developed, spraying was concentrated in forests that were economically vital, operations were initiated at the very outset of an epidemic and spraying was continued until the end of the epidemic.

An ecological monitoring network was set up in 1974 covering all the areas treated on an annual basis, to follow the effect of the insecticides on bird populations, small mammals and aquatic insects, and to assess the amount of insecticide residue in the ecosystem (soil, water and foliage).

These surveys were taken each year and allowed us a measure of security as to the toxicity of the products employed (fenitrothion and aminocarbide). They revealed that as the doses employed, the aerial spraying of insecticide produced no perceptible effects on the environment.

1977 to 1983: Efforts Concentrated in the East: The Epidemic Temporarily Halted.

Beginning in 1977, activities were primarily concentrated in eastern Quebec, especially in the bas St-Laurent/Gaspésie region. The spread of the infestation was temporarily halted in 1979 and 1980, but it appeared with renewed vigour in 1981. The area sprayed had fallen from 1.4 million hectares in 1977 to 188 000 hectares in 1980, only to return to 1 253 million hectares in 1983.

During this period, few changes were made in the chemical insecticides themselves. However, with the new environmental legislation and the resulting consultation process, it became increasingly important to devote considerable research to the effects of the large-scale use of these products on human health and the environment in general, and to search for other means of fighting the devastating effects of this insect.

Experimental treatment with *Bacillus thuringiensis* continues over small areas. However, despite some success, there continue to be serious limitations to its use because of the low concentrations of the active ingredient in the product available on the market. In 1975, an experimental program over 100 000 hectares using a Bt product that proved to be defective was a failure.

However with recent developments, we were able to carry out more than 40% of our spraying program using biological insecticides on almost 300 000 hectares of infested forest in 1984. Although the price of these products has dropped dramatically, cost and logistic problems remain the principal factors hampering their widespread use. In 1984, it was still twice as expensive to use biological insecticides as to use chemical insecticides.

This state of affairs could have important repercussions on future economic and investment decisions. Whereas in the 1970's, we were concerned solely with the financial benefit, today we must demonstrate that our protection programs will benefit society as a whole.

As a result, the methods used to assess benefits must be changed. If we make a cost-benefit analysis using an interest rate of 4%, then it can be shown that both biological and chemical spraying will produce benefits for the government. However if the costs are analysed using the concept of opportunity costs and an interest rate of 10%, then only a spraying program using chemical insecticides will produce an overall benefit for society.

Nevertheless, some basic realities remain once we get beyond the various economic approaches and the difficulties of assessment they imply. Since our objective and our mandate is to ensure that the forest makes a maximum contribution to Quebec's economic development, it follows that the protection of the forest must be seen from a dynamic perspective of future development.

There are two approaches we could take. Under the first approach, the forest would be left to itself, and would ultimately be destroyed by the spruce budworm or another pest. While the existing forest was gradually being destroyed, it would be possible to rebuild a new forest as a replacement. However this does not take into account the loss of employment during the interim until the new forest becomes commercially exploitable.

Under the second approach, we would continue to protect the existing forest with the means at hand that do not present undue health and environmental risks. At the same time, however, we would begin to create a new forest that, as far as possible, would be less vulnerable to the budworm to make up for losses already suffered and to make improvements in the forest so as to generate additional economic activity.

As forest managers in Quebec, our basic professional concern focuses on the improved welfare of all Quebecers, we must therefore consider factors outside the realms of forestry, and for this reason choose the second approach and opt for development.

From the point of view of development, the necessity of protection programs becomes more tangible. The greater our investment in forest development, the more pressing the need to have cost-effective methods for protecting these enhanced forests and the investment they represent. Indeed, forest protection and development should be seen as complementary activities aimed at increasing the forest's yield; one is not a substitute for the other.

In keeping with this philosophy, we believe it is becoming increasingly probable that silvicultural efforts will reduce the vulnerability of part of our forest to the budworm. Controlled burning after cutting, followed by reforestation with less vulnerable species is one such approach.

How do things stand now?

It is estimated that before the current spruce budworm epidemic ends, it will have destroyed almost 235 million m³ of softwood, or the equivalent of 10 years of industrial consumption at current levels. We have already spent more than \$110 million on budworm control and have already lost an estimated 135+ million m³ of wood.

According to an impact study we have carried out, we shall have to increase the effectiveness of our spraying program and continue spraying until the end of the epidemic if we are to avoid adding to the losses that have already occurred. Otherwise, substantial additional losses could occur with an even greater potential impact on the harvest over the coming years and create interruptions in supply which even now threaten certain regions.

At the same time, however, pressure groups have become increasingly persistent in questioning the methods employed on the grounds of their potential long-term impact on the environment and on human health. The use of insecticides will become more widespread in the future. Despite the more thorough environmental follow-up that is built into our spraying program, we shall always be faced with a degree of potential risk that will be not be possible to eliminate entirely.

On the other hand, should we discontinue protection employment will suffer inevitably. Indeed the current debate over the proposed forest protection program brings up the whole question of risk management and the values at stake.

This is a social choice, and society as a whole, as well as the agencies that are responsible for assisting society in the decision-making process (such as the bureau des audiences publiques du Québec) must take responsibility for the future consequences of their eventual choices on the well being of Quebecers. At the same time, it has never been more important for foresters in Quebec to enter the debate and give it a proper focus.