Professional Articles/ Articles professionnels

The Future of Spruce Budworm Research¹

by

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Abstract

What is the future of budworm research? In a word, bleak. Having said that, I must give my reasons for saying so. First I shall give a brief historical perspective. Then I shall outline the present situation, the control options, and the outlook for new options. Finally I shall state what I believe has to be done to ensure that the forest industry does not find itself without control options.

Résumé

La tordeuse de bourgeons de l'épinette constitue le ravageur le plus important de l'épinette et du sapin en Amérique du Nord. De part sa nature cyclique, les fonds destinés à la recherche historiquement ont été seulement à profusion lorsque les populations ont été élevées et les dommages très évidents. Compte tenu d'une multitude de raisons, la majeure partie des fonds de recherche doit venir des gouvernements. Ceux qui élaborent les politiques gouvernementales ne comprennent pas les besoins de la recherche, et presque invariablement ne considèrent que son aspect à court terme. Les populations actuelles de tordeuses de bourgeons sont faibles, et le personnel professionnel de recherche oeuvrant dans le domaine a diminué de plus de 50% comparativement aux nombres atteints lors de la période de pointe, tandis que le personnel de soutien a été coupé encore plus. Ceci est regrettable car la clé de la solution de quelques uns des plus importants secrets de la tordeuse de bourgeons réside dans l'étude des populations lorsque celles-ci sont faibles et sont les plus difficiles et coûteuses à étudier.

Historical

Spruce budworm research has been going on in Canada since the First World War, in response to the outbreak of 1910-1920 in New Brunswick. It received great impetus from the outbreak of the late 'forties-early 'fifties and, of course, from the realization that to ensure the vital forest industry a wood supply, we could not afford to give it up to the spruce budworm. Until 1945, there was no practical way to protect forests. It was the development of DDT and the surplus of good aircraft after World War II that made it possible. The way we protect our forests has greatly changed because of new knowledge, and we have to continue to search for more effective, economical, safer, and environmentally rational tactics. The history of budworm research, with variations, has been similar elsewhere.

The Present

Throughout the budworm-susceptible forests of north-eastern North America, budworm populations are declining. The protected forests are green and growing, and the unprotected budworm-devastated forests are regenerating themselves. Last year and this year, the hazard was and is great enough to require protective measures only in the Gaspé and adjacent parts of northern New Brunswick.

Going out of sight, the budworm is also going out of mind. Research teams are shrinking, and budgets for those who remain are shrinking. The following table gives some idea of what has been happening. The numbers are the best estimates I could find of federal scientists involved full time in some aspect of budworm research. Numbers of university and contract researchers follow similar trends because they depend mainly on federal funding.

	Peak	Now
Newfoundland	3.5 (1979)	1.6
Maritimes	14 (1970)	7.5
Northeastern US	15 (1982)	0.5
Maine	5 (1982)	0.5
Quebec	6 (1988)	6
Ontario	22 (1950)	12.4
Total	65.5	28.5

So What?

To short-sighted pragmatists it seems logical to reduce research effort when the problem diminishes. But is it realistic? No, it is not. I shall explain. But first I must outline the present situation.

The depredations of the spruce budworm can be controlled safely and economically with fenitrothion and amino-carb, and less reliably at greater cost with *Bt*. Fenitrothion is under attack off and on by some environmentalists who

¹Based on a talk given to the 13th annual Eastern Spruce Budworm Research Work Conference, Hugh John Flemming Forestry Centre, Fredericton, New Brunswick, 24 January 1989.

1975 (year of worst defoliation)

1988 (present defoliation)

Courtesy of E.G. Kettela, Forestry Canada

presume to know more about ecology and environmental toxicology than the scientists do. Don't misunderstand me, I appreciate that peoples' fears are real and, in many contexts, political reasoning may be just as valid as scientific reasoning. Furthermore, scientists and forest managers know that all forest management practices have environmental costs, and are constantly searching for better ways to reduce these costs.

Aminocarb, which is more benign than fenitrothion, is unavailable because the market is too small for the manufac-

turer to produce it. That is because all "chemicals" have been banned for forest spraying in Ontario, Quebec, and Nova Scotia for political, not scientific, reasons.

That leaves *Bt* and, much to the credit of a number of government and industrial scientists, there is much research going on to make *Bt* more effective and economical. There is also research going on to ensure our confidence in *Bt*'s environmental safety, although this is slow coming because of the presumption that *Bt* is safe.

My concern is that *Bt* kills insects because of the toxin it produces. For some reason, in spite of aflatoxins, demoic acid, cocaine, and viper venom, people still seem to think that natural chemicals are safe and artificial ones are not. Thus, we cannot rely on *Bt* or any other pest control product or tactic as being a panacea. Neither can we depend on finding a final solution to the budworm problem, as some people believe possible.

What happens if forest managers lose *Bt* as a forest management tool? The chances are that the industry will be defenceless, the next outbreak will rage out of control, the industry will have to adjust to a diminished wood supply, people will lose jobs, and communities dependent on the industry will suffer. Nobody knows the time frame of this scenario, but it is more likely to happen if government support for budworm research is not increased.

Why Emphasize Government Support

Insect control methods of the future have to be more target specific, which means they have to be hazardous, if possible, only to the target pest. That is expensive. Pesticide industries are not interested because the market for a specific insecticide or other insect control method is small and unprofitable. Industry is leery of broad spectrum pesticides these days because of public chemophobia and mistrust of scientists, public regulatory officials, and pest managers. It costs between \$12 and \$90 million to develop a new insecticide, and that has to cover the failures too. Biological insecticides are at the lower end of the cost scale because less environmental impact study is required, but the biologicals are usually more specific and less interesting to the companies.

Future Controls

Nobody knows what these will be: take your pick of parasites, diseases, antifeedants, pheromones, molting hormones, bioengineered trees, alternative tree species, selected and bred trees, or any number of approaches that I haven't mentioned. Individual researchers sometimes appear to know

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because of the way they have to boost their own approach in the intense competition for very limited funds. Controls of the future will have to be based on a greater knowledge of the budworm itself. We must find its Achilles' heel. We have to know more about its relationship with the host tree: how it physically and chemically relates to the tree, its nutrition, and how the tree reacts to damage under a multitude of circumstances. We have to know more about the parasites, predators, and diseases of the budworm, and more about its physiology, particularly its reproductive and endocrine physiology. We have to know more about the dynamics of its populations, its reproductive biology, demography, and behavior, as well as those of its hosts, parasites, predators, diseases, and competitors. We must find out why budworm populations soar and then collapse. There are enough potential PhD theses for a thousand scholars, and we still wouldn't know everything, because the budworm is an organism as complex as any other, including man. To know is to understand and to understand is to be in control.

Why is the Federal Government Cutting Back on Research?

The answer is simply that it does not understand it and people don't demand it. According to a recent survey, the professional group most ignorant of science and the environment is lawyers, and 80% of politicians are lawyers. In times of restraint, science is usually cut first, because most people don't care; politicians dare not cut social programs even if they are retrogressive. This is not a feature peculiar to the present government. The process has been going on in Canada under at least the last four governments, and the public is to blame because we allow it to happen. It's happening in Britain, the U. S., and, I understand, in Australia too.

How is Research Being Cut in Canada?

Canada spends only about 1.35% of its GNP on research, only half the average of its major competitors. Canada has less than half the per capita number of scientists in its work force than the average of the industrialized developed countries.

Research effort is diverted into high profile fields from those of fundamental importance. For example, the much heralded space research program involves no new money; the government's own news release indicates diversion of funds from other fields including agriculture, forestry, and the environment, which are fundamental. The concept seems to be that "science" is a designer of saleable widgets.

The National Sciences and Engineering Research Council, which is the principal agency through which university researchers are funded, has run grant programs only to be told that there is no money for them.

Budget cuts are a recurring phenomenon, yet research is investment, not charity.

The money that is available is largely gobbled up by overhead, which is jargon for all the administrative and management costs. Administrators and most managers are paid according to the size of their empires, not what they accomplish, so the situation just gets worse. It seems a whole new generation has not heard of Parkinson's Law.

Summer student employment programs are getting smaller in spite of government statements to the contrary.

Current policy assigns a higher proportion to private business and industry, while budworm researchers, who depend heavily on students to help with the heavy summer workload, have been getting fewer every year. It seems there is an attempt to turn all students into business entrepreneurs instead.

Research budgets have been cut to the extent that many government researchers have to scrounge outside for help and use of equipment. Buildings such as the Hugh John Flemming Forestry Complex are relatively easy to get because they tell the public that the government is doing something. The fact is that there are now fewer researchers, particularly in budworm research, than there were when the building was planned. Buildings don't do research.

I could expand this list, but I think I have made my point.

It is obvious to most researchers that politicians do not understand the difference between science and technology, let alone the difference between basic and applied scientific research. Technology is applied science, the application of knowledge acquired through research into problems and processes in society. Technology stems from a broad base of applied research, which has immediate problem-solving goals. Like the base of a pyramid, basic research forms the foundation. If the pyramid is inverted, it topples over; if we invest only in technology, which feeds on research, we impoverish technology. Politicians and their advisors seem to think that goals for research can be set and attained within a fiscal year, but we know that science doesn't work that way. Technologies we take for granted today are based on research done twenty or more years ago.

There is a strong trend in government to do only research that is demanded by industry, and to support research in universities only if costs can be shared with industry (the "matching funds" program). This would preclude any basic research because industry is motivated by short-term profit, and governments seldom plan beyond the next election campaign. I wouldn't say the motivation of industry is wrong, but rather that we should be able to look to the government to foster the long-term interests of society.

There are people in high places who believe that Canada can import technology, and point to Japan as an example. They are out-of-date, because Japan now invests a much greater proportion of its GNP on research than we do, and it is increasing, because they have realized that it is the only way they are going to stay ahead in international competition. Only countries with low labor costs can profit by importing technology.

Back to the Budworm

It seems I have rambled off the subject of budworm research. Not so. Budworm research involves chemistry, physics, genetics, physiology, ecology, and other basic disciplines as they apply to the insect, its hosts, its enemies, and the natural environment in which we find it. If the present trend towards less support for budworm research continues, we could lose a large part of our past investment because data must span a considerable time to allow meaningful interpretation of trends, variations, and reasons for them. The key to some of the most important budworm secrets is to study populations when they are low, and that is when the work is most difficult and expensive, but it must be done now, or be postponed until after the next outbreak in 25 to 30 years. Future generations will suffer if timber is lost because we conduct research only at times of outbreaks.

If we really want a more effective, economical, safer, and environmentally benign way to deny our wood supply to the budworm, then we shall all have to demand more research, not less. "We" includes forest managers, researchers, environmentalists, the general public, and, as guardians of the public interest, the media. Most politicians are not really moved by logical or financial arguments, only by the perception that votes are to be gained or lost. I urge you to get involved and speak up.

EMPTY PLACES
AT THE BENCH!

Cartoon by D.G. Embree

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