Canada's research to expand its forest output includes introducing more productive non-native species, such as the Norway spruce, the Japanese larch and the European larch, and genetic breeding, such as the development of a white spruce that grows 15 to 20 per cent higher than normal. One of the most promising current projects is the development of a hybrid poplar tree by the Ontario Ministry of Natural Resources.

Protection from diseases, pests and fires

In Canada, where the total annual forest harvest averages 128.4 million cubic metres, insect losses are estimated at 14.3 million cubic metres and fires destroy about 10.5 million cubic metres annually. Together they account for losses equivalent to nearly 20 per cent of the harvest.

A wide range of forestry protection research programs are conducted by the Canadian Forestry Service at six regional forestry research centres, by two national institutes, provincial forestry agencies, the forest industry and universities.

A few insect species, whose larvae eat tree foliage, stems and cones, are the major source of lost fibre and timber production in Canada. They may destroy trees or merely reduce growth.

In 1977, Canada and the United States agreed to develop a six-year joint research program aimed at accelerating technology to control the destructive spruce budworm. Expenditures in this program will be $7 to $8 million annually.

Since 1952, spraying with chemical insecticides has been the main method used to control the spruce budworm. However, when trees are saved with insecticides, the budworm infestations are prolonged since the budworms do not starve as they ordinarily would. There are also public doubts about the long-term hidden effects of spraying. As a result, some provinces have elected not to spray and now more research is directed toward finding alternative methods of control, including biological ones.

Each year about 8,000 fires sweep across more than 2 million hectares of Canadian forest land. Losses are estimated at $65 million a year.

The Canadian Forest Fire Weather Index is a fire-danger rating system that predicts fire occurrence and behaviour in the Canadian forest. Based on temperature, relative humidity, wind-speed and 24-hour rainfall, it has been adopted by all fire control agencies in Canada.

A computerized system has also been developed which assists in daily detection and fire control decision-making. It draws on information related to such matters as forest fuels, thunderstorm paths and historical fire data to aid aerial detection.

Specially designed lightning detectors have been developed as an inexpensive and reliable means of thunderstorm tracking. These sensors, each with a range of about 32 kilometres form a network extending over the major Canadian forested regions. A strong relationship exists between the sensor counts, fuel moisture and the occurrence of fires caused by lightning. With a formula that relates counts and index value to fire starts, it is possible to use the sensors to obtain a reliable estimate of possible lightning fires over an area.

Pacific Forest Research Centre researchers are using aerial thermal infrared scanning technology to detect fires before visible signs such as flames or smoke occur. The British Columbia Ministry of Forests now operates six thermal scanners. They are usually flown by helicopter and are capable of pinpointing a burning cigarette from an altitude of 300 metres.

Product research

Canada's federal forest products laboratories are managed by Forintek, a new non-profit, private corporation. Their efforts cover all aspects of product development, from the forest to the production of durable, economical finished goods. Among recent projects is a steam process for producing particleboard that requires a shorter processing time and makes thicker panels economical; a weather-resistant fire retardant, Exterior-Fire-X, that inhibits flames in shingles, plywood and lumber and reduces smoke, poisonous gases and heat; a heavy-duty wood preservative that prevents decay of wood buried underground and can be used on such difficult-to-treat species as native spruce; and a ribbed tree shear blade, a single blade for cutting down trees, which causes 30 per cent less fracture damage than a conventional double blade. All four inventions are (or soon will be) produced commercially.

In recent energy-conscious years, wood has been making a comeback as a home-heating fuel. In Canada, it is also being used to create heat and steam to produce electricity in the pulp and paper industry. Canadian scientists are working on methods of using it as biomass in the synthesis of flammable gas, methanol and industrial chemicals.

Wood to burn

When fireplaces became primarily a source of aesthetic pleasure rather than heat, bark, waste wood and sawdust from Canadian mills were incinerated or used as landfill. Today they are hogged (chopped up), squeezed dry and burned to produce steam that in turn produces electricity.

The pulp and paper industry is one of 14 national sections that agreed to participate in the federal government's voluntary energy conservation program. The target was to reduce the use of purchased fossil fuels and electricity *per* unit of

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A worker floats logs down a river in Kitimat, British Columbia.