III. The Vernon Laboratory and federal entomology in British Columbia

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Over its fifty years of existence the personnel of the Vernon forest entomology laboratory conducted scientific research on B.C.'s insect species, battled epidemics that threatened commercial timber, and monitored their populations. Between 1920 and 1970, first as part of the Department of Agriculture and more recently within the Canadian Forestry Service, the facility provided tangible evidence of the federal government's interest in the provincial forest economy. Prior to the 1930 transfer of natural resources to the provinces Ottawa's stake in the Railway Belt provided sufficient reason for such a presence, perhaps, but the laboratory survived after B.C. claimed complete jurisdiction over timberlands in the province. Transcending provincial boundaries, forest insect problems were an appropriate area of Dominion scientific inquiry.

An early twentieth century bark beetle epidemic in the southern interior created the motivation for Ottawa and Victoria to cooperate in control projects that operated each spring and summer during the 1920s. Ralph Hopping directed that effort, and stayed on to head the laboratory's small staff until passing the reins to his son George in 1938. The facility remained B.C.'s major centre of forest entomology until losing its research orientation to a new federal installation in Victoria in the 1950s, then closed entirely in 1970. Ironically, soaring interior bark beetle populations have lowered the value of vast stretches of timber in subsequent decades.

Forest entomology in Canada began to emerge from its amateur origins in 1909, with the hiring of C. Gordon Hewitt as Dominion Entomologist. Hewitt, in a refrain entomologists would repeat often in coming decades, observed that the depradations of insects received much less attention than fire in Canadian conservation circles. Some research had been conducted on larch sawfly and spruce budworm outbreaks, but their significance paled in comparison to the damage caused by several species of bark beetles which had yet to receive any scientific attention. The first step in correcting this situation came with the 1912 appointment of J.M. Swaine, a graduate of Cornell and recognized North American bark beetle authority, as Assistant Entomologist for the study of forest insects in the Department of Agriculture's Entomology Branch. Swain took charge of the new Division of Forest Insects, and immediately undertook a study of bark beetle outbreaks in Canadian forests.[1]

A cooperative agreement between the Dominion Department of Agriculture and the B.C. Forest Branch took Swaine to the west coast in the summer of 1913 for a survey of forest insect damage. Swaine covered the Kootenay, Okanagan, Similkameen, lower coast, and Vancouver Island regions. His preliminary investigation found the coastal forests relatively free of extensive outbreaks, but in the southern interior pine beetles were

[1] M.L. Prebble, "Forest Entomology," *The Canadian Entomologist* 88 (July 1950), p. 351; D.R. Wallace, "Forest Entomology or Entomology in the Forest? Canadian Research and Development," *Forestry Chronicle* 66 (Apr. 1990), p. 120 [hereafter *FC*]; "Will Study Forest Insects," *Canadian Forestry Journal* 8 (Jan. – Feb. 1912), p. 26 [hereafter *CFJ*]; C. Gordon Hewitt, "Investigations on Forest Insects, and Forest Protection," *CFJ* 8 (Mar. – Apr. 1912), p. 36.

inflicting serious losses to yellow pine stands. Conditions were particularly acute in the Princeton area, where an outbreak had killed much valuable timber. "The clumps of "red tops" may be distinguishing upon the mountain-side and in the valleys for many miles," he noted in a report on the infestation.[2]

Swaine returned in the summer of 1914 to discover that the Okanagan infestation had spread as far west as Princeton. On Okanagan Lake the hillsides appeared "as though swept by a great fire," with only isolated patches of Douglas fir surviving. In other areas beetle attacks were decimating the white pine, and authorities noted the relationship between the slash left by logging operations and beetle outbreaks. Hewitt advocated the adoption of "vigorous control methods" to prevent the spread of beetles from fresh slash to standing timber. "It should be a settled policy in British Columbia to burn all pine slash each season between October and May, as an aid to bark-beetle control," he wrote.[3]

The infestation continued running its course over the next few years, with Swaine investigating outbreaks and pressing the provincial government for funds to control the devastation which threatened the province's white and yellow pine. Infested trees should be logged and handled in a manner that destroyed broods contained in the bark, reducing beetle populations to an extent that they would find sufficient breeding material in slash rather than standing timber. U.S. Bureau of Entomology control projects had demonstrated that the removal of 75 percent of infested trees would check an outbreak. Floating logs in water killed some of the broods, barking trees and burning the debris was another option, but if profitable utilization was not possible simply burning infested timber provided the cheapest means of control. Finally, in 1919 Swaine and B.C. Forest Branch officials entered into serious negotiations aimed at developing a cooperative effort to control the bark beetle menace. By this time the epidemic around Princeton had died out after killing about 130 million feet of yellow pine, but a new outbreak had emerged around Merritt.[4]

Swaine's discussions with B.C. authorities produced an agreement to establish a laboratory at Vernon, and he asked Ralph Hopping, then employed by the United States Bureau of Entomology in California, to take charge. Regarded as one of the "leading students of forest-insect life on the west coast," Hopping accepted the position as Dominion Forest Entomologist for B.C., settled in at the Vernon courthouse in December 1919, and prepared to launch what Minister of Lands T.D. Pattullo called the province's "war on the pine beetle." It would prove to be a significant campaign, occupying Hopping's energies for much of the next decade.[5]

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[2] H.R. MacMillan, "In British Columbia," *CFJ* 9 (July 1913), p. 106; H.R. MacMillan, "British Columbia Forest Work," *CFJ* 9 (Oct. 1913), p. 156; J.M. Swaine, "A Forest Insect Survey in British Columbia," *CFJ* 9 (Nov. 1913), pp. 166-67; J.M. Swaine, "The Economic Importance of Canadian Ipidae,"*Proceedings of the Entomological Society of British Columbia* (1913), pp. 41-43.

[3] C. Gordon Hewitt, "Forest Insect Investigations in British Columbia," *CFJ* 10 (Oct. – Nov. 1914), pp. 102-3.

[4] "Fighting Forest Insects," *CFJ* 11 (Mar. 1915), p. 42; J.M. Swaine, "Problem of the Bark Beetle," *CFJ* 11 (June 1915), pp. 89-92; "Beetles are Killing the Yellow Fir in B.C.," *Western Lumberman* 16 (Oct. 1919), p. 49 [hereafter *WL*]; R.H. Hopping, "Annual Report for 1923, Forest Insect Control, Pacific Forest Centre Library [hereafter PFCL].

[5] Kenneth Johnstone, *Timber and Trauma: 75 Years with the Federal Forestry Service, 1899-1974* (Ottawa: Minister of Supply and Services, 1991), pp. 106-7; "Fighting Pine

A provincial allotment of $10,000 permitted direct control operations to begin during the spring of 1920 in the Midday Creek valley, a tributary of the Coldwater River. In the Railway Belt, a Dominion Forest Service crew under D. Roy Cameron worked in the Spius Creek valley about fifteen miles south of Canford. Designated men first inspected infested areas, marking trees for cutting. A working party followed, cutting down the trees, peeling the bark, and burning both bark and limbs. By starting projects early in the spring Hopping hoped to destroy the beetles before they matured and took flight. "The epidemic can be practically eradicated," he declared, given the allotment of sufficient funds to undertake a comprehensive control program. The province had made admirable progress in its fire suppression program, but fiscal support for handling the insect menace remained insufficient to the task. The control effort was "successful as far as it has gone with the limited funds," but Hopping had no illusions about his capacity to cope with the ecological and economic consequences of unregulated cutting. Winter logging operations left an abundant supply of cull logs and limbs to become infested the following June and July. Lacking fresh slash that summertime logging would have provided, the beetles attacked standing trees after emerging. Another winter's cut simply added impetus to the outbreak, fuelling an epidemic capable of spreading even in standing timber by virtue of the immense populations. "The removal of slash and infested standing timber is absolutely necessary if we are to reduce the loss to the minimum, and prevent a state of chronic menace to our forests," he warned.[6]

The cooperative project had three distinct components: direct control, involving cutting and burning of infested trees; timber sales in areas accessible to mills; and a preventative emphasis on the burning of slash and cull logs. Hopping supervised all three phases of the operation, overseeing the work of control crews, inspecting timber sales worked by Nicola Pine Mills of Merritt, and instructing operators about proper logging methods. Swaine described the first season's work as "remarkably successful," but estimated that some $20-$40 million worth of yellow pine remained at risk.[7]

Four control projects involving forty-eight men worked between April 1 and June 30 the following year in the Vernon and Kamloops Forest District. Crews at Kingsdale, Spius Creek, Midday Creek and the north end of Adams Lake cut and burned thousands of trees, but funds were inadequate to keep pace with the infestation. Hopping requested a doubling of the provincial allotment to $20,000 but held out little hope that the increase would be granted. The *Pacific Coast Lumberman* supported his argument that the province should make a small immediate investment rather than suffer heavier future costs.[8]

Provincial expenditures rose to $15,500 in 1922, enabling Hopping to place three crews in the field around Merritt. Together with a federal project on Spius Creek, they treated over 8,000 trees. "We have found that direct control work on infestations reduces the infestations 80 percent," Hopping reported. An untreated epidemic, on the other hand,

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Bug in British Columbia," *WL* 17 (Mar. 1920), p. 40; R.C. Traherne, "A Further Review of Applied Entomology in British Columbia," *Proceedings of the Entomological Society of British Columbia* (1921), p. 144.

[6] "Epidemic of the Bush Beetle," *WL* 17 (May 1920), p. 49; "Fighting Bark Beetle in Pine Forests," *WL* 17 (June 1920), pp. 35-36; Ralph Hopping, "Control of Bark Beetle Infestations," *Pacific Coast Lumberman* 5 (Nov. 1921), p. 77 [hereafter *PCL*].

[7] J.M. Swaine, "Bark Beetle Successfully Combatted," *WL* 18 (Mar. 1921), p. 28.

[8] R.H. Hopping, "Annual Report, 1921," PFCL; "The Bark Beetle Menace," *PCL* 5 (Nov. 1921), p. 22.

would increase by 100 to 150 percent, or even more in certain conditions. Thus, work conducted during the 1922 season saved over five million feet of timber, worth perhaps $8,000. Encouraged, he suggested that another year or two of direct control would reduce the infestation sufficiently to permit a much lower annual expenditure.[9]

Five projects – four in the Merritt area and one at Adams Lake – involved eighty-five men during the 1923 season at a cost of over $20,000. Hopping again expressed regret that insect control, which had destroyed about 200 million feet of timber around Princeton and Merritt at a loss to the province of perhaps $6 million, did not receive the same support accorded fire prevention and suppression. He also stressed repeatedly that the balance of nature had been disrupted by lumbering. "Promiscuous cuttings, unless regulated by the government, upset the natural balance and cause such outbreaks as we are having at the present time," the entomologist observed in 1923. The provincial and Dominion governments then doubled their allotment to about $45,000 for direct control during 1924. The provincial share amounted to $35,000 in support of five large fifteen to thirty-six man projects and several smaller "flying crews," that treated 19,000 trees. Federal crews continued to work small infestations at Spius Creek and Adams Lake. With a temporary staff of four, including H.H. Thomas, Kenneth Auden, Norman Cutler and son George, Hopping found himself short-handed during the hectic summer season. Although epidemic infestations in controlled areas had been reduced by 90 percent as a rule, the expansion of lumbering around the province contributed to the rise of new outbreaks, "tremendously increasing the work of the personnel." The Vernon laboratory, Hopping declared in a blunt plea for additional help, "finds that it has been impossible to properly carry on."[10]

The appointment of Hector Richmond and William Mathers as Pest Inspectors in 1925 permitted an expanded research effort. Hopping had initiated cage experiments earlier in the decade in an effort to determine when the emergence of beetles began, peaked, and ended, and to identify parasites and predaceous insects. Richmond and Mathers were assigned to this work, felling, bucking, and limbing infested trees and constructing cages over the trunk and stump. Richmond inspected the cages daily, collecting and preserving in alcohol the insect material that emerged. Study of the cedar borer also began during this period at the Vancouver Forest Products Laboratory under George Hopping, and Mathers commenced an investigation of the life history of the spruce budworm.[11]

Ralph Hopping declared victory in the war against the bark beetle in the yellow pine stands around Merritt early in 1928. "The control measures have been entirely successful," he reported, "no epidemic now existing in the yellow pine of British Columbia for the first time in over fifteen years." He estimated the saving to the province at $5 million, attributable to the "100 percent method" of cutting and burning every infested tree and periodically recleaning infested areas. Over 50,000 trees had been treated in this manner

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[9] R.H. Hopping, "Annual Report for 1922," PFCL; "Saving Yellow Pine," *PCL* 6 (Aug. 1922), p. 64.

[10] R.H. Hopping, "Annual Report for 1923," PFCL; Ralph Hopping, "Forest Entomology," Proceedings of the Entomological Society of British Columbia (1923), p. 187; R.H. Hopping, "Annual Report, Entomological Laboratory, Vernon, B.C., 1924"; Ralph Hopping, "Forest Insect Problems of British Columbia and Their Importance," *WL* 22 (Sept. 1925), p. 60.

[11] R.H. Hopping, "Annual Reports, Vernon Forest Insect Laboratory, 1925,"; Hector Allan Richmond, *Forever Green: The Story of One of Canada's Foremost Foresters* (Lantzville: Oolichan Books, 1983), p. 20.

since the start of the campaign, at a cost of approximately $100,000. The situation in lodgepole pine, however, was less bright. Mountain pine beetle infestations had devastated vast areas of this commercially unimportant species, moving so rapidly that control operations had little hope of success even if funding had been available. The laboratory would also continue to monitor the steady growth of Douglas fir beetle infestations, the spruce budworm, and other forest insects.[12]

By this time Hopping had achieved some success in educating National Parks Service and Dominion Forest Branch rangers to the importance of identifying and reporting incipient outbreaks, but had made no such progress with B.C. Forest Branch personnel. "The unconcern of forest rangers and others of the Forest Branch with regard to forest insect infestations throughout the Province, has been strikingly apparent to us for some time," he informed Chief Forester P.Z. Caverhill. Many outbreaks had not been reported for two or three years after their onset, a situation he hoped to correct by having an information package sent to each Ranger and making lectures by Division of Forest Insect officers a feature of annual meetings. An educational campaign of visits to Ranger headquarters around the province went into effect in 1928, permitting joint inspections of forest districts. Officials hoped that this sort of cooperation would foster prompt reporting of outbreaks and eliminate the need for costly control projects.[13]

The Vernon laboratory conducted only one small control project in lodgepole pine during 1928, reflecting the gradual shift to a focus on education and research. The following year Hopping requested funds for a crew to take action against a lodgepole pine infestation in the Railway Belt, but the species had too little commercial value to justify the expenditure. George Hopping broke new ground on the coast, however, overseeing B.C.'s first airplane dusting project on a small area around the Wigwam Inn resort on Burrard Inlet. Undertaken in part to demonstrate the feasibility of the technique to Dominion and provincial forestry officials, the experiment against the hemlock looper saw a Western Canada Airlines Boeing flying boat dust forty-five acres with calcium arsenate. Mathers studied a spruce budworm infestation at Barkerville that summer, work that would contribute to his discovery of the budworm's two-year life cycle in the area. The younger Hopping took charge of a sub-laboratory at the University of British Columbia in 1930, and oversaw larger dusting projects on Stanley Park and Seymour Inlet that June. These endeavours involved three Boeing flying boats at a total cost of over $10,000. [14]

The onset of the Great Depression had an immediate impact on the activities of the Vernon laboratory. Unable to secure funds for control of growing bark beetle infestations in Douglas fir and lodgepole pine, Ralph Hopping did spend $5,000 that spring in response

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[12] R.H. Hopping, "Annual Report, Forest Insect Laboratory, Vernon, B.C., Fiscal Year 1927-1928;" J.M. Swaine, "Progress in Forest Insect Control in Canada," *FC* 4 (Feb. 1928), np.

[13] R.H. Hopping to the Chief Forester, 14 Nov. 1927, copy included in 1927-28 Annual Report; J.M. Swaine, *Forest Entomology and its Development in Canada* (Ottawa: King's Printer, 1928), p. 12.

[14] R.H. Hopping, "Annual Report, 1928," PFCL; J.M. Swaine, "Forest Insect Investigations in Canada, 1928," *FC* 5 (June 1929), pp. 37-38; R.H. Hopping, "Annual Report, 1929," PFCL; G.H. Hopping, "An Account of the Western Hemlock Looper, *Ellopia Sominaria* Hulst, on Conifers in British Columbia," *Scientific Agriculture* 15 (Sept. 1934), pp. 24-28; W.G. Mathers, "The Spruce Budworm in British Columbia," *FC* 8 (Sept. 1932), pp. 154-57.

to a massive beetle attack at Aspen Grove, one of the original project sites. But a cash-strapped B.C. government curtailed allocations for fire protection in the early thirties, and in this fiscal context Hopping had no hope of beetle control funding. Federal budget cutting in April 1932 led to layoffs of all temporary staff at Vernon. Richmond and the others continued working in the hopes that their positions would be renewed, receiving a six-month extension in May accompanied by a 10 percent pay cut that reduced Richmond's monthly salary to $112.50.[15]

Despite the need for direct control of further beetle outbreaks in the yellow pine stands around Merritt during the early 1930s, the laboratory was confined almost entirely to research. Richmond conducted bark beetle studies at Aspen Grove during the summer months, devoting the autumn to surveys of damage inflicted to interior forests. Hopping's confident assertions of victory in the bark beetle campaign appear to have been misplaced, then. According to Richmond beetle populations subsided during the mid-1930s due to several factors, primary among them the exhaustion of mature pine stands. The laboratory enjoyed greater success, apparently, in combatting an infestation of the European larch sawfly around Fernie during this period. A 1933 inspection by Mathers discovered an outbreak of some seventy miles in extent, and a parasite obtained from the Dominion Parasite Laboratory at Belleville was released over the next two years. This early instance of biological control in B.C. forest entomology had a beneficial impact on sawfly populations, saving extensive larch stands from the defoliator.[16]

In 1934 J.J. De Gryse took over as Director of the Department of Agriculture's Division of Forest Insects from Swaine, who became the agency's Director of Research. De Gryse would go on to initiate many important organizational developments, beginning with the nation-wide Forest Insect Survey. Swaine had taken a step in this direction in 1931 with the establishment of the Forest Insect Intelligence Service. In addition to publishing a number of circulars dealing with Canada's principal forest insects, Swaine had these distributed to industry organizations and forest services along with a request that field men submit reports on outbreaks in their districts. But after an initial favourable response Intelligence Service activities waned under the impact of the Depression, leaving the program moribund.[17]

De Gryse's effort to revive the initiative began in December 1934, with an Entomological Branch conference at Ottawa. Industry and Dominion Forest Service attendance at sessions dealing with forest insect problems prompted discussions of the need for cooperation to gather information on the threat posed by the European spruce sawfly to spruce stands in eastern Canada. A committee organized under the auspices of the Canadian Society of Forest Engineers and headed by De Gryse rounded up support among heads of protection organizations, corporations, and wildlife departments in Ontario and Quebec, and developed procedures for the collection and submission of insect

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[15] R.H. Hopping "Annual Report, 1930," PFCL; Hector Allan Richmond, "A History of Forest Entomology in British Columbia, 1920-1984," Pt. I, *B.C. Forest History Newsletter* 9 (Nov. 1984), p. 5.

[16] R.H. Hopping, "Annual Report of the Vernon Forest Insect Laboratory, 1932," PFCL; R.H. Hopping, "Annual Report, 1933," PFCL; R.H. Hopping, "Annual Report of the Vernon Forest Insect Laboratory, 1934," PFCL; Richmond, *Forever Green*, pp. 102-3; George R. Hopping, "A Forest Insect Problem in British Columbia," *FC* 11 (Dec. 1935), pp. 258-61.

[17] Prebble, "Forest Entomology," p. 352; Wallace, "Forest Entomology," p. 121.

samples to the Division of Forest Insects. In 1936 about eight hundred cooperators participated, examining trees in their areas to determine the presence of the sawfly and other destructive pests. They were provided with collapsible boxes for mailing samples, instructions, report forms, relevant circulars, and asked to make monthly reports between June and September. The Ottawa laboratory received 512 samples in 1936, the first stage in fulfilling De Gryse's vision of a national forest insect intelligence system.[18]

The Forest Insect Survey expanded to the Maritimes and B.C. in 1937, with the Vernon laboratory serving as headquarters for activities in the west. The B.C. Forest Branch and National Parks Branch participated the first year, field men making collections by placing a canvas ground sheet beneath a tree and "shaking it vigorously or hitting it with an axe" to dislodge larvae. Although the Vernon laboratory received no sawfly specimens in 1937, three hemlock looper outbreaks were brought to light in this fashion. The number of cooperators increased steadily over the following years, along with the volume of material sent in for analysis and rearing. De Gryse's establishment of a corps of trained forest insect rangers added to the survey's effectiveness. By 1947 seven rangers operated in B.C., divided evenly between the coast and interior districts. Surveying of the coastal forests reached a new level of efficiency that year with the commissioning of a sixty-foot boat, the *J.M. Swaine*.[19]

After supervising the survey through its initial stage, Ralph Hopping retired in December, 1938. He died at his Vernon home only two years later, acknowledged as one of the foremost forest entomologists in North America. His son George took over as director at the Vernon laboratory, now part of the Entomology Division of the Department of Agriculture's Science Service after a 1937 reorganization. The younger Hopping's leadership coincided with the establishment of a summer field station and insectary at Trinity Valley. Plans were also in the works that resulted in a similar facility for coastal studies at the B.C. Forest Branch's Cowichan Lake Experiment Station. By this time the most pressing problem facing the Vernon staff involved a massive beetle outbreak in Kootenay National Park. Infestation of the park's lodgepole pine stands began in the early 1930s, and covered seventy-two square miles by 1937. Ralph Hopping had recommended control measures to contain the outbreak, a proposal that fell victim to Depression-era budget constraints.[20]

A major restructuring of the Science Service's western forest entomology organization in 1940 brought a new laboratory at Victoria into existence. M.L. Prebble was transferred from Fredericton to head that facility, which took over the equipment from the UBC sub-

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[18] Canada, *Annual Reports of the Forest Insect Survey, 1936-1937-1938* (Ottawa: King's Printer, 1939), pp. 1-2; J.J. De Gryse, "Cooperation in Forest Insect Studies Relating to Conservation," *Journal of Forestry* 36 (1938), pp. 983-86.

[19] Canada, *Annual Reports of the Forest Insect Survey, 1936-1937-1938*, pp. 26-33; R.H. Hopping, "Annual Report of the Vernon Forest Insect Laboratory for the Fiscal Year Ending March 31, 1938," p. 2; Canada, *Annual Report of the Forest Insect Survey, 1947* (Ottawa: King's Printer, 1947), p. 91.

[20] R.H. Hopping, "Annual Report of the Vernon Forest Insect Laboratory for the Fiscal Year Ending March 31, 1937," PFCL; R.H. Hopping, "Annual Report of the Vernon Forest Insect Laboratory for the Fiscal Year Ending March 31, 1938," PFCL; "Ralph Hopping (1868-1941)," *Proceedings of the Entomological Society of British Columbia* 38 (1942), pp. 3-4.

unit. Kenneth Graham moved west from Vernon, while William Mathers returned to Vernon from the now defunct Vancouver branch. The new Victoria research centre took responsibility for forest and shade tree insect problems in the coastal area. The shuffle confined Vernon's jurisdiction to B.C. forests east of the Cascade range and all of Alberta with the exception of the province's southeast corner, to be administered from the Science Service's laboratory at Indian Head, Saskatchewan.[21]

Canada's entry into World War II forced funding restrictions at Vernon, where the insect survey and research on the larch sawfly dominated activities. George Hopping discontinued work on some of the less pressing research projects, but by 1941 the bark beetle problem had become acute on the Kootenay and Banff National Parks. By the end of that year an estimated 400 million board feet of lodgepole pine had been destroyed on the former, and Banff had become the scene of a large, unrelated outbreak in 1940. Hopping and Mathers attributed the mountain pine beetle infestations to several years of below-average precipitation that diminished the vigour of the mature lodgepole pine stands covering extensive areas in both parks.[22]

Since the situation on Kootenay National Park was beyond repair, officials decided to concentrate control efforts at Banff, where the outbreak was in its early stages. Fortunately, given the severity of wartime labour shortages, the Parks Branch succeeded in securing a supply of Alternative Service Workers for the project. Three forty-man camps for the conscientious objectors were established during the fall and winter of 1941, the crews working until late spring. Three or four men from each crew served as a cruising party, the remainder cutting, decking, and burning the infested trees. They covered 5,725 acres during the 1941-42 season, treating 9,192 trees. Crews resumed after the 1942 fire season, completing control work in the Bow valley. This effort, in conjunction with low temperatures in January 1943 that killed a high percentage of broods above the snow line, left only a small area to work the following season. Hopping and Mathers praised the conscientious objectors who, with few exceptions, "proved to be reliable workers rapidly acquiring proficiency in control procedure." Thanks to prompt action and the availablility of the Alternative Service Workers, the Banff project stands out as a rare success in the direct control of a bark beetle infestation, saving the park from a "major catastrophe."[23]

Federal government support of forest entomology increased in the immediate postwar period as wood products assumed greater importance in the economic boom. In late 1945 Reconstruction Minister C.D. Howe announced the creation of a Forest Insects Control Board, comprised of federal, provincial, and industry representatives, to coordinate entomological research and control measures across the country. In B.C., growing recognition of the threat insects posed to commercial forestlands was reflected in the establishment of an industry-endowed chair in forest entomology at UBC. George Hopping received a leave-of-absence from Vernon to initiate the course of instruction

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[21] M.L. Preeble, "Forest Insect Investigations, Victoria Unit, Report for 1940," PFCL; G. Hopping, "Annual Report, Vernon Forest Insect Laboratory, 1940," PFCL; Hector Allan Richmond, "A History of Forest Entomology in British Columbia, 1920-1984," Pt. II, *B.C. Forest History Newsletter* 10 (Mar. 1985), p. 3.

[22] G. Hopping, "Annual Report of the Vernon Forest Insect Laboratory, 1940," PFCL; G. Hopping, "Annual Report of the Vernon Forest Insect Laboratory, 1941," PFCL.

[23] George R. Hopping and W.G. Mathers "Observations on Outbreaks and Control of the Mountain Pine Beetle in the Lodgepole Pine Stands of Western Canada," *FC* 11 (June 1945), pp. 98-108; G. Hopping, "Annual Report, Vernon Forest Insect Laboratory, 1942," PFCL; G. Hopping, "Annual Report of the Vernon Forest Insect Laboratory, 1943," PFCL.

during the 1947-48 academic year. Industry figures also met with De Gryse in 1948 to discuss the development of insect control strategies on the west coast. Prebble left Victoria to take charge of a new research centre at Sault Ste. Marie that same year, bringing Richmond to Victoria as his replacement. That laboratory became the headquarters for forest entomological work in B.C. in 1948, relegating Vernon to sub-laboratory status.[24]

The Vernon laboratory, with a staff of fifteen during the summer months, remained responsible for the forest insect survey in the interior. By 1950 there were eleven forest insect rangers in the interior and nine on the coast. The establishment of permanent sample plots around the province made for more systematic collections, and the introduction of a punch card system of data entry in 1952 facilitated rapid analysis at the laboratories. By this time 171 permanent sample plots had been established in the vast interior of B.C. Insects sent to Vernon were sorted, and immature forms reared at the Trinity Valley field station near Lumby for the determination of life histories and host-parasite relationships.[25]

Airborne chemical attack on defoliators involving the application of D.D.T. captured the enthusiasm of forest entomologists during the postwar decades. Scientists at the Victoria laboratory studied an alarming incidence of attacks by the black-headed budworm and hemlock looper in coastal forests during the 1940s. The Division of Entomology cooperated with the B.C. Forest Service and industry in the first aerial spraying with D.D.T. on 12,000 acres in the Nitinat valley in 1946 to control a looper infestation. No effort to examine the impact on aquatic life accompanied this project, but the conflict between D.D.T. spraying in defence of timber values and the consequences for the fisheries resource would come to play a major part in limiting use of the insecticide. Vernon entomologists participated in the first aerial spraying of D.D.T. in the interior in 1948, when a false hemlock looper infestation threatened the Christmas tree crop in the Windermere valley.[26]

The most extensive application of D.D.T. in B.C. occurred in 1957 in response to a black-headed budworm infestation on northern Vancouver Island. By 1956 the outbreak covered some 3,000 square miles. Representatives of firms with holdings in the area collaborated with Forest Service and Forest Biology Division officials in developing a control project designed to save timber valued at $300 million. An experimental spraying that summer proved effective, and plans went ahead to spray 156,000 acres the following

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[24] Johnstone, *Timber and Trauma*, p. 138; "Destruction of Canadian Timber By Forest Insects Attains "National Disaster" Proportions, Says Minister Howe," *British Columbia Lumberman* 29 (Dec. 1945), p. 30 [hereafter *BCL*]; Richmond, *Forever Green*, p. 131; "Forest Entomology Vital Study, Says Expert," *BCL* 31 (Dec. 1947), p. 114; "Forest Entomology," *FC* 24 (Dec. 1948), pp. 293-94.

[25] "Forest Insect Survey in Interior B.C. Extended," *BCL* 34 (Feb. 1950), p. 103; B.C., *Report of the Forest Service, 1948* (Victoria: King's Printer, 1949), p. 55; B.C. *Report of the Forest Service, 1949* (King's Printer, 1950), p. 72; H.A. Richmond, "Forest Insect Surveys," *Proceedings of the Entomological Society of British Columbia* (1953), pp. 28-30; George Hopping, "Forest Insect Laboratory at Vernon Responsible for Control in Huge Area," *BCL* 31 (July 1947), pp. 112, 114.

[26] M.L. Prebble and K. Graham, "The Current Outbreak of Defoliating Insects in Coast Hemlock Forests of British Columbia,"*BCL* 29 (Feb. 1945), pp. 25-27, 42-48; "Forest Insect Conditions and Research in 1946," *FC* 23 (Mar. 1946), p. 89; H.A. Richmond, "Forest Insect Problems in British Columbia," *BCL* 32 (May 1948), p. 76; "Helicopter Fighting False Hemlock Looper Attack," *BCL* 32 (July 1948), p. 141.

summer with costs shared equally by the B.C. Loggers Association, federal, and provincial governments.[27]

By this time some evidence of fish mortality from D.D.T. spraying in New Brunswick had been accumulated, and officials of the B.C. Game Commission and federal Department of Fisheries participated in the planning process. Industry's Pest Control Committee turned down requests to have some fish- producing areas eliminated from the project. The fisheries biologists were also denied when they asked that the D.D.T. dosage be cut by half, to one-half pound per acre. Forest Biology Division representatives ruled that the reduced dosage might not be effective, in rejecting the proposal. The Committee did agree, however, to make some adjustments in flight patterns to minimize damage to fish populations. The project was declared a success from an entomological standpoint, although Richmond observes that budworm populations declined simultaneously on untreated areas in the following years. More significantly, the project resulted in considerable mortality in cohoe salmon populations. One industrial forester involved warned that if D.D.T. spraying was to be continued, it must be on the basis of non-lethal concentrations or public opinion would forbid its use altogether.[28]

The 1957 disaster influenced procedures followed in 1960 on Moresby Island, when a black-headed budworm infestation promped another D.D.T. control program. This time forestry officials agreed to reduce the dosage to one-quarter pound per acre, resulting in negligible salmon mortality. But studies carried out in conjunction with the project indicated that even this concentration was lethal to salmon fry, supporting other research that prompted a general outcry against use of the insecticide in North America. Awakening to the need for acceptable alternatives, the Forest Biology Division and B.C. Loggers Association initiated tests of a bacterial insecticide on the Queen Charlotte Islands in 1960.[29]

Bark beetles remained the major problem confronting entomologists in the interior during the early 1950s, although increasing spruce budworm populations also caused concern. Large outbreaks of the mountain pine beetle developed in the Columbia valley, and the Douglas fir bark beetle caused significant losses in the Quesnel region. Scientists studied the efficacy of ground-spraying insecticides such as D.D.T. in an effort to develop a faster and less costly method of controlling pine beetle epidemics, but such operations were themselves considered too expensive for widespread use in the province.[30]

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[27] B.C. *Report of the Forest Service for 1956* (Victoria: Queen's Printer, 1957), p. 79; B.C. *Report of the Forest Service for 1957* (Victoria: Queen's Printer, 1958, p. 70; G.S. Brown, A.P. Randall, R.R. Le Jeune, and G.T. Silver, "Black-Headed Budworm Spraying Experiments on Vancouver Island, British Columbia," *FC* 34 (Sept. 1958), pp. 299-306.

[28] E.G. Marples, "Significance of Fish Mortality in Forest Spraying Operations," *Proceedings of the Western Forestry and Conservation Association* (1957), pp. 44-55; R.A. Coulter and E.H. Vernon, "Effects of Black-Headed Budworm Control on Salmon and Trout in British Columbia," *Canadian Fish Culturalist* 24 (1959), pp. 23-40.

[29] I.S. Todd and K.J. Jackson, "The Effects on Salmon of a Program of Forest Insect Control with D.D.T. on Northern Moresby Island," *Canadian Fish Culturalist* 30 (Dec. 1961), pp. 15-27; Hector A. Richmond, "A New Look at Aerial Spraying in Forest Resource Protection," *Proceedings of the Western Forestry and Conservation Association* (1960), pp. 30-32.

[30] B.C., *Report of the Forest Service for 1951* (Victoria: King's Printer, 1952), p. 85.

Jack Walters of the Victoria Biological Laboratory and UBC forest entomologist Ken Graham worked on the Douglas fir beetle problem, investigating the factors contributing to recent outbreaks. One rewarding study at Douglas Lake involved the felling of "trap trees" and release of beetles to determine their flight patterns and the types of trees most vulnerable to attack. By the late 1950s it had been demonstrated that the presence of felled logs in a stand induced attacks on surrounding timber, insight that informed a silvicultural control project involving Western Plywoods, the Forest Service, and Forest Biology Division. This early effort to merge forestry and entomological principles into forest management planning sought to draw Douglas fir beetles into pre-selected areas with attractive logs, then remove these along with nearby infested trees in an attempt to lower populations.[31]

Vernon's status as a centre of entomological research declined during the 1950s, as the Victoria laboratory became the hub of federal government biological science. By 1955, when D.A. Ross replaced William Mathers as officer-in-charge at Vernon, the staff numbered twenty-one permanent employees concerned primarily with carrying out the insect and disease survey in the interior. Five years later the Forest Biology Division became the Forest Entomology and Pathology Branch of the new Canada Department of Forestry under director M.L. Prebble, and by 1963 the Vernon staff had dwindled to fifteen. Opening of the Department of Forestry's new $2.5 million forest research laboratory at Victoria in 1965 further undermined the Vernon station's prospects.[32]

During the same period forest insect problems in the interior became, if anything even more serious. During the early 1960s the central interior experienced the most serious spruce bark beetle outbreak ever recorded, and damage from the Douglas fir and mountain pine beetles increased in the southeastern part of the province. Between 1961 and 1965 the spruce beetle destroyed over 500 million cubic feet of timber in central B.C., an outbreak presumed to be caused by abundant slash, warm summers, and mild winters. Research on these infestations was carried out from Victoria, while the B.C. Forest Service supervised large-scale salvage operations in damaged timber.[33]

The end for the Vernon sub-laboratory came in 1970, when an economizing federal government closed the facility. Most of the staff members transferred to Victoria laboratory, now the centre of federal forestry science and base of the insect and disease survey for the entire province. Federal authorities insisted that the closure would not impair entomological work in any way, claiming improved efficiency for its entire B.C. operation. Nevertheless, Ottawa's decision to terminate activity at Vernon has been questioned frequently. Indeed, expansion of the pulp and paper industry in the central and southern interior since the 1960s has given these forests greater economic importance than the coastal stands that provided the raw material for the province's early lumber industry.

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[31] K. Graham, "The Bark-Beetle Problem in Douglas Fir of the Interior," *BCL* 36 (July 1952), p. 42; "Bark Beetle Spreads," *BCL* 36 (Aug. 1952), p. 100; H.A. Richmond, "Douglas Fir Bark Beetle in B.C.," *BCL* 37 (May 1953), pp. 43, 90-92; B.C., *Report of the Forest Service For 1958* (Victoria: Queen's Printer, 1959), p. 68.

[32] Miles Overend, "Intelligence Service Battles Bugs,"*BCL* 47 (May 1963), p. 38; Dr. D.A. Ross, "Forest Entomologist, Retires," *Truck Logger* (Jan. 1967), p. 23.

[33] Canada, *Department of Forestry Annual Report, 1963-1964* (Ottawa: Queen's Printer, 1964), pp. 33-35; "Spruce Beetle Damage Studied," *BCL* 51 (Jan. 1967), p. 66; Canada, *Department of Forestry Annual Report, 1964-1965* (Ottawa: Queen's Printer, 1965), pp. 33-35.

Moreover, bark beetles remain a significant obstacle to rational forest management in these areas. In recent years Ralph Hopping's old enemy the mountain pine beetle has re-emerged with great intensity in the Okanagan and Cariboo regions, thanks to favourable climatic conditions and the advance in postwar fire protection techniques that brought extensive lodgepole pine stands to maturity. Hopping would also be familiar with government's modern response to these epidemics, if not the precise techniques. Although entomologists now rely on sophisticated computer mapping systems to trace the progress of epidemics, salvage harvesting is the primary control technique. Much damaged timber now finds its way to the sawmill or pulp mill, and the use of trap trees and pheromones show promise in slowing the spread of outbreaks. But the magnitude of recent spruce and pine beetle infestations leave forestry officials no alternative but to concentrate logging operations on the most severely affected areas, an approach which in principle differs little from Hopping's early twentieth century control projects.[34]

Journal Abbreviations in footnotes

BCL *British Columbia Lumberman*
CFJ *Canadian Forestry Journal*
FC *Forestry Chronicle*
LSJ *Logging and Sawmilling Journal*
PCL *Pacific Coast Lumberman*
PFCL Pacific Forestry Centre Library
WL *Western Lumberman*

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[34] "Dr. D.A. Ross," pp. 36-37; Hector Allan Richmond, "A History of Forest Entomology in British Columbia, 1920-1954," Pt. II, *B.C. Forest History Newsletter* (Mar. 1985), p. 3; "Northwood Confronts Beetle," *Logging and Sawmilling Journal* 14 (Nov. 1983), pp. 16-18 [hereafter *LSJ*]; L. Ward Johnson, "Chasing the Pine Beetle," *LSJ* 21 (July 1990), pp. 14-16; "Beetle Attack Prompts AAC Increases," *LSJ* 23 (Oct. 1992), p. 7; Jim Stirling, "Going to War," *LSJ* 31 (Feb. 2000), pp. 5-7.