

# Green Shoots: Aerial Insecticide Spraying and the Growth of Environmental Consciousness in New Brunswick, 1952-1973

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*C'est principalement l'opposition grandissante au programme provincial controversé d'arrosage contre la tordeuse des bourgeons de l'épinette, dans les années 1950 et 1960, qui donna l'impulsion au mouvement écologiste moderne au Nouveau-Brunswick. Si à l'origine cette « bataille de la tordeuse » résultait des inquiétudes des associations de chasse et pêche concernant les effets de l'insecticide DDT sur le saumon de l'Atlantique, les recherches menées par la communauté scientifique et technique de la province encouragèrent une opposition accrue à l'arrosage – opposition qui contestait la position traditionnelle du gouvernement provincial en matière de gestion des ressources naturelles. Pour contrer les allégations de dommages à grande échelle causés à l'environnement, les représentants de l'industrie forestière et du gouvernement firent valoir que le programme d'arrosage était nécessaire pour sauver les forêts et les entreprises forestières de la province.*

*Modern environmentalism in New Brunswick was triggered primarily by the growth of opposition to New Brunswick's controversial spruce budworm spraying program in the 1950s and 1960s. While this "Battle of the Budworm" initially arose from concern within sportsmen's organizations over the effects of the DDT spray on Atlantic salmon, research by the province's scientific and technical community fostered greater opposition to the spraying – opposition that challenged the provincial government's traditional stance on resource management. Forest industry and provincial government officials countered assertions of massive ecological damage by arguing that the spraying program was necessary to save the province's forests and forest industries.*

Before it takes the air in greener shoots  
A seed is nurtured by surrounding soil  
And patterned by whatever streams can coil  
Where worms and borers worked their slow pursuits.<sup>1</sup>

ON 20 OCTOBER 1970, RICHARD HATFIELD, leader of the Progressive Conservative Party of New Brunswick, wrote to Kenneth Langmaid, a soil scientist at the University of New Brunswick (UNB) in Fredericton and founding president of the Conservation Council of New Brunswick (CCNB). Hatfield assured Langmaid that if

<sup>1</sup> Fred Cogswell, excerpt from "New Brunswick," in Cogswell, *The Stunted Strong* (Fredericton, NB: Fiddlehead Poetry Books, 1954), 16. Thanks to David Frank for this reference. On the life and work

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the Progressive Conservatives won that month's provincial election, they would work to "preserve New Brunswick's natural environment for the benefit of the people and the economy" and "implement a comprehensive pollution control program." Hatfield was acknowledging a letter that Langmaid had sent earlier that month to the leaders of the province's three main political parties, which asked each of them to take "a clear stand" on certain environmental issues "so that voters may choose wisely."<sup>2</sup> Six days after he sent his letter to Langmaid, New Brunswickers elected Hatfield's Progressive Conservatives to form the next provincial government. During his first term as premier (1970-74), Hatfield's government passed the most comprehensive environmental legislation ever enacted in New Brunswick – at least up until that point – and created an environmental division within the Department of Fisheries; a separate Department of the Environment was created in 1975. These political actions established the "environment" as a legitimate political issue within the provincial bureaucracy. In large part the Hatfield government was responding to lobbying from the CCNB and other environmental organizations, which were themselves products of a growing environmental consciousness in New Brunswick in the late 1960s and early 1970s.<sup>3</sup>

Modern environmentalism in New Brunswick was triggered primarily by the so-called "Battle of the Budworm" in the early 1950s, one of the largest and longest sustained aerial insecticide spraying programs in the world.<sup>4</sup> The first groups to protest the spray were sportsmen's organizations, and they were principally interested in the conservation of their most prized game fish – the Atlantic salmon. With the infusion of ecological science into the spraying debates, New Brunswickers' unease about the spraying program expanded in the late 1950s and early 1960s to include concerns about the effects of the spray on general forest and water ecologies. Those opposed to the spraying program, however, invariably encountered the economic reality of industrial forestry in New Brunswick.<sup>5</sup> Due to the centrality of the forestry

of Fred Cogswell, see *The New Brunswick Literary Encyclopedia*, "Frederick William Cogswell," <http://w3.stu.ca/stu/sites/nble/c.html>. An earlier version of this article was presented at the Canadian Historical Association Annual Meeting (Montreal, 30 May-1 June 2010). Thank you to the participants at the conference for their comments. The author would also like to thank all of the anonymous readers, plus Bill Parenteau, David Frank, and Jason Hall for their helpful suggestions and editing. For access to their records and their useful insights, a special thank you to David Coon and everyone at the Conservation Council of New Brunswick as well as the Social Sciences and Humanities Research Council of Canada, which supported this research through a Canada Graduate Scholarship.

- 2 Richard Hatfield to K.K. Langmaid, 20 October 1970 and Langmaid to Hatfield, 5 October 1970, Conservation Council of New Brunswick Records (CCNB Records), MC1107, file MS1-1-1, Provincial Archives of New Brunswick (PANB), Fredericton.
- 3 Two other organizations were the Moncton chapter of Pollution Probe, formed in 1970, and the Maritime Energy Coalition (MEC), formed in 1974. Pollution Probe – Moncton was a general environmental group, strongly anti-pollution, and the MEC was an anti-nuclear group.
- 4 It should be noted that the term "insecticide" is used for substances that are specifically designed for the prevention or destruction of insects, while "pesticide" is the term for a whole range of substances used against any "pest" (including insects).
- 5 The province's forest industries had an estimated value of \$175 million at the end of the 1950s, three-quarters of which was attributed to the pulp and paper industry; the number of mills within this industry, from the end of the Second World War to the early 1970s, increased from six to 11 while production increased considerably in five of the original six mills. See New Brunswick, *Annual*

sector in the New Brunswick economy, industry and provincial government officials countered assertions of massive ecological damage by arguing that the spray option was necessary to save the province's forests and forest industries from the budworm. Despite these pro-spray arguments, though, opposition to the spraying gradually increased within the province in conjunction with the growing ecological and environmental awareness of many New Brunswickers. As in other regions, this environmental consciousness in New Brunswick emerged in large part because of the work of members of the province's scientific and technical community – particularly the scientists associated with the Fisheries Research Board of Canada marine research station in St. Andrews as well as some scientists affiliated with UNB. The resultant growth in environmental consciousness was an important factor in the establishment of the CCNB in October 1969. The CCNB was New Brunswick's first environmental organization and one of the first such organizations in Canada; environmental groups such as the CCNB challenged the provincial government's traditional stance on resource management in New Brunswick as early as 1970.

Modern environmentalism in North America emerged in the years after the Second World War through a confluence of a number of factors. First, the ideological precedents of both conservation and preservation paved the way for the development of environmentalism during the post-war period. Both ideologies matured as intellectual movements in the late 19th and early 20th centuries, but they differed philosophically in terms of how humans should interact with nature. Conservationists had a utilitarian view of nature, and they advocated the "wise use" of natural resources to help ensure their continued sustainable use by future generations. Preservationists, in contrast, celebrated "wilderness," or natural areas largely unaffected by human activity, and they believed that individuals had to personally connect with such wild areas on a regular basis in order to maintain spiritual and mental well-being. The lines of distinction between the two ideologies were often blurry, and conservationists and preservationists frequently collaborated on shared political agendas, such as the establishment of national parks systems. The second factor contributing to the rise of modern environmentalism was a series of environmental issues at the local, national, and global levels that received increasing public attention after the Second World War. Many of the specific issues were the result of wartime technologies that became Cold War-era dangers, such as radioactive fallout from atomic weapons and chemical poisoning, or they were long-term problems that were exacerbated by North

*Report of the Department of Lands and Mines* (Fredericton, NB: Government of New Brunswick, 1958), 9, and R.E. Tweeddale (Executive Director), *Report of the Forest Resources Study* (Fredericton, NB: Government of New Brunswick, 1974), 25. In terms of employment in the forestry sector, there were approximately 10,500 woods workers in New Brunswick in 1960. That number represented a significant drop from the more than 14,000 woods workers in 1951, and the 1960 number would be almost halved by the mid-1970s due to the mechanization and professionalization of woods work. There were also more than 8,800 New Brunswickers employed in the manufacturing phase of the major wood-using industries by the early 1970s. See New Brunswick Department of Labour, *Camp Conditions in the New Brunswick Logging Industry* (Fredericton, NB: Government of New Brunswick, 1961), p. 23, Deputy Minister of Health Records, RS136, file A-10-b1, PANB; Tweeddale, *Forest Resources Study*, 67; and Canada, *Ninth Census of Canada, 1951*, vol. 4 (Ottawa, ON: Dominion Bureau of Statistics, 1953), Table 4-3.

America's post-war industrial boom, such as deforestation and water pollution. By the 1960s, it became more difficult for North Americans to ignore the consequences of "modern" life on natural environs and human health, particularly in their own backyards. Finally, there was the influence of the post-war scientific and technical community, particularly due to the gradual emergence of ecology as a distinct scientific discipline from the 1950s to the 1970s. Ecological science quantified effectively the environmental impacts of human activity, provided a useful framework through which scientists and the general public could better understand post-war environmental changes, and often served as a "subversive science" by calling attention to the side effects of North America's post-war economic growth. These various factors coalesced by the 1960s and fostered the growth of environmental consciousness, which can be defined as an acute sense of awareness of humanity's interconnectedness with and impacts on natural environments.<sup>6</sup> Environmental consciousness, though, developed unevenly across North America, as different regions experienced the factors mentioned above at different times. It was the debates about the merits of the spruce budworm spraying program in the 1950s and 1960s that helped fuel the growth of environmental consciousness in New Brunswick.

The eastern spruce budworm (*Choristoneura fumiferana*) is an insect species native to eastern Canada and the northeastern United States. The budworm caterpillars, measuring about 2.5 centimetres at full length, hatch in the spring season and feed on the foliage of softwood tree species such as balsam fir and various types of spruce, which often leads to high rates of tree mortality during epidemics.<sup>7</sup> Historically, budworm epidemics occurred every 40 to 70 years in eastern Canada, although the occurrence of such outbreaks was much more frequent in the 20th century.<sup>8</sup> This was due mainly to human-made circumstances. In a series of transitions

6 See, for example, Thomas R. Dunlap, *Nature and the English Diaspora: Environment and History in the United States, Canada, Australia, and New Zealand* (Cambridge, UK: Cambridge University Press, 1999); Samuel P. Hays, *A History of Environmental Politics since 1945* (Pittsburgh: University of Pittsburgh Press, 2000); Samuel P. Hays and Barbara D. Hays, *Beauty, Health and Permanence: Environmental Politics in the United States, 1955-1985* (Cambridge, UK: Cambridge University Press, 1987); Ted Steinberg, *Down to Earth: Nature's Role in American History*, 2nd ed. (Oxford: Oxford University Press, 2009); and Donald Worster, *Nature's Economy: A History of Ecological Ideas*, 2nd ed. (Cambridge, UK: Cambridge University Press, 1994). On the evolution of modern environmentalism in Canada, see Jane E. Barr, "The Origins and Emergence of Quebec's Environmental Movement: 1970-1985" (M.A. thesis, McGill University, 1995); Arn Keeling, "Sink or Swim: Water Pollution and Environmental Politics in Vancouver, 1889-1975," *BC Studies* 142/143 (Summer/Autumn 2004): 69-101; Ryan O'Connor, "Toronto the Green: Pollution Probe and the Rise of the Canadian Environmental Movement" (PhD diss., University of Western Ontario, 2010); Jennifer G. Read, "'Let us heed the voice of youth': Laundry Detergents, Phosphates and the Emergence of the Environmental Movement in Ontario," *Journal of the Canadian Historical Association* VII (1996): 103-29; John Sandlos, "Where the Scientists Roam: Ecology, Management and Bison in Northern Canada," *Journal of Canadian Studies* XXXVII, no. 2 (Summer 2002): 93-129; and Frank Zelko, "Making Greenpeace: The Development of Direct Action Environmentalism in British Columbia," *BC Studies* 142/143 (Summer/Autumn 2004): 197-239.

7 Epidemics occur when optimal conditions allow the budworms to reproduce in large numbers. Generally, budworm outbreaks collapse naturally after several years once the food supply within a certain area has been exhausted and the budworms starve to death.

8 Gordon Baskerville (Task-Force Leader), *Report of the Task-Force for Evaluation of Budworm Control Alternatives* (Fredericton, NB: Government of New Brunswick, 1976), 11-20; C.A. Miller,

starting in the late 18th century, New Brunswick's forest industries shifted from the production of ship masts to square timber, then to long lumber, and finally to pulp and paper in the 1920s.<sup>9</sup> Each transition resulted from a variety of factors: changing markets, state economic policy, new entrepreneurship, and particularly environmental degradation. Successive industries simply cut the biggest and the best trees they needed to supply a particular market, a process commonly known as "high-grading," which altered the make-up of the province's forests. By the early 20th century, the majority of New Brunswick's forests consisted of balsam fir and certain species of spruce, which are the kinds of trees favoured by both the pulp and paper industry and the budworm.<sup>10</sup> In addition, only 28.0 to 29.5 per cent of wood consumed in New Brunswick's pulp mills came from the province's Crown lands from the 1930s to the mid-1950s.<sup>11</sup> This created huge areas of "mature" trees in the northern half of the province, a precondition for a spruce budworm epidemic. After an epidemic in the late 1940s, the pulp and paper industry and the budworm consequently competed on a large scale for the same forest resources.

The "Battle of the Budworm" was a massive insecticide spraying program initiated by the pulp and paper companies and the New Brunswick government in the early 1950s.<sup>12</sup> The Canadian Pulp and Paper Association initially approached the federal and provincial governments in the mid-1940s with concerns about increased budworm activity in eastern Canada. In response, a federal-provincial experimental

"Spruce Budworm: How it Lives and What it Does," *The Forestry Chronicle* LI, no. 4 (August 1975): 136-8; Alan Miller and Paul Rusnock, "The rise and fall of the silvicultural hypothesis in spruce budworm (*Choristoneura fumiferana*) management in eastern Canada," *Forest Ecology and Management* LXI, no. 1-2 (October 1993): 171-89.

- 9 Burton Glendenning, "The Burchill Lumbering Firm, 1850-1908: An Example of Nineteenth Century Entrepreneurship" (MA thesis, Concordia University, 1978); A.R.M. Lower, *Great Britain's Woodyard: British America and the Timber Trade, 1763-1867* (Montreal: McGill-Queen's University Press, 1973); William M. Parenteau, "Forest and Society in New Brunswick: The Political Economy of the Forest Industries, 1918-1939" (PhD diss., University of New Brunswick, 1994); Graeme Wynn, *Timber Colony: A Historical Geography of Early Nineteenth Century New Brunswick* (Toronto: University of Toronto Press, 1981).
- 10 Asaf Rashid, "Compromising the Environment? The Spruce Budworm, Aerial Insecticide Spraying, and the Pulp and Paper Industry in New Brunswick," *FES* [York University's Faculty of Environmental Studies] *Outstanding Graduate Student Paper Series* XIII, no. 3 (June 2003): 4-5, <http://www.yorku.ca/fes/research/students/outstanding>. There were some early but very limited experimental reforestation efforts by the federal government, the province, and some of the companies (the 1920s), but it was not until the late 1950s – when the Irving interests started planting trees – that it became widespread; the Great Depression (and the Second World War) delayed this development. The province did not have its own tree nursery until the early 1960s. The federal Acadia experimental station did provide some trees in the 1940s and 1950s, but that was still a minor program.
- 11 Parenteau, "Forest and Society in New Brunswick," 260-88. The figures for 1940 to 1955 were calculated from New Brunswick, *Annual Report of the Department of Lands and Mines* (Fredericton, NB: Government of New Brunswick, 1940-55). The rest of the wood consumed in the province's pulp mills from 1940 to 1955 came from private (corporate) lands (25 per cent) and "other sources" (46 per cent) – from outside the province (Quebec) and from farmers' woodlots. Also, about half of New Brunswick's total land area is Crown land.
- 12 "Battle of the Budworm" was a slogan used by International Paper to describe the spruce budworm spraying program in promotional pamphlets in the 1950s. See New Brunswick International Paper (NBIP), *The Battle of the Budworm: An Experiment in Forest Management* (1952).

area to study methods to manage budworm outbreaks was established in 1945 on the Green River watershed near Edmundston. Dr. Reginald E. Balch, a federal forest entomologist in charge of the Dominion Entomological Laboratory at UNB, directed the project.<sup>13</sup> Balch was also one of the first people to suggest the possibility of using chemical insecticides sprayed from airplanes to control the budworm.<sup>14</sup> Entomologists and forest scientists proceeded to test the effectiveness of different forms of forest management against the spruce budworm at the Green River project in the late 1940s. The Green River project was an attempt to discover a forest composition that was not “ideal” for budworm propagation (“natural” budworm control), yet which would allow the pulp and paper industry to utilize the forests unabated. The project, though, never had the opportunity to succeed.<sup>15</sup> In the summer of 1951 the budworm epidemic worsened in the Upsalquitch River watershed in northern New Brunswick, which was part of Crown lands leased by the New Brunswick International Paper Company (NBIP) (based in Dalhousie). With a sense of emergency, NBIP, under the direction of its president Vernon E. Johnson, disregarded the idea of using forest management to control the budworm as unproven and too long-term and cooperated with the New Brunswick government to utilize much of what had been learned about insecticidal spraying in earlier real-world trials of aerial spraying in Ontario and the states of Oregon and Washington. NBIP built an airstrip and 16 buildings in the woods of northern New Brunswick in late 1951 and early 1952 – an area the company named “Budworm City” – and hired 17 American pilots and their Stearman biplanes and four other planes from other companies in Canada to spray the forests in the spring of 1952.<sup>16</sup> The insecticide they used against the budworm was dichlorodiphenyl-trichloroethane, more commonly known as DDT. Used effectively to control insect-

- 13 Minutes of a meeting of the Spruce Budworm Committee, 21 September 1944, file 12-1a, as well as R.E. Balch, *Summary Account of Green River Project* (May 1946), Records of the Deputy Minister of Natural Resources (DMNR), RS106, file 12-1c, PANB; F.C. Hirtle, “Studies on the Bionomics and Natural Control of the Spruce Budworm in the Green River Watershed, New Brunswick” (MScF thesis, University of New Brunswick, 1949), 1-3.
- 14 R.E. Balch, *The Spruce Budworm and Forest Management in the Maritime Provinces* (Ottawa, ON: Department of Agriculture, Division of Entomology, 1946), 2.
- 15 Green River Project Work Committee, *The Green River Project for the Study of Forest Management in Relation to Spruce Budworm Control* (1948), DMNR, RS106, file 30-11h, 2 of 2, PANB; H.D. Henney, “The Green River Project,” *The Atlantic Advocate* LIII, no. 8 (April 1963): 47-51. For several decades after the Green River project, proponents and opponents of the spraying program debated the merits of forest management versus chemical spraying as the best possible means to control the budworm. They were engaged in what Stephen Bocking has referred to as the “politics of science” – opposing sides of a debate use scientific knowledge to reinforce their arguments, all the while claiming that the other side’s scientific “facts” are inaccurate. See Stephen Bocking, *Nature’s Experts: Science, Politics, and the Environment* (New Brunswick, NJ: Rutgers University Press, 2004), especially chap. 2. On the debate over the most effective method to control the budworm (forest management versus the spray option), see Miller and Rusnock, “The rise and fall of the silvicultural hypothesis,” as well as Rashid, “Compromising the Environment?” 19-29.
- 16 NBIP, untitled manuscript (circa 1960), pp. 1-19, DMNR, RS106, file 22-4p1, PANB. This document is an unfinished and unpublished manuscript of a book that NBIP was going to publish in the early 1960s to counter claims that the spruce budworm spraying program was executed haphazardly. Furthermore, the “spray season” was planned to coincide with the budworm’s life cycle. Budworm caterpillars hatch in mid-spring, so planes would spray insecticide for a couple of weeks in June to kill the budworms before they turned into moths.

borne diseases such as malaria and typhus during the Second World War, this “miraculous” insecticide was marketed commercially for agricultural and home use in the post-war period.<sup>17</sup> The sprayers applied a mixture of one pound of DDT per gallon of oil-water solution to every acre of the approximately 81,000 hectares they covered that spring.<sup>18</sup> Federal entomologists reported that the budworm “kill rate” was above 99 per cent in areas where they had set up sample plots.<sup>19</sup> After the so-called success of NBIP’s 1952 anti-budworm operations, other pulp and paper companies also wanted to spray the Crown lands under their licence.<sup>20</sup> The provincial government and four pulp and paper companies formed a public-private company called Forest Protection Limited (FPL) to spray the vast expanses of public forests in the province’s northern half, and NBIP’s Vernon Johnson was named FPL’s president.<sup>21</sup> The budworm epidemic continued to get worse throughout the 1950s, so FPL built more airstrips, hired more pilots, and sprayed the DDT mixture over much of New Brunswick’s Crown lands for the rest of the decade. In the spring of 1957, FPL’s biggest spray season of the 1950s, more than 200 planes were involved in anti-budworm operations and more than 2,000,000 hectares were sprayed.<sup>22</sup> There was, though, a reduction in the percentage of DDT sprayed. FPL employees had discovered in 1953 that spraying one-half pound of DDT per gallon of oil-water solution per acre was as effective as using one pound of DDT per acre, so FPL used the one-half pound of DDT formula until the end of the 1950s.<sup>23</sup>

The first organized civic opposition to chemical spraying in post-war New Brunswick came from fish and wildlife conservationists. The conservationists were members of sportsmen’s fishing and hunting organizations, groups that had for decades

17 On the history of the development of DDT, see Edmund Russell, *War and Nature: Fighting Humans and Insects with Chemicals from World War I to Silent Spring* (New York: Cambridge University Press, 2001) as well as Thomas R. Dunlap, *DDT: Scientists, Citizens, and Public Policy* (Princeton, NJ: Princeton University Press, 1981).

18 One acre equals approximately 0.405 hectares.

19 NBIP, untitled manuscript, p. 17, DMNR, RS106, file 22-4p1, PANB; New Brunswick, *Annual Report of the Department of Lands and Mines* (Fredericton, NB: Government of New Brunswick, 1953), 102-3. DDT is largely insoluble in water, so the oil was added as a “wetting agent.” Once treated with oil, DDT could then be suspended in water for use as a spray.

20 It was a “so-called success” because although the spray killed almost all of the budworms it can be safely assumed that it also killed lots of non-target species in the same area.

21 NBIP, untitled manuscript, pp. 18-19, DMNR, RS106, file 22-4p1, PANB. The four pulp and paper companies involved in FPL were NBIP, Bathurst Power and Paper Company, Fraser Companies, and Irving Pulp and Paper Company. Funding for FPL was split equally between industry (the pulp and paper companies), the New Brunswick government, and the federal government. Out of FPL’s 100 shares, New Brunswick’s Department of Lands and Mines held 92 of them while the remaining eight shares were held by the four pulp and paper companies. The provincial government had a larger ownership share because the land to be sprayed was Crown land, although the pulp and paper companies had a majority of seats on the board of directors and were in charge of FPL’s day-to-day operations as they were perceived to have more direct knowledge of forestry matters.

22 NBIP, untitled manuscript, pp. 48-50, DMNR, RS106, file 22-4p1, PANB; New Brunswick, *Annual Report of the Department of Lands and Mines* (Fredericton, NB: Government of New Brunswick, 1958), 115-17; CBC Newsmagazine, “Budworm City,” <http://archives.cbc.ca>.

23 New Brunswick, *Annual Report of the Department of Lands and Mines* (Fredericton, NB: Government of New Brunswick, 1955), 109; C.J. Kerswill and P.F. Elson, “Preliminary Observations on Effects of 1954 DDT Spraying on Miramichi Salmon Stocks,” *Progress Reports of the Atlantic Coast Stations of the Fisheries Research Board of Canada*, no. 62 (July 1955): 17.

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played a prominent role in wildlife conservation in the province. Those organizations strongly opposed to the spray were the Miramichi Salmon Association (MSA), founded in 1953, and the New Brunswick Fish and Game Protective Association (FGPA), formed in 1928. Another conservation group, the Atlantic Salmon Association (ASA), founded in Montreal in 1948, was not opposed to the spray, no doubt due in large part to the fact that NBIP and FPL president Vernon Johnson was also president of the ASA during the 1950s.<sup>24</sup> A major reason why the MSA and the FGPA participated in the DDT spraying debates was that there were larger numbers of sportsmen venturing deeper into New Brunswick's woods in the 1950s than ever before. From the end of the Second World War to the late 1950s, the province's forestry companies constructed thousands of kilometres of private woods roads deep into previously inaccessible forested areas. The number of travel permits granted to use those roads rose from 8,700 seasonal and 18,400 short-term permits in 1945 to 14,300 seasonal and 48,000 short-term permits by 1960.<sup>25</sup> The participation by members of these sportsmen's organizations in the debates also reflected the problems and contradictions of elite sporting organizations in making the transition from a conservation program built on controlling commercial harvesting and subsistence hunters and fishers to an environmental program focused on the prevention of nuisances that compromised the ecosystems on which desired species depended.<sup>26</sup> In particular, the sportsmen were concerned about the effects of the DDT spray on Atlantic salmon after the spraying program started in 1952 – concerns that were initially predicated on a utilitarian view of the role of salmon as a game fish in sport angling.

From the outset, members of New Brunswick's scientific and technical community were also deeply involved in the spraying debates. Scientists in New Brunswick, like those elsewhere in North America, were influenced greatly by the gradual emergence of ecology as a distinct scientific discipline after the Second World War, particularly the concept of an "ecosystem." First introduced as a concept in the 1930s, ecologists had theorized by the 1950s that an ecosystem was a "natural unit" (for example, a pond) composed of living (biotic) and nonliving (abiotic) parts that interacted and cycled energy and materials to produce a stable system. Something that interrupted the stability of the system was labelled either a "human disturbance" or a "natural disturbance."<sup>27</sup>

24 The Atlantic Salmon Association, "Officers 1953," *The Atlantic Salmon Journal*, no. 5 (December 1953): i.

25 New Brunswick, *Annual Report of the Department of Lands and Mines* (Fredericton, NB: Government of New Brunswick, 1945), 103; New Brunswick, *Annual Report of the Department of Lands and Mines* (Fredericton, NB: Government of New Brunswick, 1960), 70.

26 On the participation of sportsmen in early conservation programs in North America, see Jamie Benidickson, *The Culture of Flushing: A Social and Legal History of Sewage* (Vancouver: UBC Press, 2007), especially chap. 11; Bill Parenteau, "A 'very determined opposition to the law': Conservation, Angling Leases, and Social Conflict in the Canadian Atlantic Salmon Fishery, 1867-1914," *Environmental History* IX, no. 3 (July 2004): 436-63; and John F. Reiger, *American Sportsmen and the Origins of Conservation*, 2nd ed. (Corvallis, OR: Oregon State University Press, 2001).

27 Stephen Bocking, *Ecologists and Environmental Politics: A History of Contemporary Ecology* (New Haven, CT: Yale University Press, 1997); Sharon E. Kingsland, *The Evolution of American Ecology, 1890-2000* (Baltimore: The Johns Hopkins University Press, 2005).

Elements of ecosystem ecology are apparent in the research of the scientists who were first drawn into New Brunswick's DDT spraying debates. C.J. Kerswill and P.F. Elson were biologists associated with the Atlantic Biological Station in St. Andrews, the first marine biological research station in Canada (established in 1899). The research station was operated by the Fisheries Research Board of Canada (and its predecessor, the Biological Board of Canada), which was a board of professional scientists that oversaw marine fisheries research across the country and reported to the federal government.<sup>28</sup> Kerswill and Elson had started a study in 1950 to calculate the number of young salmon returning to the Miramichi. In June 1954, FPL planes sprayed DDT on an area that included about one-third of the Miramichi River watershed, and so Kerswill and Elson were the first scientists to be able to investigate the effects of DDT spraying on Atlantic salmon in a major river system. They published their findings in July 1955, reporting extremely high rates of death among young salmon and aquatic insects in streams that were sprayed with DDT. Kerswill and Elson concluded that the fish deaths were either the result of "direct contact with the poison or the result of eating poisoned insects which may have fallen into the water from nearby vegetation." In addition, they stated that the massive deaths of aquatic insects that salmon relied on as food "will probably affect their survival in 1955 and perhaps later." Kerswill and Elson also explained that biologists had already known that some stream fishes died in areas sprayed with DDT, but it had always been assumed that the effects of DDT in a large river system would be "rather slight." Kerswill and Elson's 1954 study disproved that assumption.<sup>29</sup>

Kerswill and Elson's report was also very influential in New Brunswick's conservation community. Ott Hicks, the "Outdoors" editor for the *Moncton Transcript*, wrote an article entitled "DDT Kills Salmon, Spraying Operations Puts Salmon Crop in Jeopardy" for the August 1955 issue of *Rod and Gun in Canada*, the country's premiere hunting and fishing magazine for much of the 20th century. Hicks had also previously written an article entitled "Danger – DDT" for the July 1954 issue of the magazine, in which he warned readers about the possible dangerous results of DDT spraying on fish in the Miramichi River. In his August 1955 article Hicks relied on Kerswill and Elson's study, and statements from a recent meeting of fisheries protective officers in Newcastle, to justify his earlier concerns and to inform readers that the previous year's DDT spraying had killed large numbers of salmon, trout, certain species of "rough fish," aquatic insects, and vegetation "as well as virtual elimination of algae and food organisms so vital to well-being and growth of young fish, perhaps for years to come."<sup>30</sup> Angered by Hicks's article, the ASA wrote to

28 In the early 1970s the federal government assumed management of the marine research station in St. Andrews, and the FRB folded by the end of the decade. See Jennifer M. Hubbard, *A Science on the Scales: The Rise of Canadian Atlantic Fisheries Biology, 1898-1939* (Toronto: University of Toronto Press, 2006); Kenneth Johnstone, *The Aquatic Explorers: A History of the Fisheries Research Board of Canada* (Toronto: University of Toronto Press, 1977); and Edward A. Trippel, "The first marine biological station in Canada: 100 years of scientific research at St. Andrews," *Canadian Journal of Fisheries and Aquatic Sciences* LVI (1999): 2495-507.

29 Kerswill and Elson, "1954 DDT Spraying"; Trippel, "The first marine biological station," 2502.

30 Ott Hicks, "DDT Kills Salmon, Spraying Operations Puts Salmon Crop in Jeopardy," *Rod and Gun in Canada* 57, no. 1 (August 1955): 5, 17.

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Deputy Minister of Lands and Mines W.W. McCormack in August 1955, stating that Hicks had written his article “in an alarmist tone and expresses a great many fears far in advance of scientific proof.” The association wanted McCormack to respond to Hicks’s claims by highlighting the importance of the anti-budworm campaign as a form of forest protection, which in turn saved trees that provided shade for fishing rivers, and even sent the deputy minister a rough draft of a letter that he could use as his response.<sup>31</sup> After consulting with Minister of Lands and Mines Norman Buchanan, McCormack replied that the department did not want to “enter into a controversy on the subject in a national publication” and that a retort would be more effective if it came from FPL’s president or general manager.<sup>32</sup> Meanwhile the MSA’s legislative committee wrote to Minister Buchanan in November 1955, calling on the New Brunswick government to pass certain pieces of legislation to halt the dwindling numbers of salmon in the Miramichi River. The first of the MSA’s ten recommendations dealt with “the pollution of streams.” The association requested that the government create legislation to “prevent further pollution of streams from all sources,” including sewage disposal, industrial wastes from mills and mining developments, and the spruce budworm spraying program.<sup>33</sup> MSA President D. Malcolm Neill, owner of the CFNB radio station in Fredericton, conveyed the same ten recommendations to the ASA’s annual meeting on 18 January 1956, and he criticized the federal and provincial governments in his address for not having a “progressive interest” in maintaining or protecting “our salmon industry.”<sup>34</sup>

A significant moment during the DDT spraying debates in the 1950s was the South Esk incident. This episode demonstrated categorically to the anti-spray conservation groups the soundness of Kerswill and Elson’s 1955 report and the deadly effects of DDT poisoning on a large scale. On 9 June 1956, planes under contract with FPL sprayed the forests surrounding the federal Northwest Fish Hatchery in the Parish of South Esk. The hatchery’s fish pools were partly covered by wooden sun shades, but some of the DDT spray drifted onto the shades and was washed into the pools by rain later in the day; the spray also drifted over streams that supplied the hatchery with fresh water. Hatchery workers found that DDT had saturated some of the fish food in the pools. Almost 1 million young salmon and trout, or 26.7 per cent of the hatchery’s fish stocks, died from eating the poisoned food or from direct contact with DDT.<sup>35</sup> Once MSA president Neill heard about the large numbers of dead fish, he described the incident as a “shocking massacre.”<sup>36</sup> He also stated (as reported on the radio):

31 Robson Black to W.W. McCormack, 9 August 1955 (including the attached letter draft), DMNR, RS106, file 18-2a, PANB. In his letter, Black explained that he had “discussed the above with Vernon Johnson before writing you.”

32 McCormack to Black, 11 and 19 August 1955, DMNR, RS106, file 18-2a, PANB.

33 J. Alex M. Bell to Norman Buchanan, 29 November 1955, DMNR, RS106, file 18-2c, PANB.

34 *Daily Gleaner* (Fredericton), 18 January 1956. The ASA reacted favourably to the vast majority of Neill’s recommendations since he focused largely on issues that were uncontroversial in the sportsmen community, such as the general protection of salmon and government regulation of fishing gear and angling licences. It was Neill’s characterization of the DDT spray as one of many forms of “stream pollution” that the ASA disagreed with.

35 *Her Majesty the Queen v. Forest Protection Limited*, no. 127731 (Exchequer Court of Canada, 1961), 5-8,13; *Telegraph Journal* (Saint John), 22 June 1956; *Daily Gleaner*, 22 June 1956.

36 NBIP, untitled manuscript, p. 44, DMNR, RS106, file 22-4p1, PANB.

“These facts bear out Dr. Kerswill’s reports conclusively and offer positive proof that DDT is used to the detriment of the small game fish.”<sup>37</sup> Neill immediately sent a telegram to federal Fisheries Minister James Sinclair asking the federal government to investigate the matter, and it was Neill who leaked the initial report about the South Esk incident to the local media.<sup>38</sup> The FGPA was equally disturbed by the accidental spraying. The association relied on the Northwest Fish Hatchery for hundreds of thousands of the fish it used in its salmon restocking program, and plans for restocking in 1956 were seriously curtailed by the DDT poisoning. At its annual meeting in September 1956, FGPA members passed a resolution declaring that the association was opposed to any future spray operations that would not be “conducive to good wildlife management practice.”<sup>39</sup> By January 1957, the FGPA had delivered numerous petitions to the minister in charge of the Department of Lands and Mines recommending the full cessation of the spraying program.<sup>40</sup>

The stark confirmation at South Esk of Kerswill and Elson’s research broadened the scope of New Brunswick’s DDT spraying debates. For instance, heated exchanges between opponents and proponents of the spraying program appeared in the editorial section of Fredericton’s *Daily Gleaner* in December 1956 and January 1957. Many of these letters to the editor demonstrate the beginning of a shift from concerns about DDT based primarily on the instrumental value of salmon to humans to a larger unease about the effects of chemical poisoning on forest and water ecologies. Those in favour of the spray option, though, consistently maintained that the program was essential to the survival of the province’s forestry sector and necessary for the restoration of the natural balance upset by the excessive number of budworms, particularly since “nature” was “not concerned with balancing the books of our forest industries.” The opponents of the program – the conservation groups and certain scientists – countered that it was the spray that “upset the natural balance of forces” by prolonging the budworm outbreak, and they questioned why supporters of the spray option were so quick to defend the program even though there was so much scientific evidence that demonstrated DDT’s harmful effects on fish and wildlife. Wildlife biologist Bruce S. Wright, for instance, declared in one letter to the editor: “The case for the budworm spray may be made on the grounds of forest economics, but it certainly cannot be made on the grounds of benefits to wildlife.”<sup>41</sup>

37 CBC Radio, “DDT Spraying Wipes Out Fish Hatchery,” <http://archives.cbc.ca>.

38 *Daily Gleaner*, 23 June 1956.

39 Don MacDougall to McCormack, 2 February 1957 (including the attached resolutions), DMNR, RS106, file 18-2d1, PANB.

40 *Daily Gleaner*, 9 and 16 January 1957.

41 The exchange between opponents and proponents of the spraying program in December 1956 was triggered by an article about the Canadian Forestry Association’s approval of the DDT spraying campaign with a “nearly” unanimous vote at the end of November. See *Daily Gleaner*: 27 November 1956; 1, 4, 7, 13, and 20 December 1956. The exchange in January 1957 occurred after the *Daily Gleaner* reported that the FGPA had delivered petitions to the minister of the Department of Lands and Mines recommending the full cessation of the spraying program. See *Daily Gleaner*: 9, 16, 18, 25, and 29 January 1957. There were six letters in the first exchange and four in the second, which were split about half-and-half between opponents and proponents. Wright’s comments were very typical for those who opposed the spraying program. In addition, critics of the spraying program consistently maintained that the use of chemical insecticides simply prolonged budworm outbreaks. They argued that the spray option prevented outbreaks from collapsing naturally; since some of the

The South Esk incident also represented a turning point in the federal government's position on the spruce budworm spraying program. The federal government had contributed funds for one-third of the costs of the spraying program since 1953, as it had considered the program to be an effective form of forest protection, but "Sea Coast and Inland Fisheries" were under federal jurisdiction and the fish deaths in New Brunswick due to DDT poisoning were something the federal government could no longer ignore.<sup>42</sup> FPL's DDT spray had drifted over federal fish hatcheries on two other occasions prior to June 1956, yet the number of dead fish in those two instances had been much less than at the Northwest Fish Hatchery. Due to the high rate of fish mortality at South Esk, the federal government launched a lawsuit against FPL in November 1956 to recoup close to \$6,000 in damage. Federal lawyers claimed in court that FPL was in contravention of the Fisheries Act, which "prohibits the pollution of waters containing fish; or the escape of a dangerous thing," while lawyers for FPL and the provincial government argued that most of the fish had died from overcrowding at the hatchery.<sup>43</sup> Their counterarguments were a reflection of how economic considerations frequently trumped ecological concerns during this period and how desperately pro-spray forces wanted to keep the spraying program. FPL and provincial government officials were particularly concerned about the precedent that could be set by the federal government's lawsuit. If the lawsuit were to be successful, a lawyer for the provincial government explained, "the Company may conceivably be forced to cease operations due to a multiplicity of claims by residents of the Province who live downstream from the areas being sprayed."<sup>44</sup> The lawsuit went before the Exchequer Court of Canada in the summer of 1960. In the final ruling, which was delivered on 17 February 1961, the judge found in favour of the plaintiff, the federal government.<sup>45</sup> Moreover, the federal government pressured New Brunswick and FPL to reduce the concentration of DDT in the anti-budworm spray mixture after 1956. Biologists had continued to release studies after Kerswill and Elson's 1955 study that demonstrated the deadly consequences of DDT on New Brunswick's forest and water ecologies, and the federal government was receptive to the scientists' warnings.<sup>46</sup>

budworms eventually became resistant to the type of insecticide used, this allowed a medium-level outbreak to persist. See Rashid, "Compromising the Environment?" 26-9.

42 Canada, *A Consolidation of the Constitution Acts, 1867 to 1982* (Ottawa: Department of Justice, 1998), 27.

43 *Her Majesty the Queen v. Forest Protection Limited* (1961), 12; *Her Majesty the Queen v. Forest Protection Limited*, no. 127731 (Exchequer Court of Canada, 1956); and *Daily Gleaner*, 13 July 1956.

44 Memo from John T. Gray to Buchanan, 22 November 1956, DMNR, RS106, file 30-11f, PANB. See also Johnson to Buchanan (14 November 1956), Buchanan to Johnson (22 November 1956), Buchanan to MacLean (19 July 1957), and MacLean to Buchanan (24 July 1957), all in DMNR, RS106, file 30-11f, PANB.

45 *Her Majesty the Queen v. Forest Protection Limited* (1961), 11-15.

46 J. Angus MacLean to Buchanan, 24 November 1959, as well as Buchanan to MacLean, 26 November 1959, DMNR, RS106, file 30-11c, PANB. For an example of one of the studies, see F.E. Webb and D.R. Macdonald, *Studies of Aerial Spraying against the Spruce Budworm in New Brunswick: Surveys of Stream-Bottom Fauna in some Sprayed and Unsprayed Streams, 1955-1957* (Fredericton, NB: Canada Department of Agriculture, Forest Biology Division, 1958). Kerswill and Elson had continued their salmon studies as well. See Elson and Kerswill, "Forest Spraying and Salmon Angling," *The Atlantic Salmon Journal*, no. 3 (Autumn 1964): 20-9.

Despite evidence of ecological damage, proponents of the spray option consistently defended the program throughout the 1950s and 1960s. L. Anders Sandberg and Peter Clancy have pointed out that support for the spraying program was extensive throughout industry and provincial government circles, as a “network” of “foresters and forest scientists based in industry, the provincial government, the Maritime regional office of the Canadian Forestry Service, the forestry faculty at UNB and the local (Maritime) section of the Canadian Institute of Foresters” both legitimized and advocated “the chemical spray approach to forest protection.”<sup>47</sup> From the program’s inception in 1952, supporters described spraying with DDT as the “only option” and as critical to the survival of New Brunswick’s forestry sector – the largest source of employment in the province at that time. They also portrayed the budworm as “a competitor with humans for harvesting *rights* for pulpwood,” and Reginald Balch, the federal entomologist, even asserted in 1952 that direct methods of control such as the spraying program were required to maintain the “ordinary balance of nature” disturbed by budworm outbreaks. According to its proponents, the spraying program was justified by the “need” to control the epidemic until budworm-damaged trees could be salvaged. All of these reasons were advanced in favour of the spraying despite the fact that it had been known since the mid-1940s that a broad-spectrum insecticide such as DDT was highly toxic to non-target fauna, such as stream fish. These justifications for the spraying program made it clear that, for supporters of the program, some collateral damage was acceptable.<sup>48</sup> Even after the South Esk incident, proponents of the program did not concede. In a letter to Premier Hugh John Flemming, a former sawmill operator, on 1 October 1956, FPL’s Vernon Johnson wrote that he believed the public to be generally supportive of the spraying program, even though New Brunswickers had “been feeding on a fare in the press and radio which must be confusing to them.” Johnson wanted Flemming to issue a public statement in support of FPL’s use of the spray, as there was “no other alternative” to control the budworm.<sup>49</sup> Later that same month, FPL’s board of directors recommended a news release by the premier to explain “what the effect on employment and on the provincial economy might have been had we not sprayed in previous years.”<sup>50</sup>

Contrary to the FPL approach, however, the North American debates about human-nature interactions during the late 1950s and throughout the 1960s, including the controversy surrounding New Brunswick’s spraying program, increasingly focused on ecological implications of such interactions. Ecologists demonstrated that humans could no longer simply conceive of the natural world as individual components that could be easily separated from one another (e.g. conservationists concerned solely

47 L. Anders Sandberg and Peter Clancy, “Politics, Science and the Spruce Budworm in New Brunswick and Nova Scotia,” *Journal of Canadian Studies* XXXVII, no. 2 (Summer 2002): 170.

48 Rashid, “Compromising the Environment?” 5-11; Kerswill, “Effects of DDT Spraying in New Brunswick on Future Runs of Adult Salmon,” *The Atlantic Advocate* XLVIII, no. 8 (April 1958): 65-8.

49 Johnson to Hugh John Flemming, 1 October 1956, Records of the Office of Premier Hugh John Flemming, RS415, file F3b3, PANB.

50 Minutes of a meeting of the board of directors of FPL, 30 October 1956, DMNR, RS106, file 30-11e, 1 of 3, PANB. Flemming’s administration had always been and continued to be supportive of the spraying program, consistently describing it as “the most effective weapon” against the budworm in newspaper reports. See, for example, *Telegraph Journal*, 28 August 1956, and *Daily Gleaner*, 17 April 1957.

about the effects of DDT on Atlantic salmon). Instead, they popularized concepts such as that of an “ecosystem” to emphasize “the intricate interrelationship between organisms and their physical environments.”<sup>51</sup> Ecology also acted as a “subversive science” by questioning the notion of unlimited economic growth at nature’s expense, which made it an essential component to the development of modern environmentalism in North America. The work of many members of the post-war scientific and technical community, such as Kerswill and Elson, revealed the extent to which human activity had profound and potentially disastrous effects on the natural world, and this helped to spread the concept of “ecology” amongst the general public.<sup>52</sup> The most prominent of these was Rachel Carson, an American marine biologist and author of *Silent Spring* (first published in 1962). In this influential book, Carson argued exhaustively that the indiscriminate use of pesticides such as DDT for industrial and agricultural purposes was detrimental to the health of humans and wildlife.<sup>53</sup> Carson’s work, and the pesticide issue in general, fostered greater environmental awareness by drawing attention to humanity’s impact on and interdependence with natural environments.<sup>54</sup> As William Cronon has noted, *Silent Spring* was a lightning rod – it helped to focus various environmental concerns into a larger environmental movement.<sup>55</sup> *Silent Spring* has a major New Brunswick connection as well. The first six pages of Carson’s ninth chapter, titled “Rivers of Death,” relate the effects of DDT spraying on the Miramichi River in the 1950s, a testament to the level of international interest and concern as well as the scale and toxicity of New Brunswick’s spraying program during this period.<sup>56</sup>

Two members of New Brunswick’s scientific and technical community contributed significantly to the growth of ecological and environmental awareness, both in New Brunswick and across North America. They also represented a trend in which scientists increasingly dominated New Brunswick’s spraying debates in the 1960s.<sup>57</sup> First, there

51 Read, “‘Let us heed the voice of youth’,” 228.

52 Bocking, *Ecologists and Environmental Politics*; Kingsland, *American Ecology*; Worster, *Nature’s Economy* (especially chap. 16).

53 Rachel Carson, *Silent Spring* (Cambridge, MA: Houghton Mifflin, 1962).

54 On Rachel Carson’s life and work as well as the influence of *Silent Spring*, see Mark Hamilton Lytle, *The Gentle Subversive: Rachel Carson, Silent Spring, and the Rise of the Environmental Movement* (New York: Oxford University Press, 2007); Priscilla Coit Murphy, *What a Book Can Do: The Publication and Reception of Silent Spring* (Amherst, MA: University of Massachusetts Press, 2006); and Maril Hazlett, “‘Woman vs. Man vs. Bugs’: Gender and Popular Ecology in Early Reactions to *Silent Spring*,” *Environmental History* IX, no. 4 (2004): 701-29.

55 William Cronon, “*Silent Spring* and the Birth of Modern Environmentalism,” in *DDT, Silent Spring and the Rise of Environmentalism*, ed. Thomas R. Dunlap (Seattle, WA: University of Washington Press, 2008), ix-xii.

56 Carson, *Silent Spring*, 129-35, 321-2. Carson relied heavily on many of Kerswill’s studies for the section on the Miramichi River.

57 The conservation groups were still part of the spraying debates in the 1960s. For instance, MSA president J.T.H. Fenety discussed the spraying program during a presentation at a two-day joint meeting of the Association of Registered Professional Foresters and the Maritime section of the Canadian Institute of Forestry in February 1969. He told those in attendance that “a great mistrust” had developed amongst the public because they had been “uninformed” of the spray option’s true consequences by the “keepers of the public’s forest heritage.” Fenety also stated that the budworm epidemic would no longer have been an issue of concern if forest management had been originally used to control the budworm. See *Daily Gleaner*, 19 February 1969.

was the aforementioned Bruce S. Wright. Originally from Quebec, Wright received his forestry degree from UNB in 1936. He worked for New Brunswick's Forest Service during the late 1930s, served as a "frog man" in the Royal Canadian Navy during the Second World War, and was the first Canadian to graduate from Aldo Leopold's wildlife management program at the University of Wisconsin after the war.<sup>58</sup> Wright founded the Northeast Wildlife Station at UNB at the end of the 1940s, making him the first person to bring scientific wildlife management to New Brunswick, and he saw the effects of the DDT spray first-hand through his wildlife studies in the province's forests in the 1950s. An avid hunter and angler, Wright was also a member of the FGPA. He gave presentations in the late 1950s and throughout the 1960s to the public and government officials on the effects of DDT, and wrote close to 100 books and articles in his lifetime – some of which dealt with DDT poisoning.<sup>59</sup> In 1960, Wright published an influential study on woodcock reproduction rates in sprayed areas of New Brunswick, which showed a decrease in woodcock chick births in places treated with DDT. Rachel Carson read Wright's study, wrote to him about it, and used it as part of her case against DDT and other pesticides in *Silent Spring*.<sup>60</sup> In 1966, Wright published what is probably his best-known book – *Black Duck Spring*. It recounts the life story of an adult male black duck, including his encounters with DDT spraying in New Brunswick, which kills the duck's mate in the final chapters of the book.<sup>61</sup> *Black Duck Spring* humanized the black duck's experiences in much the same way that Farley Mowat anthropomorphized the much maligned wolf in the 1960s, thus making it easy for readers to identify with the duck's misfortunes.<sup>62</sup>

The other New Brunswicker who contributed significantly to the growth of ecological and environmental awareness was Reginald Balch. Born in England, Balch moved to Canada one year before the outbreak of the First World War in 1914, and he enlisted and served with the Canadian Field Artillery for over three years. He graduated with a bachelor's degree from the Ontario Agricultural College in 1923, received his master's degree in science from Syracuse University's New York State College of Forestry in 1928, and then obtained his doctorate from the same institution in 1948. Balch was appointed officer-in-charge of the Dominion Entomological Laboratory in Fredericton in 1930, which positioned him to be intimately involved in New Brunswick's DDT spraying debates more than 20 years later.<sup>63</sup> As stated earlier,

58 Aldo Leopold was an American forester, ecologist, and nature writer. He advocated the scientific management of wildlife habitats, and his writings on the preservation of nature and wildlife were highly influential in the development of the modern environmental movement. His most famous work, *A Sand County Almanac*, first published in 1949, equalled *Silent Spring*'s influence in the formation of modern environmentalism. On Leopold's life and his work, see Curt Meine, *Aldo Leopold: His Life and Work* (Madison, WI: University of Wisconsin Press, 1988), and Julianna Lutz Newton, *Aldo Leopold's Odyssey: Rediscovering the Author of "A Sand County Almanac"* (Washington, WA: Island Press/Shearwater Books, 2006).

59 Gilbert Allardyce, *On the Track of the New Brunswick Panther: The Story of Bruce Wright and the Eastern Panther* (Fredericton, NB: Author, 2001).

60 Allardyce, *New Brunswick Panther*, 88-9; Carson, *Silent Spring*, 166-7, 327.

61 Bruce S. Wright, *Black Duck Spring* (Toronto: Clarke, Irwin, 1966).

62 On Farley Mowat's anthropomorphism of wolves, see Tina Loo, *States of Nature: Conserving Canada's Wildlife in the Twentieth Century* (Vancouver: UBC Press, 2006), especially chap. 6.

63 Astrid Brunner, "Introduction," in R.E. Balch, *A Mind's Eye* (Fredericton, NB: Fiddlehead Poetry Books and Goose Lane, 1985).

Balch was one of the first people to suggest that chemical insecticides sprayed from airplanes could be used to control the budworm, and he was a vociferous defender of the spraying program throughout the 1950s and early 1960s. Nevertheless, Balch's introduction to ecological concepts through his work in the 1950s and 1960s gradually changed his opinion of the spraying program. In the spring of 1965, Balch worked with Harold Hatheway, who was a producer with CBC Radio in Fredericton, to broadcast a series of five lectures entitled "The Ecological Viewpoint" as part of CBC's University of the Air. The lectures introduced many Canadians to the concept of "ecology," and they were so popular that the CBC published them in paperback format; the book has been reprinted several times. According to Hatheway, it quickly became "an essential book for anyone wishing to understand the development of environmental thought and action" in Canada.<sup>64</sup> In the lectures, and in the subsequent book with the same title, Balch explained the roots of ecology as a science, and he used examples from his work as an entomologist to demonstrate "the interdependence of living things on each other and their environment." Balch also stressed that human society had to adopt an ecological point of view if it was going to circumvent many of the problems associated with population growth. Pointing out that technological innovation would not be enough to maintain the affluent lifestyles to which North Americans had become accustomed, Balch concluded that humans had to keep in mind the interconnectedness of all life on Earth when planning future economic activity and use of resources in order to ensure their own survival and to minimize environmental degradation. Balch also made clear that he still supported the use of DDT and other insecticides to manage the spruce budworm in New Brunswick's forests, but he elaborated that they should be utilized in tandem with silvicultural controls and "must be used with due regard for their effects on the whole forest ecosystem."<sup>65</sup> By the end of the 1960s, Balch's ecological research had convinced him that the spraying program was more harmful than beneficial, and he actively campaigned for strict controls to be placed on pesticide usage in the province.<sup>66</sup>

Despite growing opposition to unbridled chemical spraying during particularly the 1960s, FPL and the New Brunswick government did not relent on the spray option. Indeed, FPL sprayed ever larger areas of the province throughout the decade, covering in excess of 50 per cent of New Brunswick's land area annually by the mid-1970s; overall, from 1952 to 1968, the company released more than 65 million litres of insecticidal solution over 11.5 million hectares of the province's forests, 95 per cent of which was the DDT formula.<sup>67</sup> Forestry was still the most important economic

64 Harold Hatheway, "The Balch Eye," in R.E. Balch, *Celebrations of Nature* (Fredericton, NB: Goose Lane, 1991), 1-6.

65 R.E. Balch, *The Ecological Viewpoint* (Toronto: Canadian Broadcast Corporation, 1965). See pages 24-8 of the book for his comments on his continued support for the use of DDT and other insecticides within the context of "due regard for their effects on the whole forest ecosystem."

66 David Folster, interview by author, Fredericton, NB, August 2010, notes in author's possession. In January 1986, Balch wrote on the title page of a copy of the 1971 reprint of *The Ecological Viewpoint* that the spruce budworm section in Chapter 2 was "a bit out of date" and that he "would be more emphatic about the limitations and dangers of insecticides, especially in forestry, and the need for silviculture management, to protect and develop *all* the values of forest land – environmental as well as economic" (emphasis in original). See Norval Balch, e-mail message to author, 16 March 2011.

67 Barney Flieger, "Background Information – Forest Protection Ltd.," 28 October 1968, p. 9 and attached table 1, DMNR, RS106, file 30-11n, 1 of 2, PANB. The percentage of the province sprayed

sector in the province, and Premier Louis Robichaud's administration used generous government incentives to entice industrialists to build four more pulp and paper mills in New Brunswick during the 1960s.<sup>68</sup> The increased number of industrial forest users in the province ensured that the "Battle of the Budworm" would continue in some form. Perhaps unsurprisingly, FPL officials remained steadfast in their conviction that aerial spraying was the most effective method to control budworm outbreaks.<sup>69</sup> At meetings in October and November of 1963, the company's directors did examine the issue of possibly halting the spraying program for one or two seasons because the budworm was developing a resistance to DDT. The most resolute that the program should continue unabated was K.C. Irving, the most powerful industrialist in New Brunswick and the head of Irving Pulp and Paper Company. He asserted that there was no surplus timber in the province and that the demand for wood was only going to increase as the pulp and paper industry expanded. Accordingly, Irving proposed an expansion of the spraying program, a different and stronger insecticide (if necessary), and blanket spraying of heavily infested areas. FPL's board of directors voted to spray in 1964, and the company adopted most of Irving's recommendations.<sup>70</sup>

FPL sprayed more forested area in the spring of 1964 than it had in the previous two years combined. The company also started to experiment with a new insecticide to which the budworm had no resistance – phosphamidon – which was also an attempt to meet growing concerns about the spray option. Another reason FPL chose to experiment with phosphamidon was as a means to appease the federal government's anxiety about the effects of the spraying program on the province's fish stocks, since this insecticide was supposed to be less harmful to young salmon.<sup>71</sup> Unfortunately for the company, the concentration of the phosphamidon it sprayed over 64,800 hectares

by the mid-1970s was calculated from New Brunswick, *Annual Report of the Department of Natural Resources* (Fredericton, NB: Government of New Brunswick, 1976), 22, and *Annual Report of the Department of Natural Resources* (Fredericton, NB: Government of New Brunswick, 1977), 23. The figure of 11.5 million hectares includes about 2.14 million hectares of forest that was sprayed two or three times (and are thus counted more than once in this total).

- 68 Mark J. McLaughlin and Bill Parenteau, "A 'Fundamental Cost that We Can't Deal With': The Political Economy of the Pulp and Paper Industry in New Brunswick, 1960-Present," in *Exploring the Dimensions of Self-Sufficiency for New Brunswick*, ed. Michael Boudreau, Peter G. Toner, and Tony Tremblay (Fredericton, NB: New Brunswick and Atlantic Studies Research and Development Centre, 2009), 13-34; Della M.M. Stanley, *Louis Robichaud: A Decade of Power* (Halifax, NS: Nimbus, 1984).
- 69 FPL officials still considered forest management unproven as a form of budworm control and that any potential benefits would have taken too long to be realized. Biological controls, such as the deliberate spreading of budworm parasites, were also dismissed as unproven and too long-term. See Rashid, "Compromising the Environment?" 29-33.
- 70 Minutes of a meeting of the board of directors of FPL, 11 October and 8 November 1963, DMNR, RS106, file 30-11g, PANB. After the South Esk incident, FPL attempted to avoid direct spraying of most waterways. Irving's recommendation to blanket spray would have meant a reversal of that decision, but the board of directors did not adopt that specific recommendation.
- 71 New Brunswick, *Annual Report of the Department of Lands and Mines* (Fredericton, NB: Government of New Brunswick, 1965), 121; K.B. Brown to Richard Belyea, 2 December 1964 (including the attached press statement draft), file 30-11k; H. Graham Crocker to Hédard Robichaud, 22 January 1964, DMNR, RS106, file 30-11m, PANB; J.R. MacDonald, *Effects of Forest Spraying on New Brunswick Salmon* (Halifax, NS: Canada Department of Fisheries, Fish Culture Development Branch, 1964), DMNR, RS106, file 30-11m, PANB.

of forests proved to be extremely lethal to birds, and residents near the spray area reported large numbers of dead birds during the summer of 1964.<sup>72</sup> FPL experimented for the next few years with different concentrations of phosphamidon and other types of insecticide, including novathion and sumithion (more commonly known as fenitrothion), as the company attempted to discover one insecticide or a combination of two or more that was not overly detrimental to fish and wildlife.<sup>73</sup> In addition, the provincial government passed legislation in the mid-1960s that prohibited direct spraying of stream banks with DDT.<sup>74</sup> The federal government was also successful in persuading FPL to reduce the amount of DDT it used by 50 per cent in 1961, resulting in a spray application of one-quarter pound of DDT per one-half gallon of oil-water solution per acre.<sup>75</sup> The last spray season that FPL used DDT was 1968. National and international pressure to ban DDT was mounting, so FPL replaced it with fenitrothion in an attempt to keep federal funding for the spraying program. However, the federal government stopped contributing to the financial costs of New Brunswick's spray operations in 1969. Environmental consciousness was developing within the federal government, evidenced by the introduction of a partial ban on DDT in Canada in 1970, and it no longer viewed the budworm outbreak as an "emergency" or "national in scope."<sup>76</sup>

By the end of the 1960s, FPL's spraying program and the excessive use of pesticides had encouraged the development of a new environmental consciousness in New Brunswick. While it is difficult to quantify a fluid concept such as "environmental consciousness," a new level of shared awareness was demonstrated by the founding of the province's first environmental organization, the CCNB, in October 1969. In April of that year, members of the New Brunswick Institute of Agrology hosted a meeting of individuals who were concerned about the conservation

72 *Daily Gleaner*, 5 November 1964; C. David Fowle, *Preliminary Report on the Effects of Phosphamidon on Bird Populations, 1964* (Toronto: Canadian Wildlife Service and Department of Biology, York University, 1964), DMNR, RS106, file 30-11m, PANB.

73 P.A. Pearce, *Summary Statement on the Effects on Bird Populations of Novathion, Sumithion, and Sumithion-Phosphamidon Mixtures, New Brunswick, 1967* (Fredericton, NB: Canadian Wildlife Service, 1967), DMNR, RS106, file 30-11n, 1 of 2, PANB; D.R. Macdonald, "Management of Spruce Budworm Populations" (paper presented at the joint annual meeting of the Canadian Institute of Forestry and the Society of American Foresters, Ottawa, 15-19 October 1967), pp. 3-5, DMNR, RS106, file 30-11n, 1 of 2, PANB.

74 Rashid, "Compromising the Environment?" 11.

75 New Brunswick, *Annual Report of the Department of Lands and Mines* (Fredericton, NB: Government of New Brunswick, 1962), 105-6. FPL used the concentration of one-quarter pound of DDT per one-half gallon of oil-water solution per acre for most of the 1960s. This would have been the second reduction. The first move to reduce the use of DDT was the company's own reduction in 1953 (mentioned above), from one pound per gallon to one-half pound per gallon. The reduction in 1961 (by another 50 per cent) came to fruition as a result of federal pressure (also mentioned above), which resulted in a spray application of one-quarter pound per one-half gallon. This third formulation – the one used for most of the 1960s – was 87.5 per cent weaker than the original one pound per gallon used in 1952.

76 Report of a meeting of the Interdepartmental Committee on Forest Spraying Operations, 20-21 November 1968, pp. 6-12, file 30-11n, 1 of 2, DMNR, RS106, file 30-11p, PANB; W.R. Duffie to Jean Marchand, 6 February 1969, DMNR, RS106, file 30-11p, PANB; Louis Robichaud to Pierre Trudeau (5 January 1970) and Trudeau to Robichaud (4 February 1970), Records of the Office of Premier Louis J. Robichaud, RS416, 1970, file 269, PANB.

of the province's natural resources. Those at the meeting decided to form an umbrella organization to coordinate the activities of the numerous conservation-oriented groups in New Brunswick – a council of conservation – yet it soon developed into a stand-alone organization that had its own agenda and its own specific conservation and environmental concerns. Kenneth Langmaid was named provisional chairman of the new group (and later president), and a “number of prominent citizens” were invited to form the council's directorate.<sup>77</sup> The CCNB's founding board of directors consisted of scientists, conservationists, foresters, professionals, former politicians, journalists, and authors, including Milton F. Gregg, the former university president and federal cabinet minister; Harold Hatheway, the CBC producer; David Walker, the well-known author of such books as *Geordie* and *Where the High Winds Blow*; J.W. Kerr, the dean of the forestry faculty at UNB; and Smith Hilton, former director of the agricultural research station in Fredericton.<sup>78</sup> The CCNB's original members were well aware of the spruce budworm spraying program's tumultuous history during the 1950s and 1960s.<sup>79</sup> For example, Reginald Balch, who was also one of the organization's founding directors, had supported the spray option well into the 1960s, but he opposed the program by the end of the decade and was the honorary president of the CCNB in the early 1970s.<sup>80</sup> Pesticide usage in New Brunswick was one of the major issues discussed at the organization's founding meeting on 18 October 1969.<sup>81</sup> Within six weeks of its founding meeting, the CCNB announced that it was going to conduct a study of the types, amounts, and applications of pesticides in the province, making it the organization's first major endeavour as an environmental group and “the first detailed report on the problem of its kind” in New Brunswick.<sup>82</sup>

The growth of environmental consciousness in New Brunswick and political pressure from environmental groups such as the CCNB forced the provincial government to take into account the possible ecological consequences of present and future use of natural resources. One such area was the issue of pesticide usage in the province. The CCNB's pesticide committee, chaired by Dr. George Gerald Shaw, delivered its final report in the summer of 1970, and its biggest criticism was the unregulated and unchecked way that pesticides were utilized in New Brunswick.<sup>83</sup> The pesticide report and the CCNB's subsequent lobbying on the issue, as well as the end of federal support for the spruce budworm spraying program, were the main motivators behind the Hatfield administration's enactment of the Pesticides Control

77 *Daily Gleaner*, 16 August 1969.

78 The vast majority of individuals on the CCNB's founding board of directors were English-speaking, male professionals. See audio recording of the CCNB founding meeting, 18 October 1969, Fredericton, NB, recording in the CCNB's possession, Conserver House, Fredericton, NB. Bruce Wright was also a member of the CCNB. See Allardyce, *New Brunswick Panther*, 107.

79 The CCNB had approximately 200 members by the early 1970s.

80 David Coon, informal interview by author, Fredericton, NB, May 2010; audio recording of the CCNB founding meeting; Brunner, “Introduction.”

81 Audio recording of the CCNB founding meeting.

82 *Daily Gleaner*: 27 November 1969, 6 November 1970.

83 George Gerald Shaw (Chairman), *Report of the Pesticide Committee of the Conservation Council of New Brunswick* (Fredericton, NB: Conservation Council of New Brunswick, 1970); *Daily Gleaner*, 6 November 1970.

Act in early 1973.<sup>84</sup> The act provided, for the first time, a regulatory and licensing framework within the Department of Agriculture for the use and sale of pesticides in the province.<sup>85</sup> FPL and other pesticide users thereafter had to abide by a minimum set of regulatory standards, although critics of the spraying program argued for years after that the Pesticides Control Act contained too many loopholes that allowed FPL to continue spraying largely undeterred.<sup>86</sup> Additionally, FPL's switch to the fenitrothion formula created its own set of problems. Widespread environmental consciousness was readily apparent in New Brunswick during the second half of the 1970s when a wave of popular protest swept the province after revelations that fenitrothion was possibly harmful to children. A study conducted out of Halifax found higher rates of Reye's syndrome in New Brunswick, and the study's authors cited the large-scale use of fenitrothion and/or the emulsifiers in the spray as probable causes. A number of parents were alarmed by a 1976 CBC report on the study, so they formed the Concerned Parents Group to lobby the provincial government to end the forest spraying program.<sup>87</sup>

Ultimately, two decades of opposition to the spraying program in New Brunswick helped fuel the development of environmental consciousness and a political voice for environmental issues in the province. Part of a larger and uneven trend across North America in the years after the Second World War, the growth of environmental consciousness in New Brunswick was a coalescence of a dominant environmental issue, older notions of conservation, and the influence of the province's scientific and technical community. The origins of this consciousness lay in the concerns fish and wildlife conservationists had about the harmful effects of DDT on Atlantic salmon, which were bolstered by Kerswill and Elson's 1955 report and confirmed on a grand scale by the accidental spraying of the Northwest Fish Hatchery in 1956. The infusion

84 Langmaid to Donald J. Blackburn, 17 April 1972, CCNB Records, MC1107, file MS1-1-2, PANB; *Minutes of the Pesticide Advisory Board Public Hearing* (Fredericton, NB: Government of New Brunswick, 1978), 52; *Daily Gleaner*, 15 April 1971. The CCNB practiced a moderate form of environmental activism based on public outreach, research committees, and government lobbying as opposed to the rather more radical form of environmental activism later associated with groups such as Greenpeace. For example, the council held "a seminar to inform provincial MLAs from both sides of the legislature . . . of the pollution problems facing New Brunswickers" in the spring of 1970. According to Kenneth Langmaid in late 1970, "the major criticism of the organization has been that it has not been militant enough." See *Daily Gleaner*, 6 November 1970.

85 New Brunswick, *New Brunswick Acts* (1973), 136-50.

86 Some of the CCNB's criticisms of the Pesticides Control Act were that there was no representation from industry or the general public on the newly-formed Pesticide Advisory Board (PAB), that the board did not evaluate "risk to the public" when it considered permit applications, and that the PAB's decision-making process should be more transparent – particularly when it came to matters relating to spruce budworm spraying, which was "one of the more controversial permits handled" by the PAB. See *Minutes of the Pesticide Advisory Board Public Hearing* (Fredericton, NB: Government of New Brunswick, 1978), 52-63, and *Minutes of the Pesticide Advisory Board Public Hearing*, vol. 2 (Fredericton, NB: Government of New Brunswick, 1979), 30-48.

87 For the original study, see J.F. Crocker et al., "Lethal Interaction of Ubiquitous Insecticide Carriers with Virus," *Science* CXCII, no. 4246 (25 June 1976): 1351-3. On the Reye's Syndrome controversy and the activities of the Concerned Parents Group in the late 1970s and early 1980s, see Alan Miller, *Environmental Problem Solving: Psychosocial Barriers to Adaptive Change* (New York: Springer, 1999), 82-123, and Bert Deveaux, "The Poison Mist": A Special Investigation into New Brunswick's Forest Spray Programme, CBC Radio, originally aired 3 January 1982 (transcript).

of ecological science into the controversy surrounding the spraying program broadened the scope of the debate to include concerns about the effects of DDT on general forest and water ecologies, while the widespread dissemination of knowledge of the harmful effects of spraying, by scientists such as Bruce Wright and Reginald Balch, helped spread awareness within the province about human impact on and interdependence with natural environments. The actions of these individuals in New Brunswick were part of a larger pattern across North America in which sportsmen and scientists, as well as various wilderness advocates and naturalists, were key figures in the development of modern environmentalism. They served as a mid-century bridge from the end of the progressive conservation movement, which lasted from the 1890s to the 1920s, to the emergence of the environmental movement in the late 1960s – a transition from a conservation ethic to an environmental ethic.<sup>88</sup> In New Brunswick, the founding of the CCNB and similar environmental organizations challenged the provincial government's traditional stance on resource management, prompting the government to create an environmental division in the Department of Fisheries in 1971 and a separate Department of the Environment in 1975.<sup>89</sup> While forest economics took first priority over ecological consequences during the first two decades of the spruce budworm spraying program, the growth of environmental consciousness in New Brunswick eventually made "the environment" a legitimate issue that had to be taken into account by the province's natural resource managers and political leadership.

88 Dunlap, *Nature and the English Diaspora*, especially chapters 6-9; Steinberg, *Down to Earth*, especially chapters 9 and 15; Donald Worster, *Nature's Economy*, especially chapters 13-16. Samuel P. Hays has argued that government, industry, and urban elites developed conservation as an ideology during the Progressive Era, but Richard W. Judd has demonstrated, using northern New England as an example, that conservation had its roots in utilitarian views about nature in the countryside, particularly the notion of the "commons." See Samuel P. Hays, *Conservation and the Gospel of Efficiency: The Progressive Conservation Movement, 1890-1920* (Cambridge, MA: Harvard University Press, 1959) and Richard W. Judd, *Common Lands, Common People: The Origins of Conservation in Northern New England* (Cambridge, MA: Harvard University Press, 1997).

89 New Brunswick, *Annual Report of the Department of Fisheries and Environment* (Fredericton, NB: Government of New Brunswick, 1971), 9-10; New Brunswick, *Annual Report of the Department of Fisheries* (Fredericton, NB: Government of New Brunswick, 1975), 8; New Brunswick, "Introduction," *Annual Report of the Department of the Environment* (Fredericton, NB: Government of New Brunswick, 1976).