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# Naturalizing Federalism: Insect Outbreaks and the Centralization of Entomological Research in Canada, 1884–1914



The scale of global problems such as climate change and disease epidemics has stretched the limits of local governmental intervention in environmental matters. Although a national focus may seem irrelevant to some environmental historians, we must recognize the influence of nation-states in shaping the environment, since they have created and managed institutions for the exploitation, conservation, and preservation of natural resources.<sup>1</sup> Recent studies have demonstrated how these institutions drew their legitimacy from both the regulations they enforced and the technical expertise they mobilized or produced.<sup>2</sup> Yet, except for some analyses of the role of scientific information in defining regulatory norms<sup>3</sup> or in framing international treaties,<sup>4</sup> few researchers have

- 1 In a recent article, Richard White showed how this problem concerns not only environmental historians but also historians of different specialties. Richard White, 'The Nationalization of Nature,' *Journal of American History* 85 (Dec. 1999): 976–86.
- 2 Among many others, see Thomas R. Dunlap, *Saving America's Wildlife* (Princeton: Princeton University Press 1988); Arthur F. McEvoy, *The Fisherman's Problems: Ecology and Law in California Fisheries, 1850–1980* (Cambridge: Cambridge University Press 1986), as well as the less recent studies by A. Hunter Dupree, *Science in the Federal Government* (1957; Baltimore: Johns Hopkins University Press 1986), and Samuel P. Hays, *Conservation and the Gospel of Efficiency* (Cambridge: Harvard University Press 1959).
- 3 Although best exemplified by studies of the Progressive Era, with scientific experts providing objective knowledge for the formulation of policies (for example, Hays, *Conservation and the Gospel of Efficiency*), this phenomenon became widespread after the Second World War. See, among others, Samuel P. Hays, *Beauty, Health, and Permanence: Environmental Politics in the United States, 1955–1985* (Cambridge: Cambridge University Press 1987); Ronald Brickman et al., *Controlling Chemicals: The Politics of Regulation in Europe and the United States* (Ithaca: Cornell University Press 1985); Liora Salter, *Mandated Science: Science and Scientists in the Making of Standards* (Dordrecht: Kluwer Academic Publishers 1988).
- 4 Particularly informative is Kurkpatrick Dorsey, *The Dawn of Conservation Diplomacy: U.S.-Canadian Wildlife Protection Treaties in the Progressive Era* (Seattle: University of

examined the self-reinforcing character of these sources of legitimacy. They have either limited their analyses to legal questions of property and ownership<sup>5</sup> or focused on the authoritative status of science and its role in informing policy design.<sup>6</sup>

This article aims to illuminate the relationship between the scientific and the legal aspects of environmental intervention by governments in Canada. It portrays a dynamic in which the power of science, in representing the natural world, sought and found legitimacy in the political world. It compares the scientific and organizational approaches of the first two dominion entomologists, James Fletcher (1852–1908) and Charles Gordon Hewitt (1876–1920), and their influence on the definition of legal measures for preventing the introduction and distribution of foreign insects in Canada. Initially considered a local problem that, because of its biogeographical boundaries, concerned only provincial governments, the insect outbreak became a phenomenon that necessitated the mobilization of federal officers to prevent and investigate insect outbreaks across the national territory. The redefinition of this ecological phenomenon provided the federal authorities with the legitimacy and the necessary means for centralizing economic entomology in Canada, at a time when provincial services were actively engaged in crop protection.

During the period in question, the relationship between the federal government and Canadian scientists underwent profound changes. According to Vittorio de Vecchi, the federal bureaucracy in early twentieth-century Canada provided an intellectual climate conducive to abandoning a type of science based on data collection and to adopting a more interventionist, experimental approach. Historians have analyzed the

Washington Press 1998). See also Sheila Jasanoff, 'Contingent Knowledge: Implications for Implementation and Compliance,' in Edith Brown Weiss and Harold K. Jacobson, eds., *Engaging Countries: Strengthening Compliance with International Environmental Accords* (Cambridge: MIT Press 1998), 64–87.

5 The history of scientific forestry is a case in point, covering different time periods and different regions. See, for example, Nancy Peluso, *Rich Forest, Poor People* (Berkeley: University of California Press 1992); Ramachandra Guha, *The Unquiet Woods: Ecological Change and Peasant Resistance in the Himalaya* (Oxford: Oxford University Press 1992); Henry E. Lowood, 'The Calculating Forester: Quantification, Cameral Science, and the Emergence of Scientific Forestry Management in Germany,' in Tore Frangmyr, John L. Heilbron, and Robin E. Rider, eds., *The Quantifying Spirit in the Eighteenth Century* (Berkeley: University of California Press 1991), 315–42.

6 James C. Scott has provided us with a refreshing perspective on the relationships between state activities and scientific expertise. See his *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed* (New Haven: Yale University Press 1998).

emergence of the research ideal in Canadian universities, but little is known of the conditions underlying a similar process in the federal bureaucracy's scientific services and the consequences it had for federal-provincial relations. One condition for the introduction of a research practice in academic and governmental institutions was the availability of a generation of scientists trained in European universities and inclined towards research. In the case of entomology, trained scientists existed in limited numbers, and most were already active in provincial services.<sup>7</sup>

This article describes how the representation of a natural phenomenon enabled the federal government to enlarge its prerogatives and invade a field of jurisdiction traditionally occupied by provincial governments. The federal Department of Agriculture concentrated the technical manpower available in insect control and instituted a new division of labour with the provinces in which it acted as the centre of entomological expertise in Canada. Furthermore, it provided scientists with an institutional niche in which to perform research and to replace the systematic description of specimens and their geographical distribution with an analysis of the dynamic and evolutionary interactions between organisms and their environment. Scientists eager to instil governmental intervention with their new scientific outlook produced the kind of knowledge that confirmed the representation of nature as requiring federal intervention in the first place. When certain provinces invoked their constitutional rights to impose the precedence of their own legislation, knowledge produced by the federal entomological service reinforced the centralizing thrust of the Canadian Department of Agriculture. The scientific representation of a natural phenomenon by governmental experts was, at the time, co-extensive with the definition of a constitutional order.

Individuals from the Canadian and American entomological communities had long shared knowledge and practices for combatting similar insect pests in similar environments. References to American developments are therefore unavoidable and illustrate the constitutive relationships uniting governmental policy, natural phenomena, and scientific practice.<sup>8</sup>

7 Vittorio M.G. de Vecchi, 'Science and Government in Nineteenth-Century Canada' (PhD dissertation, University of Toronto 1978); Douglas Owram, *The Government Generation: Canadian Intellectuals and the State, 1900–1945* (Toronto: University of Toronto Press 1986); A.B. McKillop, *Contours of Canadian Thought* (Toronto: University of Toronto Press 1987); Yves Gingras, *Les origines de la recherche scientifique au Canada* (Montreal: Boréal 1991)

8 While historians of economic entomology have focused on environmental regulations related to insect control products, very few have dealt with quarantine issues.

## 4 The Canadian Historical Review

### INSECT OUTBREAKS AND GOVERNMENTAL RESPONSIBILITIES

Ever since the Union Act of 1841, the local and the central governments of Canada have shared responsibility for organizing the development of agriculture. Between 1850 and 1867 the Boards of Agriculture of Canada East and Canada West subsidized the promotion of agriculture, while the Department of Agriculture of the Government of the Union performed a multiplicity of functions (census, statistics, patents, technical education, public health, etc.) to support a pioneering rural population. With the British North America Act of 1867, the Dominion of Canada inherited the Union's administrative structure, but Confederation stirred a new dynamic in the division of power in agriculture. According to the economic historian Vernon Fowke, the founders of Canadian federalism envisioned the colonization of the North-West Territories as a tool for overcoming the stagnating economies of the central provinces (Ontario and Quebec). Accordingly, they provided the dominion government with constitutional powers in immigration and agriculture (the only concurrent jurisdictions of the British North America Act) to promote the settlement of the Canadian Prairies. The provinces maintained a function formerly accomplished by the Boards of Agriculture: they subsidized local associations that organized agricultural fairs and promoted the diffusion of agricultural knowledge.<sup>9</sup>

The division of power between the federal and provincial governments did not directly address agricultural research, a field of investigation still in its infancy in North America. In this case, naturalists and

See, for example, James Whorton, *Before Silent Spring: Pesticides and Public Health in Pre-DDT America* (Princeton: Princeton University Press 1974); Thomas R. Dunlap, *DDT: Scientists, Citizens, and Public Policy* (Princeton: Princeton University Press 1981); C.J. Bosso, *Pesticides and Politics: The Life Cycle of a Public Issue* (Pittsburgh: University of Pittsburgh Press 1987); Edmund Russell, *War and Nature: Fighting Humans and Insects with Chemicals from World War I to Silent Spring* (Cambridge: Cambridge University Press 2001). On quarantine regulations, see Robert Boyce, 'Insects and International Relations: Canada, France, and British Agricultural Sanitary Import Restrictions between the Wars,' *International History Review* 9 (winter 1987): 1-27; Philip Pauly, 'The Beauty and Menace of the Japanese Cherry Trees,' *Isis* 87 (March 1996): 51-73. On the early relationships between Canadian and American entomologists, see P. Palladino, *Entomology, Ecology and Agriculture: The Making of Scientific Careers in North America, 1885-1985* (Amsterdam: Harwood 1996), 48-9.

- 9 John E. Hodgetts, *Pioneer Public Service: An Administrative History of the United Canadas, 1841-1867* (Toronto: University of Toronto Press 1955); Vernon C. Fowke, *Canadian Agricultural Policy: The Historical Pattern* (Toronto: University of Toronto Press 1946)

gentleman farmers proceeded to improve agricultural techniques and gathered in local societies to further their work. Among those, the Entomological Society of Canada (created in 1864) comprised naturalists who boasted about the applicability of their knowledge of insects to the interests of prosperous and influential fruit growers. The society failed to gain financial support from the federal government for the publication of its journal, but it obtained an annual stipend from the commissioner of agriculture and arts of Ontario, John Carling, a member of the society and a personal friend of its founders. Under Carling's governance, the Agricultural and Arts Council of Ontario began subsidizing the society on an annual basis in 1871. In turn, the society published an annual report on insect pests for the farmers of the province. It also modified its name and became the Entomological Society of Ontario to acknowledge the provincial government's financial support.<sup>10</sup>

The traditional links between local societies and provincial departments of agriculture – initiated under the Union – initially deterred the dominion government from intervening in the field of insect control. A similar pattern prevailed in the United States, where various states employed entomologists or appointed them to natural history or geological surveys to answer the demands of local agriculture and horticulture. The central government started intervening on a grand scale only after a series of grasshopper invasions caused the Plains states to seek aid against a national disaster. In Canada, too, the dominion government's first intervention in economic entomology addressed a national problem, admittedly of a political nature. The failure to settle the North-West Territories retarded the recovery of the national economy from the 1870s depression, and in 1884 a parliamentary committee recommended several measures for overcoming the problems affecting the Canadian agricultural industry. In accordance with the committee's recommendations, the government assigned James Fletcher to the position of 'honorary entomologist' in the Department of Agriculture. Two years later, the department established the Experimental Farms Branch, with scientific divisions in chemistry, horticulture, entomology, and botany. It granted

10 On agricultural research at the end of the nineteenth century, see Margaret W. Rossiter, 'The Organization of the Agricultural Sciences,' in A. Oleson and J. Voss, eds., *The Organization of Knowledge in Modern America* (Baltimore: Johns Hopkins University Press 1979), 211–48. On early Canadian entomology, see J.T.H. O'Connor, 'Of Butterfly Nets and Beetle Bottles: The Entomological Society of Canada, 1863–1960,' *History of Science and Technology in Canada Bulletin* 6 (Sept. 1982): 151–71. On agriculture and the Ontario government, see John E. Hodgetts, *From Arm's Length to Hands-On: The Formative Years of Ontario's Public Service, 1867–1940* (Toronto: University of Toronto Press 1995).

official recognition to Fletcher by appointing him dominion entomologist and botanist.<sup>11</sup>

A self-taught naturalist and member of various amateur and professional scientific societies (Entomological Society of Ontario, Ottawa Field-Naturalists' Club), Fletcher had been actively engaged in the collection of plant and insect specimens since his arrival from England in 1874. His work fitted within a tradition of inventory sciences that comprised disciplines such as geology, meteorology, botany, and entomology. In these disciplines, naturalists recorded the occurrence of plant and animal specimens, mineral resources, and other natural phenomena and measured their distribution over a large territory. A few of them turned away from the simple discovery and classification of new species and compared the data they found to explain geographical variations of natural phenomena. They sought to understand the relationship between living species and their inanimate environment. Governments, however, were suspicious of these idealistic and theoretical ventures, preferring the practical and factual information provided by the inventory sciences. The tasks of identification, inventory, and map-making helped in assessing the potential wealth of new territories and in organizing economic activities such as agriculture or mining. Rather than sponsoring science for science's sake, governments expected science to provide information useful for economic application, and the inventory sciences were considered to provide such information.<sup>12</sup>

11 On the beginning of American entomology, see W. Conner Sorensen, *Brethren of the Net: American Entomology, 1840–1880* (Tuscaloosa: University of Alabama Press 1995), and Hae-Gyung Geong, 'Exerting Control: Biology and Bureaucracy in the Development of American Entomology, 1870–1930' (PhD dissertation, University of Wisconsin-Madison 1999). On the Division of Entomology (1863–1904) and its elevation to bureau status in the United States Department of Agriculture, see Gustavus A. Weber, *The Bureau of Entomology: Its History, Activities and Organization* (Washington: Brookings Institution 1930). On agricultural problems in Canada, see Government of Canada, 'Report of the Select Committee Appointed to Inquire into the Best Means of Encouraging and Developing the Agricultural Industries of Canada,' *Journal of the House of Commons* 18 (1884): 25–6; Fowke, *Canadian Agricultural Policy*, 221.

12 On Fletcher, see Arnold Mallis, *American Entomologist* (New Brunswick: Rutgers University Press 1971), 107–10; Paul W. Riegert, 'James Fletcher,' *Dictionary of Canadian Biography*, vol. 12 (Toronto: University of Toronto Press 1995), 376–7; R.B. Whyte, 'Dr. Fletcher as a Botanist,' *Ottawa Naturalist* 22 (1909): 206–7; A. Gibson, 'Dr. Fletcher as an Entomologist,' *Ottawa Naturalist* 22 (1909): 207–11. On inventory sciences in Canada, see Suzanne Zeller, *Inventing Canada: Early Victorian Science and the Idea of a Transcontinental Nation* (Toronto: University of Toronto Press 1987), and de Vecchi, 'Science and Government in Nineteenth-Century Canada.'

Another feature of the inventory sciences was that both amateur naturalists and professional scientists participated in them. This feature, along with the data collection ideal, informed the approach of the dominion entomologist. After his nomination in 1883, Fletcher established a network of four hundred correspondents – farmers, horticulturists, pomologists, and gardeners – to survey the entomological conditions of their respective regions. Their collection and identification of insects provided the dominion entomologist with data on insect outbreaks. Fletcher recorded these data in his annual report, which also contained recommendations for controlling insect outbreaks. Fletcher possessed few resources for performing field experiments and insectarium studies, and his work remained principally oriented towards the collection and dissemination of agricultural knowledge, even after the appointment of two assistants, J.A. Guignard and Arthur Gibson, during the 1890s.<sup>13</sup>

In 1898, when the division diversified its activities to cope with the outbreak of San José scale, this endeavour was less a departure from its former activities than a reply to the provinces that had organized a robust response to the insect's introduction into Canada. First discovered in the San Jose Valley of California in the early 1870s, the scale had spread throughout the United States within the next two decades. Realizing that infested nursery stocks were the main vectors by which the scale was distributed, American entomologists lobbied their respective legislatures to enact laws that would restrict interstate commerce of agricultural products. Nine states adopted quarantine and inspection laws, but the absence of national legislation enabled the scale-infested nursery stocks to travel throughout North America. By 1896 the scale had colonized orchards in fourteen eastern states and reached British Columbia and Ontario.<sup>14</sup>

13 Government of Canada, *Sessional Papers*, 1885, no. 10, 'Report of the Entomologist and Botanist: Annex to the Report of the Minister of Agriculture for the Dominion of Canada,' 366–8; Charles J.S. Bethune, 'The Rise and Progress of Entomology in Canada,' *Transactions of the Royal Society of Canada*, 2nd Series, 4 (1898): 155–65; Leland Oswald Howard, *A History of Applied Entomology (Somewhat Anecdotal)* (Washington: Smithsonian Institution 1930), 184–5. On Fletcher's activities, see Paul W. Riegert, *From Arsenic to DDT: A History of Entomology in Western Canada* (Toronto: University of Toronto Press 1980), 86.

14 Government of Canada, *Sessional Papers*, 1897, no. 8A, 'Report of the Entomologist and Botanist: Annex to the Report of the Minister of Agriculture for the Dominion of Canada'; H. Seftel, 'Government Regulation and the Rise of the California Fruit Industry: The Entrepreneurial Attack on Fruit Pests, 1880–1920,' *Business History Review* 59 (fall 1985): 369–402; L.O. Howard, 'Legislation against Injurious Insects: A Compilation of the Laws and Regulations in the United States and British

Aware of the damages caused by the scale to the Californian fruit industry, agricultural associations in both provinces immediately required their governments to enforce inspection measures to repel the insect. One year after the discovery of the scale in British Columbia, the provincial government and its Horticultural Board appointed an 'inspector of fruit pests.' The board provided the inspector with the authority to reject and destroy all potentially dangerous, insect-infested horticultural stock that reached ports of entry in British Columbia. It also established a fumigation station for the treatment of fruit trees and vegetation. This response aimed to satisfy the British Columbia Fruit Growers' Association, whose members expressed concern about the importation of infested fruits and nursery stocks.<sup>15</sup>

Unlike the Horticultural Board of British Columbia, the Department of Agriculture of Ontario was unable to limit the spread of the San José scale after its discovery in 1894. Despite the appointment of a superintendent of experimental spraying for the inspection of orchards and the demonstration of control methods, the insect reached an outbreak level in the Niagara Peninsula within three years. Facing the unsuccessful efforts of the provincial government, the Ontario Fruit Growers' Association directed its attention towards the dominion government. At a meeting held on 10 June 1897, the association petitioned the federal government for a complete embargo on American fruits and nursery products 'except under the most rigorous inspection.' Two weeks later it resolved 'that the importation from the United States or any other country where the San José scale is known to exist, of nursery stock and such fruits as are affected by the scale, be entirely prohibited.'<sup>16</sup>

Cognizant of the fact that their provincial government had done everything within its power to prevent the spreading of the scale, the Ontario fruit growers expected the federal government to use its constitutional power over trade and commerce to impose barriers on international trade. However, the federal minister of agriculture, Sydney Fisher, and the dominion entomologist rejected the idea of an embargo on American agricultural products. Both were uneasy about a measure that

Columbia,' United States Department of Agriculture, Division of Entomology, *Bulletin*, no. 33 (1898); Geong, 'Exerting Control,' 213

15 *Fifth Report of the Department of Agriculture of the Province of British Columbia, 1895-1896* (Victoria: British Columbia Department of Agriculture 1897), 1086. On insect control in British Columbia, see Riegert, *From Arsenic to DDT*, 101-94.

16 Ontario Fruit Growers' Association, *Annual Report for the Year 1897*, 29 (1898): 74. Cook provides a detailed account of the fight against the San José scale in Ontario. See George M. Cook, "'Spray, Spray, Spray!': Insecticides and the Making of Applied Entomology in Canada, 1871-1914,' *Scientia Canadensis* 22-3 (1998-9): 7-50.

might occasion diplomatic and commercial retaliations and potentially hinder the growth of a rapidly expanding fruit industry. When pressed for prohibitive legislation to prevent nursery stock from entering the country, Fletcher replied that 'our chief efforts should be directed towards finding out the best remedies without interfering with the established business of fruit-growers and nurserymen.' The dominion entomologist further remarked that 'any practical and effective measures would entail heavy expense, not only from the staff necessary to carry out the Act, but also from the litigation which would certainly arise with merchants.'<sup>17</sup>

This position presented a stark contrast with that of American entomologists, who promoted quarantine laws precisely to gain visibility and resources and to overcome the consequences of budgetary cuts imposed in the aftermath of the 1893 depression. Aside from the agitation of state entomologists for laws against the San José scale, the chief of the federal Entomology Division, Leland Ossian Howard, attempted to pass a law restricting international and interstate commerce of nursery stocks in 1897. For Howard, one of the most serious threats to American agriculture consisted of foreign insects that arrived in the United States without their natural enemies. International and local agricultural trade facilitated these unfortunate immigrations and their spread throughout the country. The San José scale, the cotton boll weevil, and the gypsy moth, for example, had all entered and travelled across the American territory over the past few decades. Howard, however, met with the opposition of nurserymen and Congressmen interested in the expansion of the fruit and nursery stock industries, and his efforts for the enactment of a national quarantine law came to no avail.<sup>18</sup>

17 Government of Canada, 'Report of the Select Standing Committee on Agriculture and Colonization (Evidence of James Fletcher),' Canada, House of Commons, *Journal*, 60–61 Victoria, A. 1897, Appendix no. 2 (Ottawa: Queen's Printer 1897), 95; *Fourth Report of the Department of Agriculture of the Province of British Columbia, 1893–1894* (Victoria: British Columbia Department of Agriculture 1895), 1059; Zeller, *Inventing Canada*, 215–16

18 On the American situation, see Gustavus Weber, *The Plant Quarantine and Control Administration: Its History, Activities and Organization* (Washington: Brookings Institution 1930); L.O. Howard, 'The Department of Agriculture in Relation to a National Law to Prevent the Importation of Insect-Infested or Diseased Plants,' U.S. Department of Agriculture, Office of the Secretary, *Circular 37* (1911): 11; L.O. Howard, 'Danger of Importing Insect Pest,' *Yearbook of the United States Department of Agriculture, 1897* (Washington: Government Printing Office 1898), 529–52; Pauly, 'The Beauty and Menace of the Japanese Cherry Trees,' 58; Geong, 'Exerting Control.'

Fletcher rejected the necessity of a federal law for reasons other than the political opposition of nurserymen and the fiscal restraint of his government. He dismissed the possibility of the scale establishing itself in Canada, as he believed that such an occurrence would contradict the current bioclimatic knowledge of animal distribution. The dominion entomologist had adopted the 'life zone theory,' an analysis of the distribution patterns of North American fauna and flora elaborated by the chief of the US Department of Agriculture's Division of Ornithology and Mammology, Clinton Hart Merriam, and used by Howard. For Howard, it was impossible for the scale to perpetuate itself in the Transition Zone, north of the Upper Austral Zone, where it was established by 1896 (fig. 1). In his evidence before the federal Select Standing Committee on Agriculture and Colonization, Fletcher reiterated Howard's conclusion and confidently claimed that even in the small area of the Niagara Peninsula, located within the Austral Life Zone, the colder Canadian winters would prevent the insect from becoming economically injurious. In his view, the colonization of some Canadian orchards by the San José scale constituted a localized phenomenon that was better dealt with by the provinces, rather than a national threat to Canadian agriculture that would warrant the involvement of the federal government.<sup>19</sup>

In this context, what prompted the minister of agriculture to introduce a bill into Parliament on 16 March 1898 prohibiting the importation of nursery plants from the United States and other countries? The establishment of the San José scale in the Niagara Peninsula orchards had certainly undermined interpretations of the life zone theory for assessing the insect's potential distribution. In 1897 Fletcher wrote to the director of experimental farms: 'It is extremely likely that the San José Scale will spread in a very short time from the states to the south of us and may do much harm in Canadian orchards, and as the nursery-men and fruit-growers I have met seem willing to allow this legislation to be enacted it may be well for the Minister to meet their wishes in a certain measure.' Later that same year, he warned Parliament that 'we cannot prevent its introduction because it is here already but we only need

19 C.H. Merriam, 'The Geographic Distribution of Animals and Plants in North America,' *Yearbook of the United States Department of Agriculture, 1894* (Washington: Government Printing Office 1895), 203-14; L.O. Howard and C.L. Marlatt, 'The San José Scale: Its Occurrences in the United States,' U.S. Department of Agriculture, Division of Entomology *Bulletin*, New Series 3 (1896). On Merriam, see Keir B. Sterling, *Last of the Naturalists: The Career of C. Hart Merriam* (New York: Arno 1974).

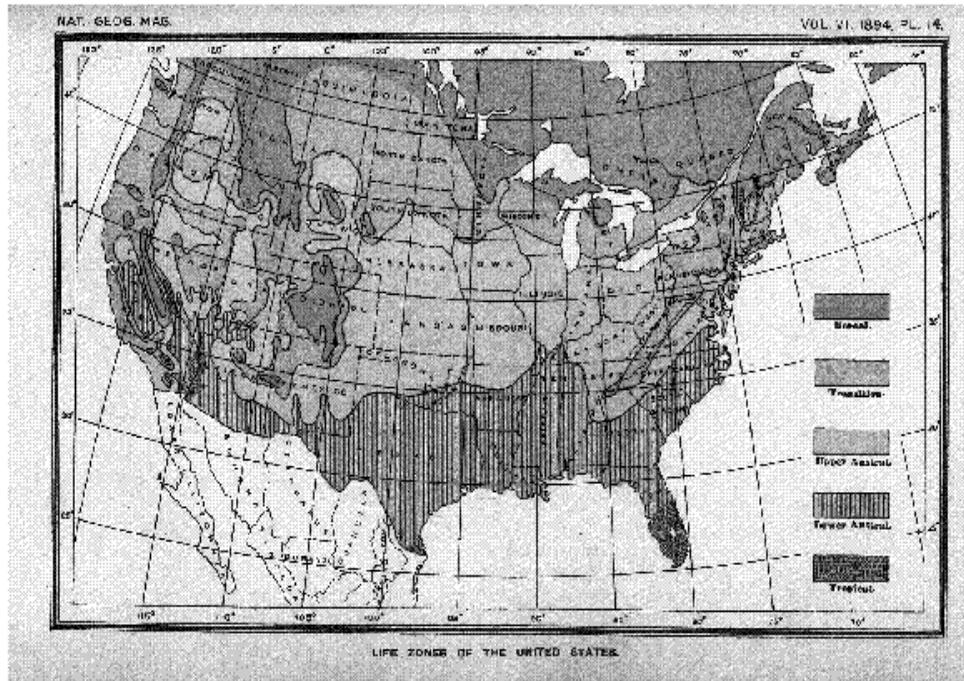


FIGURE 1: Merriam's Life Zones

Source: Clinton H. Merriam, 'Laws of Temperature Control of the Geographic Distribution of Terrestrial Animals and Plants,' *National Geographic Magazine* 6 (1894): 239

common sense to see that it does not spread widely from the few localities where it has gained a foothold.' Clearly, Fletcher's faith in bioclimatology had dwindled, and scientific knowledge alone had proved insufficient in informing a quarantine legislation.<sup>20</sup>

More important for the Department of Agriculture and for Canadian farmers, European countries had recently adopted stringent measures banning American plant products to prevent the introduction of the San José scale. They were ready to extend the ban to Canadian products if these were found to be infested. Germany enacted a decree on 5 February 1898, and a similar measure was passed in Austria-Hungary. The governments of Sweden and the Netherlands had initiated official investigations into the potential introduction of the scale. The Canadian government had to demonstrate that it had taken every precaution to protect its products from the scale, a fact that caught the attention of the dominion entomologist. One year after the enactment of the San José Scale Act, he proudly stated: '[The act] has had a very good effect on European markets where there is a recognition of the fact that Canada has taken every precaution to grow the products of her orchard of the very best quality and to protect them from the ravage of this terrible pest.' If, according to the minister of agriculture and the dominion entomologist, the absence of legal measures to prevent the introduction of the San José scale had initially strengthened the expansion of Canadian horticulture, it would henceforth represent a threat to furthering the international trade of its products.<sup>21</sup>

The House of Commons and the Senate adopted the Act to Prevent the Spread of the San José scale two days after the bill's submission. Canadian orchardists and nurserymen generally supported the rapid adoption and enforcement of the act, but opposition arose in some quarters of Ontario as a result of the provincial Department of Agriculture's drastic actions. The Ontario legislature had adopted its own Act to

20 Government of Canada, *Evidence of Dr. James Fletcher, Entomologist and Botanist, Dominion Experimental Farms, before the Select Standing Committee of the House of Commons on Agriculture and Colonization. Session of 1897* (Ottawa: Queen's Printer 1898), 15; National Archives of Canada (NA), RG 17, A1 7, Dominion Entomologist and Botanist Letterbook, vol. 2343, James Fletcher to William Saunders [Experimental Farms Branch, director], 14 June 1897

21 Government of Canada, 'Report of the Select Standing Committee on Agriculture and Colonization (Evidence of James Fletcher),' Canada, House of Commons, *Journal*, 61, Victoria, A. 1898, Appendix no. 3 (Ottawa: Queen's Printer 1898), 153. On foreign legislation concerning the San José scale, see Howard, *History of Applied Entomology*, 121-3; 'Regulations of Foreign Governments regarding Importation of American Plants, Trees, and Fruits,' United States Department of Agriculture, Division of Entomology, *Circular* 41 (1900).

Prevent the Spread of the San José Scale on 17 January 1897, authorizing provincial inspectors to enter any nurseries or orchards and burn infested trees. In 1898 inspectors had ordered the destruction of an estimated 41,000 trees, which could hardly be replaced by imported nursery stocks, given the stringent quarantine measures enforced by the federal government.<sup>22</sup>

With mounting discontent among fruit growers, the Ontario government appointed a commission of inquiry that recommended a relaxation of the law in 1899. That same year, it enacted the Fumigation Act and made compulsory the treatment of all nursery stock with hydrocyanic acid gas. After British Columbia in 1895, Ontario was the second province to set up fumigating houses. The federal government followed in the footsteps of the provinces, which, in contrast to the dominion entomologist and his laissez-faire policies, had been prime movers in adopting control measures against insect pests. On 4 April 1900 it amended the San José Scale Act to lift import restrictions and enforce the transit of nursery stocks to fumigation stations established throughout the country.<sup>23</sup>

The provinces remained at the forefront when another insect outbreak from the United States threatened Canadian orchards. Accidentally introduced from Europe, the brown-tail moth had been thriving throughout New England for some fifteen years when a Nova Scotia farmer found a winter nest of this insect in his orchard in 1906. After receiving and examining the nest, Fletcher published a lengthy article in his annual report in which he recommended that farmers resort to 'energetic measures' such as winter nest destruction and insecticide spraying. Nova Scotia's provincial government, in contrast, acting under the pressure of the Nova Scotia Fruit Growers' Association, organized a direct and effective response to the threat. It set up a survey group to assess the extent of the outbreak and initiated an extermination campaign in which inspectors scouted the infested territory to collect and destroy winter

22 Government of Canada, *Statutes*, 61 Victoria, chap. 23 (1898), 107–8; Riegert, *From Arsenic to DDT*, 75–6; Cook, "Spray, Spray, Spray!" 28–9

23 Government of Canada, *Sessional Papers*, 1901, no. 16, 'Report of the Entomologist and Botanist: Annex to the Report of the Minister of Agriculture for the Dominion of Canada,' 245; Government of Canada, *Statutes*, 63–4 Victoria, chap. 31 (1900), 213; Government of Canada, *Statutes*, 61 Victoria, chap. 23 (1898), 107–8; *Official Report of the Debates of the House of Commons of the Dominion of Canada*, 2nd Sess. 11th Parl., 61 Victoria, 1898, 46 (Ottawa: Queen's Printer 1898), 1928. Six fumigation stations were established a year later in Saint John (New Brunswick), Saint-Jean (Quebec), Niagara Falls and Kingston (Ontario), Winnipeg (Manitoba), and Vancouver (British Columbia).

nesses. It also mandated the biology professor of the Nova Scotia Agricultural College to investigate the insect's life history and distribution in the province.<sup>24</sup>

That the provincial governments, because of their traditional close links with the fruit growers' associations and their willingness to protect their industry and territory, were more eager than the federal government to act against insect pests was again obvious in the winter of 1909. In a letter to the dominion entomologist, the chief of the New York Horticultural Bureau announced the discovery of brown-tail moth nests in European nursery products being routed to Canadian nurseries. Fletcher had died suddenly in November 1908, and Arthur Gibson, the acting dominion entomologist, claimed to have no legal power to prohibit the importation of these products: the San José Scale Act was concerned solely with plants potentially carrying this insect. In line with his predecessor's policy, Gibson left the matter in the hands of the provincial departments of agriculture. In Ontario and Quebec, nurserymen voluntarily authorized inspectors appointed by provincial services to inspect their premises. In Nova Scotia and British Columbia, provincial officers inspected potentially infested incoming nursery stocks. These arrangements facilitated the discovery of more than two hundred nests. They also signalled the need for expanding federal legislation to prevent the introduction of foreign insects into Canada.<sup>25</sup>

As was the case with the San José scale, the brown-tail moth episode displayed the local nature of crop protection problems. Provincial entomological services seized on such opportunities to tighten their traditional relationships with the affluent fruit growers' associations and to increase the scope of their activities and staff. The federal Division of Entomology relied instead on its insect collector networks and confined itself to data collection and knowledge diffusion. At that time, however, natural historians were abandoning the ideals of inventory sciences to embrace different norms of scientific research. They articulated concepts such as community or succession to frame the dynamic relationships uniting living organisms and the interactions between the latter and the

24 *Annual Report of the Secretary for Agriculture of Nova Scotia for the Year 1908* (Halifax: Commissioner Public Works and Mines 1909), 21; Government of Canada, *Sessional Papers*, 1907, no. 16, 'Report of the Entomologist and Botanist: Annex to the Report of the Minister of Agriculture for the Dominion of Canada,' 47; F.T. Lord, 'The Development of Agricultural Entomology in Nova Scotia,' *Proceedings of the Nova Scotian Institute of Science* 33 (1983): 19-46

25 NA, RG 17, AI 7, vol. 2343, George Atwood to Arthur Gibson, 10 June 1909; Arthur Gibson, 'Nests of the Brown-Tail Moth in Importations of French Nursery Stock, 1909,' *Annual Report of the Entomological Society of Ontario* 40 (1910): 19-20

inanimate elements of nature. Boundaries drawn from meteorological data lost their relevance for understanding the changing behaviour of animal and plant species in environments undergoing modifications through human actions such as industrialization and pollution or colonization and cultivation of new land. But a major departure concerning the nature of science and its role within governmental agencies was required before such an ecological approach would inspire the research practices of governmental scientists and inform administrative and regulatory decisions.

#### THE CENTRALIZATION OF INSPECTION ACTIVITIES

Rapid growth and profound changes characterized the scientific bureaucracy of the federal government in the first decade of the twentieth century. Government leaders wanted to enlarge and diversify the state apparatus to intervene more directly in the nation's economic affairs. Scientists successfully expounded the idea that scientific research was key to national prosperity by solving problems related to industrial production and resource conservation. The recent growth of Canadian universities generated a fair number of graduates, making possible the expansion of the federal government's scientific agencies. A number of departmental heads wished to enlarge their administrative machinery to design specific state interventions and gain visibility. They counted on a new class of civil servant – the trained and specialized scientist – to replace the old guard of versatile scientists. The amendment to the Civil Service Act in 1908, which instituted a competitive system to appoint professionals valued for their scientific qualifications rather than their partisanship, confirmed the government's interest in a new breed of scientist.<sup>26</sup>

The expansion of the federal Department of Agriculture clearly exemplified these changes. Originally limited to five between 1886 and 1905, the number of agricultural stations reached twenty-six within the next decade. Rather than strictly allotting these stations on a territorial basis, in line with the original working of the law, the department established stations according to specific agricultural commodities. Specialization also had an impact on the organization of the Experimental

26 De Vecchi, 'Science and Government'; McKillop, *Contours of Canadian Thought*; Gingras, *Les origines de la recherche scientifique*. On the Civil Service Act, see John Edwin Hodgetts, William McCloskey, Reginald Whitaker, and V. Seymour Wilson, *The Biography of an Institution: The Civil Service Commission of Canada, 1908–1967* (Montreal and Kingston: McGill-Queen's University Press 1972).

Farm Branch, with the introduction of scientific divisions that reflected specific commodities or agricultural problems: tobacco, poultry, husbandry, horticulture, cereal, and agrostology. By their direct services to commodity producers, the new stations and divisions provided visibility to the department and the minister, and confirmed the specialization of agricultural sciences.<sup>27</sup>

Sydney Fisher, who was still heading the Department of Agriculture, personally directed the expansion of the scientific services of the Experimental Farms Branch. He selected the locations and the directors of the new stations and invited scientists to join the division. The branch's director, William Saunders, did not object to Fisher's interventions. Fisher strengthened the initial impulse that Saunders gave to the branch as far as its scientific activities and organizational contours were concerned. Despite the increasing number of regional stations and their scientific and technical specialization, scientific investigations remained firmly concentrated in Ottawa. True to the director of the Farms Branch, but also to his personal interest and shrewdness, Fisher favoured the centralization of scientific activities to avoid duplication and to increase administrative efficiency.<sup>28</sup>

In line with these transformations, Fisher brought two important changes to his department's activities in crop protection following Fletcher's death. First, he established two distinct divisions of entomology and of botany, a change that reflected the growing specialization of science and its development into discrete disciplines. Second, rather than replacing Fletcher by the two self-taught naturalists recommended by the director of the Experimental Farms Branch, Fisher entrusted the direction of the divisions to two scientists hired in Great Britain. Charles Gordon Hewitt, a lecturer in entomology and economic zoology at the University of Manchester, became the dominion entomologist, and Hans Theodor Güssow, assistant to the chief botanist of the British Museum of Natural History and of the Royal Agricultural Society, became the dominion botanist. Hewitt's selection corresponded to Fisher's desire to have highly qualified scientists at the head of the Ottawa division.<sup>29</sup>

Hewitt was a British entomologist on the rise. In 1907 he was appointed to the newly created lectureship in economic zoology at the

27 Department of Agriculture, *Fifty Years of Progress on Dominion Experimental Farms, 1886-1936* (Ottawa: King's Printer 1939)

28 De Vecchi, 'Science and Government'; Stéphane Castonguay 'Fédéralisme et centralisation de la recherche agricole au Canada. Dynamique scientifique et écologie institutionnelle,' *Bulletin d'histoire politique* 7 (1999): 21-39

29 T.H. Anstey, *Cent moissons. Direction générale de la recherche. Agriculture Canada, 1886-1986* (Ottawa: Supply and Services 1986), 55

University of Manchester's Zoology Department. During his tenure there, he published sixteen articles on the housefly and the larch sawfly and helped establish the department as a centre of expertise in economic entomology. He obtained his DSc in 1909, shortly before his Canadian appointment. Thus, despite Saunders's support for the nomination of Arthur Gibson, Fisher obviously preferred a university-trained scientist who could assert the Department of Agriculture's authority.<sup>30</sup>

The appointment of a British scientist also revealed the federal government's desire to bolster Anglo-Canadian relations and further the interests of the empire. Canadian scientists hoped to direct the flux of students away from the United States and towards Great Britain and to participate in the imperial research scheme that was directed by the British Association for the Advancement of Science. These attempts did not contribute much to the agricultural sciences, since Canadian scientists found in a shared natural environment – in terms of geography, climate, and species – a strong incentive to look for colleagues south of the border, rather than across the Atlantic. Furthermore, Canadians and Americans had little to learn from British economic entomology at that time. Applied zoology at the University of Manchester was a recent (1907) and groundbreaking venture, and major institutional initiatives (the Entomological Research Committee in 1909 and the entomology lectureship at London's Imperial College of Science and Technology in 1911) took place after Hewitt's appointment in Canada. It is worth noting that, in 1911, Great Britain started sending students to the United States to learn 'the American system of organising economic entomology.'<sup>31</sup>

30 NA, RG 17, AI 10, Deputy Minister's Letterbooks, vol. 1767, 80, G.F. O'Halloran, Deputy Minister of Agriculture, to Adam Shortt and G. LaRochelle, Civil Service Commissioners, 21 May 1909. Saunders recommended the appointment of Arthur Gibson and W.T. Macoun, the dominion horticulturist, but the Civil Service Commission confirmed the selection of the minister of agriculture. NA, RG 17, AI 10, vol. 1848, W. Saunders to G.F. O'Halloran, 23 Dec. 1908. On Hewitt, see Arthur Gibson and J.M. Swaine, 'Charles Gordon Hewitt,' *Canadian Entomologist* 52 (May 1920): 97–105; Paul W. Riegert, 'Charles Gordon Hewitt,' *Dictionary of Canadian Biography*, vol. 13 (Toronto: University of Toronto Press 1996), 530–1; Alison Kraft, 'Building Manchester Biology, 1851–1963: National Agendas, Provincial Strategies' (PhD dissertation, University of Manchester 2000), 224–7.

31 Carl Berger, *The Sense of Power: Studies in the Ideas of Canadian Imperialism* (Toronto: University of Toronto Press 1970); de Vecchi, 'Science and Government'; William A. Waiser, 'The Macoun-Merriam Connection,' *History of Science and Technology in Canada*, *Bulletin* 6 (March 1982), 3–9. Hewitt had been elected a foreign member of the American Association of Economic Entomologist in 1907 and had corresponded with Howard previous to his appointment (both were leading experts on the house fly). Howard supported his candidacy to the position. See National Archives and Record Administration (United States) (NARA), RG 7,

However, in one domain, Great Britain could inform Canadian activities in insect control. In the field of preventive measures against agricultural pests, it had enacted and enforced some broadly comprehensive regulations at the national level. This was precisely the line of attack that Hewitt took after arriving in Canada. In September 1909 the dominion entomologist advised the deputy minister of the necessity of using legal means to prevent the introduction of foreign insects. The introductory paragraphs of his four-page memorandum are worth quoting at length, as they demonstrate Hewitt's understanding of an insect outbreak and the means for preventing it.

The results of [the introduction in large quantities of agricultural and horticultural material for growing purposes] is there is a danger, which is more real than apparent, of insects and other pests being introduced with such materials from their native countries. One of the chief dangers of such introduction is that in the countries from which such potential pests are introduced, these insects are kept under control by natural means ... Fortuitously introduced into this country on imported crops, trees or bushes they are not accompanied by their controlling natural agencies, with the result that in such a virgin soil they increase to an enormous extent and become a serious pest.

... It is necessary therefore that we of the Department of Agriculture should be alive to such contingencies and able immediately on the information of the appearance or threatened appearance of an insect or other pest to deal with it without the necessity of having to seek powers from Parliament.<sup>32</sup>

Drawing on his training at the University of Manchester under the post-Darwinian zoologist S.J. Hickson, Hewitt emphasized the interactions between species and their changing environment. This approach corresponded to an understanding of nature that was gaining a strong foothold among botanists and zoologists who rejected the traditional

Records of the Bureau of Entomology and Plant Quarantine, General records, E 34, box 181, Howard to Hewitt, 6 March 1909. On British economic entomology, see J.F.M. Clark, 'Bugs in the System: Insects, Agricultural Science, and Professional Aspirations in Britain, 1890-1920,' *Agricultural History* 75 (winter 2001): 83-114. On British students in America, see Howard, *A History of Applied Entomology*, 223-4; NARA, RG 7, E 34, box 81, 'Minutes of the Meeting of the Selection Sub-Committee of the Entomological Committee Held at the Colonial Office, Friday 23rd September, 1910.'

<sup>32</sup> NA, RG 17, AI 1, Records of the Deputy Minister, General Correspondence, vol. 2764, file 202835, Memorandum on the Desirability of Further Legislation Dealing with the Introduction of Insect and Other Pests into the Dominion of Canada, C.G. Hewitt to W. Saunders, 25 Sept. 1909

practices of their colleagues in natural history. Instead of merely collecting species and describing their geographical distribution, they studied the physiological and adaptive responses of species, the structure of their community, and the interactions of population within a singular environment. During this formative period of scientific ecology, a first generation of professional ecologists defined their own concepts and tools to analyze the natural interactions forming a stable community. Their post-Darwinian understanding of the natural world still relied on a teleological metaphor – the balance of nature – to explain the regulation of animal population: a divine wisdom ordered a harmonious world between species and regulated their growth and relationships. Nevertheless, they applied experimental and quantitative methods in their studies of the relationships between organisms and their environment and provided a dynamic and evolutionary interpretation of the balance of nature.<sup>33</sup>

Hewitt's explanation of an insect outbreak fitted within this post-Darwinian ecological understanding of nature. He insisted on the fact that insect pests were principally of foreign origin. When introduced into a new territory without their natural enemies (insect parasites or diseases), insects multiplied rapidly and reached an injurious level. Hewitt extended this position to indigenous insects that became a potential threat to agriculture when new land was cultivated. Rather than limiting the distribution and population growth of insects to an area strictly circumscribed by average temperatures, Hewitt underscored the unpredictability of insect outbreaks because of the complexity of animal behaviour and its varying ecological responses to the abiotic environment and its animal and plant populations.<sup>34</sup>

Hewitt's account contrasted greatly with that of his predecessor. Here, I want to emphasize the organizational and political consequences of two

33 On biology at Manchester, see J. Stanley Gardiner, 'Sydney John Hickson (1859–1940),' *Obituary Notices of Fellows of the Royal Society* 3 (London: Harrison & Sons 1941), 383–94; Kraft, 'Building Manchester Biology.' On biogeography and post-Darwinian ecology, see Pascal Acot, *Histoire de l'écologie* (Paris: Presses Universitaires de France 1988), 43–92; Jean-Paul Deléage, *Histoire de l'écologie. Une science de l'homme et de la nature* (Paris: La Découverte 1992), 61–101; Peter J. Bowler, *The Norton History of Environmental Sciences* (New York: Norton 1993), 366–7; Sharon Kingsland, 'Defining Ecology as a Science,' in Leslie A. Real and James H. Brown, eds., *Foundations of Ecology* (Chicago: University of Chicago Press 1991), 1–13; Donald Worster, *Nature's Economy*, 2nd ed. (New York: Cambridge University Press 1994), 190–220.

34 Government of Canada, 'Report of the Select Standing Committee on Agriculture and Colonization (Importance of Entomology in the Development of Canada. Evidence of Gordon Hewitt),' Canada, House of Commons, *Journal*, 9–10, Edward VII, A. 1910, Appendix no. 1 (Ottawa: King's Printer 1910), 18

very different representations of an outbreak, rather than the scientific proficiency of the dominion entomologists. Fletcher's economic entomology – its network of correspondents and its life zone theory – fitted within a tradition in which naturalists scattered collected systematic information on the physical and organic environment over a large territory to establish biogeographical patterns of animal distribution. Fletcher limited the division's role to knowledge diffusion and entrusted farmers with the responsibility of controlling outbreaks. Hewitt, in contrast, considered that the necessary response to the insect threat ought to be a public one, involving direct governmental intervention because of all the uncertainties surrounding the potential explosion of an insect population. Since an outbreak could occur over a large territory, action was needed across – not simply within – biogeographical regions. Consequently, no local government (let alone individual) was in a position to prevent the spreading of an insect population. The appropriate strategy for checking impending insect outbreaks was preventive measures organized by public authorities, not direct control methods by individual farmers.

For Hewitt, Canada had to follow the example set by Great Britain, which had adopted the Destructive Insects Act in 1877. The act specifically targeted the Colorado potato beetle, an American insect accidentally introduced into the United Kingdom. It was later repealed and, in 1907, replaced by the Destructive Insects and Pests Act, which concerned not a specific insect, but all plant products susceptible of carrying pests. To a certain extent, the San José Scale Act was similar to the 1907 Destructive Insects and Pests Act, but it addressed only plant products from countries where the scale thrived. Hewitt proposed a more general and flexible law than the San José Scale Act. According to this law, the adoption of preventive measures would not rest on a law specific to one insect, but on a series of regulations adopted through orders-in-council, in anticipation, rather than in response, to potential outbreaks.<sup>35</sup>

The dominion entomologist wrote a bill that Fisher presented in the House of Commons in November 1909. Based on an ecological approach that emphasized the indeterminacy of an outbreak and its extension, the regulatory framework proposed by Hewitt was necessarily vague. The minister admitted that 'we never can tell what form these insect menaces will assume, we cannot define in the Bill clearly and distinctly the steps necessary to be taken.' Despite the vagueness of the

35 On the 1877 Destructive Insects Act, see John F. Clark, 'Beetle Mania: The Colorado Beetle Scare of 1877,' *History Today* (Dec. 1992): 7.

bill, he requested that his department be granted the power to deal with crop pests and to adopt, on a case-by-case basis, regulations to thwart any insect menace to Canadian agriculture.<sup>36</sup>

Some deputies worried about the extended power that the law conferred on the minister of agriculture and feared a duplication of activities or jurisdictional conflicts between the central government and the provinces. Under the pressure of their fruit growers' associations, provincial legislatures had, before the federal government did so, established an inspection service and adopted regulations to prevent the introduction and distribution of foreign insects. Suspicion was especially strong among representatives of British Columbia. Since the inauguration of the dominion fumigation station in Vancouver under the amended San José Scale Act of 1900, fruit growers had expressed doubts about a federal service whose sole purpose seemed to be the duplication of their own provincial organization, which they entrusted with legal authority and funds. During the parliamentary debate on the Destructive Insect and Pest Act, H.M. Burrell, who was also a member of the British Columbia Board of Horticulture and a former federal minister of agriculture, remarked that 'there is a strong feeling among them [the fruit growers of British Columbia] that although the jurisdiction is concurrent, we should be very loath to relinquish any of our organisation or our methods or our efforts.'<sup>37</sup>

Most provinces, however, welcomed the centralization of inspection activities. They were relieved from the financial obligation of sustaining a service that could not guarantee the efficiency of its activities in the absence of similar measures in neighbouring provinces. Furthermore, federal regulations ensured the application of uniform measures across the country. This prospect certainly pleased fruit growers and nurserymen, who sometimes faced the vagaries of zealous inspectors from competing provinces. Fisher also added specific measures to obtain the support and cooperation of nurserymen and provincial fruit growers' associations. For instance, the bill provided compensation for nursery-

36 Government of Canada, *Official Report of the Debates of the House of Commons of the Dominion of Canada, 2nd Sess., 11th parl., 9-10 Edward VII, 1909-1910*, 93 (Ottawa: King's Printer 1910), 210

37 On the situation before the agreement, see NA, RG 17, AI 1, vol. 2763, file 202663, *Report on the Inspection of the Dominion Fumigation Stations*, C.G. Hewitt to G.F. O'Hallaran, 24 Nov. 1909; NARA, RG 7, E-34, box 181, Hewitt to Howard, 26 April 1911; Government of Canada, *Official Report of the Debates of the House of Commons of the Dominion of Canada, 2nd Sess. 11th parl., 9-10 Edward VII, 1909-1910*, 95 (Ottawa: King's Printer 1910), 5635, 5938, 5941-2, 5945-6.

men whose material was destroyed by inspectors, thereby improving the working of provincial acts.<sup>38</sup>

The Destructive Insect and Pest Act received royal assent on 4 May 1910. The Entomology Division took on the duty of ensuring the protection of the national territory from the introduction and proliferation of injurious insects. All the provinces agreed to limit their activities to eradication campaigns within their boundaries, and the scope of their regulations remained intra-provincial. However, two provinces soon challenged the federal authority over international and interprovincial trade.

As already intimated, British Columbia's cooperation proved difficult to gain. As the Canadian entry point for plant products from Pacific countries, the province had set in place measures to keep notorious orchard pests, such as the San José scale and the codling moth, out of its territory. Furthermore, for the past eight years, British Columbia's fruit growers and nurserymen had been complaining about delays caused by the inspection and fumigation activities of the Entomology Division, ever since the amendment of the San José Scale Act.

Hewitt recognized the more stringent and encompassing legislation of British Columbia. On 18 April 1912 the federal Entomology Division reached an agreement with the provincial Department of Agriculture. The Provincial Board of Horticulture maintained its inspection service and fumigation station to enforce its own laws and the regulations adopted under the Destructive Insect and Pest Act. Definitions of requirements and regulations under this act remained under the supervision of the dominion entomologist. By conferring on the provincial board the executive power to inspect imported plant products and by concurrently retaining its legislative capacities to prevent the introduction of foreign insects, the federal government established its prerogatives in the field of insect control.<sup>39</sup>

38 Government of Canada, *Official Report of the Debates*, 95, 5949, 5665–6, 5673, 5974, 5894–5. On the relationships between provincial and federal authorities, see Riegert, *From Arsenic to DDT*, 75.

39 NA, RG 17, AI 1, vol. 2763, file 202663, Memorandum on Amendments to the Regulations under the Destructive Insect and Pest Act, Rendered Necessary by the Consolidation of the Federal and Provincial Work of Inspection and Fumigation at Vancouver, C.G. Hewitt to G.F. O'Hallaran, 14 March 1912; NA, RG 17, AI 1, vol. 2764, file 202835, C.G. Hewitt to J.H. Grisdale, 8 April 1912; NA, RG 17, AI 1, vol. 2777, file 226492, Agreement between the Dominion and Provincial Departments of Agriculture Entered into on April 18, 1912; Government of Canada, *Official Report of the Debates*, 95, 211

Difficulties arose shortly afterwards. In 1913 the Board of Horticulture proposed an amendment to prohibit the importation of fruit from 'regions in which any of certain pests, whose introduction they wish to prevent, occur.' Since the amendment specifically targeted the codling moth, Hewitt considered that such an amendment effectively amounted to a prohibition of fruit importation into the province, since none of the fruit-growing states or provinces exporting to British Columbia were free from this insect. Furthermore, the Provincial Board of Horticulture had contravened the agreement of 1912 by not informing the federal minister of agriculture of other proposed amendments. Hewitt informed the minister that, under such circumstances, the Division of Entomology would not, 'when appealed to, support the action of the Provincial Board of Horticulture in this matter.' The British Columbia legislature refrained from adopting the proposed amendments because of the opposition from most of the province's fruit growers, who feared a complete prohibition of nursery products necessary for their industry.<sup>40</sup>

In the case of Nova Scotia, a crew of inspectors had been at work since 1908 to limit the spread of the brown-tail moth. In 1911 the provincial House of Assembly enacted its own legislation to further protect its fruit-growing industry from insect pests – the Act to Prevent the Introduction of and Spread of Insects, Pests and Plant Diseases Destructive to Vegetation. The act enabled the provincial secretary for agriculture to appoint inspectors empowered to examine any premises suspected of being infested and to order treatment necessary for the destruction of insect pests and plant diseases. It also provided a framework to deal with the San José scale when it was discovered on plantings of young apple trees imported from Ontario nurseries in 1912. The Nova Scotia Fruit Growers' Association urged the provincial government to prohibit the introduction of fruits from Ontario. When asked to intervene on this issue by the secretary, Hewitt recommended regulations whereby provincial officers would inspect and fumigate materials imported from other Canadian provinces. Both the fruit growers and the secretary agreed to the proposition, and the province established fumigation stations at Digby and Truro for the treatment of imported nursery products.<sup>41</sup>

40 NA, RG 17, A1 1, vol. 2777, file 226492, C.G. Hewitt to J.H. Grisdale, Director, Experimental Farms Branch, 5 March 1913; RG 13, vol. 2140, file 389/1913, 11–12 March 1913, Power of Province of B.C. to Prohibit Importation of Fruit from Places Infected by Insects; NA, RG 17, A1 1, vol. 3049, file 40-15 (1), Memorandum on Codling Moth Situation in British Columbia, by Treherne, Chief Division of Field Crop Insect, 20 May 1922

41 NA, RG 17, A1 1, vol. 1135, file 212063, C.G. Hewitt to J.H. Grisdale, 1 June 1912; NA, RG 17, A1 1, vol. 2777, file 226492, C.G. Hewitt to H.M. Burrell, 9 Jan. 1913; NA, RG

Confronted with provinces that attempted to assert their autonomy, Hewitt asked the federal Department of Justice for a legal opinion concerning the provincial right to enact and enforce quarantine legislation in the absence of federal initiatives. According to the deputy minister of justice, these provincial regulations were supported by 'the provincial power to legislate in relation to Agriculture provided the legislation is not repugnant to any Act of the Parliament of Canada.' Hewitt had no choice but to allow British Columbia and Nova Scotia to exert their control over plant products entering their territory. Both provinces had not only enacted severe legal measures but had also nominated a provincial entomologist to supervise the enforcement of these measures in 1912. Hewitt opted to provide assistance to the provinces, and he even encouraged them to take over certain activities of the federal entomological service to avoid duplication and to deal with the ensuing complaints of fruit growers and nurserymen. As had been the case with British Columbia since 1912, the Nova Scotia Department of Agriculture became responsible for the fumigation and inspection of all foreign shipments: in 1915, Digby and Truro became ports of entry under dominion regulations.<sup>42</sup>

Overall, Hewitt handled regulatory issues according to two principles. His first concern was to gain and maintain the support of the fruit growers' associations. In the case of Nova Scotia especially, Hewitt feared that Ontario fruit growers would resent the provincial regulations and further blame the Destructive Insect and Pest Act. He then made sure that, regardless of the regulation a province wished to enforce, fruit growers of all provinces would receive fair and uniform treatment, especially when it involved dominion regulations. But his major concern was to prevent his organization from assuming any control measures. Although both British Columbia and Nova Scotia did not conform to his

17, AI 1, vol. 2777, file 226492, Robert Matheson, Nova Scotia Provincial Entomologist, to M. Cumming, Nova Scotia Secretary for Agriculture, 12 Feb. 1913; *Annual Report of the Secretary for Agriculture of Nova Scotia for the Year 1911* (Halifax: Commissioner Public Works and Mines 1912), 7–8; *Annual Report of the Secretary for Agriculture of Nova Scotia for the Year 1912* (Halifax: Commissioner Public Works and Mines 1913), 9–10. Hewitt had persuaded the Ontario Department of Agriculture to arrange a service for the regular inspection of nurseries and the issuing of nursery certificates, two activities that necessitated the proper enforcement of an act already adopted by the provincial legislation. NA, RG 17, AI 1, vol. 1211, file 234643, C.G. Hewitt to J.H. Grisdale, 30 Jan. 1913

<sup>42</sup> *Annual Report of the Secretary for Agriculture of Nova Scotia for the Year 1913* (Halifax: Commissioner Public Works and Mines 1914), 34; NA, RG 17, AI 1, vol. 1211, file 234643, C.G. Hewitt to G.F. O'Hallaran, 27 Feb. 1915; NA, RG 17, AI 1, vol. 2781, file 231581, C.G. Hewitt to G.F. O'Hallaran, 5 Aug. 1915

regulatory ideal, Hewitt had another priority: pursuing the centralization of economic entomology in Canada. As a scientist, he wanted scientific research to be the foundation of the Entomology Division. Research could secure the growth of the division and reinforce its central role in preventing and controlling insect outbreaks in Canada. It would also help to institute a division of labour whereby the provinces would confine their activities to control measures that were based on the knowledge produced by the division and directed towards individual farmers.<sup>43</sup>

#### EXPERIMENTAL RESEARCH IN THE FEDERAL ENTOMOLOGICAL SERVICE

Responsibilities devolved from the adoption of the Destructive Insect and Pest Act obliged the Entomology Division to recruit and station inspectors at transit points for nursery products. However, only two institutions of higher learning, the Ontario Agricultural College and Macdonald College in Quebec, offered a complete entomological training program in Canada at that time. Competition for young graduates from these institutions became intense, not only among provincial inspection services and the Entomology Division but also among American entomological services and agricultural colleges that recruited in Canada. For example, of the five 1910 graduates in entomology from the Ontario Agricultural College, three joined provincial services, while the other two became nursery inspectors in Massachusetts and New Jersey. Four years later, in an article for the *Journal of Economic Entomology* on the academic origin of United States Bureau of Entomology employees, the Ontario Agricultural College, with six graduates, ranked eighth. Ironically excluded from the category of 'Foreign institutions,' it had outnumbered fifty-two American colleges in the survey.<sup>44</sup>

Considering the availability of trained entomologists, BC deputy H.M. Burrell foresaw certain difficulties. He based his opposition to the bill partly on this issue. Speaking for the Board of Horticulture, he stated that 'knowing ... the difficulty in getting qualified men always to ascertain the real extent of injury, the question arises as to the advisability of duplicating these services.' Hewitt was also aware of this difficulty and of

43 NA, RG 17, AI 1, vol. 1135, file 212063, C.G. Hewitt to G.F. O'Hallaran, 1 June 1912; NA, RG 17, AI 1, vol. 1135, file 234643, C.G. Hewitt to G.F. O'Hallaran, 24 March 1915

44 L.O. Howard, 'The Education of the Entomologists in the Service of the U.S. Department of Agriculture,' *Journal of Economic Entomology* 7 (Oct. 1914): 280; *Annual Report of the Ontario Agricultural College and Experimental Farm* (Toronto: Ontario Department of Agriculture 1910), 25

the importance of hiring highly qualified inspectors for the Entomology Division. He had lobbied – unsuccessfully this time – for a clause requiring an examination of incoming inspectors. Such a clause, he argued, would prevent nurserymen and farmers from challenging the actions of the Entomology Division – such as the destruction of nursery stocks or the quarantine of agricultural regions – on the basis of the competence of its inspectors.<sup>45</sup>

By becoming the principal plant inspection service in Canada, the Entomology Division was well placed to attract Canadian agricultural college graduates, provincial service inspectors, and Canadian entomologists working in the United States. Among the twenty-six entomologists hired between 1910 and 1920 (the duration of Hewitt's tenure), sixteen had already worked as inspectors for other governmental organizations in Canada or in the United States. The division also employed students as summer staff, offering both a first-work experience and positions after graduation. Among the ten students recruited, five had worked as division inspectors while pursuing their undergraduate studies. Finally, the division employed a scholarly staff: by 1920 four entomologists held doctoral degrees, three held master's degrees, and thirteen held bachelor's degrees. Furthermore, by bringing a qualified staff into inspection services throughout the country, the centralization of the legal and executive powers over insect control paved the way for the conduct of entomological research.<sup>46</sup>

To accomplish this goal (one that was shared by the minister of agriculture), Hewitt had to increase the human and material resources of the Entomology Division. More important, he had to create an institutional space where entomologists could initiate research projects. The rationale expounded by Hewitt demonstrates how his interpretation of the causes of an outbreak legitimated not only the centralization of inspection activities in Canada but also the organization of the Entomology Division around scientific research.<sup>47</sup>

45 Government of Canada, *Statutes*, 9–10 Edward VII, chap. 31 (1910), 247–8; Charles G. Hewitt, 'Legislation in Canada to Prevent the Introduction and Spread of Insects, Pests and Diseases Destructive to Vegetation with Regulations Regarding the Importation of Vegetation into Canada,' Entomological Branch, *Bulletin* 6 (1912), 6; Government of Canada, *Official Report of the Debates*, 95, 5672; NA, RG 17, AI 1, vol. 2764, file 202835, C.G. Hewitt to G.F. O'Hallaran, 28 Feb. 1910. The only measure adopted was to provide every inspector with a trial period of thirty days, after which the minister confirmed the nomination.

46 NA, RG 17, BII 2, Department of Agriculture Central Registry and Indexes, vol. 2887, file 14-22, Summary of Proposed Classification, C.G. Hewitt to J.H. Grisdale, 26 July 1919

47 'Report of the Select Standing Committee on Agriculture and Colonization (Importance of Entomology in the Development of Canada. Evidence of Gordon Hewitt),' in

The Destructive Insect and Pest Act provided Hewitt with the financial means to recruit and station entomologists at different ports of entry where, according to one objective of the law, the division was to prevent the introduction of insect pests into Canada. As for a second objective of the law – to counter the distribution of insect outbreaks – the division undertook two activities that represented its first large-scale involvement in experimental research: the campaign against the brown-tail moth and the gypsy moth and the establishment of field laboratories. Both of these interventions rested on a broad interpretation of the Destructive Insect and Pest Act in which Hewitt enlarged the responsibilities of inspectors in charge of preventing the introduction and spread of insect pests. Thereafter, an army of entomologists was mobilized throughout the Canadian territory to ward off any insect threats by conducting experimental research.<sup>48</sup>

Prominent among these threats was the potential introduction of both the brown-tail and gypsy moths into Canada. Having spread throughout New England over the past three decades, the gypsy moth was now one hundred miles south of the border, and, as we have seen, nests of the brown-tail moth had already been discovered in Nova Scotia. These pests represented a major incentive for members of parliament to adopt the Destructive Insect and Pest Act. When some deputies worried about the eventual expenses related to the enforcement of the bill, whether for compensating nurserymen or for hiring inspectors, both the dominion entomologist and the minister of agriculture emphasized the costs inflicted on the American people by these insects and the millions of dollars Congress and the New England states had voted for their control. Accordingly, the fight against the two insects represented a crucial phase in the initial enforcement of the regulations adopted under the act.<sup>49</sup>

Hewitt used these regulations to legitimate the Entomology Division's first biological control research project in 1911. Among the different measures enforced to counter the brown-tail and gypsy moths, an extermina-

Government of Canada, *Canada, House of Commons, Journal*, 9–10, Edward VII, A. 1910, Appendix no. 1 (Ottawa: King's Printer 1910), 18; Government of Canada, *Sessional Papers*, 1910, no. 16, 'Report of the Entomologist: Annex to the Report of the Minister of Agriculture for the Dominion of Canada,' 223, 226, 231–2

48 According to Glen, the budget provided for the enforcement of the Destructive Insect and Pest Act was the principal financial support for the Entomology Division and the only one for regional laboratories until 1934. Robert Glen, 'Entomology in Canada up to 1956: A Review of Developments and Accomplishments,' *Canadian Entomologist* 88 (July 1956), 295

49 'Report of the Select Standing Committee on Agriculture and Colonization (Importance of Entomology in the Development of Canada. Evidence of Gordon Hewitt),' 18; Government of Canada, *Official Report of the Debates*, 95, 5975–6

tion campaign involved the scouting of New Brunswick and Nova Scotia to collect and destroy moth nests. In 1910 the Entomology Division took over the extermination campaign conducted by the provincial departments. That year, Hewitt toured New England to ascertain the extent of the outbreaks. His journey included a stop at the Gypsy Moth Parasite Laboratory (Melrose, Massachusetts), where the United States Bureau of Entomology supervised the introduction of natural enemies and all other operations related to biological control – the use of parasitic and predacious insects to regulate the populations of insect pests.<sup>50</sup>

The Gypsy Moth Parasite Laboratory provided Hewitt with the biotic and technical resources to launch a biological control campaign in Canada. There, the dominion entomologist obtained colonies of predacious and parasitic insects and recruited a graduate of the Ontario Agricultural College, John D. Tothill. Tothill was made responsible for natural control investigations for the Entomology Division. From a laboratory established on the campus of the University of New Brunswick, he studied the parasitism of indigenous insects and supervised the release of imported parasites and predators by field entomologists in the Maritime provinces. Hewitt hired a second entomologist, Leonard S. McLaine, who was employed by an American institution. A graduate of the Massachusetts Agricultural College, McLaine was deputy state nursery inspector in Massachusetts. Hewitt made him responsible for the supply of natural enemies and the collection of moth nests in Atlantic Canada and in New England. McLaine also arranged for the training of Canadian entomologists at the Gypsy Moth Parasite Laboratory so they could learn rearing techniques for the mass propagation of parasites.<sup>51</sup>

50 *Canada Gazette* 43 (14 May 1910): 3503–4; *Annual Report of the Secretary for Agriculture of Nova Scotia for the Year 1909* (Halifax: Commissioner Public Works and Mines 1910), 16; Government of Canada, *Sessional Papers*, 1910, no. 16, 'Report of the Entomologist: Annex to the Report of the Minister of Agriculture for the Dominion of Canada,' 213–14; NA, RG 17, AI 1, vol. 2764, file 202835, Report on a Visit to New England and New York States – June 6 to 24th, C.G. Hewitt, 15 July 1910; Richard C. Sawyer, 'Monopolizing the Insect Trade: Biological Control in the USDA, 1888–1951,' *Agricultural History* 64 (spring 1990): 271–85

51 NA, RG 17, AI 1, vol. 2763, file 202663, C.G. Hewitt to William Saunders, 13 Dec. 1910; NA, RG 17, AI 1, vol. 1010, file 204425, C.G. Hewitt to J. H. Grisdale, 12 April 1913; NA, RG 17, AI 1, vol. 1010, file 204425, C.G. Hewitt to W. Saunders, 31 March 1911; John D. Tothill, 'Progress of the Introduction of the Insect Enemies of the Brown-Tail Moth, *Euproctis chrysorrhoea* Linn. into New Brunswick and Some Biological Notes on the Host,' *Annual Report of the Entomological Society of Ontario* 43 (1913): 57–61; Government of Canada, *Sessional Papers*, 1913, no. 16, 'Report of the Entomologist: Annex to the Report of the Minister of Agriculture for the Domin-

Originally pursued to collect and destroy moth nests, the extermination campaign enabled Hewitt to carve out an institutional niche for the Entomology Division in research on biological control of insects. When the campaign against the brown-tail and gypsy moths ended in 1917, Tothill and his assistants investigated natural factors controlling forest insects across Canada and collected parasitic and predacious insects for their eventual propagation and distribution.<sup>52</sup>

Entomologists in charge of inspecting imported nursery products also faced a reorientation of their activities. A broad interpretation of the Destructive Insect and Pest Act similarly modified the original mission of these inspectors and legitimated the execution of experimental research to prevent the potential spread of an outbreak. In June 1911 Hewitt transmitted to the deputy minister a series of recommendations on the organization of inspection work and on the establishment of field laboratories. He wrote two distinct memoranda, but their explicit overlaps were clearly indicative of his determination to extend the entomologists' activities from the inspection station into the field laboratory. In accordance with the regulations adopted under the act, the inspection of imported plant products lasted from October to May, and the extermination campaign took place during the winter months. How was the Department of Agriculture to legitimate the presence of entomologists within the civil service after the completion of these activities? Rather than employing them on a short-term basis, Hewitt suggested granting them a permanent position and establishing field laboratories. The inspector-entomologists would study insects according to regional

ion of Canada,' 512; L.S. McLaine, 'Rearing the Parasites of the Brown-Tail Moth in New England for Colonization in Canada,' *Agricultural Gazette of Canada* 3 (Jan. 1916): 23–5. On Tothill and McLaine, see A.B. Baird, 'John Douglas Totill,' *Entomology Newsletter* 33 (Sept. 1955): 2–3, and W.N. Keenan and C.R. Twinn, 'Leonad Septimus McLaine,' *Canadian Entomologist* 76 (Jan. 1944): 1–4.

52 The spread of the outbreak ceased at the Canadian borders, where, according to Hewitt, the introduction of natural enemies of the brown-tail and gypsy moths had formed a natural barrier and hindered the colonization of the two insects up along the Atlantic coast. NA, RG 17, AI 1, vol. 2792, file 246824, C.G. Hewitt to G.F. O'Hallaran, 27 Feb. 1919; C.G. Hewitt, *Report of the Dominion Entomologist and Consulting Zoologist for the Two Years 1917 and 1918* (Ottawa: King's Printer 1920), 10; John D. Tothill, 'Notes on the Outbreaks of Spruce Budworm, Forest Tent Caterpillar and Larch Sawfly in New Brunswick,' *Proceedings of the Acadian Entomological Society* 8 (1922): 172–82; J.D. Tothill, 'Some Notes on the Control of Foliage-Eating Insects under Forest Conditions,' *Canadian Forestry Journal* 14 (May 1918): 1673–5; J.D. Tothill, 'Natural Control Investigations in Canada,' *Scientific Agriculture* 2 (Sept. 1921): 21. On the growth of biological control in Canada, see Stéphane Castonguay, 'L'Institut de Belleville. Expansion et déclin de la recherche sur le contrôle biologique au Canada, 1909–1972,' *Scientia Canadensis* 22–23 (1999): 51–100.

climatic conditions and provide technical support to farmers. Since research would generate knowledge on insect outbreaks and control methods, such activities corresponded perfectly to one of the act's objectives – preventing the spread of insects. Accordingly, it seemed legitimate to finance the establishment of field laboratories with federal appropriations allotted for the enforcement of the law.<sup>53</sup>

Hewitt insisted on the necessity of conducting research in different regions to account for variations in insect behaviour and life cycles according to climatic factors and to define control methods corresponding to local agricultural practices. Here, again, the dominion entomologist resorted to biological principles to inform a policy that specified the number and location of regional laboratories. Before the Standing Senate Committee, Hewitt expounded his rationale: 'Where you have virgin land brought under cultivation, you upset entirely the natural conditions which existed there previously ... Where man upsets this balance by suddenly introducing a large factor such as cultivation, this balance is upset and there the trouble begins.' The introduction of foreign insects was only the proximate cause of an outbreak. It also resulted from the continual modification of the agricultural environment. This factor influenced both native and foreign insects and required continual local analysis. The Entomology Division needed to establish laboratories across the country, since conclusions reached at its sole laboratory in Ottawa would prove 'unsatisfactory and unscientific' for other agricultural areas. Hewitt obtained the authorization and funding of the department to establish field laboratories in the four chief fruit-producing centres in Canada: the Annapolis Valley (Nova Scotia), southwest Quebec, the Niagara Peninsula (Ontario), and the Okanagan Valley (British Columbia).<sup>54</sup>

If the appointment of field inspectors had originally rested on the potential invasion of foreign insects, the distribution of indigenous insects formed the future basis for establishing regional laboratories and furthering the growth of the Entomology Division. Since the cereal-producing areas were served neither by an inspector nor by imported

53 NA, RG 17, AI 1, vol. 1135, file 212063, J.H. Grisdale to G.F. O'Hallaran, 10 Aug. 1911; Memorandum on the Organisation for Inspection of Imported Nursery Stock and Memorandum on the Need of Field Laboratories for the Study of Orchard and Other Insects, C.G. Hewitt to G.F. Grisdale, July 24 1911

54 A fifth laboratory was set up in Fredericton for the biological control campaign. Government of Canada, 'Report of the Select Standing Committee on Agriculture and Colonization (Importance of Entomology in the Development of Canada. Evidence of Gordon Hewitt),' 17–18.

nursery products, Hewitt did not specify the possibility of supporting cereal producers in his significantly titled Memorandum on the Need of Field Laboratories for the Study of Orchard and Other Insects. The dominion entomologist took steps, however, to provide the Prairie provinces with a federal entomologist in 1912. Funding was initially insufficient, but, the following year, Hewitt obtained the necessary resources to establish laboratories in Manitoba, Alberta, and southwestern Ontario, where severe outbreaks of cutworms and chinch bugs had devastated local agricultural production. In the context of these cases, the outbreak of an indigenous insect was deemed important enough to require the intervention of a federal entomologist. Entomologists attached to these regional laboratories were subsequently put in charge of inspection stations in North Portal (Saskatchewan) and in Grimsby (Ontario), but their initial mandate entailed, first and foremost, investigating the economics of insect pests and experimenting with control methods to combat local outbreaks.<sup>55</sup>

While preventing the introduction of foreign insects into Canada necessitated the centralization of inspection activities within the Entomology Division to organize a unified response along all borders, controlling the distribution of injurious insects – both native and foreign – required the division to extend its activities to the different regions of the dominion. From the division's field laboratory, in their capacity as inspectors, entomologists, conducted investigations. On their end, provincial entomological services ensured the diffusion of the entomological knowledge produced by federal officers. The adoption of the Agricultural Instruction Act in 1913 further reinforced the division of labour between the provinces and the Entomology Division. Provincial departments of agriculture received federal grants for educational work in agriculture. They spent small grants on original research, but the Agricultural Instruction Act principally paid for extension agents and demonstration activities. Since the Entomology Division possessed a larger amount of intellectual and material resources to increase knowledge on insects and their control, it provided most of the material that provincial services

55 NA, RG 17, AI 1, vol. 1135, file 212063, C.G. Hewitt to J.H. Grisdale, 20 Feb. 1912; NA, RG 17, AI 1, vol. 2777, file 226492, Memorandum on International Cooperation in the Investigation of the White Grub Problem, C.G. Hewitt to J.H. Grisdale, 6 May 1913; Government of Canada, *Sessional Papers*, 1914, no. 16, 'Report of the Entomologist: Annex to the Report of the Minister of Agriculture for the Dominion of Canada,' 875-7; NA, RG 17, AI 1, vol. 1135, file 212063, J.H. Grisdale to G.F. O'Hallaran, 10 Aug. 1911; NA, RG 17, AI 1, vol. 1135, file 212063, C.G. Hewitt to J.H. Grisdale, 19 March 1912

used in their activities for the diffusion and implementation of control measures. Research remained essentially a responsibility of the Entomology Division, and the Entomology Division remained essentially devoted to research.<sup>56</sup>

In April 1914 the Department of Agriculture created the Entomological Branch. This administrative reorganization responded to concerns expressed in a memorandum written less than a year after the adoption of the Destructive Insect and Pest Act, in which Hewitt had proposed that the deputy minister separate the Entomology Division from the Experimental Farms Branch. According to the dominion entomologist, the adoption of regulations for a foreseen outbreak required frequent communications between the deputy minister and the dominion entomologist. However, delays occurred when a prompt decision was required, since all communications had to be cleared with the director of the Experimental Farms Branch.<sup>57</sup>

The establishment of the Entomological Branch effectively speeded up communication between the dominion entomologist and the deputy minister and facilitated the enforcement of the Destructive Insect and Pest Act. It also enabled Hewitt to consolidate the scientific activities of his service. Parliament provided appropriations to equip regional laboratories, to enforce the act, and to pay entomologists' salaries. The branch appointed officers to the position of entomologist, not inspector as it used to do, since technical assistance in a field laboratory became as important as inspection of imported plant products to prevent the introduction and distribution of insect pests.<sup>58</sup>

56 For a province-by-province survey of economic entomology in Canada, see 'The Control of Injurious Insects,' *Agricultural Gazette of Canada* 1 (Oct. 1914): 795–818, and 'Provincial Entomological Legislation,' *ibid.*, 829–32.

57 C. Gordon Hewitt, *Report of the Dominion Entomologist for the Year 1915* (Ottawa: King's Printer 1916), 1. On Grisdale's reaction to Hewitt's recommendation, see NA, RG 17, BII 2, Department of Agriculture Central Registry and Indexes, vol. 3041, file 40-5-23, J.H. Grisdale to G.F. O'Hallaran, 16 Dec. 1912; NA, RG 32, C2, Civil Service Commission Historical Personnel Files of Government, vol. 125, file '421-Hewitt, C.G.,' Memorandum on the Desirability of Making the Dominion Entomologist Directly Responsible to the Deputy Minister of Agriculture, C.G. Hewitt to W. Saunders, 23 Feb. 1911.

58 Government of Canada, *Official Report of the Debates of the House of Commons of the Dominion of Canada*, 3rd Sess., 12th Parl., 4–5 George V, 1914, 114 (Ottawa: King's Printer 1914), 1185. See also Government of Canada, 'Report of the General Auditor for the Year Ending March 31st, 1915. Part A. Department of Agriculture,' *Sessional Papers*, 1916, no. 1, 42–4. On the nomination of entomologists after the creation of the Entomological Branch, see the file Destructive and Insect Pest Act. Appoint-

After the Entomological Branch's creation, a bureaucratic and scientific organization covering the whole country was permanently mobilized against the eventual introduction of foreign insects or the potential spread of native insects. This situation resulted from the enforcement of the Destructive Insect and Pest Act, a law that transformed the representation of what was formerly a localized phenomenon into that of a constant, generalized threat. A new perspective on insect behaviour required the continuous study of entomological fauna. As it effectively demonstrated the specific bionomic of an insect and its variations according to changing agro-ecological conditions, entomological research perpetuated the definition of nature embedded in the Destructive Insect and Pest Act.

With this new representation of nature, Hewitt had achieved, concurrently, a political order in which the federal government centralized the executive power and scientific expertise related to insect control in Canada. Henceforth, the federal entomological service based its mission on experimental research, an activity that necessitated the contribution of scientifically trained entomologists established throughout the country. In step with the growth of scientific activities within the federal entomological service, provincial services confined their activities to agricultural extension, and a 'de facto' division of labour accelerated the centralization of entomological research within the federal Department of Agriculture.

During this period, a similar centralization process occurred in other fields of intervention, and biological sciences and other forms of authoritative knowledge continued to inform and legitimate government policies. Eager to expand their sphere of influence, certain ministers looked to science and professional researchers to promote the growth of their department and federal control over natural resources, even if it meant encroaching on the activities of the provinces and taking over their responsibilities. For example, when the Canadian Parliament ratified the Migratory Birds Convention Act in 1917, science and political compromises enabled the federal government to overcome British Columbia and Nova Scotia's objections. These provinces had protective legislations for birds and attempted to protect their prerogatives and activities in the field of natural resources. The Conservative minister of agriculture, Martin Burrell, mandated Hewitt to negotiate with these provinces, and the federal government again achieved national hegemony over a

resource that transcended provincial and international boundaries. At that time, the public interventions of governmental scientists helped to consolidate the formation of the modern state by transforming natural resources into national resources. Considering the central role of these scientists in the expansion of governmental activities, an examination of the co-production of knowledge and its institutionalisation may illustrate the extent to which the federal government succeeded in exerting its power over both nature and nation.<sup>59</sup>

59 On the Migratory Birds Convention Act, see Janet Foster, *Working for Wildlife* (Toronto: University of Toronto Press 1978), 120–77; Michel Girard, *L'écologisme retrouvé. Essor et déclin de la Commission de conservation du Canada* (Ottawa: Presses de l'Université d'Ottawa 1994), 175–227; Dorsey, *The Dawn of Conservation Diplomacy*, 165–237.

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