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Environmental Anxiety in New Zealand, 1840–1941: Climate Change, Soil Erosion, Sand Drift, Flooding and Forest Conservation

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ABSTRACT

The history of environmental anxiety in nineteenth- and twentieth-century New Zealand can be traced by focusing on problems caused by deforestation. In the 1840s concerns emerged that deforestation was causing climate change, soil erosion, sand drift and flooding. In the 1900s concerns about soil erosion overtook fears of climatic deterioration. A continued priority towards agricultural development at the expense of forestry constantly hampered conservation efforts throughout the nineteenth century. Only when the extent of agricultural expansion slowed down in the 1900s could these concerns be addressed; only then could a stronger, independent forestry service be established.

KEY WORDS

Forest conservation, soil erosion, climate change, flooding, sand drift

INTRODUCTION

In nineteenth- and twentieth-century New Zealand fears abounded that deforestation was causing climate change, sand drift, soil erosion and flooding. These concerns tell a history of environmental anxiety, a history which begins in the 1840s with fears of human-caused climate change and continues in the 1940s with fears of human-caused soil erosion. Equally, they complicate the image of nineteenth-century Europeans as environmental wreckers, hell bent on transforming landscapes and oblivious to the consequences of their actions. It was widely believed that forest conservation and tree planting would alleviate these problems. Stopping the negative effects of deforestation therefore became an

important rationale for the establishment of forestry reserves and a forestry service. Initially, concern focused on preventing climatic deterioration, soil erosion, flooding and sand drift, but by the 1900s fears of soil erosion and flooding had overtaken anxiety about climate change. Sand drift also continued to be a problem in the 1900s. Climatic arguments lost popularity because overseas scientists dismissed these ideas and because New Zealand was itself experiencing increasing levels of soil erosion. Belated recognition of the problems of soil erosion came in 1941, with the establishment of the Soil Conservation and Rivers Control Council. Forest conservation throughout the nineteenth and twentieth centuries received the support of a number of prominent politicians and scientists. Their efforts in the nineteenth century were constantly hampered by the priority given to agricultural development. Only after 1920, when agricultural expansion slowed down, could there be established a stronger, more independent forestry service.

Anxieties about the effects of deforestation on flooding, soil erosion and climate change have existed for a long time. Debate on human-caused climate change, for instance, dates back to Classical times. Only by the eighteenth century, though, did it become a coherent body of thought, supported and verified by many scientists. One major step in this direction occurred in 1699, when John Woodward established the basic concept of transpiration, an idea later refined and promoted by Stephen Hales and Count Buffon. Island conservation on British and French territories began in the 1760s. It was influenced by fears that deforestation decreased rainfall, but increased both flooding and soil erosion, and thereby threatened plantation production. The example of island conservation influenced many later thinkers. J.R. Forster, J.D. Hooker and Alexander von Humboldt, for instance, all accepted and advanced these notions. Theorists, like John Croumbie Brown of South Africa, Joseph Boussingault of France, and medical staff of the East India Company also promoted such ideas in areas as diverse as South Africa, India, Australia, and Europe.¹

THE EXPRESSION OF EARLY ENVIRONMENTAL ANXIETIES IN NEW ZEALAND: 1840s–1860s

Propaganda encouraging European migration to New Zealand guaranteed immigrants a land of great natural abundance which possessed a fecund climate. This promised land, went the promoters' 'puffery', would be transformed by immigrant labour into wealth and private property. In addition to more utilitarian aims, land development fulfilled Christian and moral duties:

The injunction and blessing...is yet in progress of fulfilment, – "Be fruitful and multiply and replenish the earth and subdue it." In New Zealand...there are vast tracts [of land]...waiting for the reception of man...²



FIGURE 1. Joseph Osbertus Hamley, *Sandhills and waterfall near Tauranga*, 1864? Watercolour on cream paper, 162 x 275 mm. Alexander Turnbull Library E-047-q-047.

Agriculture in New Zealand, put simply, was to underwrite civilisation. It would sustain everything from social mobility to the nation's economy. Without agriculture, it was widely believed that humanity slipped into barbarity. Agricultural development thus received primacy over forest conservation since lowland forests often impeded agricultural expansion.³

Converting forest to farm commenced at the outset of European migration in the 1840s. So too did concern about deforestation. The relatively treeless provinces of Otago and Canterbury enacted cutting restrictions and forest reservation in the 1850s and '60s. In the next decade these provinces passed legislation encouraging tree-planting. Individuals also spoke up against deforestation.⁴

In 1844 German naturalist Ernst Dieffenbach lamented increased levels of soil erosion in New Zealand, which he believed were brought about by deforestation. Dieffenbach also held that 'forest-lands render rains more frequent than they would perhaps be if the land were cleared' by causing the near-saturated air to condense. He did not, however, see this process occurring in New Zealand. In 1859 another German scientist, Ferdinand von Hochstetter, cautioned that deforestation should not be allowed 'to turn the country into a desert to the detriment of whole generations to come'. Further anxieties (and hopes) about forests appeared in the 1860s, promulgated by Scottish natural historian William

Lauder Lindsay, politician John Gillies and naturalist Thomas Potts. Lindsay supported forest conservation because it promoted efficient use of timber, protecting the colony from timber famine and diminished rainfall. Gillies, conversely, believed tree planting in dry Central Otago 'would convert that district into the garden of Otago' by bringing more rain to the region. He illustrates the idea that tree-planting could improve upon nature.⁵

FEARS AND FOREST DEBATES: 1860s–1870s

In 1868 Thomas Potts introduced the first Bill before parliament for assessing the nation's forestry resources 'with a view to their better conservation'. Forests must be left in place, he urged, 'merely in a climatic point of view and with reference to the fertility of the soil, for they had evidence all over Europe of the evil effects' of deforestation. In Italy, Spain and Greece, he continued somewhat desperately, 'the soil had not only ceased to be fertile, but had been absolutely washed away'. W.T.L. Travers, lawyer, explorer and naturalist, agreed. He lamented that deforestation 'produced the destructive floods that had become so common' on Banks Peninsula and elsewhere. Forest destruction to make way for agriculture, he ended, wasted money by burning valuable timber, and had a destructive effect upon climate. Politician Charles O'Neill referred to conservation in the state of Victoria. Deforestation had caused more frequent floods and increasing areas of wasted fertile lands in Alpine France, Spain, Palestine, parts of Asia and Northern Africa. Potts's Bill failed, but it illustrates that fears of soil erosion, flooding and climate change informed arguments for forest conservation. Overseas examples, as used by O'Neill, Travers and Potts, furthermore, gave authority and urgency to conservation, offering terrifying lessons of what could happen if deforestation continued.⁶

Anxieties about soil erosion, flooding and climatic change increased dramatically in both scientific and parliamentary circles in the 1870s. In 1873 Charles O'Neill introduced the Conservation of Forests Bill, urging conservation 'so that history might not be able to relate that they [settlers] received a fertile country, but, by a criminal want of foresight, transmitted to posterity a desert'. O'Neill presented a nightmarish vision of an unproductive and desolate New Zealand wracked by deforestation. He bolstered his presentation with terrifying illustrations of the effects of timber felling, provided by Alexander Humboldt, Victoria's Minister of Lands, and (most probably) G.P. Marsh. O'Neill also provided reasons reading like a set of Biblical injunctions against deforestation: 'Ali Pacha burnt down the forests...and then came famine and drought'; the Russians changed the climate of the Caucasus, and 'the land became barren, drought ensued'. The moral imperative was clear: it was a Christian duty to prevent land becoming waste.⁷

Papers in New Zealand's leading scientific and intellectual journal, the annual *Transactions and Proceedings of the New Zealand Institute (TPNZI)*, reinforced anxieties and no doubt added urgency to the 1874 forestry debate. Travers, Potts and Firth, all of whom were members of a political and scientific elite, drove home these fears in parliament. Travers read the third part of his work 'On the Changes Effectuated in the Natural Features of a New Country by the Introduction of Civilized Races'. In summary, this outlined the impact of European plants, animals, and settlers on New Zealand's environment. Travers offered a sophisticated understanding of the relationship between deforestation, flooding, soil erosion and climatic change. He discussed the moral imperative of fertile Biblical countries laid waste through the folly of deforestation, relying on G.P. Marsh to strengthen his contention that flooding had increased in New Zealand's Hutt Valley. Another paper discussed climate change in Astrakhan. It drew the support of James Hector, one of the main figures in nineteenth-century New Zealand science. Hector held that deforestation was drying up New Zealand's climate. Yet others discussed the threat shifting sands posed to New Zealand's farmland. They urged the New Zealand Government to follow France's example and reclaim sand areas before valuable farmland was overrun. Politician, entrepreneur and farmer, J.C. Firth, echoed these anxieties and offered hope: plantations could stop New Zealand becoming 'an arid desert'.⁸

THE APOGEE OF CLIMATE CONCERNS: 1870s–1880s

Concerns about the negative effects of deforestation provide the background to Premier Julius Vogel's New Zealand's Forests Bill (1874). Ironically, Vogel had earlier opposed Potts's 1868 Bill, but had become a convert of conservation after witnessing deforestation in the South Island. Indeed, rates of deforestation throughout New Zealand had increased: between 1868 and 1873 the province of Canterbury alone lost an estimated 33 percent of its forests. At hand Vogel had a vast collection of forestry material. These included reports from Marsh and other Americans and Europeans, all of which he used to argue that forests prevented drought and floods by holding water and soil. The final Act made available £10,000 annually for forest management and created both a Forests Department and the position of a Conservator of Forests.⁹

Arriving in March 1876 Captain Inches Campbell Walker, formerly Deputy Conservator of Forests, Madras Presidency, became New Zealand's first Conservator. In New Zealand he promoted forest conservation as a remedy to climatic deterioration, sand drift, flooding, and soil erosion. Campbell Walker continued New Zealand's link with Indian forest conservation. A former Under-Secretary of India, Sir James Fergusson, had introduced Vogel to the work of Campbell Walker. Another former Indian civil servant and large-scale land-

owner, Sir John Cracroft Wilson, also provided vocal support for the 1874 Bill and introduced the Grass and Forests Fires Prevention Bill (1874).¹⁰

The new Conservator's arguments for, and his anxieties about, deforestation appeared in the *TPNZI* and before parliament. In these addresses and reports he advocated the establishment of highland forest reserves. He argued that conservation of high country forests safeguarded agriculture against droughts and floods. Nor, he added, did it take up the agriculturally valuable lowland plains. He also offered a warning to farmers. Farmers could well be waving 'farewell to the smiling fields in the vallies [sic] below and abundant pasture on the lower slopes of the hills', he wrote, if these conservation measures were not followed. According to him tree planting also offered a means of improving dry climates, such as those of Central Otago and Canterbury.¹¹

Sadly for Campbell Walker, his stay as Conservator was short: Parliament repealed the Act, a choice taken primarily for economic reasons. His influence, nevertheless, continued. The 1877 Land Act, designed to replace existing tree-planting legislation, incorporated some clauses of the defunct Forests Act. In



FIGURE 2. Alfred Sharpe was one of the few colonial artists to depict and protest against deforestation. Here two loggers, dwarfed by the kauri trees they will fell, stand in the middle foreground. 'Could not Government be induced to reserve a few hundred acres of the best of it, so that future generations may arise and call us blessed?', wrote Sharpe of another kauri forest in 1886. *Among the Kauri, Castle Rock, Coromandel*, 1884. Watercolour, 532 x 883 mm, private collection. Roger Buckley, *The Art of Alfred Sharpe*, (Auckland: David Bateman, 1992), plate 26, 74, (quotation) 127–8.

practical terms it reserved half a million acres of highland forest for climatic and other conservation reasons, a decision influenced by Campbell Walker's advocacy of reservation.¹²

In the late 1870s and early 1880s other papers, similar in content to Campbell Walker's, sustained interest in conservation. The ever-increasing spread of shifting sand continued to occasion apprehension, as did climate change, soil erosion, flooding, and timber famine. One of the most striking conservation proposals, by New Zealand engineer F.S. Peppercorne, emphasised physiocratic arguments borrowed from France. Physiocracy stressed the importance of agriculture to a country's livelihood and, as Richard Grove demonstrates, influenced forest conservation in nineteenth-century France. '[O]ne of the first duties of an enlightened Government', urged Peppercorne, concerned '[t]he preservation of forests of a country.' Quoting from the French forestry expert, Professor Macarel, Peppercorne demonstrated that 'All the wants of life are closely related to their conservation: agriculture, architecture, and most industries, seek therein their ailment and resources'. In the same year retired French forester, A. Lecoy, argued for state forestry in New Zealand for financial gain, as well as the conservation of climate and soil. The New Zealand Government must, he implored, for the sake of the climate, increase the extent of state forests. Private individuals would not leave forests standing for the benefit of society as a whole. Both Peppercorne and Lecoy brought physiocratic arguments to bear. Working independently, they reinforced Campbell Walker's contention that forests protected agriculture and that forests required government protection.¹³

Vogel, now Colonial Treasurer, introduced his second Bill on forestry in June 1885. This Bill aimed at establishing scientific forestry in New Zealand. It set aside forest areas for later use, as well as upland areas for climatic purposes. The newly-passed Act established three types of land use, one of which incorporated Campbell Walker's argument: '*Climatal [sic] or Mountain Reserves, to include all Forests reserved for Shelter, for the Conservation of the Water-supply, or for Climatic Reasons, irrespective of Altitude*'. These reserves had little or no commercial value. They straddled 'the crests of ranges and other situations', and had felling restrictions imposed on them (a department officer would authorise these areas). Only a limited area of forest in these protected areas could be felled. Climate reserves thus followed the forest management precedent of 1874 by incorporating Campbell Walker's suggestion of climatic reserves.¹⁴

DEVELOPMENT AND CONSERVATION: THE 1890s

The fate of the 1885 Act followed that of its predecessor. In 1887 a new government withdrew Crown funding. A departure in policy from conservation to use occurred in the following year: the State Forests Act Amendment allowed the Governor to withdraw land from State Forest areas. This reflected the shift

of both main political groupings to the pursuit of development as a means of lifting New Zealand out of depression. The Liberal Government pushed even harder for development to meet their aim of closer settlement. Under this policy forest acreage 'dropped in 1893 and did not exceed its former extent until 1900'. Agricultural needs, clearly, overrode environmental anxieties.¹⁵

Yet while the Liberals were taking out large areas of forestry before 1900, they also enacted scenery preservation laws. Scenic preservation occurred in areas of no economic use, and thus was no threat to agriculture. The Minister of Lands introduced the Tongariro National Park Bill (1893) by stressing that the land had no other benefit than scenery. Other factors also played a part in conservation. These included nationalism (the kiwi became a national symbol in the 1890s), growing fears of faunal and floral scarcity and ecological concerns. A rejection of displacement theory also furthered protection. Displacement theory held that native species inevitably succumbed to the relentless progress of European plants and animals.¹⁶

Fears of soil erosion, sand drift, flooding and climate change, meanwhile, continued to play an important role in conservation. Nationalism and aesthetics now entered these debates too. In 1897 Government heeded the recommendations (including the climatic considerations) of the 1896 Timber Conference to form a national forestry branch. This new branch came under the control of the Department of Lands and Survey.



FIGURE 3. Thomas Good, *Bush Clearing near Oeo*, 1893. Ink and wash on sheet, 136 x 224 mm. Alexander Turnbull Library A-329-005.

Forestry conservation continued to interest many of New Zealand's most prominent and influential scientists. In 1895 Augustus Hamilton, ethnologist, biologist and future Director of the Colonial Museum (1903–1913), stressed the need for forest conservation because forests maintained aesthetics, rainfall and soils. Hamilton's reliance on New Zealand examples contrasted with the reliance of earlier authors on overseas examples of deforestation (Hamilton only referred to Indian forestry). Hamilton drew heavily on Campbell Walker's 1877 parliamentary report on environmental anxieties in New Zealand. Archdeacon Walsh, in 1910, also wheeled out the familiar anxieties about deforestation, that it decreased rainfall, but increased flooding and soil erosion, and brought about aesthetic losses. Walsh also relied heavily on New Zealand examples to argue his point, including Campbell Walker's report and the work of J.P. Grossmann. Grossmann, journalist, academic and conservation zealot, wrote *The Evils of Deforestation* (1909). This book brought together international and New Zealand examples of the follies of timber cutting. Reprinted from the *Auckland Weekly News*, Grossmann aimed to 'rouse public interest' in conservation, believing 'it was the positive duty of all civilised States' to conserve forests.¹⁷

These examples from the 1900s, firstly, underline the enduring New Zealand–Indian forestry link, especially through Campbell Walker's influence. Environmental anxieties of the 1900s, in the second place, now concentrated on New Zealand examples of deforestation, instead of largely overseas evidence. Conservation ideas thus had been adapted to the New Zealand context, bearing out historian of science Roy MacLeod's observation that: 'In Australasia, independent traditions were fostered *within* the ambit of colonial science, which sustained colonial Europeans on the march to nationhood.'¹⁸

THE SHIFT TO SOIL AND WATER CONCERNS: 1900s–1940s

A move towards soil and water conservation concerns and away from climatic ones occurred in the 1900s. Grossmann had signalled it when he wrote that 'the worst effect of deforestation is EROSION'. Two things account for this change: growing evidence of land deterioration; and a change of emphasis in conservation literature towards soil erosion concerns.

Ecological concerns furthered anxieties about soil erosion and sand drift in New Zealand. Leonard Cockayne, and later G.M. Thomson, pioneered the field of ecology in New Zealand. Cockayne's alarming report on the failure of the 1903 Sand-drift Act to arrest shifting sands offers one example. Widespread evidence of land deterioration is another. Erosion was increasingly evident in many areas in the 1900s. High country burning in the South Island, 'fern crushing' (the replacement of fern with grassland) in the North Island, rabbit infestations, and other environmental problems all served as timely reminders of the difficulties facing many farmers.¹⁹

Overseas scientific publications also emphasised soil conservation over climatic conservation, as New Zealand's influential 1913 Royal Commission on Forestry illustrates. Its report included three overseas (and one New Zealand) works on this subject. The Royal Commission recommended upland forest conservation (called somewhat confusingly, Climatic Reserves) for water and soil protection, and as shelter. It also urged the publication of works stressing the importance of forests in conserving soil. G.M. Thomson, one of the leading scientists of the first quarter of the twentieth century, played an important role in the Royal Commission. It is significant that he rejected outright all climatic arguments.²⁰

In the 1920s anxieties about land degradation were strengthened by the need to increase productivity from existing areas of cultivation. Now that agricultural expansion had almost ceased, it meant forestry could occupy less productive areas. A stronger, independent State Forest Service (SFS) thus emerged in 1919 coterminous with the end of agricultural expansion. Its role included flood, soil erosion and fire prevention. Soil erosion also received belated scientific attention. The United States Dust Bowl of the 1930s and publications like *The Rape of the Earth: A World Survey of Soil Erosion* (1939) heightened fears of soil degradation and sand drift. In the 1930s the newly-formed Department for Scientific and Industrial Research (DSIR) began conducting soil erosion surveys. During this period the English trained geographer Kenneth Cumberland, recently arrived from England, and New Zealand soil conservator Lance McCaskill also lobbied for the creation of the Soil Conservation and Rivers Control Council. Founded in 1941, the Council marked belated recognition by the Department of Agriculture of the problems caused by deforestation. Thereafter mountain forest protection continued for the rest of the twentieth century, coupled with programmes of afforestation and pest control.²¹

CONCLUSION

Anxieties that deforestation increased flooding, sand drift, soil erosion and drought added a strong moral imperative to the forestry lobby's programme of promoting financial gain and preventing timber famine. These environmental concerns complicate the dominant image of nineteenth-century Europeans as wholesale environmental despoilers and are a reminder of the importance of nuances within the dominant narrative of environmental destruction. Unless forest protection or tree planting occurred, argued proponents of conservation, soil erosion, sand drift and climatic deterioration would ensue, spelling an end to agriculture in New Zealand. Overseas evidence of the damaging effects of deforestation added authority to supporters of forest conservation in New Zealand. India, Australia, and America (via G.P. Marsh), stand out as some examples drawn upon in New Zealand. Overseas forestry authorities, such

Lecoy and Campbell Walker, also played an important role. These examples and authorities not only demonstrate the cultural exchange of ideas within empires (as Tony Ballantyne highlights in his essay ‘Empire, Knowledge and Culture’), but also those from without. No amount of anxiety or authority, however, could alter the fact that in New Zealand forestry assumed secondary importance to agricultural development. Highland climatic reserves, suggested by Campbell Walker in 1876, did remove forests from their lowland land-use competition with agriculture and became incorporated into New Zealand land use. Protection forestry, however, only became established once agricultural expansion ceased in 1920. By then climatic arguments had died out, having been overtaken by concerns about soil erosion, sand drift and floods. Anxieties about the effects of deforestation heightened awareness of the role of humans in environmental degradation, demonstrating early and continuing European concern for New Zealand’s environment.²²

NOTES

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¹ On the history of fears of climate change, soil erosion and flooding see, for example, Richard H. Grove, *Ecology, Climate and Empire: Colonialism and Global Environmental History, 1400–1940* (Cambridge: White Horse Press, 1997); Grove, *Green Imperialism: Colonial Expansion, Tropical Island Edens and the Origins of Environmentalism, 1600–1860* (New York: Cambridge University Press, 1995).

² *Otago Journal* V (1848), 66.

³ On these ideas see, for instance, Rollo Arnold, ‘British Settlers and the Land’, in *Te Whenua, Te Iwi – The Land and the People*, ed. Jock Phillips et al. (Wellington: Allen and Unwin, 1987), 27–41.

⁴ Michael Roche, *History of Forestry* (Wellington: GP Print, 1990), 14–23. On Otago and Canterbury see Neil Clayton, ‘Settlers, Politicians and Scientists: Environmental Anxiety in a New Zealand Colony’ (Post-Graduate Diploma diss., University of Otago, Dunedin, 1998), 80–101; Roche, *History of Forestry*, 64–83.

⁵ Ernest Dieffenbach, *Travels in New Zealand; with Contributions to the Geography, Geology, Botany, and Natural History of That Country: Volume 1* (London: John Murray, 1843), 257, 297–8, 176. Ferdinand von Hochstetter, *New Zealand: Its Physical Geography, Geology and Natural History with Special Reference to the Results of Government Expeditions in the Provinces of Auckland and Nelson* trans. by Edward Sauter (Stuttgart: J.G. Cotta, 1867), 142. W. Lauder Lindsay, ‘On the Conservation of Forests in New Zealand’, *Journal of Botany British and Foreign*, VI (1868), 38–46; *Contributions to New Zealand Botany* (London and Edinburgh: Williams and Norgate, 1868), 25–8.

⁶ Thomas Potts, *New Zealand Parliamentary Debates* [henceforth *NZPD*] (7 October, 1868), 190. W.T.L. Travers, *NZPD* (7 October, 1868), 191. Charles O'Neill, *NZPD*, (7 October, 1868), 191–2.

⁷ O'Neill, *NZPD*, (1 October, 1873), 1545.

⁸ Founded in 1868, transcriptions and reductions of papers presented before New Zealand's Philosophical Institutes appeared in the *TPNZI*. W.T.L. Travers, 'On the Changes Effected in the Natural Features of a New Country by the Introduction of Civilized Races', Part III, *TPNZI* 3 (1870), 326–8. In essence Marsh doubted forests had a significant influence on rainfall. David Lowenthal, 'Nature and Morality from George Perkins Marsh to the Millennium', *Journal of Historical Geography* 26 (2000), 3–27. J.C. Firth, 'On Forest Culture', *TPNZI* 7 (1874), 195. Dr. A. Wjeikof, 'The Results of the Destruction of Forests upon the River Wolga at Astracan', *TPNZI* 4 (1871), 374–6.

⁹ On the Bill see Graeme Wynn, 'Pioneers, Politicians and the Conservation of Forests in Early New Zealand', *Journal of Historical Geography* 5 (1979), 171–88; Lanna Brown and A.D. McKinnon, *Captain Inches Campbell Walker: New Zealand's First Conservator of Forests* (Wellington: New Zealand Forestry Service, 1966). On deforestation rates see Roche, *History of Forestry*, 86.

¹⁰ On the origins of Indian forest conservation see, for instance, Grove, *Green Imperialism*, 380–473. On Fergusson, see Roche, *History of Forestry*, 85, 88; on Cracroft Wilson see Paul Star, 'T. H. Potts and the Origins of Conservation in New Zealand (1850–1890)' (M.A. diss., University of Otago, 1991), 84.

¹¹ Inches Campbell Walker, 'State Forestry: Its Aim and Object', *TPNZI* 9 (1876), 187–203; 'The Climatic and Financial Aspects of Forest Conservancy as Applicable to New Zealand', *TPNZI* 9 (1876), xxvii–xlix; 'Report of the Conservator of State Forests', C-3 1, *Appendices to the Journal of the House of Representatives* [henceforth *AJHR*] 1877 C-3 1, 12–49.

¹² For background and area of reservation see Brown and McKinnon, *Captain Inches Campbell Walker*, 11–16, 18. '1877 Land Act', *Statutes of New Zealand* (1877), 177–179.

¹³ On floods and sand dunes see, for instance, H.P. Higginson, 'On Floods in Lake Districts and Flooded Rivers in General, with Methods Adopted for their Prevention and Control', *TPNZI* 10 (1877), 180–9; Travers, 'Remarks on the Sand Dune of the West Coast of the Provincial District of Wellington', *TPNZI* 14 (1881), 89–94. On physiocracy see Elizabeth Fox-Genovese, *The Origins of Physiocracy: Economic Revolution and Social Order in Eighteenth-Century France* (Ithaca and London: Cornell University Press, 1976), and its influence on French forestry. Grove, *Green Imperialism*, 259. Frederick S. Peppercorne, 'Influence of Forests on Climate and Rainfall' *TPNZI* 12 (1879), 24–32. A. Lecoy, 'The Forests Question in New Zealand' *TPNZI* 12 (1879), 3–23.

¹⁴ Vogel, *NZPD*, (7 July, 1885), 445–53; Roche, *History of Forestry*, 94–5; *NZPD*, (26 June, 1885), 200–11; T.H. Kirk, 'Progress Report of the State Forests Department', *AJHR* 1886 1 C-3D, 3.

¹⁵ On the repeal see 'State Forests Act Amendment, 1888', *Statutes of New Zealand*, (1888), 71–2. On closer land settlement see Tom Brooking, *Lands for the People? The Highland Clearances and the Colonisation of New Zealand: A Biography of John McKenzie* (Dunedin: Otago University Press, 1996), 176–8. For last quote see Roche, *History of Forestry*, 137–8.

¹⁶ Star, 'From Acclimatisation to Preservation: Colonists and the Natural World in Southern New Zealand, 1860–1894', (Ph.D. diss., University of Otago, 1997), 199; Star

and Lynne Lochhead, 'Children of the Burnt Bush: New Zealanders and the Indigenous Remnant, 1880–1930', in *Environmental Histories of New Zealand*, ed. Eric Pawson and Tom Brooking (Melbourne: Oxford University Press, 2002), 119–35; Beattie, 'Rapists or Romantics? European Views of the Otago Environment, 1840–60', in *South: Celebrating Otago and Southland's Heritage* (forthcoming, December 2003).

¹⁷ 'Timber Conference', *AJHR* 1896, H-24 3, 5, 33; Mr. Prouse, 'The Preservation and Utilisation of our Forests', *AJHR* 1896, H-24 3, 28–29. See Roche, *History of Forestry*, 149 for formation of new forestry branch. On official reports see A. Lecoy, 'Papers Relating to Suggestions on Forests in New Zealand', *AJHR* 1880 H-3, 1; Kirk, 'Progress Report of the State Forests Department', *AJHR* 1886 C-3D 1, 3. On the use of aesthetic and climate and flooding arguments in the 1893 debate over native conservation see, for instance, *NZPD* (9 July, 1893), 262–9. A. Hamilton, 'On the Forests of New Zealand', *TPNZI* 28 (1895), 147–63; Walsh, 'The Effects of the Disappearance of the New Zealand Bush', *TPNZI* 43 (1910), 436–47. J.P. Grossmann, *The Evils of Deforestation* (Auckland: Brett Printing and Publishing Co., 1909).

¹⁸ Roy MacLeod, 'Introduction', *Osiris* 15, (2001), 5.

¹⁹ Emphasis in original. Grossmann, *The Evils*, 7. On the Sand-Drift Bill see Beattie, "[H]elpless witnesses of the destruction": sand encroachment and state prevention in New Zealand', (Unpublished MS, 2001); L. Cockayne, *Department of Lands: Report on the Dune-Areas of New Zealand. Their Geology, Botany, and Reclamation* (Wellington: J. Mackay, 1911). On land deterioration see Roche, *Land and Water: Water and Soil Conservation and Central Government in New Zealand* (Wellington: Historical Branch, Department of Internal Affairs, 1994), 25–6; Kenneth Cumberland, *Soil Erosion in New Zealand: A Geographic Reconnaissance*, (Wellington: Soil Conservation and Rivers Control Council, 1940), 158–64.

²⁰ On Thomson see A.P. Thomson, 'George Malcolm Thomson and the 1913 Royal Commission on Forestry: Part I: The Political Battle', *New Zealand Journal of Forestry* 30 (1985), 18–27. 'Report of the Royal Commission on Forestry', *AJHR* 1913 C-12, xv. The Royal Commission published the following international works: I. Bowman's *Physiography of the United States, and Principles of Soil in Relation to Forestry* (1911); Copenhagen Professor Eugenius Warming's *Oecology of Plants* (1909); and Dr B.E. Fernow's *Economics of Forestry* (1902). 'Report of the Royal Commission on Forestry', *AJHR*, 1913, C-12 xiv. And Cotton's on New Zealand: C.A. Cotton, 'Remarks on Erosion of Slopes in New Zealand', in 'Report of the Royal Commission on Forestry', *AJHR* 1913 C-12, lii–liii.

²¹ Robin Hodge, Brooking and Vaughan Wood, 'The Grasslands Revolution Reconsidered', in Pawson and Brooking, *Environmental Histories*, 169–82. On history of forestry since the end of the First World War see Roche, *History of Forestry*, 175 and passim. On fire reserves see Roche, *History of Forestry*, 185–7. On the Dust Bowl note G.V. Jacks and R.O. Whyte, eds, *The Rape of the Earth: A World Survey of Soil Erosion* (London: Faber and Faber, 1939). Grove, *Ecology, Climate*, 35–6. On the New Zealand lobby for soil conservation see, for instance; L.W. McCaskill, *Hold This Land: A History of Soil Conservation in New Zealand* (Wellington: A.H. and A.W. Reed, 1973); Roche, *Land and Water*; N.H. Taylor, *Land Deterioration in the Heavier Rainfall Districts of New Zealand* (Wellington: Bulletin 62, Department of Scientific and Industrial Research, 1938). On forestry protection against soil erosion, flooding and sand dunes see Peter McKelvey, *Steepland Forests: A Historical Perspective of Protection Forestry in New Zealand* (Wellington, GP Print, 1995); McKelvey, *Sand Forests: A Historical Perspec-*

tive of the Stabilisation and Afforestation of Coastal Sands in New Zealand (Christchurch: Canterbury University Press, 1999); Roche, *Land and Water*.

²² Tony Ballantyne, 'Empire, Knowledge and Culture: From Proto-Globalization to Modern Globalization', in *Globalization in World History*, ed. A.G. Hopkins (London: Pimlico, 2002), 115–40. James Braund, for instance, emphasises the importance of German scientists to New Zealand. Braund, 'German-speaking Scientists in New Zealand 1773–1951: Research Past, Present and Future' (paper presented at the Inaugural New Zealand European Studies Conference, National Centre for Research on Europe, Christchurch, 31 May, 2002).