WAI 903

The Introduction of *Pinus Contorta* into New Zealand

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INTRODUCTION

On 14 April 2009, the presiding officer of the Whanganui District inquiry directed the commissioning of research to produce a brief of evidence on how *pinus contorta* was introduced in to New Zealand. The brief is to assist the Tribunal to determine to what extent the Crown is responsible for the presence of *pinus contorta* in the Karioi region.

The Tribunal posed a series of questions:

a. When, how, where and by whom, was *pinus contorta* (lodgepole pine) first introduced to New Zealand? When, how, where and by whom, was *pinus contorta* first introduced to the Karioi region?

b. What was the purpose of introducing *pinus contorta* to New Zealand, and to Karioi? What was *pinus contorta* used for in practice?

c. If the Crown was involved in obtaining or propagating *pinus contorta*, what agency of the Crown was responsible for this?

d. When, and in what area, did it become apparent that *pinus contorta* created a wilding problem in New Zealand? What was the nature of the problem? What steps have been taken to address it?

In response, and within the comparatively limited timeframe available for the commission, research efforts have been directed towards specifically answering the questions posed above. The authors believe that this brief of evidence contains sufficient information to directly answer the questions that have been posed. It is noted, however, that there is additional archival information in both scope and detail that deals with the introduction of *pinus contorta* that the authors have not been able to include within this current project.

With advice on archival sources provided by Tony Walzl, Andrew Francis undertook the primary research for this project. Both Tony and Andrew contributed to the drafting stages and final presentation of the report.

Methodology

Archives New Zealand files from the relevant time period have provided the primary source material in this commission. Files from the following agencies have been consulted: New Zealand Timberlands Limited, Wanganui District; Department of Conservation; Ministry for the Environment; Ministry of Works and Development, Wanganui District; Nature Conservation Council; New Zealand Defence Force, and New Zealand Forest Service. As referenced in the bibliography, works by AL Poole, A Kirkland and P Berg, and MM Roche and A Sewell have been the major sources relied on to provide information on New Zealand general forestry policy. For information on the ecological aspects of the spread of *pinus contorta* articles and reports by H Dehlin, KM Jamieson, N Ledgard, and JT Miller and CE Ecroyd have been particularly useful. In addition, B Burns and P Williams provide useful information on the current eradication programme being undertaken at Karioi. Electronic sources including Environment Waikato's website and the *Dictionary of New Zealand Biography* have also provided contextual material relevant to this report. Late-19th and early 20th century newspapers accessed via the National Library of New Zealand's 'Papers Past' electronic resource provide relevant and important information on the early introduction of *pinus contorta* seeds and seedlings.

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A. THE INTRODUCTION OF PINUS CONTORTA

Pinus contorta is a small to medium-sized evergreen pine tree common to the western United States. It is also known as shore pine, beach pine, lodgepole pine, Murray pine, and *pinus murrayana*.[1] In the United States and Canada, *pinus contorta* is regarded as a prime production species and has a variety of uses including panelling, piling, railway sleepers, pulpwood, plywood and hardboard.[2] Commonly it has twisted branches and short paired needles (two leaves in a sheath). Its renowned hardiness stems from its natural habitat: *pinus contorta* naturally occurs from sphagnum moss bogs of the Alaskan coast to southern California and eastwards to the Cascade Mountains, a range of 30º of latitude and 11,000 feet of altitude.[3] It can be found grouped very densely in alpine and sub-alpine areas, but can also be found in all habitats ranging from cultivated land to scree slopes.[4] As Marlborough Catchment Board's Chief Soil Conservator, RS MacArthur, noted of *pinus contorta* in 1963:

> In its natural habitat it varies from a stunted scrubby form in swamps and on rocky ridges to a tall straight tree in forest form up to 80 feet in height (rarely over 100 feet) and up to 24 inches diameter. In New Zealand on an average site at 2,000 feet at an age of 25 years, it has reached an average height of 65 feet with a diameter of 9.2 inches.[5]

It is worth noting that this region of the western United States also supplied New Zealand with numerous other pines including *pinus ponderosa* (American

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[1] RS MacArthur, Chief Soil Conservator, Marlborough Catchment Board, 5 March 1963, AANS 6095 W5491/116 22/5144 Reserves-General-Quarantine: Use & Control of Introduced Trees & Plants 1959 - 1982, Archives New Zealand (ANZ).

[2] *Dominion*, 13 February 1991.

[3] AL Poole, *Forestry in New Zealand: The Shaping of Policy* (Auckland: Hodder & Stoughton, 1969), p.69.

[4] Environment Waikato Regional Council, URL: http://www.ew.govt.nz/Policy-and-plans/Regional-Pest-Management-Strategy/Regional-Pest-Management-Strategy-2008-2013/Part-2/5-Pest-plants/53-Containment-occupier-control-pest-plants/5314-Pinus-contorta-Pinus-contorta/, accessed 18 April 2009.

[5] RS MacArthur, Chief Soil Conservator, Marlborough Catchment Board, 5 March 1963, AANS 6095 W5491/116 22/5144 Reserves-General-Quarantine: Use & Control of Introduced Trees & Plants 1959 – 1982, ANZ.

Western yellow pine), *pinus laricio* (Corsican pine), *pinus douglasii* (Oregon pine), and *pinus radiata*. Its adaptability to growing conditions and its ability to regenerate made *pinus contorta*, along with other pines, an attractive tree variety for New Zealand's forestry and horticultural importers. Two varieties of *pinus contorta* were planted in New Zealand: *pinus contorta* ssp.*contorta* ('green' or coastal form) and *pinus contorta* ssp. *murrayana* ('yellow' or 'inland' form).[6]

1. Initial Introduction into New Zealand

Horticultural societies, acclimatisation societies, and seed stockists throughout New Zealand were responsible for the early introduction of *pinus contorta*. Although the exact date of the very first introduction of *pinus contorta* has not been identified by research conducted for this project, it is evident that specimens of the trees were being planted towards the end of the 19th century by individuals and private organisations. For example, the *Bay of Plenty Times* noted in September 1880 that the Tauranga Domain Board had acquired seeds to be planted in the Domain Reserve.[7] In 1896 Thomas Mason, horticulturalist, Quaker and Member of the House of Representatives for the Hutt, was growing the species at The Gums, a 12½-acre property he owned in Taita.[8] By the turn of the century, *pinus contorta* seeds and seedlings were easily procurable through nurseries, horticultural societies and tree auction sales.[9]

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[6] Bruce Burns and Peter Williams, 'Review of Karioi Forest pinus contorta management plan 2006-2021'; prepared for Horizons Regional Council, Manaaki Whenua-Landcare Research New Zealand Ltd., Palmerston North: Landcare Research, c 2008, p.6.

[7] *Bay of Plenty Times*, 11 September 1880.

[8] 'Thomas Mason', *1870-1900*, vol 2 of *The Dictionary of New Zealand Biography* (Wellington: Bridget Williams Books and Department of Internal Affairs, 1993), pp315-316. For further information on the species grown at the property see T. Mason, 'An account of the plants growing at The Gums, Taita', *Transactions and Proceedings of the Royal Society of New Zealand*, vol29 (1896), pp393-412, URL: http://rsnz.natlib.govt.nz/volume/rsnz_35/rsnz_35_00_004810.html, accessed 18 April 2009.

[9] See *Hawera and Normanby Star*, 6 July 1900 and 12 June 1902.

Pinus contorta's seemingly easy adaptability to New Zealand's potentially harsh climate and growing conditions, as well as its ability to regenerate, were identified early on. For these reasons it was regarded as an excellent 'shelter tree' for native varieties. The arboriculture section of the *Otago Witness* noted as early as 1882, that in California, one of its natural habitats, it grew well (to a height of 50 feet) and swiftly in exposed situations, in particular in high damp ranges.[10] James Laird and Sons' Nurseries of Wanganui supported this view, stating that *pinus contorta*, along with *macrocarpa, pinus muricata, pinus insignus,* and *pinus maritima,* provided excellent shelter, which was absolutely necessary especially in coastal areas.[11] The primary reasons, therefore, why *pinus contorta* was introduced into New Zealand were because of the speed of its growth and its hardiness to cope with sea salt storms in coastal regions and frosts in alpine conditions; two crucial attributes in protecting native species.[12] Indeed, in some circles, these same attributes led to recommendations of planting *pinus contorta* ahead of the planting of natives:

> In September of last year Mr H. M. Stowell read a paper at one of the club meetings of the Normanby Horticultural Society, and in this the writer strongly advocated the planting of native trees. The drawback to planting native trees is firstly of getting them to grow, and secondly their slowness of growth. Though Mr Stowell showed considerable skill in handling his subject, there was a good deal of theory in his deductions, and I am afraid that the native varieties will not find favor with tree planters. Of the imported trees, pinus contorta came best out of the ordeal of the storm, and it seems the most likely of the pinus family to come up to what is required. I would strongly recommend pinus contorta to growers, for no other reason than that contorta in the exposed situations where it has been grown has not suffered in the same degree as other varieties …[13]

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[10] Arboriculture section, *Otago Witness*, 25 November 1882.
[11] *Wanganui Herald*, 28 May 1900.
[12] Land for a native school at Hokorima, provided by a Mr Fox, was planted with *pinus contorta* and *pinus muricata* in order to shield the karaka and other native trees from salt storms, *Hawera and Normanby Star*, 11 July 1900.
[13] *Hawera and Normanby Star*, 1 June 1898.

2. The State Forestry Context

With *pinus contorta* increasingly in use within the private sector from 1880, it is likely that specific state agencies – such as schools, railway stations, Crown farms – utilised the tree for similar purposes of landscaping or as protection forestry. Eventually, as will be noted below, widespread use of *pinus contorta* as a plantation timber crop would be considered by the Forest Service in the 1920s with the establishment of Karioi forest. To provide some context for this occurrence, a brief summary of developments in state forestry before then is provided in this subsection.

Although initially the timber industry proceeded in accordance with supply and demand, by the 1870s the state identified a need to become involved as it was seen that the unrelenting cutting and burning of forests for farming purposes would lead to a shortage of timber within two or three generations unless something was done to conserve the timber resource.[14] The first 1874 Forests Act provided for native forests to be identified and set aside from exploitation. This led to the declaration by 1880 of 800,000 acres of existing indigenous forests, already in Crown ownership as forest reserves. Although the State Forests Act 1885 created a forestry branch within the Lands Department,[15] little further development occurred until a national timber conference held in July 1896 reported that an urgent shortage of native timber was predicted to eventuate in New Zealand within a few decades. The conference concluded that to attempt the conservation of the indigenous forest resource was unrealistic, due to continually increasing demand for settlement lands and timber. Instead plantations would have to be established to meet the country's timber requirements.[16]

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[14] Joan Boyd, *Rotorua forests: A history; a short account of the development of state forestry in the Rotorua region* (Wellington: New Zealand Forest Service, 1980), p.6.
[15] MM Roche, *Forest policy in New Zealand: An historical geography 1840-1919* (Palmerston North: Dunmore Press, 1987), p.137.
[16] Ibid, p.145.

By 1898, a 50-acre site at Whakarewarewa, Rotorua, was selected for a nursery.[17] The first state forest using seeds from Whakarewarewa was Waiotapu which was officially established on 5 March 1901.[18] Both indigenous and exotic trees were planted at Whakarewarewa nursery with one source suggesting that the very first *pinus contorta* seedlings were planted in 1902.[19] The state nurseries and plantations gradually increased in size. By 1911 state afforestation policy for plantation timber crops became firmly focused on exotic species rather than indigenous species, primarily due to the time it took for native trees to reach maturity.[20]

In February 1913, a Royal Commission on Forestry, set up to examine all aspects of the timber industry, concluded that the existing trees planted in state forests would only provide for 2.6 years of timber for consumption. The Commission therefore recommended that planting rates should be increased by at least 250 per cent.[21]

The advent of World War I put an initial hold on the Commission's recommendations. However, in 1917 a further report predicted the exhaustion of supplies of indigenous timbers in 35 years' time as the existing consumption of timber in New Zealand would have doubled by then. Proposals were put forward for increased state afforestation to make up the shortfall. One of the key requirements

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[17] 1898 AJHR, C-1, p115.
[18] Boyd, 1992, op cit, p.14.
[19] RS MacArthur, Chief Soil Conservator, Marlborough Catchment Board, 5 March 1963, AANS 6095 W5491/116 22/5144 Reserves-General-Quarantine: Use & Control of Introduced Trees & Plants 1959 - 1982, ANZ.
[20] Roche, op cit, p.64.
[21] Kirkland, Andrew & Berg, P., *Century of state-honed enterprise: 100 years of state plantation forestry in New Zealand* (Auckland: Profile Books, 1997), p.35.

called for was to establish a separate forestry department.[22] As a result, the New Zealand Forest Service came into existence on 1 September 1919.

It appears that *pinus contorta* played a very small role in this first period of state forestry exploration and experimentation. Within the context of the state seeking to find the most suitable exotic trees for the planned new forestry plantations, available evidence suggests that between 1914 and 1918, 5 acres of *pinus contorta* was planted in state forests with a further 2 acres being planted between 1919 and 1923.[23] The forests in which the clearly experimental crops of *pinus contorta* were planted have not been identified by research conducted to date. Nevertheless, these first experiments of State planting of *pinus contorta* pale in importance with the use of the species within the Karioi forest in the Whanganui inquiry district, a state plantation that was begun in the mid-1920s.

3. The Establishment of the Karioi Forest

Karioi was by far the main state forest to grow *pinus contorta.* This section examines the establishment of the forest, the introduction of *pinus contorta* and its role as a plantation crop within the forest.

The Karioi state forest was established in November 1926 when an area of 33,516 acres was set aside for forestry purposes. The New Zealand Forest Service took possession of the land on 31 March 1927. As was noted in documentation of the time: "Immediately the Service take possession, forestry operations will commence, and a tree nursery established to supply all trees for subsequent planting."[24] It was

[22] 1917, "Position with regard to Forestry…", F1-1/7-Vol 2, ANZ.
[23] 'State Forest Service Summary of Acres of Species Planted as at 31 March 1933', F1 W3129 190/26/23 Statistical data and returns, 1925-1973, ANZ.
[24] Undated, c.Nov 1926, 'Proposed Karioi Afforestation Scheme', AANQ W3797/19 30/4 Karioi Points of Interest, 1924-1931, ANZ. It was at this time that the Forest Service received a request from the

envisaged that the forest would be planted each year until its estimated completion in 1935.

The Karioi forest was established within the context of what has been called the 'first planting boom' in New Zealand forestry.[25] One of the first tasks undertaken by the new Forest Service in 1919 was a stocktake of the timber resources of New Zealand. This work was finished in 1923 when the indigenous timber inventory revealed that if a timber famine was to be avoided exotic afforestation had to proceed on a large scale and quickly. As a result, in 1925 the Service announced a planting programme of 300,000 acres of exotic forests over the next decade.[26]

Another spur to an increased afforestation programme evolved from 1927, as the country slid towards an economic slump and forestry came to be seen as an important potential avenue for unemployment relief. Nevertheless, there were powerful objections to the state's afforestation programme from private afforestation companies, the indigenous timber industry (which feared a state funded competitor) and the farming lobby (which protested that lands were being put into forests that could be farmed instead). However, it was the deepening of the Depression and the need to absorb unemployed labour which guaranteed the continuance of the afforestation programme well into the 1930s and ensured that by 1931, the 1925 goal of 300,000 acres being planted was reached. In response to the Depression, the Government decided that a planting programme of approximately 60,000 acres per annum would be maintained for at least three years.[27] Nevertheless, new forests were established at this time, and this is the context in which Karioi came into existence.

South Australian Forest Service regarding information on the varieties of pines being planted in New Zealand. This was in anticipation of a similar scheme being undertaken there, see F1 W3129 190/26/23 Statistical data and returns, 1925-1973, ANZ.

[25] MM Roche and A Sewell, *The Impact of the Depression on the Timber Industry and Afforestation in New Zealand, 1920-1935* (Wellington: New Zealand Forest Service, 1986), p.16.

[26] Ibid p.18.

[27] Kirkland, op cit, p.56.

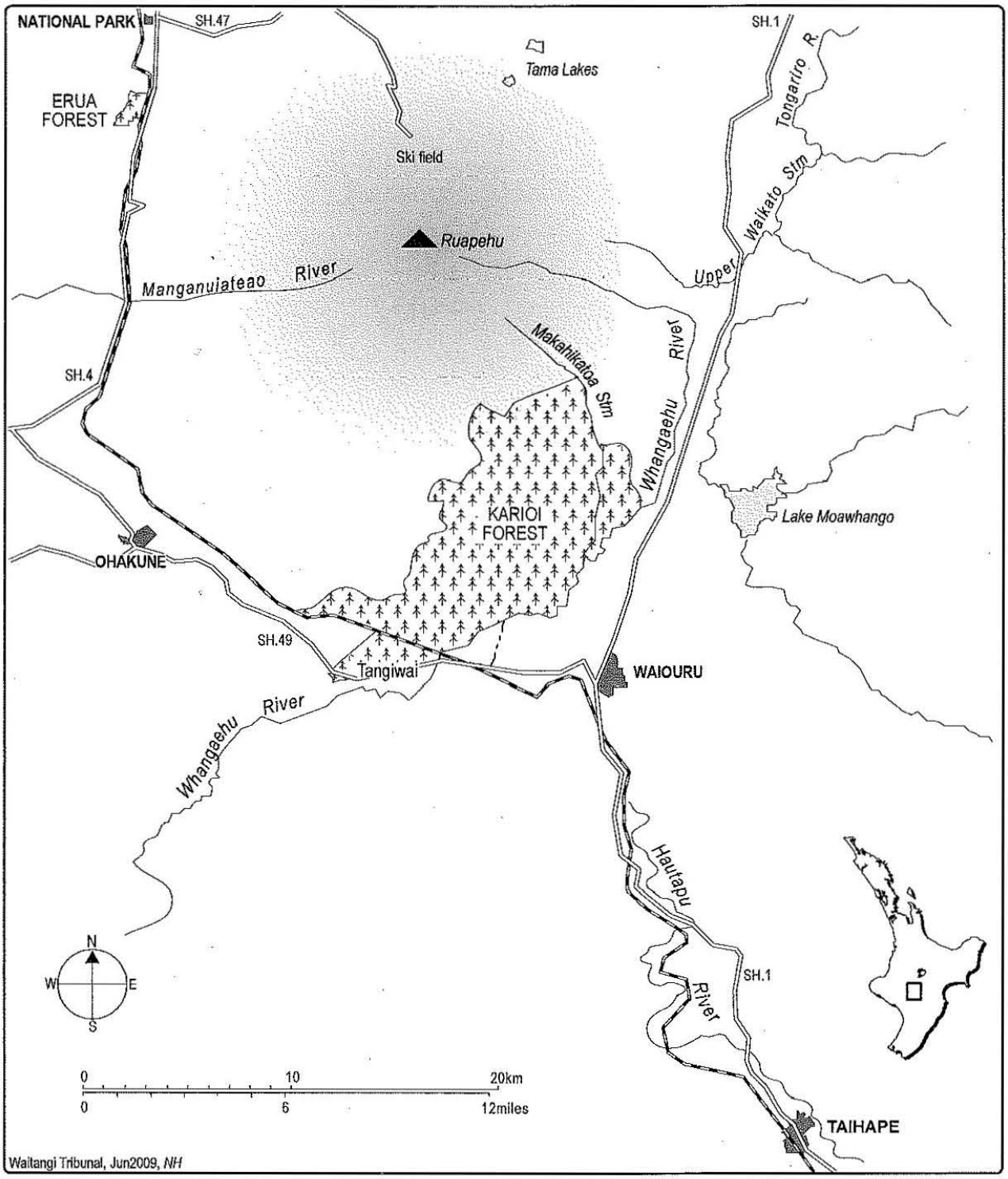

Figure 1: Location Map - Karioi Forest

The land on which Karioi was established had formerly been Crown Land under lease. In October 1925, Leon MacIntosh Ellis, Director of the State Forest Service, wrote to the Acting Office in Charge of the Service in Wellington regarding the 'Proposed Waiouru Afforestation Area':

> …re. Duncan and Campion's run, I should be pleased if you would instruct Ranger Dolamore to get in touch with the Manager as soon as possible, ascertain the position as regards the utilisation of the run, and forward me particulars shewing the production and non-productive areas, also any information procurable re. the possibility of the lessees relinquishing the no or low productive portions.[28]

The economic advantages of establishing a planting programme at Karioi were made clear. The *Ohakune Times* reported that the scheme would provide employment, introduce capital and would allow for the continuation of the saw-milling industry in the Waimarino County after indigenous forests had been cut.[29] It was proposed that the state forest would employ 13 permanent staff with a further 30-40 temporary staff during the planting season.[30]

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[28] 'Proposed Karioi Afforestation Scheme', 30 October 1925, AANQ W3797/19 30/4 Karioi Points of Interest, 1924-1931, ANZ. The landowner, WM Duncan, was a Taihape sheep farmer.

[29] 'Proposed Karioi Afforestation', *Ohakune Times*, 16 November 1926 in AANQ W3797/19 30/4 Karioi Points of Interest, 1924-1931, ANZ. The Karioi forest would be established over a period when there was a noticeable decline in numbers employed in the timber industry. Michael Roche calculated that numbers working in the sash and door factories in the Wellington region fell from 1,610 in 1925/26 to 459 in 1932/33. This reflected the national decline in numbers working in the wider timber industry, which fell from a peak of 10,082 in 1925/26 to 4,591 in 1931/32, a reduction of 45.5 per cent. The greatest reduction came in 1926/27 (the period in which Karioi was established) with a fall of 15 per cent. [Roche and Sewell, *The Impact of the Depression on the Timber Industry and Afforestation in New Zealand,* pp.10 & 11.] See also AANQ W3797/20 34/2 Afforestation Policy, 1929-1938, ANZ, which regarded planting in Karioi as a positive move given the depressed state of the saw-milling and timber industries in Karioi and Ohakune.

[30] For the 1928 planting season a total of 54 were employed, 30 of these were planters, AANQ W3797/19 30/4 Karioi Points of Interest, 1924-1931, ANZ.

Aware of the economic benefits deriving from State Forest planting, local support was forthcoming. In a memorandum to the Conservator of Forests in Palmerston North, the Forest Ranger at Ohakune Junction, stated:

> At the invitation of the mayor of Ohakune (Mr Geo. Goldfinch), I attended a public meeting here on the 8th instant, and explained briefly what the Service intended to do at Karioi, and answered a number of questions regarding various points of interest to local residents. There were a number of farmers present and practically all the business people in the township, and they appeared to be unanimously in favour of supporting the scheme.[31]

It was also noted on 16 November 1926 that "the Waimarino County Council (the body most affected in that it would lose a considerable sum in rates) passed a resolution favouring the use of the area for forestry purposes and forwarded a copy of the resolution to the Hon. the Commissioner of State Forests"[32] In part, this support arose following confirmation that utilisation of the land for forestry was the best use, as it was reported at the meeting that: "The Taihape Chamber of Commerce sent two sound practical farmers to examine the Run and the report they furnished also favoured forestry."[33] The Council's support was also brought forward within the context of Forest Service's employees highlighting the alternatives should the proposed forest not go ahead. At a Waimarino County Council meeting held in Raetihi to discuss the State Forest Service proposal, both Ranger Dolamore and an Ohakune Junction Forest Assistant "mentioned the fact that if a large amount of local opposition to the Karioi project was encountered there was a possibility that the

[31] From Forest Ranger to Conservator of Forests, Palmerston North, 13 November 1926, AANQ W3797/19 30/4 Karioi Points of Interest, 1924-1931, ANZ.
[32] 'Some Comments as a Result of the Commissioner of Forests' Visit to Karioi on 15 May 1929', p.3, AANQ W3797/19 30/4 Karioi Points of Interest, 1924-1931, ANZ.
[33] 'Some Comments as a Result of the Commissioner of Forests' Visit to Karioi on 15 May 1929', p.3, AANQ W3797/19 30/4 Karioi Points of Interest, 1924-1931, ANZ.

scheme would be abandoned, and the money which had been allotted for the purpose spent in another Region."[34]

In establishing a state forest at Karioi considerable sums were spent on infrastructure. Over a three-year period from April 1926 to March 1929 over £26,000 was spent on roads, constructing buildings, fences and bridges, establishing telephone communications and laying drains.[35]

Nurseries at Karioi and nearby Erua were established to trial seeds in order to discover which varieties of pine seeds and seedlings arriving predominantly from the United States were the most effective. At that time, it appears that many seeds were purchased from the Long Bell Lumber Company in Longview, Washington State,[36] though there were other sources including the British Forestry Commission, the Canadian Forest Service and the Duke of Atholl's Blair Atholl estate in Pitlochry, Scotland.[37] A Wellington Conservation Region Karioi Plantation Financial Statement estimated that for the year 1927/8 more than 4.3 million trees had been raised from nurseries during the year. The following year this had more than doubled to 8.9 million. Of these, more than 2.2 million were replanted in the region.[38]

Trials of numerous pine species were carried out at Karioi nursery. If a species appeared not to adapt to local conditions, other varieties were attempted. The *Ohakune Times* reported on silver pine seed trials taking place at Erua and the

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[34] Memorandum from Forest Assistant, Ohakune Junction, to Director, State Forest Service, 13 December 1926, AANQ W3797/19 30/4 Karioi Points of Interest, 1924-1931, ANZ.
[35] 'Infrastructure Wellington Conservation Region Karioi Plantation Financial Statement 1 April 1926-31 March 1929', AANQ W3797/19 30/4 Karioi Points of Interest, 1924-1931, ANZ. The exact amount given was £26,099,13s 7d.
[36] See AANQ W3797/18 28/9 Seed 1933-1949, ANZ.
[37] See memorandum from E Phillips Turner, Director of Forestry to Officer in Charge, Karioi, 1 August 1930, AANQ W3797/18 28/9 Seed 1933-1949, ANZ. *Juniperus Procera* seeds were also purchased from Kenya.
[38] Wellington Conservation Region Karioi Plantation Financial Statement 1 April 1926-31 March 1929, AANQ W3797/19 30/4 Karioi Points of Interest, 1924-1931, ANZ.

replacement of *pinus canariensis* (Canary Island pine) with *pinus sylvestris* (Scots pine) seeds when the former failed to flourish.[39]

Once underway, planting in Karioi was swift. In 1927, 1,306 acres of the forest were planted, followed a year later with a further 5,148 acres.[40] The proposed planting programme for 1929 and 1930 covered 2,000 acres and 2,500 acres respectively. The Forest's 'Summary of Operations' reported in March 1931 that a further 2,215 acres had been planted with 1,426,216 trees. Total expenditure for that year reached £13,712. Between the Forest's inception in 1927 to March 1931, over 10.7 million trees had been received from nurseries, which had been planted in an area covering 11,650 acres, at a cost of £56,524, 15s 10d.[41]

[39] *Ohakune Times*, 13 and 16 August 1929 in AANQ W3797/18 28/9 Seed 1933-1949, ANZ.
[40] Forest Ranger FJ Perham to Conservator of Forests, Palmerston North, 'Karioi Plantation, 28 January 1929', AANQ W3797/19 30/4 Karioi Points of Interest, 1924-1931, ANZ.
[41] 'Summary of Operations in Plantation to 31 March 1931', AANQ W3797/19 30/4 Karioi Points of Interest, 1924-1931, ANZ.

Figure 2: Planted Stand of 'yellow' *pinus contorta* Karioi Forest.
Source: *Burns, Bruce and Williams, Peter, 'Review of Karioi Forest pinus contorta management plan 2006-2021' 2008, p.19*

4. Pinus Contorta within Karioi Forest

At the outset of establishing Karioi forest, there was an awareness among officials of the tough local conditions. Prior to the Karioi forest being established, a scientific analysis of the soil was undertaken:

> Both soil and subsoil to a depth of 18 inches from the surface must be classed as sandy silt and therefore [vegetation, some of it naturalised] labour under all the disadvantages that such a composition implies and at this elevation [200ft above Ohakune township] subject to intense frost and unprotected by any forest one must add to the poor texture of this soil the severe winter climate.[42]

Given such conditions, it is not surprising that *pinus contorta,* with its reputation for hardiness already established, was selected as one of species to be trialled at Karioi. Nevertheless *pinus contorta* (also referred to at the time as *pinus murrayana* and lodgepole pine) was by no means the dominant pine species planted at Karioi. In fact, it was one of several early pine species planted for production forestry purposes. For the 1928 programme, 50,000 'lodgepole pine' seedlings were among those being laid out in the nursery in anticipation of the following season's planting.[43] In terms of tree numbers, 171,500 *murrayana* were planted in the 1929 programme, which equated to less than 11 per cent of the 1,573,300 trees planted that season.[44] In a later Forestry Service report, AP Thompson, Director General of Forests, estimated that approximately 5,000 acres of Karioi forest was planted in dedicated lodgepole pine plantations prior to 1939 and another 1,200 acres in

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[42] BC Aston, Chief Chemist, Department of Agriculture, 'Results of mechanised analysis of the Karioi soils and subsoil', to E Phillips Turner, Director of Forestry, 9 November 1928, AANQ W3797/19 30/4 Karioi Points of Interest, 1924-1931, ANZ.

[43] Report compiled by Arnold Hansson, Chief Inspector, New Zealand State Forest Service, 1 October 1927, AANQ W3797/19 30/4 Karioi Points of Interest, 1924-1931, ANZ.

[44] Forest Ranger to Conservator, State Forest Service, Palmerston North, 29 November 1929, 'Tree Planting: summary of area by species', AANQ W3797/19 30/4/1 Planting Programme 1929-1934, ANZ. As a comparison with other species planted: Ponderosa 473,300 (31 per cent); Laricio 402,200 (25 per

combination with other species.[45] If this was so, and the total area planted at Karioi remained the 33,500 acres outlined in 1926, approximately 19 per cent of the forest was set aside to grow lodgepole pine.

Early reports from Karioi regarding the adaptability of *pinus contorta* species to New Zealand conditions were favourable: '*Murrayana* planted as a two-year-old tree showed 100% strike and are healthy vigorous trees.'[46] By 1929 trials were taking place to discover how *murrayana* would adapt at higher altitudes. Over 450 *murrayana* (297 trees of six feet in height and 160 trees eight feet in height) were planted in experimental sample plots at 2,700 ft.[47] *Murrayana* was proving itself to be a species able to withstand not only the conditions in which it was being planted, but also the transplanting process:

> [*Murrayana*] produced very freely, and was the only species at Karioi which survived transplanting to approximately 100% in every case. So far it is keeping pace with *P.radiata* planted beside it at the same time, and it is quite possible that like *P.radiata* it will do much better than in its Native habitat[48]

Although *pinus contorta* was not the dominant timber species at Karioi, it appears that Karioi accounted for almost all of the *pinus contorta* planted in state forests by 1933, which as noted previously was near the end of the first exotic forestry planting boom.

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cent); Douglasii 278,000 (18 per cent): Lawsonia 154,100 (10 per cent): other species 94,200 (six per cent).

[45] AP Thompson, New Zealand Forestry Service, 18 November 1971, AANS 6095 W5491/450 22/5144/1 Weeds – Pinus Contorta in Tongariro National Park, 1963-1975, ANZ.

[46] Forest Ranger JF Field to Conservator of Forests, Palmerston North, AANQ W3797/19 30/4 Karioi Points of Interest, 1924-1931, ANZ.

[47] 'Forest Investigations PN/26/5, 16 January 1929', AANQ W3797/19 30/4 Karioi Points of Interest, 1924-1931, ANZ.

[48] Conservator of Forests Macpherson to Director, State Forest Service, Wellington, 12 November 1930, AANQ W3797/18 28/3/1 Seed 1929-1932, ANZ.

State Forest Service Summary of Acres of Species Planted as at 31 March 1933[49]

Species	1899-1903	1904-08	1909-13	1914-18	1919-23	1924-28	1929-32	Total
Pinus murrayana	-	-	-	5	2	1,303	5,177	**6,487**

An additional 291 acres listed in the Summary under a column titled 'Areas of 50-199 Acres' were also planted, making a total of 6,778 acres. As noted above, estimates of *pinus contorta* planted in Karioi totalled 6,200 acres.

Pinus contorta was introduced into the Karioi forest for production forestry purposes. Outside of its use as a shelter tree, *pinus contorta* has mainly been used in New Zealand in particle board manufacturing and as a pulpwood,[50] though due to its high resin content, it needs to be mixed with other woods prior to pulping.[51] *Pinus contorta* is a wood that does not tanalise well so its uses outdoor are limited.[52] However, its ability to take boron treatment means that it is suitable to be used in indoor framework for housing.

Within Karioi, as early as 1931, there was an acknowledgement that *pinus contorta* had limitations as a production timber species. In a report to Ohakune's Forest Ranger, JB Watt, Conservator of Forests in Wellington, D Macpherson, stated that:

> Monthly reports show that this year at Karioi, 3,200 acres (planting and blanking) were set out with *P.Murrayana*. As this species has everywhere a low yield per acre of saleable timber and consequently cannot be expected to return a profit on planting, it has been decided to curtail

[49] 'State Forest Service Summary of Acres of Species Planted as at 31 March 1933', F1 W3129 190/26/23 Statistical data and returns, 1925-1973, ANZ.
[50] Miller and Ecroyd, 'Introduced forest trees in New Zealand', p.8.
[51] *Dominion*, 13 February 1991.
[52] Keith Wood oral submission on behalf of claimants, week 13 hearings, 4 March 2009, Wai 903, 4.3.018.

> operations on a project which will carry from now onwards a preponderance of such an inferior species. Will you therefore please arrange next year's programme in such a way as to plant Compartments XXXV to XXXVIII (inclusive) only; this will make a planting programme of 1,625 acres, exclusive of what further blanking you may require to do. Planting at Karioi will then cease, instead of proceeding to the higher contour line previously authorised. On the higher levels, acre experimental plots of different species at different altitudes may be set out, totalling in all not more than 25 acres.[53]

Therefore, the *pinus contorta* planting programme was brought to a premature close. With presumably a number of *pinus contorta* seedlings now not going to be planted, and with the Karioi's planting programme nearing its end, it appears that around this time the Forestry Service was prepared to sell and even donate the seedlings of various pine species growing in its nurseries. This proposal was welcomed by private individuals and organisations. In a number of cases, inquiries to the Service for seedlings specifically requested trees from Karioi as that forest was seen as providing hardy trees which often would be suited to the conditions in which they would be replanted.[54]

In the main, applications for seedlings were made through the Unemployment Board (perhaps trees were gifted on the condition that unemployed labour would undertake the planting), who then forwarded the request to the Forest Service. Requests were received from numerous groups as far away as the South Island as well as various school requests for pines to be planted during Arbor Day ceremonies.[55] In most cases the recipient paid a fee for lifting, packing and freight, or if they were being purchased, the price was set at 10/- per 100 or 80/- per 1,000.[56]

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[53] 'Planting Programme 1931', D Macpherson, Conservator of Forests to JB Watt (Ohakune), 30 October 1930, AANQ W3797/19 30/4 Karioi Points of Interest, 1924-1931, ANZ.
[54] E Peters, Waiouru to New Zealand Forest Service, 8 August 1930, AANQ W3797/18 28/3/1 Seed 1929-1932, ANZ.
[55] eg Hutt Golf Club, (30 May 1932); West End School Palmerston North (14 September 1932). Five hundred *murrayana* were sent to Marlborough County Council (30 October 1932), 500 to Waipukurau Borough Council (29 August 1932), AANQ W3797/18 28/3/1 Seed 1929-1932, ANZ.
[56] AANQ W3797/18 28/3/1 Seed 1929-1932, ANZ.

Figure 3: Pure Stand of 'green' *pinus contorta* Karioi Forest.
Source: *Burns, Bruce and Williams, Peter, 'Review of Karioi Forest pinus contorta management plan 2006-2021' 2008, p.20*

5. Other Pinus Contorta Plantings within the Central Plateau Region.

As noted above, from the 1930s the state nursery that had supported the planting of Karioi forest began to make available by sale of gift seedlings including *pinus contorta.* These were distributed widely around the Wellington region with a certain proportion finding their way around the wider central plateau region. Although the available timeframe for this project has meant that the degree the nursery was a source of *pinus contorta* plantings in the central plateau outside of Karioi forest can not be ascertained with any degree of accuracy, some significant examples have been identified. These include a request for 1,000 *murrayana* from the Rangitikei County Engineer for planting at the Hihitahi railway station, south of

Waiouru township, as well as a request for 400 trees from the Bulls Town Board. [57] Various species of trees were sent from the Karioi nursery to Raetihi Borough Council, Dalgety in Taihape requested 350 trees, and the Lands and Survey department required 2,000 trees for 'projection of Reserves in the [Ohakune and Raetihi] district'.

Although planting of *pinus contorta* had ended in the Karioi State Forest by the early 1930s, another source of State-assisted and sponsored plantings emerged in the Central Plateau District immediately after the Second World War. In 1947 it was announced that the Soil Conservation and Rivers Control Council (SCRCC) were establishing an experimental area at Waiouru. Within 18 months permission was obtained from SCRCC to utilise a suitable portion of the experimental area for soil erosion purposes. Instructions were sent to plant 38,000 *murrayana* and 19,000 *laricio* trees on eroded uplands of Waiouru military reserve for the benefit of Rangitikei Catchment Board. Staff released from Karioi carried out the planting.[58] This experimental area also saw the planting of flax, marram and manuka. Two-year old *pinus murrayana* were planted as a perimeter belt species and by 1952 it was noted that the species had 'struck vigorously' and 'considerable growth has been noted.'[59] Further trees were planted on an eroding face as an experiment to determine whether trees would halt the spread of erosion into the tussock area. HCH Pearse noted that 'tree mortality has been high and the obvious approach seems to be to plant around the erosion perimeter and gradually extend the planting inward as the trees grow.'[60]

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[57] Hihitahi railway station request (23 August 1930); and 400 to Bulls Town Board (21 September 1932), AANQ W3797/18 28/3/1 Seed 1929-1932, ANZ.
[58] Resident Engineer to Conservator of Forests, 'Waiouru Experimental Area', 22 September 1947, AATC 5114/486 74/24/6 Eradication of Pinus Contorta (Waiouru) 1947-1985, ANZ.
[59] Rangitikei Catchment Board to District Commissioner of Works, 14 August 1952, AATC 5114/486 74/24/6 Eradication of Pinus Contorta (Waiouru) 1947-1985, ANZ.
[60] HCH Pearse, District Soil Conservator to Commissioner of Works, Ministry of Works, Wellington, 27 April 1954, 'Annual Report Year Ending 31 March 1954, Waiouru Experimental Area', AATC 5114/486 74/24/6 Eradication of Pinus Contorta (Waiouru) 1947-1985, ANZ.

Figure 4: Mixed high altitude stand of *pinus contorta* and *pinus radiata* Karioi Forest.
Source: *Burns, Bruce and Williams, Peter, 'Review of Karioi Forest pinus contorta management plan 2006-2021' 2008, p.21*

B. PINUS CONTORTA AND WILDING

Having outlined the way in which *pinus contorta* was introduced to New Zealand generally, and into the Karioi forest specifically, this section of the report considers the threat of wilding spread posed by *pinus contorta.* In addition, we document the time period when this threat was first recognised and give an outline of action taken to eradicate unplanted *pinus contorta* infestations.

The regenerating ability of *pinus contorta* has been well documented. Forestry commentator Ann Graeme has noted that *pinus contorta* seeds had been known to blow up to 40kms and this, coupled with its ability to grow up to 2,000 metres above sea level, higher than the natural tree lines, make it a formidable species.[61] Environment Waikato's website states that *pinus contorta* is:

> …an aggressive coloniser, particularly when planted at higher altitudes, where it is usually more competitive than native alpine vegetation. It can completely modify habitats, increase fire risks and obstruct farm operations and stock.[62]

Its colonising ability is due to it flowering first at two to three years and it spreads first because it is an aggressive fire succession species.[63]

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[61] Ann Graeme, 'Pulling pines on Ruapehu', *Forest & Bird* no 284 (1997), p.34.

[62] Environment Waikato Regional Council, URL: http://www.ew.govt.nz/Policy-and-plans/Regional-Pest-Management-Strategy/Regional-Pest-Management-Strategy-2008-2013/Part-2/5-Pest-plants/53-Containment-occupier-control-pest-plants/5314-Pinus-contorta-Pinus-contorta/, accessed 18 April 2009

[63] Miller and Ecroyd, 'Introduced forest trees in New Zealand', p.8.

Figure 5: Wilding *pinus contorta* in wetland areas Karioi Forest.
Source: *Burns, Bruce and Williams, Peter, 'Review of Karioi Forest pinus contorta management plan 2006-2021' 2008, p.19*

1. Initial Recognition of Pinus Contorta Wilding

As noted in the previous section, *pinus contorta,* despite having been rejected as a production timber species by the early 1930s, was again being trialled in the immediate post-War era to test its abilities to prevent and contain soil erosion in high altitude areas. Available evidence suggests that this trialling was still continuing in the mid-1950s. In addition, a wide range of private and public organisations had planted the tree for a wide range of purposes. By 1963, it was estimated that in total there were 20,140 acres of pinus contorta planted in pure stands of which only 1,570 acres were in the South Island. Planting was concentrated mostly on frost flats and

other difficult sites above 2,000 feet on the volcanic plateau of the Central North Island. It is possible that the Karioi state forest nursery produced a good proportion of the seeds for these stands.[64]

By the late 1950s, however, the Forest Service began to raise concerns generally about the wilding possibilities of exotic species being planted around New Zealand. On 5 March 1959, AR Entrican, Director of the New Zealand Forest Service, stated:

> For some time now the Forest Service has been deeply concerned with the obvious dangers inherent in the indiscriminate planting of trees and plants within New Zealand. As a ready example I would quote the use of certain plants for stabilising high country soils and the danger of such plants escaping to the lowlands where they could constitute potential threats to economic crops.[65]

VP McGlone, Assistant Fields Director, supported Entrican's observations, drawing particular attention to the volcanic plateau by way of example:

> Self-sown pines growing on undeveloped land in the central plateau area constitute a major weed problem. Initial clearing costs may be increased up to £5 per acre and in some cases, eradication of seedlings following burning and grassing has been equally expensive.[66]

McGlone continued:

> Where exotic forests are established in close proximity to national parks there is a real danger of self-sown pines taking charge of areas of parkland to the exclusion of everything else. This has already occurred

[64] RS MacArthur, Chief Soil Conservator, 5 March 1963, AANS 6095 W5491/116 22/5144 Reserves-General-Quarantine: Use & Control of Introduced Trees & Plants 1959 -1982, ANZ.
[65] AR Entrican, Director of Forestry, New Zealand Forest Service, to Director General of Lands and Survey Department, 5 March 1959, AANS 6095 W5491/116 22/5144 Reserves-General-Quarantine: Use & Control of Introduced Trees & Plants 1959 –1982, ANZ.
[66] VP McGlone, Assistant Fields Director, to TC Birch, Inspector-in-Charge, Development Director, New Zealand Forest Service, 18 May 1959, AANS 6095 W5491/116 22/5144 Reserves-General-Quarantine: Use & Control of Introduced Trees & Plants 1959 –1982, ANZ.

> at the Tongariro National Park and the position there is causing the department grave concern, particularly in view of the extremely limited funds available for park maintenance.[67]

Although Entrican and McGlone do not specifically mention *pinus contorta* in the above correspondence, other sources indicate that it was soon identified as a predominant species in relation to the growth of a wilding problem from exotic species in the central plateau area. This evidence is considered below.

Despite growing evidence of *pinus contorta* wilding, there was no legislative requirement to take any action. Though the Noxious Weeds Act was passed in 1950, it did not, at this stage at least, encompass trees. Administered by the Ministry of Agriculture, the Act concerned itself with the eradication of specific weeds (with the exception of two, all were introduced species) including blackberry, gorse and numerous types of thistles.[68] Furthermore, it appears that there may have been an initial reluctance among forestry officials to ban state-sponsored planting of the species due to its potential for soil erosion control. On 10 May 1961, the Director General of Forests, AL Poole, wrote to the SCRCC (which, as noted above, had been involved since the end of the War in planting tens of thousands of *pinus contorta* within an area on the Waiouru military reserve) considering the future of *pinus contorta* planting:

> Under certain circumstances, not yet clearly defined, it is a potential weed species, but this will equally be the case with any vigorous, aggressive species of strong pioneer characteristics that can be used successfully and at a reasonable cost in the revegetation or reafforestation of severely eroding mountainous catchment. There is evidence that spread of lodgepole pine into pasture land can be prevented by normal grazing. Numerous cases can be quoted of shelter

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[67] VP McGlone, Assistant Fields Director, to TC Birch, Inspector-in-Charge, Development Director, New Zealand Forest Service, 18 May 1959, AANS 6095 W5491/116 22/5144 Reserves-General-Quarantine: Use & Control of Introduced Trees & Plants 1959 –1982, ANZ.

[68] For a full list, see Noxious Weeds Act 1950, no.62, *New Zealand Statutes* (Wellington: Government Printer, 1951), pp.776-796.

> belts and other plantations of lodgepole pine being contained by well-grazing pasture. Nor does it succeed in invading country with a closed scrub cover. It is agreed that there is a danger of its colonising depleted tussock grasslands, particularly in semi-arid areas where it is difficult to develop closed swards. In view of this danger, I suggest trials with lodgepole pine be more strictly controlled than they are at present.[69]

Despite Poole's optimism that *pinus contorta* could still be utilised for soil erosion purposes if strict controls were maintained, the evidence was growing that the wilding problem associated with the species was worse than first thought. By 1964, as research into the *pinus contorta* wilding continued, it was estimated that a 'dense to light infestation' had occurred over an estimated 26,000 acres of the Waiouru Military Reserve.[70] By this time, *pinus contorta* was also increasingly being recognised as presenting wilding problems, with some other exotic species, in the high country of the South Island as a result of having been 'planted indiscriminately'. By 1960, Land and Survey Department officials were recording infestations of *pinus contorta* at Pukaki Downs Station in South Canterbury.[71] Such was the problem that within three years, HM Sievwright, Pastoral Lands Officer for the Department of Land and Survey in Canterbury recommended that 'the planting of *pinus contorta* on Crown lands should be forbidden'.[72]

The spread of *pinus contorta*, first into the Tongariro National Park and then to Defence lands at Waiouru, prompted moves to address the wilding issue. In June 1966, the SCRCC established guidelines for the future planting of the species. In these

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[69] AL Poole, Director General of Forests to Secretary of Soil Conservation and Rivers Control Council, Ministry of Works, 10 May 1961, AANS 6095 W5491/116 22/5144 Reserves-General-Quarantine: Use & Control of Introduced Trees & Plants 1959 –1982, ANZ.

[70] *Wanganui Chronicle*, 9 February 1972 in AATC 5114/486 74/24/6 Eradication of Pinus Contorta (Waiouru) 1947-1985, ANZ.

[71] HM Sievwright, Pastoral Lands Officer to Commissioner of Crown Lands, Christchurch, 13 June 1960, AANS 6095 W5491/116 22/5144 Reserves-General-Quarantine: Use & Control of Introduced Trees & Plants 1959 –1982, ANZ. Other sites with a wilding problem from other species included Mt. Cook Station (larches) and Mt John *(P Ponderosa*).

guidelines, the Council acknowledged of *pinus contorta* 'that it is out of control in the Waiouru area'. The Council was at pains to ensure, however, that the species did not get 'an undeservedly bad name' as *pinus contorta* was still viewed as being 'a species of great potential importance for both protection and production forestry'. Despite this, the SCRCC's guidelines were strong in identifying situations where the tree should not be used despite its potential use. First, it was stated that *pinus contorta* regeneration 'should not be tolerated in areas where its presence is detrimental to more important values, particularly scenic, National Park, and agricultural ones. In such areas it should, if possible, be eliminated.' Second, that *pinus contorta* 'should not be planted in situations where there is a danger of regeneration getting out of control and spreading into the sort of areas mentioned above.' To ensure this, the Council required that all proposals for the future planting of the species 'are to be referred to the council whether or not the question of subsidy is an issue, and must be accompanied by a report from the New Zealand Forest Service.'[73]

In the meantime, the problem remained 'out of control' in the central plateau district. By 1972, 'dense to light infestation' of *pinus contorta* across Defence lands at Waiouru had increased to 41,500 acres. Investigations conducted found that the infestation had spread two and a half miles east of the Karioi forest.[74] A *Dominion* article a year later referred to these acres as 'lost to the march of *pinus contorta*'[75]

By 1971, Forest Service officials such as AP Thompson, acknowledged that the State Forest at Karioi was the primary source of the wilding problem:

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[72] HM Sievwright, Pastoral Lands Officer to Commissioner of Crown Lands, Christchurch, 1 July 1963, AANS 6095 W5491/116 22/5144 Reserves-General-Quarantine: Use & Control of Introduced Trees & Plants 1959 –1982, ANZ.
[73] PG Walker, secretary of the SCRCC, 1 June 1966, AATC 5114 W3457//486 74/24/6 Eradication of Pinus Contorta (Waiouru) 1947-1985, ANZ.
[74] *Wanganui Chronicle*, 9 February 1972 in AATC 5114/486 74/24/6 Eradication of Pinus Contorta (Waiouru) 1947-1985, ANZ.
[75] *Dominion* 3 July 1973 in AATC 5114/486 74/24/6 Eradication of Pinus Contorta (Waiouru) 1947-1985, ANZ.

> Over approximately the last 25 years lodgepole pine has spread to a number of compartments previously not planted within the forest, and northwards into the park. Karioi forest is undoubtedly the principal seed source on the south-east part of the [Tongariro National] park, but other sources occur in Taurewa State Forest and the numerous shelter belts and plantations at Waiouru, Ohakune, Erua and National Park.[76]

Within Karioi forest, it was estimated that by 1974, seeds from planted *pinus contorta* had invaded unplanted higher altitude areas and other open areas such as firebreaks, leading to an additional 1,300 ha being covered in naturally established *pinus contorta*.[77] The following year, JF Robertson, Secretary of Defence, also identified Karioi forest as the source of the wilding problem but added that secondary infestations were occurring:

> Defence has become the repository of seed showers carried on the Easterly [correction in margin – Westerly] prevailing wind from *pinus contorta* stands in Karioi State Forest and in more recent times from similarly sown stands on Maori land and National Park land just to the north of the State Forest.[78]

Robertson's comments reflect knowledge among Crown officials at the highest level that Maori land in the central plateau district was also infested and that these infestations in turn had become a source of ongoing wilding.

Although the problem with *pinus contorta* on the central plateau was serious, during the 1970s the Government was not brought by its officials to a view that the species should be banned as it was still believed to have a role to play in soil conservation in other areas of the country. For example, in June 1969 JT Holloway, Director of the Forestry Protection Branch, in response to information sought from

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[76] AP Thompson, New Zealand Forest Service, 18 November 1971, AANS 6095 W5491/450 22/5144/1 Weeds – Pinus Contorta in Tongariro National Park, 1963-1975, ANZ.
[77] Burns and Williams, 'Review of Karioi Forest pinus contorta management plan 2006-2021', p.6.

the Federated Farmers of New Zealand, Marlborough branch, confirmed the particular risk of *pinus contorta* spreading but noted that this was the case with many other tree and shrub species. [79] In November 1971, AP Thompson of the Forestry Service, who as noted above knew of the wilding problems on the central plateau, nevertheless otherwise noted of *pinus contorta* that 'this extremely hardy species is of immense value in soil conservation and watershed protection work, particularly for difficult, severely eroded high altitude land'[80] Therefore, despite its aggressive wilding abilities, *pinus contorta* remained a species of choice in combating soil erosion. In a 1973 *Dominion* article on the uses of *pinus contorta* for combating soil erosion, AP Thompson argued that '*pinus contorta* is one of the most valuable conservation tools which New Zealand has at its disposal and it must continue to be used for this purpose.' [81]

Given the persistence of these views, it is not surprising that the National Water and Soil Conservation Organisation's policy by 1974 remained that 'no general restrictions should be placed on the use of *pinus contorta* where [it] is required for the control of soil erosion.' Despite this, the Organisation clearly became aware that there was some risk of liability to the Government in the face of a ban not being brought into effect. Therefore, it sought legal opinion on the matter of responsibility of its spread and reported that there was no 'statutory prohibition of *pinus contorta*', and 'under Common Law, *pinus contorta* is unlikely to be regarded as a 'nuisance''.[82]

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[78] JF Robertson, Secretary of Defence, to Minister of Defence, 2 September 1975, ABFK 7291 W4776/19 203/192/2 pt.5 Works and Buildings – Waiouru Military Camp – Noxious Weeds and Pinus Contorta Control, 1977-1980, ANZ.
[79] JT Holloway, Director of Protection Forestry Branch to WB Parker, Federated Farmers of New Zealand (Marlborough), 10 June 1969, AANS 6095 W5491/116 22/5144 Reserves-General-Quarantine: Use & Control of Introduced Trees & Plants 1959 –1982, ANZ.
[80] AP Thompson, 18 November 1971, AANS 6095 W5491/450 22/5144/1 Weeds – Pinus Contorta in Tongariro National Park, 1963-1975, ANZ.
[81] *Dominion*, 20 February 1973 in AANS 6095 W5491/450 22/5144/1 Weeds – Pinus Contorta in Tongariro National Park, 1963-1975, ANZ.
[82] National Water and Soil Conservation Organisation, 22 April 1974, AATC 5114/486 74/24/6 Eradication of Pinus Contorta (Waiouru) 1947-1985, ANZ.

Therefore, right through to 1977, SCRCC policy remained similar to that reflected in its guidelines in 1966, with the Council noting that 'no general restriction be placed on the planting of the species for soil erosion purposes'. This was tempered, however, by the Council's recommendation that *pinus contorta* not be planted 'where satisfactory alternative species are available', and 'where its spread is likely to affect adjacent land unless its planting can be justified.'[83]

Despite this persistence of policy during the 1970s, in 1980 plantings in State Forests ceased and seedlings were withdrawn from sale in forest nurseries.[84] Three years later, the New Zealand Government declared p*inus contorta* a Class B noxious weed and since then, numerous containment and eradication measures have been employed to combat its' spread.[85]

[83] EM Basil-Jones, Soil Conservation and Rivers Control Council, Ministry of Works and Development, 22 April 1977, AANS 6095 W5491/116 22/5144 Reserves-General-Quarantine: Use & Control of Introduced Trees & Plants 1959 –1982, ANZ.
[84] Miller and Ecroyd, 'Introduced forest trees in New Zealand', p.7.
[85] Ledgard, 'The spread of lodgepole pine', p.45.

Figure 6: Roadside wilding of *pinus contorta* Karioi Forest.
Source: *Burns, Bruce and Williams, Peter, 'Review of Karioi Forest pinus contorta management plan 2006-2021' 2008, p.22*

2. Eradication and Containment Examples

The *pinus contorta* wilding issue was first addressed at Waiouru in 1970.[86] It became clear by the mid-1970s that methods of eradication, or at least containment, were required to combat further spread. Adding to the urgency was the knowledge that if left unattended, increasing sums of money would be required to facilitate such work. In 1975, $30,000 was set aside for the Director of Works to eradicate *pinus contorta* on Defence lands at Waiouru. The following year, the annual amount increased to $100,000, and remained so for the next three years.[87]

Major MJ Steeds, of the Waiouru Camp, noted that 'the *pinus contorta* eradication programme being pursued within the Waiouru Training Area is aimed at restoring the natural vegetation of the central plateau and hence return to full use, the largest and most important Army training area in New Zealand.'[88] Steeds noted further that:

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[86] Major-General RDP Hassett to Lt. Col. DK McKenzie, 23 December 1977, ABFK 7291 W4776/19 203/192/2 pt.5 Works and Buildings – Waiouru Military Camp – Noxious Weeds and Pinus Contorta Control, 1977-1980, ANZ.

[87] 1979/80 eradication programme, 17 September 1979, ABFK 7291 W4776/19 203/192/2 pt.5 Works and Buildings – Waiouru Military Camp – Noxious Weeds and Pinus Contorta Control, 1977-1980, ANZ. The 1975 payment was granted to the Director of Works, the 1976-1978 payments to the Minister of Defence, and the 1979 payment to the Rangitikei-Wanganui Catchment Board.

[88] Major MJ Steeds, 'Minute on eradication of pinus contorta: Waiouru Training Area, 28 February 1978', ABFK 7291 W4776/19 203/192/2 pt.5 Works and Buildings – Waiouru Military Camp – Noxious Weeds and Pinus Contorta Control, 1977-1980, ANZ.

> Experience has now demonstrated that the conditions of the central plateau are ideal for the germination of the self-sown seeds of these pines and the prevailing westerly winds have rapidly spread the seeds from Karioi. The Tongariro National Park and other areas have also been affected, both directly from Karioi and from seed-bearing self-sown trees in the training area.[89]

Steeds made it clear that the 'unforeseen success and consequent threat' of *pinus contorta* caused concern within government departments, local bodies and recreational organisations. Investigations involving 'Forestry, Agriculture, Lands and Survey Departments, the Rangitikei-Wanganui Catchment Board and the Nature Conservation Council, resulted in the evolution of the present programme.'[90] There is no mention of the involvement of the Maori Affairs Department to assist in addressing the spread that had occurred of *pinus contorta* onto Maori land.

The approach of the eradication programme in the late 1970s was to roller-crush and burn dense stands of trees, and machine and manual cut sparse areas.[91] An organised burn-off in 1977 resulted in a fatality from a traffic collision caused when visibility was lost due to heavy smoke from a *pinus contorta* burn off crossing the Desert Road.[92] Despite the tragedy, this method continued. More recent burn-offs of the Army's firing range at Waiouru illustrate the scale of the operation involved. A 1991 action required a complete helicopter muster of the area's wild horses, sheep and deer, which was followed by chemical spraying of the infected area to 'brown' off the trees to ensure a successful burn. Once it was certain that no animals had

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[89] Steeds, 'Minute on eradication of pinus contorta: Waiouru Training Area, 28 February 1978', ABFK 7291 W4776/19 203/192/2 pt.5 Works and Buildings – Waiouru Military Camp – Noxious Weeds and Pinus Contorta Control, 1977-1980, ANZ.

[90] Steeds, 'Minute on eradication of pinus contorta: Waiouru Training Area, 28 February 1978', ABFK 7291 W4776/19 203/192/2 pt.5 Works and Buildings – Waiouru Military Camp – Noxious Weeds and Pinus Contorta Control, 1977-1980, ANZ.

[91] Steeds, 'Minute on eradication of pinus contorta: Waiouru Training Area, 28 February 1978', ABFK 7291 W4776/19 203/192/2 pt.5 Works and Buildings – Waiouru Military Camp – Noxious Weeds and Pinus Contorta Control, 1977-1980, ANZ.

[92] The collision took place on 10 March 1977, ABFK W3593/4 1/6/41pt.2 Waiouru: Control of Pinus Contorta 1977-1979, ANZ.

returned to the zone the fire was lit from the air using a gel accelerant. To ensure the fire was contained, fire appliances from three stations, army personnel, and helicopters with monsoon buckets were all placed on standby.[93]

A less dramatic, and undoubtedly less costly, approach to eradicating lodgepole pine on the southern flank of Mount Ruapehu has been undertaken by teams of volunteers over a considerable number of years. Members of North Island tramping clubs, conservationists, parties of schoolchildren, and many more have devoted their efforts to combat the spread of *pinus contorta* in the region. 'Aborta contorta', a campaign launched in the 1960s, brought teams of volunteers and Department of Conservation staff to the region to undertake cullings of seedlings.[94] If the seedlings were small enough (less than 0.5m tall) they were pulled out by their roots; for larger trees, the needles needed to be removed and the bark stripped to ground level.[95] For large trees, felling and application of chemicals including sodium chlorate, ammonium sulphamate and glyphosate all proved effective.[96]

It has been noted that the containment and or eradication of *pinus contorta* is a long-term commitment. Due to its aggressive regenerative capacity, experts recommended at least two removal 'sweeps' separated by five to ten years to achieve success. The reason for this is that small seedlings may be overlooked, and with seeds being able to survive up to ten years in the soil, slow germination is possible.[97]

In their recent review of the 2006-2021 Karioi Forest *pinus contorta* management plan, Burns and Williams identified five critical factors in ensuring the

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[93] *Dominion*, 13 February 1991.
[94] See Weedbusters Newsletter, Issue 5, April 2005, http://weedbusters.co.nz/downloads/NewsletterPDF/weedbusters5lowres.pdf, accessed 25 May 2009. Also see Graeme, 'Pulling pines on Ruapehu', p.35.
[95] For further information on methods used see Ledgard, 'The spread of lodgepole pine', pp.51-52.
[96] Ibid, p.52.

eradication of *pinus contorta* from the forest: detection, containment, extirpation, commitment and restoration. Detection requires 'repeated surveying, particularly in the vicinity of known occurrences or on the site of former occurrences.' Their report noted that containment could be achieved by 'strategically prioritising treatments to remove those populations with the highest probability of causing spread.' Extirpation, either hand-pulling seedlings or cutting adult trees at ground level, is the conventional method of control, and at Karioi, this technique, according to Burns and Williams, will continue to be used. The report noted that eradication of weeds requires long-term and consistent financial and institutional commitment. 'There are', they observed, 'significant financial benefits and time savings in detecting and controlling weeds early compared with delayed control because of the exponential rate of weed population increase.' The final factor, restoration, requires the 'revegetation or restoration of sites to prevent secondary weeds from using the opportunity created by the removal of the target weed.'[98]

[97] Ibid, p.35. Burns and Williams recommended searches for new seedlings every three years, Burns and Williams, 'Review of Karioi Forest pinus contorta management plan 2006-2021', p.11.
[98] Burns and Williams, 'Review of Karioi Forest pinus contorta management plan 2006-2021', pp.7-9.

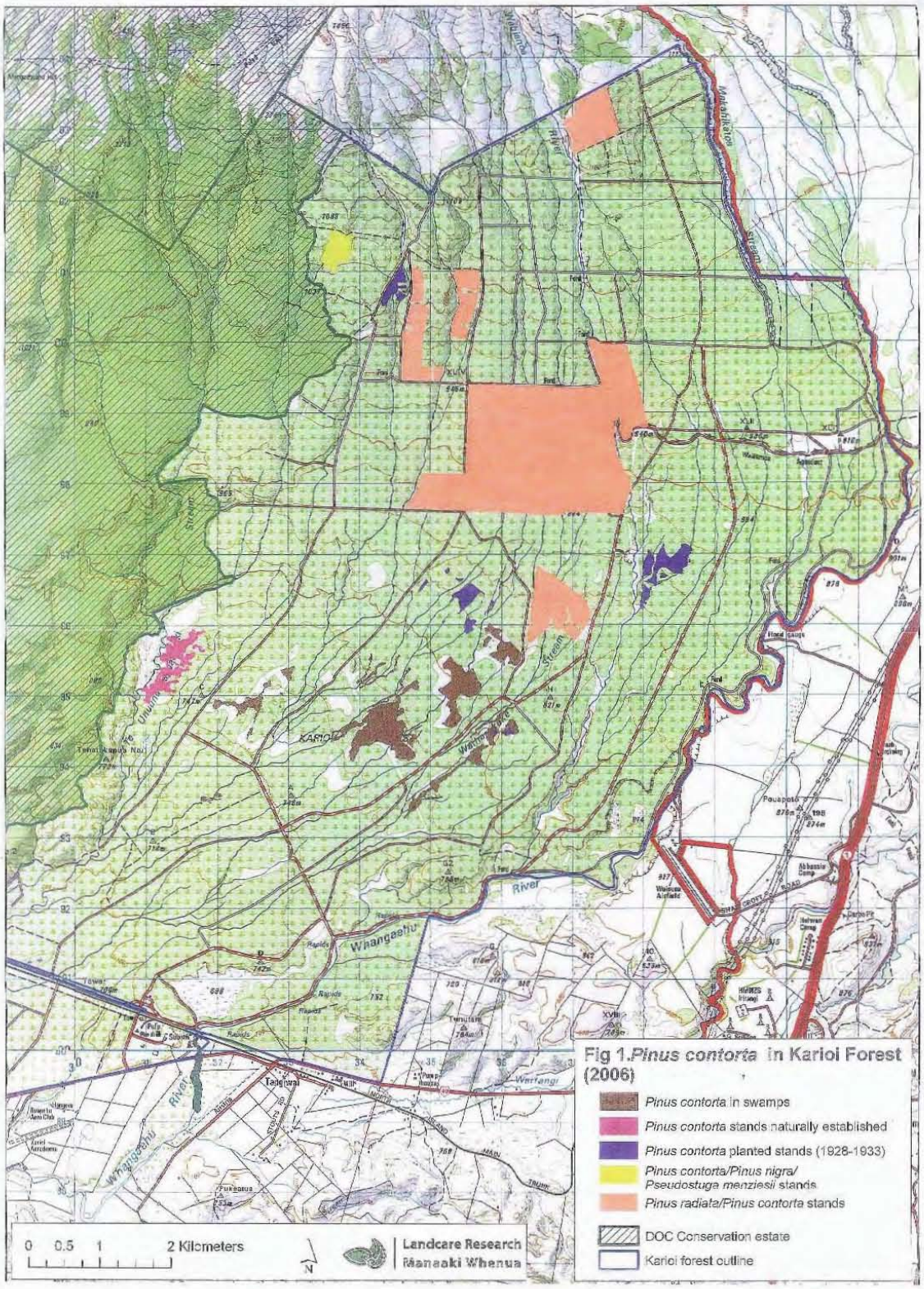

Figure 7: Location of *pinus contorta* in Karioi forest as at 2006.
The location of *pinus contorta* in wetlands and as 'naturally established' reflect major areas of wilding remaining in the forest. Although the map shows in blue *pinus contorta* stands remaining in Karioi that were planted between 1928 and 1933, this does not represent the more than 5,000 acres of original pure stands of *pinus contorta* that were planted in this period as most of these trees were harvested in the late 1950s and the 1960s.
Source: Burns, Bruce and Williams, Peter, 'Review of Karioi Forest pinus contorta management plan 2006-2021' 2008

C. CONCLUDING SUMMARY

Having presented a chronological narrative in relation to the introduction, utilisation and, subsequently the containment of *pinus contorta*, the information presented can be summarised and formatted to address the set of questions posed by the Tribunal on 14 April 2009 when directing the commissioning of research.

A. THE INTRODUCTION OF PINUS CONTORTA		
1. In New Zealand	a. When	The research completed within the timeframe for this project points to a date of around 1880 as being the time when *pinus contorta* was initially introduced into New Zealand.
	b. How	As far as can be judged from the evidence considered within the timeframe for this project, it appears that *pinus contorta* was initially introduced by private individuals and organisations who had acquired seeds or seedlings through nurseries, horticultural societies and at auctions.
	c. Where	Specific examples of the introduction of *pinus contorta* before 1900 have been identified by research as having occurred in Tauranga, Lower Hutt, Taranaki, Dunedin and Wanganui. Based on this, it is reasonable to speculate, that the introduction of *pinus contorta* would have been widespread around New Zealand because of the broad uses to which it was being put. (See response to Question B)
	d. Whom	As noted above, it appears that the introduction of *pinus contorta* occurred through private individuals and organisations. As the use of *pinus contorta* spread, it is likely public organisations (such as schools or local body councils) also planted stands of the trees.

2. To the Karioi region	a. When b. How c. Where d. Whom	There are three discernible periods of *pinus contorta* introduction to the Karioi region: • 1929-1932 in the Karioi forest: The Karioi State Forest was established in November 1926 when an area of 33,516 acres was set aside for forestry purposes. From the outset, *pinus contorta* was to be included in the forest. *Pinus contorta* seedlings were established in the nursery and first planted out in 1929. Although initially intended to be planted through to 1935 as part of the Forest's overall planting programme, disappointing yield performance meant that the *pinus contorta* planting programme was ended in 1932 (with the possible exception of a few high altitude experimental plots). In total, an estimated 6,200 acres of *pinus contorta* had been planted by this time (or 19 per cent of the Karioi forest.) • c.1931-1933 around the wider Karioi region: With the decision in 1931 to terminate the full planting programme for *pinus contorta*, the remaining seedlings in the nursery were available for sale or given away to private and public organisations. Although the seedlings were distributed to many places around the wider Wellington province, (and further afield), a good number were distributed locally in the region around Karioi. • c.1947 a specific programme of planting occurred within the Waiouru Military Reserve undertaken under the auspices of the Soil Conservation and Rivers Control Council. As a result, 38,000 *pinus contorta* were planted within the Waiouru Experimental Area.

B. THE PURPOSE OF INTRODUCTION OF PINUS CONTORTA	
1. In New Zealand	It appears that the initial introduction of *pinus contorta* in the 19th century by private individuals and organisations would have been for a range of purposes, including landscaping and as shelter belts. As familiarity with the use of the tree grew, it particularly became valued due to the speed of its growth and its hardiness to cope with sea salt storms in coastal regions and frosts in alpine conditions. Increasingly, *pinus contorta* came to be seen as a protective forest species in coastal or high altitude districts. From 1914 to the early 1920s, it appears that the tree came to be considered as a plantation timber crop species as small experimental areas (less than 10 acres in total) were planted in state forests. This was followed by a full planting programme in Karioi. (See below) Following World War II and through into the 1970s, *pinus contorta* particularly came to be seen as a valuable plant to combat soil erosion in high altitude countryside.
2. In Karioi	The three discernible periods of *pinus contorta* introduction to the Karioi region, described in response to Question A, equate with different purposes: • 1929-1932 in Karioi forest: *pinus contorta* was planted with the intention of developing a production timber species. • c.1931-1933 around the wider Karioi region: Uses by the private and public organisations to which seedlings were distributed would have been wide ranging and have included landscaping, shelter belts and soil conservation. • c.1947 within the Waiouru Experimental Area: Planting of *pinus contorta* was for experimentation to assess the capabilities of the tree as a high altitude soil conservation species.
The use of *pinus contorta* in practice	The comments noted above in response to Questions B1 and B2 deal with the purposes of the introduction of *pinus contorta* at different times. Considering these comments, it can be said that the tree was largely used in practice for the purposes intended (landscaping, protection forestry, soil conservation) the exception being as a plantation timber crop. Although those trees planted at Karioi were harvested

	and probably put to some commercial use, it does not appear that state agencies made a further serious attempt to establish *pinus contorta* as a timber species.

C. THE CROWN AGENCIES INVOLVED IN THE INTRODUCTION OF PINUS CONTORTA	
1. In New Zealand	On research completed within the timeframe for this project it does not appear that Crown agencies were directly responsible for or involved with the initial introduction of *pinus contorta* into New Zealand by the 1880s. However, as the use of the tree spread for general purposes such as landscaping or as shelter belts, then specific, localised use on a small scale by a wide variety of individual Crown entities (such as schools, railway stations, Crown farms) is likely. The extent of this type of introduction by Crown agencies has not been ascertained by research conducted within the timeframe available for this project. Forest Service involvement appears to have begun at some time after 1900 within the context of the Service experimenting with a wide variety of exotic trees to ascertain which would be the best timber crop of the future. The exact location of the 7 acres purported to be planted between 1914 and 1923 has not been located by research conducted to date. Whilst the specific introduction by Crown agencies within the Karioi Forest and Waiouru Experimental Area is discussed below, it does appear from the end of World War II that on a national basis there was ongoing support through to the late 1970s from the Soil Conservation and Rivers Control Council and the Forest Service for *pinus contorta* as a species for high altitude soil conservation purposes. Although specific research has not been undertaken within the timeframes available for this project on exactly how this support translated into use of *pinus contorta* by Crown agencies, it is likely that some degree of use must have continued as it was not until 1980 that the Forest Service specifically instructed its officials to stop any further planting of *pinus contorta.*

2. In Karioi	As indicated by previous responses, for the three discernible periods of *pinus contorta* introduction to the Karioi region, the Crown agencies responsible were: • 1929-1932 in the Karioi forest: The New Zealand Forest Service. • c.1931-1933 around the wider Karioi region: The New Zealand Forest Service as a supplier of often free seedlings. In addition, a wide variety of individual Crown entities (such as schools, railway stations) would have been responsible for some portion of planting. • c.1947 planting within the Waiouru Experimental Area: the Soil Conservation and Rivers Control Council (an agency under the overall auspices of the Ministry of Works) assisted by resource from the New Zealand Forest Service's Karioi staff.

D. PINUS CONTORTA AND WILDING	
1. When was the wilding problem of *pinus contorta* apparent	Evidence collected to date suggests that the wilding problem may have been noticed as early as the mid-1950s, but that it received high level attention within the Forest Service from 1959.
2. In what area was the wilding problem of *pinus contorta* apparent	Research undertaken for this project has revealed that the central plateau was identified as a region where, by the 1960s, the wilding of *pinus contorta* was described as being 'out of control.' Although there has not been the time within the course of this project to undertake a full analysis of where else *pinus contorta* wilding was recognised as problematic, another area revealed in passing during research to have a wilding problem, as recognised by 1960, was the high country areas of South Canterbury. (Today, websites reveal a widespread recognition of *pinus contorta* wilding with most regional councils having a pest management strategy and groups such as the Central North Island Pinus Contorta Control Group and the South Island Wilding Conifer Management Group having been in place since the 1980s and 1990s)

3. What was the nature of the wilding problem of *pinus contorta*	The wilding problem associated with *pinus contorta* was related to the tree's rate of seed production, seed survival, seed spread and rate of growth. By the 1960s, in the central plateau region, spread of *pinus contorta* as a result of wilding was documented within Karioi forest itself (by 1974 there were 1,300 ha infested), in the Waiouru Military Reserve (by 1972 there were 41,500 acres infested) and into the Tongariro National Park (where infestation was occurring at altitudes up to 6,000 feet, or well above the natural timber line of Mount Ruapehu). Focus of officials during the 1960s and 1970s was primarily on Crown estates although by 1975 there was some indirect recognition in passing that Maori land in the district had also been infested.
4. What steps have been taken to address the wilding problem of *pinus contorta*	Although Forestry and Soil Conservation officials acknowledged by the mid-1960s that *pinus contorta* wilding was 'out of control' in the central plateau region, the potential of the tree for high altitude soil erosion control meant that opposition remained against a nationwide ban until 1983. Nevertheless, research undertaken for this project identified the following steps were taken to address the wilding problem nationally and in the Karioi region: • 1966: the Soil Conservation and Rivers Control Council issued guidelines that whilst not banning planting, stated that there were areas where *pinus contorta* regeneration should not be tolerated (in scenic areas, in national parks, on agricultural land); that adjacent lands to these areas should not be planted in *pinus contorta* and that all planned planting had to be evaluated by the Council; • 1960s onwards: 'Aborta contorta' campaign involving volunteers culling seedlings especially in Tongariro National Park; • 1975-78: a sustained eradication programme undertaken on Defence lands at Waiouru with periodic eradication efforts on Waiouru defence lands thereafter; • 1980: plantings in State Forests ceased and seedlings withdrawn from forest nurseries; • 1983: the New Zealand government declared *pinus*

	contorta a Class B noxious weed; • 1980s: Central North Island Pinus Contorta Control Group established; • 1990s: South Island Wilding Conifer Management Group established. The above list represents evidence of steps against *pinus contorta* uncovered within the timeframe for this project. It is not intended to be exhaustive. Furthermore, the researchers have not located material indicating the relative effectiveness of eradication and containment measures adopted to date.

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APPENDIX I : THE COMMISSION

WAITANGI TRIBUNAL

CONCERNING the Treaty of Waitangi Act 1975

AND the Whanganui district inquiry

DIRECTION COMMISSIONING RESEARCH

1. Pursuant to clause 5A of the second schedule of the Treaty of Waitangi Act 1975, the Tribunal commissions Andrew Francis, a member of the Tribunal's staff, and Tony Walzl, an historian, to produce a brief of evidence on how *pinus contorta* was introduced to New Zealand. The brief of evidence will assist the Tribunal to determine to what extent the Crown is responsible for the presence of *pinus contorta* in the Karioi region. The brief should address the following questions:
   a. When, how, where and by whom, was *pinus contorta* (lodgepole pine) first introduced to New Zealand? When, how, where and by whom, was *pinus contorta* first introduced to the Karioi region?
   b. What was the purpose of introducing *pinus contorta* to New Zealand, and to Karioi? What was *pinus contorta* used for in practice?
   c. If the Crown was involved in obtaining or propagating *pinus contorta*, what agency of the Crown was responsible for this?
   d. When, and in what area, did it become apparent that *pinus contorta* created a wilding problem in New Zealand? What was the nature of the problem? What steps have been taken to address it?
2. The commission will commence on 14 April 2009. The commission ends on 29 May 2009, at which time the brief of evidence must be filed with the Registrar of the Waitangi Tribunal.
3. At the discretion of the presiding officer the commission may be extended.
4. The Registrar is to send copies of this direction to:
   Andrew Francis
   Tony Walzl
   Claimant counsel and unrepresented claimants in the Whanganui district inquiry
   Chief Historian, Waitangi Tribunal
   Manager - Research/Report Writing Services, Waitangi Tribunal
   Inquiry Facilitator, Waitangi Tribunal
   Solicitor General, Crown Law Office
   Director, Office of Treaty Settlements

Chief Executive, Crown Forestry Rental Trust
Chief Executive, Te Puni Kōkiri

Dated at Wellington, this 14th day of April 2009.

Judge C M Wainwright
Presiding Officer
WAITANGI TRIBUNAL