



Thomas Kirk in New Zealand forestry

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Thomas Kirk (1828-98) is regarded widely as one of the most eminent botanists in New Zealand in the nineteenth century. However his substantial efforts in the early development of New Zealand are less well known. In addition to writing the definitive Forest Flora of New Zealand, Kirk was experienced in the timber trade, possessed a good technical knowledge of timber and promoted the wise use of the national timber resource. His survey of the native forests and the industry based on them was the basis of the native forestry policies of the Stout-Vogel administration. For a short period, 1886-87, he was the Chief Conservator of Forests and Head of the Forest and Agriculture Branch of the Lands Department. Although the Branch was abolished in 1888 and State forestry was in abeyance for the next ten years, some of the thrust of his work persisted, to be absorbed in later State forestry policies.

Thomas Kirk is principally remembered these days as one, and perhaps the doyen, of the prominent nineteenth century New Zealand botanists who contributed much to early scientific development. Such an assessment does not cover all of Kirk's accomplishments because, in addition to his pioneering botanical work, he had much to do with the early development of New Zealand forestry. This point was recognised by Brown

(1968) in her important study of Kirk and the forestry era in which he worked. The current essay draws heavily on the work of Brown, seeks to add a little to it and to take advantage of the longer historical perspective provided by a further 22 years of forestry progress. There is nothing new here in terms of detailed biographical findings, which would have been most difficult anyway because Kirk's correspondence was destroyed, a great pity as he wrote c.1000 letters a year for 30 years (McLintock, 1966). However there is perhaps a keener view these days of Kirk's place in forestry because attention is now more focussed on New Zealand forestry history, doubtless because of the tremendous changes which have taken place in New Zealand forestry during the decade just ending.

Kirk played many roles during the 35 years he lived in this country; in common with many settlers he had to turn his hand to a variety of tasks. But four vocational roles were more important than others: enthusiastic and dedicated botanist, experienced and busy timber merchant, accomplished and acclaimed teacher, and the first State forestry administrator.

The early years

It is not surprising that his passion for botany developed early because his English parents, who saw that he had a good grounding in the subject, ran a nursery and landscaping business. Their influence in this respect would have been heightened because young Kirk did not go to school and indeed received no formal education. Instead he was taught by his father and by his own efforts. Kirk was born in Warwickshire in 1828. It was natural that he turned his attention to the flowering plants and cryptograms of that country; that he did so effectively is shown by his publishing his first botanical paper by the time he was 19. When his father died Kirk took over the family business. But the long hours working outside in the cool, wet Warwickshire climate did not suit him and he developed a pulmonary illness, possibly tuberculosis. He was to be dogged all his life with lung trouble (Brown, 1968).

Retreat inside from the nursery and landscaping work brought him into contact with the timber industry, for he took a job as bookkeeper in a timber firm in Coventry. The lack of a formal education did not seem to hinder Kirk at any time, for a general competence in a range of occupations characterised his career. It was no different with the timber industry and in time he became a partner of the firm, (Brown, 1968). Working in the large Coventry sawmill clearly gave him a good knowledge of timber processing and use which helped him with the 'sharp end' of forestry in New Zealand.

To New Zealand

Kirk married in 1850. By 1862 there were four children and the family's future in Coventry looked grim. Kirk's health was poor. Business prospects were dim because of a general economic malaise. And there was another factor which may have contributed to his dissatisfaction with England: he was a staunch Baptist and probably non-conformists were less well



Thomas Kirk – photo by courtesy of Alexander Turnbull Library.

The author, Peter McKelvey, is a retired Professor of Forestry at Canterbury University.

received in mid-nineteenth-century England. His Baptist faith was obviously important to Kirk because he was later to become deacon and secretary of the Wellington Baptist Church, and president of the Baptist Union in New Zealand in 1892. So Kirk and his family set sail in 1862 for New Zealand with a party of non-conformists (Brown, 1968). When Kirk stepped ashore in Auckland in 1863 he faced problems common to many immigrants: a wife and family to support and little money. He must have been a resilient, perhaps desperate, settler for he earned that much-needed first injection of cash by breaking stones in the quarry at Mount Eden (Brown, 1968).

The energy and competence of the man prevailed in the new environment. Here was an opportunity to use the skills he had acquired in Coventry in the timber trade. Before long he had set up in Auckland as a timber merchant, and also as a surveyor. His timber business extended north to Big Omaha which he came to visit routinely, with the opportunity to botanise along the way. Moore (1973) reported that his first botanical collections were made within a month of his arriving in New Zealand. Volume 1 of the *Transactions and Proceedings of the New Zealand Institute*, which appeared in 1868, carried his notes on plants observed during a visit to North Auckland, probably a by-product of his timber business trips. This paper was to be the first of some 130 botanical treatises which appeared over the following 30 years (Brown, 1968). By 1868 he had botanised on Great Barrier and Little Barrier Islands and in the Kaipara district as well as North Cape and many places closer to Auckland (Hamlin, 1965).

Kirk was first and foremost interested in the plants themselves rather than in ecological aspects, although his lists of species were often placed in broad habitat classes. Comprehensive ecological study of New Zealand plants had to await the next century and the work of Leonard Cockayne. It is not hard to see the work of the two as sequential and complementary. Thomson (1986) has written of Cockayne being encouraged to study the New Zealand flora by becoming aware of the herbarium in the Canterbury Museum with each species named in Kirk's handwriting.

Kirk got to know the Kaipara district well because he became a pioneer farmer there for a while, freeholding a block of 16 hectares under a provincial settlement scheme (McLintock, 1966). But he did not stay there long; his abilities were not to be buried in such a rural environment. By 1868 he was back in Auckland with an astonishing range of duties; he was initially Curator and Secretary of the Auckland Institute and Museum, posts which were supplemented the following year by his being made Deputy Registrar of Births, Deaths and Marriages, and also Meteorological Observer (McLintock, 1966). All the time the botanical expeditions continued, among them visits to the north-east coast of North Auckland, the Thames goldfields and the Waikato district (Hamlin, 1965). They produced a steady flow of papers reporting his findings and an equally steady stream of correspondence with prominent botanists overseas. Specimens of New Zealand plants were sent to botanical collections in many parts of the world (Brown, 1968). In 1871 came his well deserved fellowship of the Linnaean Society (McLintock, 1966).

Then followed a period of teaching which covered eight years. In 1874, following the resignation of the geologist and biologist Frederick Hutton, Kirk was appointed professor of natural sciences at Wellington College, which was then affiliated with the University of New Zealand. He taught there until 1880 when the connection with the University was severed. He shifted to Canterbury and taught biology and geology at Lincoln Agricultural College in 1881 and 1882, again following Hutton (McLintock, 1966; Brown, 1968). The two years at Lincoln were rather unhappy ones because of his ill-health in the variable Canterbury climate (Thomson, 1986). Kirk was a most successful teacher. McIntock (1966) reported that "his lectures were models of instruction, and his

ability to impart knowledge, together with his air of authority, won the respect and interest of his pupils".

Involvement in forestry

Kirk's involvement in botany and timber merchandising excited his interest in the well-being of the forests. Indeed, Brown (1968) reported that Vogel acknowledged the influence of Kirk on his introducing the bill which led to the first New Zealand Forests Act of 1874. Brown suggested, intriguingly, that Kirk had good opportunities to communicate with the Premier about forestry because for a while his cottage in Tinakori Road had no water laid on and Kirk had to tramp across to the Vogel residence opposite to collect his supplies in a bucket. The 1874 Act provided, *inter alia*, for \$10,000 to be spent annually for ten years on forest management, and also for the establishment of a forestry school. Unfortunately the bill was to a large extent emasculated by the opposition of the Provincial Governments to the central Government having the power to proclaim State forests and the Act that was passed left it to the Provincial Governments, if they wished, to volunteer land for the national forest estate (Roche, 1987), a mechanism in which Vogel must have had little confidence. It was essentially a conflict between the rights of provincial and central Governments in the administration of public land. But at least there was now a forest statute and provision of finance.

The first step in the new forestry era was the appointment of a professional forester. Captain Inches Campbell-Walker, Deputy-Conservator of Forests in Madras, India, was appointed Conservator of Forests and Head of the new State Forests Department and arrived in New Zealand in March 1876. The appointment provided the opportunity for Kirk to be more formally involved with State forestry. When the Act was passed Kirk wrote to Vogel, pointing out the importance of any conservator from overseas becoming familiar with local conditions, species and their growth rates, and offering to assist in the induction. The offer was sensibly accepted by the Cabinet. Vogel and Campbell-Walker soon decided that the best thing to do first was for the latter to spend a year travelling around the country becoming familiar with the forests and their habitat, the timbers, land matters in general and the views of the public on forest conservation by the State. It was the obvious approach. The offer of help from Kirk was followed up by the latter drawing up a field itinerary for Campbell-Walker and later accompanying him on part of it (Brown and McKinnon, 1966).

It was a long itinerary which eventually took the new Conservator 215 days. He started with Kirk showing him how to recognise some of the New Zealand species at Karori and Makara, near Wellington. Then the two visited native forest at Upper Hutt, Pakuratahi and on the flanks of the Rimutaka Range. Kirk accompanied Campbell-Walker on his visit to the Auckland province where he started with kauri and kahikatea forest on the Coromandel Peninsula; then on to Auckland and up the west coast of Northland inspecting forests in the Kaipara and Hokianga catchments; then across to the Bay of Islands in the east and back to Auckland (Campbell-Walker, 1877). Kirk had his teaching responsibilities and so could go with the Conservator only in the college holidays, when he was employed at "two guineas a day plus travelling allowances" (Brown and McKinnon, 1966).

Kirk rejoined Campbell-Walker in December 1876 in Otago where the tour included the Catlins district, forests near Invercargill and forests at the heads of Lakes Wakatipu, Wanaka and Hawea. The pair were most disappointed that they could not visit Stewart Island and the sounds of Fiordland as planned because, apparently at the last minute, no Government steamer could be made available. Kirk travelled to Oamaru by himself, while his companion was off elsewhere, to look at and

report on plantations in the district and his account appears as an appendix to Campbell-Walker's report. He found that "the conifers most extensively planted are *Pinus insignis*, *P. halepensis*, *P. pinaster* and *P. sylvestris*. The latter especially flourishes more luxuriantly than I have observed it elsewhere in the colony." The many species of eucalypts planted at Awamoa near Oamaru were difficult for him to identify on the spot so, with his characteristic thoroughness, Kirk arranged for dried specimens in flower and fruit to be sent on to him (Campbell-Walker, 1877).

In the latter part of January 1877 Kirk went with Campbell-Walker over Arthur's Pass into Westland. Bad weather restricted them but they had a good look at forests near Hokitika and then went south to forests near Ross and forests on the banks of the Mikonui and Waitaha Rivers. It appears that Kirk accompanied the Conservator on his journey to Nelson via Reefton and the Buller and Hope Rivers, although the latter does not mention it (Hamlin, 1965).

It seems the two travellers got on well together, but then Kirk seemed to have got on well with everybody. They must have learnt much from each other, Campbell-Walker about New Zealand forests and the New Zealand timber trade, Kirk probably about some of the concepts and precepts of professional forestry with which hitherto he likely had had only haphazard acquaintance. It is not hard to envisage these two intelligent men together, in the forests, in bush camps, in primitive country hotels and boarding houses, discussing for hours many aspects of forestry in New Zealand. There is a passage in Campbell-Walker's report which hints at the content of some of the discussion and the understandings achieved: "No forest is inexhaustible unless systematically worked on principles which ensure the capital not being trenched upon and the income alone utilised; and, in the case of the valuable kauri forests of the north, the date at which this exhaustion or annihilation will have become an accomplished fact may almost be set down as within the present generation. With a large export, both intercolonial and foreign, great waste in what the French style exploitation and conversion, and no attempt at reproduction, Nature's efforts at which are frustrated by fire, the need is not far to seek. Kirk puts it down at 40 years, and I am not sure that he is not beyond the mark."

Campbell-Walker owed much to Kirk and acknowledged it, at the same time paying tribute to his efforts in New Zealand forestry: "For most of the information on geological and botanical points and distribution I am indebted to Professor Kirk, whose help in identifying trees has been of the greatest service and whose efforts in the cause of forest conservancy and planting have been unremitting, and merit the highest acknowledgements on my part, and, I think, on the part of the colony at large." (Campbell-Walker, 1877)

In a more personal way Campbell-Walker showed his gratitude by giving Kirk a silver-mounted drinking horn which was appropriately engraved (Brown and McKinnon, 1966). This trophy is now securely preserved in the traditions of the New Zealand Institute of Forestry, being awarded from time to time to a member highly prominent in the profession. Unfortunately the first conservatorship of forests did not last long. Campbell-Walker left New Zealand in the same year as he presented his report to the Government, principally because there was not the necessary public support to enable him to operate effectively. However his efforts were not all in vain; the publication of his report resulted in 202,400 hectares of forest being gazetted as climatic reserves under the Land Act 1877 (Brown and McKinnon, 1966).

Interest in New Zealand timbers

In 1875, the year before Campbell-Walker arrived, Kirk reported on the durability of New Zealand timbers in a substantial publication of the Government Printer (Kirk, 1875). It



A drawing from Kirk's 'Forest Flora of New Zealand'.

was a valuable record of empirical evidence on the natural durability of 39 indigenous species. There is mention too of chemicals used for wood preservation at that time: acetate of lead (Hyett's method), creosote, and chloride of zinc. Included also, perhaps stemming from the lore of the Coventry timber trade, is Kirk's exhortation to confine felling to the winter months as "... the durability of timber felled in the winter is much less likely to suffer from the process of fermentation than that felled during the spring or summer months." This view of Kirk's has recently been reinforced in current management of black beech in Canterbury where beech felled in winter has been found to yield the best timber (Rooney, 1990).

Three years later Kirk (1878) wrote of the commercial potential of timbers in New Zealand forests which were currently neglected. It would have been a familiar theme to his associates as he had long been concerned that many valuable timber species were being wasted because of ignorance about their value, although he admitted that high transport costs and the high costs of labour were also contributory factors. Kirk maintained that struggling settlers in forest districts could improve their lot by converting and selling timber species which at present were being left in the forest or burnt. Also, he pointed out, it was highly important to use such timbers because at the present rate of logging the kauri resource would be exhausted in 30 years. One species he referred to in particular was rewarewa which, in his view, would fetch a much higher price in England in the cabinet market than 'American birch' which retailed there at from "6 to 12 pence per super foot". He went on to prescribe how rewarewa should be carefully seasoned by filleting before being shipped and showed with calculations how the boards could be sold in England at a handsome profit. Toro, tipau (*Myrsine australis*) and ngaio were recommended as other valuable furniture or special purpose timbers. He pointed out too that tawa and kahikatea, both occurring in large quantities, could be made more valuable by preserving them against boring insects and suggested that there be experiments to try to achieve this using

zinc chloride, 'pyrolignite of iron', chloride of lime or creosote using a gravity-fed sap replacement method. He thought that, when preserved, kahikatea timber could compete successfully in the English market with the best 'Baltic white deal' (presumably European *silver fir*). And finally, partly in support of his theme, he explained that now rimu was being used in Auckland as a furniture timber, where only kauri had been used before and rimu neglected, simply because the new Waikato railway could bring good supplies from Drury, Pukekohe and Pokeno, where settlers were now sawing the species into boards for profit rather than burning it. He expected other similar changes to occur (Kirk, 1878).

The 1886 Kirk Report

Late in 1884, almost two years after he had finished teaching at Lincoln, Kirk was drawn fully into New Zealand forestry. That year the Stout-Vogel administration commenced and with it came a renewal of interest in forestry on the part of the State. The first forestry move of the new Government was to ask Kirk to undertake an examination of the indigenous forests and the large timber industry they supported (Roche, 1983). The development of New Zealand forestry, often a slow and uncertain business, has been influenced at irregular intervals by major reports. The first was that of Campbell-Walker (1877). The process has continued to the present; indeed reports have come thick and fast in the last 15 years or so, resulting in pronounced policy changes for State forestry. Kirk's was such a major report; indeed it was the second after Campbell-Walker's. It was essentially a compilation exercise based on a range of sources: past work of others, field notes made by Kirk on previous travels, inspections made by him for this report, and a few specific short reports requested from others by Kirk.

The report (Kirk, 1886) was mainly descriptive without a great deal of emphasis on explicit and detailed recommendations. Many of these were implicit and probably elaborated to the Government in subsequent discussion; they appear to have been accepted for there was no hesitation about what to do when Kirk assumed an administrative role a little later. The descriptive nature of the report gives it great historical value for it represents detailed regional pictures of New Zealand forests at that time. It is not possible to include details of the report here; a full summary is given in Brown (1968).

One valuable feature of the report was the regional forest descriptions which listed the tree species present, explained their distributions and described the timber stands. Many aspects were disturbing; the attitude of some Provincial Governments to public forests had clearly been profligate. Now the central Government received a suspiciously poor return from timber licences in State forests; obviously there was little or no supervision. And there was wide and unjustifiable variation between regions in the royalty rates paid in State forests. Highlighted was the amount of waste: waste due to royalties being charged on sawn out-turn rather than assessed standing timber which encouraged the sawmillers to 'pick the eyes' out of their blocks; waste due to carelessness with fire; and waste due to uncoordinated release of State timber encouraging undue regional competition and over-production. It was not hard for Kirk to see what should be done.

The School of Forestry, Pomology and Agriculture

It seems that training in forestry was an important part of Kirk's grand plan. In the same volume of the Appendices to the Journal of the House of Representatives as his report on the native forests and timber industry are proposals for a professional school at Whangarei which would turn out people trained in the principles and practices of forestry, pomology

(fruitgrowing) and agriculture (Kirk, 1886b). He envisaged 16-21 students enrolling either in forestry/pomology or agriculture. Instruction would be through lectures, experiments and analyses in biological and chemical laboratories, and practical work in forest, orchard, garden and farm. There was to be a general manager and lecturers in Biology, Chemistry, Forestry/Pomology, and Mathematics. A porter, gardener/forester and a dairyman would complete the staff of the residential school (Kirk, 1886b).

It was a concept well suited to both the needs and mores of the developing colony where many people lived close to the pioneering frontier. There was to be much emphasis on practical skills and also an egalitarian approach; students would have to clean their rooms, wait at table in turn and share other domestic duties. Kirk wanted to avoid turning out graduates who became dissatisfied later with the life-style of rural environments (Brown, 1868). Kirk recognised another important requirement; the school would have to contribute towards its running costs. With this in mind he recommended the establishment on school land of 100 ha in wattle plantations, 20 ha in jarrah, and 2 ha in fruit trees.

As Chief Conservator

Obviously Kirk's report impressed Vogel and his Government. It influenced the State Forests Act of 1885 and helped earn Kirk his appointment as Chief Conservator of Forests which he took up in 1886 (Roche, 1983).

Regulations under the Act were gazetted in his first year of office. They contained a range of general provisions, the thrusts of some of which were to persist for a century: provisions which dealt with penalties for lighting fires in or near State forests and recovery of any damages, requiring people in the vicinity to assist with fighting fires in State forests, imposing penalties for trespass of stock plus recovery of any damage and impounding of trespassing stock, empowering forest staff to arrest suspicious trespassers on State forest land, fines and damages for cutting outside the boundaries of State forest sawmill areas, sawmill licences not to exceed 81 hectares with some assurance of further supply from adjacent bush. There was provision for special licences for firewood, shingles, charcoal, potash, bark (for tanning), pitch etc, reflecting Kirk's interest in secondary products.

However there were two provisions which especially reflected Kirk's priorities. The first was the classification of State forests into three categories: *Mountain Reserves* were the protection forests where any felling was to be "by special selection only, and not more than one-sixth of the area of a reserve shall be felled in any one season". *Forest Reserves* were the permanent production forests, including the plantations, where there were no special protective functions. Felling was to be "by periodic selection, or by rotation of area". *Timber Reserves* were, essentially, land destined eventually for clearing for settlement, but cutting was not to take place until the timber could be "profitably converted". It was a simple but effective classification suited to the times, especially because it sought to counter the wasteful clearance of forest for settlement.

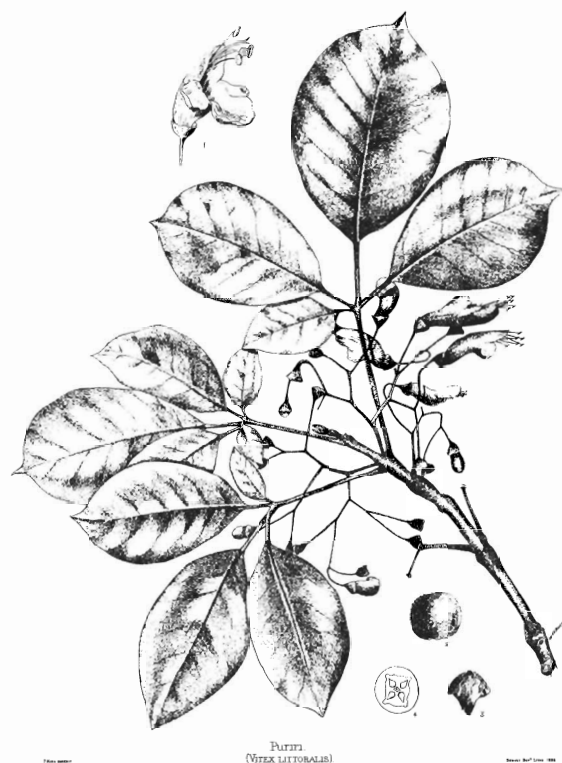
The second was to standardise royalty rates on a national basis. Now the sawmillers in State forest would have to pay "per hundred super feet, two shillings for totara and matai exceeding 40 feet in length and 2 feet in diameter at base. . . one shilling and three pence for kauri. . . to three pence for rimu, kahikatea and tawa". The regulations were not specific about a related matter on which Kirk had firm views, the payment of royalties on the assessed standing timber, rather than output, which was the practice. This reform to reduce wasteful cutting had been promoted earlier by Lecoy, a retired French forester living in Wellington who had suggested, inter alia, that forest officers should mark, measure and

estimate the market value of trees to be sold to sawmillers from State forests (Lecoy, 1879). Doubtless Kirk realised that he did not have the staff resources to implement it; indeed this most desirable measure was not implemented until some 35 years later (Allsop, 1973).

Kirk's responsibilities far outstripped his resources. He had only 18 staff spread over the whole country. True, he had a nominal force of 57 conservators, the chairmen of county councils, plus the county surveyors who were the nominal forest inspectors (Brown, 1968). But these busy men could not possibly spare enough time to administer the State forests effectively. It was really all over to Kirk with his small staff, who had no advanced training. They shouldered the responsibilities of a forest authority extension service and a forest management agency. In particular, the Forest and Agriculture Branch of the Lands Department, which Kirk now headed, had to protect the State forests against fire and illegal cutting; to advise the Government on all aspects of forestry; to classify State forests as to whether their roles were primarily protective, were suitable for the sustained yield of timber, or should be felled prior to settlement; to advise the Government on the proclamation of new State forests; to manage individual State forests, including the sale of timber to produce the all-important revenue, and the formulation of working plans. Further, the Branch was to give advice to settlers on planting stands of timber, to identify any forest pests which caused damage and to advise on the control of such pests. Nor was advice to be confined to timber trees because the Branch had also to arrange supplies of fruit trees for settlers and provide guidance on any follow-up measures needed. On top of all this Kirk was commissioned to produce a forest flora (Brown, 1968).

It was a mammoth contract. Kirk made a determined start which, as his progress report for the 1886/87 year showed (Kirk, 1887), was on a broad front. It revealed that, because the new timber sale regulations came into force only in the last quarter of the fiscal year, expenditure (\$9438) still exceeded revenue (\$7748). It explained that the formative stage of new State plantations would result in expenditure exceeding revenue but that the deficit would be made up by the issue of debentures for \$10,000, as provided by the new Act. It promoted, forlornly, the sale of standing State timber based on actual measurement before cutting. It announced the recognition of a new species of totara – *Podocarpus totara*. And it contained an account of the manufacture in America of crude potash from wood ash, for the information of settlers so that they might supplement their incomes with secondary forest products. The New Zealand Gazette for 1885-88 list about 332,990 hectares of former Crown land which were declared State forest. Of this total 7906 hectares were classed as Mountain Reserves, 71 hectares as a Forest Reserve and 4486 hectares as Timber Reserves. Even though classification had not gone far, the expansion of State forests was great progress in which Kirk had played an important role. He was not so successful in another direction; he tried to impose an export tax on baulk kauri to encourage local processing but was not supported by the Government (Brown, 1968; Roche, 1983).

The Government made available for the School of Forestry, Pomology and Agriculture the 1575 hectares Kioreroa Block which was close to Whangarei, as was specifically provided for in the 1885 Act. But the poor soil of the block presented a problem; it would be difficult for the School to earn revenue from it. Kirk was determined and persistent. He found some good land which was available at Papatawa, close by, and approached the Whangarei County Council which owned the land, and also settlers in the district to explain his difficulties. The response indicated Kirk's mana and his ability to get on with people. The Council gifted half of the area (about 20 hectares) for experimental grounds of the School and local settlers raised enough money by public subscription to buy the



Another drawing from Kirk's 'Forest Flora'.

remainder. It was a good start but apparently not good enough for an immediate start to the School. A prudent Government insisted that it be delayed until revenue from the orchards and plantations was certain (Brown, 1968). It seems the commitment of the Government to professional forestry training was less than resolute.

The first 'New Zealand Forest Service' did not last long. The Stout-Vogel Government was defeated in 1887 and its replacement, headed by Atkinson, opted for retrenchment. The Forest and Agriculture Branch was an easy target and it was abolished in 1888. The report of the Crown Lands Department for the year ending March 1888 (McKerrow, 1888) acknowledges the demise with chilling brevity. It records that at Waeranga near Te Kauwhata, where 690 hectares had been fenced in, half of which had been cultivated and sown with tree seeds for tanning material, only a few hectares of wattles survived. And at Maniototo, where about 180 hectares had been rabbit-proof fenced and eight hectares cultivated and sown with tree seed, the result was failure, as also was the case in the small nursery nearby. However the experimental nursery and plantations already begun in the School grounds near Whangarei were to continue, but not be expanded. It seemed, almost, that the Forest and Agriculture Branch had never been. Kirk was retained for three months to complete the Forest Flora. In fact the job took nine months for which he was poorly compensated (Brown, 1968).

The Forest Flora

Kirk is best remembered by foresters for his "The Forest Flora of New Zealand". It was a tour de force, an authoritative, scholarly exposition which represented the state of knowledge about the indigenous forests in 1889 and their major tree and shrub species. It provided a potential prelude to management of the indigenous forests. Kirk's objective, as Cheeseman (1906) was to point out 17 years later, "... was to diffuse a knowledge of the forest resources of the colony and to describe

the chief methods of timber working and conversion. . .". There were full botanical descriptions, often with excellent drawings. The distributions of the species were given. The major species were described in terms of growth form and height, the latter sometimes conservatively as rimu is recorded as being between 12 and 24 metres. The modern forester stares with puzzlement at two of the species of beech included: *Fagus blairii* and *Fagus apiculata*; the current perspective of the southern beeches had not then been achieved. However there was little autecological detail and no real synecological treatment. The description of kauri comes closest to acknowledgement of an association, as it included a brief list of species which occurred frequently in the undergrowth. But there was not wide and detailed recognition of natural groupings of species in the indigenous forests.

There was much information about timber yields per unit area and the methods of logging and converting the important species and the uses made of the timber. There was much information also about wood properties, about specific gravity, 'breaking weight', and sometimes about 'elasticity'. As to be expected, kauri was treated most fully with inclusion of data about 'transverse strength' as well as about tree growth. Perhaps the most striking feature about the Flora was the blend of the scientific and the utilitarian, of taxonomy and timber.

Later years

The abolition of the Forest and Agriculture Branch and the loss of his position must have been a heavy blow to Kirk. It was really a double blow: an intense professional disappointment because he could see so much needing to be done in New Zealand forestry and he had laid a lot of the foundations; and a personal hardship because he had no resources other than his salary and he had a large family to launch. In fact he lived hand to mouth for the rest of his life (Brown, 1968).

He kept his deep interest in forestry. Eight years later he was busily engaged in the 1896 Timber Conference as a member of the By-products Committee and providing assistance to the other four committees who dealt with exporting, sawmilling, building and forestry. His efforts were appreciated because at the conclusion the Conference passed a complimentary vote of thanks (Simpson, 1973). One of the outcomes of the Conference was the formation in 1897 of the Forestry Branch of the Lands Department and its involvement in afforestation (Roche, 1987). Kirk lived to see this and the commencement of plantings at Kaingaroa, Hanmer and Dusky. The forestry revival had started but it had developed in the exotic sector and not in the indigenous forests as envisaged by Kirk (Roche, 1987).

After the abolition of the Forest and Agriculture Branch Kirk absorbed himself in his botany (Brown, 1968). Surprisingly, at this late stage in his career, he undertook field studies in the most demanding environments of all. Hamlin (1965) records that in 1890 he visited the Snares, the Auckland Islands, Campbell Island, the Antipodes Islands (where he was the first to record the vegetation) and Stewart Island. On Stewart Island he was the first European to climb Mt Anglem. Moore (1973), quoting from his notes, revealed that he and his companions had to struggle through a snowstorm and sleet and hail to reach the summit and he was too chilled to use his notebook and pencil. The party lingered too long on the mountain to get back to base before dark and had to camp out sodden and cold. Kirk was then 62 and certainly not a well man. Hardihood was an essential quality for pioneer botanists in New Zealand and Moore observed that his experience of the harsh environment on Mt Anglem was probably recorded only to describe the conditions under which the plants grew.

There was a final important commission for Kirk. In 1894 the Government asked him to produce a New Zealand flora.

Unfortunately there was not sufficient time left to him to complete the assignment; he had covered only two-fifths of the species when he died suddenly of a burst pleural abscess (Brown, 1968). The incomplete work was published posthumously by the Education Department, Wellington, as "The Students' Flora of New Zealand and the Outlying Islands". The content was purely descriptive with the objective of identification. The organisation of the Flora revealed no distinction between introduced and indigenous plants; they mingled on the same page and Moore (1973) remarked on the Students' Flora being unique in that it described native and introduced plants in one sequence. Plants were plants to Kirk and he did not seem to regard the indigenous as inherently more interesting than the introduced. In a paper written on the interaction between indigenous and introduced plants – the "displacement theory" had attracted some support at the time – Kirk (1895) provided a balanced viewpoint by pointing out that the invaders rarely displaced the indigenous and that usually some sort of balance resulted. He would probably regard the modern attitude of making a marked distinction between indigenous and introduced plants with some surprise.

His interest was in individual plant species more than in associations. Research in the latter had to await Cockayne in, as it were, a succession of botanists. However Kirk was alive to the phenomenon of plant succession, as demonstrated in his 1895 paper, in his graphic description of the plant changes which followed the clearing of forest on both sides of the Great South Road between Drury and the Waikato River, to prevent Maori ambush of the Imperial troops. He described the resultant heavy growth of poroporo which acted as a nurse to many shrubs and young trees, totara prominent among the latter.

Conspectus

There is no doubt of his eminence as a botanist. Moore (1973) stated that for much of his time in New Zealand and up to the time of his death he was the leader of botanical thought in the country. His eminence in forestry is less clearly recognised, at least by professional foresters. The common view is that Kirk was not a professional forester; rather he was a botanist who worked for much of his time in forest. Indeed, by the yardstick of formal training Kirk was not a professional anything because he had no formal education. This did not seem to have hindered him. He had a deep knowledge of plants and a deep knowledge of timber; he was both a botanist and, allowing for the standards of the times, a wood technologist. He understood too the fundamental forestry tenets of conservation and renewal. And he came to understand, by force of necessity, the economic and political forces which impinged on New Zealand forestry. All these elements were integrated and applied, or the application attempted, in his brief administration. It was surely a professional synthesis. And many of the things he did, or tried to do, persisted, to become entrenched in later forest policy.

He was an essentially practical man, seeing in the forests a great renewable resource which could be used to develop the colony and improve conditions for many of its hard-pressed settlers. He was one of a type of effective and influential New Zealanders prominent last century, an all-rounder. Kirk made a substantial contribution, not only to New Zealand forest botany but also to the beginnings of forest management. He deserves to be recognised as 'the second Conservator of Forests'.

Finally, it is hard to study his life and accomplishment without regarding him with a great deal of respect. There was a mix of altruism, modesty and dedication, and an absence of rancour and egotism. McLintock (1966) referred to his personal qualities of dignity, courtesy, gentlemanliness, amiability and humour. No wonder that he got on well with other people, which must have enhanced his effectiveness in New Zealand forestry.

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Climate change and tree planting in Central Otago

Jolyon Manning

There is little doubt but that the climate in Central Otago has already changed significantly in our lifetime. Winters are frequently milder. It is more difficult to be precise about possible changes in precipitation. Improved irrigation practices and better weed control could offset predictable disadvantages (in the event of further climate change in the next few decades) that may arise with increased drought – especially for such horticultural crops as grapes and commercially viable herbs.

The range of tree species suitable for planting in Central Otago could be extended with the provision of well-designed shelter belts, and irrigation in suitable soils.

Widespread discussion on the topic of climate change and the 'greenhouse effect' has now directed our attention to some of the possible regional impacts. However, it is important that we consider in greater detail the critical climatic 'threshold values' and those crops now growing in what might be regarded as 'marginal climates'. The semi-arid Central Otago climate zone provides a good example where these critical physical boundaries and their impact on plant life can be closely observed.

For any crop (be it grassland or trees) there are critical climatic constraints and threshold values of which the occurrence of frost and/or persistent drought are simple examples.

These irregularities make a big demand on many introduced trees and plants.

It is the frequency with which such thresholds are crossed that provides the best index of the effect of climate on crop. This is especially important when such thresholds are exceeded in successive years. The nearer a system of land use is to the meteorological limits appropriate to such a system, the more

susceptible it is to small fluctuations in climate (e.g. grapes and cherries in Central Otago).

This factor is of paramount importance in arid and sub-arid areas and the period of fluctuations that must be considered is no more than the lifetime of a single farmer. (*Smith, London. UNESCO Conference on Climate Change. Rome 1961*)

In areas where farming (and forestry) is of primary importance the variability of the rainfall may be critical. This is particularly so in an area of low rainfall, where variations from the mean can be of major economic significance. (*Maunder. Central Otago, 1965*).

So how dry is Central Otago? The average annual rainfall in Alexandra is about 335 millimetres. If we use this as a base index of 100 then some of the better-known forests rank as follows: Balmoral (Canterbury) 186, Naseby 188, Berwick (near Dunedin) 220, Tapanui 276, Hanmer Springs 359, Golden Downs (Nelson) 402, Whakarewarewa (Rotorua) 450, Kain-garoa Forest 466, and Mohaka (Hawkes Bay) 467.

Yet given reasonably deep soils it is surprising how well *P. radiata* does even in these exceptionally dry conditions in Central Otago.

About 80 per cent of the growth in most crops (grasses and trees) occurs in the months from September to December. In Alexandra we get on average only about four 'effective' showers in excess of 10 millimetres with total 'effective' rainfall in this period often less than 100 millimetres at a time when open pan evaporation might total about 500 millimetres.

Since systematic records have been taken in Alexandra in 1923 very dry years have included 1975/76, 1977/78, 1955/56, and 1963/64. And in 1963/64 Alexandra recorded the lowest ever 12-month rainfall yet recorded in New Zealand – 167 millimetres.

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