



## LAKE TAUPO WATER QUALITY AND THE ROLE OF NATIVE PLANTS

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– from Roger MacGibbon — *Restoration ecologist and Trustee, Tane's Tree Trust*

In November 2008 the Environment Court ruled in support of Environment Waikato's proposed rules to manage the quality of Lake Taupo's water by placing a cap on the amount of nitrogen that can leach from rural and urban properties within the lake catchment. The imposition of regulations that place legal limits on the quantity of specific nutrients that will be permitted to flow from any parcel of land sets a precedent and will have significant implications for all landowners in the Taupo catchment and, in time as this approach is adopted by other regional councils, for landowners throughout New Zealand.

The deteriorating state of Lake Taupo's water quality has been well documented. Lake water monitoring over the past two decades has shown a significant increase in the amount of nitrogen in the lake water and increasing amounts of nitrogen entering the lake in ground water and streams. Nitrogen is carried readily down through the soil by water (leaching), reaching groundwater aquifers which eventually drain into Lake Taupo. Unlike some of the lakes in the Rotorua area, the nutrient levels in Lake Taupo are still relatively low, so the implementation of sound science-based initiatives now that prevent any further increases in the nutrient load entering the lake may halt any further decline in lake water quality and sustain Lake Taupo as a popular fishing, swimming and water recreation venue free of the characteristic poor water clarity and weed and algal growth of unhealthy lakes.

Unfortunately, this is more easily said than done. The management of nutrient flow into Lake Taupo, and especially any attempt to prevent further deterioration of water quality, is complicated by the fact that a significant proportion of the nitrogen currently entering the lake was generated more than 30 years ago, before some of the land in the catchment had been developed for farming and well before the intensification of agricultural practices that has led to increased use of nitrogen fertiliser. We know this because detailed aging of ground water before it enters the lake has shown some water to be up to 180 years old, that is, it fell as rain up to 180 years ago. The consequence of this is that the lake has yet to receive the full impact of high nitrogen loads associated with the intensification of pastoral farming and increased nitrogen fertiliser use. In other words, the amount of nitrogen entering the lake can be expected to continue to increase for many years to come. So, to prevent lake water quality deteriorating past current levels, the placement of a cap on nitrogen leaching will not be enough; the amount of manageable nitrogen (that generated on farms and from urban areas) entering the lake will have to be reduced – by at least 20% according to Environment Waikato scientists.

The Lake Taupo Protection Trust was established in 2007 and has been charged with the responsibility of reducing manageable nitrogen levels entering Lake Taupo by 20 % by 2020. It has at its disposal a public fund of \$81.5 million to undertake this task. The Trust intends to meet its 20% target by encouraging and assisting landuse

change, purchasing land or nitrogen within the catchment, and by funding research and other initiatives that assist landowners to reduce the nitrogen impact of their activities on Lake Taupo. To date they have concentrated on purchasing farms with the intention of placing restrictive landuse covenants on each farm before selling them again. Five properties have been purchased so far.

Not unexpectedly, the nitrogen cap has caused considerable consternation amongst Taupo catchment farmers. Conversion of more of the west Taupo land to dairying will not now be possible and the feeling amongst some farmers is that the nitrogen cap will restrict their ability to improve profitability from conventional sheep and beef farming and consequently further reduce the value of their land for sale. Agricultural research is making good progress in the development of techniques and products that enable more efficient and cost-effective utilisation of nutrients on-farm, but whether these alone will be enough to sustain farm profitability and meet the 20% nitrogen reduction is questionable. So what are the options?

Pine forestry has been identified as an alternative landuse with low nitrogen yield (equivalent to the N yield of native forest and one third that of pastoral sheep farming) but as much as 32% of the existing pastoral land in the lake catchment will need to be converted to pines to generate a 20% catchment-wide reduction in nitrogen load. While increased planting of pines on less productive sectors of existing farms is an appropriate landuse, it is questionable whether Taupo catchment residents and the many thousands of annual visitors to the lake will tolerate the visual obtrusion of a sizeable increase in the area of pine forestry close to the lake when approximately 40% of the lake's lower catchment is already in pines. It is also easy to forget that the single greatest environmental threat to Lake Taupo 30 years ago was sediment generated by extreme soil erosion as the light pumice soils were opened up by cultivation. Extra care will need to be taken in the selection of suitable sites for pine forestry and management at harvest time if a significant increase in sediment inputs to the lake is not to occur.

Alternative crops and "low-impact" livestock are being investigated, but none evaluated to date have international markets large and reliable enough to sustain catchment-wide production.



*Open grazed watercourse in a Taupo catchment*



*Stream bed with good natural plant filter established*



The potential multi-purpose potential of native plants as a tool for the management of nitrogen (and other environmental factors) in the Lake Taupo catchment has, to date, largely been ignored. In the first instance, this is probably because the establishment of natives onto pasture or scrubland is expensive (at \$10,000 to \$24,000 per ha), probably too expensive to be considered by most landowners on a medium to large scale. Secondly, the planting of native trees is often only associated with the permanent retirement of land rather than for any productive purpose, and thirdly, while there is some expertise on the subject, there are very few practical working examples of the potential of native plants to extract nutrients, especially nitrogen, from soil and waterways.

In reality, the applied and appropriate utilisation of native plants, in conjunction with low nitrogen farming systems and exotic forestry, has the very real potential to benefit the nitrogen status of Lake Taupo in a number of different ways:

Mixed native tree and shrub plantings to replace nitrogen-producing scrub, such as gorse and broom, on marginal and unproductive land should lead to a 70% reduction in the amount of nitrogen leached from the system.

Establishment of stands of native trees for the purpose of sustainable timber production on less productive land will reduce nitrogen leaching to levels equivalent to pine forestry but without the added risk of sediment erosion at harvesting.

Targeted planting of native trees, shrubs, sedges and grasses to intercept, utilise and extract nitrogen from soil, waterways and ground

water. Many of the streams flowing into Lake Taupo are fed by springs containing aged re-emerging groundwater carrying nitrogen generated years or decades ago. Any nitrogen that can be permanently extracted from those streams will provide a very important second hit before the water reaches the lake.

And, of course, native plantings provide many other landscape-scale benefits including providing habitat for native plants and animals, shelter for livestock, erosion control, carbon sequestration and visual enhancement.

Tane's Tree Trust successfully bid for research funding from the Lake Taupo Protection Trust last year to begin to look at ways to reduce the cost of establishing native plants. Trial plots of bare-rooted native plants will be established on farmland on the west side of the lake this coming spring as part of that research. We are hoping to expand that research over the next few years to demonstrate, on a farm-scale, how and where natives can be used to lessen the amount of nitrogen entering the lake while also contributing positively to farm profitability.

The challenge of reducing nitrogen inflow to Lake Taupo by at least 20% by the year 2020 will be a difficult one, and currently it is questionable whether Taupo landowners or the Lake Taupo Protection Trust have the tools or management options available to reach that target. Increased investment in innovative and less conventional strategies is needed and the Trustees of Tane's Tree Trust will be working hard to see that research into the applied use of native plants is well funded.

## NEW ZEALAND TREES

*This is the second part of the article on New Zealand trees by Captain A Jouan of the French Navy, which appeared in the supplement to the Weekly News of February 16th 1867.*

Bent wood or knees, necessary for the construction of vessels, are furnished by two species of the myrtacid family. The pohutukawa (*metrosideros robusta*, A.Cunn) is a large tree full of branches of irregular forms, the principle ones being almost as large as the trunk of the tree itself. The foliage is abundant, of a beautiful sombre green colour, and has somewhat the appearance of the holly. The tree affects more particularly the borders of the sea, flourishing upon the steepest cliffs and in the windings of the rocks where there is scarcely any earth to cover its roots and it becomes a wonder how any tree of its size can offer any resistance, with such feeble supports, to the tempests of New Zealand. Toward the middle of December, when the tree is in full bloom, it forms a pretty sight, each branch carrying in the midst of green foliage, a bouquet of long stamens of the colour of carmine. The wood is deficient in pliancy; is very hard, heavy and difficult to work. Upon being first cut, it is the colour of the dregs of wine, but becomes paler at the expiration of some time. The wood is used for the making of ribs of ships.

The rata (*callistemon Novæ Zelandiæ*, Polack) furnishes also knee-pieces for naval constructions. This tree is very common in the forests; and grows to a height of about 15 meters. Its branches distorted in every sense of the word, carry leaves to their extremities. From the trunk and the inferior branches, aerial roots descend, and, fixing themselves in the soil, support the crown and the superior part of the trunk, whilst the lower portion appears to have lost its vitality. When polished the wood has the colour of deep mahogany. It is in the midst of the roots of the rata that one finds half buried in the ground the awetohotetè of the natives: chenille végétale of the English settlers. It is so called from being a plant (*sphæris Robertsia*, Hooker) which has grown upon a dead caterpillar, and has substituted itself for the animal, leaving the exterior form altogether intact. The chenille has a length of 6 or 7 centimeters, and from the nape of the neck—never otherwise—a short fibrous stem of a plant shoots out for a length of 20 or 25 centimeters.

All the clayey portions of the country, the plateaux the most arid, the cliffs on the shore and the promontories, exposed to all the winds of heaven, are covered by the manuka (*leptospermum scoparium*, Forster: tea tree of the settlers), a kind of myrtle which has the appearance of a beautiful heath, and growing to a height of two meters. In this state of growth it is only useful for making brooms; but in the sheltered forest it attains ten meters, and even it is said 18; in the bush in the Middle

Island, the wood turners make use of part of the wood which is very hard. The leaves and the little white flowers exhale an odour special to myrtles. An infusion of the leaves is recommended to persons suffering from lassitude; and Captain Cook had a drink prepared from it for his crew, which he compared to tea.

Puride or puriri (*vitex littoralis*, A.Cunn.) is of the verbena family, and, attains the height of ten meters under the branches, having the base of the trunk four meters in circumference. From the top of the trunk large branches shoot out and extend as it were in the shape of a parasol. The heart of the tree is ordinarily bad—the wood being perforated by worms, which make oblique furrows being more than a centimetre in diameter. It does not possess any inner bark worthy of being spoken of. The grain of the wood is fine, and the timber has somewhat near the consistence and colour of teak. It does not suffer deterioration by immersion in the sea; and the piles which have been withdrawn from the sea at the end of 20 years have been found not to have undergone any alteration. The wood is used for ribs of vessels, piles and timberwork exposed to humidity. It is also very good for making pulleys. Ordinarily it grows on the borders of rivers.

A beautiful tree of the leguminous family, the kowai (*Edwardsia microphylla*, A.Cunn), is also frequently met with in the Northern Island on the borders of rivers. The specimens of this tree found in the colony are said to have proceeded from seeds by Marion, at the Bay of Islands, twenty-nine years ago. September is the flowering season, and the appearance of the tree is then magnificent, as it is covered with bunches of flowers of a beautiful yellow golden colour. After the flowers succeed long husks, the seeds in which serve as nourishment for many species of birds—amongst others, to the handsome philedon à cravate (parson bird). The wood is very useful and very durable.

There yet remain to be cited the following kinds, which, although little employed at the present time, are notwithstanding very serviceable: The rohuu (*myrtus bullata*, Hooker), employed in cabinet work; the tawero (*leptospermum racemosum*, A.Cunn.), similar to mahogany; the kohikohi (*hartighsea spectabilis*, A.Cunn.) useful for palisading; the akeake (*Dodonea spathulata*, A.Cunn.), a shrub. The wood is heavy, very hard, red with black veins. The rewarewa (*Knightia excelsa*, id); the maire, of which there are two kinds—*mida eucalyptoides*, A.Cunn.; and *mida myrtifolia*, is of the family of the santalaceae, furnish the hardest woods of New Zealand. It withstands attempts to cut it so effectually that the tools used are frequently notched, and it is employed with success in making cogs for wheels. The warangipiro is



a golden yellow wood, prettily marbled, and which is cut in small pieces for veneering. The hinau (*eleocarpus hinau*) from which the bark, when stripped and infused in water, gives a beautiful and very durable black dye. Another *eleocarpus*, the mako, furnishes a beautiful blue tincture, very tenacious. Amongst the ornamental plants may be cited two laurels – the tahua (*laureataua*, A. Cunn.) and the taraire (*laurea taraire* id). The purple coloured berries of the last named are much sought after by pigeons, but it is said the berries are dangerous to man. The koraka maori (*cynocarpus laevigata*, Forster) has a fine grain and the wood might be utilized, but up to the present the tree has been respected in consequence of its fruit. There are many *Arelia* &c which also could be named.

The phormium tenax, or flax, of New Zealand, has had for a long time such a celebrity that we cannot pass it by in silence, inasmuch as, although it may not have attained all that which was expected from it, it can be made notwithstanding a most useful article. The phormium tenax appertains to the liliaceae family, with tuberous roots. The leaves are in the form of the blade of a sword, between three and four metres in length and are a little thick, solid and bare (glabre). Its large purple flowers have a monophyllous cup with six indentations, and full up to the brim with a sort of syrup, very sweet. The plant nourishes best in low and humid soil, where it grows in large and compressed tufts, from the centre of which rises the stem which carries the flowers. In places too marshy it perishes. The leaves when opened exude a colourless gum, which for adhesive purposes would serve as a substitute for gum Arabic. It is possible to draw from the leaf a very thin thread, which at first is very resistant, but after some time becomes heated and loses much of its force. From this cause the hope that has been raised that the flax will be serviceable for the making of cords and cloth for sails has not been realized; there are nevertheless some manufacturers always on the lookout, and who despair of not utilizing a great portion of the material. In any case one would not employ it but for making heavy ropes, mats and beds, which would undoubtedly prove a great advantage had one an abundance of the raw material at hand. Although the phormium tenax grows altogether in a wild state, it is necessary to cultivate it in order to secure a good crop. The aborigines classify the different threads of phormium as ten in number, according to the degree of fineness and the variety of the plant. The superior qualities are obtained from the better sorts of leaves, which have been softened between the fingers and separated into threads by the nails. For inferior qualities shells are used, also pointed nails and bodkins. We have seen the thread perfectly white, and possessing a resemblance to silk. The inferior qualities serve to make large cloaks, mats, sails for canoes &c.

Ferns are much scattered in New Zealand, and many kinds are arborescent; but the most common species is at the same time the most useful. It is of mediocre size, resembling the common fern of France, the pteris esculenta (Forster), and which covers all uncultivated land. Horned cattle eat the young branches with avidity, and thrive well upon it. Formerly this plant was very useful to the aborigines, who found in its root, slightly roasted, their principal food – a sad enough mess. At the present time they give a preference to potatoes, which are gathered twice a year, and which they cultivate not only for their own use but of which they export a considerable quantity.

A Jouan, Captain of Frigate formerly Captain of the sailing transport "Bonite".

- i Cordyrops robertsii Hook -The vegetable caterpillar
- ii It seems likely that the author has assumed that kanuka and manuka are the same species.
- iii Not known what this means. Du Fresnois was killed in 1772 and not 1832 as implied by this statement.
- iv Some confusion here as the tui is not known to eat kowhai seed.
- v Kamahii (*Weinmannia racemosa*); previously *Leiospermum racemosum*
- vi Kohekohe (*Dysoxylum spectabile*)
- vii Some confusion here. Seems to be referring to *Mida salicifolia* and *M. salicifolia* var *myrtifolia*. Not sure if their wood is hard so that reference may be to *Nestegis Cunninghamii* (black maire)
- viii Probably wharangi-piro (*Melocope ternata*) but the name also used by Maori for *Olearia rani* and *O. furfuracea*
- ix *Aristotelia serrata* – wineberry
- x Tawa and taraire. Some confusion re berries being poisonous as neither species is.
- xi *Pteridium aquilinum* var. *esculentum* (bracken)

## THE UNCERTAIN STATUS OF INDIGENOUS FORESTRY

The current recession, which some argue is the worst for many decades, should be of concern for those New Zealanders involved in indigenous forestry. For if history repeats itself, as it often tends to do, the advancement of indigenous forestry – especially research – could be an early casualty.

Agitation for the more efficient use of our forests began early when in 1867 one of our early conservationists, T H Potts questioned the profligacy already becoming evident. A few years later in 1874 Vogel passed the first Forests Act and appointed Inches Campbell-Walker as the first Conservator of Forests. However there was much opposition and the Act was allowed to lapse when Vogel relinquished the Premiership. Vogel proposed a new act when he became Premier again in 1876 and the second Forests Act became law in 1884. Thomas Kirk was appointed Conservator and he engaged staff to begin work. This effort was short lived as the infant Forestry Branch of the Lands Dept was dispensed with by the new Atkinson Ministry in 1887, during the long depression which lasted with varying intensity from 1879 until 1896. (Brown, 1968).

As early as the 1880's the attitude that indigenous species were disappearing was becoming prevalent. For example in the parliamentary debates of 1885 the Minister of Lands William Rolleston stated: "with regard to conservation of existing forests very little can be done"; while John Buckland said: "I speak with large experience of the forests of New Zealand, and, I have a deep feeling of regret that our forests are likely to disappear, but, still, I cannot help thinking that the task of conserving them is useless". (Roche, 1990). The one thing these two gentlemen, and in fact most M.P.s, lacked was a knowledge of forests and forestry; for at the time scientific knowledge of this aspect of New Zealand was virtually non-existent. Yet, based upon this lack of knowledge, the exotic invasion began with the Forestry Branch of the Lands Dept being reconstituted and setting up nurseries from 1895 and planting forests like Hanmer and Whakarewarewa. Apart from a few ornamental natives, exotic species comprised most of the planting.

There was one small glimmer of light for, in the north – probably encouraged by the one man with a small knowledge of indigenous vegetation – Thomas Kirk, the State nursery at Ruatangata was growing totara and puriri. In 1904/05 they had 150,000 totara and 8000 puriri and in 1906/07 350,000 totara. Most of these were planted in the Puhipuhi area and most were lost, mainly to fire. A few small blocks remained, re-discovered by George Parry of Forest Research Institute in the mid 1980's. These should be retained as a monument – not only to what might have been but also as the progenitors of the new totara industry taking its first faltering steps in Northland today.

Between the beginning of the Forest Service in 1919 and today, intermittent steps were taken to progress indigenous forestry and just as frequently these efforts were stopped, usually by lack of funding (Barton, 1975). While current efforts to get indigenous forestry moving again are now underway, thanks to the efforts of Tāne's Tree Trust and the Indigenous Section of Farm Forestry, these could easily be stymied by a reduction in the miniscule amount of current funding.

We need to be continually vigilant and fight any proposals to reduce the current main funders – FoRST and the Sustainable Farming Fund – while continually searching for further sources of finance.

Ian Barton – Chairman, Tāne's Tree Trust.

### References

- Barton I L 1975 The management of kauri forests; a historical review of government policy and a proposal for the future. *NZ Jnl of Forestry* 20 (1), 86-106
- Brown L 1968 The forestry era of Professor Thomas Kirk. F.L.S. NZ Forest Service Information Series 56. 26 p
- Roche M 1990 History of Forestry. NZ Forestry Corp in Association with GP Books. 466p



# NATIONAL CONFERENCE TO CELEBRATE TEN YEARS

This will be held at Waikato University from the 18th to the 20th November this year. We have been successful in getting good funding from the Sustainable Farming Fund and are actively seeking sponsorship wherever we can. Despite the difficult times several organizations have already offered to assist.

More work has been done on the programme, which is outlined below. Although this is still subject to change it should be finalized by the time of the September newsletter.

The conference will be divided into six workshops each of which will be introduced by a short position paper, followed by discussion groups. The likely workshop topics are:

- Managing trees on farms using Northland totara as an example
- Reducing establishment costs.
- Ecosourcing.
- Non timber values
- Iwi perspective workshop
- Indigenous research directions

In addition there will be two keynote papers (topics and speakers yet to be finalized) and a presentation on Tāne's Tree Trust. "What is it; what are its achievements"

During the conference we will also be launching the new training manual and the AGM of Tāne's Tree Trust will be held.

At the dinner on the first evening the speaker will be Paul Mahoney of DoC who is an expert on old methods of timber extraction and milling. An entertaining speaker and not to be missed.

The conference will be concluded by a plenary session with reports back from workshops & determination of next steps where required. This will be summarised by the final speaker under the topic "Tāne's Tree Trust - the next ten years"

Day 3 will be a field trip to indigenous sites, both planted and natural; Whatawhata, Maungatautiri and David Wallace's

It is expected that the registration fee will be \$95 for the three days which will include all lunches, copy of workshop proceedings, field trip costs etc., but not include the cost of the dinner on the first night or accommodation. This will be available at the University Halls of Residence for \$66 per day and includes breakfast. Some motel accommodation will also be reserved.

Registration forms will be sent to all Tāne's Tree Trust members with the September newsletter but members are invited to register their interest in the conference whenever they wish by emailing Ian Barton at [ibtrees@wc.net.nz](mailto:ibtrees@wc.net.nz) or writing to PO Box 1169, Pukekohe 2340. [Note: Ian is overseas until 10 July but Peter Berg will empty the mail box and can be contacted on [p.berg@pentarch.biz](mailto:p.berg@pentarch.biz).]

Papers and poster displays are sought and if anyone wishes to have a commercial display please contact either of the above for details.

## NOTICES:

### Unpaid subscriptions:

There are still a few members who have not paid their 2008/09 subscription. If you are one of these this is the last newsletter you will receive unless your sub is paid by 31st August 2009.

### Do you have or know of any planted native trees?

Over the past 150 years, it is estimated that at least 80 million seedlings of native timber trees have been planted throughout NZ to meet a wide range of purposes. There is no nationwide comprehensive assessment or ongoing monitoring of these planting programmes. Tāne's Tree Trust is now surveying significant plantings of native tree species throughout the country in order to add new information to existing databases that will be available for growth and carbon accounting models. Information on the growth and performance of all substantial stands of planted native trees are of interest. The project is funded for three years by MAF's Sustainable Farming Fund and Tāne's Tree Trust, with complementary funding from Scion's FRST Diverse Forestry Species Programme funded through Future Forest Research.



*Puriri, age 5 years*

What we want:

- Species planted, year of planting and approximate size of planting or number of trees
- Ideally stands to comprise a minimum of 15 trees to allow measurement of within-stand trees, thus avoiding edge trees
- Interested in all planted native stands and species irrespective of age and why they were planted

If you can help, please contact Dr David Bergin, Scion, Private Bag 3020, Rotorua, [david.bergin@scionresearch.com](mailto:david.bergin@scionresearch.com).

### Do you know of any planted beech stands?

As part of two Tāne's Tree Trust projects funded by the Sustainable Farming Fund (production of a Beech Bulletin and the Indigenous Plantation Survey) Mark Smale and David Bergin are in the midst of listing all the significant planted stands of beech throughout the country – location, owners etc. They will be visiting key planted beech stands and catching up with landowners in several regions throughout the South Island starting in April. If you can help with any information on planted beech stands anywhere in NZ please contact David or Mark at [David.Bergin@scionresearch.com](mailto:David.Bergin@scionresearch.com) or [SmaleM@landcareresearch.co.nz](mailto:SmaleM@landcareresearch.co.nz).



*Planted beech species – property of J Purey-Cust, near Gore*

### Information needed on windfallen or cut down native trees

I need to find windfallen/felled trees to undertake sampling to determine rates of decay over time. This is part of a project contributing towards NZ's commitment under the Kyoto Protocol under which we need to quantify carbon release and decomposition rate during the decay of coarse woody debris within indigenous forests. Of particular interest are mountain beech, kanuka, hard beech and miro.

The following criteria must be known:

- 1) Time of death – ideally wind throw of a live tree (+/- a year or two)
- 2) The original volume able to be measured/estimated
- 3) The complete length of the log – ideally up to 10 cm diameter
- 4) If it has been decaying for over 10 years.

If anyone can help us locate windfallen trees within a forest situation, how long has it been on the ground, hopefully with stem intact etc, please contact me. Please send this message on to anyone else who may be able to help – it could be trees that were cut down 10 to 20 years ago that you know are still on the ground and roughly when they were dropped. If you require further information on the project please contact me: Loretta Garrett ([Loretta.Garrett@scionresearch.com](mailto:Loretta.Garrett@scionresearch.com)).