Citation

de Lange, P.J.; Lowe, D.J.; Newnham, R.M. 1996. What was the original forest composition of Great Island (Three Kings)? *Conservation Science Newsletter (Science and Research Division, Department of Conservation)* **21/22**, 7-11.

RESEARCH IN PROGRESS

What was the original forest composition of Great Island (Three Kings)?

By Peter J. de Lange[1], David J. Lowe[2] and Rewi M. Newnham[3]

[1] Science & Research Division, Auckland Conservancy, Department of Conservation, Private Bag 68908, Newton, Auckland, New Zealand

[2] Department of Earth Sciences and Geochronology Research Unit, University of Waikato, Private Bag 3105, Hamilton, New Zealand

[3] Department of Geographical Sciences, University of Plymouth, Drake Circus, Plymouth PL48AA, England

The Enigma of the King's Flora

Following the extermination of goats (*Capra hircus*) from Great Island in 1946 the recovery of that island's vegetation has been of tremendous scientific interest. Numerous papers have been written on the subject and recent visits to Great Island by the Northland Conservancy have continued to document changes in forest structure. Since 1989 it is becoming evident that in many places the monotonous and extremely dense kanuka (*Kunzea ericoides s.l.*) canopy is starting to collapse, presumably due to the combined affects of old age and exposure to the often stormy maritime climate. Of interest is what the new forest structure will be. While in places the canopy and understorey is now dotted with rapidly growing specimens of porokaiwhiri (*Hedycarya arborea*), mangeao (*Litsea calicaris*) (Cameron *et al.* 1987; P.J. de Lange pers. obs.) and albeit less frequently, titoki (*Alectryon excelsus* var. *grandis*), the spread of these trees is being hampered by a lack of natural seed dispersers. Therefore many patches of forest either lack an understorey or have a forest composition comprising short-lived smaller trees such as pukanui (*Meryta sinclairii*), cabbage tree (*Cordyline kaspar*), Three Kings rangiora (*Brachyglottis arborescens*) or shorter stature trees (really large shrubs) e.g. Fairchild's kohuhu (*Pittosporum fairchildii*) and Oliver's mapou (*Myrsine oliverii*).

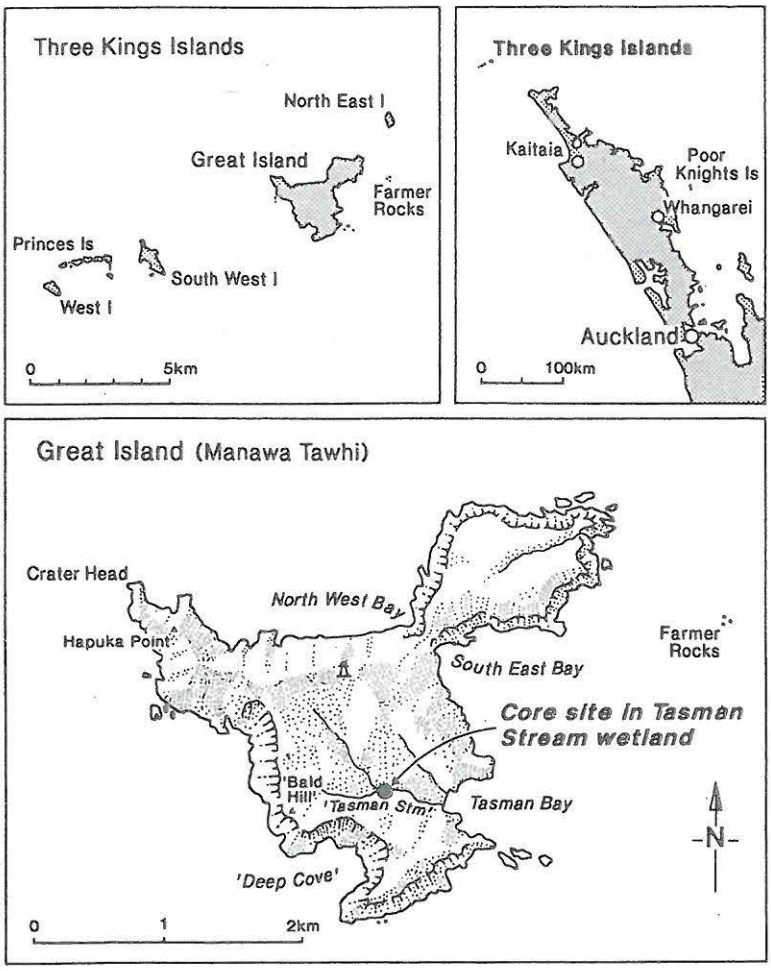


Figure 1 Great Island, in the Three Kings group, showing the core site and features named in the text.

The question of greatest interest is just what the actual forest composition of the Great Island will be when the kanuka dominated vegetation completely collapses? At present the only proposed model (Baylis 1951, 1958) is based on a comparison of the associated and presumably less disturbed, but significantly smaller, South West, North East and West Islands. These islands support pockets

of pukanui or pohutukawa (*Metrosideros excelsa*) dominated forest. Through comparison of these with Great Island Baylis (1951, 1958) suggested that in time the kanuka forest of Great Island will be replaced by a forest structurally similar to that of the smaller islands. However, there are some major differences in the composition of tree species between these islands and Great Island, and it will be interesting to see what role titoki, porokaiwhiri, mangeao, karaka (*Corynocarpus laevigatus*), tawapou (*Pouteria costata*), coastal maire (*Nestegis apetala*) and puriri (*Vitex lucens*) will have in the future forest composition of Great Island.

Furthermore, it is becoming increasingly evident that all of these smaller islands have been settled by humans for varying lengths of time, so their composition may not necessarily be an accurate reflection of what the "pristine Kings" may have looked like. Aside from this interesting problem, there are also the wider questions of whether other common Northland forest trees and shrubs were also present on the Kings in the past, and if these were eliminated during the human occupation of the Three Kings or later following the liberation of goats on Great Island. For example, during the recent Northland Conservancy December 1995 visit, plants of an undescribed sun orchid (*Thelymitra* "rough leaf") were found on Great Island. Elsewhere on mainland New Zealand this species has only ever been found in association with soils containing the remains of kauri (*Agathis australis*) (de Lange in press; B.P.J. Molloy pers. comm.). Does this mean that kauri was once present on Great Island? Possibly of greater conservation interest, however, is the question as to whether Three Kings endemics, such as the monotypic *Elingamita johnsonii*, known only from West Island and Hinemoa Rock, was ever present on Great Island. Furthermore, how common was *Tecomanthe speciosa* or *Pennantia baylisiana*? Both are currently known from single specimens only on Great Island. What is needed to answer these questions is a "window" into the pre-human occupation vegetation of Great Island.

During October 1991 a small (25 m^2) wetland was discovered halfway up the Tasman Stream (Fig. 1 & 3) by one of us (PdeL). This wetland occupies a small depression above the Tasman Stream. The present day wetland vegetation comprises a dense 1.2 m tall sedge/fernland (principal species: *Baumea rubiginosa, Carex virgata, Blechnum minus*) through which several tall cabbage trees protrude (Fig. 3). The wetland formed probably through the slumping of colluvium caused by a small spring which drains the upper slope 10 metres from the wetland. This is the only wetland of any reasonable extent on Great Island. So, despite its small size, the possibility that this wetland may preserve some pollen record of pre-Polynesian settlement Great Island vegetation could not be overlooked.

Tasman Stream Wetland Cored

In December 1995 one of us (PdeL) probed the wetland and found it overlies a shelf of hard argillite rock, and attains a maximum depth of 1 metre. Using a specially designed Russian Jowsey D-Section peat corer loaned from the Department of Earth Sciences, University of Waikato, three intact cores (Fig. 2 & 4) were sampled from this wetland for later analysis for plant macro "fossils" (PdeL), pollen (RMN), and volcanic ash and charcoal

Figure 2 Lower 50 cm of the core from the Tasman Stream wetland site.

(DJL). After each core was extracted it was photographed and carefully described in the field, wrapped in gladwrap and stored for later analysis. Back at Waikato University the cores were subjected to further scrutiny resulting in a composite stratigraphic log (Fig. 4), before each was systematically sampled for pollen and plant macro "fossils". Two samples from all three cores were submitted to the University of Waikato Radiocarbon Dating Laboratory (Fig. 4).

Preliminary Results

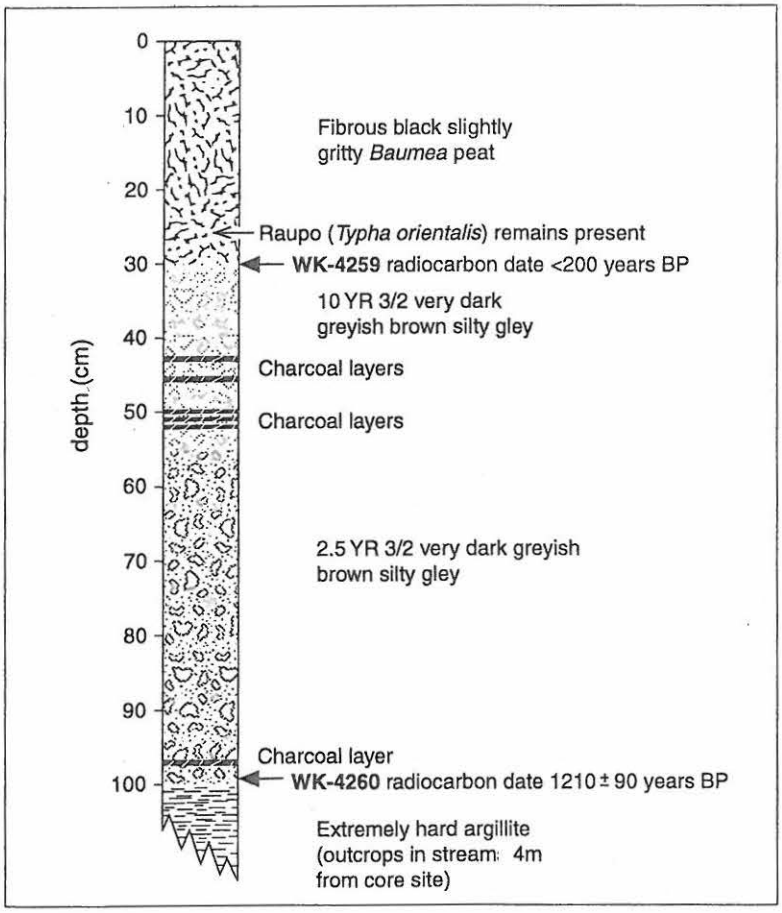
As of May 1995 analyses of the core have revealed that the upper 30 cm of peat contains no obvious volcanic ash, although small quantities of weathered glass are present in the lower part of the core. Beneath the peat layer, the core comprises gleyed organic silts through which several prominent lithic layers are dispersed. Charcoal layers occur to a depth of 60 cm and then again at the base of the core (c.108 cm). A radiocarbon date from the peat/gley (WK-4259) contact obtained a "modern" age (i.e. less than 200 years old) while that from the base (WK-4260) resulted in an age of 1210 ± 90 radiocarbon years BP.

Pollen analysis of the samples has not yet proceeded and it will be interesting to see whether the gleyed silts have preserved any pollen, and if so in what condition. Plant macro "fossils" were not evident in the gleyed silts, but the peat contains numerous fragments of *Baumea ?rubiginosa, Carex ?virgata, Blechnum ?minus* and, interestingly, raupo (*Typha orientalis*) (P.J. de Lange, Dec 1995, AK 225158) a species not presently known from the Three Kings. The

Figure 3 Dense sedge/fern vegetation i n Tasman Stream wetland.

raupo sample came from near the gley/peat contact and may suggest that when the wetland formed, there were pools of water covering its surface. However, raupo can also grow within seepages and on seasonally damp ground, so the discovery of this species has only limited palaeoecological value. Similarly, the other species recorded are present in the modern wetland and their presence in the peat was therefore not unexpected. Consequently, until the results from the pollen analyses are available, we can shed no further light as to the nature and composition of the Three Kings vegetation, or whether our core pre-dates human occupation of Great Island. While it is now generally accepted that Polynesian settlement of New Zealand happened within the last c.700 years (McFadgen *et al.* 1994; Newnham *et al.* 1995), the basal section of the Three Kings core contains charcoal. Although the basal date for this core is 510 years older than the recently proposed date of human occupation of New Zealand thereby suggesting that the basal charcoal layer is the result of a natural fire (cf Burrows 1996), the fact that the wetland formed through the slumping of colluvial material, could mean that the basal date has been influenced by the introduction of older carbon carried downslope by water draining the adjacent hillside (McFadgen 1996). It is therefore possible that our core is actually much younger than the basal date indicates.

Figure 4 Composite stratigraphic log from the three intact cores.



Acknowledgements

Peter de Lange is grateful to the staff of the Northland Conservancy for facilitating access to the Three Kings and the Ngati Kuri for permission to collect samples from there. David Lowe acknowledges an internal Department of Earth Sciences grant for the C-14 dates and Dr(s) Alan Hogg and Tom Higham are thanked for assaying these samples. Sean Hutton kindly drafted Figures 1 and 4. We would also like to acknowledge the comments received from Ewen Cameron (Auckland Museum), Bruce McFadgen (Science & Research), Brian Molloy (Research Associate, Landcare Research Ltd), and David Norton (University of Canterbury) on an earlier version of this article.

References

Baylis, G.T.S. 1951: Incipient forest regeneration on Great Island, Three Kings group. *Records of the Auckland Institute & Museum 4*: 103-109.

Baylis, G.T.S. 1958: A botanical survey of the small islands of the Three Kings group. *Records of the Auckland Institute & Museum 5*: 1-12.

Burrows, C.J. 1996: Radiocarbon dates for Holocene fires and associated events,

Canterbury, New Zealand. *New Zealand Journal of Botany 34*: 111-121.

Cameron, E.K.; Baylis, G.T.; Wright, A.E. 1987: Vegetation quadrats 1982-1983 and broad regeneration patterns on Great Island, Three Kings Islands, northern New Zealand. *Records of the Auckland Institute & Museum 24*: 163-185.

de Lange, P.J. *In press*: Orchids of Great and South West Islands, Three Kings Island Group, Northern New Zealand. *Tane 36*:

McFadgen, B.G. 1996: Dating the Rangitoto Ash and its implications: letter to the editor. *Geological Society of New Zealand Newsletter 109*: 4-9.

McFadgen, B.G.; Knox, F.B.; Cole, T.R. 1994: Radiocarbon calibration curve variations and their implications for the interpretation of New Zealand prehistory. *Radiocarbon 36*: 221-236.

Newnham, R.M.; de Lange, P.J.; Lowe, D.J. 1995: Holocene vegetation, climate and history of a raised bog complex, northern New Zealand based on palynology, plant macrofossils and tephrochronology. *The Holocene 5*: 267-282.