Vegetation History of the Hunter Valley

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For an overview of the pattern and process of vegetation change in Australia see Flora of Australia Vol.1 Ed. 2, 1999, for detail see Hill, R.S. (Ed.) History of Australian Vegetation, Cretaceous to Recent, 1994.

From Early Times to the Tertiary

During the Carboniferous (365-290 million years ago), the coastline of central NSW moved, from somewhere near the centre of the present position of the Hunter Valley, eastwards, with the accretion of land, to the east of the present coastline. After the retreat of the glacial conditions during the early Permain period (290-245 million years ago), the Hunter Valley was occupied by the coal forming peat swamp vegetation of ferns, seed ferns and the Glossopteris flora, which has left abundant fossil evidence. Over this time the main Valley was an area of deposition while the Barrington Tops was an area of erosion as it was uplifted and formed the southern extension of the New England foldbelt. The erosion of this area and of the Lachlan foldbelt to the west by large southwards flowing rivers during the Triassic era (240-200 million years ago) produced the widespread Narrabeen conglomerate and sandstone sediments across much of the Valley. It was also a time of the evolution of the open conifer woodland with cycads, ginkos, and ferns as an understory. The Jurassic (200-130 million years ago) Talbragar fossil beds, just west of the present Hunter Valley, indicate that this type of vegetation was now present in the area. Even though eastern Australia lay in high latitudes, the climate is believed to have been warm and humid, and as revealed by the fossil record in the Ulan-Dunedoo-Merriwa area the fresh water lakes teemed with many fishes and were surrounded by open woodlands of Agathis species, Podocarps, with Pentoxylon (a possible ancestor of the Pandanus palm) and heath-like Dicroidium species in the understory. Ferns and treeferns were abundant in the protected areas.

During the long Cretaceous period (130-65 million years ago), angiosperms developed and by Tertiary times (65-2 million years ago) had largely replaced this earlier vegetation with angiosperm rainforest type vegetation. Ferns, in particular the tree ferns such as Dicksonia, and the descendents of some conifers and cycads, such as the relict Wollemia
nobilis in the Wollemi NP, and Podocarpus elatus, a descendent from another old conifer family and now widespread in rainforest habitats, still persist, as do the descendents of some cycads (now Macrozamia species) in the Hunter region. In the earlier Cretaceous, the sea flooded many areas of the Australian landmass and the upper Hunter was drained to the northwest. Not until the early Tertiary, with the volcanic activity associated with the uplifting of the eastern highlands, was the Liverpool Range area elevated sufficiently to cause the Hunter to drain eastwards. The rifting of a narrow 'terrane' from the east coast and the inception of the formation of the Tasman Sea brought the Hunter region closer to the east coast.

**The Tertiary Period**

The early part of the Tertiary period saw, at least over eastern Australia (or that part of Gondwana then occupied by what is now eastern Australia) vegetated with an early angiosperm rainforest type of vegetation. It is also thought that, in response to the poor soils, especially away from the alluvial valleys, sclerophyll type plants, such as Banksia, Grevillea, and Casuarinaceae and then Acacia and the precursor of the Eucalyptus were evolving. It appears that there is no fossil evidence of these early Tertiary plants in the Hunter region, but it is reasonable to assume that the rainforest type vegetation existed, at least in the valleys, and that the interfluves, with the poorer and drier soils, were vegetated by the Casuarinaceae and sclerophyllous type flora, as these types of vegetation were wide spread, at least across much of eastern Australia. Adaption of the sclerophyll vegetation to the poor soils and drier conditions also enabled it to better survive fire which appears to have become more frequent during the Miocene, commencing about 20 million years ago. The climate also become cooler and generally drier during this time.

Through much of the Tertiary period the uplifting of the eastern highlands was accompanied by massive basalt outpourings. This would have produced a continium of changing soils and environments (on a geological and evolutionary time scale), and coupled with the changing climate as Australia drifted northwards produced conditions amenable to vicariance and speciation.

In the Barrington Tops area grows Nothofagus moorei, a derivative from the once widespread temperate rainforest genus which entered the continent via Antarctica (the 'South Pacific' or 'Antarctic track', (Orchard 1999:338) when it formed part of Gondwana, while other plants of this cool montane area, such as the Poa tussocky grasses, Gaultheria species (related to the Ericaceae heaths), Euphrasia species and many others related to plants in the northern hemisphere are thought to be later arrivals via the 'Pan-temperate track' through SE Asia and New Guinea(Orchard op.cit.)
By the time of the Miocene, precursors of the modern *Acacia* and *Eucalyptus* were growing in the interior of the continent, and as an increasing dryness spread outwards from the centre of Australia towards the coasts these species also spread outwards, diversifying with changing climates and soils and with consequent diminishing of the rainforests. It is also likely that increased frequency of fire favoured the sclerophyllous vegetation over the rainforests, assisting with the expansion of the former.

By the time of the Pliocene (about 5.5 million years ago), the vegetation had evolved to its present form and the climate entered the present glacial and interglacial cycles, with cool to cold, dry windy periods punctuated by warmer, moister times. During the moister phases, forest and rainforest would spread, while the drier times would favour the expansion of woodlands, heaths and grasslands.

By 16,000 to 17,000 years before the present, S.E. Australia was subject to a severe arid phase (*Bowler 1978* in Barlow in George 1981:63). The existence of sand dunes of this age in the Warkworth area (*Story, et al 1963*) suggests that the Hunter Valley was dry and poorly vegetated, and it was probably then that the Upper Hunter acquired the drier western species, of which *Acacia salicina, Geijera parviflora* and *Acacia melvillei* continue to exist. Open woodland and grassland would have been widespread. The influence of the Aborigines on the vegetation can only be presumed to have involved an increase in the frequency of fire, also favouring the development of grasslands and woodlands.

From about 8,000 - 4,000 years before the present, (*Walker and Singh in Groves, 1982; Singh in Smith, 1982*) the climate became wetter and the forests again expanded. This may also have been a time when the non-sclerophyllous plants (dry and warm-temperate rainforest species) spread into the Valley from coastal refuga colonising suitable sites as far west as the Liverpool Range.

**The Liverpool Rainforests**

The Liverpool Rainforests are warm temperate rainforest patches on weathered basalt extending along the southern aspects of the Liverpool Range. They are concentrated in the drainage lines, and vary in size from being small, a few hectares, to 100 hectares in area (*Fisher, 1984*).

It is probable that their present occurrence is related to the recent Holocene expansion during the present interglacial period, probably about 10,000 to 6,000 years ago, since there are no species endemic to these patches, speciation appears not to have occurred, their floras are closely related to the warm-temperate rainforest floras of the coastal areas, and the species richness declines westwards. Fisher (1984) suggests that the most westward forest is relatively young. Further, the dispersal distance...
is relatively small, and many of these rainforest species appear to have a high dispersal ability. Some species also occur in small patches of dry rainforest in the eastern half of the Upper Hunter, with a few isolated occurrences extending as far west as Lees Pinch.

It is not known whether the more modern rainforest flora existed on the Liverpool Range in times before the last glacial period, with the maximum aridity in the Hunter Valley about 17,000 years ago, and whether they might have been eradicated during the arid phases.

**Nothofagus moorei in the Barrington Tops - Gloucester Tops Area**

The pollen record indicates that *Nothofagus moorei* was widespread on the Barrington Tops plateau and the higher parts of the southern Mt Royal Range from 6,500 years ago to 3,500 years ago (Dodson, et al, 1986) with extensive *Eucalyptus* forests on the western part. These forests began to be replaced by the snow-gum woodland - tussock grassland from about 1600 years ago. There was also a contraction of the *Nothofagus* cool-temperate rainforest to more sheltered sites at this time. However, a slow expansion has since commenced, and according to Turner (1976) *Nothofagus* appears to be still moving upwards, most likely under the influence of a slowly changing climate. Their dispersal ability, however, appears to be very low (Hore-Lacey in Turner, 1976; Turner 1976). The vegetation changes are attributed to climatic temperate and precipitation changes.

Probably the peri-glacial conditions on Barrington Tops during the last glacial were too cold and dry for *N. moorei* to survive at the higher altitudes. Relict populations presumably existed at lower altitudes. The species does not occur on the Coolah Tops plateau which has a similar altitude or on the Liverpool Range, its absence from these areas would seem to be due only to the reduced precipitation and humidity westwards, as edaphic and altitudinal conditions are similar, but it does occur at the junction of the Mt Royal and Liverpool Range in the Hall Gap N.P. area.

The swamps appear to have come into existence around 11,000 years ago (Dodson, et al, 1986) with the return of milder conditions. However, its was not until some 3,500 years ago that they became dominated by the Sphagnum moss communities although peat was being formed within a few thousand years of their establishment (Dobson, 1987).

**Warkworth Sand Dunes Flora**

According to Galloway (1983) the Warkworth sand dunes were formed during the arid period about 18,000 to 15,000 years ago from the sandy alluvium of the Wollombi Brook. At that time, cold winters with dry windy summers prevailed (Bowler, 1987).
The present flora of these dunes contain very few arid or semi-arid species - an exception being *Acacia salicina*. It is composed almost entirely of species from the surrounding area and some coastal species, in particular, *Banksia integrifolia*. Most likely, the dunes were mobile and unvegetated due to the arid and windy conditions, and on the amelioration of the climate they were invaded by the surrounding flora.

It is interesting to note there there is no floristic resemblance between the Warkworth dune systems and the flora of the Anges Banks sand sheet near Richmond, described by Benson (1981). Both systems are of similar origin and age and are roughly the same distance from the present coastline.

**Present Vegetation**

Since the time of European settlement, the vegetation of the Hunter Region has been substantially altered by the extensive thinning and clearing of the land on the better soils. Although rainforest covered only a small area of the Hunter Valley, it extended in dense stands on some sections of the alluvial flats along the lower reaches of the Hunter River, including near Maitland and Morphet and on Ash Is., and along sections of the Patterson and Williams Rivers. Most of this has been removed. In the central valley, much of the original eucalypt woodland vegetation has been cleared or extensively thinned and converted to grassland, although some natural grassland is thought to have existed in the Upper Hunter (Story, 1963). The woodland-shrublands occurring on the poor thin soils of the sandstone hills surrounding the Goulburn River valley and on the southern watershed of the Hunter River have remained substantially intact.