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CONSERVATION OF PENCIL PINE COMMUNITIES ON THE CENTRAL PLATEAU

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Most visitors to the lake country of Tasmania's Central Plateau region would agree that the area attains much of its charm from the thousands of lakes and tarns which are often surrounded by small stands and occasionally forests of native Pencil Pines. In fact, it is these features which make this region unique in Australia, the Southern Hemisphere, and arguably the world.

This article draws attention to the degraded state of Pencil Pine (*Athrotaxis cupressoides*) forests on the Central Plateau. Their degradation has been brought about by two factors, both of which can be attributed to the activities of European settlers; fire and overgrazing.

Large areas of *A. cupressoides* have been destroyed by fire (Jackson 1973) and there appears to be little or no regeneration on these sites. Increases in forestry operations, hydro-electricity development, and the roading activities associated with these works have increased the chances of many remaining stands being burnt. Also, the general upsurge in wilderness recreation and trout fishing has increased the potential threat from fire. Consequently there is concern for the conservation of the species.

Pencil Pines have a widespread but discontinuous distribution in central, western, and southern Tasmania, at altitudes between 630 and 1320m a.s.l. (Fig 1). They are most common on the Central Plateau and in the Central Highlands and at Mt Field but, there are also populations in the West Coast Range, the King Williams, Frenchman's Cap, Mt Anne, Lake Skinner in the Snowy Range, Pinders Peak, and Precipitous Bluff. Pencil Pines usually grow to be upright trees between 6 and 20m in height, sometimes taller, with larger individuals having a butt diameter well in excess of 1m. At high altitudes and in the more southerly extent of their range, Pencil Pines occur as stunted trees or in a prostrate form. A few extensive forests and many scattered stands of Pencil Pines occur on parts of the Central Plateau, in the Central Highlands and at Mt Field at around 1000m a.s.l. Elsewhere they tend to be restricted to small stands around tarns and bog margins, along streams, and on dolerite block streams. These stands usually comprise areas of less than 1 ha. At their lowest densities, Pencil Pines are found beside streams which have transported seed from higher altitude populations.

Pencil Pines are extremely slow growing trees. It takes, on average, 55 years for a seedling to reach 1m tall (Ogden 1978). However, they are capable of living for a very long time and trees in excess of 1000 years old are common.

There is considerable variation in the structure and floristic composition of forests dominated by Pencil Pines throughout Tasmania. Pencil Pines are often found as the sole dominant in open montane rainforests on the Central Plateau (see Jarman *et. al.*, 1984 for definitions of Tasmanian rainforest types) or it may be found with Snow Gum (*Eucalyptus coccifera*), Yellow Gum (*E. subcrenulata*), Deciduous Beech (*Nothofagus gunnii*), Myrtle (*N. cunninghamii*), Sassafras (*Atherosperma moschatum*), Celery Top Pine (*Phyllocladus aspleniifolius*), Milligan's Leatherwood (*Eucryphia milliganii*), and King Billy Pine (*Athrotaxis selaginoides*) in a variety of open montane, implicate and thamnic rainforest types. Communities dominated by Pencil Pines are described in Jarman *et al.* (1984), Cullen (1987), Jackson (1973), and Kirkpatrick (1977, 1984a and 1984b).

The distribution pattern of Pencil Pine is explained by the ability of the species to tolerate extremely low temperatures (by Tasmanian standards) (Cullen and Kirkpatrick, 1988a; Sakai *et.al.* 1981). The Central Plateau and the Central Highlands are the only large areas in Tasmania which are capable of supporting extensive natural populations of Pencil Pine, under present climatic conditions. However, their present distribution and fossil evidence suggests that Pencil Pine forests were probably widespread at lower altitudes in southern and western Tasmania during the colder climates of the last glacial and preceding interstadial (Cullen, 1987).

Cullen (1987) identified 6 forest types dominated by Pencil Pine, of which 3 have only been recorded in the Central Plateau Protected area or the Walls of Jerusalem National Park. These 3 types, namely open montane rainforest with Pencil Pine over grassy understories (eg Dixon's Kingdom stands), open montane rainforest with Pencil Pine over bog understories, and open montane rain-

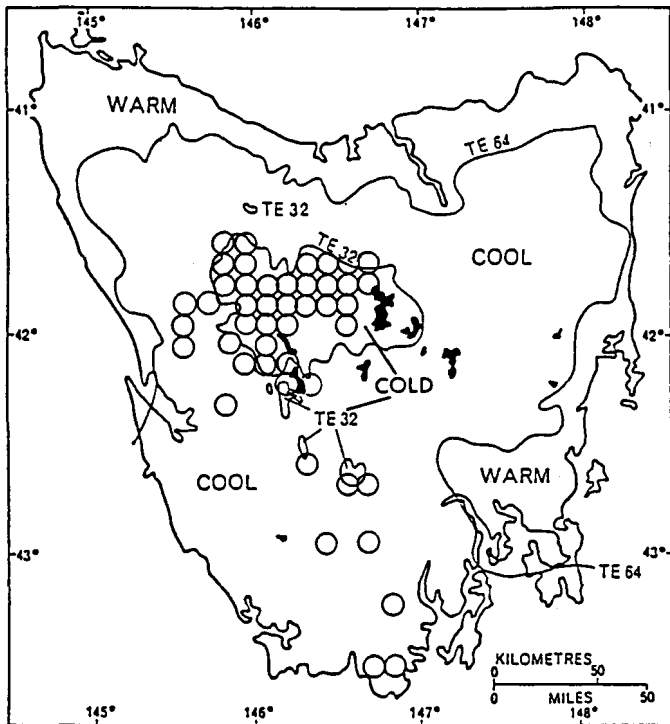


Figure 1. The distribution of *A. cupressoides* and temperature efficiency: *A. cupressoides* distribution taken from Brown et al. (1983) and updated. Temperature efficiency provinces after Gentilli (1972). Circles indicate areas where the species is known to occur.

forest with Pencil Pine over scrub and heath (eg the roadside stand at Pine Lake), occur in the most easterly portion of the species' range. They owe their structure and floristic composition to the lower precipitation and colder temperatures experienced in this region. Higher precipitation, different topography, and less frost combine to create an environment which promotes very different Pencil Pine forests, usually characterized by Deciduous Beech (*Nothofagus gunnii*).

A survey of the distribution of Pencil Pine throughout Tasmania reveals that 33% of the area supporting Pencil Pines on the Central Plateau has been burnt in the 1960/61 and subsequent fires. There have been many older fires which have also burnt areas of Pencil Pines but is difficult to trace the boundaries of these. In fact it is very hard to find a stand anywhere on the Central Plateau which does not contain at least some fire-killed trees.

More alarmingly, the Central plateau stands generally show a lack of regeneration which extends back for at least 100 years. Detailed information concerning size and age of individuals in Pencil Pine populations was collected at 40 sites throughout Tasmania. Many of the stands sampled on the Central Plateau have either a complete lack, or only very low numbers, of seedlings and saplings up to 2m high. This situation is most pronounced in stands with grassy understoreys. The time taken to attain this height would well exceed 50 years, as seedlings are, on average, less than 1m high at this age.

It appears that conditions suitable for the germination of Pencil Pine seedlings are abundant in the region (Cullen and Kirkpatrick, 1988b) as densities of between 50 and 100 per square metre were recorded at many sites following the seed year of 1982/83. Pencil Pines only produce seed once every 5-6 years when there is a mass flowering of all trees. Therefore, it is likely that either climatic conditions are not suitable for the establishment of these seedlings or they are being destroyed by grazing by introduced and/or native mammals. Sheep and cattle were introduced to the Central Plateau region by 1830 and rabbits were introduced around 1910 (Shepherd, 1974). The stands with grassy understoreys would be most attractive to grazing animals and this would explain the total absence of seedling in these stands. By contrast, the stands with heath and scrub understoreys on dolerite block fields have a lower abundance of grass and herbs and are probably less attractive to grazing animals, this would explain the low levels of regeneration present in them.

A series of six 1m x 1m enclosures were established at Mickeys Creek and Pine Lake to test if the removal of grazing pressure would enhance seedling survival. At the onset of the trial, the number of seedlings present in each enclosure and on an adjacent, similar unenclosed 1m x 1m plot were counted. Seedling numbers were monitored every 3 to 6 months for approximately 3¼ years. The protective effect of the enclosures is demonstrated in Table 1. In all cases the numbers of unprotected seedlings decreased by greater amounts than the number of seedlings inside the enclosures. The results are statistically significant (see Cullen and Kirkpatrick 1988a) and indicate that grazing pressure has been

Table 1. The effect of grazing over a 3¼ year period on Pencil Pine seedlings on the Central Plateau.

Location Plot no	Mickeys Creek				Pine Lake	
	1	2	3	4	1	2
Enclosed seedlings						
No. seedlings at start	80	50	270	11	36	37
No. seedlings after 3¼ years	68	49	69	239	48	37
% change	-15	-2	-74	+110	+33	0
Unenclosed seedlings						
No. seedlings at start	59	92	241	132	44	44
No. seedlings after 3¼ years	4	51	47	82	14	13
% change	-93	-45	-81	-38	-68	-70

responsible for loss of seedlings at the 2 sites investigated. It appears that the Pencil Pine seedlings were consumed at random along with the other vegetation, rather than preferentially, as many seedlings remain on the unprotected plots. Rabbit and wallaby droppings were collected on all the unprotected plots.

Records indicate that the drought season on 1987/88 was particularly severe in the area where these trials were carried out. The seedlings survived this drought with little or no losses and seedlings were recorded at a wide variety of sites in the area. It is therefore unlikely that drought has resulted in lowering of regeneration.

A survey of over 20 stands in the region revealed that there has been limited survival of Pencil Pine seedlings in most situations. Dung from sheep, rabbits, and wallabies was found in areas supporting Pencil Pine seedlings. The numbers of droppings can be confidently used as a measure of the number of animals using the area (Johnson and Jarman, 1987; Bakker *et al.*, 1983). The high numbers of droppings counted at some sites are comparable to counts from other areas on the Central Plateau which experience high grazing pressure (N. Gibson pers. commun.).

In the past the numbers of sheep and cattle grazing on the Central Plateau were much higher. Shepherd (1974) estimated that each year approximately 350,000 head of sheep and 6,000 head of cattle were sent to the region in the late 1800's and some of the flocks remained over winter, even on the highest areas. He reports—"the numbers were kept high in order to produce 'hunger-fine' wool". Therefore it is reasonable to assume that grazing pressure during this period was very intense. Rabbits arrived on the Central Plateau around 1910 (Shepherd, 1974) and their rapid rise to plague proportions would have maintained and possibly increased the grazing pressure. They are still thought to be responsible for considerable damage to the vegetation of the region (Jackson, 1973).

As noted previously, the onset of the regeneration failure of Pencil Pine broadly coincides with the introduction of sheep and cattle to the region. This event also coincides with the destruction of the Tasmanian hunting and gathering culture. Archeological evidence (Kiernan *et al.*, 1983) and historical accounts (Cosgrove, 1984) indicate that wallabies formed an important proportion of the diet to the Tasmanian Aborigines. Aborigines frequented the Central Plateau on a regular basis, probably for about the last 10,000 years (Cosgrove, 1984; Thomas, 1984). Their activities, and those of the now extinct Thylacine, may have kept a check on wallaby numbers in the region.

In the absence of further evidence, the loss of Pencil Pine regeneration through grazing must be attributed to the combined effects of sheep, cattle, rabbit, and wallaby populations rather than to any one species. The role played by these species has most certainly varied through time. Sheep and cattle numbers have declined whereas the numbers of rabbits and most probably wallabies have risen during this century. Consequently, the pressure on populations of Pencil Pine seedlings has probably been maintained over a long period.

Intense sheep grazing of the Central Plateau has now ceased, but flocks of

sheep are still grazed in the area during the summer. This reduction in grazing pressure may be responsible for the low numbers of seedlings surviving at the stands investigated.

The effect of grazing on the regeneration of Pencil Pine is undoubtedly intensified by the intermittent seed production and extremely slow growth rates of the species. These factors, combined with the increase in wildfires since the arrival of Europeans and the dramatic upturn in the use of the Central Plateau for recreational purposes, are likely to place Pencil Pine populations in this area in long term danger of mass depletion. Should this happen the area will undoubtedly lose much of its natural charm. It is therefore paramount that sheep or cattle grazing should not be allowed to continue in areas supporting Pencil Pine populations. Despite knowledge of this situation and considerable evidence to prove that grazing in the high country is both environmentally unsound and uneconomic, the recent State Government Select Committee into land-use on the Central Plateau has recommended that the grazing leases be renewed on the Central Plateau on areas above 1000m including regions where Pencil Pines are found.

Further loss of Pencil Pine populations through burning must also be avoided. The probability of wildfires on the Central Plateau must therefore be kept to an absolute minimum, and all available means must be used to suppress those which start. To this end it may be necessary to restrict vehicles access in some areas and to encourage walkers and fishermen to use fuel stoves. It may also be desirable to ban the use of campfires during high fire danger periods.

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TRAPPED SWALLOW LEADS TO GRISLY DISCOVERY

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On 1/10/88, I was alerted to the sounds of a trapped bird, scratching and fluttering in its attempts to escape from inside a wall cavity. Access had been gained via an opening at the top of the wall, measuring 200 x 400mm and at 2300mm above ground level.

The wall cavity measured 80mm in width, 740mm in length and 600mm from the opening to the bottom of the cavity. It was obviously too narrow to allow for flight, and the vertical surfaces too smooth to climb. On removing the outer cladding of the wall, the trapped swallow, *Hirundo neoxena* flew away, leaving its freshly dead companion to add to the carpet of mummified corpses within.

The total count of dead birds was 23, and included 17 Dusky Robins (*Melanodryas vittata*) 5 Welcome Swallows (*Hirundo neoxena*) and a single Flame Robin (*Petroica phoenicea*). The specimens were all adult and had presumably accumulated over 14 years of the buildings existence, possibly becoming trapped whilst searching for nesting or roosting sites.

Specimens were lodged with the Queen Victoria Museum, Launceston Reg. No. 1988/2/83.

Thanks to Dr R.H. Green for assistance in ascertaining the age of the specimens.