

# Aspects of the ecology of the rare *Grevillea kennedyana* (Proteaceae) in north-western New South Wales

Ann Duncan

## Abstract

Duncan, A. (c/- National Herbarium of New South Wales, Royal Botanic Gardens, Sydney, NSW, Australia, 2000) 1992. Aspects of the ecology of the rare *Grevillea kennedyana* (Proteaceae) in north-western New South Wales. *Cunninghamia* 2(4) 533–539. *Grevillea kennedyana* occurs only in Sturt National Park and on adjacent pastoral properties in north-western New South Wales. The number of plants is estimated to be approximately 7 000. Population size and distribution of *Grevillea kennedyana* at Sturt National Park and adjoining properties in the north-western region indicate that the species does not appear to be threatened. Some survival mechanisms of this species are described.

## Introduction

*Grevillea kennedyana* F. Muell. (family Proteaceae) is a shrub of restricted distribution occurring naturally in the extreme north-west of New South Wales. Conservation code is 2VCi, i.e. vulnerable with a range less than 100 km and inadequately reserved (Briggs & Leigh 1988). 'This species is not closely related to any other eastern Australian *Grevillea* species but does have some affinity with *Grevillea juniperina* R. Br. and *G. victoriae* F. Muell. However, it differs from these most significantly in its very oblique torus and its longer ovarian stipe as well as its lack of stylar indumentum, among other things. It shares most features with and appears closely related to *Grevillea acuaria* F. Muell., a Western Australian species,' (P. Olde, pers. comm.).

Prior to this study, populations of *Grevillea kennedyana* were known from mesa slopes at Mount Wood and Olive Downs in Sturt National Park (latitude 29°00' – 29°45' S, longitude 141°40' – 142°05' E) and at the nearby pastoral properties of Onepah to the east and Yandama to the south. The scree slopes of these mesas consist of extensive remnants of a formerly extensive duricrust of silcrete that weathers to moderately coarse fragments overlying brown, loamy lithosols (Geological Survey of New South Wales 1967).

Vegetation is semi-arid low woodland dominated by *Acacia aneura*, *A. cambagei* and *Atalaya hemiglauca*, with occasional *Casuarina pauper* up to seven metres high. The associated low shrubs include *Eremophila freelingii* (predominant upslope); other species are *Acacia tetragonophylla*, *Scaevola spinescens*, and species of *Eremophila* and *Senna*. A low chenopodiaceous ground cover is invariably present.

Following the discovery of a third population in Sturt National Park, at McDonalds Peak, an assessment of population size and ecology of *Grevillea kennedyana* was commenced.

## Methods

Separate populations of *Grevillea kennedyana* at Mount Wood, Mount Wood Hills, McDonalds Peak, Olive Downs Escarpment and Onepah (Fig. 1) were either counted or estimated. Site differences of aspect, slope, and canopy cover at Mount Wood and at Trig Hill within the Mount Wood Hills were examined. The population age structure, stem size and number, height and canopy cover were recorded on three 100 m<sup>2</sup> study sites at Mount Wood.

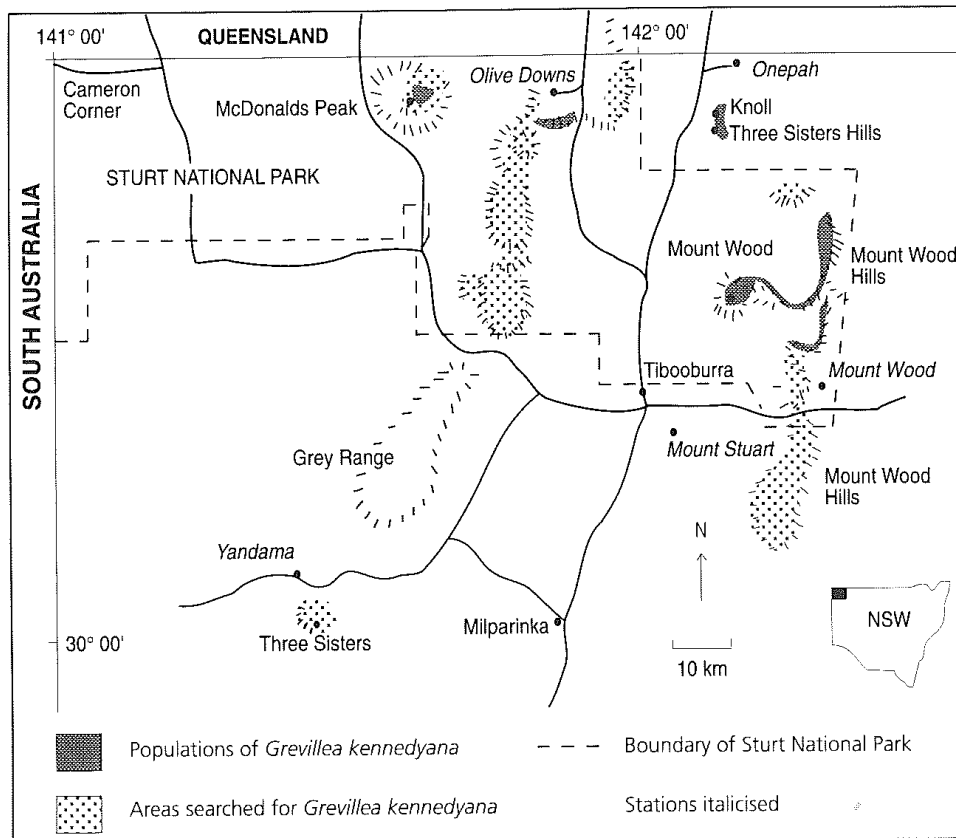


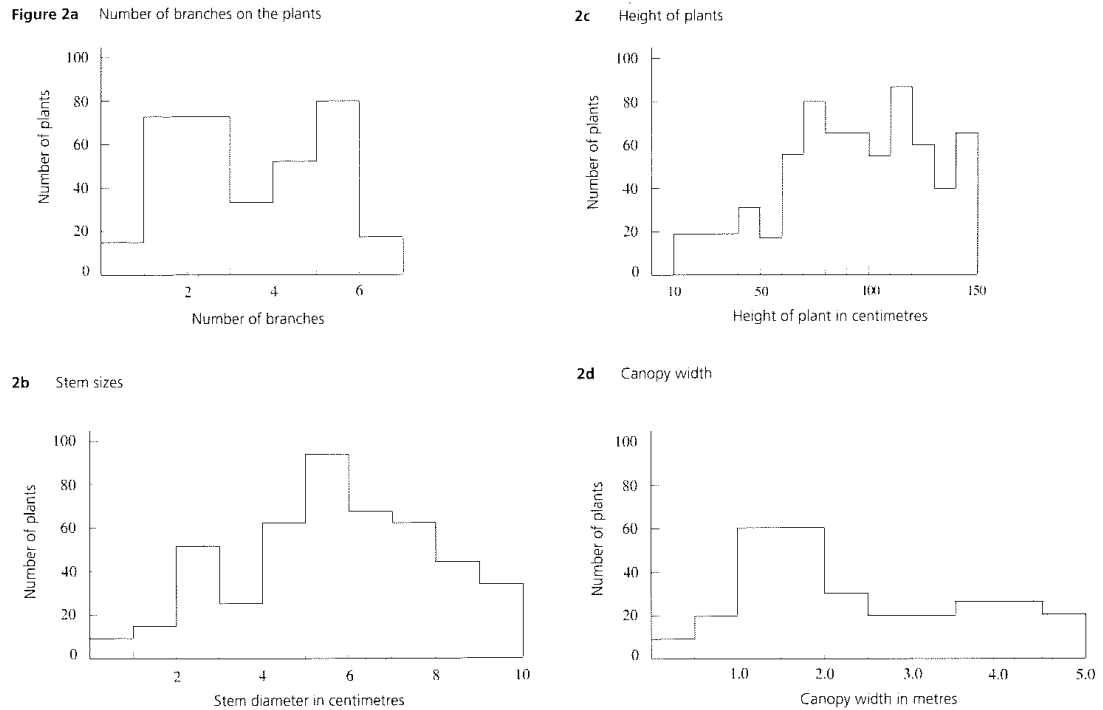
Figure 1. Locations of *Grevillea kennedyana* in north-western New South Wales

Rainfall data were obtained from the Bureau of Meteorology and unpublished records at Tibooburra. Observations on fire regime and pattern were provided by Mr R. Betts, a local resident.

### Growth pattern

*Grevillea kennedyana* is a many-branched shrub arising from either ground level or a consolidated stump (Fig. 2a). Few plants possess more than six thick stems and the majority of these branches are between 4 cm and 8 cm in circumference (Fig. 2b). Overall shrub height is between 0.7 m and 1.5 m, (Fig 2c). An occasional 2 m plant has been observed.

A distinctive feature of *Grevillea kennedyana* populations is the close grouping of plants. Such groups consist of 4 to 8 close growing plants with intertwining branches. Canopies of isolated individual plants average 1.5 m<sup>2</sup>, but a group or colony can result in



**Figure 2.** Number of branches, height, stem size and canopy width of *Grevillea kennedyana* plants at Mount Wood

a combined canopy of 3–5 m<sup>2</sup> (Fig. 2d). Formation of most groups appears to be coppicing from roots. This phenomena was most pronounced at Onepah where investigations indicated that the individuals forming a colony had connecting horizontal roots. Other groups may have resulted from seedling establishment near an adult plant.

### Distribution and population size

Population counts took these groups into consideration by treating them as one individual. Large populations,  $\geq 100$ , were estimated by counting the number of isolated individual plants and canopies. In smaller populations where plants could be studied individually, difficulties were sometimes experienced in distinguishing between seed-generated and coppicing stands, as this was impossible to confirm without digging up individual plants. Overall total population numbers may be underestimated.

*Grevillea kennedyana* locations in north-west New South Wales are shown in Fig 1. Its range is only 70 km. The estimated number of plants is now about 7 000 (Table 1). Localised populations of the species are fragmented and discontinuous, with major concentrations at Mount Wood, McDonalds Peak, and East Olive Downs Escarpment. Limited exploration at Yandama failed to locate the previously recorded population, (Collier, 1960 NSW 93160).

Altitude range for *Grevillea kennedyana* is from 140 m at Mount Wood to 200 m at Olive Downs. A horizontal concentration of plants midslope is frequently apparent, with an upslope limit about 20 m below ridge crest. Slope ranges from almost level (about 10°) to steep (about 75°) and aspect through 360°.

**Table 1.** Population numbers of *Grevillea beadleana*

| <b>Locality</b>        | <b>Total No.</b> | <b>Population range of localised groups</b> |
|------------------------|------------------|---|
| Mount Wood             | 1 500            | 30 – 400                                    |
| Mount Wood Area        | 650              | 1 – 200                                     |
| Mount Wood Hills       | > 1 500          | 1 – 250                                     |
| McDonalds Peak         | 900              | 1 – 100                                     |
| Olive Downs Escarpment | 1 600            | 47 – 400                                    |
| Onepah                 | 750              | 10 – 300                                    |
| Yandama                | –                |   |
| Total number           | 6 900            | –   |

**Table 2.** Canopy Cover

| <b>Mount Wood (29°20'S, 142°10'E)</b> |                                  | <b>Trig Hill (29°28'S, 142°11'E)</b> |                                  |
|---------------------------------------|----------------------------------|--------------------------------------|----------------------------------|
| Tall shrubs                           | 4%                               | Tall shrubs                          | 55%                              |
| Medium shrubs                         | 6%                               | Medium shrubs                        | 30%                              |
| <i>Grevillea kennedyana</i>           | 30%                              |                                      |                                  |
| Low chenopods                         | 60%                              | Low chenopods                        | 15%                              |
| Aspect                                | 0–360°                           | Aspect                               | 0–360°                           |
| slope                                 | 30–45°                           | slope                                | 45°                              |
| Surface                               | covering of large silcrete rocks | Surface                              | covering of large silcrete rocks |

Concentrations of *Grevillea kennedyana* occur where there is little or no other canopy cover and a sparse, low, chenopodiaceous cover between plants of *Grevillea kennedyana* (Table 2). Smaller populations are usually in clearings where trees and taller shrubs are absent. At Mount Wood where the shrub canopy cover is only 10%, *Grevillea kennedyana* cover is 30%. However, at Trig Hill, Mount Wood Hills, where *Grevillea kennedyana* is not present, the shrub canopy cover is 85%. Both Mount Wood and Trig Hill are designated Flat Top (land system series Sheet 54–7). The absence of *Grevillea kennedyana* plants from Trig Hill suggests that this high proportion of canopy cover may be a factor in habitat selection.

The region has low rainfall, 236 mm per year, with a peak in January when isolated summer storms are experienced (Figure 3). There are long periods without precipitation, but the rain that falls in summer is sometimes torrential, so that infrequent though these episodes are, the relative importance of running water as an agent to disperse seeds may be high. Although most larger populations are found on slopes, the frequently observed occurrence of smaller populations of *Grevillea kennedyana* along streams or drainage lines may reflect seed movement by water.

The main Grey Range is similar geologically to McDonalds Peak and Olive Downs escarpment – Tertiary sediment (*Geological Survey of NSW 1967*) – but the absence of *Grevillea kennedyana* from large sections of the Range is not explained (Figure 1). On the slopes of the main Range the underlying erodible material is exposed without a covering of larger rocks, indicating a possible correlation between the nature of the scree slope and the species occurrence. *Grevillea kennedyana* appears to be associated more frequently with slopes containing a higher proportion of rough silcrete scree.

### Ecology and management of *Grevillea kennedyana*

The ecology of *Grevillea kennedyana* involves episodes of drought and fire. Life expectancy of mature shrubs is unknown. Although branches greater than 12 cm in circumference are rarely seen, stems up to 20 cm have been observed. Generally, there is very little evidence of plant senescence. Though many *Grevillea* species are short-lived, some are long-lived. An individual of the tree species, *Grevillea striata*, a dense-wooded tree, at Poole's grave near Milparinka, just south-west of Sturt National Park, marked by Sturt in 1845, is still surviving nearly 150 years later.

Flowering occurs during winter and spring, becoming sporadic during drought. The pollinators are unknown, but flower size, red flowers and long styles suggest that it is likely to be bird-pollinated. *Grevillea kennedyana* does not appear to retain fruit or seed in the canopy for long periods after maturation. No fruits were observed during this survey. Regeneration is by seed or vegetatively. Maconochie (1982) suggests that on clay soils regeneration of many arid zone plant species is from seed, either stored in the ground or freshly fallen, and only occurs at irregular intervals under favourable conditions. Populations of *Grevillea kennedyana* consist of mixed size stands which probably relate to different ages. The most recent recruitment from seed would possibly have been after reasonable rain in 1988–89. Other years of regeneration could have been 1984, 1974–76. Resprouting or coppicing, the alternative regenerative method, may enable established individuals to survive and expand under stressed conditions. Observations indicate that *Grevillea kennedyana*, though it does not possess obvious storage organs, has the ability to resprout from adventitious buds in stems (branches), bases and roots. The ability to produce these buds has been observed in many desert plants (Kasses 1966). Stimulation of new growth can be caused by physical damage. Exposure and damage of roots and branches may be caused by macropods as *Grevillea kennedyana* clumps are favoured as rest pads.

The evolutionary significance of fire for Australian arid zone species is not adequately understood. The frequency, intensity and season of fires has radically altered in the last 100–150 years. Overgrazing by domesticated and feral animals, with increased grazing by macropods within the park, together with the predominance of *Atriplex vesicaria*, a species of low flammability (Hodgkinson 1982), has greatly reduced the

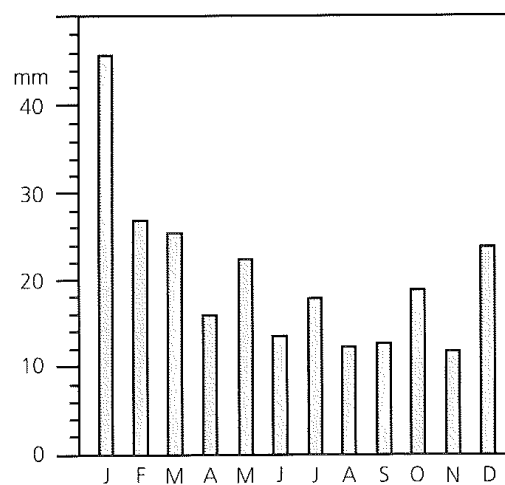


Figure 3. Average monthly rainfall (mm) for Tibooburra 1962–1991

frequency of fire. Since 1975 there have been no fires in the study areas (Mr R. Betts, pers. comm.).

The browsing pattern by animals may also have changed. In general, there is very little evidence of browsing on mature plants. Prior to 1973 all areas would have been grazed by sheep, which prefer chenopodiaceous species (Davey 1983). Since the formation of Sturt National Park and the subsequent removal of livestock, the numbers of Red Kangaroos (*Macropus rufus*) and the Euro (*M. robustus*) have increased. The major component of their diet is grass but in times of drought the Red Kangaroo has been recorded consuming sharp-spined *Sclerolaena* species (Davey 1983), so under severe drought conditions it is possible that *Grevillea kennedyana* may be browsed.

On the pastoral property of Onepah 30–40 plants of *Grevillea kennedyana* 10–12 cm high had numerous densely leaved shoots sprouting from single 1 cm diameter stems. A possible explanation is vegetative recovery after heavy browsing. Kangaroos and rabbits are present on the property but the main browsers are stock. Prior to 1989 sheep were the main animals but they have now been replaced by cattle. Similar reshooting plants were not observed within Sturt National Park.

The rabbit populations were drastically reduced subsequent to the 1950s and the introduction of myxomatosis, but numbers are again increasing. Rabbits are versatile feeders and the impact on regeneration of *Grevillea kennedyana* is unknown. Studies on *Acacia carnei* at Kinchega National Park demonstrated that rabbits graze not only on suckers or seedlings, but also chew roots (Benson 1991). To test the relative importance of rabbit and kangaroo grazing on the survival of young plants, wire cages would need to be erected to exclude either or both these animals. Although goats are a problem elsewhere in western New South Wales, currently they do not constitute a problem in Sturt National Park.

At present the population of *Grevillea kennedyana* does not appear to be threatened in the short term. The disjunct nature of the habitats tends to protect the species even though a local population catastrophe may occur. The majority of the populations are contained within Sturt National Park and are subject to strict conservation practice. With two mechanisms of regeneration, seed and vegetative reproduction, the species may cope adequately with the two major environmental influences of fire and drought. Plants appear to have the potential to live for decades. The absence of young seedlings suggests a possible long-term threat and the monitoring of study areas would indicate whether this is due to animal herbivory or seasonal conditions. Approximately 90% of the population of *Grevillea kennedyana* (over 6 000 plants) is in Sturt National Park and it would therefore appear appropriate to consider revising the conservation status from 2VCi (Briggs & Leigh) to 2VCa.

### Acknowledgements

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### References

- Benson, J. (1991) Beautiful but vanishing flora. *GEO* 13: 53–61.
- Briggs, J.D. & Leigh, J.H. (1988). *Rare or threatened Australian plants*. Special publication No. 14. (Australian National Parks and Wildlife Service: Canberra).
- Cunningham, G.M., Mulham, W.E., Milthorpe, P.L. & Leigh, J.H. (1981) *Plants of Western New South Wales*. (Government Printer: Sydney).
- Davey, K. (1983) Large kangaroos, in *Our arid environment*. (A.H. & A.W. Reed: Frenchs Forest).
- Geological survey of New South Wales (1967) 1:250 000, Milparinka SH 54–7. Division of Regional Geography. (Government Printer: Sydney).
- Hodgkinson, K.C. & Griffith, G.F. (1982) Adaptation of shrub species to fires, in Barker W.R. & Greenslade P.J.M. (eds) *Evolution of the flora and fauna of arid Australia*. (Peacock Publications: Frewville).
- Kassas, M. (1966) Plant life in deserts, in Hills E.S. (ed) *Arid lands, a geographical appraisal*. (Methuen, London/UNESCO, Paris).
- Maconochie, J.R. (1982) Regeneration of arid zone plants: a floristic survey, in Barker W.R. & Greenslade P.J.M. (eds) *Evolution of the flora and fauna of arid Australia*. (Peacock Publications: Frewville).
- Soil Conservation Service of NSW (1978) *Land system series sheet SH 54–7*. (Government Printer: Sydney).

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