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Woodland to Grassland: the future for the Top End

David Liddle works for Parks and Wildlife in a scientific role.

On Thursday 15 April, David spoke to a small group of members about the potential impact that the combination of exotic grasses and fire might have on the Top End environment.

As way of introduction, *Cycas armstrongii* is a local member of the cycad species. It can be found around Darwin, south to Hayes Creek, on the Cobourg peninsula and Tiwi islands.

Figure one: Still a Woodland!: cycads at Charles Darwin National Park

C. armgstrongii is distinctive plant, 2 to 4 metres tall, with a single stem often seen growing in stands. The straight trunk is covered by a rough dark gray bark often blackened by fire. Dark green fronds 50 to 100 cm long arise from the top of the stem. They are divided into numerous stiff, straight flat narrow leaflets. Often sharply pointed when mature the fronds are soft with velvety hair when young. Late in the wet season fallen brown fronds carpet the ground around the stem with new frond growth arises from the apex.

Female cycads have pendulous flattened hairy spikes with a triangular tip with sharp spines at the tip and along edges from which the fruit can be seen. These arise from the apex of the trunk. Fruits are hard smooth round 2 to 4 cm in diameter becoming red-brown when ripened, containing a single seed. Fruiting occurs March to September; later fruit can be seen scattered around the plant. The seed has been long used as bush flour by Aboriginal people but requires carefully washing and soaking to remove toxic chemicals. Male cycads have a single cone arising from the apex of the trunk typically 12 to 20 cm long, consisting of spirally arranged scales.

There has been much impact on the cycad environment in recent years. For example land clearance for plantation timber on the Tiwi Islands and around Darwin the urban development, mango farms and pasture development. Cycad leaves are also harvested by the floral industry for use in flower arrangements.

Exotic grasses such as Gamba and Mission grass play a role in environmental changes in several ways; through competition with native grasses and through the increased fuel load and the timing of when that fuel load is susceptible to burning. David estimates that the presence of Gamba grass within a woodland area may increase fuel load from 5 to 7 tonnes per hectare up to 20 tonnes per hectare.

Mission grass (*Pennisetum polystachion*) is a slender stemmed, tussocking perennial grass that grows to 3 metres. It has a propensity to grow in disturbed areas along the side of roads, neglected pastures and waste sites. It also displaces native grasses. Mission grass was introduced as a pasture species but proved unsuitable and now is a declared noxious weed. It remains green until late in the dry season thus providing additional fuel for late dry season hot fires.

Gamba grass (*Andopogon gayanus*) is taller growing up to 4 metres in height and more robust. It favours creek lines, flood plain fringe and *Eucalyptus* savannahs where rainfall exceeds 600 mm a year. It was also introduced as a pasture species, but becomes unpalatable to

stock when mature. Gamba grass forms dense stands, which greatly adds to the fuel load of dry season fires. Gamba grass is not a declared noxious weed, although there are many who would disagree with its official status.

David has collected data from select areas in Charles Darwin National Park. This area of bushland between Winnellie and the mangrove has been the responsibility of Parks and Wildlife since 1997. Its history includes storage of military munitions going back to the 1940's with heritage listed storage shelters still on site.

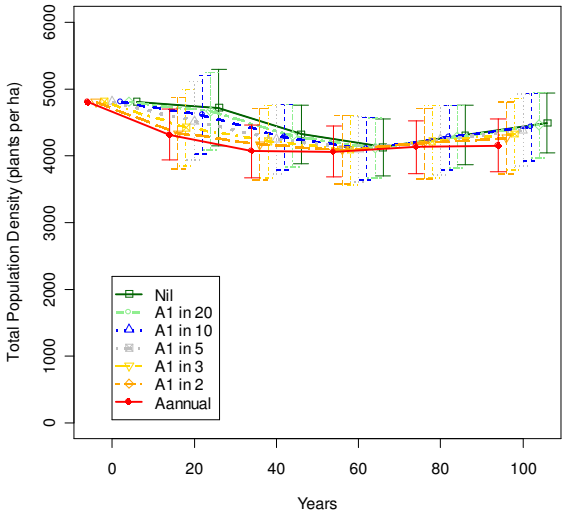
1997 was notable for a large bush fire in the area. Since 1998 different fire regimens have been used on various plots of land within the Park. These include no burning, annual burning, triennial burning and intensive burning using hay bales to represent the effect of exotic grasses.

Figure two: A "cool" fire burning away undergrowth in the Top End.

David has observed that any fires will damage cycad stems and may even destroy stems but the plant may resprout the next wet season. The hotter the fire the more likely the plant will be killed. Cycads are long-lived and slow growing (3 to 5 cm per year). It is uncertain as to how long it will take for such resprouts to reach reproductive maturity.

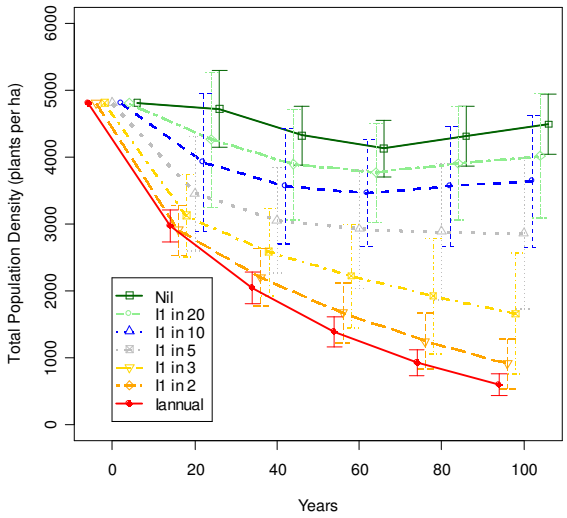
Using statistical modeling based upon collected data from field trips, David presented a series of graphs to illustrate his theories.

Figure three: Impact of ambient fuel fires.



The data presented in figure one reveals that with annual burning, the population of cycads is likely to remain stable over the 100 year period with populations densities never falling below 4000 plants per hectare. There appears to be little difference in the impact of fire frequency. Looking at graphs, which differentiated the plants into levels of maturing, such fires, not unexpectedly had the greatest impact on the young juvenile plants.

Figure four: Impact of intense fires



The modeling data presented in figure two reveals a much more dire problem for cycad populations. Here annual intense burning, such that may happen should Gamba or mission grasses become a feature of the environment, will reduce densities to less than 1000 plants per hectare. Even burning at a frequency of every 5 years appears to have a substantial effect upon cycads. Looking at the differential graphs, the impact is spread across the populations, with a much higher impact on the reproductively mature individuals than the less intense fires.

Figure five: Modeled Probability of Decline With Fire

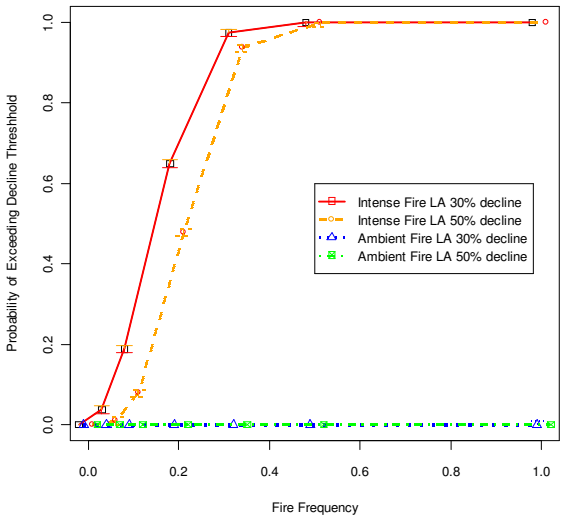


Figure three summarises the disparity between the impact of ambient versus high fire loads and the relationship to fire frequency. Thus it is evident that even with annual low intensity fires that the probability of exceeding decline threshold remains essentially nil. Whereas the probability of exceeding decline threshold reaches one, that is certainty, when intense fires occur every 5 years. Even with an intense burns every decade the probability of exceeding decline threshold is markedly increased.

It remains uncertain as to what is the critical number required to sustain the population of cycads. However as numbers fall, the loss of genetic diversity is likely to lead to inbreeding and adversely affect reproduction.

Table one: Death of woody plants following the different fire regimens.

	Nil	Ambient	Intense
Ironwood (Erythrophleum chlorostachys)	0%	75%	89%
Woollybutt (Eucalyptus miniata)	0%	8%	11%
Stringybark (Eucalytpus tetradonta)	0%	14%	30%
Cocky Apple (Planchonia careya)	0%	32%	94%
Billy Goat Plum (Terminalia ferdinandiana)	0%	11%	100%

Table one shows that cycads are not alone when it comes to being impacted upon by intense fires. Some species have great susceptibility to fire; for example, of the five species described only the Eucalypts appeared to be spared during the intense fires. Of note the Billy goat plum seems to be well adapted to ambient fuel load fires with a loss in a similar percentage to the Eucalypts in these cooler fires.

David concluded that fires that occur once Gamba or Mission grasses become established tend to be hotter because of the fuel load. And thus these hotter fires have the potential to destroy all wood plants including cycads and over time grasslands will replace our tropical woodland. It doesn't take much to consider the impact of this on bird and animal life, potential for soil erosion and affect on river ecology and impact on air quality and our own health.

By Mark Raines with illustrations courtesy of David Liddle

Additional information

Brock J. Top End Native Plants 1988 John Brock. Darwin.

Smith NM Weeds of the wet/dry tropics of Australia. Environment Centre NT Inc. Darwin 2002