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Fire Resistance in a Queensland Livistona

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Palms demonstrate an amazing ability to survive harsh conditions in nature. I've seen photographs of *Trachycarpus fortunei* lumbering under snow in the foothills of the Himalayas, and of *Medemia argun* roasting in the heat and drought of the Sudan Desert. The most extreme treatment nature can offer—fire—spells doom to most life forms, yet there are palms that can survive even this.

Last October I visited the Cooktown area of North Queensland, hoping to see an undescribed *Livistona* species in habitat. With only vague instructions that it was "locally common near the town," I set out down some dirt roads in a rented 4WD. Initially I made the mistake of looking in creek bottoms and in damp areas, which is where most east coast *Livistona* can be found. Coming up empty, and becoming increasingly frustrated, I was ready to give up, and started heading back to Cairns. Driving on Barrett's Creek Road, just behind the airfield, I spotted a young fan palm by the roadside, and with a feeling of "Eureka!" I thought I'd found it.

Scattered here and there in the midst of dry, open eucalypt forest were many specimens of *Livistona,* with heights to 4–5 m. I had thought they were the undescribed species, but later they proved to be *L. muelleri.* The land appeared to be vacant crown land, although much of the area surrounding Cooktown is used for cattle grazing.

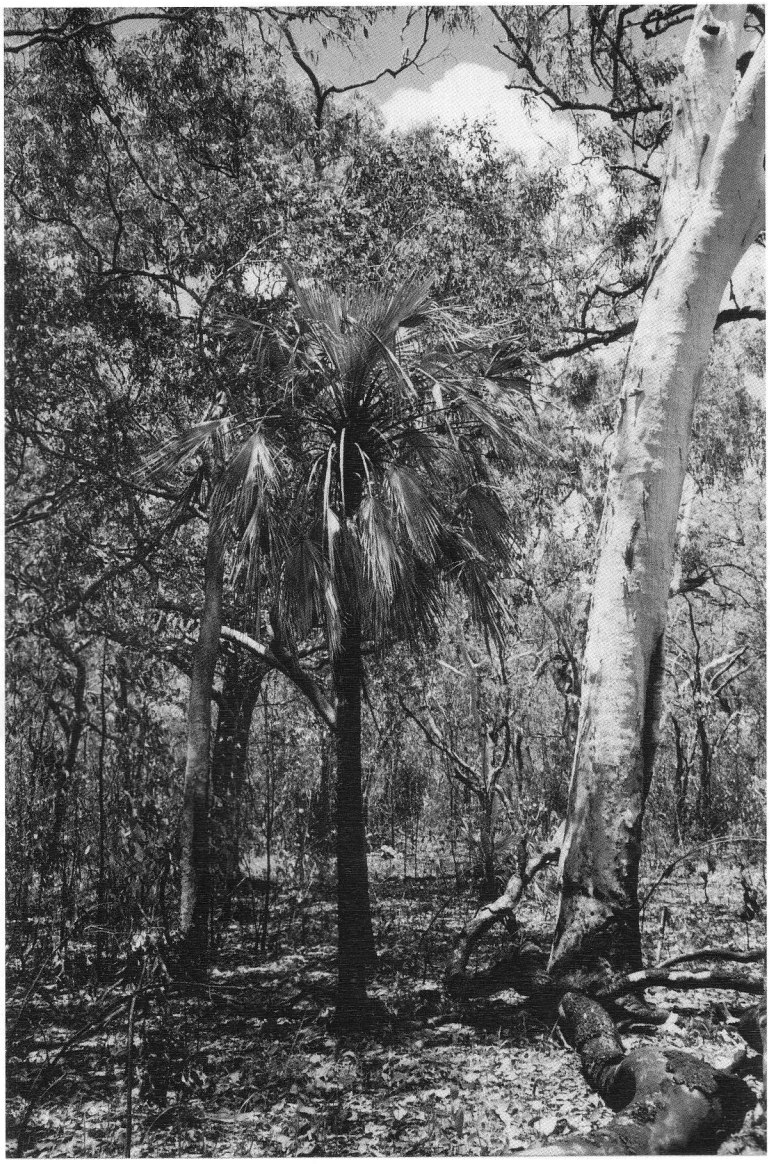
What struck me was that nearly the entire area, as far as the eye could see, had been burnt by bushfire only a couple of months earlier. It was late in the dry season, with little or no rainfall recently, and there was a near-total absence of undergrowth. The ground was stiff and crunchy to walk on, with hardly a blade of grass in sight. In fact, the only green to be seen was the leaves of some eucalypts, and in the palms themselves. The trunks of the older palms were blackened, their crowns surrounded by a ring of scorched fronds. Yet the tops of the crowns themselves showed lush, new growth (Fig. 1).

Even more striking was that young plants, some under a meter tall and still trunkless, were also still alive, having survived total engulfment in flames (Fig. 2). The *Livistona* has evidently evolved a durable, fire-resistant trunk, which is thick enough to protect the growing point from the intense but short-lived heat of the fire.

Palms are monocotyledons; their trunks do not have true bark, normally an easily damaged vital zone in dicotyledonous trees. They lack a cambium, the thin formative layer between the xylem and phloem that gives rise to new cells and permits secondary growth. While this means mature palms cannot grow significantly in girth once their trunks are formed, it does give them a clear advantage when it comes to fire. As long as the growing point remains undamaged, well protected as it is at the apex of the palm by layers of developing leaf sheaths, partial damage to the stem is not necessarily fatal.

Bush fires are a major factor in the ecology of many parts of Australia. Human activities in the last few thousand years of settlement have only increased the frequency of what was already a natural occurrence. The drier parts of the interior, and those parts of the North with a pronounced dry season (such as Cooktown) are at serious risk of fire, and many species of plants have adapted to it. For example, next to one palm was a blackened specimen of *Cycas media* (Fig. 3). In 1991 I had seen burnt, lifeless trunks of this cycad near Cardwell and assumed they were killed by fire. However, I found them alive and well some months later, with large flushes of new leaves.

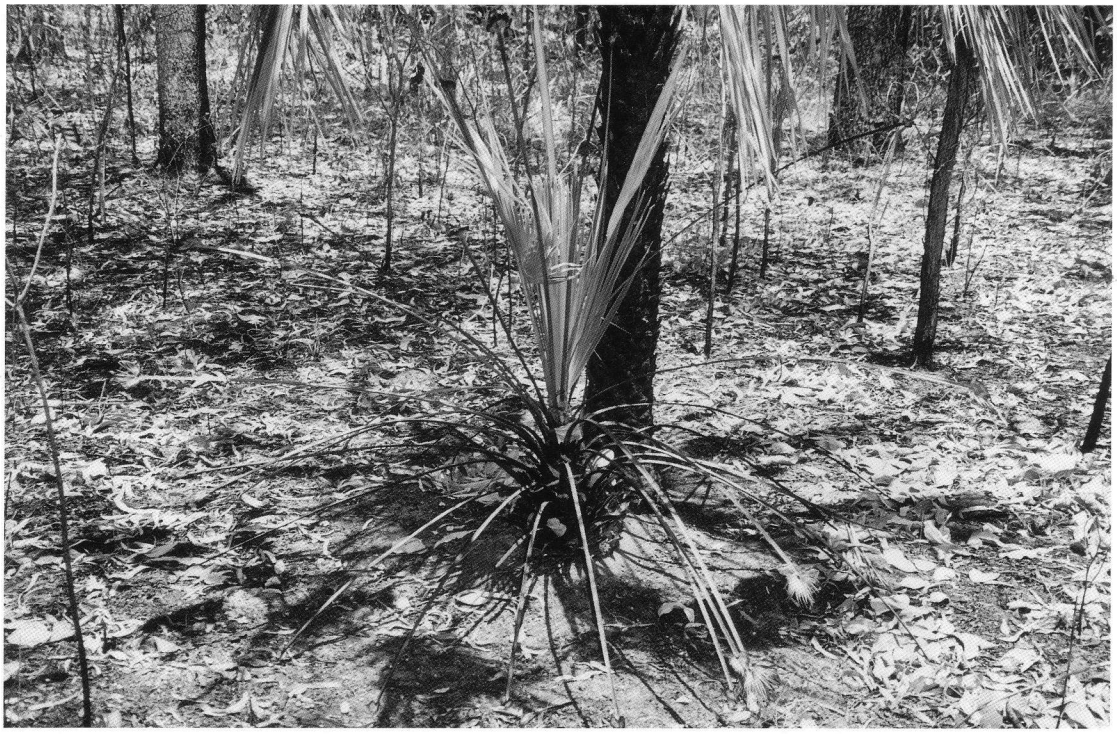
In January 1998 I had the interesting (and terrifying) experience of seeing a bushfire up close, when my own home on the outskirts of Melbourne was threatened by a fire only a few hundred me-



1. *Livistona muelleri,* new growth emerging after recent fire.

ters away in the bushland behind my property. It too is mainly grassland with a few eucalypts. With high temperatures (40°C/104°F) and a strong wind, the fire front moved rapidly through the dry grass, moving as fast as a person can walk. At any one spot, the fire burned for only a few seconds, then moved on, leaving only smoking black ashes. Occasionally the larger trees burst spectacularly into flames, but even these were out in a minute or two, as their foliage and smaller branches burnt off. Some trees were killed outright, but most of the larger eucalypts were unharmed, and grew new leaves within a couple of months.

Fire is responsible for the continuation of many plant communities in Australia. In the ranges near Melbourne, the towering Mountain Ash (*Eucalyptus regnans*) holds on to its seed capsules for years, until fire cracks them open; they germinate within a week on the now-uncrowded forest floor. In South West Australia, "mallee" eucalypts form multiple trunks from a



2. *Livistona muelleri,* new growth emerging after recent fire.

3. Fire-blackened *Livistona*; to its right, a singed *Cycas media* trunk.

4. A thriving specimen in an unburnt area.

massive root stock. These can all be burnt without killing the tree; new stems rapidly sprout from a ring of stout buds. Bottlebrushes (*Callistemon* spp.) will not shed seed until there is a fire; likewise the woody seed capsules of some *Banksias* will not open except in the intense heat of a fire. Grass trees (*Xanthorrhoea* sp.), common in dry areas, are helped in a different way by fire. The great quantities of ethylene gas released by burning vegetation is believed to be a trigger for the appearance of its flower spike (Attenborough 1995).

John Dowe, who helped me identify the correct species at Barrett's Creek, believes that 30% of the world's palm species are adapted to fire, including all of the Australian *Livistona*. He considers that rather than being a destructive element, for many species fire is beneficial, and a primary factor in the maintenance of populations. Benefits are realized from the reduction in competition from grasses in open forest habitats, and the temporarily increased soil nutrient levels.

With the benefits come the obvious lethal ef-

fects on regeneration of the palms. At the Barrett's Creek site I could find no trace of fallen seed beneath any of the trees, nor any seedlings under the age of at least four years. (Interestingly, there were a large number of one-leaf seedlings of the *Cycas* present.) For a population to regenerate, it would seem that several fire-free seasons must pass for the palm seedlings to become sufficiently established and reach an adequate size to survive a fire. Fruiting of most *Livistona* in northern Australia occurs in the wet season, around December to March, with germination taking place late in this period. As fires occur from the middle to the end of the dry season, most surface seeds would by then have become unviable due to predation, rot, or desiccation. Only those that survive and enter the upper soil layer would receive adequate protection from the typical low-intensity fires that characterize tropical monsoonal Australia.

Palms in other parts of the world have also had to adapt to fire. The Cerrado of Brazil is open woodland scrub or savannah that is subject of burning. Many palms growing there are remarkable for their ability to survive fire. Most of these have acaulescent, deep subterranean stems which initially grow deep into the soil and not upwards. Palms of the Cerrado include *Allagoptera campestris, Syagrus petraea,* and *Acrocomia* sp. In the southeastern USA, *Serenoa repens* is adapted to fire: plants can endure several hot fires before any noticeable decrease in vigor (Uhl and Dransfield 1987).

In the lowlands of western Madagascar, human activity has created palm savannahs. Fire-resistant fan palms *Bismarckia nobilis, Hyphaene coriacea, Borassus madagascariensis,* and *B. sambiranensis* survive in annually burned grassland, the only perennial woody plants that are capable of doing so (Dransfield and Beentje 1995).

Returning to the object of my original search in North Queensland, I never did locate any specimens of the so-called Cooktown *Livistona,* though it is indeed present near the town. It is very different in appearance from *L. muelleri,* being taller (20–30 m) and having a large crown of deeply divided leaves with drooping (rather than stiff) leaf segments (Tucker 1987). Currently, John Dowe is describing it as part of a broader study of the genus in Australia.

As for *Livistona muelleri,* it is an attractive ornamental palm, having stiff, finely divided fan-shaped leaves, and a compact growing habit. On young plants the leaves are deeply divided. When unmolested by fire it develops a large head of upright bright green fronds (Fig. 4). It is capable of withstanding hot, dry conditions, and would seem ideal for such places as southern California or inland Australia. In my limited experience, it is reasonably cold-tolerant. I have several plants under four years old that have seen nights down to freezing with no apparent harm. Seed and plants can occasionally be purchased from suppliers around Cairns, but it is not a commonly cultivated species due to its slow growth rate.

While in Cooktown, I inquired about the local fan palms from a nurseryman. He said they were slow-growing plants (I assume he was referring to *L. muelleri*), and that he rarely sold any, as they were common enough for locals to simply dig one out of a nearby field. He advised that transplanting was not always successful, and far easier in the wet season than in the dry.

Human activity remains the principal threat to palms in Australia, mainly from loss of habitat due to development and the encroachment of the grazing and sugar industries. It is the attitude of some in Queensland that all land must be "used" for something, and cattle ranches can now be found even in the remotest and driest areas. Fortunately, *L. muelleri* is still a common palm with a wide distribution; its natural range extends from just south of Innisfail to the top of the Cape York peninsula (Irvine 1984), and can easily be seen in undeveloped land just north of the city of Cairns. It certainly deserves both our admiration and protection as a truly remarkable survivor.

Acknowledgments

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