

Cyclone Larry

by Nigel Tucker, Jeff Middleton and Kris Kupsch (Biotropica Australia)

As tropical forest scientist Mike Hopkins once wrote, 'disturbance is the forest transformer'. No ecosystem on Earth is unaffected by disturbance; it is one of the major drivers of the ongoing evolution of all species. In fact, the "intermediate disturbance hypothesis" proposes that biodiversity is highest when disturbance is neither too great nor too small. Try to imagine a forest where no leaves or trees fall, where streams remain forever fixed and unaffected by flooding, and animals and plants remain static in space and time. This is the road to an evolutionary abyss. Natural disturbance is part of Darwinian evolution, the selection of individuals with superior ability to recover and persist. In fact, cyclonic disturbance in north Queensland is a bit like the evolutionary process itself - as Steven Jay Gould once described it... "like the life of a soldier - long periods of boredom interspersed with short periods of terror". Sifting and sorting the survivors of this brief terror is going on as you read this article.

For the forests between Cairns, Tully and surrounding hinterland, Cyclone Larry was not a much stronger cyclonic event than has been experienced in many decades. Damage can be attributed to two main factors: the strength of the core winds generated, and the highly fragmented nature of our vegetation due to historical clearing. These elements combined to produce a wide range of responses from many species, varying from 'ho-hum' to 'what the ??'. This article seeks to describe these responses, in particular those exhibited by individual plant species. It should be recognized that these responses are likely to vary considerably throughout the region depending on the degree of disturbance experienced.

Birds have exhibited some of the most conspicuous behaviours. Many species have changed their typically foraging behaviours and distribution in response to the sudden and almost complete loss of their preferred food resources. Birds commonly associated with the forest interior have been observed foraging along edges and even in urban gardens. The pressure to forage over larger areas has brought many birds into closer human contact. For cassowaries this has been particularly catastrophic with ten birds killed in the Mission Beach area since the cyclone. 'A fed bird is a dead bird' is a truthful axiom, and the urge to hand feed birds should be ignored.

Surprisingly, arboreal leaf-eating mammals appear to have survived the direct impact of Cyclone Larry but how they will persist over time is more uncertain with the forest stripped bare in many areas. All the possums, including Lemuroid, Green and Herbert River Ringtails and Striped Possums have been recorded in heavily damaged forests in the Maalan area in similar numbers to before the cyclone, and there are reports of Tree Kangaroos from around Atherton. Like the birds, many mammal species are likely to be experiencing severe food shortages and are moving into human dwellings and gardens. The urge to hand feed these animals (however cute) should also be ignored.

The response by insects has been interesting. Stick insects and praying mantids disappeared overnight, and they remain absent in (damaged) lowland environments where

they usually linger longer through winter. By comparison, populations of many flies and ants literally exploded, particularly the very small species. In the Palmerston area, the regular suite of night time autumn moths disappeared. One species from the family Noctuidae that has never been previously seen in the area has occurred in plague numbers.

Trees have also shown a range of responses to the cyclone. Some generalized observations are listed below (Table 1).

Table 1. Some generalized tree responses to Cyclone Larry

Local native species	See Table 2 below for examples	Better performed
Non-local natives	Tallow wood, Southern Silky Oak	Many snapped
Exotic species (excl. fruit trees)	Caribbean Pine	Poorly performed
Fast growing native species	Sarsaparilla, Wattle	Mostly snapped
Slow growing native species	Tulip Oak	Best performed

Some species managed to withstand even the strongest winds. Tropical Ash (*Flindersia schottiana*) takes the prize as the most wind-resistant tree in north Qld. In Mission Beach, Innisfail and East Palmerston, we found this species to be the least affected (in Kris's words - 'they didn't lose a leaf!'). Other damage-resistant species are listed below (Table 2).

Table 2. Damage-resistant native tree species

Scientific name	Common name	Comment
<i>Agathis robusta</i>	Kauri Pine	Young trees are susceptible; however old trees only lost occasional limbs. Exposed conditions increased threat
<i>Alstonia scholaris</i>	Milky Pine	Limbs may blow off however trunk is very sturdy
<i>Archontophoenix alexandrae</i>	Palms	All slender Palms are very tolerant of strong winds
<i>Argyrodendron</i> spp.	Tulip Oaks	Only limbs lost
<i>Barringtonia calyptrata</i>	Mango Pine	Good tolerance, quick resprout of leaves
<i>Callistemon viminalis</i>	Red Bottle Brush	Moderately tolerant due to squat stature
<i>Calophyllum inophyllum</i>	Beach Touriga	Extremely tolerant
<i>Castanospermum australe</i>	Black Bean	Limbs may break however trunk is very stable
<i>Cordyline</i> spp.	Palm Lilies	Very tolerant of strong winds
<i>Cryptocarya hypospodia</i>	Northern Laurel	Minimal loss of foliage, branches or trunk

<i>Cyathea</i> spp.	Tree Ferns	<i>C. cooperi</i> , fronds destroyed however trunk very tolerant
<i>Elaeocarpus grandis</i>	Blue Quandong	Some damage however main trunk persists
<i>Ficus virens, septica, congesta, hispida, microcarpa, drupacea</i>	Figs	Most <i>Ficus</i> are very sturdy
<i>Flindersia</i> spp.	Hickory & Maples	<i>F. schottiana</i> especially immune
<i>Glochidion sumatranum</i>	Umbrella Cheese Tree	Leaves shredded however most branches remain
<i>Nauclea orientalis</i>	Leichardt Tree	Limbs damaged however trunk persists well
<i>Pandanus</i> spp.	Pandanus	All <i>Pandanus</i> species tolerated cyclonic winds
<i>Schefflera actinophylla</i>	Umbrella Tree	Leaves blown off however stems are very flexible
<i>Scolopia braunii</i>	Flintwood	Minimal damage to foliage, branches or trunks
<i>Syzygium</i> spp.	Lillipilli/Satinash	<i>Syzygium</i> and <i>Acmena</i> genera showed tolerance of strong winds
<i>Terminalia catappa</i>	Sea Almond	Leaves are shredded however main trunks remain intact
<i>Xanthostemon chrysanthus</i>	Golden Penda	Very tolerant
<i>Xanthostemon whitei</i>	Hairy Penda	Very tolerant

The severe loss of canopy cover (e.g. forest cover along Sutties Gap Rd near Millaa Millaa declined from 92-96% to 30-50%) has greatly increased the amount of light reaching the forest floor which is likely to have profound effects on many ecological processes, particularly the timing of flowering. Species such as *Brombya platynema*, *Medicosma sessiliflora*, and *Pullea stutzeri* flowered very heavily suggesting their life history traits have been positively influenced by disturbance. Over the past two decades heavy flowerings have been recorded for the Hairy Penda which all corresponded with cyclone events (1986, 1997, 1998 and 1999). In other years flowerings have been very rare and small. This year, Hairy Penda produced one of the largest flowerings in memory; strongly suggesting that, for this species, cyclones are a welcome event. A possible explanation for this is that, when the Hairy Penda seeds fall next January the increased light levels in the forest would benefit the germination of its very small seeds which don't germinate within the shade of the forest.

The other clear effect was the heavy damage inflicted along forest edges and in large gaps. Wind penetration and resulting tree fall is always greater along forest edges compared to forest interiors. The cyclone has dramatically demonstrated this particularly around the edges of fragments that are surrounded by farmland. Likewise, narrow stream bank plantings (e.g., 10-20 metres wide) have been more damaged than wider (e.g., 50 metres wide) plantings, where there is lower ratio of 'edge' to 'interior' habitat. One of the biggest challenges will be to manage weeds within plantings and narrow fragments. Many smaller plantings will be overwhelmed unless landholders manage weed invasion.

The cyclone has clearly demonstrated that there are winners and losers. The unanswered question is whether or not this cyclone was the 'one every century' event, or whether it marks the beginning of a period of more intense cyclone activity brought on by climate change as suggested by recent work by Professor John Nott from James Cook University. Records of cyclone activity obtained from bands laid down in stalagmites from Chillagoe caves covering the last 3500 years, suggest that we are overdue for an increase in cyclone activity. If severe cyclones occur more frequently, there are likely to be rapid and long-lasting changes in forest structure. Larger forest blocks may be more resilient to these changes than smaller forest remnants which is of particular concern for the management of endangered forest types such as the highly fragmented Mabi forests.

More immediately there is a need to ensure plantings near infrastructure such as electricity lines are more carefully considered by landholders. Thankfully the days of the Caribbean Pine and Tallow-woods on the Tablelands appear numbered and for this we should all be truly grateful.

Stop press: Nigel Tucker reports that mantids reappeared both on the lowlands and the uplands in the first week of July.