

LESSONS FROM CYCLONE LARRY

Nearly three years after Cyclone Larry cut a swathe through the town of Innisfail and the tropical rainforests of Far North Queensland, the landscape is recovering. But what lessons have been learnt for future management?

Severe Tropical Cyclone Larry, with maximum wind gusts near 240 km per hour, crossed the coast near Innisfail as a category 4 storm on 20 March 2006, causing extensive damage across a 100-km strip of coastal lowlands and nearby uplands and producing patches of catastrophic forest damage.

Larry was the most severe cyclone to descend on the Wet Tropics bioregion since a devastating (unnamed) cyclone hit Innisfail in 1918. It was a very 'compact' system with maximum winds extending in a 30-km radius from the centre and was followed one

measured impacts on wildlife and monitored the recovery of terrestrial ecosystems.

Director of the joint venture, Professor Steve Turton, says the most striking natural resource management lesson from Larry was that a more resilient landscape has a better chance of withstanding cyclone impacts and recovering faster.

Forest damage in the storm's aftermath was patchy, with many areas remaining intact despite being close to the centre of the cyclone. These areas became important refuges for many animals while nearby areas of damaged forest recovered.

Fragmented forest effects

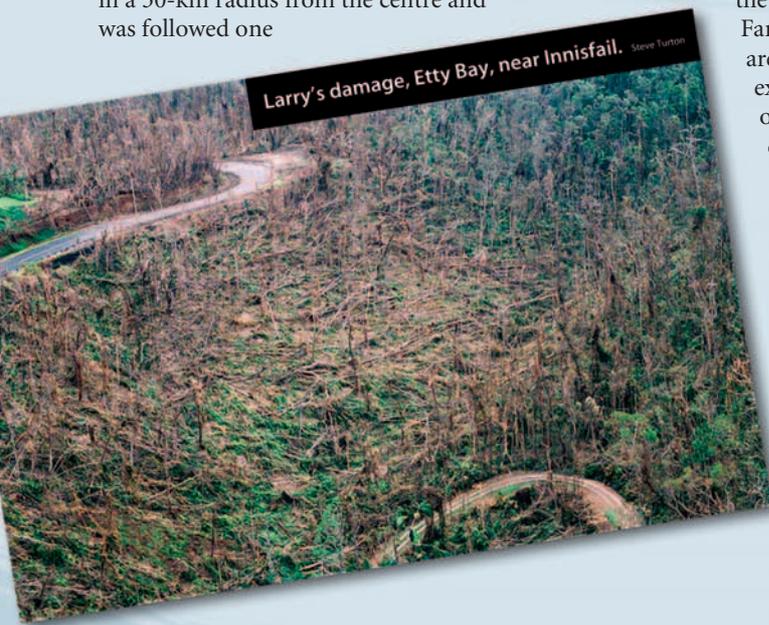
Although cyclones are part of the ecosystem dynamics of tropical rainforests, the coastal rainforests of Far North Queensland are mostly fragmented, existing between areas of farmland and urban development. This

A year on, in both small and larger forest fragments, it was clear that the cyclone had increased the variability of plant species' responses to the disturbance. Some were doing better than others.

Thin riparian vegetation (beside rivers and streams) was particularly prone to serious degradation by Cyclone Larry, exacerbating water quality and erosion risks in post-cyclonic flooding. Healthy native vegetation now needs to be restored along the region's rivers.

Effects on wildlife

The population numbers of five species of leaf-eating marsupials in fragmented forests remained stable six to eight months after the cyclone compared with pre-cyclone estimates. Numbers of fruit-eating birds, which were much reduced two weeks after the cyclone in severely affected forest fragments, had returned to pre-cyclone levels by seven months after the cyclone. This excludes the majestic cassowary, which suffered



Larry's damage, Ettty Bay, near Innisfail. Steve Turton



Flattened banana trees near Innisfail. Queensland EPA



Stripped interconnector

month later by another severe cyclone – Monica. Monica inflicted considerable damage on the tropical savanna ecosystems in the Top End of the Northern Territory. Long-term data sets from the tropical landscapes affected by these two cyclones gave ecologists a unique opportunity to measure their impact and how well the ecosystems recovered.

A James Cook University and CSIRO Tropical Landscapes joint venture assessed the ecological impacts of Cyclone Larry, particularly on fragmented forests. Using field surveys and remote sensing, the researchers mapped canopy damage,

makes them much more vulnerable to cyclones' energy.

Forest structure impacts, measured up to six months after Larry, did not differ between small (less than 40 hectares) fragments and larger forested areas on the Atherton Tablelands, north-west of Innisfail. The severity of effects in both was determined, again, by distance from the cyclone's eye, suggesting that there are interactions between forest fragmentation and the physical dynamics of tropical cyclones that require further study.

a significant decline due to direct deaths and displacement (see box).

The flying foxes (*Pteropus conspicillatus*) which used to roost in large camps before the cyclone hit, altered their roosting behaviour to form many small camps.

As a result of global warming, tropical cyclones are expected to become more severe although their overall frequency is predicted to remain the same. Two factors that contribute to more intense tropical cyclones – ocean heat content and water

Being casso-way on the coast

Fragmented rainforest on the coast and Atherton Tablelands provides critical habitats for rare and endangered species such as cassowaries, mahogany gliders and tree-kangaroos. While areas of forest with a critical mass are recovering well from Cyclone Larry, a lack of effective corridors between fragments has given these rare animals fewer recovery options.

Thirty-five per cent of cassowary populations were killed directly during Cyclone Larry, but those that survived and ventured beyond the fragments suffered even higher mortality – struck by cars or attacked by dogs.

Queensland Parks and Wildlife Service (QPWS) confirmed that 23 cassowaries had been killed since Cyclone Larry, most of them hit by cars. QPWS then instigated a cassowary feeding and relocation program that proved controversial in the local community, with some people arguing that both feeding and relocation raised the level of threat to the birds.

A number of studies have recommended local area biodiversity planning as the best way to achieve cassowary conservation on the 'Cassowary Coast', especially at Mission Beach.

Terrain NRM and CSIRO are working with the Mission Beach community to develop

and implement the Mission Beach Habitat Network Action Plan. Terrain NRM has written to private owners of habitat linkages, offering incentives for continued cassowary habitat and corridor conservation.

Terrain's Chief Executive Officer, Dr Allan Dale, said the incentives could include money to formally protect existing habitat or corridors (e.g. through a covenant) or provision of a skilled work crew to help restore areas on their properties.

'A small revegetation project might receive a few thousand dollars, whereas a perpetual conservation covenant might receive substantially more funds,' Dr Dale said.

Other strategies being investigated include cassowary road crossings, better bike paths and lower speed limits. The draft Mission Beach Habitat Network Action Plan will be released for public comment in early 2009.

Substantial investment is required to ensure survival of the cassowary on the 'Cassowary Coast'.

In January CSIRO Sustainable Ecosystems launched a new technique that identifies DNA in dung which will improve the confidence of population estimates made across the Cassowary's entire range. The DNA gives information on the sex, age and



Queensland's cassowaries, already under habitat pressure, had their resilience further weakened after Cyclone Larry displaced them, causing traffic collisions and dog attacks. David Cook, Rainforest Rescue

family group, which then will help inform management plans for the vulnerable bird in Far North Queensland.

The organisation Rainforest Rescue recently reported that local research (by Les Moore) suggests population estimates of cassowaries in Mission Beach and other locations may have been overestimated by six times the real number because of small survey areas.

Mission Beach Habitat Network Action Plan, see www.terrain.org.au

DNA cassowary identification, see www.csiro.au/science/Cassowary-management.html



ecting forest. Steve Turton



An adult male cassowary. David Cook, Rainforest Rescue



Damaged parks infrastructure. Steve Turton

vapour – have both increased over the past several decades.

An increase in the severity of tropical cyclones will tend to favour plant species more resistant to strong winds, such as palms, and those more tolerant of post-disturbance environmental stresses, such as pioneer species, vines and weeds.

Professor Turton says that securing landscape resilience to cyclonic events in the Wet Tropics bioregion means focusing natural resource management investments in six key areas: landscape connectivity, river repair, protecting coastal assets, cyclone resilient farms, education and avoiding climate change.

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More information:

Turton SM (Ed.) (2008) Ecological impacts of tropical cyclones on Australian terrestrial ecosystems: insights from Cyclones Larry and Monica. *Austral Ecology* 33(4), 365–584 [Special issue].