



Why road ecology?

“Quaid Road”



Obviously appalling design & the opposite of best practice construction methods. But it certainly brought impacts of rainforest roads to the forefront.

Kuranda Range, Kennedy Highway



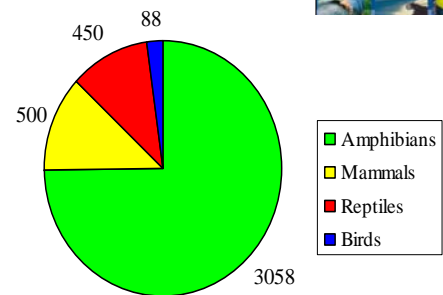
Mortality Methodology



- Four 0.5km rainforest transects,
2 with many curves and slower traffic speeds,
2 much straighter with faster traffic
- Surveyed weekly for 38 months by walking
- Road Factors surveyed:
clearing width: 10-28m, road surface: 8-12m
microtopography : cutting, steep slope,
creek, gully, flat area
degree of curvature i.e traffic speed
traffic volume, sight distance
- weather - temperature, rainfall etc



Mortality statistics



- more than 4,000 vertebrates in 38 months/ 2 km
- >3000 amphibians, 450 reptiles, 500 mammals



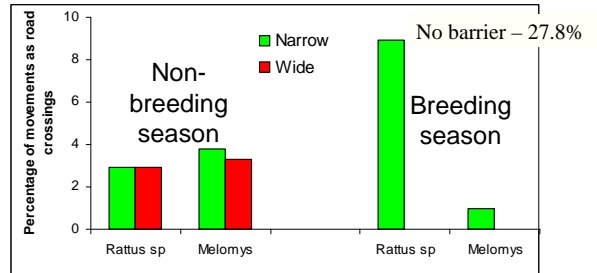


- Topographic effects – more road deaths near creeks and gullies
- Clearing width effects – more deaths on narrow road sections
- Seasonal, year (population) effects
- Traffic speed impacts

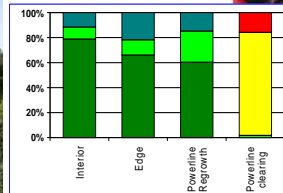


Barrier Effects – 12 & 20 m wide unsealed road – 1-5 cars/day

Road Crossings as Percentage of Movements



Significant barrier effects, compared with expected 27.8% crossing, Significant width effects for *Rattus* in breeding season



No movements across 60m grassland swathe
No problem where gullies had rainforest regrowth



Research Fellow studies:

- Variety of small and arboreal mammal projects, traffic counters funded by WTMA for 2 years
- Rainforest CRC road and powerline clearing ecology studies – 5 years – reveg monitoring, hotspot ID
- BACI monitoring of Atherton Tableland underpasses funded by QDMR
- Variety of projects concerning Kuranda Range upgrade funded by QDMR over 3 years e.g. road mortality, canopy bridges, traffic noise and headlight impacts
- Graduate student and postdoc funded by Powerlink





Southern Cassowary



Lumholtz's Tree-kangaroo



Assessing Adverse Impacts



Impacts of Kuranda Range road on habitat connectivity, firstly for current road, then current road with expected traffic in 10 years and finally new design:

Several species groups each including threatened species chosen as representative of potential users of connections

- 1) Arboreal mammals require canopy connectivity
- 2) Southern Cassowary and larger macropods – require relatively high clearance under bridges – at least 3 m
- 3) Smaller mammals, lizards etc require less clearance >1m
- 4) Aquatic species/frogs require stream connectivity without culvert barriers



- Because the design David showed has many more potential crossings than the current road (only about 2 reasonably sized culverts, one of which is always wet), the new design was a net gain.
- Further collaboration improved permeability of the road design by including another underpass, considering impacts of culvert removal to improve fish passage, encouraging top-down construction etc



- On the other hand, the assessment of habitat demonstrated a net loss of several hectares
- Most other biodiversity and habitat indicators showed gains or neutral effects
- The current highway poses a severe barrier to many rainforest species and results in high levels of road kill
- Position in the landscape - the highway divides the only rainforest connection between upland areas of high endemism – a genetic overlap zone
- Therefore the increase in connectivity was thought to outweigh the habitat loss.
- However, all design principles that could decrease the area lost were applied – a successful collaboration

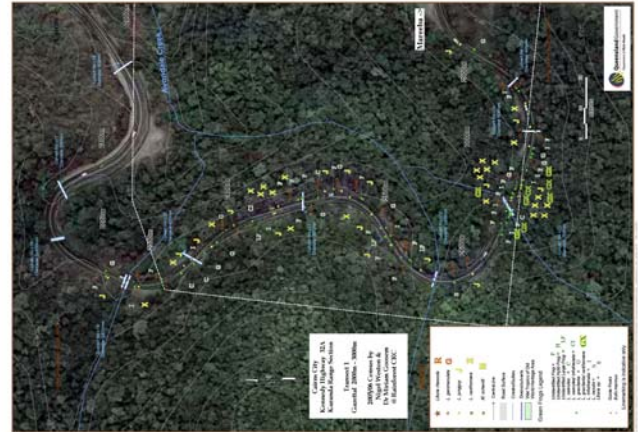


Further Research Undertaken



During the process, several knowledge gaps requiring further research were recognised and projects initiated:

- Impacts of traffic noise on rainforest wildlife
- Impacts of headlights and streetlighting
- Road mortality data update
- Uncertainty regarding whether specialised rainforest arboreal fauna would use much longer canopy bridges than had previously been trialled
- Ability of bridge designs to allow continued growth of rainforest canopy and understorey beneath
- Revegetation techniques for gabions and other structures minimising clearing width in the design



Lumholtz's tree-kangaroo



Community roadkill data

205 road-killed tree-kangaroos

Mainly killed early in morning

Mainly dispersing sub-adult males



Potential Corridors for Tree-kangaroos:

- location of preferable habitat patches
- location of riparian and remnant vegetation patches to aid in vegetation connections
- distribution of tree-kangaroo sightings in cleared areas

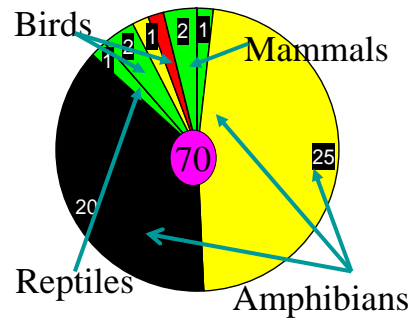


Underpasses with furniture

- 1) Soil, rocks and logs for cover
- 2) Tree trunks and branches for escape from predators
- 3) ropes for arboreal species



Revegetation corridors 3 yrs after planting

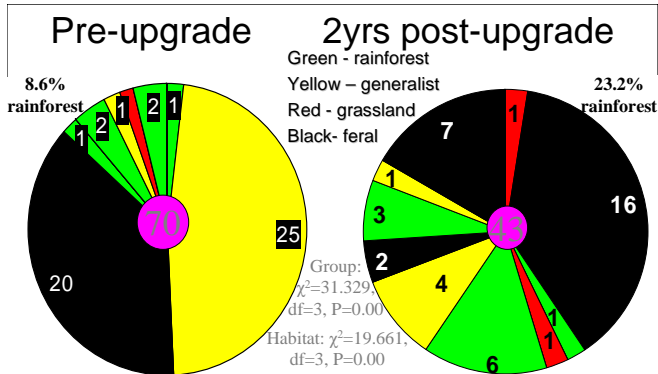


Roadkill 12 months prior to upgrade

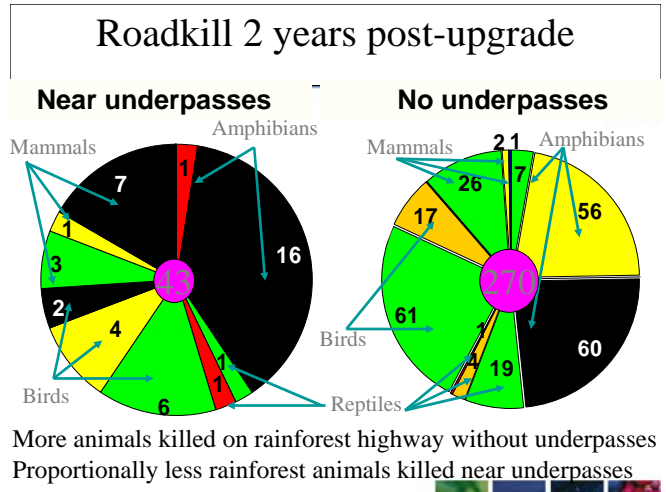
- Green - rainforest
- Yellow - generalist
- Red - grassland
- Black - feral

Before upgrade, roadkill mostly generalist species, feral amphibians, + a few other rainforest vertebrates





- Less animals killed after underpass installation.
- Increase in proportion of rainforest species killed, although no significant change in numbers.



Fauna using underpasses

More monitoring required
At least until regular use by target species is established, preferably more population studies

Species	Count
bandicoots	237
red-legged pademelon	233
brush-tail possum	104
rodents	53
brush turkey	12
feral cat	21
humans	13
dog or dingo	50
other birds	13

2 individual tree-roos
1 cassowary attempt

Maintenance of structures should form part of the road project!

Mission Beach Road Underpasses

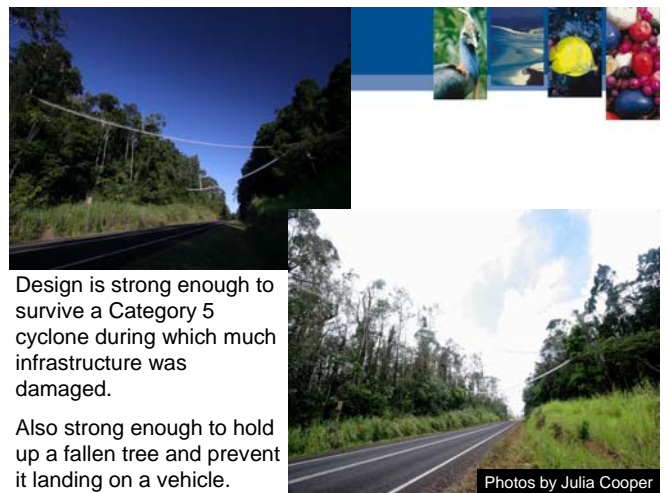
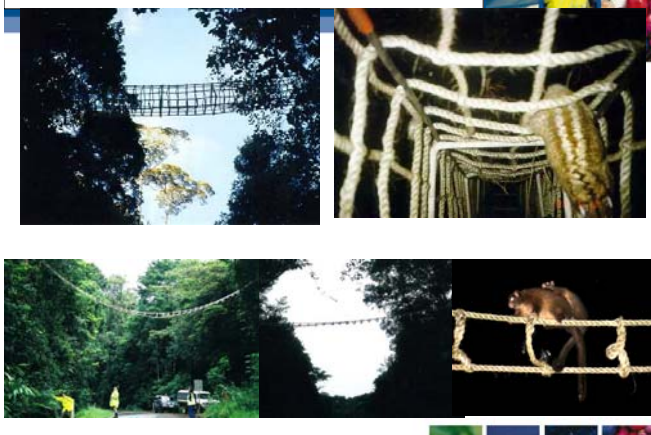


However:
High bridges
are used as
underpasses

Traffic Counter – Speed information

- Data from traffic counters show speeds up to 130 km/hr in the 80 km/hr legislated speed zone
- Speeds are high during peak hour traffic in morning and afternoon i.e. the locals travelling to work
- Signs attract tourists and traffic between peak hours tends not to travel as fast as peak hour traffic

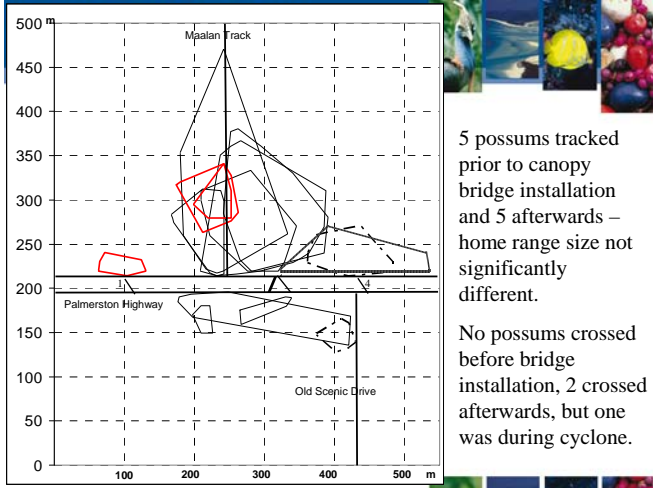
Rope Bridge Overpasses



Design is strong enough to survive a Category 5 cyclone during which much infrastructure was damaged.

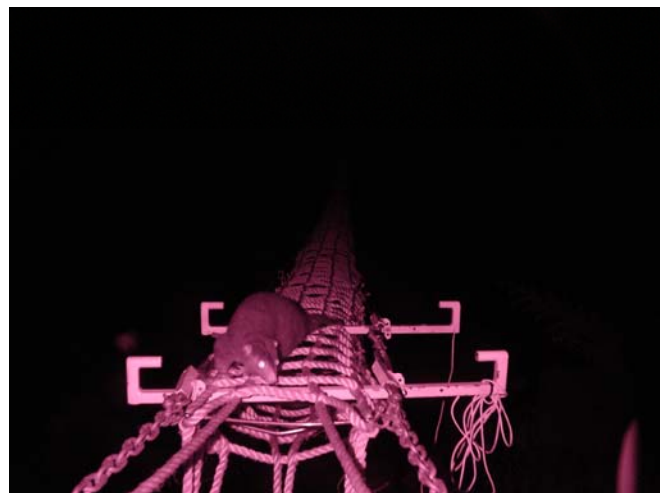
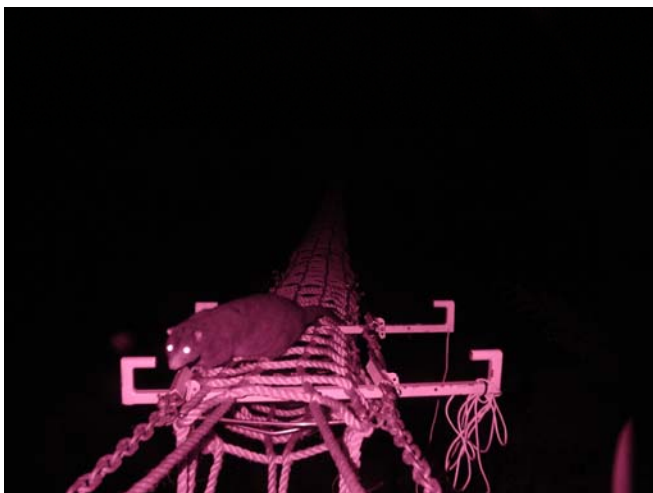
Also strong enough to hold up a fallen tree and prevent it landing on a vehicle.

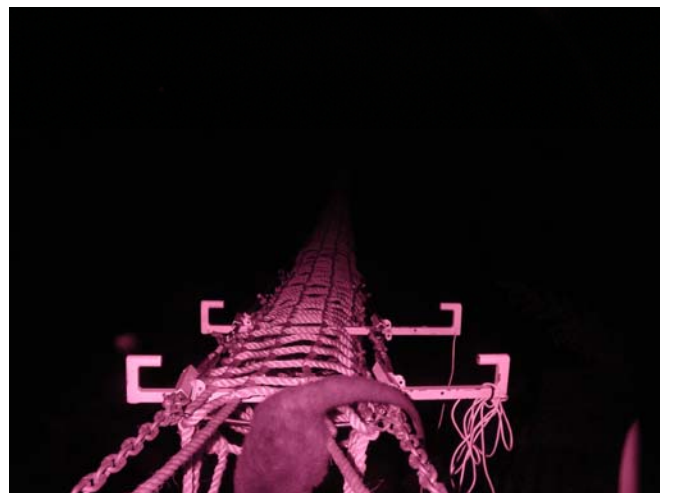
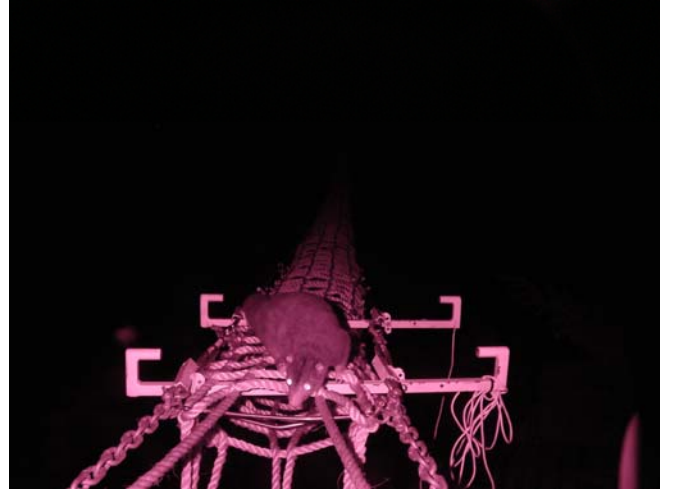
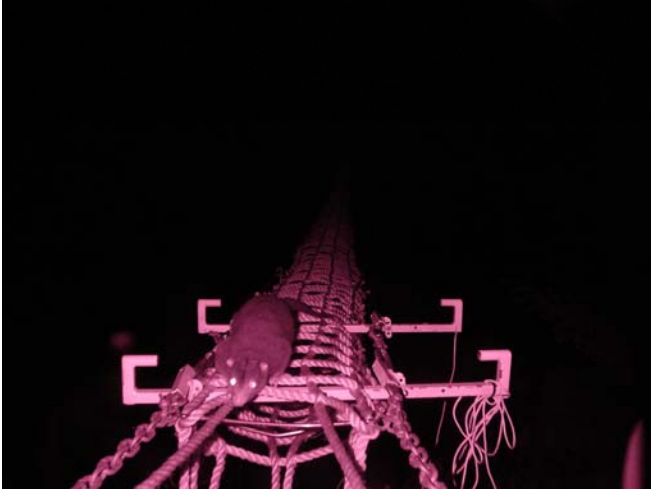
Photos by Julia Cooper

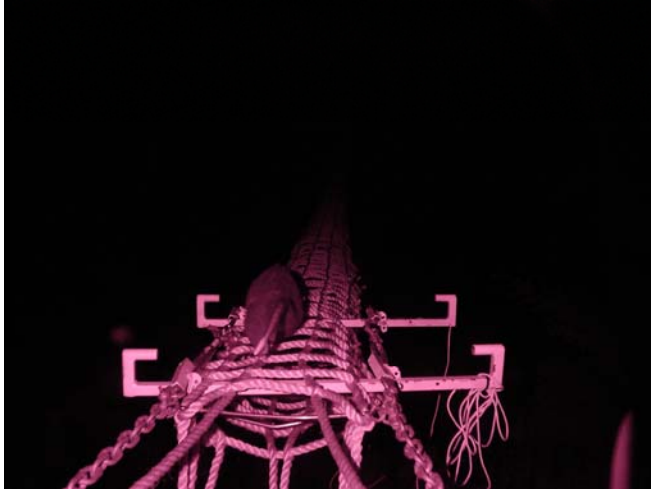


5 possums tracked prior to canopy bridge installation and 5 afterwards – home range size not significantly different.

No possums crossed before bridge installation, 2 crossed afterwards, but one was during cyclone.







Will this work?

- These measures show promise, being based on current best practice
- However, they will need to be monitored in the long-term to determine whether they achieve their goal of allowing crossings by mahogany gliders and cassowaries, as both species are rare.
- The budget must contain funds for this monitoring or we will not have any information to put towards future designs and the current designs will just self-perpetuate rather than be adapted against a proper evaluation.



Conclusions

- These collaborations have been very successful over the years in delivering best practice outcomes
- Underpasses work for many species, but more monitoring is required to see more crossings by target species
- Canopy bridges work on narrow clearings, but more monitoring is needed to see whether they work for all species over wider roads
- We still need population viability data to determine overall effectiveness
- Monitoring for a sufficient length of time should be included in road budgets – to at least ensure regular use by target species
- Maintenance of structures should also be included in road budgets
- Road budgets should also consider pre- and post-construction population and genetic studies.

