Transport Knowledge Hub Webinar Series 2020
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Edge Effects of New Zealand Roads

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Transport Knowledge Hub

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Why this research?

This research addresses the knowledge gap regarding ecological effects of edges ("edge effect") created by constructing and operating linear transport. This project is:

- *a response to government directives*
- *a response to NES Freshwater ; wetland protection*
- *prepares for NPS Indigenous Biodiversity*
- *enables more consistent prediction and management of edge effects*

SH1 eco-viaduct, north of Orewa

New Zealand and Road Ecology

Roads facilitate environmental degradation at a scale disproportionate to the land they occupy[1]"

There is substantial international literature on effects of roads[2,3] but very little in New Zealand.

New Zealand land transport projects likely under-estimate: the size of the effected zone, the long-term effects of edges, and the cumulative effects of road density.

[1] Bellis, M.A et al. 2007 Utilizing a Multi-Technique, Multi-Taxa Approach to Monitoring Wildlife Passageways on the Bennington Bypass in Southern Vermont. UC Davis, California.

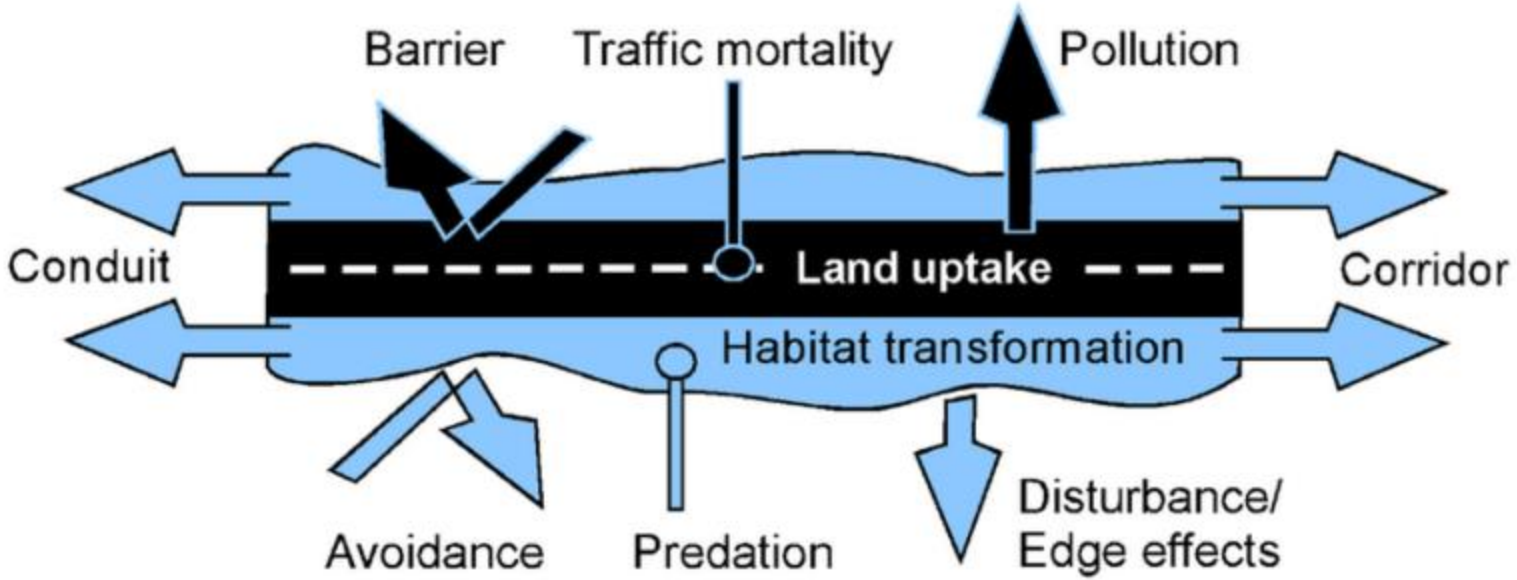
[2] van der Ree et al. 2015. Handbook of Road Ecology. Wiley Blackwell. 522p

[3] Forman RTT et al. 2003. Road Ecology Science and Solutions. Island Press

Edge Effects of Roads Research Project

- Review edge effects of roads (international and New Zealand).
- Identify where NZ roads and ecosystems are similar to, or different from overseas, and what this means for determining edge effects.
- Address knowledge gaps.
    - Recommendation for identifying and measuring edge effects at a project scale.
    - Test a 'Rapid Edge Assessment Method' in recent projects in contrasting ecosystems.
    - Prioritise research recommendations to fill knowledge gaps.

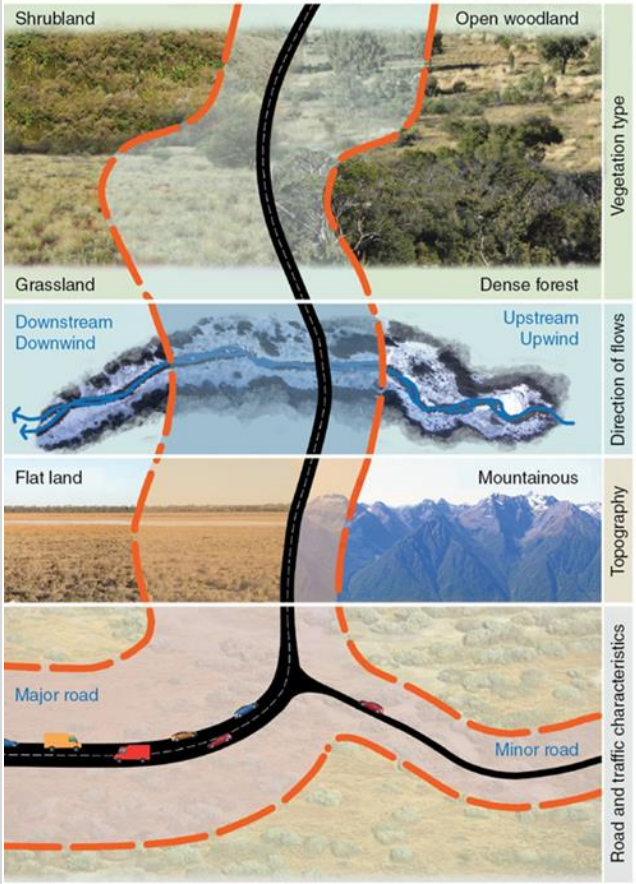
Effects of roads



1 -Schematic representation of the five primary ecological effects of infrastructure which together lead to the fragmentation of habitat. (Modified from van der Zande et al., 1980)

Edge Effects and the Road Effect Zone

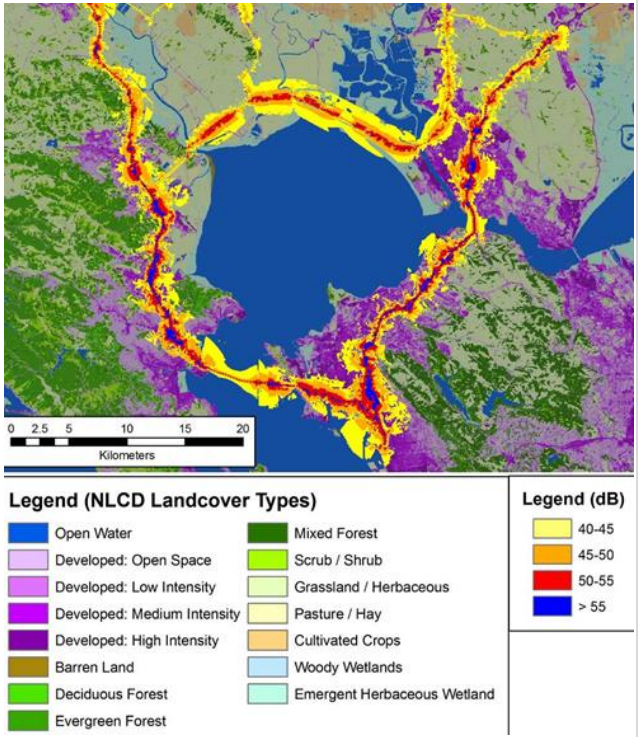
- The ‘road effect zone’ varies depending on the effect, what ecological feature is affected and landscape context.
- Some effects ‘ripple out’; in places for 1000s of metres
- The road effect zone is influenced by road design, traffic and effects management interventions
- Many effects amplify over time and are permanent



van der Ree et al. 2015. *Handbook of Road Ecology*. Wiley Blackwell. 522p

Some effects 'spread' widely

- **Noise** affects animal communication and predation
- **Light** affects feeding and predation
- **Dust/air emissions** NOx, SOx, affect plant growth, heavy metals affect animal health
- **Stormwater** amplifies peak flows (erosion) & contaminants (including temperature)
- **Hydrology** changes affect drought and waterlogging
- **Roadside plants** spread in some places



Shilling, F.M and Weitjen, D.P. 2012. *The Road Effect GIS Model*. Sustainable Transport Centre, UC Davis, California.

What makes NZ different

- Extreme endemism of fauna, flora, ecosystems; flightless, large, slow-breeding fauna
- High vulnerability to disturbance and edge effects as many species are adapted to forests
- Unique pressures from pest animals across most of New Zealand
- ‘Backlog’ of pest plants spreading (>2500 naturalised species)

A lot of research overseas but very little published research on responses of key NZ taxa with which to derive relevant, practical mitigations

Vulnerability of fauna to edges varies

Species that:	Examples
Walk across roads	Kiwi, pateke, weka, penguin, snails, pukeko
Attracted to artificial light	Morepork, Westland petrel, bats, many nocturnal insects
Vulnerable to desiccation/ low humidity/ high light	Peripatus, snails, many leaf litter invertebrates, some lizards
Attracted to road surface	Fur seals, some birds
Attracted to roadkill	Harriers, pukeko, weka, some seagulls
Communicate using calls	Small birds (fantail, tui, bellbird?)









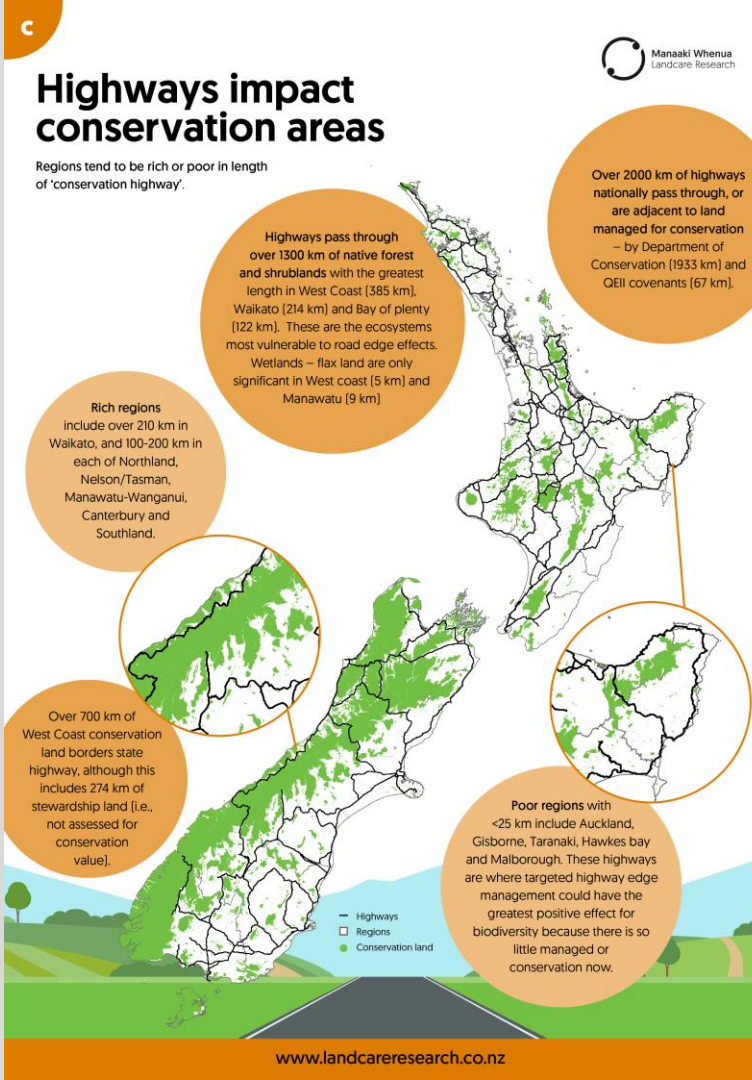
Mapping 'hot areas'

At national scale:

- areas managed for conservation
- areas with native plant cover in LCDB5

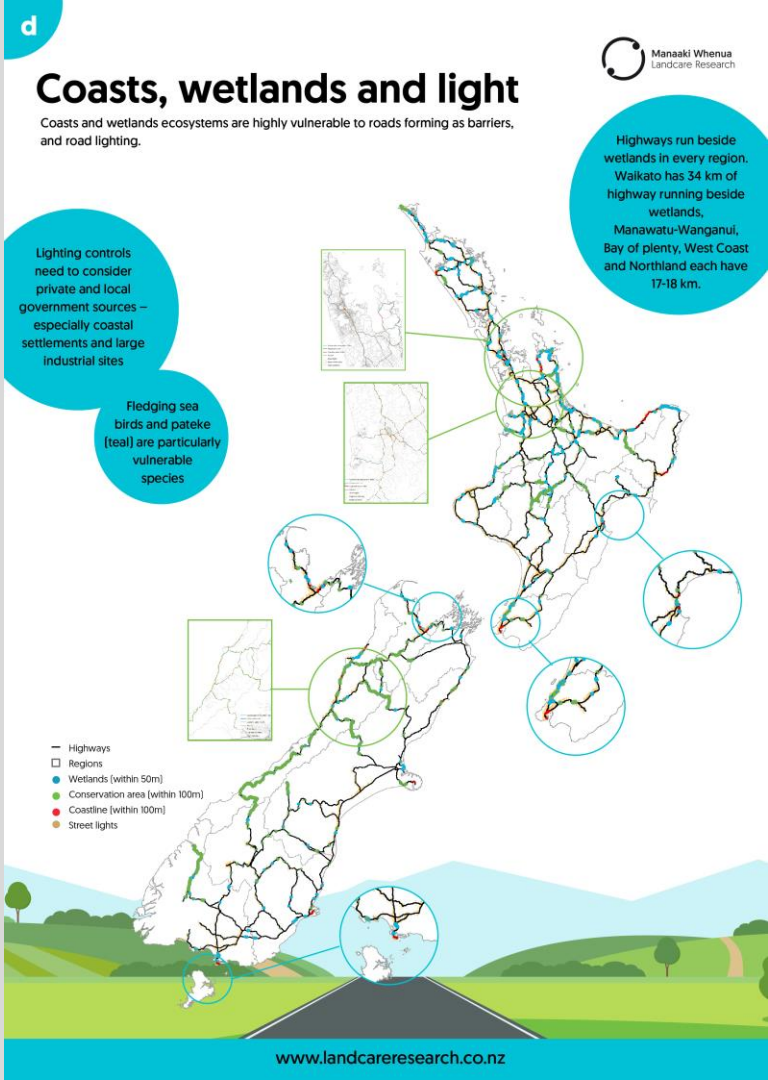
At local scale developing an assessment tool:

- where vulnerable habitats are present
- where vulnerable species live / move
- where effects are difficult/costly to mitigate in capital project
- where effects accumulate over time



Mapping vulnerable typologies

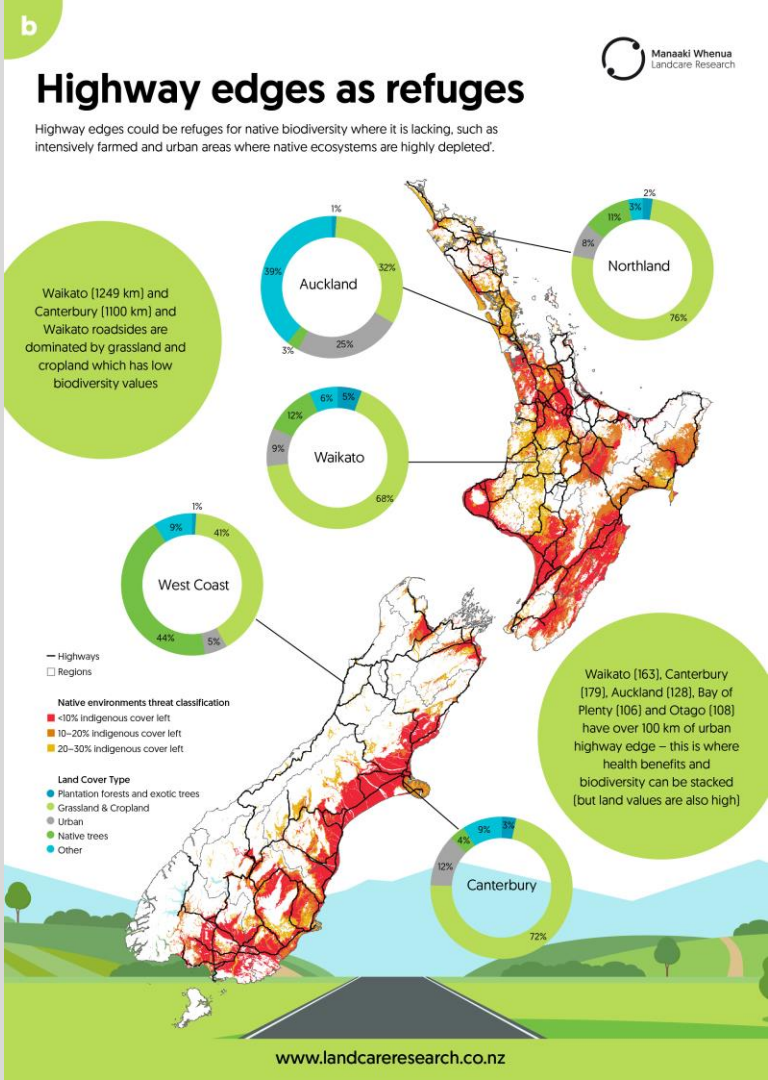
- Knowing what matters and is most vulnerable enables early constraint mapping and understanding of likely magnitude of effect.
- Better understanding of NZ ecology and landscape considerations. Formally recognised conservation areas may not always be the (only) key environment that projects need to consider.
- Use to guide ecological assessments and prioritise upgrades that enhance biodiversity



Road edges could benefit ecology

Identify ecological assets that could be enhanced by expansion, buffering and connecting

- In some areas transport corridors are rare 'green' space and connect fragmented habitats.
- Corridors can be managed to buffer and reduce edge effects from other developments.
- Huge opportunities to improve biodiversity in poorest regions where transport network can contribute to national biodiversity goals.



Applied Research Outcomes

Identify areas / features where edge effects of roads are likely high

- Early understanding of vulnerability of ecological features present and potentially affected by a project.
- Guidance on existing features needing active management to support existing indigenous biodiversity.
- Understanding what environments may be more robust to transport activities.

Applied Research Outcomes

Strategies to mitigate edge effects

- Building & buffering threatened habitats in lowlands
- Minimising edge zone – lighting control, noise control
- Minimising impacts
  - – stormwater controls, buffering
  - – underpasses, fencing, 'escapable' culverts
  - - revegetation with habitat features (logs, refuges)
- Reducing weed spread onto and along roads

SH 12 kauri bridge

Conclusion and Next Steps

- Little known about how far edge effects extend into the environment.
- Literature review suggests strongly that AEE's underestimate the magnitude of the effect.
- We need to address knowledge gaps.
- To do this we need to start collecting data on roading projects, both the existing state highway and also new projects to understand degradation over time and short term vs long term edge effects.
- A method shall be developed to do this.