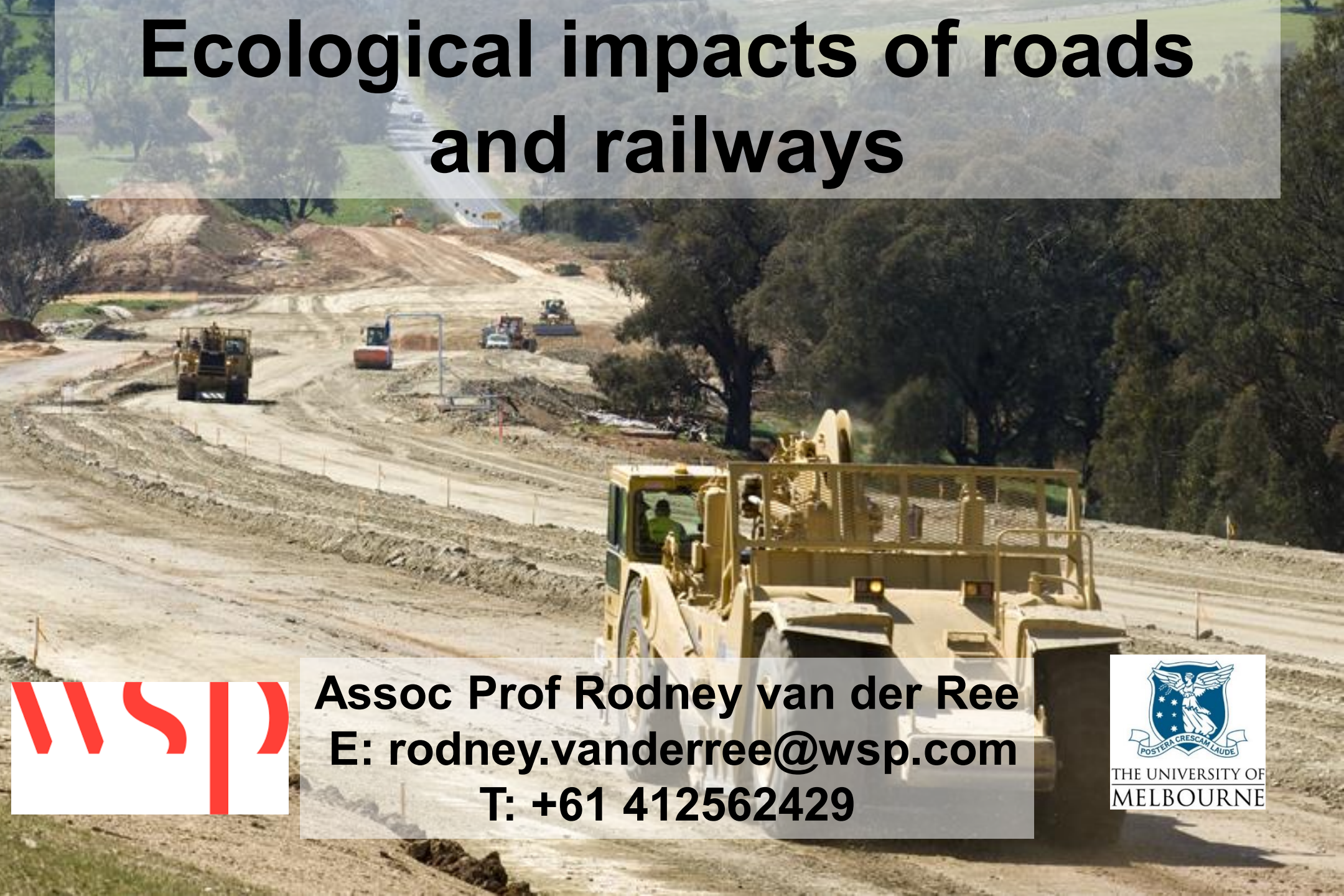
TRAINING ON

Planning and Design of Smart Infrastructure for Biodiversity Protection

25–27 April 2022

Rhino Lodge, Sauraha, Nepal

Ecological impacts of roads and railways



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Research.

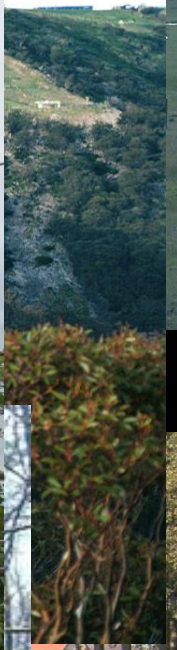
Here you'll find easy-to-read summaries of scientifically rigorous, evidence-based and peer-reviewed publications from around the world to help you better plan, build and manage ecologically sustainable linear infrastructure.

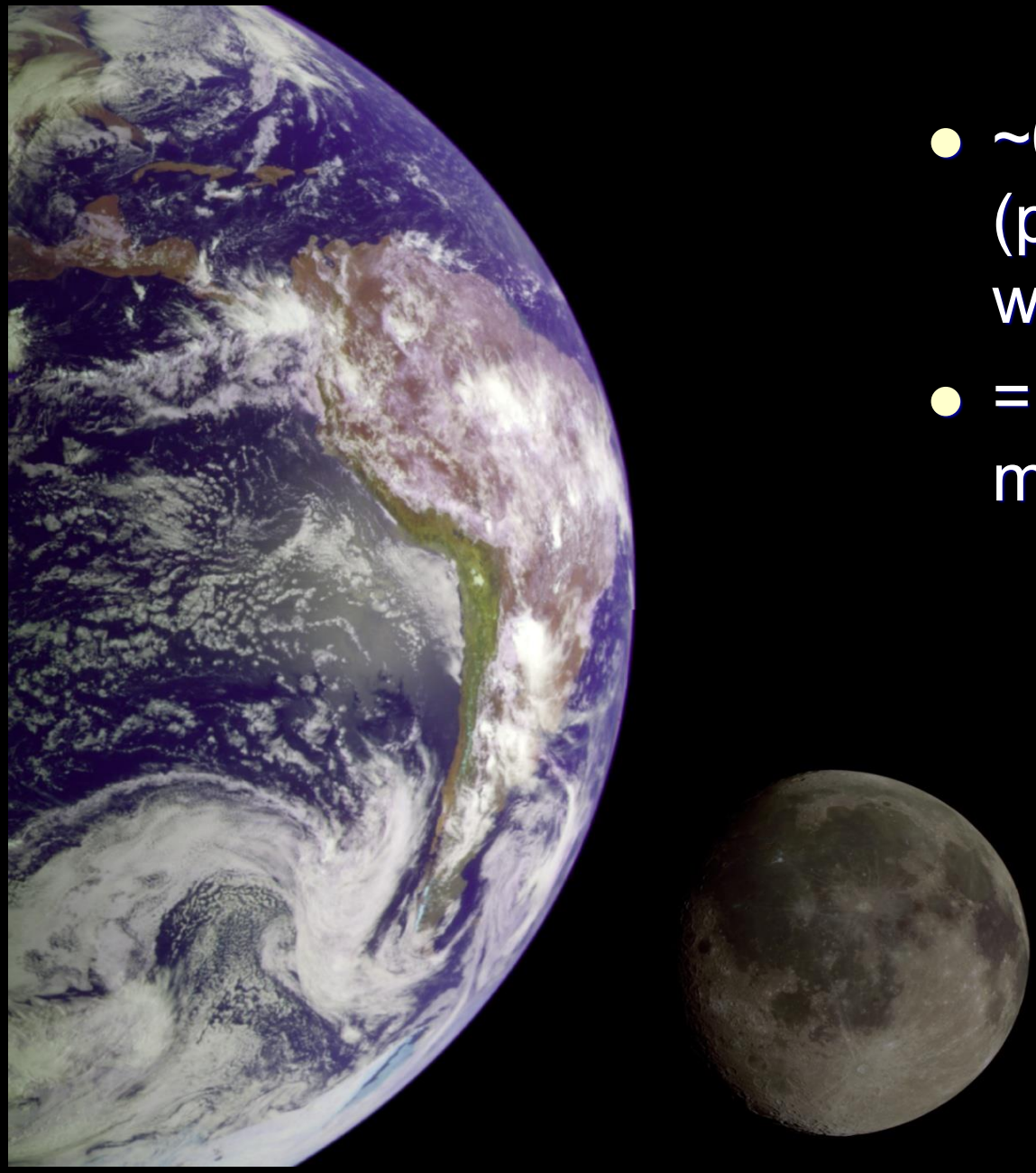
Best Practice.

Here you'll find guidance, instructions and methods to help you plan, design, build and manage roads and other linear infrastructure that are ecologically friendly, as well as design surveys and monitoring programs, undertake analyses, and ensure the decisions you make are supported by reliable data and evidence .

Case Studies.

Here you'll find easy-to-read case studies of real-life projects and experiences from around the world to help you better plan, build and manage ecologically sustainable linear infrastructure. Case studies are written by practitioners working on road, rail, powerline and other linear infrastructure projects and showcase what worked, what failed and lessons learnt.





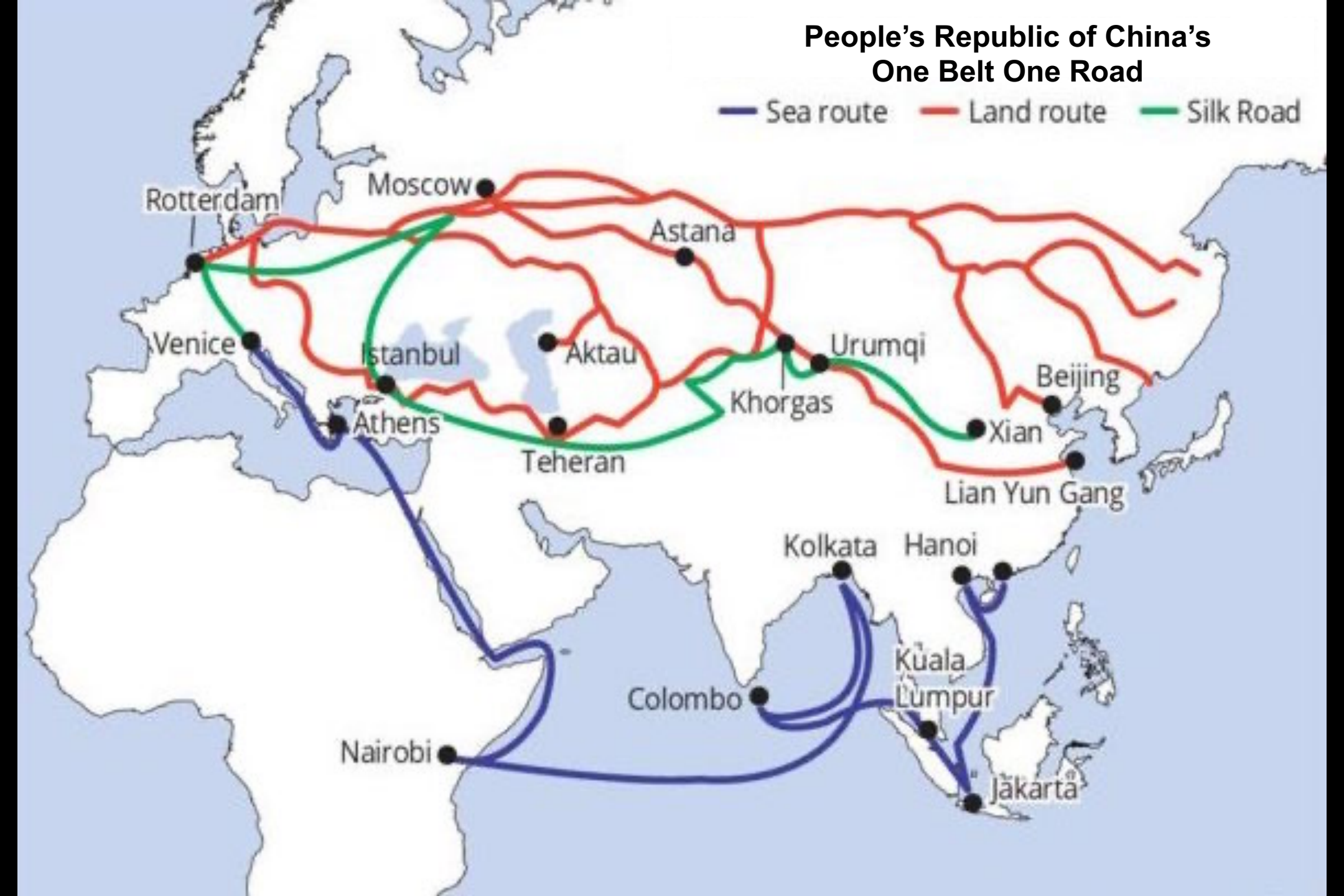
- ~64 million km of road (paved and upaved) worldwide
- = 83 return trips to the moon!

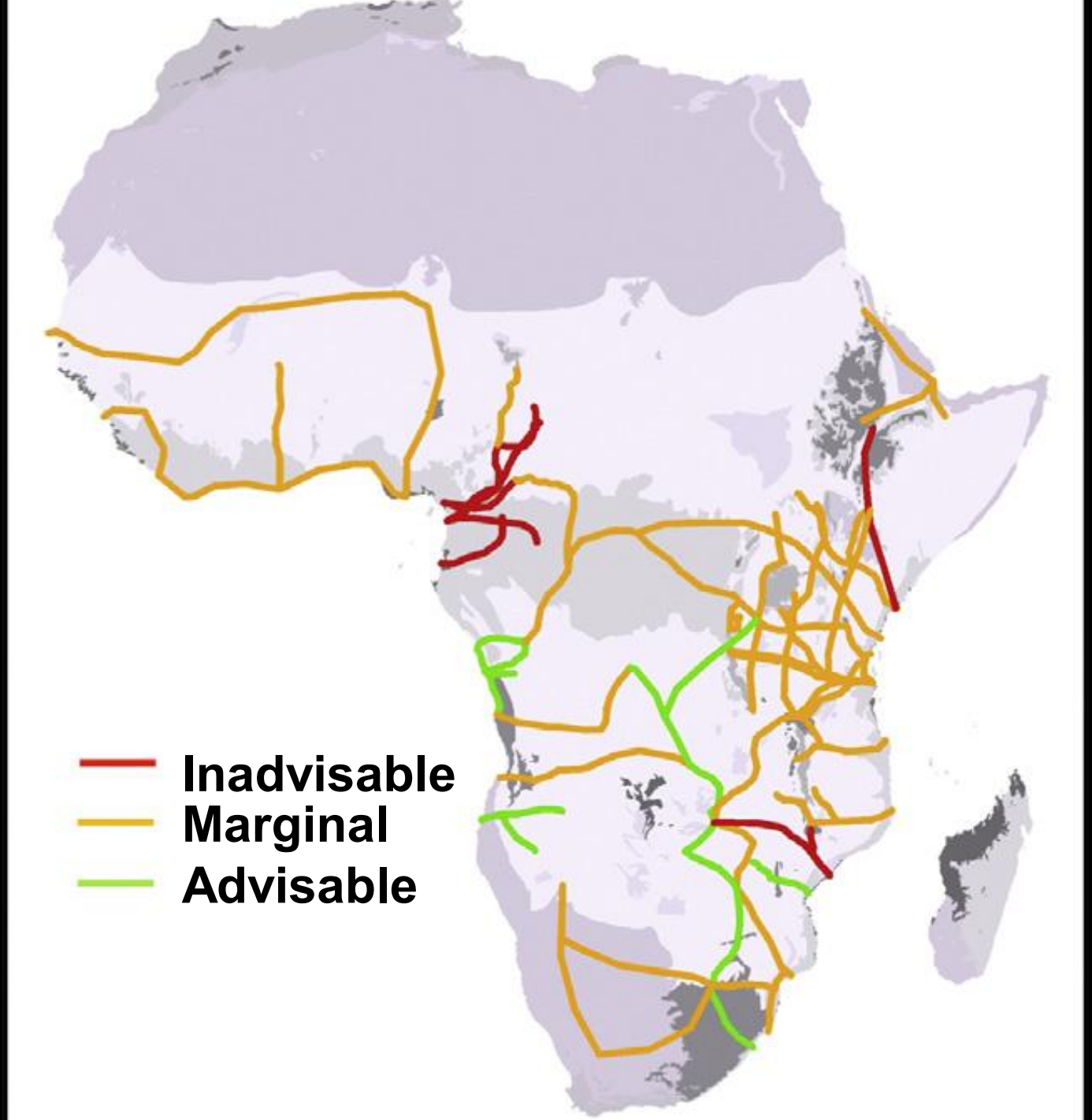
Globally by 2050….

- Additional 25 million lane-km of roads
- 90 % in non-OECD countries
- 1.7 to 2.8 billion vehicles (0.9b in 2009)
- 5-fold increase in vehicles in non-OECD
- Individual travel to treble to 100 trillion passenger km annually
- China's Belt and Road initiative – with $1 trillion(?) to be spent on infrastructure globally

Global Infrastructure Hub

- G20 mandate to grow the global pipeline of quality, bankable infrastructure projects.
- 20 largest economies pledged $60 - $70 trillion dollars into infrastructure over next 15 years

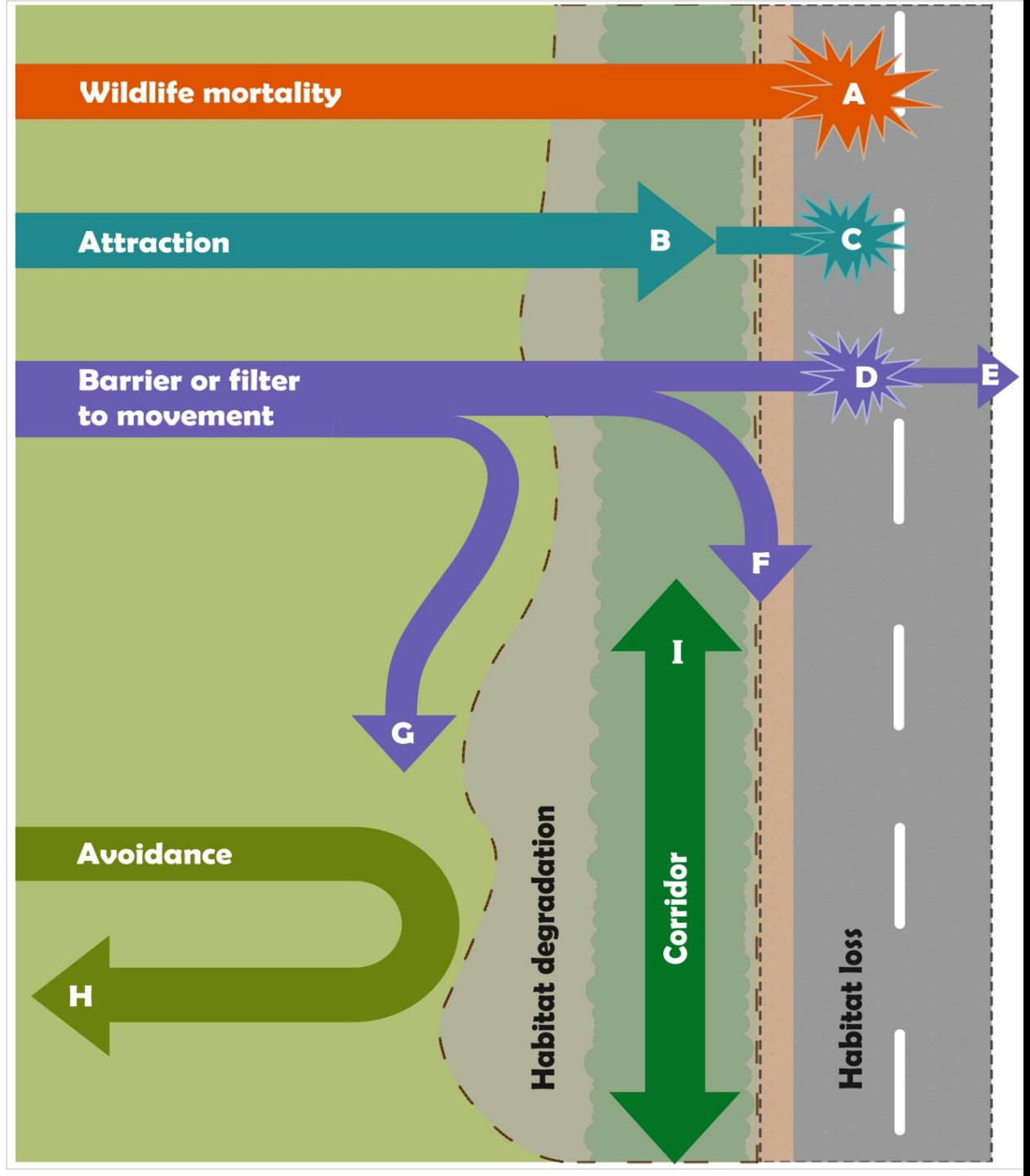

People's Republic of China's
One Belt One Road
Sea route
Land route
Silk Road
Rotterdam
Moscow
Astana
Venice
Istanbul
Aktau
Urumqi
Beijing
Khorgas
Athens
Xian
Teheran
Lian Yun Gang
Kolkata
Hanoi
Kuala
Lumpur
Colombo
Nairobi
Jakarta

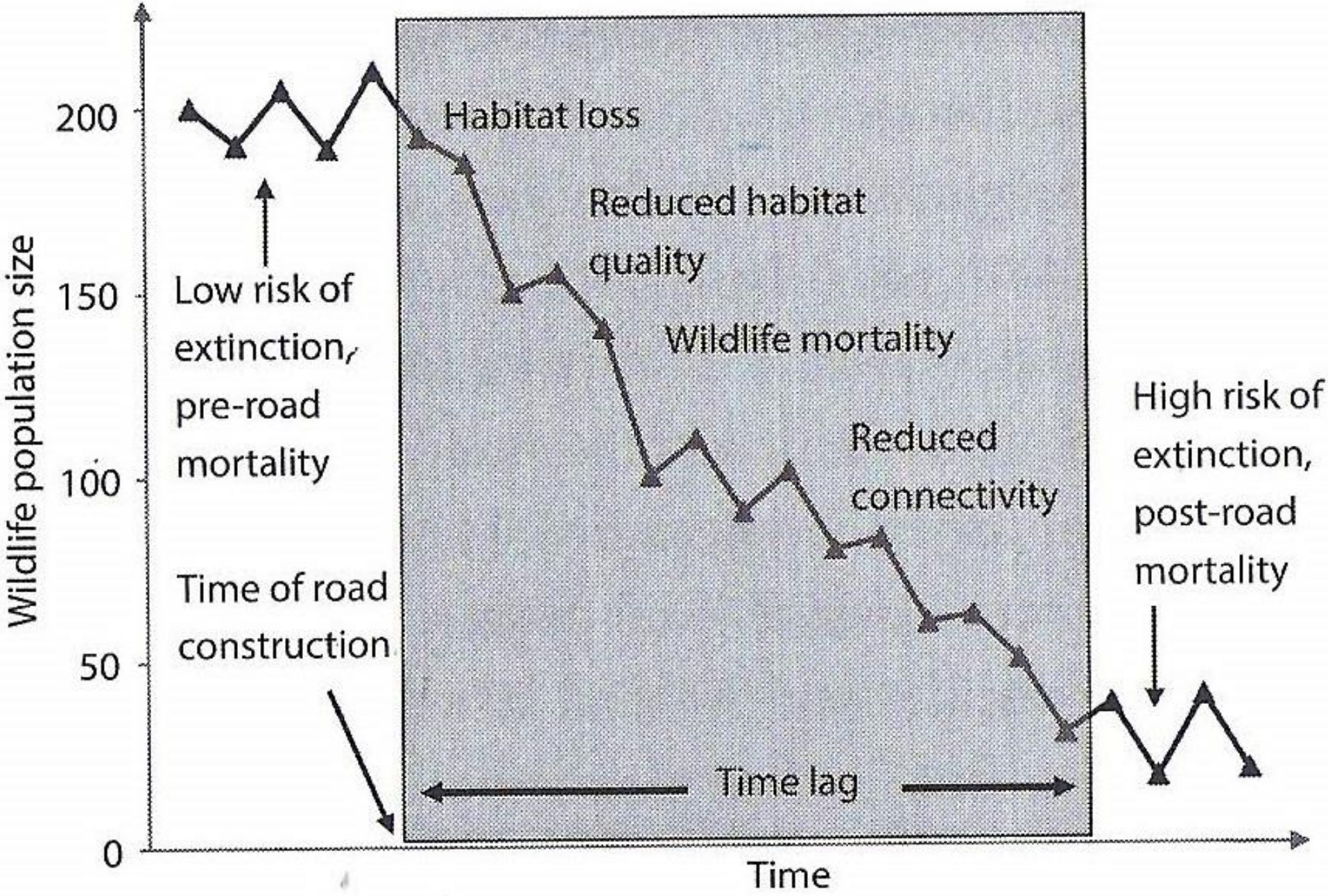


53,000 km of developm ent corridors in Sub-Saharan Africa

(Laurance et al 2015)

1) Identify specific impact(s)





Source: Jaeger et al

Construction footprints too large!

Wildlife-vehicle collisions

- ~ 2 million WVC in USA annually, 29,000 people injured, 200 killed
- 30,034 frogs over 4 yrs, along 3.6 km road, Canada
- 70% decline in Alaska Moose pop'n due to train collisions
- 80 mill birds killed annually, USA
- 100 – 3000 insects killed per car, per km = trillions annually
- Road mortality can be the single largest cause of anthropogenic wildlife mortality
- Problem for rare/endangered spp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WDP4B 20075
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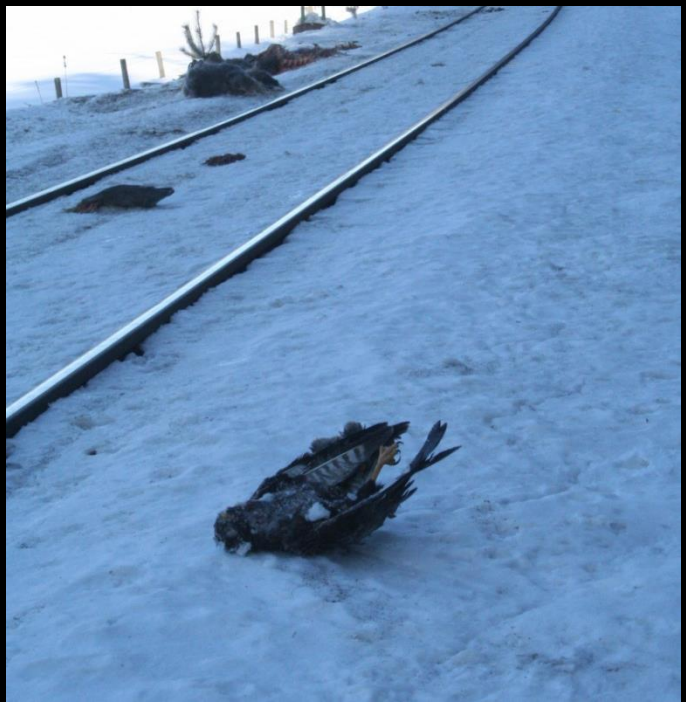
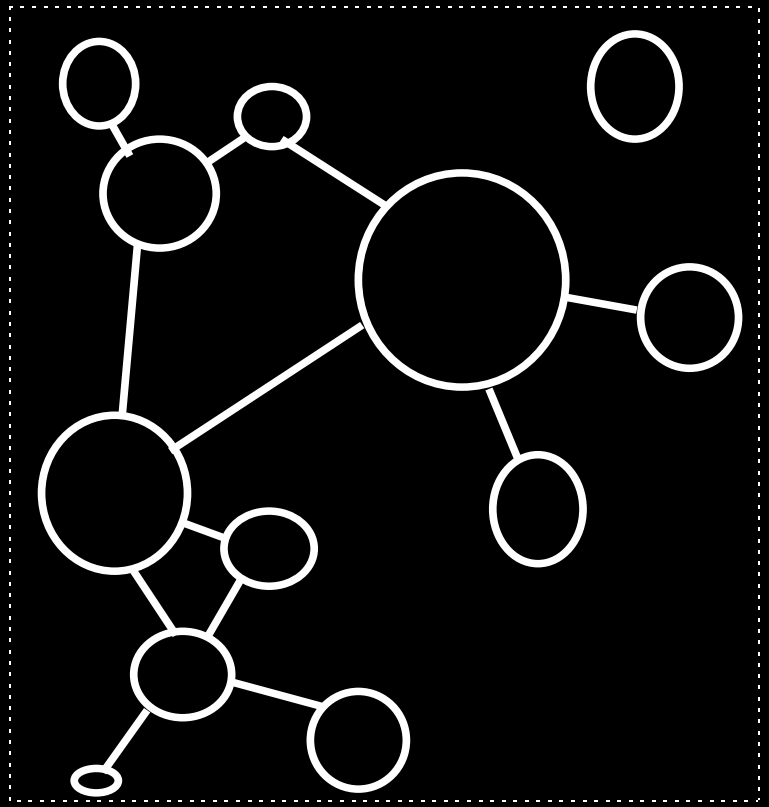
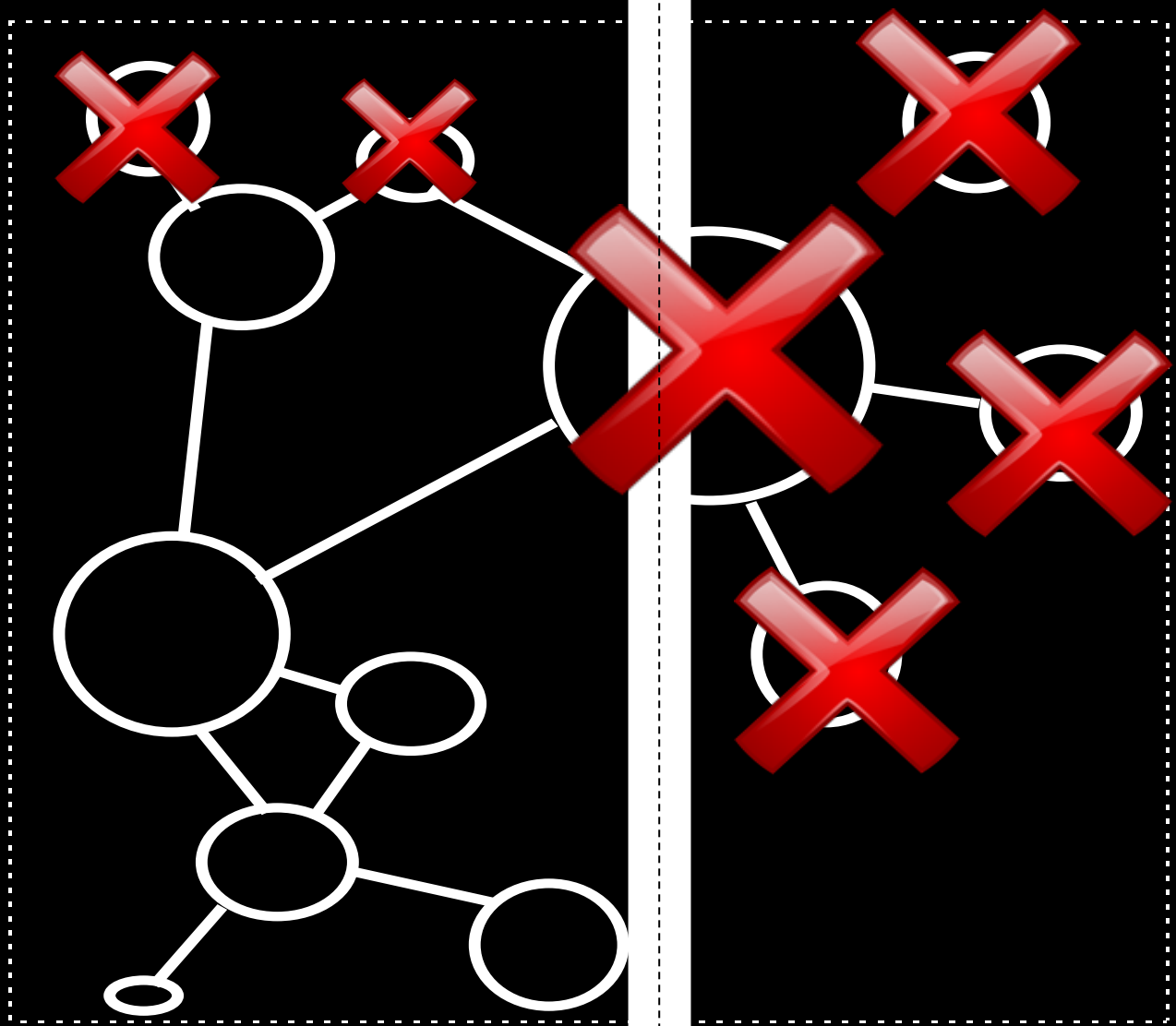
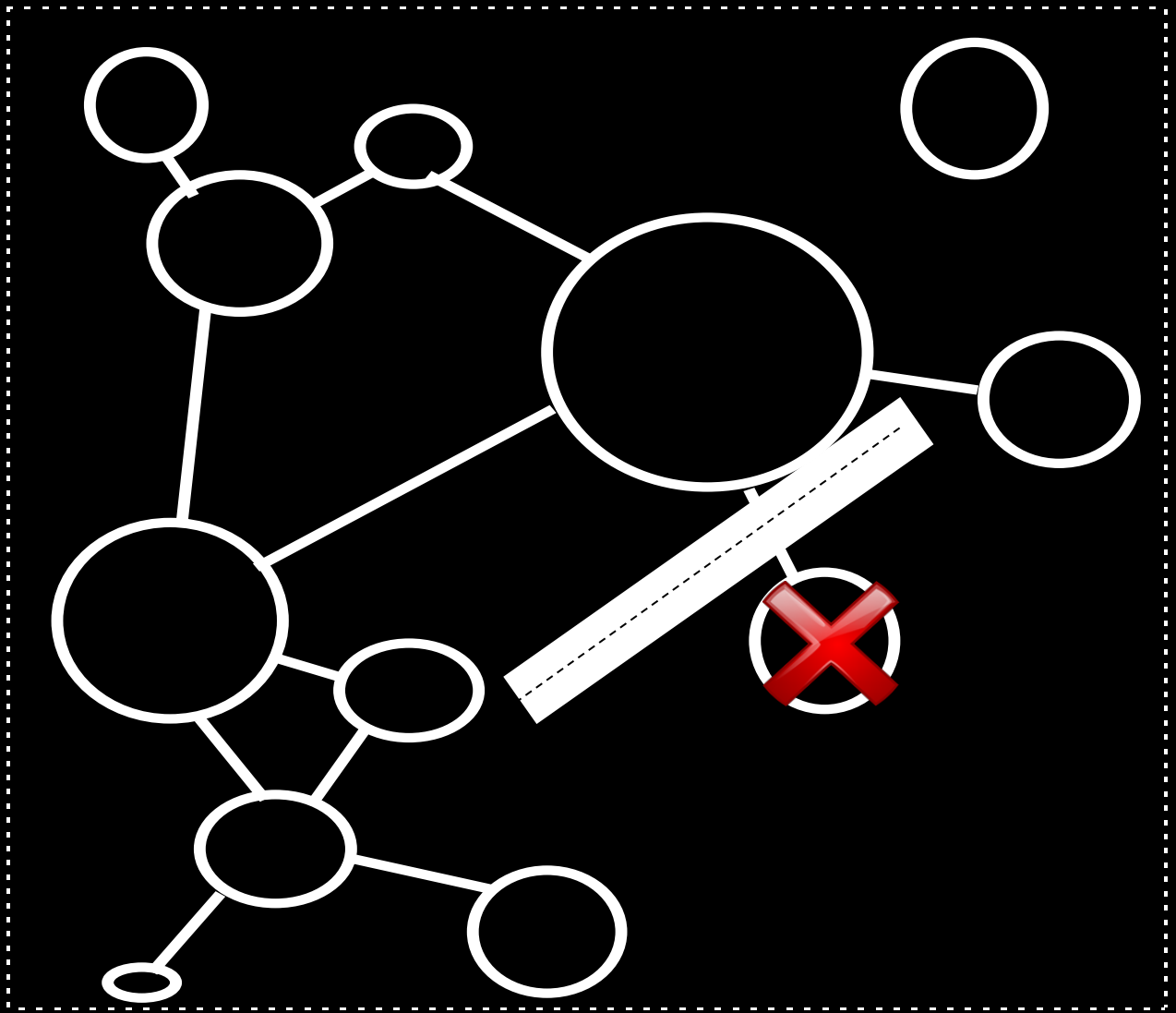


Why are barriers a problem?

- Single species distributed in multiple habitat patches
- Metapopulation persistence a function of
  - number of patches
  - size of patches
  - within patch dynamics
  - inter patch movements
- Daily movements, seasonal migration, dispersal







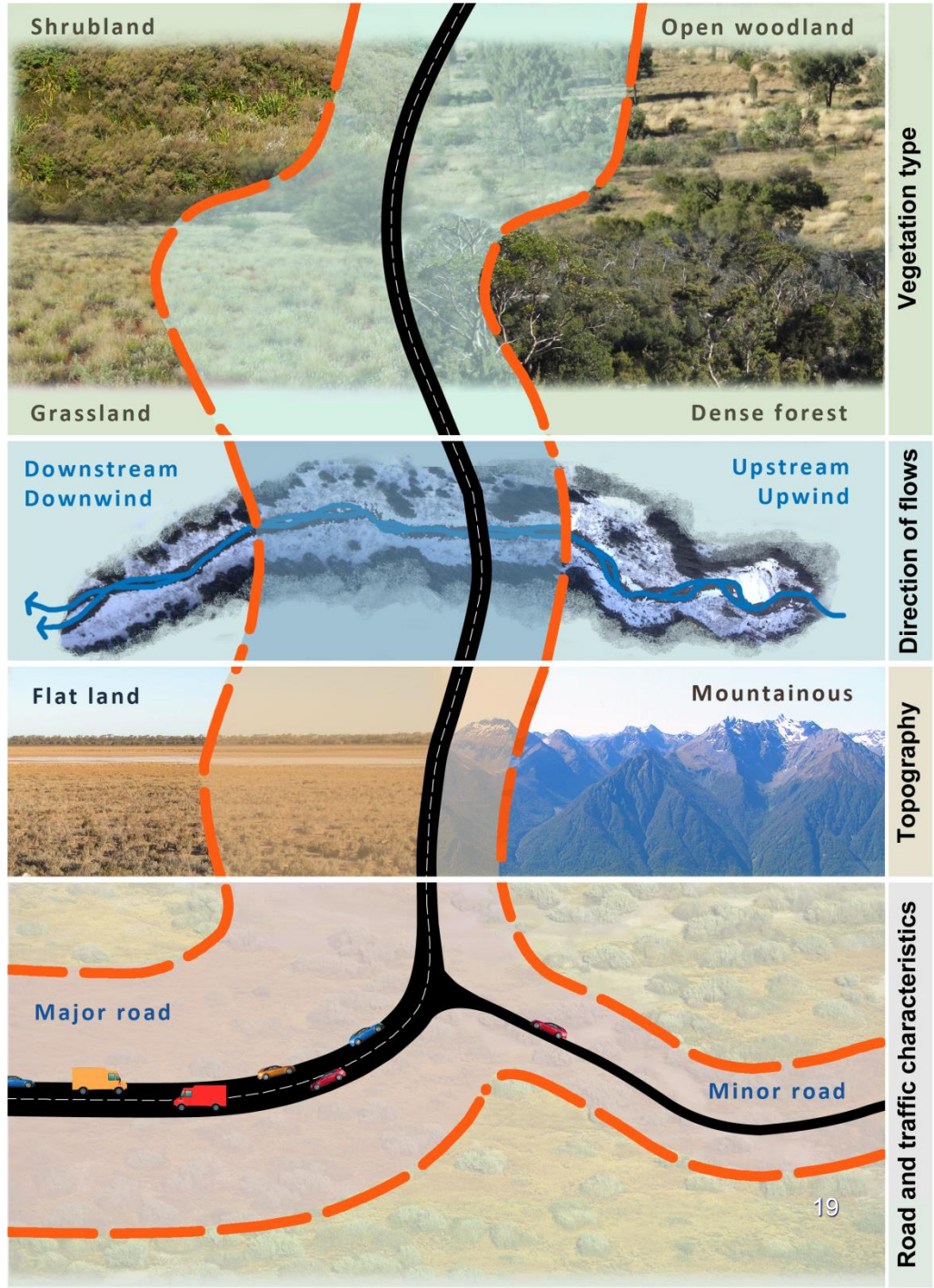
Road-effect zone

‘Area in which effects of road / traffic occur’

Can extend 1000’s m
Depends on:
- species
- traffic volume
- topography, etc

1% of USA roaded, but 20% of land affected

Source: Handbook of Road Ecology, 2015



Light pollution - Dubai by night

(Source: NASA)

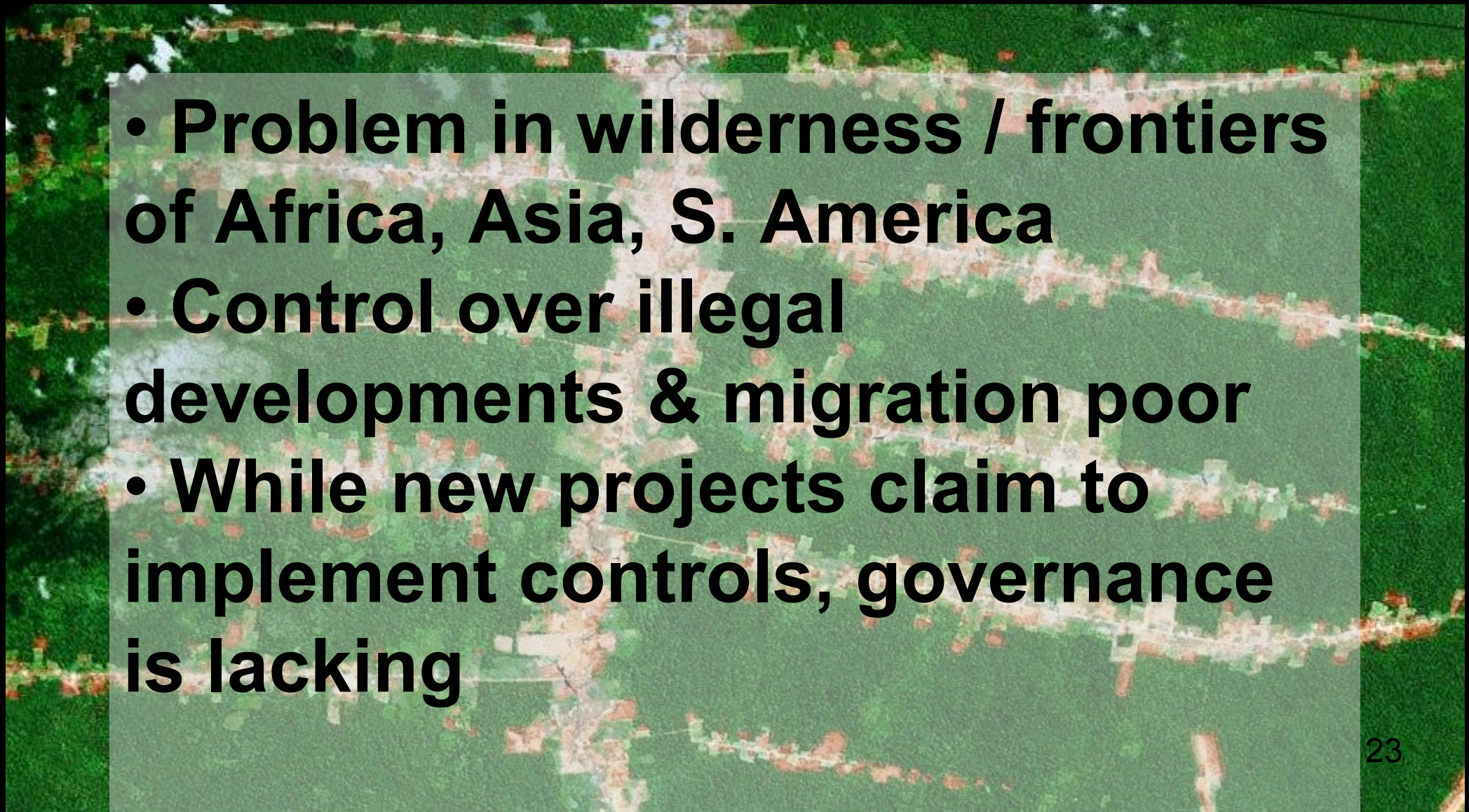
Artificial lighting & photoperiod

- Natural stimulus – affects animal behaviour, breeding, mate choice, physiology, movement
- ‘Trapped by the beam’ – lighting on oil rigs & towers – birds die from collision or energy depletion
- Turtle hatchlings attracted to streetlights rather than the moon over the ocean
- Light >500nm can affect magnetic compass in migrating birds

Noise

- Construction noise – high intensity, short duration
  - Construction noise can injure – especially fish
    - Barotrauma – sound waves cause gases in fish to expand, causing injury or death
- Traffic noise – peaks & toughs, but 365 days/yr
  - Stressful
  - Affect ability to hear each other, prey and predators
  - Temporary or permanent hearing loss

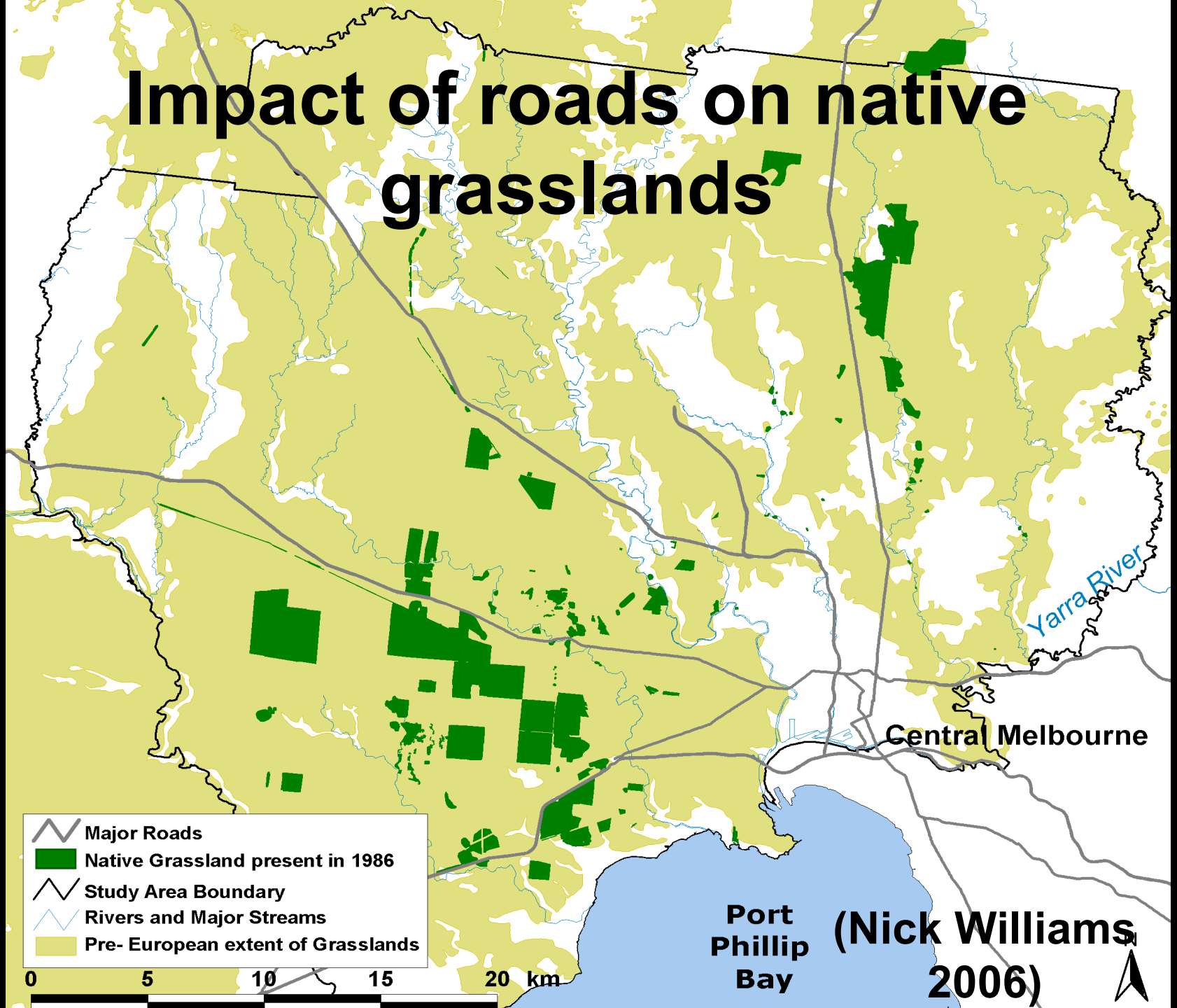
Roads lead to further land-clearing

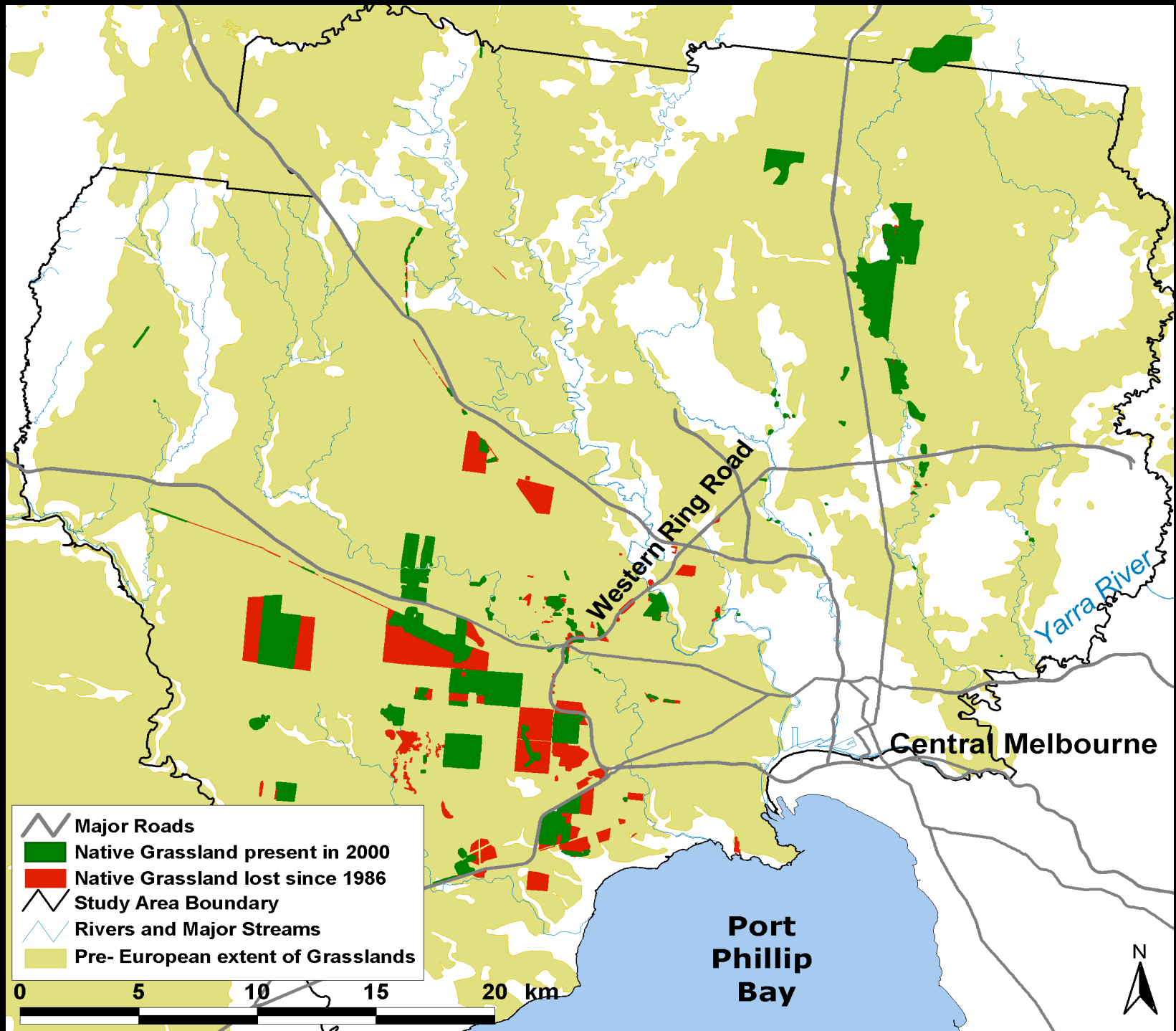


- Problem in wilderness / frontiers of Africa, Asia, S. America
- Control over illegal developments & migration poor
- While new projects claim to implement controls, governance is lacking

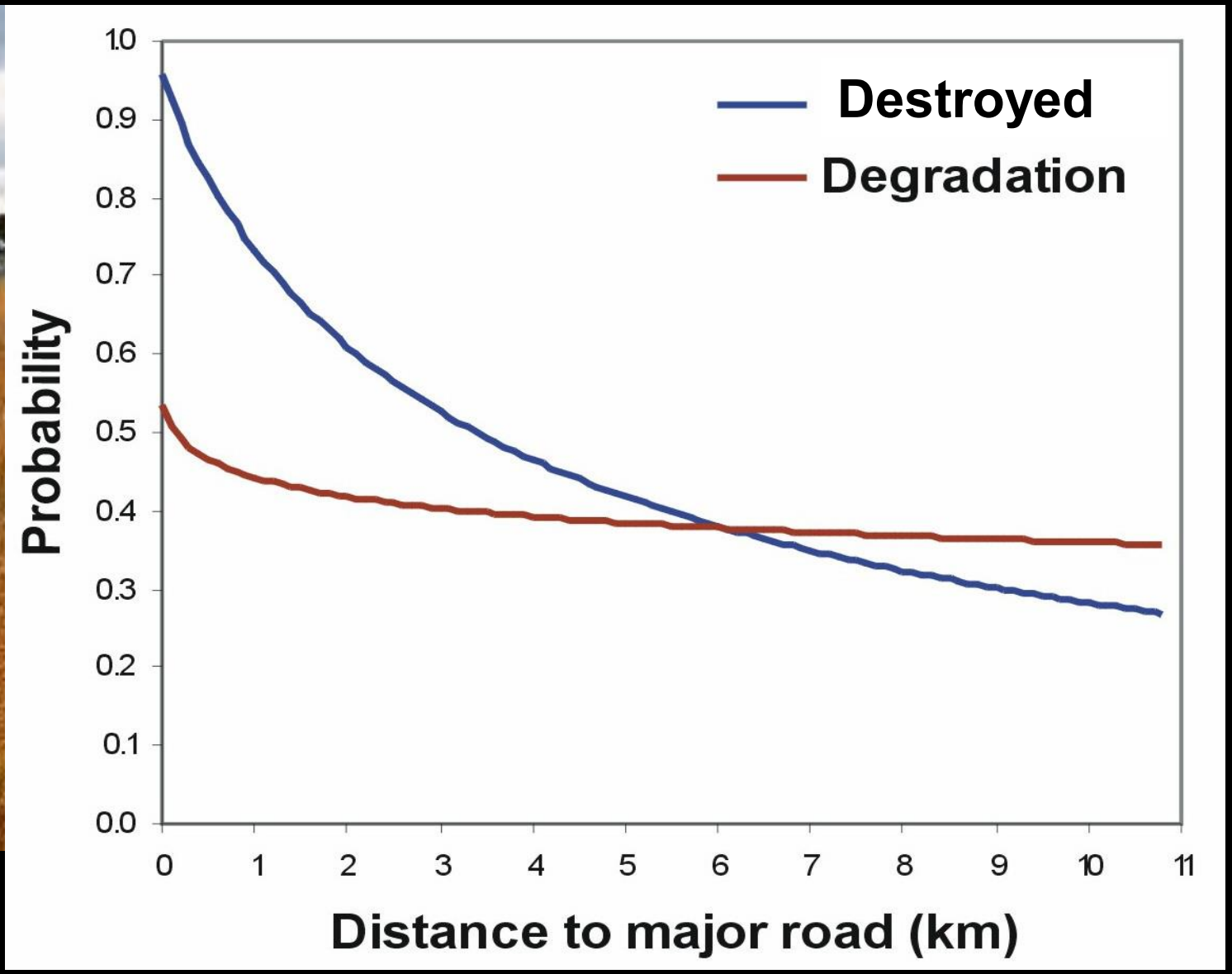
Increased access by people

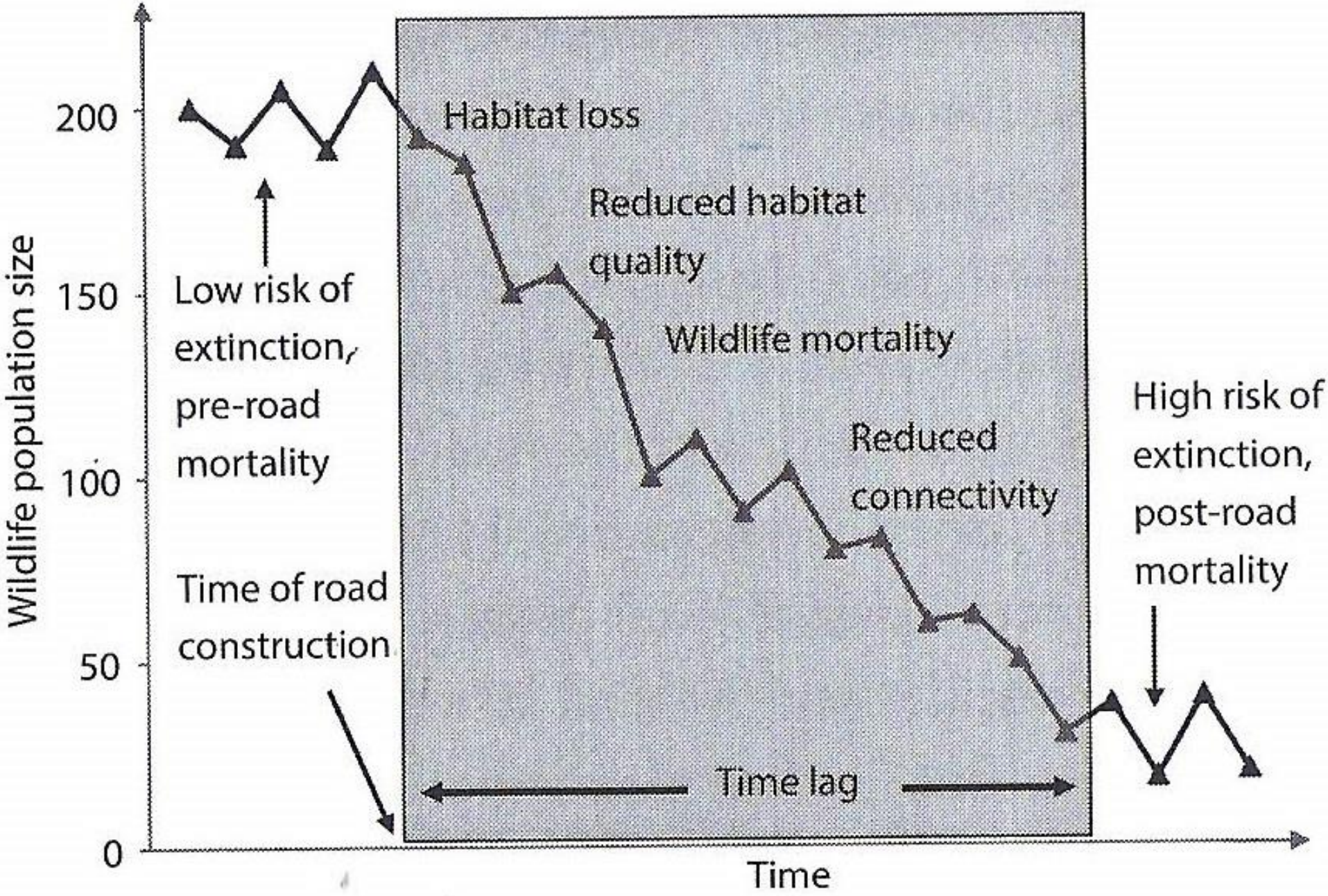
- Increased rates of hunting (Bushmeat & trophy) *during* and *after* construction
- Increased access by tourists
- Development follows road construction
- Loss of indigenous cultures


Impact of roads on native grasslands
Yarra River
Central Melbourne
Port Phillip Bay
(Nick Williams 2006)
Major Roads
Native Grassland present in 1986
Study Area Boundary
Rivers and Major Streams
Pre- European extent of Grasslands
0 5 10 15 20 km


Western Ring Road
Yarra River
Central Melbourne
Port Phillip Bay
Major Roads
Native Grassland present in 2000
Native Grassland lost since 1986
Study Area Boundary
Rivers and Major Streams
Pre- European extent of Grasslands
0
5
10
15
20 km
N

Effect of distance to major road





Source: Jaeger et al

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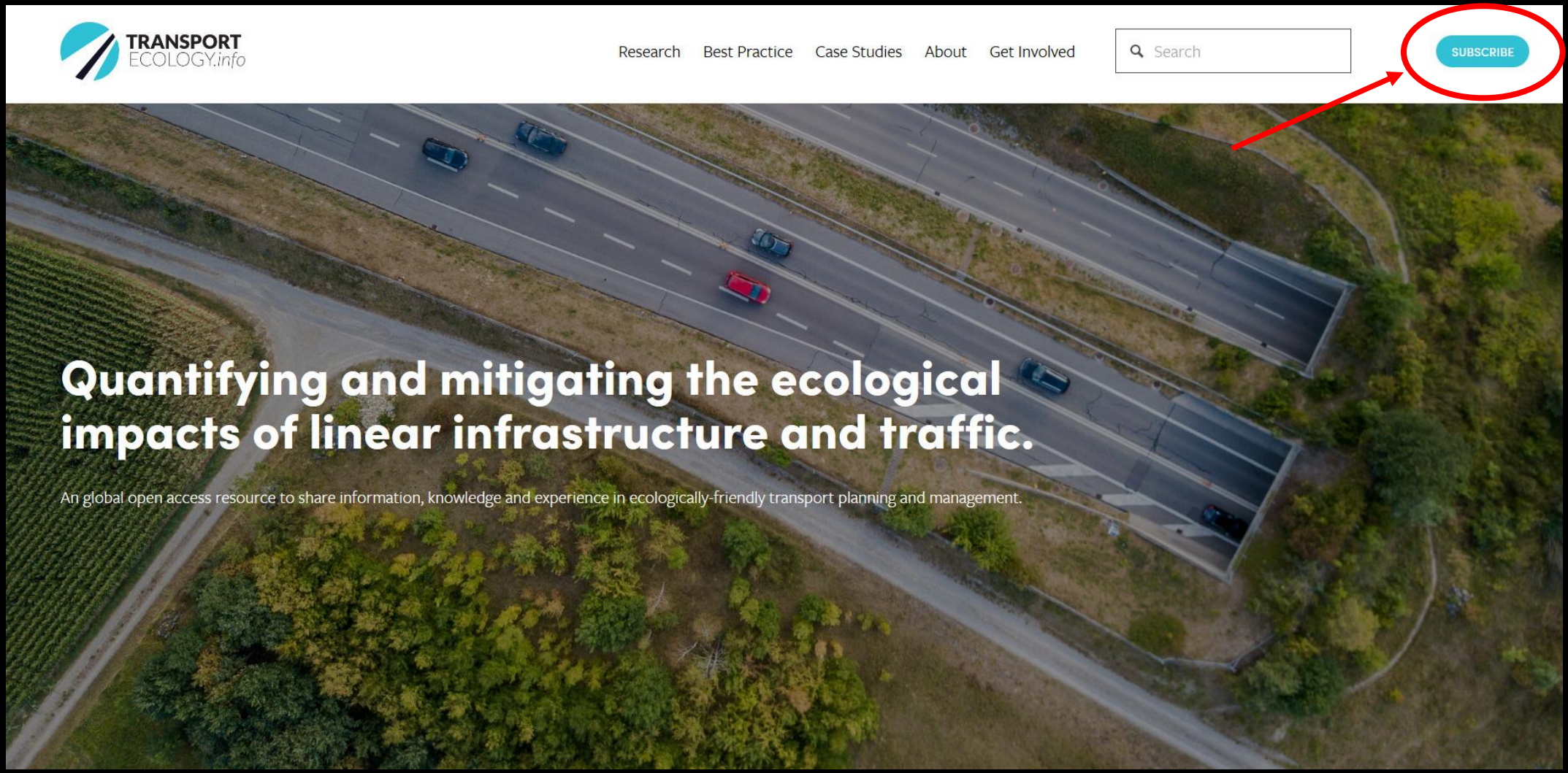

THANK YOU