

# **Ecological Considerations and Mitigation Measures to Build Capacity for Smart Green Infrastructure: *Some Perspectives***

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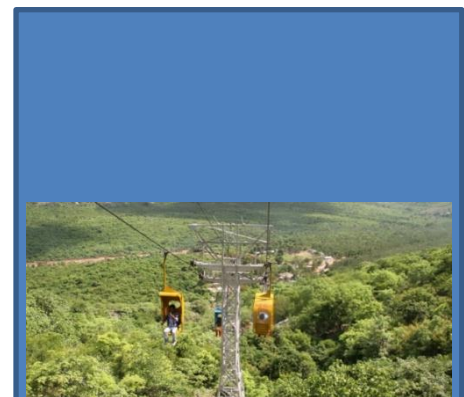
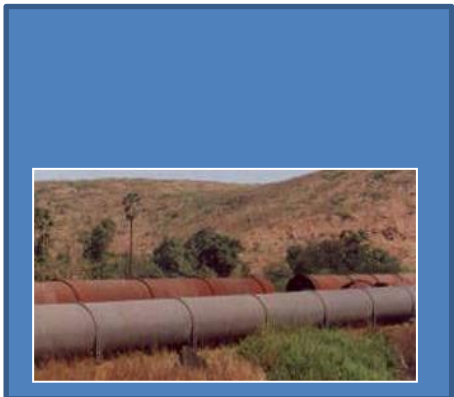
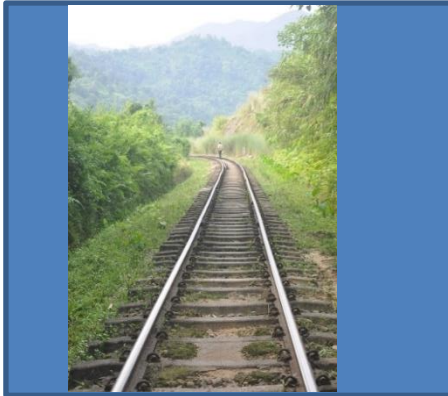
**Presented in ADB-WII-Webinar on 15<sup>th</sup> December, 2021**

# Presentation Outline...

- **Mainstreaming Linear Infrastructure**
- **Ecological Impacts: Overview**
- **Mitigation Principles**
- **The Way Ahead**

# Linear Infrastructure...

Features that promote economic growth; provide mobility and enhance delivery of goods and services ~ all vital for human development and well being



# Linear Infrastructure and Natural Resource Conservation



©<https://www.indileak.com/2014/10/elephants-calf-gets-drowned-in-bengal-canal/>

# India's Linear Infrastructure Development Philosophy: *Mainstreaming*

**Mainstreaming** is best understood as an attempt of modifying larger development strategies by incorporating biodiversity goals for both development and conservation.

- *Development without Destruction*
- *Development with Design*



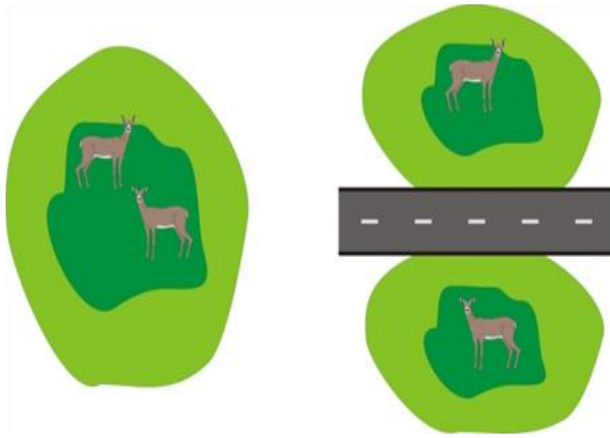
# Mainstreaming Approaches

Linear infrastructure developments need to be made '*animal friendly*' to provide pathways for movement of species and be '**SMART**' and '**Green**' to effectively mitigate the ecological impacts of roads, railway line and power lines, when routed through sensitive ecosystems and habitats.

**Green infrastructure must promote both smart growth and smart conservation**

# Linear Infrastructure: *Overview of Impacts*

## Habitat Fragmentation



Habitat fragmentation results in far greater reduction in area of available habitat for species in bisected patches (Source: Rajvanshi et al. 2013).



(Picture: A. Pragatheesh and Mohamed Zahir)



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# Linear Infrastructure: *Overview of Impacts*

## Mortality of Wild Animals



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# Linear Infrastructure: *Overview of Impacts*

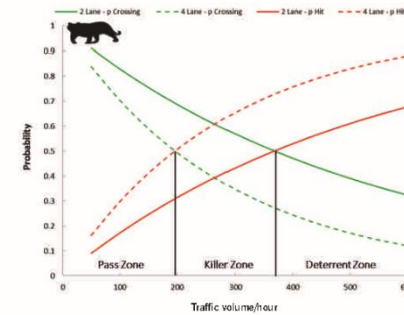
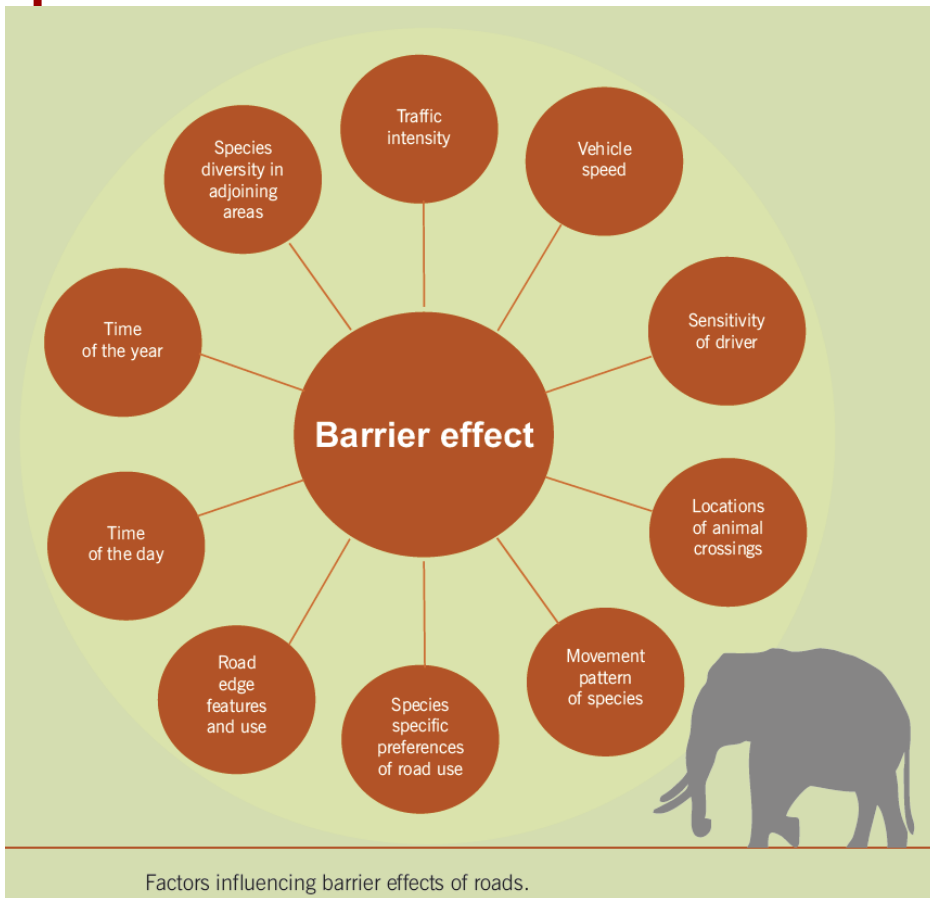
## Habitat Loss and Degradation



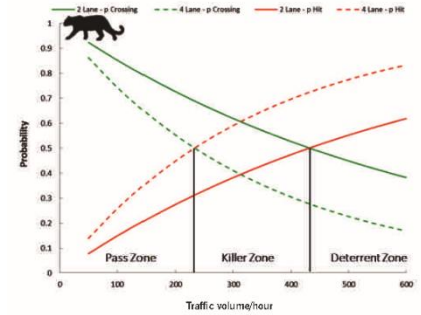
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# Linear Infrastructure: *Overview of Impacts*

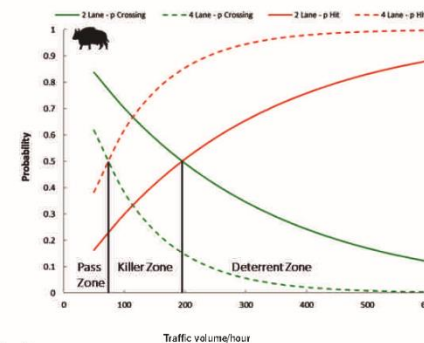
## The '*Barrier Effect*' and its Manifestation



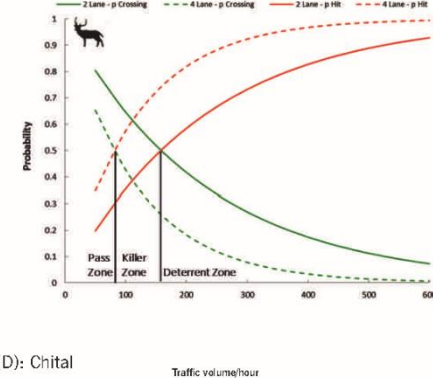
(A): Tiger



(B): Leopard



(C): Gaur



(D): Chital

Traversability models showing probability of hit (red lines) or successful crossing (green lines) of (A) Tiger (B) Leopard (C) Gaur and (D) Chital on NH 7 with respect to available traffic volume (452 vehicles/hr) and heterogeneity as on March, 2015

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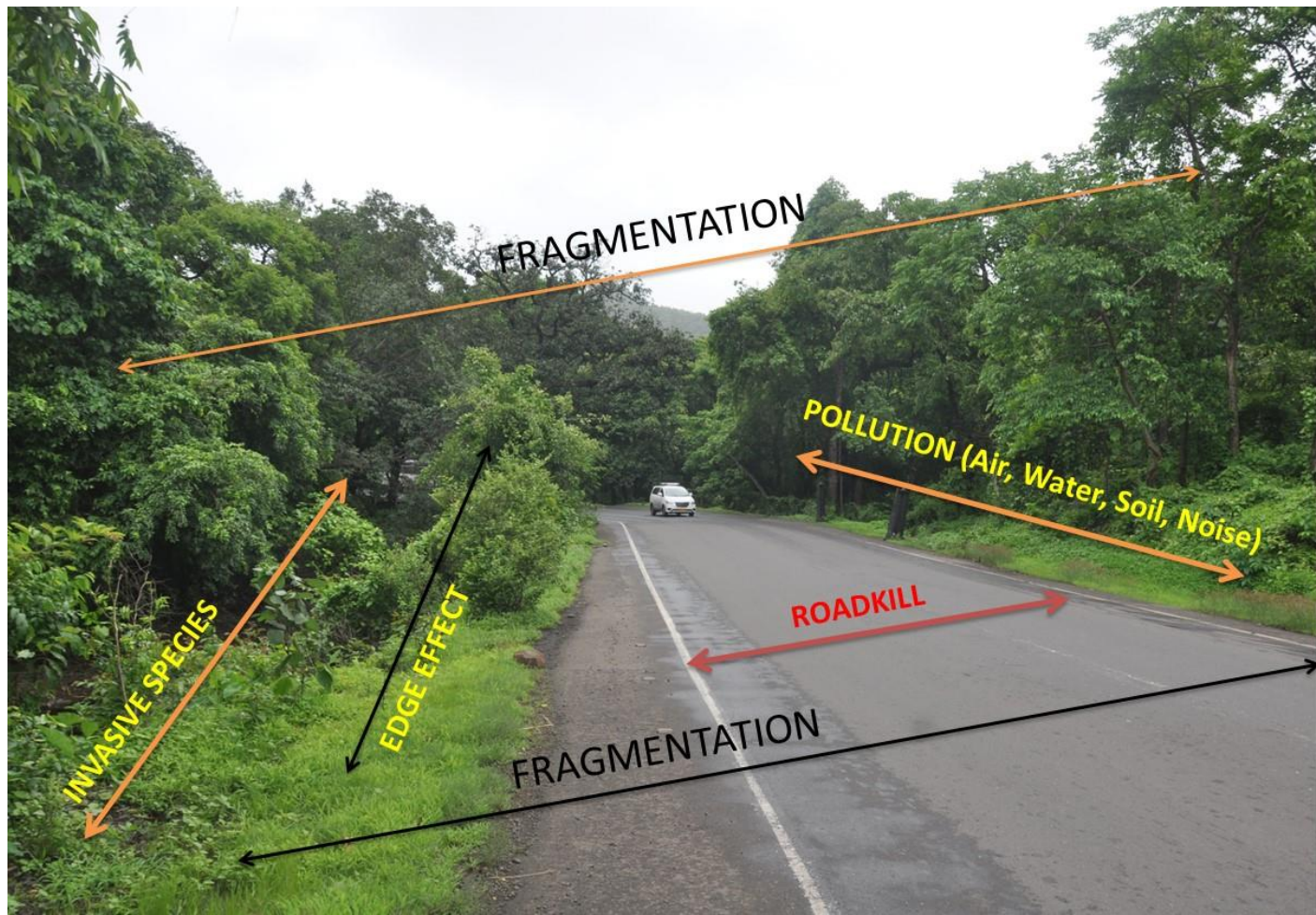
Source: Habib et al. 2015



# Linear Infrastructure: *Overview of Impacts*

## Impacts at a Glance...

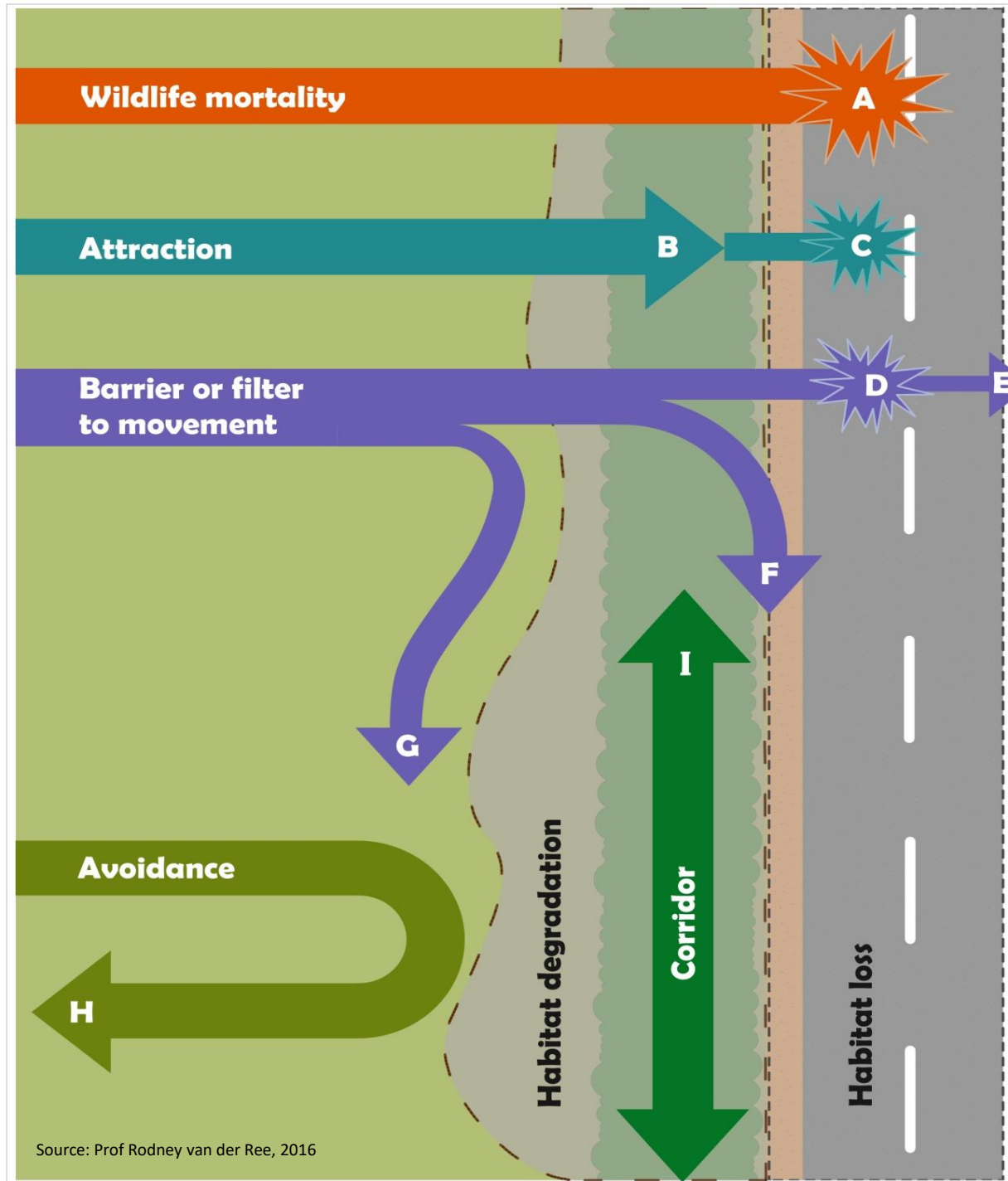
(All these ultimately impair genetic exchange)



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# Linear Infrastructure: Overview of Impacts

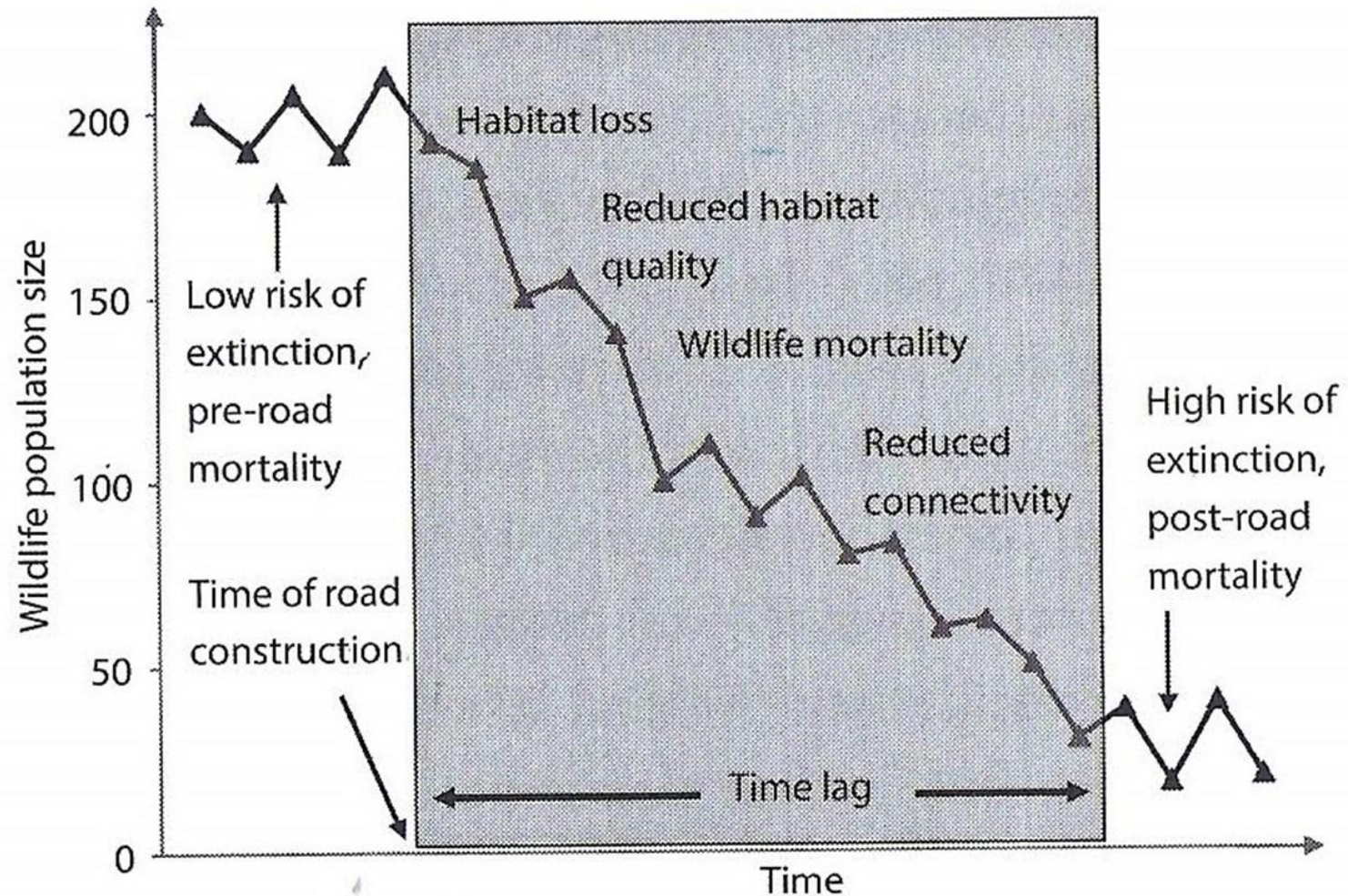
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# Linear Infrastructure: *Overview of Impacts*

## Modeling the long-term Impacts



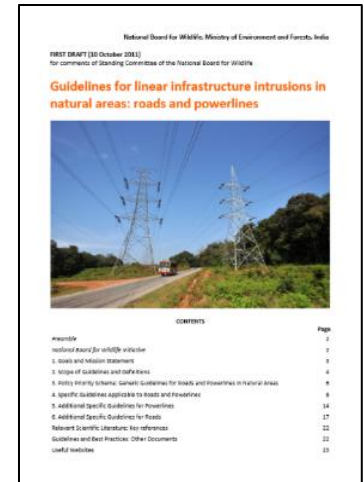
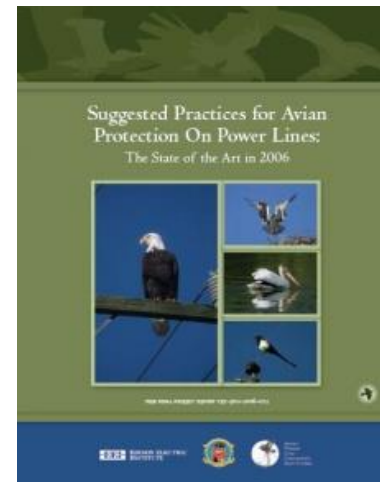
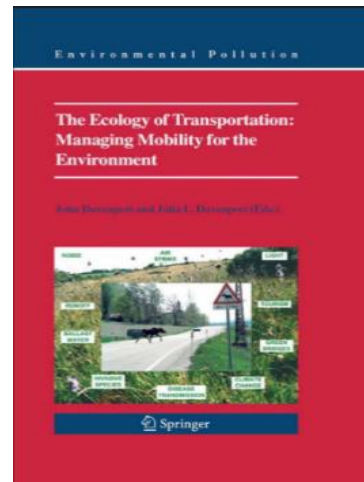
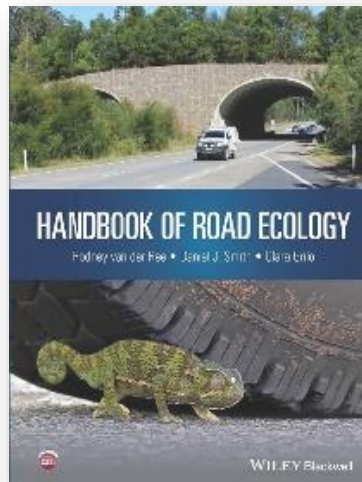
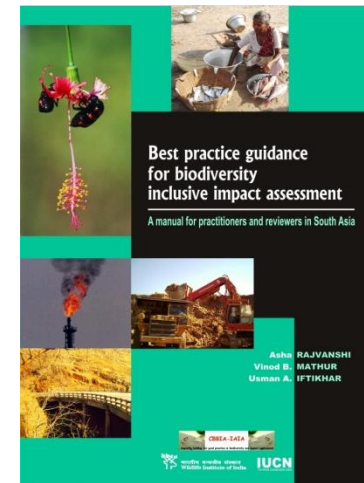
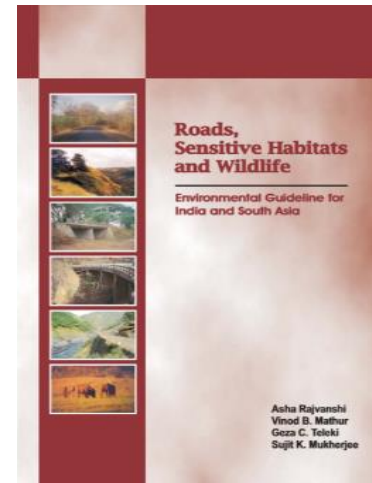
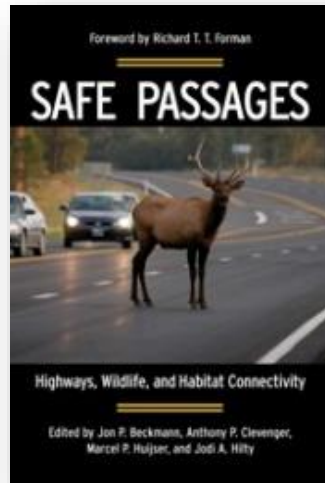
# Green Infrastructure...

A process/ approach to counter the negative impacts of linear infrastructure developments

## MITIGATION PRINCIPLES

- Sensitive planning and design to protect wildlife
- Connectivity is the key
- Context matters
- Grounded in science, land use theory and practice
- Pre-identifies ecologically significant lands and suitable development areas
- Designed to provide a framework for growth
- Planned and protected *before* development

# Available guidance



# Why a new guide for building capacity for SGI?

- Provide solutions so that conservation values and actions are aligned to land development, growth management and linear infrastructure planning in the Indian context.
- Means to sensitize developers to plan, implement and pursue development objectives in sink with conservation priorities.
- Serve as a '**How to**' guide for planning biodiversity-friendly developments especially by agencies such as NHAI, Indian Railways, Powergrid Corporation.



# The new Best Practice Guide '*Eco-Friendly Measures to Mitigate Impacts of Linear Infrastructure on Wildlife*'



High Resolution:

[http://www.wii.gov.in/images//images/documents/eia/EIA\\_BPG\\_Report\\_2017.pdf](http://www.wii.gov.in/images//images/documents/eia/EIA_BPG_Report_2017.pdf)

Low Resolution:

[http://www.wii.gov.in/images//images/documents/eia/EIA\\_BPG\\_Report\\_2017\\_low.pdf](http://www.wii.gov.in/images//images/documents/eia/EIA_BPG_Report_2017_low.pdf)

# Greening the Transport Sector through Smart Plans and Eco-friendly Designs

## *What Country Capacities are needed?*

Scientific capacity to generate data/ information to prove that wild species conservation would get '*impaired*' by infrastructure development

Nature-engineering based capacity to plan, design and construct infrastructure, which is both smart and green



*more...*



# The Way Ahead...

- Use best available science for planning and implementing '*species-specific*' and '*site specific*' mitigation options.
- Collaborate and coordinate with road/ highway development agencies in all stages of planning and implementing to avoid '*retrofitting*' and '*fait accompli*' situations.
- Provide best practice guidance tool/ approach.



High Resolution:

<http://www.wii.gov.in/images//images/documents/eia/EI A BPG Report 2017.pdf>

Low Resolution:

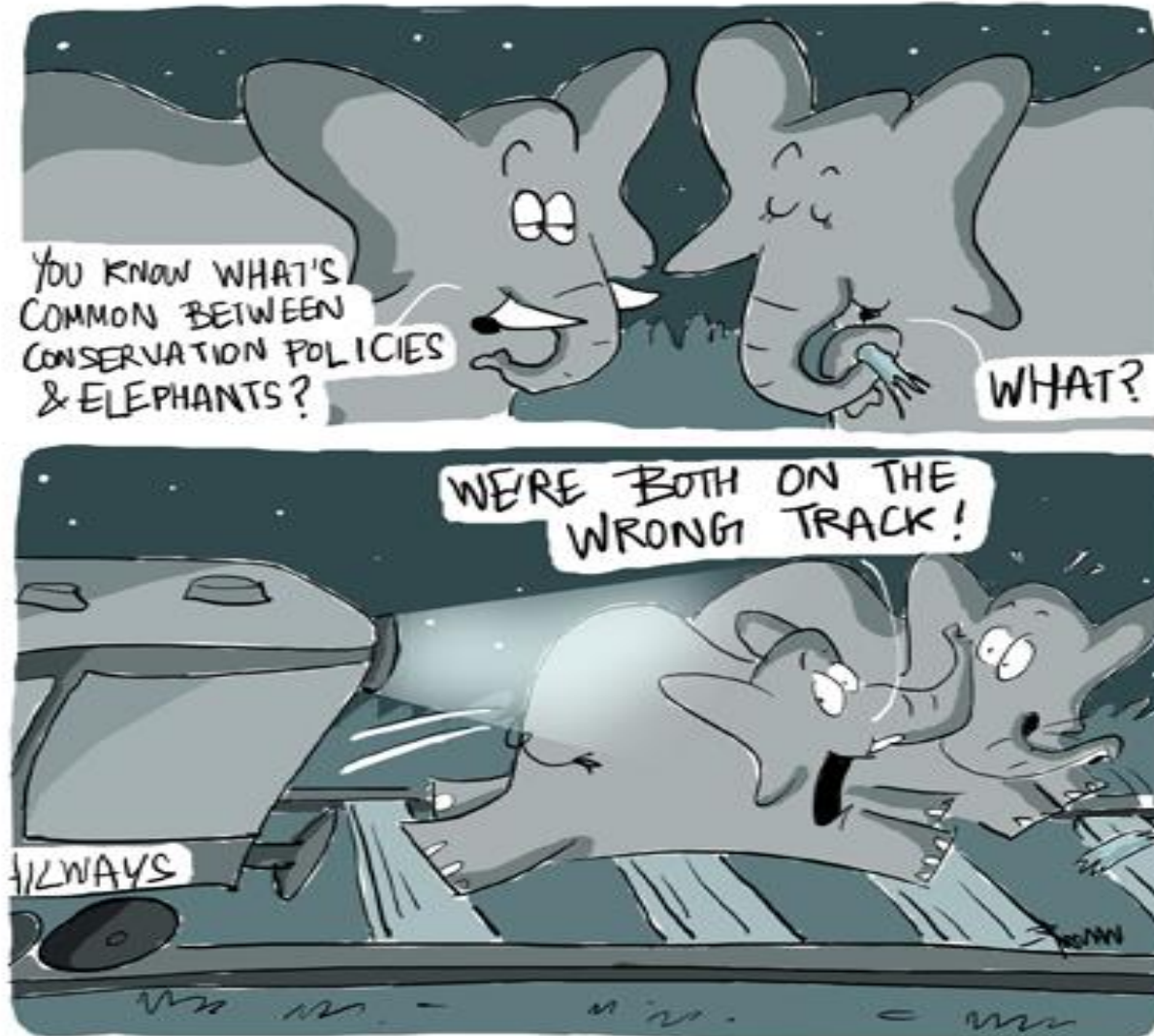
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# **Beyond the Best Practice Guidance on SGI...**

- ◆ **Training of Stakeholders.**
- ◆ **Training of Decision-makers/  
Regulators**
- ◆ **Compliance Monitoring**
- ◆ **Continuous investments of technical  
and financial resources in natural  
capital conservation and SGI  
development by ADB, World Bank and  
others..**



# Are we on the wrong track...



Science is about knowing; *Engineering is about doing...*  
*Henry Petroski*





# Nature Nurtures... Conserve Nature

Together we can build a frame work that  
nourishes and not depletes our natural assets...

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***Thank You !***

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