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BUILDING A FOUNDATION FOR LINEAR INFRASTRUCTURE SAFEGUARDS IN ASIA


Credit: Asif Imran

MODULE 4.

BEST PRACTICES FOR DATA COLLECTION AND MITIGATION

CONTENT

PART 1

1. IMPACTS OF LI
2. MITIGATION HIERARCHY
   - Case study – Nepal*
3. DATA NEEDS:
   - Pre & Post Construction?
   - Methods
   - Case studies

PART 2

1. CASE FOR WILDLIFE CROSSINGS
   - Effective measures
   - Considerations for design
2. ENGAGING BIOLOGISTS
   - Case study – China*
3. 5 MOST IMPORTANT POINTS
4. LOOKING FORWARD

*Invited presenter

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BIODIVERSITY IS DECLINING ACROSS THE GLOBE AT AN UNPRECEDENTED RATE.

*Approximately 50 to 70% of the Earth's land surface currently modified for human activities**

*Tucker et al. 2018. Moving in the Anthropocene. Science 359:466-469.

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HABITAT LOSS AND FRAGMENTATION - CAUSED BY NATURE

Hurricanes – Fires – Drought – Insect outbreaks ….

Credit: Ian Turnell from Pexels

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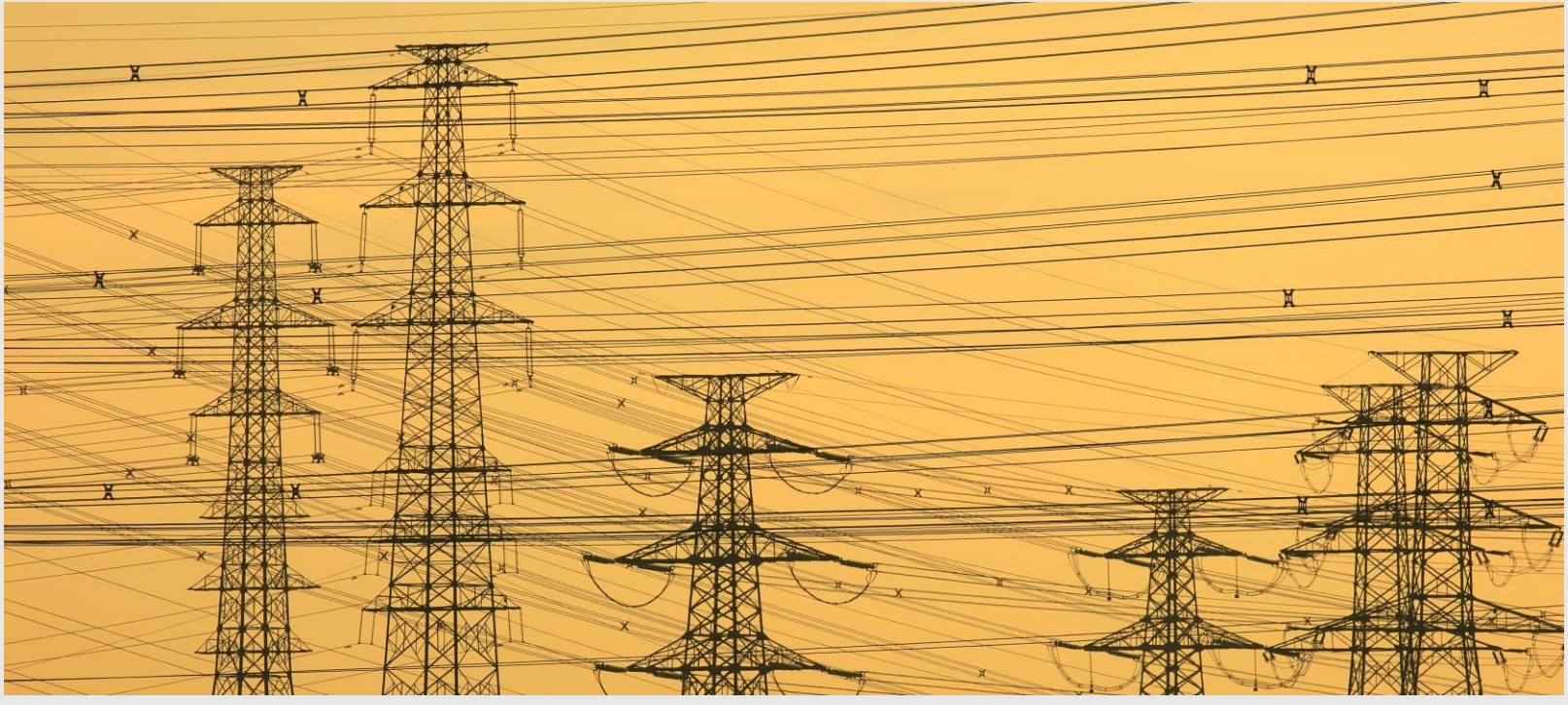
HABITAT LOSS AND FRAGMENTATION – CAUSED BY HUMANS



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A PAVED PLANET:

- 25 million km of new road lanes
- 300,000 km new railway tracks

Dulac, J. 2013. Global transport infrastructure requirements, Estimating road and railway infrastructure capacity and costs to 2050. IEA, Paris, France.

Credit: Tom Fisk from Pexels

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Asia is Global Biodiversity Hotspot

Among 25 of the world's biodiversity hot spots, 7 are in Asia*

Without proper safeguards, ongoing and anticipated expansion of LI will further fragment habitat, increase wildlife mortality, and threaten biodiversity.

Myers, N., Mittermeier, R., Mittermeier, C. *et al.* (2000) Biodiversity hotspots for conservation priorities. *Nature*

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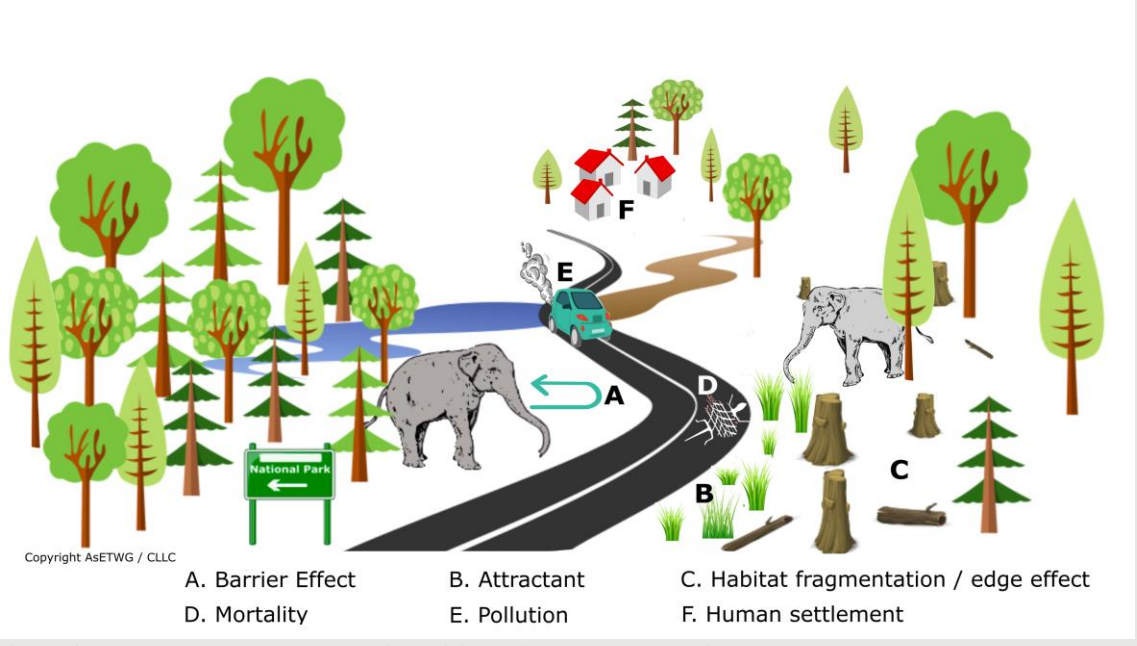
LISA PROJECT TASKS

Conduct	Conduct spatial analyses of LI projects most likely to impact biodiversity and critical habitats
Synthesize	Synthesize research to understand the impacts of LI on wildlife and critical habitats
Compile	Compile case studies of exemplary wildlife-friendly LI projects and provide cautionary examples
Examine	Examine capacities regarding policies, regulations and resources for adopting LI safeguards
Identify	Identify opportunities and barriers for implementing biodiversity safeguards in key countries
Develop	Develop training materials for a capacity building program

LINEAR INFRASTRUCTURE (LI) – ROADS, RAILS, AND TRANSMISSION LINES



Credit: Asian Elephant Transport Working Group / Center for Large Landscape Conservation

Impacts of LI

Direct effects

Indirect effects

LI Effect Zone

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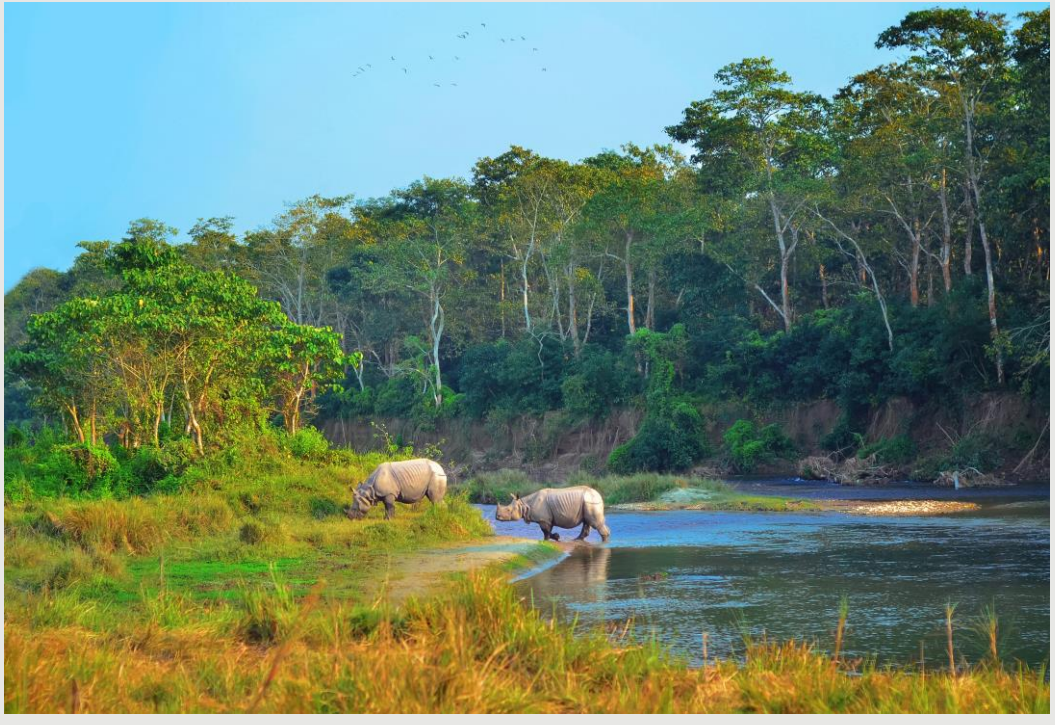
MODULE 4

Conservation of Biodiversity and Wildlife Populations



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HABITAT

…is a place where an organism makes its home.

…meets all the environmental conditions an organism needs to survive.

…..everything it needs to find and gather food, select a mate, and successfully reproduce

Credit: Ian Clevenger

HABITAT LOSS AND FRAGMENTATION *VS.* ROADS

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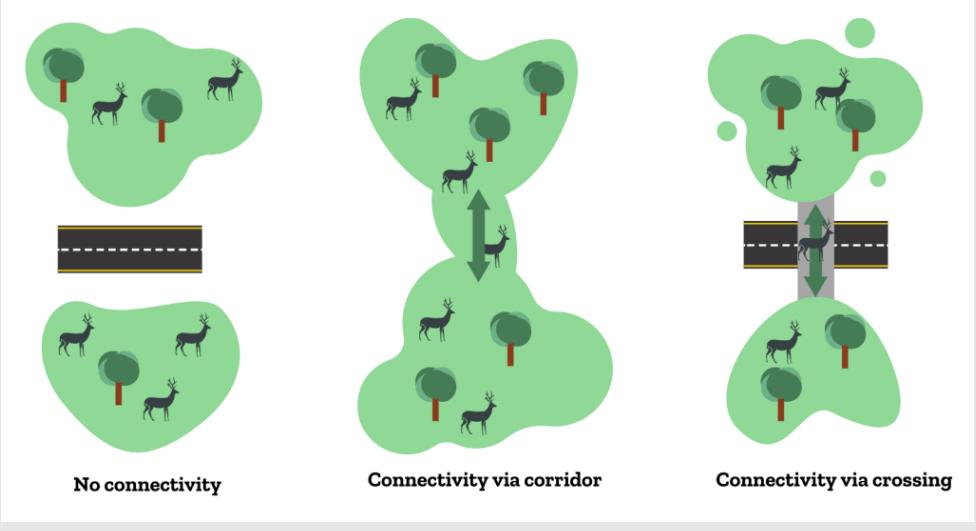
HABITAT CORRIDORS

Components of the landscape that facilitate the movement of organisms and processes between areas of intact habitat.



Credit: Center for Large Landscape Conservation

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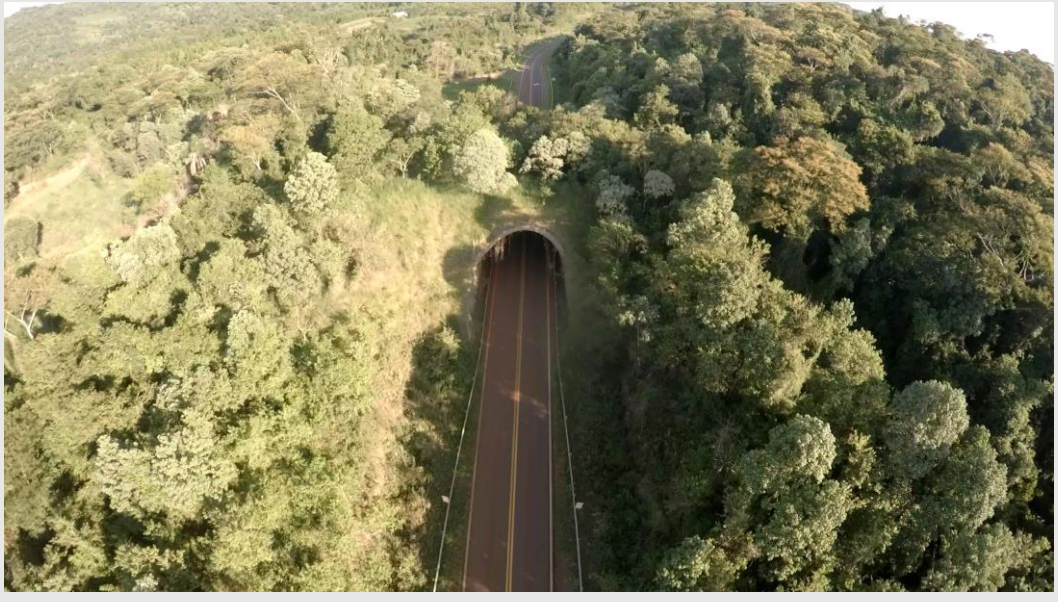
LANDSCAPE PERMEABILITY

Keeping Connections Intact

- ✓ OVERPASSES
  - ✓ Tunnels
- ✓ UNDERPASSES
  - ✓ Flyovers
- ✓ FENCING
  - ✓ No fence



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MITIGATION HIERARCHY

1. AVOID
2. MINIMIZE / MITIGATE
3. COMPENSATE
4. RED FLAG PROJECTS

Credit: Rob Ament

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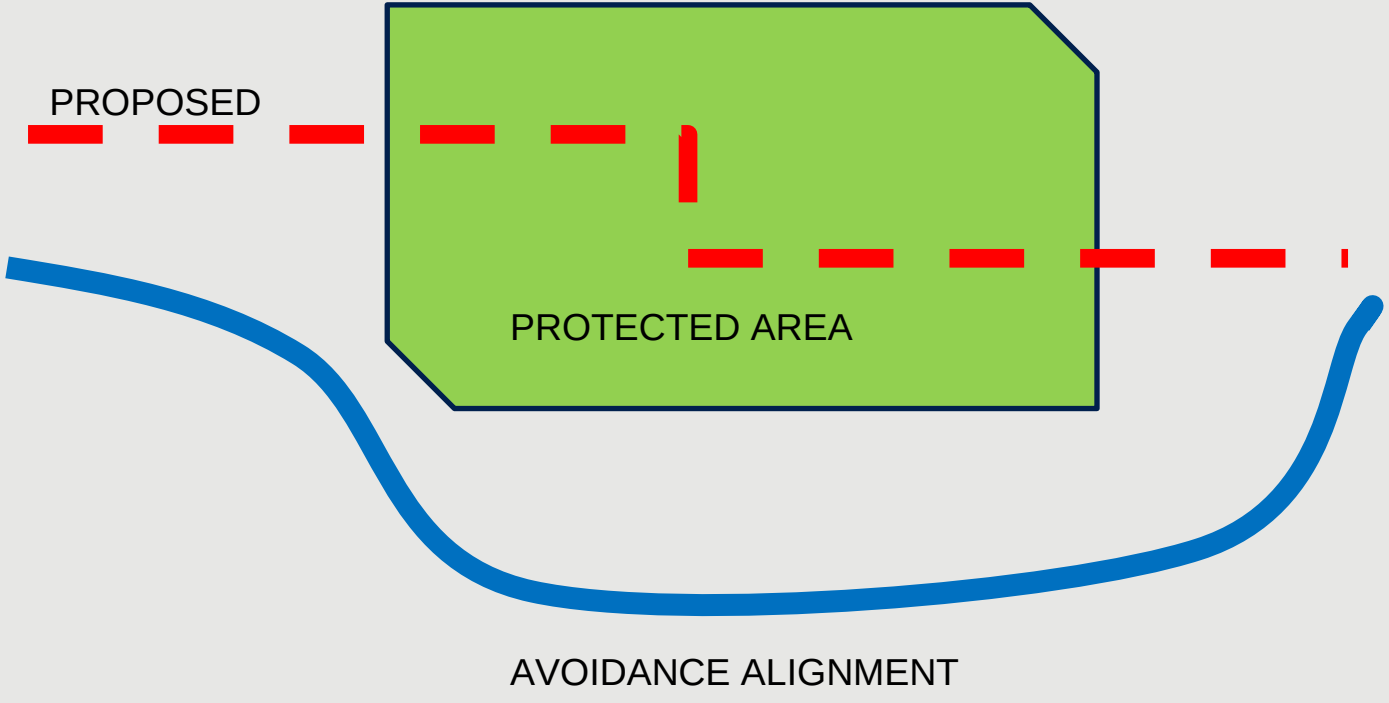
MITIGATION HIERARCHY

AVOIDANCE



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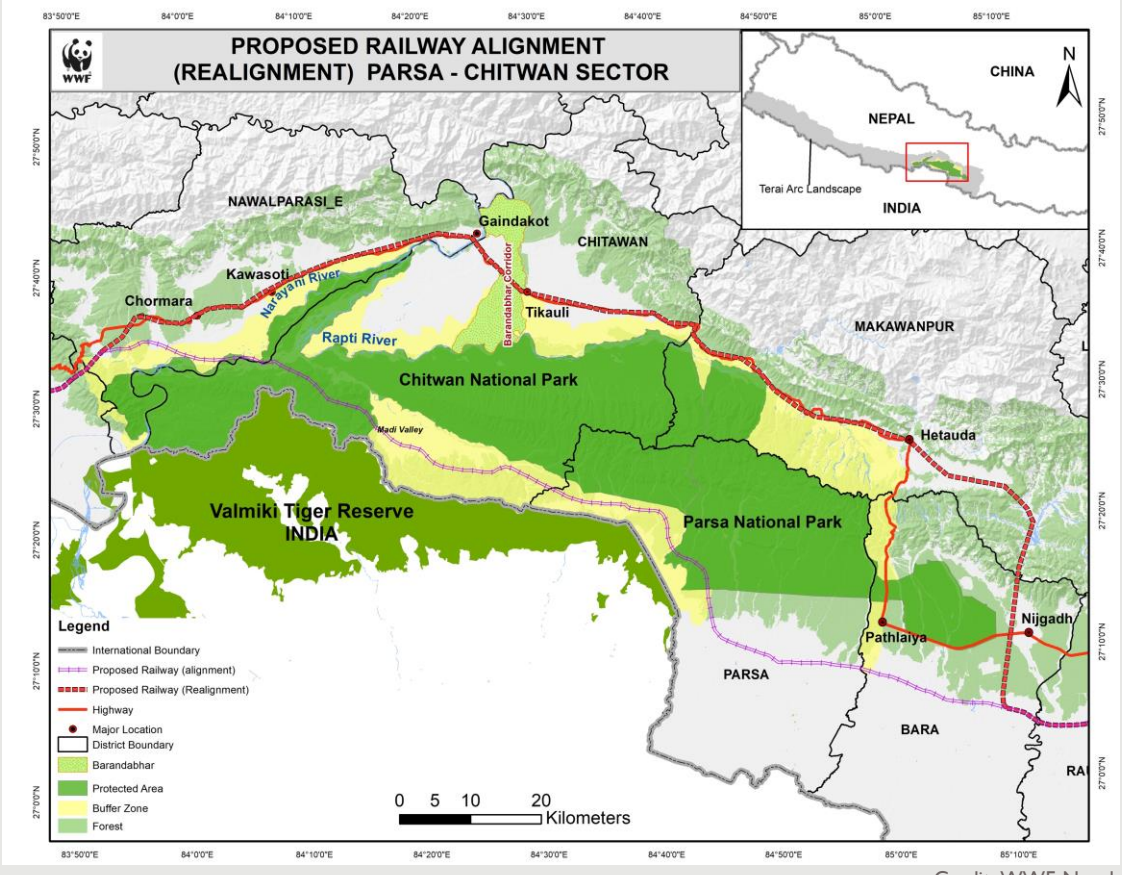
CASE STUDY – NEPAL RAILWAY



Credit. WWF-Nepal

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—Case Study Presenter:

Pramod Neupane,
Sustainable Infrastructure Programs Manager,
WWF Nepal

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CASE STUDY – NEPAL RAILWAY

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MITIGATION HIERARCHY

MINIMIZE / MITIGATE

Credit. Rob Ament

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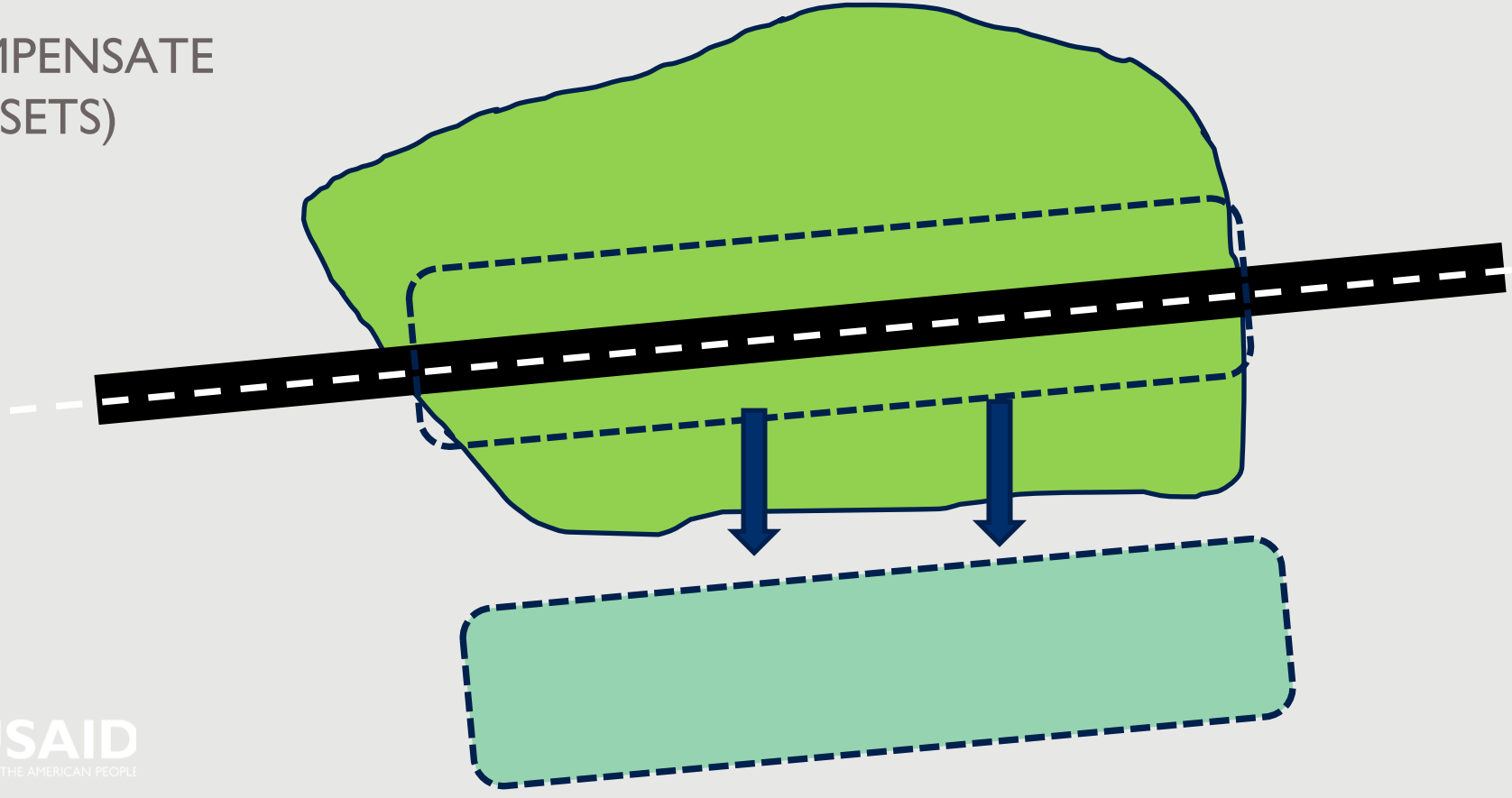
MITIGATION HIERARCHY

COMPENSATE (OFFSETS)



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RED FLAG PROJECTS

"*IF YOU CAN'T BUILD WELL, THEN BUILD NOTHING AT ALL*"

W. LAURANCE

Laurance, W. (2018). If you can't build well, then build nothing at all. Nature, 563(7731), 295–295. https://doi.org/10.1038/d41586-018-07348-3

ENVIRONMENTAL IMPACT ASSESSMENTS

GENERAL IN DESCRIPTION OF IMPACTS
Physical, Ecological, Social, Cultural

"CATEGORY A" – Need greater scrutiny and detail
Baseline Biodiversity Assessment (BBA)

Who does this ? – Subject matter experts

PRE-CONSTRUCTION DATA COLLECTION

BIODIVERSITY BASELINE ASSESSMENTS (BBA)

Category A projects

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WILDLIFE DATA NEEDS FOR PLANNING

What data do we need to collect?

What are the impacts?

"The objectives"

1. Mortality hotspots
   - Existing LI
   - New alignment ?
2. Species occurrence

Credit: Wenjing Xu

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Credit: Rob Ament

DATA OUTPUTS

Results of field data collection

Road-kill hot spots/clusters (transects, surveys)

- Species occurrence
- Location
- Severity of impact

Species Occurrence (detection methods, modelling)

- Distribution
- Corridors
- Modelling Connectivity

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METHODS

SYSTEMATIC SEASONAL DATA

SURVEY APP USED
- DEAD WILDLIFE
- LIVE OBSERVATIONS
- ROAD CROSSINGS

Credit T Clevenger:

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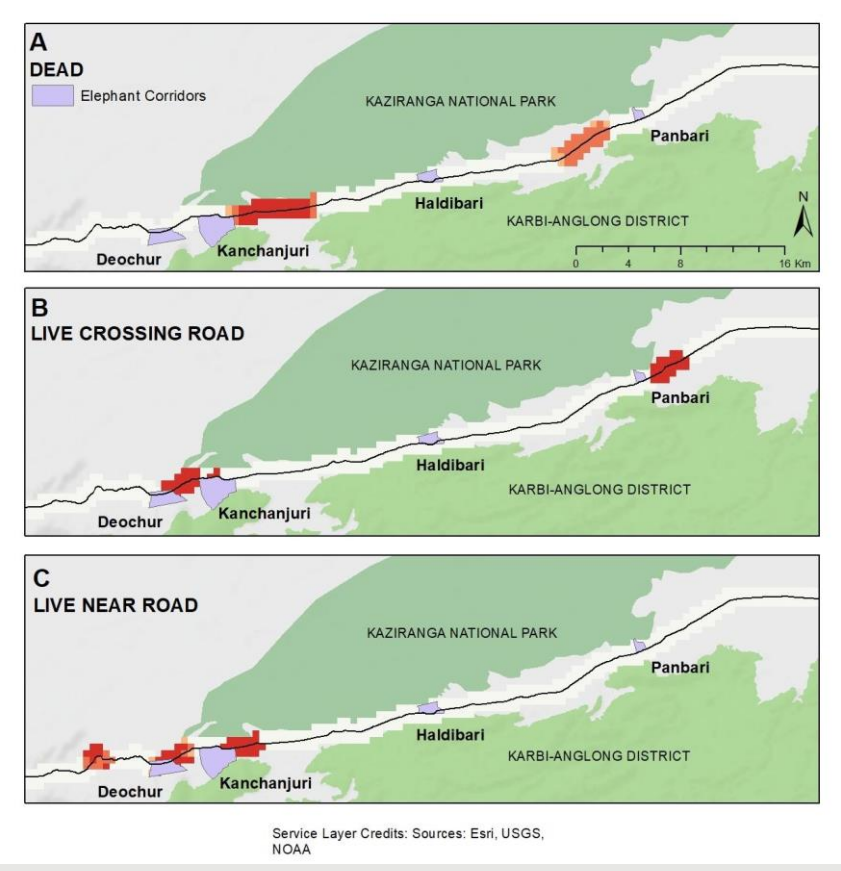
CASE STUDY - NH-37

Kaziranga National Park
Assam, India

ROaDS



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METHODS

Camera Trap Surveys

Credit: Norris Dodd

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METHODS

Camera Trap Surveys

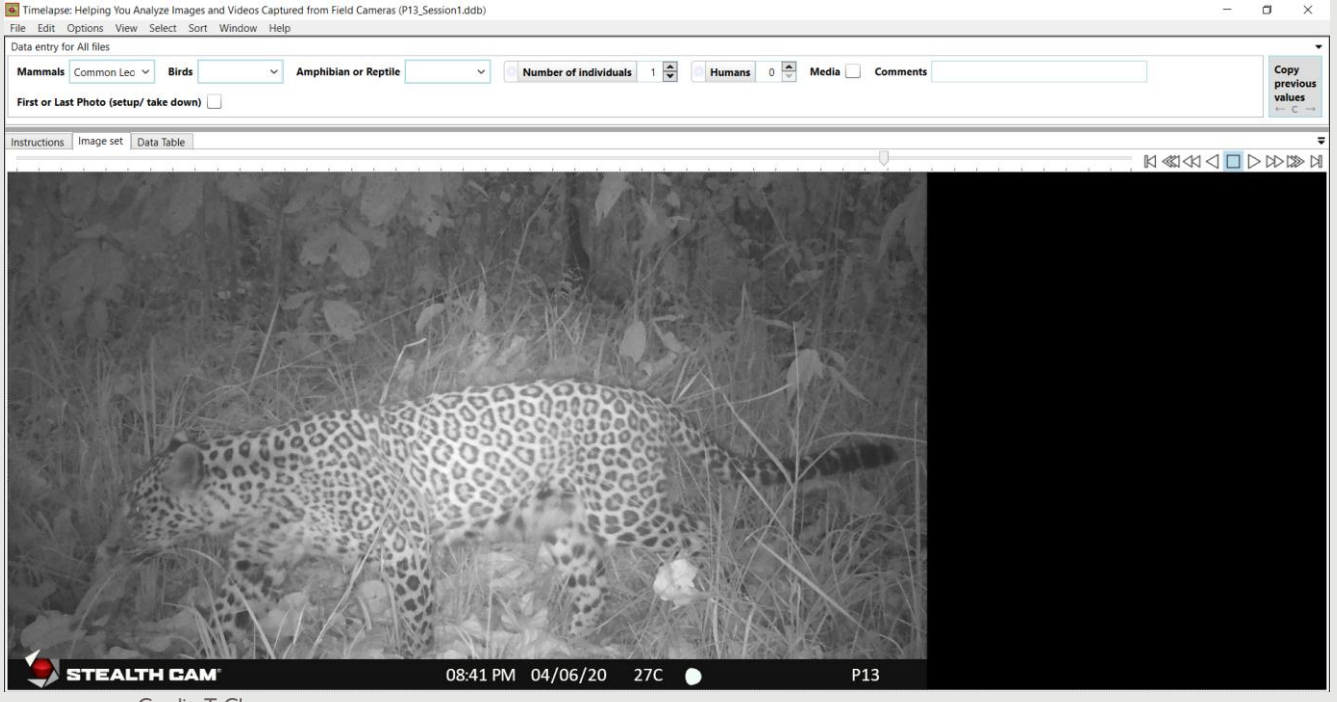
Canopy Camera Trap

Arboreal Canopy-dwellers

Credits: T. Gregory, Smithsonian Conserv Biol. Inst.

CAMERA TRAPS

Photo-classification of “Raw Data”



Credit: T Clevenger

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Sign Surveys

Credit: T Clevenger

Wildlife species: Small to large

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METHODS
UNDERPASS MONITORING (EXISTING)

Camera traps
Tracking mediums:
- Sand
- Sooted track plates

Credit: T Clevenger

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ASIAN DEVELOPMENT BANK

Biodiversity Baseline Assessment (BBA)
Pre Construction data collection
Phipsoo case study

Credit: Karma Chogyel

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CASE STUDY: BHUTAN

- Mountainous country with high biodiversity
- 52% of country in Protected Areas
- Road Network Project II (East-West Highway)

Southern Bhutan road projects:

- NH2 and NH 5
- NH2 within Phipsoo Wildlife Sanctuary

Credit: Tandin from Pexels

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CASE STUDY: BHUTAN

- EIA conducted: NH 2 & NH5 road projects:
  Wildlife Crossings recommended

- BBA for Phipsoo Wildlife Sanctuary (2014-15)
  1st BBA in Bhutan

- Surveys in 4 zones
  Border lowlands to upper foothills
  Terrain, elevation, vegetation differences

CASE STUDY: BHUTAN

BBA Design

Desktop screening of IUCN listed species
Camera trapping
Forest vegetation inventory
Avian surveys

SURVEY: 38 Cameras/33 sites (6 months)

4300 mammal images
27 species, 15 species IUCN-listed (2 Critically End.)

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CASE STUDY: BHUTAN

BBA – LESSONS LEARNED

1. Pre-construction data critically important for informed decisions

2. Biodiversity values:
    Highest in Core; Lowest on Border
    Re-alignment recommended (Avoidance, no net loss)

3. Project resulted in 1st wildlife crossing in Bhutan

Road construction cancelled . . . .
    Security and safety issues along Indian border

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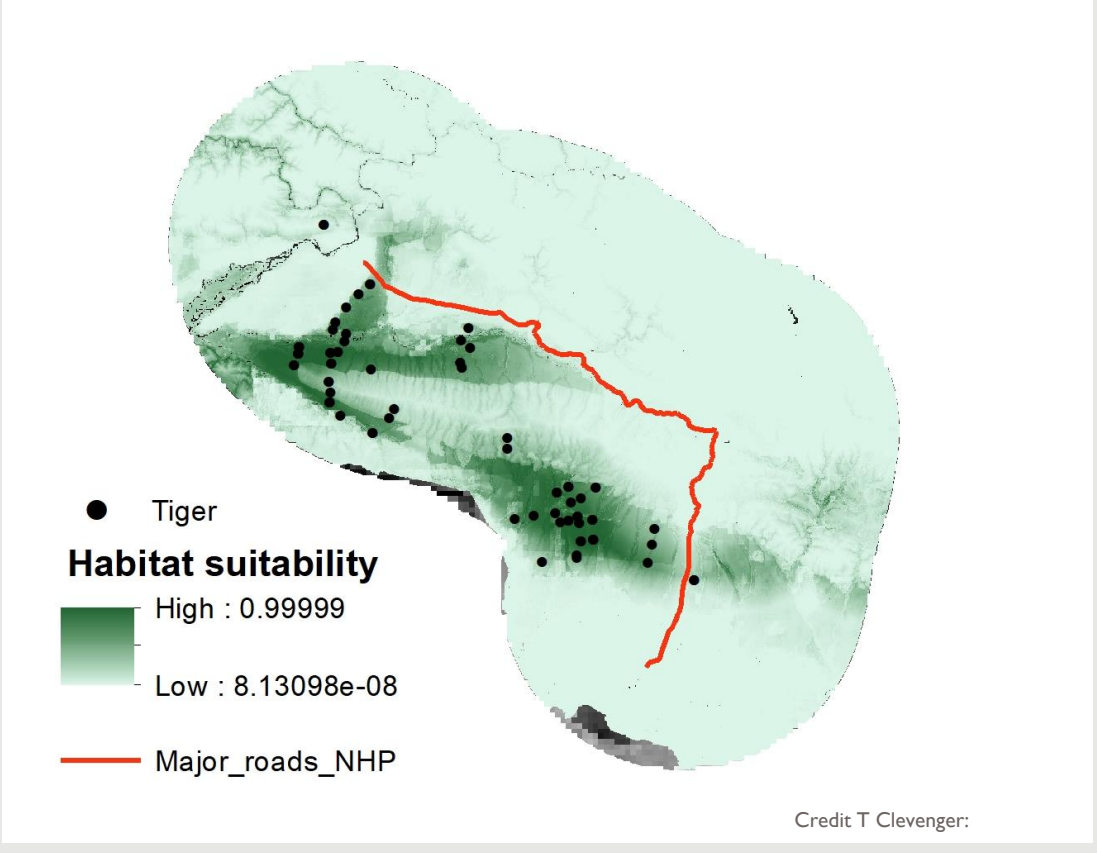
MOVEMENT/CONNECTIVITY

Models Used

<u>Identify:</u>
Critical habitats
Movement corridors
LI–Wildlife conflict areas

Narayanghat-Hetauda-Pathlaiya Road near Chitwan NP, Nepal



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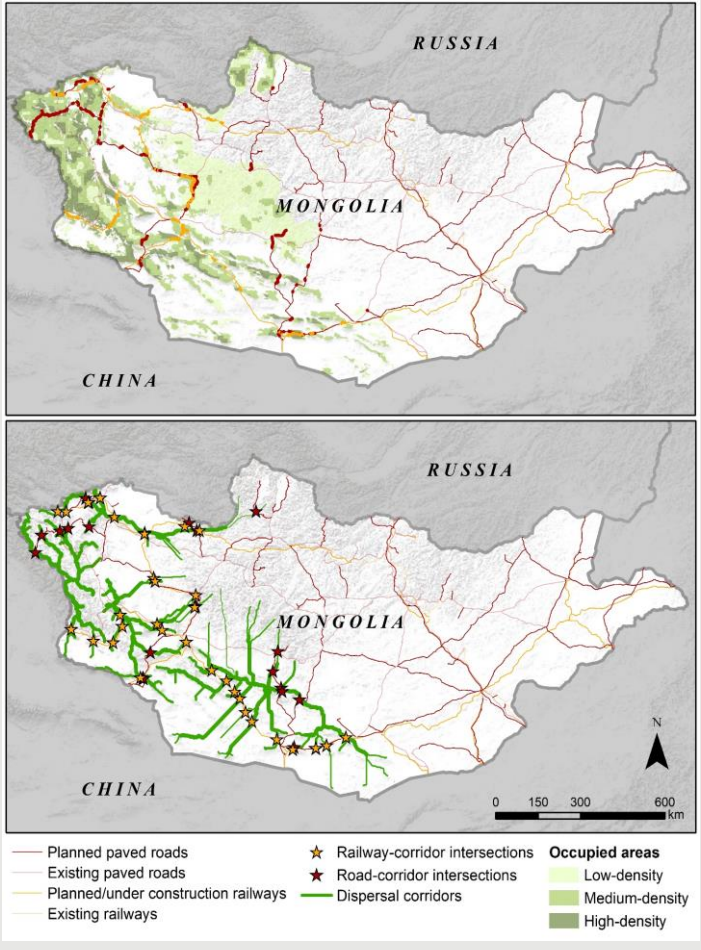
SPATIAL ANALYSIS

SNOW LEOPARD - MONGOLIA

Species occurrence

Predicting LI impacts



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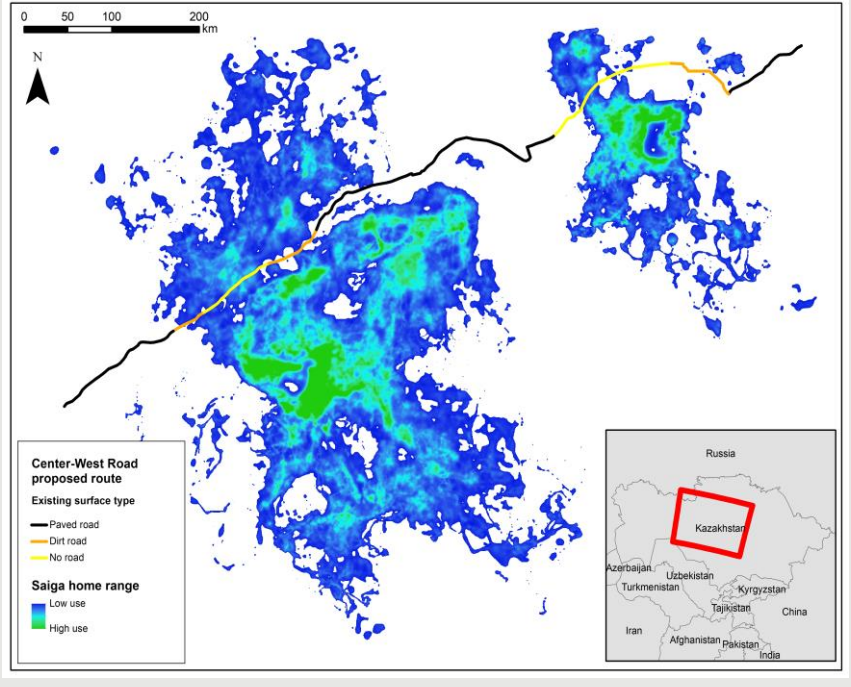
SPATIAL ANALYSIS

KAZAKHSTAN - - Center-West Road Planning
SAIGA ANTELOPE (Betpak-Dala population)

Home range use LI/Surface layers

Impacts on crossings:

2% paved roads
16% dirt road
81% no road



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POST-CONSTRUCTION DATA COLLECTION

MITIGATION EVALUATIONS & ASSESSMENTS

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MITIGATION OBJECTIVES

REDUCE MORTALITY

CONNECT POPULATIONS

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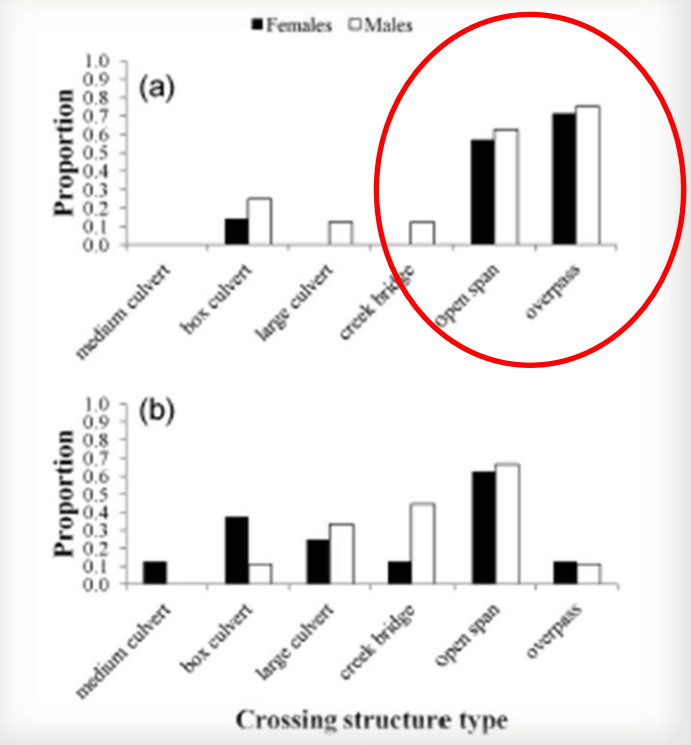
Monitoring Helps Inform Design

USE OF PASSAGE TYPE/DESIGN

Grizzly bears – Trans-Canada Highway
Banff National Park, Canada



Clevenger et al. Unpublished data.

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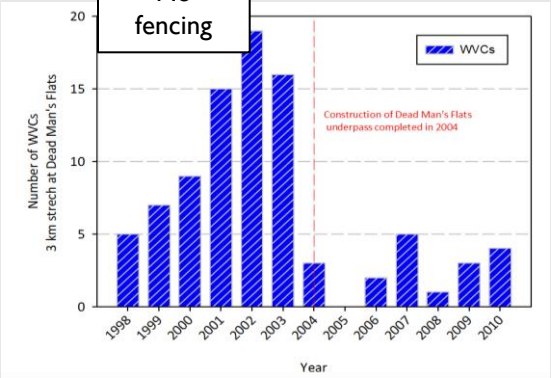
MONITORING OF MEASURES

BEFORE-AFTER CONTROL-IMPACT (BACI)

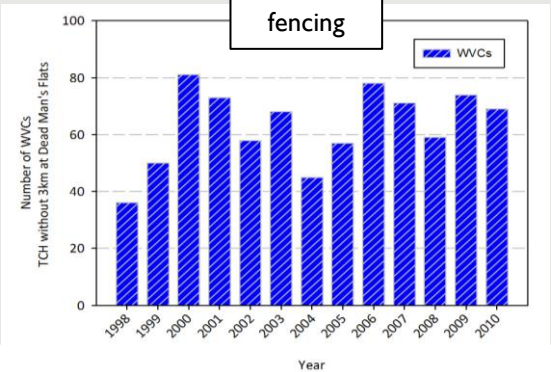
Credit: T Clevenger

BEFORE- No fencing

AFTER fencing



No fencing



Clevenger, unpublished data

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MONITORING OF MEASURES

BEFORE-AFTER CONTROL-IMPACT (BACI)

Movements and Population Connectivity

Increased movements will result in:

- Demographic connectivity (Breeding females)
- Genetic connectivity (Increased genetic diversity)

Long-term population viability !

True or False:

The mitigation hierarchy is used in the late stage of planning to help locate mitigation measures.

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True or False:

Biodiversity Baseline Assessments provide greater detail than Environmental Impact Assessments?

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Which of these methods of data collection is not used to detect wildlife species?

a. Camera traps
b. Observations
c. Satellite imagery
d. Surveys searching for sign (e.g. faeces, tracks)

THE CASE FOR WILDLIFE CROSSINGS

PROVEN MITIGATION MEASURES

- Warning signs
- Vegetation removal
- Fencing
- Relocation
- Animal Detection System (ADS)
- Crossing structures
- Speed reduction

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WILDLIFE CROSSING DESIGN TYPES

Overpass Design:

1. Landscape bridge
2. Wildlife overpass
3. Multi-use overpass
4. Canopy crossing

Credit: T Clevenger

Underpass Design:

5. Viaduct/flyover
6. Large mammal underpass
7. Multi-use underpass
8. Underpass with water flow
9. Small/medium-sized mammal underpass
10. Modified culvert design
11. Herpetile tunnel

FENCING IS BY FAR MOST EFFECTIVE

VARIED DESIGNS
Species needs

MATERIALS
Page/woven wire
Barrier walls
Synthetic fabric

Credit T Clevenger:

EFFECTIVE MEASURES

50 - Research papers reviewed*

"the combination of fencing and crossing structures led to an 83% reduction in road-kill of large mammals, compared to a 57% reduction for animal detection systems, and only a 1% for wildlife reflectors".

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*How Effective Is Road Mitigation at Reducing Road-Kill? A Meta-Analysis. (2016). https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0166941

THE CASE FOR WILDLIFE CROSSINGS

PROVEN MITIGATION MEASURES

Bhutan

Credit: Karma Chogyel

Credit: N Dodd

THE CASE FOR WILDLIFE CROSSINGS
PROVEN MITIGATION MEASURES

Bangladesh

4.8 x 30m wildlife underpass

Credits: Asif Imran ADB

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THE CASE FOR WILDLIFE CROSSINGS

PROVEN MITIGATION MEASURES

Credit: Rob Ament

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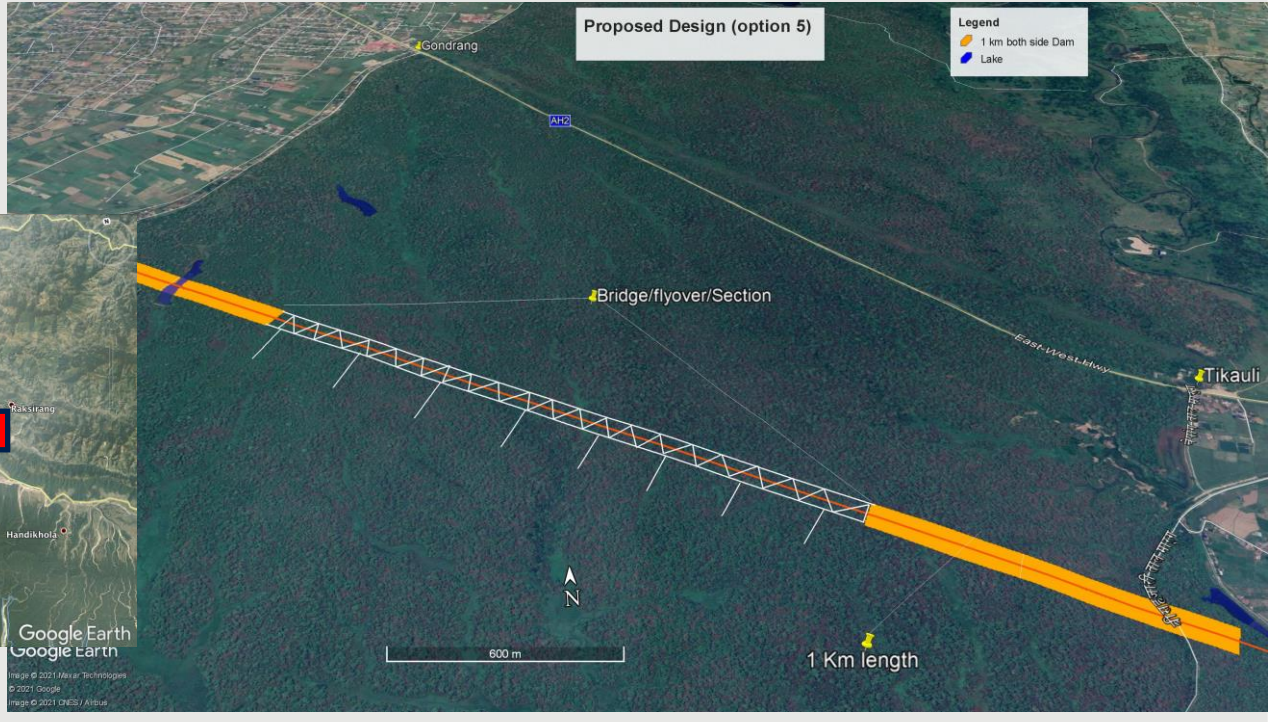
THE CASE FOR WILDLIFE CROSSINGS

PROVEN MITIGATION MEASURES



Credit: Department of Railway, Nepal

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THE CASE FOR WILDLIFE CROSSINGS

PROVEN MITIGATION MEASURES

3 Segments – Viaducts Planned

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THE CASE FOR WILDLIFE CROSSINGS

METHODS

MONITORING MITIGATION MEASURES

Credit: T Clevenger

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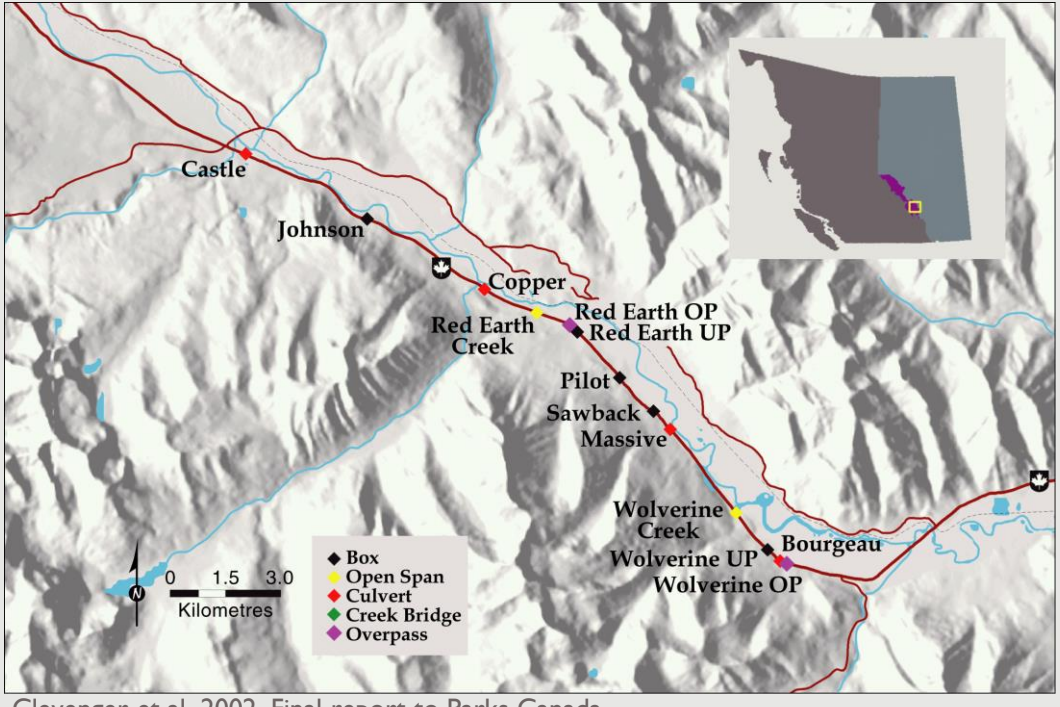
THE CASE FOR WILDLIFE CROSSINGS

PLANNING CONSIDERATIONS
SPACING INTERVAL & HOW MANY ??



Clevenger et al. 2002. Final report to Parks Canada.

THE CASE FOR WILDLIFE CROSSINGS

PLANNING CONSIDERATIONS

DESIGN TYPE ?

FOCAL SPECIES ?

MULTI-SPECIES ??

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THE CASE FOR WILDLIFE CROSSINGS

PLANNING CONSIDERATIONS
Over or Under ?? What Passage Type is Best ??

Credit T Clevenger:

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THE CASE FOR WILDLIFE CROSSINGS

PLANNING CONSIDERATIONS

Fencing / Barrier Wall

Credit: Rob Ament

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THE CASE FOR WILDLIFE CROSSINGS

PLANNING CONSIDERATIONS

Human Use and Disturbance

Credit T Clevenger:

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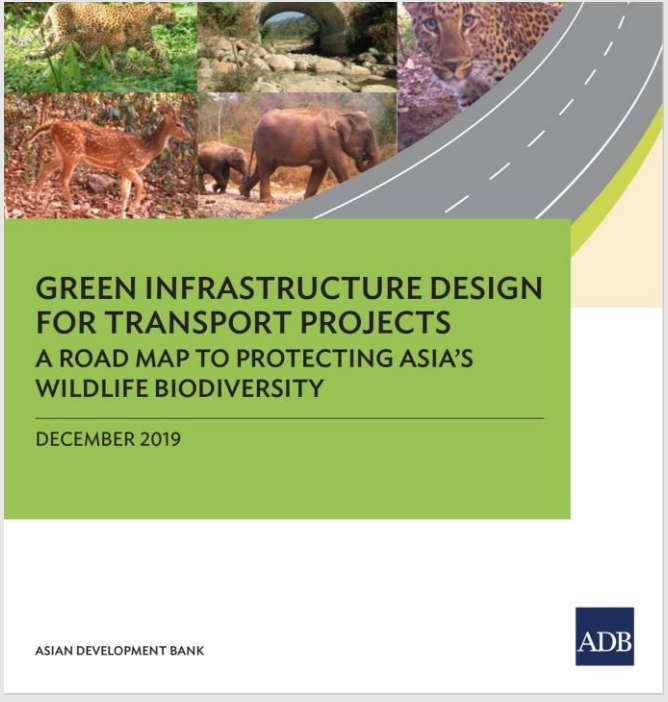
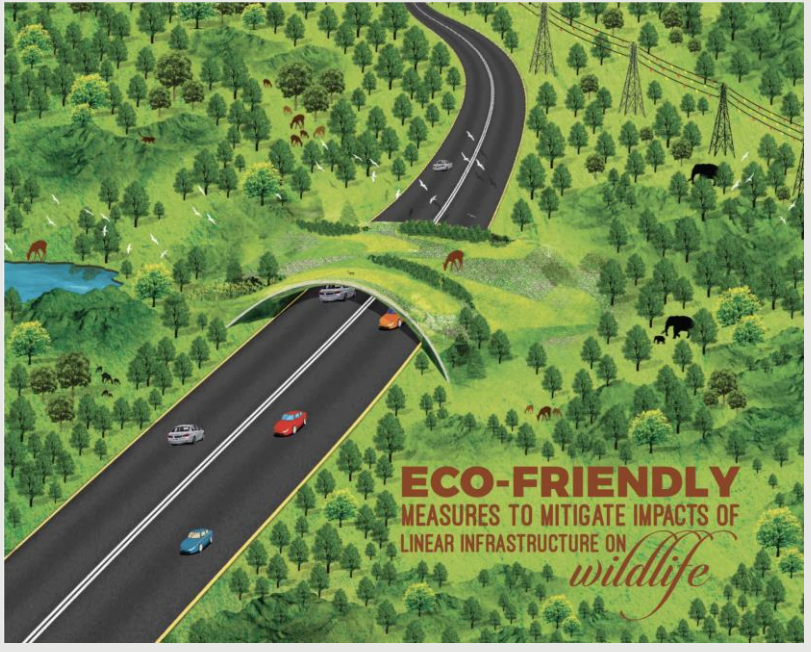
THE CASE FOR WILDLIFE CROSSINGS

RESOURCES AVAILABLE TODAY

ADB Handbook



Asian Development Bank



Wildlife Institute of India

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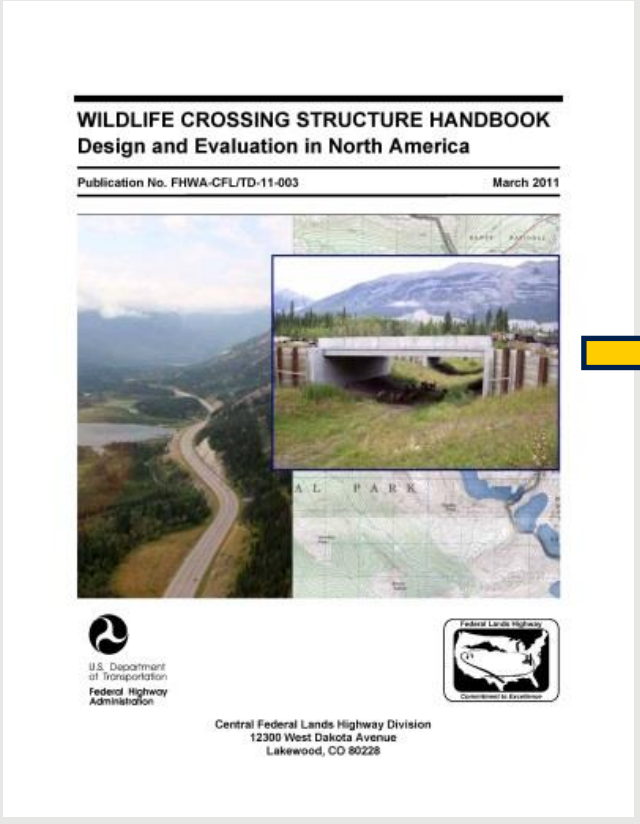

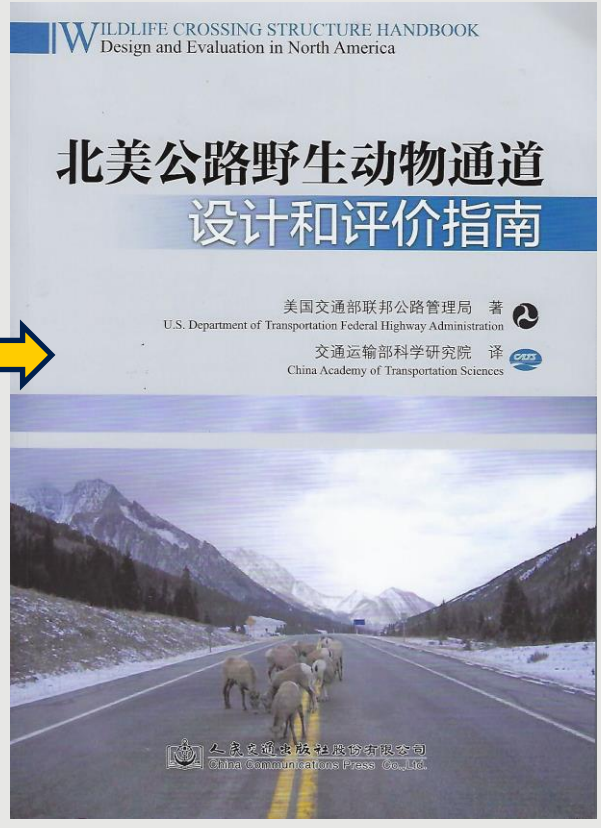

THE CASE FOR WILDLIFE CROSSINGS

PROJECT PLANNING & DEVELOPMENT

Lesson Learned from USAID LISA Case Studies

1. **LI projects need to use most current science** in terms of study design and methods used to assess impacts on key biodiversity and wildlife populations.

2. **Subject matter experts with extensive experience in assessment of LI impacts and design of biodiversity safeguards are critical** to ensure projects meet international standards and best practices are employed.

3. **Post-construction monitoring of safeguards with sufficient budgets** are needed to properly evaluate performance and project mitigation objectives are met.

4. Lessons learned from post-construction monitoring of safeguards should be **used to inform future plans and design on projects in Asia**

—Case Study Presenter:

Wenjing Xu, Fifth year PhD candidate,
University of California, Berkeley.

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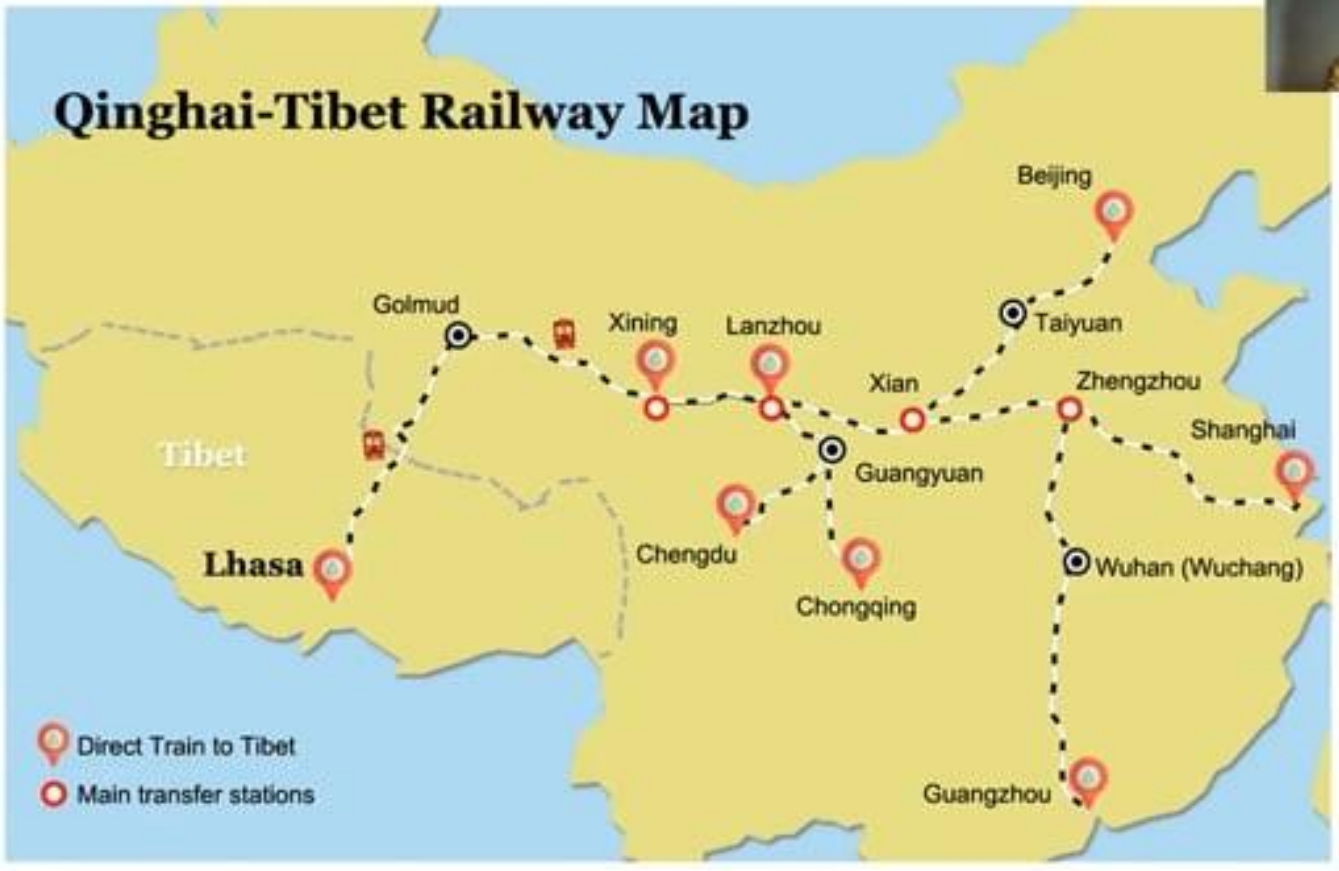
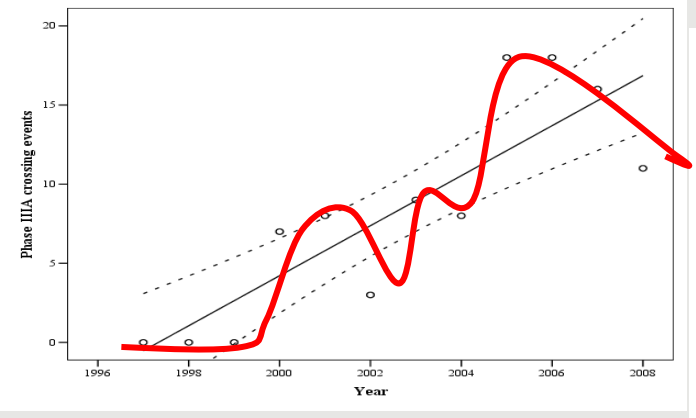

Qinghai-Tibet Railway Map
Beijing
Golmud
Xining
Lanzhou
Taiyuan
Xian
Zhengzhou
Shanghai
Tibet
Guangyuan
Lhasa
Chengdu
Chongqing
Wuhan (Wuchang)
Guangzhou
Direct Train to Tibet
Main transfer stations

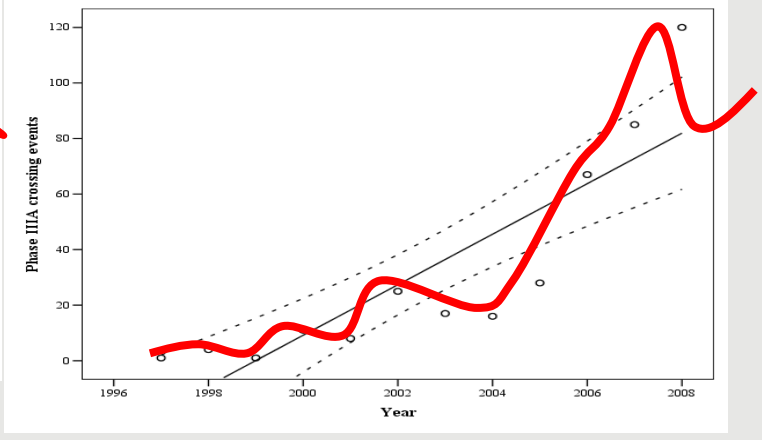
ADAPTATION/LEARNING

How long do we need to monitor use?

Species-specific trends, Banff NP, 1997-2008



Moose



Grizzly bear

Credit: Clevenger et al. 2009

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COMMON QUESTION AND MISCONCEPTION

Aren't Crossings Prey Traps?

Credit: T Clevenger

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It is important to evaluate mitigation measures because:

a. Others can learn from each project results
b. Mitigation measures are costly
c. Results of evaluations can help adjust future designs
d. All of the above

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Which of these is a critical part of the success of wildlife crossing structures?

a. Government endorsement
b. Local community support
c. Fencing
d. Hunting near wildlife crossing structures
e. None of the above

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THE CASE FOR WILDLIFE CROSSINGS

5 MOST IMPORTANT POINTS TO REMEMBER

1. LOCATION:
2. SCIENCE-BASED DATA:
3. DESIGN FOR MULTI-SPECIES: But focal drives design
4. RETROFITS: Easy and low-cost
5. MONITOR PERFORMANCE: Good investments?

PROVEN EFFECTIVE ! – 2 Decades of research

LOOKING FORWARD

AMBITIOUS LI PROGRAM IN ASIA

CAPACITY BUILDING IMPROVING

PROJECT APPROVALS & INCREASING CAPACITY

The need for rapid change in practices

ROLE OF MODEL PROJECTS TO CHANGE PRACTICES

Compelling evidence for implementation

QUESTION AND ANSWER SESSION

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ROB AMENT: rament@largelandscapes.org

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