TRAINING ON

Planning and Design of Smart Infrastructure for Biodiversity Protection

25–27 April 2022

Rhino Lodge, Sauraha, Nepal

Planning and Design of Smart Linear Infrastructure for Biodiversity Protection

25 – 27 April 2022

CREDIT: GREGOIRE DUBOIS

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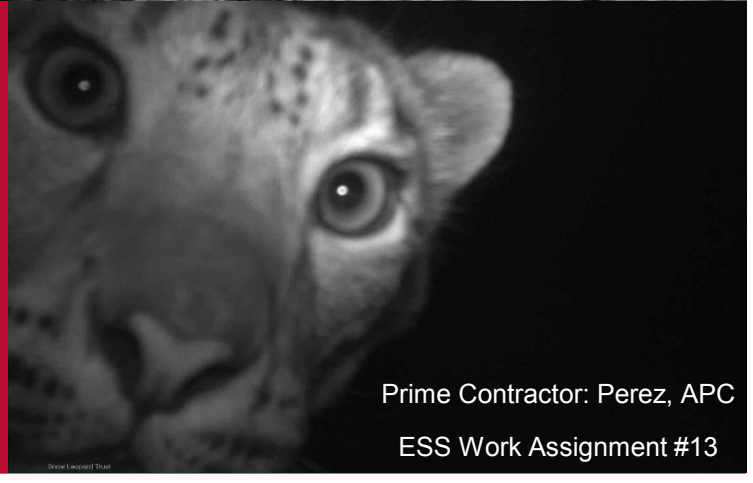
BUILDING A FOUNDATION FOR LINEAR INFRASTRUCTURE SAFEGUARDS IN ASIA

"THE LISA PROJECT" BIODIVERSITY RESULTS

Rob Ament,
LISA Project Manager

Senior Conservationist,
Center for Large Landscape Conservation

Road Ecology Program Manager,
Western Transportation Institute – Montana State University

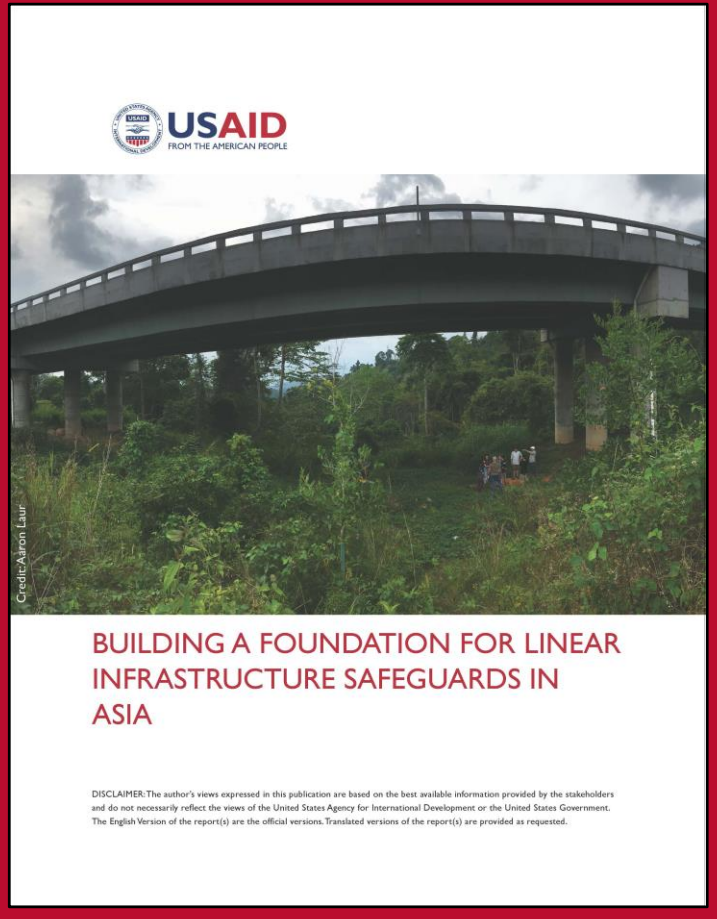


Prime Contractor: Perez, APC

ESS Work Assignment #13

“THE BIG PICTURE”

LINEAR INFRASTUCTURE
&
ECOLOGICAL CONNECTIVITY
BIODIVERSITY - WILDLIFE
CLIMATE CHANGE



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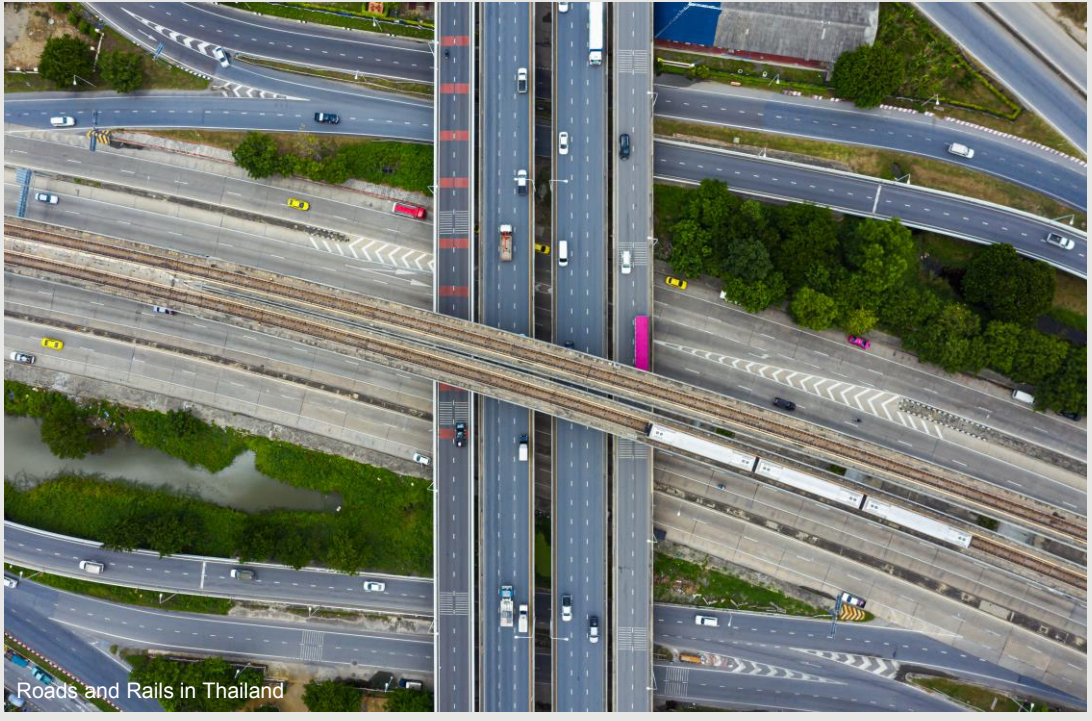
A PAVED PLANET, by 2050

- 25 million km of new road lanes

- 300,000 km new railway tracks

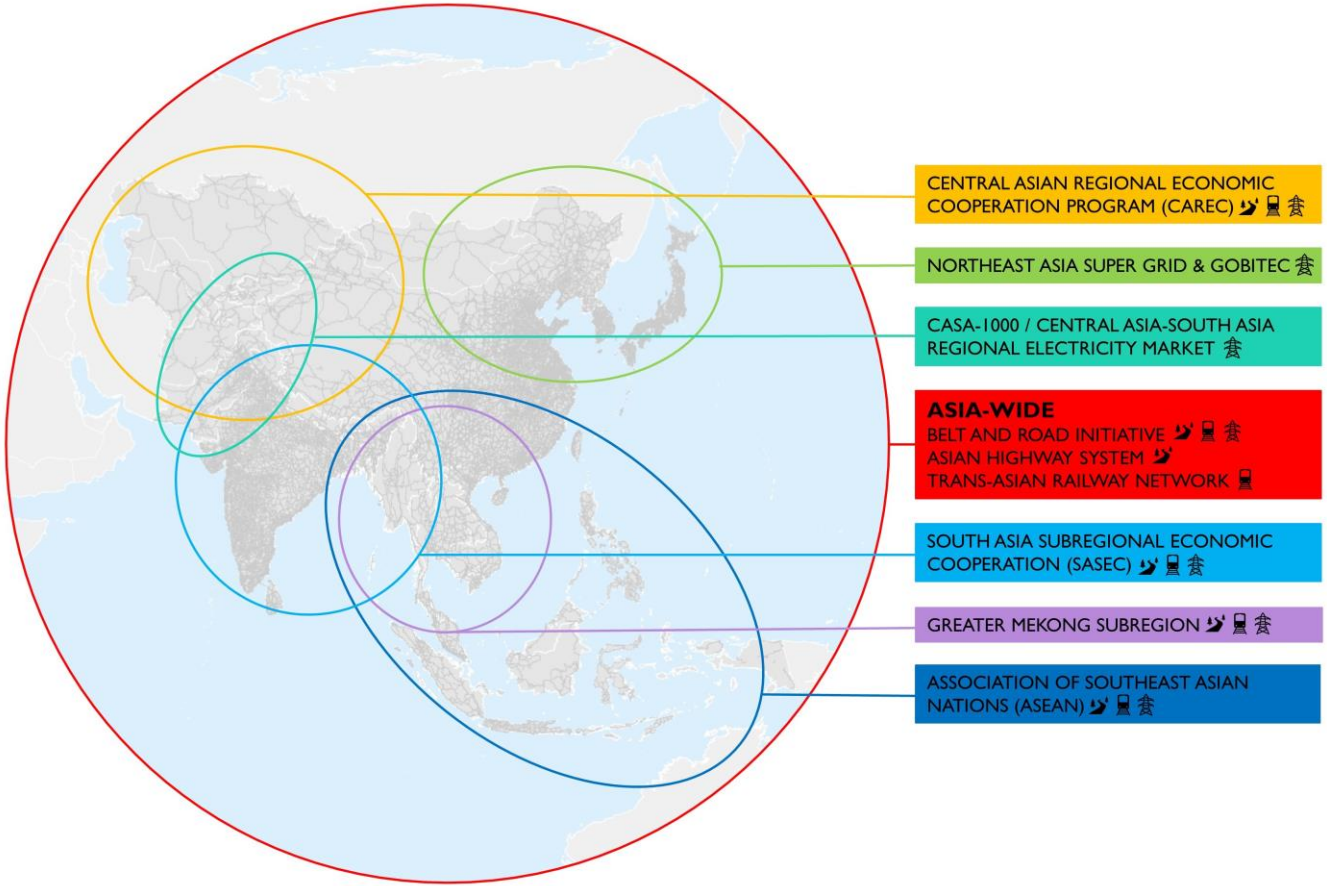
Dulac, J. 2013. Global transport infrastructure requirements, Estimating road and railway infrastructure capacithy and costs to 2050. IEA, Paris, France.



Roads and Rails in Thailand

Currently worldwide: 33.5 million km of roads

ASIA'S INTERNATIONAL INITIATIVES: COORDINATED LI EXPANSION



EXTINCTION RISK HIGHEST IN FRAGMENTED LANDSCAPES
TERRESTRIAL MOVEMENT OF WILDLIFE REDUCED BY 50% IN HIGHLY MODIFIED LANDS

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Crooks et al. 2017. Quantification of habitat fragmentation reveals extinction risk in terrestrial mammals. PNAS, 114, 7635–764
Tucker et al. 2018. Moving in the Anthropocene, Global reductions in terrestrial mammalian movements. Science 2018: 359: 466-469

CONNECTIVITY, ANIMALS & CLIMATE CHANGE

Many studies find significant shifts in species distributions in response to climate change

- Animals can respond to climate change in three ways:
  - Move
  - Adapt
  - Die
- Top Strategy: increase connectivity between natural areas and provide lands that animals can migrate along, such as riparian areas, to reach good habitat

Heller and Zaveleta. 2009. Biodiversity management in the face of climate change: A review of 22 years of recommendations. Biological Conservation, 142, 14-32

Keeley et al. 2018. New concepts, models, and assessments of climate-wise connectivity. *Environ. Res. Lett.* 13 (2018) 073002

Gerik-Jeli Hwy Underpass, Malaysia. Credit: Rob Ament

PROVEN INFRASTRUCTURE SOLUTIONS FOR WILDLIFE

Southern Bhutan
National Highway 2

Credit: Norris Dodd

Nagpur, India
National Highway 44

Wildlife Institute of India / Dr. Bilal Habib

Yunnan Province, China
Simao-Xiaomengyang
Espressway (G213)

Credit: Rob Ament

THE LISA PROJECT

By the numbers

300+	LI experts responding to the Lisa Project survey on capacity
28	Asian countries
24+	LISA Project specialists in policy, ecology, finance, transport planning, economics
14	Months
5	Representative countries – India, Nepal, Bangladesh, Thailand, Mongolia (assessment)
4	Reports (annexes) – Literature Review, Spatial Analyses, Case Studies, Capacity Assessment
1	COVID pandemic

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LISA PROJECT SCOPE

Linear Infrastructure Focus

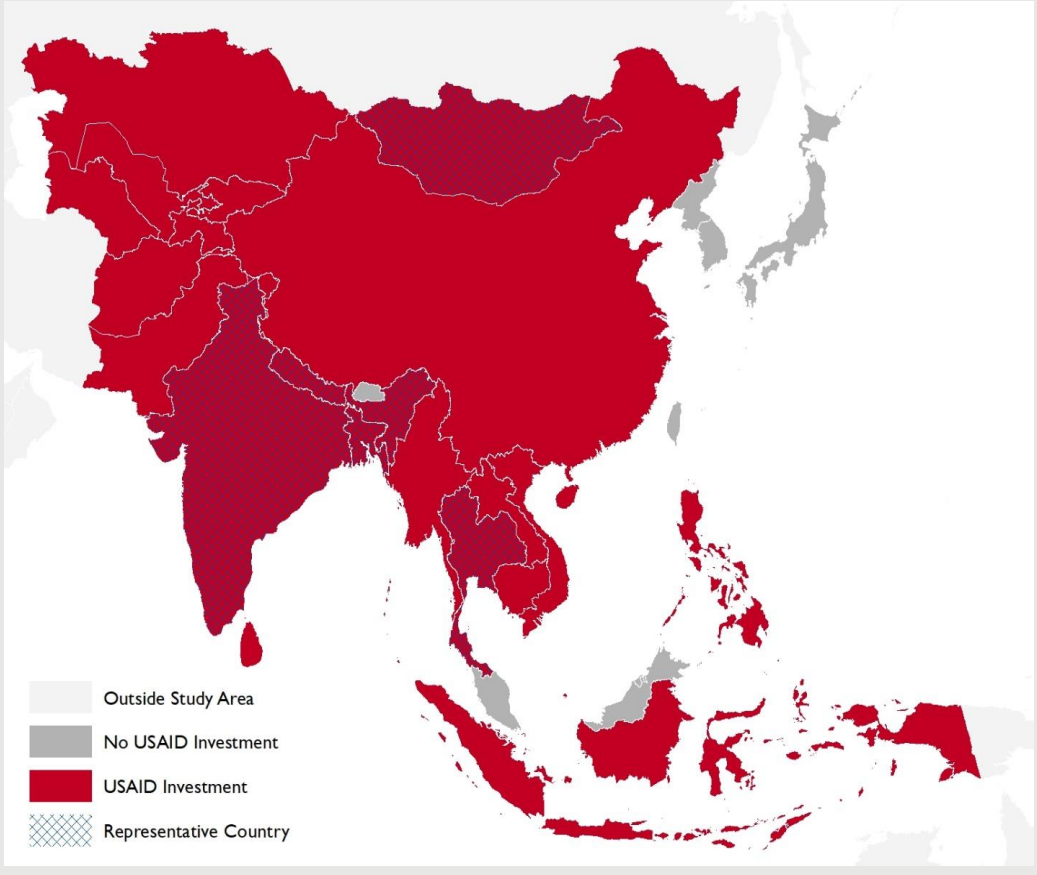
Roads

Rails

Power Transmission Lines

Photo: Nilanga Jayasinghe/ WWF-US

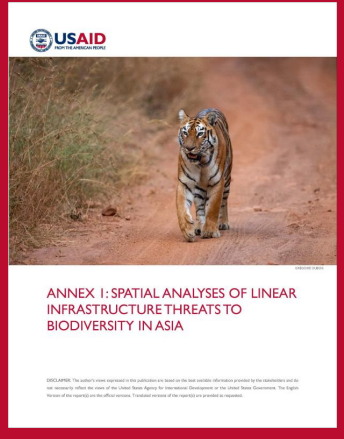
28 ASIAN COUNTRIES IN LISA PROJECT

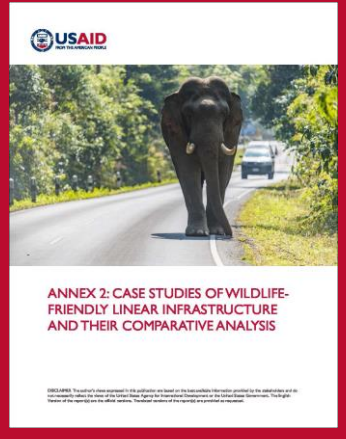


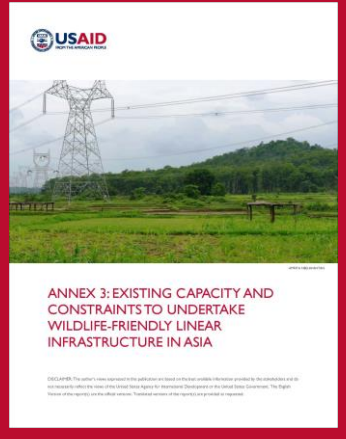
RESULTS OF THE LISA PROJECT

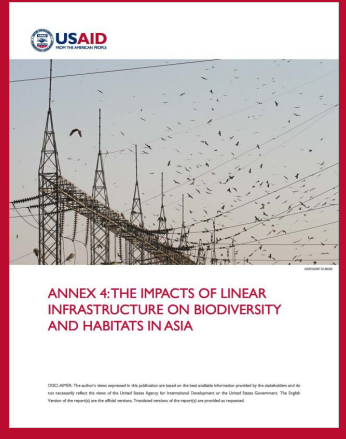
FOUR ANNEXES to THE FINAL REPORT

Annex 1: Spatial Analyses
Annex 2: Case Studies
Annex 3: Capacity Assessment
Annex 4: Literature Review









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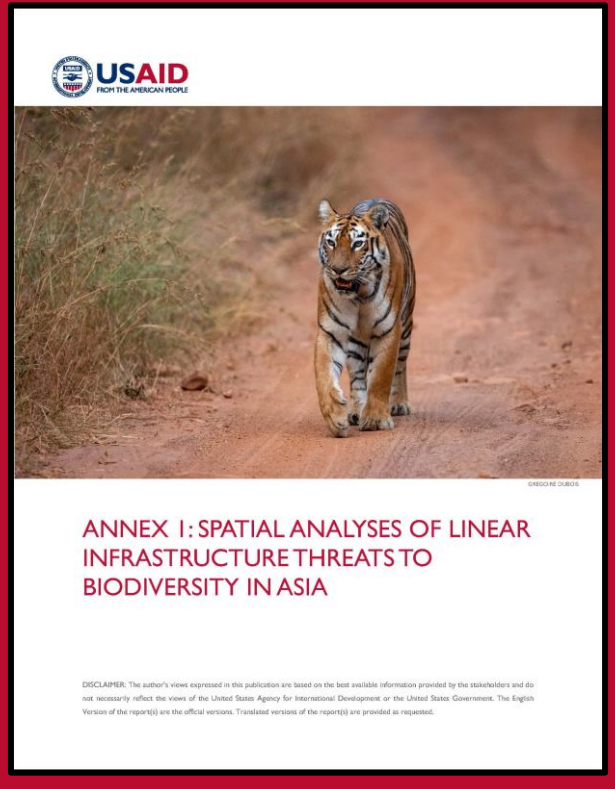
RESULTS OF THE LISA PROJECT

Annex 1: Spatial Analyses



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ANNEX 1: SPATIAL ANALYSES

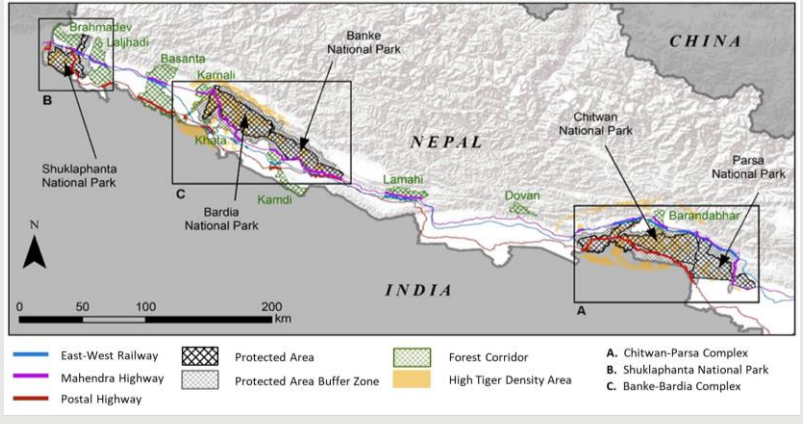
1. Asia wide spatial analysis

2. Fine-scale spatial analyses
   - Tiger (Nepal)
   - Snow leopard (Mongolia)
   - Goitered gazelle and khulan (wild ass) (Mongolia)
   - Saiga antelope (Kazakhstan)
   - Birds and powerlines – multiple species (Thailand)
   - Use of roadkill data – multiple species (India)

3. Review of 11 exemplary spatial analyses of projected impacts

ROADKILL IN INDIA

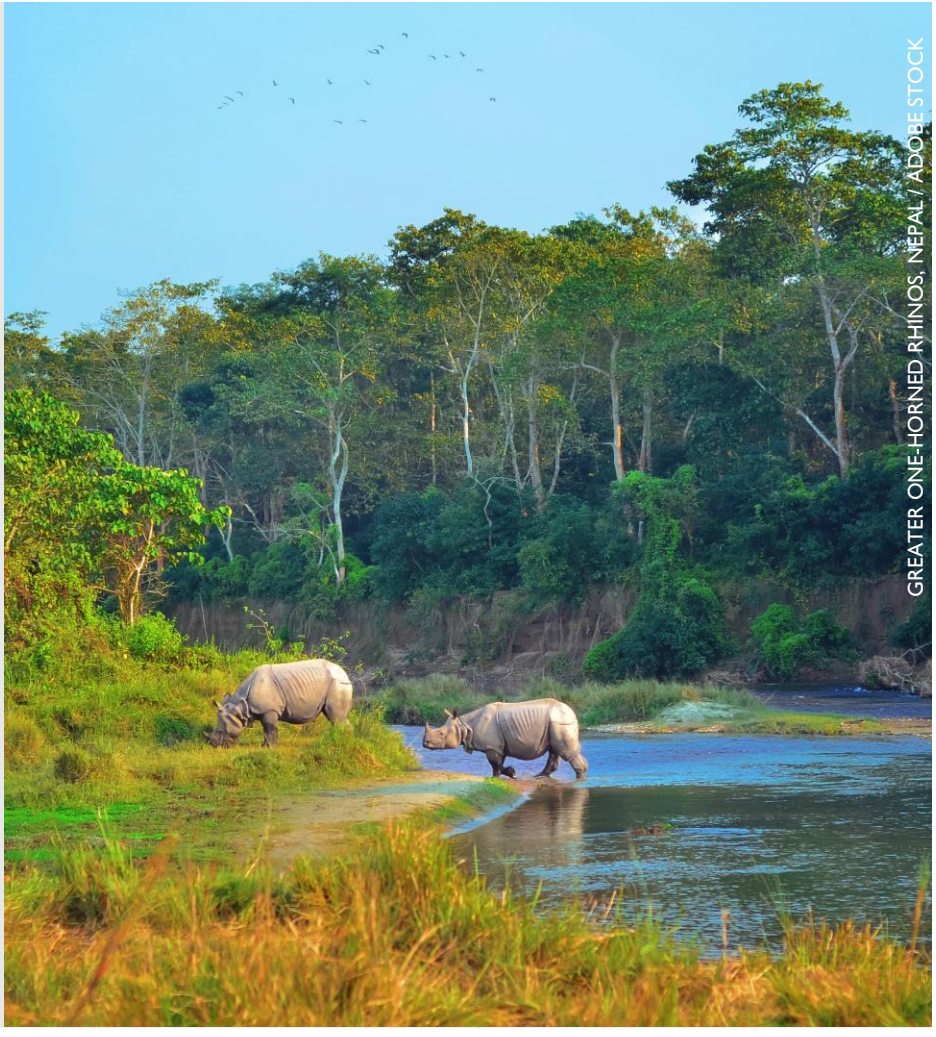
LI IMPACTS TO TIGER HABITAT IN NEPAL



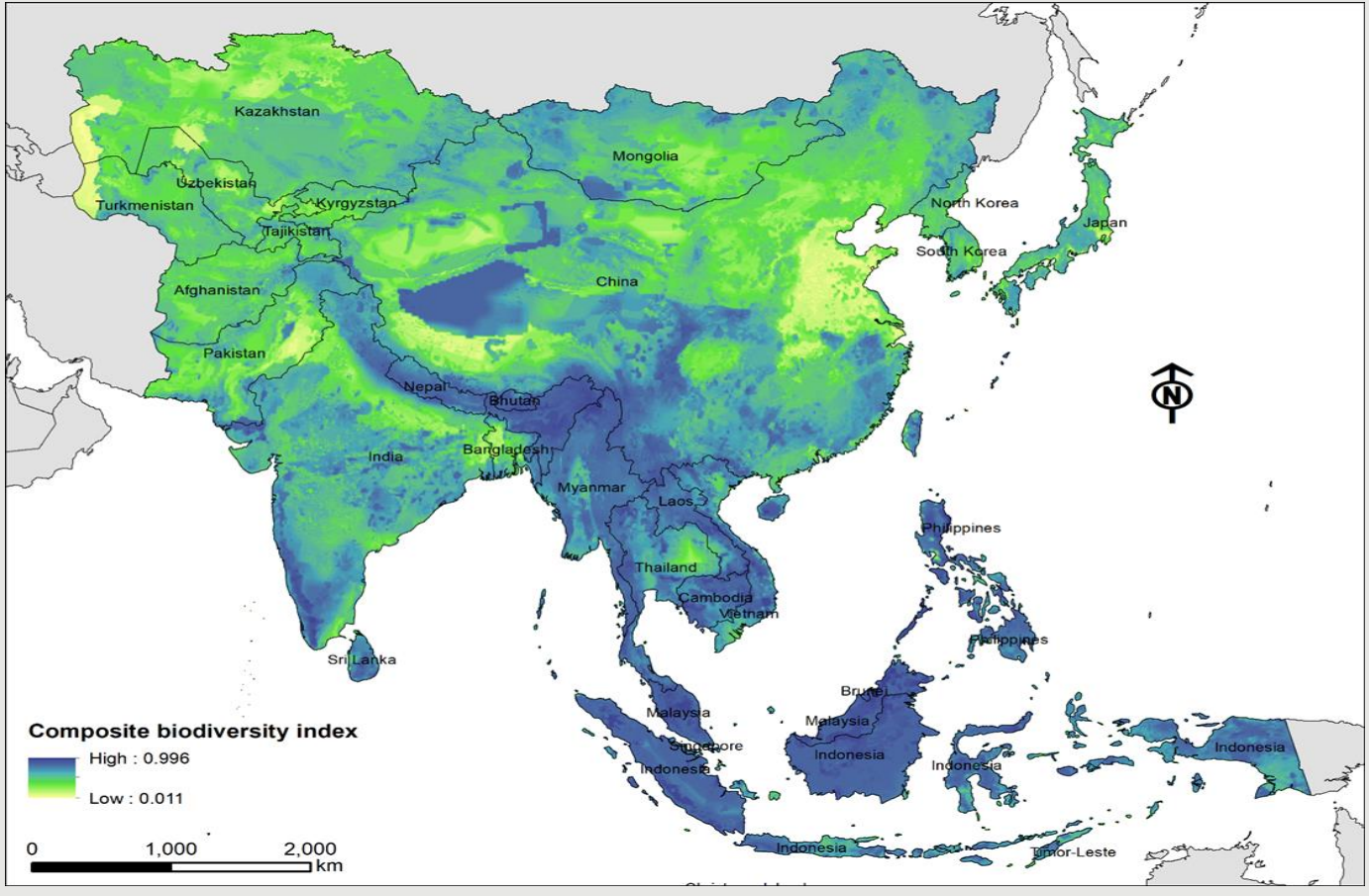
ASIA-WIDE BIODIVERSITY ANALYIS: DATA LAYERS

Composite biodiversity index (CBI) average value of nine biodiversity-related layers:

- Ecoregion intactness - Beyer et al. (2020)
- Biodiversity intactness (abundance-based) - Newbold et al. (2016); Sanchez Ortiz et al.(2019)
- Mammal community intactness - Belote et al. (2020)
- Global priority areas for protected area expansion - Pouzols et al. (2014)
- National priority areas for protected area expansion - Pouzols et al. (2014)
- Threatened amphibian species richness - Jenkins & Pimm (2013)
- Threatened bird species richness - Jenkins & Pimm (2013)
- Threatened mammal species richness - Jenkins & Pimm (2013)
- Weighted endemism including global endangerment - Farooq et al. (2020)

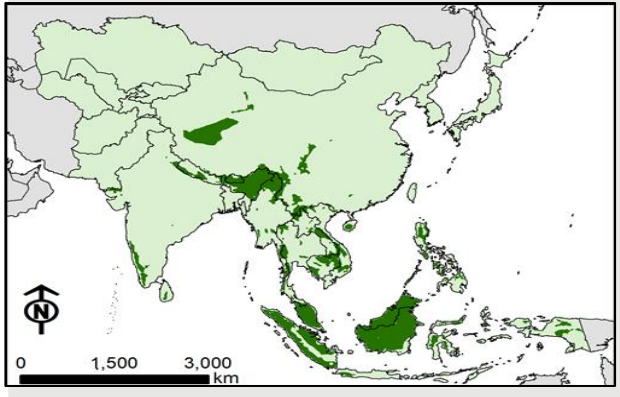

GREATER ONE-HORNED RHINOS, NEPAL / ADOBE STOCK

FINDINGS: COMPOSITE BIODIVERSITY INDEX

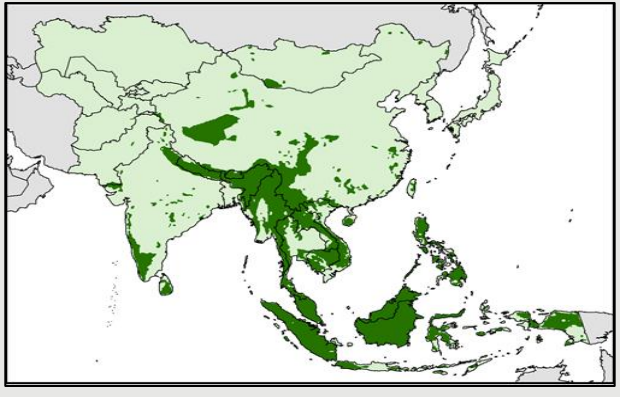


FINDINGS:
BIODIVERSITY RICH LANDSCAPES (CONTINENTAL)

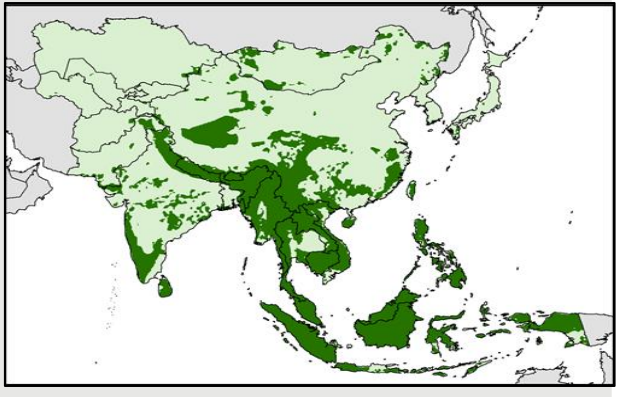
TOP 10%



TOP 20%



TOP 30%



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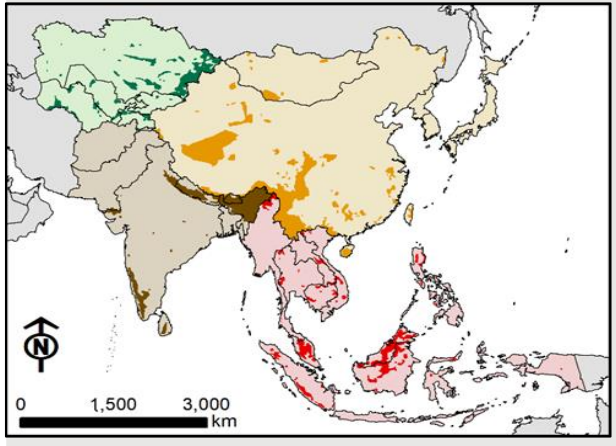
FINDINGS:
BIODIVERSITY RICH LANDSCAPES (REGIONAL)

TOP 10%



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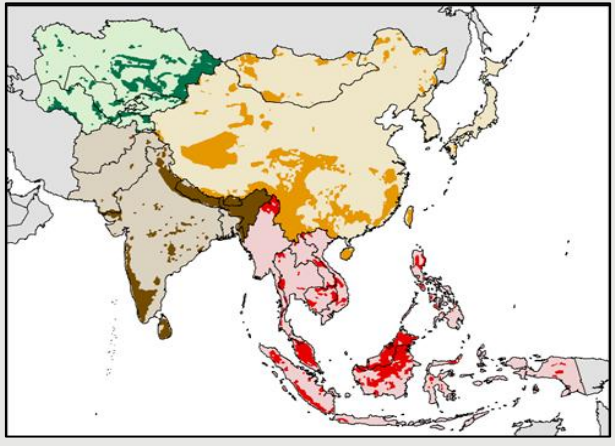

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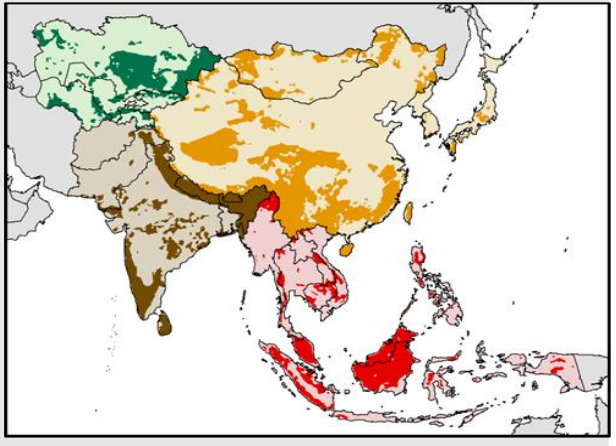

green = Central Asia, orange = East Asia,
brown = South Asia, red = Southeast Asia

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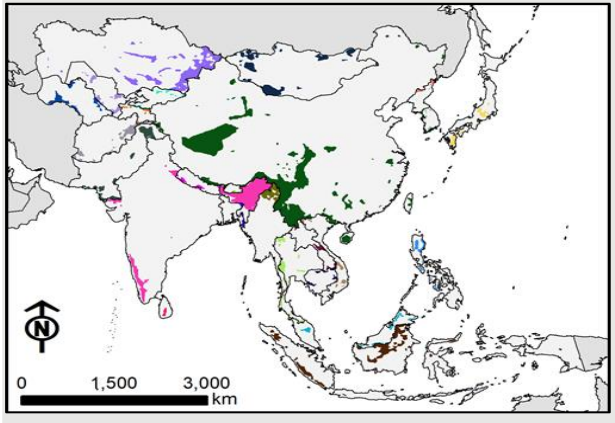
FINDINGS:
BIODIVERSITY RICH LANDSCAPES (NATIONAL)

TOP 10%



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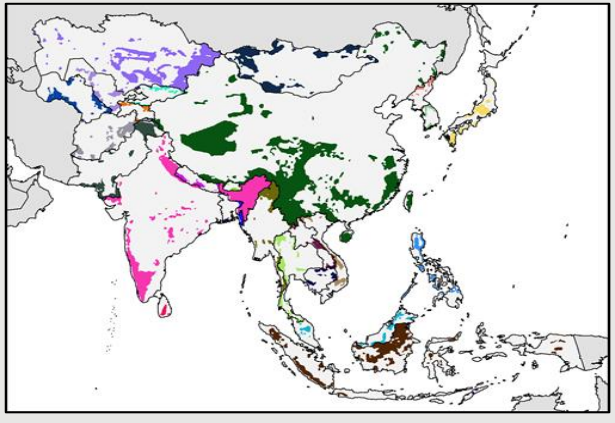

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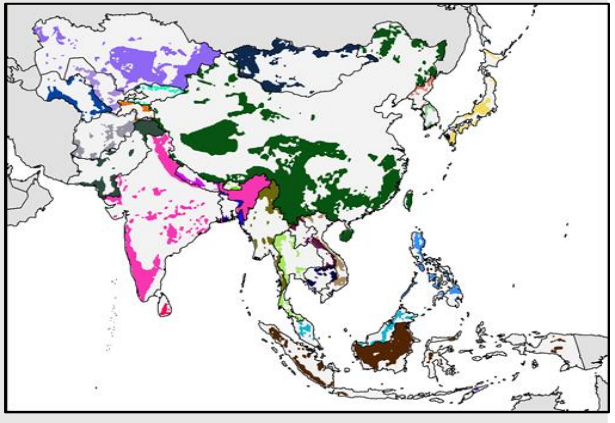
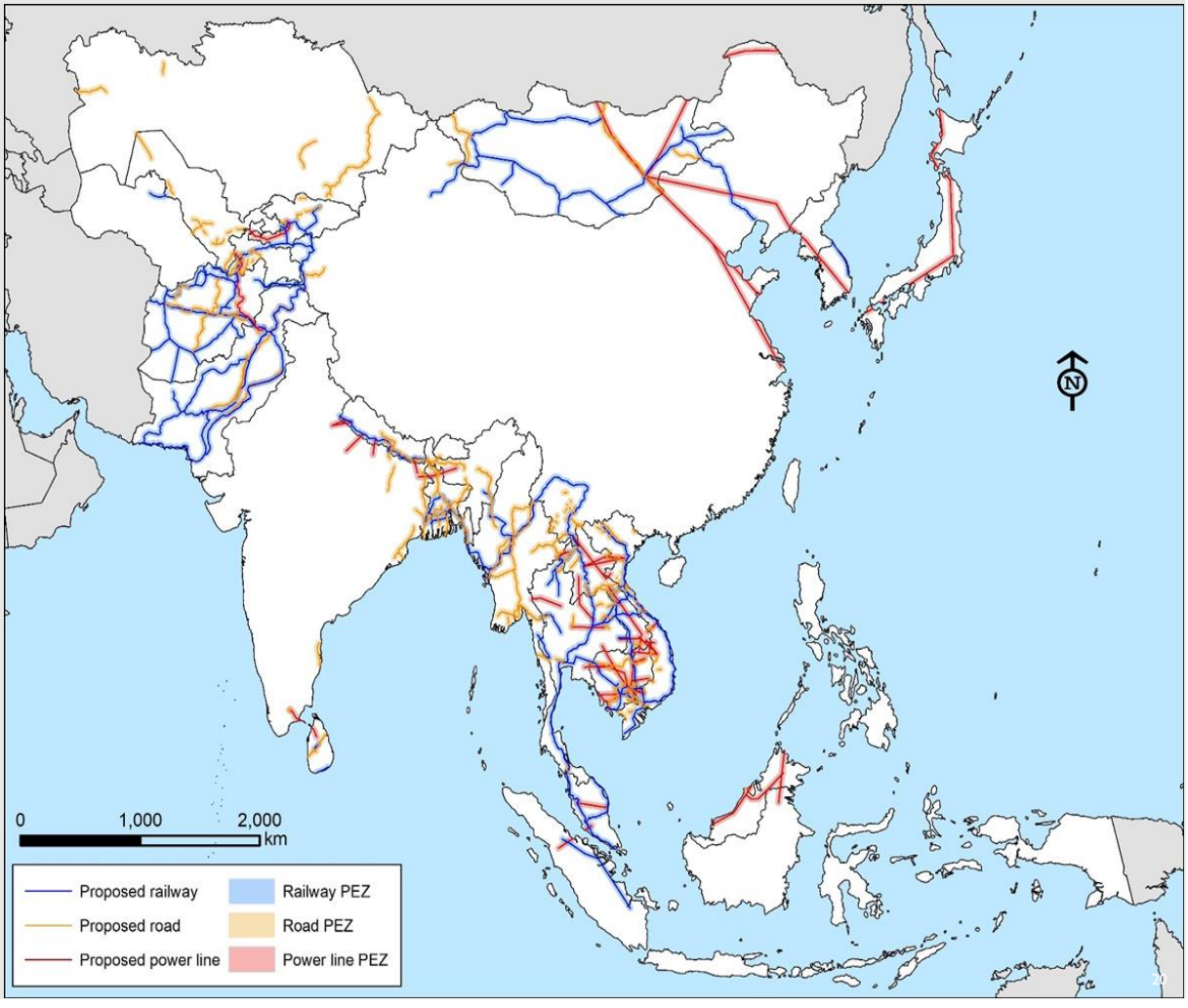


ASSESSING THE POTENTIAL IMPACT OF LI ON BIODIVERSITY

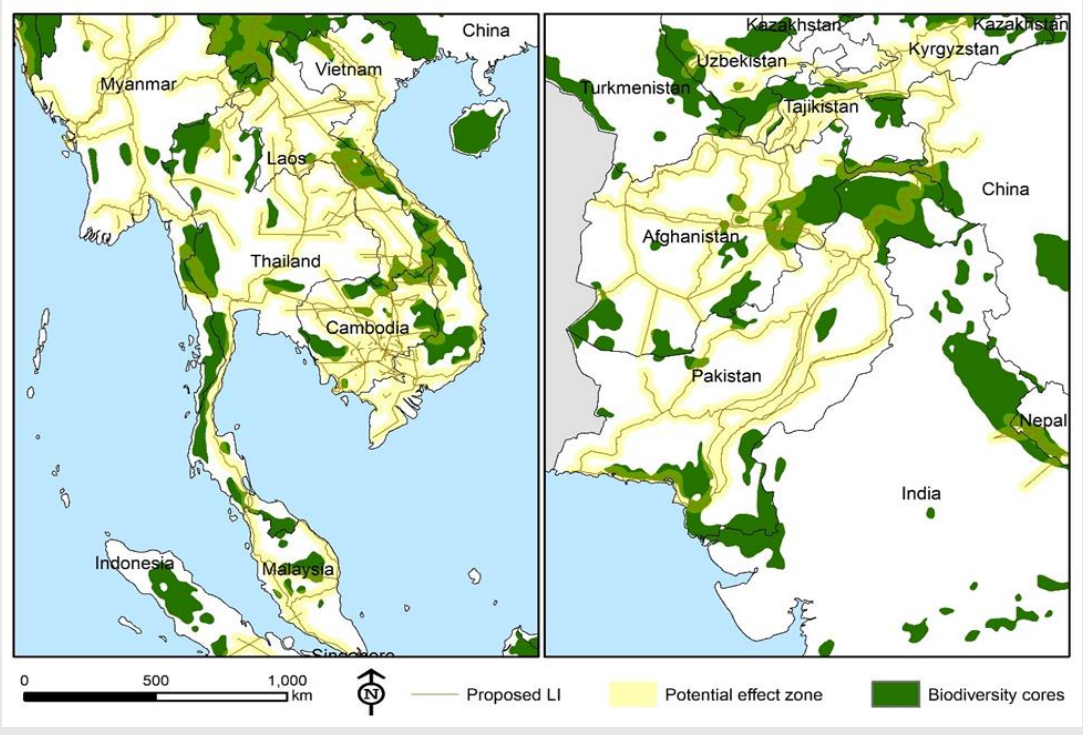
Mapped proposed LI development from major LI Initiatives

- ~ 2/3 new routes
- ~ 1/3 upgrades

- More than 81,000 km of proposed LI
  - Rail: 35,698 km
  - Road: 27,919 km
  - Power Line: 17,991 km



FINDINGS: BIODIVERSITY and FUTURE LI CONFLICT AREAS

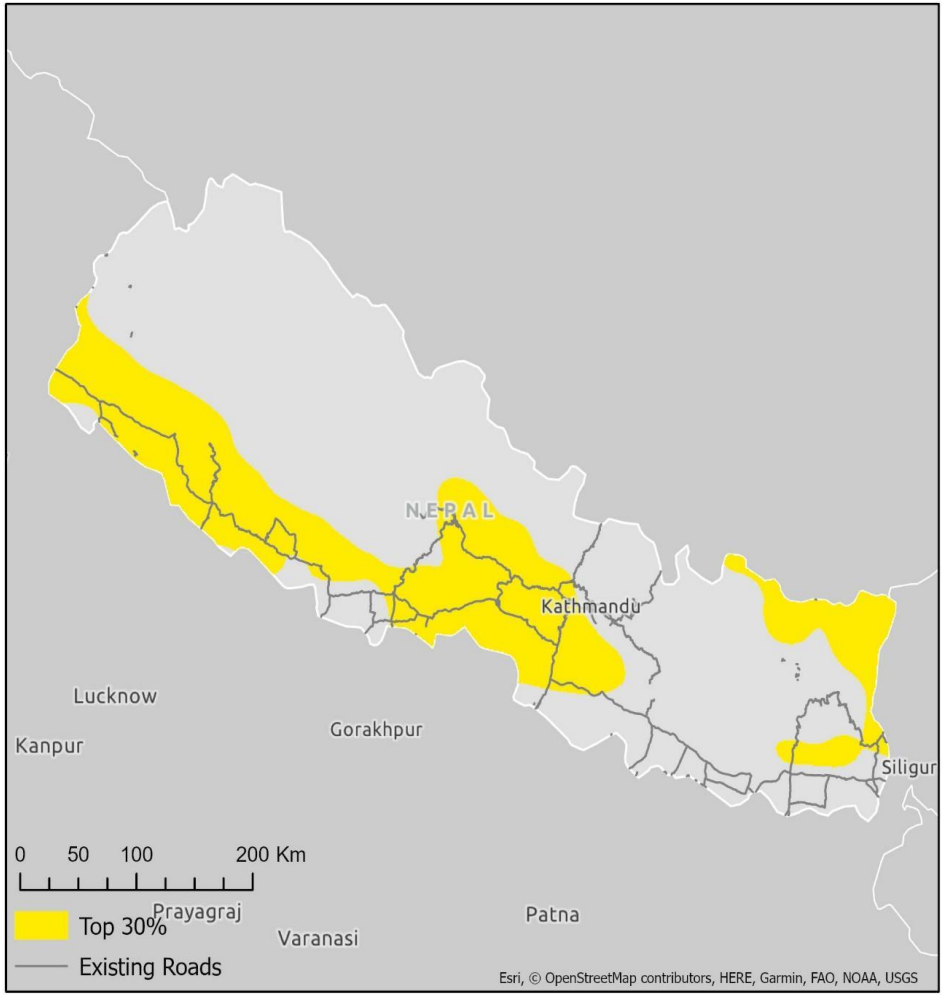


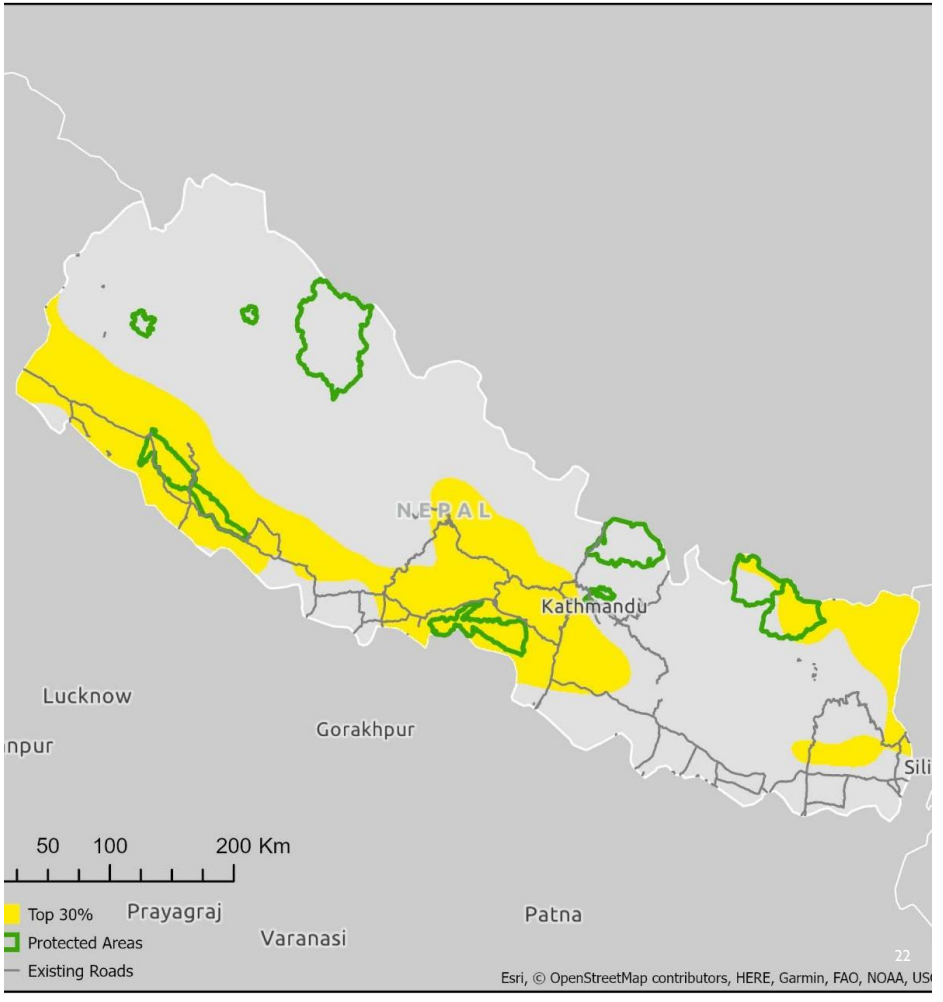
Overlap between potential effect zones (PEZs) of proposed LI routes and top 20% biodiversity core areas within selected regions of Asia.

Finding 1: 15-20% of the planned LI PEZs overlapped core biodiversity areas, depending how they were defined.

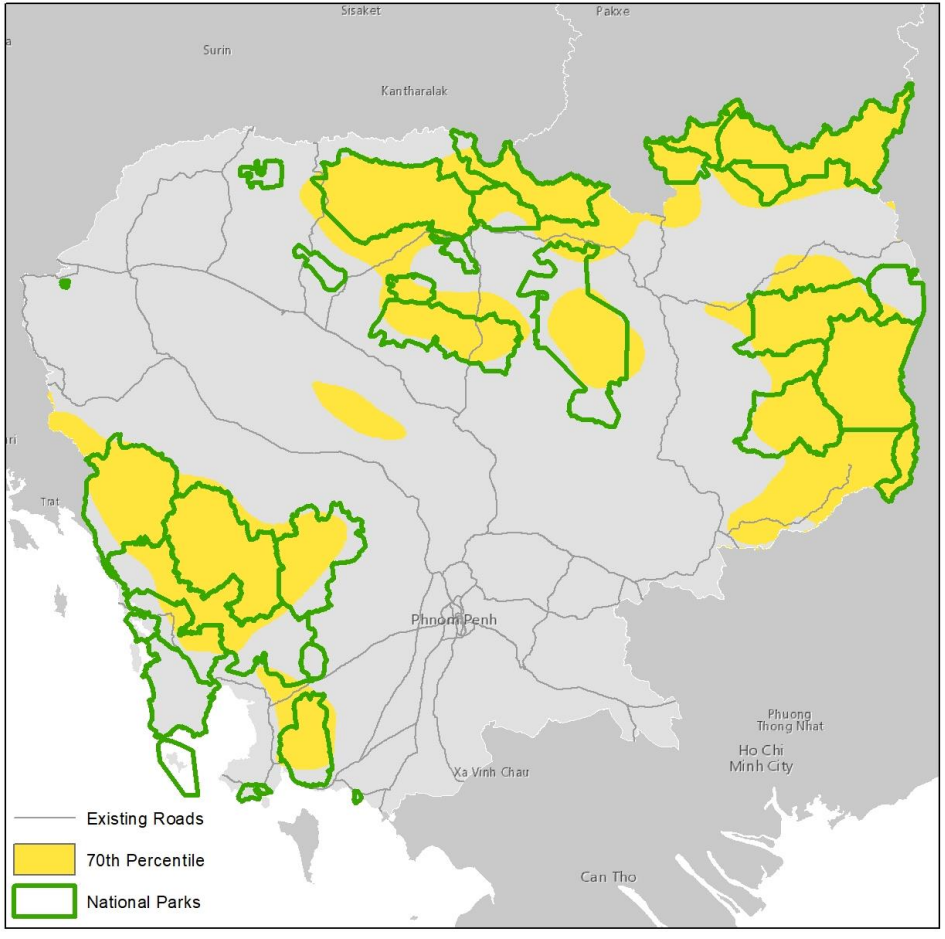
Finding 2: 363 protected areas are located within the PEZs of the proposed LI routes

NEPAL TOP 30 PERCENTILE CORE BIODIVERSITY AREAS/ PROTECTED AREAS

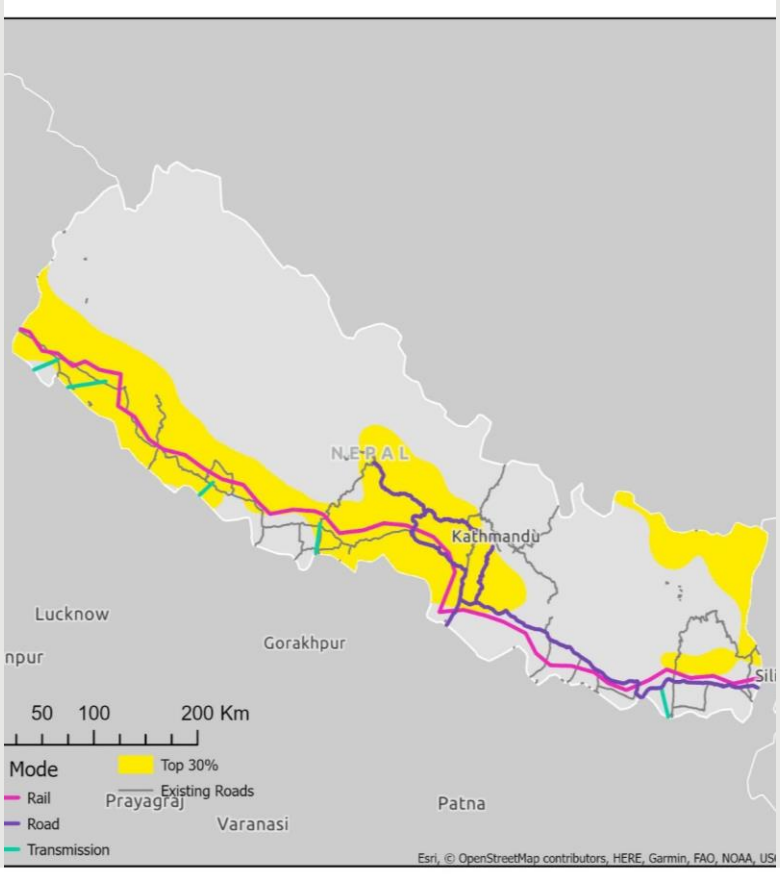




CAMBODIA TOP 30 PERCENTILE CORE BIODIVERSITY AREAS/PAs



NEPAL: TOP 30 PERCENTILE OF CORE BIODIVERSITY AREAS
&
PROPOSED MULTILATERAL LI PROJECTS



SPATIAL ANALYSES: KEY FINDINGS AND RECOMMENDATIONS

- Spatial analyses at both coarse and fine scales are important for characterizing LI threats to biodiversity and prioritizing sites for safeguards
- Better data on proposed LI is needed – LI project proponents should create centralized geospatial databases of LI projects
- Spatial analyses should give more consideration to cumulative effects from multiple LI projects
- High profile ecosystems are threatened by proposed LI, but so are many lower-profile ecosystems with similar biodiversity value
- Existing analyses at the global or continental scale have focused largely on LI projects associated with China's Belt and Road Initiative (BRI), they need to combine other regional economic development initiatives (e.g., SASEC, CAREC, ASEAN) and national and regional LI development to have a more complete understanding

THE LISA PROJECT

ANNEX 4: Literature Review

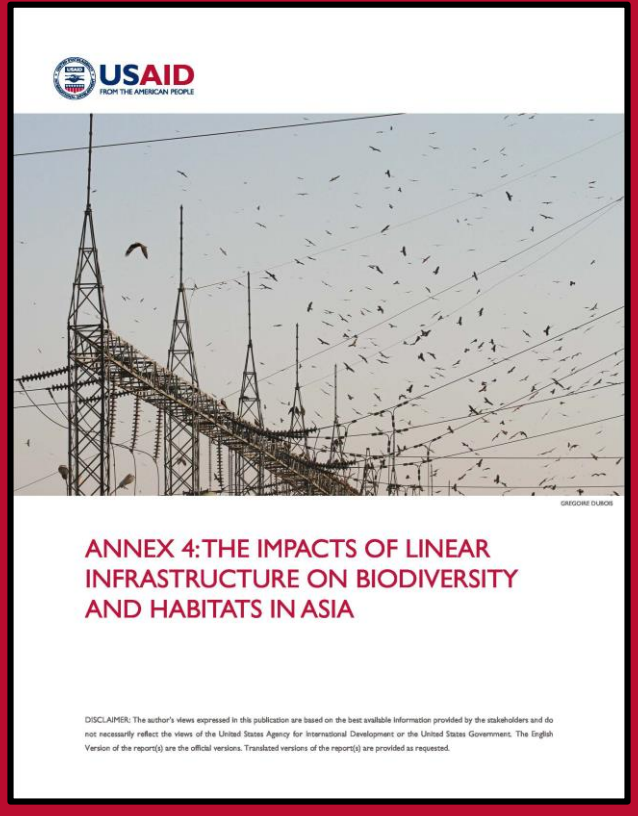


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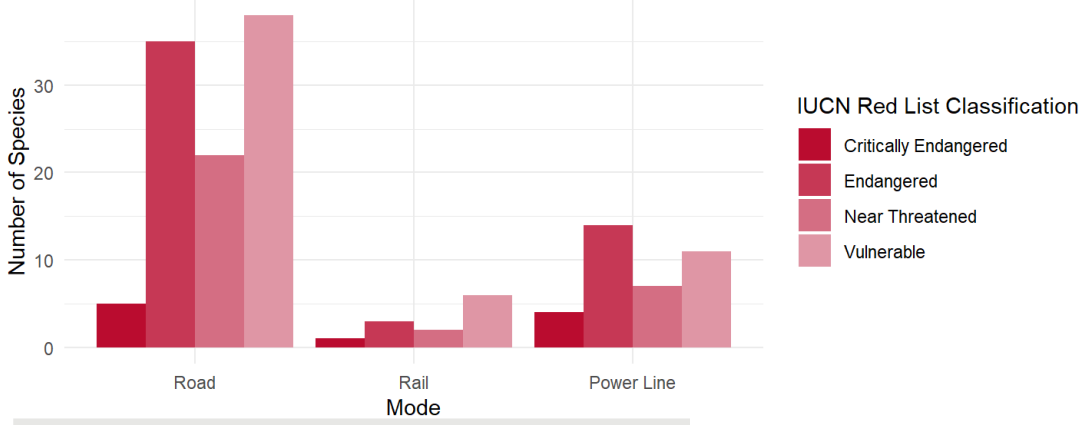
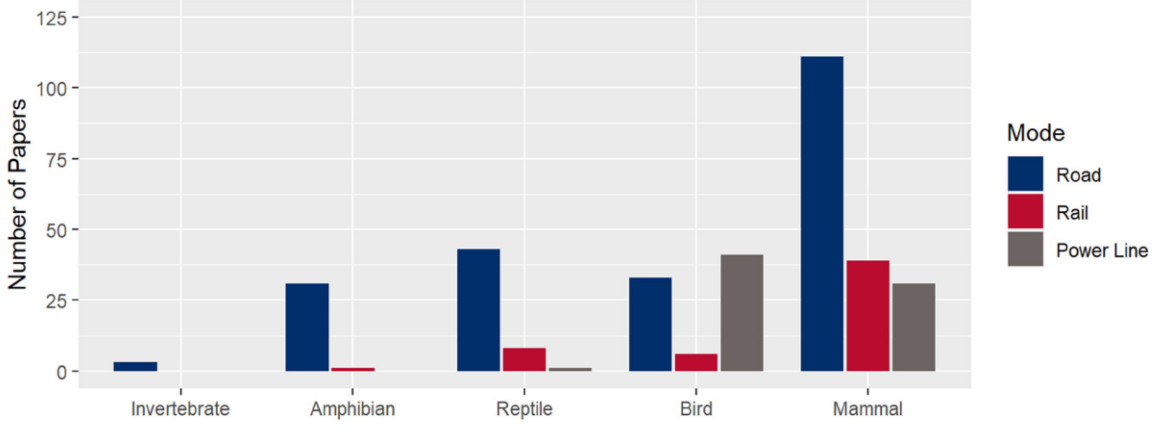
Figure 16: The Number of IUCN Red List Species Documented as Killed by Collisions on Roads and Rails, or with Power Lines in Asia.



ANNEX 4 Results

TOTAL PEER REVIEWED PAPERS	
Roads	162
Railways	49
Power Lines	78



LITERATURE REVIEW: KEY FINDINGS AND RECOMMENDATIONS

- The three LI modes differ in the extent to which their contribution to direct animal mortality is documented; railways, in particular, require more of these basic data.
- Direct mortality of wildlife by LI requires better correlation with explanatory variables to identify (and hence mitigate) risk factors.
- The consequences of direct impacts on population viability is currently under-studied across all three modes.
- The study of animal movement across roads and railways needs to be better linked with demographic rescue, gene flow and access to habitat.

FINDINGS:
LITERATURE REVIEW

- We found only a handful of studies that rigorously evaluated the impacts of LI or mitigation measures in a before and after study design. Before-After-Control-Impact (BACI) study designs can provide a robust framework to understand impacts and evaluate the efficacy of interventions.

- Economic benefits of environmental safeguards need greater study.

- Cumulative impacts of roads, railways and power lines are rarely addressed, and require greater study.

- Studies driven by flagship species must be leveraged for additional insights on co-occurring species. We found that charismatic species (particularly large mammals) are the subject of many more numerous LI studies….

QUESTIONS?

CONTACT

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THANK YOU

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