

TRAINING ON

# Planning and Design of Smart Infrastructure for Biodiversity Protection



25–27 April 2022

Rhino Lodge, Sauraha, Nepal



# Underpasses Camera Monitoring - Case Study

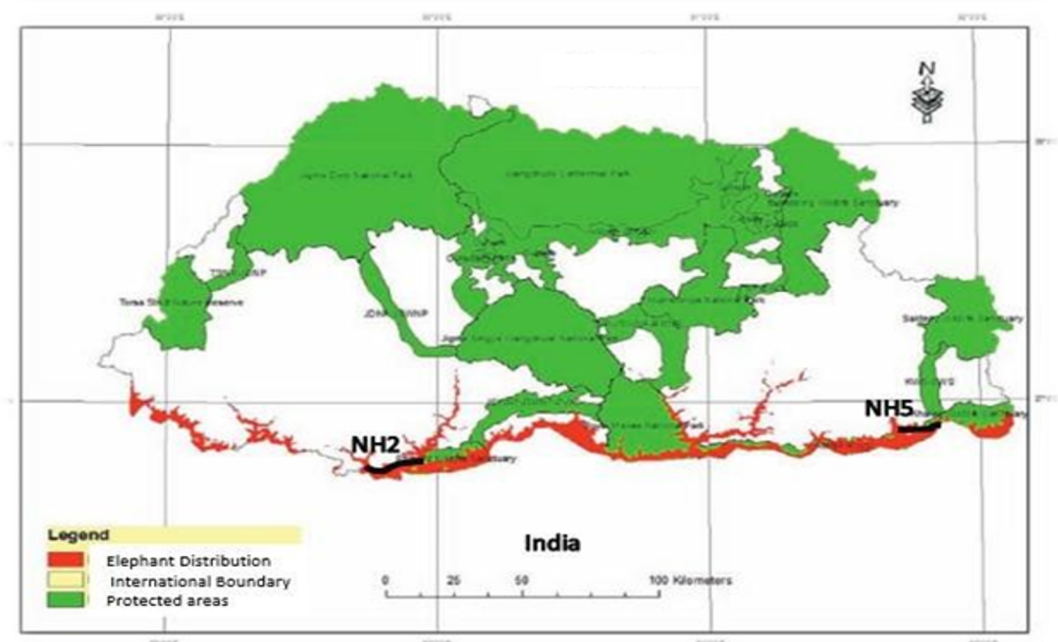
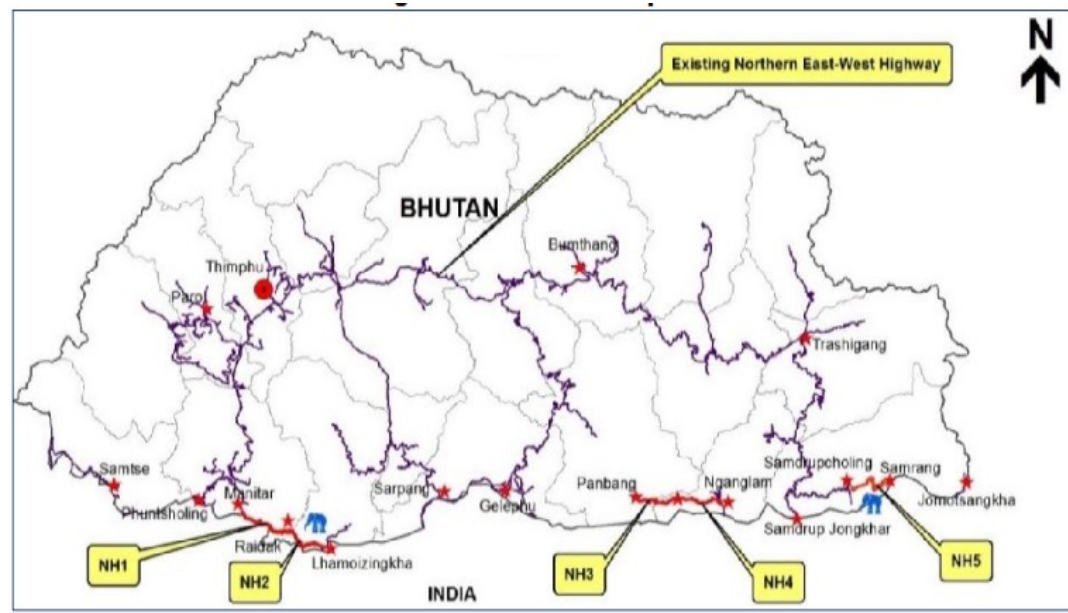
Southern Bhutan

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Karma Yangzom

*Asian Development Bank*

# Road Network Project (RNP) II – Southern Bhutan

- 183 km highway & feeder road constructed under RNP II with the technical and financial assistance of the ADB
- 2 segments – NH2 & NH5 passed through elephant habitats
- Road construction through sensitive habitats results in habitat destruction, fragmentation, and act as barrier to the movement of elephants



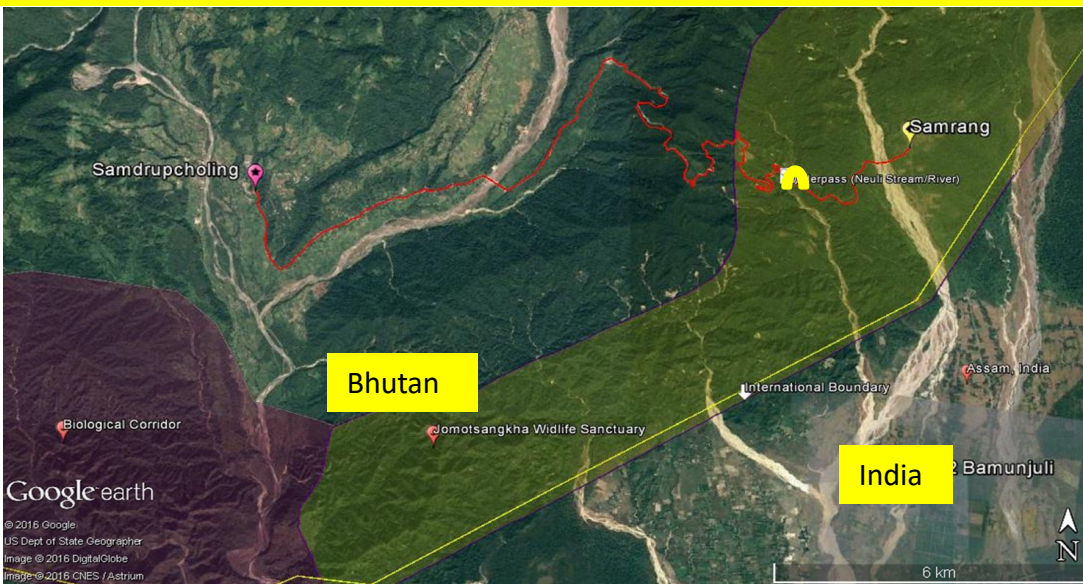
## NH2 : Raidak – Lhamoizingkha Road



### Mitigation Measures:

- **Department of Roads designed and constructed underpasses to minimize the barrier effect of the roads**
- **Elephants were known to use rivers/streams corridors for the movement upstream and back in search of fodder, waterholes, salt (mineral) lick areas and mates**
- **Elephant movement is also transboundary in nature**
- **7 Underpasses were constructed at NH2**
- **1 Underpass at NH5**

## NH5 : Samdrupcholing – Samrang Road



# Underpasses Camera Monitoring

- **Pilot study – 2yrs (2015-2017)**
- **Follow-up study – 2 years (2019-2021)**

## NH2 – 3 Underpasses



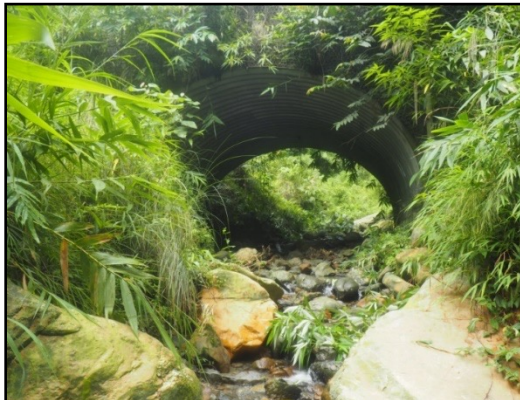
- **Under Pilot study**
  - **4 large Underpasses (3 at NH2 and 1 NH5) were monitored**
  - **Elephants used these underpasses readily and regularly**
  - **Our aim was find Underpasses usage and efficacy**

## NH5 – 1 Underpasses



# Underpasses Camera Monitoring

- **Follow-up monitoring (2019-2021)**
  - **7 large Underpasses (6 at NH2 and 1 NH5) are monitored**
  - **Different sizes of underpasses being monitored to assess elephant preferences**
  - **Almost all the underpasses except smallest with openness ratio of 1.39 is used regularly**



# Wildlife species recorded

- **Follow-up monitoring study (2019-2021)**
  - **All 6 underpasses recorded regular elephants and other wildlife species crossings except for the smallest underpass**



## Smallest UP

**Width = 3.8m**

**Height = 3.6m**

**Length = 9.9 m**

- **A lone elephant was recorded crossing the underpass only once for the entire duration of the monitoring (May 2019- July 2020)**
- **Further monitoring will be carried out to confirm the regular usage**

# Findings of the Pilot study and the follow-up monitoring study

## Pilot Study

- **4 large underpass (3 on NH2 & 1 on NH5) monitored**
- **7 wildlife species recorded**
- **5 IUCN red listed species – endangered, threatened and vulnerable species**
- **Endangered species includes an Asian elephant**
- **Overall average crossing rate for all species is 75%**
- **75.5% of successful crossing rate was observed for the Asian elephant**

## Follow Monitoring Study (Draft)

- **7 large underpass (6 on NH2 & 1 on NH5) monitored**
- **15 wildlife species recorded**
- **8 IUCN red listed species – endangered, threatened and vulnerable species**
- **Endangered species includes an Asian elephant**
- **Overall average crossing rate for all species is 88.1%**
- **58.6% of successful crossing rate was observed for the Asian elephant**

**Successful crossing rates for all species decreased as some species approached the Underpass but did not cross**

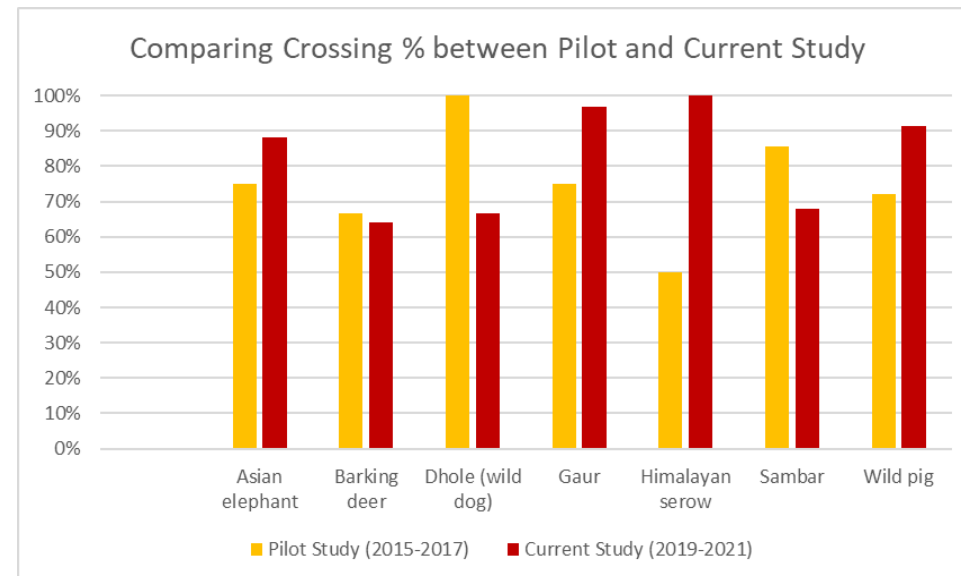


# Comparison of Same Underpasses monitored data – NH2

## Pilot & Follow-up studies:

- **Comparison done only for same underpasses for the studies.**
- **Successful crossing rate for the Asian elephant has increased to 88% in the follow-up monitoring studies in comparison pilot study (75%)**
- **There is a marked increase in the successful crossing rate for Gaur (from 75% in the pilot to 97% in the follow-up study)**
- **Overall average crossing rate for all species increased by 7.3% (from 75% to 82%) in the follow-up monitoring study**

Species	Pilot Study (2015-2017)	Current Study (2019-2021)
Asian elephant	75.00%	88.10%
Barking deer	66.70%	64.10%
Dhole (wild dog)	100.00%	66.70%
Gaur	75.00%	96.95%
Himalayan serow	50.00%	100.00%
Sambar	85.70%	67.85%
Wild pig	72.00%	91.50%
All	74.91%	82.17%

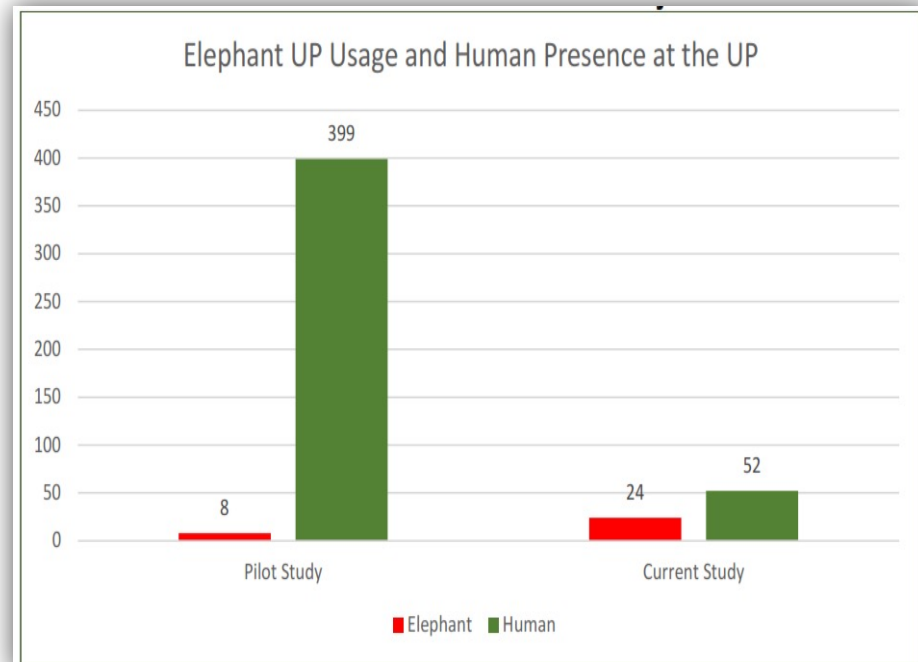


**Further monitoring and the detailed analysis will be required for a meaningful comparison.**

# Comparison of only underpass monitored – NH5

## Pilot & Follow-up studies:

- **Only one wildlife species in the pilot study vs 3 species in the ongoing study**
- **Total of 24 individual in 6 groups of elephants were recorded in our ongoing study in comparison to the pilot study (8 individuals in 4 groups)**
- **Human encroachment (presence of cattle shed & recreational activity close to the underpass) discouraged the elephants' use of underpass after more than a year of disuse**
- **With a drop in human encroachment of underpass usage has increased**



## Concluding Remarks

- Number of wildlife species recorded has doubled in the ongoing monitoring study comparing to the pilot study (from 7 to 15 species).
- Successful crossing by the Asian elephant has increased by 13%
- Overall average rate for all species also increased by 7.3%
- All large underpasses were readily and regularly used by the Asian elephant even during the construction
- Smaller underpasses are also frequently used. (More data needs to be collected for complete understanding).
- Prefabricated metal-plate arch design for our Underpasses proved effective for a wide range of wildlife species including Asian elephants. The design is not only effective in promoting connectivity, but cost effective and highly appropriate for remote places like Bhutan.



**Thank you  
Tashi Delek**



# THANK YOU



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