Overview of road related impacts on biodiversity rich landscapes

Studies from central Indian landscape





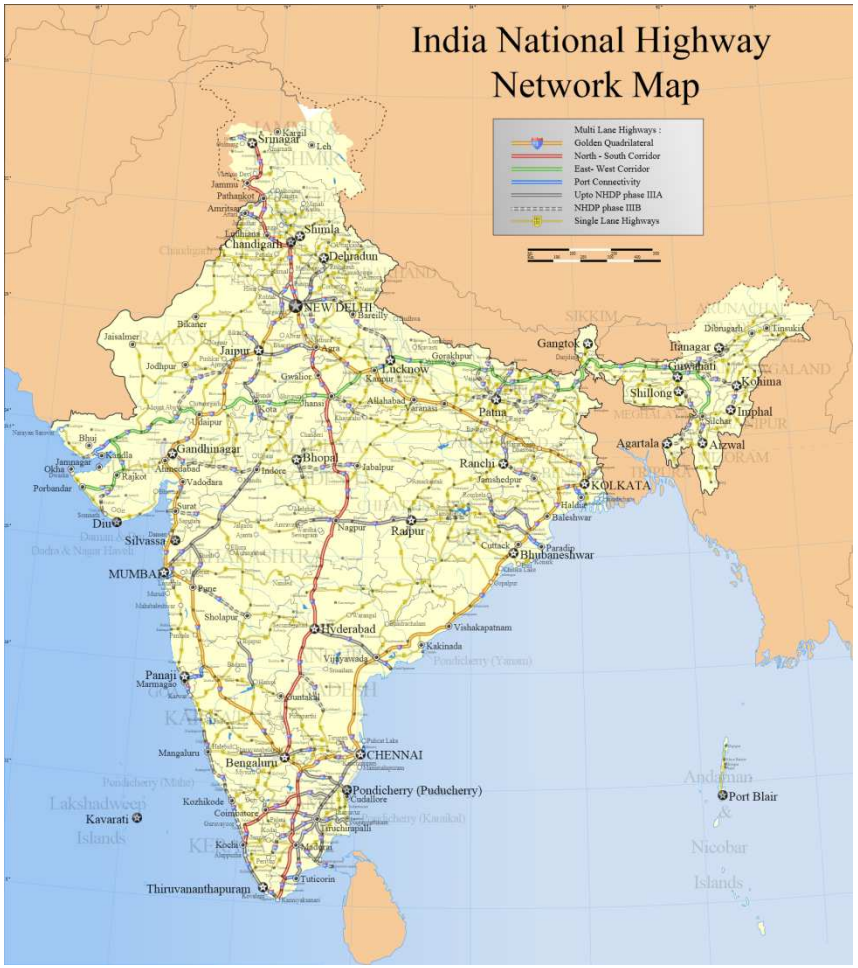

Dr. Asha Rajvanshi

Senior Professor & Head, EIA Cell

भारतीय वन्यजीव संस्थान
Wildlife Institute of India

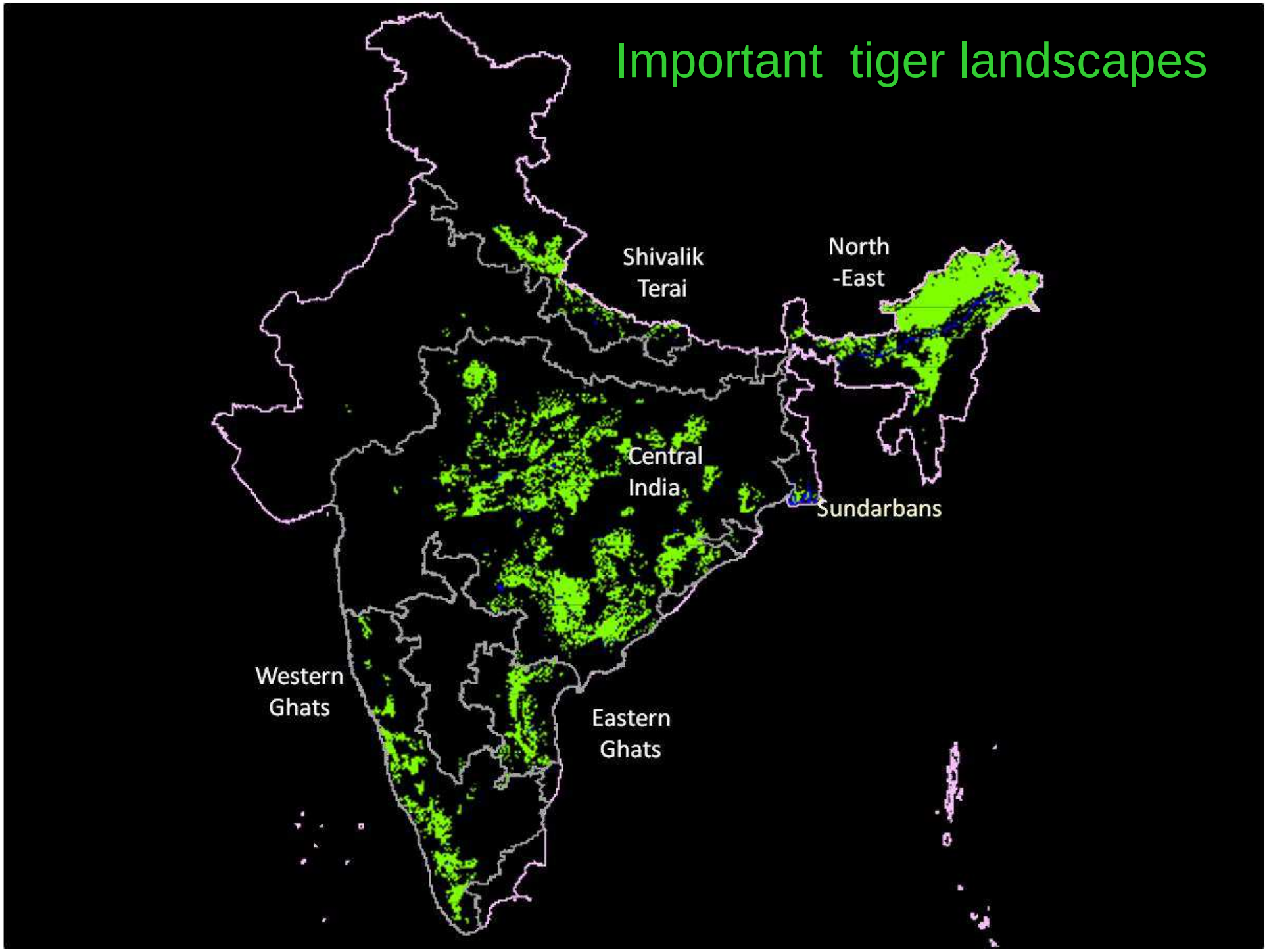
In India

- Roads cover 4.32 million km of the landscape
- World's third largest road network
- Approx. 26,697 km road passes through forests
- About 14,279 km length of National Highways proposed for widening
-

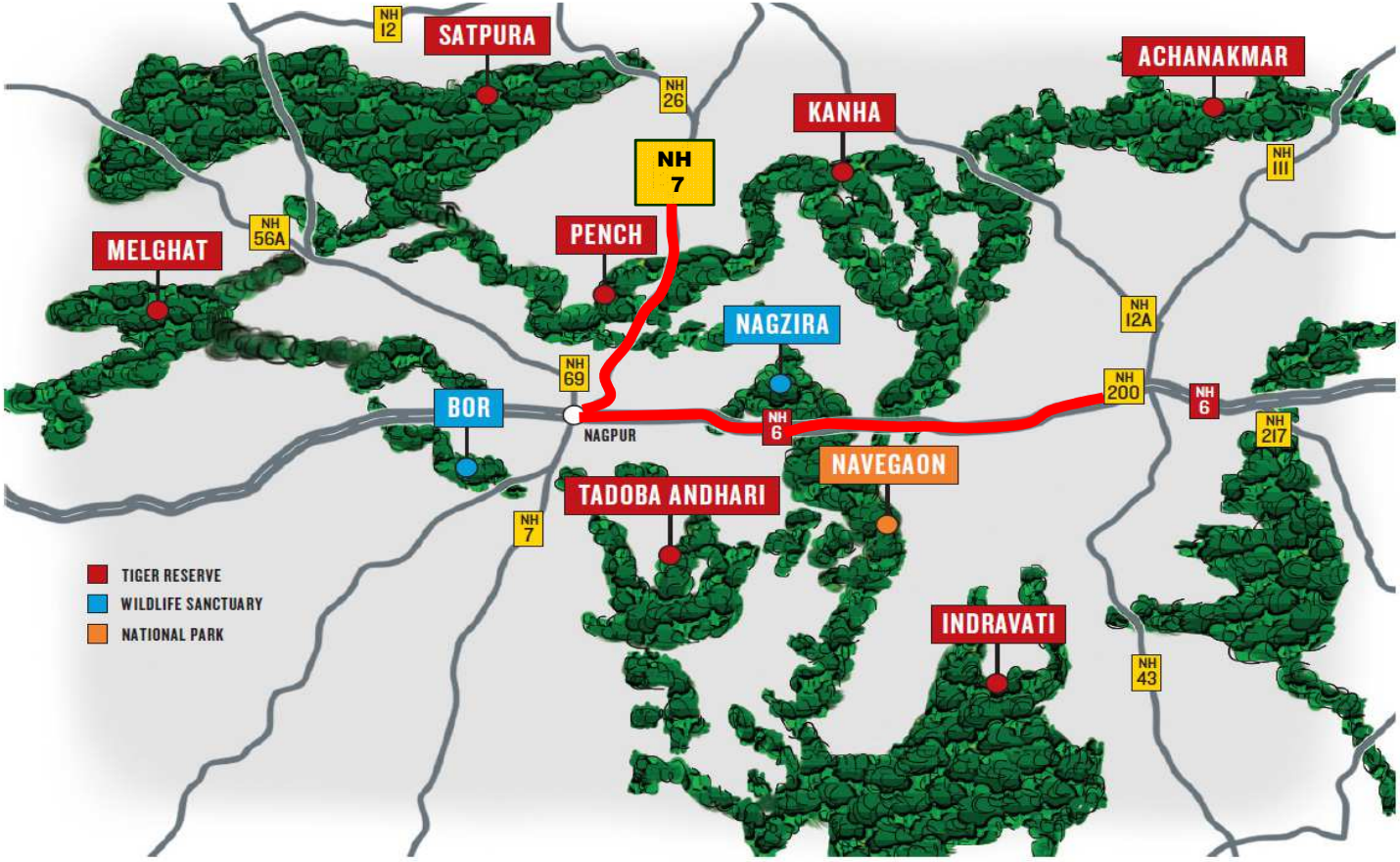


http://upload.wikimedia.org/wikipedia/commons/7/78/India_roadway_map.svg

Important tiger landscapes



National highway network traversing through central Indian landscape

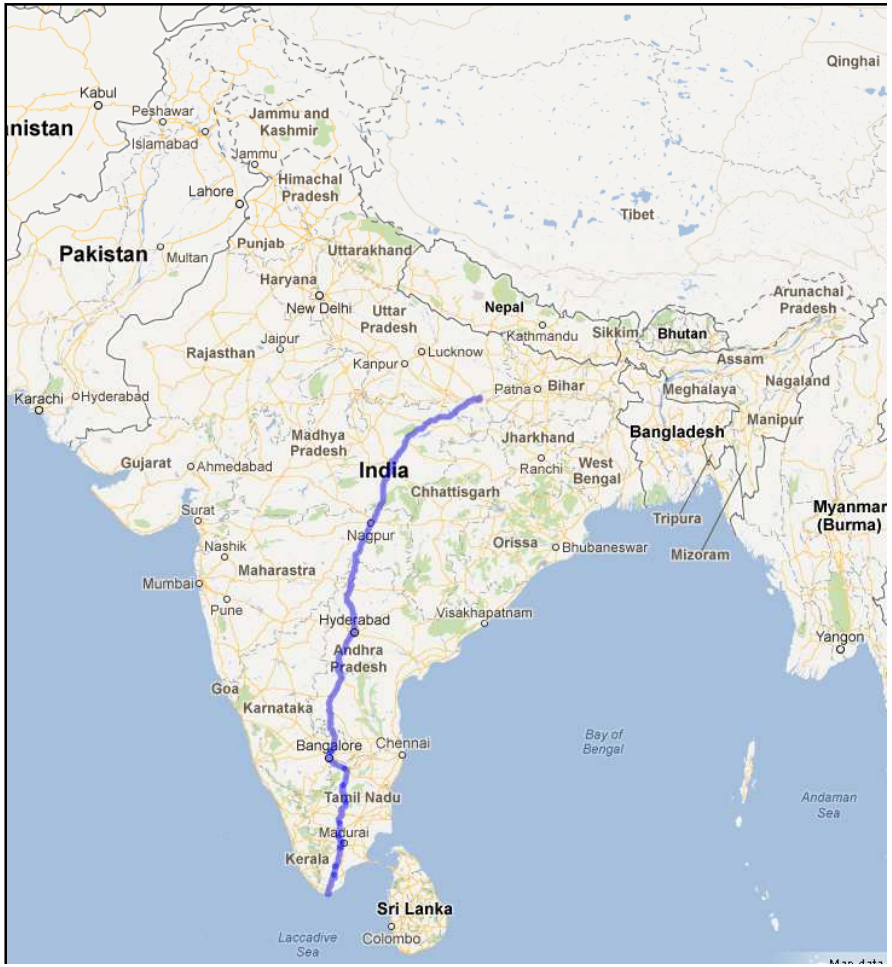


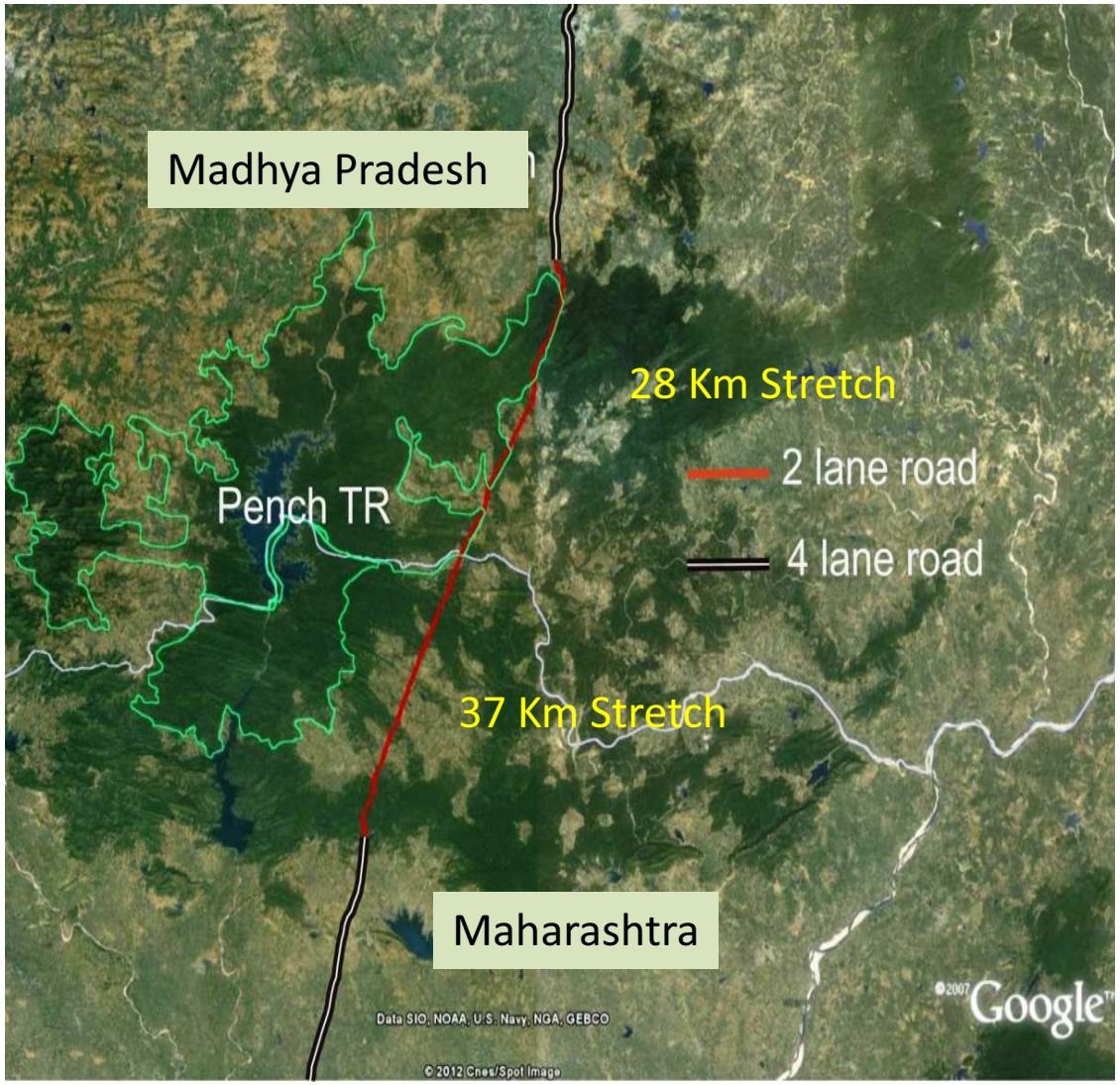
Source: www.tehelka.com/story_main53.asp?filename=Ne070712Pittance.asp

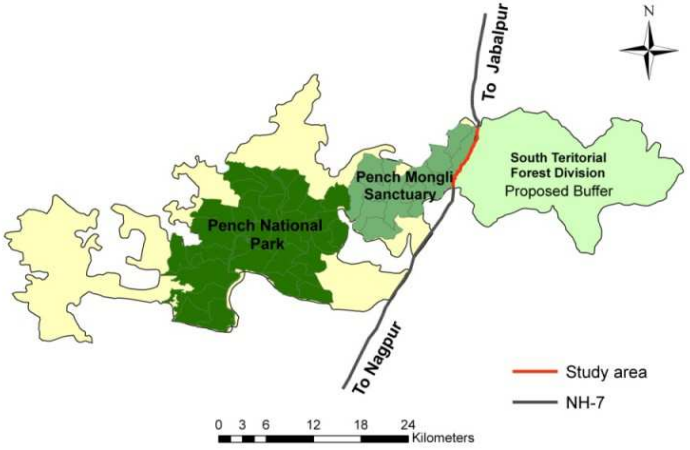
NH–7 along Pench Tiger Reserve

Ecological issues and best practice mitigation options

- Longest national highway
- Runs north-south for over 2,369 km from Varanasi to Kanyakumari.
- Cuts through 7 states (Uttar Pradesh, Madhya Pradesh, Maharashtra, Andhra Pradesh, Karnataka, and Tamil Nadu).



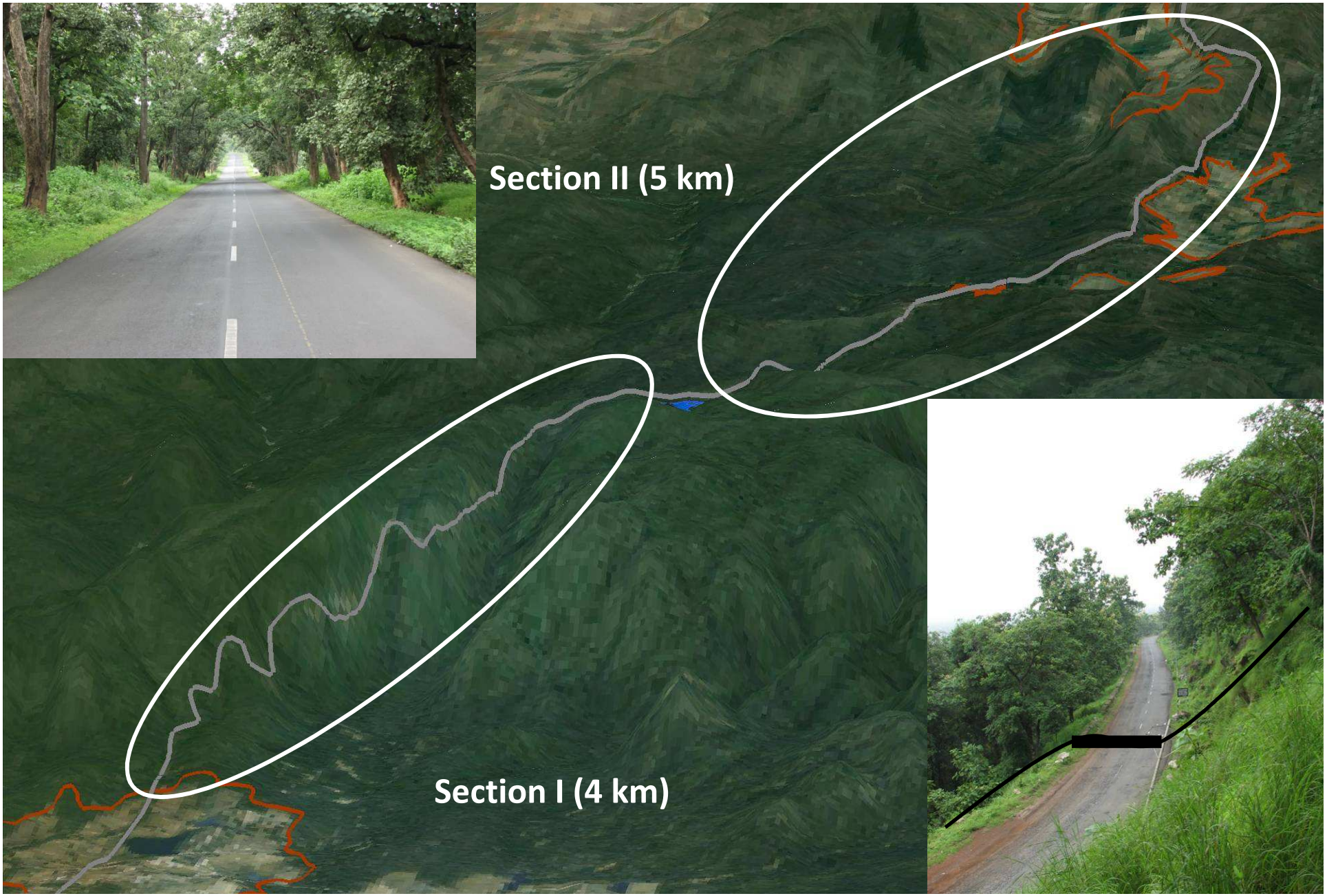




The NH 7 cuts through one of the most important wildlife corridors between Pench Tiger Reserve and Kanha National Park.

Source: WII, 2011

Topography of the road



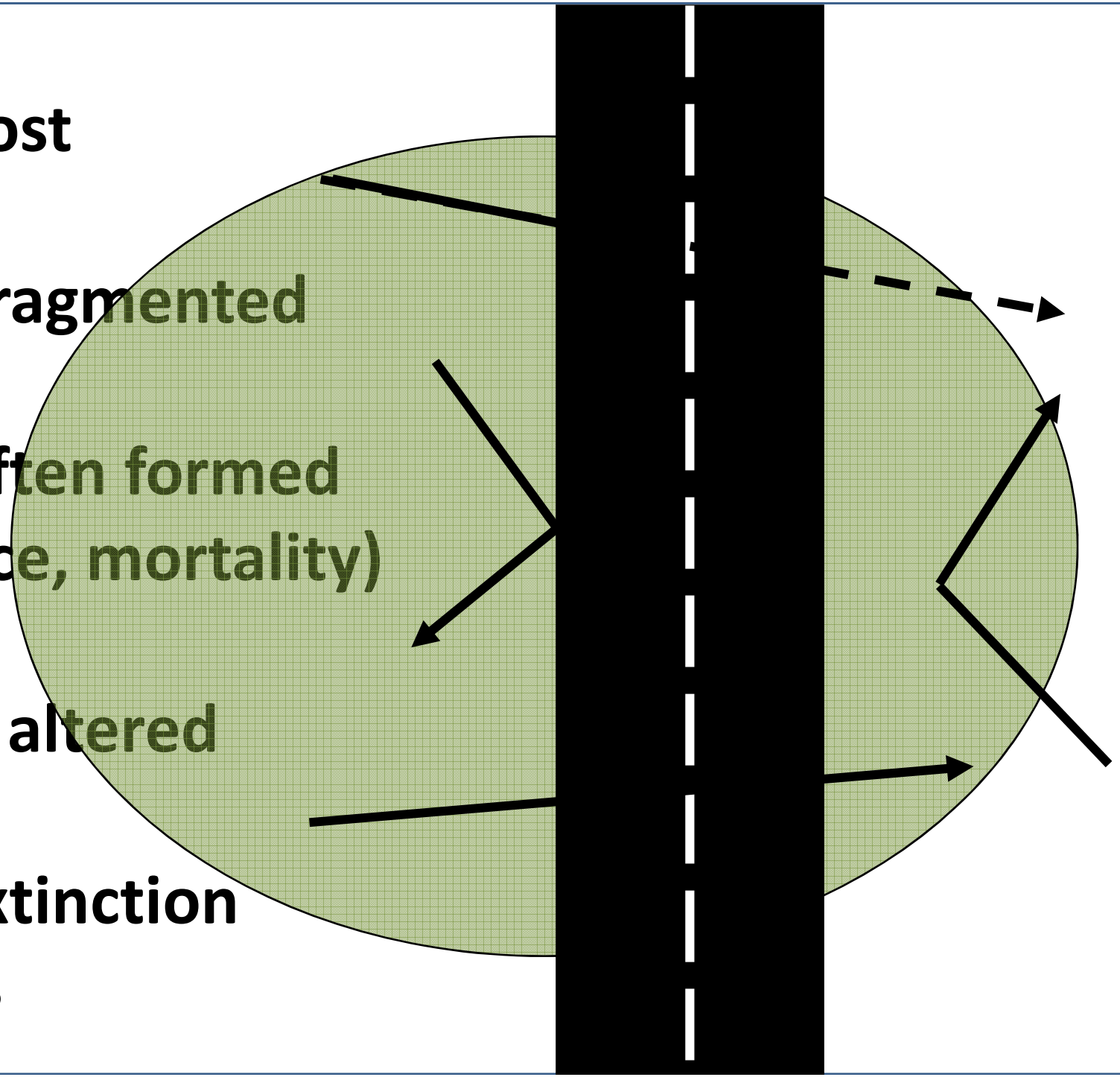
Habitat lost

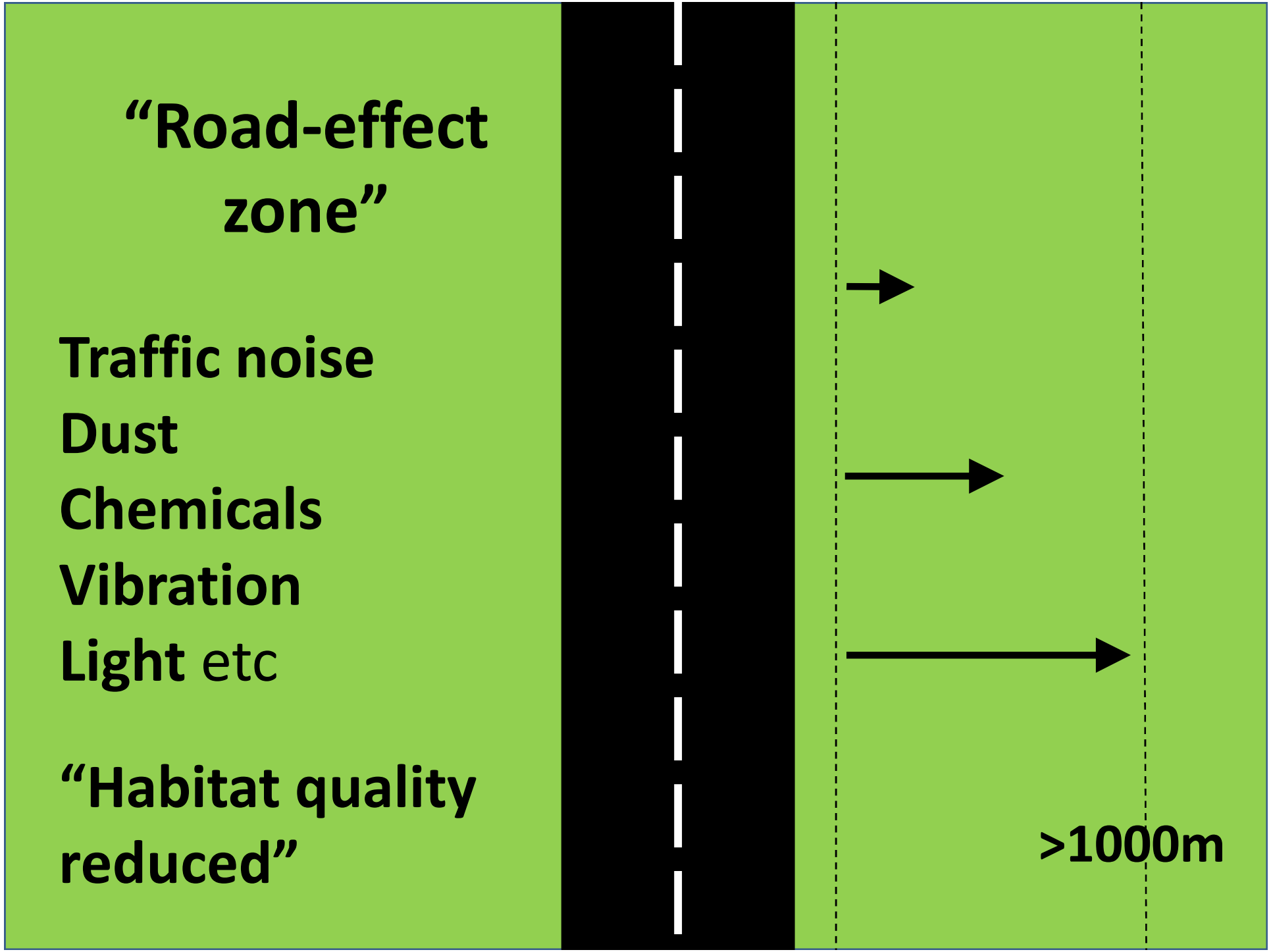
Habitat fragmented

Barrier often formed (avoidance, mortality)

Behavior altered

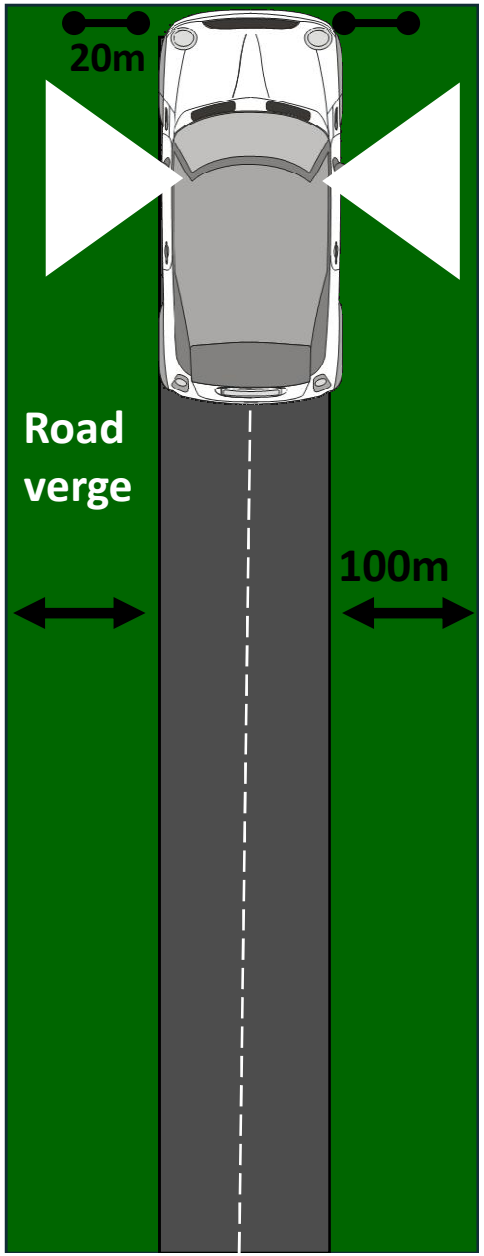
Risk of extinction increases




"Road-effect zone"
Traffic noise
Dust
Chemicals
Vibration
Light etc
"Habitat quality reduced"
>1000m

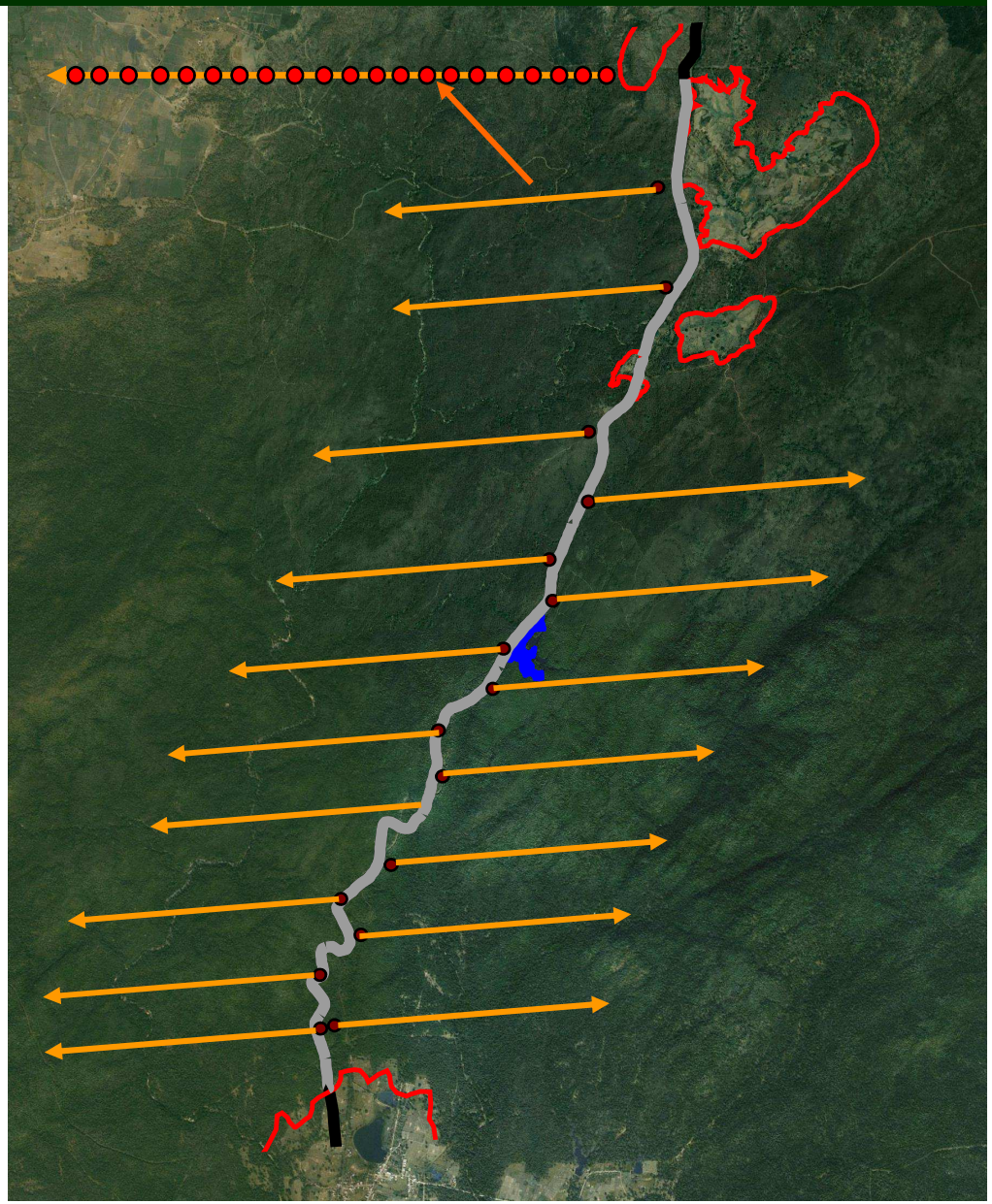
4. Assessment of the road use

- Road side count for assessing the use of road verge and adjacent habitats by wild animals
- Continuous monitoring (24 hours) for assessing road use by animals (3 days in every month)
- Direct observations of the animal movements on the road and across the road
- Indirect evidences of animals in the road verge (20m width)



2. Assessment of the vegetation structure and biotic pressures

- Circular plots (10m radius) laid at every 100 m,
- Tree, shrub, grass sp; canopy cover and ground cover recorded
- Data on lopping, wood cutting and presence of human and livestock trails recorded for assessing biotic pressure



Presence of animal in the road verge

Day time – Wild dog, Gaur, Chital, Wild pig, *Rhesus macaque*, *Hanuman langur*

Night time – Jungle cat, Sambar, Nilgai, Chital, Wild pig, Palm civet, Mongoose, Flying squirrel, Hare

Road related mortality

Reptiles

Species	No. of Kills
Bamboo pit viper	6
Barred wolf snake	99
Beaked worm snake	12
Checkered keelback	16
Common trinket snake	6
Common bronzeback tree snake	14
Common cat snake	49
Common krait	16
common kukri snake	9
Common sand boa	11
Common trinket snake	19
Common wolf snake	15

Continued.....

Total days of observations = 430

Number of kills = 490

Number of species = 24

Reptiles Continued.....

Species	No. of Kills
Forstens cat snake	9
Green keelback	17
Indian rat snake	7
Indian rock python	12
Russells kukri snake	7
Russell's viper	20
Saw scaled viper	19
Spectacled cobra	4
Striped keelback	38
Unidentified	53
Calotes	27
Indian Monitor	5
Total	**490**


Bamboo pit viper
18 07 2010 07 48


Barred wolf snake
10 07 2010 07 54


Beaked worm snake
18 03 2010 07 12


Checkered keel back
04 07 2010 08 15


Bronzeback tree snake
05 06 2010 06 11


Common cat snake
09 05 2010 06


Common krait


Sand boa
29 04 2010 06 37


Trinket snake
18 03 2010 08 11

Birds

Species	No. of Kills
Common myna	29
Jungle crow	3
Drango	2
Gray night jar	5
Indian roller	16
Jungle Babbler	18
Jungle owlet	14
Oriental magpie robin	5
Plum headed parakeet	3
Red-vented bulbul	4
Rose ringed parakeet	3
Spotted dove	9
Spotted owlet	13
Starling	4
White breasted water hen	2
White throated kingfisher	2
Unidentified	11
Total	**143**

Total days of observations = 430

Number of kills = 143

Number of species = 16


Barred jungle owlet

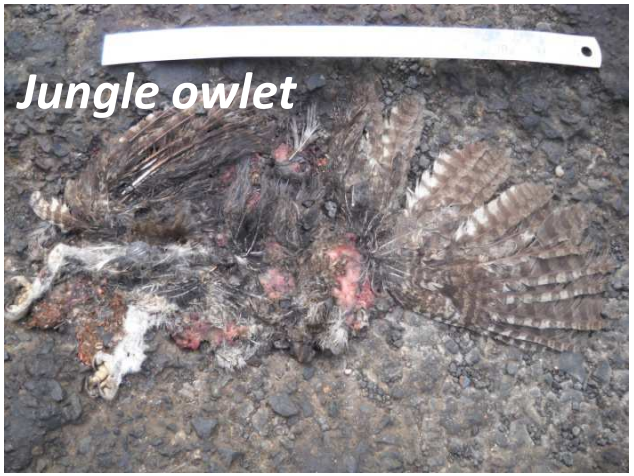

Common myna
13 03 2010 08 27


Jungle crow


Gray night jar
27 04 2010 06 07


Indian roller


Jungle babbler


Jungle owlet


Plum headed parakeet
12 04 2010 17 39


Pose ringed parakeet
03 04 2010 06 43

Mammals

Species	No. of Kills
Jackel	2
Indian Fox	1
Jungle cat	9
Cheetal	6
Sambar	1
Wild pig	2
India hare	5
Indian Porcupine	1
Mongoose	1
Palm civet	5
Striped squirrels	9
Bat	15
Rat	109
Hanuman langur	23
Rhesus macaque	31
Total	220

Total days of observations = 430

Number of kills = 220

Number of species = 15


Jackel


Fox


Jungle cat


Chital


Sambar


Wild pig


Hare


Porcupine


Palm civet

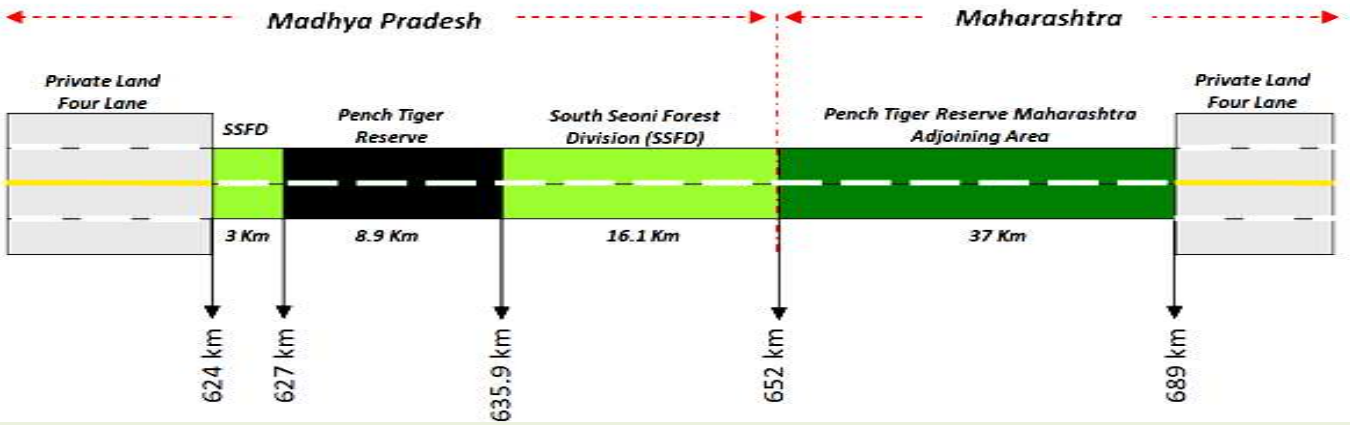
Key Findings

- Road side habitat use by wild animals vary with seasons
- Use of roadside habitats by wild animals is highest during summer at night time
- Road related mortality of animals is very high (1035 road kills in 430 days)
- Most vulnerable group of animals are the reptiles
- Slope, distance from water sources and proximity to agriculture area influences habitat use

- Use of underpasses by animals is influenced by their size, design and location
- Water availability influences the habitat use by animals
- Biotic pressures are most pronounced within 700m of the road

Road Upgradation Proposal of NHAI

4 laning of the National Highway -7



Total Stretch in MP and Mahrashtra: 65 km

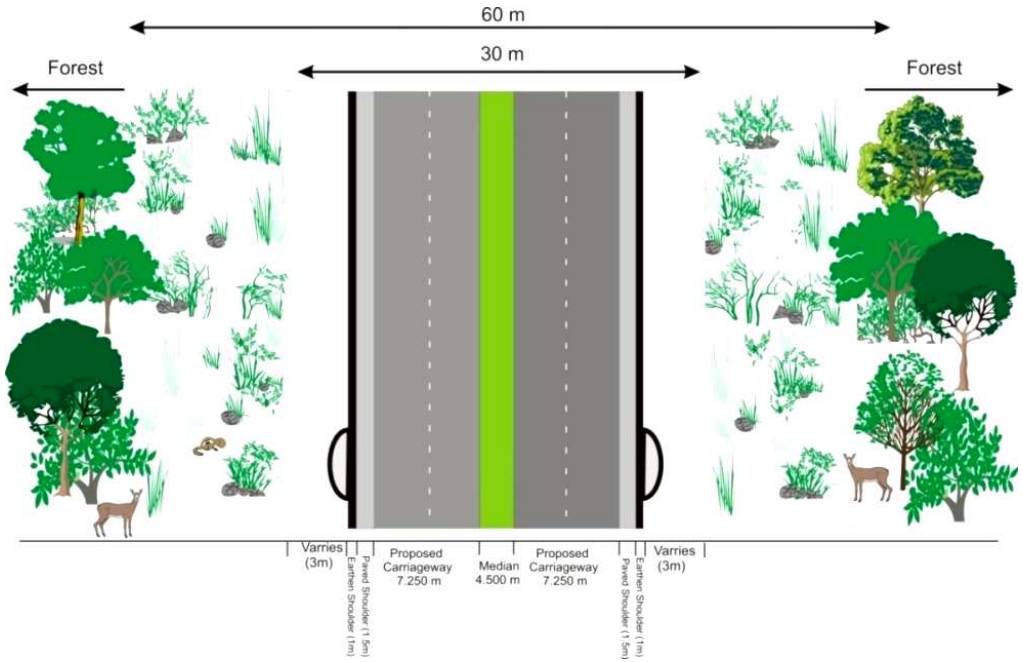
This involved:

- Request for diversion of forest area for widening of NH-7
- Directives of Hon'ble Supreme Court to NHAI to revise proposal for reducing demand on forest area
- NHAI proposed 39 crossing structures through PTR
- Technical review of proposal by WII on the directive of NTCA

Key stakeholders

Proposal for diversion of forest area under NH-7

Type of forest	Original area (ha)	Revised area (ha)
Pench Sanctuary	16.727	4.493
South Seoni Div.	48.969	30.065
Revenue Forest	5.020	0.6220
TOTAL	**70.716**	**35.178**

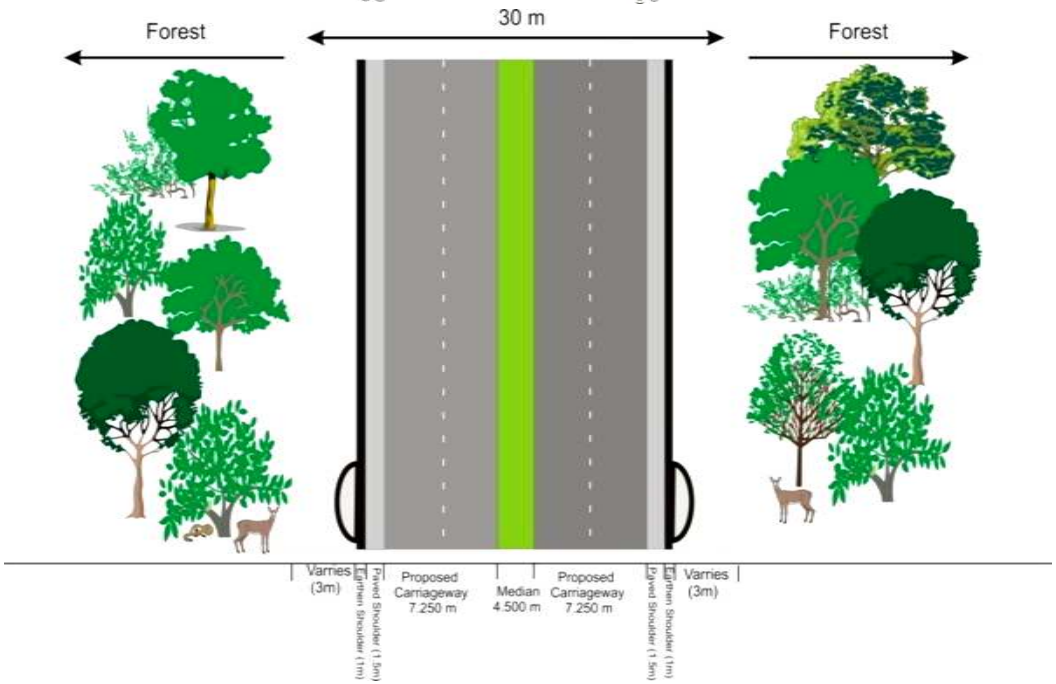


Initial Proposal

Right of Way : 60 m

Road verge: 30 m

Median: 4.5 m



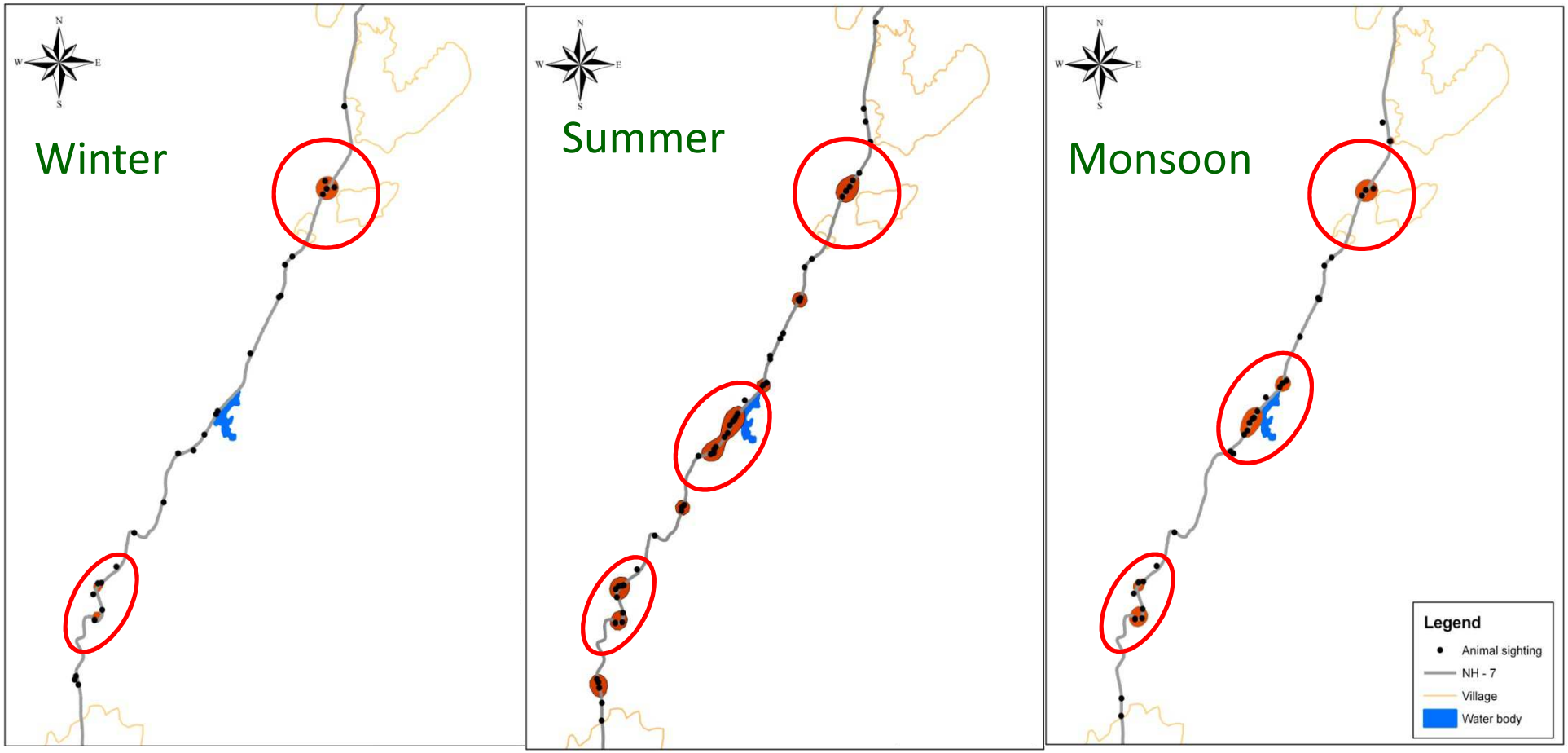
Revised Proposal

Right of Way : 30 m

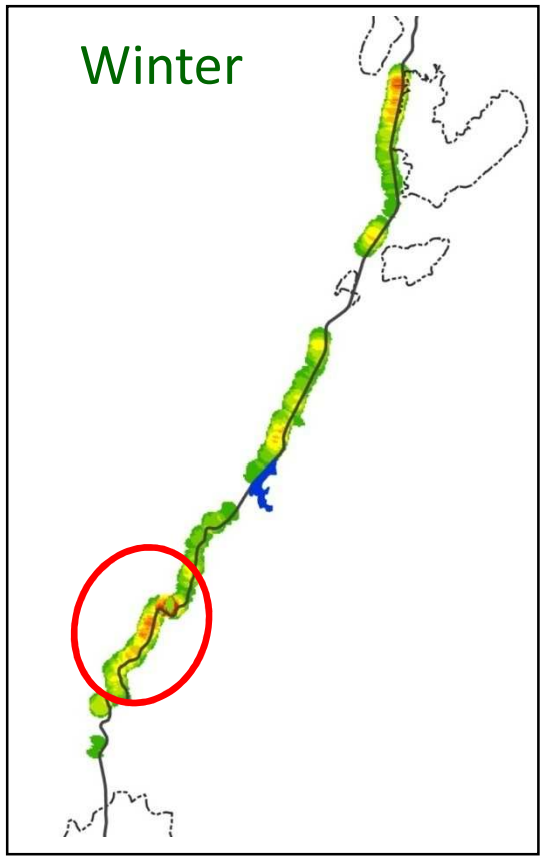
Median: 4.5 m

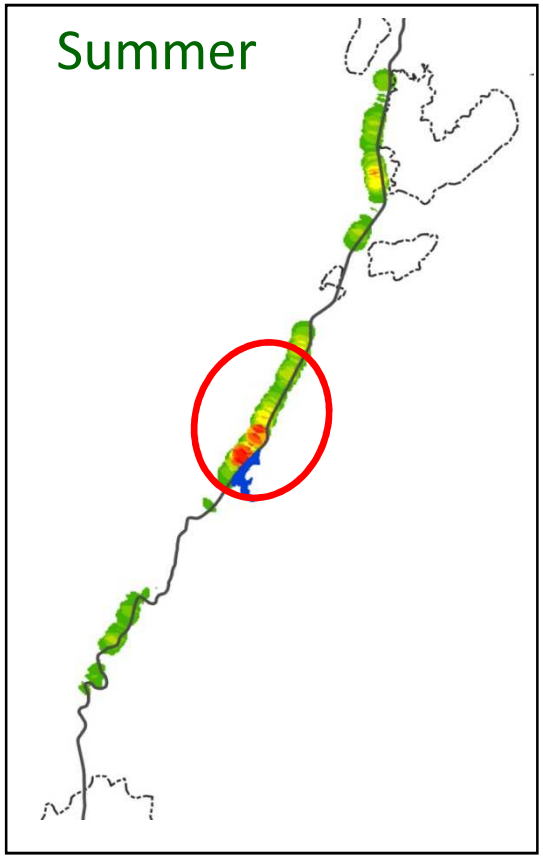
No road verge

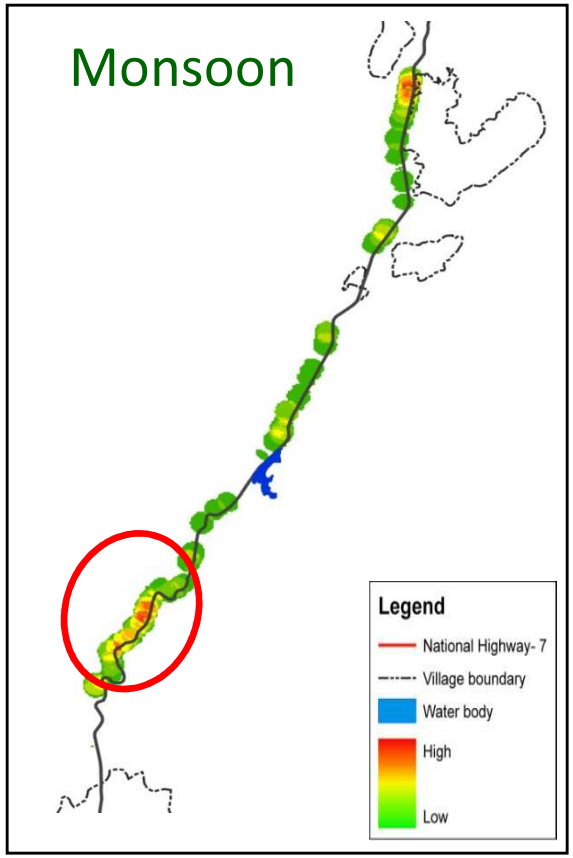
Animal sightings in the road verge



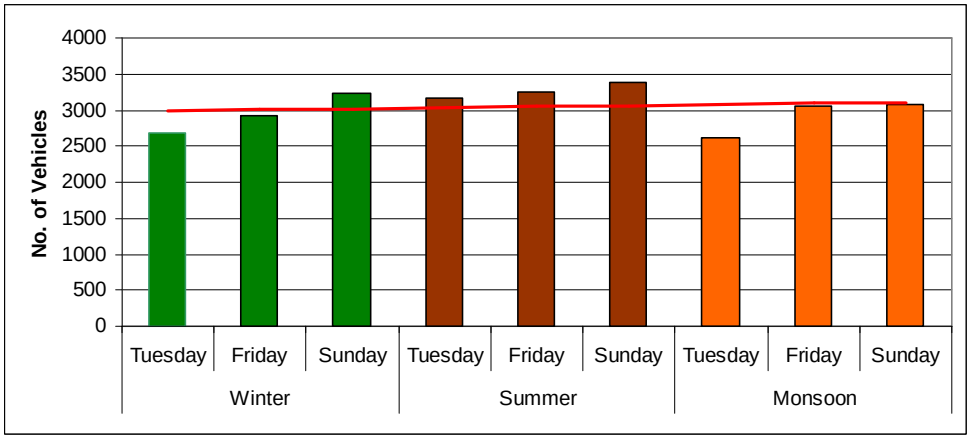
Indirect animal evidences along the road verge

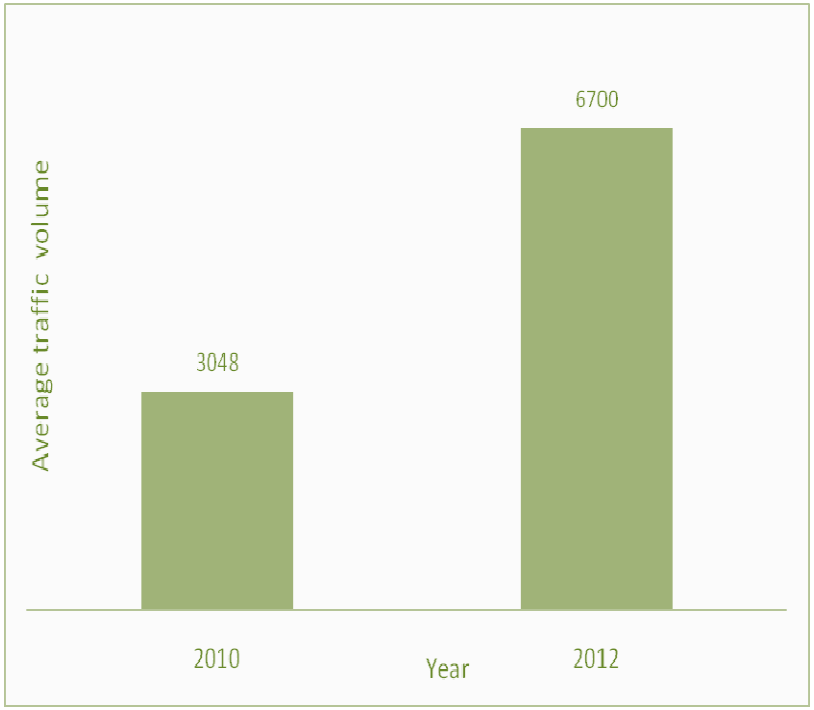


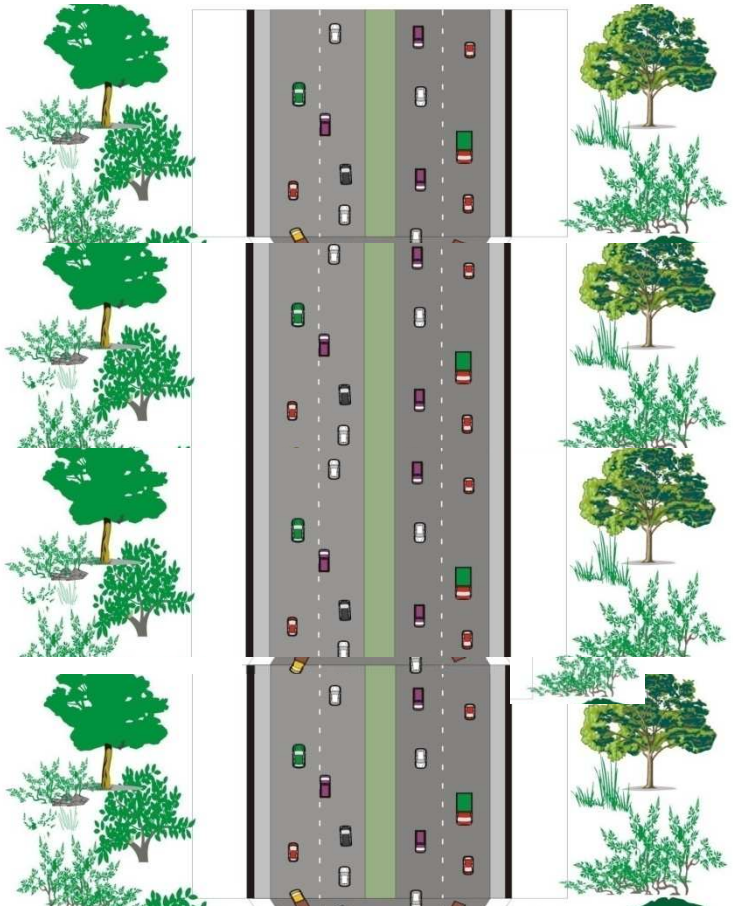




Highest peak traffic based on 24hr monitoring in summer **(3382 vehicles per day)**



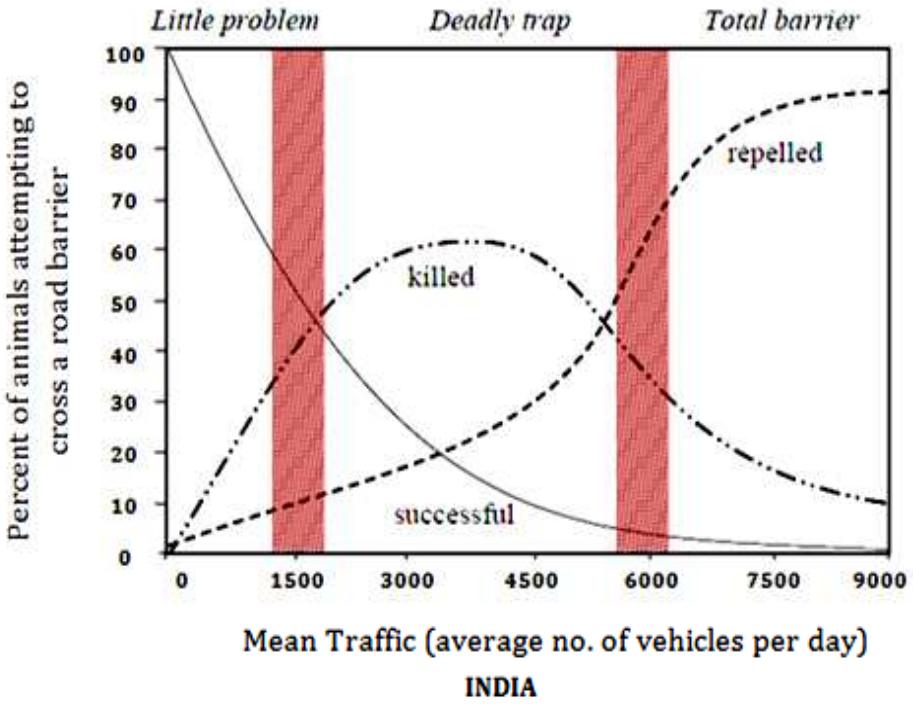


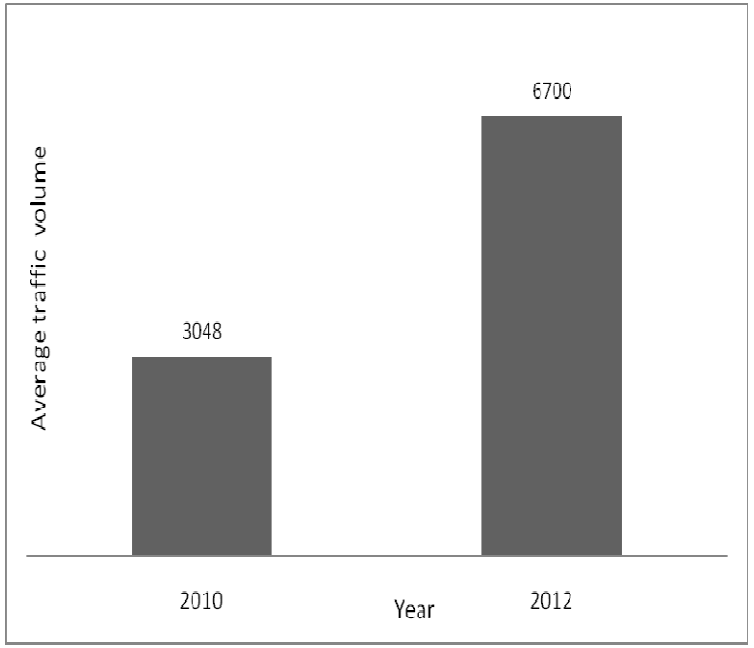


Four lane road merging into two lane road
Results :tail back effect. Time spent on the road section by the vehicles will increase, which will result in barrier effect and disturbance

Time spent on the road section by the vehicles will increase, which will result in barrier effect and disturbance

Fait Accompli Situation

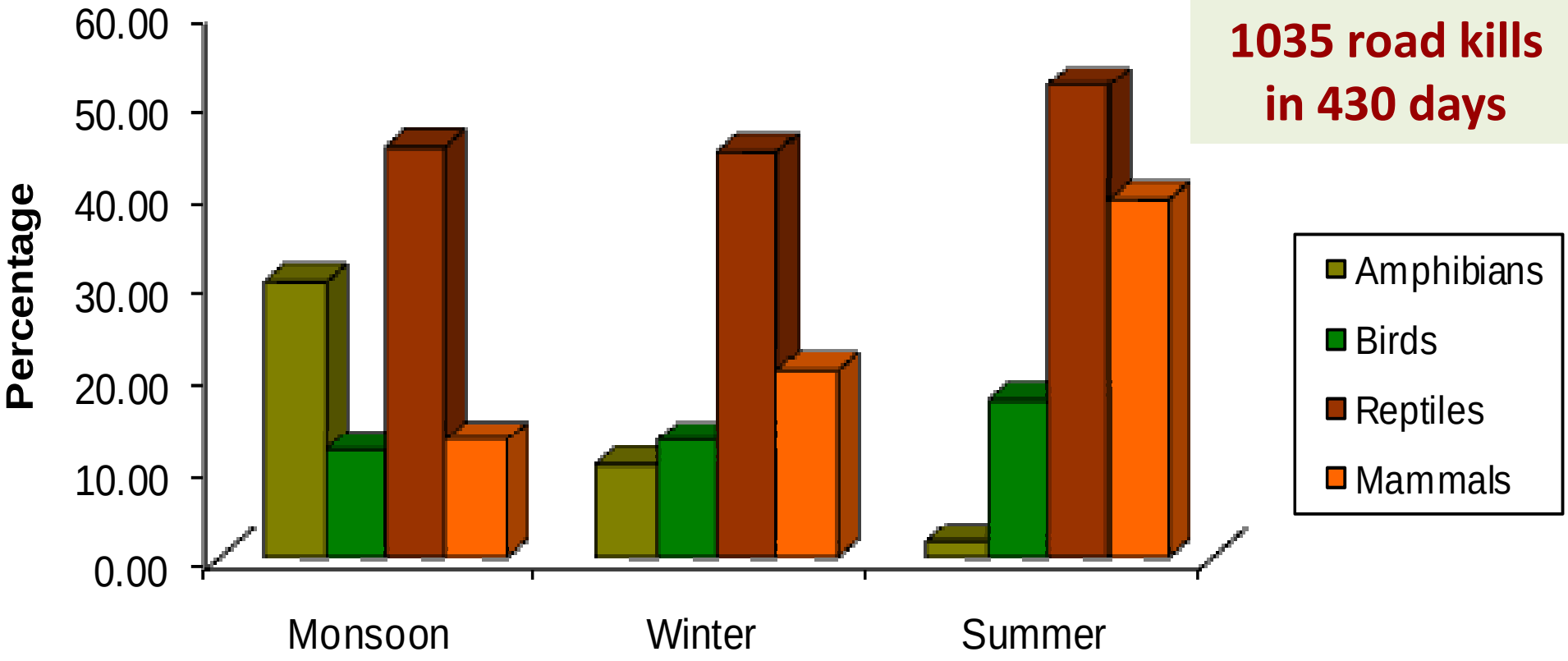




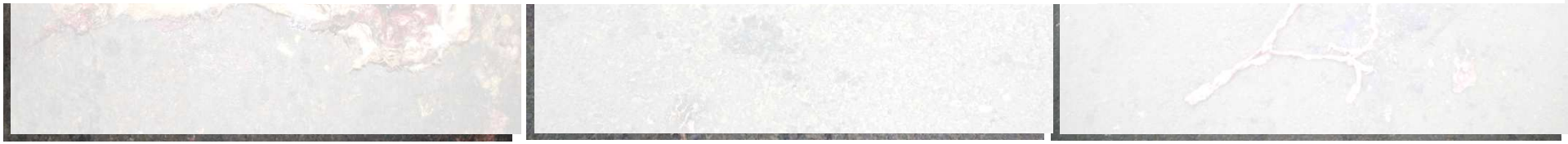
Conceptual model: Effect of traffic volume on the percentage of animals that can successfully cross a road, are repelled or get killed as they attempt to cross.

The model is based on empirical data indicating that most collisions occur on intermediate roads (Adapted from Seiler - 2003)

1035 road kills in 430 days

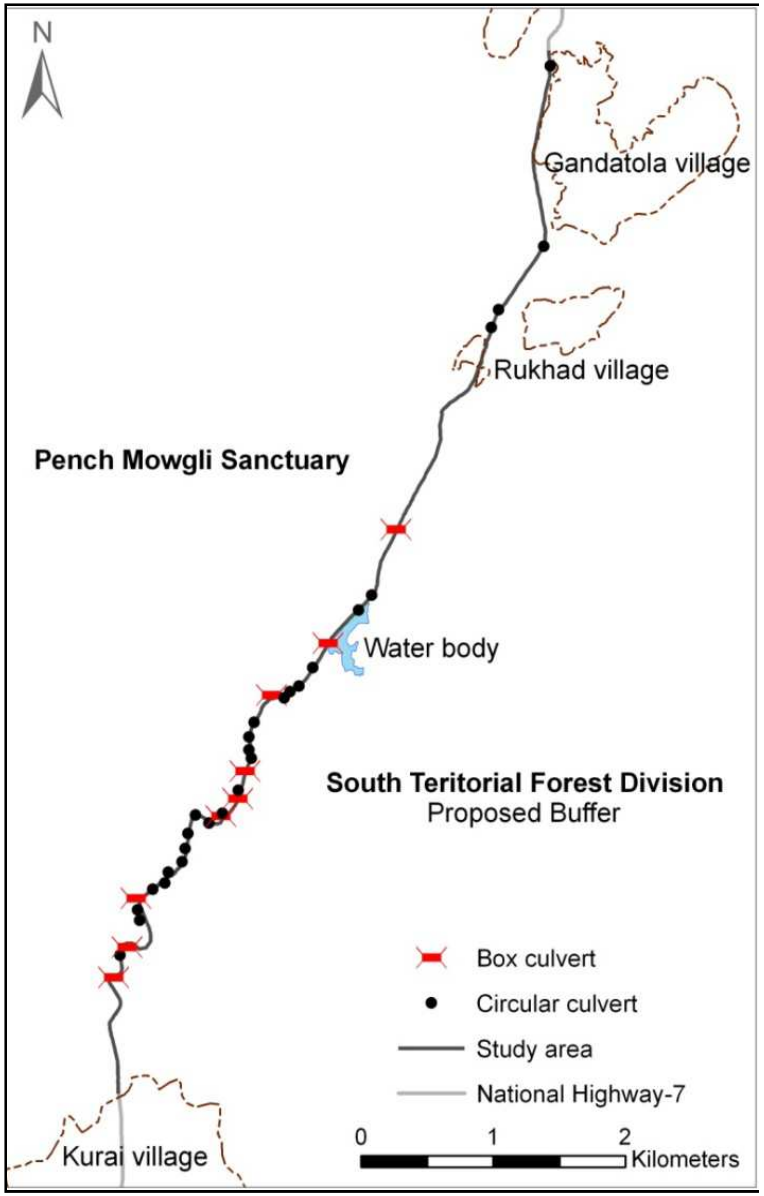


Road kills in different seasons



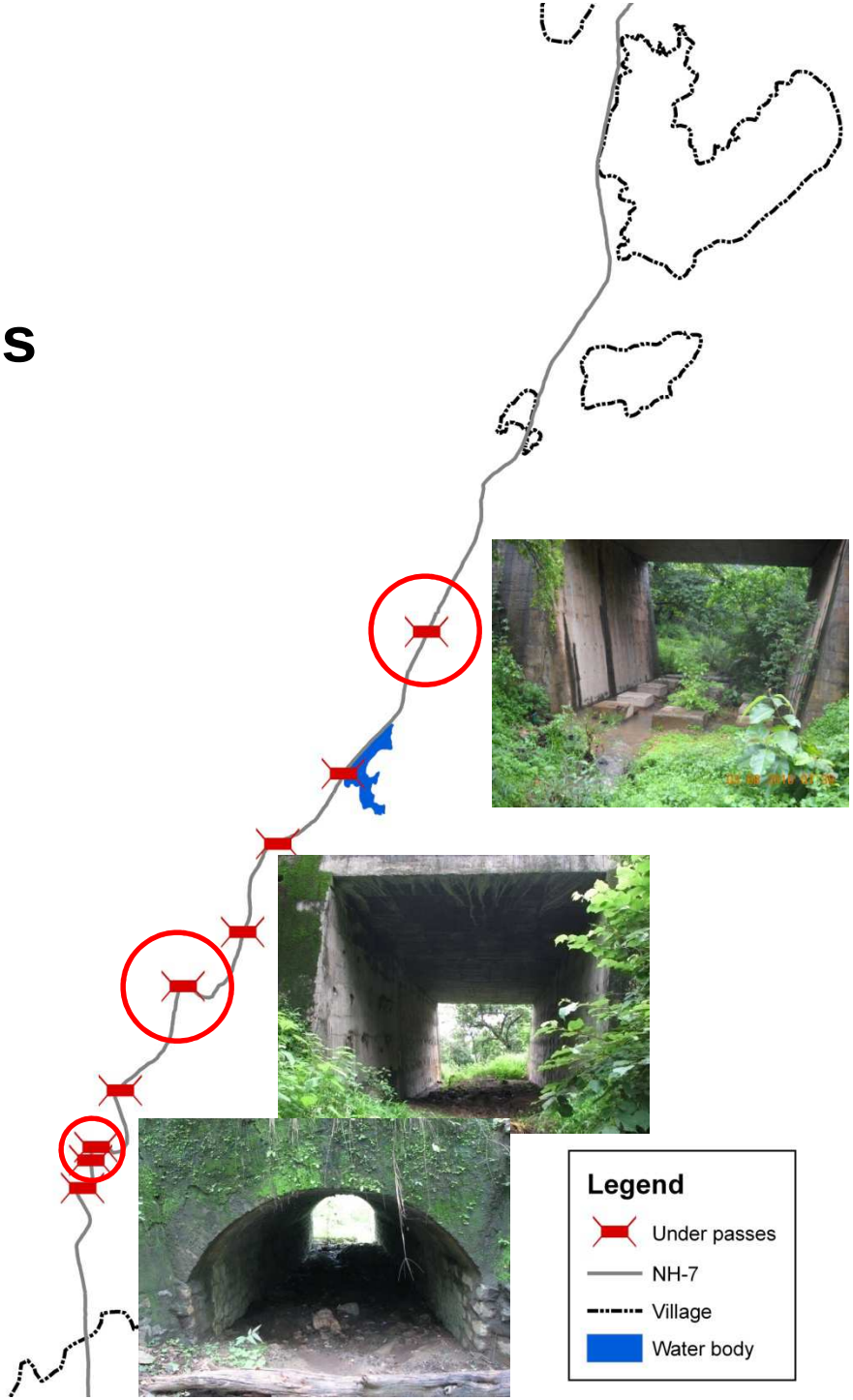
Proposed crossing structures in PTR

Type of structures	Pench Sanctuary
Underpasses	14
Minor Bridge	Nil
BoxCulverts	13
Hume Pipe Culverts	12



Use of underpasses by animals

(based on signs and photo captures)



Technical evaluation of NHAI proposal by WII

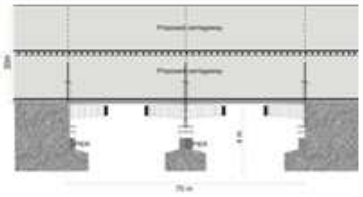
Underpass

Km mark: 634.730

GPS location: 21 50 03.13N, 79 30 11.56E

Dimension: Height x Width (m): 4 x 70

Proposed design features by NHAI:



Suitability: Location is suitable but the height of the piers is not suitable for creating appropriate underpass for use by animals such as large carnivore and large ungulates.

Recommendation: Level of road should be raised to ensure that the underpass dimensions are at least 7x 70 m. This is being suggested as large numbers of animals are crossing this section. Landscaping efforts are needed for attracting the animals to use the underpass.

Slab culvert

Kilometer mark: 635.093

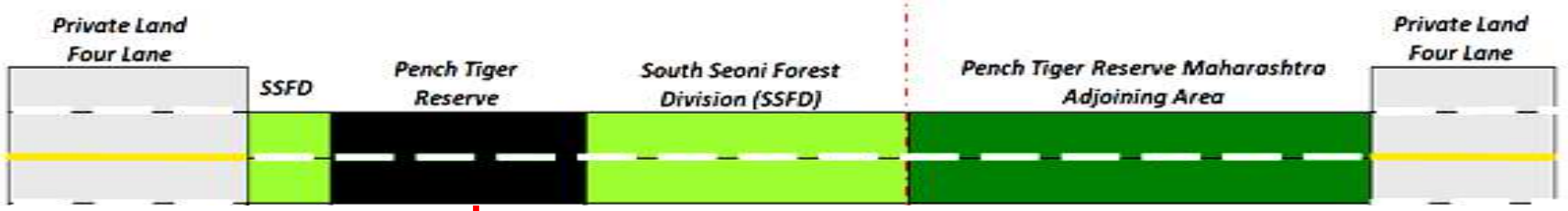
GPS location: 21 49 51.40N, 79 30 08.66E

Height x Width (m): 1 x 2

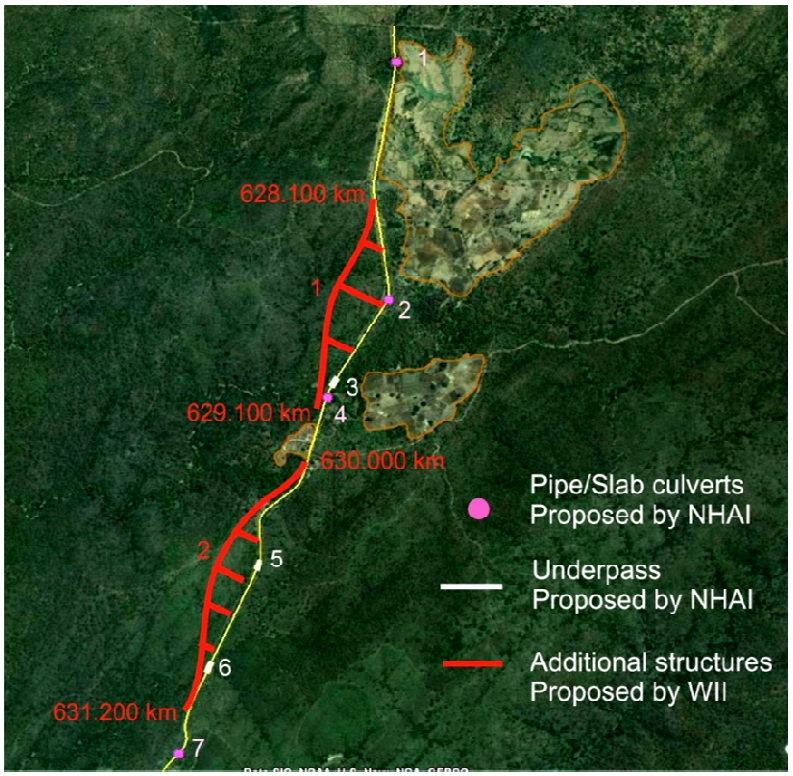
Existing structure:

Suitability: Location and size is suitable for use by reptiles and small mammals.

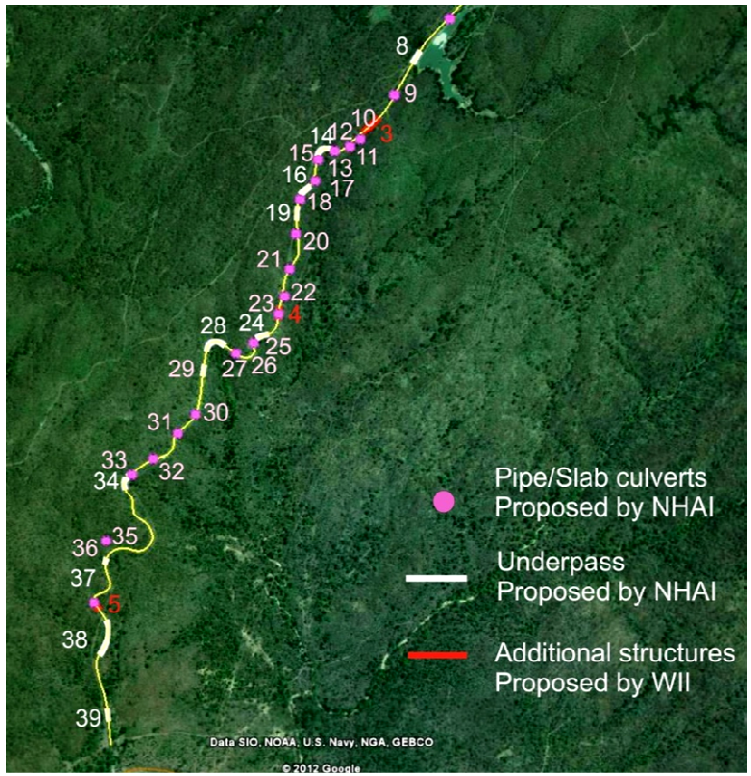
Recommendation: Landscaping efforts are needed for guiding the animals to use the culvert.

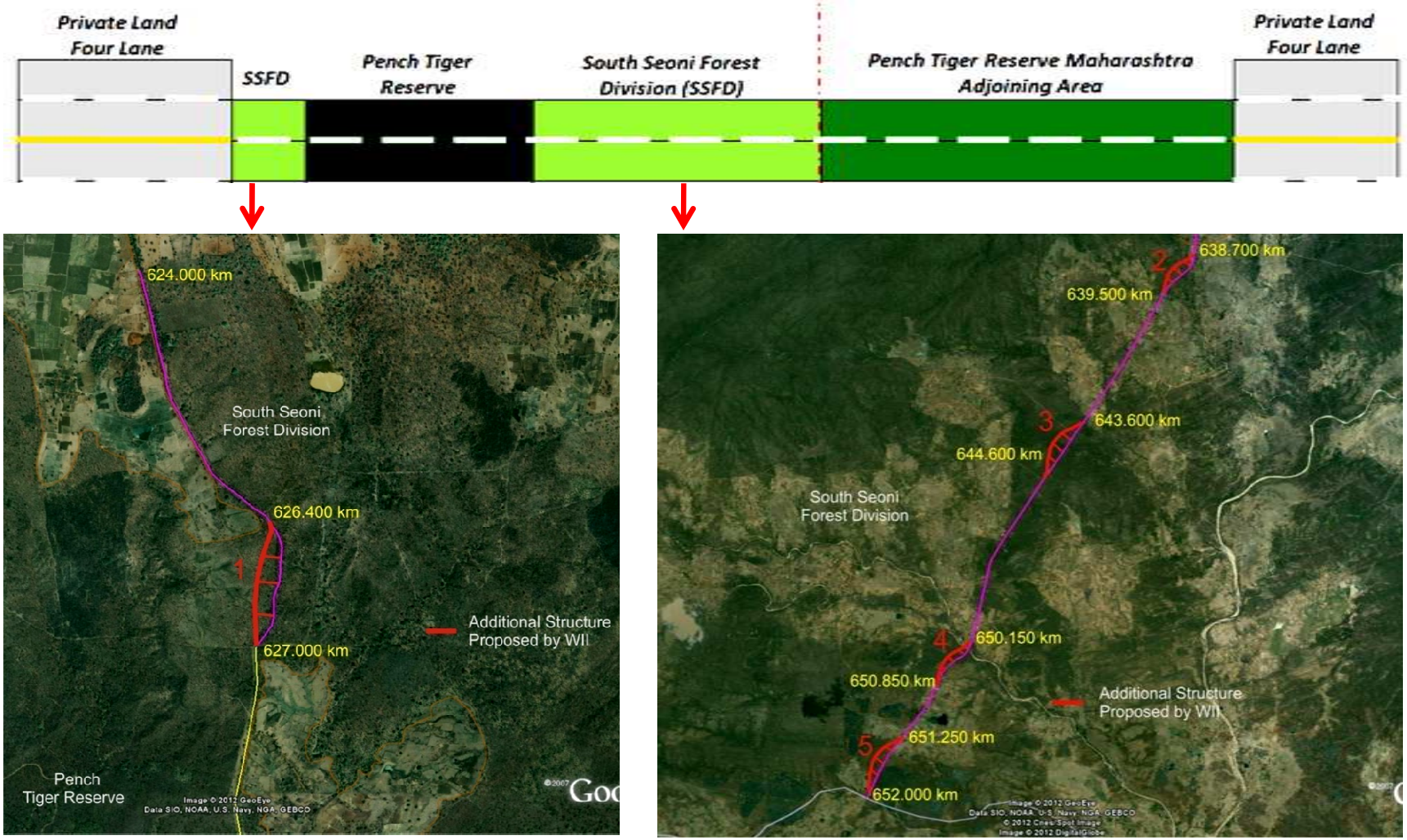


Flat section



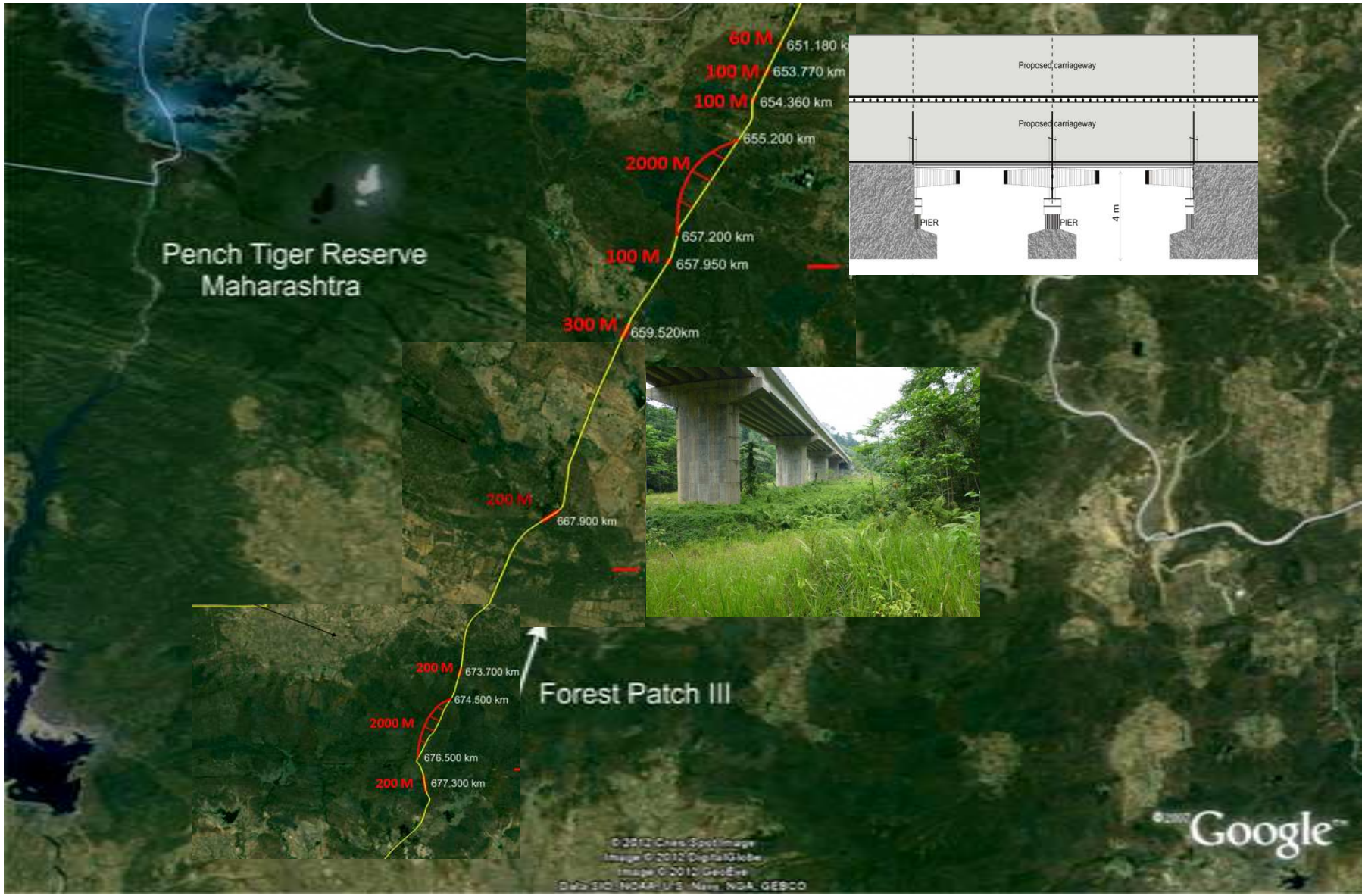
Hill section





Type of structures	South Seoni Forest Division
Underpasses	07
Minor Bridge	07
BoxCulverts	11
Hume Pipe Culverts	12

NH 7 Maharashtra Section



Key lessons

Time to plan smart green infrastructure for responsible growth

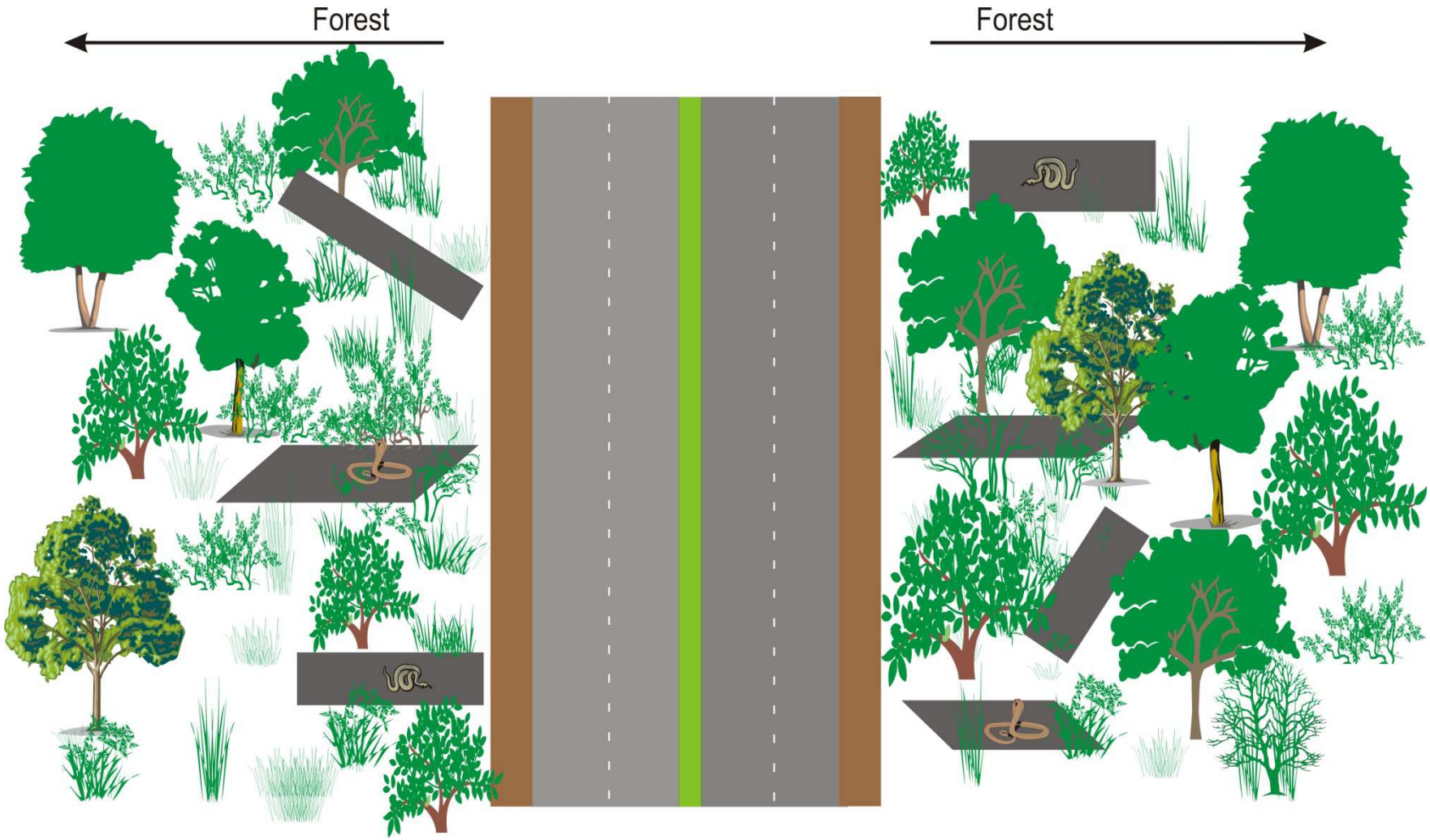
Green Infrastructure is "Smart" if it address the ecological and social impacts of Sprawl and the accelerated fragmentation of open land.

Benedict & McMahon, 2000

Biodiversity-inclusive and biodiversity-friendly SEAs and EIAs can provide the operative framework

Existing practice	Smart Green Road Infrastructure
Individual projects have fixed road length (80 km)	Entire road through a landscape as one project
Forest and non-forest road sections - separate projects	Encourages integrated project planning as actions in non forest may have a bearing on forest area
Fait accompli situation	Plan precedes operation based on a smart highway plan
Modifications in existing crossing structures	Adopts a concept of smart green designs for addressing species specific needs
Emphasis on maintaining minimum requirements for animals movement	Ensures and secures animal movement across landscapes by envisioning a good design
Retrofitting is the password	Innovation is the password

Existing practice	Smart Green Road Infrastructure
Individual projects have fixed road length (80 km)	Entire road through a landscape as one project
Forest and non-forest road sections - separate projects	Encourages integrated project planning as actions in non forest may have a bearing on forest area
Fait accompli situation	Plan precedes operation based on a smart highway plan
Modifications in existing crossing structures	Adopts a concept of smart green designs for addressing species specific needs
Emphasis on maintaining minimum requirements for animals movement	Ensures and secures animal movement across landscapes by envisioning a good design
Retrofitting is the password	Innovation is the password


Forest
Forest

Thank you..