

MODULE 2

Managing and Analyzing Biodiversity Data

ADB

Emerging Tools and Technologies Used in
Terrestrial Biodiversity Assessments for
Transportation Development Projects
The Modern Road Ecologist's Toolbox





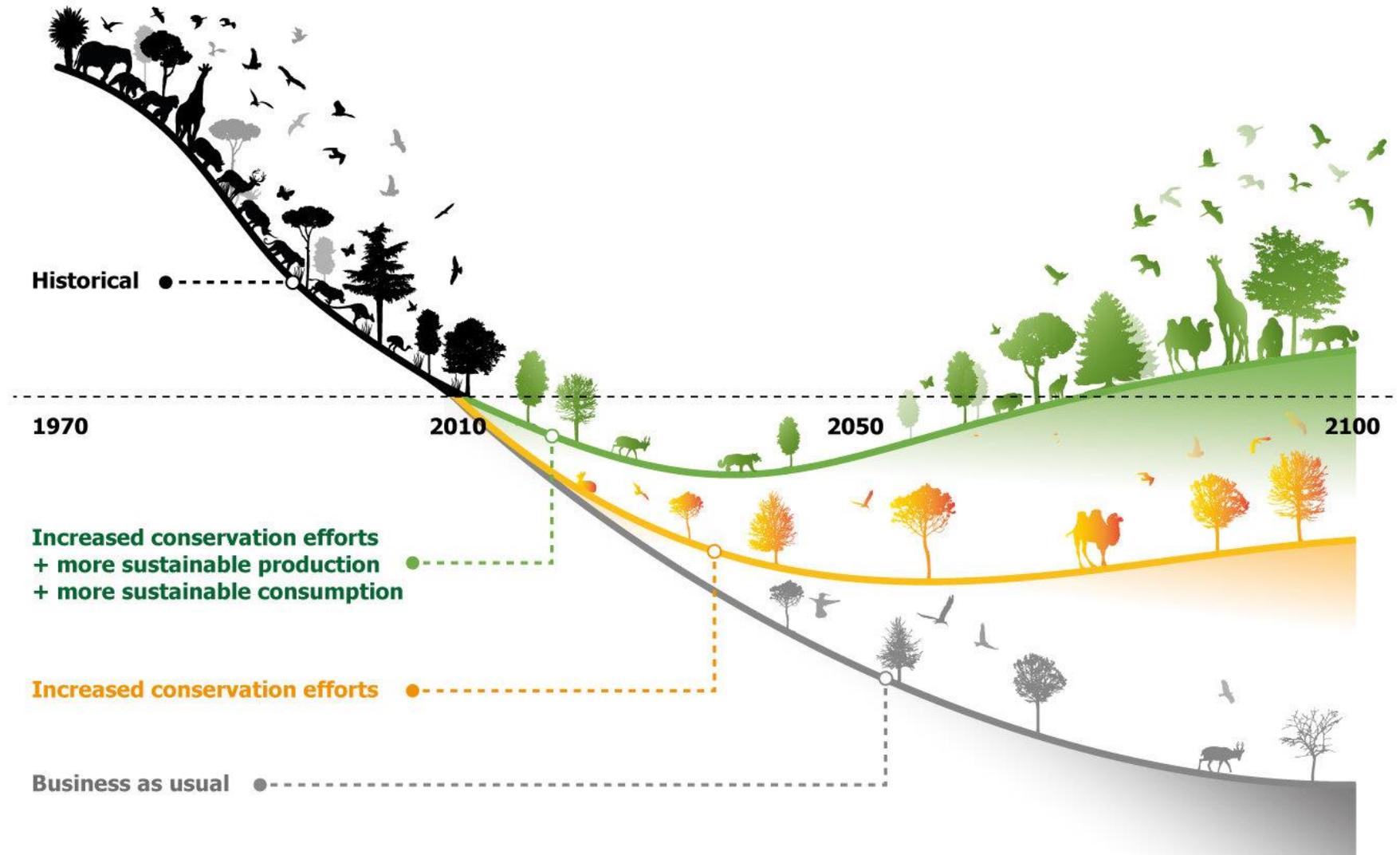
Module 2: Managing and Analyzing Biodiversity Data



- A. Example BBA IN NEPAL
- B. Demo Nepal apps and DB
- C. TOOLS AND BEST PRACTICES FOR COLLECTING DATA
- D. DEMONSTRATIONS: DATA COLLECTION TOOLS & DASHBOARDS

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



This artwork illustrates the main findings of the article, but does not intend to accurately represent its results (<https://doi.org/10.1038/s41586-020-2705-y>)



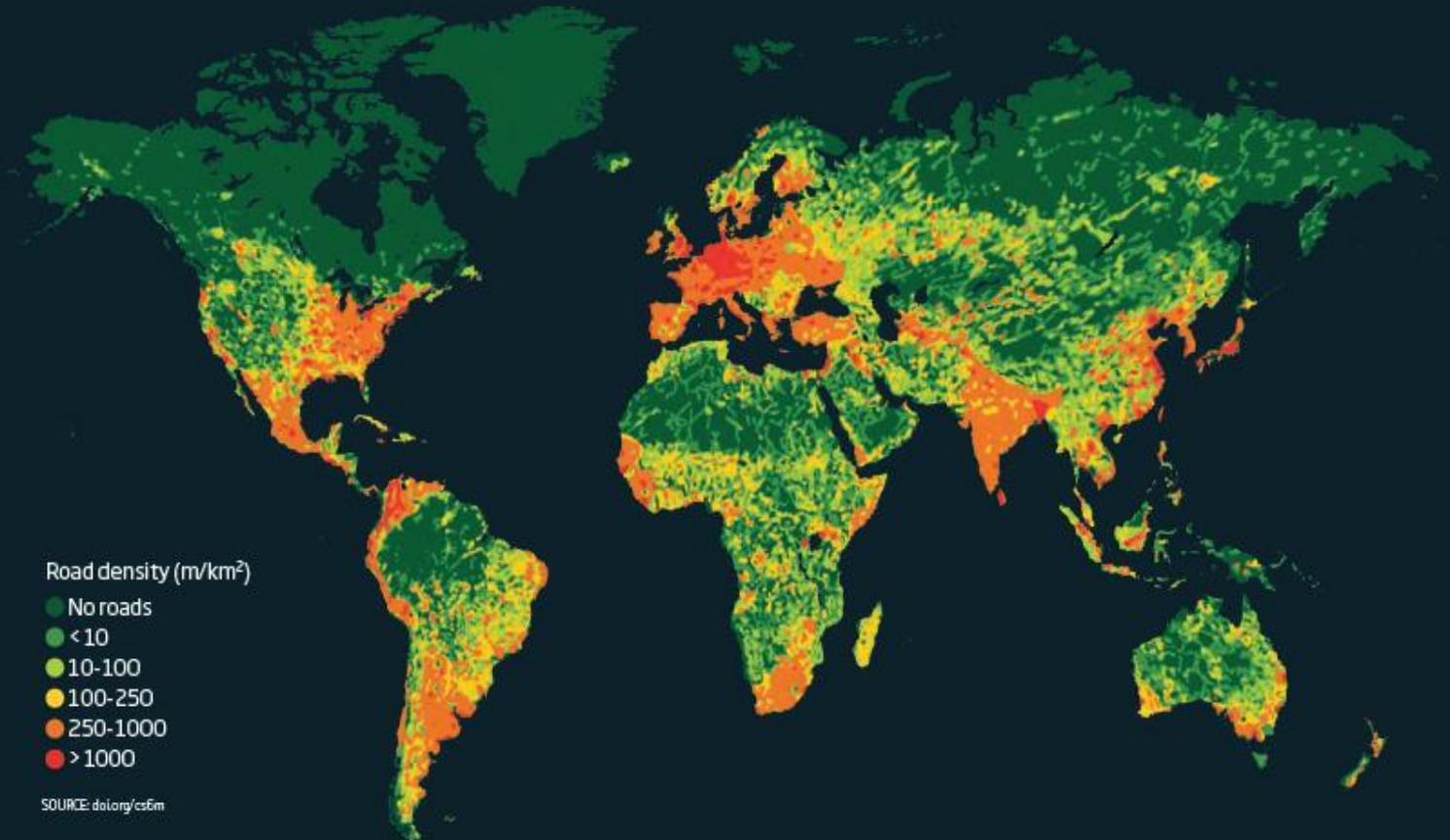
12 million km roads built since 2000

25 million km roads projected to be built by 2050 (Dulac, J. 2013.)

38 | NewScientist | 1 September 2018

PAVED PLANET

Large infrastructure programmes threaten biodiversity across the globe – with China's Belt and Road Initiative a new threat



Narayanghat-Hetauda-Pathlaiya (NHP)

*Smart Infrastructure Planning and Design
to Protect Natural Habitats and Biodiversity
(TA-9461)*





BACKGROUND

SASEC Road Improvement Project

Funders: Govt Nepal, ADB

Location: Terai Arc NEPAL

Roads: **NB:** Narayanghat-Butwal (*115 km*)

NHP: Narayanghat-Hetauda-Pathlaiya
(Mahendra Highway - *108 km*)

Status: NB in construction; BA/EIA completed

NHP BBA in progress; Nov 2021

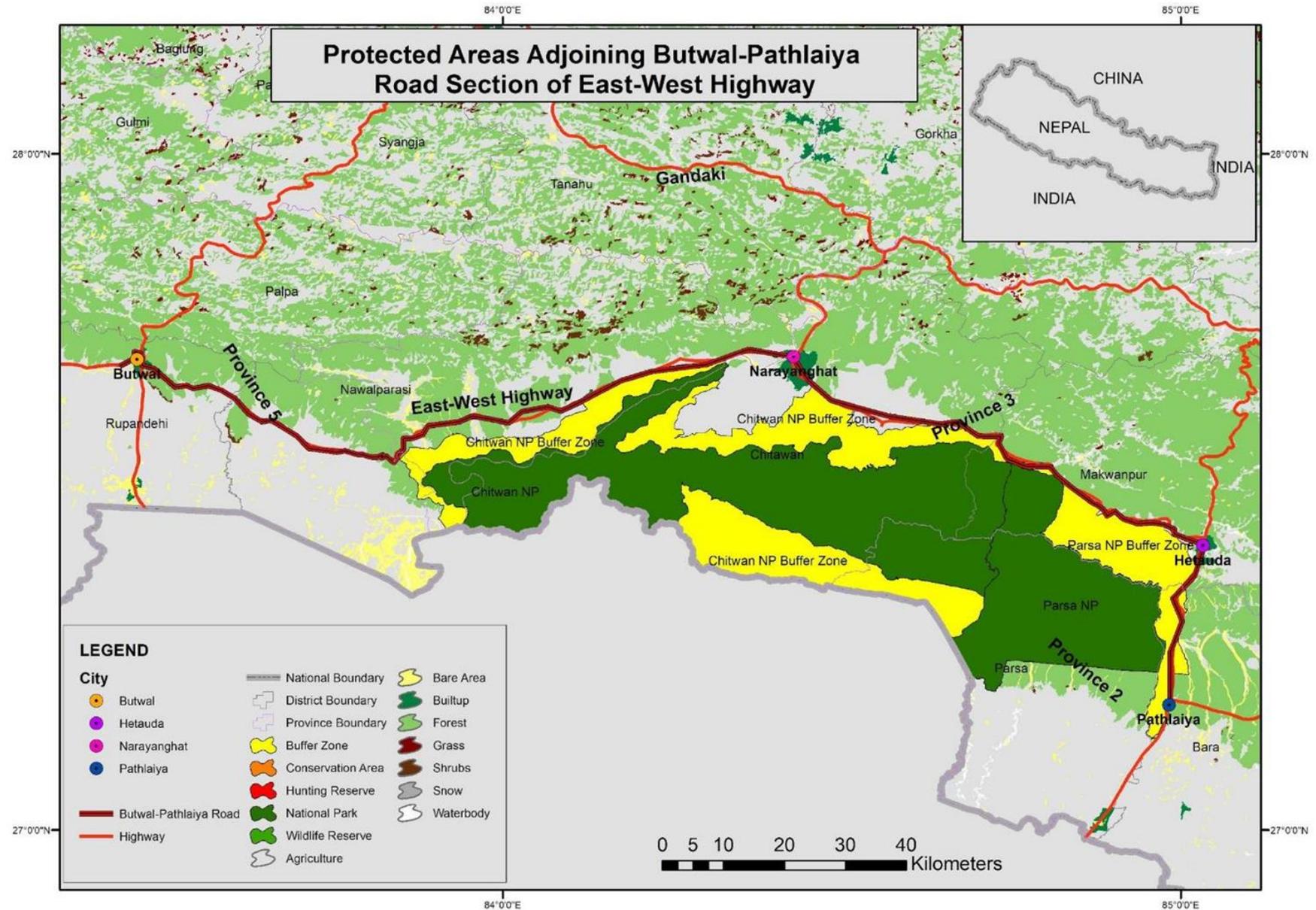
SASEC Road Improvement Project Objectives

Upgrading from 2 to 4 lanes
Adjacent to buffer zone
Chitwan NP



“CATEGORY A”

Narayanghat –
Hetauda –
Pathlaiya (NHP)
- 108 km





OBJECTIVES

1. “To conduct comprehensive and in-depth ecological studies in and around the project area for the NHP road.”
2. “Provide technical support and guidance for design and implementation of the wildlife mitigation measures and biodiversity conservation plan”

What are the impacts ??

Increased traffic, disturbance...

Effects:

mortality, movements/connectivity



TEAM AND OBJECTIVES

TA 9461 - Smart Infrastructure planning and design to protect natural habitats and biodiversity

- NEPAL (Jade Consult, Kathmandu)
- INTERNATIONAL/CANADA (ESSA Technologies, Vancouver)

BBA Objectives

Enhance the sustainability of its investments by integrating measures to protect natural habitats and biodiversity.

- Biodiversity
- Bio-engineering
- CEA – Climate change
- Natural Capital
- Training & Knowledge Product



OBJECTIVES OF NHP PROJECT

What data do we need to collect ?
What are the impacts ??

MORTALITY

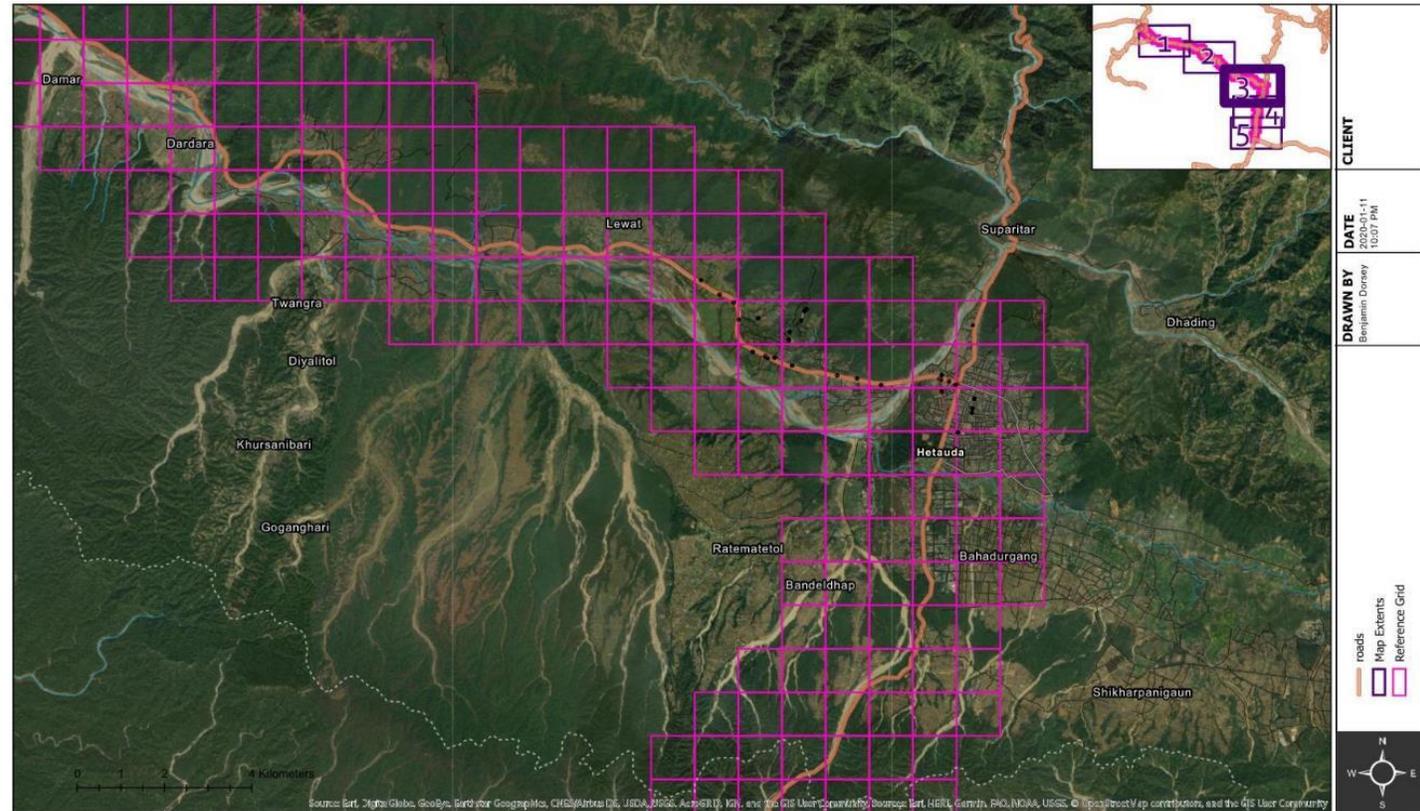
- From vehicles

MOVEMENT

- Habitat Connectivity

What species ??

NHP Road Field Map - Draft



Informed study design & data collection



- *Umbrella Species ??*
- *Big charismatic species ?*
- *Multi-taxon ??*
- *Can we use all the species data ??*
 - » *Niche characteristics**

*see: Animal Conservation 19:251 (2016)





FOCAL TAXA CATEGORIES

1. Species of Conservation Concern

IUCN Listed:

Tiger, Rhino, Elephant, Leopard, Sloth Bear etc.

2. Arboreal/Canopy-dwelling species

Terai Grey Langur

3. Small/Med-sized Vertebrates

Hispid hare, Leopard cat, Yellow-throated marten etc.

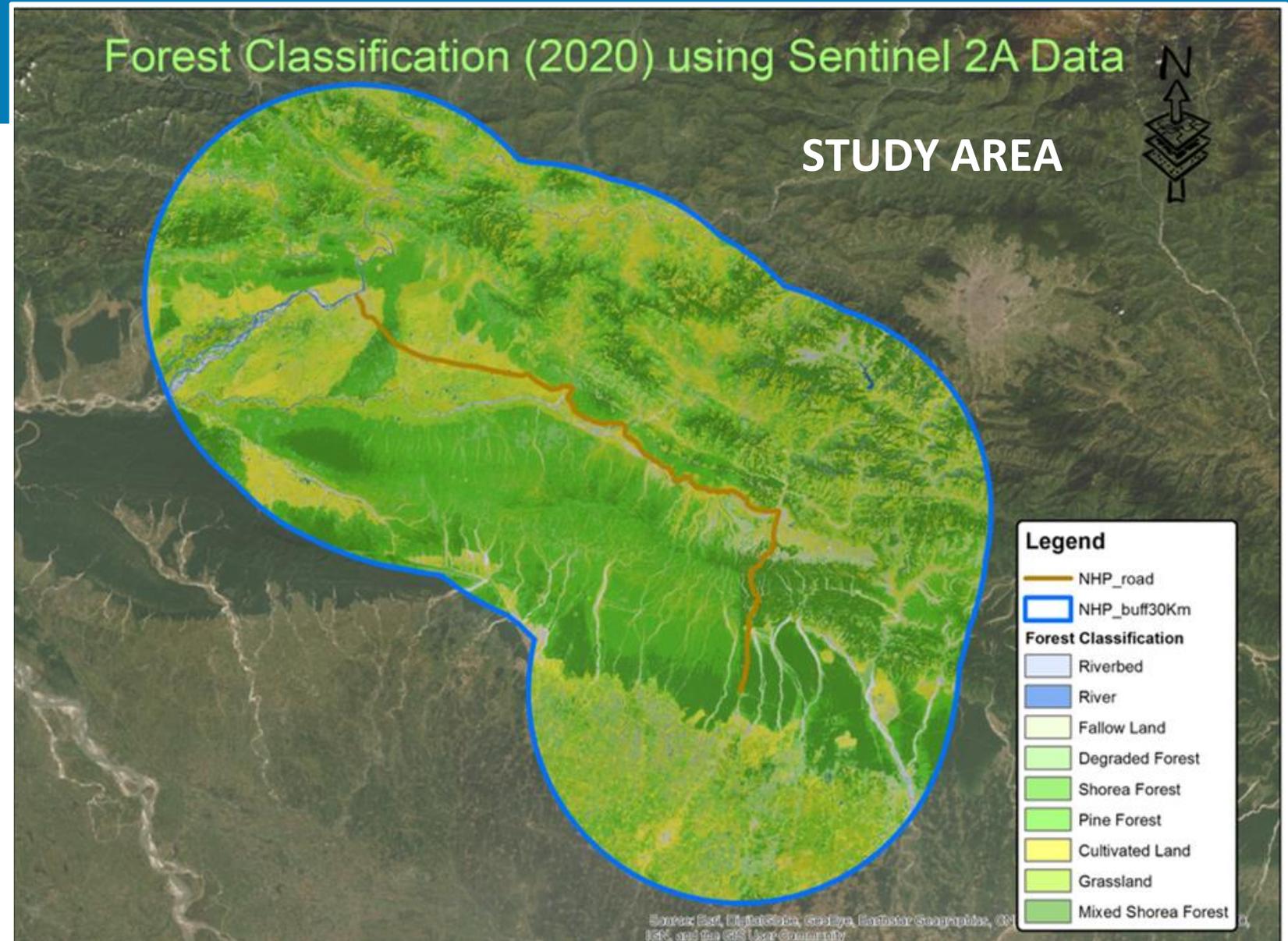
MERGING AND SYNTHESIS



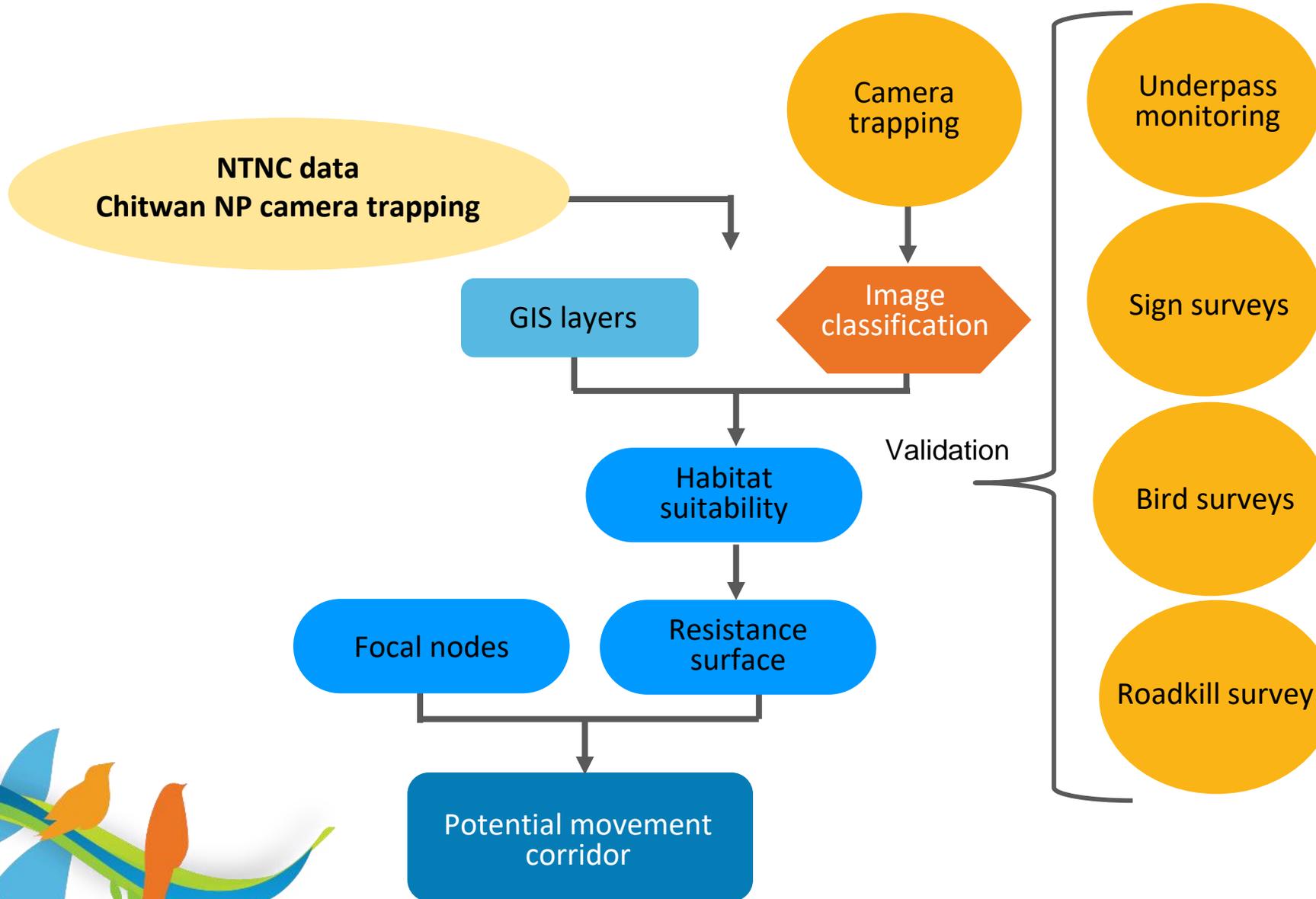


WHERE TO BEGIN?

Study area & design

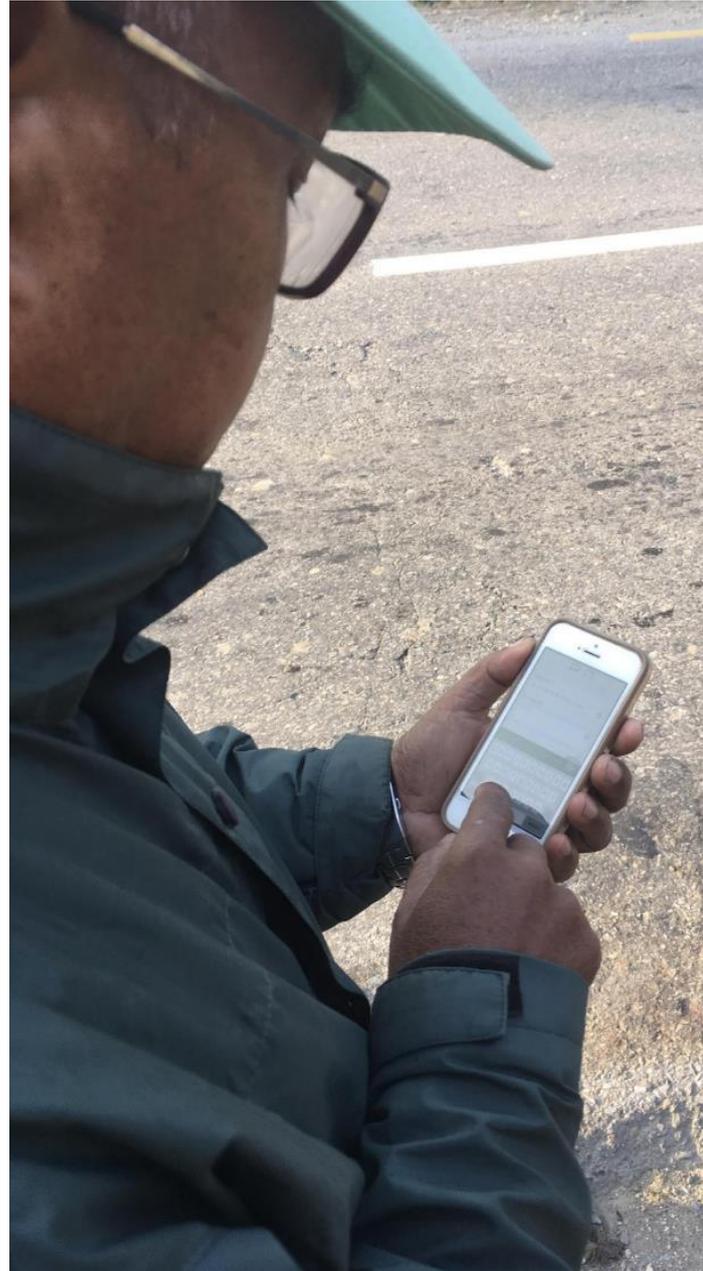
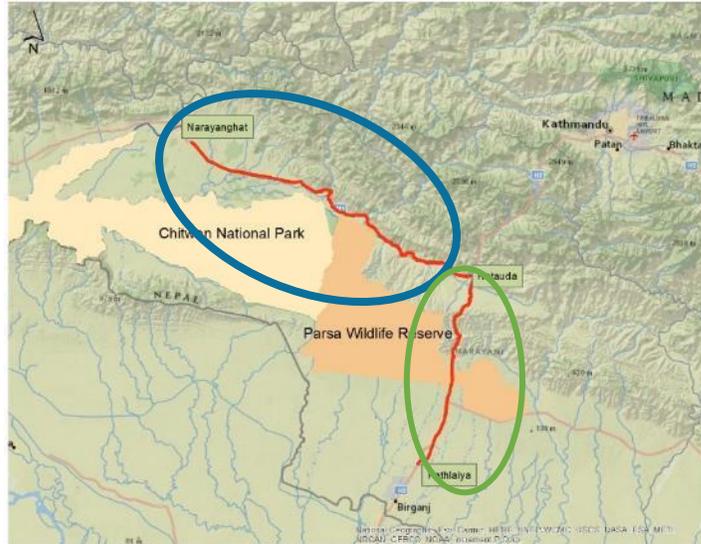


PROJECT DATA & PROCESS



Roadkill survey

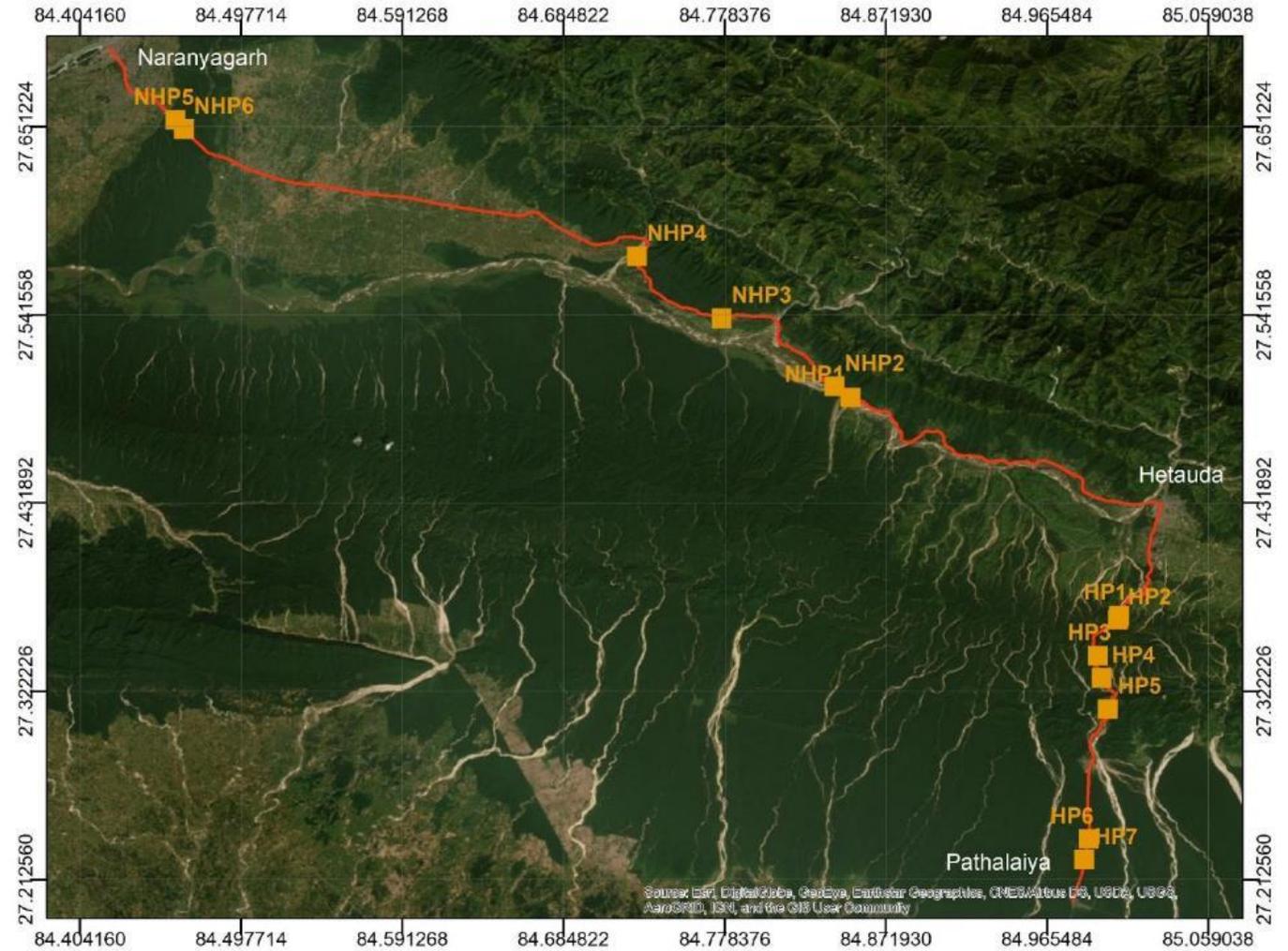
5 times / week
2 field Crews
Rdkill/Live Observ
Local knowledge



Underpass Monitoring



Another track ??

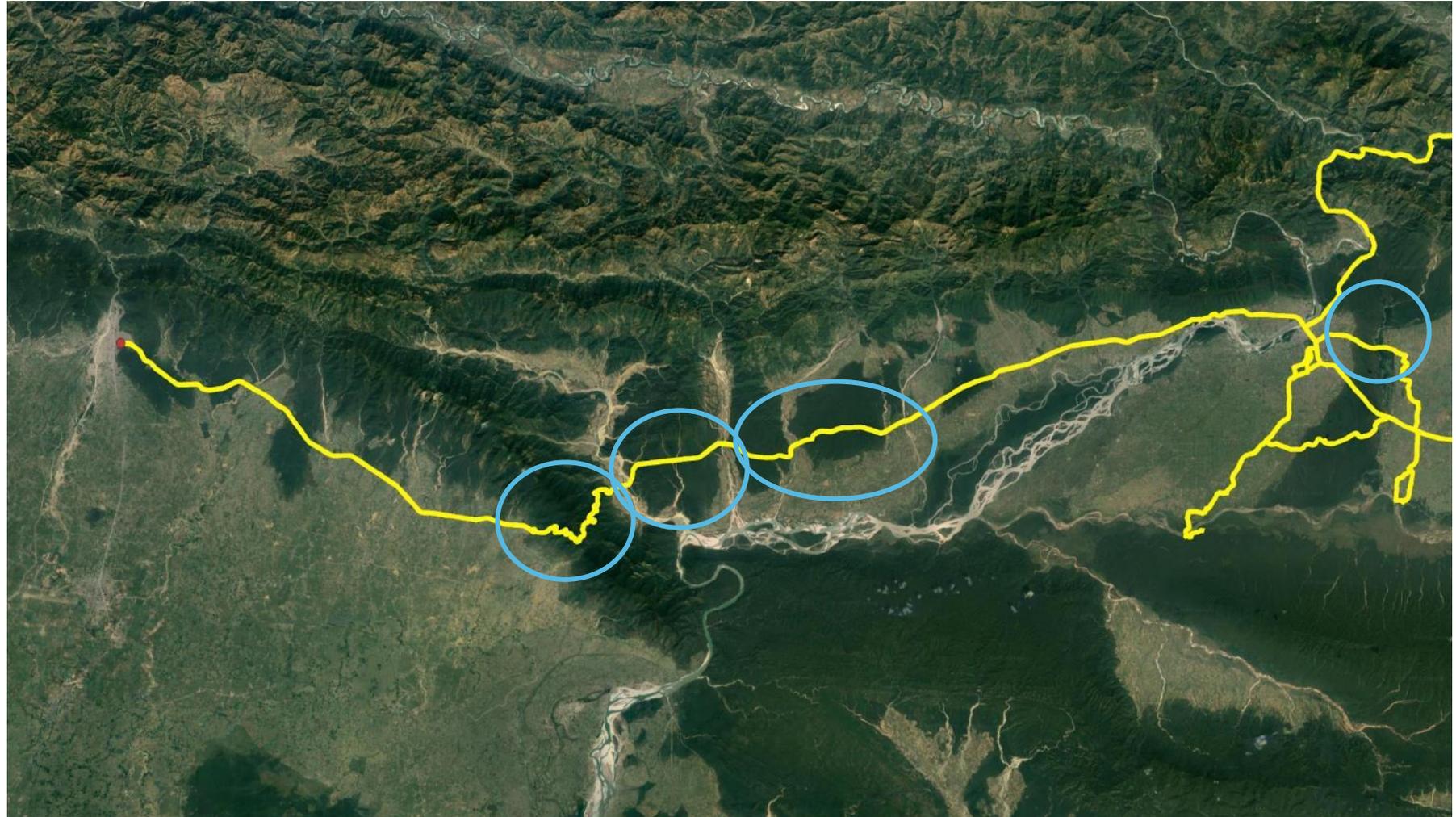


Existing Underpasses



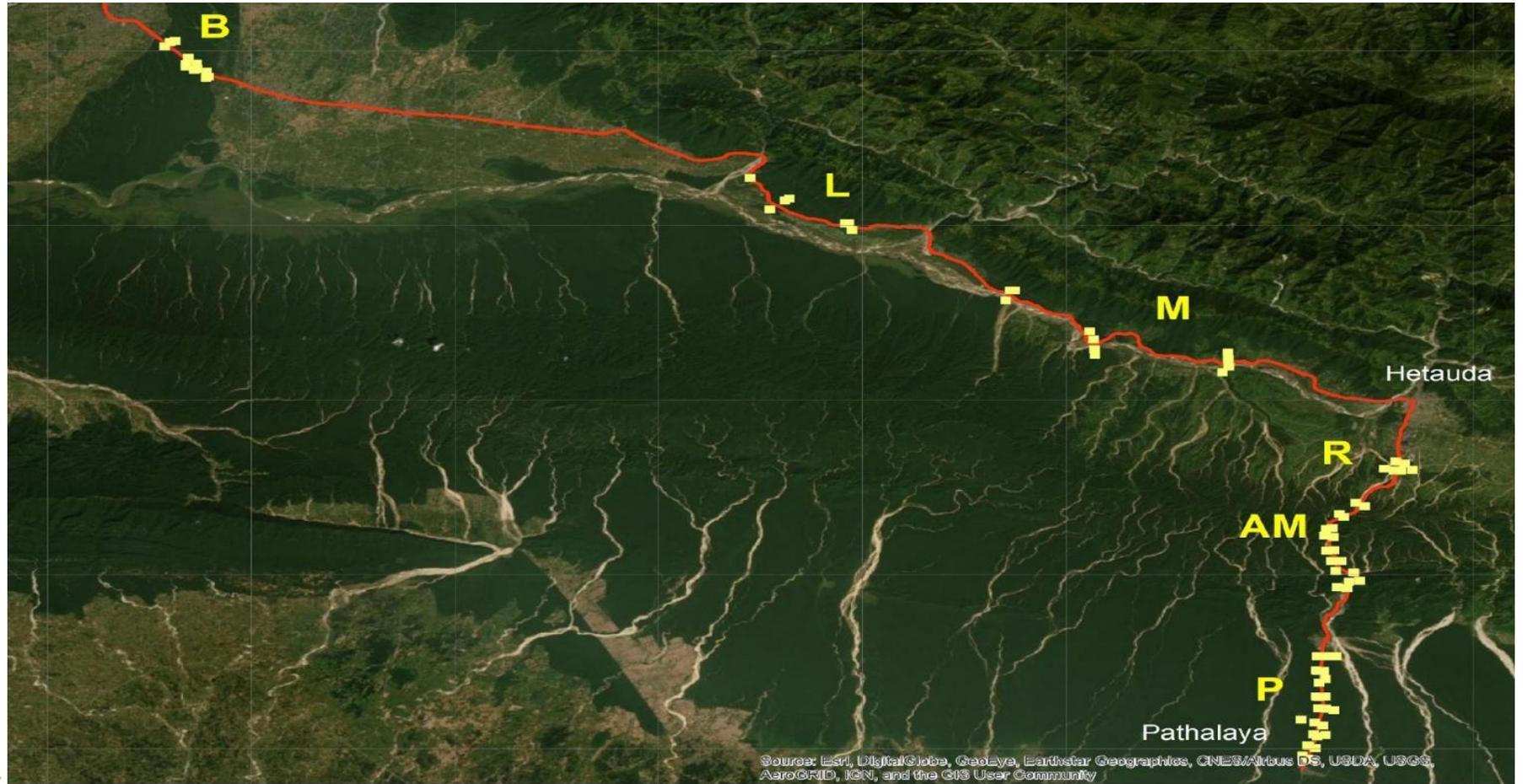
Camera/Sign Surveys

Intact and
Connected
Forest/Habitat
“Critical Linkages”



Camera/Sign Surveys

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Barandabhar Corridor

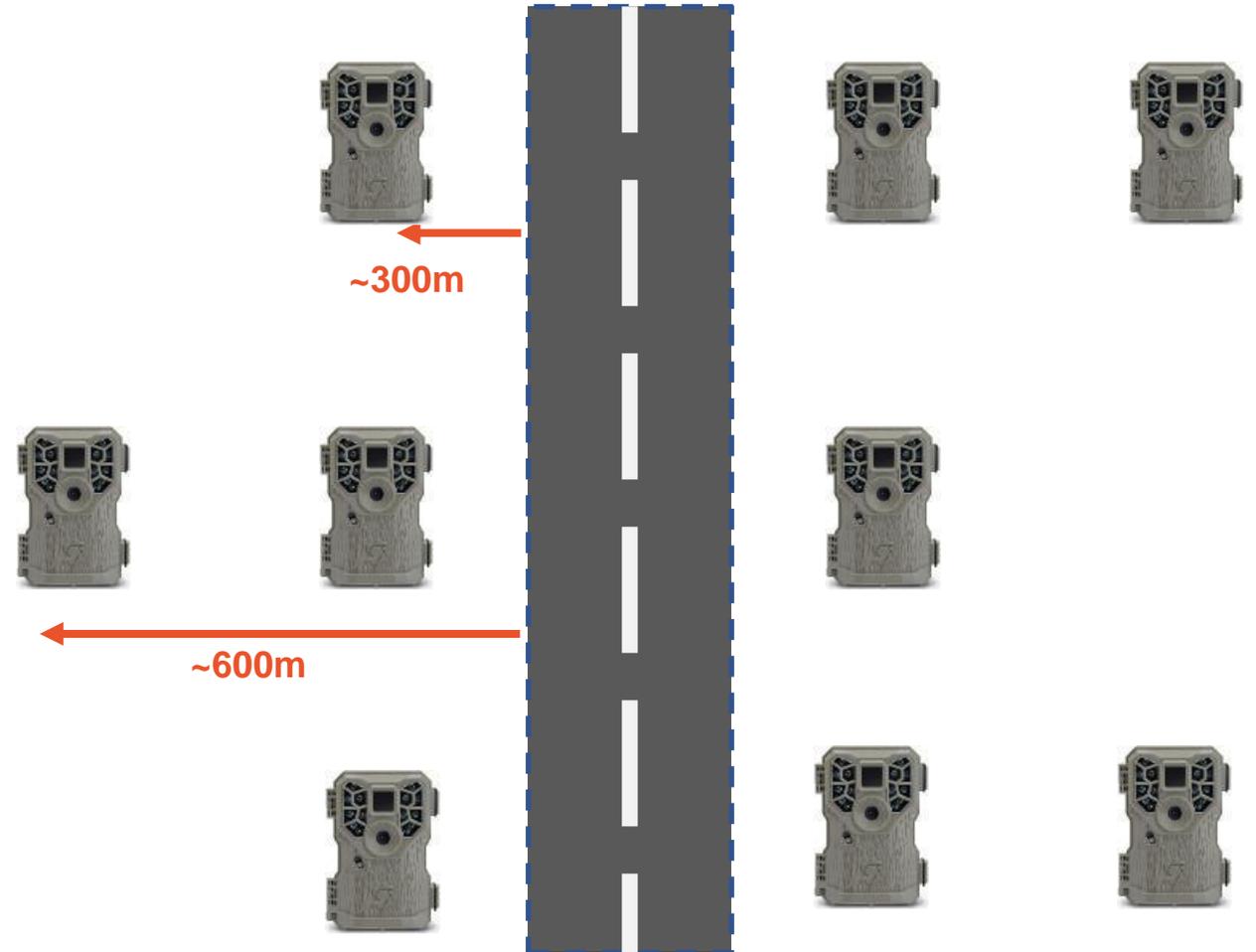


Camera/Sign Surveys



Camera trapping

SEASON Monsoon Dry	# SITES 82
# CAMERAS 20	SURVEY PERIOD 20 days



Camera Traps

- *Set-up*
- *Programming*
- *Training*



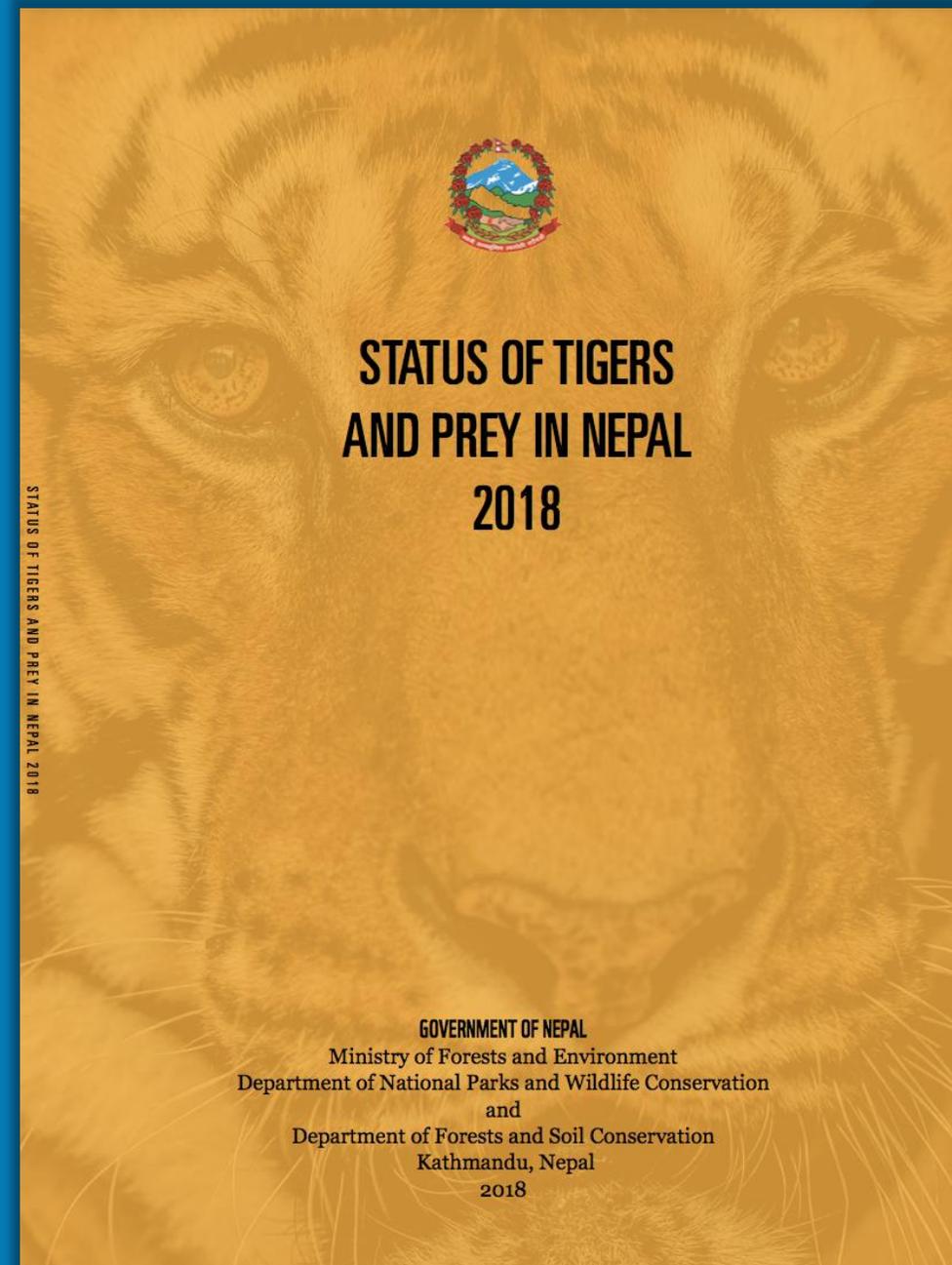
National Tiger Census

NTNC data

Chitwan NP camera trapping

2.5x2.5 km cells – NPs

15x15 km cells outside NPs





What to do with all these photographs ??

Image
classification
TIMELAPSE

Timelapse Template Editor (TimelapseTemplate - Nepal.tbl)

File View Help

Brief Instructions Template

Type	Default Value	Label	Data Label	Tooltip	Width	Copyable	Visible	List	
FixedChoice		Camera Location	Location	Choose an item from the menu	100	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Define List	Add
FixedChoice		Mammals	Mammals	Choose a species from the menu	100	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Define List	Count
FixedChoice		Birds	Birds	Choose a species from the menu	100	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Define List	Choice
FixedChoice		Amphibian or Reptile	AmphibRept	Choose a species from the menu	100	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Define List	Note
Count		Number of individuals	Count	A count of how many animals appear in this image	50	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		Flag
FixedChoice		Sex	Sex	Choose an item from the menu	100	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Define List	
Count	0	Humans (not researchers)	Humans	A count of how many people appear in this image	50	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		Remove
Flag	false	Media	PublicShot	Flags an image as useful for media, web or publicity purposes	20	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
Note		Comments	Comments	Here you can add info on ego, litter size, behaviours etc.	5450	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
File		File	File	The file name	100	<input type="checkbox"/>	<input type="checkbox"/>		
RelativePath		RelativePath	RelativePath	Path from the folder containing the template and image data	100	<input type="checkbox"/>	<input type="checkbox"/>		
Folder		Folder	Folder	Name of the folder originally containing the template and images	100	<input type="checkbox"/>	<input type="checkbox"/>		
DateTime	1000-01-01 12:00:00.000	DateTime	DateTime	Date and time taken (Year Month Day Hours Minutes Seconds)	160	<input type="checkbox"/>	<input type="checkbox"/>		
ImageQuality		ImageQuality	ImageQuality	System-determined image quality: OK, dark if mostly black	85	<input type="checkbox"/>	<input type="checkbox"/>	Define List	
DeleteFlag	false	Delete this image?	DeleteFlag	Junk images, not data	20	<input type="checkbox"/>	<input type="checkbox"/>		
Flag	false	Camera setup, take-down or service	FirstLastPhoto Used	Use to record when the camera started and stopped working	20	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
Note		Start yyyy-mm-dd	StartDate	Date the camera trap started working	100	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
Note		Classified by	Classifier	Who Classified these images?	100	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		

What the interface will (roughly) look like. Drag and drop these controls (by their labels) to re-arrange their order to your preference

Camera Location: AM1 | Mammals: Asiatic Eleph | Birds: Black Francol | Amphibian or Reptile: Asiatic Rat Sn | Number of Individuals: 1

Humans (not researchers): 0 | Media: | Comments: | Camera setup, take-down or service: | Start yyyy-mm-dd:

Classified by:

The spreadsheet column order. Drag and drop columns to re-arrange their order to your preference

File | RelativePath | Folder | Date | Time | ImageQuality | DeleteFlag | Count | Humans | Classifier | Comments | PublicShot | Mammals | Sex | FirstLastPhoto | Birds | AmphibRept | Location | StartDate



Image classification - The Unexpected !



Honey Badger



Crab-eating fox



Be adaptable to changing environment

(political, social, pandemics, weather...) **THE BEST INTENTIONS**

Survey	Status
Roadkill/live observations	These surveys are completed (Dec 2019 – Jan 2021). There was a total of 51 road-kill records and 66 sightings of next to road animals. 13 animals were observed crossing the road.
Local observations/knowledge	Data were not collected due to Covid-19 Lockdown.
Camera/sign surveys	Camera surveys are completed. Photo-classification is taking place and will be completed by April 2021.
Bird surveys	Bird surveys are completed. Data are being input to spreadsheet and not ready for summary.
Underpass monitoring	Completed. Few data are available for use in the study.



BONUS!

NTNC camera trap and photo-classification from the National Tiger Survey

Scientific Name	Species	Nepali Name	Conservation Status				Habitats	Number of photos
			CITES	IUCN	NRDB	NPWC Act		
<i>Cuon alpinus</i>	Asiatic Wild Dog	Dhole, Ban Kukur	II	EN	VU		Forest	27
<i>Vulpes bengalensis</i>	Bengal Fox	Phusro Phyuro		LC	SU		Forest	5
<i>Canis aureus</i>	Golden Jackal	Syal		LC			Forest fringe, open areas	324
<i>Panthera pardus</i>	Common Leopard	Chituwa	I	NT	SU		Forest	199
<i>Felis chaus</i>	Jungle Cat	Ban Biralo		LC	SU		Forest fringe	227
<i>Felis bengalensis</i>	Leopard Cat	Chari Bagh	II	LC	VU	P	Forest	158
<i>Panthera tigris tigris</i>	Royal Bengal Tiger	Bagh	I	EN	SU	P	Forest	84
<i>Herpestes urva</i>	Crab-eating Mongoose	Gangate Nyurimus		LC	SU		River beds	8
<i>Herpestes edwardsii</i>	Indian Grey Mongoose	Thulo Nyurimusa		LC			Forest fringe	18
<i>Martes flavigula</i>	Yellow-throated Marten	Malsapro		LC			Forest	25
<i>Mellivora capensis</i>	Honey badger			LC				7
<i>Viverra zibetha</i>	Large Indian Civet	Thulo Nirbailo		NT			Forest	127
<i>Paguma larvata</i>	Masked Palm Civet	Gajale Nirbiralo		LC			Forest	3
<i>Viverricula indica</i>	Small Indian Civet	Sano Nirbiralo		LC			Forest	47
<i>Paradoxurus hermaphroditus</i>	Toddy Cat	Tadi Nirbiralo		LC			Forest	47
<i>Boselaphus tragocamelus</i>	Blue bull	Nil Gai		LC	VU		Forest	6
<i>Bos gaurus</i>	Gaur Bison	Gauri Gai	I	VU	EN	P	Forest	16
<i>Muntiacus muntjak</i>	Barking Deer	Rate, Rato Mriga		VU	SU		Forest	1058
<i>Axis porcinus porcinus</i>	Hog Deer	Laguna, Pade		EN	SU		Forest	36
<i>Cervus unicolor</i>	Sambar Deer	Jarayo		VU	SU		Forest	561
<i>Axis axis</i>	Spotted Deer	Chittal		LC			Forest	889
<i>Sus scrofa</i>	Wild Pig	Bandel		LC			Forest	215
<i>Lepus nigricollis</i>	Indian Hare	Khairo Kharayo		LC			Grassland	74
<i>Rhinoceros unicornis</i>	Greater One-horned Rhinoceros	Gaında	I	VU	EN	P	Forest	132
<i>Macaca mulatta</i>	Rhesus Macaque	Rato Bandar		LC	SU		Forest	450
<i>Semnopithecus hector</i>	Terai Gray Langur	Kalo Bangur	I	NT			Forest	114
<i>Elephas maximus</i>	Asiatic Elephant	Hatti	I	EN	EN	P	Forest, grassland	249
<i>Hystrix indica</i>	Indian Crested Porcupine	Jure Dumsi		LC			Forest	130

NTNC included **5236** species detections, including 11 species with endangered (EN), vulnerable (VU) or near threatened (NT) status according to IUCN classification.



Nepal Road Ecology Project

Convenient access to Maps and Apps

Observations Recorded (Roadkills and Live Wildlife)

826

*Live data is pulled from records entered into Survey123 Field data entry forms.
[View live data from Survey123 field forms](#)



Survey123 Apps

The following data entry forms can be used through a web browser or in the Survey123 app. Download the app from [Google Play store](#) or [Apple App store](#). Just search for Survey123. Once the app is installed on your phone, use the phone's camera on the QR Code below or the urls below to access the data entry forms.

Below you can see the live data submitted through these forms

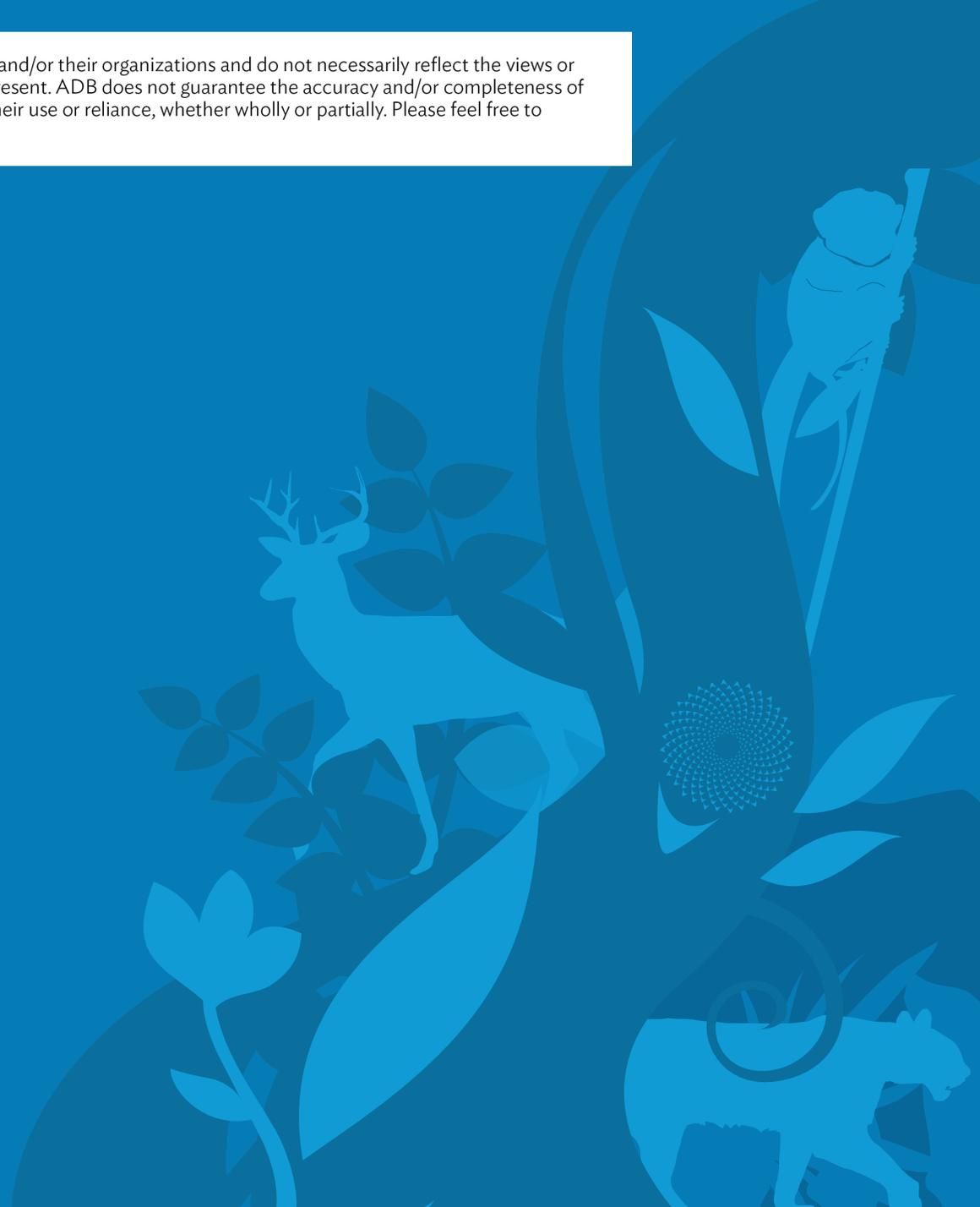
How we
got here



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Demonstration of the Data Dashboard for the Nepal Project

Benjamin Dorsey, Parks Canada



Smart forms with Survey123



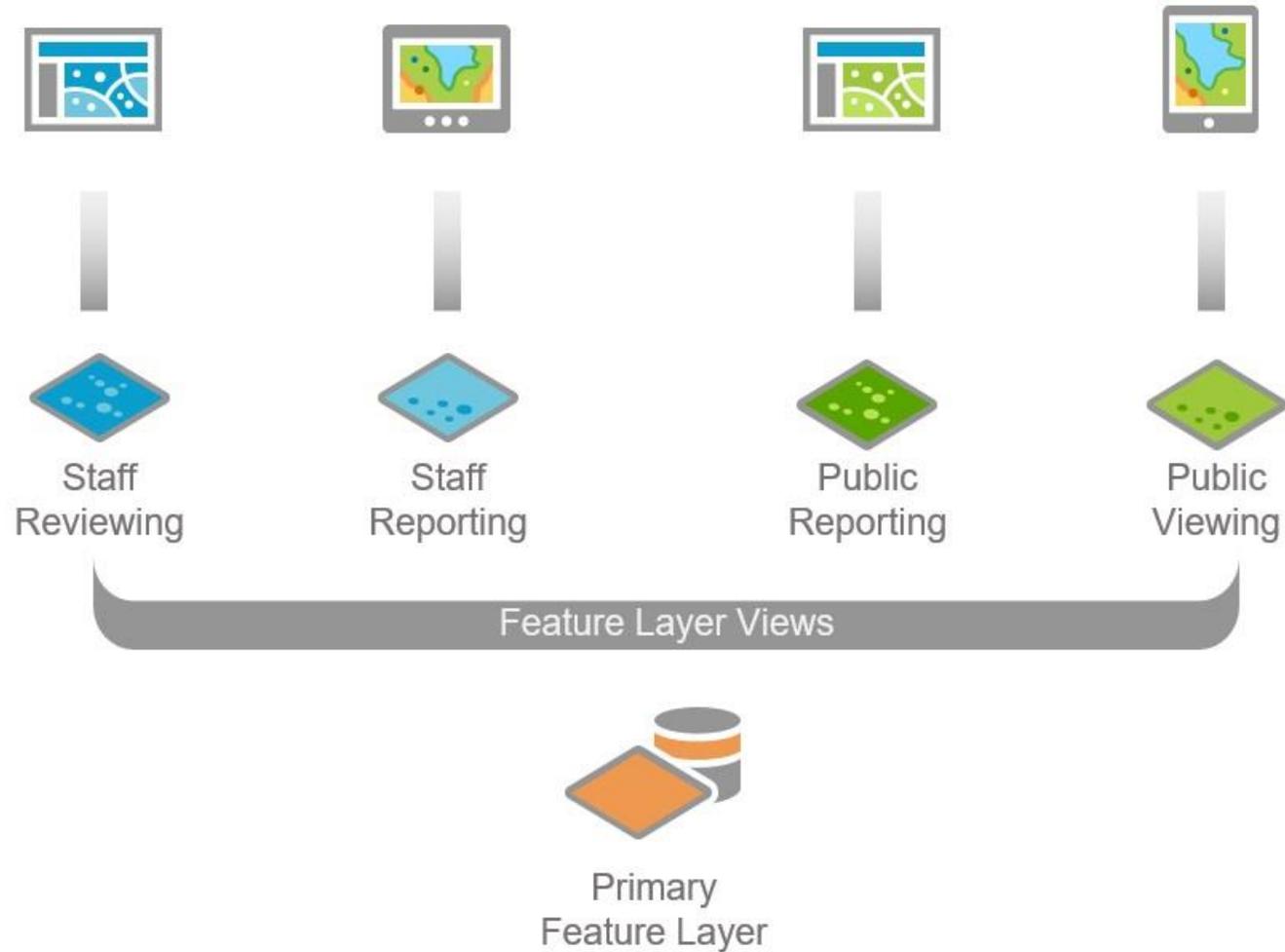
Demo Survey123 – 15 min



Integration of Survey123 and the BBAs



Access to information



Managing team apps and Sit awareness



Web GIS

Apps



Portal

Manage Geographic Knowledge
Control Access



Web Services

Data

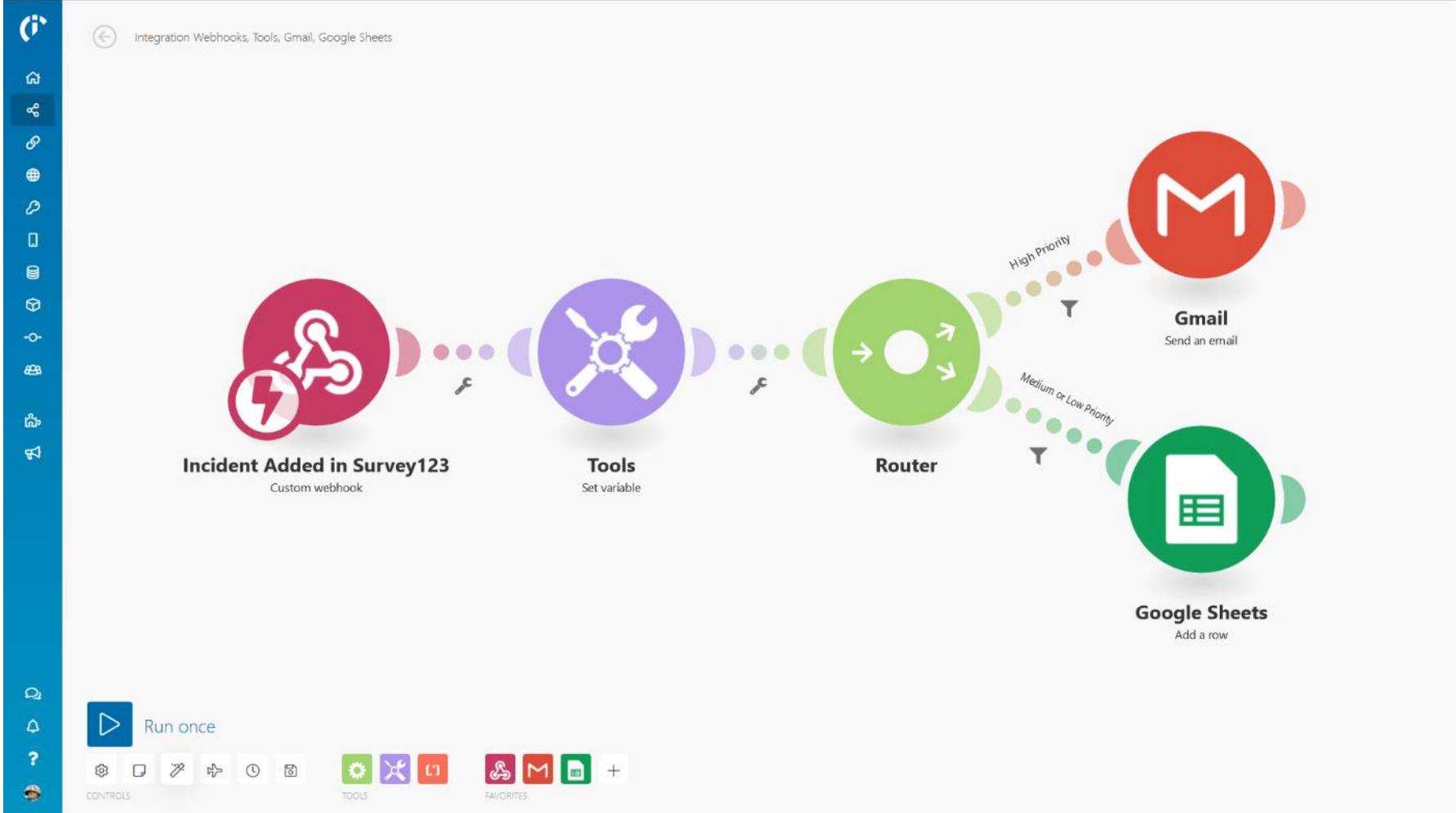


GIS Servers
Authoring tools



Ready-to-Use
Content

Smart forms with automated reporting (webhooks)



Dashboards – Information Synthesis





Total Confirmed

1,413,415

Confirmed Cases by Country/Region/Sovereignty

- 386,817 US
- 140,617 Spain
- 135,586 Italy
- 110,049 France
- 107,458 Germany
- 82,718 China
- 62,589 Iran
- 55,946 United Kingdom
- 34,109 Turkey
- 22,253 Switzerland
- 22,194 Belgium
- 19,709 Netherlands
- 17,046 Canada
- 13,717 Brazil
- 12,635 Austria
- 12,442 Portugal
- 10,331 Korea, South
- 9,248 Israel

Admin0 Admin1 Admin2

Last Updated at (M/D/YYYY)
4/7/2020, 1:48:44 PM



Cumulative Confirmed Cases Active Cases

184

countries/regions

Lancet Inf Dis Article: [Here](#). Mobile Version: [Here](#). Visualization: JHU CSSE. Automation Support: [Esri Living Atlas team](#) and [JHU APL](#). Contact US: [FAQ](#).
Data sources: [WHO](#), [CDC](#), [ECDC](#), [NHC](#), [DXY](#), [1point3acres](#), [Worldometers.info](#), [BNO](#), state and national government health departments, and local media reports. Read more in this [blog](#).
Downloadable database: [GitHub](#): [Here](#). Feature layer: [Here](#).
Confirmed cases include presumptive positive cases.

Total Deaths

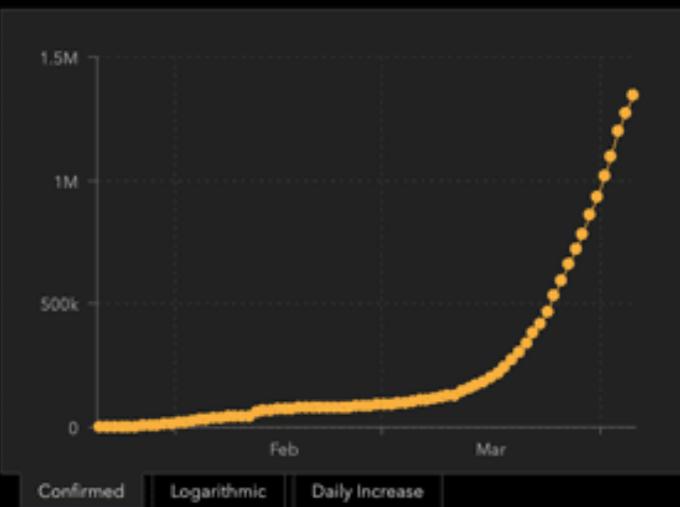
81,200

- 17,127 deaths Italy
- 13,912 deaths Spain
- 10,328 deaths France
- 6,159 deaths United Kingdom
- 4,009 deaths New York City **New York US**
- 3,872 deaths Iran
- 3,212 deaths **Hubei China**
- 2,101 deaths Netherlands
- 2,035 deaths Belgium
- 1,983 deaths **Germany**

Total Recovered

298,389

- 77,410 recovered China
- 43,208 recovered Spain
- 36,081 recovered Germany
- 27,039 recovered Iran
- 24,392 recovered Italy
- 20,191 recovered US
- 19,516 recovered France
- 8,704 recovered Switzerland
- 6,694 recovered Korea, South
- 4,157 recovered **Belgium**



Confirmed Logarithmic Daily Increase

Demonstration of ADB Tool: SPADE

Bonapart Villalino Masangcay



Demo ADB tool: SPADE
(~15 min)
Guest: Bonapart
Villalino Masangcay



Next week – Module 3

Mapping Habitat Connectivity for Wildlife

Creating a resistance surface (MaxEnt) and run least-cost path model (Circuitscape) and follow-up with Instructors.

Exercise 3: Analyze ecosystem connectivity

