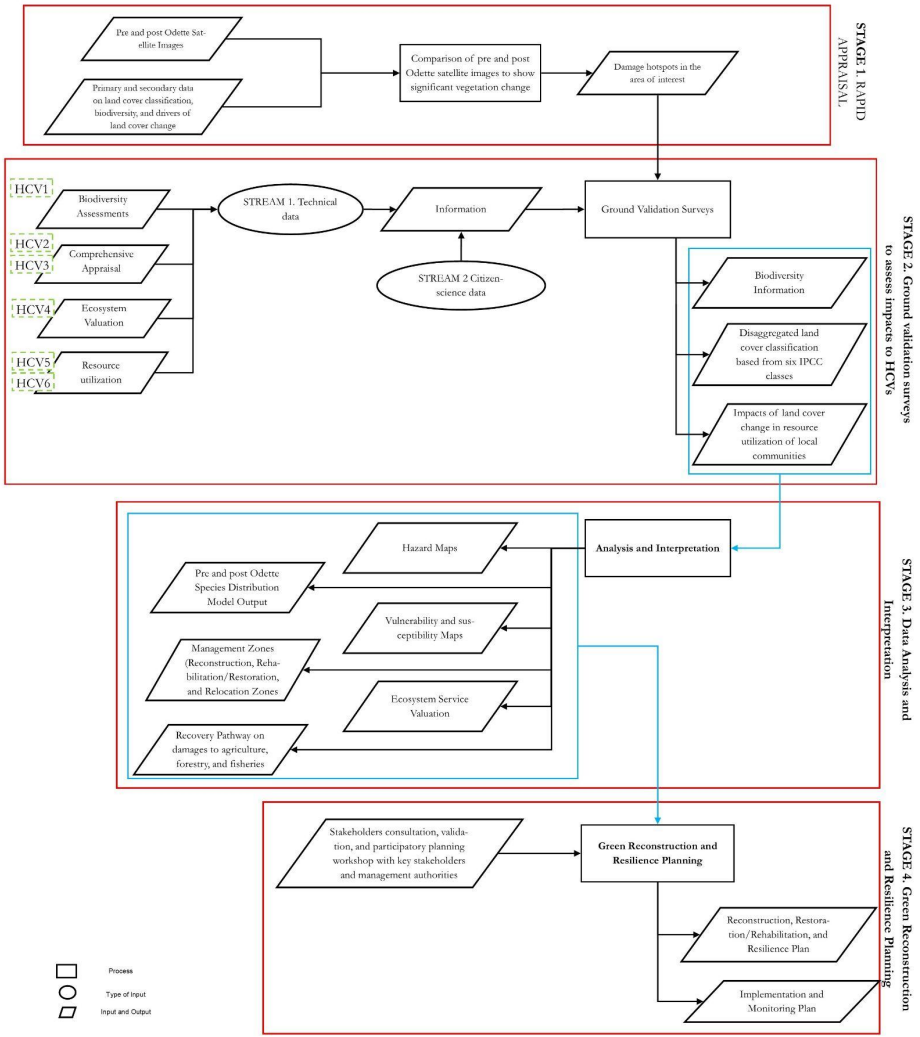
Sustainable Interventions for Biodiversity, Oceans, and Landscapes Project

Palawan Green Assessment Preliminary Results

August 9, 2022

Sustainable Interventions for Biodiversity, Oceans, and Landscapes Project

The Green Assessment Framework



Rapid Appraisal (Stage 1)

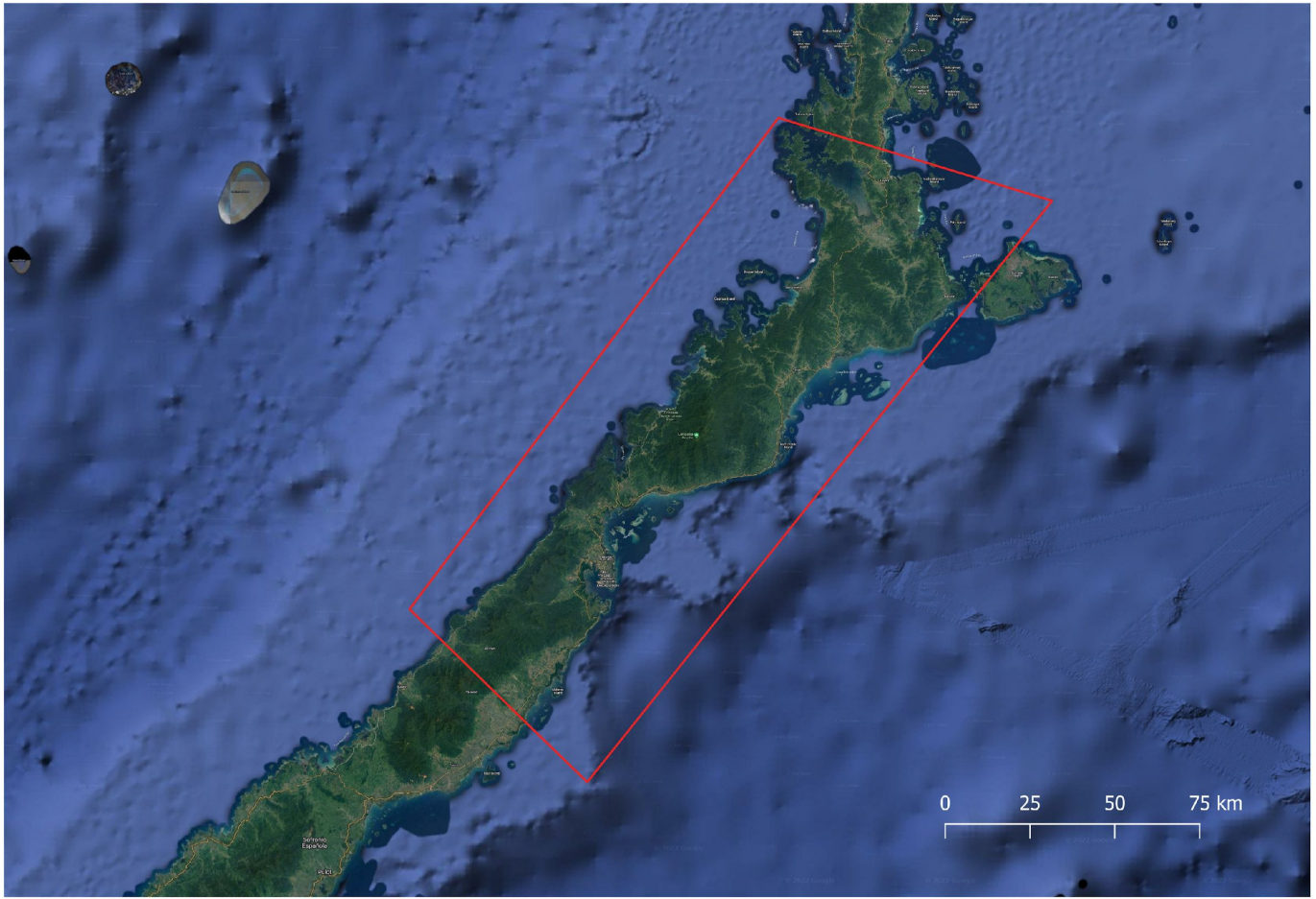
Ground Validation Surveys (Stage 2)

Analysis and Interpretation (Stage 3)

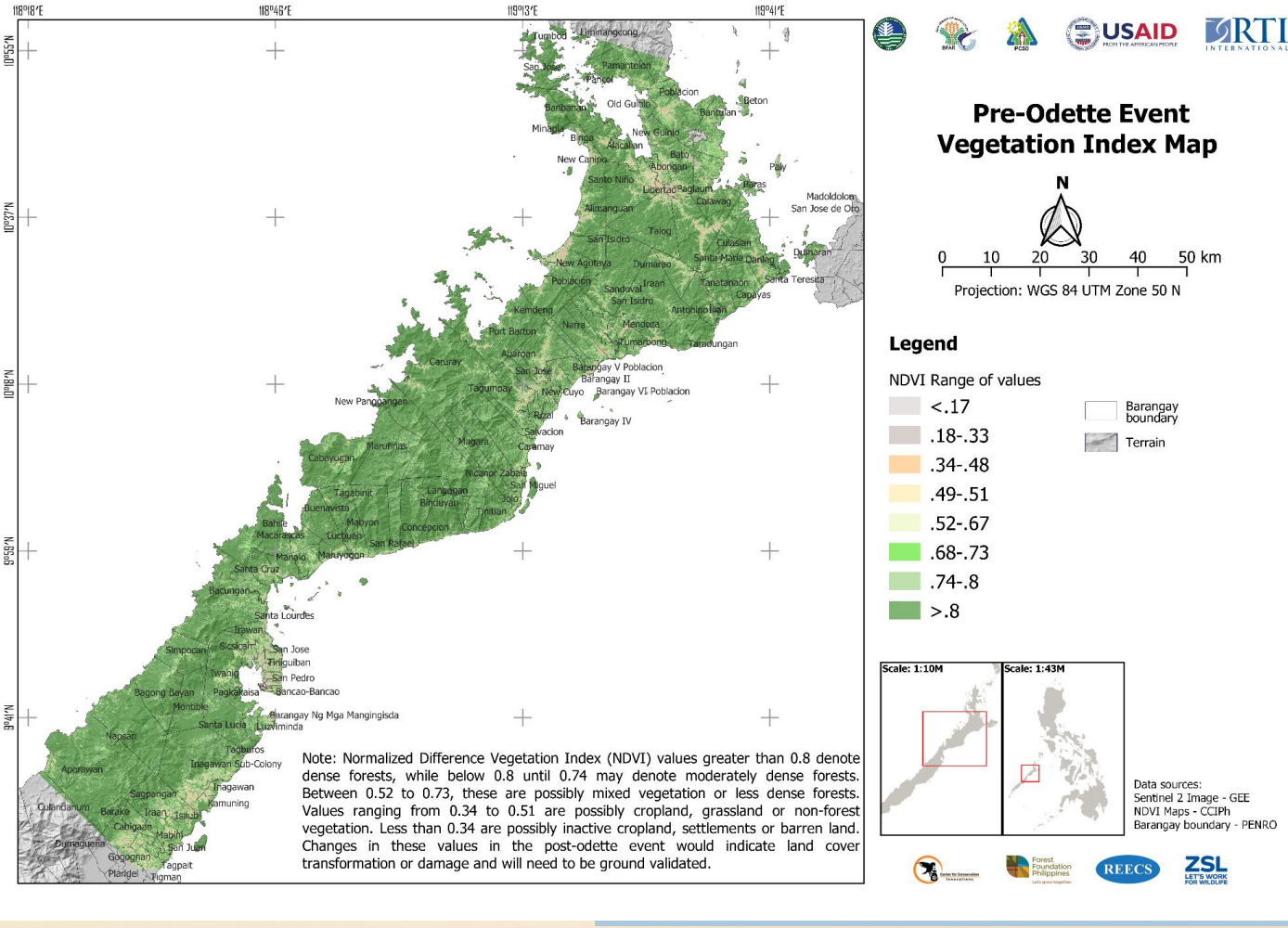
Green Reconstruction and Resilience Planning (Stage 4)

Sustainable Interventions for Biodiversity, Oceans, and Landscapes Project

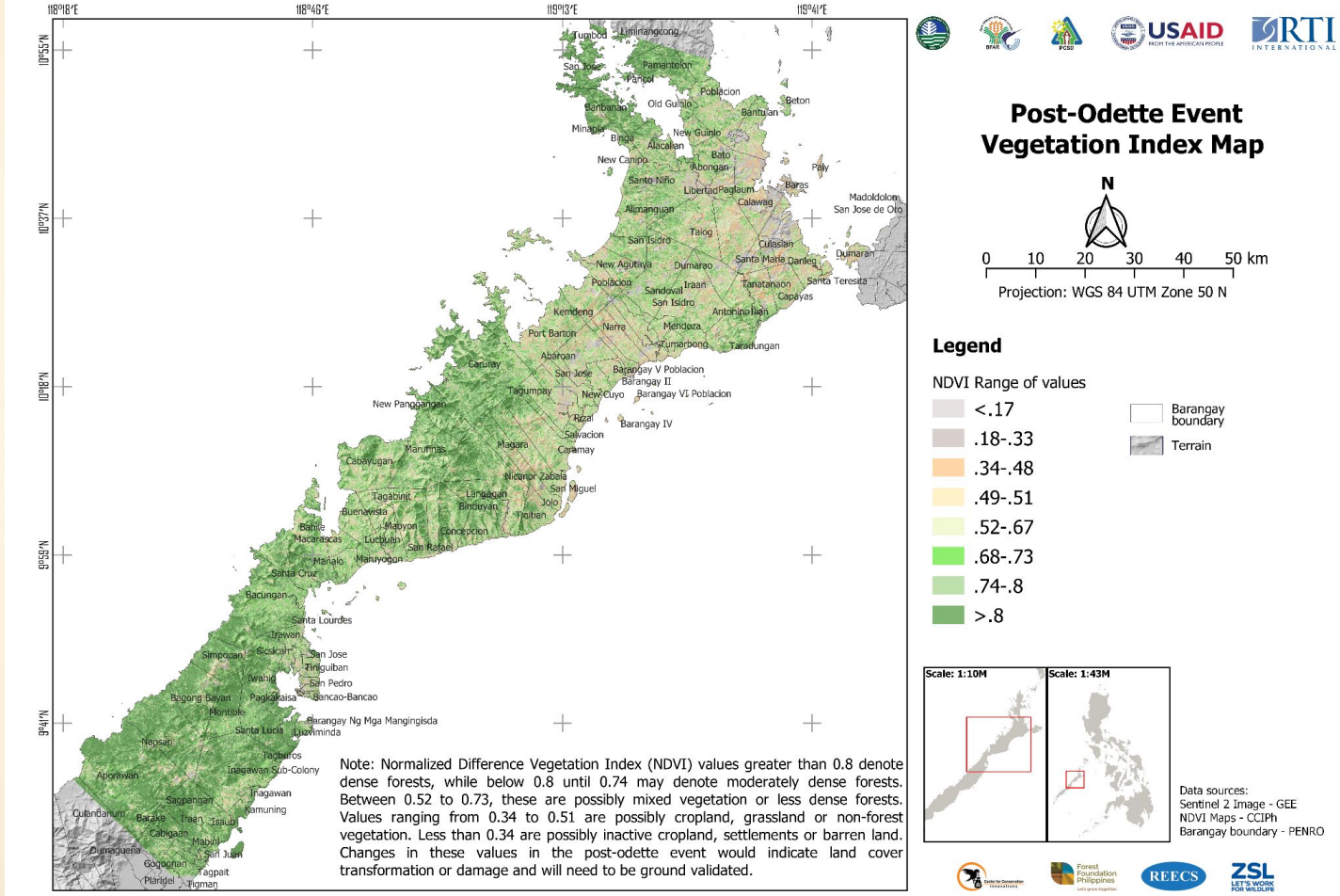
Stage 1 - Rapid Appraisal


0
25
50
75 km

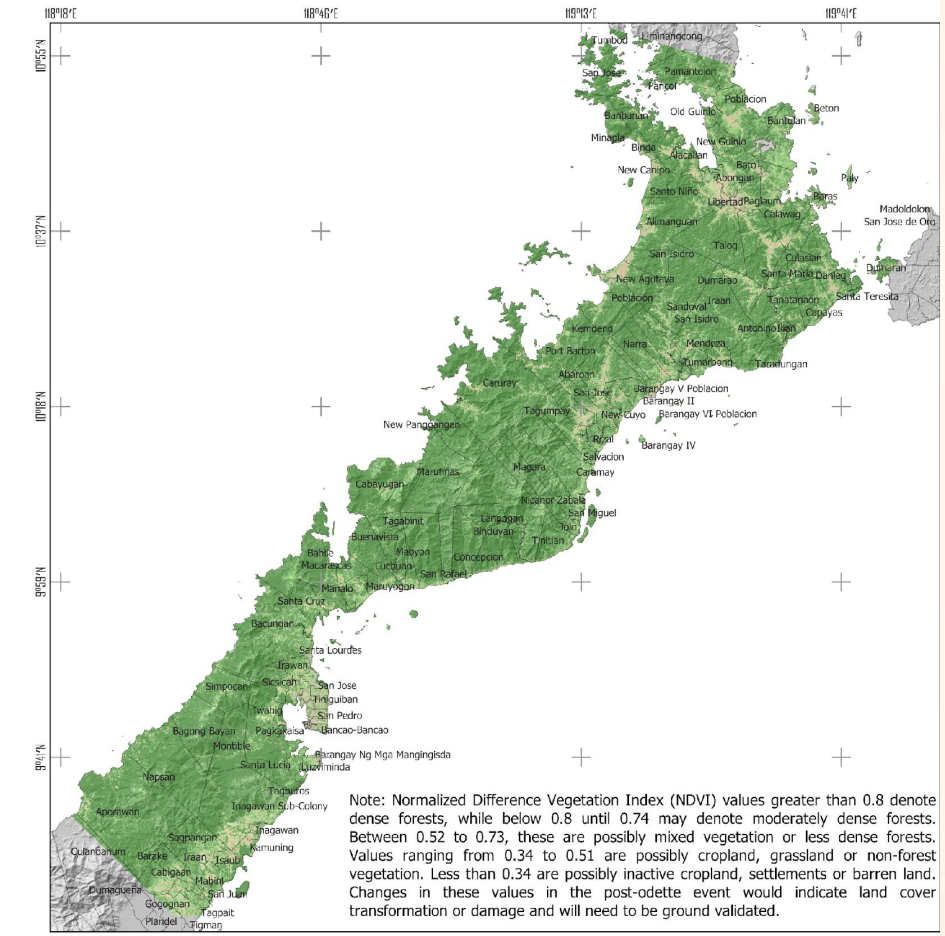
Normalized difference vegetation index (NDVI) in 2021 before the typhoon.

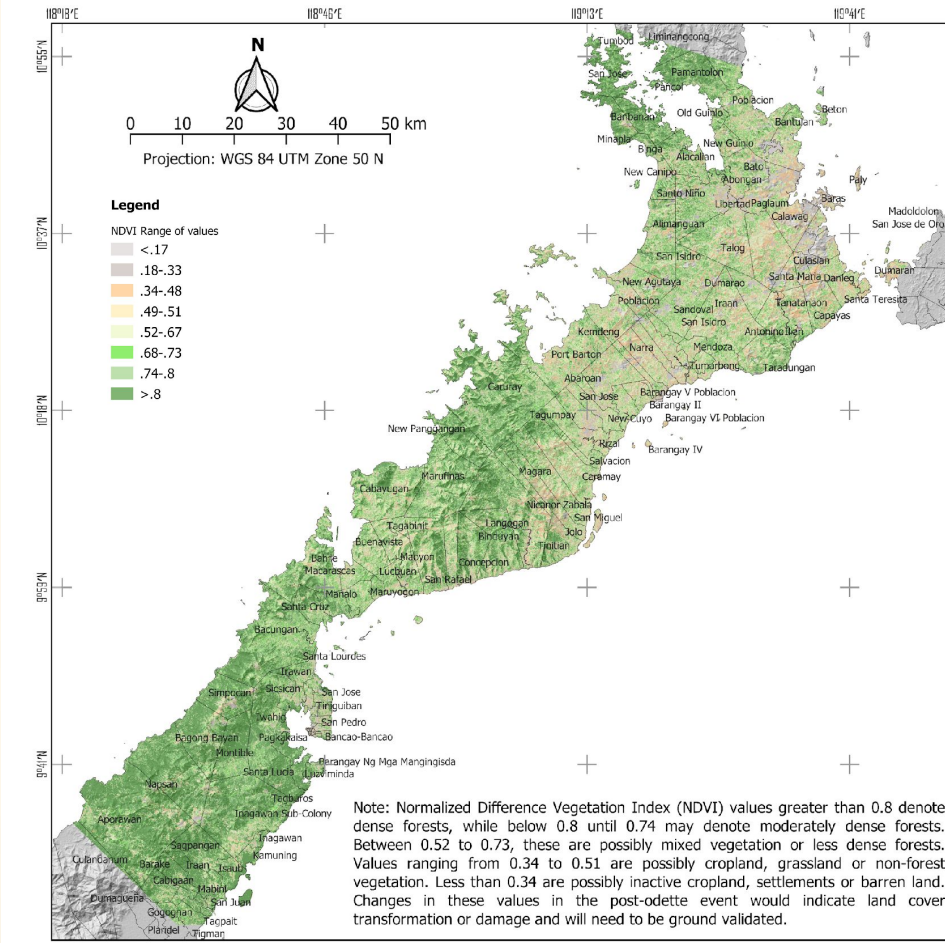


Normalized difference vegetation index (NDVI) post-Odette revealed massive loss.

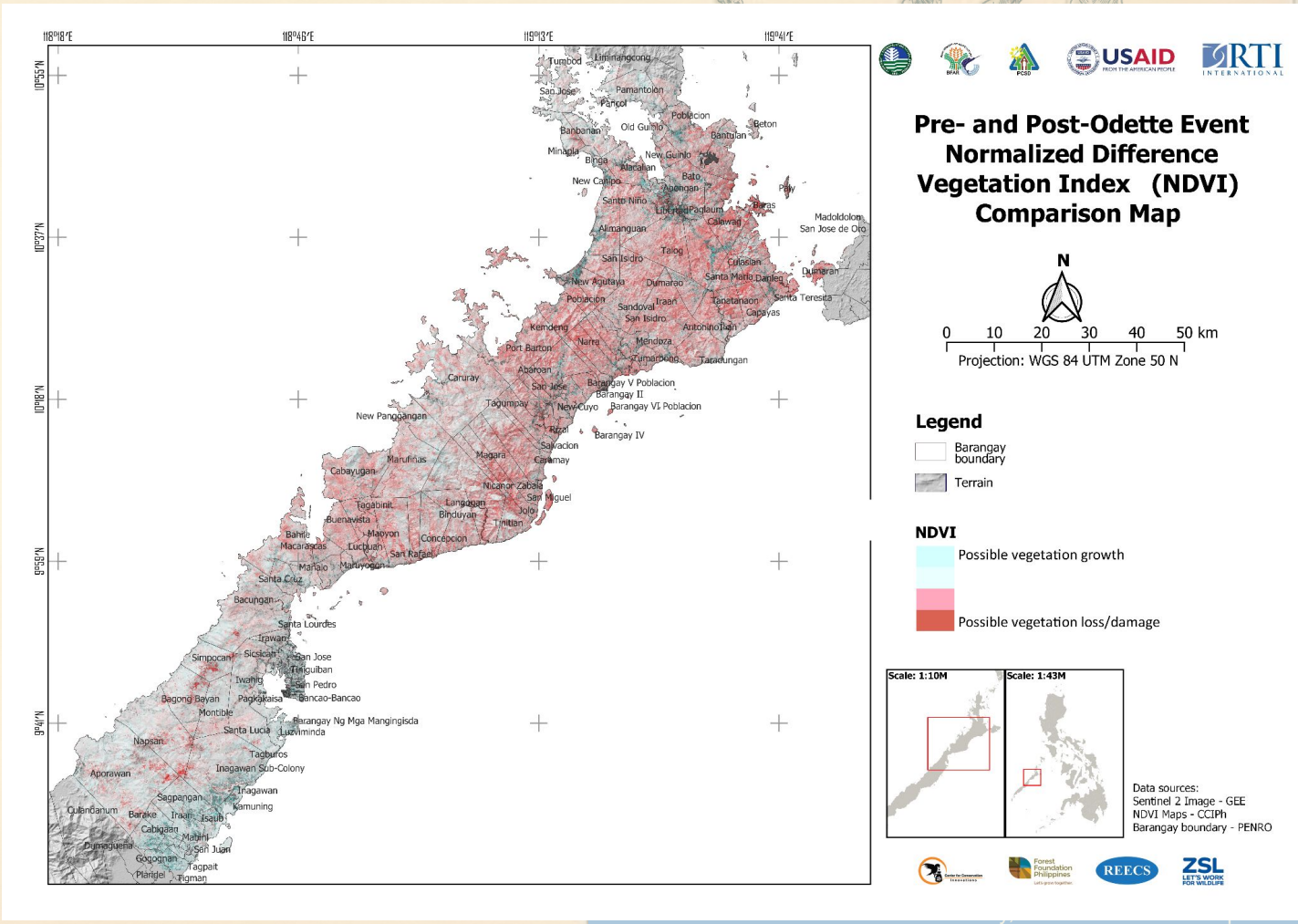


STAGE 1 : RAPID MAPPING USING NDVI





…where changes occurred from pre- to post-Odette



Sustainable Interventions for Biodiversity, Oceans, and Landscapes Project

Stage 2 - Ground Validation Surveys

Activity 1 - Aerial Ground Truth Survey

Sampling Effort for Aerial Ground Truthing

Puerto Princesa - 70 Flights
- Cabayugan (2 Flights)
- San Rafael (5 Flights)
- Tanabag (6 Flights)
- Conception (3 Flights)
- Binduyan (1 Flight)
- Langogan (9 Flights)
- Buenavista (7 Flights)
- Tagabinet (8 Flights)
- Bahile (5 Flights)
- Marufinas (11 Flights)
- New Panggangan (12 Flights)

Roxas - 78 Flights
- Tinitian (10 Flights)
- Jolo (8 Flights)
- Nicanor Zabala (7 Flights)
- Caramay (6 Flights)
- Magara (13 Flights)
- San Jose (4 Flights)
- San Miguel (14 Flights)
- Minara (5 Flights)
- Dumarao (8 Flights)
- Rizal (3 Flights)

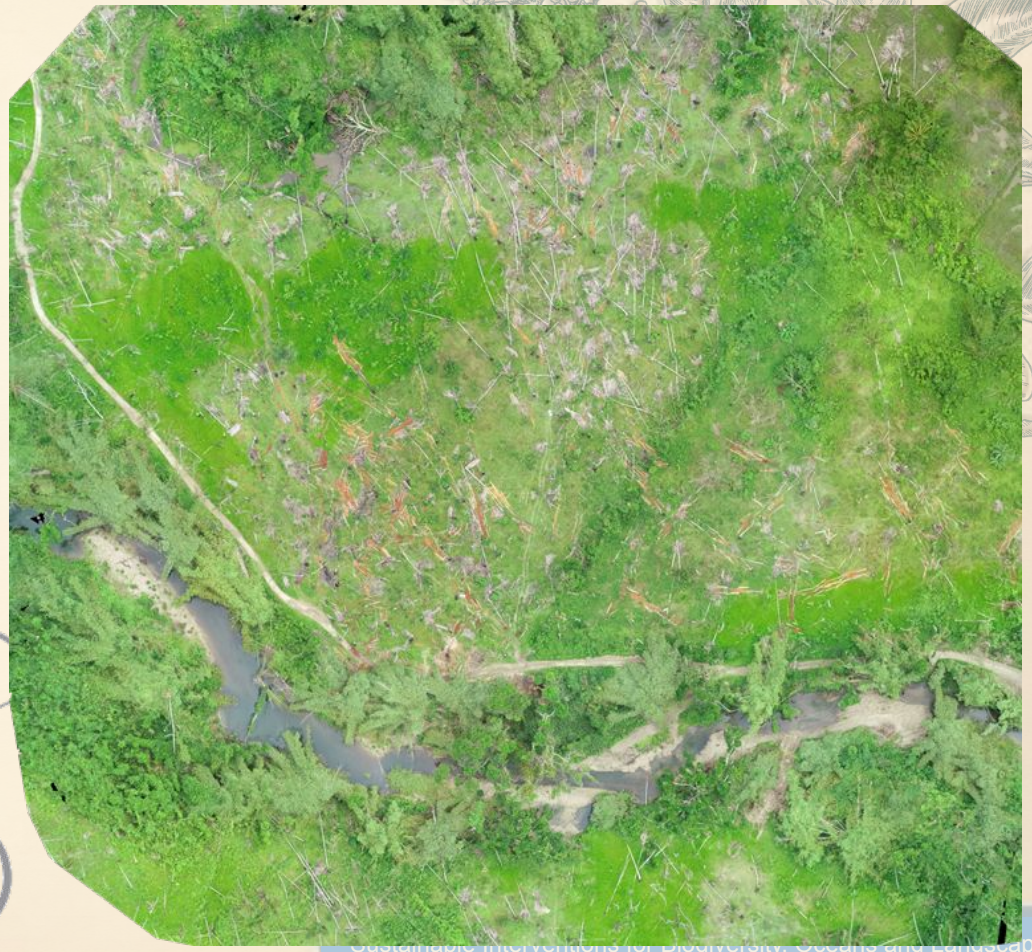
San Vicente - 55 Flights
- Kemdeng (4 Flights)
- Port Barton (11 Flights)
- Binga (4 Flights)
- Alimanguan (3 Flights)
- San Isidro (2 Flights)
- Caruray (16)

Sample processed drone image showing damaged mangrove forest in San Miguel, Roxas

Flight area = 5.4 ha

Sample processed drone image showing damaged coconut plantation in Tinitian, Roxas

Flight area = 7.0 ha

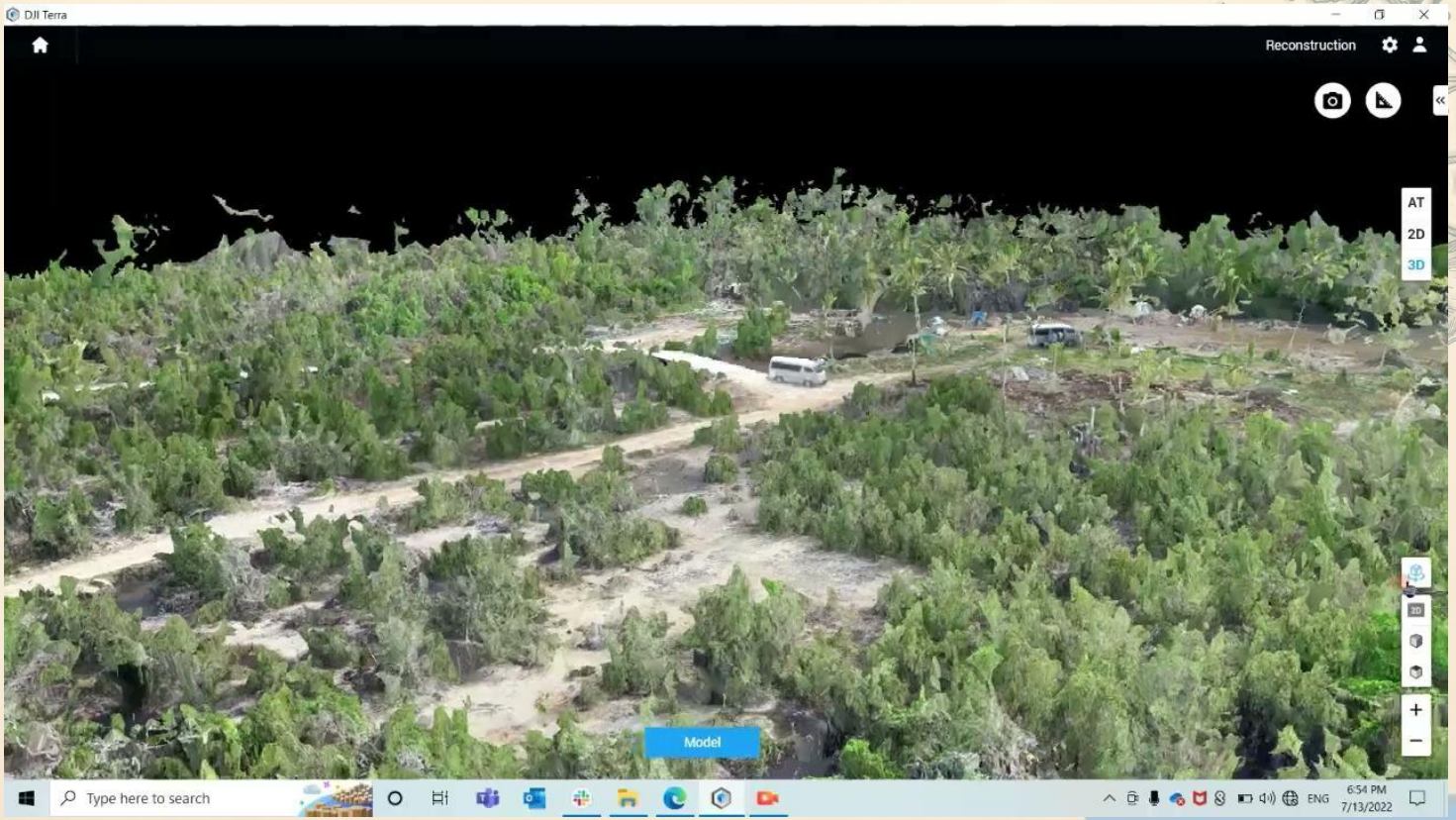


Sample processed drone image showing damaged settlements in Tanabag, Puerto Princesa City

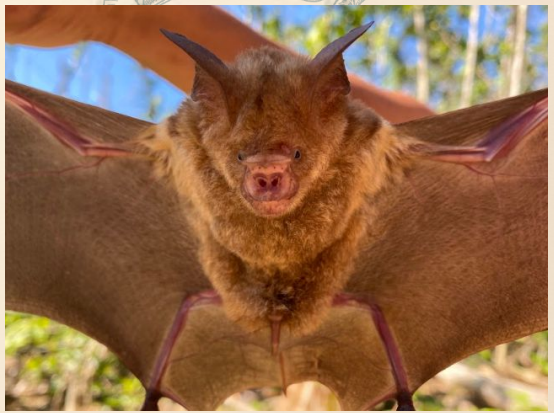
Flight area = 4.5 ha

Sample processed drone image showing impacts of the typhoon to riverine ecosystems in Cleopatra's Needle Critical Habitat

Sample 3D model reconstruction



Activity 2 - Rapid Biodiversity Assessment



Study Sites for Rapid Biodiversity Assessment

PPSRNP (12 days)

- Sitio Calaga, and Panablan, Marufinas - March 11 to 22, 2022

CNCH (Cleopatra's Needle KBA) (13 days)

- Sitio Kalakwasan, Tanabag - March 29 to April 5, 2022
- Sitio Mangapin, Langogan - April 7 to 11, 2022

Roxas (Cleopatra's Needle KBA) (7 days)

- Sitio Kayasan, Nicanor Zabala, Roxas - April 23 to 29, 2022

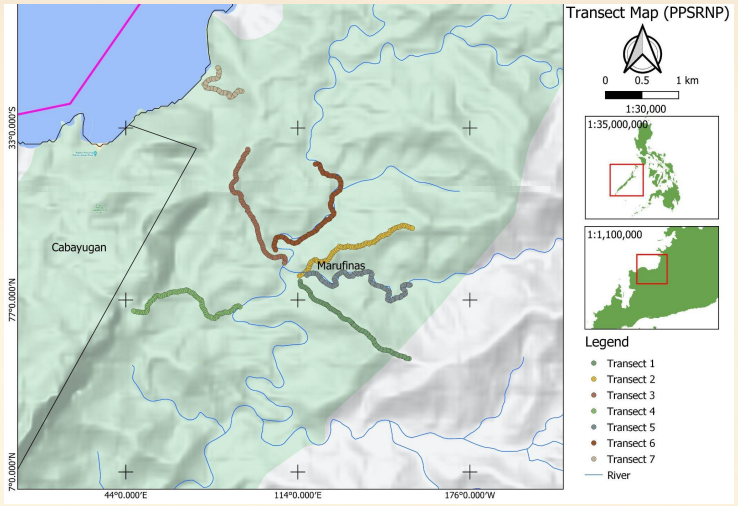
Sampling Effort for Rapid Biodiversity Assessment

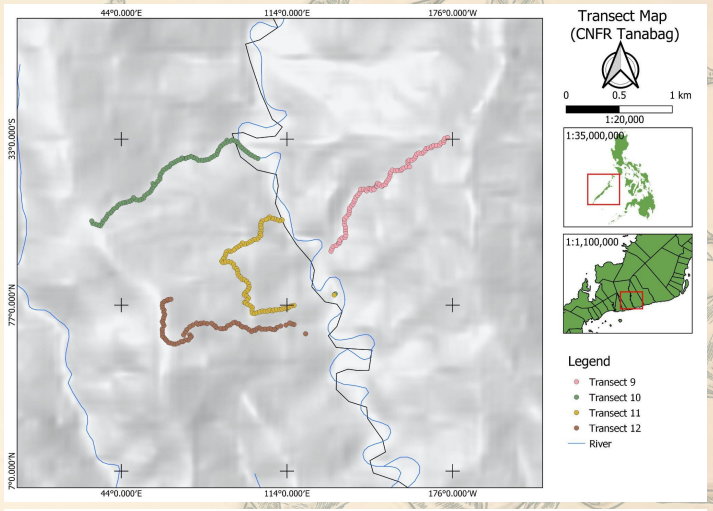
Overall effort = 21 2-km biodiversity transect lines
(coverage = 40 km or 320 ha)

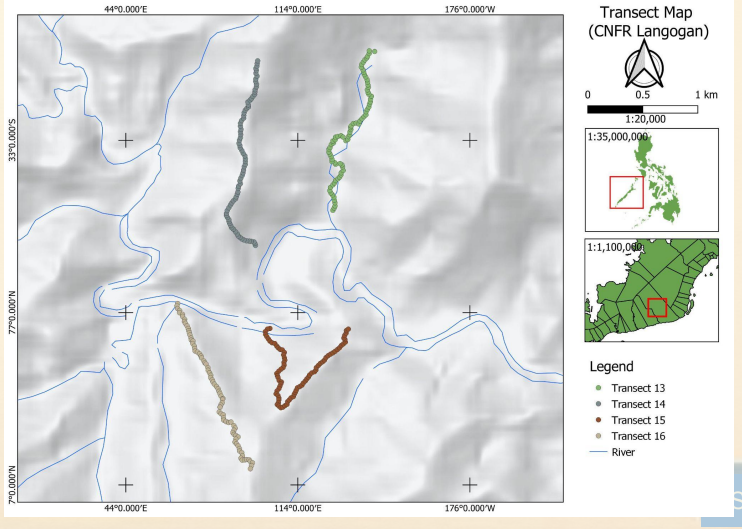
Effort per taxonomic group

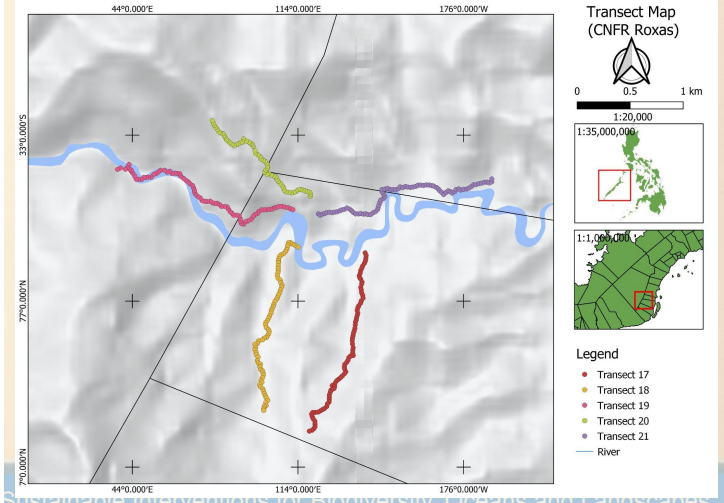
- Herpetofauna - 550 person-hours
- Mammals - 1,470 trap nights
- Birds - Length: 40 km, Width: 80 m
  - Area = 320 ha
- Flora - Length: 40km, Width: 40 m
  - Area = 160 ha

Sampling sites

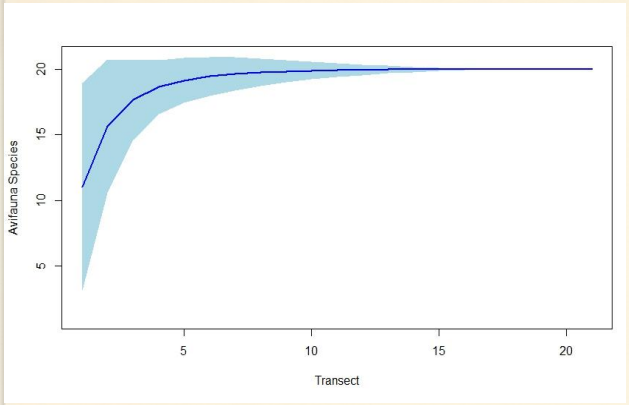


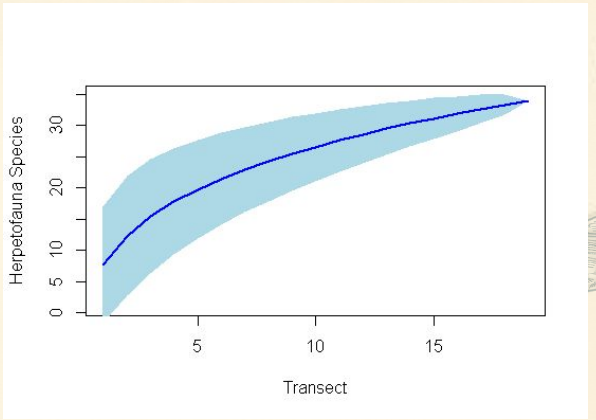


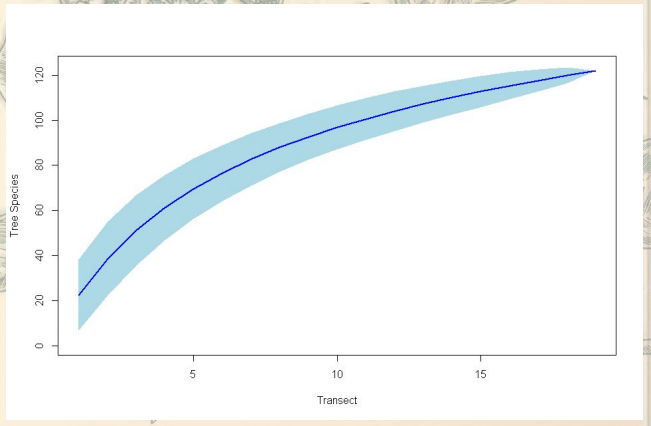


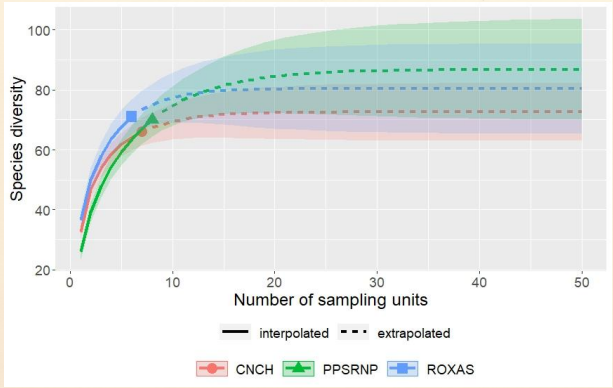


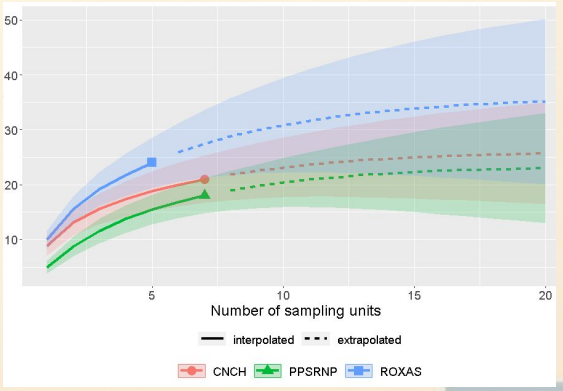
Species Accumulation and Rarefaction Curves

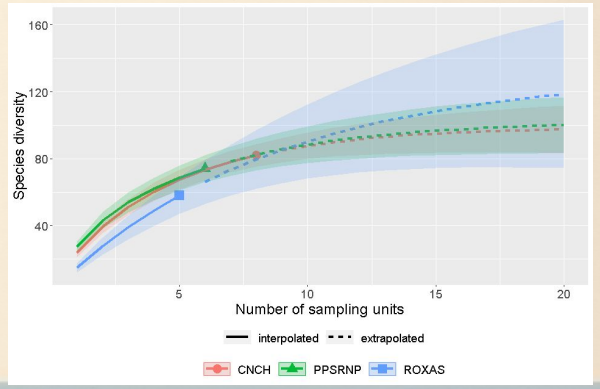












Avifauna

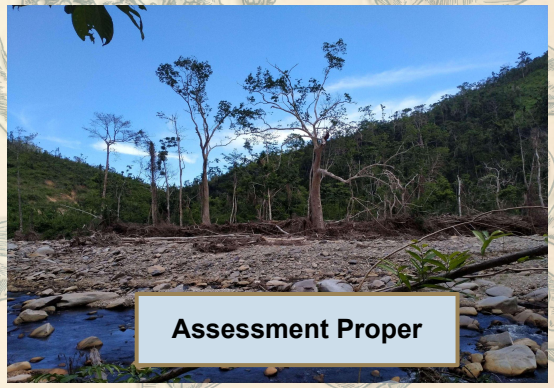
Herpetofauna

Trees

Activity 3 - Study of Land Use Change

Preliminary Work

Calibration Training

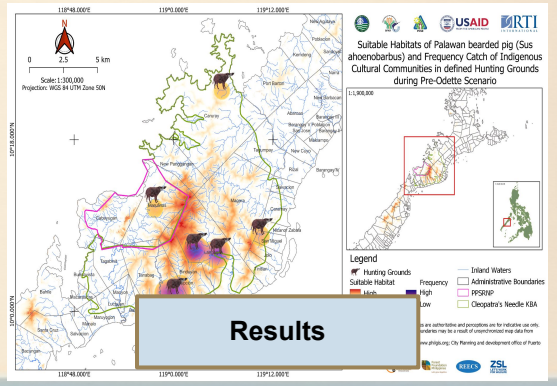


Assessment Proper

Stakeholder Inputs

Category	x	y	Barangay	Frequencies of Catch per Season
Hunting Ground	118.9631	10.1812	Marufinas	4
Hunting Ground	118.963	10.18118	Marufinas	4
Hunting Ground	118.9603	10.17657	Marufinas	4
Hunting Ground	118.9809	10.02827	Tanabag	4
Hunting Ground	118.9808	10.02991	Tanabag	4
Hunting Ground	118.9802	10.03	Tanabag	4
Hunting Ground	118.9861	10.03183	Tanabag	4
Hunting Ground	118.9891	10.03408	Tanabag	4
Hunting Ground	118.9894	10.03394	Tanabag	4
Hunting Ground	118.9898	10.0343	Tanabag	4
Hunting Ground	118.9864	10.03264	Tanabag	4
Hunting Ground	118.9856	10.03166	Tanabag	4
Hunting Ground	119.0178	10.02571	Concepcion	4
Hunting Ground	119.0126	10.037	Concepcion	4
Hunting Ground	119.0108	10.03827	Concepcion	4
Hunting Ground	119.0118	10.03725	Concepcion	4
Hunting Ground	119.0076	10.03376	Concepcion	4
Hunting Ground				
Hunting Ground				
Hunting Ground				
Hunting Ground	119.0101	10.02231	Concepcion	4

Analysis



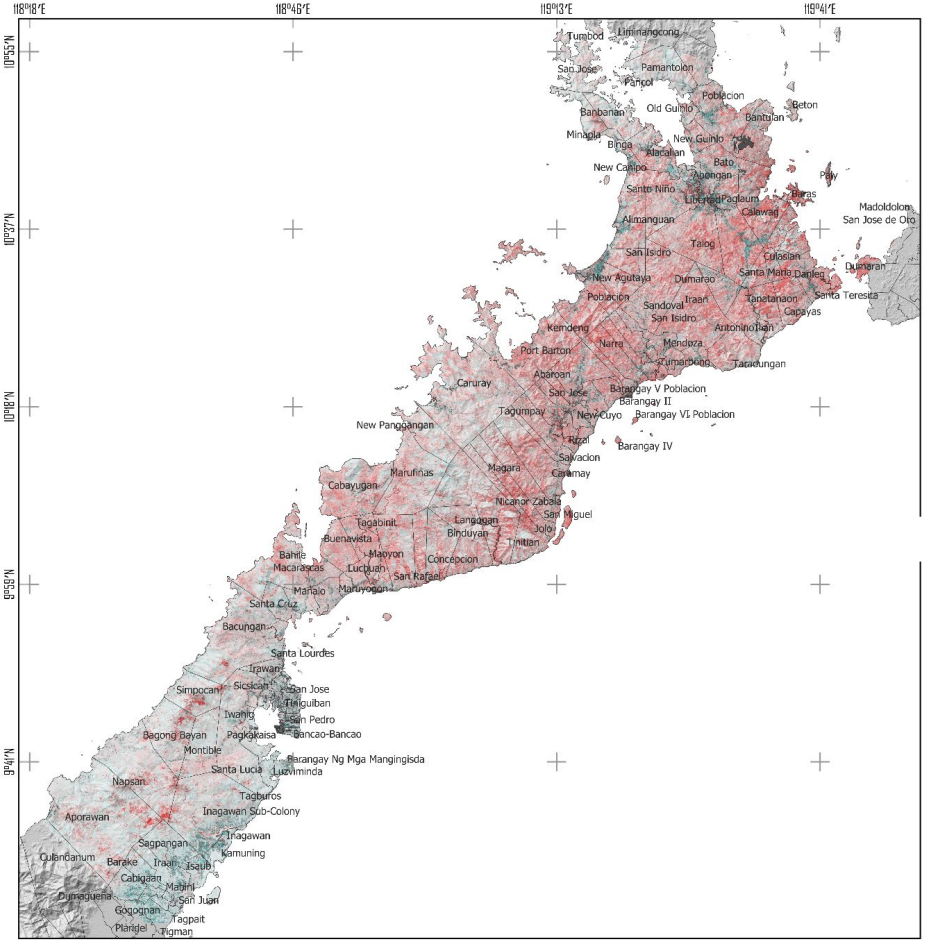
Results

Sustainable Interventions for Biodiversity, Oceans, and Landscapes Project

Stage 3 - Analysis and Interpretation

Land Cover and Habitat

Stage 3 - Analysis and Interpretation



Pre- and Post-Odette Event Normalized Difference Vegetation Index (NDVI) Comparison Map

N

0 10 20 30 40 50 km

Projection: WGS 84 UTM Zone 50 N

Legend

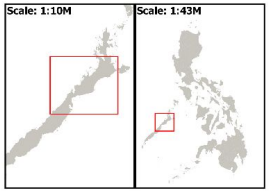
Barangay boundary

Terrain

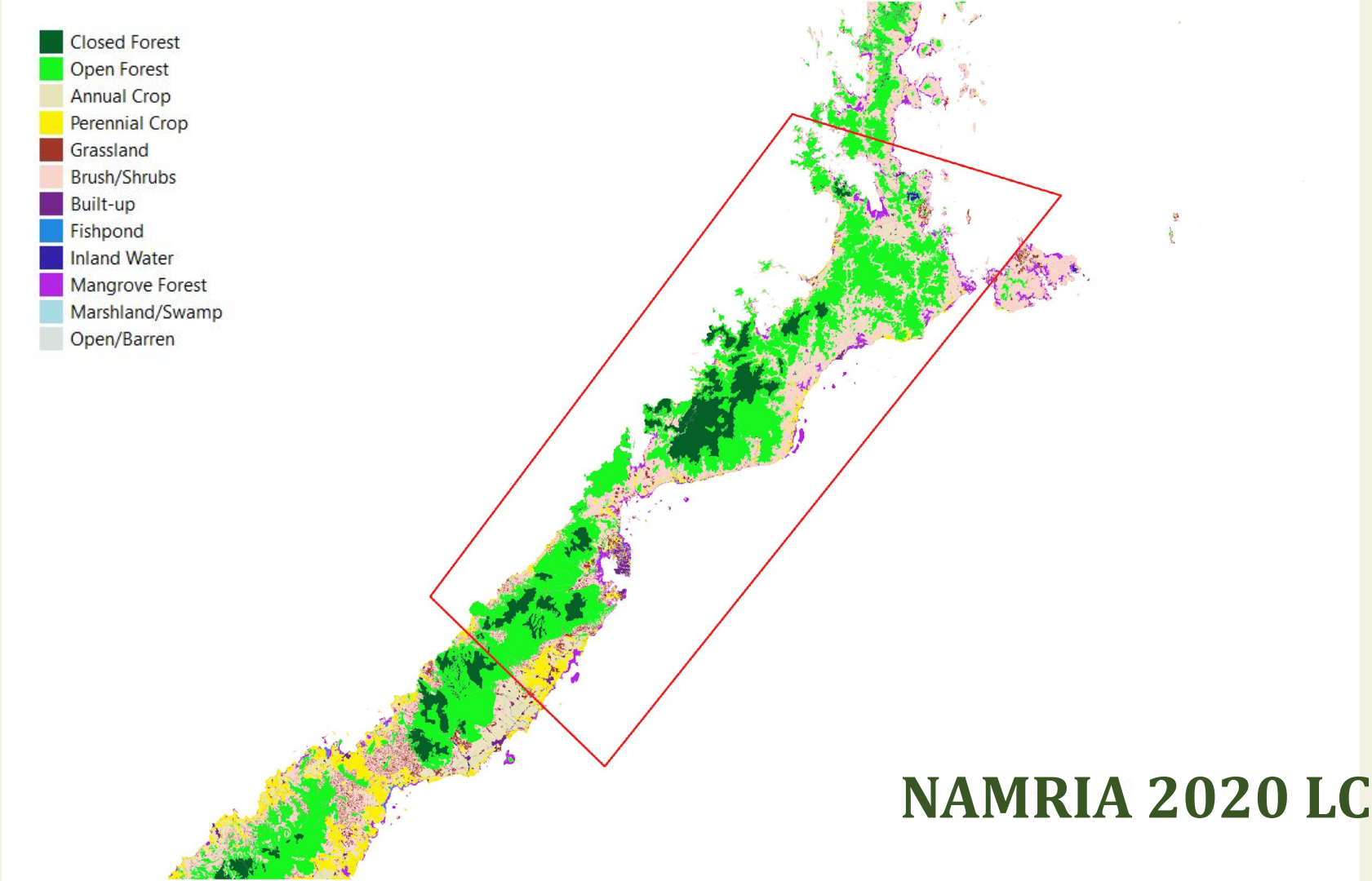
NDVI

Possible vegetation growth

Possible vegetation loss/damage

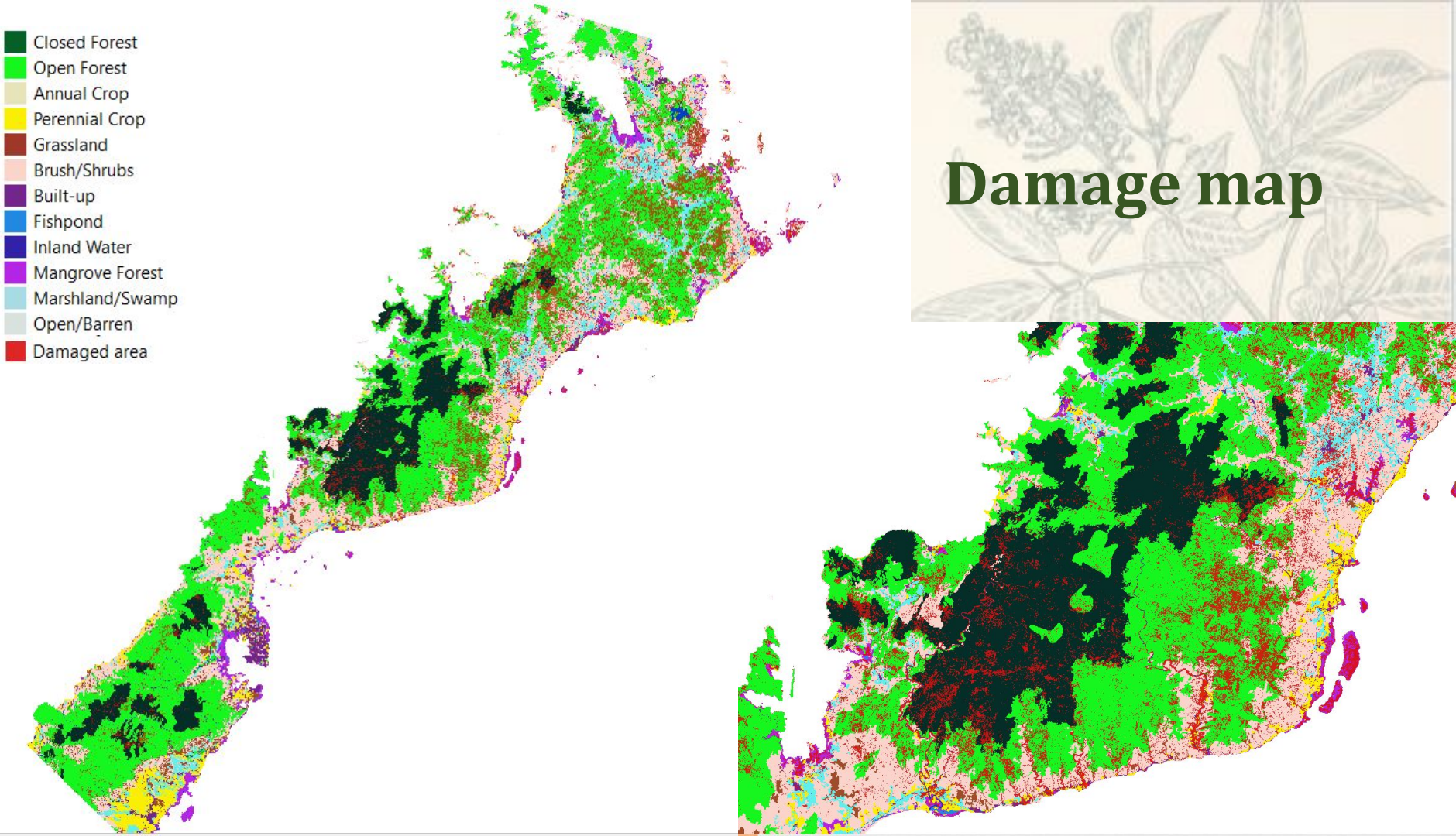


Data sources:
Sentinel 2 Image - GEE
NDVI Maps - CCIPh
Barangay boundary - PENRO

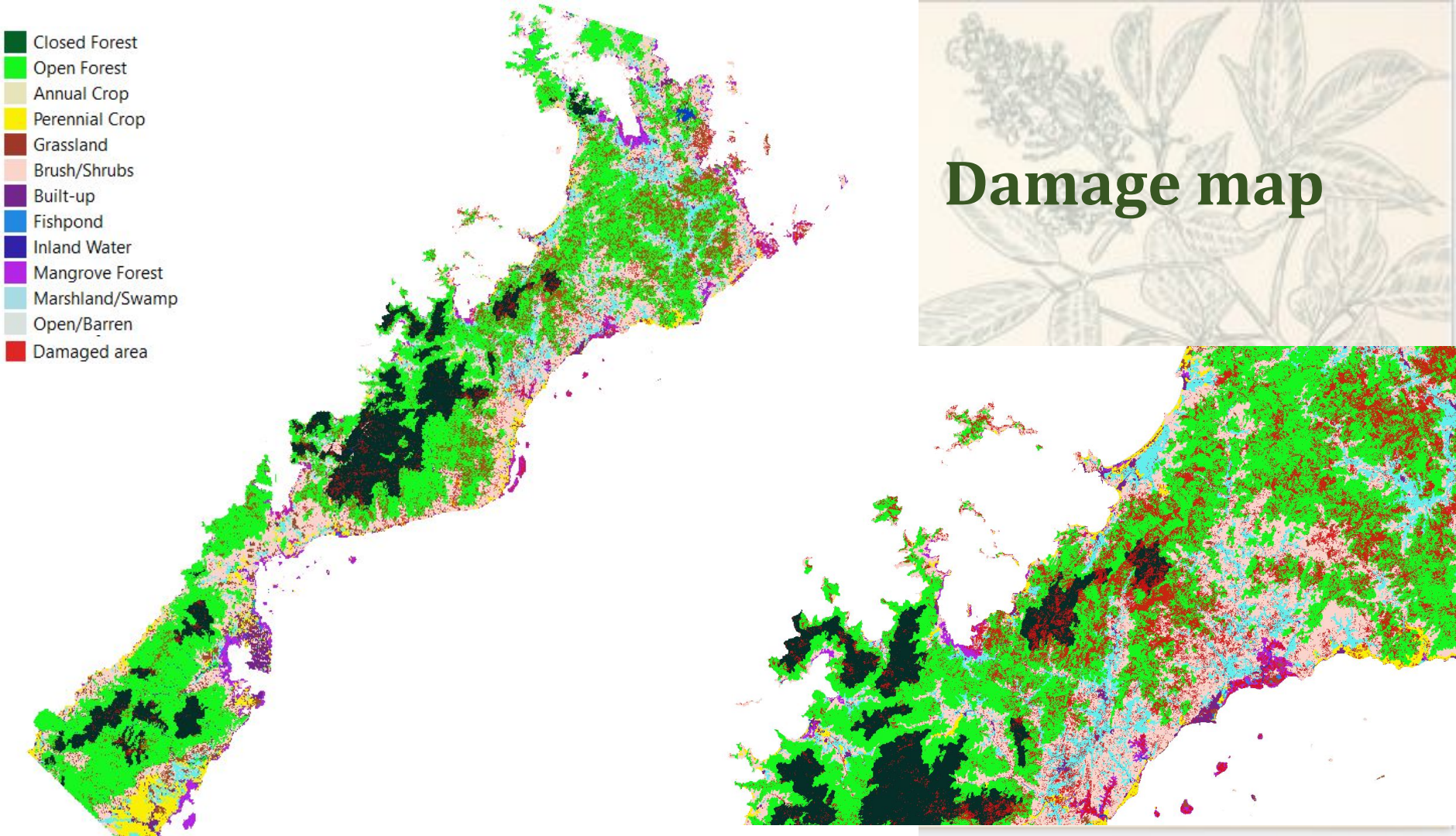


NAMRIA 2020 LC

Damage map


Closed Forest
Open Forest
Annual Crop
Perennial Crop
Grassland
Brush/Shrubs
Built-up
Fishpond
Inland Water
Mangrove Forest
Marshland/Swamp
Open/Barren
Damaged area

Damage map


Closed Forest
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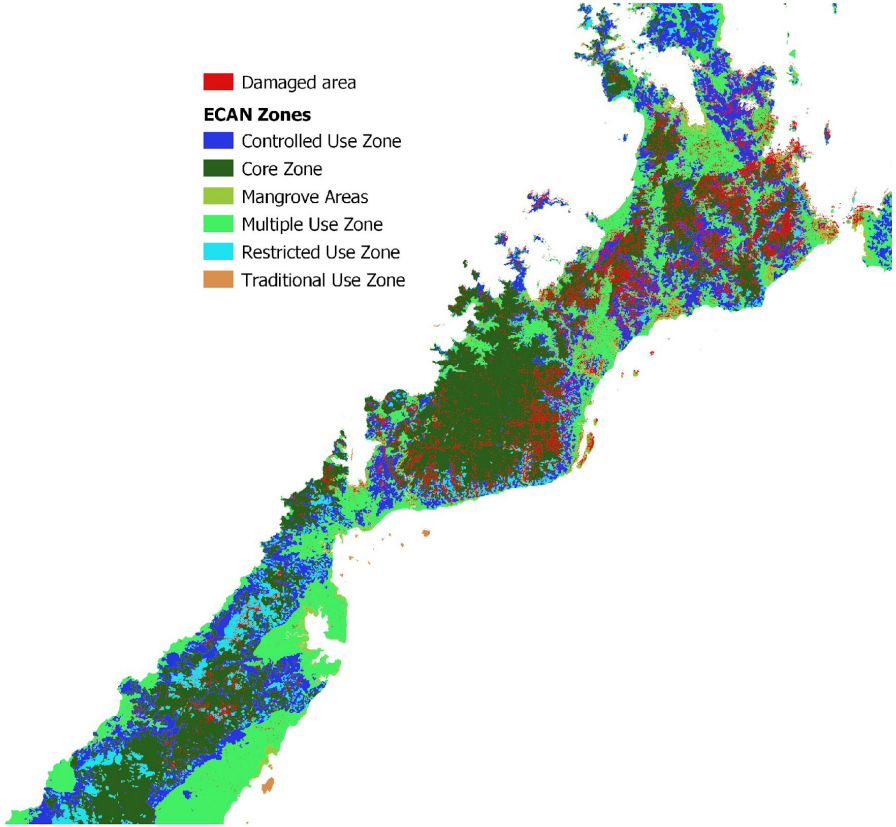
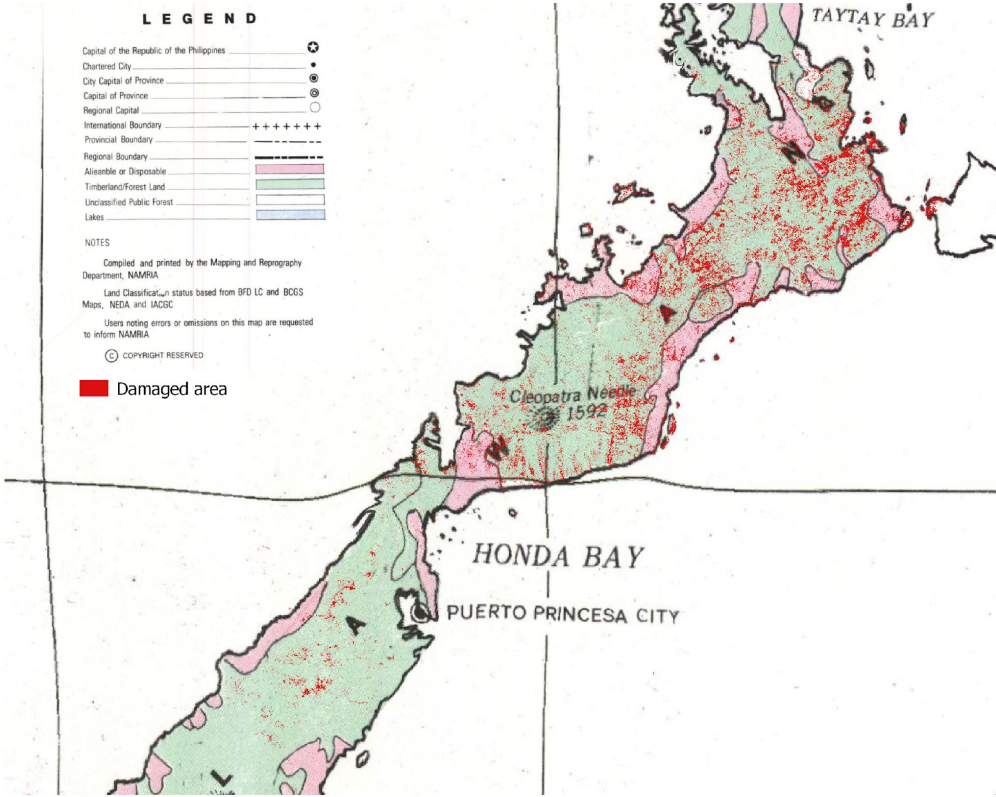
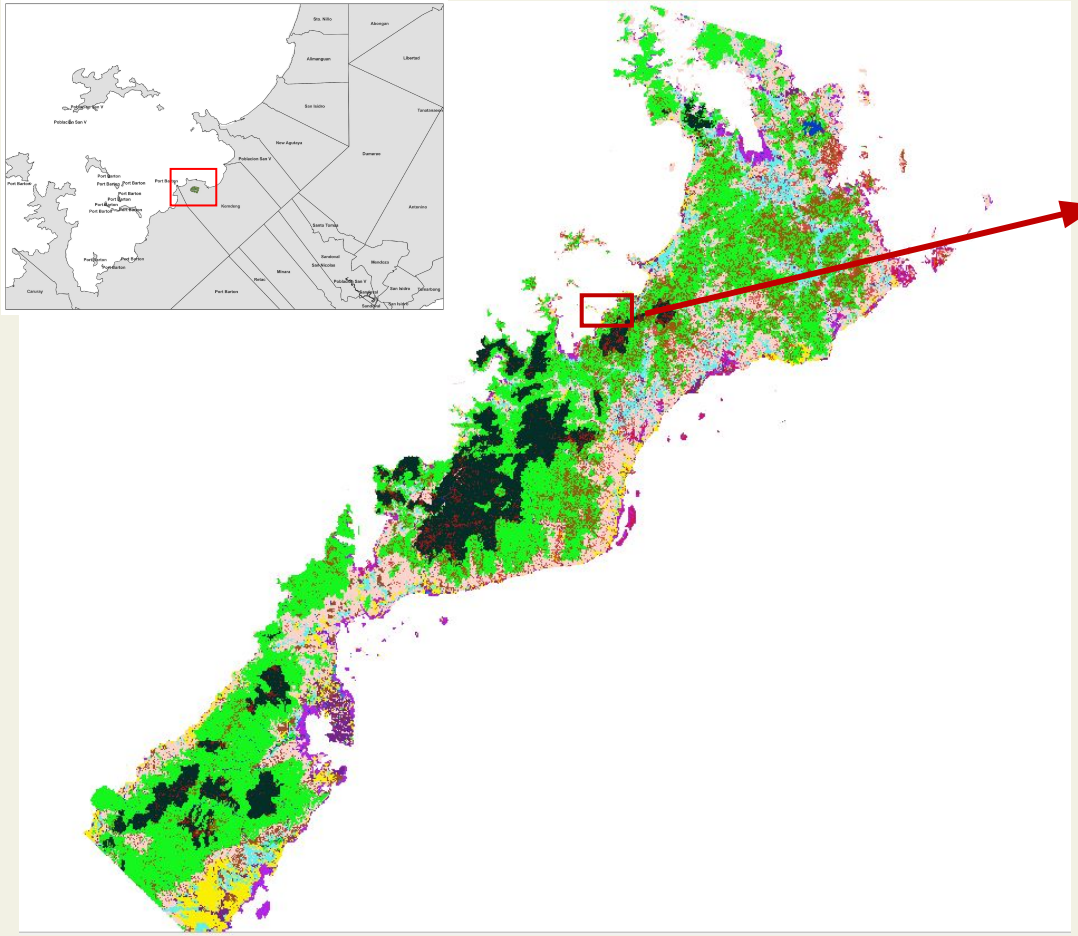
Grassland
Brush/Shrubs
Built-up
Fishpond
Inland Water
Mangrove Forest
Marshland/Swamp
Open/Barren
Damaged area

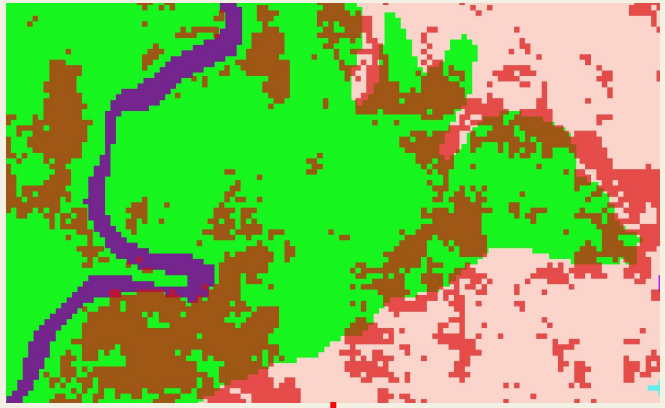
Damage Map of ECAN zones and Land Classification



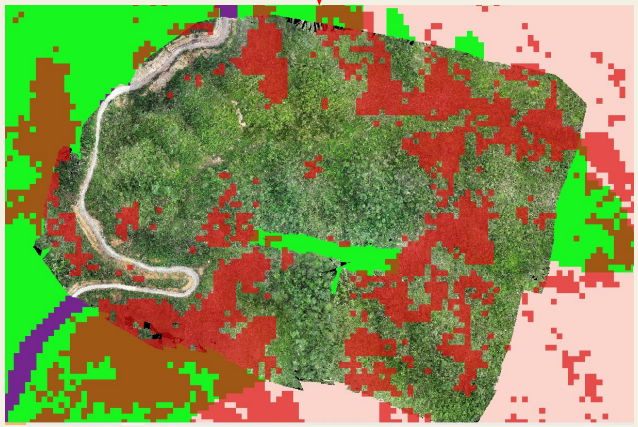


STAGE 2 : AERIAL GROUND VALIDATION





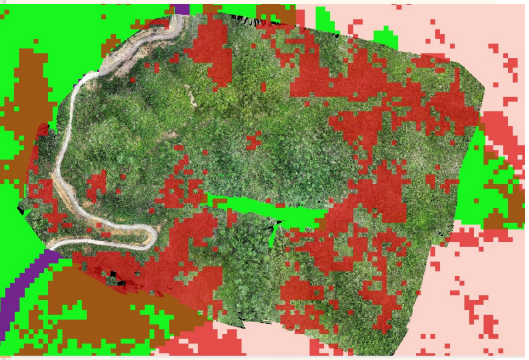
STAGE 1 Rapid Map



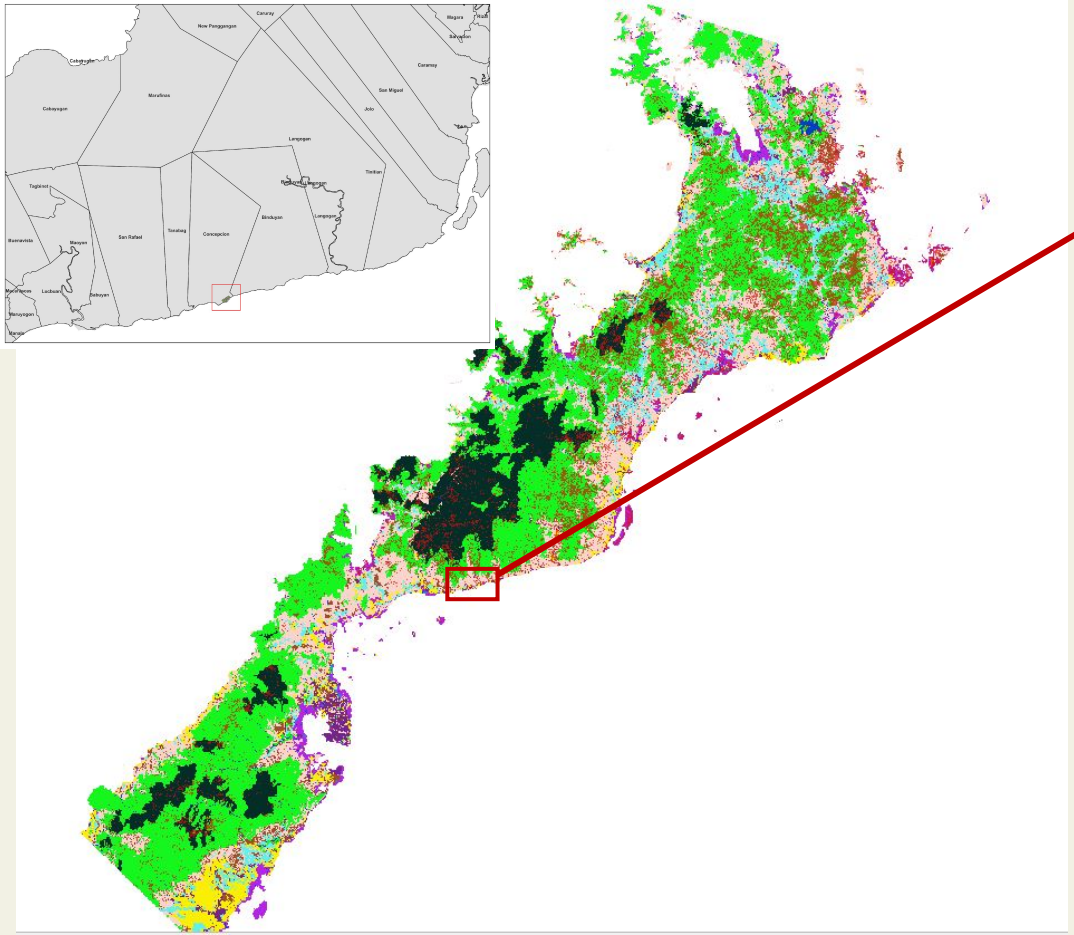
STAGE 2 Ground-truth

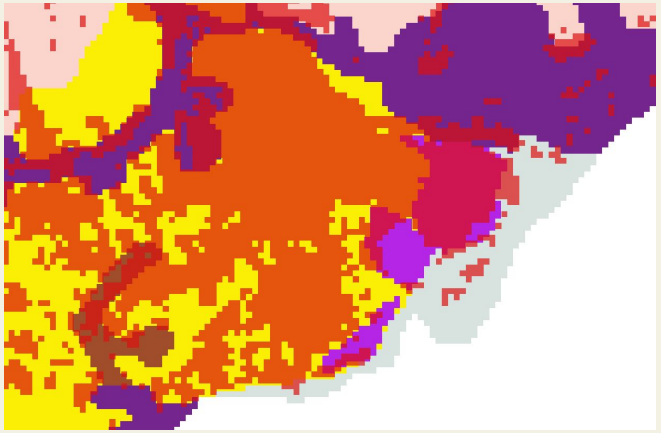
Sample: Damaged forest at close range via aerial survey

Conformance of the Stage 1 rapid map with Stage 2 ground-truth

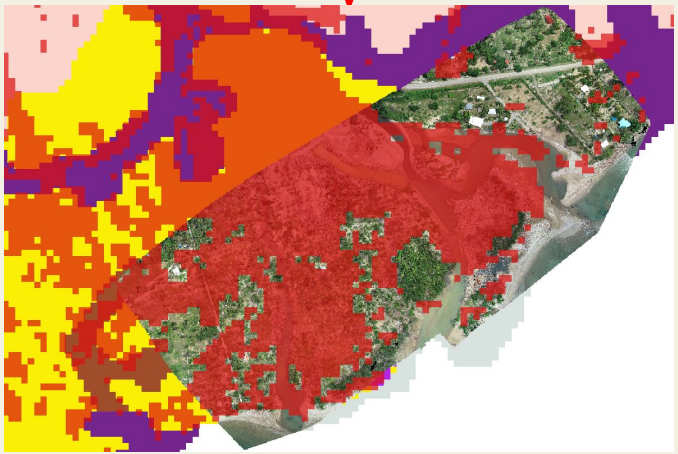


Sample: Damaged Mangroves and Perennial crops

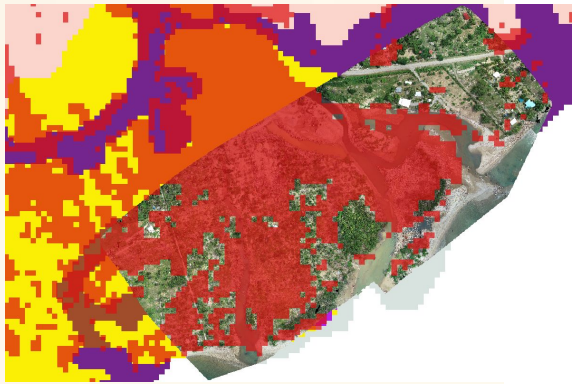




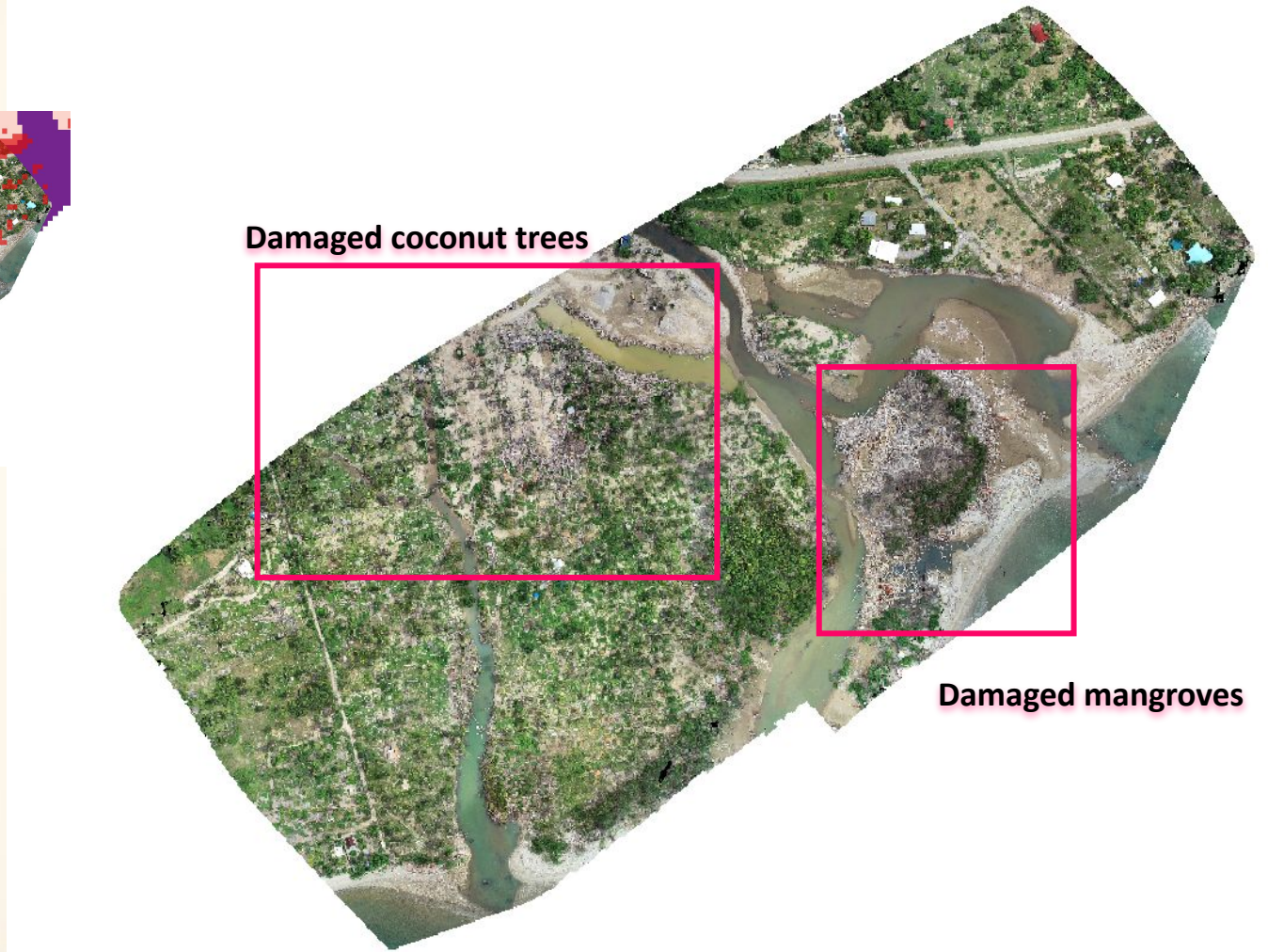
STAGE 1 Rapid Map



STAGE 2 Ground-truth



Conformance of the Stage 1 rapid map with Stage 2 ground-truth



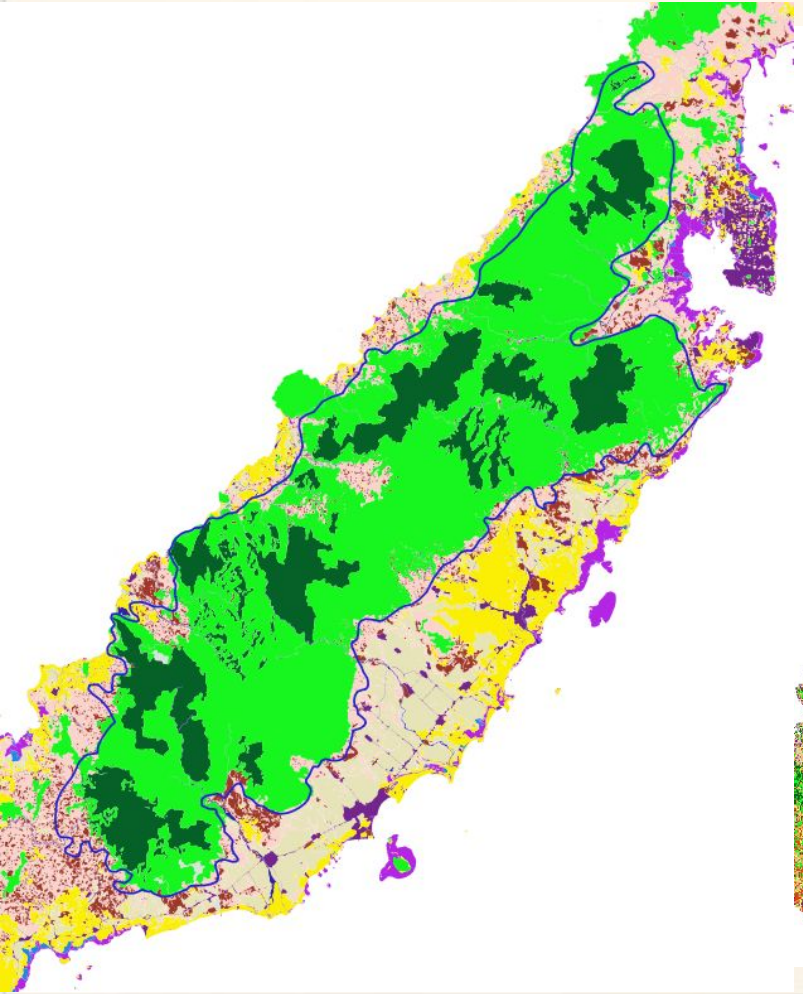
Currently, we are processing:

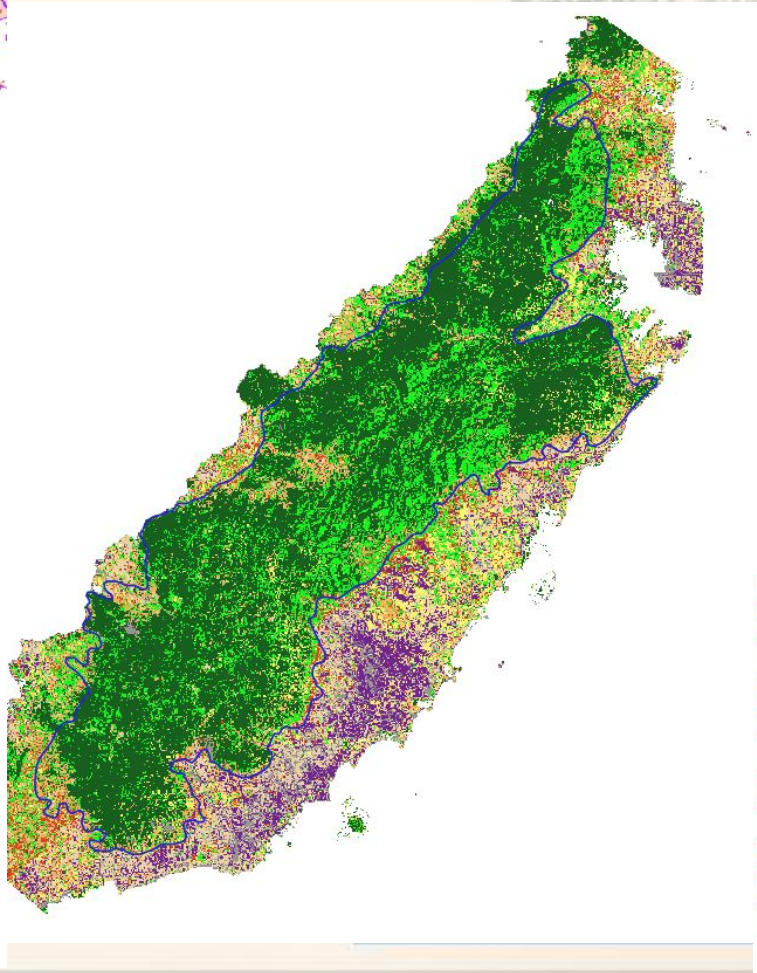
	No. of flights	No. of flights processed
Danflights1	69	53
ReignTinflights	30	15
TinCityENROflights	22	12
Roxasboysflights	14	0
Danflights2	53	5
TOTAL	**257**	**138**
To Process:		**119**
PalawanPCSD flights	15	15

Result of Image when overlayed for interpretation/classification

- Makes it easier for the analyst to interpret and classify the image, will not need much adjusting when creating training polygons/data to fit pixels position. Hence, a well-done drone survey shortens the time for interpretation and fitting on the satellite imagery.

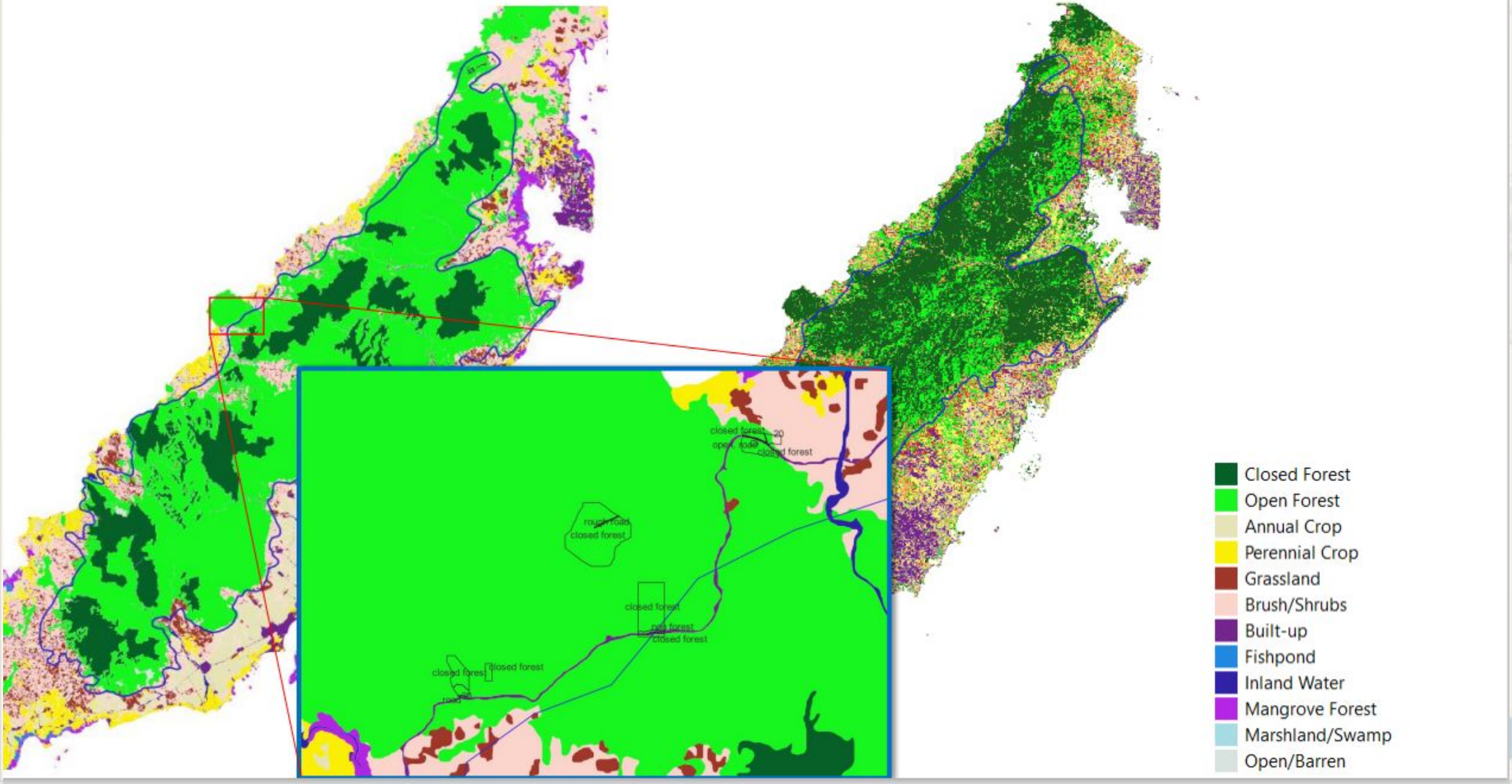
NAMRIA 2020 LC vs VAMR 2020 LC



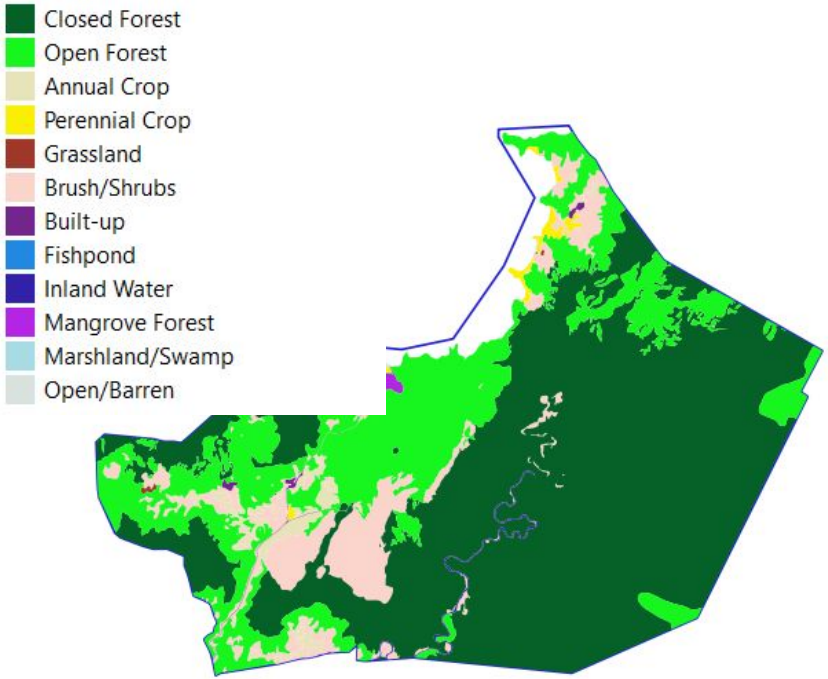


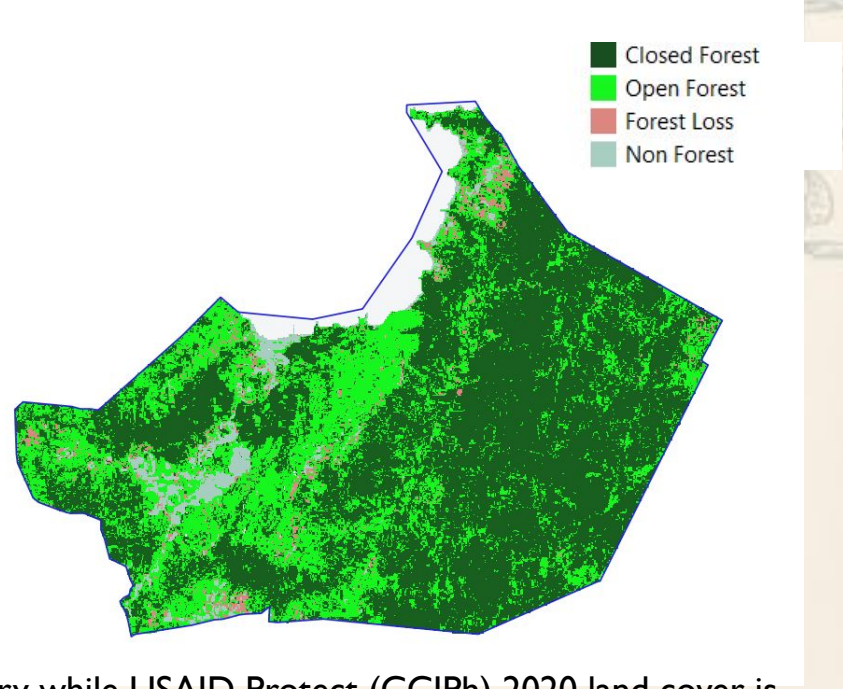
- Closed Forest
- Open Forest
- Annual Crop
- Perennial Crop
- Grassland
- Brush/Shrubs
- Built-up
- Fishpond
- Inland Water
- Mangrove Forest
- Marshland/Swamp
- Open/Barren

NAMRIA 2020 LC vs VAMR 2020 LC



NAMRIA 2020 LC vs USAID Protect (CCIPh) 2020 LC*





*NAMRIA 2020 land cover is based from 2015 satellite imagery while USAID Protect (CCIPh) 2020 land cover is based on 2019 satellite imagery .

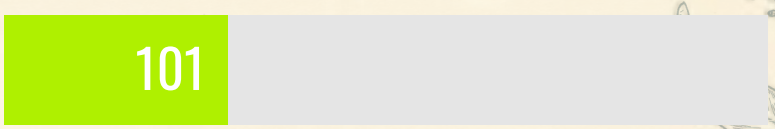
Biodiversity

Stage 3 - Analysis and Interpretation

Species Richness

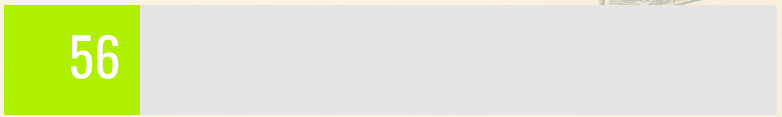
26%

Endemic Species



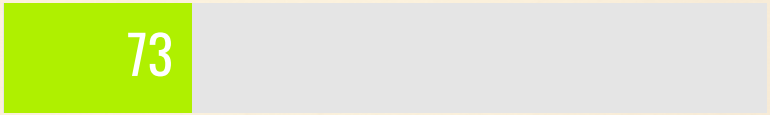
14%

Globally Threatened
(IUCN, 2020)



19%

Locally Threatened
(DAO 2019-09, 2017-11)



390

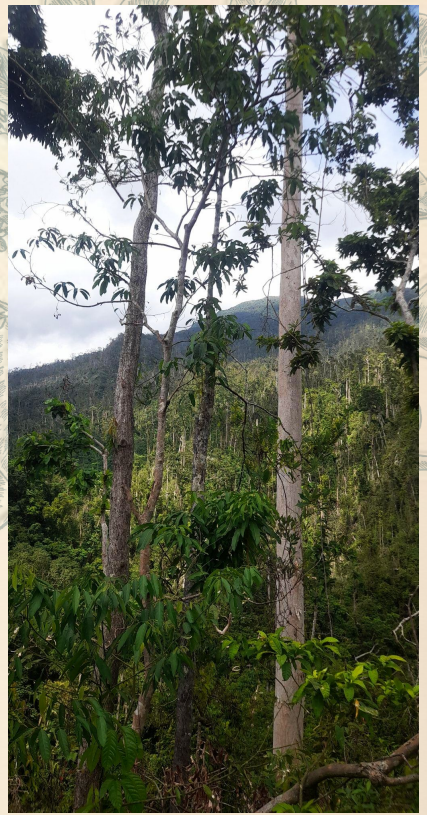
Total Number of Species

Flora and Habitat Key Observations

Apitong
Dipterocarpus grandiflorus
(Blanco) Blanco
EN (IUCN, 2020), VU (DAO, 2011-17)

Ipil
***Intsia bijuga* (Colebr.) Kuntze**
NT (IUCN, 2020), VU (DAO, 2017-11)

Almaciga
***Agathis philippinensis* Warb.**
VU (DAO, 2011-17)



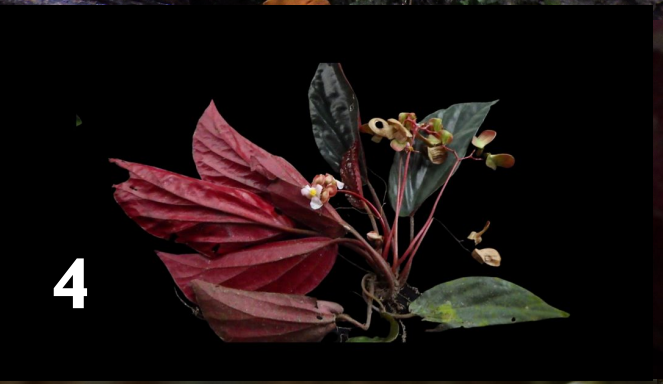
Duguan
***Myristica philippensis* Lam.**
OTS (DAO, 2011-17)

Flowering/Fruiting Understory Vegetation

1

2

3


4

5

6

7

8

9

Puerto Princesa Subterranean River National Park (PPSRNP)

Marufinas - High percentage of crown defoliation and broken stems

Low elevation → **High Elevation** **Decrease in canopy cover**

Understorey and ground cover vegetation underneath the fallen logs

Forest floor: Increase in leaf litter due to defoliation and dried epiphytes

Emergent trees were uprooted or broken from the buttress. Small to medium sized trees were broken in the middle.

Severe crown defoliation, broken stems, and significant decrease in canopy cover in PPSRNP

Q	Defoliation	Broken Stems	Number of Damaged Trees	Fruiting and Flowering Trees	Regenerants	Litter Depth	Fallen Logs or Uprooted Trees	Canopy Cover (Ave %)
0	1	1	1	3	65	4	0	82.66
1	2	2	8	0	35	8	5	39.11
2	2	2	6	0	56	8	4	58.125
3	3	3	13	0	20	10	11	25.405
4	3	3	10	0	25	8	9	25.3025
5	3	3	10	0	25	4	9	28.87
6	3	3	10	0	35	5	7	22.87
7	3	3	9	0	15	9	12	29.18
8	2	2	6	0	30	5	4	58.245

Slight

Moderate

Severe

Canopy Opening - Opportunistic species

Ixora palawanensis

Scrambling bamboos
(*Dinochloa* spp.)

Cleopatra's Needle Critical Habitat

Kalakwasan, Tanabag

Mangapin, Langogan

Kalakwasan, Tanabag - Landslides and uprooted Trees

The increase in water volume during the typhoon **uprooted most of the trees and exposed large rocks near the rivers and creeks** of Kalakawasan. The upland areas consist primarily of patches of old-growth and advanced secondary growth forests, but some portions were severely damaged due to **landslides**. Some landslides were proximal to **kaingin areas**.

Minor to moderate crown defoliation and broken stems, high number of uprooted trees in CNCH

Q	Defoliation	Broken Stems	Number of Damaged Trees	Fruiting and Flowering Trees	Regenerants	Litter Depth	Fallen Logs or Uprooted Trees	Canopy Cover (Ave %)
0	1	1	10	0	0	2	3	2.74 (Riverine)
1	2	2	5	0	0	2	9	3.83 (Riverine)
2	1	1	1	1	20	8	2	59.29
3	2	2	3	2	15	4	6	62.22
4	2	2	6	2	18	6	4	55.50
5	1	1	1	1	18	7	1	85.90
6	3	3	4	0	2	1	12	57.90
7	2	2	5	1	14	8	4	7.99
8	1	1	1	3	10	6	0	35.60

Slight Moderate Severe

Higher occurrence of herpetofauna near water bodies

Bird detection reduced with increased canopy openings as a result of damaged trees and defoliation

Palawan Frogmouth

Palawan Blue Flycatcher

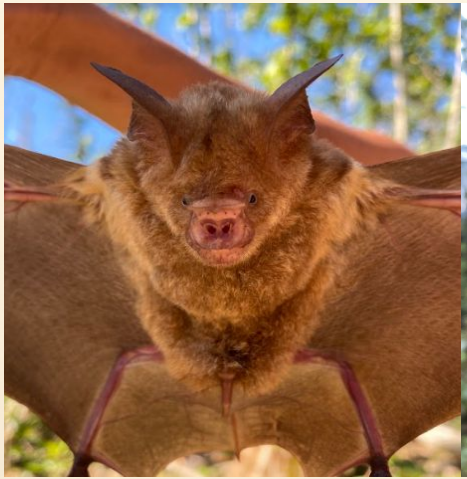
Palawan Hornbill

Blue-naped Parrot

Is the observed dominance of insect bats in PPSRNP linked to low fruiting of defoliated trees?

70% species were insectivorous bats

90% individuals caught were insectivorous bats



Did the effects of Typhoon Odette increase the population's vulnerability to zoonotic diseases?

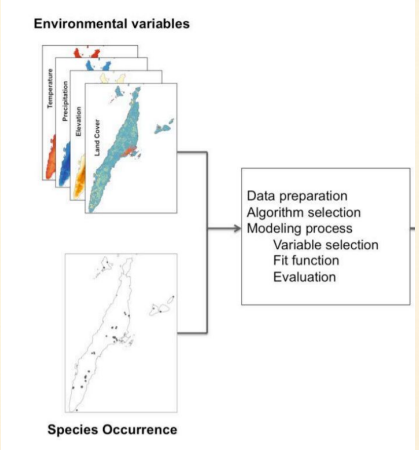
Increase in dengue, malaria and swine fever in the recent months

Species distribution modeling was conducted to compare changes in suitable habitats before and after the typhoon.

Species	x	y
Anthracoceros marchei	118.9693	10.0172
Anthracoceros marchei	119.0856	10.11683
Anthracoceros marchei	119.174	10.13462
Anthracoceros marchei	118.9801	10.02549
Anthracoceros marchei	119.1668	10.14507
Anthracoceros marchei	118.9429	10.19513
Anthracoceros marchei	118.947	10.23442
Chloropsis palawanensis	118.9528	10.18183
Chloropsis palawanensis	118.965	10.17385
Chloropsis palawanensis	118.9715	10.03245
Chloropsis palawanensis	118.9617	10.02821
Chloropsis palawanensis	118.9635	10.02924
Chloropsis palawanensis	118.9708	10.01763
Chloropsis palawanensis	118.9693	10.0172
Chloropsis palawanensis	118.9666	10.01623
Chloropsis palawanensis	118.9646	10.01631
Chloropsis palawanensis	118.9643	10.01917

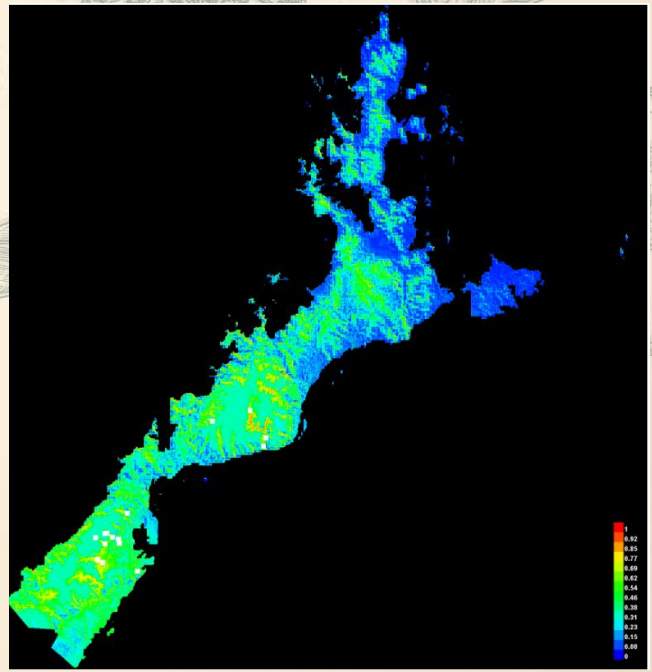
Occurrence records for pre-odette scenario covering January 2020 to December 2021 (sourced from CCIPH, 2020; BMS records, and online repositories) and post-odette scenario from March to May 2022 (data collected during field survey)

+



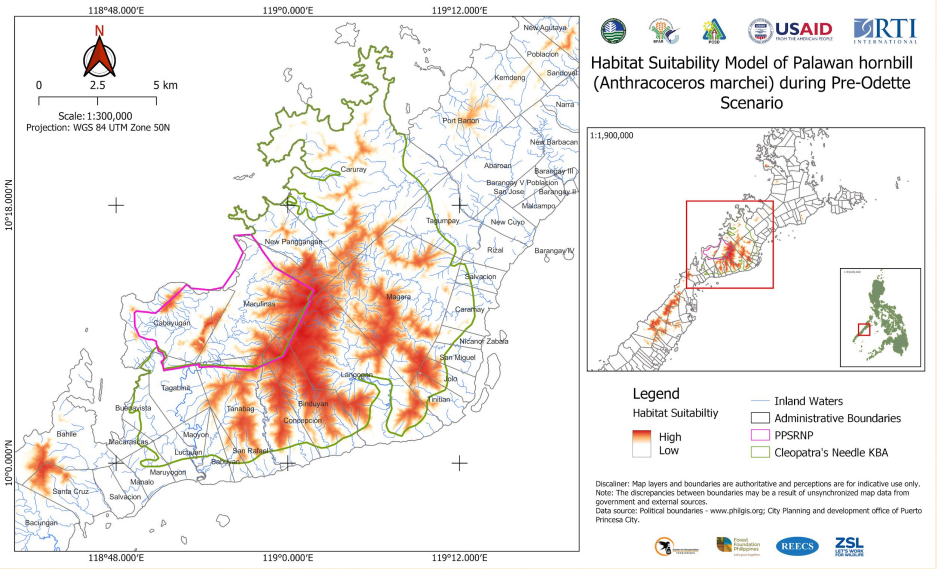
Environmental variables used included the vegetation index (NDVI) layers for 2021 and 2022, and elevation at 30x30 m resolution.

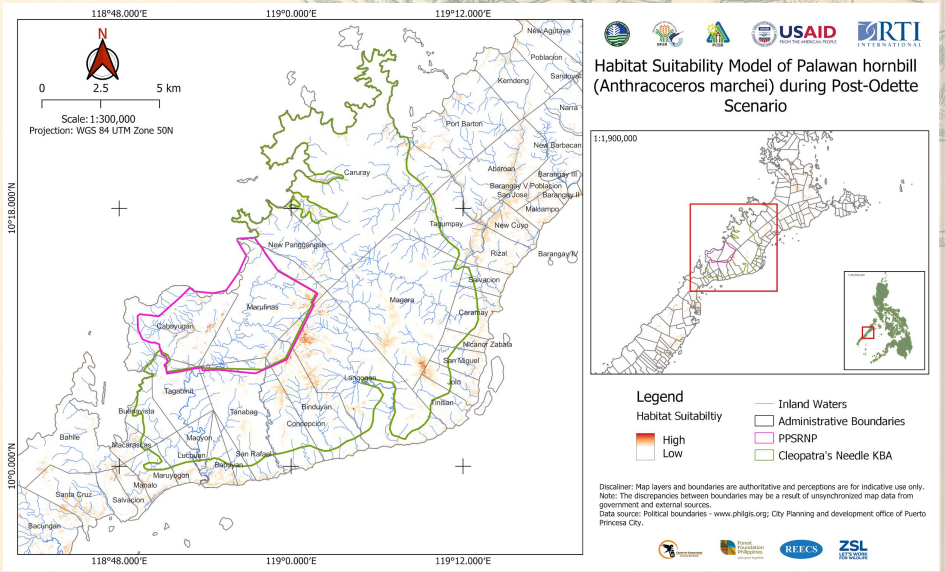
=



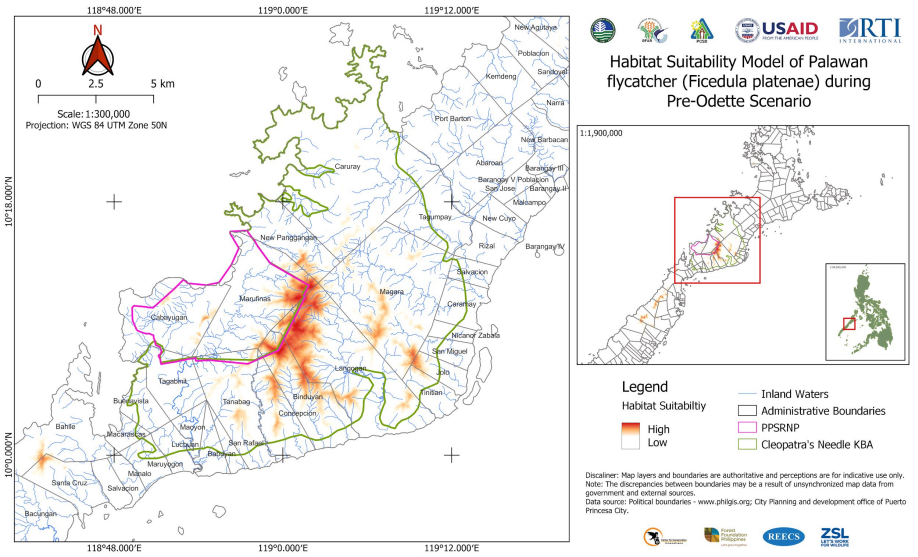
Model output per species. The results were then overlaid to create species congruence maps.

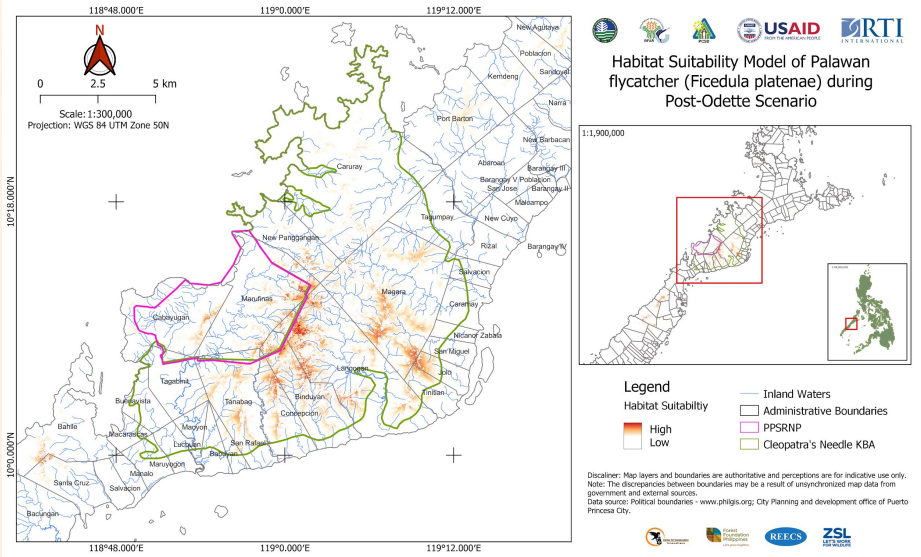
Habitat Suitability Model of **Palawan Hornbill** during Pre-Odette Scenario (2021) and Post Odette Scenario (2022)



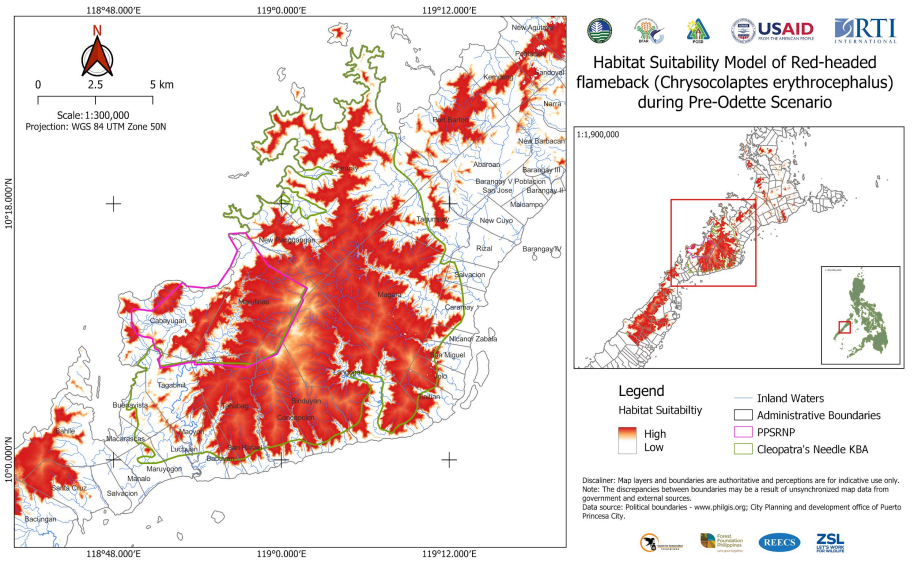


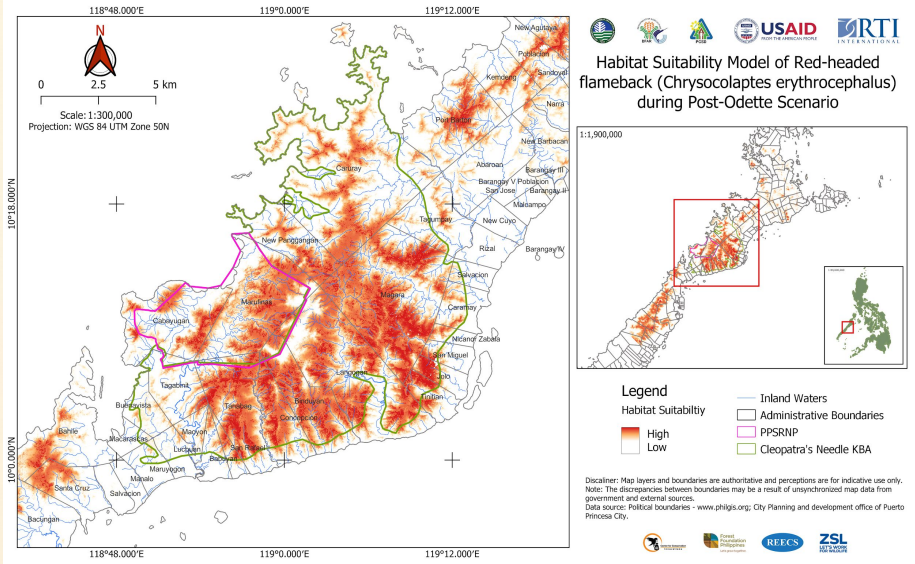
Habitat Suitability Model of **Palawan Flycatcher** during Pre-Odette Scenario (2021) and Post-Odette Scenario (2022)



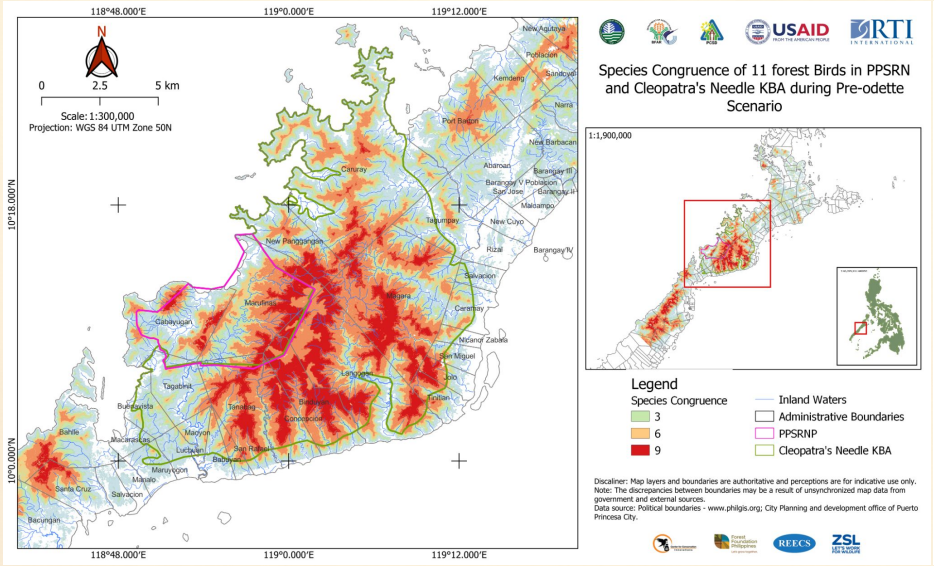


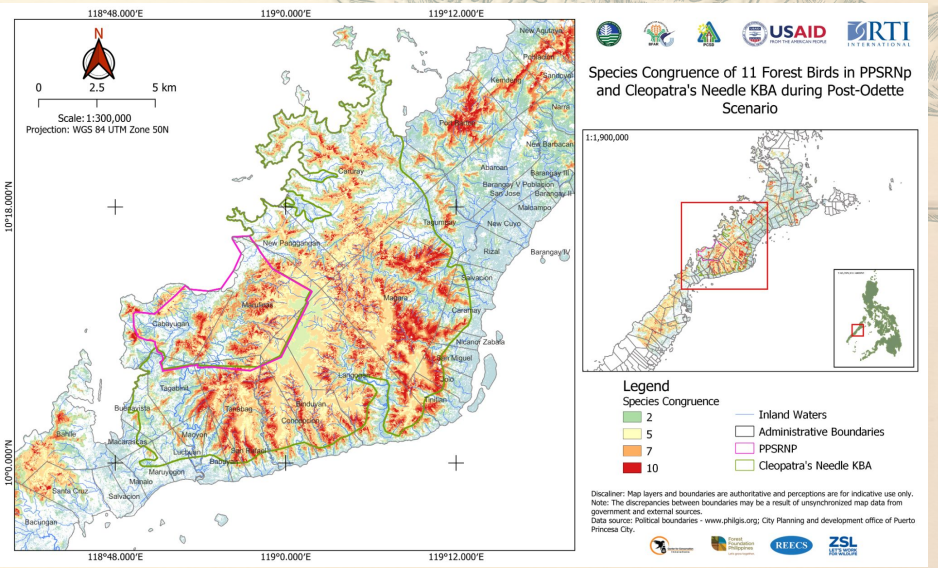
Habitat Suitability Model of **Red-headed Flameback** during Pre-Odette Scenario (2021) and Post-Odette Scenario (2022)



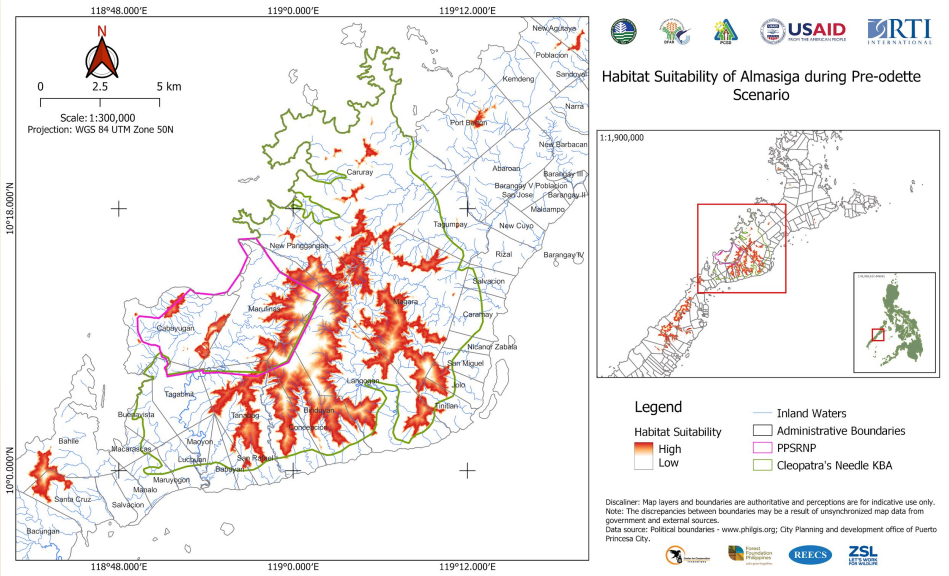


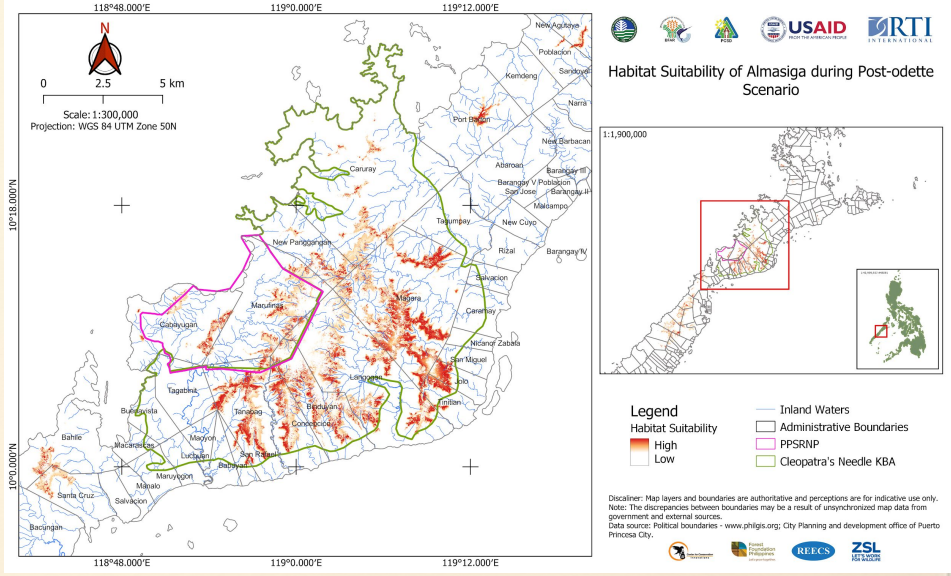
Species Congruence Species of **11 Forest Birds** during Pre-Odette Scenario (2021) and Post-Odette Scenario (2022)



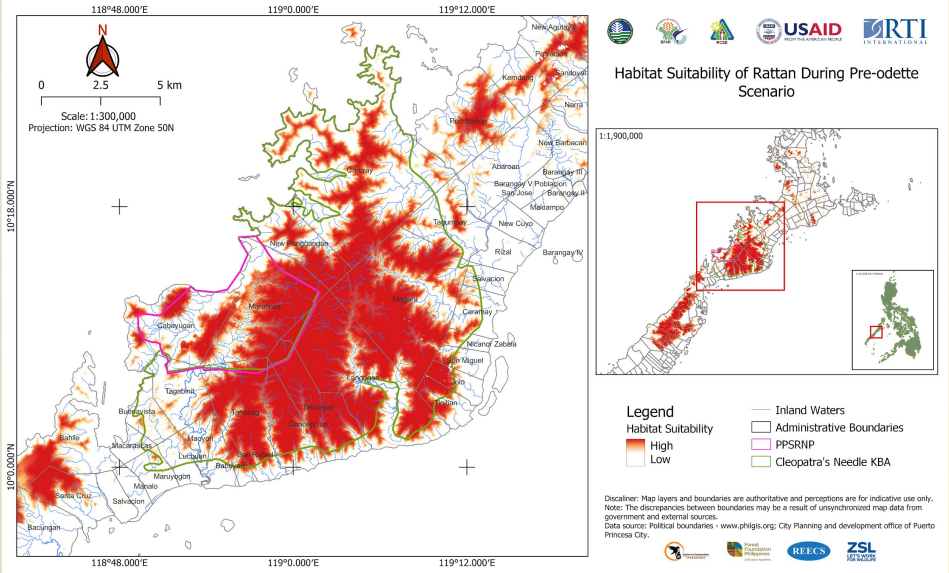


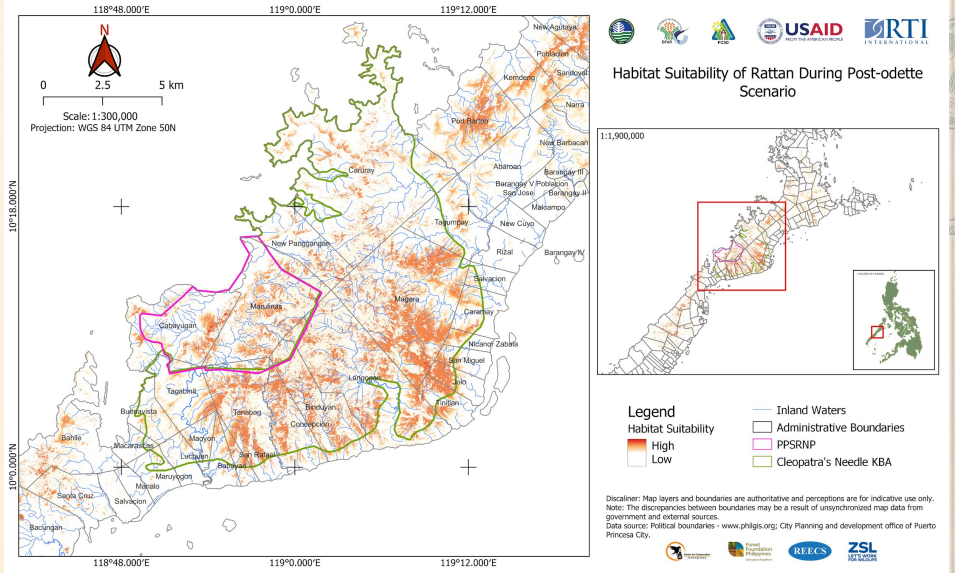
Habitat Suitability of **Almaciga** during Pre-Odette Scenario (2021) and Post-Odette Scenario (2022)





Habitat Suitability of **Rattan** during Pre-Odette Scenario (2021) and Post-Odette Scenario (2022)





Drivers of Land-use Change

Stage 3 - Analysis and Interpretation

Study of Land Use Change - Ground Assessment in P. Princesa

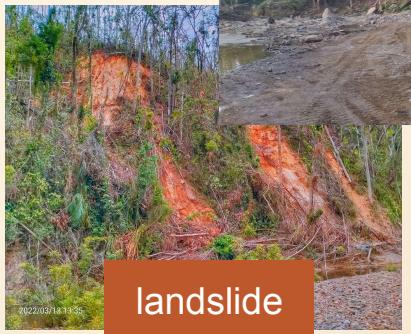
Back

Forest

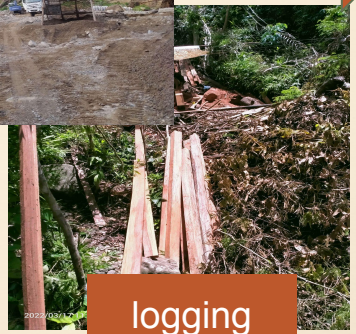
siltation

drying up

quarry



landslide



logging

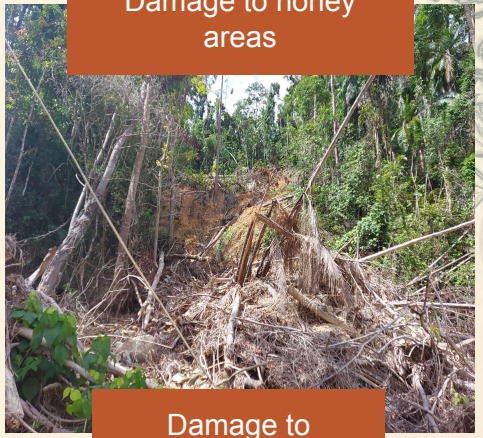
- Clearing of debris also led to unregulated logging
- Insecure water supply
- Loss of NTFP areas
- Displacement of wildlife and humans
- Traditional ecological knowledge and practices set aside
- Customs, rituals, taboos and myths integral part of IP communities lost

Study of Land Use Change - Ground Assessment in P. Princesa

Back

NTFP Areas

Damage to honey areas



Damage to almaciga areas

Loss of main source of income

Redistributing areas for NTFP collection amongst households

Traditional ecological knowledge and practices set aside

Study of Land Use Change - Ground Assessment in P. Princesa

Back

Residential

Damage to residential areas

Competing for land and natural resources

Weak legal claims over new lands

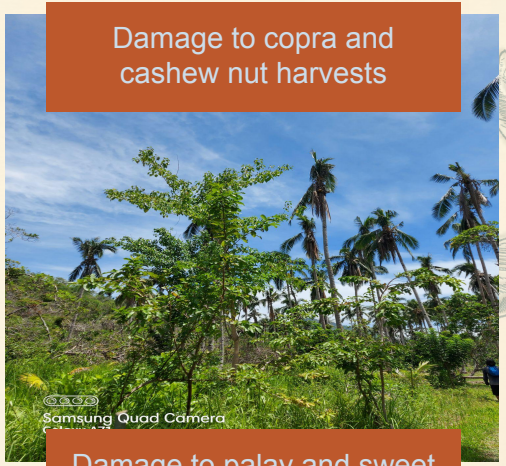
Unregulated use of materials to rebuild homes

Study of Land Use Change - Ground Assessment in Roxas

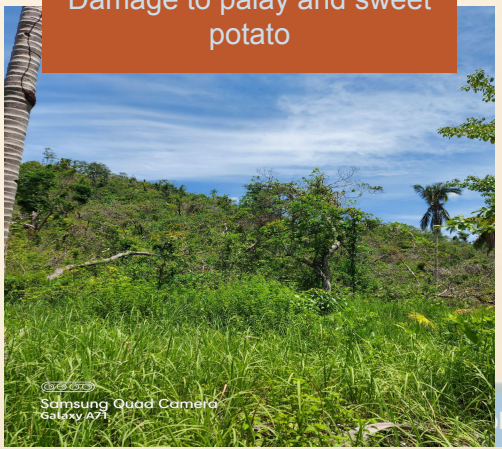
Back

Cropland

Damage to copra and cashew nut harvests



Damage to palay and sweet potato



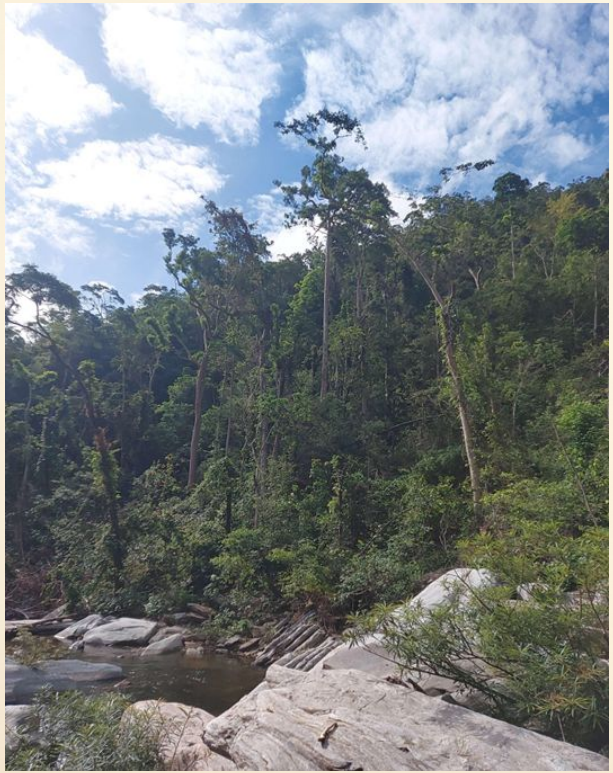
Opening up of new lands with a short-term outlook

Alternative livelihood to secure planting materials

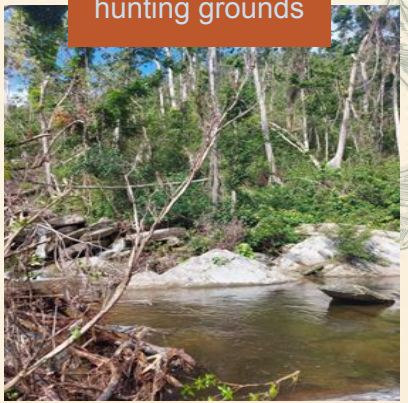
Study of Land Use Change - Ground Assessment in Roxas

Back

Hunting Grounds



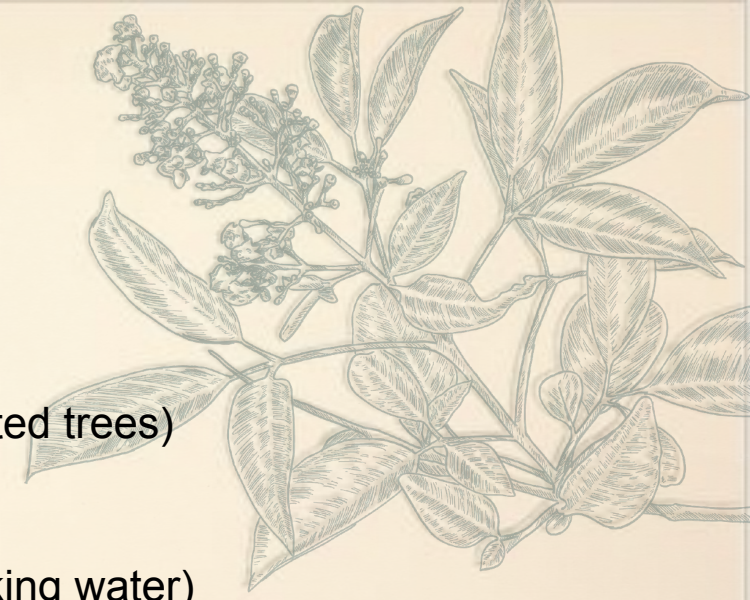
Damage to hunting grounds



Displacement of wildlife

Opening for tourism

Challenges



- Artifact of sampling
  - Accessibility of sites (high number of uprooted trees)
  - Bad weather
  - Difficult field conditions (i.e. scarcity of drinking water)
- Data (GPS coordinates) for time series comparisons are unavailable. Only species lists are available.

Recommendations

- Consider habitat succession for forest recovery
- Prioritize clearing of debris and control of opportunistic species to ensure survival of regenerants
- Soil analysis in CNCH (water holding capacity, moisture, etc.)
- Revisit management zones of protected areas