

START
NETWORK



VULNERABILITY AND IMPACT ANALYSIS:

(TROPICAL CYCLONE –
SEVERE WIND & FLOODING)

RIMCU is an independent research institute founded in 1957 that has conducted a considerable number of locally, nationally and internationally funded studies that covers a wide range of interest such as, but not limited to:

- ❖ crises situations such disasters,
- ❖ conflict situations, peace and ethnic relations;
- ❖ poverty and food (in)security;
- ❖ preventing/countering violent extremism;
- ❖ violence against women and children;
- ❖ women's concern and gender relations/issues; and
- ❖ sexual and reproductive health and rights.



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RIMCU

- proven experience in conducting mixed methodologies
- mapping analysis, evaluation and impact studies, census studies, and longitudinal studies, among many, that combines both qualitative and quantitative data collection, processing, and analysis.
- history of collaborating with various stakeholders to ensure strong understanding of each study topic
- institution's collaboration with other agencies range from concept development, data collection and analysis, and results dissemination
- informs both policy and practice with its research findings- reaches out and package messages to various target audiences for the utilization of its research results



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Fieldwork



VULNERABILITY AND IMPACT ANALYSIS

attempted to:

- Identify the geographic and socio-economic extent of impacts of severe winds and flooding due to tropical cyclones in the Philippines
- Identify vulnerability factors and cross-sectoral issues related to tropical cyclones
- Identify existing community-based coping mechanisms that can be leveraged on by the humanitarian sector

Summary outline of the methodological approach

Tier	Component	Method	Source	Particulars
1	Impact	<ul style="list-style-type: none"> Hazard characterization Impact documentation 	<ul style="list-style-type: none"> National data To include online databases such as, but not limited to, Hazard Hunter, PAGASA, and MGB 	<ul style="list-style-type: none"> Data gathering and digitalization via GIS Disasters documentation and digitalization via GIS
2	Vulnerability and Coping mechanisms	<p>Key informant interviews*</p> <ul style="list-style-type: none"> Zoom interviews Phone interviews <p>Review of secondary data</p>	<ul style="list-style-type: none"> 1 highly exposed 4th – 6th class municipalities (mountainous) 1 highly exposed 4th – 6th class municipalities (plains) 1 highly exposed 4th – 6th class municipalities (coastal) <p>Secondary data: National Disaster Risk Reduction Management Council; Philippine Statistics Authority; LGUs situation reports</p>	<p>Study participants from various levels:</p> <ul style="list-style-type: none"> DRRM various levels Representatives from local civil society organisations specifically those dealing with DRRM Informal leaders in the community and disaster response volunteers (groups) <p>Data processing procedures:</p> <ul style="list-style-type: none"> Transcription of all interviews Data matrices

Criteria used in coming up with the list for the case study areas:

1. Multi-hazard occurrence and level-flood (50), storm track (50), Extreme Wind (50)
2. Past Disaster Events
3. Population / Population Density
4. Geomorphology

Informants of the Interviews

1. DRRM – Various levels
2. Community Service Organizations
3. Informal sectors

Case Study Areas

Luzon: Coastal

Province: Catanduanes

Visayas: Mountainous

Province: Eastern Samar

Mindanao: Plain

Province: Surigao del Norte

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Hazard Characterization and Preliminary Risk Analysis

Dexter S. Lo, Jefferson R. Vallente Jr., Therese Rhea Rose M. Baliwag

Xavier University - Ateneo de Cagayan

Where are hazards most likely to hit?

Hazard
earthquake, storm, flood, virus, etc...

Exposure
people, properties, systems, etc...

RISK

Where (Who) are the most at risk?

Vulnerabilities (Capacities)
poverty, physical, preparedness, education, etc...



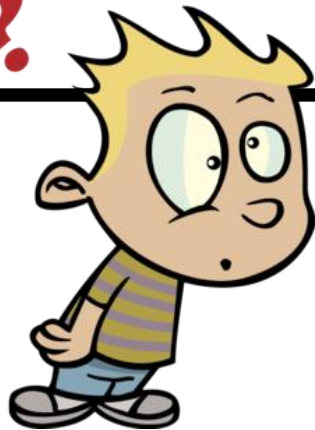
$$R = H + E + V$$

$$R = H \times E \times V \quad R = \frac{H \times V}{C}$$

$$R = H \times V - C$$

$$R = \text{Freq} \times \text{Consq}$$

$$V = f(E, S, AC)$$

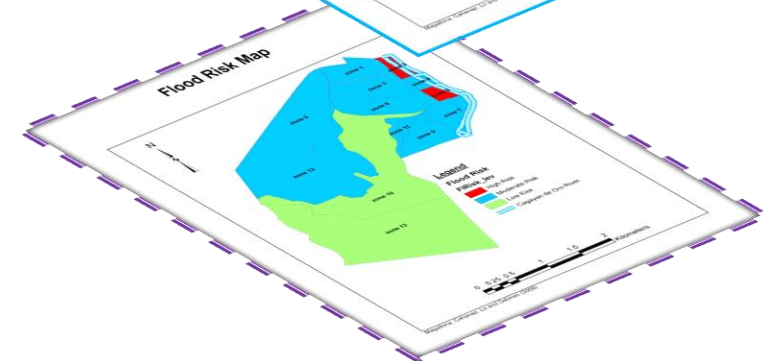
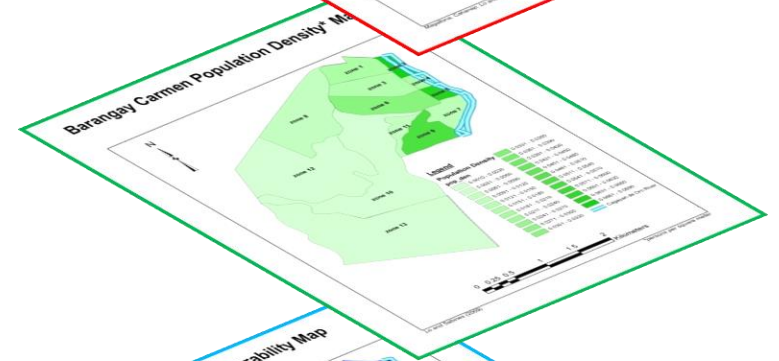
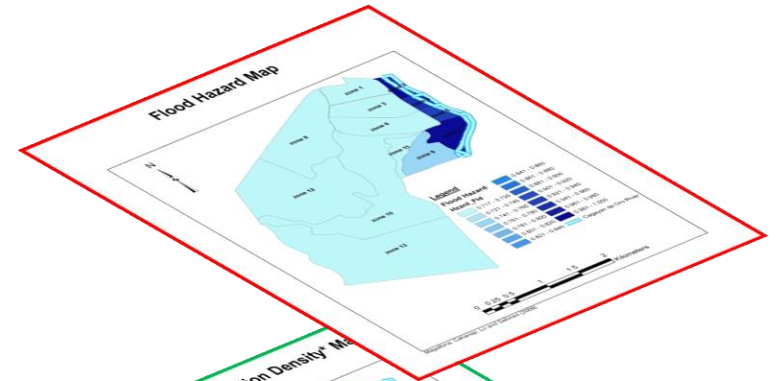


H

E

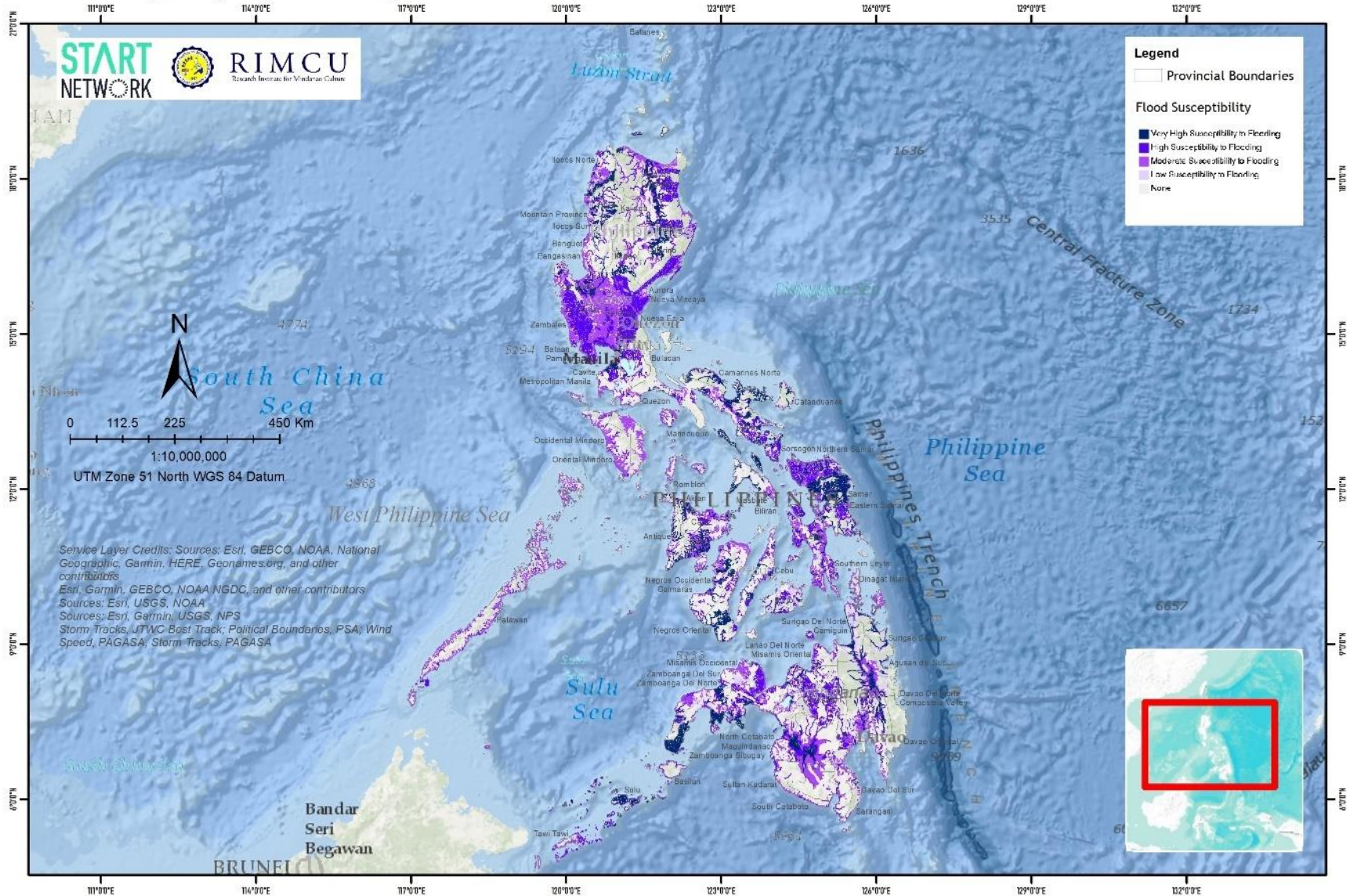
V

R



Where are the Flood-prone provinces in the Philippines?

Flood Susceptibility Map of the Philippines

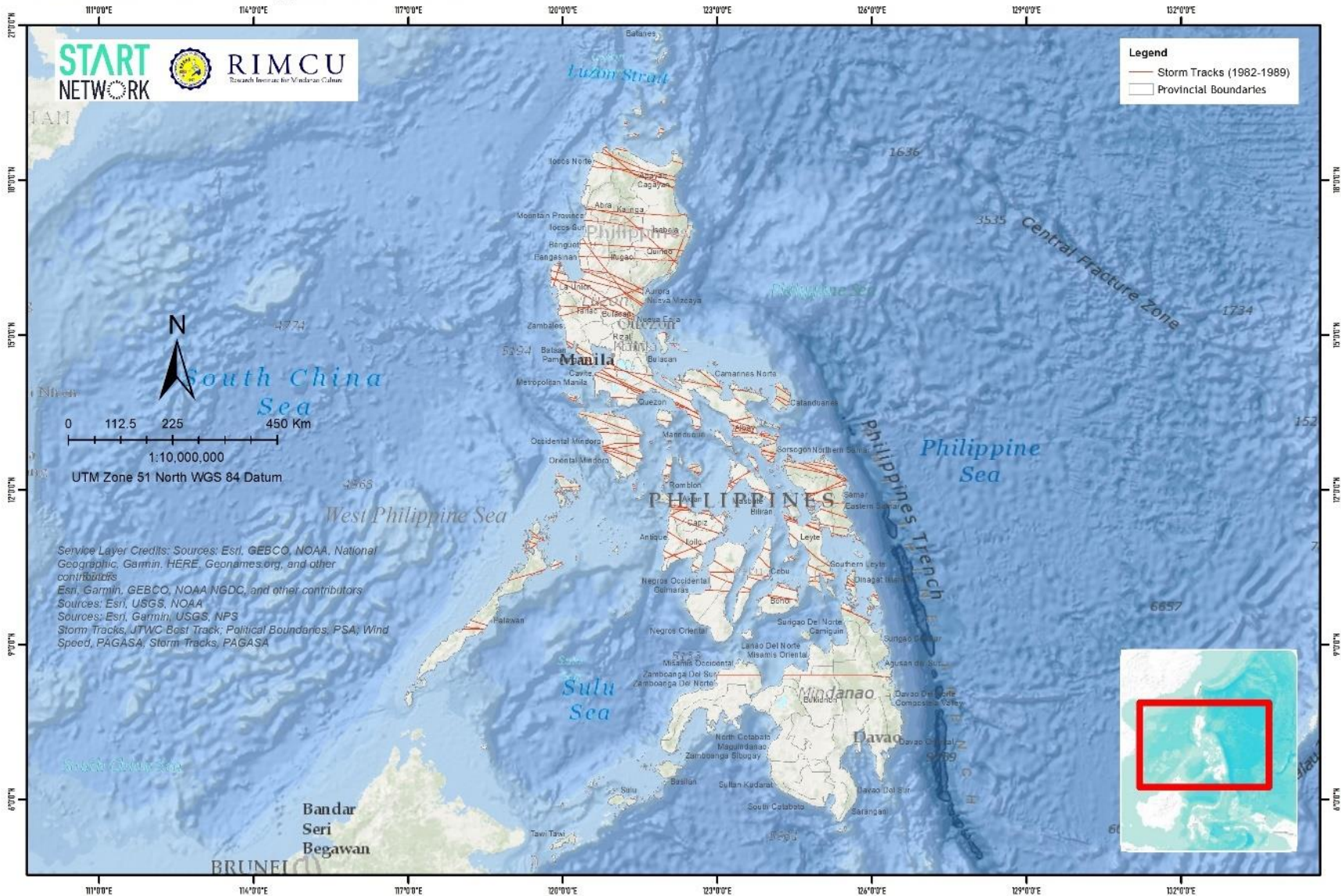


There are 52 provinces with very high* flood susceptibility rating.

**Very High - more than 2 meters flood height and/or more than 3 days flooding (MGB)*

Which provinces do Tropical Cyclones usually pass? (1982-1989)^

Storm Tracks of the Philippines (1982-1989)

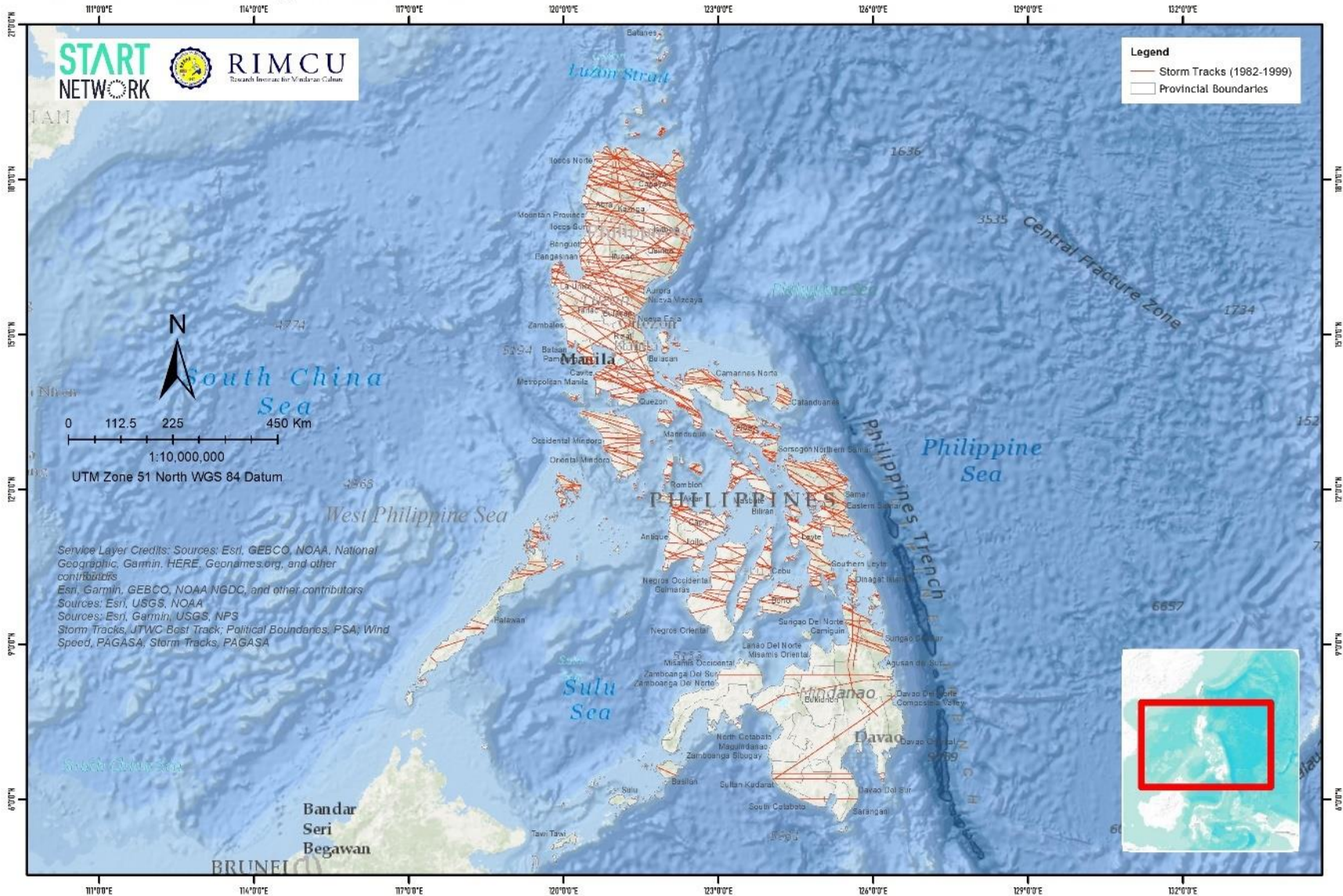


Top Provinces:

1. Palawan (Luzon)
2. Occidental Mindoro (Luzon)
3. Aurora (Luzon)
4. Masbate (Luzon)
5. Oriental Mindoro (Luzon)
6. Quezon (Luzon)
7. Antique (Visayas)
8. Cagayan (Luzon)
9. Romblon (Luzon)
10. Sorsogon (Luzon)

Which provinces do Tropical Cyclones usually pass? (1982-1999)^

Storm Tracks of the Philippines (1982-1999)

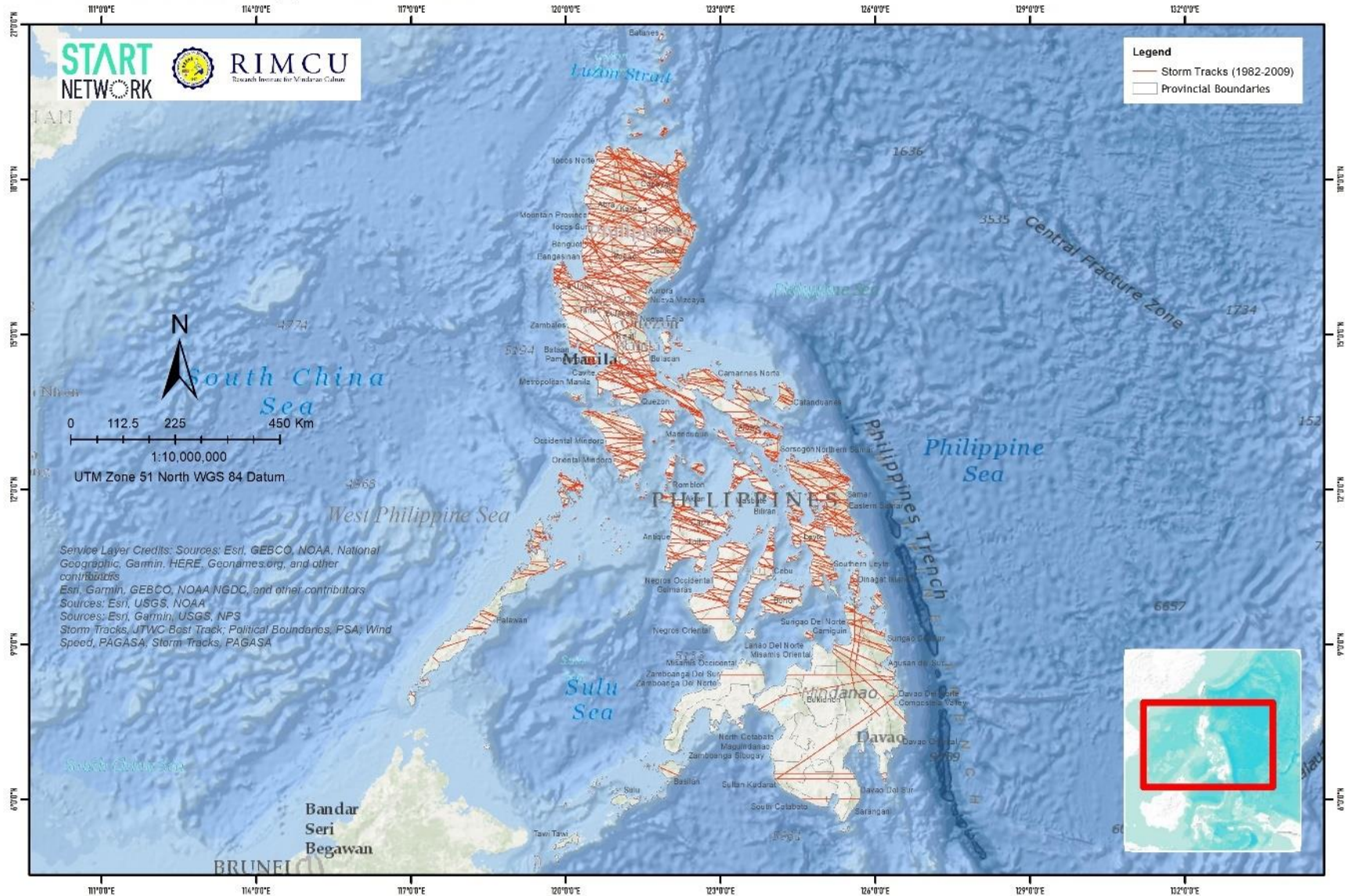


Top Provinces:

1. Cagayan (Luzon)
2. Palawan (Luzon)
3. Quezon (Luzon)
4. Masbate (Luzon)
5. Antique (Visayas)
6. Eastern Samar (Visayas)
7. Aurora (Luzon)
8. Cebu (Visayas)
9. Occidental Mindoro (Luzon)
10. Oriental Mindoro (Luzon)

Which provinces do Tropical Cyclones usually pass? (1982-2009)^

Storm Tracks of the Philippines (1982-2009)

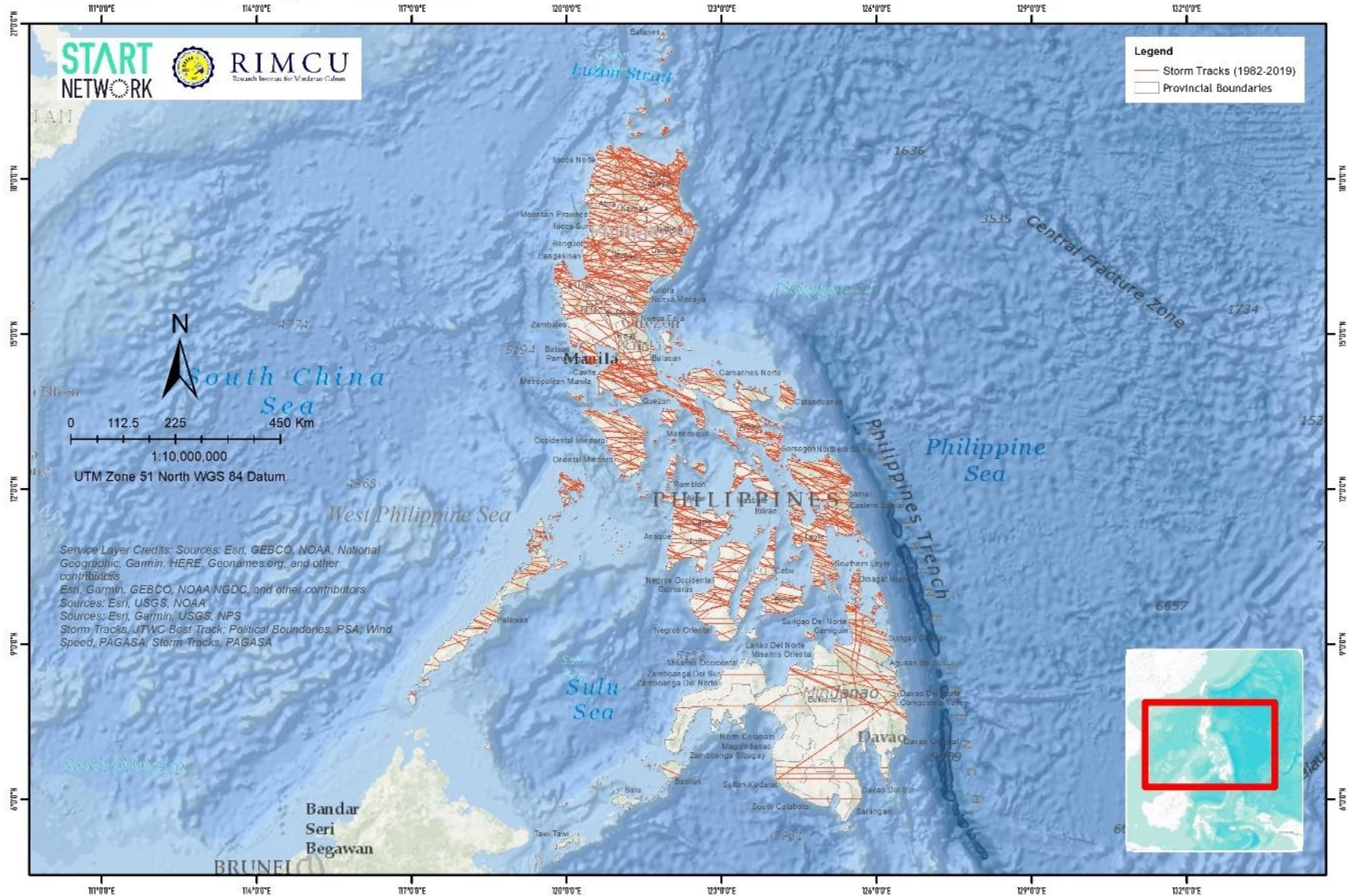


Top Provinces:

1. Cagayan (Luzon)
2. Palawan (Luzon)
3. Quezon (Luzon)
4. Antique (Visayas)
5. Eastern Samar (Visayas)
6. Cebu (Visayas)
7. Aurora (Luzon)
8. Isabela (Luzon)
9. Masbate (Luzon)
10. Occidental Mindoro (Luzon)

Which provinces do Tropical Cyclones usually pass? (1982-2019)^

Storm Tracks of the Philippines (1982-2019)

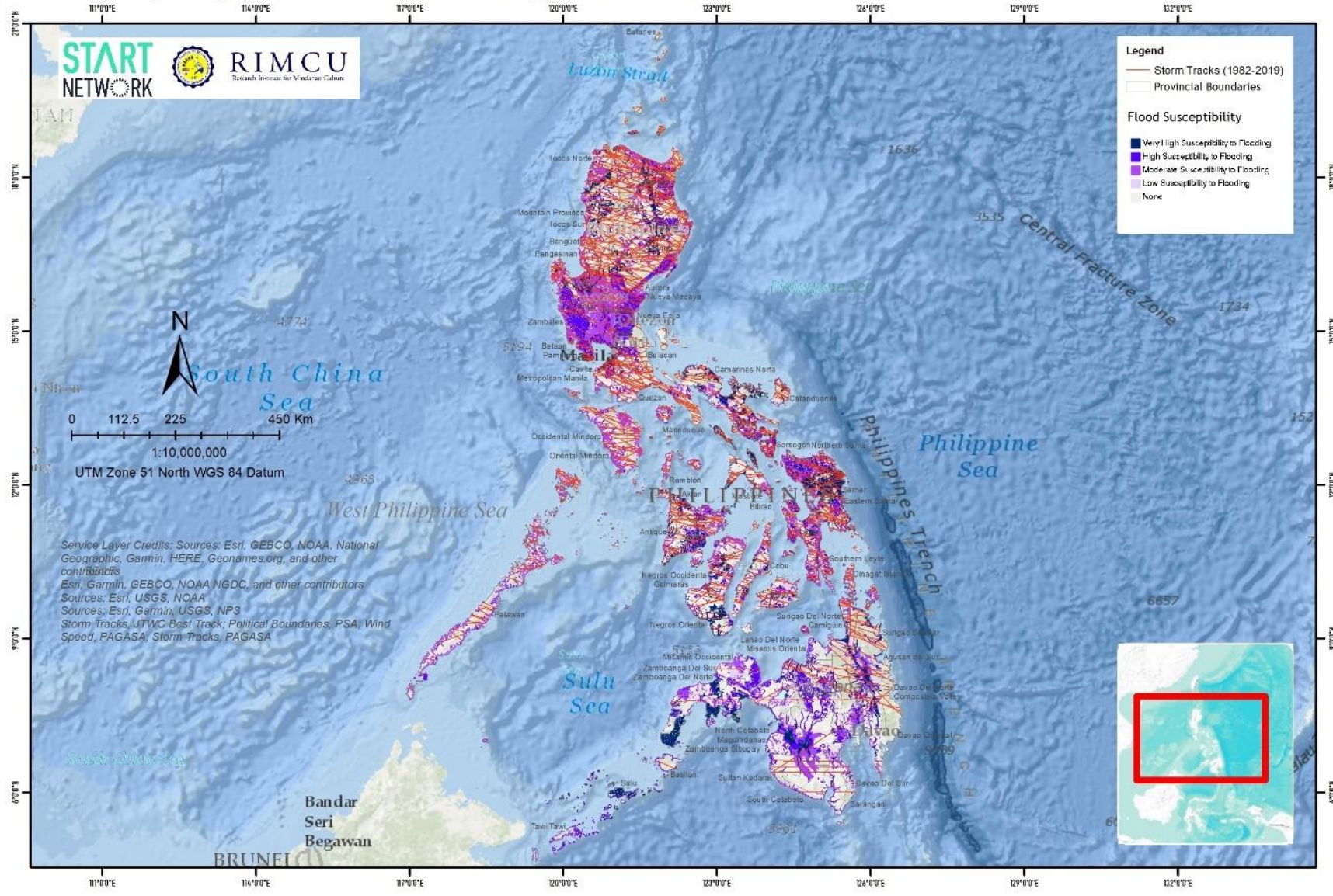


Top Provinces:

1. Cagayan (Luzon)
2. Palawan (Luzon)
3. Antique (Visayas)
4. Quezon (Luzon)
5. Eastern Samar (Visayas)
6. Cebu (Visayas)
7. Aurora (Luzon)
8. Isabela (Luzon)
9. Leyte (Visayas)
10. Occidental Mindoro (Luzon)

Flood-prone* provinces where Tropical Cyclones^ usually pass:

Flood Susceptibility and Storm Tracks of the Philippines (1982-2019)



Top 10 Provinces:

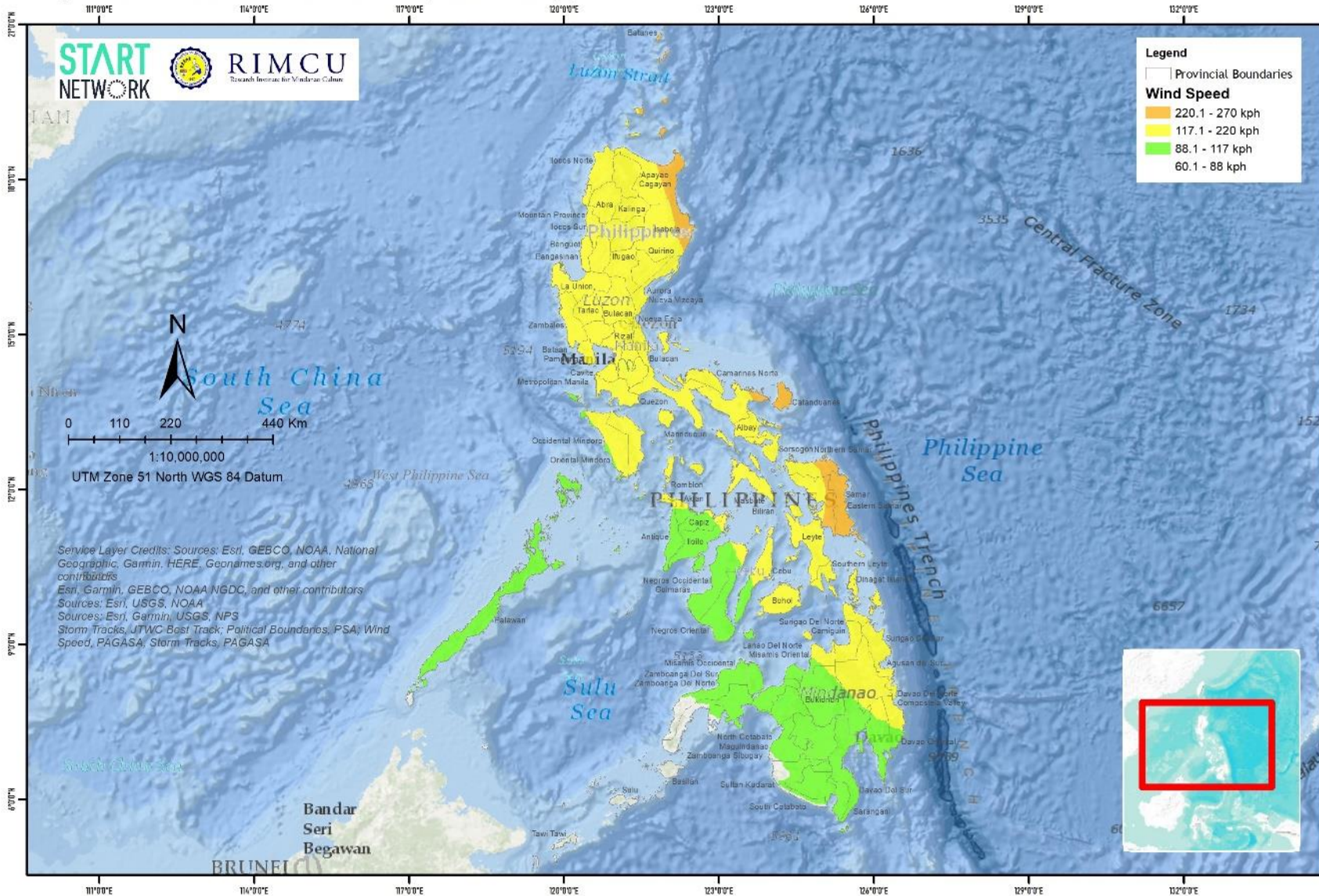
1. Antique (Visayas)
2. Quezon (Luzon)
3. Eastern Samar (Visayas)
4. Cebu (Visayas)
5. Aurora (Luzon)
6. Isabela (Luzon)
7. Leyte (Visayas)
8. Masbate (Luzon)
9. Samar (Visayas)
10. Iloilo (Visayas),
Oriental Mindoro (Luzon)

*Very High - more than 2 meters flood height and/or more than 3 days flooding (MGB)

*very high susceptible, ^1982-2019

Which provinces are exposed to Severe Winds? (20-year return period)^

20-year Return Period Severe Wind Map of the Philippines



Top Provinces:

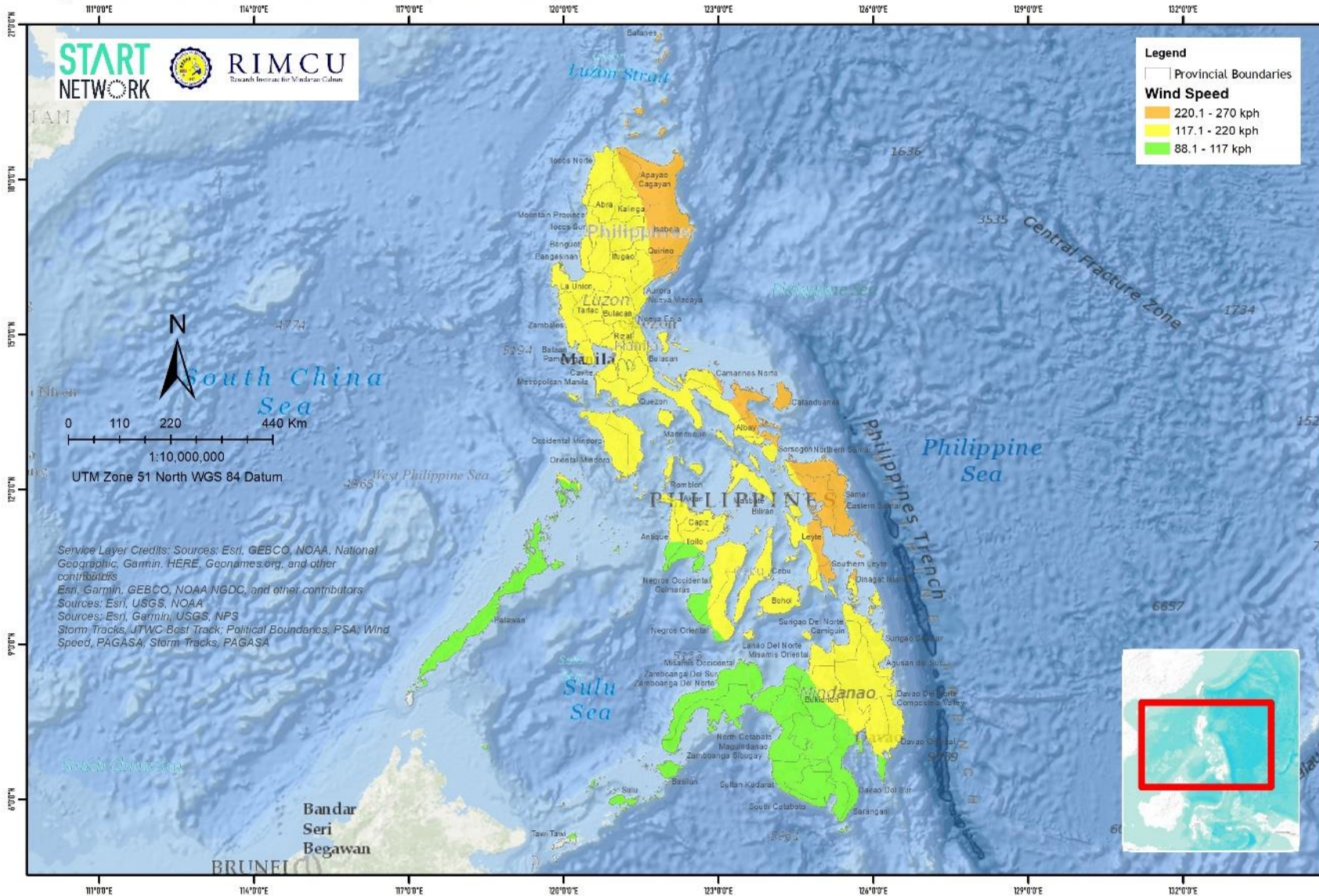
*Wind Speed: 220.1 kph - 270 kph

1. Batanes (Luzon)
2. Cagayan (Luzon)
3. Camarines Sur (Luzon)
4. Catanduanes (Luzon)
5. Eastern Samar (Visayas)
6. Northern Samar (Visayas)
7. Samar (Visayas)

Top provinces are those with wind speed rating of 220.1 kph - 270 kph; followed by 51 provinces with 117.1 kph - 220 kph wind speed.

Which provinces are exposed to Severe Winds? (50-year return period)^

50-year Return Period Severe Wind Map of the Philippines



Top Provinces:

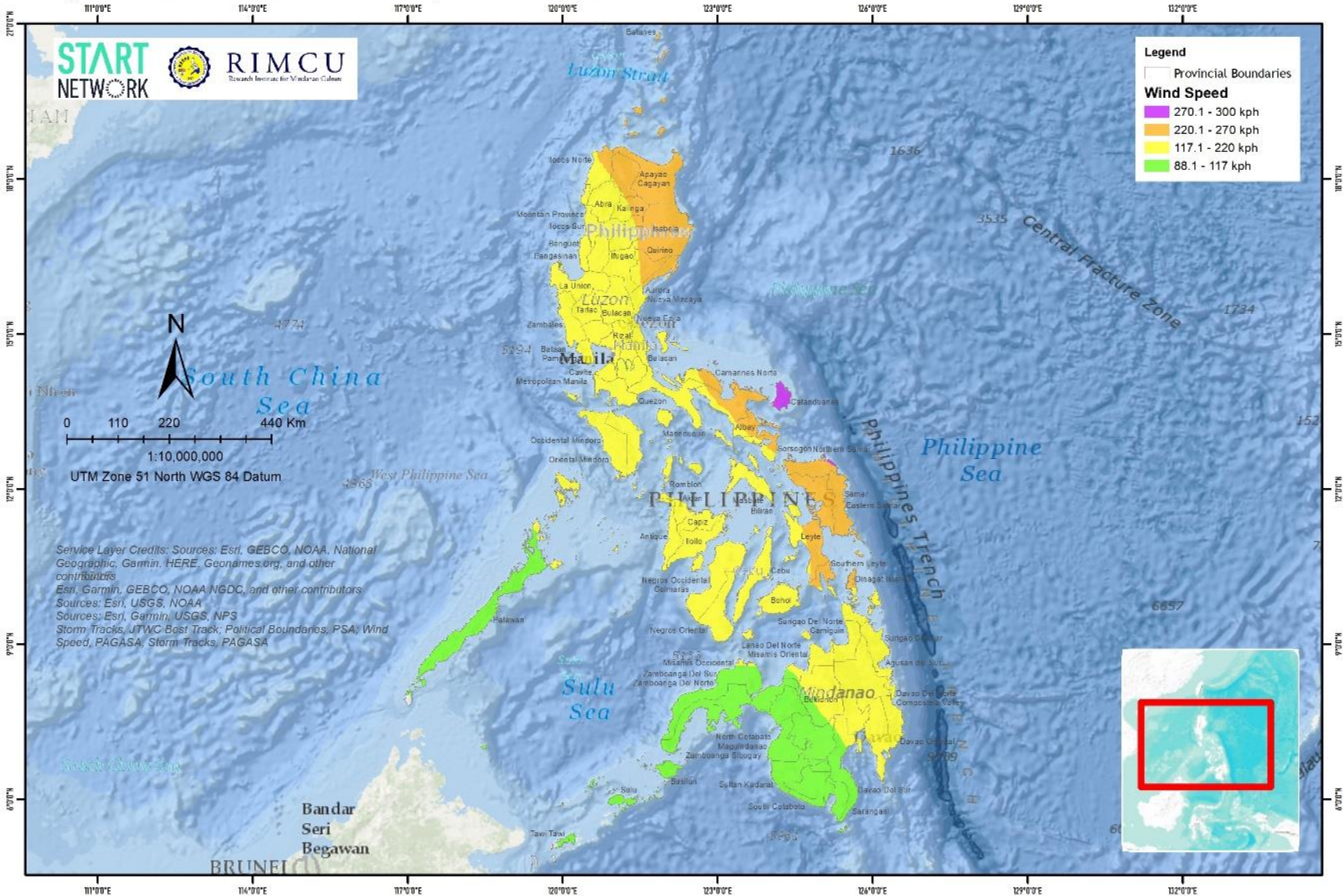
*Wind Speed: 220.1 kph - 270 kph

1. Apayao (Luzon)
2. Batanes (Luzon)
3. Cagayan (Luzon)
4. Isabela (Luzon)
5. Quirino (Luzon)
6. Aurora (Luzon)
7. Albay (Luzon)
8. Camarines Norte (Luzon)
9. Camarines Sur (Luzon)
10. Catanduanes (Luzon)
11. Sorsogon (Luzon)
12. Eastern Samar (Visayas)
13. Leyte (Visayas)
14. Northern Samar (Visayas)
15. Samar (Visayas)
16. Southern Leyte (Visayas)
17. Dinagat Islands (Mindanao)

Top provinces are those with wind speed rating of 220.1 kph - 270 kph.

Which provinces are exposed to Severe Winds? (100-year return period)^

100-year Return Period Severe Wind Map of the Philippines



Top Province:

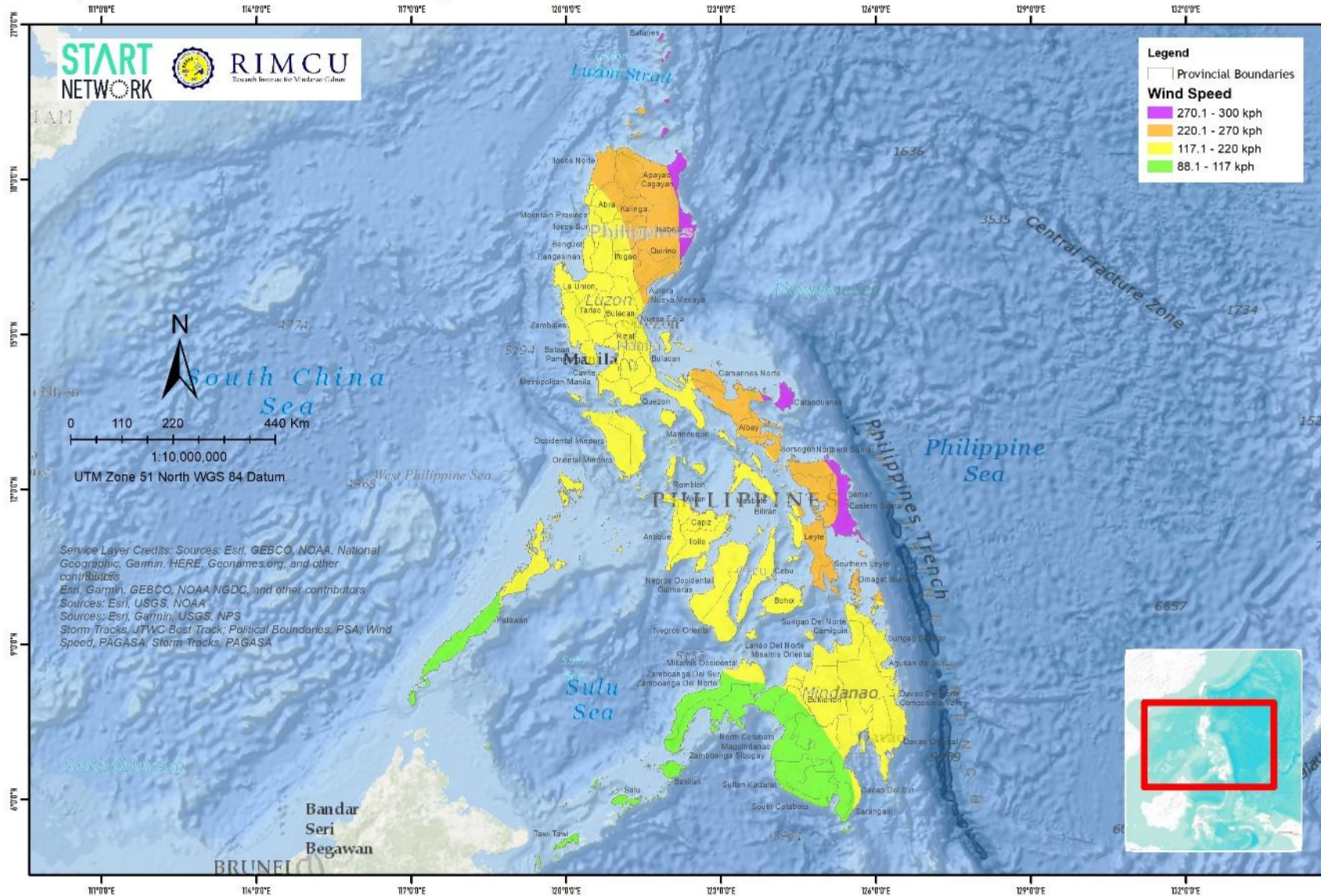
*Wind Speed: 270.1 – 300 kph

1. Catanduanes (Luzon)

Top province is with wind speed rating of 270.1 - 300; followed by 21 provinces with 220.1 kph - 270 kph wind speed.

Which provinces are exposed to Severe Winds? (200-year return period)^

200-year Return Period Severe Wind Map of the Philippines



Top Provinces:

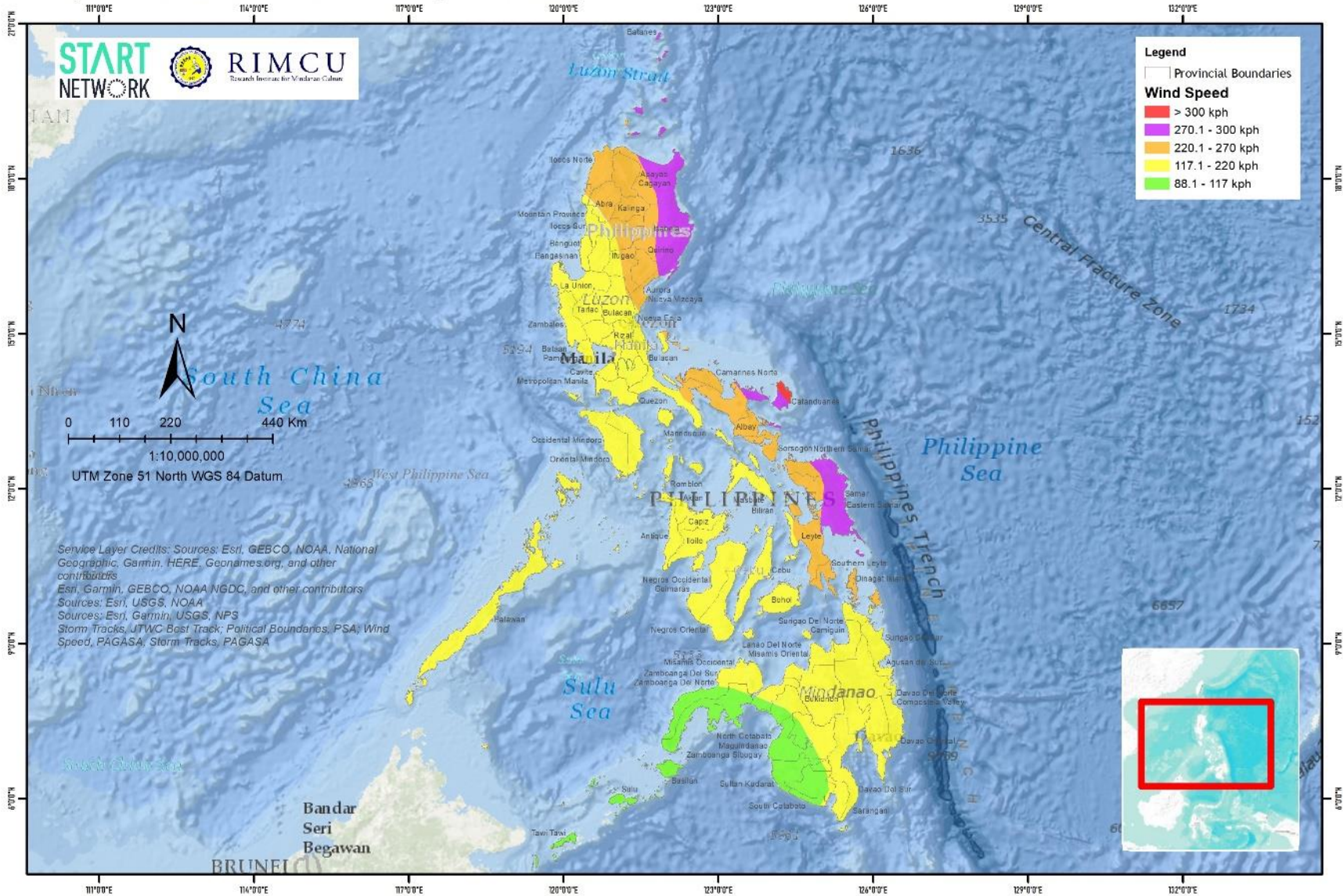
*Wind Speed: 270.1 – 300 kph

1. Batanes (Luzon)
2. Cagayan (Luzon)
3. Isabela (Luzon)
4. Camarines Sur (Luzon)
5. Catanduanes (Luzon)
6. Eastern Samar (Visayas)
7. Samar (Visayas)

Top provinces are those with wind speed rating of **270.1 – 300 kph**; followed by 18 provinces with 220.1 kph - 270 kph wind speed.

Which provinces are exposed to Severe Winds? (500-year return period)^

500-year Return Period Severe Wind Map of the Philippines



Top Provinces:

***Wind Speed: >300 wind speed**

1. Catanduanes (Luzon)

***Wind Speed: 270.1 – 300 kph**

2. Batanes (Luzon)

3. Cagayan (Luzon)

4. Isabela (Luzon)

5. Aurora (Luzon)

6. Camarines Sur (Luzon)

7. Eastern Samar (Visayas)

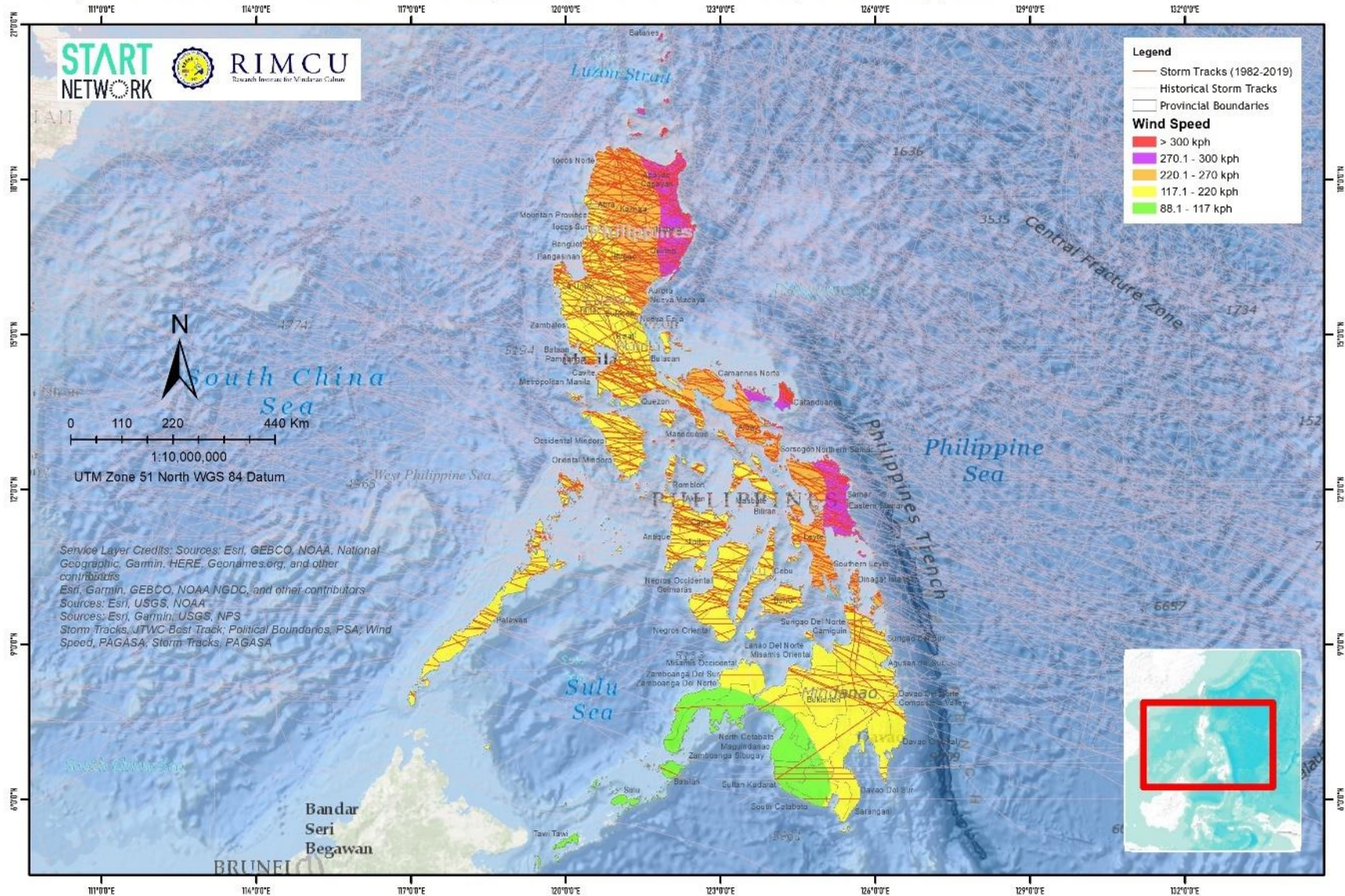
8. Leyte (Visayas)

9. Northern Samar (Visayas)

10. Samar (Visayas)

Provinces where Severe Winds* and Tropical Cyclones^ may occur:

500-year Return Period Severe Wind with Tropical Cyclones (1982-2019) Map of the Philippines

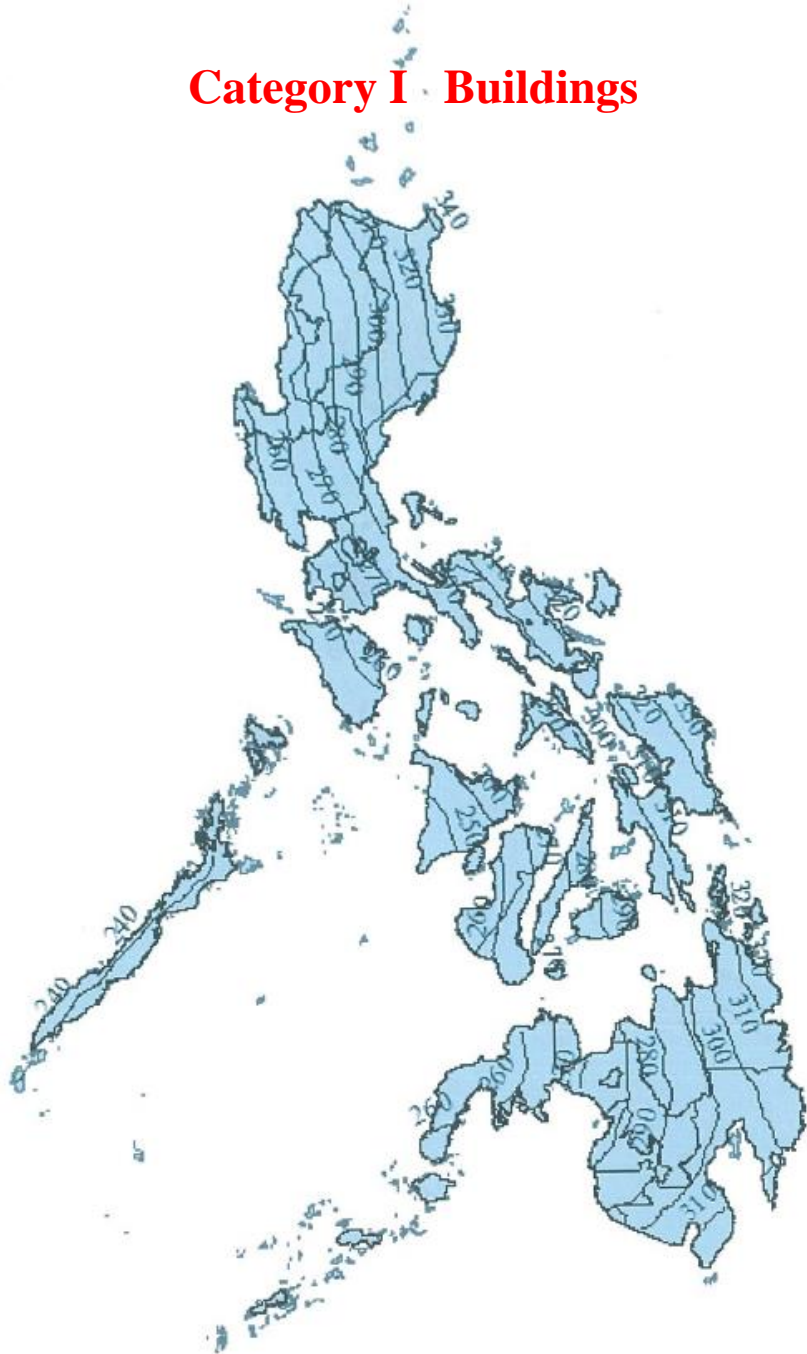


Top Provinces:

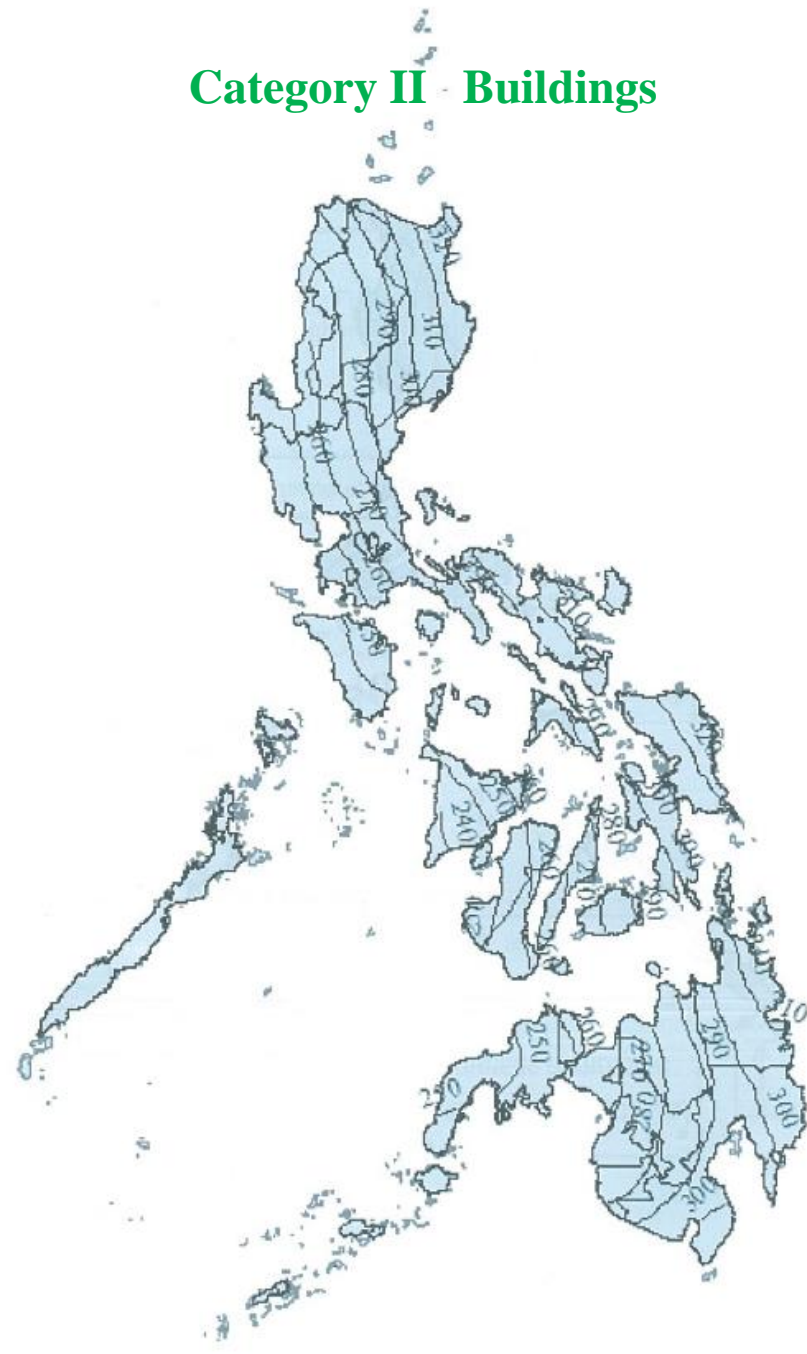
1. Cagayan (Luzon)
2. Eastern Samar (Visayas)
3. Aurora (Luzon)
4. Isabelita (Luzon)
5. Leyte (Visayas)
6. Samar (Visayas)
7. Nueva Vizcaya (Luzon)
8. Apayao (Luzon)
9. Albay (Luzon)
10. Ilocos Norte (Luzon)

*500-year, ^1982-2019

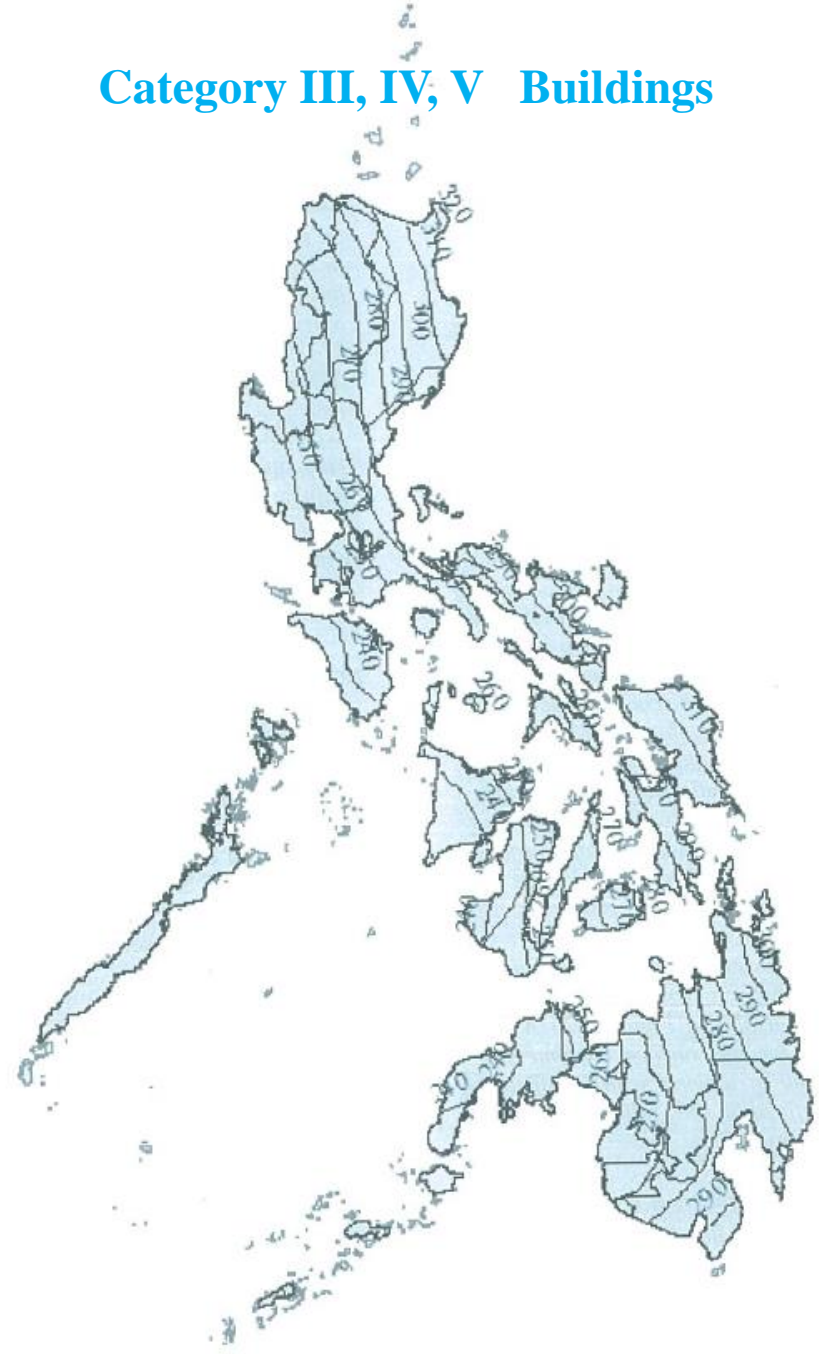
Category I Buildings



Category II Buildings

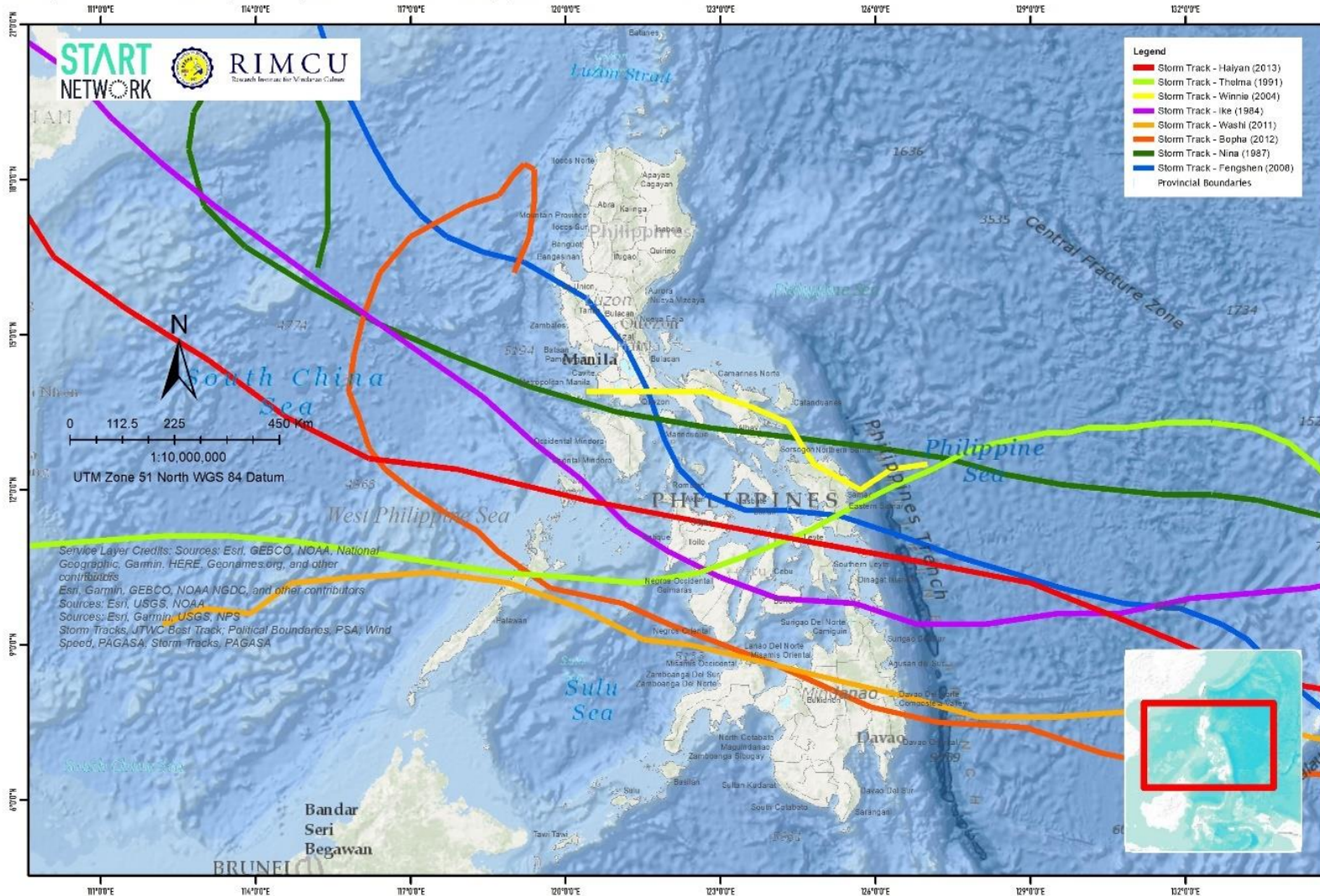


Category III, IV, V Buildings



Top 10 Deadliest Weather-related Disasters in the Philippines (*1970-2020)

Top 10 Deadliest Tropical Cyclones in the Philippines (1970-2020)

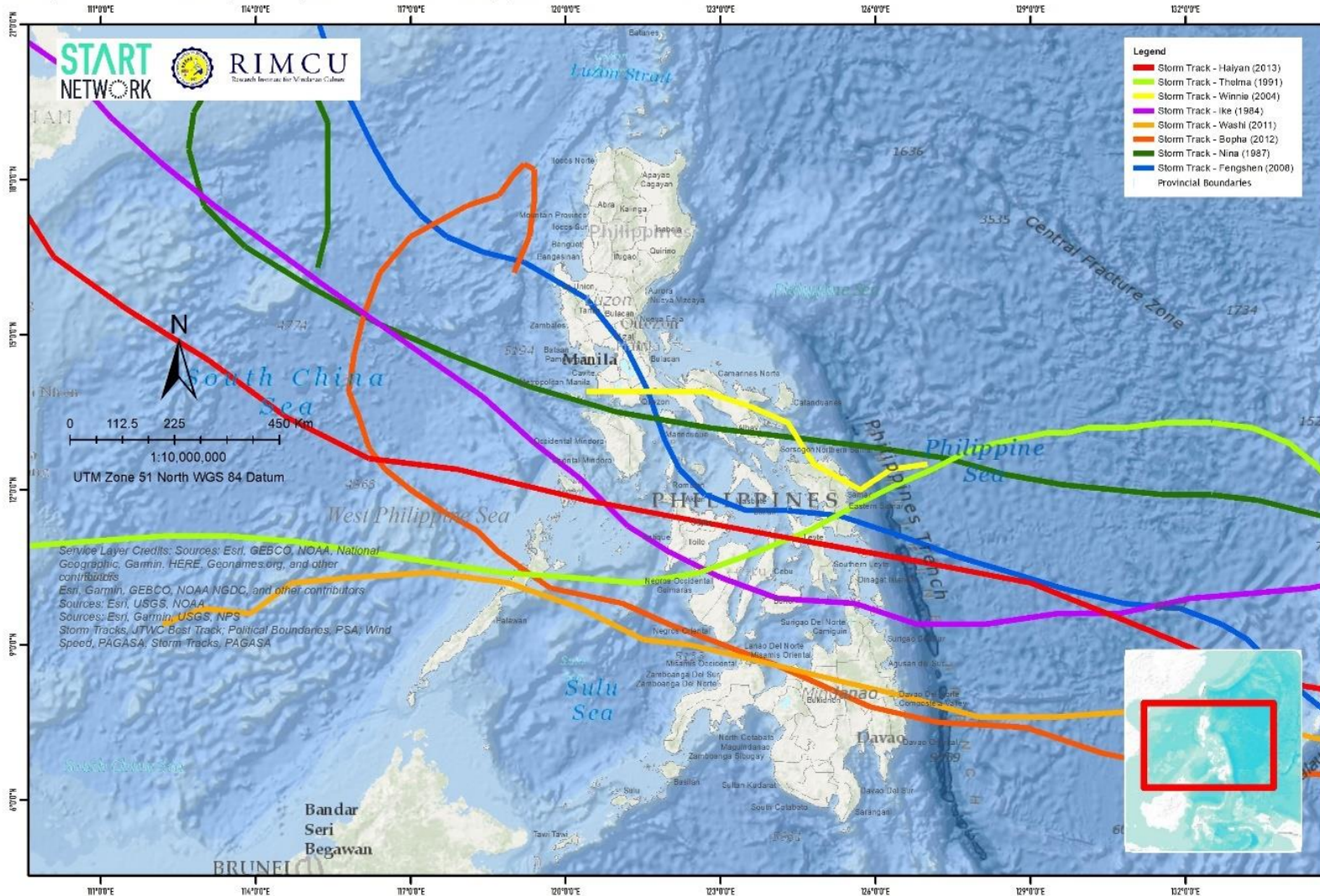


	Typhoon	Casualty	Areas Affected	Year
1	*Haiphong	20,000	Northern part of PH	1881
2	Haiyan (Yolanda)	6,300	Leyte, Samar, Eastern Samar, Iloilo	2013
3	Thelma (Uring)	5,101	Leyte, Negros Occidental	1991
4	*Angela	1,800	Catanduanes, Abra	1867
5	TD Winnie	1,600	Quezon, Aurora, Rizal	2004

Provinces in red font are those that are also in top 10 Provinces with Very High Flood susceptibility-Tropical Cyclone and 10 Provinces with Very High Severe Winds-Tropical Cyclone

Top 10 Deadliest Weather-related Disasters in the Philippines (*1970-2020)

Top 10 Deadliest Tropical Cyclones in the Philippines (1970-2020)

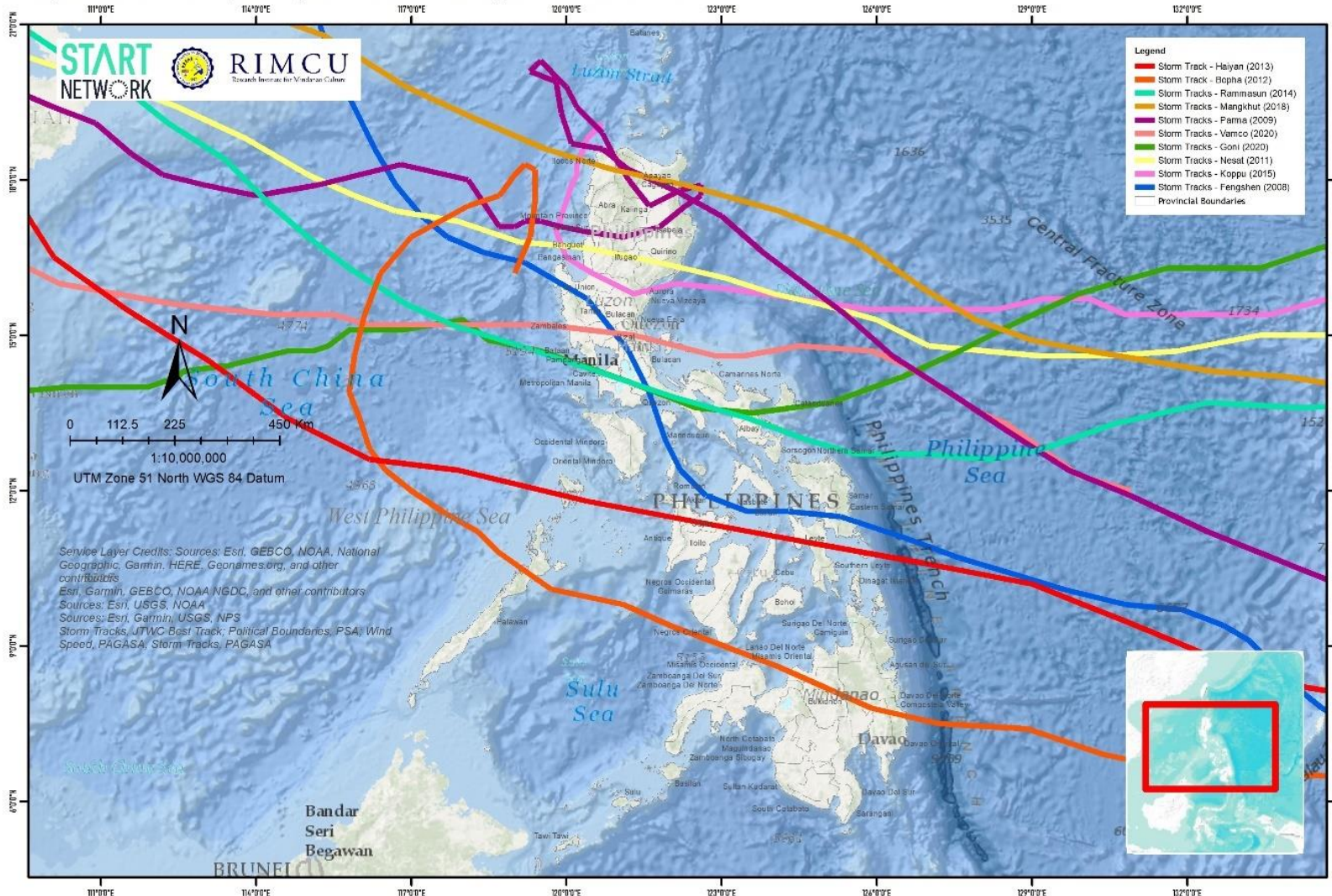


	Typhoon	Casualty	Areas Affected	Year
6	Ike (Nitang)	1,363	Surigao del Norte, Bohol, Negros Occidental	1984
7	Washi (Sendong)	1,268	Lanao del Norte, Misamis Oriental	2011
8	Bopha (Pablo)	1,248	Davao Oriental, Compostela Valley	2012
9	Nina (Sisang)	979	Albay, Sorsogon, Camarines Sur	1987
10	Fengshen (Frank)	938	Iloilo, Capiz, Aklan, Antique, Leyte, Eastern Samar	2008

Provinces in red font are those that are also in top 10 Provinces with Very High Flood susceptibility-Tropical Cyclone and 10 Provinces with Very High Severe Winds-Tropical Cyclone

Top 10 Costliest Weather-related Disasters in the Philippines (1970-2020)

Top 10 Costliest Tropical Cyclones in the Philippines (1970-2020)

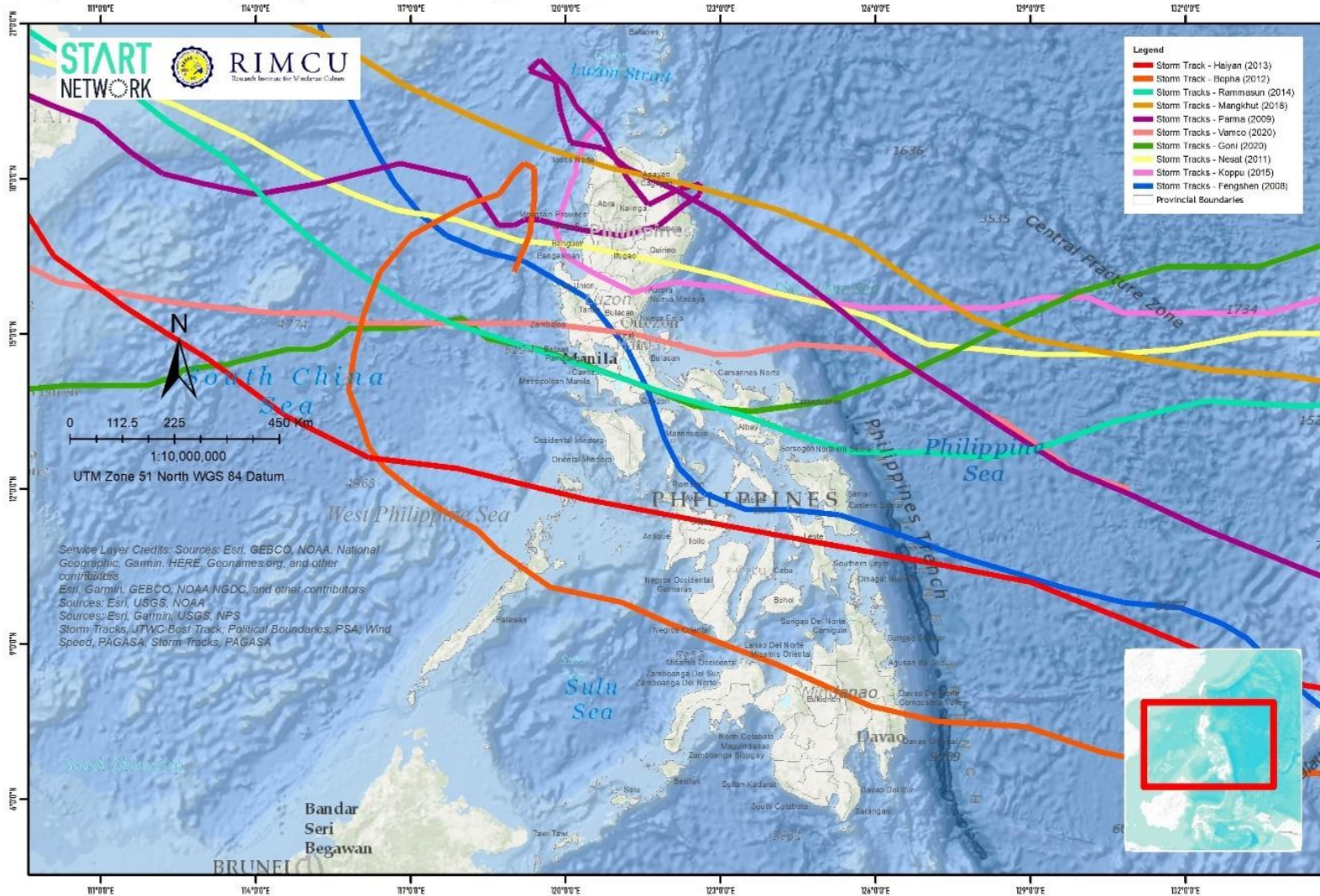


	Typhoon	Cost of Damages	Areas Affected	Year
1	Haiyan (Yolanda)	95.5B	Eastern Samar, Leyte, Western Samar, Biliran, Southern Leyte	2013
2	Bopha (Pablo)	43.2B	Albay, Camarines Sur, Catanduanes	2012
3	Rammasun (Glenda)	38.6B	Quezon, Sorsogon, Camarines Sur, Albay	2014
4	Mangkhut	33.9B	Isabela, Cagayan, Tarlac	2018
5	Parma (Pepeng)	27.3B	Camarines Norte, Camarines Sur, Catanduanes	2009

Provinces in red font are those that are also in top 10 Provinces with Very High Flood susceptibility-Tropical Cyclone and 10 Provinces with Very High Severe Winds-Tropical Cyclone

Top 10 Costliest Weather-related Disasters in the Philippines (1970-2020)

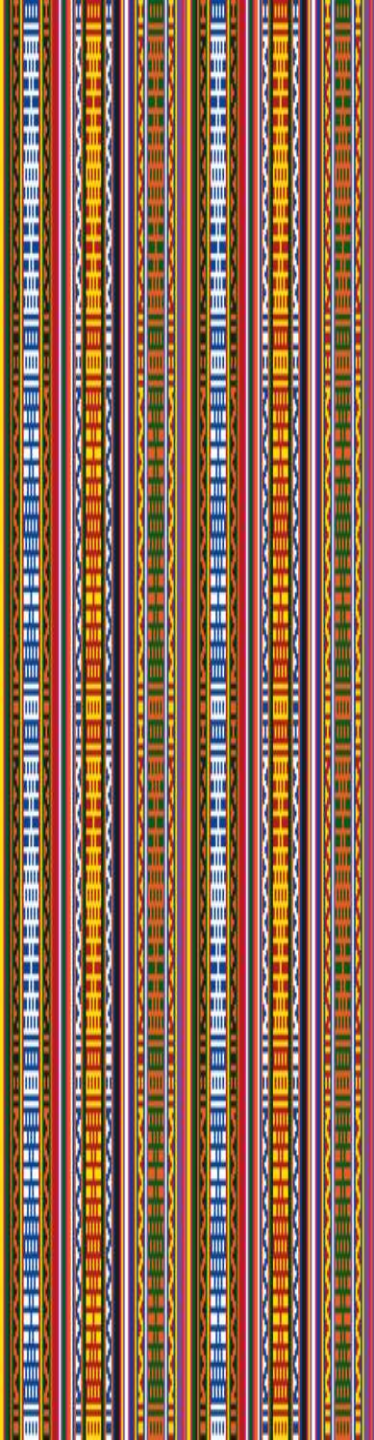
Top 10 Costliest Tropical Cyclones in the Philippines (1970-2020)



	Typhoon	Cost of Damages	Areas Affected	Year
6	Vamco (Ulysses)	19.3 B	Isabela, Quezon, Pangasinan	2020
7	Goni (Rolly)	17.9B	Albay, Camarines Sur, Catanduanes, Quezon, Batangas	2020
8	Nesat (Pedring)	15.6B	Nueva Ecija, Bulacan, Pampanga	2011
9	Koppu (Lando)	14.4B	Pangasinan, Nueva Ecija, Tarlac	2015
10	Fengshen (Frank)	12.3B	Region VI, Region IV-B, Region VIII	2008

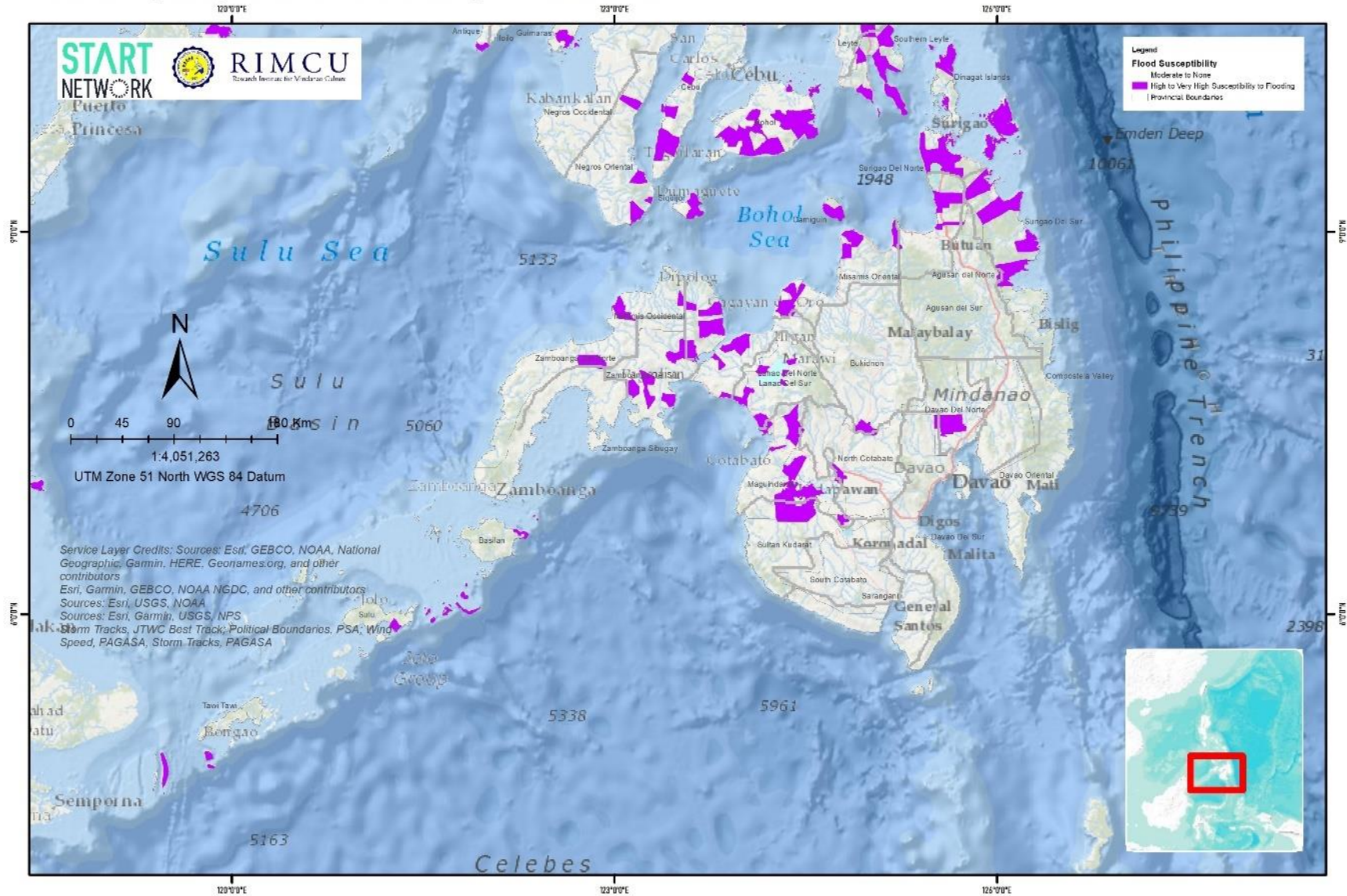
Provinces in red font are those that are also in top 10 Provinces with Very High Flood susceptibility-Tropical Cyclone and 10 Provinces with Very High Severe Winds-Tropical Cyclone

*How about
Mindanao?*



Where are the Flood-prone*, 4th-6th class municipalities in Mindanao?

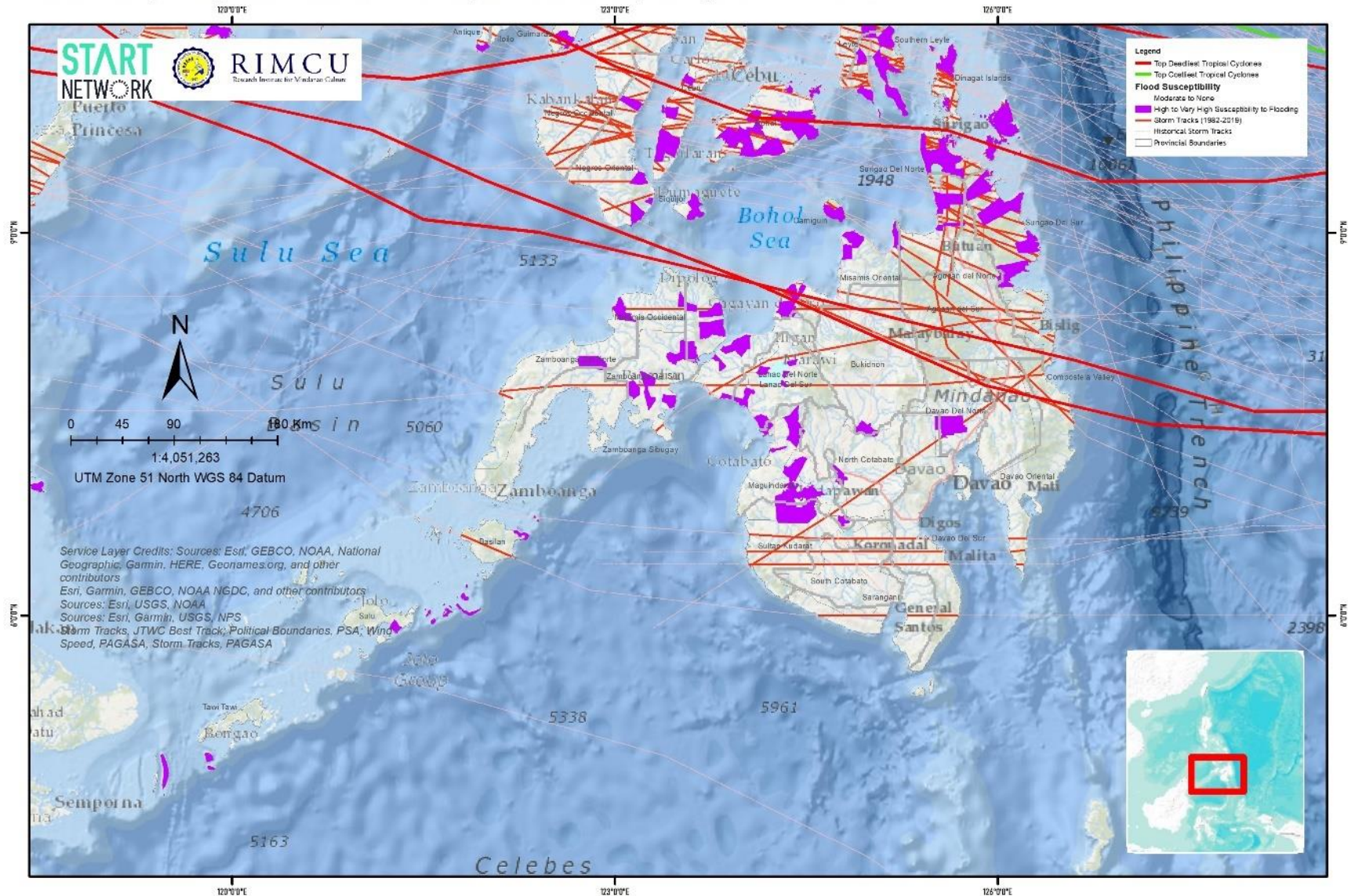
Flood Susceptibility of 4th-6th Class Municipalities in Mindanao



*very high - susceptible

Where are the Flood-prone*, 4th-6th class municipalities in Mindanao?

Flood Susceptibility of 4th-6th Class Municipalities with Tropical Cyclones in Mindanao



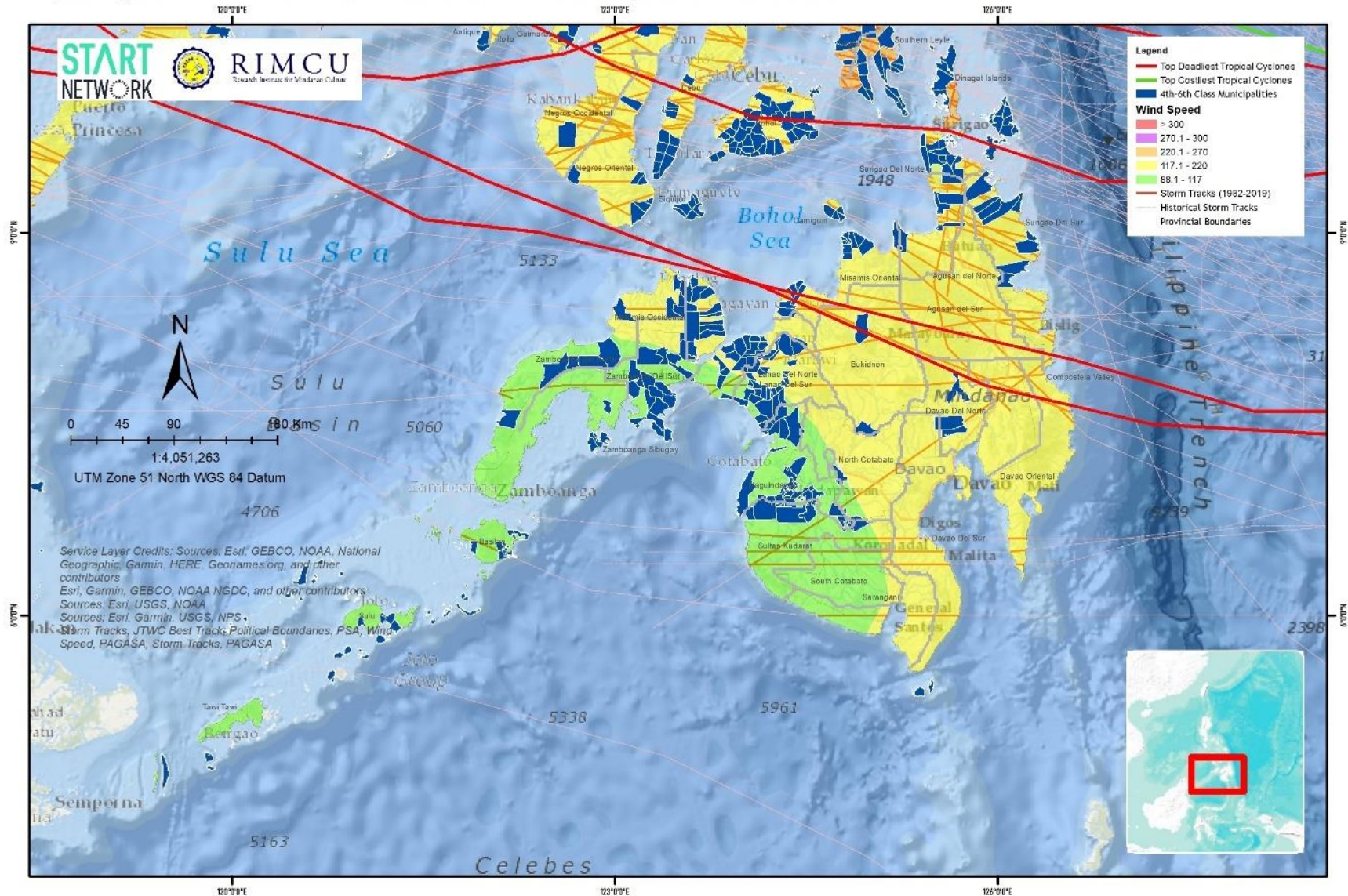
Do Tropical Cyclones[^] usually pass by these area?

*Are they in provinces that experienced the **Deadliest** or **Costliest** weather-related disasters?*

*very high - susceptible, ^1982-2019

How about Severe Winds*? (4th-6th class municipalities in Mindanao)

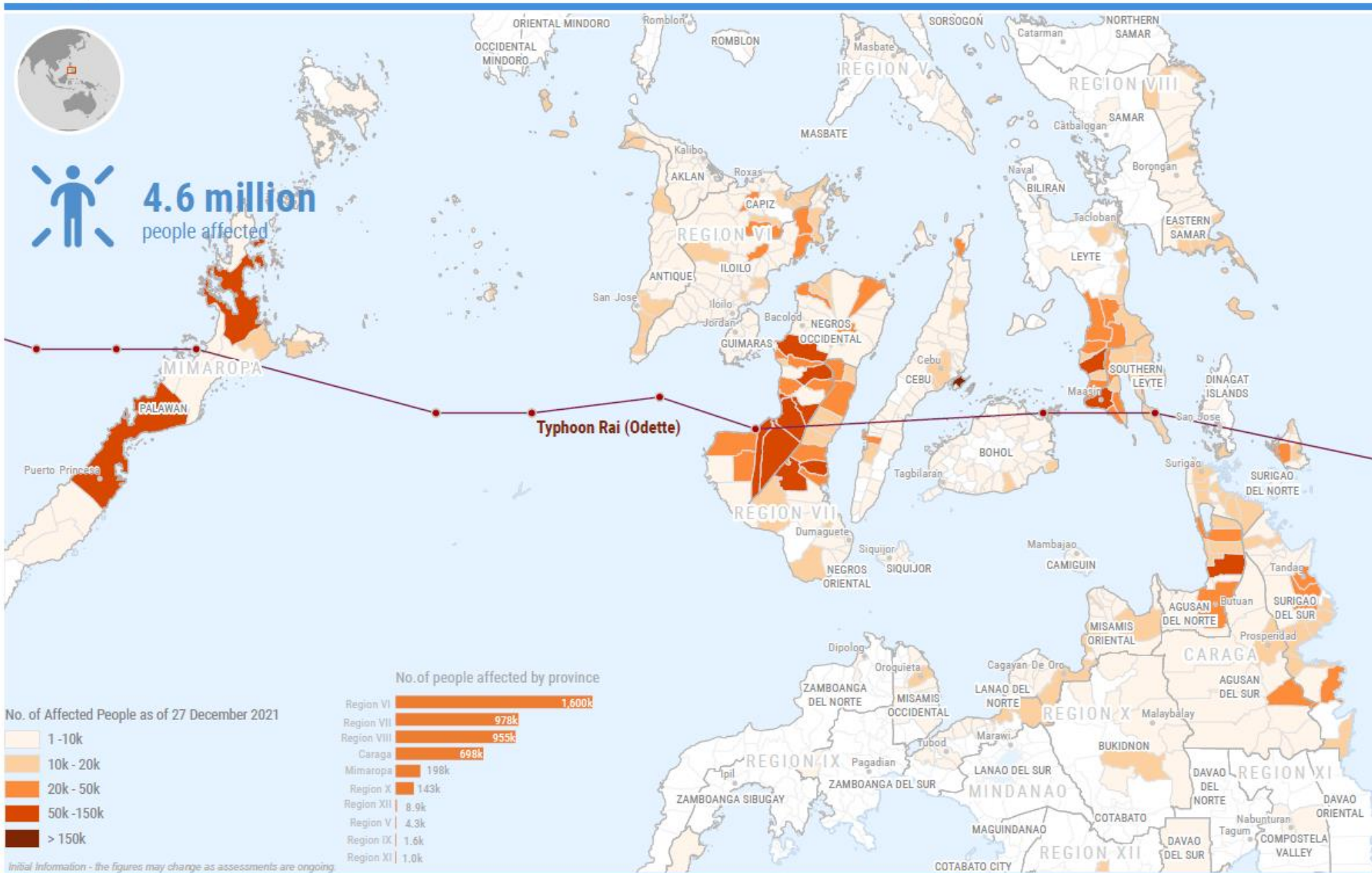
Tropical Cyclones and Severe Winds of 4th-6th Class Municipalities in Mindanao



Do Tropical Cyclones[^] usually pass by these area?

*Are they in provinces that experienced the **Deadliest** or **Costliest** weather-related disasters?*

*500-year, ^1982-2019



Luzon: Profile of Catanduanes Province



- The 100-year return period for severe winds shows Catanduanes as the only province that may experience a maximum wind speed of 270.1 - 300kph.
- The 500-year return period shows that only the province of Catanduanes is likely to experience a maximum wind speed of over 300 kph
- Experienced one of the Top 10 Deadliest Weather-related Disasters in the Philippines (1867)
- Experienced two of the top 10 costliest Weather-related Disasters in the Philippines (1970-2019) (2009, 2020)
- **Interviewed: PDRRMO, MDRRMO, K of C, Tau Gamma, Barangay Councilor, Youth Sector Representative**

Visayas: Profile of Eastern Samar Province



- Classified as high susceptibility to flooding (i.e., likely to experience flood heights of more than one meter and/or flood duration of more than three days)
- Classified as frequently visited by Tropical Cyclones
- Then for a 200-year return period, the province of Eastern Samar, and Samar may experience a maximum wind speed of 270.1 - 300kph.
- Experienced two of the Top 10 Deadliest Weather-related Disasters in the Philippines (1970-2019) (2008, 2013)
- Experienced two of the top 10 costliest Weather-related Disasters in the Philippines (1970-2019) (2008, 2013)

Informants from: PSWD, MPDC, Barangay Chairperson, CSO, Rep of informal Sector

Mindanao: Profile of Surigao del Norte Province



- Strong typhoons hit the province in the 80's
- Experienced one of the Top 10 Deadliest Weather-related Disasters in the Philippines (1984)
- Past 10 years only encountered LPAs, ITCZ and typhoons; though did not directly hit the province, still brought devastation to the communities
- Classified as high susceptibility to flooding (i.e. likely to experience flood heights of more than one meter and/or flood duration of more than three days)

Informants: PDRRMO, MDRRMO, Barangay Chairperson, Barangay CSO (Women's organisation), Community Relations Officer of a Mining company

VIEWS OF INFORMANTS

Tier 2 – Comps 2 & 3

Devastating tropical cyclones,
Vulnerability factors, community-based coping mechanisms,
and response mechanisms

Catanduanes: Top 3 most devastating TCs in the past 10 years

Tropical cyclones	Why devastating
Super typhoon Goni or Rolly (2020)	Powerful tropical cyclone characterized by strong winds, causing storm surge, heavy rains, and severe flooding; brought havoc to the locality
Super typhoon Nock-ten or Nina (2016)	Caused injuries when people fell off the roof while repairing their house
Typhoon Molave or Quinta (2020)	Brought havoc to the locality, seven lives were lost, caused physical injuries to residents

Catanduanes: Vulnerabilities - Who and why

Sectors	Reasons
Farmers	Lose of income; reliance on relief assistance
Fisherfolks	Lose of income; reliance on relief assistance
Business sector	Transport goods via sea; struggle in recovering income
Elderly	Access to basic and health services affected; refuses to evacuate; worry over belongings
Children	Susceptible to illness; traumatised

Catanduanes: Cross-sectoral issues

Issue	Reasons
Gender-based violence	Disruption with livelihood and provision for the family; when people have nothing to do ('an opportunity for evil to work').
Malnutrition	Needs of the children are not given attention
Food insecurity	Occurs if unable to access mainland Catanduanes after days and weeks; businesspeople cannot buy their supplies; delays of distribution happen with the impassable roads as aftermaths of typhoons.
Exclusions	In relief distributions, due to favoritism, or the " <i>padrino</i> " system

Catanduanes: Community-based coping mechanisms

Mechanisms	What else can be done?
Construction of flood control/mitigating structures (e.g. drainage canals, seawalls)	For the sustainability of infrastructure projects to mitigate the destructive impact of tropical cyclones, more considerable funding is needed to build concrete/sturdy seawalls, flood canals, and other structures.
Identification of LGUs of evacuation houses (i.e. houses made of concrete materials)	Funding for an evacuation centre
GAD spaces/GAD conscious	GAD-related mechanisms to cascade to other municipalities and barangays
CSO conduct relief efforts; voluntary assistance	Maximising these efforts in the context of COVID-19

Eastern Samar: Top 3 most devastating TCs in the past 10 years

Tropical cyclones	Why devastating
Typhoon Hagupit or Ruby (2014)	<i>'What happened during [TC] Ruby was painful because it brought immense damage... It rained for almost two days.'</i>
Super typhoon Haiyan or Yolanda (2013)	Losses of properties, including agricultural assets, and damages to infrastructure and agricultural products
Typhoon Surigae or Bising (2021)	<i>'It was difficult at the time of Bising because of the pandemic. It was hard for people to help others due to COVID.'</i>

Eastern Samar: Vulnerabilities -Who and why

Sector	Reasons
Elderly	Difficulty in mobility
PWDs	Difficulty in mobility
Children	Difficulty in mobility

Eastern Samar: Cross-sectoral issues

Issue	Reasons
Gender-based violence	GBV cases happen when men cannot provide for their families, and their wives expect it from men
Malnutrition	Occurs as families depend on food packs that often contain canned sardines and instant noodles
Food insecurity	Occurs as food sources are imported from other places; with typhoons, the entry of these food sources is delayed.

Eastern Samar: Community-based coping mechanisms

Mechanisms	What else can be done?
Preparing, responding, and coping with the aftermaths of TCs are routinary activities	<ul style="list-style-type: none"> • Access to food relief • Locating people with the mindset of going beyond 'disaster preparedness'
Leaving fate to God when typhoons happen	Working on the 'getting accustomed' & 'acceptance of the situation' attitude
Evacuation (a contentious matter)	<ul style="list-style-type: none"> • Working on the 'getting accustomed' & 'acceptance of the situation' attitude • The construction of appropriate evacuation centres within barangays/municipalities • Evacuation in the context of a pandemic
Disaster preparedness	Engaged with the four thematic areas of DRRM

Surigao del Norte: Top 3 most devastating TCs in the past 10 years

Tropical cyclones	Why devastating
Tropical Storm Dujuan or Auring (2021)	People got scared of the strong wind; worried that they have nowhere to go if the water will rise
Tropical Storm Sanba or Basyang (2018)	There were flash floods, 205 barangays were affected with flood and several moderate landslides, which resulted in the increase of IDPs
Tropical Storm Krovanh or Vicky (2020)	124 households evacuated and stayed in the evacuation centre for two nights

Surigao del Norte: Vulnerabilities - Who and why

Sector	Reasons
Fisherfolks	Unable to work
Farmers	Damaged crops
Elderly	Difficulty in mobility

Surigao del Norte: Cross-sectoral issues

Issue	Reasons
Prioritisation with the distribution of relief assistance	Evacuees staying in the evacuation centres were prioritized over those outside in terms of the distribution of food packs
Poverty	Loss of income of poor households
Food insecurity	Loss of the main source of income triggers food insecurity in the households

Surigao del Norte: Community-based coping mechanisms

Mechanisms	What else can be done?
Evacuation: Go' bags that contained clothing, essential documents, food, and health kits	Constructing an evacuation centre (barangay level) to avoid overcrowding; disaster response amidst a pandemic
Accessing loans or buying items on credit	Mechanisms to augment income, to have savings
A set of coping/response mechanisms, but not 'fix'	Increase of people's knowledge and awareness of DRRM, including those at the municipal level

In summary: Vulnerabilities - Who and why

Sector	Reasons
Fisherfolks	Unable to work
Farmers	Damaged crops
Elderly	Difficulty in mobility
Children	Difficulty in mobility; susceptible to diseases and trauma

In summary: Coping mechanisms to leverage on

Catanduanes	Eastern Samar	Surigao del Norte
Identification of LGUs of evacuation houses (i.e., houses made of concrete materials)	Evacuation (a contentious matter)	Evacuation: Go' bags that contained clothing, essential documents, food, and health kits
Construction of flood control/mitigating structures (e.g., drainage canals, seawalls)	Routine activities: Preparing, responding, and coping with the aftermaths of TCs	Accessing loans or buying items on credit
GAD spaces/GAD conscious	Leaving their fate to God when typhoons happen	A set of coping/response mechanisms, but not 'fix'
CSO conduct relief efforts; voluntary assistance	Disaster preparedness	

Thank You

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