Impact-based forecasting for cyclones

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12 April 2022

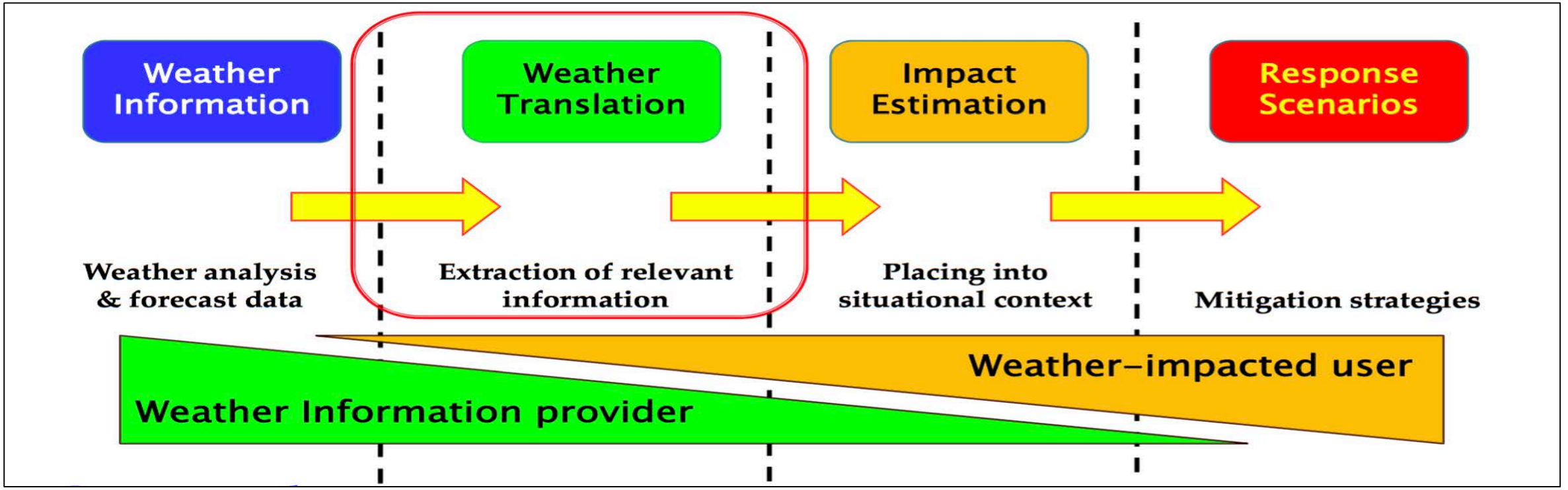
Part 1. The concept of Impact-Based Forecasting




Impact-based Forecasting

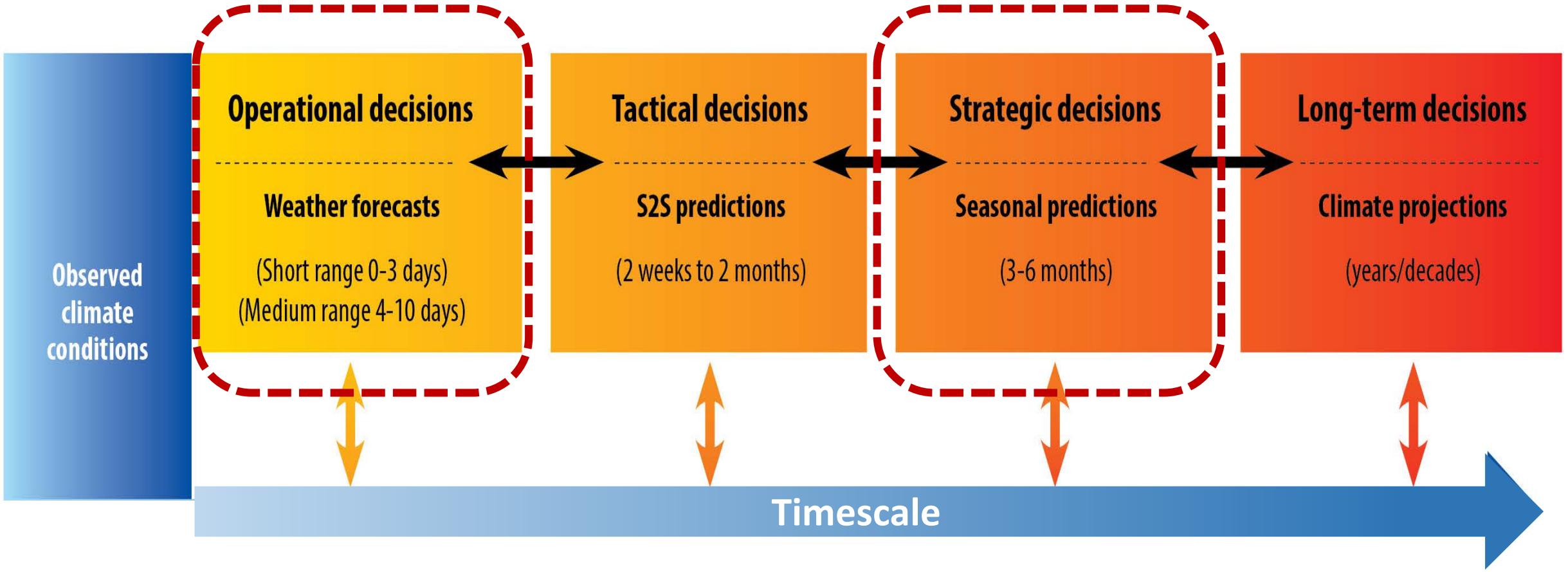
An illustration on how weather information can be translated to response actions

- Relevant information from **weather information is extracted and placed into the situation context to produce impact estimations.**
- With potential impact information available, response scenarios can be set-up.



Source: Baode Chen and Xu Tang (2014) Translating weather forecasts into impact-relevant information

IBF, in different timescale, can help decisions of relevant stakeholders.



Source: ESCAP(2018) Asia-Pacific Disaster Report 2017

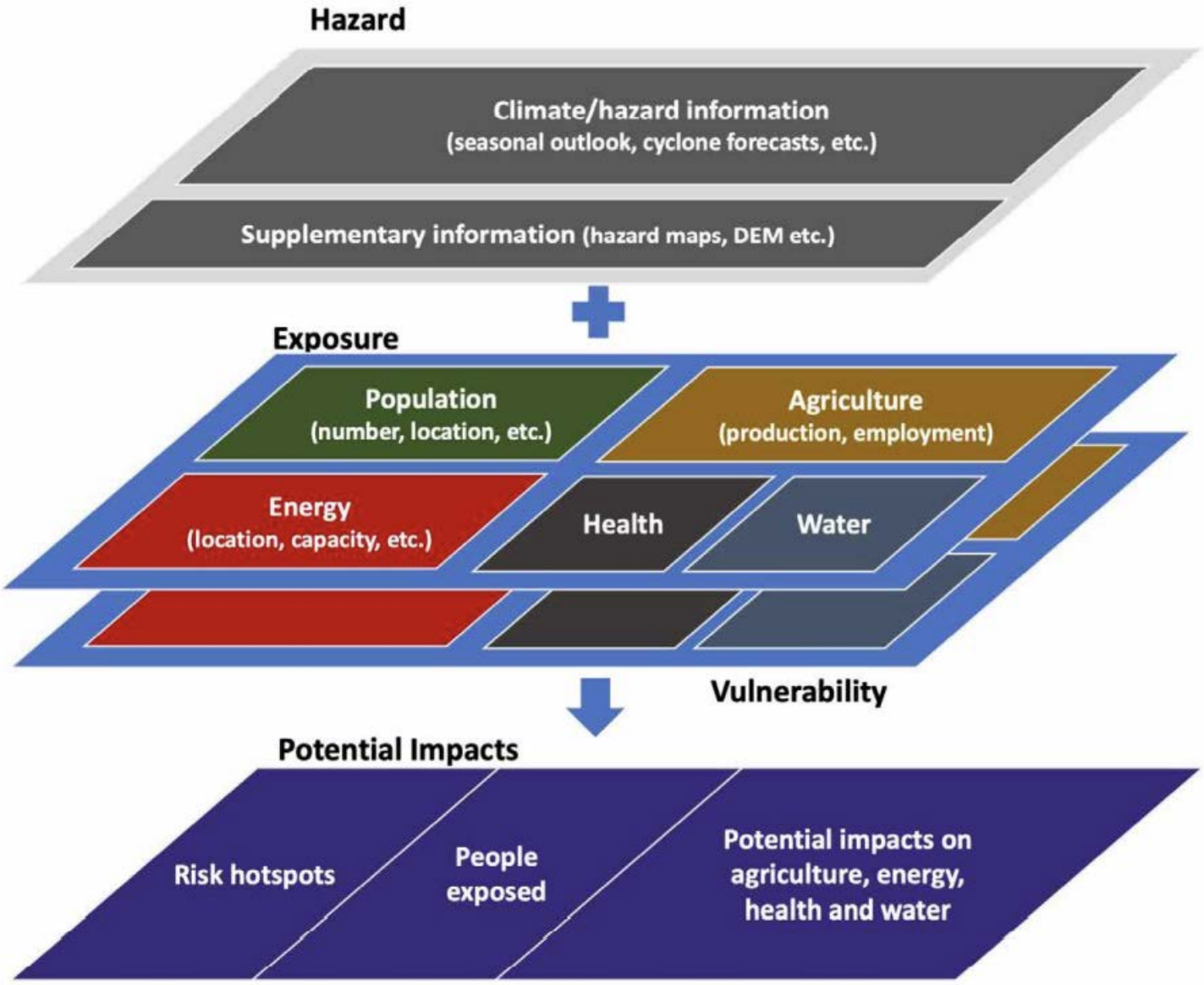
UNITED NATIONS ESCAP
Economic and Social Commission for Asia and the Pacific

Approach for Impact-based Forecasting

Global Framework for Climate Services
(https://gfcs.wmo.int/)

Priority areas

- Agriculture and food security
- Disaster risk reduction
- Energy
- Health
- Water



Source: ESCAP (2021) Overview of the work of secretariat and the UN system at the regional level. ESCAP/CDR/2021/INF/1

Softwares

https://www.qgis.org/en/site/

https://www.esri.com/en-us/arcgis/products/arcgis-desktop/resources

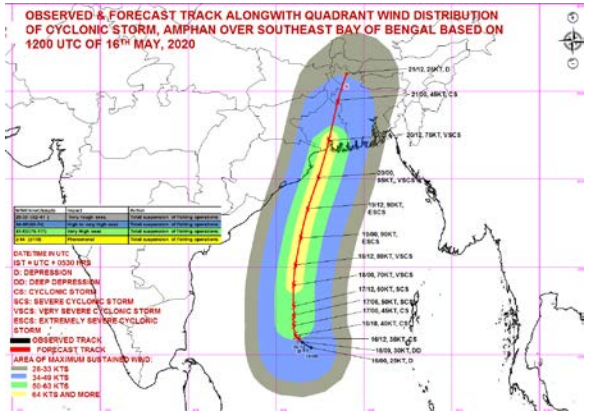
- Excel
- SPSS

Part 2. Impact based forecasting for cyclone Amphan

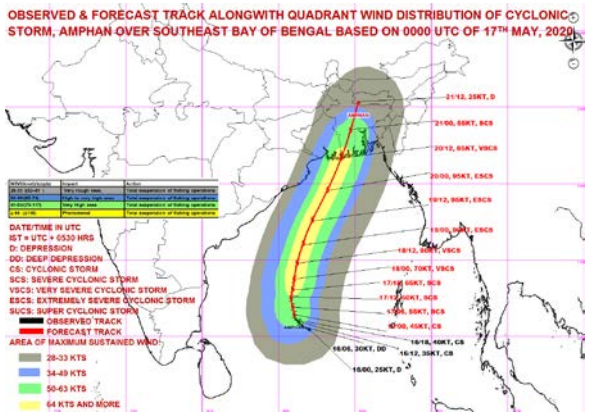



Examples of observed and forecast tracks of Cyclone Amphan (16 – 20 May 2020)

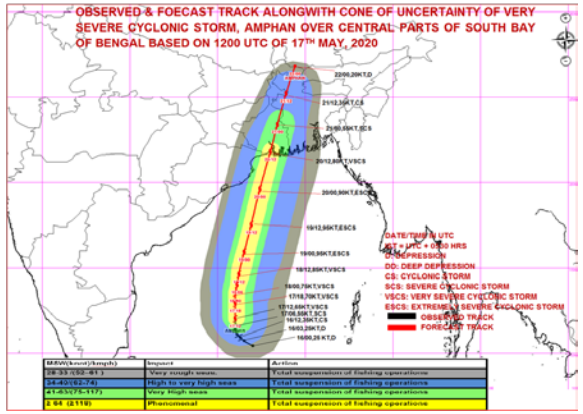
12 hrs



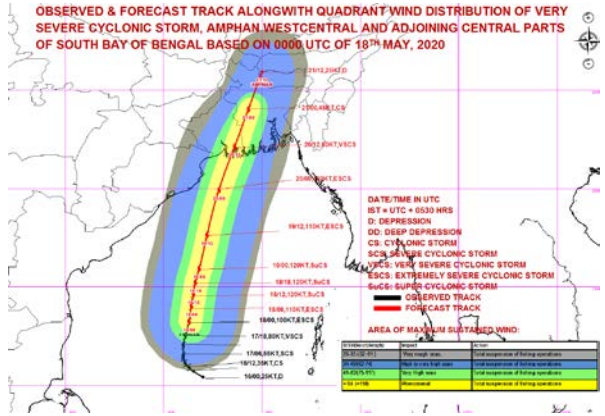
24 hrs



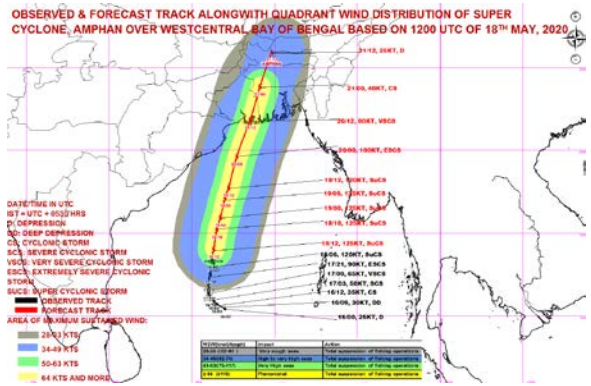
36 hrs



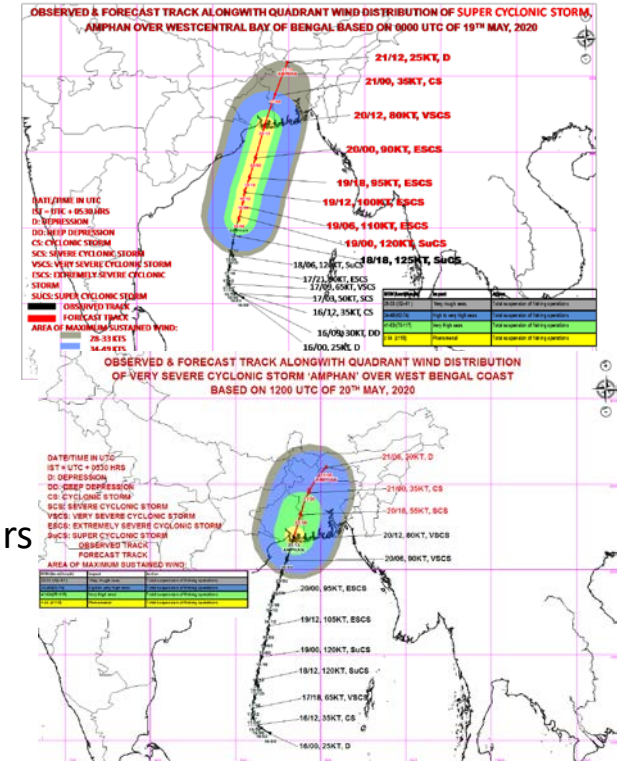
48 hrs



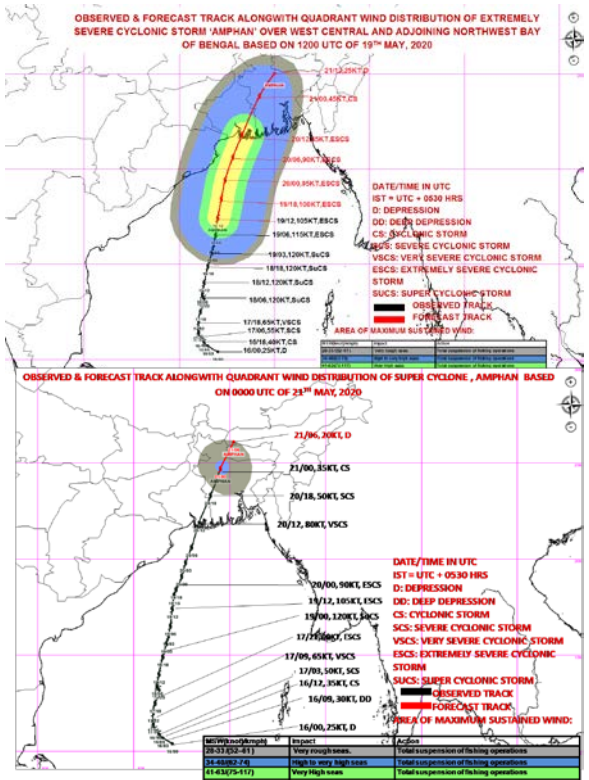
60 hrs



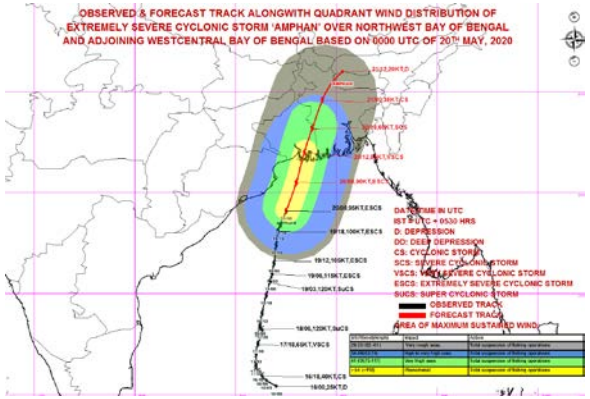
72 hrs



84 hrs



96 hrs



108 hrs

120 hrs

Source: provided by Indian Meteorological Department (IMD)

Drawing the cyclone wind data

- Insert the Cyclone image png file into the QGIS project file
- Install ***'Georeferencer GDAL' plugin***

  Then, georeference the Cyclone image png file

  Safe the georeferenced map as a raster (tiff file)

- Redraw the cyclone map

create a new shapefile layer by using this function

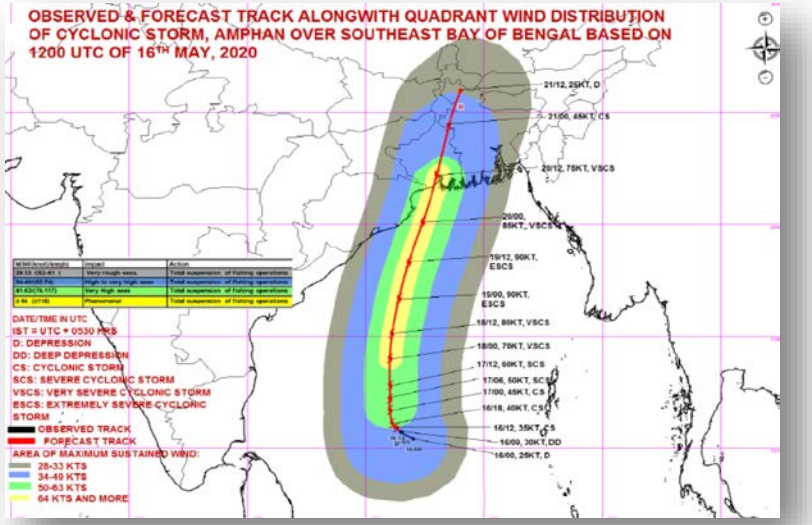
Layer ► New ► New Shapefile Layer

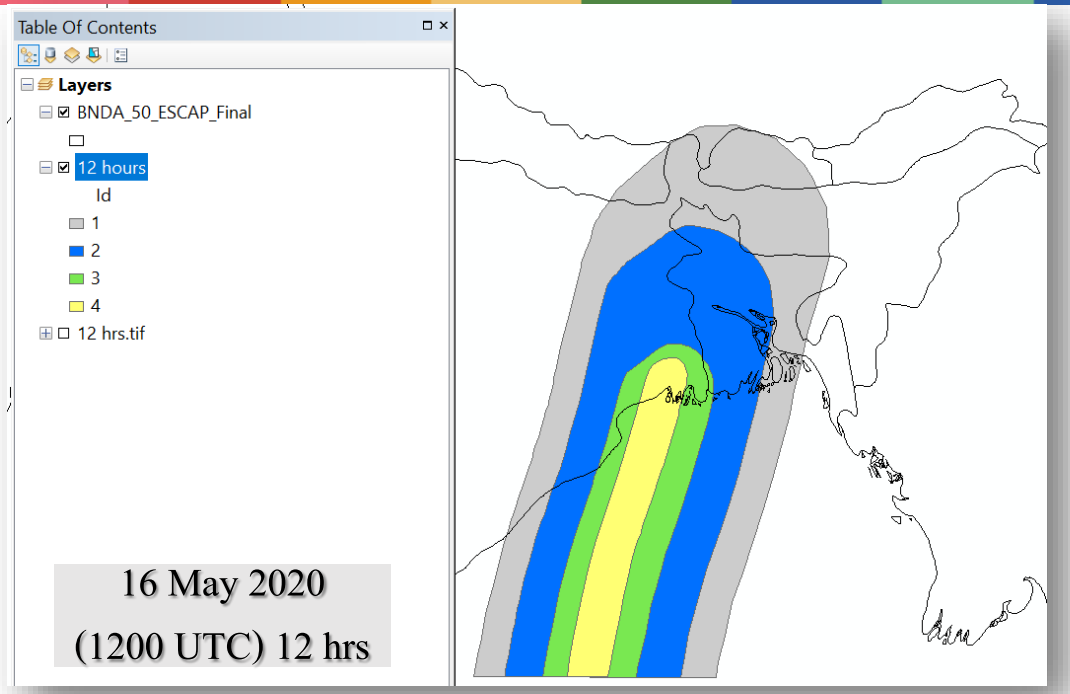
(https://docs.qgis.org/2.14/en/docs/training_manual/create_vector_data/create_new_vector.html)

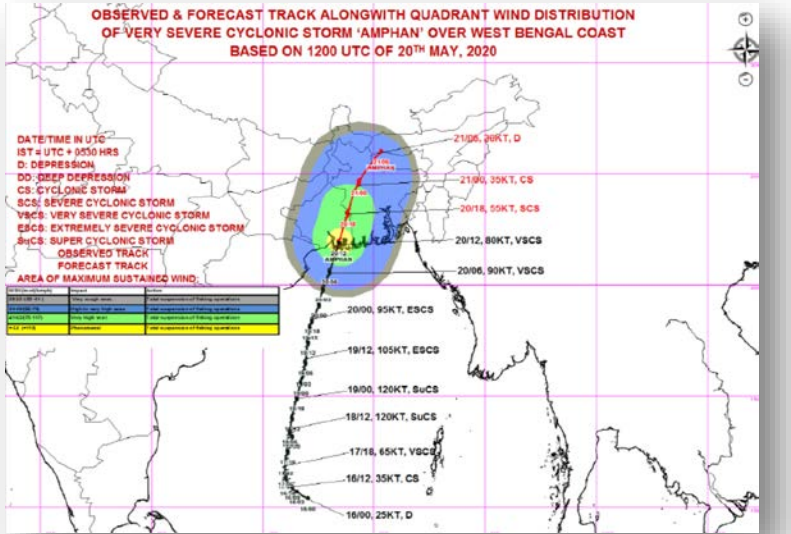
- Create polygons in that shapefile, and start tracing the cyclone wind areas.

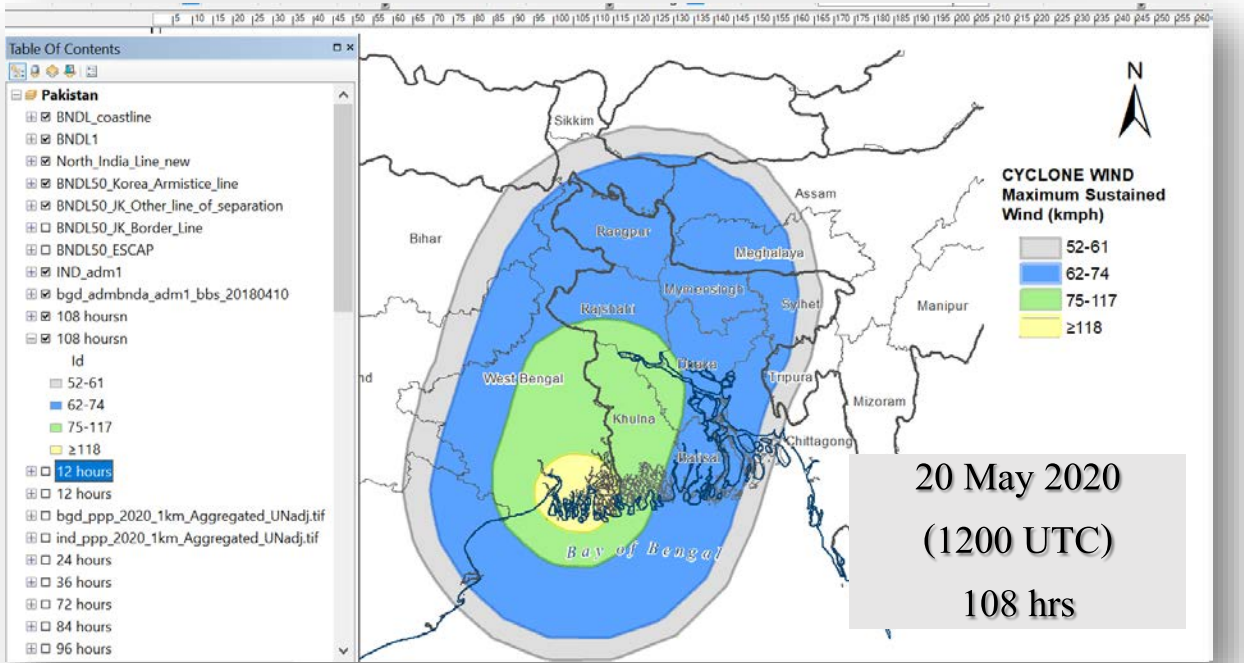
  Save the edits.

Drawing the cyclone wind data

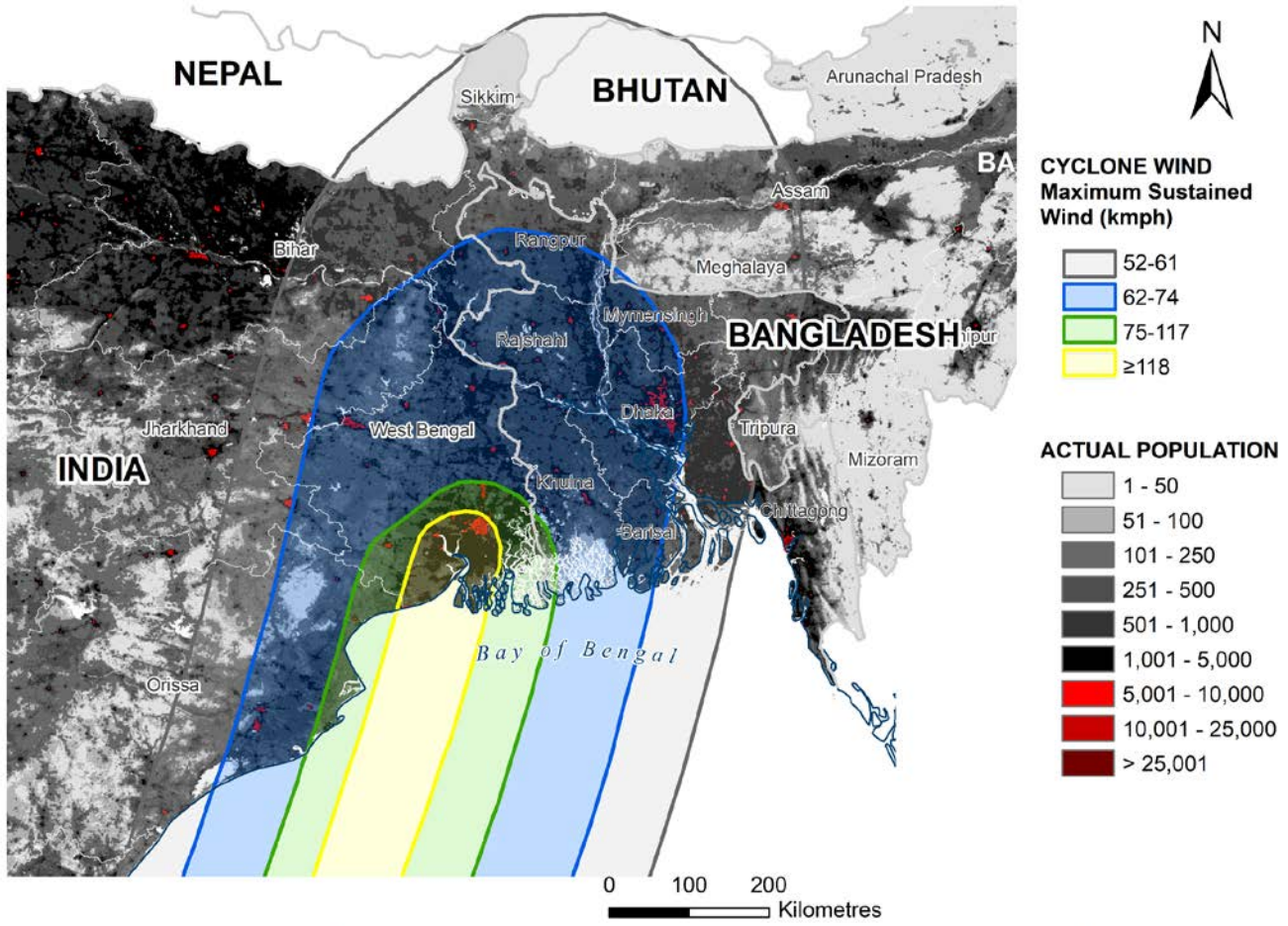




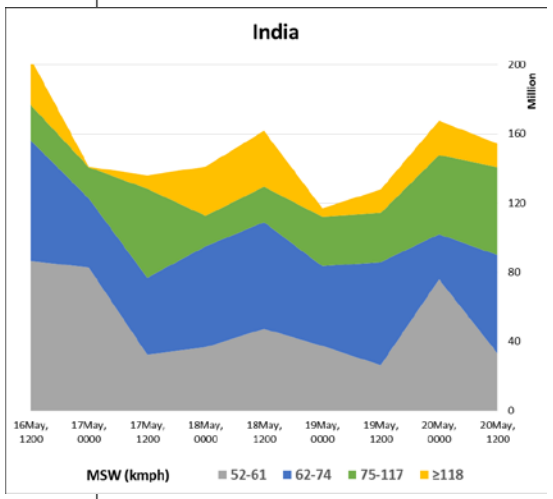


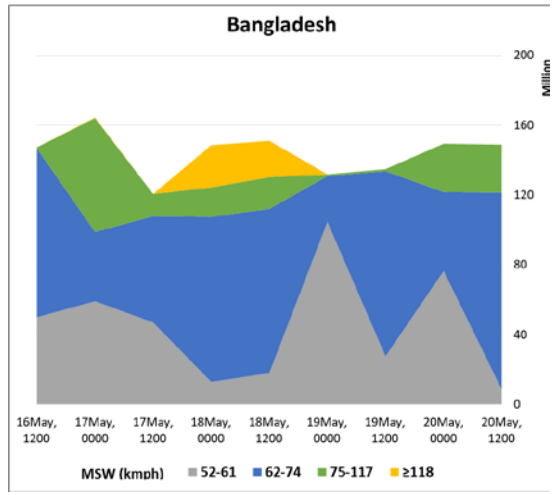


Population likely to be hit by Cyclone Amphan



Cyclone wind Maximum Sustained Wind	CODE	12 hrs		108 hrs	
		BD	IN	BD	IN
52-61	1	50,077,271	86,706,406	8,683,466	33,176,700
62-74	2	96,752,504	69,760,775	112,788,123	56,890,460
75-117	3	563,530	20,503,415	27,442,564	50,818,034
≥64	4	0	26,909,633	392	13,588,580
		147,393,305	**203,880,229**	**148,914,544**	**154,473,774**



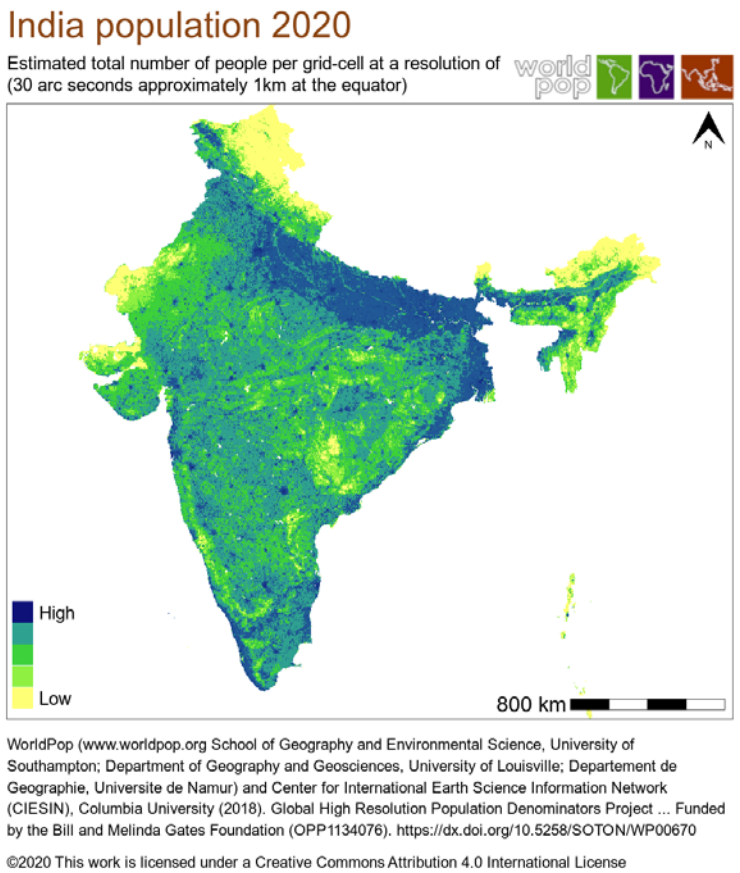


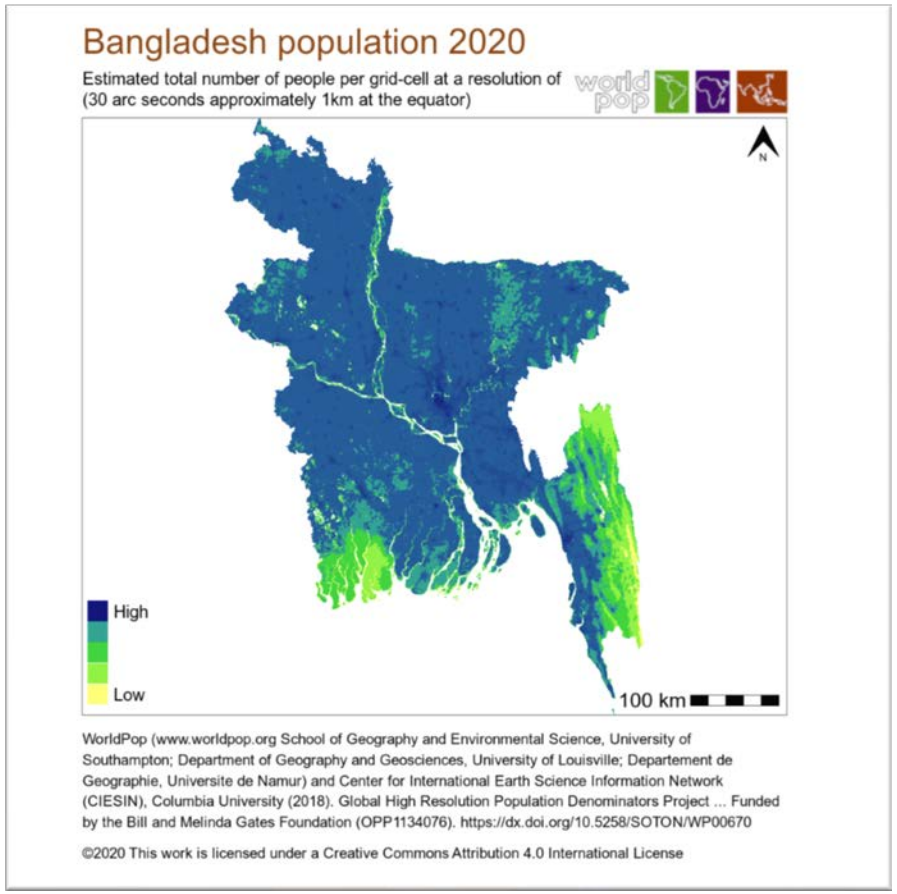
Sources : ESCAP, based on India Meteorological Department's ESCAP based on IMD Cyclone Amphan Observed and Forecast Data on 16 May 2020 (1200, UTC) and Worldpop 2020 Population Estimates for Bangladesh and India.

Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Population data-set

- Worldpop website https://www.worldpop.org/geodata/listing?id=62
- Download population (global) or country-wise
- Download country boundary from https://www.worldpop.org/geodata/listing?id=62
- Convert the boundary file from raster to vector by using **Raster pixel to polygon** function



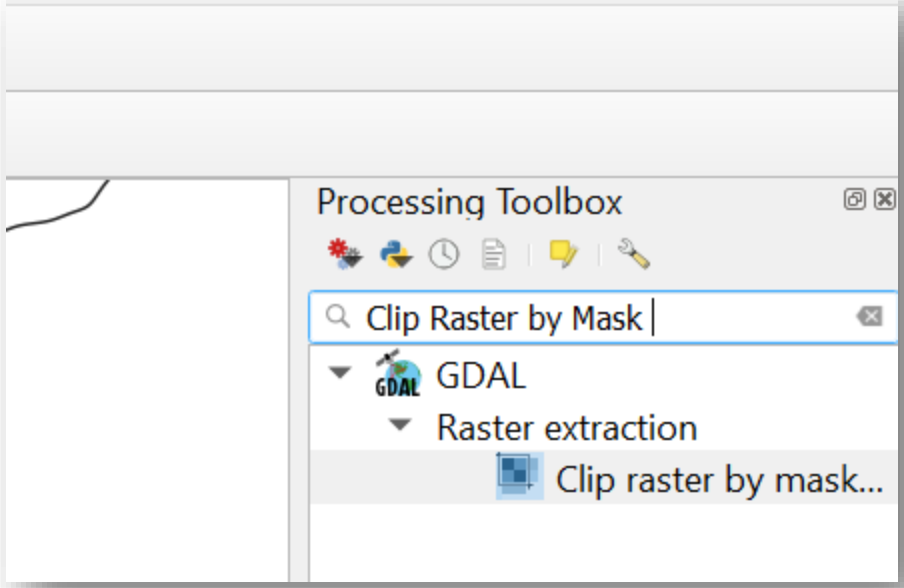


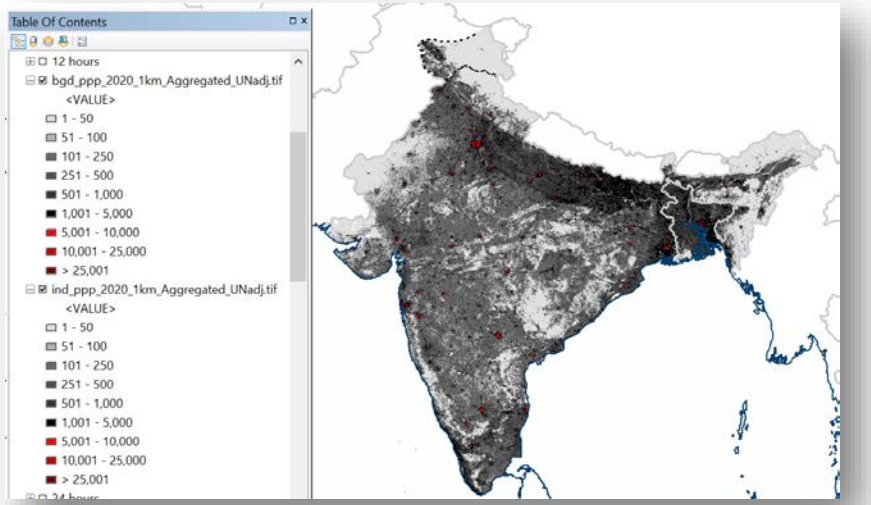
Clipping population data-set

- **Clip raster by mask layer**
  Note: Projection system depends on …

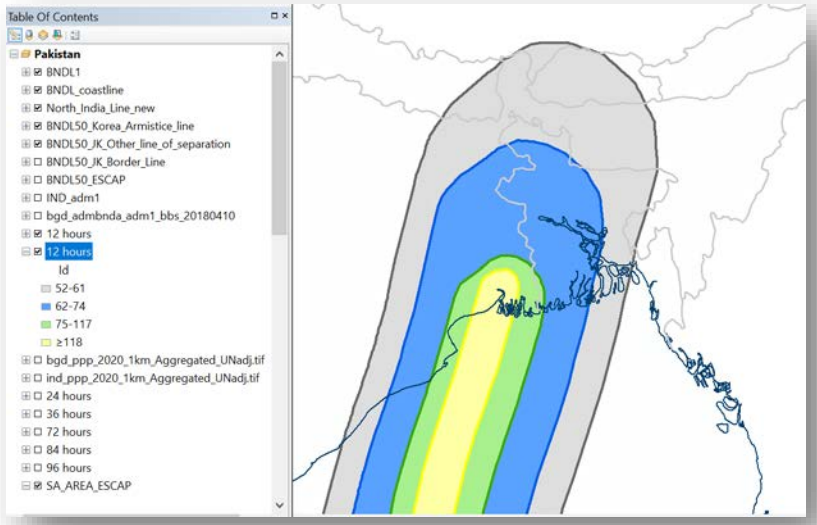
Raster unit (x and y): 0.0088333

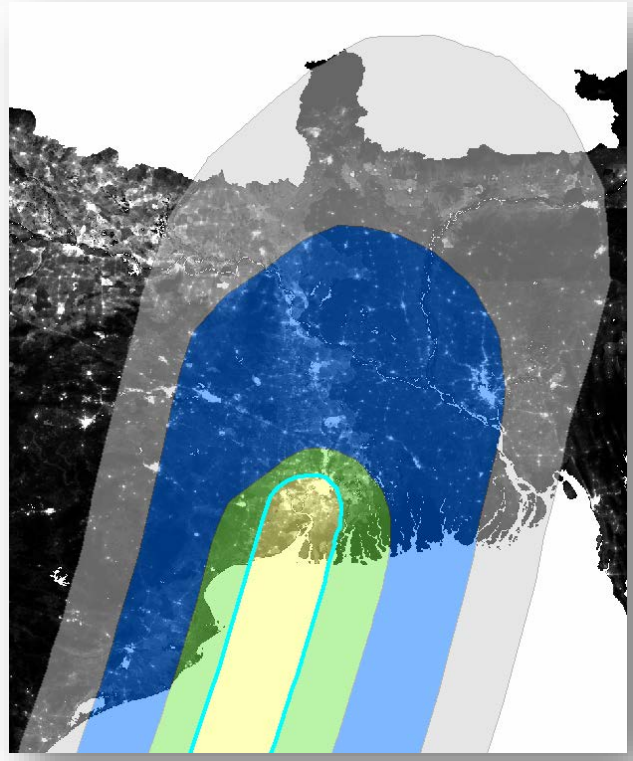
File to make: raster data of Bangladesh and India population are clipped with cyclone wind layer



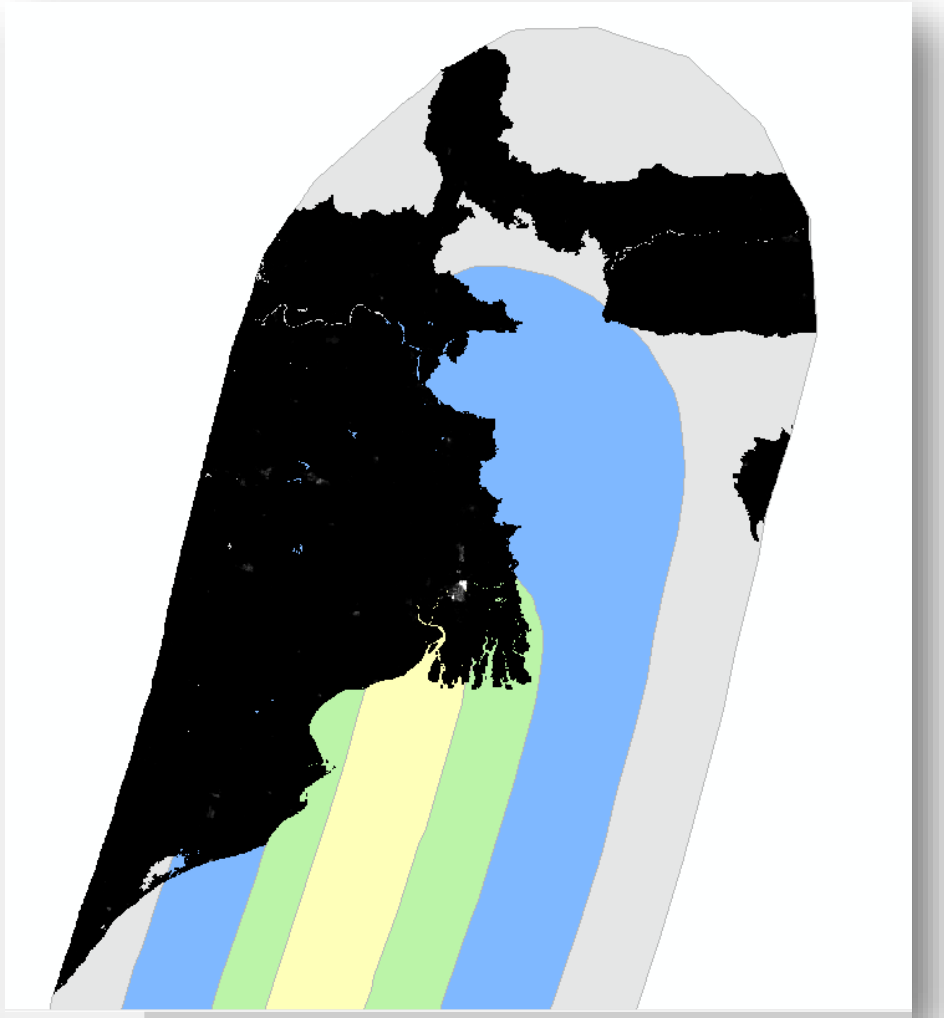


ind_ppp_2020_1km_Aggregated_UNadj.tif

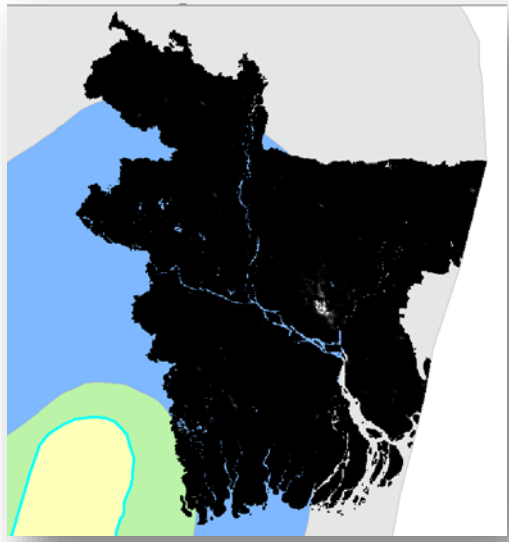




- India clipped population



- Bangladesh clipped population

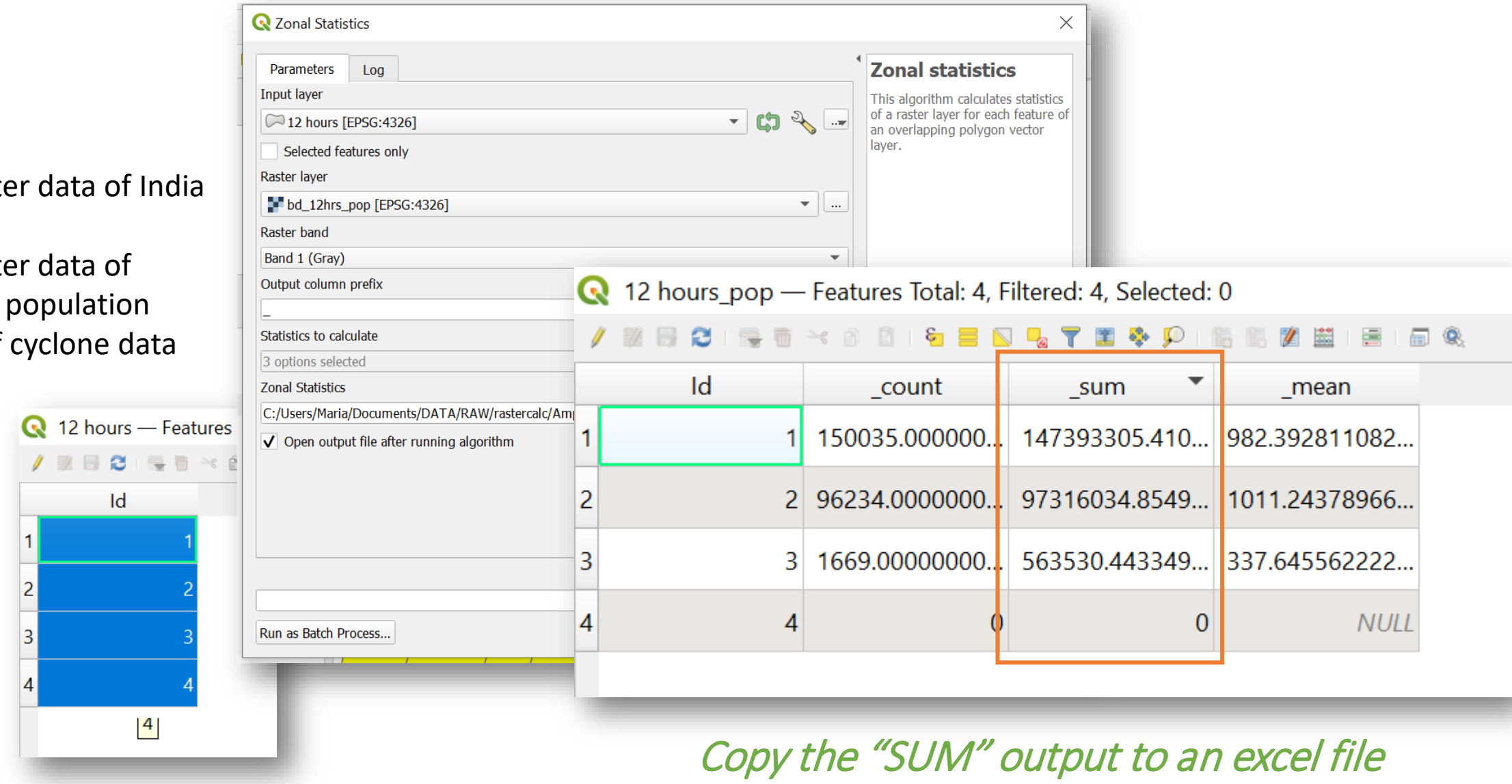


Calculating the exposure of population to Cyclone Amphan (1/3)

Zonal statistics – for calculating population exposed to particular cyclone wind category

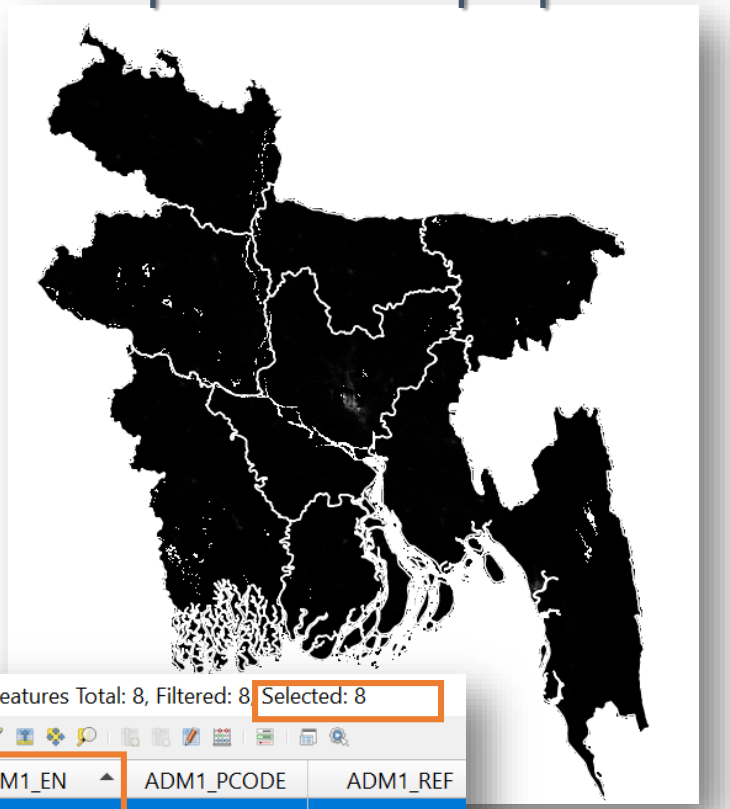
File to use:

- Clipped raster data of India population
- Clipped raster data of Bangladesh population
- Shapefile of cyclone data



Copy the "SUM" output to an excel file

Calculating the exposure of population to Cyclone Amphan (2/3)



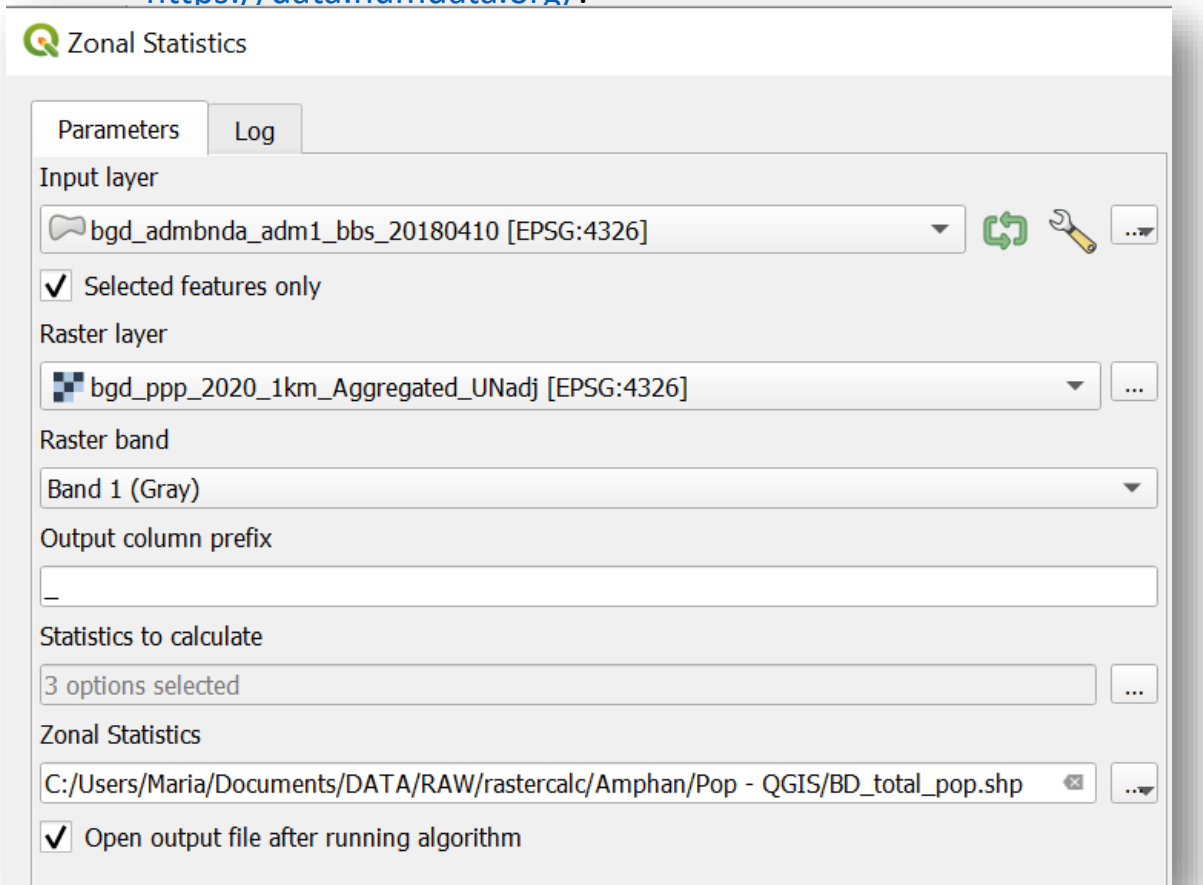
bgd_admbnda_adm1_bbs_20180410 — Features Total: 8, Filtered: 8, Selected: 8

	Shape_Leng	Shape_Area	ADM1_EN	ADM1_PCODE	ADM1_REF
1	25.42460438700	0.88939513745	Barisal	10	NULL
2	30.28732120690	2.73779583154	Chittagong	20	NULL
3	12.19775793130	1.80650588740	Dhaka	30	NULL
4	38.40938469700	1.82657492875	Khulna	40	NULL
5	8.16657735137	0.94181167913	Mymensingh	45	NULL
6	8.41022082480	1.62485589936	Rajshahi	50	NULL
7	15.36968313740	1.46568139261	Rangpur	55	NULL
8	9.80029271362	1.10396330243	Sylhet	60	NULL

Zonal statistics –
for calculating total population

Files to use:

- Raster of Bangladesh or India population
- Shapefile of Bangladesh and India administrative boundaries from Worldpop or OCHA HDX https://www.worldpop.org/project/categories?id=17 or https://data.humdata.org/.



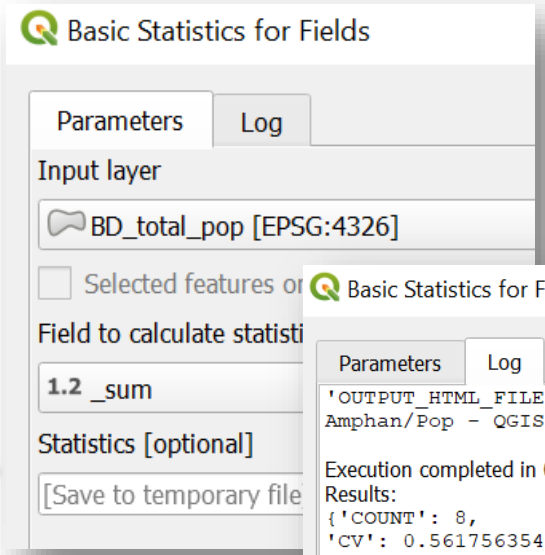
Calculating the exposure of population to Cyclone Amphan (3/3)

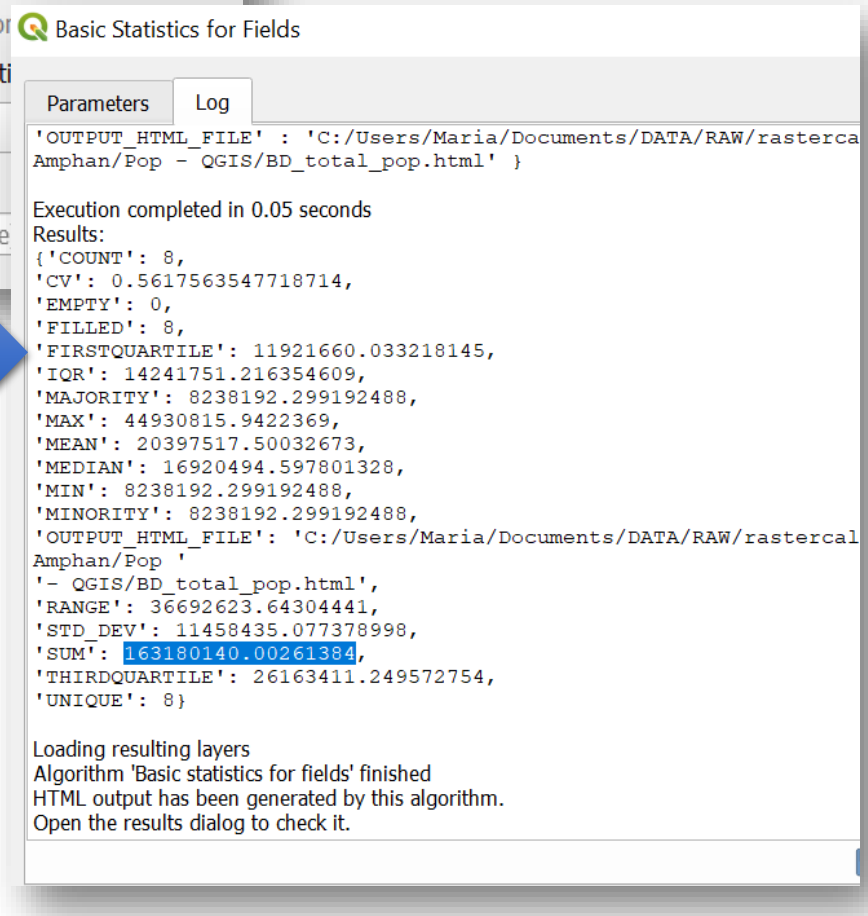
Then, proceed with the ***Basic statistics for field***

- Shapefile of Bangladesh administrative areas which has new field (sum)

iltered: 8, Selected: 0

ADM1_EN	41_PC	DM1_R	A1ALT	A1ALT	DM0_E	40_PC	date	validOn	validTo	oul	_sum	_mean
Barisal	10	NULL	NULL	NULL	Ban...	BD	2015-0...	2018-0...	NULL	126..	8238192.29919...	651.858862097...
Mymensingh	45	NULL	NULL	NULL	Ban...	BD	2015-0...	2018-0...	NULL	135..	12007229.7499...	887.321146171...
Sylhet	60	NULL	NULL	NULL	Ban...	BD	2015-0...	2018-0...	NULL	157..	11836090.3164...	752.836173288...
Rangpur	55	NULL	NULL	NULL	Ban...	BD	2015-0...	2018-0...	NULL	208..	17392316.5036...	835.205364180...
Rajshahi	50	NULL	NULL	NULL	Ban...	BD	2015-0...	2018-0...	NULL	229..	20426542.7732...	891.677264417...
Dhaka	30	NULL	NULL	NULL	Ban...	BD	2015-0...	2018-0...	NULL	255..	44930815.9422...	1761.71643437...
Khulna	40	NULL	NULL	NULL	Ban...	BD	2015-0...	2018-0...	NULL	259..	16448672.6919...	632.835976142...
Chittagong	20	NULL	NULL	NULL	Ban...	BD	2015-0...	2018-0...	NULL	388..	31900279.7258...	821.981492073...





Result:

Copy the SUM value (163180140.003) to an excel file

Cyclone Molave - Quantifying population exposure

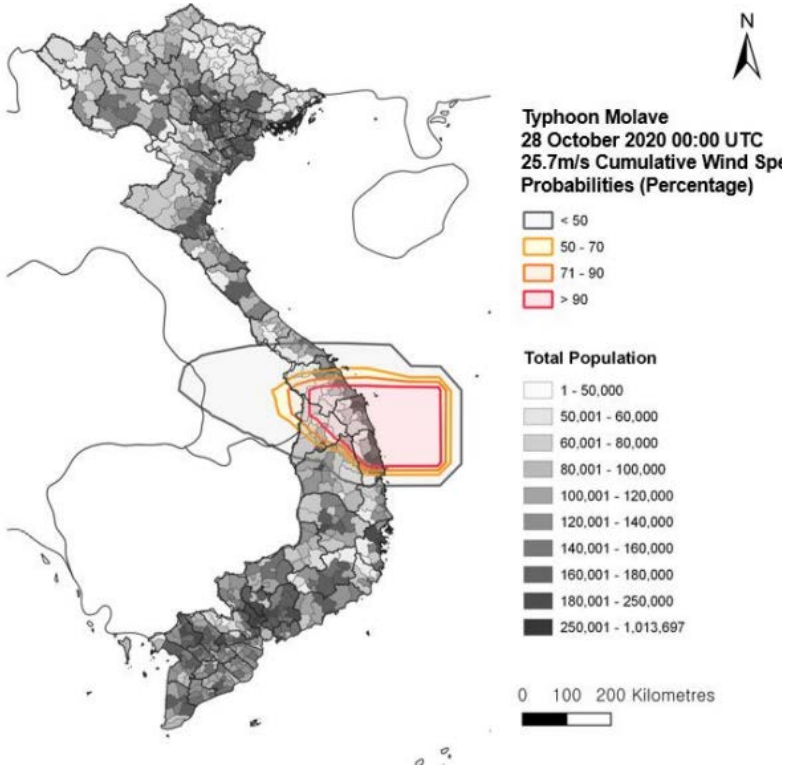
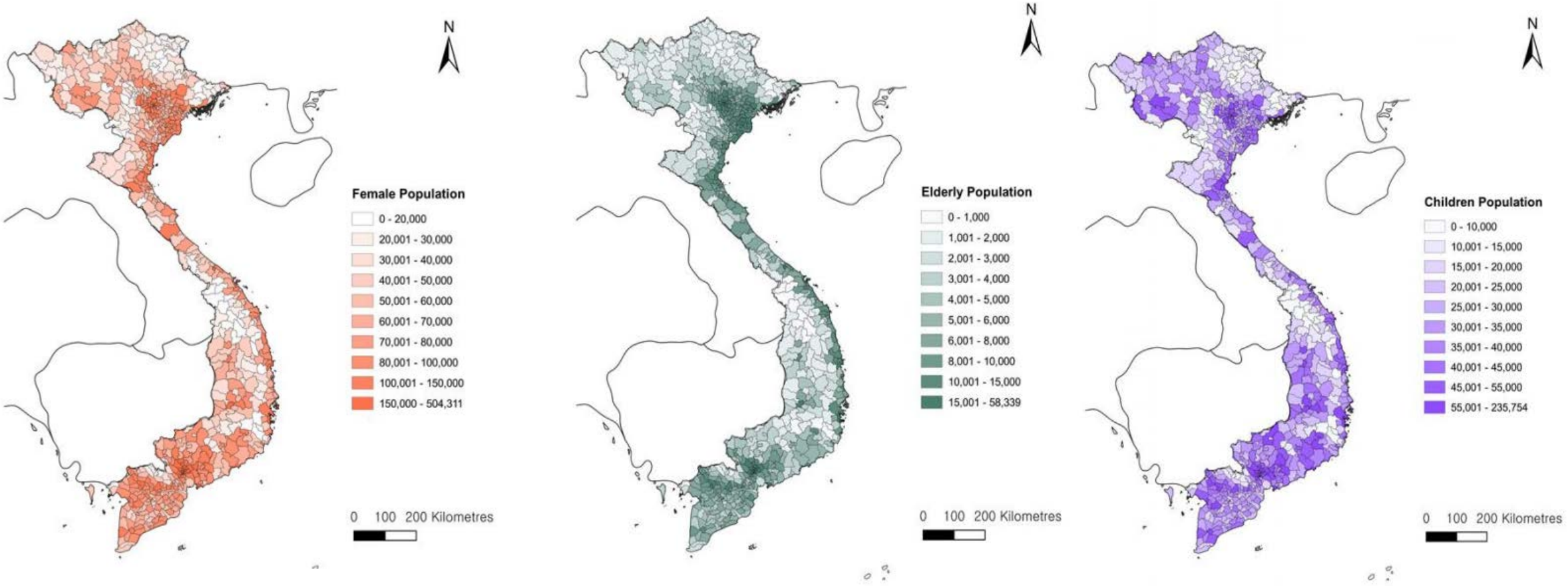


Figure 8. Total population in each category of forecasted extreme wind speed probability

Probability (%) of strong wind (25.7m/s)	Population exposed	Total population	% of population exposed
> 90	2,412,500	97,411,255	2.48%
71 - 90	874,091		0.90%
50 - 70	1,134,937		1.17%
< 50	2,627,150		2.70%

Source: ESCAP IBFWS training module (2021)

Cyclone Molave - Quantifying population exposure and vulnerability (1/2)



Source: ESCAP IBFWS training module (2021)

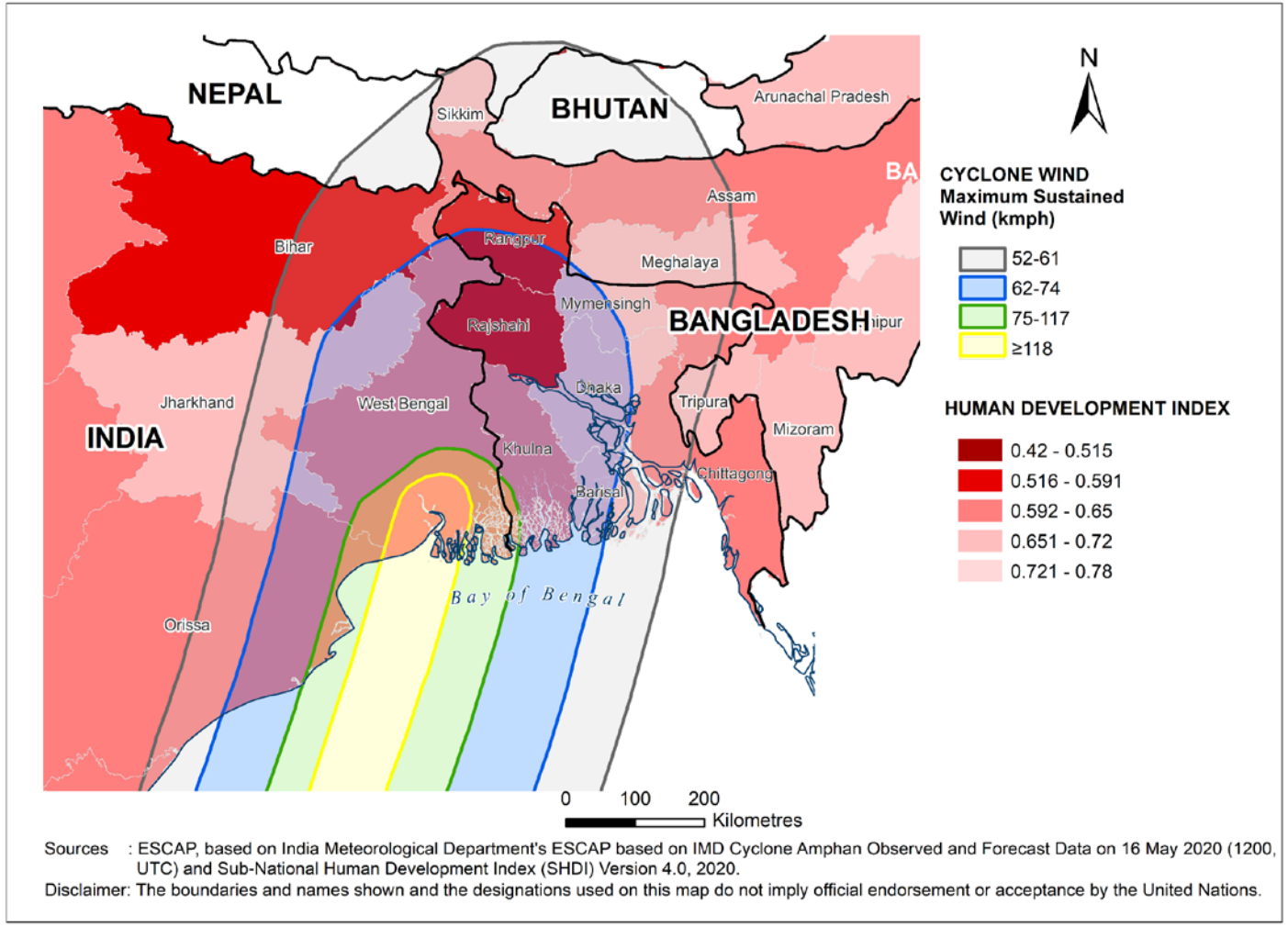
Cyclone Molave - Quantifying population exposure and vulnerability (2/2)

Probability (%) of strong wind (25.7m/s)	Population exposed	Female (%)	Children (%)	Elderly (%)
> 90	2,412,500	1,285,118 (53.3)	610,637 (25.3)	141,424 (5.9)
71 - 90	874,091	410,900 (47.0)	213,793 (24.5)	41,600 (4.8)
50 - 70	1,134,937	602,119 (53.1)	312,810 (27.6)	66,836 (5.9)
< 50	2,627,150	1,386,955 (52.8)	706,693 (26.9)	151,661 (5.8)

Source: ESCAP IBFWS training module (2021)

Vulnerability

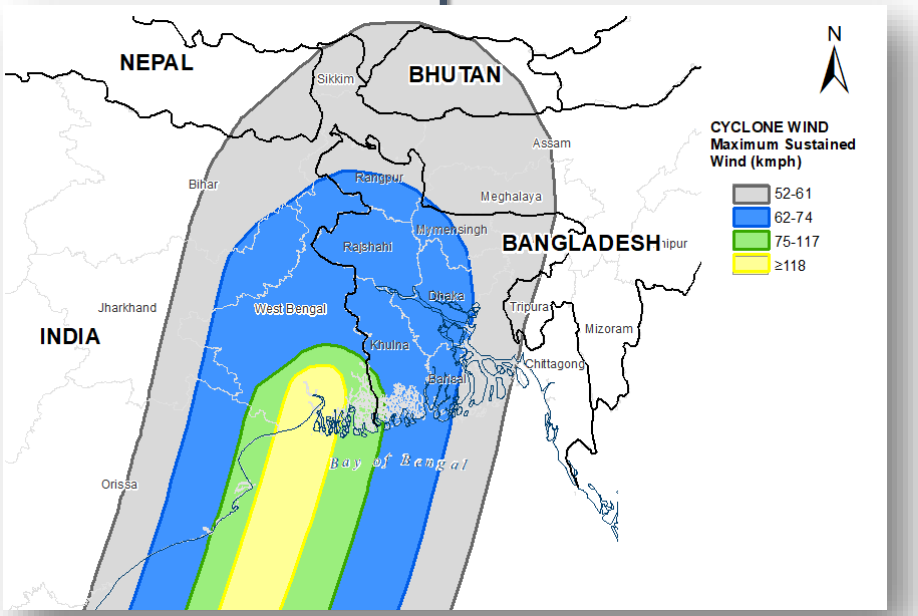
Vulnerability indicators can be added to understand the vulnerability of people likely to be affected.

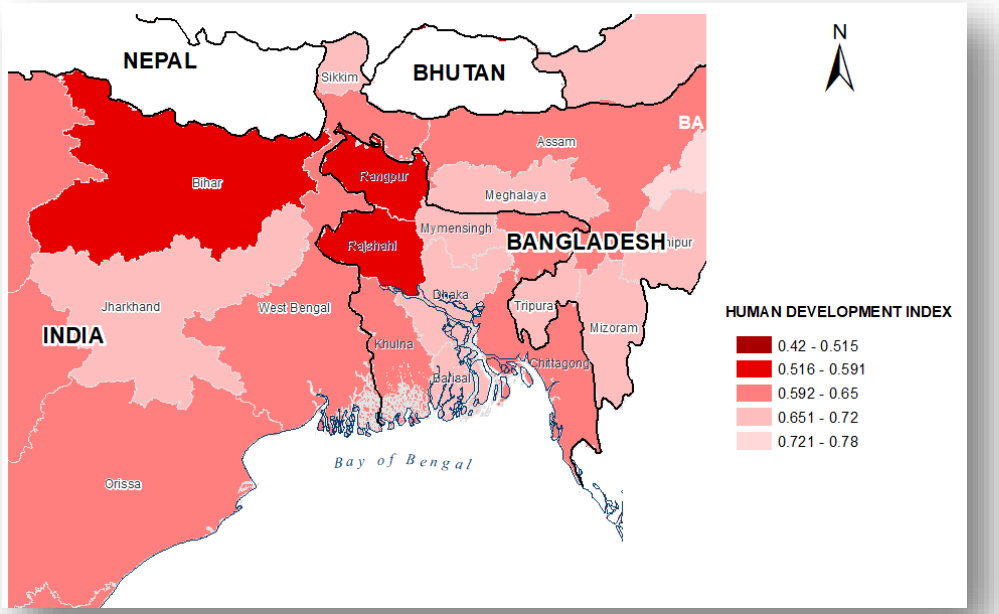


HDI is overlaid to understand the vulnerability of people exposed.

Other indicators (poverty, income, education, literacy, or other vulnerability indicators) can be used as appropriate.

Human Development Index

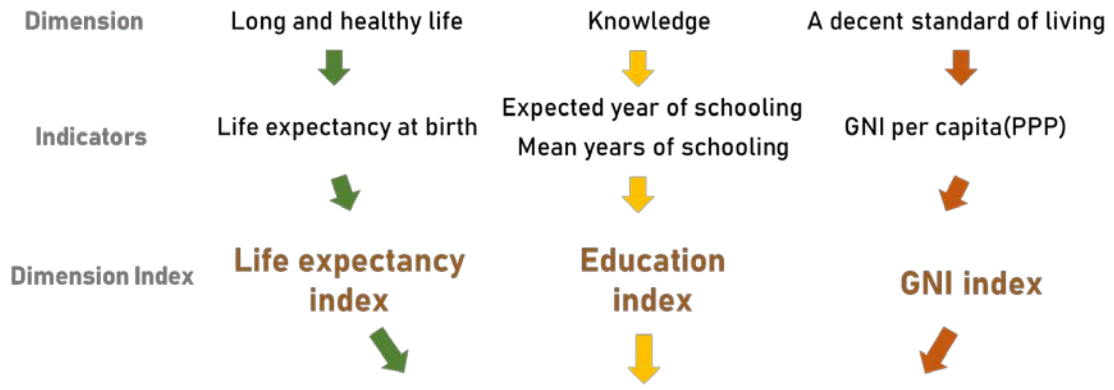




Sub-national Human Development Index (SHDI)

South asia_HDI

FID	Shape	ID_0	ISO	NAME_0	ID_1	NAME_1	HDI_HDI	HDI_INT
84	Polygon	105	IND	India	24	Mizoram	0.679	0.679
85	Polygon	105	IND	India	25	Nagaland	0.746	0.746
86	Polygon	105	IND	India	26	Orissa	0.606	0.606
87	Polygon	105	IND	India	27	Puducherry	0.738	0.738
88	Polygon	105	IND	India	28	Punjab	0.723	0.723
89	Polygon	105	IND	India	29	Rajasthan	0.629	0.629
90	Polygon	105	IND	India	30	Sikkim	0.716	0.716
91	Polygon	105	IND	India	31	Tamil Nadu	0.708	0.708
92	Polygon	105	IND	India	32	Telangana	0.669	0.669
93	Polygon	105	IND	India	33	Tripura	0.658	0.658
94	Polygon	105	IND	India	34	Uttar Pradesh	0.596	0.596
95	Polygon	105	IND	India	35	Uttaranchal	0.684	0.684
96	Polygon	105	IND	India	36	West Bengal	0.641	0.641
97	Polygon	217	LKA	Sri Lanka	1	Ampara	0.78	

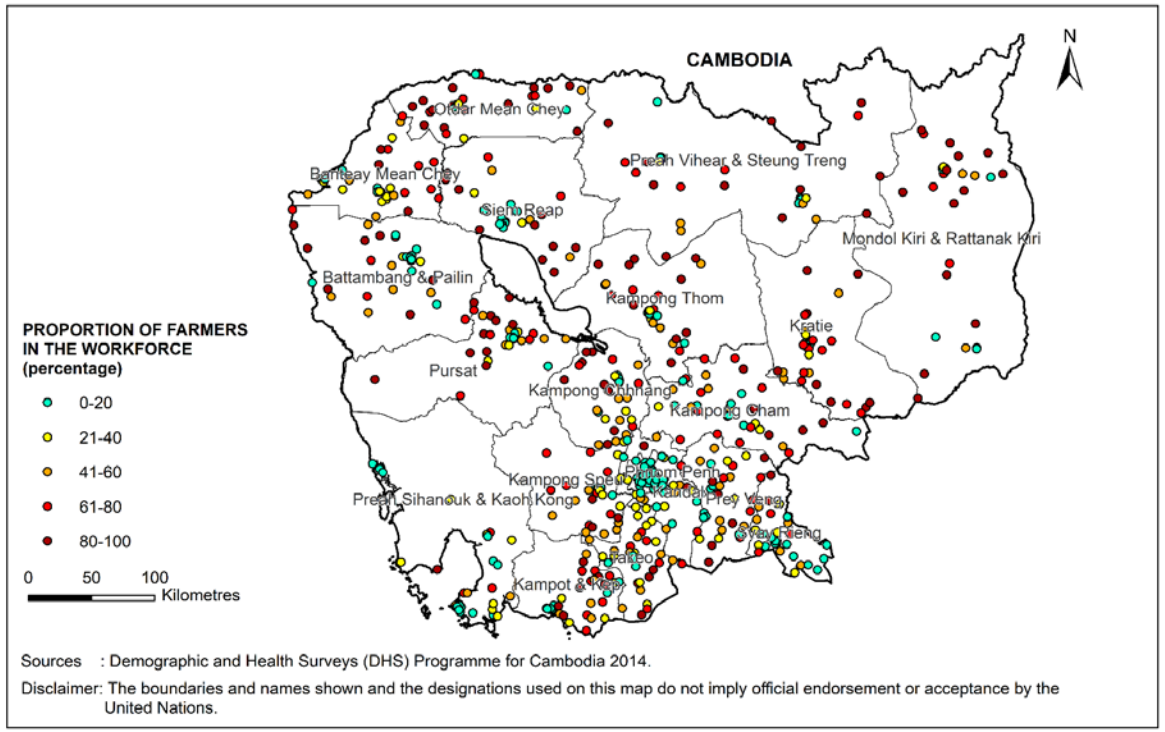


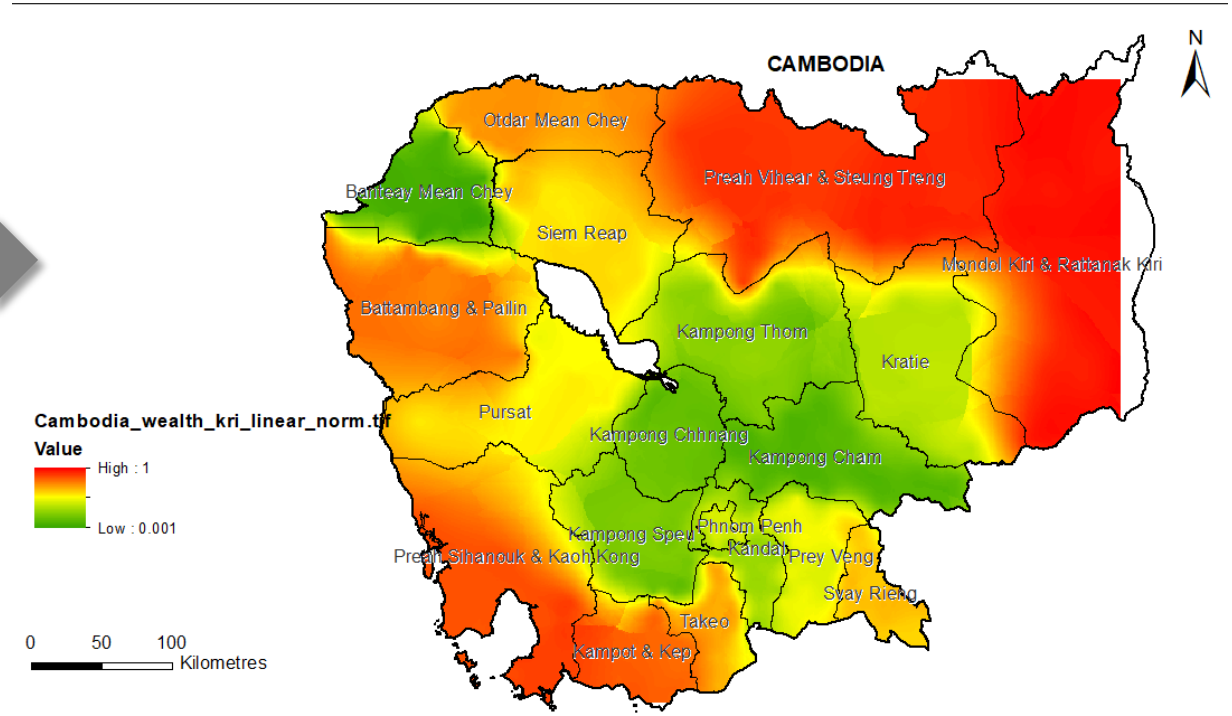
https://globaldatalab.org/shdi/download_files/

Source: UNDP, 2019.

Another example of vulnerability data - Wealth dataset (a Cambodia example)

Wealth data at cluster level from the Demographic and Health Surveys (DHS)





https://dhsprogram.com/data/available-datasets.cfm

Interpolating points data

Process the raw DHS variable data in SPSS

Process the data in excel, convert to CSV type

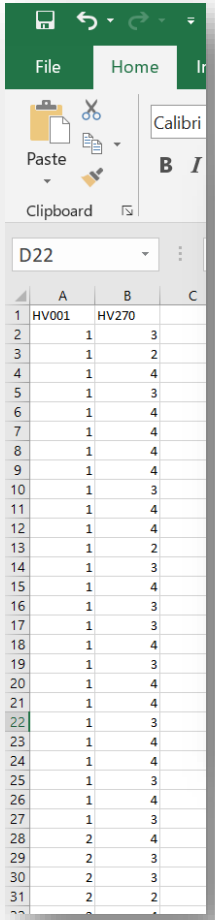
Open the data in GIS.
Join the CSV file to the geolocation of DHS clusters

Interpolate the data
Value: -10 t0 623

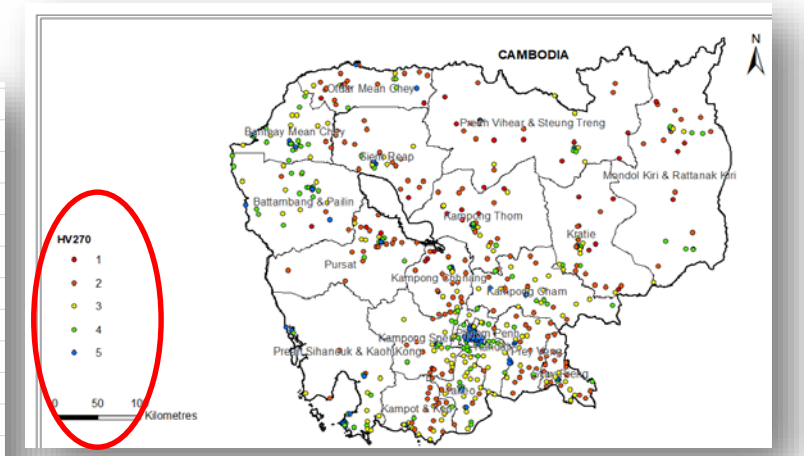
Normalize the data

Thousands of household

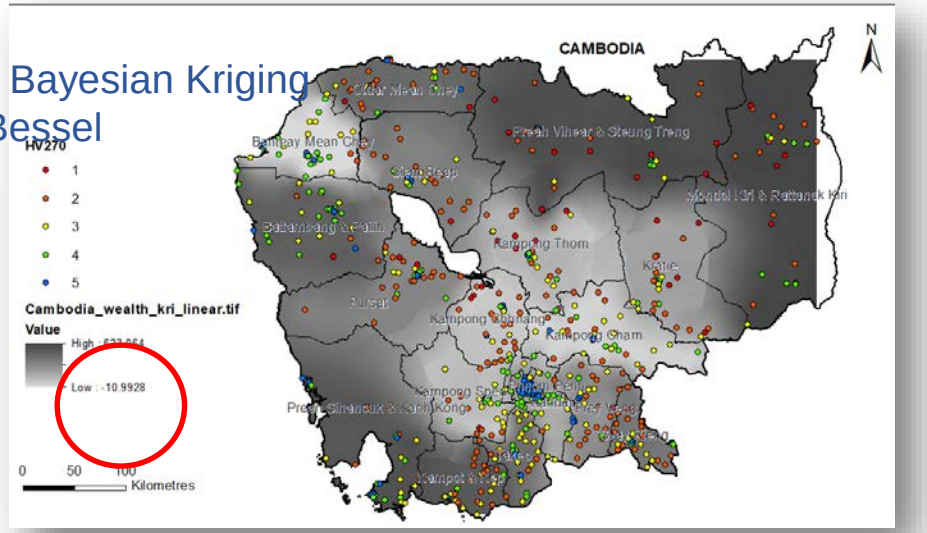
Approximately 450 clusters

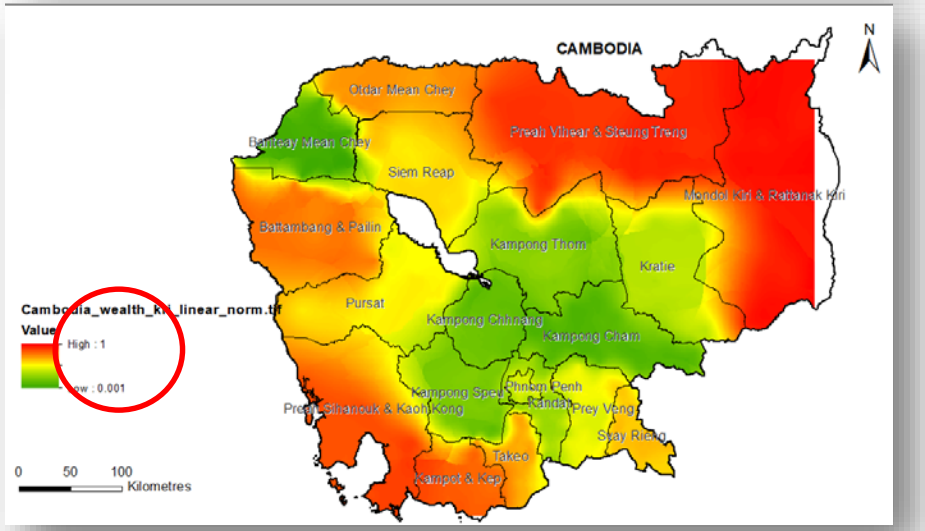


Row Labels	Average of HV270
1	3
2	2
3	4
4	1
5	2
6	3
7	2
8	3
9	3
10	4
11	4
12	4
13	2
14	4
15	2
16	2



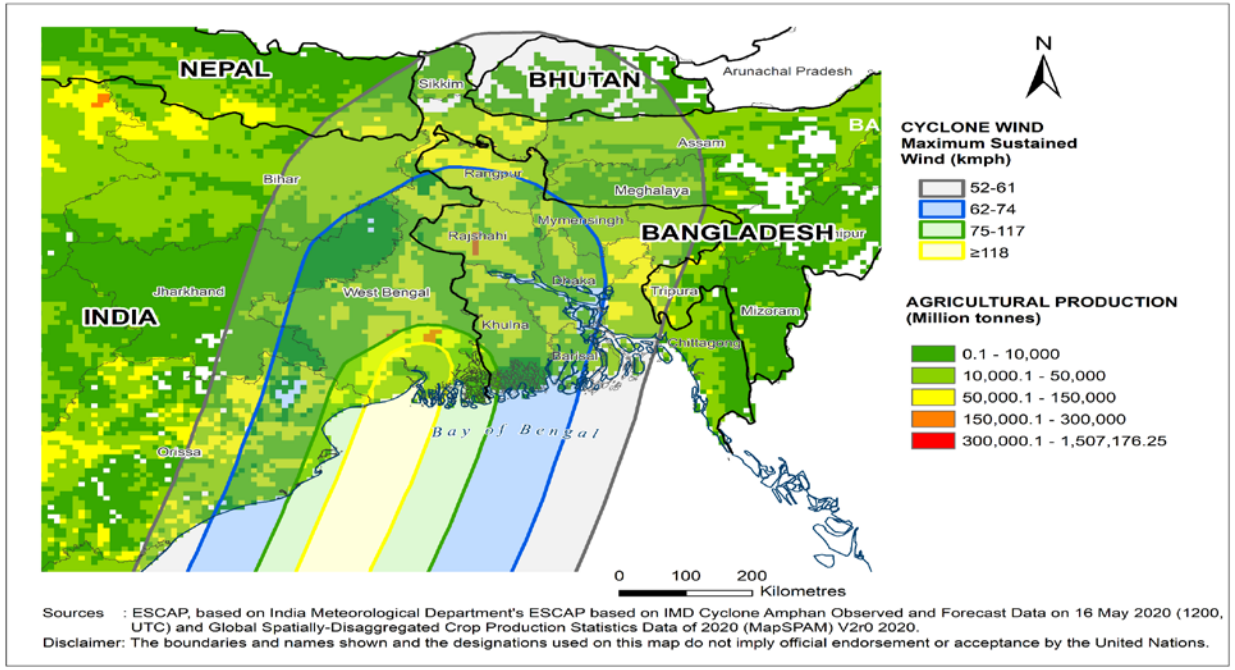
Empirical Bayesian Kriging
Type: K-Bessel



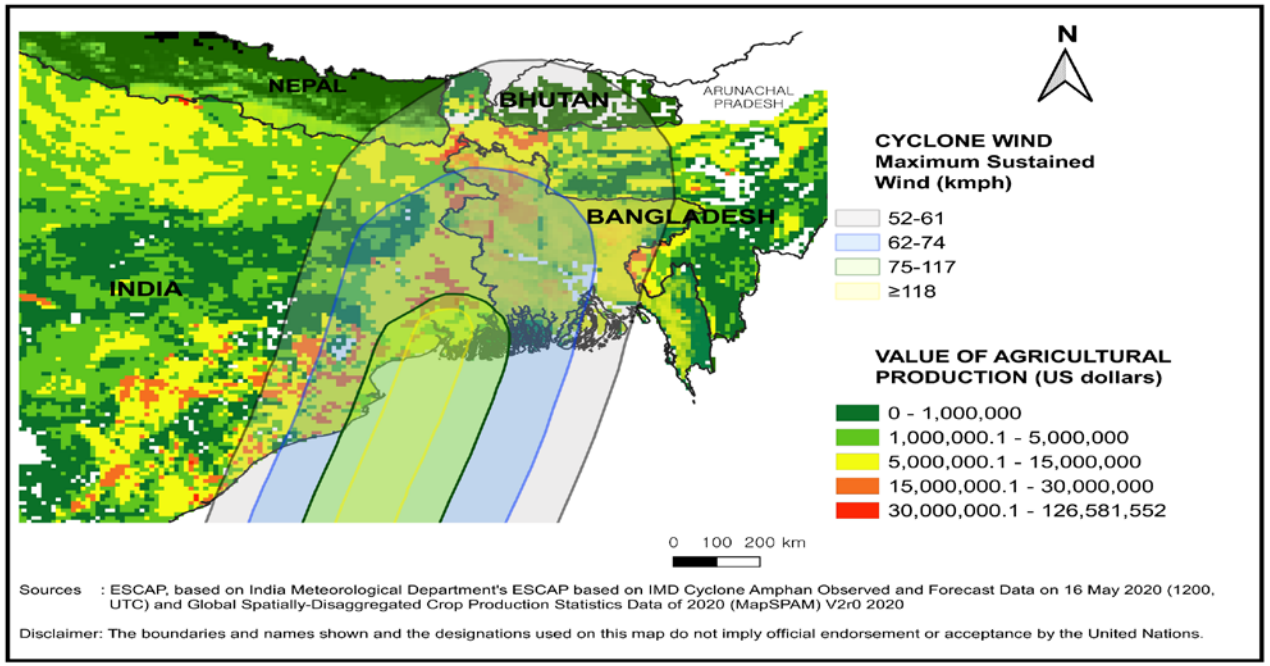


Agriculture

Potential impact on agriculture can be also analyzed.



(agricultural production quantity)

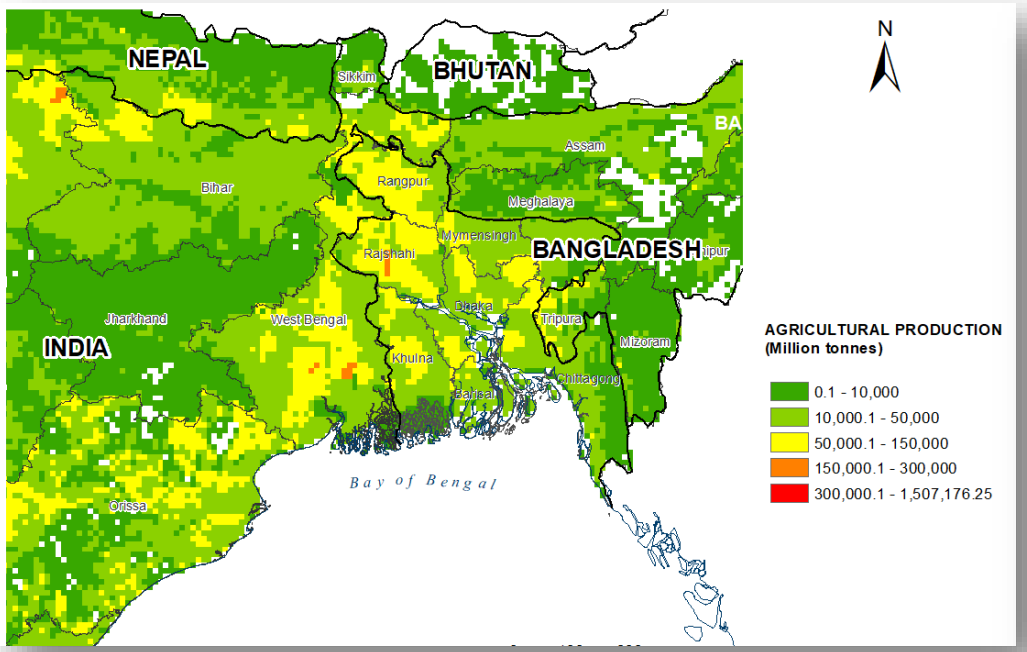


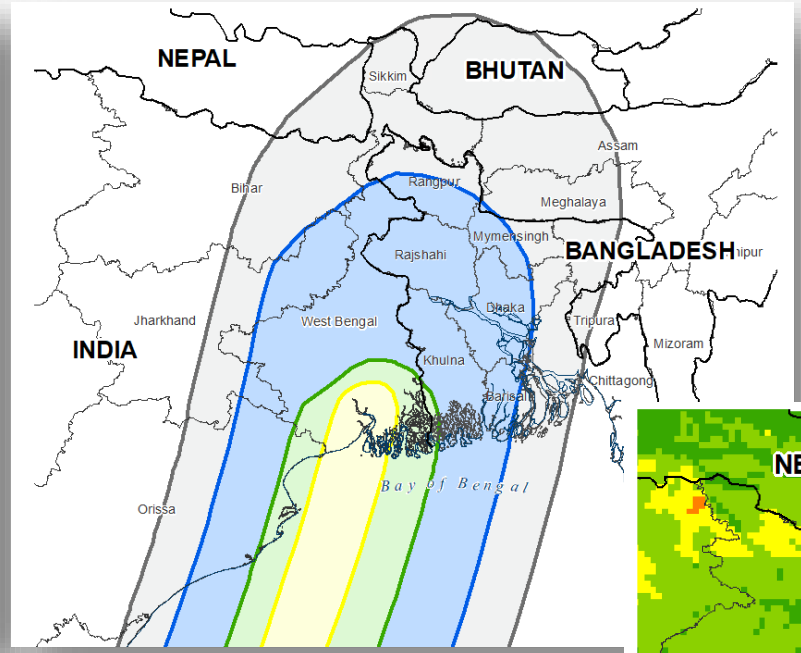
(agricultural production value)

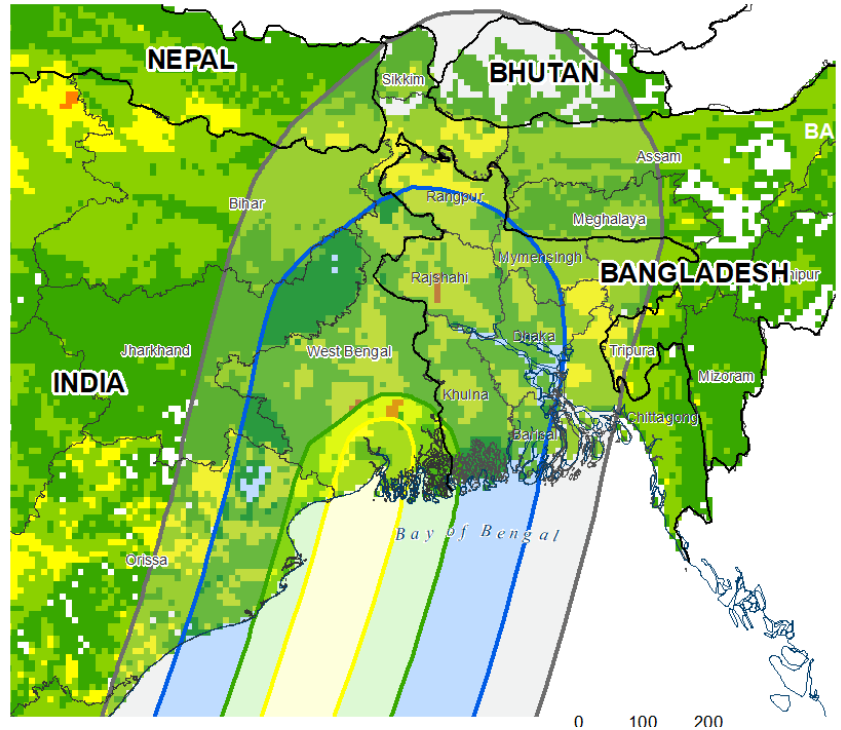
Cyclone Amphan was expected to affect the areas with large agri production quantity and value.

In India, the areas likely to receive MSW of 75 kmph or more were responsible for 1.6% of total agricultural production quantity and 2.0% of value.

Quantity of agricultural production data-set







FAO's Global Spatially-Disaggregated Crop Production Statistics Data (MapSPAM) for 2010

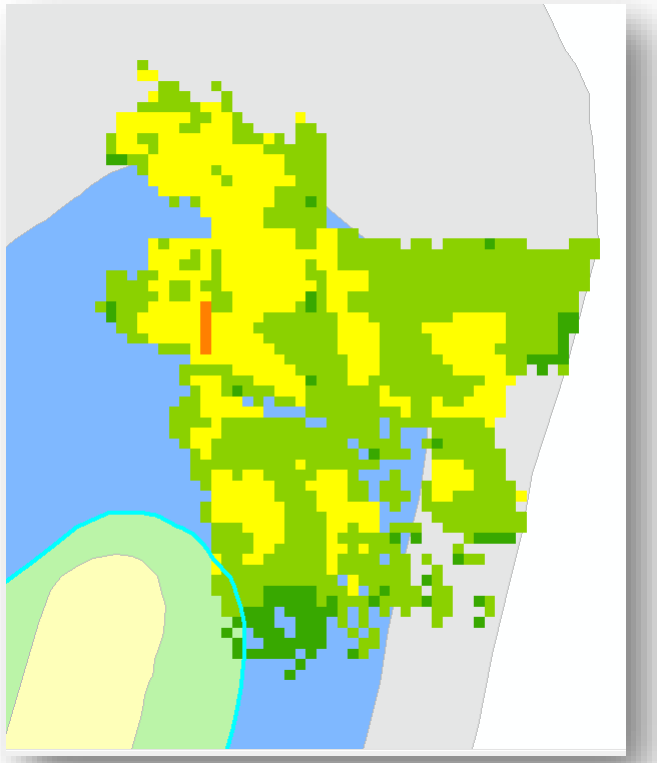
https://data.apps.fao.org/map/catalog/static/api/records/0c6be5d1-3a73-4516-953b-dbe2b511d6b3

https://data.apps.fao.org/map/catalog/static/search?keyword=HiH_MAPSPAM

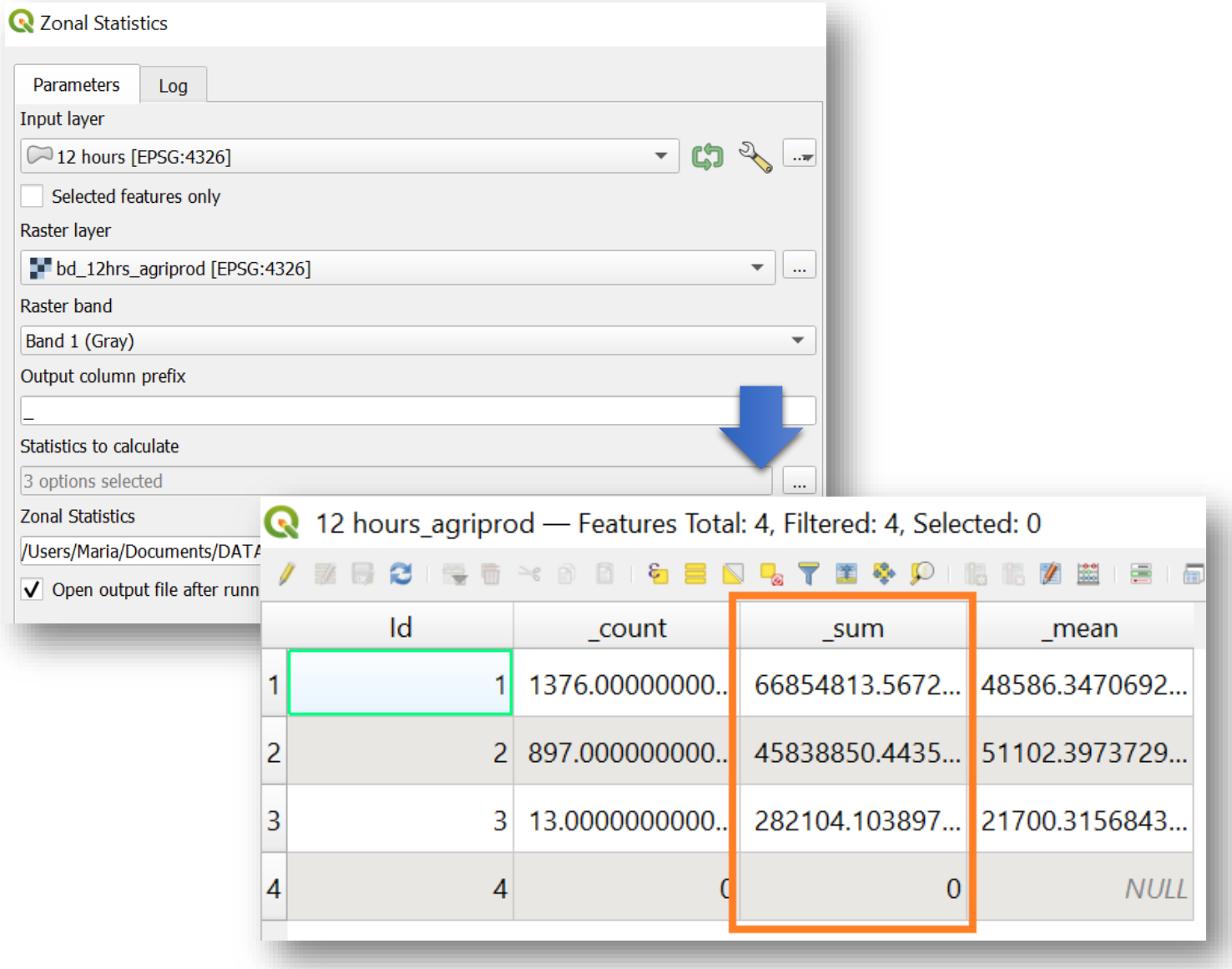
Calculating the agricultural production quantity exposure to cyclone

Clip raster by mask layer

Result:

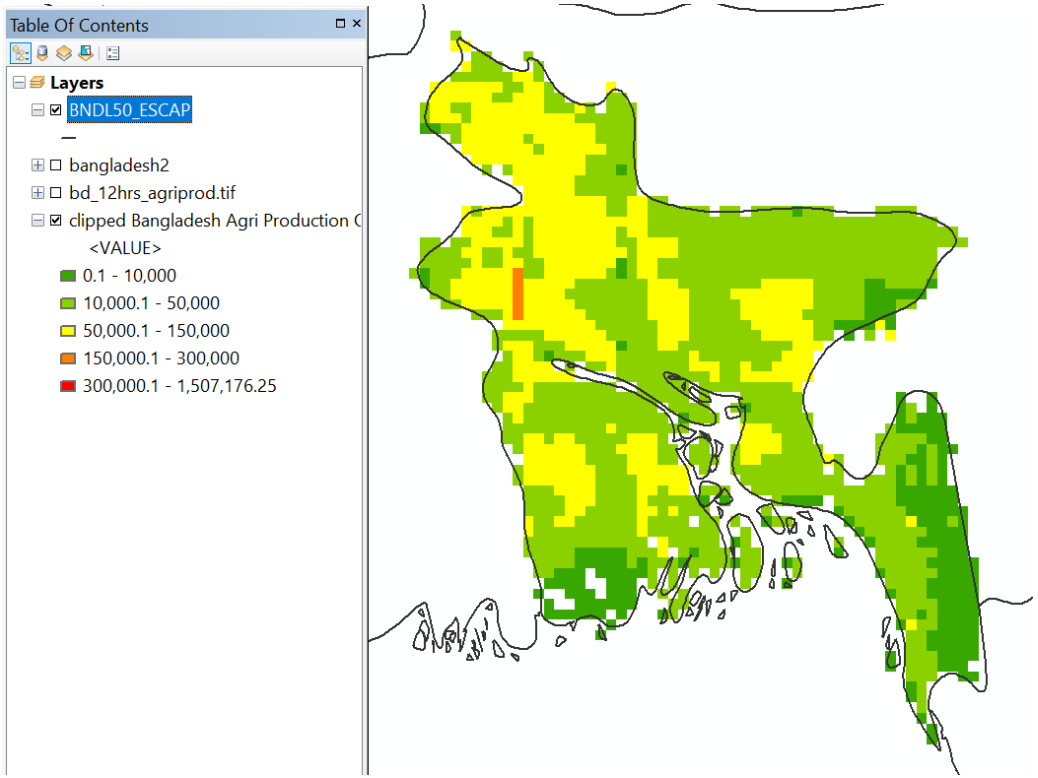


Zonal statistics

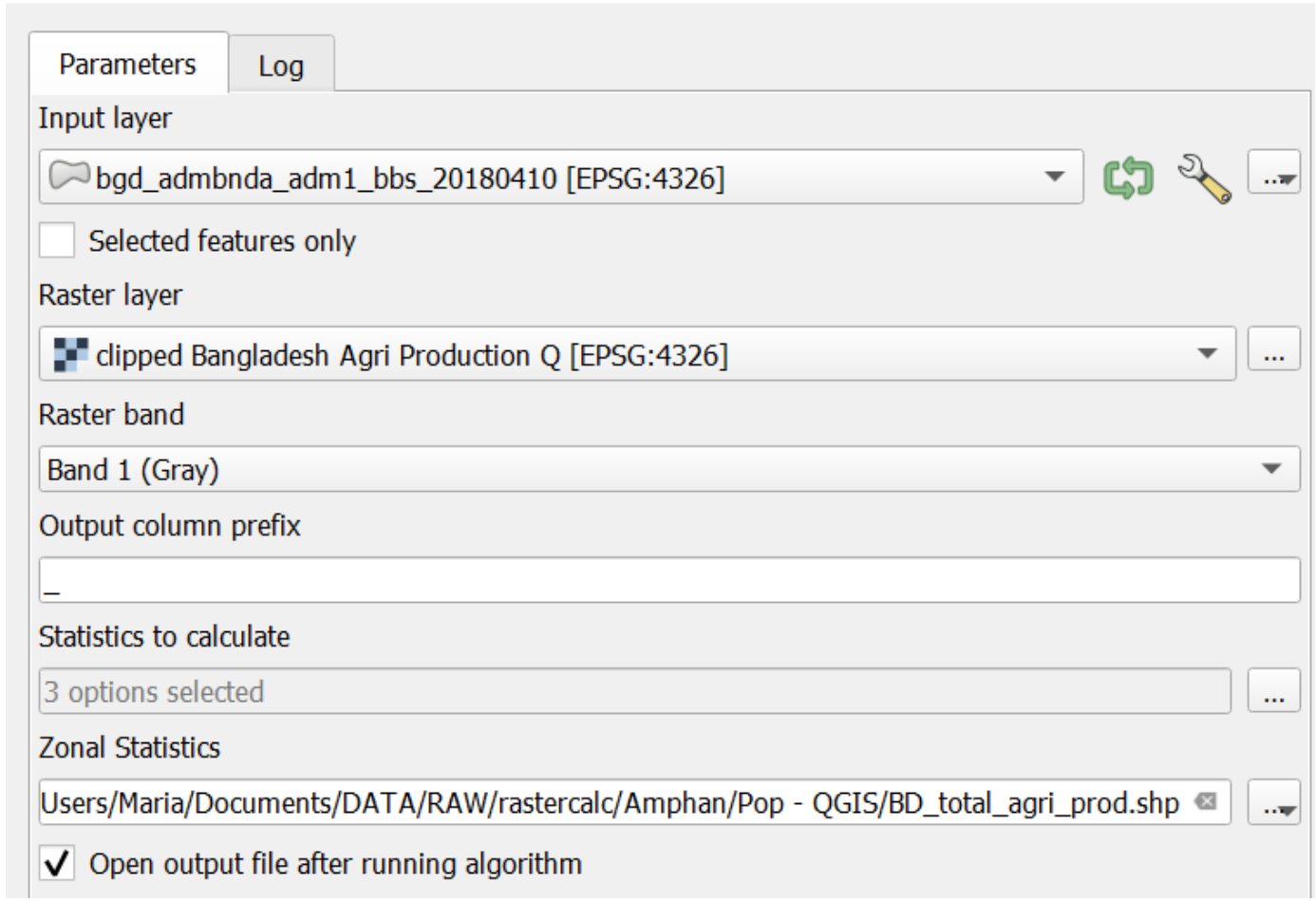


Calculating the total agricultural production quantity (1/2)

Clip raster by mask layer



Zonal statistics



Calculating the total agricultural production quantity (2/2)

Output of Zonal Statistics

BD_total_agri_prod — Features Total: 8, Filtered: 8, Selected: 0

	Shape_Leng	Shape_Area	ADM1_EN	M1_PC	DM1_R	M1ALT	M1ALT	DM0_E	M0_PC	date	validOn	validTo	_cour	_sum
1	25.42460438700	0.88939513745	Barisal	10	NULL	NULL	NULL	Ban...	BD	2015-...	2018-...	NULL	83...	2932740.52622...
2	30.28732120690	2.73779583154	Chittagong	20	NULL	NULL	NULL	Ban...	BD	2015-...	2018-...	NULL	356...	8765473.63504...
3	12.19775793130	1.80650588740	Dhaka	30	NULL	NULL	NULL	Ban...	BD	2015-...	2018-...	NULL	230...	10875837.8647...
4	38.40938469700	1.82657492875	Khulna	40	NULL	NULL	NULL	Ban...	BD	2015-...	2018-...	NULL	244...	9570799.77320...
5	8.16657735137	0.94181167913	Mymensingh	45	NULL	NULL	NULL	Ban...	BD	2015-...	2018-...	NULL	135...	5902535.80664...
6	8.41022082480	1.62485589936	Rajshahi	50	NULL	NULL	NULL	Ban...	BD	2015-...	2018-...	NULL	234...	15501532.6428...
7	15.36968313740	1.46568139261	Rangpur	55	NULL	NULL	NULL	Ban...	BD	2015-...	2018-...	NULL	212...	13526914.0495...
8	9.80029271362	1.10396330243	Sylhet	60	NULL	NULL	NULL	Ban...	BD	2015-...	2018-...	NULL	160...	4228728.48307...

Basic statistics for field

Basic Statistics for Fields

Parameters | Log

Input layer

BD_total_agri_prod [EPSG:4326]

Selected features only

Field to calculate statistics on

1.2 _sum

Statistics [optional]

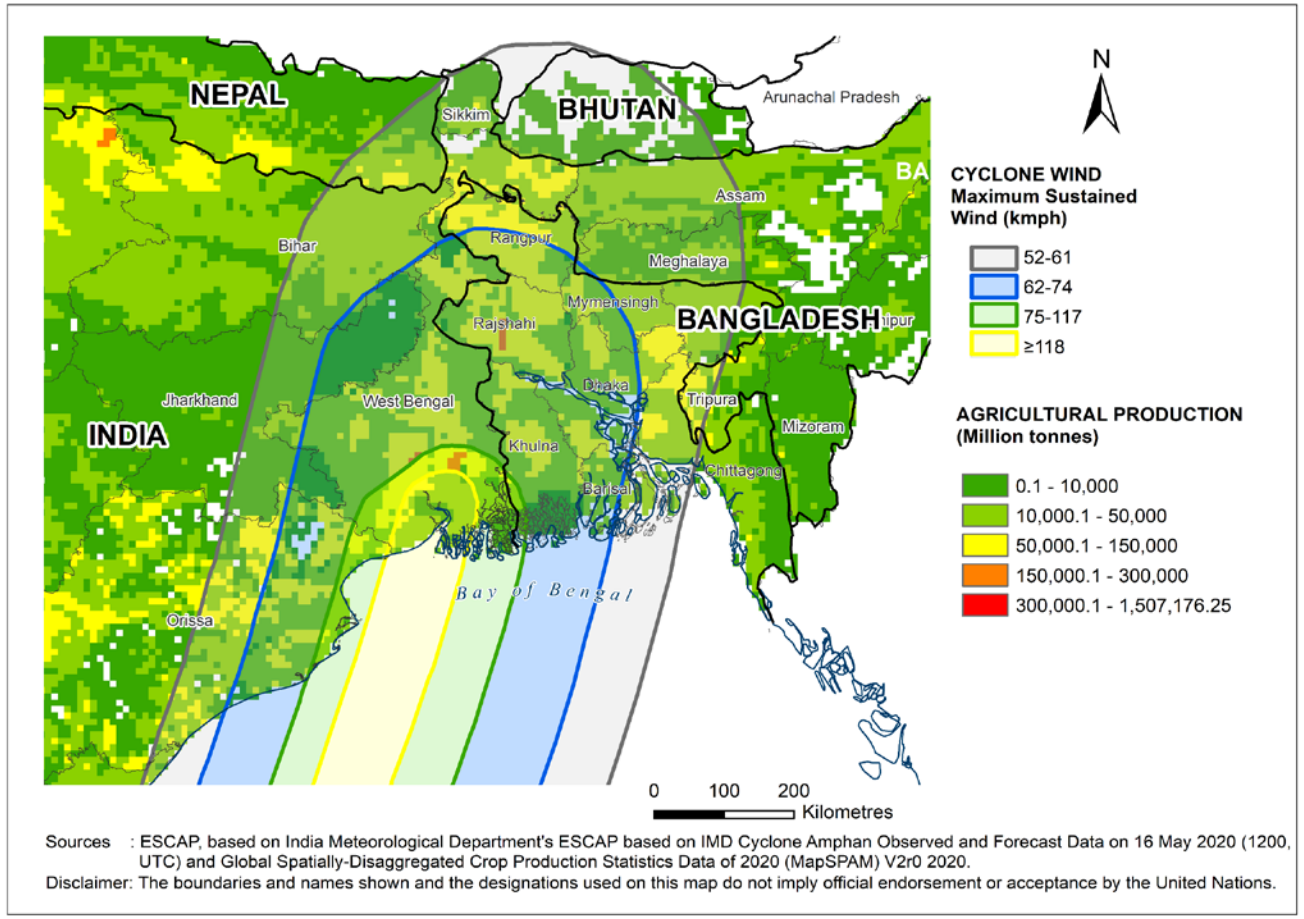
Users/Maria/Documents/DATA/RAW/rastercalc/Amphan/Pop - QGIS/BD_total_agri_prod.html

Basic Statistics for Fields

Parameters | Log

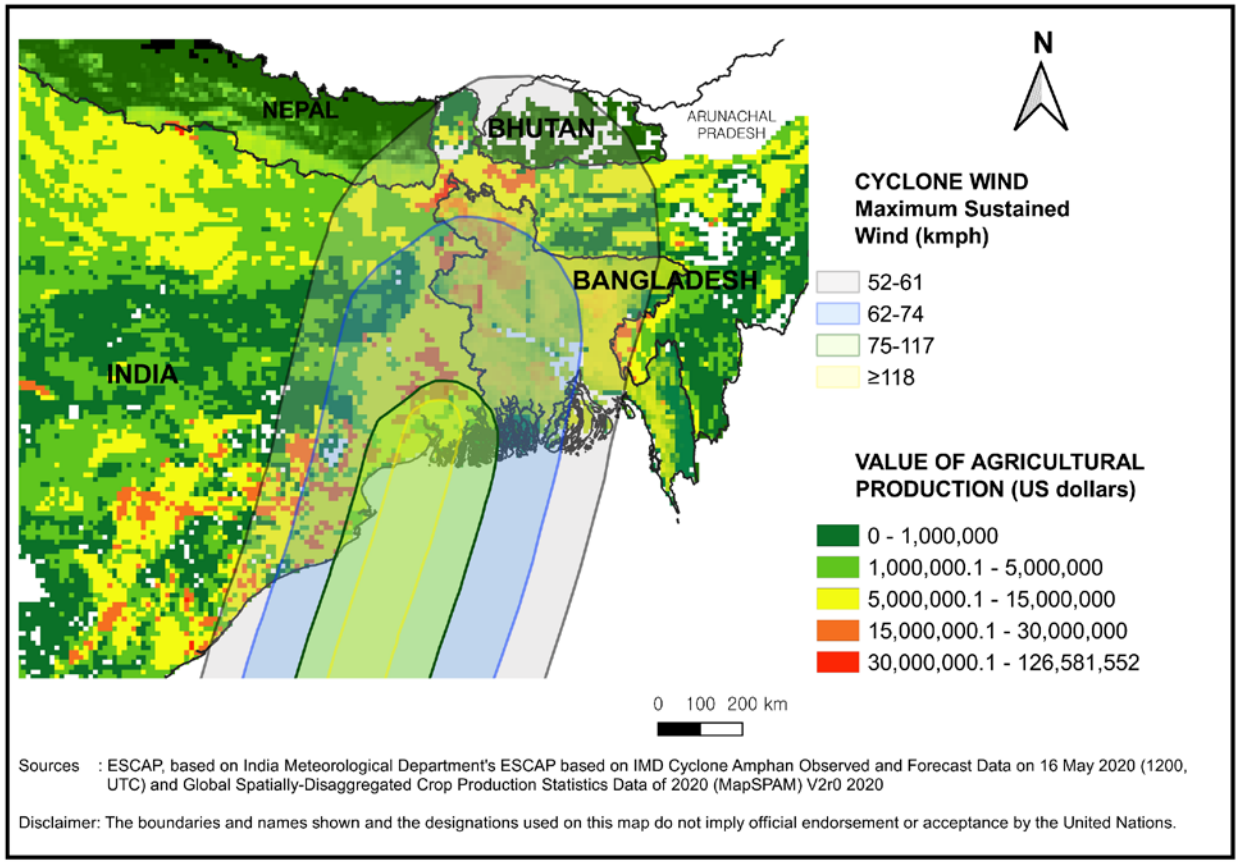
```
'OUTPUT_HTML_FILE' : 'C:/Users/Maria/Documents/DATA/RAW/rastercalc/
Amphan/Pop - QGIS/BD_total_agri_prod.html' }

Execution completed in 0.04 seconds
Results:
{'COUNT': 8,
'CV': 0.46220465516837955,
'EMPTY': 0,
'FILLED': 8,
'FIRSTQUARTILE': 5065632.144855499,
'IQR': 7135743.812297821,
'MAJORITY': 2932740.5262277126,
'MAX': 15501532.642822266,
'MEAN': 8913070.34766516,
'MEDIAN': 9168136.704126835,
'MIN': 2932740.5262277126,
'MINORITY': 2932740.5262277126,
'OUTPUT_HTML_FILE': 'C:/Users/Maria/Documents/DATA/RAW/rastercalc/
Amphan/Pop '
'- QGIS/BD_total_agri_prod.html',
'RANGE': 12568792.116594553,
'STD_DEV': 4119662.606534085,
'SUM': 71304562.78132129,
'THIRDQUARTILE': 12201375.95715332,
'UNIQUE': 8}
```

Agricultural production quantity exposure to Cyclone Amphan



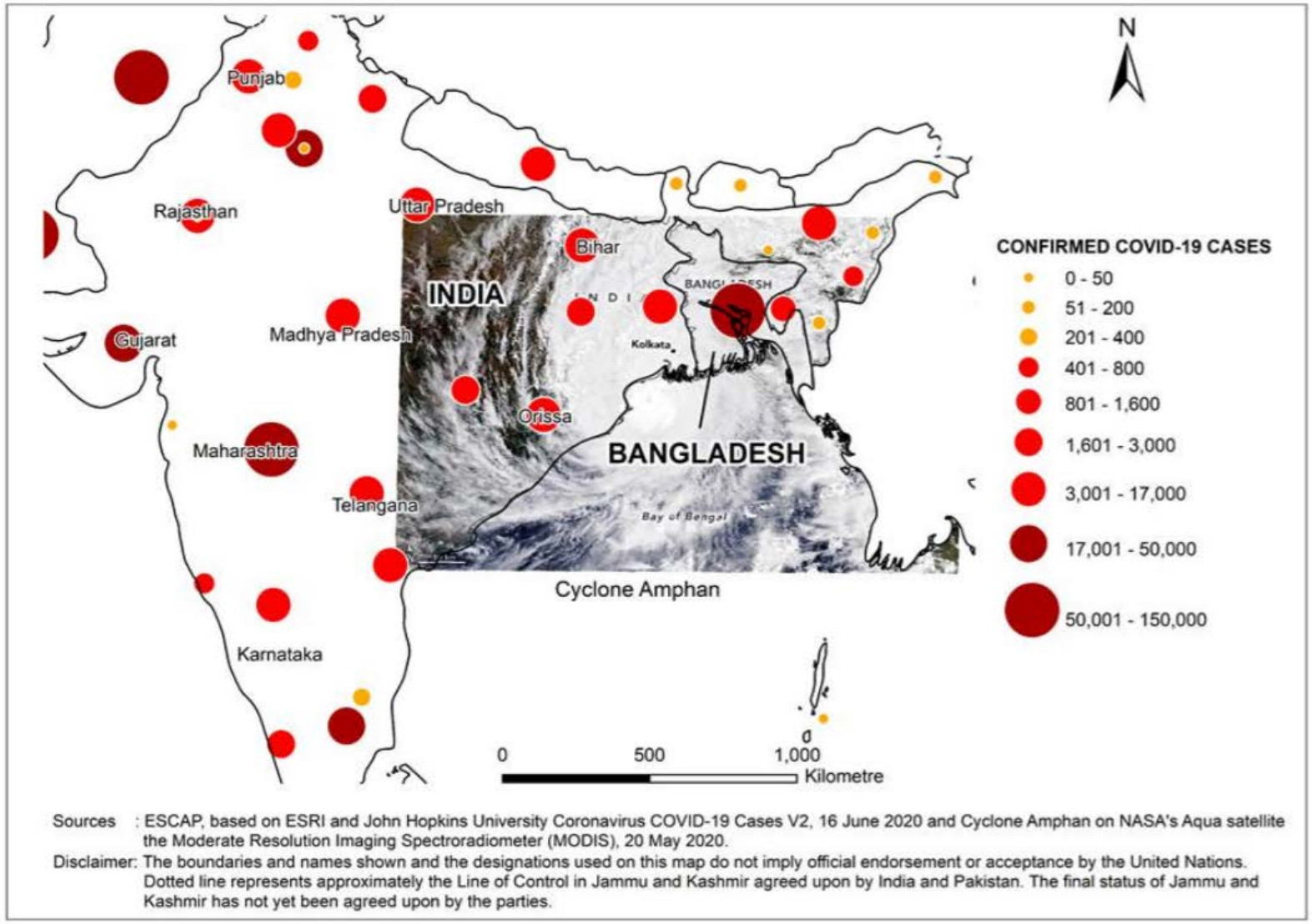
Country	Total Value (USD)	Exposure to Cyclone 1	Exposure to Cyclone 2	Exposure to Cyclone 3	Exposure to Cyclone 4	Not exposed to cyclone
Bangladesh	71,555,293	8,269,699	58,303,011	282,104	0	4,700,480
India	870,852,800	33,787,839	37,841,374	10,041,246	3,483,513	785,698,828

Value of Agricultural production exposure to Cyclone Amphan



Country	Total Value (USD)	Exposure to Cyclone 1	Exposure to Cyclone 2	Exposure to Cyclone 3	Exposure to Cyclone 4	Not exposed to cyclone
Bangladesl	18,457,650,744	5,560,985,455	11,339,258,755	80,175,988	0	1,477,230,546
India	168,748,222,149	9,295,723,904	9,491,616,887	2,432,862,780	963,795,085	146,564,223,493

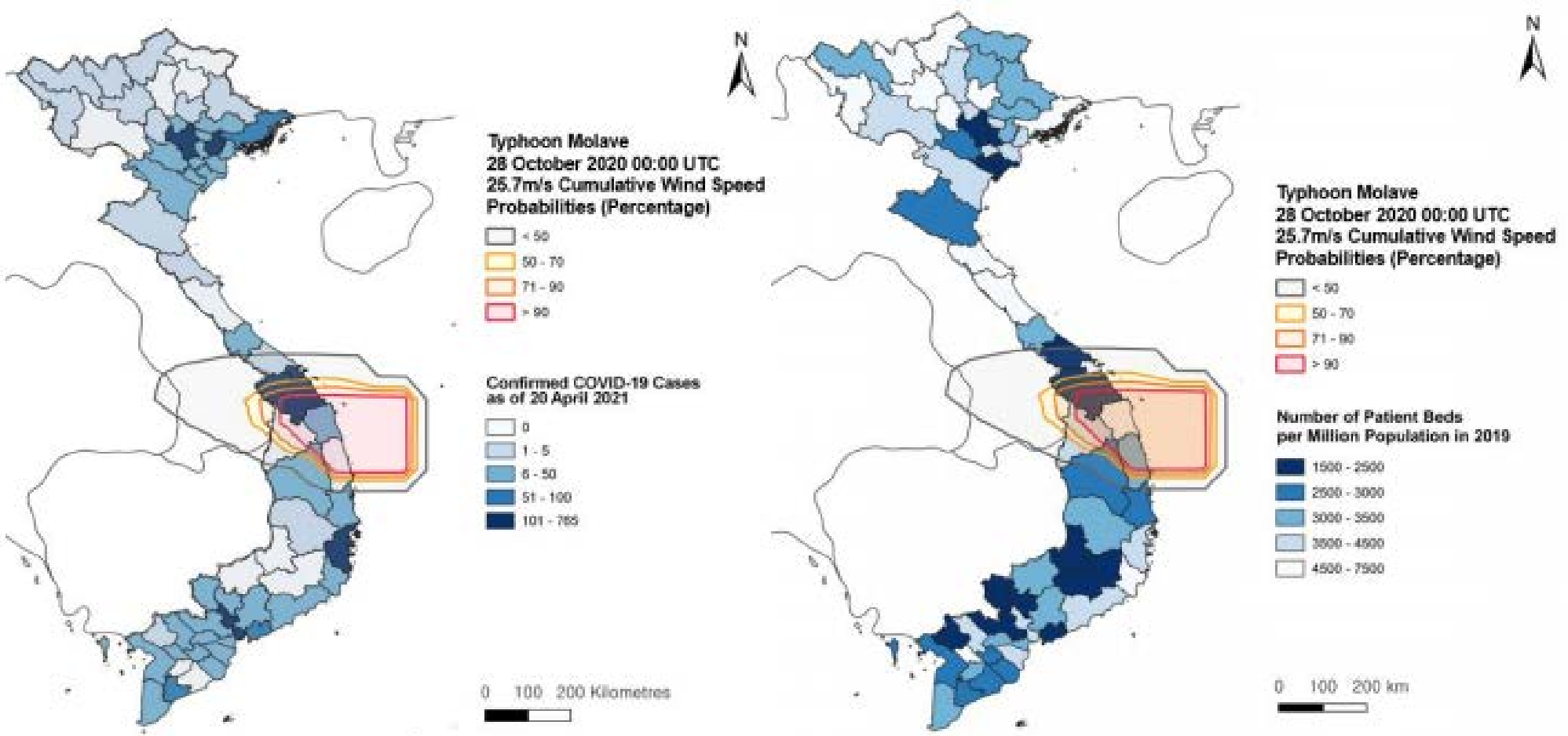
Collision of Cyclone Amphan with the COVID-19 pandemic



Coronavirus COVID-19 Cases V2 https://www.arcgis.com/apps/dashboards/bda7594740fd40299423467b48e9ecf6

https://coronavirus-resources.esri.com/maps/1cb306b5331945548745a5ccd290188e/about

Cyclone Molave - Vulnerability layer: Healthcare system capacity

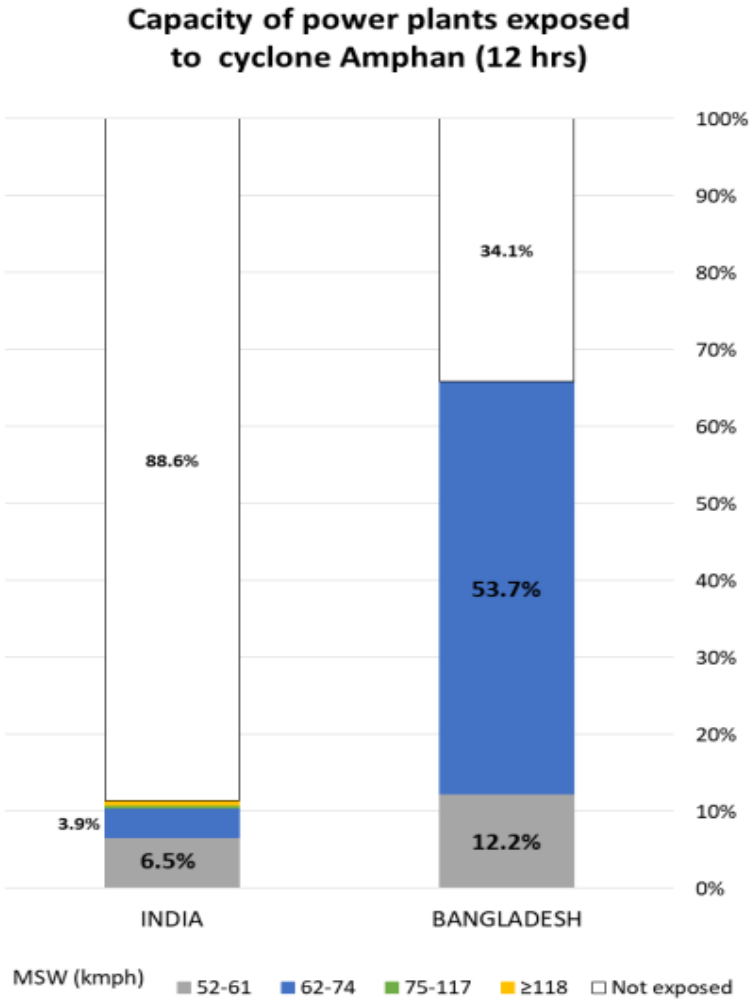


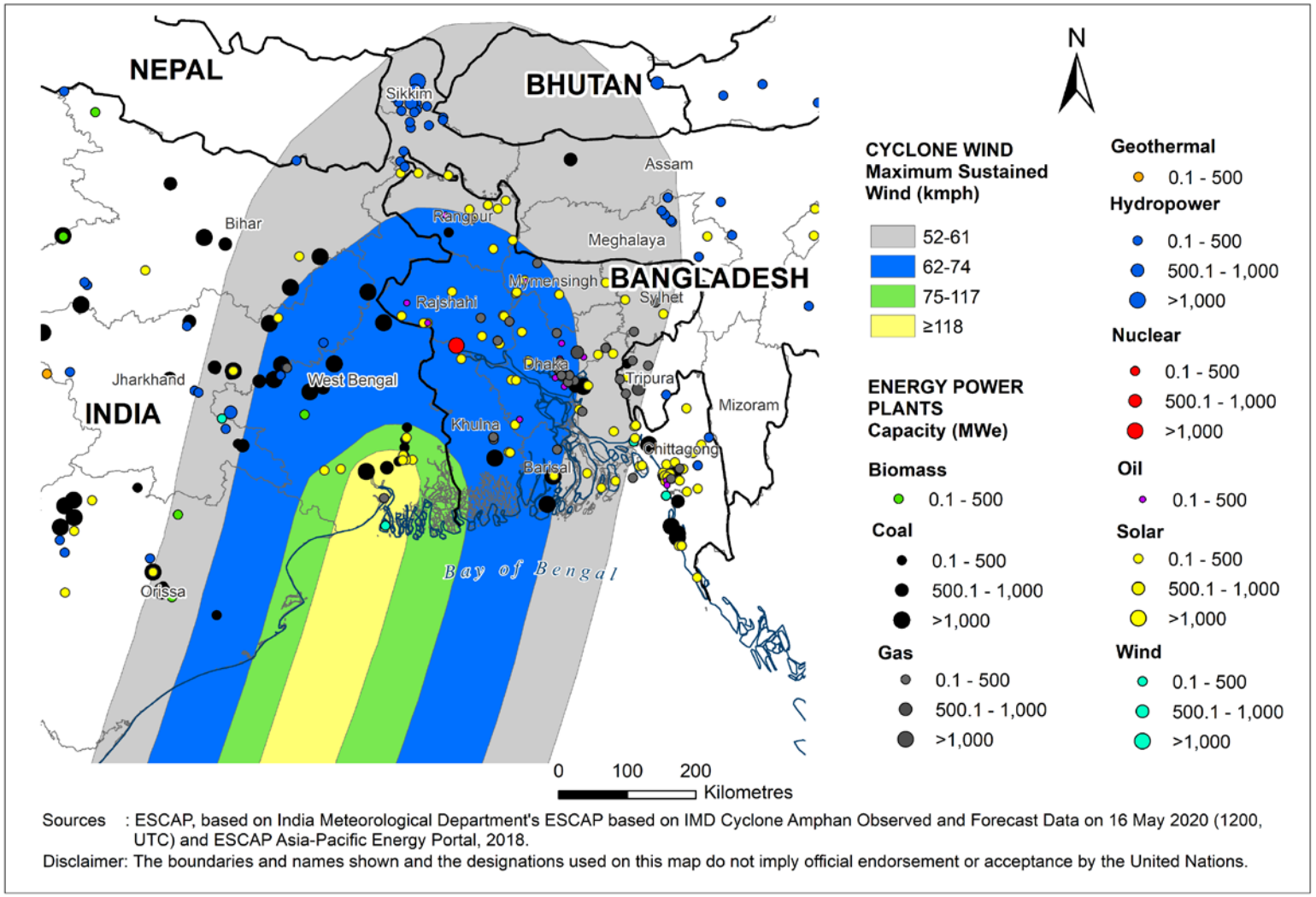
Data source: Vietnamese Ministry of Health for COVID-19 data, and Viet Nam General Statistics Office for number of patient beds

Source: ESCAP IBFWS training module (2021)

Energy

Exposure of energy infrastructure can be understood.





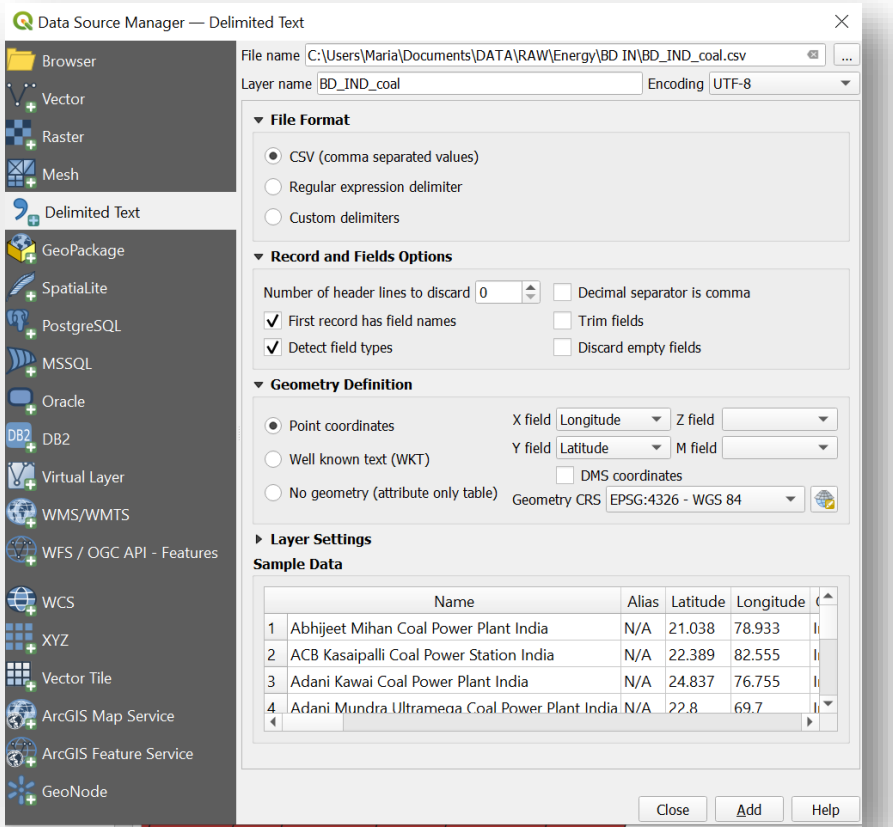
There are 9 power plants located in the areas expected to receive above 118 kmph of cyclone wind and 7 power plans to receive between 75 and 117 kmph of cyclone wind. These respectively account for **0.7% and 0.3% of the total capacity of India**.

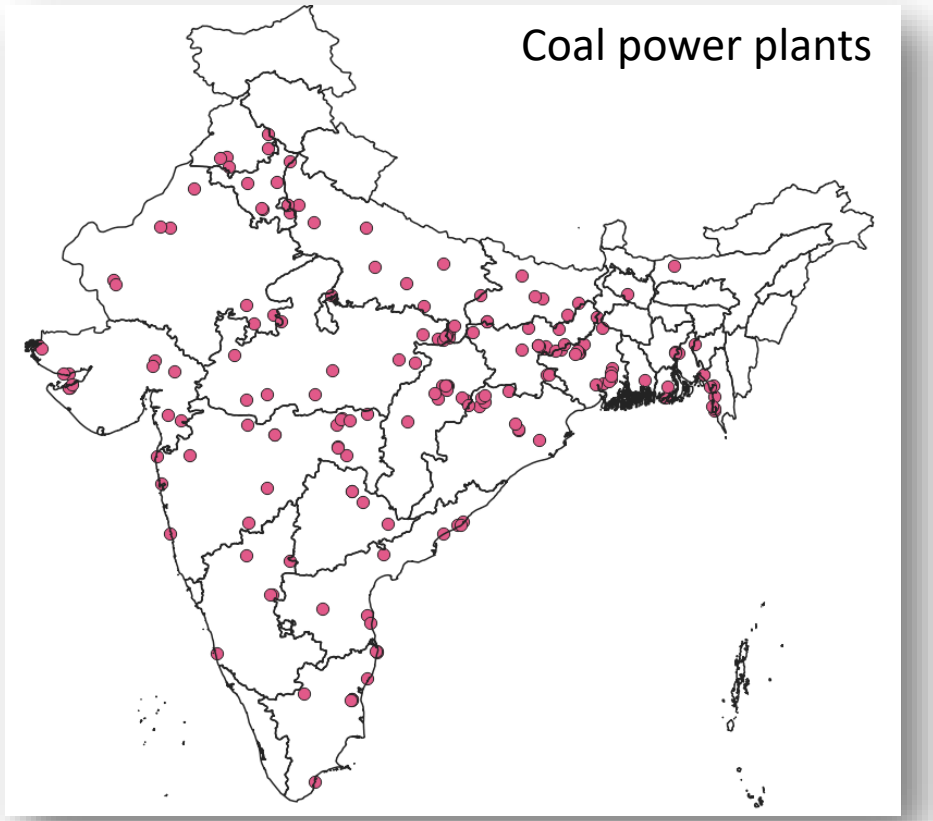
Calculating the exposure of energy power plants to cyclone

- **Refactor fields**
  To convert text data into decimal number

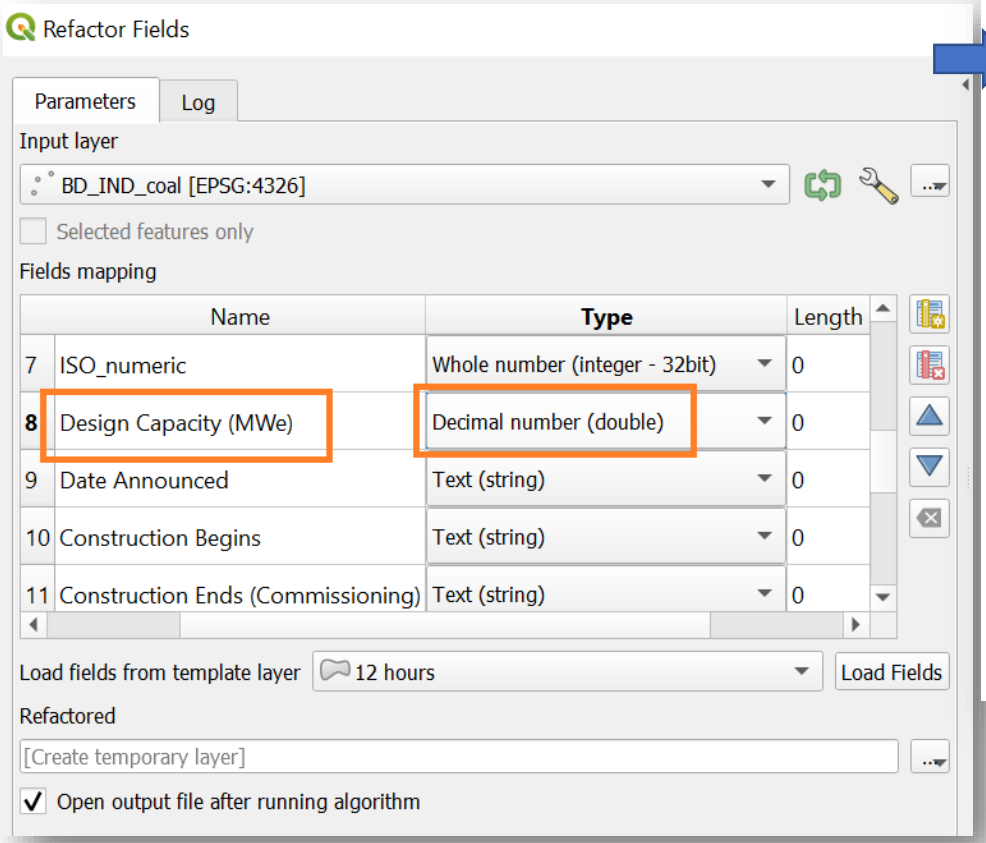
- **Import the saved CSV file**
  Open Data Source Manager (Ctrl +L)
  Go to “Delimited Text”, locate the saved CSV file, and add it

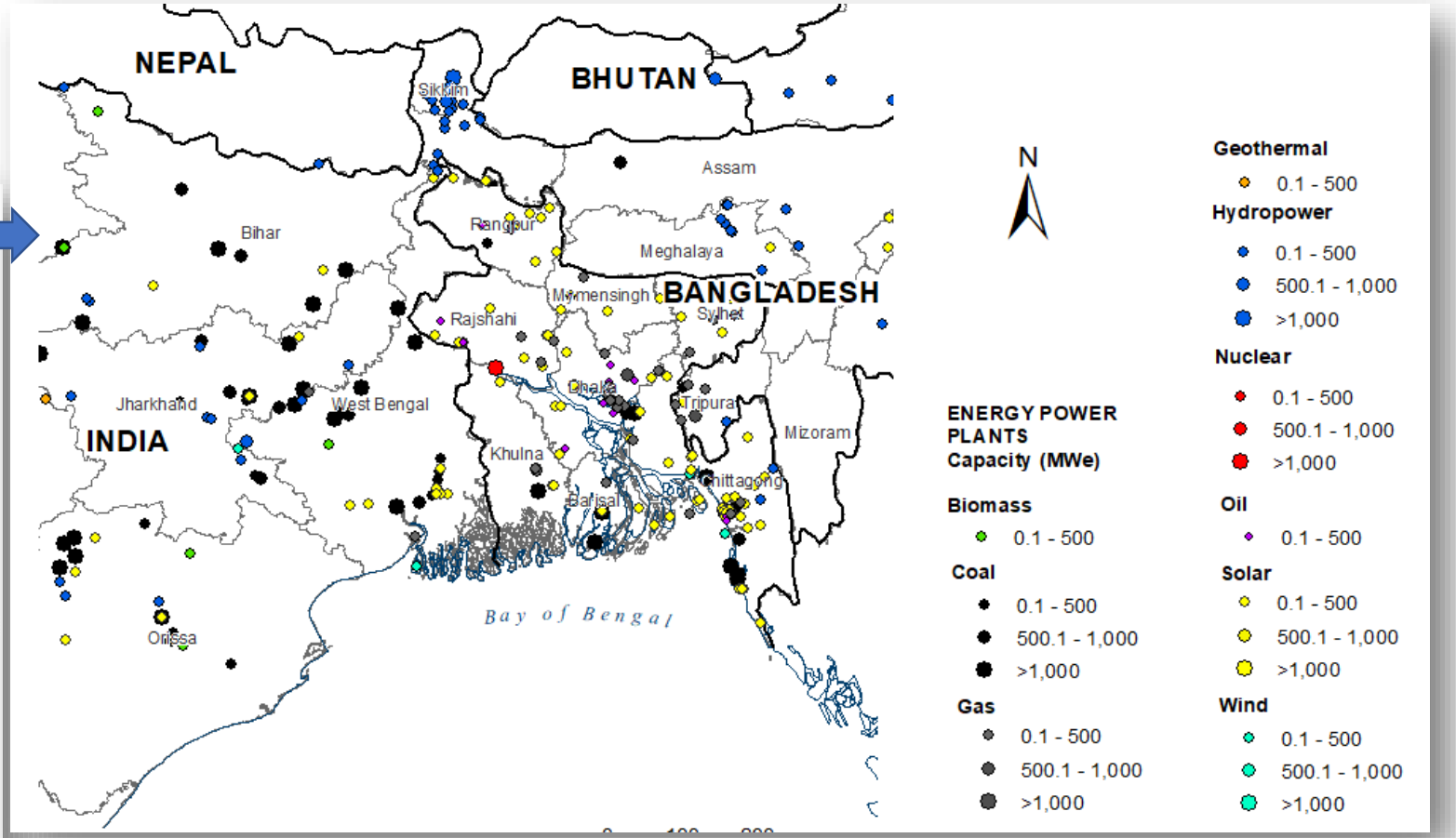
Open the CSV file in GIS → Export it to shapefile → Refactor fields





- **Refactor fields**
  To convert text data into decimal number

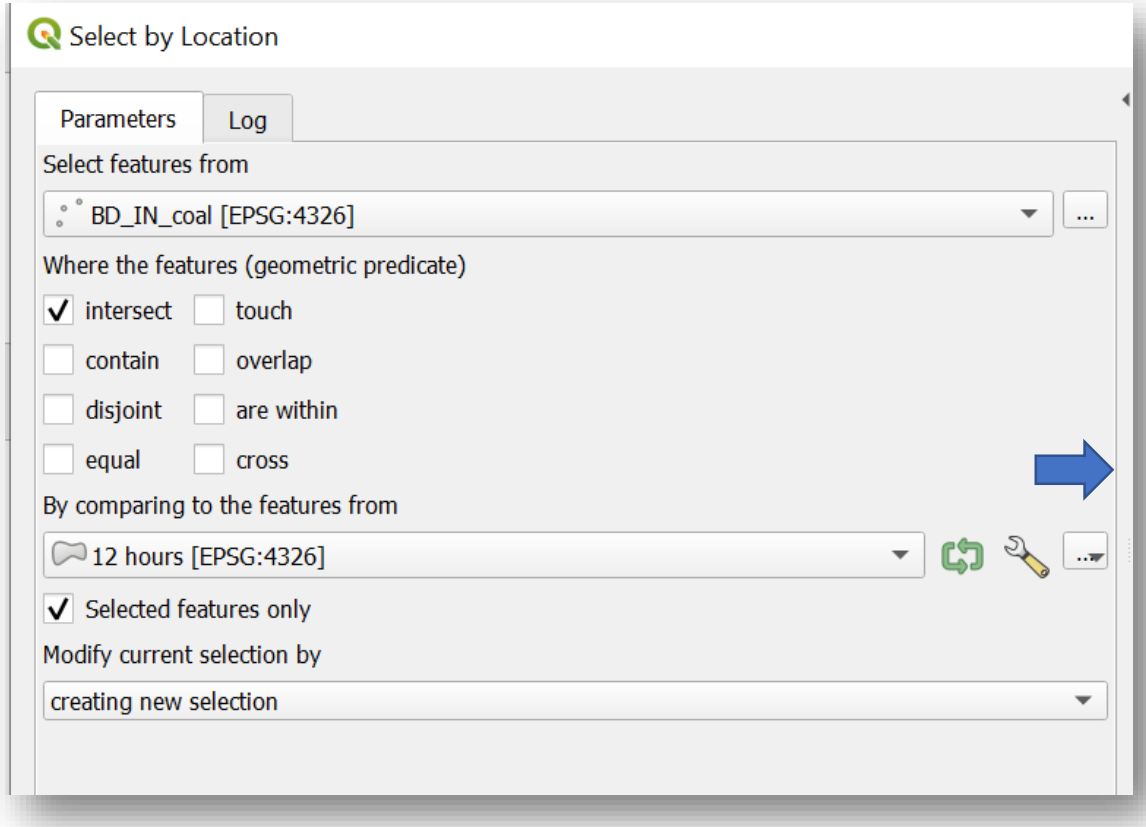


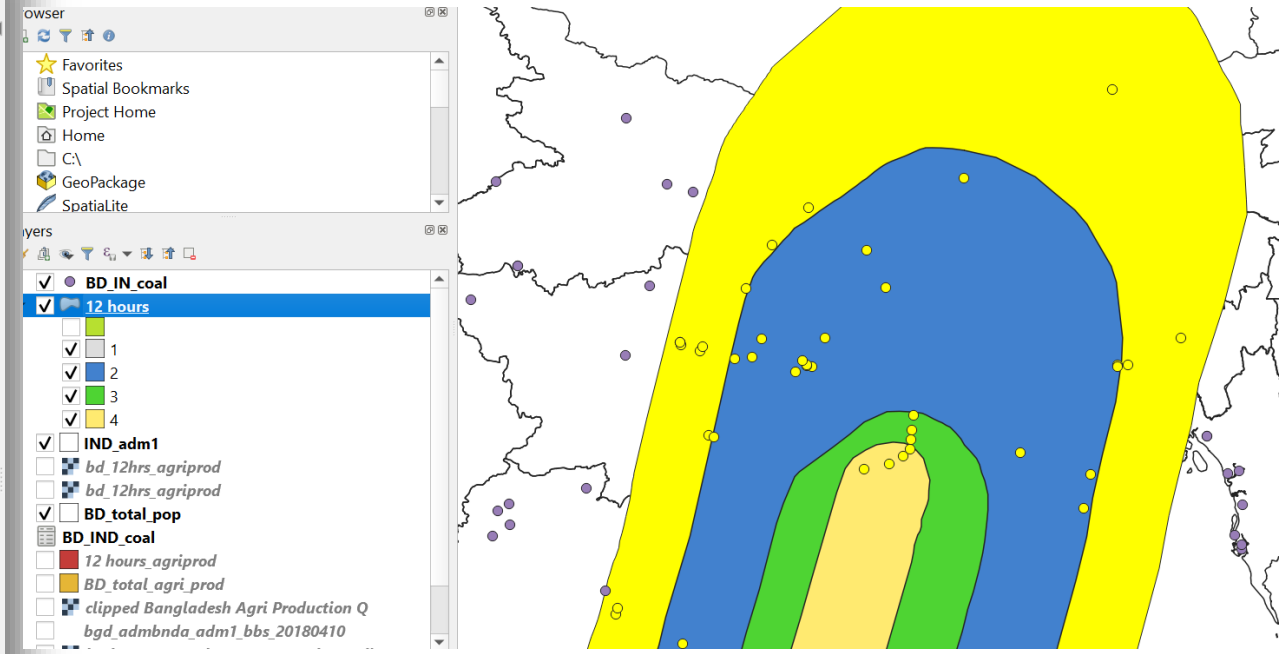


*** To get all types of power plants exposure, merge all power plants shapefile and repeat the processes**

- **Select by location**

  Import the WMO precipitation shapefile, right click it and Open Attribute Table, select only Id 1 and minimize the attribute table window.
  Go to Processing>Toolbox, search “Select by location” and follow the below pic
  Note: Check “Selected features only”

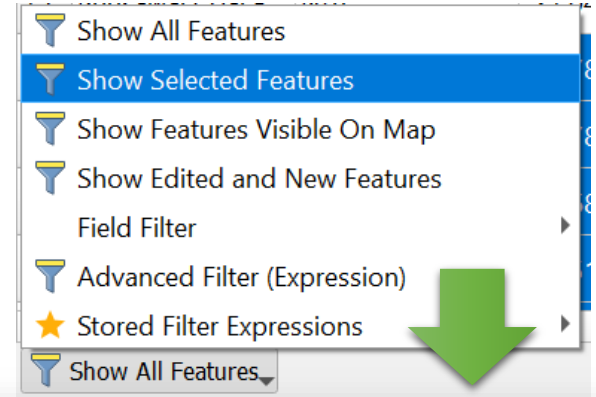


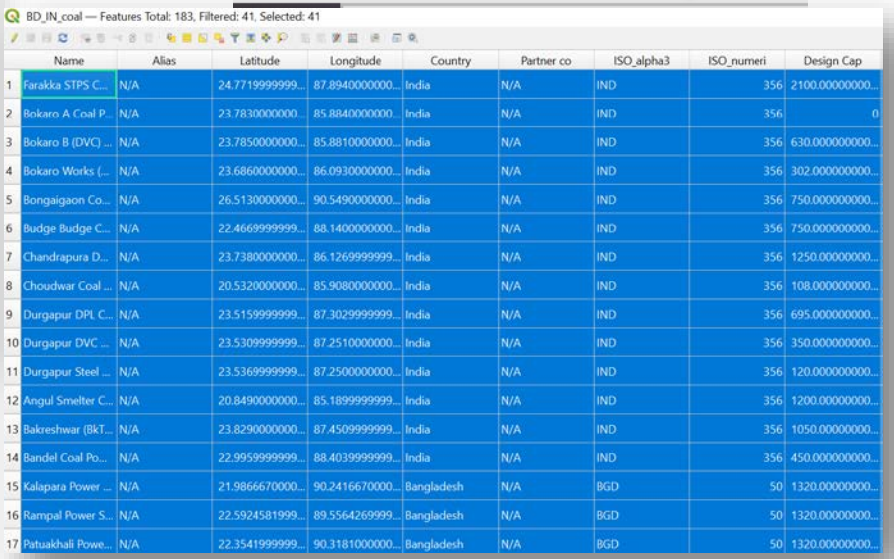


BD_IN_coal — Features Total: 183, Filtered: 183, Selected: 41

	Name	Alias	Latitude	Longitude	Country	Partner co	ISO_alpha3	ISO_numeri	Design Cap
1	Essar Mahan Co...	N/A	24.0079999999...	82.4170000000...	India	N/A	IND	356	1200.00000000...
2	Essar Salaya Co...	N/A	22.3050000000...	69.7099999999...	India	N/A	IND	356	1200.00000000...
3	Essar Vadinar P2...	N/A	22.3240000000...	69.7360000000...	India	N/A	IND	356	510.000000000...
4	Essar Vishakhap...	N/A	17.7210000000...	83.2720000000...	India	N/A	IND	356	25.0000000000...
5	Farakka STPS C...	N/A	24.7719999999...	87.8940000000...	India	N/A	IND	356	2100.00000000...
6	Faridabad Exten...	N/A	28.3739999999...	77.3080000000...	India	N/A	IND	356	110.000000000...
7	Gandhinagar Co...	N/A	23.2510000000...	72.6740000000...	India	N/A	IND	356	870.000000000...
8	Giral Lignite Po...	N/A	26.0450000000...	71.2540000000...	India	N/A	IND	356	250.000000000...
9	Guru Hargobind...	N/A	30.2669999999...	75.1659999999...	India	N/A	IND	356	920.000000000...
10	Guru Nanak Dev...	N/A	30.2330000000...	74.9249999999...	India	N/A	IND	356	440.000000000...
11	Harduaganj B C...	N/A	28.0159999999...	78.1310000000...	India	N/A	IND	356	1330.00000000...
12	Hindalco Renus...	N/A	24.1819999999...	82.7920000000...	India	N/A	IND	356	854.000000000...
13	Bellary (BTPS) C...	N/A	15.1930000000...	76.7199999999...	India	N/A	IND	356	1700.00000000...
14	Bhilai Steel CPP ...	N/A	21.1720000000...	81.3889999999...	India	N/A	IND	356	574.000000000...
15	Bhusawal Coal P...	N/A	21.0479999999...	75.8460000000...	India	N/A	IND	356	1420.00000000...
16	Bokaro A Coal P...	N/A	23.7830000000...	85.8840000000...	India	N/A	IND	356	0
17	Bokaro B (DVC) ...	N/A	23.7850000000...	85.8810000000...	India	N/A	IND	356	630.000000000...
18	Bokaro Works (...	N/A	23.6860000000...	86.0930000000...	India	N/A	IND	356	302.000000000...
19	Bongaigaon Co...	N/A	26.5130000000...	90.5490000000...	India	N/A	IND	356	750.000000000...

- **Export the selected features**
  Right click “Refactored” layer and Open Attribute Table, click “Show selected Features”, copy and paste on the Excel sheet





- **SUM the values in the Design Capacity column**

  The number of energy powerplant in area 1 is 41 given the number of the selected features

  To calculate the exposed capacity, SUM the Design Capacity column J

Row Labels	Count of wkt_geom	Sum of Design Cap
Bangladesh	7	6515
India	34	32251
Grand Total	**41**	**38766**

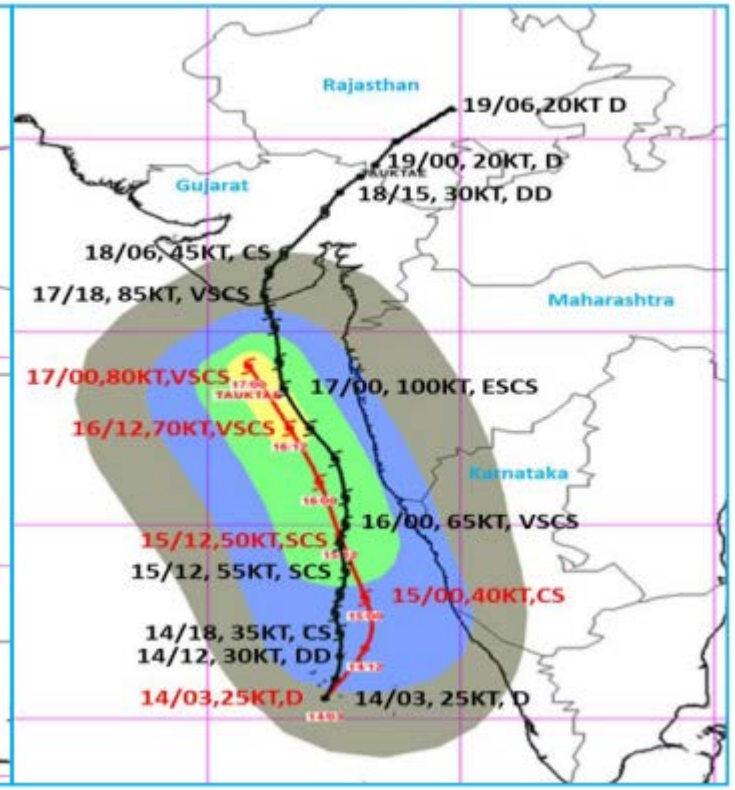
- **Repeat the processes for cyclone category 2, 3 and 4.**

Part 3. Impact based forecasting for Cyclone Tauktae

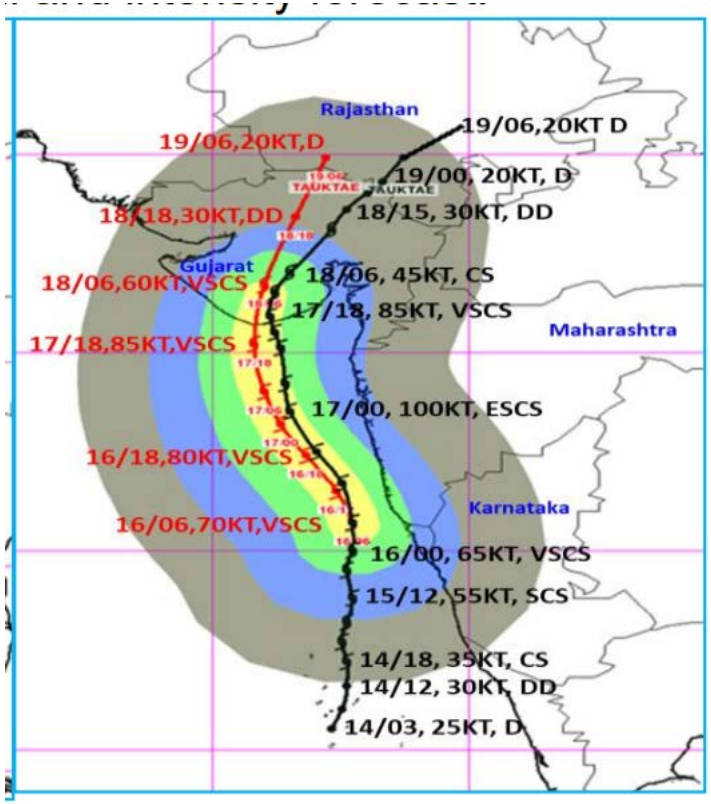



Examples of observed and forecast tracks of Cyclone Tauktae (14 – 17 May 2021)

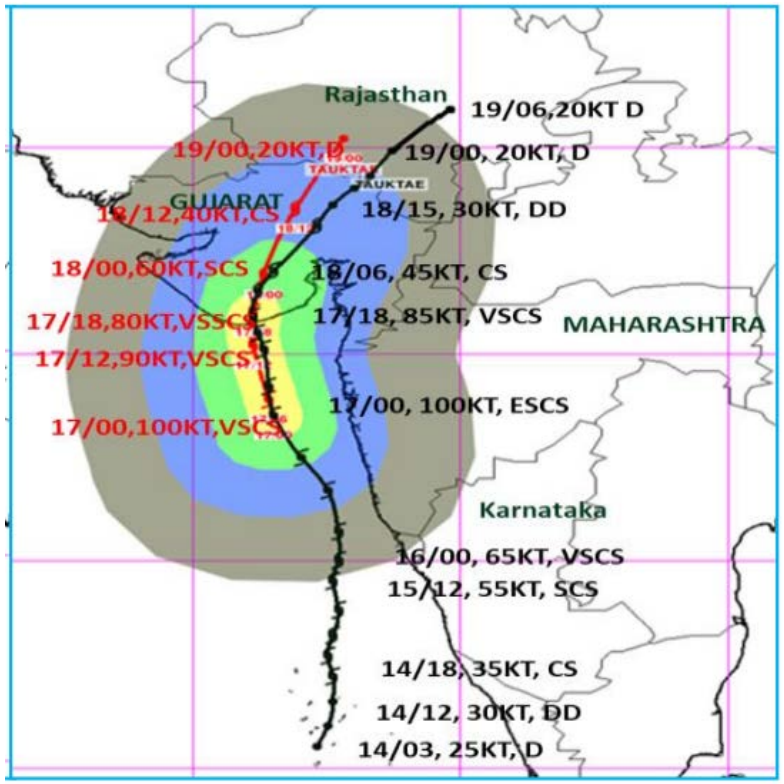
80 hrs
12:45 IST, 14 May 2021



36 hrs
14:30 IST, 16 May 2021



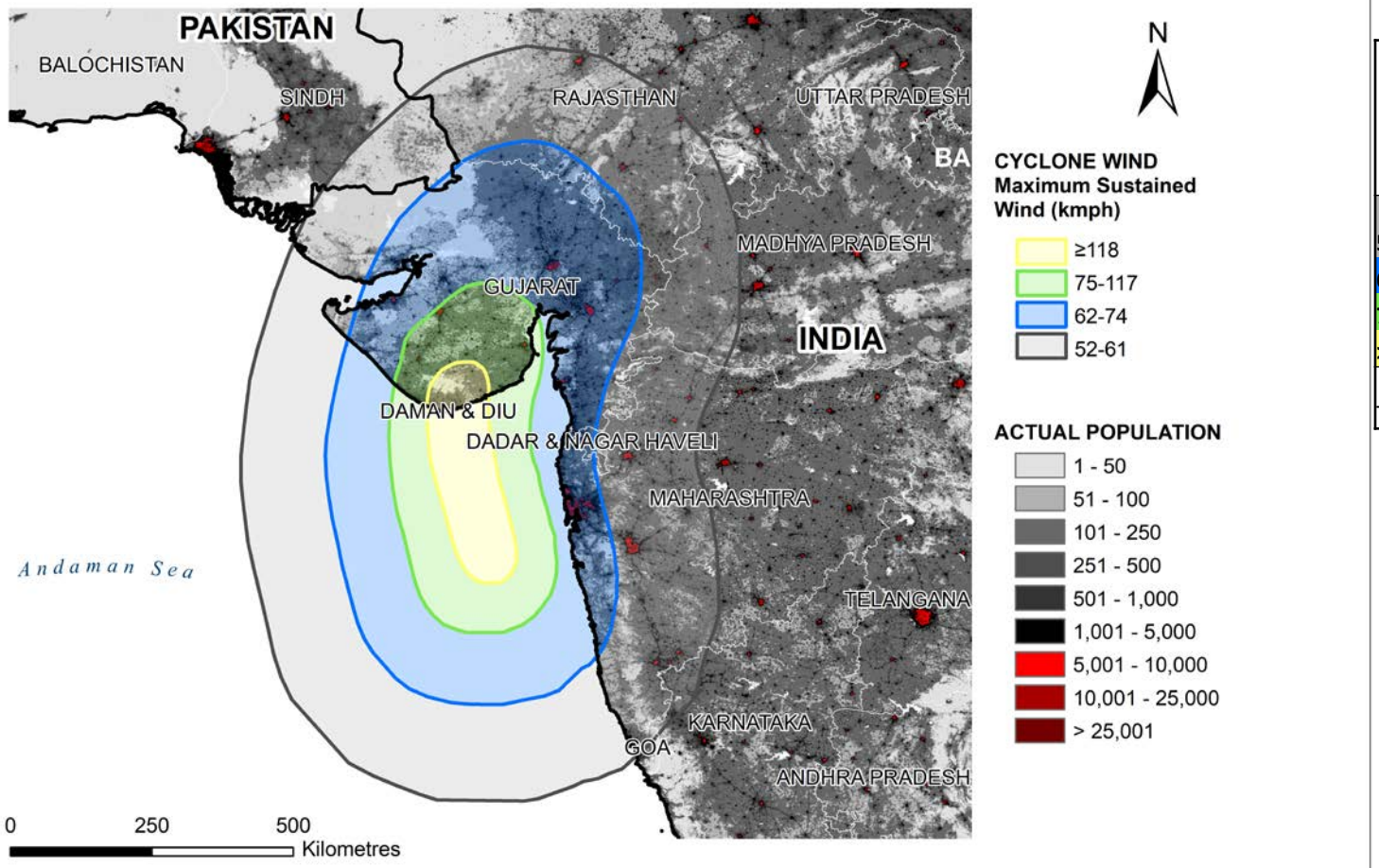
15 hrs
05:30 IST, 17 May 2021



Source: Indian Meteorological Department (IMD), 2021.

https://internal.imd.gov.in/press_release/20210611_pr_1132.pdf

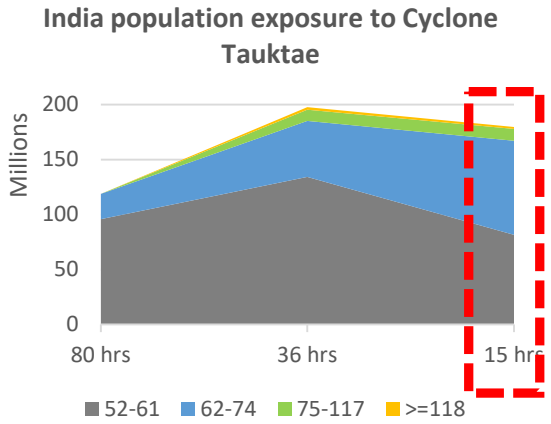
Population likely to be hit by Cyclone Tauktae

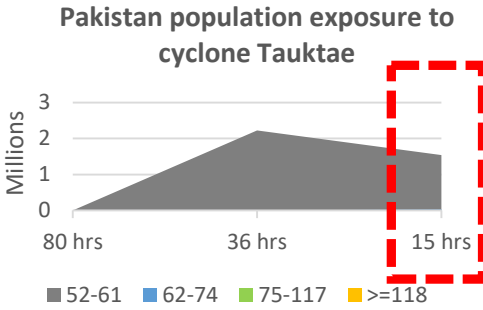


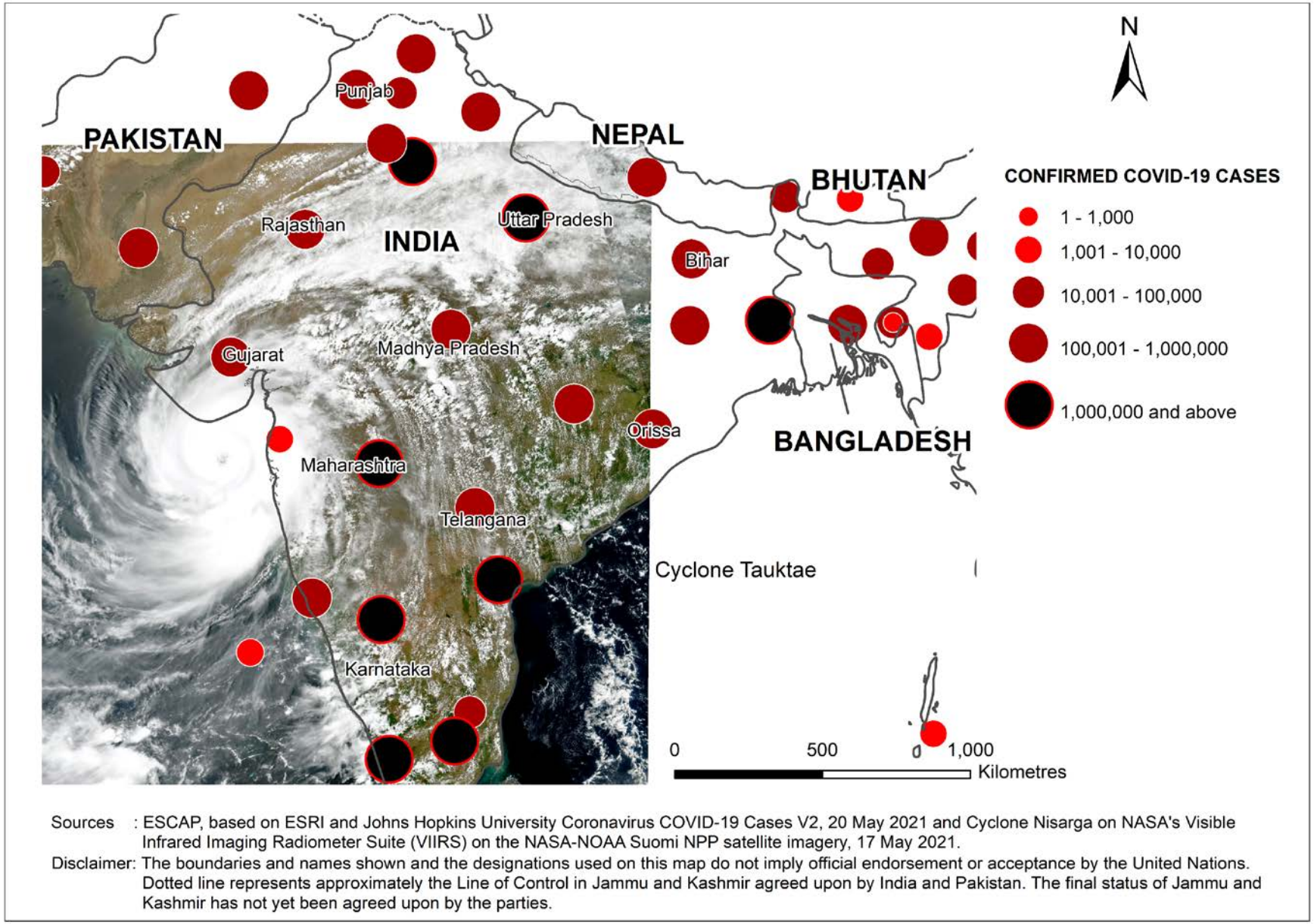
Sources : ESCAP, based on India Meteorological Department's ESCAP based on IMD Cyclone Amphan Observed and Forecast Data on 17 May 2021 (05:30 IST) and Worldpop 2020 Population Estimates for India and Pakistan.

Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Cyclone wind Maximum Sustained Wind	Category	80 hrs		36 hrs		15 hrs	
		IND	PAK	IND	PAK	IND	PAK
52-61	1	95,951,965	0	134,188,285	2,222,065	81,646,847	1,544,966
62-74	2	22,911,284	0	50,779,203	0	85,554,279	33,019
75-117	3	0	0	10,398,294	0	10,672,006	0
>=118	4	0	0	2,269,487	0	1,614,419	0
TOTAL		118,863,249	0	197,635,269	2,222,065	179,487,550	1,577,985

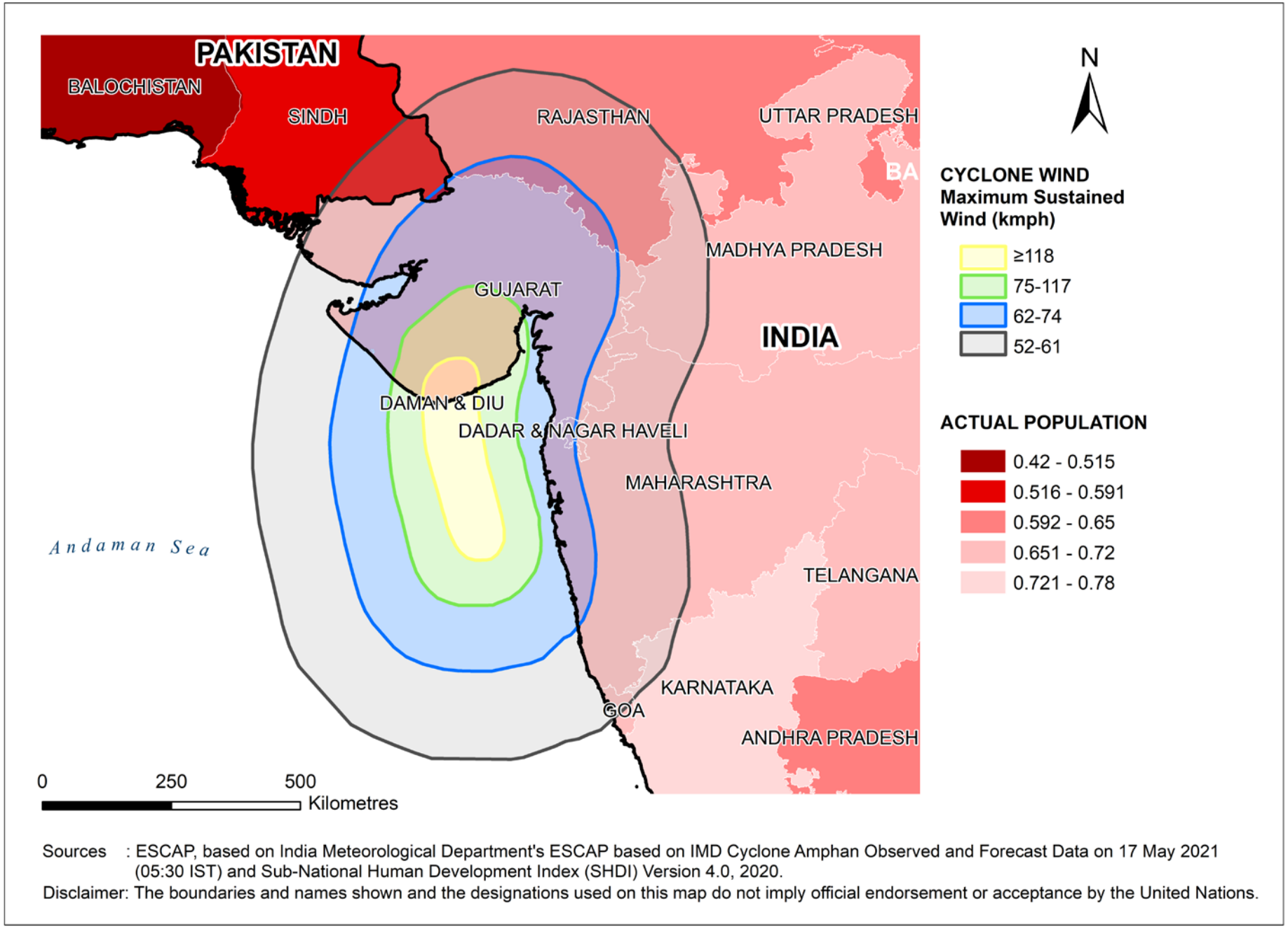






ESCAP Blog. 28 May 2021. Cyclone Tauktae: a perfect storm of climate change and pandemic
https://www.unescap.org/blog/cyclone-tauktae-perfect-storm-climate-change-and-pandemic

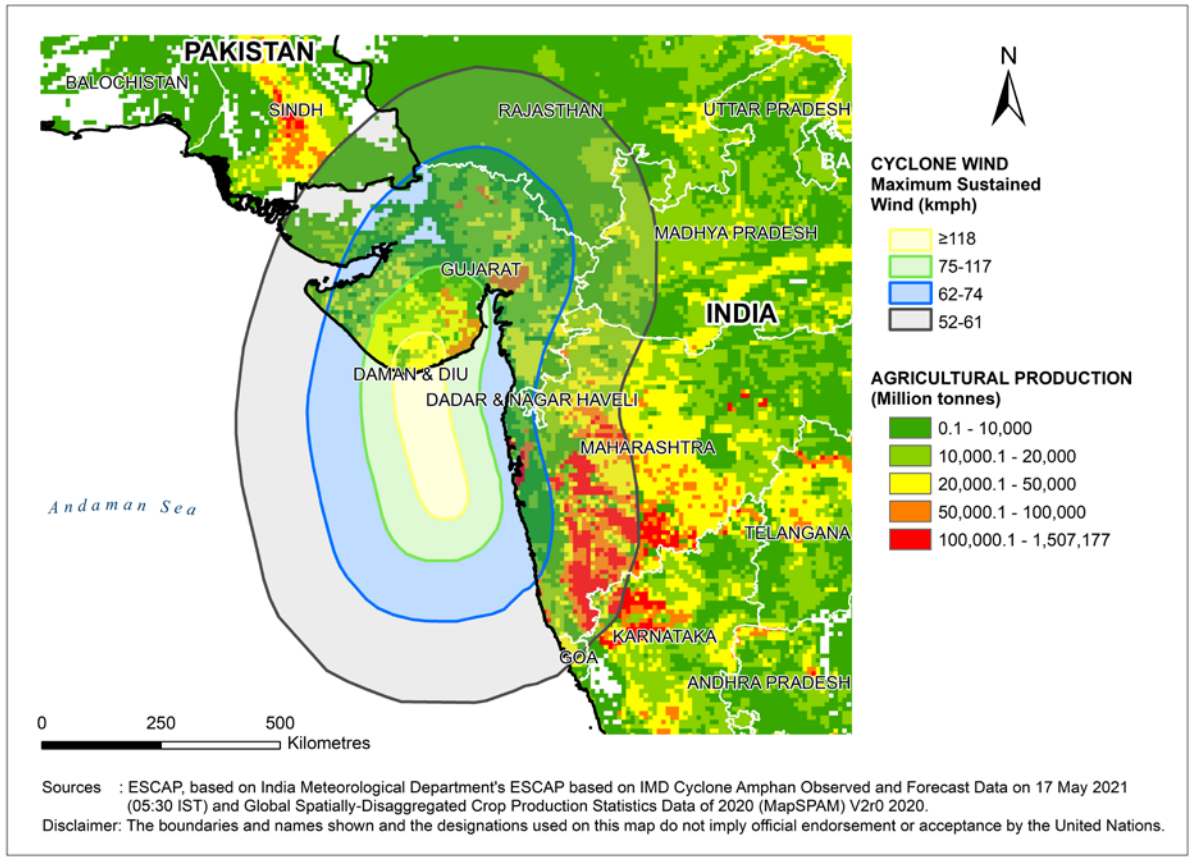
Areas with high proportion of vulnerable population to be hit by Cyclone Amphan



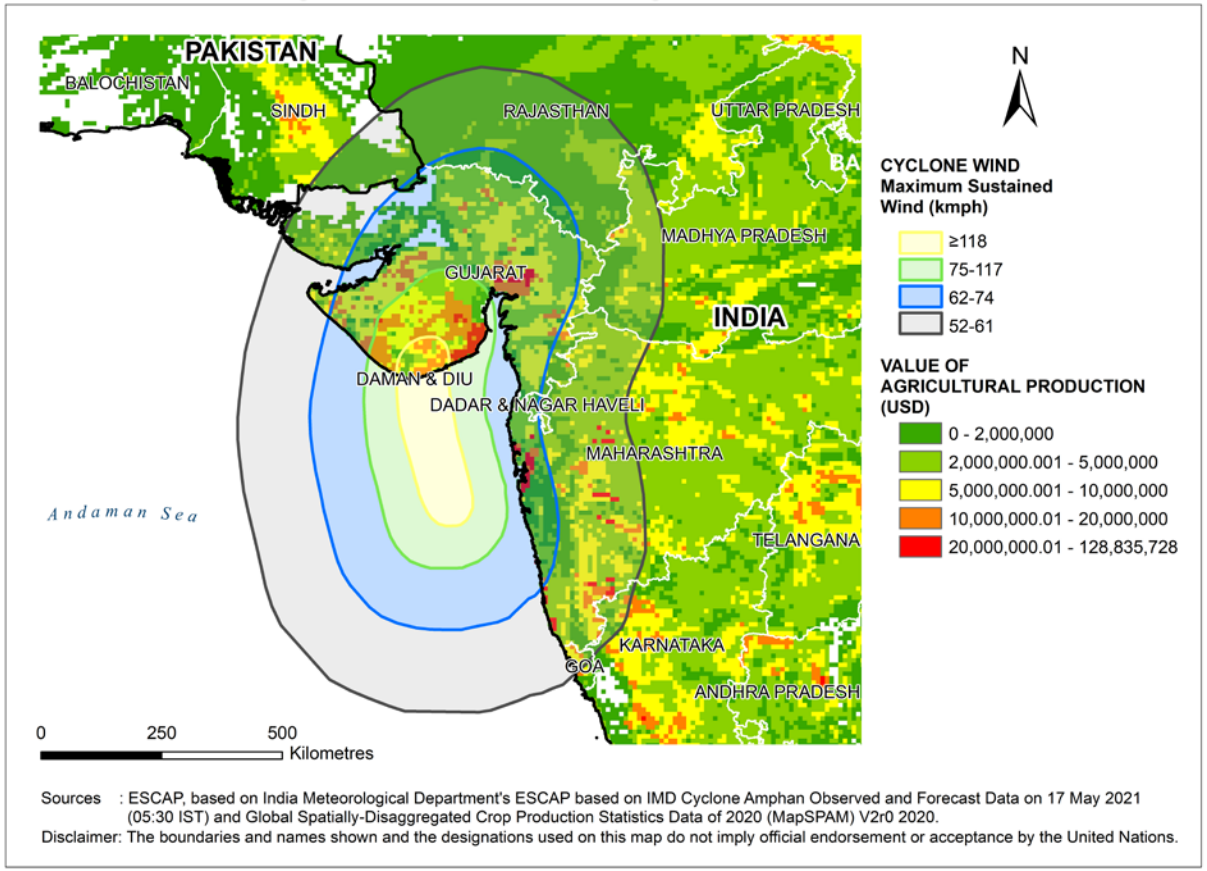
Sources : ESCAP, based on India Meteorological Department's ESCAP based on IMD Cyclone Amphan Observed and Forecast Data on 17 May 2021 (05:30 IST) and Sub-National Human Development Index (SHDI) Version 4.0, 2020.

Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Agricultural production quantity and value exposure to Cyclone Tauktae



Sources : ESCAP, based on India Meteorological Department's ESCAP based on IMD Cyclone Amphan Observed and Forecast Data on 17 May 2021 (05:30 IST) and Global Spatially-Disaggregated Crop Production Statistics Data of 2020 (MapSPAM) V2r0 2020.
Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.



Sources : ESCAP, based on India Meteorological Department's ESCAP based on IMD Cyclone Amphan Observed and Forecast Data on 17 May 2021 (05:30 IST) and Global Spatially-Disaggregated Crop Production Statistics Data of 2020 (MapSPAM) V2r0 2020.
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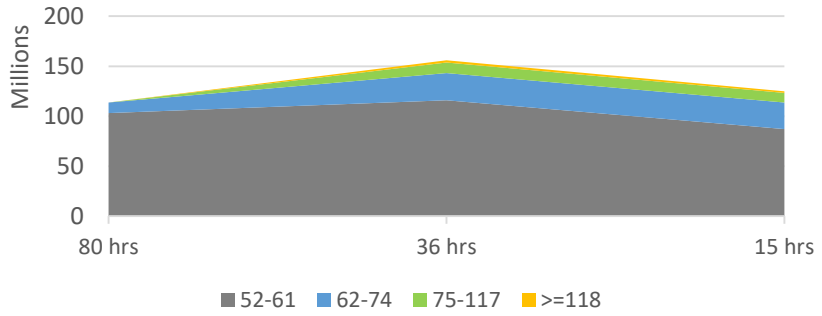
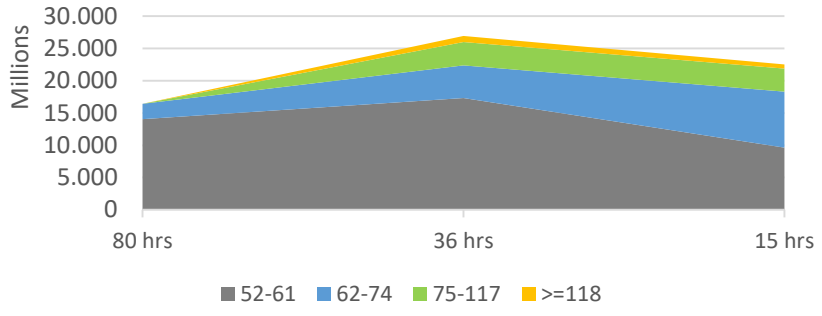
India agricultural production quantity exposure (mt)

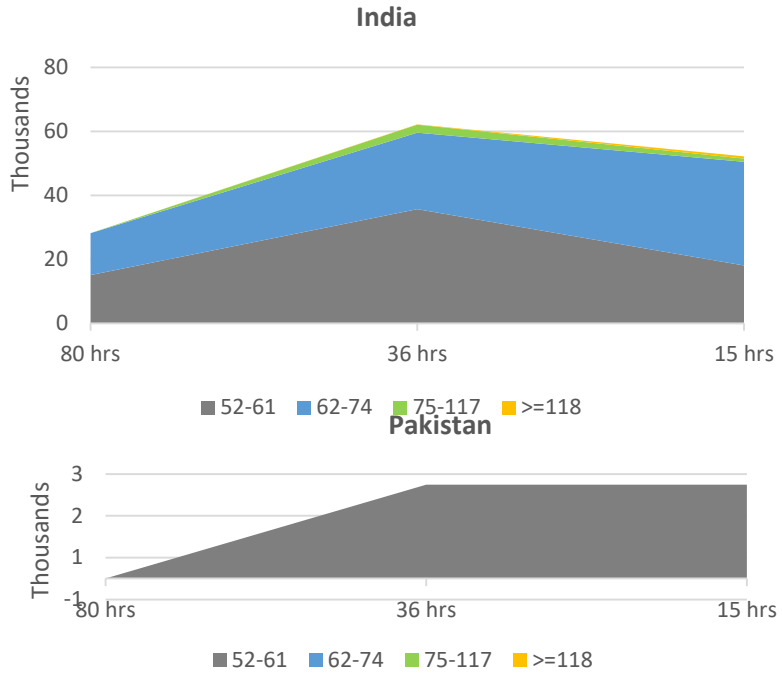


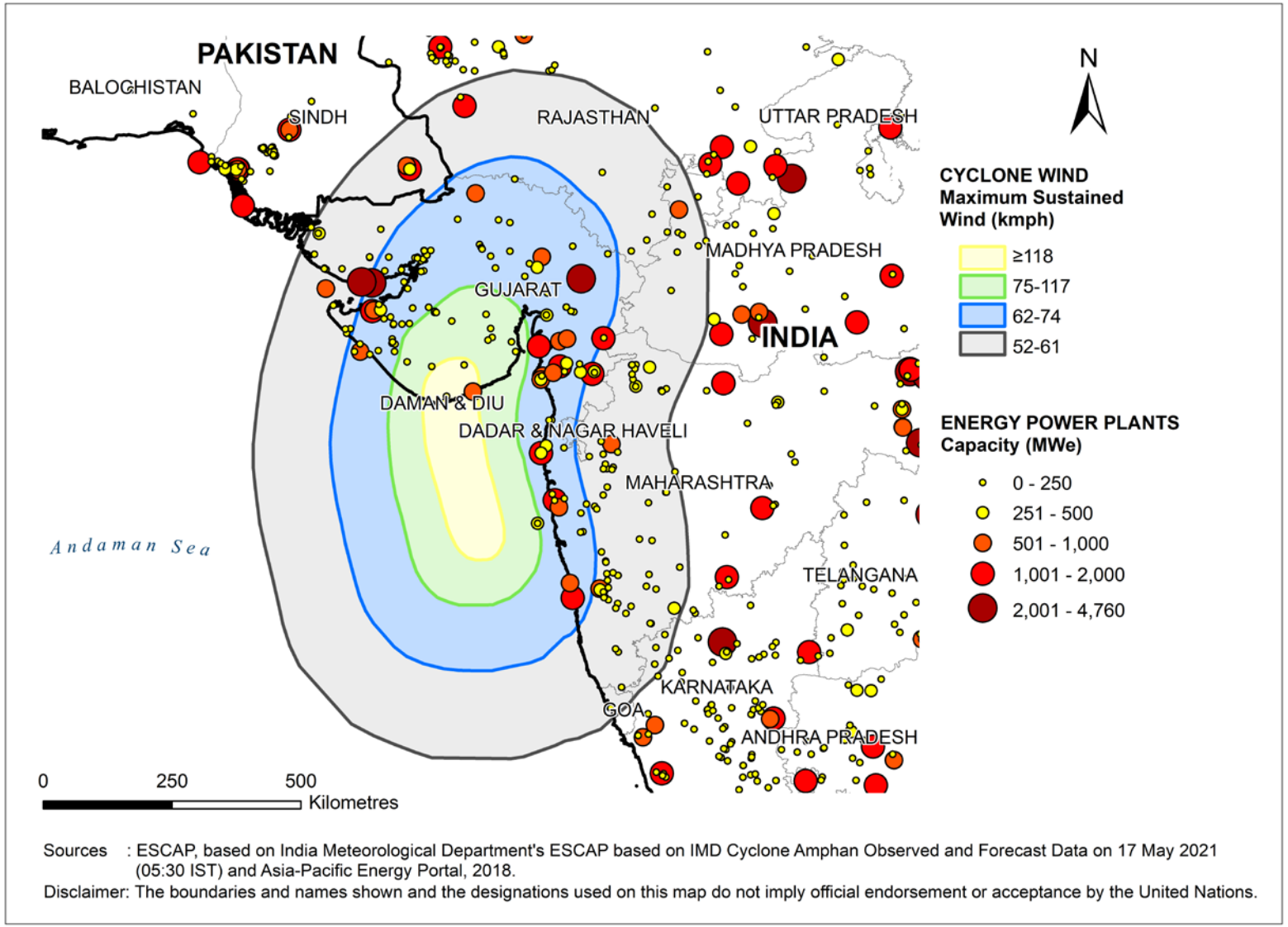
India agricultural production value exposure (USD)



Energy exposure to cyclone

Cyclone wind Maximum Sustained Wind	Category	80 hrs		36 hrs		15 hrs	
		IND	PAK	IND	PAK	IND	PAK
52-61	1	4.3%	0.0%	10.3%	3.3%	5.2%	3.3%
62-74	2	3.8%	0.0%	6.9%	0.0%	9.3%	0.0%
75-117	3	0.0%	0.0%	0.7%	0.0%	0.3%	0.0%
>=118	4	0.0%	0.0%	0.0%	0.0%	0.2%	0.0%
TOTAL CAPACITY (MWe)		347,598	68,037	347,598	68,037	347,598	68,037





Sources : ESCAP, based on India Meteorological Department's ESCAP based on IMD Cyclone Amphan Observed and Forecast Data on 17 May 2021 (05:30 IST) and Asia-Pacific Energy Portal, 2018.

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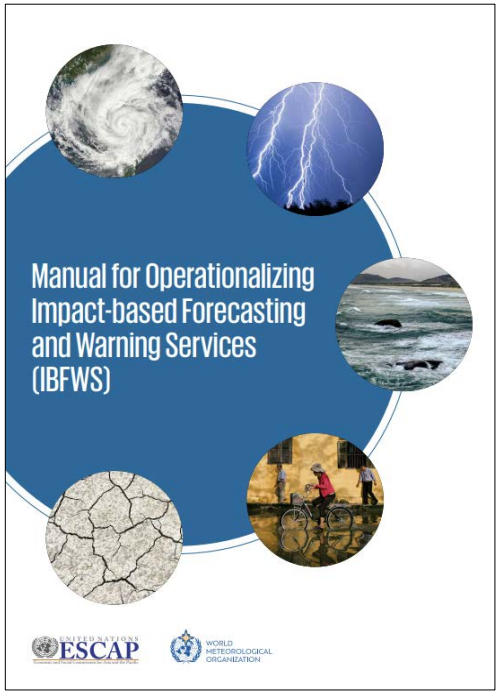
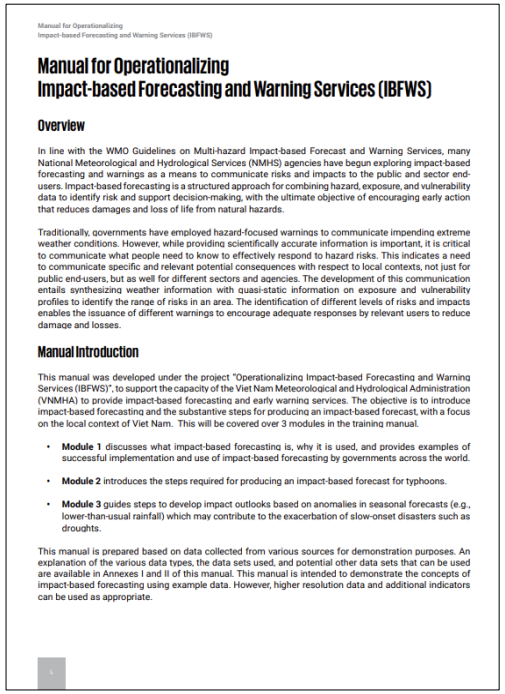
Useful references




Impact-based forecast and warning services - Training manual

A project funded by WMO's CREWS-Canada





Manual for Operationalizing
Impact-based Forecasting and Warning Services (IBFWS)

Manual for Operationalizing
Impact-based Forecasting and Warning Services (IBFWS)

Overview

In line with the WMO Guidelines on Multi-hazard Impact-based Forecast and Warning Services, many National Meteorological and Hydrological Services (NMHS) agencies have begun exploring impact-based forecasting and warnings as a means to communicate risks and impacts to the public and sector end-users. Impact-based forecasting is a structured approach for combining hazard, exposure, and vulnerability data to identify risk and support decision-making, with the ultimate objective of encouraging early action that reduces damages and loss of life from natural hazards.

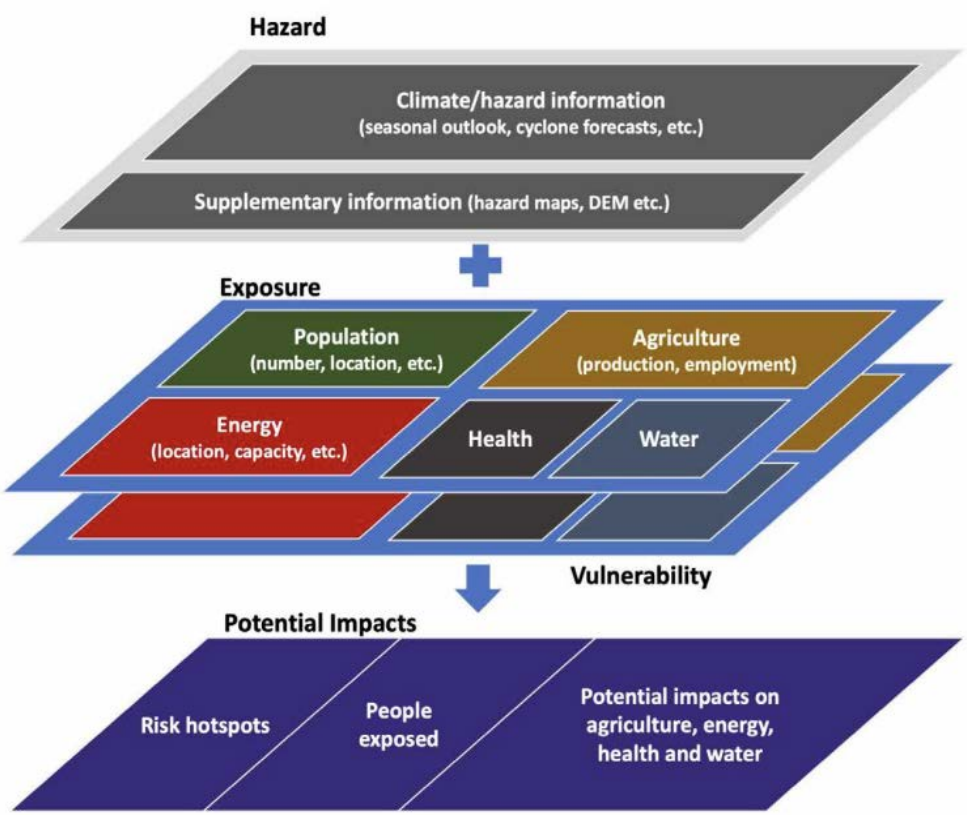
Traditionally, governments have employed hazard-focused warnings to communicate impending extreme weather conditions. However, while providing scientifically accurate information is important, it is critical to communicate what people need to know to effectively respond to hazard risks. This indicates a need to communicate specific and relevant potential consequences with respect to local contexts, not just for public end-users, but as well for different sectors and agencies. The development of this communication entails synthesizing weather information with quasi-static information on exposure and vulnerability profiles to identify the range of risks in an area. The identification of different levels of risks and impacts enables the issuance of different warnings to encourage adequate responses by relevant users to reduce damage and losses.

Manual Introduction

This manual was developed under the project "Operationalizing Impact-based Forecasting and Warning Services (IBFWS)", to support the capacity of the Viet Nam Meteorological and Hydrological Administration (VNMHA) to provide impact-based forecasting and early warning services. The objective is to introduce impact-based forecasting and the substantive steps for producing an impact-based forecast, with a focus on the local context of Viet Nam. This will be covered over 3 modules in the training manual.

- **Module 1** discusses what impact-based forecasting is, why it is used, and provides examples of successful implementation and use of impact-based forecasting by governments across the world.
- **Module 2** introduces the steps required for producing an impact-based forecast for typhoons.
- **Module 3** guides steps to develop impact outlooks based on anomalies in seasonal forecasts (e.g., lower-than-usual rainfall) which may contribute to the exacerbation of slow-onset disasters such as droughts.

This manual is prepared based on data collected from various sources for demonstration purposes. An explanation of the various data types, the data sets used, and potential other data sets that can be used are available in Annexes I and II of this manual. This manual is intended to demonstrate the concepts of impact-based forecasting using example data. However, higher resolution data and additional indicators can be used as appropriate.



- Module1. Introduction to impact-based forecasting
- Module2. Impact-based forecasting for typhoons
- Module3. Impact outlooks using seasonal forecasts

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OPERATIONALIZING IMPACT-BASED FORECASTING AND WARNING SERVICES

This manual was developed under the project "Operationalizing Impact-based Forecasting and Warning Services (IBFWS)", to support the capacity of the Viet Nam Meteorological and Hydrological Administration (VNMHA) to provide impact-based forecasting and early warning services. The objective is to introduce impact-based forecasting and the substantive steps for producing an impact-based forecast, with a focus on the local context of Viet Nam.

ABSTRACT

Traditionally, governments have employed hazard-focused warnings to communicate impending extreme weather conditions. However, while providing scientifically accurate information is important, it is critical to communicate what people need to know to effectively respond to hazard risks. This indicates a need to communicate specific and relevant potential consequences with respect to local contexts, not just for public end-users, but as well for different sectors and agencies. The development of this communication entails synthesizing weather information with quasi-static information on exposure and vulnerability profiles to identify the range of risks in an area. The identification of different levels of risks and impacts enables the issuance of different warnings to encourage adequate responses by relevant users to reduce damage and losses.

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Thank you very much

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Q & A