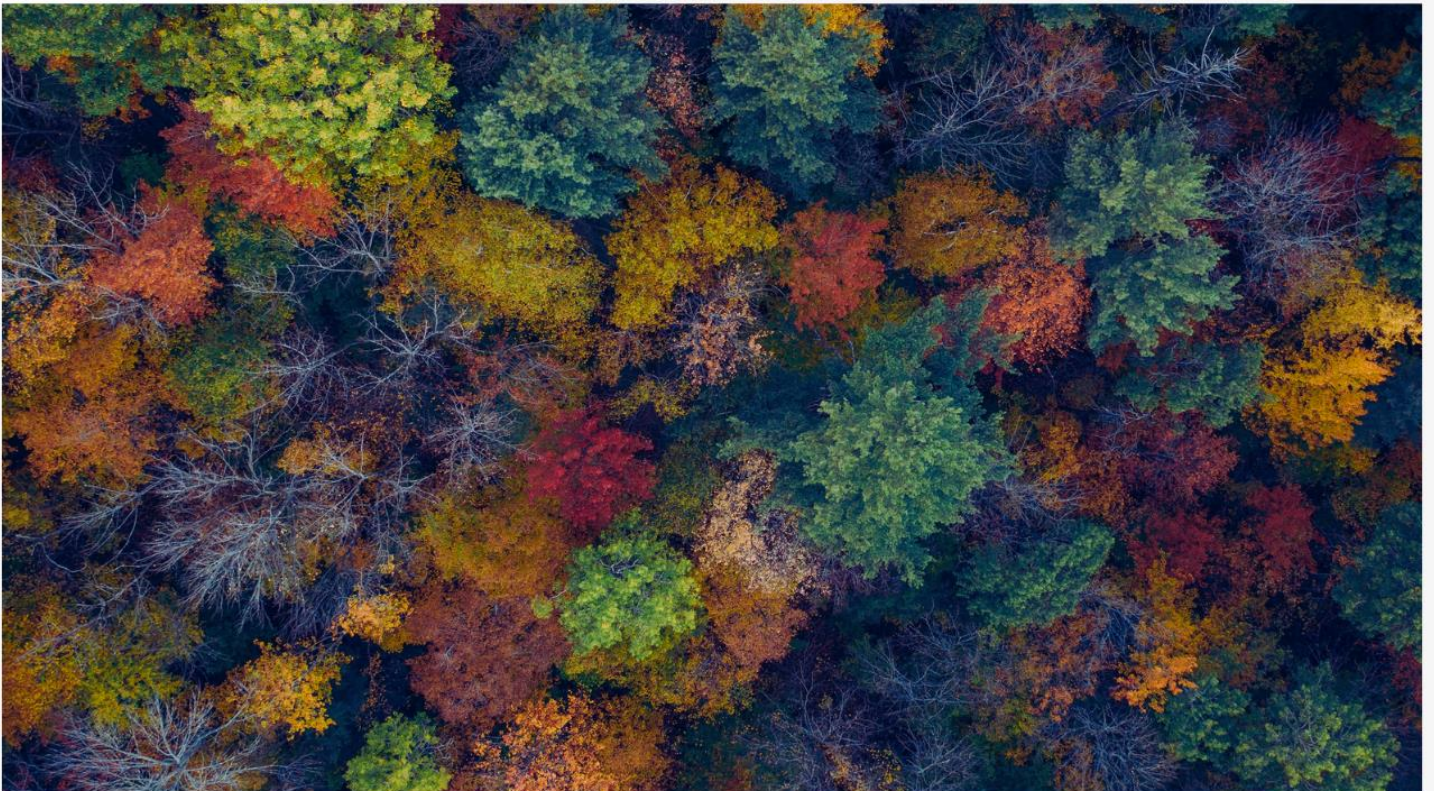


DATASET GUIDE

PRIORITY AREAS FOR REFORESTATION

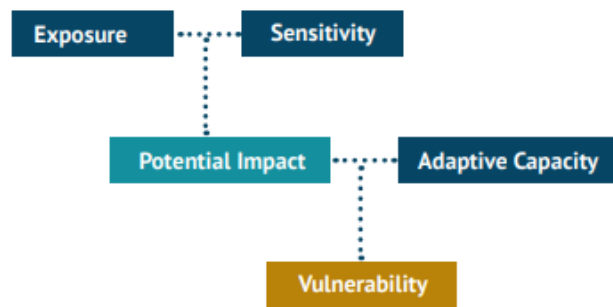


**ANALYZING VULNERABILITY
AS A FUNCTION OF IMPACT AND ADAPTATIVE CAPACITY
IN ORDER TO CLASSIFY PRIORITY AREAS FOR REFORESTATION**

**PREPARED AND PRESENTED BY
MARK ANTHONY CABANLIT**

Vulnerability

The Intergovernmental Panel on Climate Change defines Vulnerability as “the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes.” It is a function of (1) the degree of the system’s Exposure to climate hazards; (2) its Sensitivity to such hazards; and (3) its Adaptive Capacity (IPCC, 2001)



Adaptive Capacity

These are the layers used for calculating the adaptive capacity.

Political Category

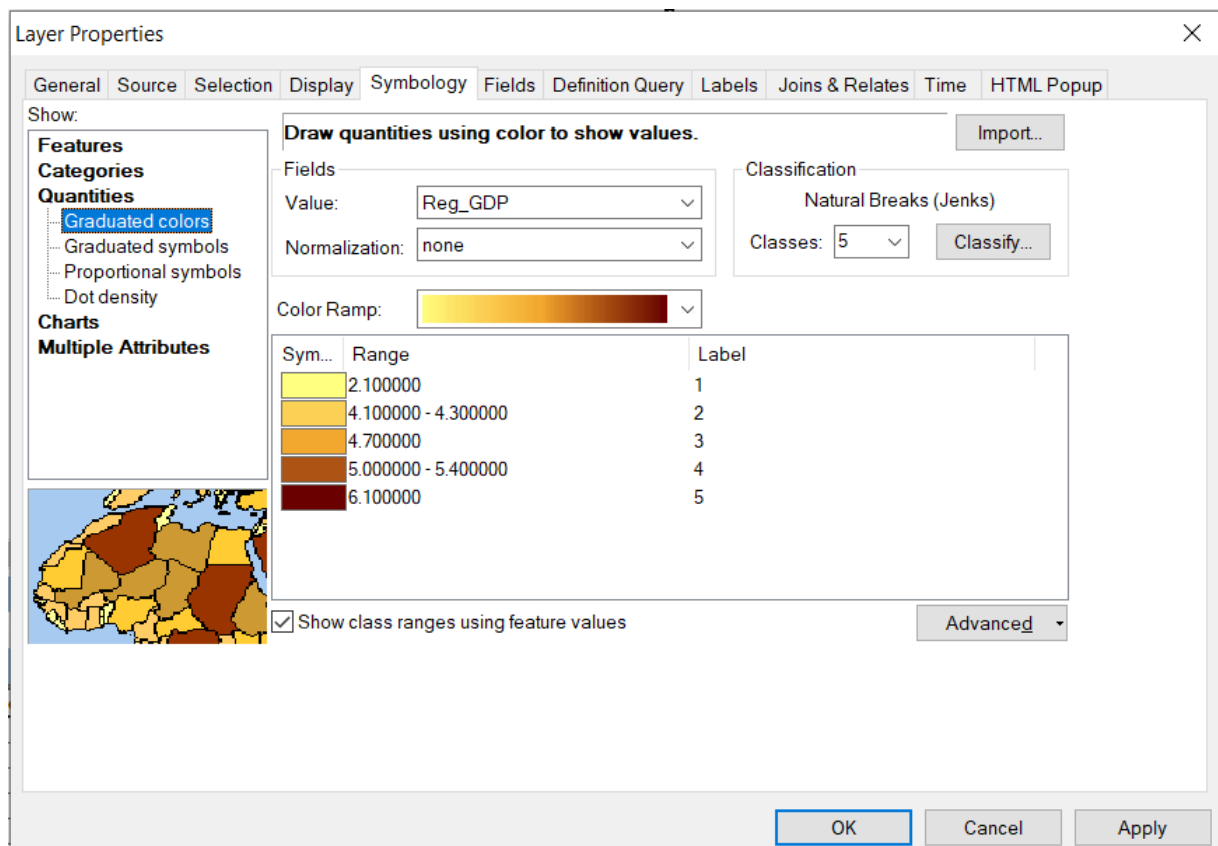
This layer divides the data into the following categories. The shapefile was derived from the Phil-LiDAR Project of the Department of Science and Technology. Most cities would have more money to provide aid, thus higher adaptive capacity.

- 5 – City
- 3 - Municipality

Regional GDP

The regional gross domestic product was accessed from PSA. The values were then divided into five classes as shown in the layer properties below.

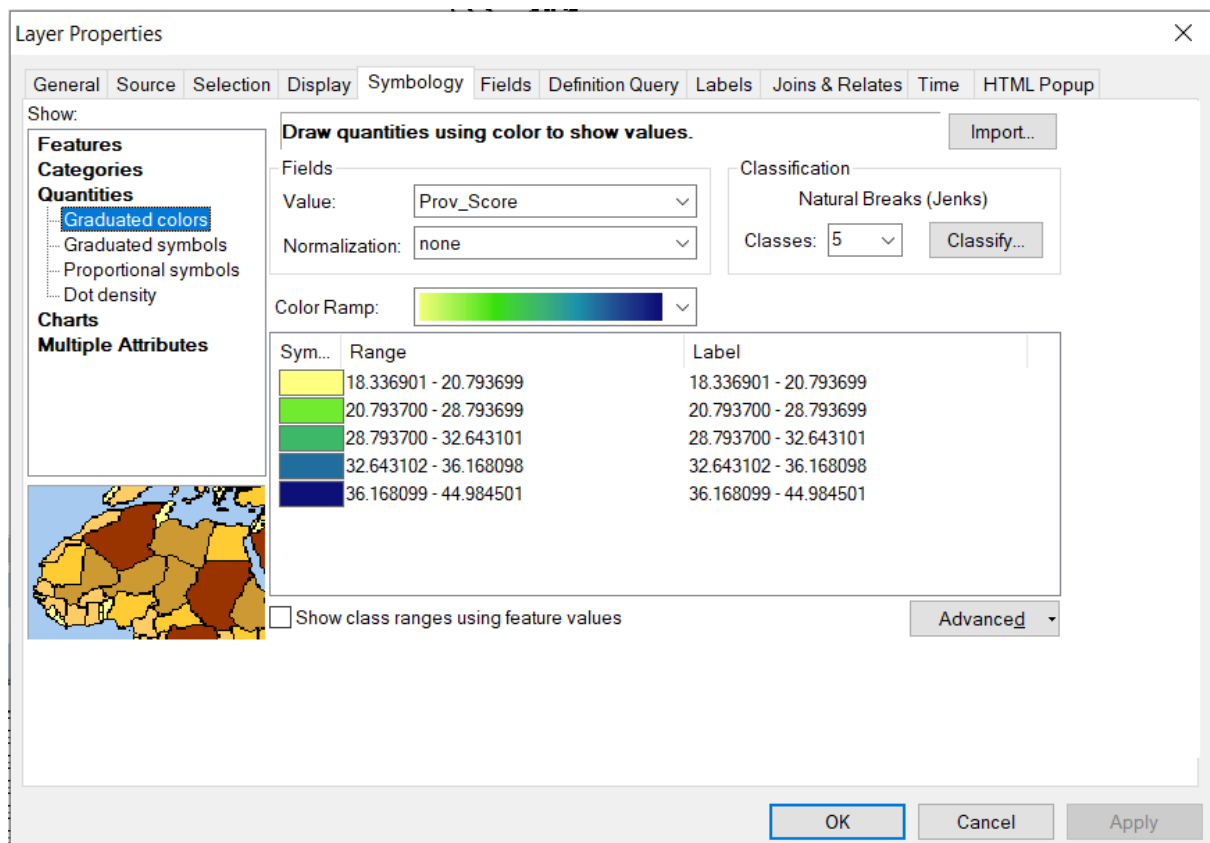
- <https://psa.gov.ph/grdp/grdp-id/167338>



Provincial Score

This is a score derived from the Department of Trade and Industry. Rankings of Cities and Municipalities are based on the sum of their scores on 4 Pillars: Economic Dynamism, Government Efficiency, Infrastructure, and Resiliency. Provincial rankings are based on population and income weighted average of the Overall scores of cities and municipalities under a province.

- <https://cmci.dti.gov.ph/rankings-data.php?unit=Provinces>



```
def reclass(x):  
    if x <= 20.793699 :  
        return 1  
    elif x >= 20.793700 and x <= 28.793699 :  
        return 2  
    elif x >= 28.793700 and x <= 32.643101 :  
        return 3  
    elif x >= 32.643102 and x <= 36.168098 :  
        return 4  
    else:  
        return 5  
  
reclass( !Prov_Score! )
```

Land Cover

The land cover data was retrieved from below:

- <https://data.humdata.org/dataset/philippines-other-0>

<all other values>

DESCRIPT

- Arable land, crops mainly cereals and sugar
- Built-up Area
- Closed canopy, mature trees covering > 50 percent
- Coconut plantations
- Coral Reef
- Crop land mixed with coconut plantation
- Crop land mixed with other plantation
- Cultivated Area mixed with brushland/grassland
- Eroded area
- Fishponds derived from mangrove
- Grassland, grass covering > 70 percent
- Lake
- Mangrove vegetation
- Marshy area and swamp
- Mossy forest
- Open canopy, mature trees covering < 50 percent
- Other barren land
- Other fishponds
- Other plantations
- Pine forest
- Quarry
- Riverbeds
- Siltation pattern in lake
- Unclassified

```
"DESCRIPT" in ( 'Arable land, crops mainly cereals and sugar' , 'Closed canopy,
mature trees covering > 50 percent', 'Coconut plantations', 'Crop land mixed with
coconut plantation', 'Crop land mixed with other plantation', 'Cultivated Area
mixed with brushland/grassland', 'Grassland, grass covering > 70 percent',
'Mangrove vegetation', 'Marshy area and swamp', 'Mossy forest', 'Open canopy,
mature trees covering < 50 percent', 'Other plantations', 'Pine forest')
```


Mean Green

The value was extracted from ESRI RGB green band.

colors
symbols
all symbols

Normalization: none

Classes: 5

Classify...

Color Ramp:

butes

Sym...	Range	Label
	23.546000 - 58.453701	23.546000 - 58.453701
	58.453702 - 69.981697	58.453702 - 69.981697
	69.981698 - 80.967003	69.981698 - 80.967003
	80.967004 - 95.461304	80.967004 - 95.461304
	95.461305 - 143.912994	95.461305 - 143.912994

☐ Show class ranges using feature values

Advanced

```
def reclass(x):  
    if x <= 58.453701 :  
        return 1  
    elif x >= 58.453702 and x <= 69.981697 :  
        return 2  
    elif x >= 69.981698 and x <= 80.967003 :  
        return 3  
    elif x >= 80.967004 and x <= 95.461304 :  
        return 4  
    else:  
        return 5  
  
reclass( !Green_Val!)
```

Change in Global Tree Cover on Agricultural Land – 2000-2010

This data was retrieved from: <http://apps.worldagroforestry.org/global-tree-cover/data-download.html>

Layer Properties

General Source Selection Display Symbology Fields Definition Query Labels Joins & Relates Time HTML Popup

Show:

Features

Categories

Quantities

- Graduated colors
- Graduated symbols
- Proportional symbols
- Dot density

Charts

Multiple Attributes

Draw quantities using color to show values.

Fields

Value: TreeCover

Normalization: none

Color Ramp:

Classification

Natural Breaks (Jenks)

Classes: 5

Classify...

Import...

Sym...	Range	Label
	-13.400000 - -2.793330	-13.400000 - -2.793330
	-2.793329 - 0.785714	-2.793329 - 0.785714
	0.785715 - 3.898620	0.785715 - 3.898620
	3.898621 - 7.750000	3.898621 - 7.750000
	7.750001 - 16.846201	7.750001 - 16.846201

☐ Show class ranges using feature values

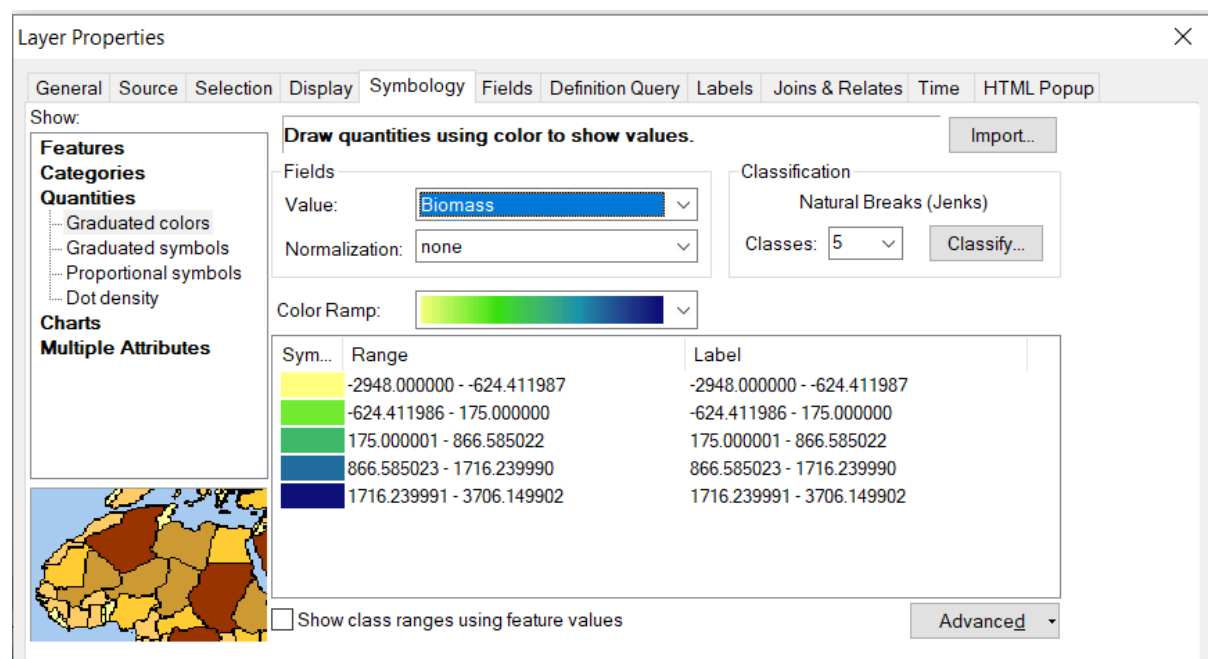
Advanced

```
def reclass(x):
    if x <= -2.793330 :
        return 1
    elif x >= -2.793329 and x <= 0.785714 :
        return 2
    elif x >= 0.785715 and x <= 3.898620 :
        return 3
    elif x >= 3.898621 and x <= 7.75:
        return 4
    else:
        return 5

reclass( !TreeCover! )
```

Change in Global Biomass Carbon on Agricultural Land – 2000-2010

This data was retrieved from: <http://apps.worldagroforestry.org/global-tree-cover/data-download.html>

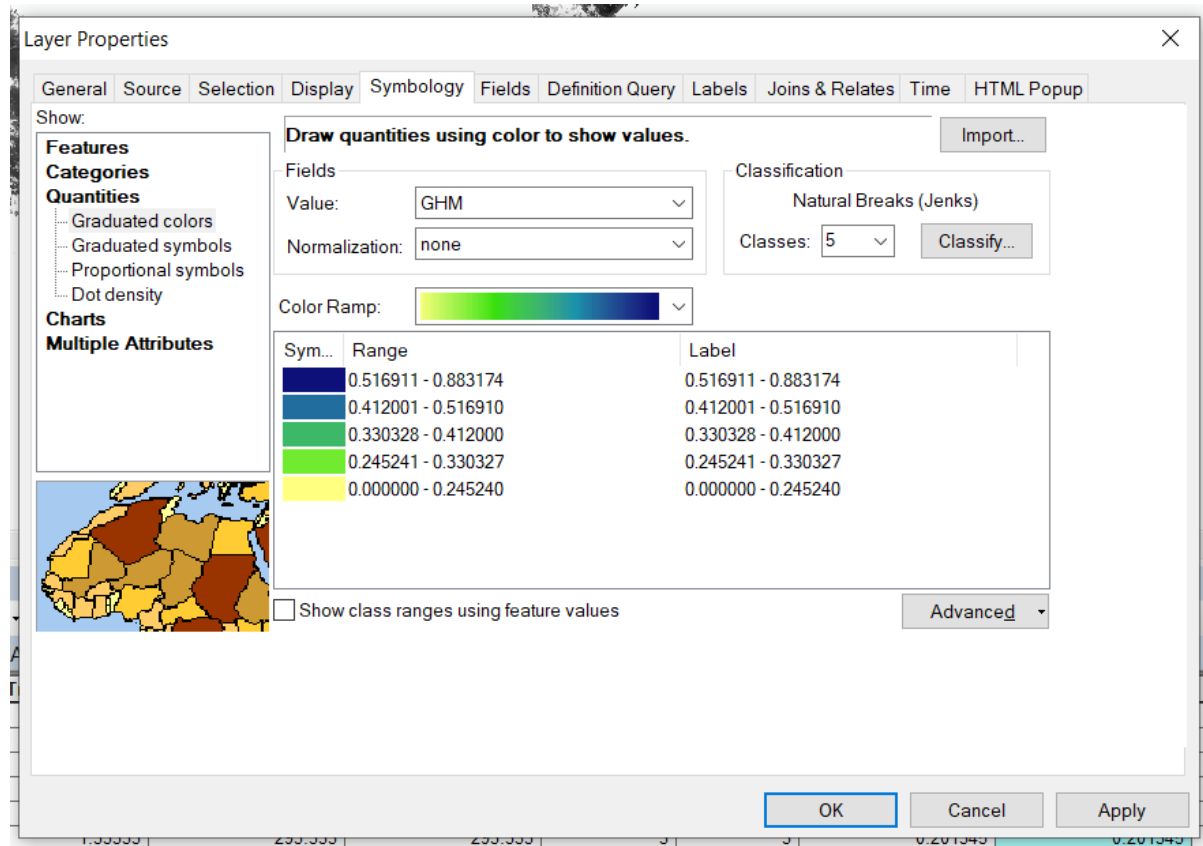


```
def reclass(x):
    if x <= -624.411987 :
        return 1
    elif x >= -624.411986 and x <= 175 :
        return 2
    elif x >= 175.000001 and x <= 866.585022 :
        return 3
    elif x >= 866.585023 and x <= 1716.239990:
        return 4
    else:
        return 5

reclass( !Biomass! )
```

Global Human Modification

The data was retrieved from: <https://sedac.ciesin.columbia.edu/data/set/lulc-human-modification-terrestrial-systems>



```
def reclass(x):  
    if x <= 0.245240 :  
        return 5  
    elif x >= 0.245241 and x <= 0.330327 :  
        return 4  
    elif x >= 0.330328 and x <= 0.412 :  
        return 3  
    elif x >= 0.4120001 and x <= 0.516910:  
        return 2  
    else:  
        return 1  
reclass( !GHM!)
```

Normalized DifferenceVegetation Index

Using google earth engine, calculate for NDVI before and after Odette to estimate the change in cover.

```
function addNDVI(image) {  
    var ndvi = image.normalizedDifference(['B5', 'B4']);  
    return image.addBands(ndvi)  
}
```

```

}

var visPaaramsTrue = {bands: ['B4', 'B3', 'B2'], min: 0, max: 0.3, gamma: 1.4};

var before_odette = ee.ImageCollection("LANDSAT/LC08/C02/T1_TOA")
  .filterDate('2021-01-01', '2021-12-15')
  .filterBounds(roi)
  .min();

var after_odette = ee.ImageCollection("LANDSAT/LC08/C02/T1_TOA")
  .filterDate('2021-12-17', '2022-03-30')
  .filterBounds(roi)
  .min();

var ndvi_before_odette = addNDVI(before_odette)
var ndvi_after_odette = addNDVI(after_odette)
Map.addLayer(ndvi_before_odette, {min:0, max:0.5}, 'NDVI Before Odette')
Map.addLayer(ndvi_after_odette, {min:0, max:0.5}, 'NDVI After Odette')
Map.addLayer(before_odette, visPaaramsTrue, 'Before Odette')
Map.addLayer(after_odette, visPaaramsTrue, 'After Odette')
Map.centerObject(roi, 8);

var area =
ee.FeatureCollection('users/kalyejenner/odette_affected_municipalities');
Map.addLayer(area, {}, 'Affected Areas')

Export.image.toDrive({
  image: before_odette.float(),
  description: 'BeforeOdette',
  scale: 30,
  region: roi
});
Export.image.toDrive({
  image: after_odette.float(),
  description: 'AfterOdette',
  scale: 30,
  region: roi
});

```

Impact

These are the layers used for calculating the impact. Most of the values on this layer was retrieved from the National Disaster Risk Reduction's monitoring dashboard.

- <https://monitoring-dashboard.ndrrmc.gov.ph/page/situation/situational-report-for-tc-odette-2021>

Casualties

CASUALTIES									
REGION	CONFIRMED			FOR VALIDATION			TOTAL REPORTED		
	dead	injured	missing	dead	injured	missing	dead	injured	missing
TOTAL	101	318	11	304	1053	41	405	1371	52
MIMAROPA	18	0	0	7	2	4	25	2	4
Region 6	54	170	7	0	3	0	54	173	7
Region 7	2	2	0	218	544	32	220	546	32
Region 8	18	112	4	8	0	0	26	112	4
Region 9	1	2	0	0	0	0	1	2	0
Region 10	8	28	0	0	0	0	8	28	0
CARAGA	0	4	0	71	504	5	71	508	5

Number of Deaths

Layer Properties

General

Source

Selection

Display

Symbology

Fields

Definition Query

Labels

Joins & Relates

Time

HTML Popup

Show:

Features

Categories

Quantities

Graduated colors

Graduated symbols

Proportional symbols

Dot density

Charts

Multiple Attributes

Draw quantities using color to show values.

Import...

Fields

Value:

Death

Normalization:

none

Classification

Natural Breaks (Jenks)

Classes:

5

Classify...

Color Ramp:

Sym...	Range	Label
<div></div>	72 - 220	72 - 220
<div></div>	27 - 71	27 - 71
<div></div>	9 - 26	9 - 26
<div></div>	2 - 8	2 - 8
<div></div>	0 - 1	0 - 1

☐ Show class ranges using feature values

Advanced

OK

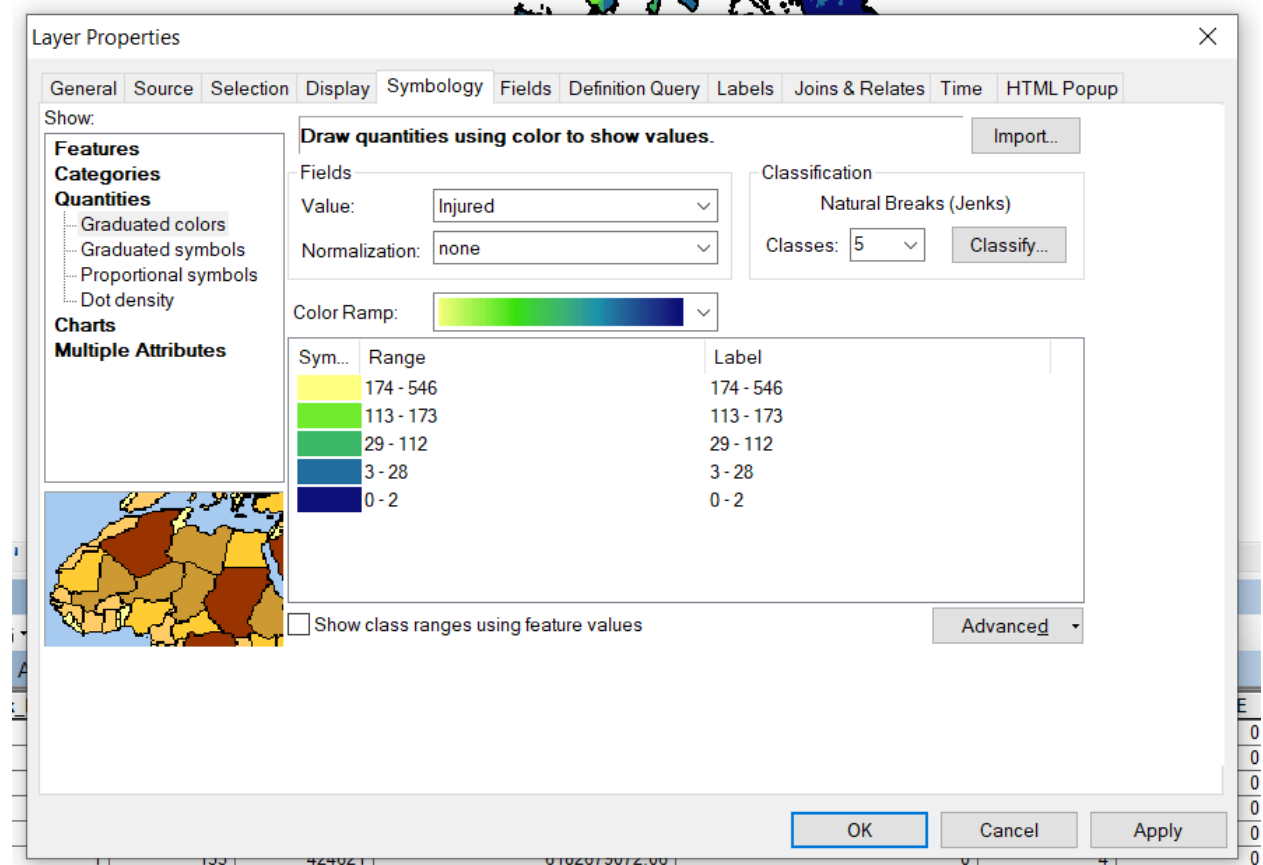
Cancel

Apply

```
def reclass(x):
    if x >= 72:
        return 5
    elif x >= 27 and x <= 71:
        return 4
    elif x >= 9 and x <= 26:
        return 3
    elif x >= 2 and x <= 8:
        return 2
    else:
        return 1

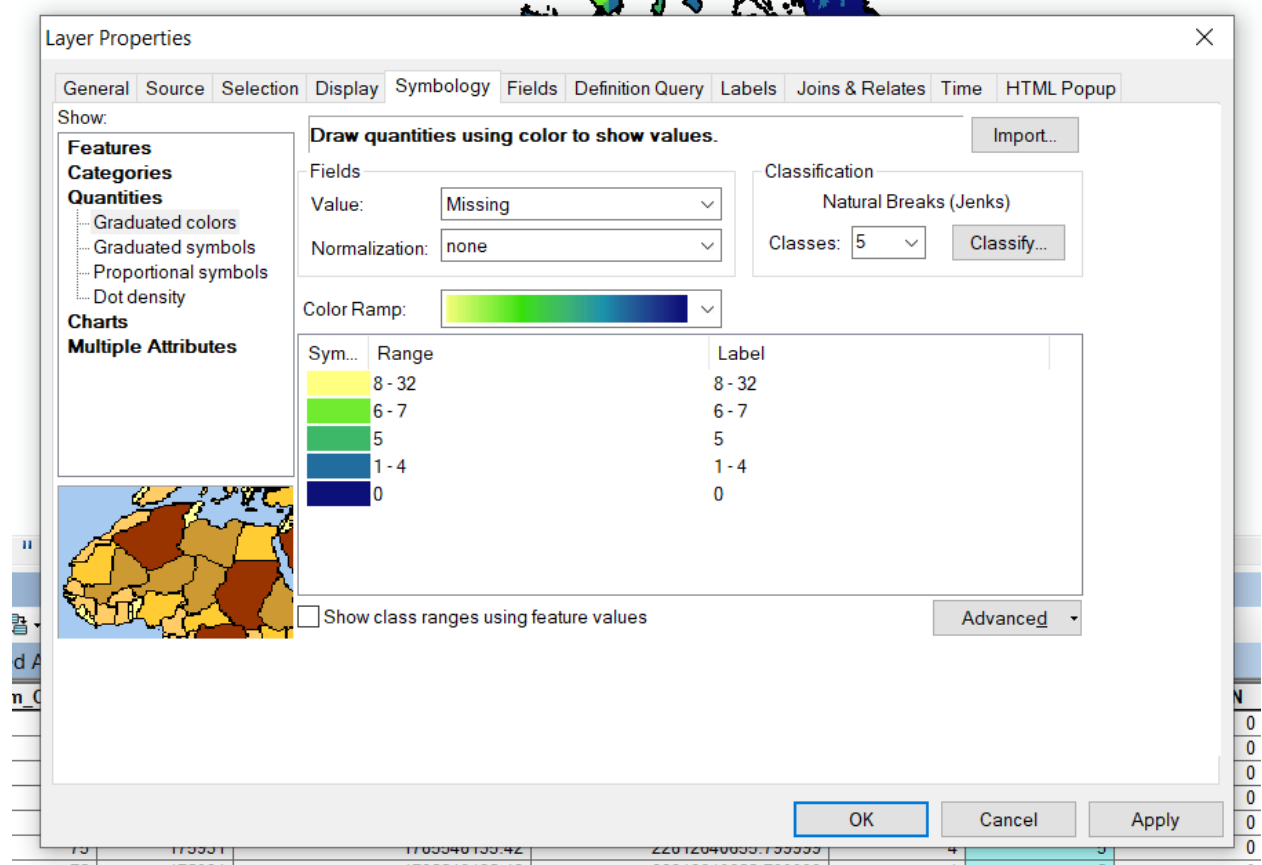
reclass( !Death! )
```

Number of Injured



```
def reclass(x):
    if x >= 174:
        return 5
    elif x >= 113 and x <= 173:
        return 4
    elif x >= 29 and x <= 112:
        return 3
    elif x >= 3 and x <= 28:
        return 2
    else:
        return 1
reclass( !Injured! )
```

Number of Missing People



```
def reclass(x):
    if x >= 8:
        return 5
    elif x >= 6 and x <= 7:
        return 4
    elif x >= 5 and x <= 5:
        return 3
    elif x >= 1 and x <= 4:
        return 2
    else:
        return 1

reclass( !Missing! )
```

Roads and Bridges

ROADS AND BRIDGES				
	NOT PASSABLE		PASSABLE (previously reported as not passable)	
	ROADS	BRIDGES	ROADS	BRIDGES
GRAND TOTAL	8	1	233	26
MIMAROPA	0	0	23	8
Region 6	0	0	43	1
Region 7	8	1	64	5
Region 8	0	0	55	8
Region 10	0	0	27	3
CARAGA	0	0	21	1

Damaged Roads

Layer Properties

GeneralSourceSelectionDisplaySymbologyFieldsDefinition QueryLabelsJoins & RelatesTimeHTML Popup

Show:

Features

Categories

Quantities

Graduated colors

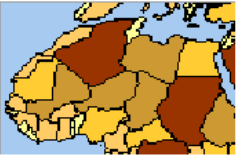
Graduated symbols

Proportional symbols

Dot density

Charts

Multiple Attributes




Draw quantities using color to show values.

Fields

Value: Blk_Roads

Normalization: none

Color Ramp: 

Classification

Natural Breaks (Jenks)

Classes: 5

Classify...

Sym...	Range	Label
	56 - 72	56 - 72
	28 - 55	28 - 55
	24 - 27	24 - 27
	1 - 23	1 - 23
	0	0

☐ Show class ranges using feature values

Import...

Advanced

OKCancelApply

```
def reclass(x):
    if x >= 56:
        return 5
    elif x >= 28 and x <= 55:
        return 4
    elif x >= 24 and x <= 27:
        return 3
    elif x >= 1 and x <= 23:
        return 2
    else:
        return 0
```

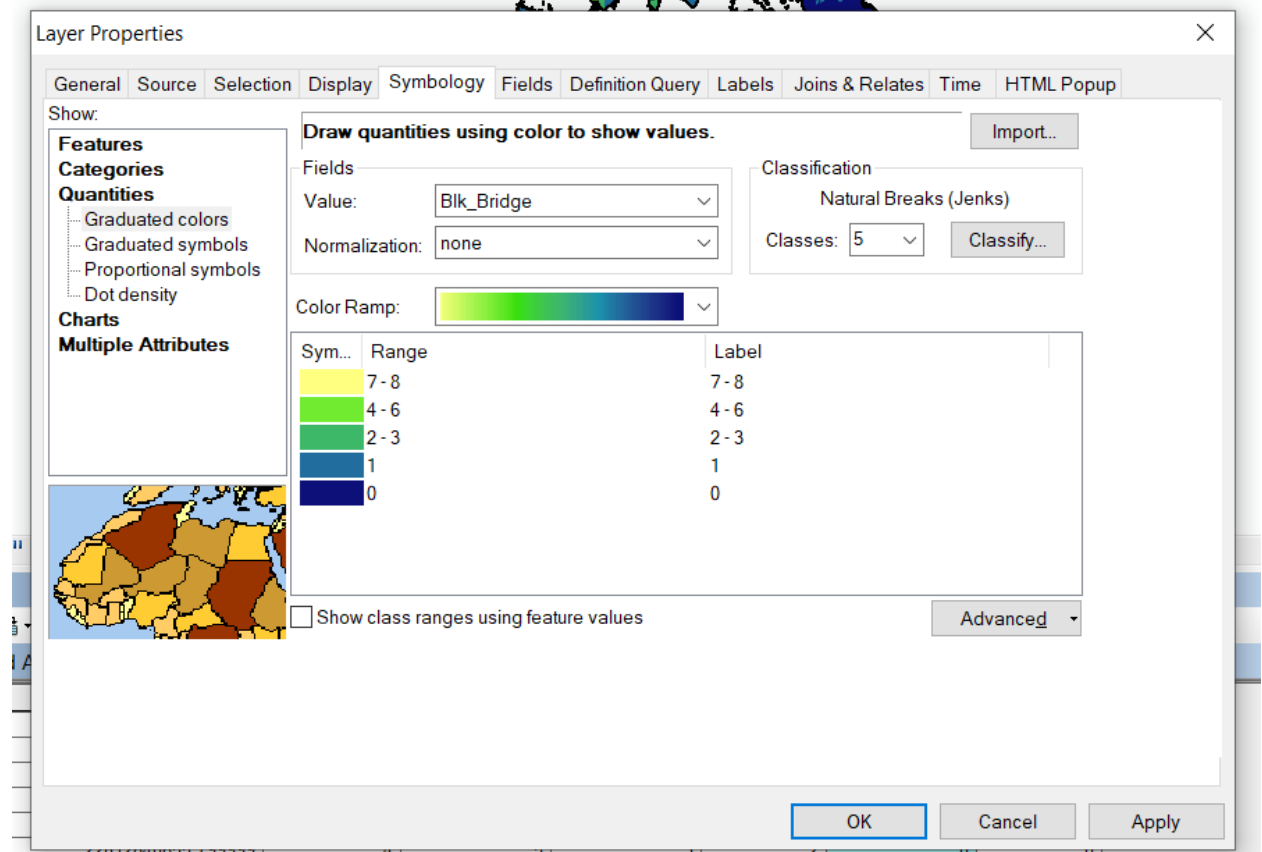
```

return 1

reclass( !Blk_Roads! )

```

Damaged Bridges



```

def reclass(x):
    if x >= 7:
        return 5
    elif x >= 4 and x <= 6:
        return 4
    elif x >= 2 and x <= 3:
        return 3
    elif x >= 1 and x <= 1:
        return 2
    else:
        return 1

reclass( !Blk_Bridge! )

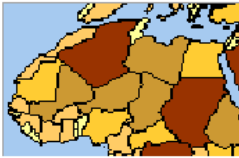
```

Communication Lines

COMMUNICATION LINES

There are 76 areas in MIMAROPA, Region 7, Region 8, CARAGA, BARMM which are still experiencing communication outage/issues.

Region	No of Areas	
	Without Communication	Restored Communication Lines
GRAND TOTAL	76	473
MIMAROPA	3	35
Region 6	0	133
Region 7	24	122
Region 8	1	1
Region 9	0	71
Region 10	0	7
CARAGA	8	67
BARMM	40	37



Layer Properties

General Source Selection Display Symbology Fields Definition Query Labels Joins & Relates Time HTML Popup

Show:

- Features
- Categories
- Quantities
 - Graduated colors
 - Graduated symbols
 - Proportional symbols
 - Dot density
- Charts
- Multiple Attributes

Draw quantities using color to show values. Import...

Fields

Value: Dam_Comm

Normalization: none

Classification

Natural Breaks (Jenks)

Classes: 5 Classify...

Color Ramp:

Sym...	Range	Label
	78 - 146	78 - 146
	39 - 77	39 - 77
	8 - 38	8 - 38
	3 - 7	3 - 7
	0 - 2	0 - 2

☐ Show class ranges using feature values Advanced

```
def reclass(x):
    if x >= 78:
        return 5
    elif x >= 39 and x <= 77:
        return 4
    elif x >= 8 and x <= 38:
        return 3
    elif x >= 3 and x <= 7:
        return 2
    else:
        return 1

reclass( !Dam_Comm! )
```


Damaged Houses

DAMAGED HOUSES

A total of 2,031,824 damaged house/s are reported in MIMAROPA, Region 6, Region 7, Region 8, Region 9, Region 10, Region 11, Region 12, CARAGA, BARMM.

REGION	PARTIALLY	TOTALLY	TOTAL	AMOUNT (PHP)
GRAND TOTAL	1,585,252	446,572	2,031,824	62,675,818
MIMAROPA	74,319	15,465	89,784	0
Region 6	362,743	61,878	424,621	0
Region 7	900,558	245,659	1,146,217	0
Region 8	135,489	52,221	187,710	0
Region 9	103	136	239	0
Region 10	6,389	857	7,246	62,225,818
Region 11	0	2	2	0
Region 12	0	1	1	0
CARAGA	105,591	70,340	175,931	0
BARMM	60	13	73	450,000

Layer Properties

General

Source

Selection

Display

Symbology

Fields

Definition Query

Labels

Joins & Relates

Time

HTML Popup

Show:

Features

Categories

Quantities

Graduated colors

Graduated symbols

Proportional symbols

Dot density

Charts

Multiple Attributes

☐ Show class ranges using feature values

Draw quantities using color to show values.

Import...

Fields

Value: Dam_House

Normalization: none

Classification

Natural Breaks (Jenks)

Classes: 5

Classify...

Color Ramp:

Sym...	Range	Label
	424622 - 1146217	424622 - 1146217
	187711 - 424621	187711 - 424621
	89785 - 187710	89785 - 187710
	7247 - 89784	7247 - 89784
	2 - 7246	2 - 7246

Advanced

OK

Cancel

Apply

```
def reclass(x):
    if x >= 424622 :
        return 5
    elif x >= 187711 and x <= 424621:
        return 4
    elif x >= 89785 and x <= 187710:
        return 3
    elif x >= 7247 and x <= 89784:
```

```

return 2
else:
return 1

reclass( !Dam_House!)

```

Damage to Agriculture

DAMAGE TO AGRICULTURE

Estimated cost of damage to agriculture of Php 17,748,148,271.91 was incurred in CALABARZON, MIMAROPA, Region 5, Region 6, Region 7, Region 8, Region 10, Region 11, Region 12, CARAGA.

REGION	AFFECTED CROP AREA (Hectares)	NUMBER OF AFFECTED LIVESTOCK/POULTRY	COST OF DAMAGED TO FISHERIES	NUMBER OF AFFECTED AGRICULTURAL INFRASTRUCTURE/EQUIPMENT	COST OF DAMAGE (PHP)
GRAND TOTAL	10,243,619.844	120,350	2,015,999,954.51	6,177.2	17,748,148,271.91
CALABARZON	0	0	514,600	0	514,600
MIMAROPA	22,698.79	80,914	330,699,963	4,621	4,768,816,954.82
Region 5	0	0	1,017,475	0	1,017,475
Region 6	98,510.665	0	736,718,305.01	1,542.2	6,182,679,072.06
Region 7	1,504.75	4,975	743,130,500	0	1,284,610,039
Region 8	0	0	0	0	2,529,794,285
Region 10	15,493.039	3,552	26,459,291.5	0	1,130,179,415.82
Region 11	1,910.8	0	0	0	54,784,894.79
Region 12	455	0	0	0	10,203,400
CARAGA	10,103,046.8	30,909	177,459,820	14	1,785,548,135.42

Decrease in the amount of damage to agriculture was due to validation.



Layer Properties

General

Source

Selection

Display

Symbology

Fields

Definition Query

Labels

Joins & Relates

Time

HTML Popup

Show:

Features

Categories

Quantities

Charts

Multiple Attributes

Graduated colors

Graduated symbols

Proportional symbols

Dot density

Draw quantities using color to show values.

Fields

Value: Dam_AgriP

Normalization: none

Color Ramp:

Classification

Natural Breaks (Jenks)

Classes: 5

Classify...

Sym...	Range	Label
	2529794285.000001 - 6182679072.060000	2529794285.000001 - 6182679072.060000
	1785548135.420001 - 2529794285.000000	1785548135.420001 - 2529794285.000000
	1284610039.000001 - 1785548135.420000	1284610039.000001 - 1785548135.420000
	54784894.790001 - 1284610039.000000	54784894.790001 - 1284610039.000000
	0.000000 - 54784894.790000	0.000000 - 54784894.790000

☐ Show class ranges using feature values

Advanced

OK

Cancel

Apply

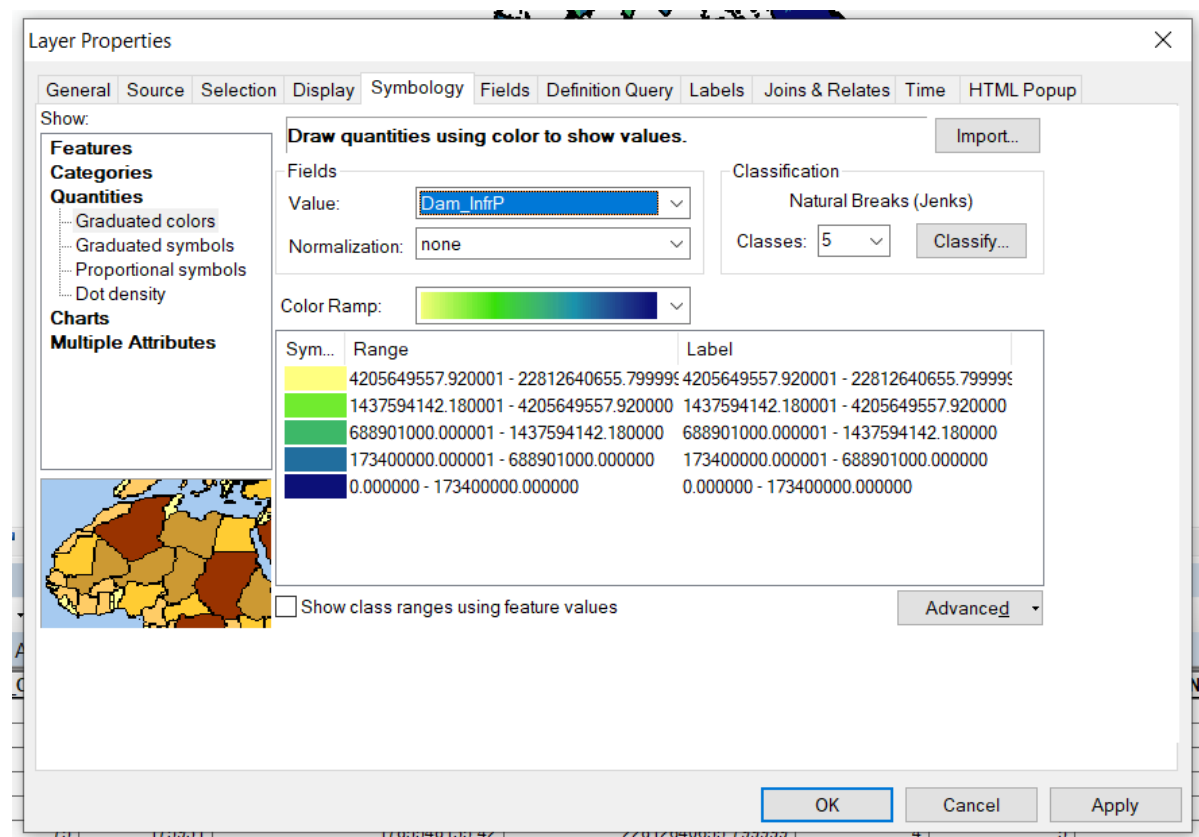
```
def reclass(x):
    if x >= 2529794285.000001 :
        return 5
    elif x >= 1785548135.420001 and x <= 2529794285.000000:
        return 4
    elif x >= 1284610039.000001 and x <= 1785548135.420000:
        return 3
    elif x >= 54784894.790001 and x <= 1284610039.000000:
        return 2
    else:
        return 1
reclass( !Dam_AgriP!)
```

Damage to Infrastructure

DAMAGE TO INFRASTRUCTURE

Estimated cost of damage to infrastructure of Php 29,338,185,355.94 was incurred in MIMAROPA, Region 7, Region 8, Region 10, Region 12, CARAGA, BARMM.

REGION	NUMBER OF DAMAGED INFRASTRUCTURE	COST OF DAMAGE (PHP)
GRAND TOTAL	1,733	29,338,185,355.94
MIMAROPA	1,181	1,437,594,142.18
Region 7	469	4,205,649,557.92
Region 8	20	173,400,000
Region 10	55	688,901,000
Region 12	1	20,000,000
CARAGA	0	22,812,640,655.84
BARMM	7	0



```
def reclass(x):
    if x >= 4205649557.920001 :
        return 5
    elif x >= 1437594142.180001 and x <= 4205649557.920000:
        return 4
    elif x >= 688901000.000001 and x <= 1437594142.1800000:
        return 3
    elif x >= 173400000.000001 and x <= 688901000.000000:
        return 2
    else:
        return 1

reclass( !Dam_InfrP!)
```

Calculating for Impact

```
IMPACT =
[IMP_DEATH]+ [IMP_INJURE]+ [IMP_MISSIN]+ [IMP_ROAD]+ [IMP_BRIDGE]+ [IMP_COMM]+
[IMP_HOUSE]+ [IMP_AGRI]+ [IMP_INFRA]+ [IMP_PATH]
```

If the no. of criteria = 10	
Maximum score	(10 x 5) = 50
Minimum score	(10 x 1) = 10
Total range	[max - min] = 40
Intervals	$40 \div 3 = 13.3$ or 13
Interval	40/3 13.3
Rating	Range
Low	10-23
Medium	24-37
High	38-50

```
def reclass(x):
    if x >= 38:
        return 'H'
    elif x >= 24 and x <= 37:
        return 'M'
    else:
        return 'L'

reclass( !IMPACT!)
```

Calculating for Adaptive Capacity

```
ADCAP = [ADC_POLITI]+ [ADC_GDP_R]+ [ADC_PROV]+ [ADC_GREEN]+ [ADC_TreeC]+  
[ADC_BioC]+ [ADC_GHM]+ [ADC_LCOVER]
```

If the no. of criteria = 8	
Maximum score	(8 x 5) = 40
Minimum score	(8 x 1) = 8
Total range	[max - min] = 32
Intervals	$32 \div 3 = 10.7$ or 11
Interval	$32/3$ 10.7
Rating	Range
Low	8-18
Medium	19-29
High	30-40

```
def reclass(x):  
    if x >= 30:  
        return 'H'  
    elif x >= 19 and x <= 29:  
        return 'M'  
    else:  
        return 'L'  
  
reclass( !ADCAP! )
```

Calculating Vulnerability

Vulnerability				
Potential Impact	Adaptive Capacity			
		L	M	H
	L	M	L	L
	M	H	M	L
	H	H	H	M

```
def reclass(im, ac):  
    if im == 'L' and ac == 'L':  
        return 'M'  
    elif im == 'L' and ac == 'M':  
        return 'L'  
    elif im == 'L' and ac == 'H':  
        return 'L'  
    elif im == 'M' and ac == 'L':  
        return 'H'  
    elif im == 'M' and ac == 'M':  
        return 'M'
```

```
elif im == 'M' and ac == 'H':  
    return 'L'  
elif im == 'H' and ac == 'L':  
    return 'H'  
elif im == 'H' and ac == 'M':  
    return 'H'  
else:  
    return 'M'  
  
reclass( !ADCAP_LMH! , !IMPACT_LMH! )
```