Vulnerability Assessment for Agriculture to Climate Change

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Warming of the climate system is unequivocal

- Mean temperature (1906 - 2005): 0.74°C
- Average sea level: After 1961 1.3mm/year
- Last 50 years: Temperature 0.128 °C / 10 years
Vulnerability of a system refers to its physical, social, and economic aspects.

According to IPCC, vulnerability is a function of the character, magnitude and rate of climate variation to which a system is exposed; its sensitivity; and adaptive capacity.

Vulnerability is a function of all the three terms.

- Vulnerability = f (Exposure, Sensitivity, Adaptive Capacity)
Vulnerability Assessment

- Exposure is defined as degree of climate stress upon a particular unit analysis
  - For example, precipitation and temperature change

- Sensitivity is the degree to which a system will be affected by, or responsive to climate stimuli

- Adaptive capacity refers to the potential or capability of a system to adjust to climate change, including climate variability and extremes
Vulnerability assessment includes estimations on the

- Probability of an undesirable occurrence
- Potential impact of an event on humans
- Potential impact of an event on property and the environment
- Potential impact of an event on income and the agricultural sector
- Inventory of available internal and external resources to respond to an event

Sources: FEMA; amanet.org
Agriculture to climate change is directly, indirectly more vulnerable than any other industries.

Moreover, agricultural products damage by meteorological disasters were caused decrement of farmer’s incomes.

- Climate change → Meteorological disasters
- Agricultural sector damage
<table>
<thead>
<tr>
<th>Criteria</th>
<th>Indicator</th>
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</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>The number of people employed in agriculture of total population</td>
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<tr>
<td></td>
<td>Production of crop</td>
</tr>
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<td></td>
<td>Production of fruits</td>
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<td>Area of disease and insect pest (ha)</td>
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<td>Exposure</td>
<td>The number of days below marginal low temperature (17°C, July–September)</td>
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<td>The number of days above marginal high temperature (30°C)</td>
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<tr>
<td></td>
<td>Sum of solar insolation (April–October)</td>
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<tr>
<td></td>
<td>The number of days with daily precipitation above 80mm</td>
</tr>
<tr>
<td></td>
<td>The number of days with maximum wind speed exceeding 14 km/h</td>
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<tr>
<td>Adaptive Capacity</td>
<td>The self-reliance ratio of local finance (%)</td>
</tr>
<tr>
<td></td>
<td>GRDP (Gross Regional Domestic Product)</td>
</tr>
<tr>
<td></td>
<td>The number of farmhouses using PC</td>
</tr>
<tr>
<td></td>
<td>Available reservoir storage</td>
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</tbody>
</table>
Add Join

- Keep All
- Indicator
- City
- Add Join
- Re_Indicator
Polygon to Raster

- Re_Indicator
- Polygon to Raster
- Cellsize
- AC1
Get raster properties

Min

Get Raster Properties

AC1_Min

AC1

Get Raster Properties (2)

AC1_Max

Max
Raster calculator

Map Algebra expression

Layers and variables

- Keep All
- AC1
- AC1_Max
- AC1_Min
- Min
- Max
- AC1_PolygonToRaster2

Expression:

```
("%AC1%" - %AC1_Min%) / (%AC1_Max% - %AC1_Min%)
```
Raster calculator

Sensitivity $\times$ Exposure

Adaptive capacity
Entire process
Application

- National scale vulnerability assessment
- Find Impact factor

Vulnerability

- Climate change strategy
- Future Agriculture engine

Policy development

- Technical supports
- Difficulties, Technical consultants

Government and Farmers

- Local Alignment
- Solve problems
- Management skill supply
- Education, Promotion
Thank You!