Vulnerability Index calculation: tutorial

CM 615

Content

1. What is vulnerability index
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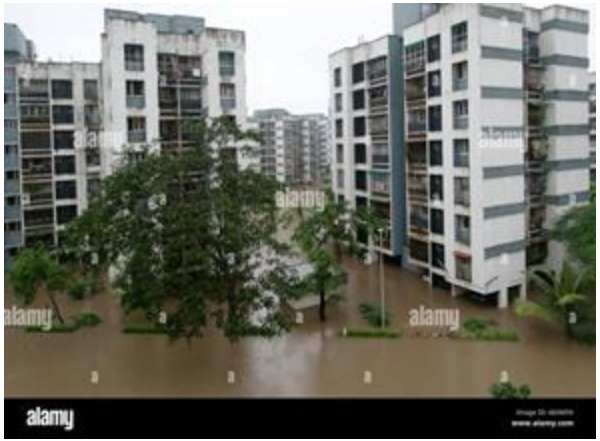
Need for computing vulnerability index

https://www.mapsofindia.com/maps/india/cyclone-prone-areas.html



Vulnerability Index

Vulnerability Index measures a country's exposure, sensitivity and ability to adapt to the impact of climate change.

Vulnerability = (Exposure * Sensitivity) - Adaptive capacity

Vulnerability = (Exposure - Adaptive Capacity)*Sensitivity

Vulnerability (V) (IPCC 2007, p. 883)
"The degree to which a system is susceptible to, and [**or** in IPCC 2001] unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation [**climate variation** in IPCC 2001] to which a system is **exposed**, its **sensitivity**, and its **adaptive capacity**." (bold emphasis added)

Exposure (IPCC 2001, p. 987)
"The nature and degree to which a system is exposed to significant climatic variations."
(not defined in IPCC 2007)

Sensitivity (IPCC 2007, p. 881)
"The degree to which a system is affected, either adversely or beneficially, by climate variability or change. The effect may be direct (e.g., a change in crop yield in response to a change in the mean, range or variability of temperature) or indirect (e.g., damages caused by an increase in the frequency of coastal flooding due to sea-level rise)."

Adaptive capacity (IPCC 2007, p. 869)
"The ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences."

Steps to compute vulnerability index

Step 1: Selection of variables for each sub-index (Exposure, sensitivity and adaptive capacity)

Step 2: Data collection

Step 3: Data normalisation

Step 4: Data aggregation

Step 5: Final result

Step 6: Interpretation

Data normalisation

Positively affecting factors:

$$x_{ij} = \frac{X_{ij} - \min_i \{X_{ij}\}}{\max_i \{X_{ij}\} - \min_i \{X_{ij}\}}$$

Negatively affecting factors:

$$y_{ij} = \frac{\max_i \{X_{ij}\} - X_{ij}}{\max_i \{X_{ij}\} - \min_i \{X_{ij}\}}$$

Data aggregation

Averaging over sub indicator: Exposure, Sensitivity and Adaptive capacity

Vulnerability index = (Exposure * Sensitivity) - Adaptive capacity

Assignment

1. Compute state-level vulnerability assessment considering at least five states of India.
2. Compare the level of vulnerability based on exposure, sensitivity and adaptive capacity.
3. State which factors need more focus to reduce the level of vulnerability

Variables

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The Livelihood Vulnerability Index: A pragmatic approach to assessing risks from climate variability and change—A case study in Mozambique

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Data

1. Exposure:

   Precipitation: Frequency of >95 percentile and <5 percentile

   Temperature: Frequency of >95 percentile and <5 percentile

1. Adaptive capacity: Data is provided (If necessary random data can be generated for other variables, if you want to include any)
2. Sensitivity: Data is provided (If necessary random data can be generated for other variables, if you want to include any)

Report structure

1. Introduction
2. Data and methods

    2.1. Data

    2.2. Methods

    2.3. Study area

1. Results
2. Interpretation
3. Conclusion