Role of Earth Observation in Multi-Hazard Disaster Risk Assessment and Monitoring Targets of the Sendai Framework

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Content

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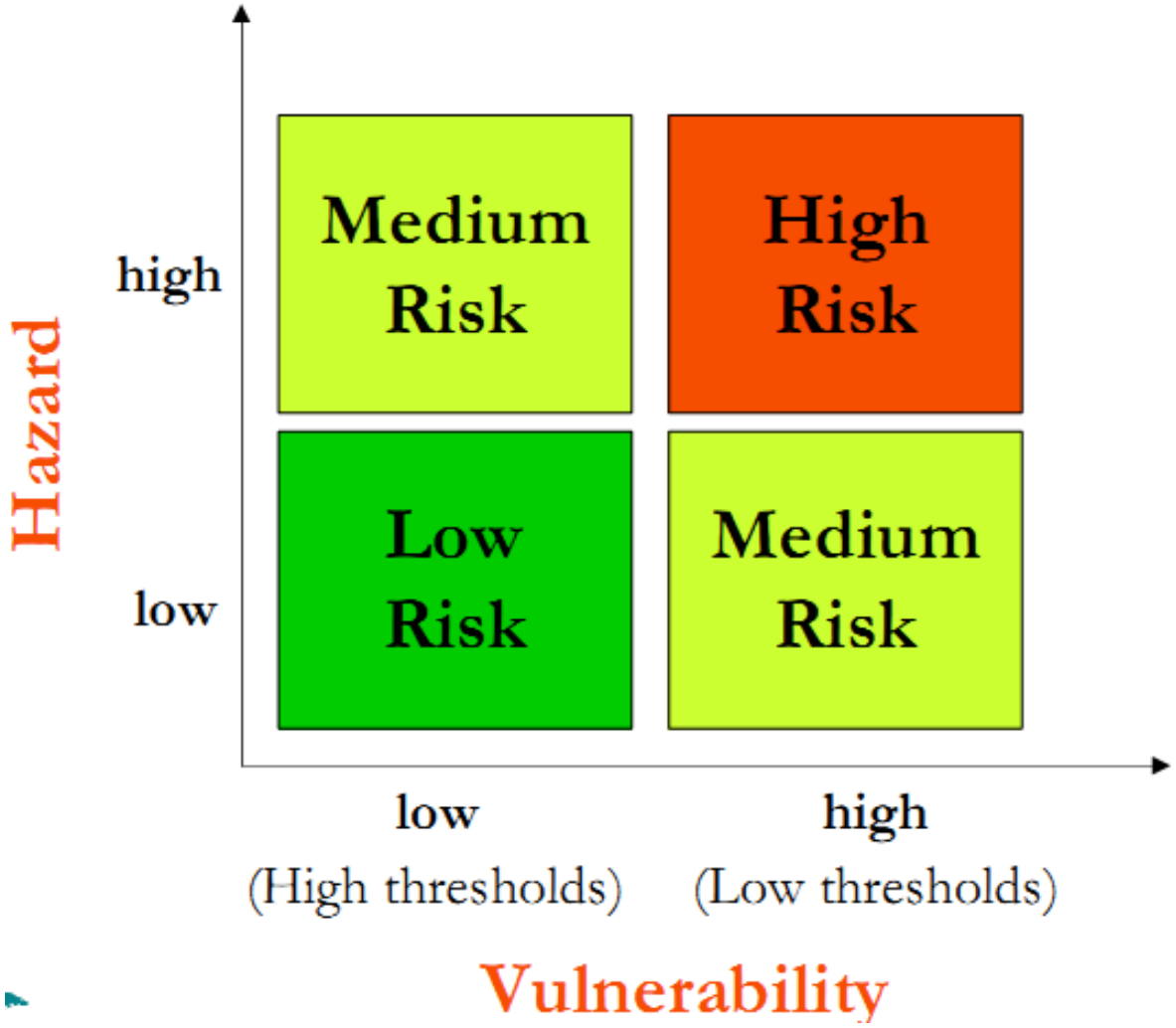
2. Vulnerability Mapping
3. Risk Mapping
4. Index Insurance

What is risk?

What are the steps of risk assessment?

Hazard, Vulnerability and Risk



Risk = Hazard * Vulnerability / Capacity….(a)

Risk = Hazard * Vulnerability * Amount of elements-at-risk ----------(b)

Basic data requirement for Flood risk assessment

- Flood inundation
- Peak depth
- Peak flood velocity
- Flood warning time

Hazard

- Occupancy Type
- Depth-damage curves
- Fatality Rate
- Flood security

Vulnerability

- Study area polygon boundary
- Population map
- Building and landuse maps
- Infrastructure maps (different types of roads)

Exposure

Risk

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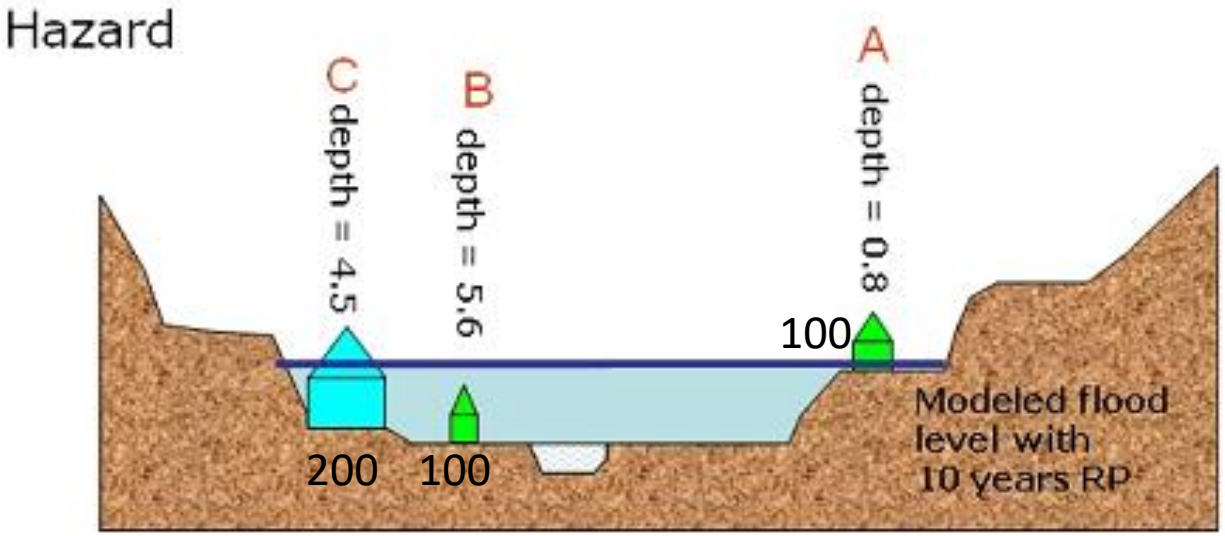
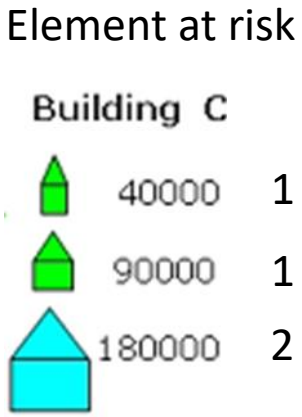
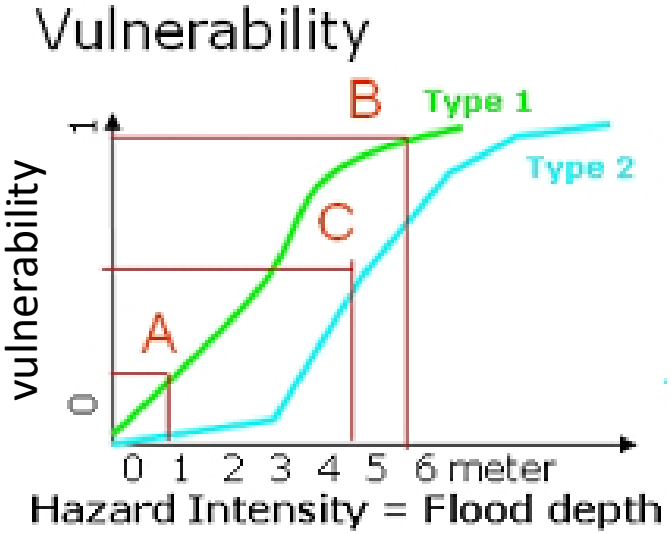
Flood hazard, Vulnerability and risk Mapping







Building class	Hazard	Vulnerability	Element at risk	Building value	Building-Damage/ risk
Class – 1					
Class – 1					
Class – 2					

1. What would be the annual risk of the buildings in the example?

2. What would be the annual risk of the buildings in the example if the return period of the event was 25 years?

3. What would be the annual risk of the buildings in the example if the return period of the event was 25 years, after 10 year with an increase in house prices of 8 % per year?

Flood hazard, Vulnerability and risk Mapping

Building class	Hazard	Vulnerability	Element at risk	Building value	Damage
Class – A					
Class – B					
Class – C					

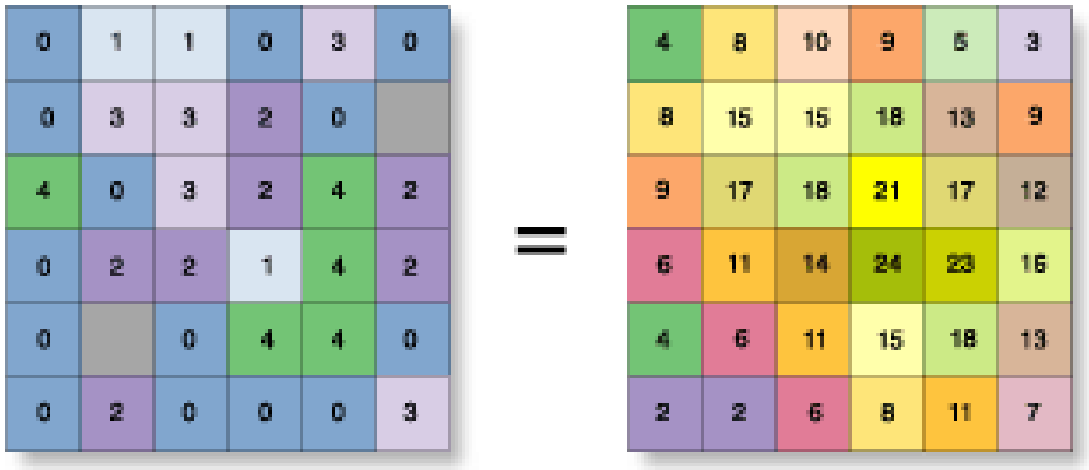
Spatial Flood Risk Assessment

Data requirement

- Flood Hazard (historical data)
- Flood Depth/Velocity
- Flood exposure (population/Building/Agriculture)

Floodwater Depth Estimation Tool (FwDET)

1. Flood extent polygon to polyline
2. Polyline to Raster - DEM extent and resolution (Env)
3. Con - DEM values to Raster
4. Calculate Focal Statistics mean (for pixels)
5. Water depth calculation - difference between Focal Max output and DEM



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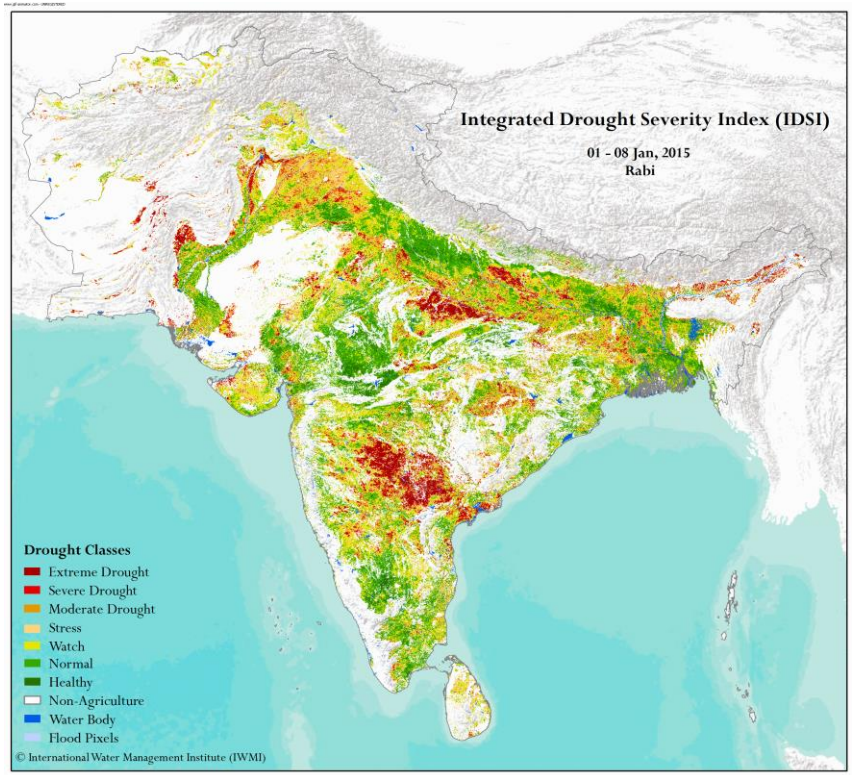
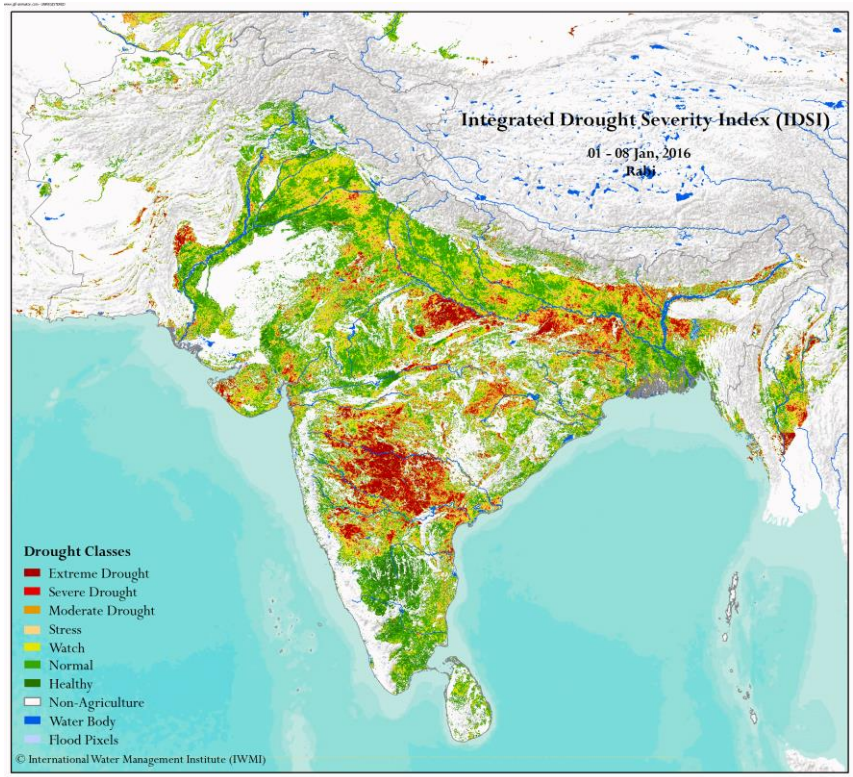
Drought Monitoring and risk assessment





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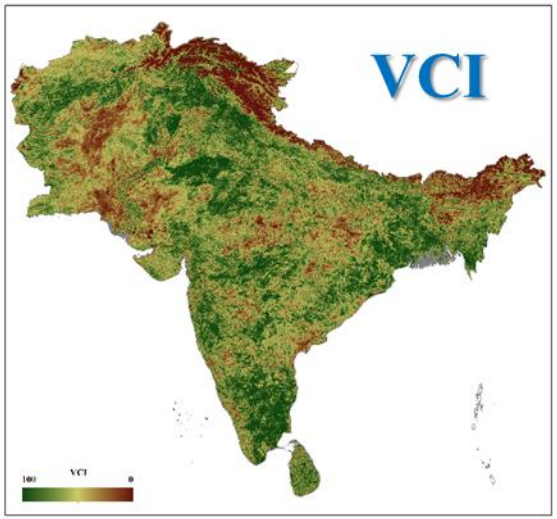
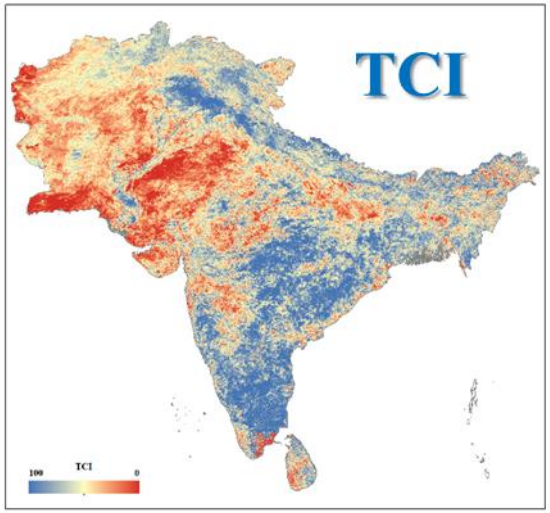
Index calculation

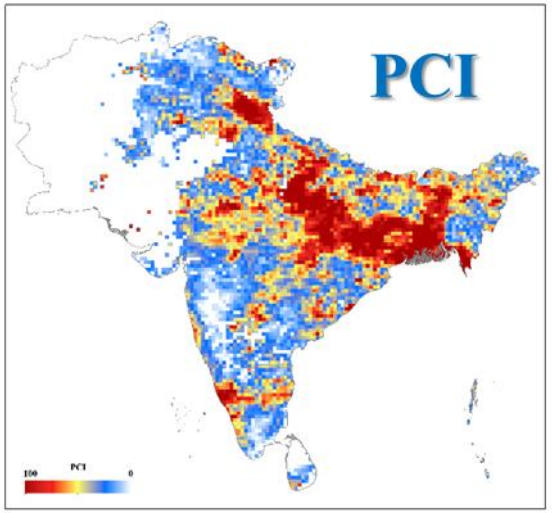
$$VCI_{ijk} = \frac{NDVI_{ijk} - NDVI_{ijn}}{NDVI_{ijx} - NDVI_{ijn}} * 100$$

$$TCI_{ijk} = \frac{LST_{ijx} - LST_{ijk}}{LST_{ijx} - LST_{ijn}} * 100$$

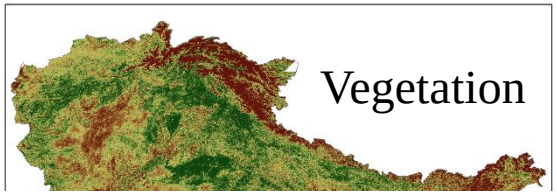
$$PCI_{ijk} = \frac{TRMM_{ijk} - TRMM_{ijn}}{TRMM_{ijx} - TRMM_{ijn}} * 100$$

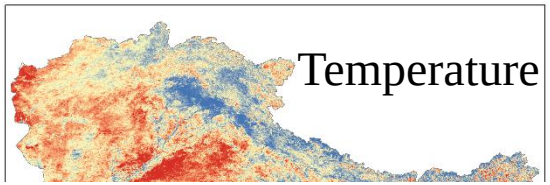


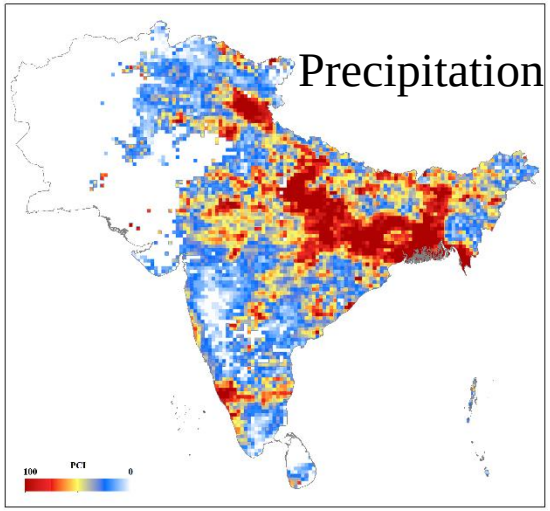


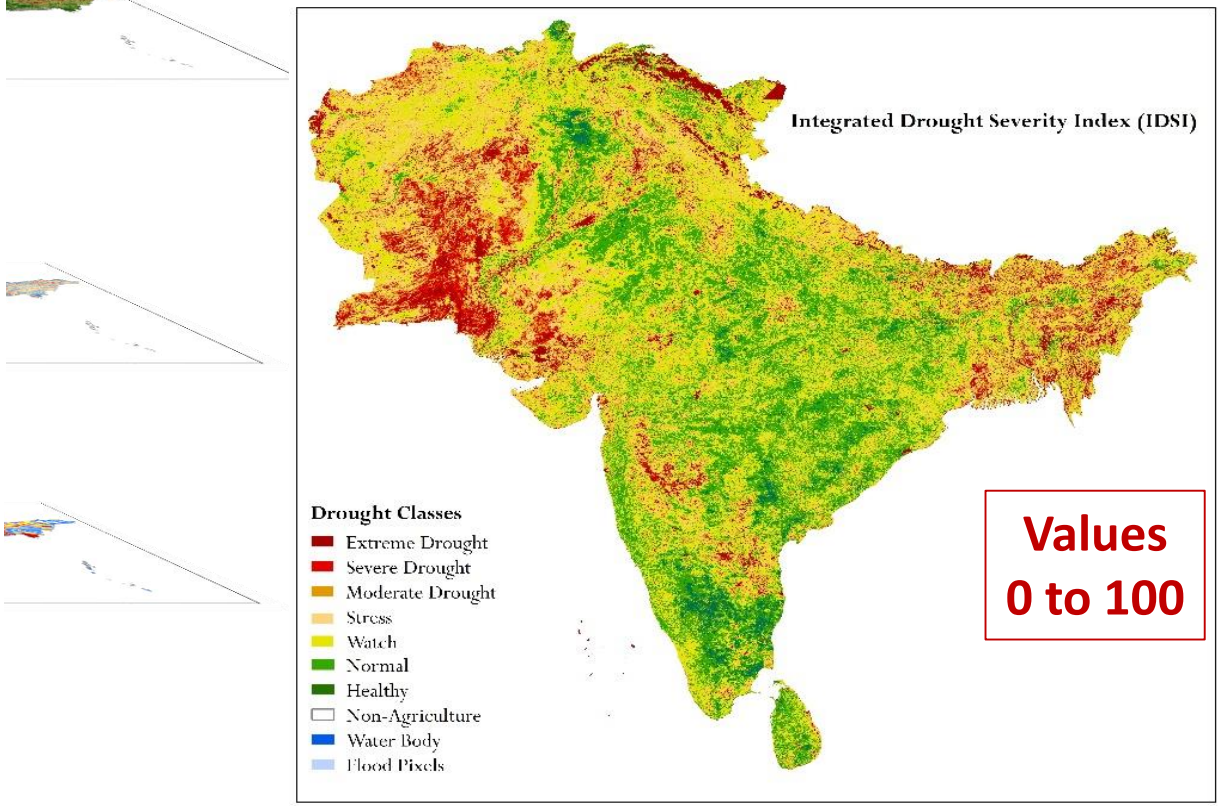


Integrated Drought Severity Index (IDSI)









IDSI Equation

$$IDSI_{ijk} = \left[L * VCI_{ijk} * \left\{ c + \frac{1}{\left(L * (VCI_{ijk} + TCI_{ijk} + PCI_{ijk} + c \right)} * \left(TCI_{ijk} + PCI_{ijk} \right) \right\} \right]$$

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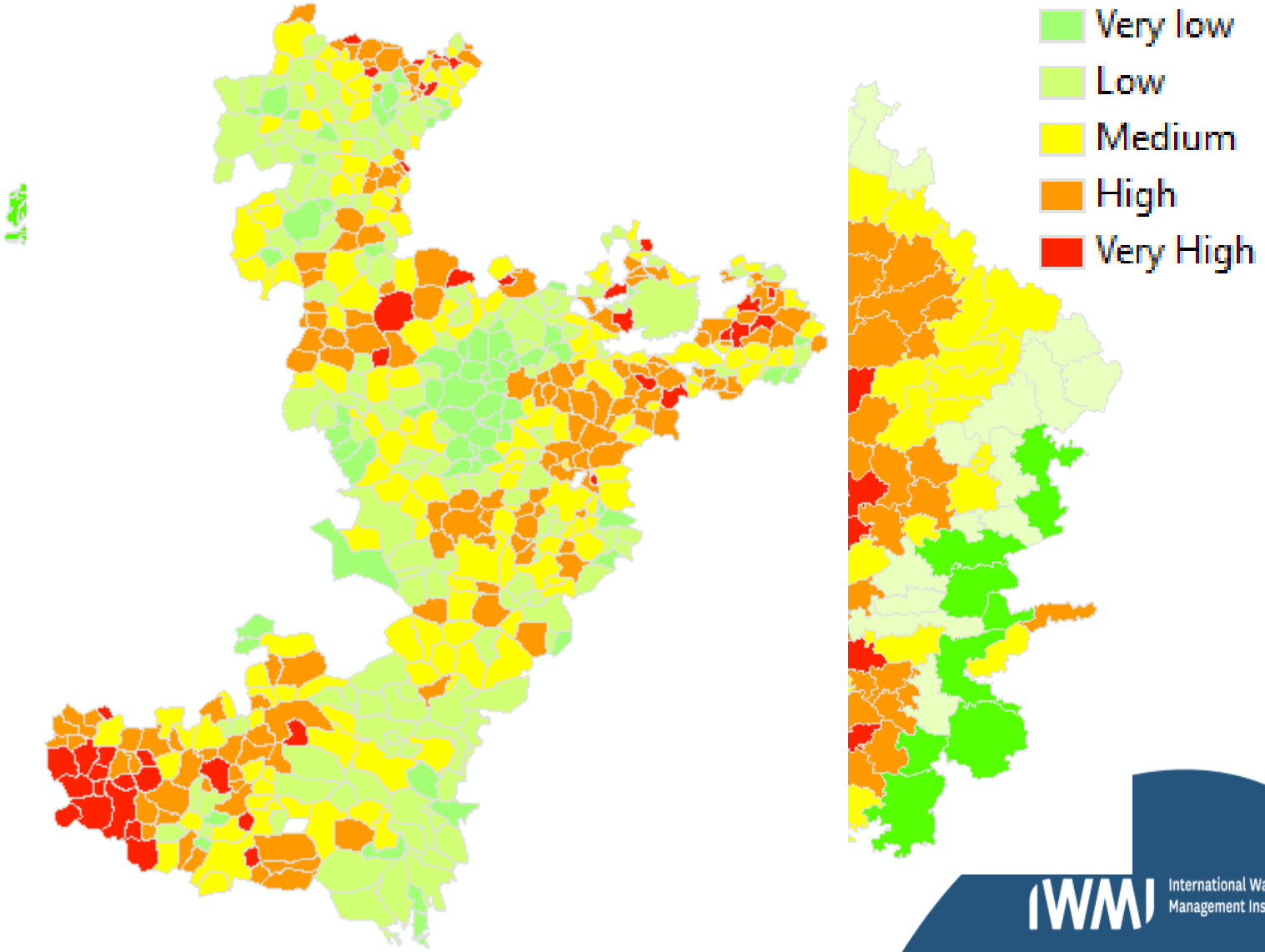
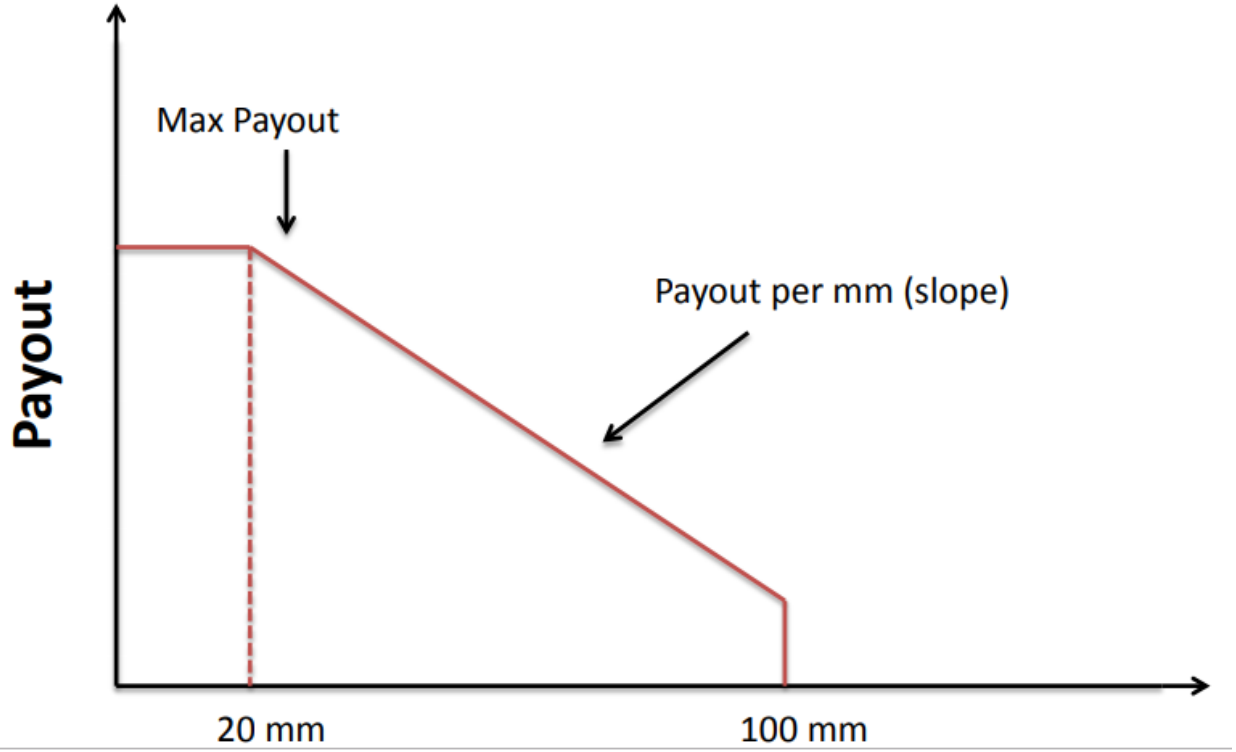
Drought Hazard Mapping



Weather Index Concept



The indemnity is paid according to tl

Let

x = cumulative rainfall
y = Minimum Pay-out
z = Pay-out per mm
a = Trigger
b = Stop loss

Payout = 0 if x > a
Payout = y + (a-x)*z if b < x <= a
Payout = y + (a – b)* z if x <= b

Weather Index Concept - Example

Example of the Payout Structure

Weather Variable: Cumulative Rainfall p.m
Trigger : 100mm
Stop Loss: 20mm
Minimum Payout: Rs 300
Maximum Payout: Rs 3000
Payout Per mm: Rs 33.75

$$\text{Payout} = y + (a-x)*z$$

If rainfall recorded is 67 mm then payout to the farmer will be:

$$300 + (100 - 67)*33.75 = \text{Rs } 1413.75\ 6$$

IBFI Product Notes –Scheme Description

The product pays out in case the given territory undergoes continuous inundation for certain number of days. An inundated day is recorded in case the average water level modelled for the given village surpasses the trigger values associated with that village under two different components:

- 50% of sum insured goes towards Component 1
- The remaining 50% of sum insured goes towards Component 2

Pay-out Structure: Component 1

Duration (Days)	Level	Payout
0	1	0
9	1	35%
13	1	55%
23	1	100%

Pay-out Structure: Component 2

Duration (Days)	Level	Payout
0	1	0
25	1	100%

Exercise

Using provided flood depth data calculate the payout for the given village