Building Urban Resilience

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What is Risk?

Climatic: Sea level rise, heat waves, droughts, floods, cyclones, landslides due to precipitation
Tectonic: Tsunamis, earthquakes, volcanic eruptions, landslides due to land shaking
Man-Made: War, industrial accidents, unsustainable resource systems

Location and concentration of the elements at risk : People, Settlements, Buildings, Systems (water lines, gas lines), Infrastructure, Livelihoods

Inherent characteristics of elements that increase their propensity for risk to certain hazards : Social, Economic, Environmental, Institutional

$$\text{Risk} = f(time\&space) = \frac{\text{Hazard x Vulnerability x Exposure}}{\text{Capacities}}$$

Inherent characteristics of the elements that decrease their propensity for risk and help in coping : Social, Economic, Environmental, Institutional



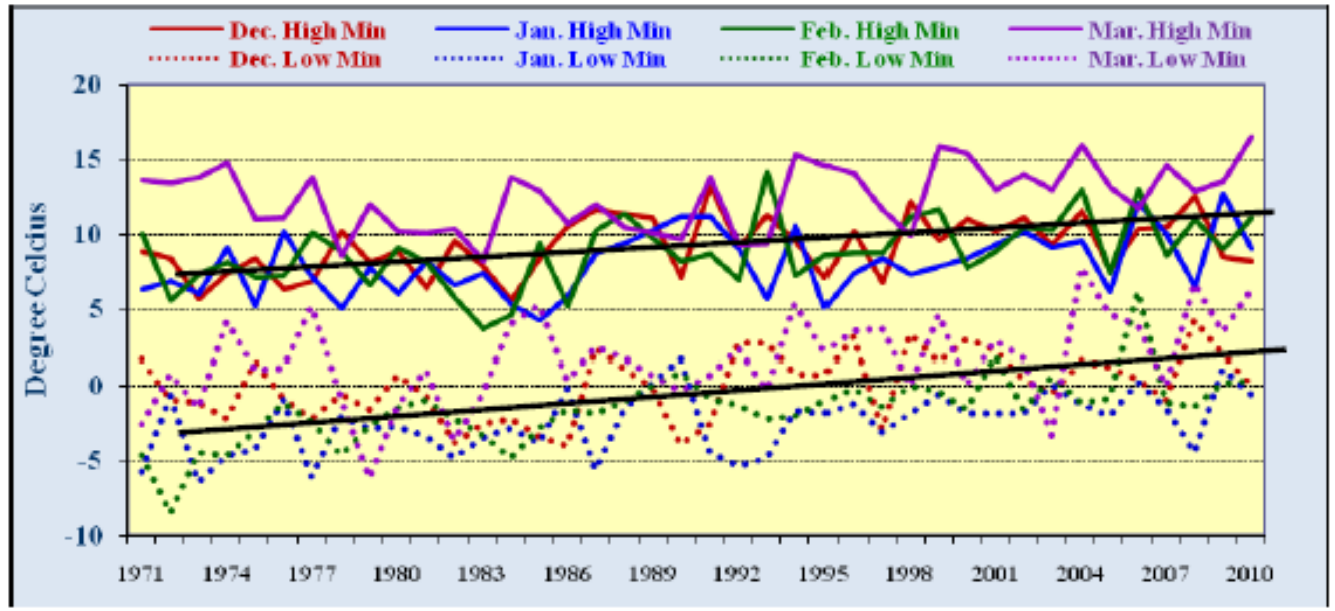

Figure 5 Lowest and Highest minimum temperature trends during winter (1971 – 2010) [15]

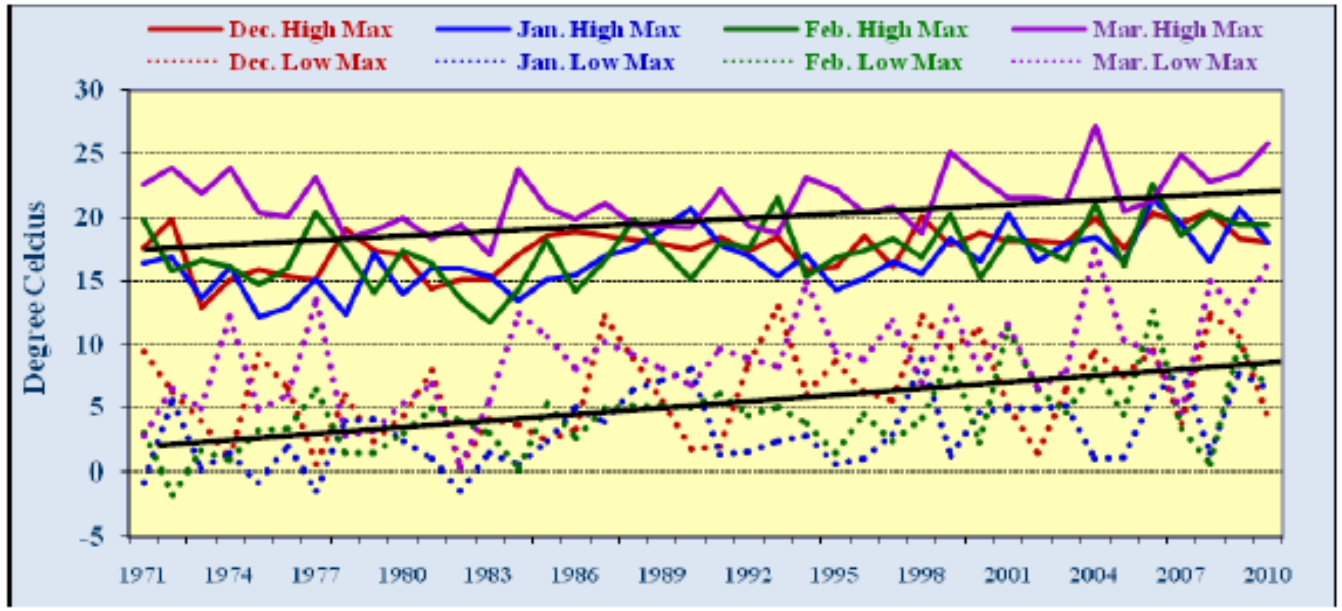

Figure 6 Lowest and Highest maximum temperature trends during winter (1971 – 2010) [15]

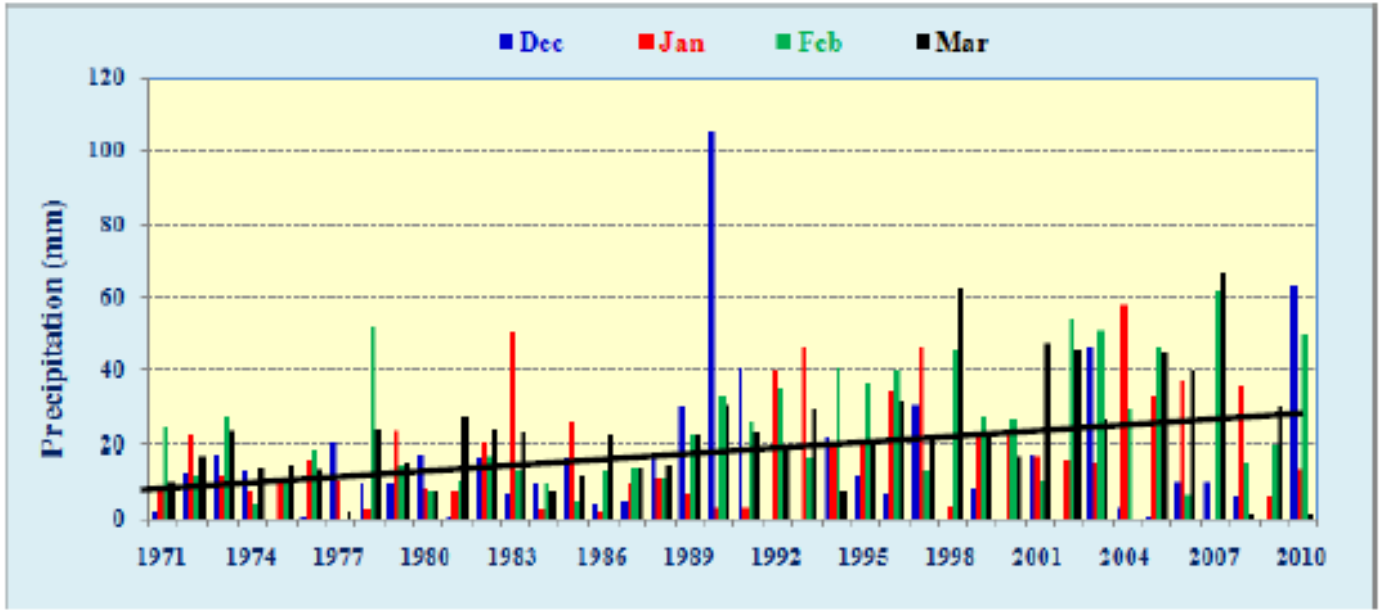

Figure 9 Precipitation trends in Shimla (Dec- Mar, 1971 – 2010) [16]

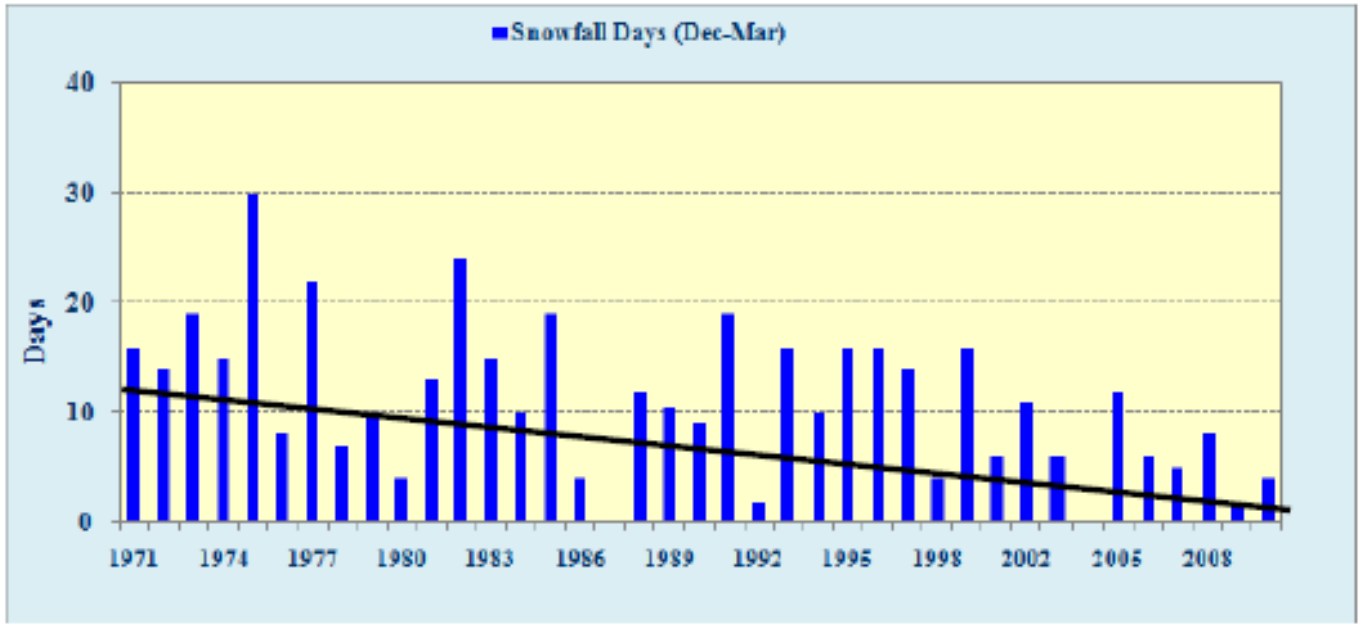

Figure 10 Snow fall trends (1971 – 2010) [16]


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WHAT IS RESILIENCE?

The ability of a system, community or society exposed to hazards to **resist, absorb, accommodate to and recover from** the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions. (UNISDR 2011)

Jo da Silva outlines the following as **characteristics** of a resilient [location/city] –

(a)	Minimal human vulnerability,	V
(b)	Diverse livelihoods and employment,	C
(c)	Adequate safeguards to human life and health,	V/C
(d)	Collective identity and mutual support,	C
(e)	Social stability and security,	C
(f)	Availability of financial resources and contingency funds,	C
(g)	Reduced physical exposure and vulnerability,	E/V
(h)	Continuity of critical services,	H/E
(i)	Reliable communications and mobility,	C
(j)	Effective leadership and management,	C
(k)	Empowered stakeholders, and	C
(l)	Integrated development planning.	E/C

$$Resilience = \frac{1}{Risk}\ ?$$

How to reduce Risk?

- Reduce vulnerabilities
- Address and manage exposure
- Improve capacities to cope

Risk Accumulation in Urban India

Concentration of **Hazards**

> Intensity and Frequency of Key Hazards = Droughts, Floods (Pluvial and Fluvial), Cyclones, Landslides (due to precipitation or earthquake), Tsunamis, Earthquakes.

Concentration of **Vulnerability**

> Quality of Built, Economic and Social Environment

Concentration of **Exposure**

> Concentration of People, Systems and Economy = Population Density

Provision of **Capacities**

> Quality of Planning and Institutional Systems

Equation 1: $Risk = \frac{\left(\prod_l^i H \times \sum_m^j V \times \sum_n^k E\right)}{\sum_a^b C}$

Equation 2: $Risk = \left(\prod_l^i (Hl \times \sum_m^j \frac{V}{C}) \times \sum_n^k E\right)$

$where$

H = Product of all Hazard Probabilities

V = Sum of all Vulnerability Indicators

E = Sum of all Exposure Indicators

C = Sum of all Capacity Indicators

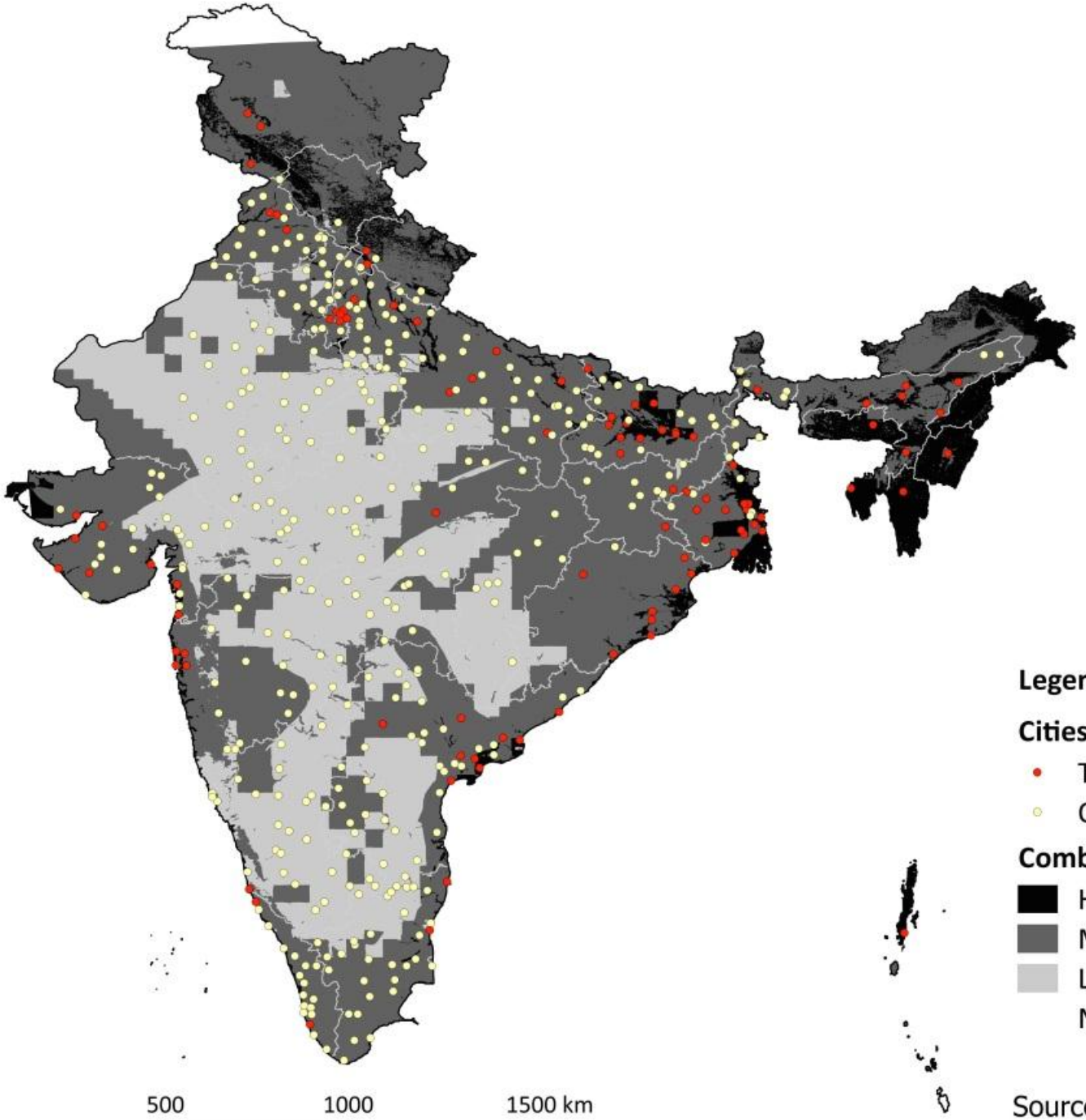
(Adapted from Blaikie et.al., 2003)

Hazards (10) : Earthquake, Wind Pressure , Cyclonic Storm, Landslides, Landslides, Droughts, Tsunami, Fluvial Floods, Potential for Disease Incidence.

Vulnerabilities (13): **People**: Slum Population, Access to Assets (mobile phones, landlines, television, vehicles, internet, radio, banking services); **Buildings**: Houses with temporary walls, and temporary Roofs; **Systems**: Households without access to sanitation systems, households without access to electricity, households consuming water not from a treated source.

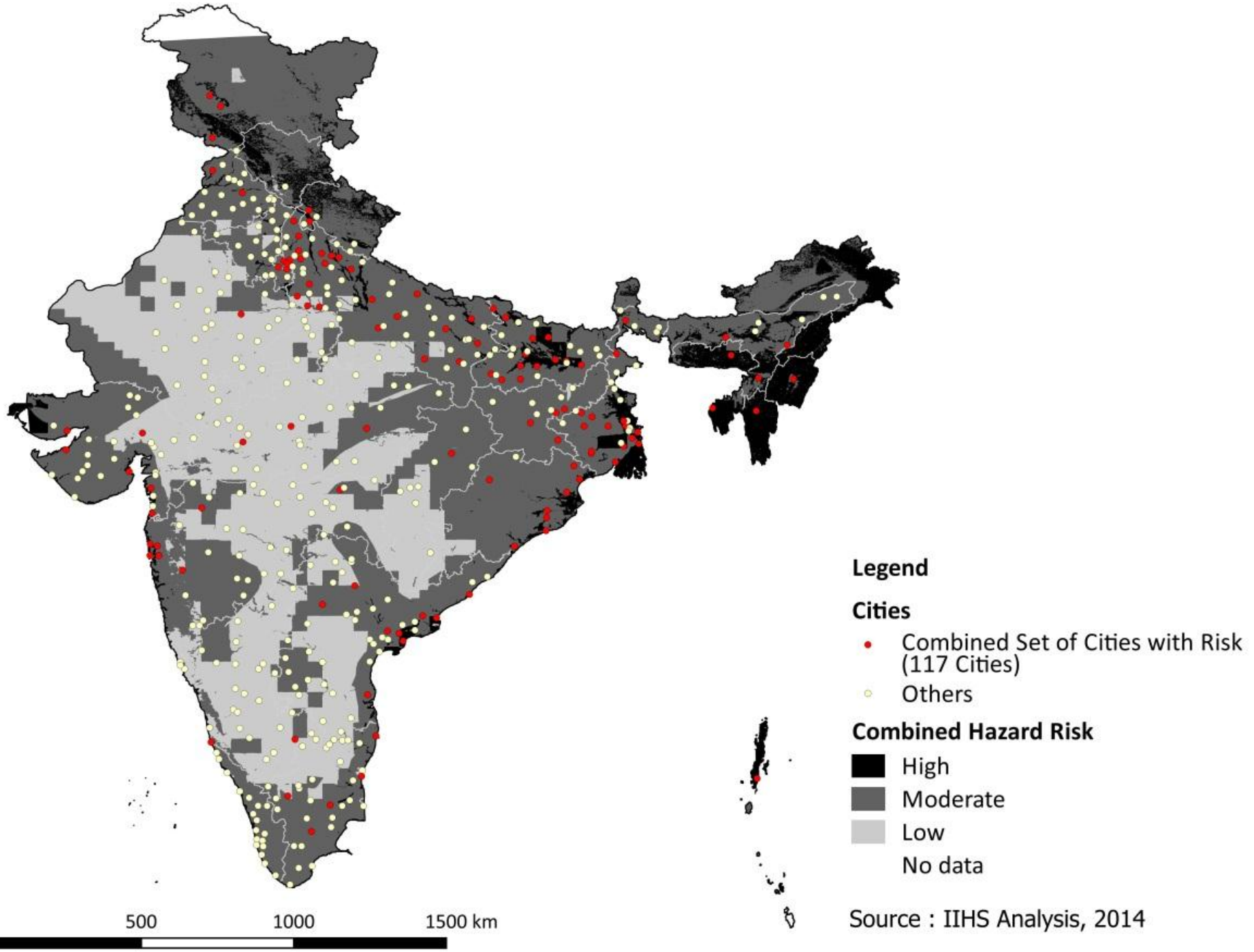
Exposure (4): Population, Area, Density, Economy (Working Population)

Capacities (12) : **Critical Infrastructure**: Roads, Hospital Beds; **Socio-Economic Assets**: Access to banking Services, Asset ownership; **Plan Status**: City Development Plan, City Disaster Risk Management Plan, State Action plan on Climate Change



Combined Hazard Risk

Most of these cities are located in the Indo-Gangetic plains, Himalayan range or coastal India



Composite Risk

100 Cities with highest composite risk

Most of these are in the more populated states of UP, Bihar& West Bengal, poorer states of Madhya Pradesh and Orissa other than those in the Indo-Gangetic plains, Himalayan range or coastal India

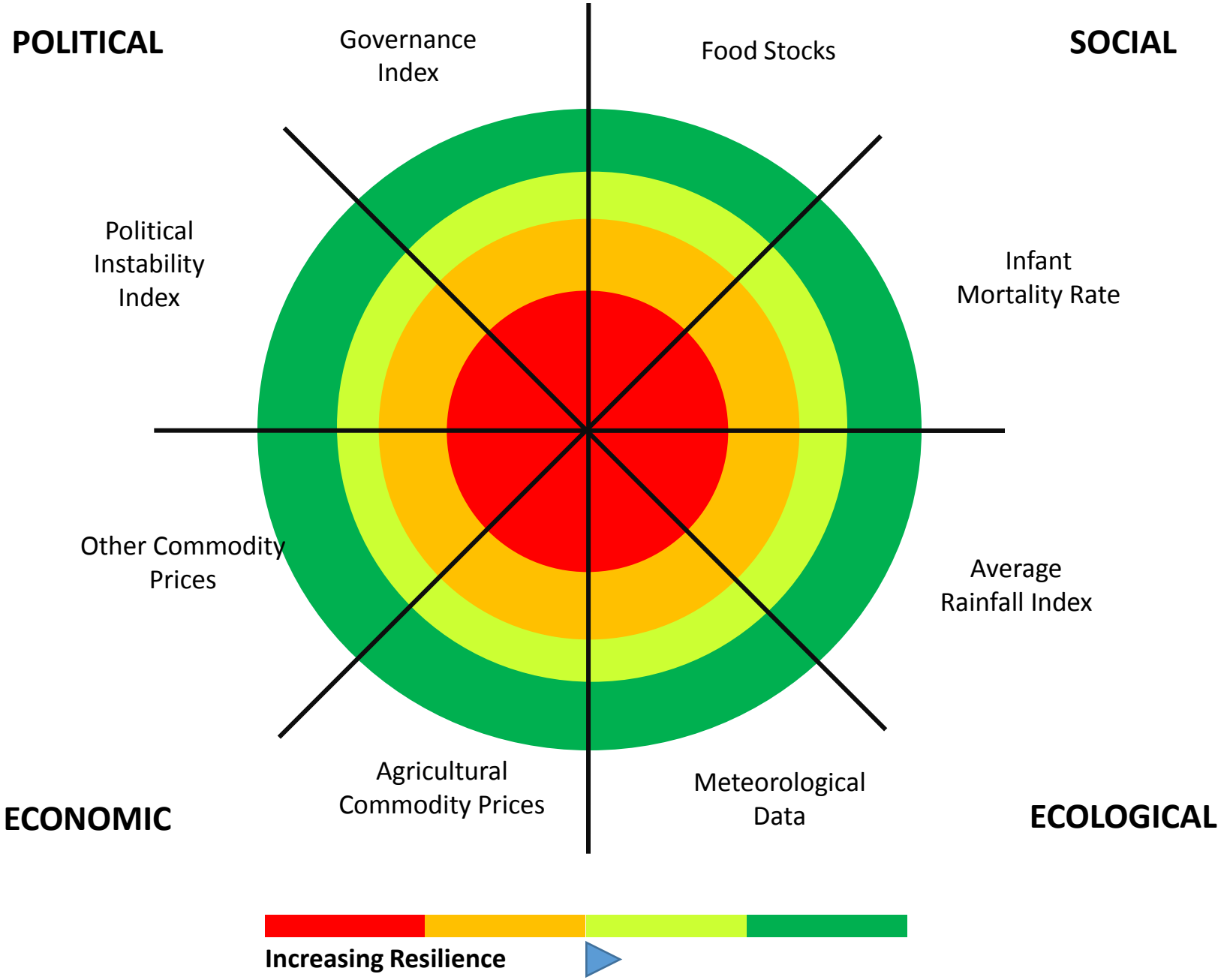
Global

Resilience

Operating

Window

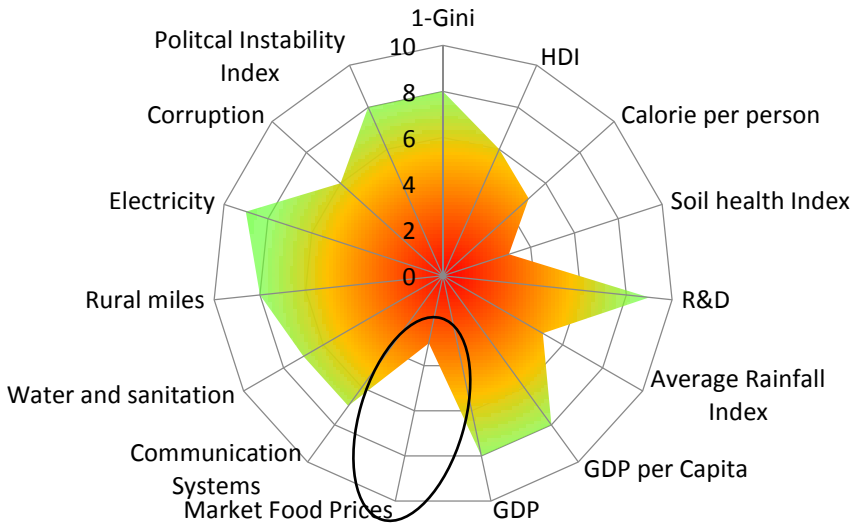
MONITORING AND RESPONSE SYSTEM : G.R.O.W.



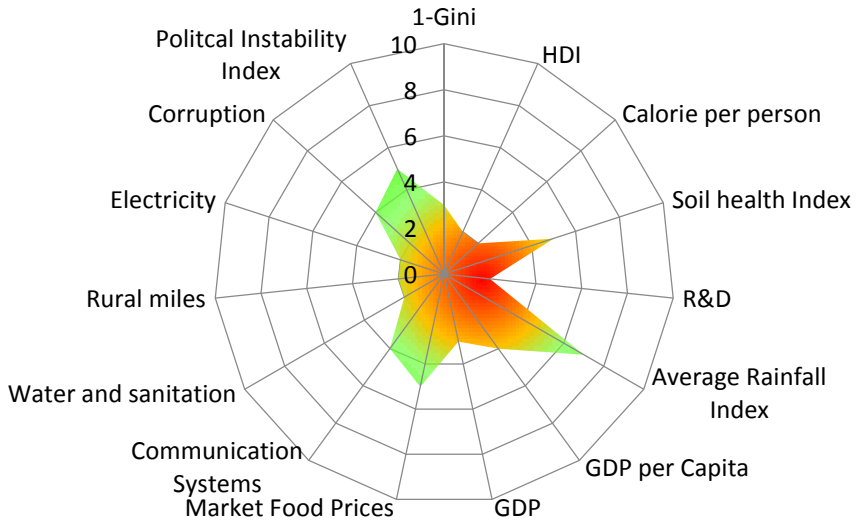
MONITORING AND RESPONSE SYSTEM : G.R.O.W.

1. Comparative Analysis:
   - Regional, National, Sub-National, City
   - Short Term & Long Term
2. Vulnerability and capacity Mapping
3. Historical Analysis
4. Planning and Coordination
5. Response Strategies

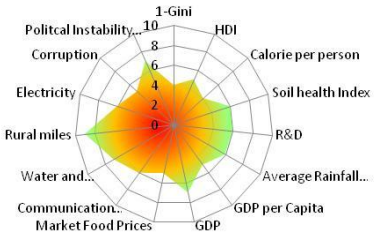
COUNTRY A, 2004



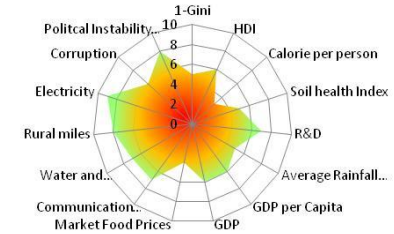
COUNTRY B, 2004



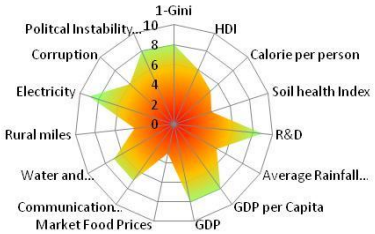
COUNTRY A, 1999



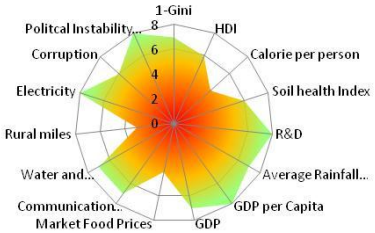
COUNTRY A, 2000



COUNTRY A, 2001



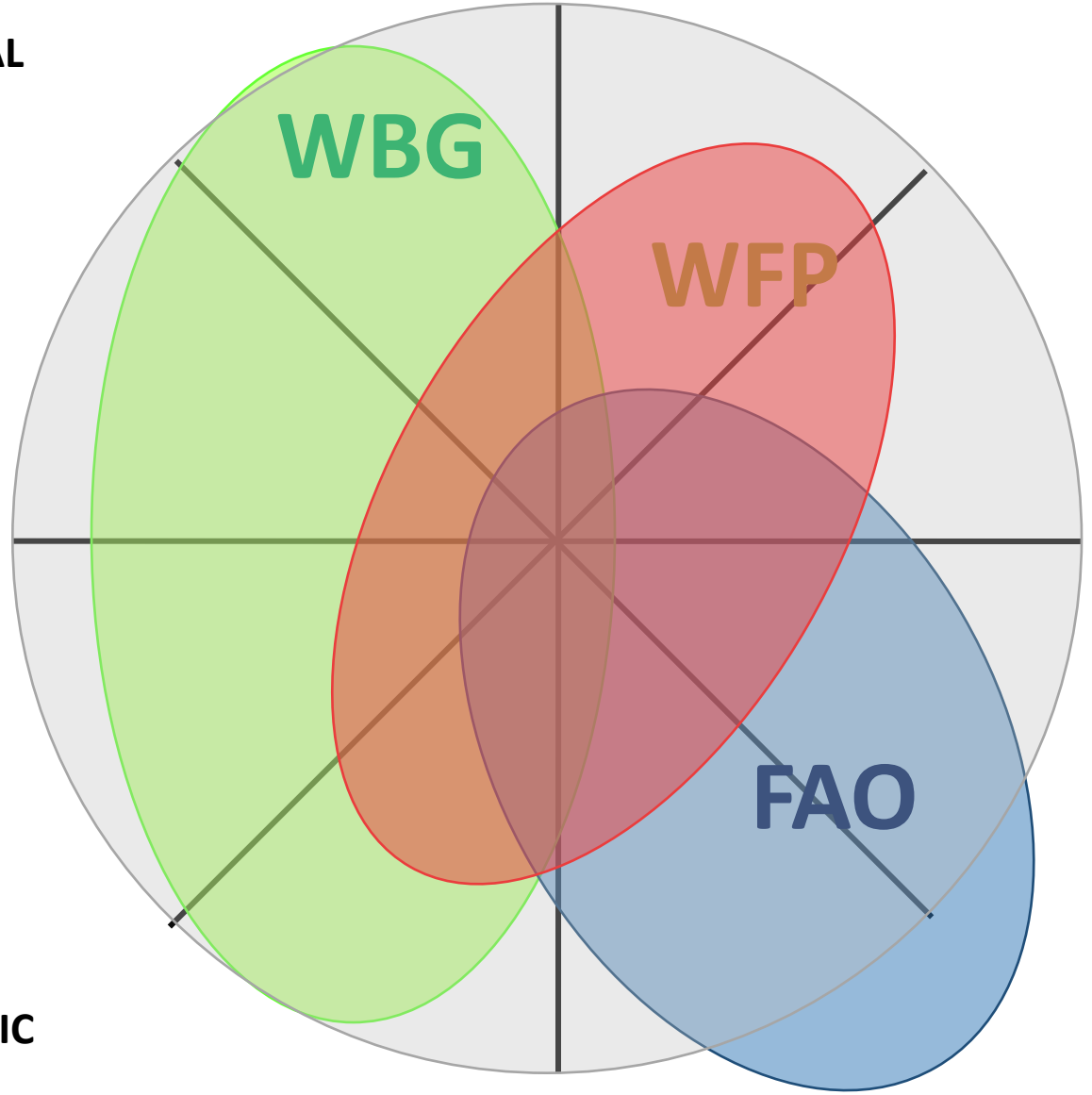
COUNTRY A, 2002



COORDINATION TOOL

POLITICAL

SOCIAL



ECONOMIC

ECOLOGICAL

National/ Local Govt.