Key vulnerabilities from a human dimensions perspective

Anand Patwardhan

Indian Institute of Technology-Bombay, and,
Technology Information, Forecasting & Assessment Council (TIFAC)

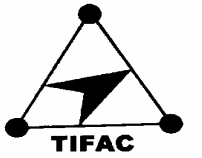
Three questions

- Why focus on key vulnerabilities?
- What are the problems in using the notion of key vulnerabilities to address DAI?
- What are the implications for the current policy debate?

Key vulnerabilities

- Article 2 criteria need operational measures corresponding to end-points / outcomes
  - Biophysical
  - Socio-economic
- Focus on outcomes that matter, and have high policy salience and immediacy
- Response (whether adaptation or mitigation) needs to be tied to these outcomes
- Vulnerability useful in capturing the complex interplay between hazard, exposure and adaptation

Role of climate change in creating the outcome



- Future climate change is expected to manifest through changes in nature and frequency of climate and weather variability and extremes.
- Extreme climatic and weather conditions and their impacts *even now* usually fall outside the coping range of human societies and natural systems.
- Extreme climate and weather events may play either of the following two roles in leading to outcomes:

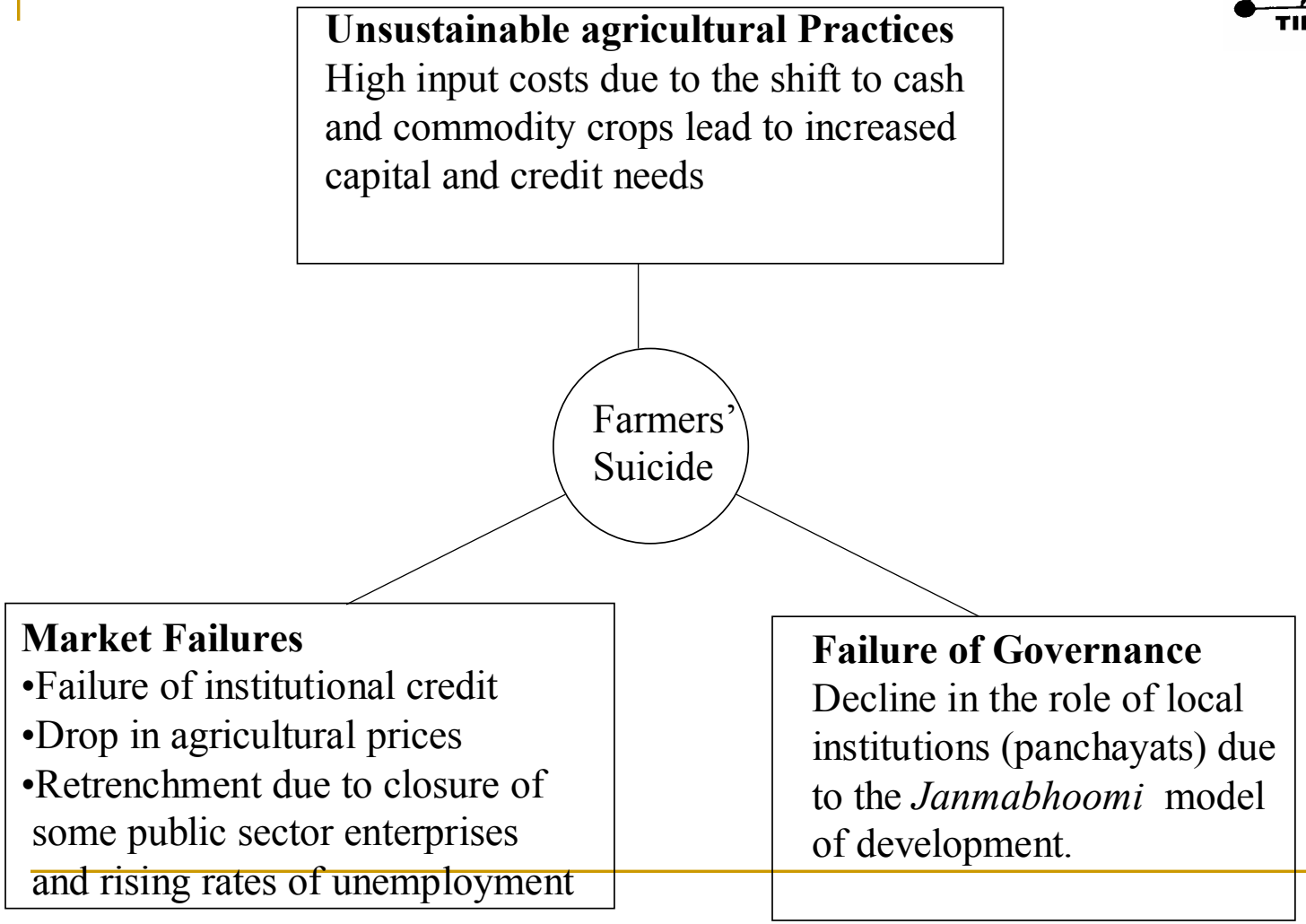
  Triggering / Precipitating role – *in this case system is already moving toward deterioration and the climate / weather event simply causes a threshold to be crossed*

  Causative role – *climate change and related biophysical stress is a direct cause of the outcome*

Farmers' suicide in Andhra Pradesh

- According to official reports about 300 farmers took their lives in the summer of 2004, but the number is closer to 600 or more according to the media reports.
- These suicides are often attributed to crop-failure due to drought, whereas they were debt driven and drought was a precipitating factor. The conditions that created the perception in the minds of the farmers that they had no choice but suicide are socio-political and economic in nature.
- Background: there are 11 million farmers in Andhra Pradesh. 90% of them are small farmers. 70% of the state's 78 million people are dependent on agriculture.

Factors that led to the deterioration of the farmers' situation



Changes in Cropping Pattern

There are three-distinct agro-climatic regions viz. Coastal Andhra, Rayalaseema and Telangana. Traditionally, Andhra Pradesh relied more on food crops (rice and jowar pre-dominantly) with 77 percent area covered under them. But since 1980's there is a significant fall in the area covered by jowar, bajra, ragi and millets.

	AP TOTAL		Rayalseema		Telangana		Coastal	
	82-83	92-93	82-83	92-93	82-83	92-93	82-83	92-93
% Area under food crops	76	64.4	61.1	32.3	81.6	71.2	79	76.7
% Area under non-food crops	24	35.4	39.9	67.7	18.4	28.8	21	23.3

Market issues

- **Shift to cash / commodity crops and increased input requirements leads to increased working capital & credit needs**
- **Failure to provide cheap institutional credit**

  For 1990 the credit supply by all the scheduled commercial banks has averaged only Rs. 2000 per ha. of net sown area. By any standards this is considered to be a meager amount which is not expected to fulfill even 20 percent of the credit needs of the farming community. Banks ask for land as collateral security for giving crop loans. This disqualifies tenant farmers from any institutional credit. As a result *farmers take loans from the unorganized credit market at exorbitant rates.*
- **Price variation**

  Cash / commodity crops experience greater price volatility. Food grains have minimum support prices and market prices are more stable. Absence of a market stabilization fund for intervening as required.

Climate hazard in the causative role

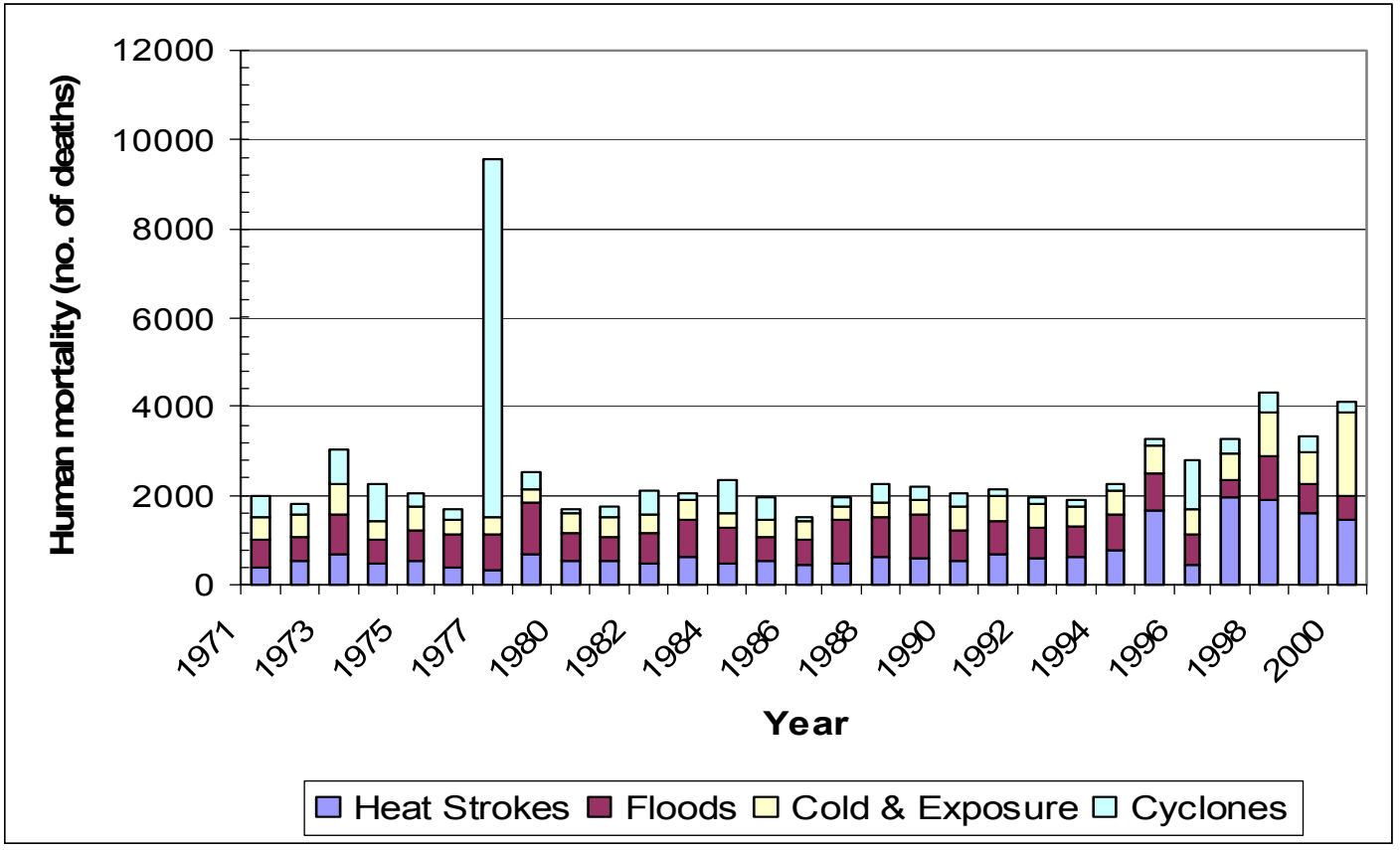
- Even in its causative role the climate hazard does not directly cause the outcome. It is mediated by the exposure and adaptive capacity characteristics of the system.

- The interaction of exposure and adaptive capacity with the climate hazard can be understood better within a conceptual framework of vulnerability.

Impacts of climate hazards: Descriptive Summary

Climate hazard	Average annual total mortality	Average annual male mortality	Average annual female mortality
Heat Strokes	594	408	186
Cold & Exposure	443	340	103
Cyclones	670	395	275
Floods	743	490	253
Climate hazard	**Standard deviation**	**Standard deviation**	**Standard deviation**
Heat Strokes	247	201	65
Cold & Exposure	104	79	33
Cyclones	1551	797	755
Floods	159	111	58.5

Relative Total Mortality Due to Different Climate Hazards



Trends in Climate hazard Impacts

	Total Mortality		Male Mortality		Female Mortality	
Climate hazard	**Trend coefficient**	**p value**	**Trend coefficient**	**p value**	**Trend coefficient**	**p value**
Heat Strokes	14.43	0.0317	10.70	0.0532	3.73	0.0341
Floods	3.31	0.4633	3.34	0.2869	-0.025	0.9879
Cold & Exposure	2.33	0.4308	2.94	0.1832	-0.61	0.5167
Cyclones	-41.96	0.3399	-23.97	0.2873	-17.99	0.4021

State level trends in mortality due to heat waves

	Actual Mortality		Mortality normalized by population	
State	**Trend coefficient**	**p value**	**Trend coefficient**	**p value**
Andhra Pradesh	**1.35**	**0.0012**	0.10	0.1330
Bihar	**0.92**	**0.0490**	-0.07	0.3705
Gujarat	1.21	0.1813	0.11	0.6569
Madhya Pradesh	0.14	0.8132	**-0.36**	**0.0248**
Maharashtra	-1.37	0.0776	**-0.34**	**0.0244**
Orissa	**1.13**	**0.0092**	0.22	0.1073
Punjab	**1.17**	**4.95E-06**	**0.39**	**0.0012**
Rajasthan	**1.51**	**0.0019**	0.18	0.1042
Uttar Pradesh	0.11	0.9334	-0.21	0.0621
West Bengal	**1.53**	**9.05E-05**	**0.12**	**0.0364**

State level trends in mortality due to cold waves

	Actual Mortality		Mortality normalized by population	
State	**Trend coefficient**	**p value**	**Trend coefficient**	**p value**
Bihar	2.15	2.13E-05	0.116	0.1762
Gujarat	0.92	0.00099	0.0379	0.5851
Himachal Pradesh	0.04	0.84339	-0.860	0.0651
Jammu&Kashmir	-0.30	0.1796	-0.873	0.0297
Madhya Pradesh	-1.75	0.00208	-0.707	0.00018
Punjab	0.82	0.00142	0.125	0.3282
Rajasthan	0.52	0.00312	-0.059	0.2072
Uttar Pradesh	0.90	0.51139	-0.0182	0.7528

Grouping housing stock based on types of wall materials

Category	Wall Material
X	Grass leaves, reeds, thatch and bamboo, GI and other metal sheets and other materials.
A	Mud, unburnt brick, stone, wood and Ekra.
B	Burnt brick
C	Concrete

How is the housing stock exposed?

Hazard	Districts	%X	%A	%B	%C	Exposure
High cyclone Incidence Districts	Baleshwar	10.3	80.4	7.8	1.6	High Exposure
High cyclone Incidence Districts	Nellore	8.8	49.1	38.5	3.6	Relatively Low Exposure
Low Cyclone Incidence Districts	Sindhudurg	7.9	88.1	2	2.1	High Exposure
Low Cyclone Incidence Districts	Alaphuza	22.7	13.3	55.5	8.4	Relatively Low Exposure

Impact on housing stock-Interaction of hazard (similar intensity cyclone) with exposure and adaptation

Year	State	District	Impact - Damage to houses				Exposure	Adaptation - Type of construction material			
			Partly	Fully	Total	% houses damaged	Total No. of Houses	X	A	B	C
1985	TN	Chennai	90000	36000	126000	18.6	676310	4.4	67.5	26	2.1
		Chengalpattu	95000	80000	175000	23.5	743775	4.6	57.5	35	2.6
		Tanjavur	70000	34000	104000	11.9	873620	5.6	65	28	1.5
		South Arcot	80000	20000	100000	11.6	858790	4	71.8	23	1.9
1996	TN	Chennai	121350	44080	165430	18.4	899925	5.3	10.4	66	18
		Chengalpattu	56944	91856	148800	13.4	1111275	3.7	44.3	48	4.3
		Tanjavur	28231	2935	31166	2.7	1158170	6	56	36	2.4
		South Arcot	46584	1E+05	165954	14.3	1157405	2.7	63.4	31	2.6

Implications of using key vulnerabilities

- Outcomes are determined through complex interactions of hazard, exposure and adaptive capacity
- Over time, these interactions evolve, often in unexpected ways
- This depends on how impacts will be perceived, how they will be evaluated, and the response that will happen

Policy significance

- First, to focus policy attention exclusively, or largely on the question of setting a stabilization target may actually miss the point; especially if the outcomes that matter are weakly or indirectly related to that target.
- Second, policy response has to include adaptation; not instead of, or substitutable by mitigation; but in its own right, as an obligation under the Convention.
- Finally, then, we are left with a dilemma. On the one hand, the practicalities of the policy and negotiation process suggest that in order to create a process that is viable, that will engage the attention of policy-makers, and that will have high salience, we need to focus our attention on the key vulnerabilities to climate change, and use them to try and reach a shared consensus around what constitutes, in the language of the UNFCCC, dangerous anthropogenic interference with the climate system. On the other, focusing on key vulnerabilities, in most cases will make it that much more difficult to draw direct inferences backwards from undesirable outcomes that need to be avoided.
- One answer, might be to not focus too much on a specific number, whether global mean temperature change, or CO2 concentration; but recognize that preventing dangerous anthropogenic interference is a process that needs to be informed in a regular and effective manner by knowledge about the consequences of climate change

Research needs

- What really is adaptive capacity?
- Indicators
  - Scale, process relevance
- Impacts – proximate, non-proximate; marginal, non-marginal, stocks vs. flows
- Interactions across scales (spatial, temporal, institutional) – aggregation issues
- Extremes and variability
- Scenarios