Current capabilities in the analysis of climate risks and adaptation strategies in critical areas

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Climate Risk

Risk is generally considered to be a product of consequences and likelihood - what can happen, and what are the odds of its happening

Uncertainty is a critical factor in assessing both climate risks and the effectiveness of different policy strategies. Each climate risk is identified by its own natural characteristics, including geographical area, time of the year it is most likely to occur and its severity.

Types of climatic risks

1. Due to average changes in climate parameters*

3. Due to extreme events (floods, droughts, cyclones etc.)

*Temperature and precipitation as main climatic variables of climate uncertainty

Tools for risk analysis

- Agro-climatic indices
- Statistical and econometric analysis
- Mathematical models
- community based participatory tools such as climate risk maps, community history, focus group meetings and historical transect, matrix rankings, seasonal calendars and vulnerability indices etc.

Indices

- Climate indices are developed in a simplified way to communicate more complex climate change impact relations.

  Mean temperature and precipitation sums can be seen as (simple) climate indices, other examples may be Leaf area index, Potential soil moisture deficit, Growing Degree Days etc.

Models

- Climate Models

  - GCMs

    Provide data on climate variables generally at a resolution of 300 x 300 Km

  – Accurate Temperature prediction in most of the cases (IPCC report 25 models)
  – Precipitation prediction still needs betterment

- RCMs
  - Provides data on climate variables generally at a resolution of 30x30 by 50x50Km resolution.
  - A number of models available
  - Main ones are RegCM and PRECIS
  - Perform best in the areas where they are developed.
  - Large data set requirements for model evaluation

Generally the capability in most of the Asian countries is low in terms of seasonal (annual/interannual) prediction.

- Hydrological models
  - Used for water resources management studies
  - A number of models available viz; VIC,HEC family of models, WASMOD, WEAP etc.
  - Performance requires high input data which most of the countries do not have.

- Crop Models
  - Can predict well the growing season length and yield for those areas where they have been established
  - A long list of UNFCCC reported CSMs (DSSAT, APSIM, EPIC, WOFOST, etc.)
  - Although for each region calibration is the prerequisite for the studies yet regional crop coefficients needs to be changed in the models e.g; base temperature requirements and light extinction coefficient.

- A comprehensive model which takes into account the varibales from sowing till economic analysis with a number of options for inputs, insect-pest measurements, GHG emissions considerations is still awaited.

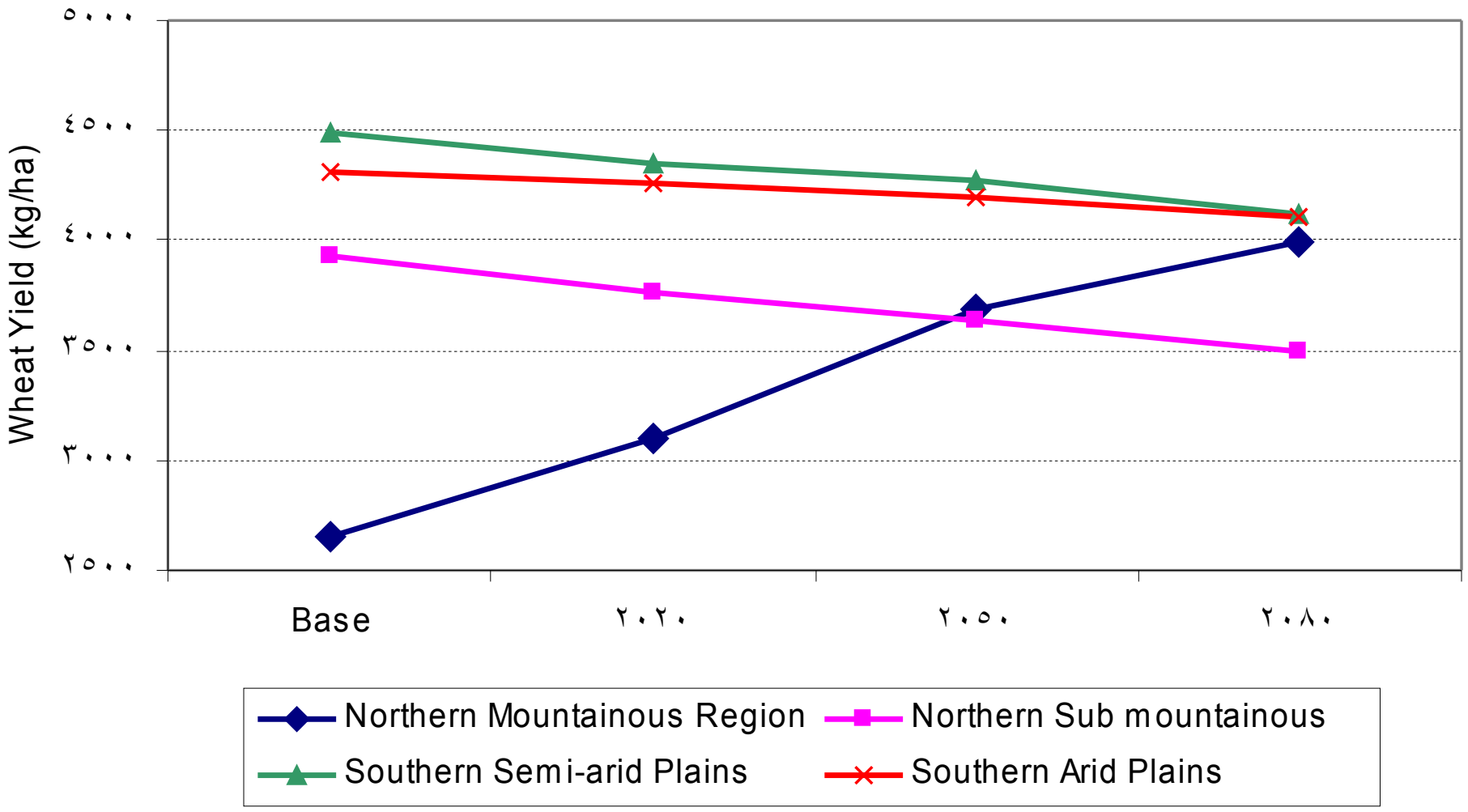
Studies for extreme events

- Presently statistical analysis tools are employed for extreme event studies
- The prediction element is poorly reflected in these tools
- IPCC (2007) reports of more extreme events and natural disasters in the years to come.
- Urgent need to assess the forecasting skills of natural disasters to determine those where greater research is needed. Lack of good forecast skill in drought , for example, is a constraint to improved management and adaptation.

Impact of rise in temperature on wheat Growing Season Length in Northern and Southern parts of Pakistan

Temperature ˚C (increase over baseline)	Growing Season Length (Days)			
	Northern Pakistan		Southern Pakistan	
	Mountainous Region (Humid)	Sub-Mountainous Region (Sub-humid)	Plains (Semi-arid)	Plains (Arid)
Baseline	246	161	146	137
1	232	155	140	132
2	221	149	135	127
3	211	144	130	123
4	202	138	125	118
5	194	133	121	113

Wheat Yield in different agro-climatic zones of Pakistan under A2 Scenarios



Climate Change Impact on Wheat Production in Pakistan by 2085 under A2 and B2 Scenarios

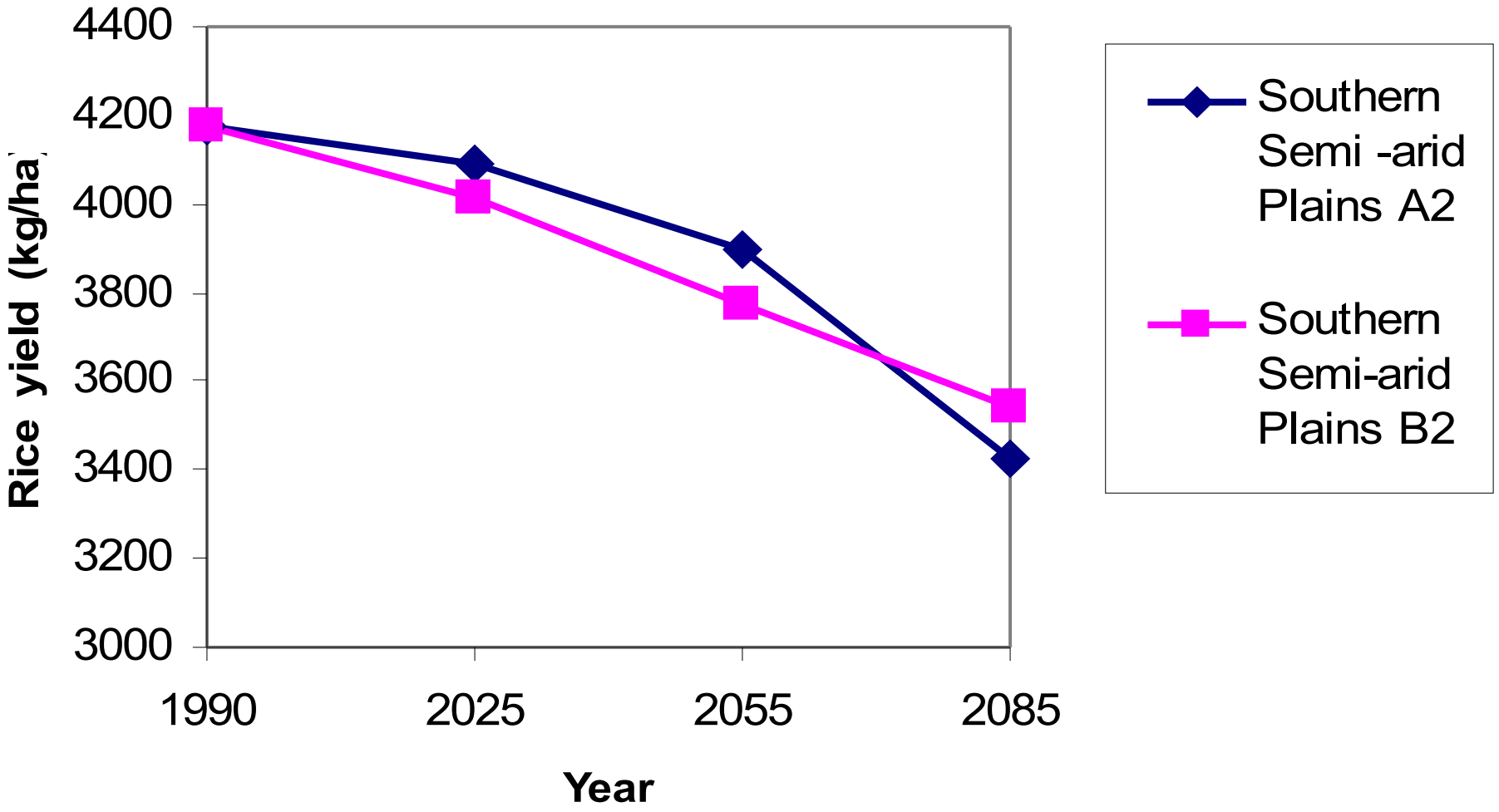
Region	% Share in National Production	Baseline Yield (kg ha^{-1})	% Change in yield in 2085	
			A2 Scenario	B2 Scenario
Northern Mountainous	2	2658	+50	+40
Northern Sub-mountainous	9	3933	-11	-11
Southern Semi arid Plains	42	4306	-8	-8
Southern Arid Plains	47	4490	-5	-6
Pakistan	100	4326	-5.7	-6.4

Effect of increase in Temperature on Growing Season Length of Rice in Semi arid areas of Punjab

(Cv. Basmati Super transplanted in 1st Week of July)

Temperature (°C)	Growing Season Length (Days)
Baseline	108
1 (increase over baseline)	102
2	100
3	98
4	92
5	89

Basmati Rice Yield in Southern Semi-arid Plains of Pakistan under A2 and B2 Scenarios



Yield decrease by 2085:18% in A2 and 15% in B2 Scenarios

Adaptation

- Refers to the responses and adjustments to climate change that may be used to reduce vulnerability and strengthen resilience

- It also relates to actions that exploit new opportunities resulting from climate change

Approaches

- Through policy and planning-Improving infrastructural base.
- Through actions or adjustment already being used to address climate change e.g., investment in drip irrigation to address water scarcity.
- Addressing current problems to increase overall resilience to climate change. e.g., economic reforms, improved management and increased monitoring.
- Technological and Engineering solutions- Costly but long term options. e.g., water desalination

Strategies

- **Agronomic**
  - Change in Cropping Pattern/Cropping intensity
  - Changes in sowing and harvesting dates
  - Choice of suitable varieties
  - Appropriate cultural practices for warmer and drier climates e.g., deep tillage every 2-3 years to store rain water in soil profile
  - Efficient Irrigation scheduling (based on critical growth stages and deficit amount)
  - Weed management

Strategies (Contd…)

- **Crop Breeding**

  Developing varieties from climate change perspective

  - Short Duration
  - High Temperature Tolerant
  - Resistant to Abiotic (drought, salinity) and Biotic (insect pests and diseases) stresses

  using conventional as well as mutation breeding and

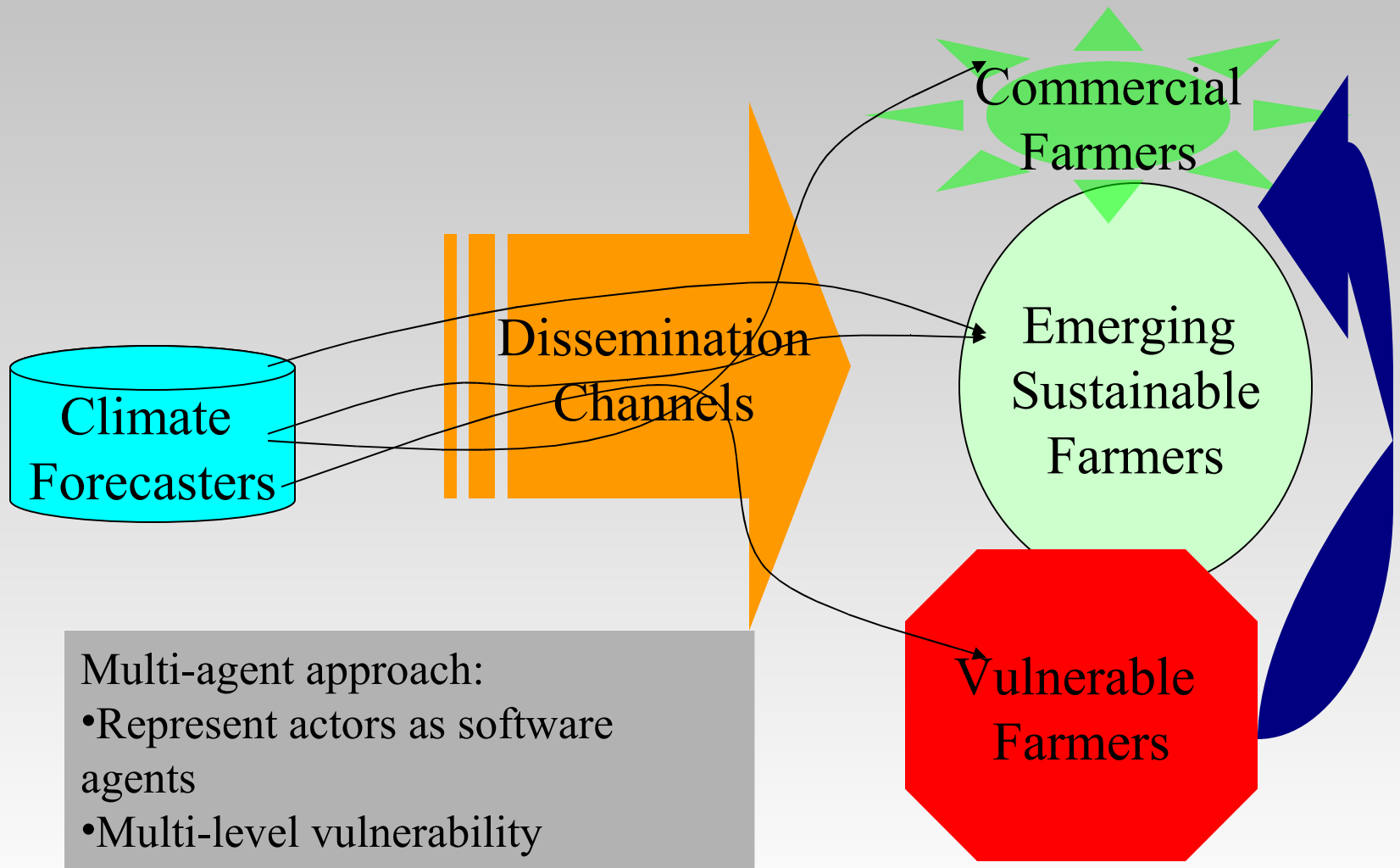
  through biotechnology & genetic engineering

Strategies (Contd..)

Water conservation

- Laser Land leveling
- Shift in water management practices
  - Sprinkler irrigation
  - Drip irrigation
  - Pitcher irrigation
  - Bed and Furrow irrigation
- Reduced tillage
- Direct seeding
- Subsurface irrigation channels in arid areas
- Cycling /reuse of municipal, sewage and industrial effluents

Dynamic pathways: Linking present vulnerability to climate outlooks



Multi-agent approach:
- Represent actors as software agents
- Multi-level vulnerability
- Emergence from interactions

Concluding Remarks

- Asia mostly arid , semi arid and rain-fed
- Accounts more towards farming to nourish its growing population
- Per capita land availability is low
- Most countries have the poor capacity to have sufficient knowledge of climate change to assess their impacts and devise adaptation strategies respite some developed/developing countries like Japan, Malaysia, China and India.
- Once the capability to assess the climate risks is there, the countries can perform cc impact studies more rigorously and can better plan for adaptation strategies.

Thanks