Climate Change, Seed Systems and Food Security

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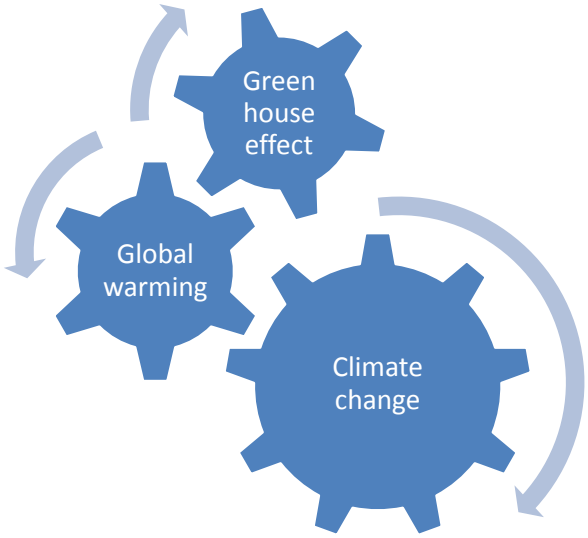
Outline

- Climate change and Agriculture
- Effects and welfare loss
- Adaptation and resilience
- Seed systems and adaptation
- Drivers of food security
- Conclusion

News: Scientists predict warmer and wetter Himalayas (5 August 2013)

- W. W. Immerzeel, F. Pellicciotti & M. F. P. Bierkens 2013 Rising river flows throughout the twenty-first century in two Himalayan glacierized watersheds, Nature Geoscience (2013)
- Published online 04 August 2013

Jargons on the way



Climate Change and Agriculture

Production
Consumption
Demographics
Technology

Mitigation reduces emissions

Modification of farm practices

Emissions 42 Gt $CO_{2\text{-eq}}$/year (2000)
(Agri 14%, Land use 18%)
GHG in the atmosphere 430 ppm




Green house effects (heat trap) → Global warming (Temp) → Climate change (Temp, preci, wind) → Effects on production → Impact on Welfare

Adaptation reduces impacts (Seed, irrigation, technology)

Effects of Climate Change

- South Asia likely to suffer more from climate change than the rest of the world (ADB, 2009).

1. Nepal is in the most vulnerable region, and already plagued by a range of climatic hazards (snow melting, floods, droughts, heat waves).
2. Natural resource based economy, any alteration in the natural system would lead to major changes in equilibrium of the whole economy.
3. Highly populated, social inequities widespread.

Effect

Effects on production

Table 2: Effects of climate change on cereal production (no CO_2 fertilization)

Production	Region	Production in 2000 (mmt)	Production in 2050, no climate change (mmt)	With climate change (% change)
Rice	South Asia	119.8	168.9	-14.3
	Developing countries	370.3	434.9	-11.9
	World	390.7	455.2	-11.9
Wheat	South Asia	96.7	191.3	-43.7
	Developing countries	377.9	663.6	-33.5
	World	583.1	917.4	-27.4
Maize	South Asia	16.2	18.7	-18.5
	Developing countries	321.3	556.2	-10.0
	World	617.2	1061.3	0.2
Millet	South Asia	10.5	12.3	-19.0
	Developing countries	27.3	66.2	-8.5
	World	27.8	67.0	-8.4

Note: mmt = million metric tons. Estimates based on Commonwealth Scientific and Industrial Research Organization, Australia (CSIRO) model. Source: Nelson et al. (2009)

Welfare loss to Agrarian Population

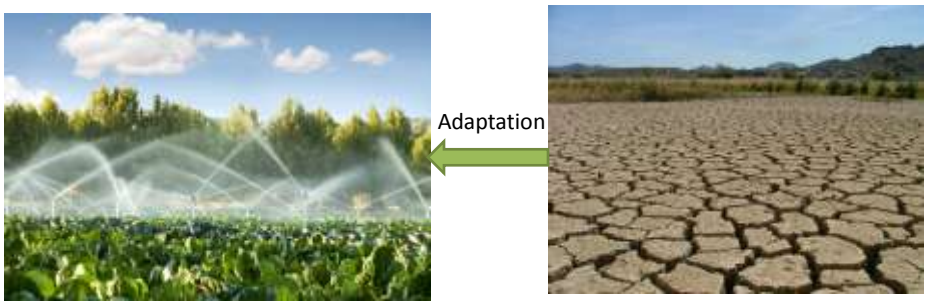
1. Disruption of water supplies to agriculture
2. Loss of agricultural output due to drought
3. Loss of species and forest area – biodiversity loss
4. Pest spread
5. Disruption of weather patterns
   - increased frequency of floods, hurricanes and other extreme weather events
6. Positive feedback effects
   - increased temperate increases the release of CO_2 from warming arctic tundra and methane from marshy lands and paddy field.

Benefits of Climate Change in Agriculture

1. Increased agricultural production in cold regions , provided water is available
2. CO_2 fertilization on crops, up to certain level

Adaptation

- Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities (IPCC TAR, 2001 a)
- Is a process by which strategies to moderate, cope with and take advantage of the consequences of climatic events are enhanced, developed, and implemented (UNDP, 2005)



Resilience is necessary for Adaptation

- Tendency to maintain integrity when subject to disturbance (UNDP, 2005)
- Refers to three conditions that enable social or ecological systems to bounce back after a shock.
  - ability to self-organize,
  - ability to buffer disturbance and
  - capacity for learning and adapting (Tompkins et al. 2005)

Types of Adaptations

1. **Autonomous adaptation**: market forces and natural behavior lead to some "natural" adaptation to CC, e.g. by changing crop varieties so that crops are more tolerant of dry conditions.
2. **Planned adaptation**: conscious and deliberate policies and investments (IPCC reports)

- Adjustments in natural or human systems in response to actual or expected CC impacts
  1. reactive in response to actual CC impact
  2. proactive to anticipated CC
- Planned and proactive adaptation requires full understanding and awareness of the problem

Ways for Adaptation

- Preventing the loss
  - Planning, resiliency
- Sharing the loss
  - insurance, portfolio management, safety-nets
- Changing the use
  - Varieties, crop diversity, irrigation, fertilizer, planting dates or farming practices
- Researching for alternatives
  - Suitable seeds, resource conservation

Seed Systems for Adaptation

- **Seed security**:
  - Ready access by farmers to adequate quantities of quality seed and planting materials of crop varieties,
  - adapted to their agro-ecological conditions and socioeconomic needs,
  - at planting time, under normal and abnormal weather conditions (FAO).
- A sustainable seed system ensures
  - high quality seeds of a wide range of varieties and crops are produced
  - fully available in time and affordable to farmers
- Yet to fully benefit from the advantages of quality seed
  - inefficient seed production, distribution and quality assurance systems,
  - bottlenecks caused by a lack of good seed policy and legislation
  - Inadequate storage facilities
  - fluctuating food prices and famine
  - climate change

Key issues of Seed System Development

- Policy and legislation
  - norms, taxes, subsidy, laws, IPR, international and regional cooperation
- Science
  - genetics, technology, physiology, entomology, pathology, agronomy, biodiversity....
- Economy
  - management, marketing, investment, finance, credit
- Culture and social
  - livelihoods, traditions, indigenous knowledge

Adaptation costs and benefits

Adaptation benefits

- Avoided damage costs or
- Accrued benefits following the adoption and implementation of adaptation measures (IPCC TAR, 2001 a)

Adaptation costs

- Costs of planning, preparing for, facilitating, and implementing adaptation measures, including transition costs (IPCC TAR, 2001 a)

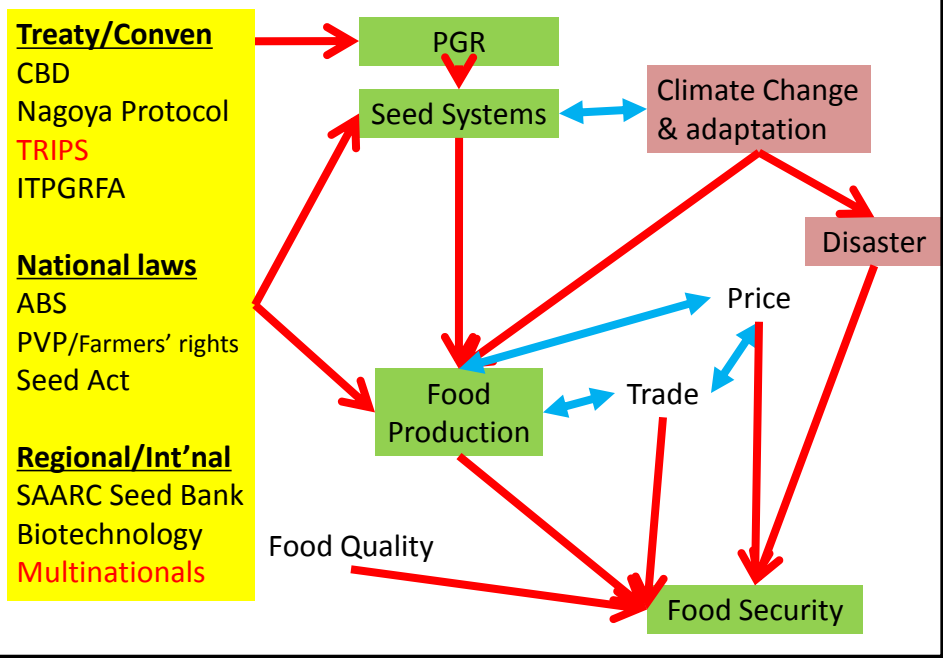
Adaptation Costs in Agriculture

Table 3: Additional annual investment expenditures needed to counteract the effects of climate change on nutrition (US$ million at 2000 price)

	Budget heads	South Asia	Developing countries
1	Agricultural research	185	1373
2	Irrigation expansion	344	882
3	Irrigation efficiency	1006	2128
4	Rural roads (area expansion)	16	2881
5	Rural roads (yield increase)	13	74
	Total	1565	7338

Note: Based on CSIRO simulation model that does not include the effects of CO2 fertilization. Source: Nelson et al. (2009)

Drivers of Food Security



Conclusions

- Climate change is a challenge to food security
- Sustainable seed systems can help in adaptation
- Seed system is affected by availability and use of PGR
- Seed systems and flow of PGR are affected by national and international legislations
- Framework policy is necessary to guide development of seed legislations
- Enactment of ABS laws, PVP laws and revision of Seed Laws are necessary to facilitate breeding and sustainable seed systems necessary for climate change adaptation and food security.
- These three acts should have strong complementarities.

Thank You

For further comments: kppant@gmail.com