Costs and benefits of addressing the climate change challenge

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Meeting of climate experts and development practitioners

September 26, 2006

Climate Change Resilient Development

- Climate change resilient development requires implementation of cost-effective mitigation and adaptation strategies

- It requires integrating considerations of current climate variability and projected changes in climate in sector and national economic planning

  - while there is a need to minimize the emissions of greenhouse gases, it must be recognized that access to affordable energy is a pre-requisite condition for poverty alleviation and sustainable economic growth – a key issue especially in Sub-Saharan frica - therefore, the challenge is to develop and utilize cost-effective low-carbon energy technologies (production and use)

  - the vulnerability of sectors to current climate variability and projected changes in mean climate, climate variability and extreme events needs to be reduced through improved project and policy design

Energy Investment Options for Low Income Countries

- Additional generation capacity (including through regional projects)
- Scaled-up programs of household electrification (grid and off-grid)
- Access to clean cooking, heating and lighting fuels (through sustainable forest management and improved cookstoves)
- Energy services to schools and clinics
- Modern illumination packages for households without electricity

Emphasis will be placed on implementing an action plan for energy access for the poor in Sub-Saharan Africa – an additional $2B per year of concessional funding is needed to increase access from 25% today to about 50% in 2030

Energy Options for Middle Income Countries

The investments needed for electricity generation in developing countries is about $165 billion per year – currently at about $80 billion per year

- Better governance for better utilities
- Increase trade to decrease cost
- Private sector participation to decrease cost
- Financially healthy sector to enable prudent investments
- Decrease financing gap through reforms, increased IFI and private funding
- Better technology to decrease air and water pollution impacts
- End-use efficiency and demand management

Mitigating Climate Change

Mitigating Climate Change

- The magnitudes of the technological, policy and financial challenges are dependent upon:
  - the desired maximum allowable rate and equilibrium change in climate global mean surface temperature (used as proxy for other changes in climate such as precipitation and sea level)
    - greenhouse gas stabilization level;
    - the pathway to stabilization; and
    - the underlying development paradigm

- The challenge is to decrease both the energy intensity (good track record to date) and carbon intensity of the energy sector (singularly unsuccessful to date)

Potential technological options

- **Efficient production and use of energy:** coal plants (e.g., re-powering old inefficient plants and developing IGCC); vehicles (e.g., fuel cell cars) and reduced use of vehicles (e.g., mass transit and urban planning), buildings, and industries

- **Fuel shift: coal to gas**

- **Renewable Energy and Fuels:** Wind power; solar PV and solar thermal; small and large-scale hydropower; bio-energy

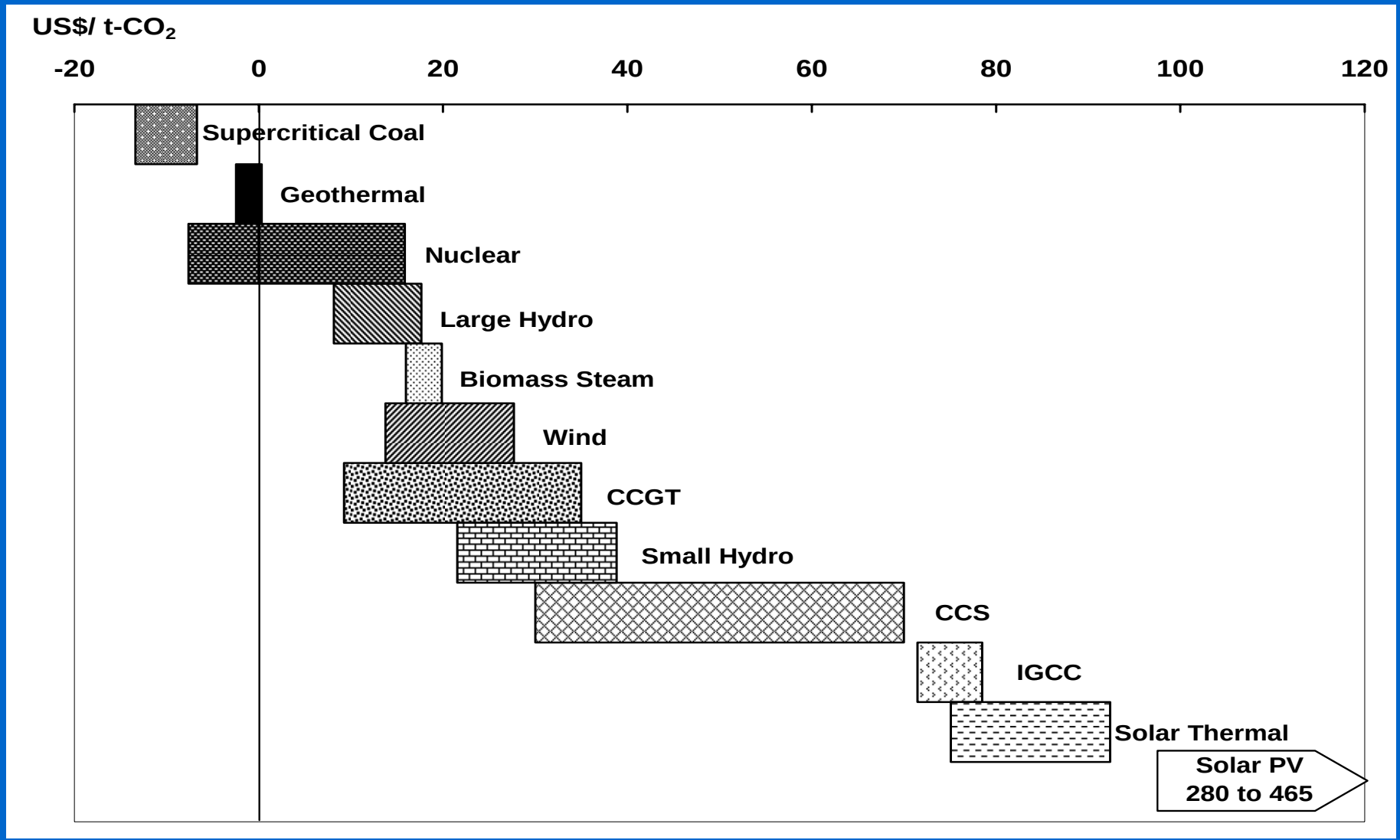
- **CO_2 Capture and Storage:** Capture CO_2 in the production of electricity followed by geological storage (e.g., IGCC – CCS)

- **Nuclear fission:** Nuclear power

- **Forests and Agricultural Soils:** Reduced deforestation; reforestation; afforestation; and conservation tillage

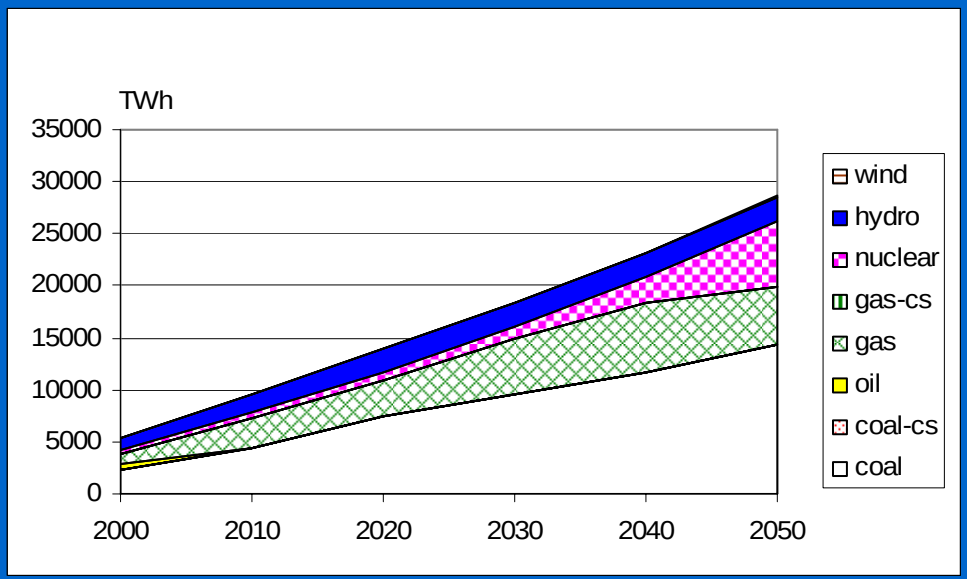
- **Other GHGs:** Methane, nitrous oxide, halocarbons and tropospheric ozone precursors

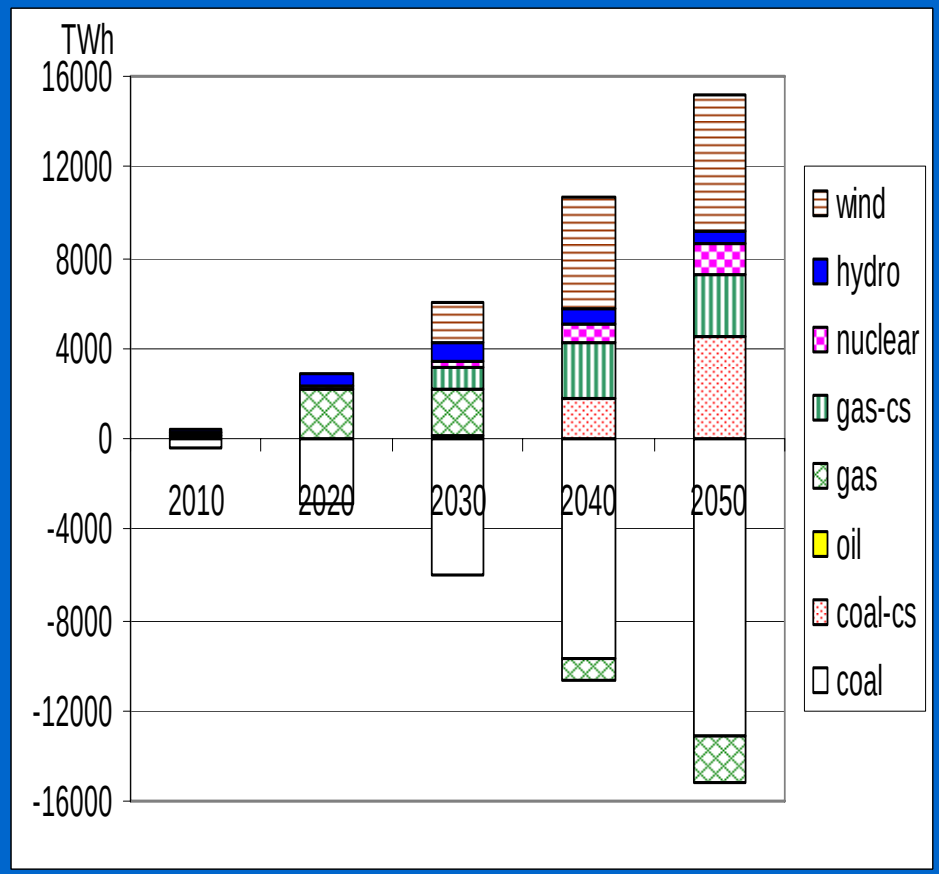
Costs of Reducing Carbon Dioxide Emissions relative to sub-critical coal (life-cycle)



A key challenge is to reduce the cost of IGCC and CCS, which are still pre-commercial

Baseline and low-carbon projected energy scenarios for non-OECD countries





Baseline

Low carbon scenario

CO_2 would stabilize at about 450 ppm in the low carbon scenario, requiring an investment of ~$30 billion/year in electricity generation

Policy Instruments

- **Policies, which may need regional or international agreement, include:**
  - Long-term stable global regulatory framework on GHG emissions with differentiated responsibilities
  - Tradable emissions permits--domestic and global
  - Energy pricing strategies and taxes
  - Removing subsidies that increase GHG emissions
  - Internalizing the social costs of environmental degradation
  - Regulatory programs inc energy-efficiency standards
  - Incentives for use of new technologies during market build-up
  - Voluntary programs
  - Education and training -- product advisories and labels

- **Accelerated development of technologies requires intensified R&D by governments and the private sector**

Funding for mitigation activities

- Only three sources of funding for mitigation are available:
  - (i) voluntary actions,
  - (ii) international grants,
  - (iii) carbon trading.

- Carbon trade is likely to confer the biggest flow of funds to developing countries - between US$20 and $120 billion per year

- Carbon trade requires a long-term global regulatory framework (i.e., a 2050 target) with differentiated responsibilities – with intermediate targets

Overview of Existing Instruments

- **GEF**: Mechanism providing grants to meet the incremental costs in reducing greenhouse gas emissions
- **Carbon Funds:** to cost-effectively reduce carbon emissions while contributing to sustainable development
- **Risk Instruments,** e.g. MIGA Guarantees

Global Environment Facility

- Largest source of grant financing for energy efficiency and renewable energy: $2 billion since 1992

- Successful in removing barriers to the deployment of near-commercial energy efficiency and renewable energy technologies

- Resource levels and funding strategies limit GEF's ability to scale up market transformation and bring-down capital costs of technologies for shift to a low carbon economy
  - to play a significant role in transitioning the world to a low-carbon economy would require an increase in funds by a factor of ten or more

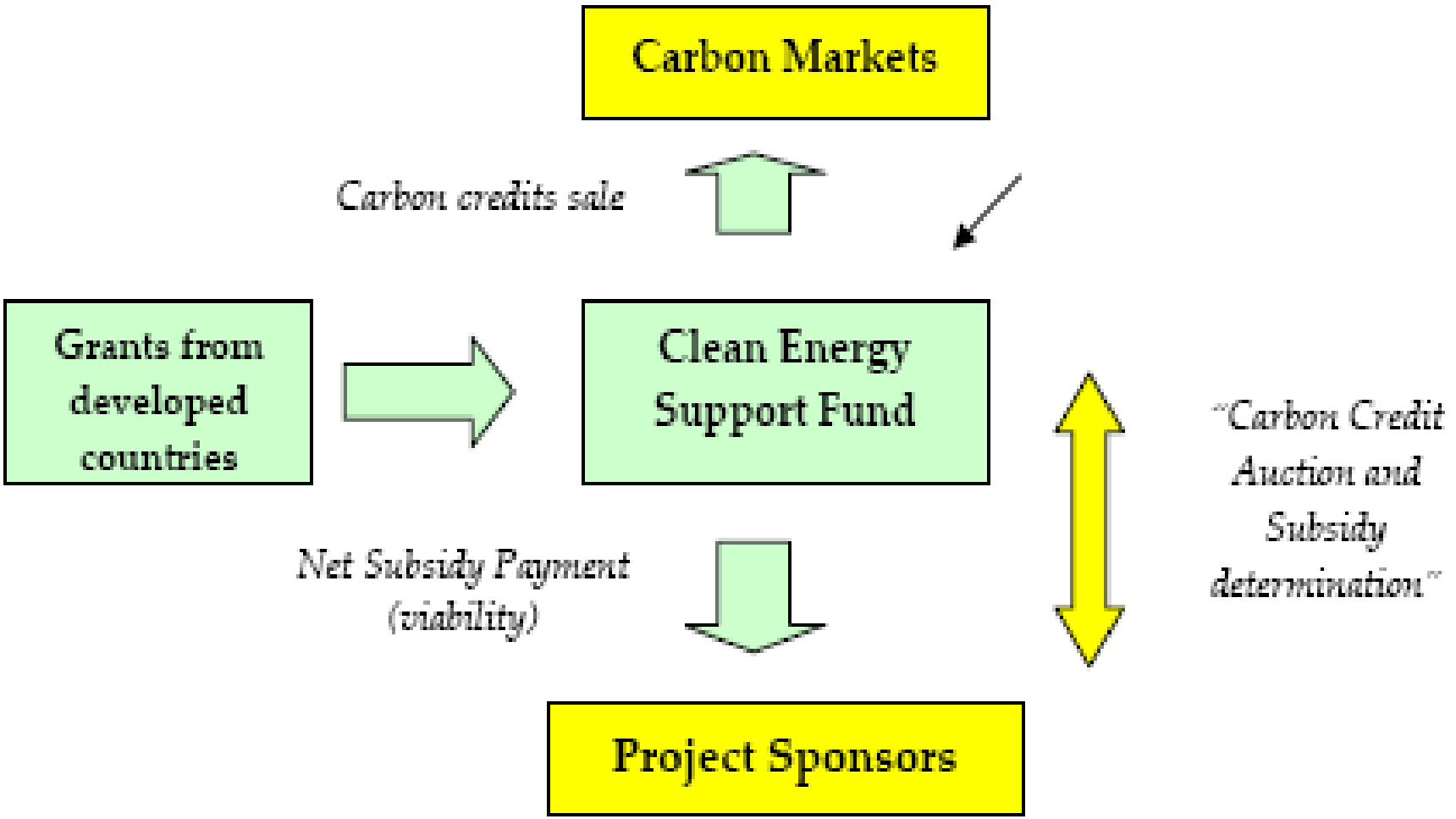
World Bank role in the carbon market

- Facilitating the development of the carbon market – e.g., new methodologies, verification systems
- Increasing participation of developing / transition countries in the carbon market
- Funds to benefit small / rural communities and transition economies from carbon finance
- There are 9 carbon funds and facilities, funded by governments and private sector companies and managed by the World Bank as a Trustee (capitalization of about US$1.9 billion):
  - Bank-launched Prototype Carbon Fund (PCF);
  - Netherlands JI and Netherlands CDM Facilities;
  - Community Development Carbon Fund (CDCF);
  - Bio-Carbon Fund;
  - Italian Carbon Fund;
  - Spanish Carbon Fund;
  - Danish Carbon Fund; and
  - the Umbrella Carbon Facility (UCF)

Evolution of the carbon market

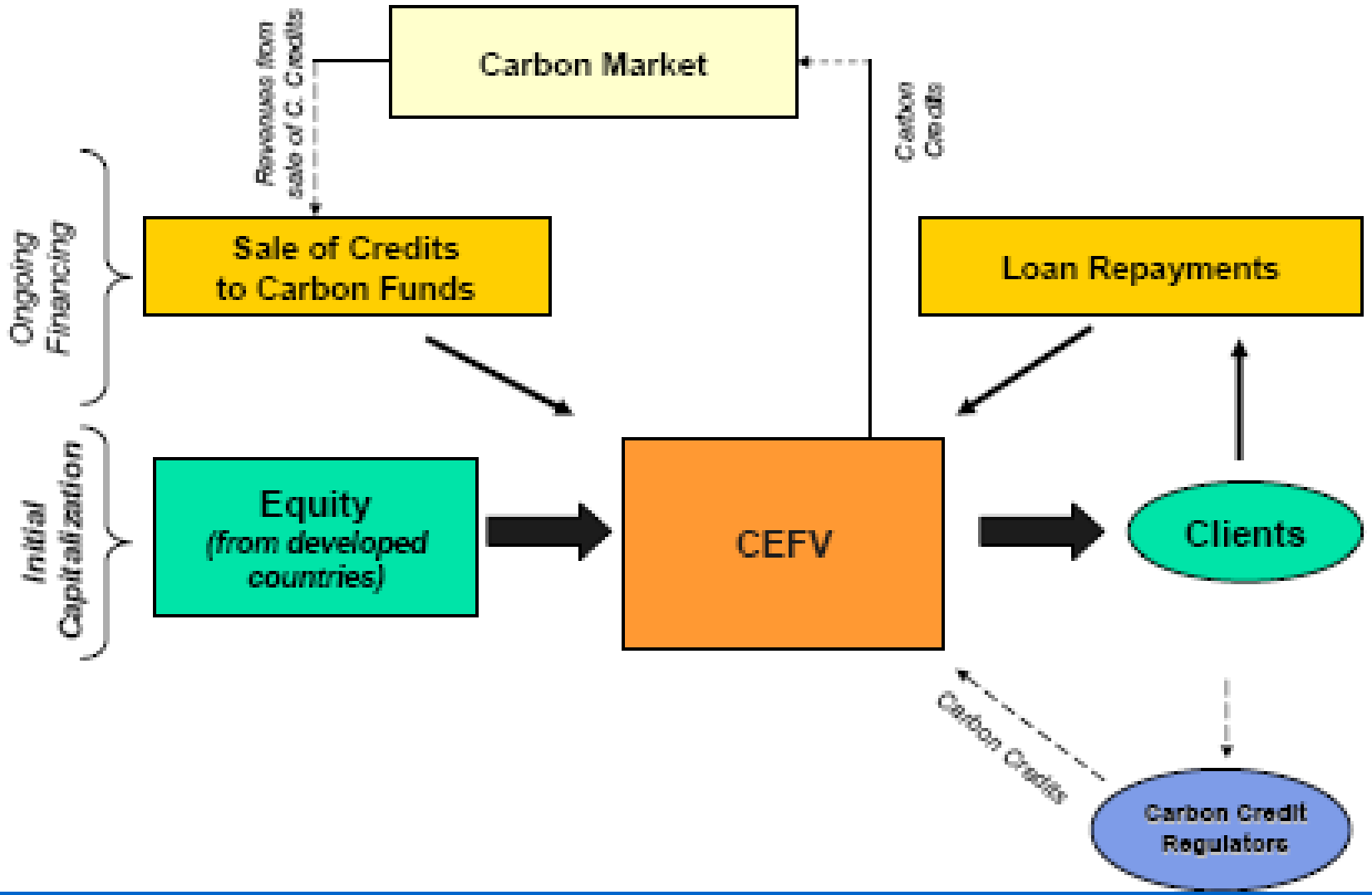
- Prepare new tranches using existing carbon funds
- Scale –up using programmatic approaches and larger scale projects (would be post-2012)
- Initiate projects in Economies in Transition (e.g., Russian Federation) – i.e., greening hot air
- Support a multi-stakeholder dialogue on the continuity of the carbon market post-2012
- Promote the creation of a carbon market continuity fund to:
  - demonstrate long-term viability of carbon finance for sustainable development;
  - develop innovative carbon finance tools; and
  - keep capacity and institutions in place for continuity of the carbon market

Alternate Subsidy Model for Carbon



Provides up-front capital - would require periodic replenishment

Alternate Business Model for Carbon



Provides up-front capital as a low-interest loan - self-sufficiency depends on cost of low-carbon technologies and carbon market price

Adapting to Climate Change

Climate Change and Development

Projected changes in climate variability, mean climate and extreme events are projected to:

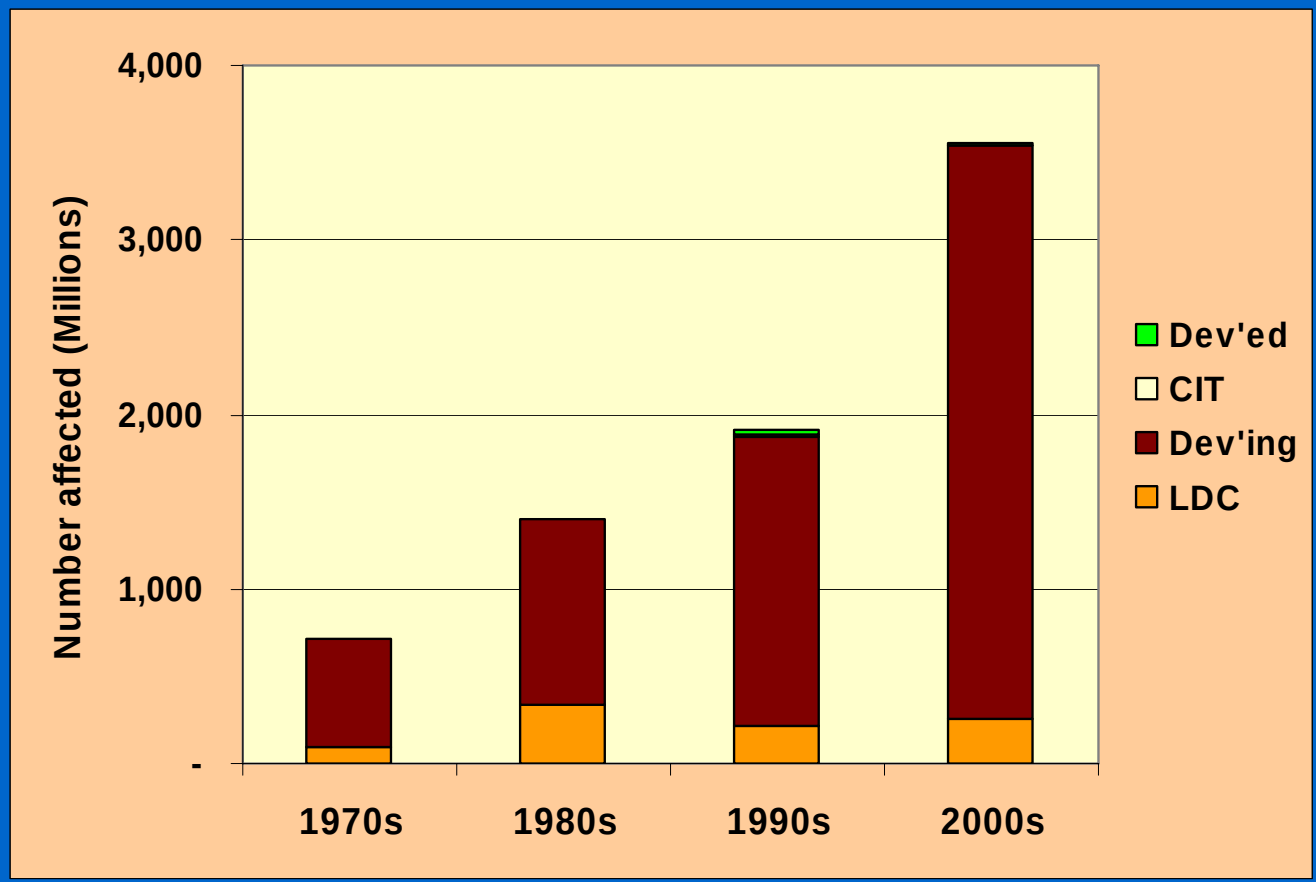
- Decrease water availability and water quality in many arid- and semi-arid regions – increased risk of floods and droughts in many regions
- Decrease the reliability of hydropower and biomass production in some regions
- Increase the incidence of vector- (e.g., malaria and dengue) and water-borne (e.g., cholera) diseases, as well as heat stress mortality, threats nutrition in developing countries, increase in extreme weather event deaths
- Decrease agricultural productivity for almost any warming in the tropics and sub-tropics and adverse impacts on fisheries
- Adversely effect ecological systems, especially coral reefs, and exacerbate the loss of biodiversity

Why Climate Change is a Serious Development Issue

All countries are vulnerable to climate change but the poorest countries and the poorest people within them are most vulnerable. They are the most exposed and have the least means to adapt.

In this decade over 3 billion people in developing countries are likely to be affected by climate related disasters

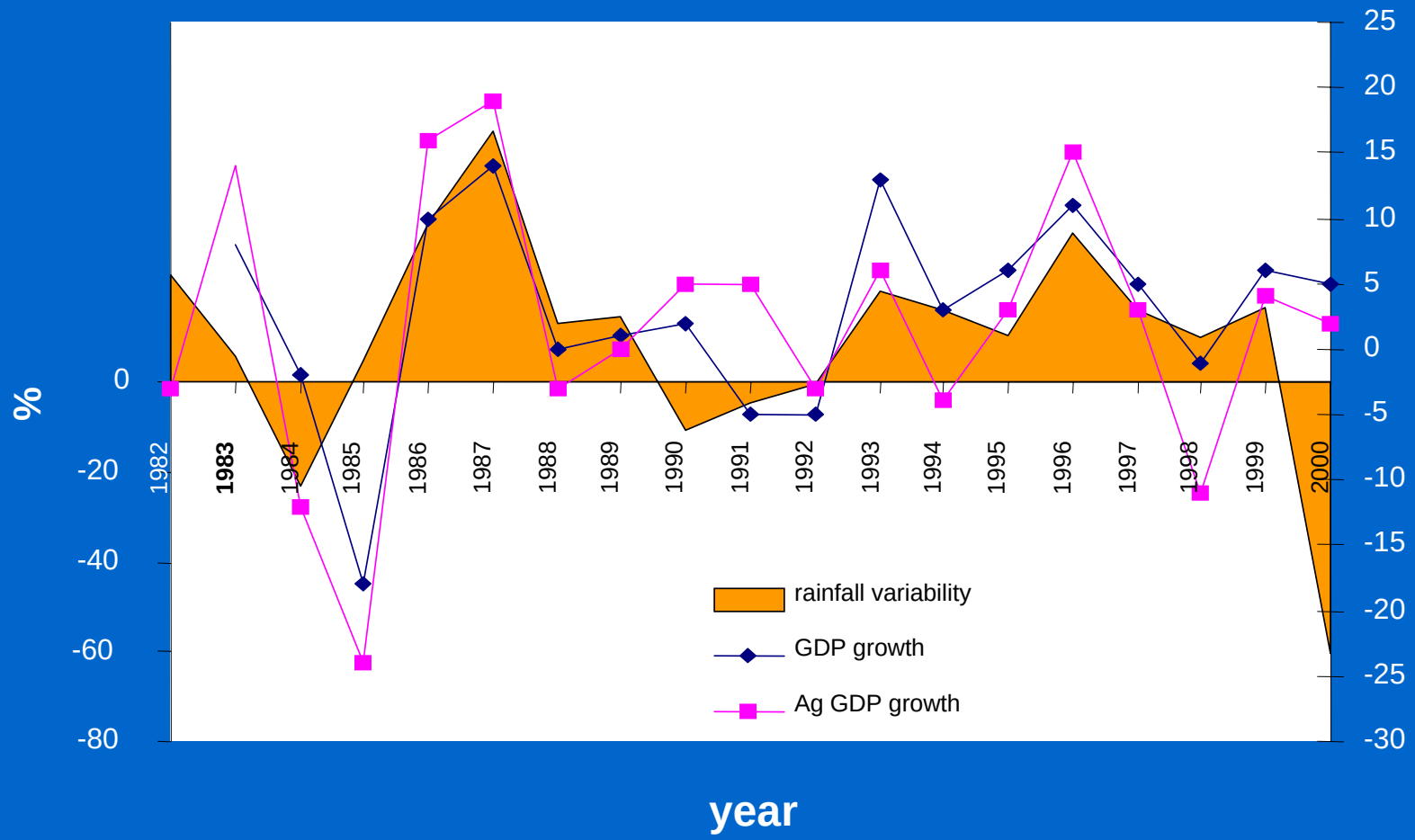
People in developing countries are affected at 20 times the rate of those in developed countries



Source: World Bank analysis based on CREDA data.

Climate variability is already a major impediment to development

Ethiopia



Preliminary results from : **A Country Water Resources Assistance Strategy for Ethiopia**

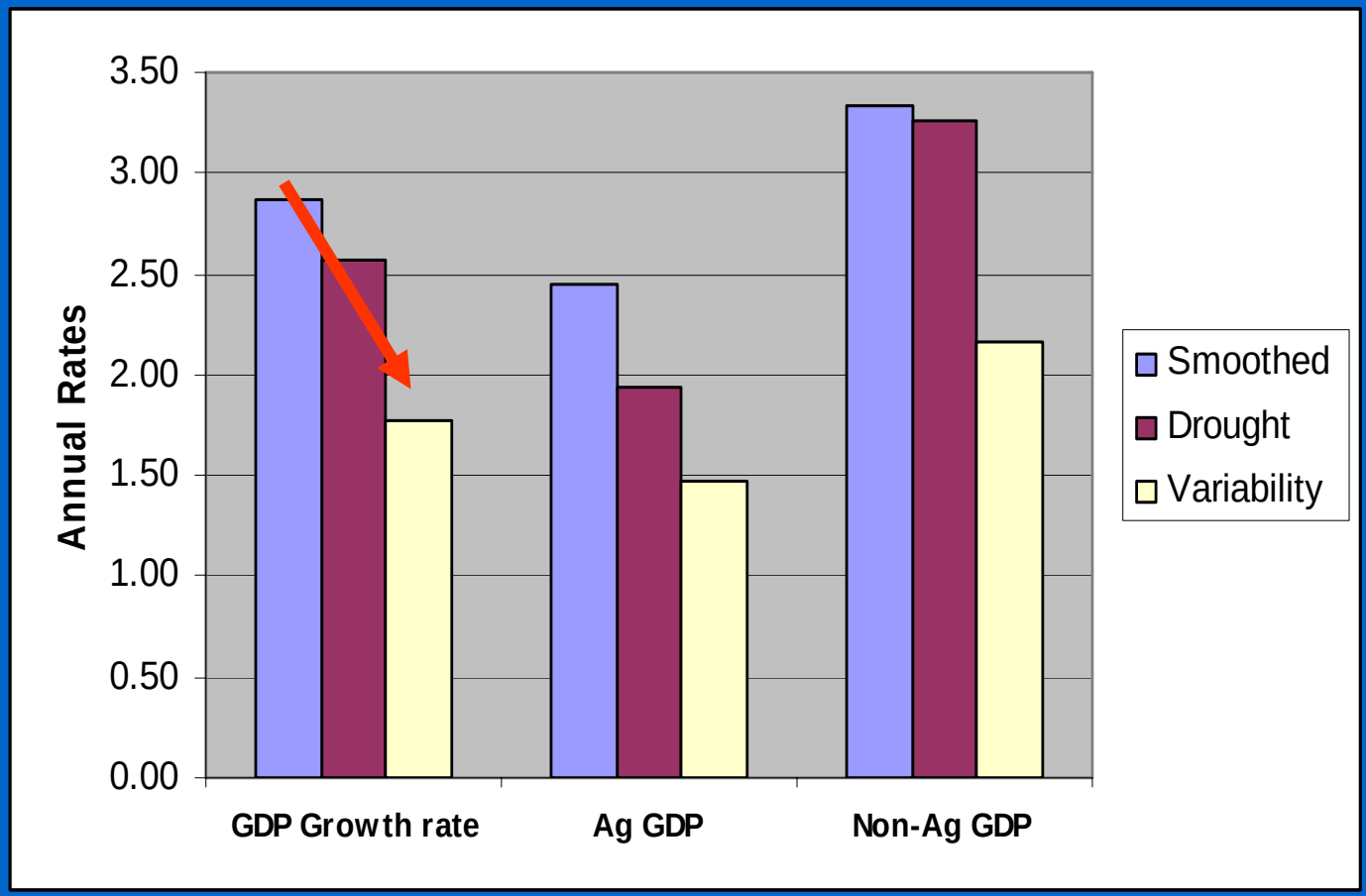
From Claudia Sadoff

Including climate variability gives a different picture of growth prospects

Ethiopia

Model of 12 years of growth using

- Smoothed (average rainfall)
- A simulated 2-year drought
- Realistic variability



Development Perspective on Adaptation

- Adaptation to climate change is recognized as part of the development process and not separated from it – must be integrated into national economic planning
- Existing capacities (and weaknesses) form the starting point for anticipatory adaptation actions
- The process must be country driven and focus on national needs and local priorities
- We must not hinder projects by focusing unnecessarily on precise breakdown of costs into global and local, or baseline and incremental

Adaptation

- *Poverty reduction agenda:* Failure to adapt adequately to climate variability and change is a major impediment to poverty reduction – chronic losses are as important as catastrophic losses

- A climate risk management approach: take account of the threats and opportunities arising from both current and future climate variability in project design

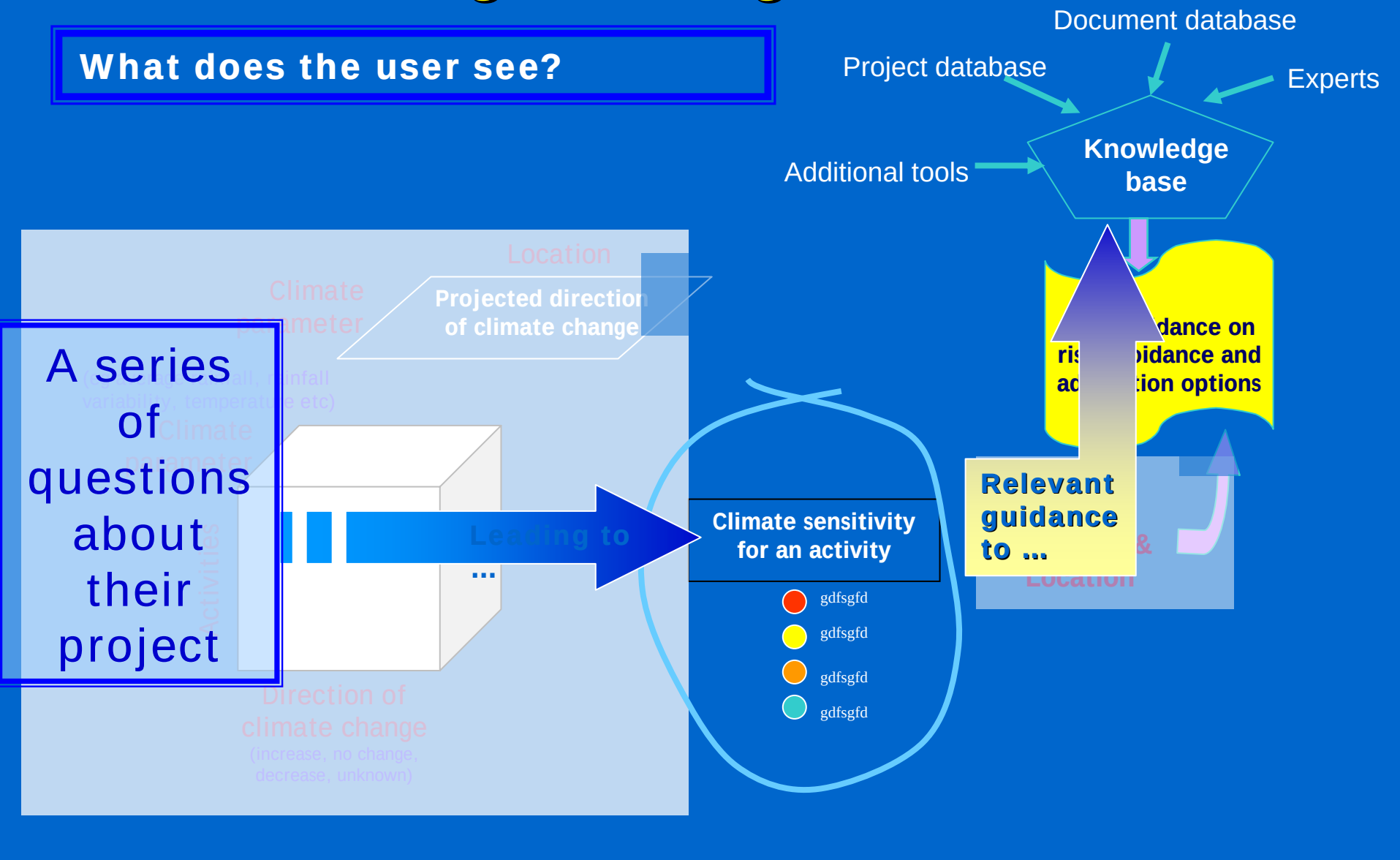
Adaptation in the World Bank

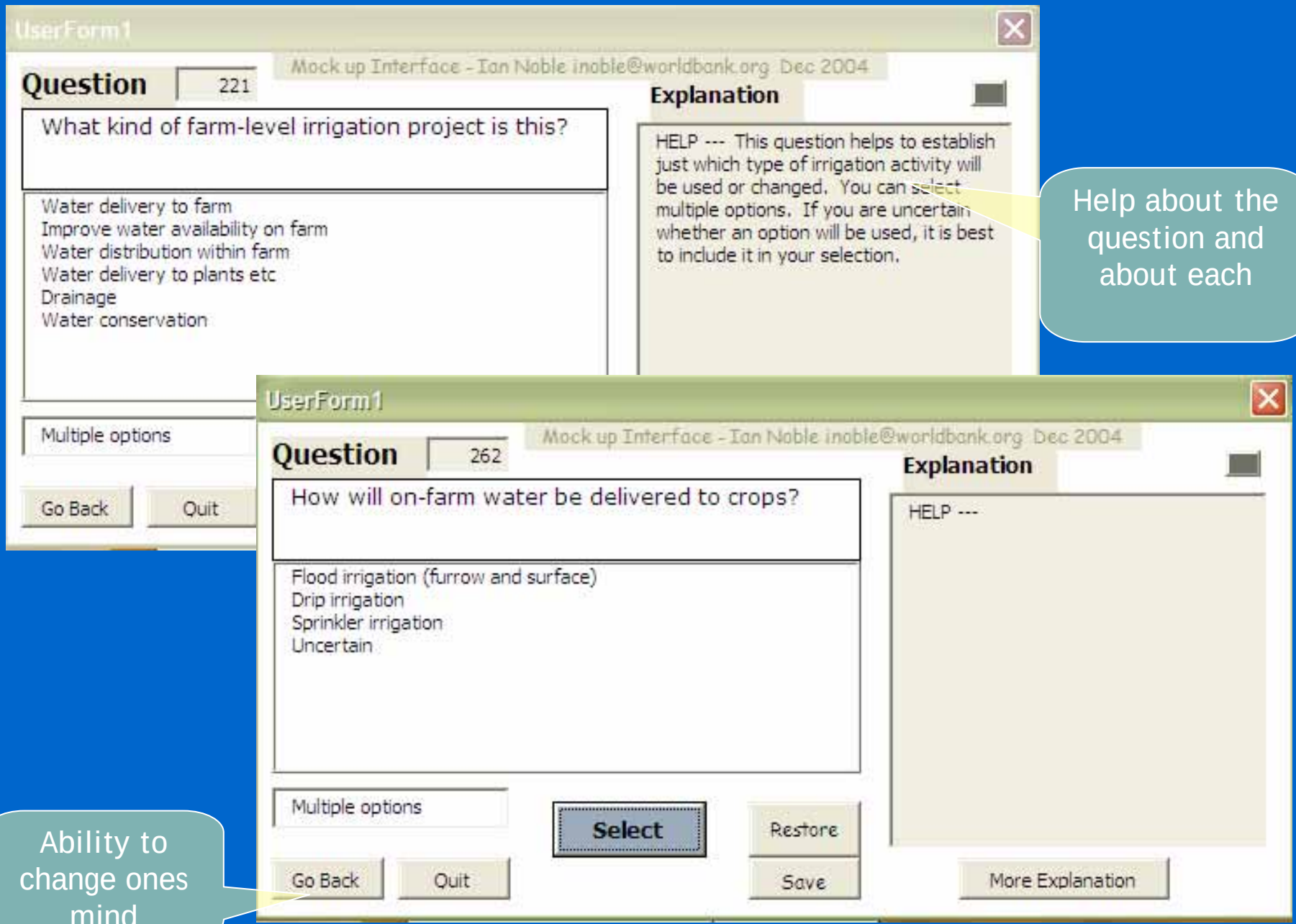
Provide project design teams with:

- Awareness of the threat and its urgency
- Information and tools to quickly screen for climate risks
- Information, analytical tools and options to tackle identified threats
- Resources ($$$) to implement

A framework for a screening & design tool

What does the user see?




UserForm1
Mock up Interface - Ian Noble inoble@worldbank.org Dec 2004
Question
221
What kind of farm-level irrigation project is this?
Water delivery to farm
Improve water availability on farm
Water distribution within farm
Water delivery to plants etc
Drainage
Water conservation
Explanation
HELP --- This question helps to establish just which type of irrigation activity will be used or changed. You can select multiple options. If you are uncertain whether an option will be used, it is best to include it in your selection.
Help about the question and about each
Multiple options
Go Back
Quit
UserForm1
Mock up Interface - Ian Noble inoble@worldbank.org Dec 2004
Question
262
How will on-farm water be delivered to crops?
Flood irrigation (furrow and surface)
Drip irrigation
Sprinkler irrigation
Uncertain
Explanation
HELP ---
Multiple options
Select
Restore
Save
Go Back
Quit
More Explanation
Ability to change ones mind

Prototype T

on your description of the project.

Welcome to th
screening and

This tool is designe
assessing whether a
sensitive to the effects

It then provides guic
sources of informatio
potenial effects into ac
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The tool provides
assessment base

Climate Summary

NOTE: The coding to identify the location and best climate projections has NOT yet been implemented in this prototype.

Summary of climate projections for your site ...
>> No significant change in annual rainfall is expected
>> Rainfall variability is expected to increase moderately This will result in more frequent periods of unusually wet or dry conditions.
>> Annual mean temperatures are expected to increase moderately (e.g. by 0.5 to 1 °C by 2050).

NEXT Flag

NEXT OutCome

OutCome Code: A_ir_canal

OutCome: construction of irrigation canals.

Flag Value: Y

Explanation

Significant increases in rainfall are projected for your project site. Ensure that the canal design takes higher rainfed flows into account.

Relevant Documents

Click on document to view a summary

4 Shah, T. and Raju, K / Rethinking Rehabilitation:
8 WB / Gujarat Medium Irrigation II P
13 Rahimi, H. and Baroo / Concrete Canal Lining C
15 Snell, M. / Lining Old Irrigation Canals:
19 Selvarajan, S. / Sustaining India's Irrigation
32 FAO / Agricultural Drainage Water Ma
34 FAO / Land Degradation in South Asia
35 Patode, R.S. and Mal / Optimal Spacing of Tub
43 Foster, S., Tuinhof, / Groundwater Managemer
45 World Bank / Karnataka Tanks Irrigation Pro
51 World Bank / Maharashtra Composite Irrigati
57 Hillel, D. / Salinity Management for Sustai

QUIT

Acrobat Reader - [Embedded File]

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ii

IMPLEMENTATION COMPLETION REPORT

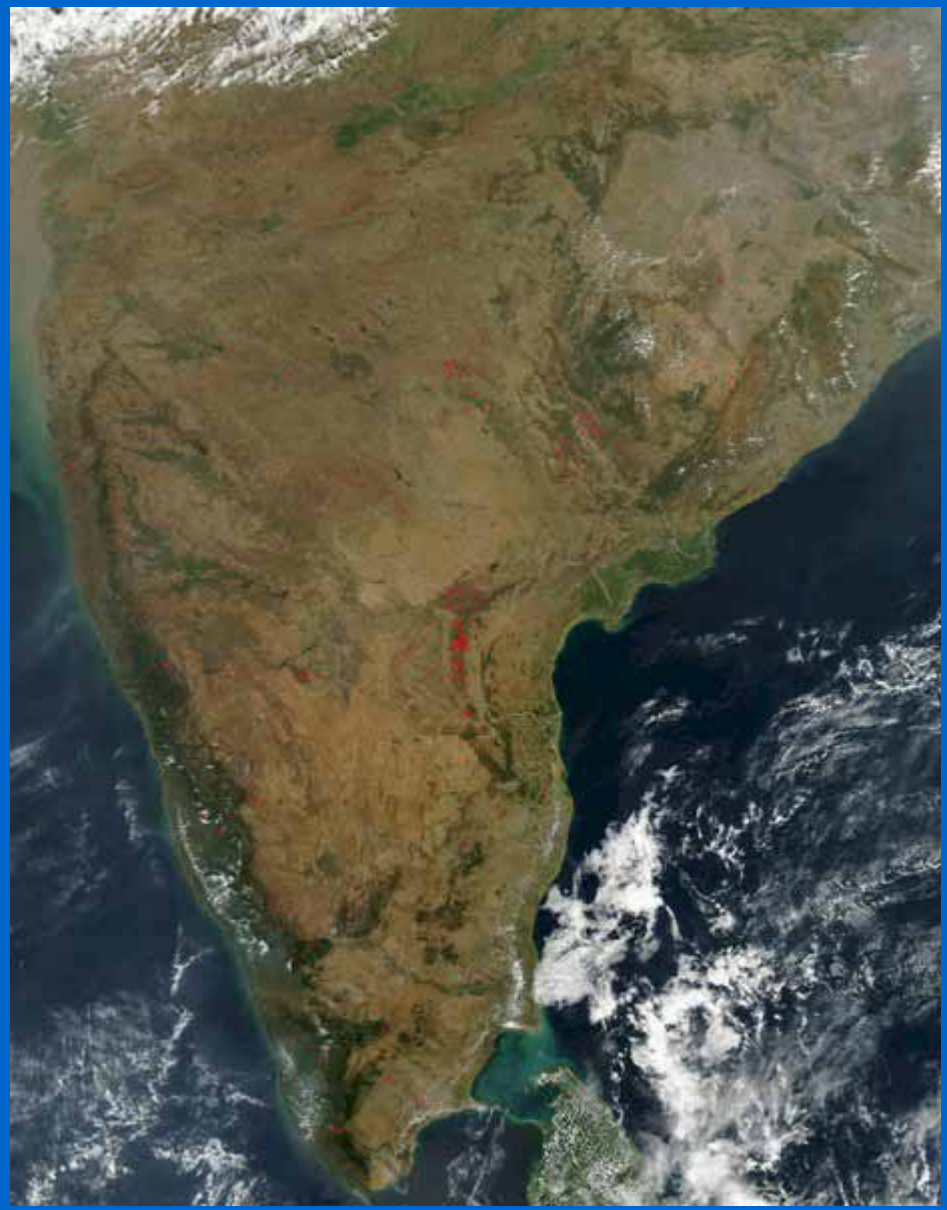
INDIA

MAHARASHTRA COMPOSITE IRRIGATION PROJECT III
(Cr. 1621-IN)

Evaluation Summary

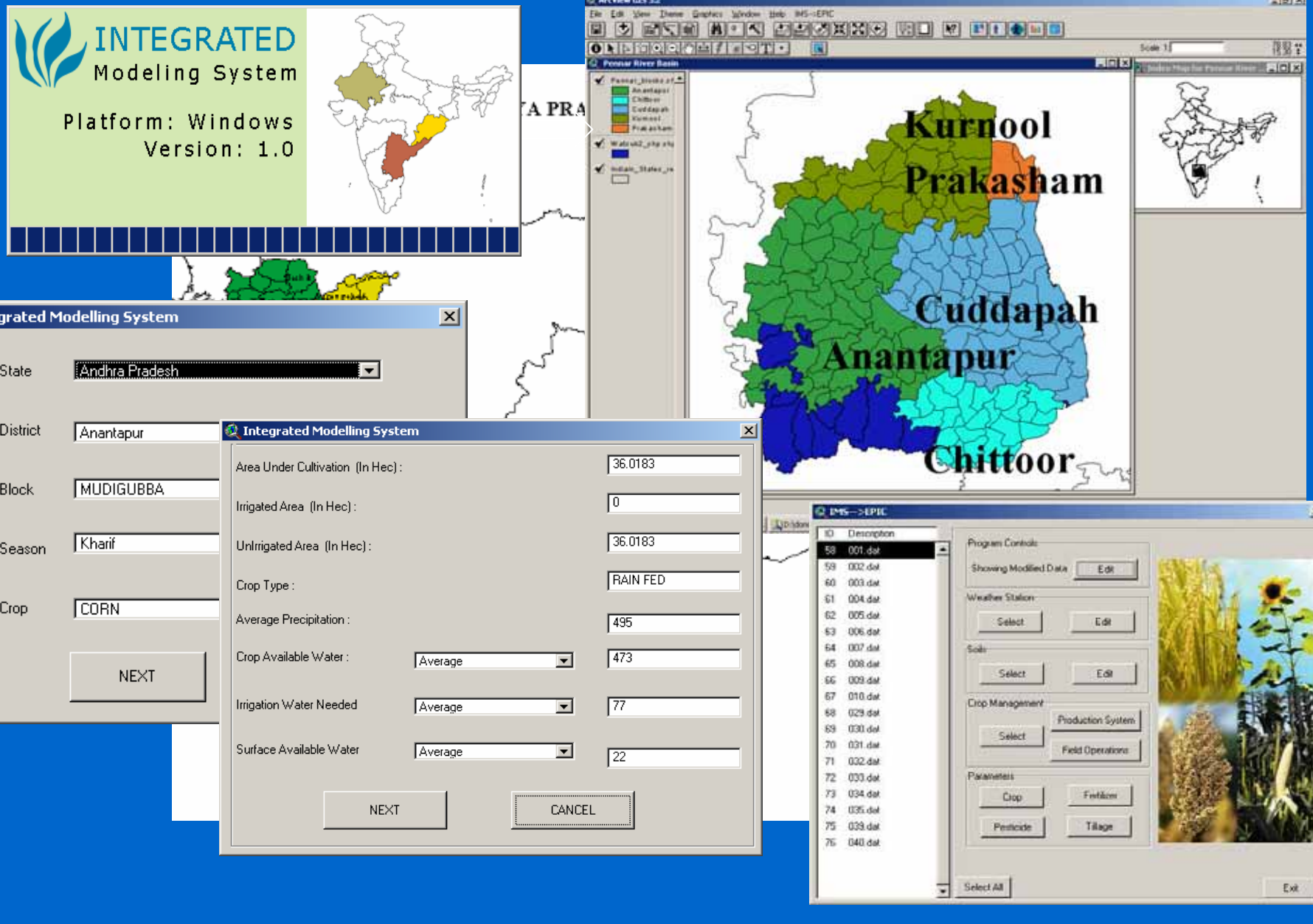
Introduction

1. The Maharashtra Composite Irrigation Project III (MCIP III) initially provided for the completion of the Jayakwadi and construction of the Majalgaon schemes. These schemes, located



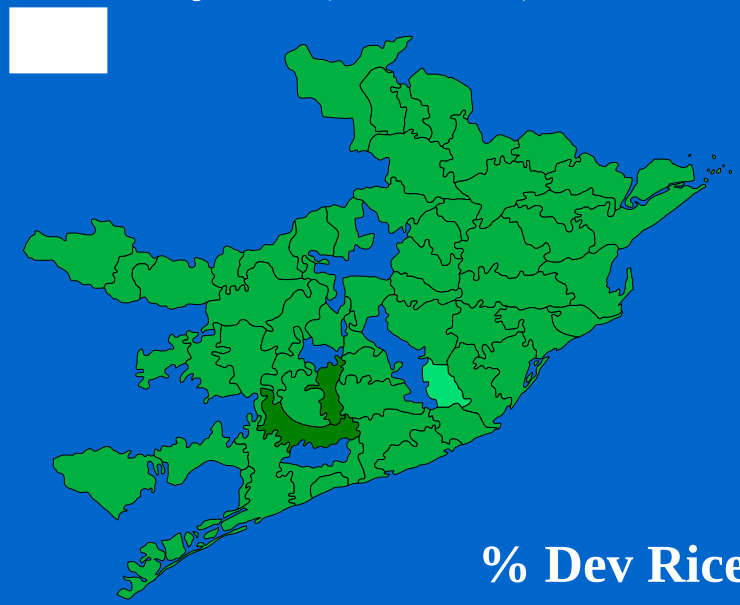
Climate variability, climate change and adaptation in India

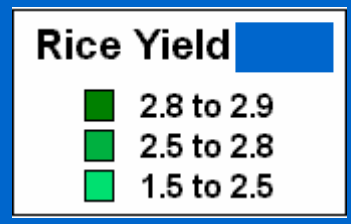
Integrated Modeling System – GUI



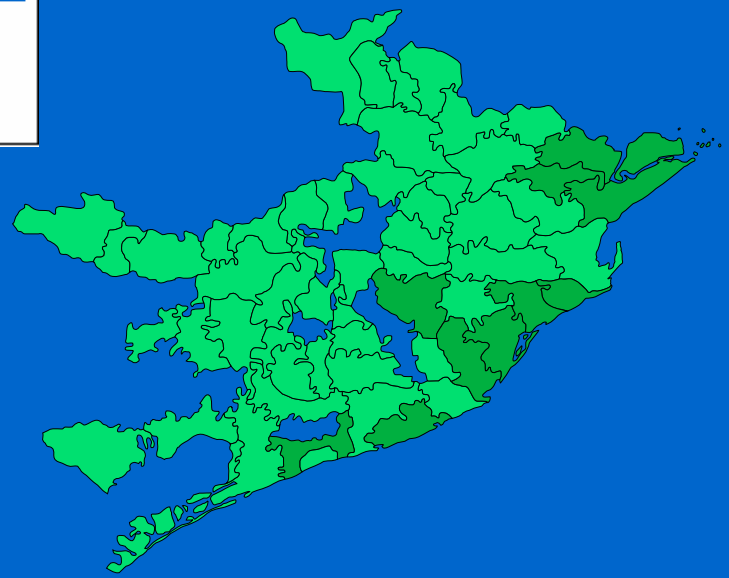
Impact of climate change on Rice Yields – A2 Scenario

Rice yield (Baseline)

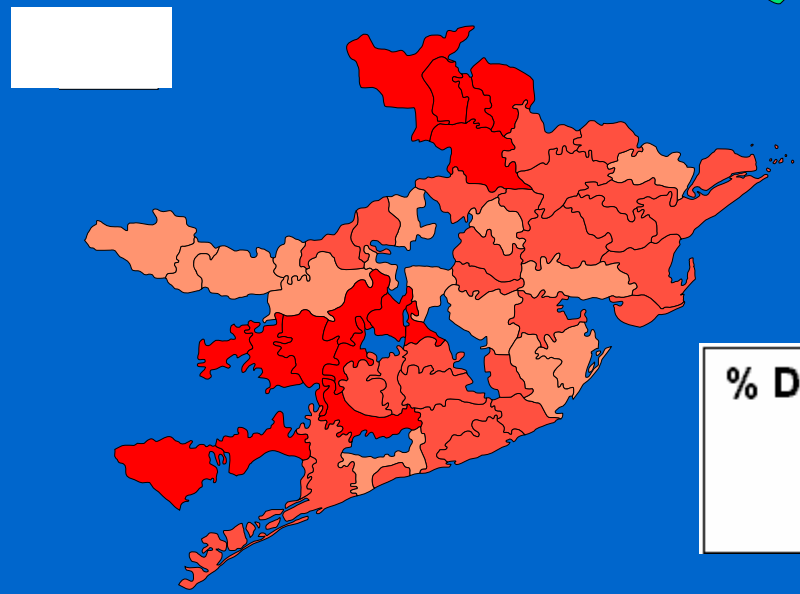


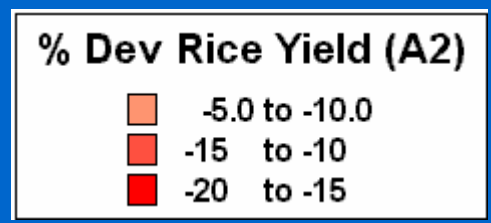


Rice yield (A2)



% Dev Rice yield (A2)





Cost of Adaptation?

- Is this the correct question?
- Estimates of the costs of inaction cover a huge range:
  - $10Bs to $100Bs per year in developing countries by mid century
  - GDP losses range up to about 10% for developing countries for a doubling of atmospheric CO_2
- Some adaptive actions are direct costs – e.g. strengthening coastal protection
- Others are done because cost benefit analysis points to them – e.g. change in agricultural systems
- Some adaptive actions changes the priorities in the use of a limited resource -- e.g. concessional finance

Adaptation to Climate Risks: Costs

- A preliminary assessment (WB and OECD) shows that tens of billions dollars per year of ODA & concessional finance investments are exposed to climate risks

- Much larger exposure of private sector investment

- Response by private sector in developing countries is constrained by
  - Lack of information on the nature of the risks and adaptation options
  - Vulnerable public infrastructure on which they depend
  - Insufficient risk spreading mechanisms – e.g. insurance

World Bank and IADB Studies

Calculation of the proportion of sensitive projects:

World Bank

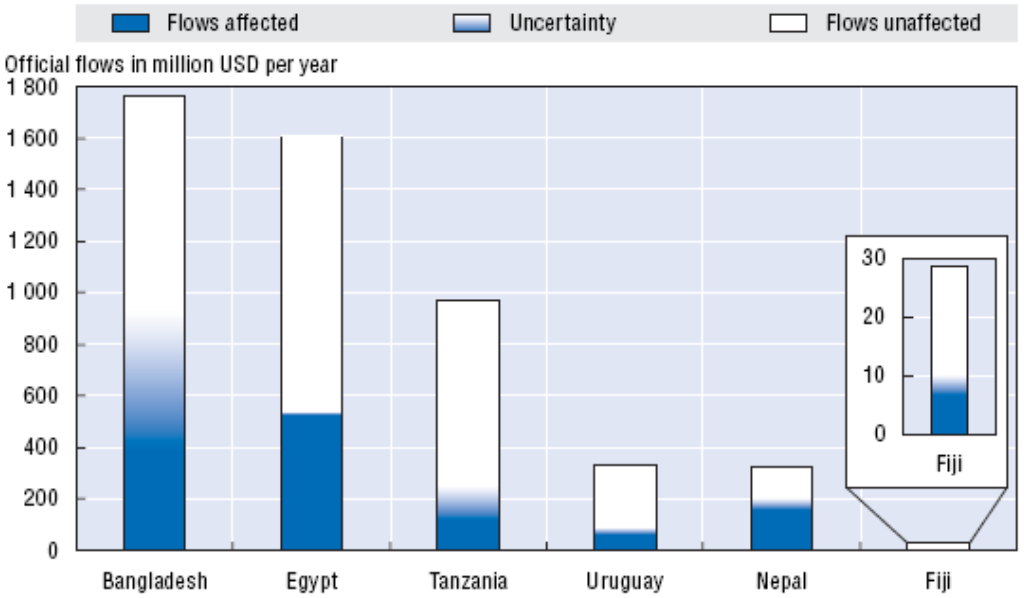
Year	2003	2004	2005		2003-5	Per Year	No. of projects sensitive
Total projects	400	425	494		1319	439.7	
sampled	50	50	50		150		
Sensitive (>=1)	22	32	28		82	27.3	55%
>=2	16	25	19		60	20.0	40%
>=3	10	15	12		37	12.3	25%

At significant risk

Analysing Climate Risk in the Development Portfolio

OECD Study

Figure 3.2. **Annual official flows and share of activities potentially affected by climate change**



Note: Based on DAC database, Table 4: Destination of Private Direct Investment and other Private Capital (aggregates only). OECD (2004c), last accessed in March 2004.

15 – 60 % of official flows potentially affected by climate change

Source: Bridge Over Troubled Waters: Linking Climate Change and Development, OECD (2005), p. 67

Adaptation to Climate Risks: Costs

- Comprehensive project planning and additional investments to climate-proof development projects will require at least $1 billion per year
  - $20-40 billion projects at risk – additional costs to climate-proof them is estimated at 5-20% per project, therefore, $1-8 billion per year

- Actions include:
  - Better access to information on climate risks and impacts
  - Reduce institutional barriers to comprehensive planning across multiple sectors (e.g. water allocation between power generation, irrigation, industrial, human and natural resource use)
  - Revise standards for planning and infrastructure
  - Additional investments meet revised standards and retrofit existing infrastructure

Adaptation to Climate Risks: Public Funding

- Primary public financial instruments available –
  - ODA – currently only a few percent directly for adaptation
  - GEF special funds for adaptation – rising to c. $100M pa
  - Adaptation Fund funded by a 2% tax on the Clean Development Mechanism – less than $100M pa

- These instruments technically adequate –but funds flowing through them need to be substantially increased

Adaptation to Climate Risks: Private Sector Funding

- Private sector has a commercial incentive to reduce exposure to climate risks and to take up adaptive options once known, but to achieve this they depend upon:
  - Greater climate resilience of public infrastructure including transport and harbor facilities, energy supply, etc
  - Improved access to risk spreading instruments such as insurance, including
    - Cost effective approaches such as weather indexed insurance
    - Risk pooling instruments to facilitate access to commercial re-insurance

Conclusions

- Human-induced climate change, as well as loss of biodiversity, and land and water degradation, threatens poverty alleviation, sustainable economic growth and regional security
- “Industrialized countries have been the primary cause to date of human-induced climate change, but developing countries and poor people are the most vulnerable
- The actions of today’s generation will profoundly effect the Earth inherited by our children and future generations
- There are cost-effective and equitable solutions, but political will and moral leadership is needed
- A long-term stable regulatory framework with differentiated responsibilities is needed to stimulate the carbon market and provide the incentives for private sector engagement
- Innovative public-private partnerships and technology transfer are needed
- Market reform is needed – reduction of energy subsidies and internalization of local/regional externalities (i.e., pollution costs)
- Increased public and private sector funding for energy R@D