Costing Adaptation:
Preparing for Climate Change in India
A BC3-TERI Study

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Climate change is expected to have a range of impacts, most of which will be negative for developing countries like India. These include damage to infrastructure and human populations as extreme weather events increase in frequency, more flooding in coastal zones and in some river systems, changes in yields of crops, shortages of water and increases in the incidence of water and vector borne diseases. Though the impacts have been studied in some depth, there still remain great uncertainties regarding the magnitude and timing of the impacts. The case for action is strong at two levels: to reduce the likely impacts by reducing emissions of greenhouse gases and to reduce the consequences of the impacts by adapting to the changes that will occur. While the former (mitigation) is a global problem, where decisions have to be taken globally, the latter (adaptation) is a local problem, where decisions have to be taken as the level of the city, river basin or agro-ecological zone. This study estimates what the cost of appropriate adaptation actions for India would be. Working from the bottom-up it represents the first attempt at a national assessment of the measures that will be needed in the medium term (by 2030).

The study tries to address a number of methodological challenges are the literature on adaptation is considerably weaker than that for mitigation and detailed assessments such as this one are very rare, especially for developing countries where required datasets and results from impact assessments are scant. This study was carried out by TERI, India in collaboration with the Basque Centre for Climate Change (BC3), Spain. The study focuses on five key sectors namely, human health, forests, agriculture, coastal zones and water and evaluates the feasible measures needed to reduce the negative impacts of climate change. The sector wise approach adopted and the major findings are as follows:

Forests

The study aims at developing a methodological framework for estimating the costs of adaptation for ecosystems and biodiversity. A detailed methodology has been developed contributing to the existing literature on adaptation costs, which involves first the identification of the climatic impact; second based on the impacts, the identification of the vulnerable areas; third the identification and election of the adaptation options; fourth the unitary costs of the adaptation measures; and finally fifth, the total cost of the adaptation measure. The magnitude of the adaptation options needed have been identified for both positive and negative impacts on Indian forests. Results of the study show that adaptation costs for forests in India are in the range of 192.92M$ and 335.48M$ per year in 2085, depending on the adaptation scenario.

Health

The study on health sector presents a methodological framework, partially based on a bottom-up approach, to estimate the additional cost of planned adaptation for malaria, diarrhea and malnutrition in India under different climate scenarios, taking into account

the influence of economic growth which is already taking place at a fast pace in India. The approach adopted is built on a state-level assessment, taking into account the existing geographical, demographical and socio-economic diversity between states in India, as well as the national programs and strategies being implemented by the government. Results of the analysis place the estimates for the additional annual adaptation cost in the range of US$ 171-546 million in the unmitigated scenario and US$ 141-445 million in a scenario of stabilization at 550ppmv, for year 2030, under different development settings. The results highlight the fact that prevention will play a crucial role in reducing the mortality burden, and will therefore reduce the need for reactive measures and associated costs which are largely supported privately by the individuals.

Agriculture

The assessment for the agriculture sector is based on the best existing estimates on the impacts of climate change on Indian agriculture and value added to the analysis by 'breaking down' the estimates to the level of agro-climatic zones in the country by using self-estimated projections on the climatic variables. This is based on different scenarios derived from a range of climate models Both autonomous and planned adaptation have been accounted for. For autonomous adaptation it was assumed that all losses resulting from climate change impacts on agriculture will be made good and this can be taken as the upper bound of autonomous adaptation cost.To arrive at the unitary cost figures for planned adaptation measures, a rigorous review of the various plans and programs being currently implemented by the Government of India was done. In some cases where data was not available the results have been provided at the state level. Estimates indicate an annual loss of around US$1 to US$1.5 billion by 2020 and increasing up US$1.8 to US$2.2 for autonomous adaptation by 2050 and the annual costs for planned adaptation could turn out to be about 1.3 billion US$ per year.

Coastal Margins

For coastal zones the approach used in the study allows for more soft options and is not so tied to the hard engineering-based options as used in some previous studies. The main adaptation options considered are: beach nourishment, shelterbelt plantation, which also includes mangrove regeneration, cyclone risk mitigation through cyclone shelters, desalinisation and coastal protection. The study ignores autonomous adaptation because the impacts of climate change on the coastal zones are primarily beyond coping capacity of the individuals and would require planned interventions. The interactive DIVA model has been used for the cost assessment. The findings of the study show that the cost of adaptating in the coastal regions comes out to be approximately 2.16 billion US$ per year for the year 2030.

Water

For the estimation of the costs of adaptation to the effects of climate change in freshwater systems, the unit of analysis adopted is the river basin level, both for identifying the potential impacts and adaptive measures. The assessment plans to focus on two aspects: firstly, the decrease of water availability due to decrease in rainfall and increase on frequency and intensity of droughts and secondly on the increase of the risk of flooding. The methodological framework for this sector is under construction.