

# Green Growth and Adaptation in Punjab

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# Green Growth and Adaptation in Punjab

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## 1 Introduction

Adaptation is one of the most prominent response strategies required to cope with climate change impacts. Adaptation to changing climate does include many aspects which are not new as societies have been coping to changes since centuries but unprecedented anthropogenic climatic variability has added a new dimension of uncertainty which makes coping difficult for the communities and ecosystems. This also implies use of new technologies and involvement of more stakeholders in the process of adaptation as compared to traditional coping practices (Fussler, 2007). Adaptation to climate change is usually planned or implemented for selected target systems at local to region scale. This is because multiple factors at the local level function as drivers of vulnerability. India as a country has immense diversity in terms of physical and socio-economic factors which results in a complex vulnerability profile across regions and sectors thus requiring action at sub-national levels.

The state of Punjab is predominantly dependent on natural resources for livelihoods and economy. Some of the key sectors such as agriculture, water, forest, ecosystems and biodiversity are however, facing a number of developmental pressures. For instance, the agriculture and water sectors are facing problems of overexploitation of groundwater, excessive usage of chemicals and soil degradation. Ecosystem and biodiversity are facing impacts of rapid development. Climate change has added to the existing challenges being faced by the key sectors in the state. Observation data indicates that the maximum and minimum temperatures have increased as compared to the baseline of 1971-2000 (Jerath et al., 2014). Climate projections indicate increase in temperature, with higher increase in minimum temperature than the maximum in the short term (2021-2050). The annual average precipitation is projected to increase, however, the winter precipitation is likely to decrease.

These changes will have direct impacts on the climate sensitive sectors which are already facing developmental pressures. Likely changes in precipitation pattern in the form of heavy rainfall events will lead to higher runoff and increasing likelihood of flash floods. Projected increase in temperature is likely to result in a decline in the productivity of crops like rice and wheat. Horticulture crops such as potato will also be affected due to this rise in temperature. Temperature increase will also have adverse impact on the livestock. In terms of fisheries, the temperature increase may result in decreased fish spawning and may also cause thermal stress. Changes in climate will also have an impact on the flora and fauna of the state in the form of phenological changes and migratory behavior of species. Since the dependence of the economy and livelihoods of the people of Punjab is huge on natural resources, there will be a need to design and implement appropriate adaptation strategies.

## 2 Policy landscape

As discussed, Punjab is facing significant vulnerabilities to current and future climate change posing threats to its natural resources and for the communities dependent on them. Adaptation is thus imperative for coping with the observed and anticipated risks and impacts in the state. Agriculture, water resources, forest and biodiversity are some of the key sectors driving the livelihoods of the majority of the population in the state and will thus require adaptation. With the objective of responding to the threats of climate change, the Punjab state government released the Punjab State Action Plan on Climate Change in 2012. The plan has been prepared by the Punjab State Council for Science and Technology. As discussed earlier, India released the National Action Plan on Climate Change (NAPCC) in 2008 to address the challenges of climate change. As part of this plan, each state of India has prepared a state action plan on climate change (SAPCC) in order to fulfil the objectives of the NAPCC. These SAPCCs are required for translating national policy as well as the objectives of the NAPCC into action especially at local levels.

The Punjab State action plan on climate change highlights the state specific adaptation and mitigation strategies (Jerath et al., 2014). The approach of preparation of the action plan included i) review of state related circumstances and climate related concerns, ii) assessment of climate change impacts and key vulnerabilities with respect to key sectors, iii) development of strategies for adaptation and mitigation in consultation with relevant stakeholders, iv) review by departments and dissemination. The SAPCC of Punjab comprehensively explains the state context in relation to climate change, current environmental conditions faced by the state and observed and projected climate change. The plan identifies some of the knowledge gaps faced in Punjab including data gaps, observational gaps, understanding climate projections and their impacts, understanding vulnerabilities to climate change and capacity building needs for integration of climate change in the overall development process. The document presents state objectives and targets with respect to each of the eight missions under the NAPCC. For each of the missions and respective sectors, key climate change challenges and strategies have been identified. The plan holistically presents strategies for adaptation to climate change along with a cost estimate for implementing these strategies (Table 1).

**Table 1:** Sector specific strategies for adaptation to climate change in Punjab as identified under the SAPCC

Strategies	Total Cost estimation of actions envisaged under the strategy in the 12 <sup>th</sup> and 13 <sup>th</sup> Plan (Rs. In Crores.)
<b><i>Water Mission</i></b>	
Draft a State Water Policy to undertake an integrated water resource management at a basin level within the state to conserve water, minimize wastage and ensure equitable distribution.	0.75
Undertake a focused approach to augment ground water especially in problematic/over-exploited areas taking advantage of continued projection of excess rainfall with respect to base line scenario.	2814.00
Enhance water use efficiency by 20% with respect to the present	6284.81.00
Augment surface water resources to accommodate excess rainfall and runoff projected for mid century	5497.10
Manage floods in a future erratic and excess extreme rain fall scenario	150.00
Contain the likely enhanced water logging situation in the south west districts of Punjab due to the projected rain fall exceeding 50% of the base line scenario in this region.	2201.00
Abate continued water pollution of underground and surface water sources which is likely to increase due to increase in industries and population	7530.13
Establish adequate institutional support for efficient water resource augmentation, conservation, distribution and governance through development of basin level Integrated Water Management plans.	59.00
Suggested Research and monitoring activities for effective decision making	193.50
<b>Total</b>	<b>24844.09</b>
<b><i>Agriculture</i></b>	
Promote crop diversification in the state as per the suitability of production in its different agroclimatic zones and take advantage of efficiency of C3 vs C4 crops in the enhanced CO2 environment.	10073.52
Sustainably manage agriculture crop residue to avoid the ill effects of on farm burning of crop residue in Punjab and also benefit from management of the same	293.40
Promote resource conservation of soil, water and energy	4654.39

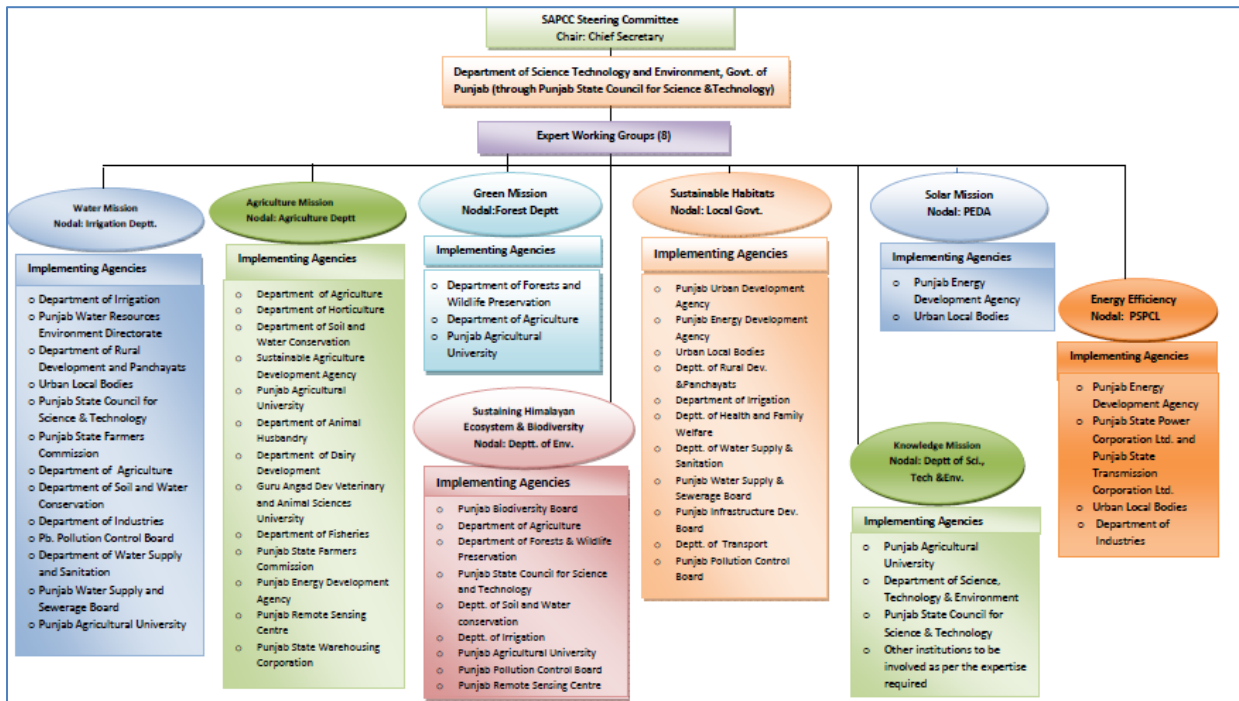
Formulate Agriculture Market Intelligence Cell within the Deptt. of Agriculture in order to adjust the production systems each year which have to be aligned according to the variable climate as well as to the demands of the markets after meeting the basic demand of food security of the state.	10.00
Develop cultivars and enhance germ plasm base that are (a) thermal resistant, (b) can withstand water stress, (c) can grow in water logged areas, (d) withstand emerging pests and diseases and (e) withstand enhanced levels of CO <sub>2</sub>	1209.65
Manage new and emerging pests, diseases and weed in crops.	30.45
Diversify into value addition activities to avoid waste of agriculture produce and increase storage capacity for grains to ensure farmer incomes in a changing climate scenario.	450
Promote cooperative farming amongst marginal, small, and medium farm land owners to reduce input costs, and maximize productivity and farm incomes and hence ensure livelihood security and income for farmers.	5.5
Manage Climate Risk through crop insurance and by assessing the socio economic impacts of Climate change on Agriculture.	1951.50
<b>Total</b>	<b>18678.41</b>
<b><i>Agriculture: Livestock and Dairy</i></b>	
Manage heat stress and ensure sustainable productivity of livestock in a climate change scenario.	91.95
Recover energy from livestock waste	514.00
Manage livestock health in the emerging pest and disease scenario	30.00
Ensure adequate green fodder availability for livestock	255.50
Ensure cover to the Climate Risk of livestock	33.00
<b>Total</b>	<b>924.45</b>
<b><i>Agriculture: Fisheries</i></b>	
Ensure sustainable production of Fish in the state to withstand the impacts of climate change and ensure livelihood security of people dependent on this sector	106.14
<b><i>Green Mission</i></b>	
Add at least 8.13% more area under forest and tree cover to the existing area bringing the total area under forest and tree cover to 15% of the total geographical area of Punjab by 2020	2530.00
Enhance forest density in the Shivaliks.	3336.00



Undertake capacity building activities for sustainable forest management based on scientific principles of forest management and integrate the same in working plans and management plans	44.00
Strengthen biodiversity conservation measures	2.10
<b>Total</b>	<b>5912.10</b>
<b><i>Sustaining Himalayan Ecosystem and Biodiversity</i></b>	
Understanding the response of Himalayan glaciers to climate change	7.00
Protect, Preserve and Conserve Shivalik Biodiversity of Forests	170.00
Protect, Preserve and Conserve Wetlands in Punjab	39.00
Promote cropping of indigenous varieties	40.00
<b>Total</b>	<b>337.50</b>
<b><i>Sustainable Habitat Mission</i></b>	
Avert enhanced heat island affect and promote self-sustainability in cities	1444.00
Address challenges associated with projected excess rainfall scenarios	30709.75
Contain pollution in river water in a warming scenario	2060.00
Ensure human health security vis a vis impacts of climate change	880.00
Develop a sustainable integrated transport system in Punjab	30384.04
Avail waste to energy in major cities in Punjab	325.00
<b>Total</b>	<b>65802.74</b>

**Source:** Jerath et al., 2014

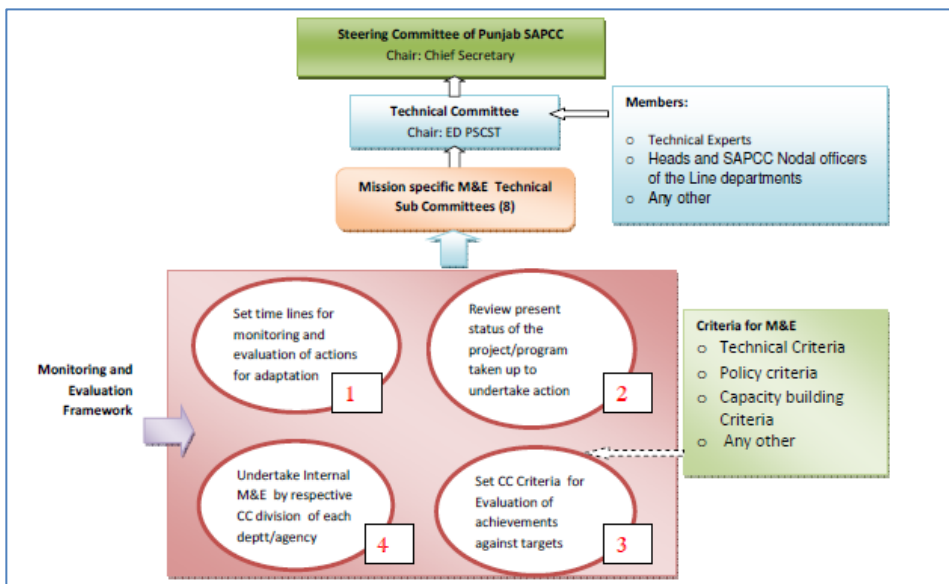
For facilitating the implementation of the proposed actions, the Punjab SAPCC clearly defines an institutional arrangement involving all relevant departments and institutions (Figure 1). According to the framework, the actions implemented by each of the departments/institution, will receive technical guidance from Expert Working Groups that will be set up for each mission. The Working Groups will include experts from the academia, representatives from industries, non-governmental organization, and concerned line departments. The Steering Committee of the SAPCC will be responsible to operate and oversee the fulfilment of the implementation of the strategies and the proposed actions. The plan also mentions that it is a dynamic document, and thus, the steering committee will regularly review the SAPCC with respect to the latest developments in science of climate change and policy needs and accordingly give directions for introduction of new strategies/revision of strategies.



**Figure 1:** Institutional framework for implementing the strategies of Punjab SAPCC

**Source:** Jerath et al., 2014

The plan also gives a monitoring and evaluation framework to ensure that the objectives and targets mentioned in the plan are achieved timely and to avoid maladaptation (Figure 2). The plan has been reviewed and endorsed by the Expert Committee on Climate Change under the Ministry of Environment, Forests & Climate Change, Government of India.



**Figure 2:** M& E framework for implementation of SAPCC

**Source:** Jerath et al., 2014

The SAPCC of Punjab provides a framework for implementation of proposed activities under each of the missions with a list of identified departments and institutions for implementation. Under each of the missions, all the relevant departments involved have

been listed along with their involvement with respect to implementation of specific activities. Since, in some cases there are multiple institutions identified for implementation of activities, it will be good to also give a mechanism for coordinating activities of different departments within a mission. In this respect, the plan mentions that integrated approaches for implementation will be undertaken to address inter-sectoral and cross cutting issues. Also, the implementation plan does not give details of how the implementation process will be carried out at different spatial scales – district, city, block and village and how they will be aligned to achieve the common goal.

The budget estimates for adaptation and mitigation strategies have been given for each of the proposed activities. The estimates have been quoted as proposed budget under the 12<sup>th</sup> and 13<sup>th</sup> five year plan with no information given on existing funds under each sector. How much of the proposed budgetary requirements can be met through ongoing policies and plans has not yet been identified. This has also resulted in the large estimates without consideration of existing funds. In this context, the SAPCC highlights the necessity to undertake an in depth review of the plan budgets given in 12th plan which are aligned towards adaptation to climate change to check the overlaps in the funds sought through the SAPCC. There is also a need to explore the sources of funding apart from the funds from the government, as highlighted in the plan, including the role of private sector in financing climate change activities in the state.

### 3 International Mechanisms

The activities identified under the different missions of the SAPCC of Punjab will require exploration of additional funding opportunities other than the government funding as well as technological support for implementation. There are a few international mechanisms which can be explored for financial and technological support.

#### 3.1 Mechanisms available for Punjab

Adaptation fund - The adaptation fund, which is financed with a share from the clean development mechanism (CDM) project activities and other sources of funding, is in particular meant to finance concrete adaptation projects and programmes in developing countries. The fund has been formulated under the Kyoto Protocol to assist in meeting costs of adaptation for developing country parties, and in particular communities and sector that are predominantly vulnerable to the adverse effects of climate change. The funding within the Adaptation fund will be on full adaptation cost basis (UNFCCC, 2014a).

The Adaptation fund(AF) is an example of direct access as in each country there is a National Designated Authority (NDA) for recommending or endorsing project proposals for funding to the Adaptation Fund Board (AFB). In India, NDA for Adaptation Fund is Ministry of Environment, Forest and Climate Change (MoEFCC). The responsibility of overall management of projects and programmes financed by the AF, however, lies with the National Implementing Entity. For example, in case of India, National Bank for Agriculture and Rural Development (NABARD) has been designated as the National Implementing Entity (NIE). NABARD's role as NIE includes:

- Identification, preparation, and implementation of activities that would enable adaptation to the adverse effects of climate change.
- Ensure to meet the criteria adopted by AFB for project sanction.
- Ensure quality in operations and accountability for implementing projects according to the principles and modalities of AFB
- Management, operation, and use of funds for activities approved by the AFB based on standards established by AFB
- Ensure appropriate monitoring, independent evaluation, and financial audits of all activities funded by the AFB.
- Submission of periodic reports as prescribed by AFB

Source: NABARD, 2014

To access funding through Adaptation Fund, Government Departments, Research Institutions, Universities, NGOs, can submit projects directly to NIE (NABARD) according to the template prescribed by Adaptation Fund.

Green climate fund – The Green Climate Fund (GCF) has been set up under the Convention to support the developing country parties on combating climate change through adaptation and mitigation activities. The resources for the fund are to be generated through developed country parties and other public and private sources. India, as a country, is eligible for accessing the GCF for getting financial support for adaptation and mitigation activities at national and regional level (GCF, 2014). Similar to the Adaptation Fund, the GCF will be accessible to institutions and government agencies within a country through a National Implementing Entity identified in each of the countries. Projects can be prepared and submitted by the NIEs to the National Designated Authority for endorsement to the GCF Board Secretariat for consideration and sanction. The NDA for the GCF in India is MoEFCC, similar to the AF. Recently, NABARD has been selected as the first NIE in India for the GCF for climate change adaptation and mitigation primarily in agriculture and rural sector (MoEFCC, 2014a, NABARD, 2015b). The NIE will be accredited by the GCF Board on the basis of the recommendations of the national government and will be accountable to the GCF board for all the resources received from the fund for the projects and programmes.

Climate Technology Centre and Network (CTCN) – The CTCN has been formulated in order to assist in transfer of technology to developing countries. Its primary objective is to support developing countries in enhancing their clean technology capabilities and facilitating prompt action on the deployment of existing technologies. The role of CTCN is also to facilitate collaboration with the private and public sectors, as well as with academic and research institutions, in developing and transferring emerging technologies (UNFCCC, 2014b). This technological support to developing countries will be channelized through a national designated entity (NDE). The NDE has a prominent role in coordinating requests to the CTCN in synergy with national priorities and strategies. The NDE will be link between the CTCN and local stakeholders, including the private sector and government institutions.

### 3.2 Institutional needs for Punjab to benefit from the mechanism

In order to access funds from the Adaptation Fund under the Kyoto Protocol for concrete adaptation projects, the process needs to be channelized through the NIE identified in India, which is NABARD. The state of Punjab needs to prepare specific adaptation proposals and approach NABARD for funding. Once the project is endorsed by NDA only then it can be sent to the AF secretariat for consideration and sanction. One of the prerequisites of proposals for funding is a justification of the extent to which the proposed project contributes to adaptation and climate resilience. The Projects/Programmes need to take into account national sustainable development strategies, national communications and national adaptation programmes along with state vulnerabilities and priorities. The projects for funding can be at national, regional and community levels. The projects also need to give arrangements or mechanism for implementation.

The eligibility for receiving funding for projects from the AF includes:

- Endorsement of project by the Government
- Supporting concrete adaptation actions
- Provision of economic, social and environmental benefits
- Cost-effectiveness of the project
- Consistency with national developmental strategies/plans/national communications
- Adherence to relevant national technical standards
- Avoid duplication with other funding sources
- Justification for the funding

Recently the Adaptation Fund Board endorsed three projects from India - building climate resilience agriculture and water management in Tamil Nadu and Rajasthan (USD 1.227 million); improving the adaptive capacity of fishermen in Madhya Pradesh (USD 1.738 million); developing climate resilient livelihood systems for rural farmers in West Bengal (USD 2.534 million) (MoF 2014, NABARD, 2015a) .

NABARD in particular has been focusing on aligning strategies and activities to priorities listed under NAPCC and SAPCCs. It also plans to climate proof the wide array of NRM projects being planned and implemented in India (NABARD, 2014).

Similar to the Adaptation fund, for the Green Climate Fund, once the funds of GCF are available for projects, the state of Punjab can prepare project proposals meeting the criteria laid out within the domain of GCF to access these funds.

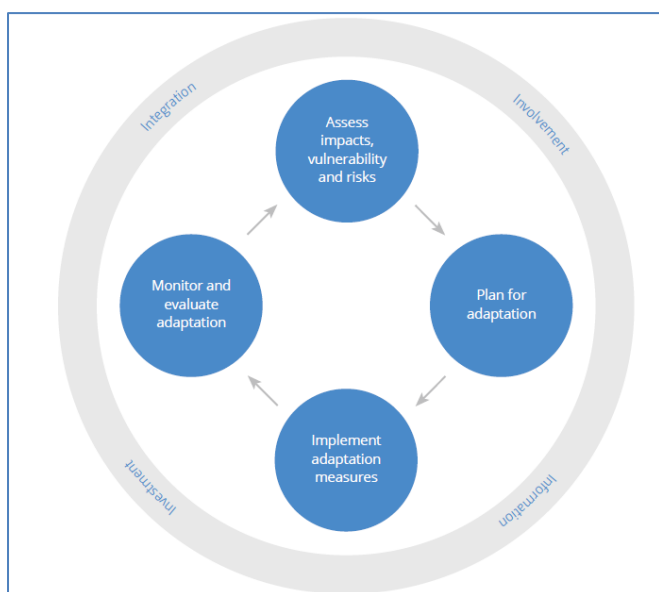
For accessing the mechanism available for technology transfer under CTCN, Punjab or any other state of India will have to approach the National Designated Entity identified for India. NDEs are the national entities for the development and transfer of technologies and

act as focal points for interacting with the Climate Technology Centre regarding requests from developing country Parties about their technology needs. The NDE identified for India is the Ministry of Environment, Forest and Climate Change (CTCN, 2015). Punjab can access this mechanism to facilitate better use of technologies for adaptation and mitigation. TERI is one of the Centres of Excellence for CTCN.

## 4 Ways Forward

### 4.1 Institutional coordination

As mentioned earlier, the SAPCC of Punjab provides an institutional framework for coordinating action on climate change which is well outlined. As the plan moves towards implementation, it will be useful to consider the UNFCCC framework of four I's for adaptation for better facilitation of the implementation process of the activities. These include integration, involvement, investment and information (Figure 3).



**Figure 3:** The four I's to adapt

**Source:** UNFCCC, 2014c

According to UNFCCC, institutional arrangements are predominant in facilitating the **integration** of adaptation into planning and implementation of development policies, strategies and projects. Clearly defined roles and responsibilities among different institutions involved including the department within each of the working groups of the missions of SAPCC will help in achieving its objectives and in ensuring the integration of adaptation into the development planning of the state (UNFCCC, 2014c).

The second component of this framework talks about the **involvement** of relevant stakeholders. Although the SAPCC of Punjab has involved a number of experts from different disciplines, it will be more beneficial to also involve the communities as well as other relevant stakeholders such as private players in the process of the implementation of adaptation strategies.

Another component highlighted in the framework is the exchange of **information**. As identified in the Punjab SAPCC, the state faces challenges in the form of availability of sufficient data and information. Better institutional arrangements involving all relevant stakeholders can help in better exchange of information and knowledge for taking informed decisions and measures. Also, use of better technology can help in addressing some of the data gaps. Box 1 provides an example of using ICT in improving information availability in agriculture and for taking informed decisions.

**Box 1: Example of using ICT in agriculture for management of risks**

Unpredictable and sudden changes in the weather can have adverse impacts on agriculture and the farmers who are completely dependent on crops for their livelihoods. However, use of Information and Communications Technology (ICT) can play a significant role in facilitating informed decision making by the farmers and building their capacity to respond to changes. An example of use of this technology is Reuters Market Light (RML), a business which provides a package of ICT solutions to farmers across the agriculture value chain in India. Presently, about 1.4 million farmers in 50,000 villages across 17 states in India including Punjab are using RML. RML has coverage of more than 450 crop varieties and 1300 markets.

In several cases, farmers in India get lesser price for their final produce as compared to the developed world and some of the prime reasons for this include lack of reliable and timely information about localized weather forecast, crop prices across markets and advice to improve productivity. RML provides a solution to these problems by delivery of personalized information service to farmers. It is a daily SMS based service to give specially designed agriculture information to the farmers customized on the basis of language, crops, markets and location. The information delivered to the farmers includes weather forecast and information related to every stage of the crop cycle, from pre-sowing to harvest as well as sale of crops for informed decision making (Reuters Market Light, 2014). Use of these services has the potential to increase income of farmers and make them more capable of responding to risks.

**Investment** is the fourth component of the framework which emphasizes that streamlining institutional support can enable better focus and use of available resources. Given that there will be financial gaps to address the short term and long term needs for adaptation it will be useful for the state to use better coordinated institutional arrangements for efficient utilization of existing resources as well as accessing additional resources.

## 4.2 Overcoming financial gaps

As discussed earlier, the SAPCC of Punjab highlights some of the financial gaps. The first requirement to address these gaps would be to identify more detailed activities under each of the vulnerable sectors based on current and future climate trends as well as ongoing activities. In alignment to its current programmes and policies, detailed estimates of the budgetary requirements with respect to each of the proposed activities and identification of the extent of additional funding will be required. The possible funding sources need to be explored for adaptation activities.

There are international financial mechanisms such as the Adaptation funds and the Green Climate Fund which can provide financial assistance for adaptation activities. Since the adaptation fund is meant for developing countries, and NABARD, in particular, is aligning activities under the NAPCCS and SAPCCs, the Punjab government can tap this opportunity for implementing concrete adaptation projects. The Punjab government can also look for other sources of funding through different models and involving private funding sources.

The state of Punjab with its immense repository of natural resources faces significant vulnerabilities to climate change impacts. The state government is taking a number of initiatives to address the challenges of climate change. The release of the State Action Plan on Climate Change of Punjab is an example of such initiatives. Addressing the institutional and financial gaps highlighted in this document can help in achieving the states' objectives of adapting to climate change.



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## **About TERI**

A unique developing country institution, TERI is deeply committed to every aspect of sustainable development. From providing environment-friendly solutions to rural energy problems to helping shape the development of the Indian oil and gas sector; from tackling global climate change issues across many continents to enhancing forest conservation efforts among local communities; from advancing solutions to growing urban transport and air pollution problems to promoting energy efficiency in the Indian industry, the emphasis has always been on finding innovative solutions to make the world a better place to live in. However, while TERI's vision is global, its roots are firmly entrenched in Indian soil. All activities in TERI move from formulating local- and national-level strategies to suggesting global solutions to critical energy and environment-related issues. TERI has grown to establish a presence in not only different corners and regions of India, but is perhaps the only developing country institution to have established a presence in North America and Europe and on the Asian continent in Japan, Malaysia, and the Gulf.

TERI possesses rich and varied experience in the electricity/energy sector in India and abroad, and has been providing assistance on a range of activities to public, private, and international clients. It offers invaluable expertise in the fields of power, coal and hydrocarbons and has extensive experience on regulatory and tariff issues, policy and institutional issues. TERI has been at the forefront in providing expertise and professional services to national and international clients. TERI has been closely working with utilities, regulatory commissions, government, bilateral and multilateral organizations (The World Bank, ADB, JBIC, DFID, and USAID, among many others) in the past. This has been possible since TERI has multidisciplinary expertise comprising of economist, technical, social, environmental, and management.



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