



RESEARCH PROGRAM ON  
Climate Change,  
Agriculture and  
Food Security



International Maize and Wheat Improvement Center

# Framework Guidelines and Governance for Designing **Local Adaptation Plan of Action** to Mainstream **Climate Smart Villages** in India



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**International Maize and Wheat Improvement Center (CIMMYT)**

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# Foreword

The major challenges being faced by Agriculture globally are degradation of natural resources and increasing frequency of climate change induced risks. In pre-green revolution period, the farmers practiced a more resilient agriculture that inherently adapted to climate variability through optimal use of biodiversity i.e. a careful selection of crop mix to suit the condition of water scarcity, drought and cold wave etc. But the present day intensive agriculture faces the daunting challenge of transforming itself for providing enough food in an ecologically sustainable manner in view of existing uncertainties about regional and local impacts of climate change. To overcome the situation, there is a need to engage diverse stakeholders in preparation of coherent policies that take advantage of rapid advances in Science and Technology and incentivize their adoption to stimulate a behavioral change and align them for action at different levels. The adaptation process will require validation and tailoring various strategies at regional to farm level due to variations in resource endowments viz soils, tools and technologies etc.

At national level, the National Action Plan on Climate Change and at State level, State Action Plans on Climate Change have been prepared to combat the growing vulnerabilities due to climate change. However, various states in their State plan have highlighted increasing realization of need for local adaptation of plan of action (LAPA) in order to effectively implement the national and state level plans at local level. This study aims to outline a road map for designing a local adaptation plan of action (LAPA) and mainstreaming climate-smart villages into it for scaling-up climate smart agricultural practices relevant to diverse farm household typologies. There are some practical suggestions which the policy makers can take note of for improving the synergy between various development programmes and thereby help local communities to mitigate the effects of increasing climate variability .

I congratulate the authors and their organizations for developing this frame work and organization structure for implementing the local action plans for adapting to climate change. I am hopeful that this report will be of immense help to the policy makers, researchers and development agencies for transforming the agriculture in the country and other regions into a climate-smart agriculture.

Chandigarh  
Dated: 25<sup>th</sup> August 2015



(B.S. Sidhu)

Commissioner Agriculture  
Government of Punjab, India

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**Authors**

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# Acronyms

ADB	Asian Development Bank
BRIFFS	Bottom-up, responsive, inclusive, flexible, forward-looking and sustainable
CA	Conservation Agriculture
CBA	Cost-Benefit Analysis
CBOs	Community based Organisations
CC	Climate Change
CEA	Cost-Effective Analysis
CCAFS	Climate Change, Agriculture and Food Security
CGIAR	Consultative Group on International Agricultural Research
CIMMYT	International Maize and Wheat Improvement Center
CSAP	Climate Smart Agricultural Practices
CSV	Climate Smart Villages
DFID	Department of International Development
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GOI	Government of India
GON	Government of Nepal
GTZ	German Development Cooperation
ICAR	Indian Council for Agricultural Research
ICT	Information and Communications Technology
INCCA	Indian Network for Climate Change Assessment
IPCC	Inter-governmental Panel for Climate Change
KVK	Krishi Vigyan Kendra
LAPA	Local Adaptation Plan of Action
M&E	Monitoring and Evaluation

MCA	Multi-Criteria Analysis
MoEF	Ministry of Environment and Forest
MST	Ministry of Science and Technology
NAPCC	National Action Plan on Climate Change
NICRA	National Initiative in Climate Resilient Agriculture
PRI	Panchayati Raj Institutions
SAPCC	State Action Plan on Climate Change
UN	United Nations
UNDP	United Nations Development Programme
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNFCCC	United Nations Framework Convention on Climate Change
US-EPA	United States-Environmental Protection Agency
VCCCAR	Victorian Centre for Climate Change Adaptation Research
WB	World Bank

# Executive Summary

Climate change has already affected economic development through its impact on various sectors of the economy. India is highly vulnerable to climate change because majority of its population rely on climate sensitive sectors for their livelihood. Therefore, adaptation to climate change is inevitable for reducing the vulnerability due to climate change and to achieve food security and sustainable development in the face of climate change.

Realising the need for planned efforts to address the challenges due to climate change, Government of India initiated National Action Plan on Climate Change (NAPCC) in 2008. The NAPCC, which is coordinated by the Prime Minister's Council on Climate Change, provides a policy framework for adaptation and mitigation to climate change. The NAPCC has eight major national missions comprising national solar mission, national mission for enhanced energy efficiency, national mission on sustainable habitat, national water mission, national mission for sustaining the Himalayan ecosystem, national mission for a green India, national mission for sustainable agriculture and national mission on strategic knowledge for climate change. However, national missions on climate change cannot be achieved unless it is supported by the state level action plan on climate change. Thus, the national Government of India called for the State Action Plan on Climate Change (SAPCC) from each state. Most of the Indian states has prepared the SAPCC based on their climate risks and priorities. Also, efforts are continued to align both NAPCC and SAPCCs with periodic development plans of the nation. However, given the nature of impacts of climate change which vary across locations, the effective implementation of adaptation may not be realised in the absence of local action plans. Therefore, this study provides a framework for the formulation and implementation of local adaptation plan of action (LAPA). In addition, recognising the role of CGIAR research program on Climate Change, Agriculture and Food Security (CCAFS) in documenting the science-based evidence for climate change adaptation in agriculture at Climate Smart Villages (CSVs), we propose to mainstream CSVs into LAPA.

Based on the extensive review of existing frameworks and practices on climate change adaptation and authors experiences in Indian context, this study presented BRIFFS (bottom-up, responsive, inclusive, flexible, forward-looking, and sustainable) as the major guidelines for developing LAPA. This study presented the major steps of LAPA with clear actions, activities and also tools that can be used in each step. The nine steps of LAPA are as follows: 1) Communicating climate change risks and adaptation measures at local level, 2) Assessment of climate risks and vulnerabilities and scoping of adaptation actions, 3) Prioritisation of adaptation options, 4) Formulation of LAPA, 5) LAPA integration in planning process, 6) Institutional arrangement to implement LAPA, 7) Implementation of LAPA, 8) Progress assessment of LAPA, and 9) Feedback and revision of LAPA.

This study highlighted the possible synergy by mainstreaming Climate Smart Villages (CSVs) into LAPA and also presented a framework to do this. Given that CSV emphasises the adoption and up-scaling of Climate Smart Agricultural Practices (CSAPs), this can contribute to LAPA in selecting and prioritising location-specific CSAPs with climate change adaptation benefits. Another important contribution is the sharing of international knowledge on climate change adaptations and potential mobilisation of international funds for local adaptation programs. Therefore, mainstreaming CSVs into LAPA not only minimises the replication of same programs in the same locality by different organisations but also enhances sustainability of the program through better targeting and convergence at local level.



# 1

## Introduction

Climate change has emerged as the single most pressing challenge because of its serious implication on food security, poverty reduction and sustainable development. Increasing climatic variability affects most of the biological, physical and chemical processes that drive productivity of agricultural systems including livestock and fisheries (Easterling et al., 2007). Growing population and natural resource degradation can further add on to this adversity, making a large number of people in India vulnerable to climate change. On the one hand, climate change can intensify the degradation process of natural resources which are central to meet the increased food demand, while on the other hand, changing land use pattern, natural resource degradation (especially land and water), urbanisation and increasing pollution could affect the ecosystem in this region directly and also indirectly through their impacts on climatic variables (Lal, 2011). Increase in mean temperature, increased variability both in temperature and rainfall patterns, changes in water availability, shift in growing season, rising frequency of extreme events such as terminal heat, floods, storms, droughts, sea level rise, salinisation and perturbations in ecosystems have already affected the livelihood of millions of people. For example, about 51% of the Indo-Gangetic Plains may become unsuitable for wheat crop, a major food security crop for India, due to increased heat-stress by 2050 (Lobell et al., 2012; Ortiz et al., 2008). Therefore, adaptation to climate change is no longer an option, but a compulsion to minimise the loss due to adverse impacts of climate change and reduce vulnerability (IPCC, 2014, 2007).

Climate change affects almost all sectors in the economy including agriculture, fisheries, infrastructure, human health, water supply and sanitation (GOI, 2010). A recent report (GOI, 2010) on climate change and its impact on four regions (the Himalaya region, the Western Ghats, north-eastern region, and the coastal region) and four sectors (agriculture, forest, human health and water) of India shows that all the regions and sectors are affected adversely. However, the severity of the impacts varies across regions and sectors and by the type of events related to climate change. For example, increase in temperature, change in frost events and glacier melt are more likely to affect hill agriculture while the sea-level rise affects the coastal agriculture (GOI, 2010). Higher thermal stress reduces productivity and also adversely affect livestock health. Climate change will also have negative effects on human health as this propagates most of the diseases. Increased temperature will not only raise the risk of heat strokes, but also increases the probability of transmission of vector-borne diseases. Water contamination due to flooding increases the risk of water-borne diseases mainly diarrhea while the massive floods increases the risk of mortality and loss of properties including houses, and other public infrastructures.

Given that climate change induced disasters affect most of the sectors in different ways, the adaptation measures need to be sector and location-specific. Although the adverse impact of climate change on different sectors and human life is widely acknowledged, the task of integrating adaptation to climate change at local level planning has not yet become a common practice (Davidse et al., 2015; Wilson, 2006). On this pretext, formulation of local adaptation plan of action is a crucial step to climate change adaptation.

Although it is difficult to estimate the exact cost of adapting to climate change, available estimates indicate much higher costs of adaptation to adverse impact of climate change (UNDP, 2010). A study by Margulis et al., (2010) estimated that the annual global cost of adapting to adverse impact of climate change could be more than US\$ 100 billion. According to Nelson et al (2009) the annual costs of adapting climate change in the agricultural sector alone could be over US\$ 7 billion. Indian State Government of Kerala (Government of Kerala, 2011) estimated that an initial cost of undertaking climate change adaptation tasks stated in SAPCC will require Rs. 6178 crore over a period of 15 years. However, this estimation will be much higher as the details of the cost needs further revision (Government of Kerala, 2011). Hence, climate change adaptation in multiple sectors of the economy and in multiple regions of the country requires much bigger costs, which cannot be sustained unless an integrated framework is designed to make it financially sustainable. Furthermore, under the business-as-usual scenario, total economic loss due to climate change will be highly prohibitive for India as annual GDP loss could be about 2% by 2050 (Ahmed and Suphachalasai, 2014). Climate change will thus increase the cost of achieving sustainable development due to the additional resources needed to address the climatic risks and the cost of managing uncertainty that is inherent with climate change. Policy makers at national, state and local levels need to prioritise adaptation action in such a way that it minimises the climate risks, risk of maladaptation, and also generate development co-benefits. Generating development co-benefits is crucial for long-term financing for climate change adaptation (UNFCCC, 2004). Therefore, mainstreaming adaptation into development planning and investment decision-making processes and adopting a long-term perspective are essential for effective adaptation to climate change. In addition, adaptation to climate change also requires changing the way the development planning is done (UNDP, 2010).

An alternative to reduce adaptation costs is to make local adaptation plan of action as the integral part of local development planning and by ensuring the engagement of local government bodies and effective participation of multiple stakeholders from the respective community. To a larger extent, mainstreaming climate change adaptation at various levels of development planning requires a repackaging of the national/state/local government plans, programs and priorities. In this case, in urban areas municipal planning can be a key avenue for local adaptation but it requires deeper understanding of the role of institutional context, leadership and competing planning agendas for local development (Measham et al., 2011).

Another way to minimising the cost of adaptation and bringing international finance and experiences is through mainstreaming Climate Smart Villages (CSVs)<sup>1</sup> in the local adaptation plans. Such a framework not only reduces cost of implementing local adaptation plans that might occur due to program duplication from different institutions or due to lack of proper prioritisation, but also provides a new insights to LAPA by focusing on mitigation co-benefits of the adaptation measures wherever possible. Estimating the cost of adaptation is complex because it involves multiple actors and competing adaptation strategies and pathways (Chaudhury et al., 2014). The usual practice of adaptation costing follows a top-down approach and mostly expert driven. Such a practice suffers from misallocation and not always reaches the vulnerable communities that are in most need (Chaudhury et al., 2014). Therefore, there is a need for a framework that guarantees multi-stakeholder participation for planning, selection and valuation of locally appropriate methods of adaptation. Participatory local planning contributes to the exploration of economic, social and environmental impacts of the adaptation actions in the local community. Examining and prioritising adaptation actions at local community minimises the information gap that the desk-based valuation by expert often has. Adaptation interventions are successful if they are designed with a thorough understanding of the local context and the government considers local factors into account while making adaptation plans

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<sup>1</sup> Details about climate smart villages are presented in Annexure 1

(Funfgeld et al., 2012). Therefore, engaging multiple stakeholders and following participatory community based approach to design adaptation help overcome the problems that may arise due to lack of local knowledge about the interventions, misconceptions about the potential cost and benefits, resources and constraints of the local community. This also provides important insights that are essential for appropriate targeting and delivery of resources needed for adaptation. This is the usual case in developed countries too. For example, most of the states in US have recently started focusing on local adaptation plans in lieu of state adaptation plans (Cruce, 2009).

On this pretext, this study synthesises major policies related to climate change in India and provides a flexible approach to design LAPA and also to mainstream the CSV in LAPA implementation. The basic framework can be modified in order to meet the specific needs of the local community, but the basic principles and major guidelines remain relevant in most of the circumstances. Therefore, the main objectives of this study are to provide guidelines required for identifying, prioritising and shaping potential local adaptation plan of action. Furthermore, this also presents a method to mainstream the concept of CSV, especially in preparing local adaptation plan related to agriculture. However, mainstreaming CSV in LAPA helps us to achieve all three pillars of climate smart agriculture – food security, climate change adaptation and mitigation. Furthermore, although CSV up to now has focused on agriculture, it contains all other sectors in the village such as natural resources (water, land, and forest), the environment (lower GHG emissions), infrastructure and communication. Its primary focus on agriculture is mainly due to the relative importance of agriculture in the village economy. In principle, in order to qualify as a climate smart village, it needs to be resilient to the adverse impact of climate change in all sectors including agriculture, natural resource management, and infrastructure. A village or the municipal ward is the local level operational unit for both local adaptation plan of action and the climate smart villages. Given the existing administrative structure in India, both LAPA and CSV have to operate either at the village level or at the municipal ward level (in case of urban area). Given this, at a particular village/municipal ward both LAPA and CSV need to address the same climate risks and work with same stakeholders. Therefore, governance at local level is same for both LAPA and CSV.



# 2

## Climate Change Policy Initiatives in India and Need for LAPA

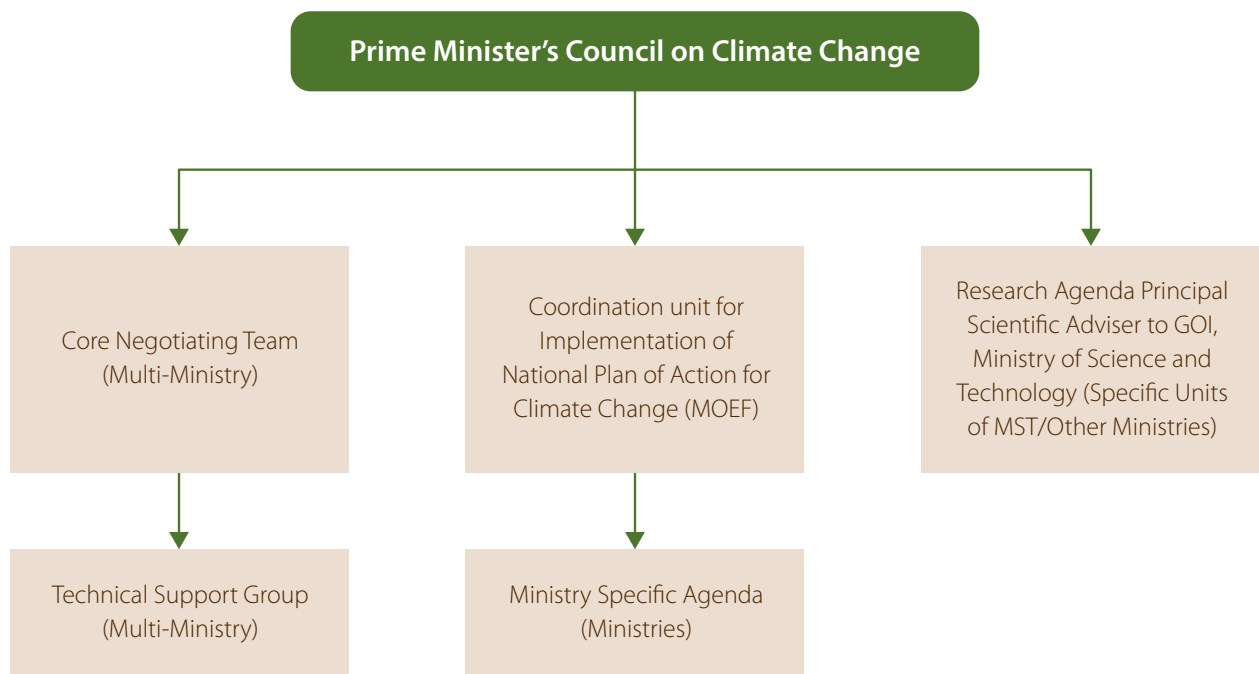
This section provides a summary of National Action Plan on Climate Change (NAPCC), State Action Plan on Climate Change (SAPCC) and some other policies and programs related to climate change at sectoral level in India. Then we argue why LAPA is relevant in this context.

Climate change affects the Indian economy on several fronts. As a result, it requires planned efforts to deal with the impacts of climate change. Realising this, India initiated National Action Plan on Climate Change (NAPCC) in 2008. The NAPCC, which is coordinated by the Prime Minister's Council on Climate Change, provides a policy framework for adaptation and mitigation to climate change. The NAPCC has eight major national missions comprising national solar mission, national mission for enhanced energy efficiency, national mission on sustainable habitat, national water mission, national mission for sustaining the Himalayan ecosystem, national mission for a green India, national mission for sustainable agriculture and national mission on strategic knowledge for climate change (GOI, 2008). Each national mission would devise strategies to make India more resilient to climate change in its respective front. For example, the national mission for sustainable agriculture devises strategies so that Indian agriculture becomes resilient to climate change. The national mission for green India focuses more on enhancing ecosystem services including carbon sinks and thus, campaign for the afforestation of 6 million hectares has already been initiated under this mission (GOI, 2008). In order to sustain the hill farming system in the Himalayan region, community based management of these ecosystems will be promoted by providing incentives to community based organisations to protect the forest and to ensure the stability of the fragile ecosystem. The national mission on sustainable habitat emphasises on improving energy efficiency in buildings, management of solid waste and modal shift to public transport. Enhancing climate resilient infrastructure, promotion of community based disaster management system, and establishing warning system for extreme weather events are also the components that fall under the national mission on sustainable habitat.

The governance structure of the NAPCC is centrally managed as the Prime Minister's Council on Climate Change oversee the overall programs. Respective ministries institutionalises the national mission related to it. In order to facilitate respective ministries to implement the mission, inter-sectoral groups are organised that includes Ministry of Finance, Planning Commission, and experts from industry, academia and civil society (GOI, 2008). According to the NAPCC (2008) document, each national mission would have to come up with specific objectives, strategies, plan of action, timelines and monitoring and evaluation criteria and submit it to Prime Minister's Council on Climate Change and each mission would report its annual performance publicly. As an institutional arrangement to facilitate national missions, the Government of India has established an Advisory Council on Climate Change, chaired by the Prime Minister. The council consists of key stakeholders including government, industry and civil society. Providing guidance for implementing national agenda related to climate change, international negotiation on climate change including bilateral, multilateral programs for collaboration, research and development, and periodic review of



**Figure 2.1:** Institutional Arrangement for National Action Plan on Climate Change (NAPCC) in India



Source: GOI, 2008

NAPCC are some of the major responsibilities of the Advisory Council on Climate Change. Figure 2.1 provides the institutional arrangement for NAPCC in India.

In October 2009, Ministry of Environment and Forest (MoEF) launched the Indian Network for Climate Change Assessment (INCCA). This is considered as network-based scientific program with the following objectives: (i) to assess drivers and implications of climate change through scientific research, (ii) to prepare climate change assessments including GHG estimations and impacts of climate change associated vulnerabilities and adaptation once in every two years, and (iii) to develop decision support systems and build capacity towards management of climate change related risks and opportunities (GOI, 2010). INCCA has accomplished two major tasks. It has completed the assessment of greenhouse gas emission and comparison between the values for 1994 and 2007. Another major study completed by INCCA is the report entitled 'climate change and India: 4x4 Assessment'. This report has provided both sectoral and regional analysis of impacts of climate change in four regions of India including Himalayan, Western Ghats, North Eastern and Coastal regions with a focus on agriculture, forests, human health, and water sectors. It confirms that sea level rise will continue to occur for substantial time period even if greenhouse gas levels are brought under control and hence adaptation is inevitable for reducing vulnerability to climate change.

In August 2010, the national consultation workshop for discussing the common framework/approach to develop the state level action plans on climate change was organised by the Government of India under the aegis of the GOI-UNDP project entitled 'Capacity Building for addressing climate change' (MoEF, 2010). The workshop was attended by 150 delegates including various central ministries, state governments, climate change experts, and civil society and development agencies. The major objective of the workshop was to seek recommendation for finalising the framework to prepare the SAPCC. In the workshop, nodal ministries related to national missions suggested each state should consider the NAPCC and its missions as a guide while formulating climate change adaptation and mitigation strategies at the state level. UNDP developed the common framework for the preparation of SAPCC in consultation with GTZ, DFID and the World Bank

(MoEF, 2010). The framework focused on planning at sub-national level, building capacity for vulnerability assessment and identifying investment opportunities based on state priorities. The framework advocated a participatory approach for the formulation of SAPCC and provided a broad and systematic process to develop SAPCC. The common framework presented by UNDP was accepted by the representatives of the states and the participants of the workshop. However, the major concerns were on how the states would include multiple sectors in SAPCC and how to finance its implementation. In general, the mission documents within the SAPCC needs to integrate with the NAPCC. It was also realised that preparation of SAPCC is not a onetime exercise but a continuous process as it needs to integrate climate change related actions with development goals. Considering that the major challenge was to convert the national missions on climate change into sub-national and regional levels, each state government of India was called upon to prepare the state action plan on climate change (SAPCC) by the end of March 2011. Though the preparation of SAPCC took longer than the expected time, it devises the strategies based on the major climate risks and its impacts in the respective state (Globe International, 2013; Negra, 2013). Delhi state is the first state to present SAPCC in 2009 while other states like Punjab, Rajasthan etc., completed it in 2014. Table 2.1 presents the status of SAPCC of all states and Union Territories of India.

The implementation and governance of NAPCC is under the central government. The central government has set up an Advisory Council on Climate Change, which is chaired by the Prime Minister. The national missions are institutionalised by respective ministries. The Advisory Council provides guidance on several issues such as international and bilateral collaboration, research and development. Governance of SAPCC relies on the individual state. For example, in Kerala state, working groups on the major sectors including General Policy and Governance, Monitoring and Strategic Knowledge Management, Water Resources, Forests, Agriculture, Fisheries and Coastal Ecosystems are set up for preliminary recommendations on how to design and implement SAPCC. These working groups are coordinated by the state level Empowered Group

**Table 2.1:** SAPCC that Addresses National Missions of NAPCC and Need for LAPA

State	Date	Focus on Eight Missions stated in NAPCC	LAPA
Andaman and Nicobar	2013	<ol style="list-style-type: none"> <li>1. Sustainable habitat mission</li> <li>2. Sustainable water mission</li> <li>3. Sustainable agriculture</li> <li>4. Green India</li> <li>5. Sustaining island ecosystem</li> </ol>	No discussion about LAPA but includes local communities and lays emphasis on community based adaptation to CC for quick response
Andhra Pradesh	2012	<ol style="list-style-type: none"> <li>1. Mission for sustainable agriculture</li> <li>2. Coastal zone management</li> <li>3. Forestry and biodiversity</li> <li>4. Energy</li> <li>5. Industries (including mining)</li> <li>6. Transportation</li> <li>7. Health</li> <li>8. Urban development</li> <li>9. Tourism</li> <li>10. Rural development</li> <li>11. Research in CC</li> </ol>	Inclusive of local communities in decision making and implementation process

Contd...

State	Date	Focus on Eight Missions stated in NAPCC	LAPA
Arunachal	2011	<ol style="list-style-type: none"> <li>1. Water</li> <li>2. Sustainable agriculture</li> <li>3. Green India (forest and horticulture)</li> <li>4. Solar</li> <li>5. Energy efficiency</li> <li>6. Sustainable habitat (urban transport, solid waste management, rural developments, disaster management, road)</li> <li>7. Tourism</li> </ol>	Acknowledges need of LAPA
Assam	2012	<ol style="list-style-type: none"> <li>1. Sustainable livelihood</li> <li>2. Natural disaster and crisis management</li> <li>3. Health</li> <li>4. Urban planning</li> <li>5. Energy sufficiency and efficiency</li> <li>6. Bio-resource protection and sustainable management of forest and wild life</li> </ol>	Community level engagement for governance and capacity building.
Bihar	2012	<ol style="list-style-type: none"> <li>1. Sustainable agriculture</li> <li>2. Forests and biodiversity</li> <li>3. Water resources</li> <li>4. Sustainable habitat (disaster management, urban development, transport, human health)</li> <li>5. Energy efficiency</li> <li>6. Industries and mining (solar, energy, agriculture and water)</li> </ol>	Specifies partnership and collaborative arrangements with Panchayat Raj Department to develop LAPA at the Panchayat level for implementation of SAPCC for addressing poverty, livelihood and equity concerns
Chhattisgarh	2013	<ol style="list-style-type: none"> <li>1. Agriculture and allied sectors</li> <li>2. Forest and biodiversity</li> <li>3. Water resources</li> <li>4. Water resources</li> <li>5. Urban development</li> <li>6. Transport</li> <li>7. Energy</li> <li>8. Industries and mining</li> <li>9. Human health</li> </ol>	Specifies partnership and collaborative arrangements with Panchayat Raj Department to develop LAPA at the panchayat level for implementation of SAPCC for addressing poverty, livelihood and equity concerns
Delhi	2009-2012	All 7 missions except sustaining Himalayan ecosystem	Acknowledge the need for local and community level adaptation
Goa	n.a	<ol style="list-style-type: none"> <li>1. Sustainable agriculture</li> <li>2. Solar energy</li> <li>3. Enhance energy efficiency</li> <li>4. Water</li> <li>5. Coastal biodiversity conservation, forest</li> <li>6. protection for livelihood of traditional inhabitants and local communities</li> </ol>	Partially mentioned about need for local community participation

Contd...

State	Date	Focus on Eight Missions stated in NAPCC	LAPA
Gujarat	2010-2011	All missions except Sustaining Himalayan Ecosystem	Community participation acknowledged
Haryana	2011	<ol style="list-style-type: none"> <li>1. Forest (Green India Mission)</li> <li>2. Agriculture</li> <li>3. Energy</li> <li>4. Solar</li> <li>5. Water</li> <li>6. Rural development</li> <li>7. Health sector</li> </ol>	Stress on involvement of local bodies and communities for implementation of SAPCC but does not have specific LAPA
Himachal Pradesh	2012	<ol style="list-style-type: none"> <li>1. Agriculture and allied sectors</li> <li>2. Greening Himachal Pradesh</li> <li>3. Water resources</li> <li>4. Solar</li> <li>5. Energy</li> <li>6. Sustainable development</li> <li>7. Programme for rural and urban areas</li> <li>8. Sustaining Himalayan ecosystem</li> <li>9. Strategic knowledge for CC towards carbon smart growth</li> </ol>	Involvement of grass root level institutions for implementation of plans
Jammu & Kashmir	n.a	<ol style="list-style-type: none"> <li>1. Sustainable energy (solar and renewable energy)</li> <li>2. Enhanced energy efficiency</li> <li>3. Sustainable habitat (health, disaster management)</li> <li>4. Green India</li> <li>5. Water</li> <li>6. Sustainable agriculture</li> <li>7. Tourism</li> <li>8. Sustainable Himalayan ecosystem</li> <li>9. Health</li> <li>10. Disaster management</li> </ol>	Neither LAPA nor local governing bodies have been mentioned in the report
Jharkhand	2014	<ol style="list-style-type: none"> <li>1. Agriculture</li> <li>2. Forest</li> <li>3. Health</li> <li>4. Industry</li> <li>5. Mining</li> <li>6. Power</li> <li>7. Urban and transport</li> <li>8. Water</li> </ol>	Neither LAPA nor local governing bodies have been mentioned in the report
Karnataka	2013	<ol style="list-style-type: none"> <li>1. Agriculture</li> <li>2. Water</li> <li>3. Forestry, Biodiversity and wildlife</li> </ol>	LAPA not well mentioned

Contd...

State	Date	Focus on Eight Missions stated in NAPCC	LAPA
		<ol style="list-style-type: none"> <li>4. Coastal zone</li> <li>5. Energy (solar and energy efficiency)</li> <li>6. Urbanisation</li> <li>7. Human health</li> </ol>	
Kerala	2011	All the missions in NAPCC are addressed	Need for local adaptation acknowledged
Lakshadweep	2012	<ol style="list-style-type: none"> <li>1. Solar</li> <li>2. Enhanced energy efficiency</li> <li>3. Sustainable habitat</li> <li>4. Water</li> <li>5. Green India</li> <li>6. Sustainable agriculture</li> <li>7. Strategic knowledge on CC</li> </ol>	Involvement of local communities and local institution of village in decision making and implementation
Madhya Pradesh	2014	<ol style="list-style-type: none"> <li>1. Forest and biodiversity</li> <li>2. Water</li> <li>3. Agriculture and allied sector</li> <li>4. Human health</li> <li>5. Urban administration and transport</li> <li>6. Energy (solar and renewable)</li> <li>7. Industries</li> <li>8. Rural development</li> <li>9. Environment</li> </ol>	Clearly specifies preparation and implementation of gender centric LAPA through Panchayat Raj Institutions (PRIs) for rural development
Manipur	2013	<ol style="list-style-type: none"> <li>1. Ecosystem, biodiversity and livelihood sustainability</li> <li>2. Water</li> <li>3. Sustainable agriculture practices</li> <li>4. Health</li> <li>5. Forest resources</li> <li>6. Enhanced energy efficiency</li> <li>7. Urban planning and sustainable habitat</li> <li>8. Climate change strategic knowledge and information</li> </ol>	Involvement of local communities for implementation
Meghalaya	n.a.	Covers all eight mission	LAPA not mentioned
Mizoram	2012	<ol style="list-style-type: none"> <li>1. Sustainable agriculture</li> <li>2. Sustainable Himalayan ecosystem</li> <li>3. Green India</li> <li>4. Sustainable habitat</li> <li>5. Health</li> <li>6. Solar and renewable energy</li> <li>7. Energy efficiency</li> <li>8. Water</li> <li>9. Strategic knowledge on CC</li> </ol>	Highlights role of local bodies for building appropriate knowledge in relevant institutions for effective adaptation and mitigation actions

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State	Date	Focus on Eight Missions stated in NAPCC	LAPA
Nagaland	2012	<ol style="list-style-type: none"> <li>1. Water</li> <li>2. Energy (solar and alternative energy)</li> <li>3. Green India</li> <li>4. Agriculture</li> <li>5. Forest and biodiversity</li> </ol>	Emphasis on need of LAPA
Odisha	2010	<ol style="list-style-type: none"> <li>1. Agriculture</li> <li>2. Coasts and disasters</li> <li>3. Energy</li> <li>4. Fisheries and animal resources</li> <li>5. Forestry</li> <li>6. Health</li> <li>7. Industry</li> <li>8. Mining</li> <li>9. Transportation</li> <li>10. Urban planning</li> <li>11. Water resources</li> </ol>	LAPA not mentioned
Puducherry	2014	<ol style="list-style-type: none"> <li>1. Solar</li> <li>2. Enhanced energy efficiency</li> <li>3. Sustainable habitat</li> <li>4. Green Puducherry</li> <li>5. Sustainable agriculture</li> <li>6. Water</li> <li>7. Strategic knowledge</li> <li>8. Coastal mission</li> </ol>	Involvement of local government and communities
Punjab	2014	Covers all eight mission of NAPCC	Involvement of local people and communities is mentioned
Rajasthan	2014	<ol style="list-style-type: none"> <li>1. Water resources</li> <li>2. Agriculture and animal husbandry</li> <li>3. Human health</li> <li>4. Forest and biodiversity</li> <li>5. Enhanced energy efficiency</li> <li>6. Urban governance and sustainable habitat</li> <li>7. Strategic knowledge on CC</li> </ol>	LAPA not mentioned
Sikkim	2011	<ol style="list-style-type: none"> <li>1. Water</li> <li>2. Agriculture</li> <li>3. Biodiversity, forest, wild life and eco-tourism</li> <li>4. Urban and rural habitat</li> <li>5. Urban transport</li> </ol>	Involvement of local governing bodies for implementation

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State	Date	Focus on Eight Missions stated in NAPCC	LAPA
Tamil Nadu	2013	<ol style="list-style-type: none"> <li>1. Water</li> <li>2. Coastal area management</li> <li>3. Forest and bio-diversity</li> <li>4. Sustainable habitat</li> <li>5. Sustainable agriculture</li> <li>6. Energy efficiency</li> <li>7. Renewable energy</li> <li>8. Knowledge management</li> </ol>	Partnership and collaborative arrangements with the Panchayati Raj Department to help Gram Panchayats develop participatory gender just LAPA, in addition to their mandate of developing and implementing the village level development plans
Tripura	2011	<ol style="list-style-type: none"> <li>1. Sustainable Himalaya</li> <li>2. Sustainable habitat</li> <li>3. Sustainable agriculture</li> <li>4. Green Tripura</li> <li>5. Strategic knowledge mission on CC</li> <li>6. Solar</li> <li>7. Energy efficiency</li> <li>8. Water</li> <li>9. Health</li> </ol>	Focus on involvement of local community for implementation
West Bengal	2012	<ol style="list-style-type: none"> <li>1. Water</li> <li>2. Agriculture</li> <li>3. Forest and biodiversity</li> <li>4. Human Health</li> <li>5. Energy efficiency and renewable energy</li> <li>6. Sustainable habitat</li> </ol>	Existence of Panchayat Raj Institutions

**Source:** Authors compilation from all SAPCCs of Indian states: (Andaman and Nicobar Islands Union Territory, 2013; Climate Change Department, 2011; EMPRI and TERI, 2013; Environment Protection Training and Research Institute, 2012; Government of Arunachal Pradesh, 2011; Government of Bihar, 2012; Government of Chhattisgarh, 2013; Government of Delhi, 2009; Government of Goa, N.D.; Government of Haryana, 2011; Government of Himachal Pradesh, 2012; Government of Jammu and Kashmir, 2011; Government of Jharkhand, 2014; Government of Kerala, 2011; Government of Madhya Pradesh, 2014; Government of Manipur, 2013; Government of Meghalaya, n.d.; Government of Mizoram, 2012; Government of Nagaland, 2012; Government of Odisha, 2010; Government of Punjab, 2012; Government of Rajasthan, 2014; Government of Sikkim, 2011; Government of Tamil Nadu, 2013; Government of Tripura, 2011; Government of West Bengal, 2012; TERI, 2012; Union Territory of Lakshadweep, 2012; Union Territory of Puducherry, 2014)

under the leadership of Chief Secretary to the Government of Kerala (Government of Kerala, 2011). In Madhya Pradesh, there is a Climate Change Cell that facilitated the formation of SAPCC and also ensured the donor engagement in the project (Jogesh and Dubash, 2014). The steering committee is a common institutional structure in all of the SAPCC examined.

A review by Kissinger and Lee (2013) showed that India has managed to integrate the priorities stated in the National Action Plan on Climate Change (NAPCC) into its development plans. This was revealed in the 12<sup>th</sup> Five Year Plan and also into the sectoral plans. However, the review pinpoints the lack of synchronisation between India's NAPCC of 2008 and the revised agricultural component in NAPCC through the National

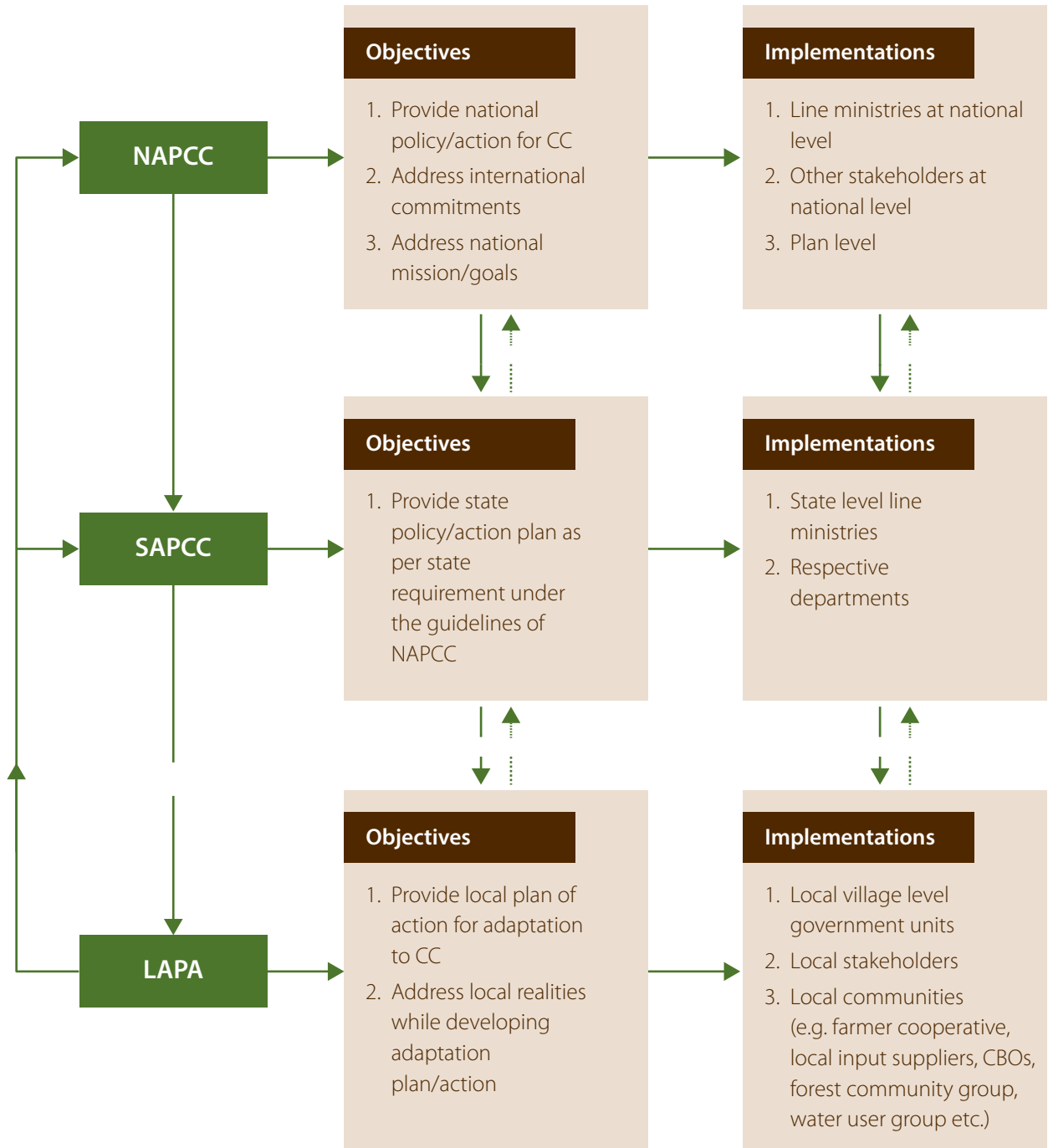
Mission on Sustainable Agriculture in the year 2012. Government of India initiated the integrated assessments that are essential for facilitating the linkage among institutional development, scientific research and policy (GOI, 2012). Although this is one of the modest steps in overcoming the common barrier of lack of cross-sectoral coordination through the integration of adaptation assessments and integrated action plans, this still requires strengthening on all fronts (Kissinger and Lee, 2013). As climate risks differs across geographical location and the adaptive capacity varies depending on local socio-economic situations and resource availability, local adaptation plans of action are essential to address local-level realities (Chaudhury et al., 2014). For the success of SAPCC, India needs adequately trained local stakeholders and their participation at each level of the preparation of adaptation plans (Dhanapal, 2014). The ultimate responsibility of adaptation to climate change falls to local level institutions and thus, the capacity of the local institutions largely influence the adaptation and its impact on mitigating climate vulnerability (Agrawal et al., 2009). Therefore, local adaptation plan of action (LAPA) is essential for the effective design and implementation of adaptation measures addressed in both NAPCC and SAPCC. Most of the SAPCC prepared by the state governments indicates that local level awareness and planning is crucial for effective adaptation to climate change (for details see Government of Bihar, 2012; Government of Chhattisgarh, 2013; Government of Haryana, 2011; Government of Jammu and Kashmir, 2011; Government of Meghalaya, N.D.). This is also found in developed countries like USA and Australia. VCCCAR project report in Australia suggested that adaptation interventions are most successful in those cases where they are designed based on the thorough understanding of local context (Funfgeld et al., 2012). Likewise the study by US Environmental Protection Agency focused on more vulnerable geographic locations, communities and demographic groups in their climate change adaptation programs (EPA-US, 2012). The EPA report also prioritised working with the local tribes for CC adaptation. Adaptation planning of US states is also focusing more on local adaptation (Cruce, 2009). Experiences from South Asian countries also reveal that local level climate change adaptation plan is crucial to understand what people actually do for adaptation and how adaptation to climate change can be made more effective (Chaudhury et al., 2014; GoN, 2011; Kissinger and Lee, 2013; Peniston, 2013; Watts, 2012). Figure 2.2 presents the need for LAPA for the effective implementation of adaptation to climate change at local level in India.

From Figure 2.2, it is clear that there is coordination between national and state levels adaptation actions to climate change. However, this is missing when it comes between state and local levels.





**Figure 2.2:** NAPCC, SAPCC and Need for LAPA in India



**Note:** In this figure, a continuous arrow implies that there is a smooth cooperation between one and the other while a discontinued arrow implies a gap.

This gap is primarily due to the absence of local adaptation plan of action. As a result, the impact of all those efforts carried out through NAPCC and SAPCCs have not fully trickled down to lower level. Therefore, formulation and implementation of LAPA is an essential component to realise the effective adaptation to climate change.

# 3

## Local Adaptation Plan of Action (LAPA) Framework

This framework presents a way to situating adaptation in the local level planning context. With a focus on local climate risks and vulnerabilities, and the local capacities and resources, this framework provides how to assess, prioritise and adopt the best-bet practices in order to reduce vulnerability in the most effective manner. Hence the main objective of this framework is to present an overall structure that will enhance action, coherence, and synergy on adaptation by strengthening and better utilising existing local institutional arrangements and local knowledge. Furthermore, it focuses on how to achieve climate resilience in the local economy in cost-effective manner. Hence, this framework highlights on synergies between different programs and better utilisation of limited resources as crucial measures to achieve financial sustainability of climate change adaptation plans. Given that adaptation plans at national and state levels are already in implementation in India, the LAPA framework needs to incorporate the processes that ensure the integration of local level climate change adaptation into local, state and national planning. Main entry points for LAPA formulation and implementation can vary across the locations and can only be decided after the series of discussion with local community and stakeholders. Hence any sector in the economy, for example, agriculture, forestry, health, water, sanitation, infrastructure, can be the entry points. To engage the local government bodies in each step of LAPA, the governance structure should be aligned with the local level government units. Therefore, in the rural area of India, local village Panchayat (village level) can be the most appropriate operational unit while it can be municipality or wards within the municipality in the urban setting. This framework draws substantially from other studies on climate change adaptation plans and frameworks (FAO, 2014, 2012, 2011; GOI, 2008; GON, 2011; IPCC, 2014, 2007; Lim et al., 2004; The Center for Climate Strategies, 2011; UNDP, 2007, 2010; UNFCCC, 2012a, 2012b) and also from the experiences gained from the different institutions (both national and international) and programs that have been working with farmers in India such as ICAR, KVKs NICRA and CCAFS. This framework will be validated and revised after we carry out some case studies in some states of India.

### 3.1 BRIFFS as a Guiding Principles of LAPA

Comprehensive local adaptation plan of action needs to be developed and implemented properly because it improves not only our ability to adapt to climate change but also economic and environmental security. Therefore, we propose BRIFFS (bottom-up, responsive, inclusive, flexible, forward-looking, and sustainable) as the guiding principle of LAPA in India. Table 3.1 presents the summary of the BRIFFS.

LAPA formulation involves the creation of a set of adaptation policies and measures that are most feasible in responding current and future climate risks and in minimising vulnerability due to such risks. Due to this, new and challenging institutional process are required to judge the adaption processes at different scales (Adger et al., 2005). The LAPA framework needs to ensure that the process of integrating adaptation to climate change at local planning should follow the six basic principles including bottom-up, inclusive, responsive, flexible, forward looking, and sustainable. Following bottom-up principle in LAPA reduces

**Table 3.1:** BRIFFS as the Guiding Principles of LAPA

Principles	Meaning	Pathway for achievement
Bottom-up	Involve local communities and stakeholders to identify local climate challenges, to assess what local people's needs to adapt to those challenges and whether the resources are available for the action	Assessing local needs in consultation with local communities and stakeholders; identify the entry sectors i.e., the most vulnerable sector to climate risks
Responsive	Immediate, efficient and effective delivery of adaptation services to vulnerable communities	Prepare local action plans and integrate with state and national plans; develop adaptation service delivery plans in consultation with local communities and stakeholders and provide such services when necessary; delegate responsibilities to specific groups or institutions so that there is clarity of tasks.
Inclusive	Include local communities in development planning so that people with different adaptive capacity in terms of their ownership and access to resources are involved in the process	Identify and ensure the participation of the resource poor people in development planning; reconcile autonomous and planned adaptation; acknowledge the highly differentiated nature of adaptive capacity at local level and plan accordingly
Flexible	To accommodate new challenges/ risks in a short period of time	Mobilise appropriate service delivery agents necessary for the implementation of LAPA
Forward looking	To project and address future climate related issues	Assessing future climate related uncertainties by working closely with state agricultural universities and local agricultural and meteorological departments; mobilise Climate Science Research Fund mentioned in NAPCC to project the future climate risks and its progression
Sustainable	To be sustainable financially and socially	Integrating LAPA to SAPCC and NAPCC; assess cost-effectiveness of each adaptation plans and compare it with its alternatives; make plans to ensure that possible international funds can be mobilised for example, seek for CDM fund when the adaptation measures have mitigation co-benefits; garner support for governance reform and capacity development at local level; using business case models as proposed in climate smart agriculture can help improve financial sustainability as well as design economic incentives to achieve this.

maladaptation that may arise due to the gap between local needs and the perceptions of the planners at the state level. Hence the involvement of local communities and stakeholders in identifying local climate risks and its impacts on them, and also what could be done in order to reduce their vulnerability. Bottom-up approach thus focuses on engaging local partner organisations at all levels of LAPA. Inclusive planning is important for ensuring the participation of different stratum of the community including those who are at most risks and thus, it should properly address the problem of social exclusion. Ensuring the participation of the poorest, the marginalised groups and women will improve the planning process

and reflect the view of the most vulnerable people. Active and early engagement of local stakeholders in LAPA formulation is a key to successful implementation of LAPA because this increases the ownership of LAPA by local stakeholders making them more responsible to it. Responsiveness is essential to ensure prompt action and effective delivery of services. This can be achieved if the responsibilities are delegated properly and the measures are taken with local needs. In this case, local government needs to look for a proper balance between acting on their own and providing enabling conditions and incentives for other local stakeholders to come forward to act (Kissingger and Lee, 2013). LAPA should not only be flexible but also forward looking as climate change adaptation is a process and can change substantially over time. Therefore, it needs to be taken as dynamic planning and hence it requires mobilisation of resources for future research.

Sustainability of the adaptation to climate change is an important principle while making LAPA framework. This ensures that the adaptation measure taken is the cost-effective measures among the available measures. As adaptation to climate change can be very costly, the mechanism to fund it needs more attention. Therefore, utilising local resources, national funding possibilities, and international funding possibilities should be taken into consideration. This is particularly the case for the developing countries that have less resources but several competing programs to implement.

## 3.2 LAPA Steps

The LAPA steps discussed here are more general and need to be adapted to location while developing the LAPA at a specific village, community or municipal wards. Modification may also require as per the sector under consideration and problems need to be addressed (GON, 2011; Kissingger and Lee, 2013; LEAD-Pakistan, 2012; Lim et al., 2004). As there are multiple ways of adapting to climate change, no single blue print can capture all facets of local adaptation plans (Agrawal et al., 2009; Funfgeld et al., 2012; Kissingger and Lee, 2013). In addition, LAPA structure and focus can be different based on climate risks that need to be addressed and operational unit i.e., village, municipal wards or community. However, the key procedure in LAPA are similar in most cases. We propose nine steps for LAPA formulation and implementation. In each step, we recommend to follow BRIFFS wherever possible. Table 3.2 summarises the major steps for LAPA formulation and implementation along with the actions/activities and tools to achieve the actions under each step.

### Step 1: Communicating CC risks and adaptation measures at local level

While formulating LAPA, the first step is to communicate the information related to climate change and its potential risks to the local people, local planners, and communities. In addition, it is important to communicate the information on how adaptation can reduce the adverse impacts of climate change. Defining the major climate risks and possible adaptation measures helps to define the scope or boundary of the adaptation actions in the particular context. Without this, adaptation to climate change can be abstract, complex and subjective issue and becomes difficult to know where and how to start the adaptation action. One of the major ways to communicate the climate change risks and adaptation measures is the sensitisation of the stakeholders. Sensitisation of local stakeholders can be done with the help of multi-disciplinary team with knowledge on diverse impacts of climate change. This team helps sensitise the impact of climate change on different sectors such as human health, agriculture, natural resources, water, forest and overall livelihood of the local people and also disseminate knowledge on how to minimise the adverse impact with proper adaptation measures. In a country like India, where most of the people use mobile phones, sending message

**Table 3.2:** LAPA Steps, Actions/Activities and Tools

Steps	Actions	Tools
1. Communicating CC risks and adaptation measures at local level	<ul style="list-style-type: none"> <li>• Carry out climate change sensitisation related actions at local and district levels</li> <li>• Increase local awareness of climate risks</li> <li>• Ensure smooth flow of information arising at various stage of LAPA</li> <li>• Facilitate formulation and implementation of adaptation action at local and district level</li> <li>• Garner support for the adaptation activities and ensure the engagement of local stakeholders</li> </ul>	<ul style="list-style-type: none"> <li>• Multi-disciplinary team to communicate climate change, risks and adaptation</li> <li>• Sharing of knowledge, skill and practices of local communities and stakeholders in adaptation</li> <li>• Climate hazard trend analysis</li> <li>• Cause and effect analysis</li> <li>• Use of mobile phone or ICT based system for disseminating information on climate risks and adaptation measures.</li> <li>• Awareness campaigns (posters, street drama, songs, essay competition, eco-club etc.)</li> </ul>
2. Assessment of climate risks and vulnerabilities and scoping of adaptation actions	<ul style="list-style-type: none"> <li>• Identification of climate vulnerable communities and sectors and set a boundary to implement the adaptation programs</li> <li>• Identification of adaptation practices and actions</li> <li>• Develop community or village profile</li> <li>• Combine both top-down and bottom-up approach</li> </ul>	<ul style="list-style-type: none"> <li>• Observation walks</li> <li>• Key informants survey</li> <li>• Make seasonal calendars using FGDs</li> <li>• Vulnerability analysis using community risk mapping</li> <li>• Hazard, impact and response analysis</li> <li>• Climate adaptation capacity assessment</li> </ul>
3. Prioritisation of adaptation options	<ul style="list-style-type: none"> <li>• Assess the need of most vulnerable communities and household</li> <li>• Prioritise urgent and cost effective adaptation activities</li> </ul>	<ul style="list-style-type: none"> <li>• Use of optimisation approaches such as cost-benefit analysis (CBA), cost-effective analysis (CEA) and multi-criteria analysis (MCA)</li> <li>• Use of uncertainty approaches such as no regrets, low regrets, adaptive management and risk management</li> </ul>
4. Formulation of LAPA	<ul style="list-style-type: none"> <li>• Formulation of plan of action for prioritised and identified issues</li> <li>• Identification of areas for implementation</li> <li>• Identification of local service provider and involve them in implementation of adaptation plan</li> <li>• Estimate cost and allocate budget for implementation of adaptation plan of action</li> <li>• Formulation of monitoring procedure for each action</li> </ul>	<ul style="list-style-type: none"> <li>• Feasibility study</li> <li>• Service provider analysis</li> <li>• Collection of information</li> <li>• Use of tools like cost-benefit analysis, cost-effectiveness analysis</li> <li>• Logical framework</li> </ul>

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Steps	Actions	Tools
5. LAPA integration in planning process	<ul style="list-style-type: none"> <li>Integration of LAPA adaptation plan in sectoral, local, state and national level planning</li> </ul>	<ul style="list-style-type: none"> <li>Institutional analysis to identify prospective partners at different level</li> </ul>
6. Institutional arrangements to implement LAPA	<ul style="list-style-type: none"> <li>Clarify the roles and responsibilities of each individual stakeholders and coordinating local institutions</li> <li>Identification of different national and international stakeholders for the implementation of adaptation plan</li> </ul>	<ul style="list-style-type: none"> <li>Organisational analysis of LAPA focusing on structural and political aspects</li> <li>Sharing of information</li> <li>Institutional analysis to identify prospective partners</li> </ul>
7. Implementation of LAPA	<ul style="list-style-type: none"> <li>Conduct training workshop for respective stakeholders identified for implementation of adaptation at local level</li> <li>Delegation of roles and responsibilities to them</li> </ul>	<ul style="list-style-type: none"> <li>Implementation design analysis to evaluate mainstream approach</li> <li>Scoping analysis for LAPA (being clear on boundary or operating space)</li> <li>Training and simulation systems</li> </ul>
8. Progress assessment of LAPA	<ul style="list-style-type: none"> <li>M&amp;E of the progress of LAPA</li> <li>Assess change in indicators and compare with baseline information</li> <li>Assess whether targets are met on time</li> <li>Monitor process and capacity building overtime</li> <li>Ensure whether the progress is reported timely or not</li> </ul>	<ul style="list-style-type: none"> <li>Individual and institutional learning and capacity building</li> <li>Self-monitoring and evaluation</li> <li>Behaviour change analysis</li> <li>Assessment of adaptation activities</li> <li>Impact assessment</li> <li>Shared learning dialogue</li> </ul>
9. Feedback and revision	<ul style="list-style-type: none"> <li>Develop proper feedback mechanism for dissemination of progress, constraints, limitation and improvement area information for the review and revision of whole process to address new challenges</li> </ul>	<ul style="list-style-type: none"> <li>Adjustment of current decision making models</li> <li>Share the need for transformational change of institutions and sectors to reflect the changing climate risks</li> <li>Sharing of progress assessment analysis</li> <li>Alternative adaptation feasibility analysis</li> <li>Dialogues with community and vulnerable groups and local stakeholders</li> </ul>

**Note:** Actions and tools are compiled by authors from several sources including (Bours et al., 2013; Funfgeld et al., 2012; The Center for Climate Strategies, 2011; UNDP, 2007, 2010; UNFCCC, 2012).

through mobile phone can be one of the effective methods to disseminate the information related to climate risks and possible adaptation measures. Use of use of existing institutional systems such as KSS can be a cost-effective way to sensitise the climate change related information in the local community.

Communicating climate change risks and adaptation information also helps to identify local institutions that can implement particular adaptation actions. Such a sensitisation at local level helps us to achieve the following objectives:

- Increase awareness of local stakeholders about climate change risks and also enhance ability to manage household-specific risks.
- Garner support for the need of adaptation actions at local level and engage local stakeholders in each steps of LAPA formulation.
- Identify local institutions and their roles and responsibilities in different stages of LAPA formulation and implementation.
- Enhances local adaptation capacity through sharing of knowledge and information among the different stakeholders.

## Step 2: Assessment of climate risks and vulnerabilities and scoping of adaptation actions

Assessment of major climate risks and vulnerabilities at the respective community/village/municipal ward is very important for identification and scoping of adaptation actions. Understanding current climate risks and its impacts on local community facilitates the scoping of the adaptation actions i.e., where and how to implement the LAPA. Sufficient knowledge on current climate risks provides a basis for developing adaptation strategies to manage future climate risks rather than collecting baseline climate data and perturbing that data using alternative scenarios of climate change (Jones and Boer, 2004). Engagement of local stakeholders is very crucial at this step as they can identify the boundaries of different adaptation actions that are crucial to make decision on the entry point of LAPA. Climate risks can be assessed by preparing community/village/municipal ward level risk mapping in each seasons or over a timeline. However, vulnerability assessment depends on the community's or individual household's adaptive capacity as well as to the exposure and sensitivity of climate risk. This requires the analysis of current and future climate risks and the current socio-economic conditions and future prospects of the village under study. Hence, vulnerability can vary widely across communities and sectors; thereby requires careful assessment. Downing and Patwardhan (2005) suggested the five activities that a vulnerability assessment team to follow while preparing vulnerability assessment. Table 3.3 summarises these activities.

The activities mentioned in Table 3.3 facilitates to identify the village/community/municipal ward that are highly vulnerable to climate change and also to identify adaptation actions that can reduce vulnerability to the climate risks. In addition, it supports the mobilisation of resources to reduce climate vulnerability through public awareness and through better adaptation policy based on vulnerability to climate risks.

## Step 3: Prioritisation of adaptation options

There are several ways to prioritise adaptation options. Some methods rely on discussion with stakeholders using a simple check list while others uses complex software applications (Funfgeld et al., 2012; The Center for Climate Strategies, 2011). UNFCCC compendium on methods and tools presented



**Table 3.3:** Activities for Vulnerability Assessment

Activities	Description/Actions
<b>Activity 1:</b> Structuring the vulnerability assessment: Definitions, frameworks and objectives	Clarify the conceptual framework and analytical definitions of vulnerability to be used for the assessment; review existing regional and national assessment relating to vulnerability for example, national development plans, natural hazard assessments, and poverty reduction strategy papers and see whether there is any common approach that can be used as a reference, and if not, develop own framework and set what are the objectives of the assessment.
<b>Activity 2:</b> Identifying vulnerable groups: Exposure and assessment boundaries	Define the system chosen for the assessment, including who is vulnerable, to what, in what way, and where. System characteristics to be defined include sectors, stakeholders and institutions, geographical regions and scales, and time periods.
<b>Activity 3:</b> Assessing sensitivity: Current vulnerability of selected system and vulnerable groups	Understanding of the process by which climate outcomes (e.g. hydrological/meteorological variables) translate into risks and disasters including identification of points of intervention and options for response to vulnerability.
<b>Activity 4:</b> Assessing future vulnerability	Develop qualitative understanding of drivers of vulnerability; understand possible future vulnerability i.e., what shapes future exposure to climate risks? And at what scales?; including ways in which planned or autonomous adaptation may modify climate risks.
<b>Activity 5:</b> Linking vulnerability assessment outputs with adaptation policy	Relating vulnerability assessment outputs to stakeholder decision-making, public awareness and further assessments.

48 different adaptation decision support tools (UNFCCC, 2012b). The methods and approaches used for prioritising adaptation options are not mutually exclusive and in practice, it is prudent to blend them to best suit the local needs (UNDP, 2010). In LAPA, it is often useful to combine expert based evaluation as well as community participatory evaluation of adaptation options. Adaptation options can be prioritised on the basis of climate risks and vulnerability of the respective community (The Center for Climate Strategies, 2011).

Generally, decision-making approaches can be classified into two categories: optimisation approaches and uncertainty approaches. Optimisation methods includes cost-benefit analysis (CBA), cost-effectiveness analysis (CEA), and multi-criteria analysis (MCA) that are commonly used decision support tools while comparing and prioritising various adaptation options. Uncertainty approaches includes four major methods: no regrets, low regrets, adaptive management and risk management. These four methods are not tools for selecting/prioritising an adaptation actions directly, but this facilitates the decision-makers to identify adaptation actions that could be appropriate to adapt to climate change (The Center for Climate Strategies, 2011). Table 3.4 provides a summary of these approaches that could be used for prioritising adaptation options.

#### Step 4: Formulation of LAPA

Prior to the formulation of LAPA, the entry point or operational unit of LAPA and the sector in which LAPA will be implemented need to be clearly defined. LAPA formulation provides the overall framework or roadmap to



**Table 3.4:** Approaches to Prioritise Adaptation Options

Approaches	Descriptions
<b>1. Optimisation Approaches</b>	
Cost-benefit analysis (CBA)	Compare benefits and cost in common metric to maximise net benefits; difficult to apply in the case of climate change adaptation due to high uncertainty about how climate will change and what the impacts resulting from these changes will be.
Cost-effectiveness analysis (CEA)	Compare alternatives that are expected to achieve the same or a similar or comparable goals or benefits; as the benefits are same, alternative are compared based on relative costs of achieving common outcome to determine which option has the least cost; easier to apply than CBA as the value of benefits does not need to be estimated.
Multi-criteria analysis (MCA)	Represent a suite of decision support tools that are able to assess the benefits resulting from adaptation actions which cannot be measured in quantitative terms; the analyst or stakeholders specify the range of activity objectives, corresponding attributes and the relative weight to each attribute; different social and environmental attributes and indicators can be used because these indicators need not be expressed in monetary terms: comparing and ranking of adaptation options are done based on how well they satisfy multiple criteria; need to be careful on the scores and weight to each indicators or attributes because these can be manipulated in order to favor certain adaptation options relative to others.
<b>2. Uncertainty approaches</b>	
<i>Identification of adaptations</i>	
No regrets adaptations	Adaptations justified under current climate and more justified under climate change; climate change is not needed to justify this adaptation action and even if there is no climate change, there is no regret in adopting this; for example, use of market mechanism to allocate water supplies or removing subsidies that encourage risky behavior.
Low regrets adaptations	Adaptations justified only if climate change; taking an adaptation actions that would not be done if there was no climate change; adaptation costs or other impacts of this actions are relatively modest; for example, purchasing inexpensive insurance related to climate risks.
Adaptive management	Adaptations can be justified for new information; rely on monitoring and new science; it is not a process for selecting specific adaptation actions but encourages to select adaptation actions that can be adjusted over time; for example, building a sea wall where the height may be raised in the future when needed due to sea level rise.
Risk management	A process by which risks area identified, assessed and then managed as needed; consider consequences and probability of outcomes in setting priorities for vulnerabilities to address

Contd...

Approaches	Descriptions
<i>Adaptation selection approaches</i>	
Triple bottom line	Consider financial, environmental and social bottom lines; in financial bottom line, revenue should exceed the cost; the environmental bottom line considers the impact of decisions on environment such as degradation or conservation of natural resources; social bottom line refers to the functioning of the society and societal system including equity, healthy life etc.; adaptation options can be compared based on the relative impacts on each bottom line.
Robust decision making	Select adaptations that provide sufficient benefits under all outcomes (climate change scenarios) of future conditions; decisions should be robust against a wide variety of scenarios.
Portfolio management	Spread risk by investing in suite of adaptations that provide complementary benefits under different conditions.
Regrets analysis	Invest in adaptations that best avoid worst or unacceptable outcomes.
Multi-attribute decision making	Aims to establish the very best adaptation actions based on local attributes and context.

Source: Adapted from 'The Center for Climate Strategies (2011)'.

implementing prioritised adaptation actions in the identified sectors. Hence, setting milestones, targets and a process to monitoring and evaluation is crucial in the formulation of LAPA. To ensure the smooth financing of LAPA, robust resource mobilisation mechanisms for climate change adaptation should be developed. This also requires proper structure to ensure that the fund flows to the most vulnerable communities and the local implementing entities receive both financial and technical support when necessary. Therefore, several rounds of workshops with all the stakeholders including local government agencies need to be carried out during its formulation. Table 3.5 summarises the major activities to be followed while formulating LAPA.

### Step 5: LAPA integration in planning process

Integration of LAPA into the development planning process of the nation and the state is crucial for its sustainability, reduction of implementation costs, and legitimacy of LAPA. Furthermore, local climate change adaptation also contributes to improved governance and poverty reduction co-benefits. LAPA also promotes new forms of partnership that is required for the local development. As a process to align NAPCC and SAPCC with the national development planning has already been initiated in India, this experience will certainly help to bring this process down to village or municipal ward level. In view that climate change adaptation is a long-term process, LAPA will not be sustainable if it is not integrated into long-term national and local development plans. Relying only on international donor assistance may not generate sufficient funds for implementing LAPA and thus, developing mechanisms to generate domestic funding for financing LAPA is crucial. Use of some economic instruments such as taxes, charges or other fiscal mechanisms can serve both as adaptive measures as well as fund generating process. However, this requires the capacity building of local level institutions that implement LAPA.

Integrating LAPA into various levels of national planning will not only institutionalise it as a part of development planning process but also initiates the processes of recognising climate adaptation and resilience while

**Table 3.5:** Main Activities to Formulate LAPA

Approaches	Descriptions
Define sector to implement and beneficiaries	Climate change will affect several sectors and location in the village. However, all these cannot be addressed at once and thus, prioritised based on impact or level of vulnerability. Therefore, the prioritised sector and areas, where adaptation action will be implemented and who are the primary beneficiaries, should be clearly mentioned.
Define adaptation actions	The adaptation actions need to be clearly defined for the specific location with the help of local stakeholders including local government bodies.
Define approach to formulate and implement LAPA	Clearly define what approach will be used to formulate LAPA and the approach to implement it. Use of participatory approach can capture and translate the complex and varied nature of local information into effective LAPA formulation. For implementation, LAPA needs to follow cooperative approach with local government institutions. This is mainly because legitimacy of LAPA will be high in the official government system if it works in cooperation with local government institutions.
Specify the implementing agency at local level	This can be any local institution that works in development or can be village council with the support from local governmental and civil society. Identifying different service providers and engaging them for implementing activities under LAPA can improve the responsiveness and flexibility of LAPA.
Specify time to implement and targets and timeline	Adaptation actions can be of varied nature and thus, can take different length of time to implement. Some adaptation actions may be related to design laws and regulation to guide, restrain or reward specific actions while others are related to infrastructure or capital works such as modification of existing roads or public utilities structure.
Estimate the cost	Financing LAPA is very crucial and thus, estimation of costs needs to be done properly. While estimating costs, we also need to regularly assess the availability of funds and its sources.
Specify the process to monitor progress	Set a system in the plan to monitor the progress periodically.
Specify how to revise as per the situation	As impacts of climate change is uncertain and thus, level of vulnerability might change, therefore LAPA need to be flexible and forward looking. Hence a continual process revision should be built-in the formulation of LAPA.

developing sectoral activities of development plans. Such an integration facilitates LAPA to coordinate with all local entities including governmental, non-governmental and private and mobilise them in addressing climate challenges. Local government entities are the best operational unit for integrating LAPA into development planning. Although there are several cross-sectoral and cross-cutting issues to be dealt for climate change adaptation, initiating integration of LAPA to development planning can be done by sector. For example, if agriculture is the most vulnerable sector in a certain village, then the adaptation options identified in LAPA can be integrated with local agricultural department. In this case, entry point is the agricultural sector. Table 3.6 presents the steps for integrating LAPA into development planning process.

**Table 3.6:** Processes to Integrate LAPA into Development Planning

Processes	Descriptions
1. Identify sector to integrate or entry points	Although adaptation actions might be essential in several sectors in a village or any local operational unit, specific sectors are prioritised in a LAPA. Clear identification of the sector is the first step required to initiate the integration process of LAPA with local development planning.
2. Review the existing local development plans and see how LAPA contributes to it	After identifying the sector, a comprehensive review of the activities in local development plans is required to know whether the adaptation actions are included in the plan and if not, how to integrate it.
3. Prepare the village level adaptation plans	After reviewing the local development plan in the sector where LAPA focused, prepare the adaptation plans by aligning it with local development planning. Ensure that it follows the BRIFFS principle in the preparation process. Dialogues/discourses and shared learnings will facilitate the process of preparing LAPA.
4. Present LAPA to respective local development planning unit and proceed for implementation with their cooperation	Present LAPA to respective local development planning unit and if necessary to ratify, proceed for this. Regular discussion and feedback on the process facilitates the integration and effective implementation.

## Step 6: Institutional arrangement to implement LAPA

Prior to implementation of LAPA, the institutional arrangement to implement LAPA needs to be clearly defined. Effective implementation of LAPA requires efficient local governance along with the engagement of civil society. In Nepal, LAPA is mostly integrated with district development planning but implemented by community based organisations (CBOs) and community mobilisers at the village development committee (GON, 2011; Peniston, 2013). In the existing institutional set up in India, village panchayat or municipal wards can be the potential institution that can implement LAPA in cooperation with some community based organisations. However this can vary depending on the location and the problem. In view of natural resource management under changing climate, a mechanism to work together with adjacent communities/ village/municipal wards in some cases of adaptation works should also be made possible (Peniston, 2013).

## Step 7: Implementation of LAPA

Local unit, for example, the village council or any local institution can implement LAPA. The implementing institutions can vary depending upon the priority sector where the LAPA focuses. In all cases, adaptive governance at local level is one of the important components required to implement LAPA. Delegation of powers and clear allocation of responsibilities are needed in order to act promptly and in a responsive manner. More flexible organisational structure can add on to this. Another crucial aspect is the coordination among different local entities and the respective government agencies, and effective participation of stakeholders while implementing LAPA. In addition, using business cases as a part of LAPA implementation strategy can help to identify the adaptation measures that have clear economic benefits along with climate change adaptation benefits. In the cases where there is clear benefits, private sector would be interested to implement such components under LAPA. For example, use of laser land leveling rather than traditional land leveling has economic advantage to both farmers and service providers along with climate change

adaptation benefits (Aryal et al., 2015; Jat et al., 2015). In order to implement LAPA properly, we need to focus on following issues:

- Stakeholders participation in implementing LAPA
- Proper institutional structure at local level for LAPA implementation
- Define clear responsibility for implementing each activity and also for oversight and coordination
- Set up proper mechanism necessary to ensure flexibility as well as responsiveness in the LAPA implementation
- Efficient adaptation service delivery
- Establish outcome-based monitoring mechanism for improving adaptive capacity and climate change governance at local level
- Follow proper decision making analysis before implementing any adaptation actions.

### **Step 8: Progress assessment of LAPA**

The major objective of LAPA is to improve the local adaptive capacity and to reduce the vulnerability of local populations and the natural and economic systems to climate change and its impact. As climate risks are increasing over time in terms of its intensity and impact on human and natural systems, new ways of adaptations are required to tackle such risks. Consequently, adaptation is not an outcome but an ongoing process that consists of a diverse suite of social, environmental, institutional and technical components. Therefore, one way of assessing the progress of LAPA can be done usually based on the multiple indicators, targets met within time proposed, and comparison with the baselines. For this, a mechanism need to be established to monitor change overtime. This can also be on the effective delivery of the services, generation of new knowledge and capacity development of local institutions working in adaptation actions.

LAPA supports the development planning process by providing information that are necessary to make it more climate responsive. Hence, this can also be assessed based on the long-term achievement of local development goals that are sensitive to climate change (UNDP, 2007). However, progress assessment of adaptation actions under LAPA should also consider the issues like attribution, relevance and calibration as in other projects impact assessments. Monitoring and evaluation (M&E) in this case can provide opportunities for learning and further improvement through feedback mechanism.

### **Step 9: Feedback and revision of LAPA**

Implementation of LAPA is an iterative process. It is a dynamic planning rather than a static one and hence, requires continual revision and reformation based on new scientific evidences and learning by doing methods. Therefore, a proper feedback mechanism is a crucial component for the long-term success of LAPA. For example, LAPA design process in Nepal is strong enough in using participatory process in both formulation and implementation, while there is no mechanism to look for and incorporate available scientific knowledge into planning and decision making process (Peniston, 2013). However, incorporating scientific knowledge and available evidences can considerably improve the quality and usefulness of LAPA. This also transforms our LAPA to rely more on evidence based planning rather than simple statements of perceived climate risks.

# 4

## Guidelines to Mainstream CSVs in LAPA Framework

Climate change adaptation is neither a simple nor a static process because of inherent uncertainties related to its impacts on multiple sectors and increasing variability over time and space. A business as usual approach in terms of designing policies, developing and refining technologies and providing extension and support services is not likely to result in effective adaptation to climate change and mitigate vulnerabilities of people to climate risks. Hence, it urges for greater participation of multiple stakeholders from affected community including the youth and women and the integrated efforts from multiple sectors and institutions. Consequently mainstreaming climate change is now widely promoted as a more effective approach than stand-alone interventions on climate change adaptation. In its broadest sense, climate change adaptation requires incorporation of climate change considerations into public policy and practice, at all planning levels, across all sectors and involving public, private and civil society actors.

Although several alternative adaptation measures can be suggested for implementation, it may have prohibitive costs and thus, cannot be realised in practice. Therefore, there is a need to generate synergy among the adaptation efforts that are carried out from different institutions. The major notion behind the mainstreaming CSVs in LAPA frameworks rests on the principle of sustainability and adaptive governance. In the context that some of the state governments in India has already called for scaling out CGIAR's climate smart village program, it is better to mainstream CSVs in LAPA (World Bank, 2015). For example, the Government of Haryana has already declared to implement 500 CSVs<sup>2</sup> in Haryana state. Furthermore, CSV is a broader concept than it is used till now. As a village comprises of different sectors and multiple challenges related to climate change, it needs to address all the sectors to be called as a climate smart village. Hence, it should not only focus on climate smart agriculture but also climate smart infrastructure, health systems, and natural resource management. Moreover, in view of the economic growth of India and rapid transformation of village economy, agriculture may or may not remain as the major sectors in all the regions. Such a transformation calls for the shift in our focus from agriculture to natural resource management, infrastructure and human health.

Given that CSVs emphasise on CSAPs that have climate change adaptation, mitigation and food security benefits, it contributes to LAPA objectives of effective adaptation with mitigation co-benefits and poverty reduction in the face of climate uncertainties. Recent studies in India have documented the climate change adaptation and mitigation benefits of several climate smart agricultural practices such as laser-assisted precision land leveling (Aryal et al., 2015a; Jat et al., 2015) and conservation agriculture such as zero-tillage (Aryal et al., 2015b; Sapkota et al., 2015). Up scaling of CSAPs is one of the major objectives of CSVs and is relevant in the existing economic situation in India. Despite the higher economic growth, agriculture sector including farming, livestock, forestry and fisheries provide livelihoods to 480 million people in India (UNESCAP, 2012). India accounts for almost 16% of agricultural GDP and 20% of total global public

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<sup>2</sup> <https://cgspace.cgiar.org/bitstream/handle/10568/67260/Haryana%20letter.pdf?sequence=1>

**Table 4.1:** Major Steps to Mainstream CSVs into LAPA

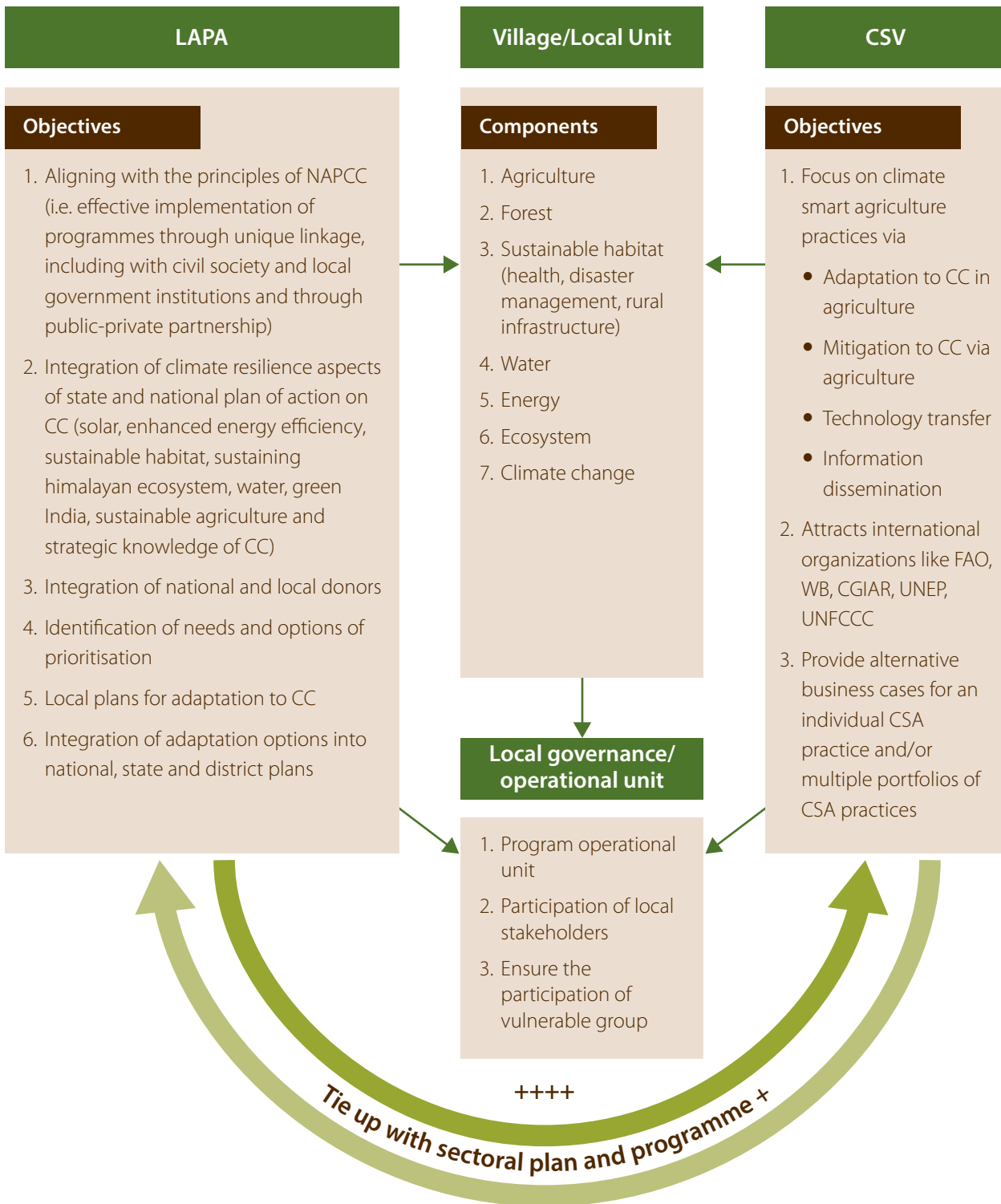
Processes	Descriptions
1. Assess the common elements of CSV and LAPA	Assess the major components of CSVs that can contribute to LAPA to achieve its objectives. Climate smart agriculture, the focus area of CSVs up to now, can be one major area where CSVs can contribute to LAPA. At the initial level, CSV can be considered as major components of LAPA where local community prioritises that agriculture is one of the most vulnerable sectors to climate change.
2. Discourses/dialogues between CGIAR institutions such as CIMMYT-CCAFS, multiple stakeholders from CSVs and local level policy makers	Dialogue with local level policy makers at multiple governmental institutions, and local stakeholders especially in those states where CSV have been successfully implemented. Interactions between CCAFS staffs and the local level policy makers can facilitate the process.
3. Establish village or local body (council) for coordinating LAPA and CSVs	Set up a local unit for coordinating LAPA and CSVs. This can be done using participatory methods including lead farmers from CSVs, key input or service delivery units, local government bodies and other local institutions like farm cooperatives and other NGOs
4. Design of mainstreaming plans in each sector	Inform the local people about the common basis of LAPA and CSVs and their operating space at local level. Also clarify them that integrating these two programs will bring synergy while reducing costs and maximises benefits from adaptation to climate change.
5. Local governance for LAPA and CSVs	Improve governance at local level by reconciling autonomous and planned adaptation. This will contribute towards minimising the ostensible gap between adaptation 'by the people' and adaptation 'for the people'. In many of the CSVs climate change adaptation is autonomous and mostly carried out by individual farmers.

agricultural research expenditures (Beintema et al., 2012). As a result, it is crucial to develop strategies to enhance adaptation capacity in agriculture sector (Rosenzweig and Tubiello, 2007).

On this pretext, mainstreaming CSVs into LAPA enables the local farmers to better adapt to climate change primarily in agriculture and natural resource management such as land and water. In CSV, technologies are prioritised based on local vulnerability and capacity. This is also one of the important steps in LAPA formulation and thus, it is not meaningful to execute these two programs separately. Furthermore, for both CSV and LAPA, the operational unit will be the same. Consequently, they work with same local stakeholders in the specific location in order to identify risks, define vulnerable communities, identify and prioritise adaptation options and setting time-bound targets. Therefore, we propose to mainstream CSVs into LAPA and to operate it through the same local institution. The major steps to mainstream CSVs into LAPA are summarised in Table 4.1.

Identifying and/or establishing local level entities to coordinate and implement LAPA contributes to align adaptation actions undertaken within LAPA and CSVs with local government plans and priorities. Such a mechanism at local level reduces duplication of the same efforts by different institutions and creates synergies among the adaptation programs to be implemented by different organisations at local level. Enhanced coordination across the programs and institutions minimises the cost of adaptation actions

**Figure 4.1:** Synergy and Governance of CSVs and LAPA at Local Level



Note: ++++ refer to climate change adaptation, greenhouse gas mitigation, food security and overall livelihood security.

through better utilisation of resources. Furthermore, the local level entities can play crucial role in sensitising the importance of climate change adaptation at various levels of governances and mainstreaming CSVs into LAPA. Figure 4.1 shows how this integration results into synergy and the governance of CSVs and LAPA at local level.



# 5

## Conclusion and the Way Forward

Climate change adaptation is essential as mitigation alone cannot reduce vulnerability to climate change. This is primarily due to the fact that past emission is already at a level that will continue to have impacts for several decades to come. However, climate change adaptation differs by sectors and location and thus, adaptation at national, regional and state level would not address the sector and location-specific issues related to climate change. In addition, adaptation requires substantial cost. As a result, it is prudent to integrate adaptation programs and plans with national development planning at various levels. In the case of India, as the country has already implemented national and state level plans for climate change and also successfully integrated those plans with the national development plans, there is a need to bring this down to local level planning. On the one hand, this will reduce the cost of the program design and implementation by converging the program and creating synergy effects and on the other, it protects the local community from maladaptation through addressing the local problem with the involvement of local partners. Another important issue for LAPA is the sustainability of the program. For this, the major issue is funding and capacity building. Therefore, there should be continual review for the identification of both domestic and international sources for funding LAPA. Mainstreaming CSV into the broader framework of LAPA provides an opportunity to bring international funding for its financing and also capacity building to further improve and implement LAPA. This is practical for climate change adaptation at local level because local governance unit or operating space is the same for both LAPA and CSV.

An important issue for the successful implementation of LAPA is the political economy context. As climate change adaptation requires a more coherent and long-term approach, downward accountability and adaptive institutions are to be in place. This is because if the political economy is not conducive to promote accountability, even the best adaptation plans will fail to achieve the intended goals. As implementation of LAPA is the responsibility of the local level authorities, success of LAPA depends on their capacity to plan, coordinate and implement the adaptation measures. Therefore, enhancing downward accountability, promoting local capacity for planning and implementation, and improving the coordination across the different local institutions and also between local, state and national level adaptation planning processes are critical for successful implementation of LAPA.



# Annexures

## Annexure 1: Climate Smart Villages (CSVs) and Climate Smart Agricultural Practices (CSAPs)

### 1. Climate smart villages: concepts and status in India

Climate smart villages are sites where researchers from national and international organisations, farmers' cooperatives, local government, community leaders, private sector organisations and key policy planners come together to identify the climate smart agriculture interventions that are most appropriate to tackle the climate challenges in the agriculture sector in the village. It works to enhance the achievement of national food security and development goals. The CSV adopts a portfolio of interventions that cover the full spectrum of farm activities. Climate Smart Agricultural Practices (CSAPs) include water smart practices (rainwater harvesting, laser land levelling, micro-irrigation, raised bed planting, crop diversification, alternate wetting and drying in rice and direct seeded rice), weather smart activities (ICT-based agro-met services, index-based insurance, stress tolerant crops and varieties), nutrient smart practices (precision fertilizer application using Nutrient Expert decision support tools, GreenSeeker and Leaf Color Chart, residue management, legume catch-cropping), carbon and energy smart (zero tillage, residue management, legumes) and knowledge smart activities (farmer-farmer learning, capacity enhancement on climate smart agriculture, community seed banks and cooperatives).

The CSVs were first piloted in 3 states of India: Punjab, Haryana, and Bihar. Within these states, district specific data was collected to identify the potential climatic risks, farmer's perception to cope-up those risks and potential climate smart agriculture (CSA) interventions. Key focus areas of CSVs are: multi stakeholder participation and local adaptation, convergence of investments with co-benefits, focus on youth, women and socially disadvantaged groups, and innovation systems such as farmers' cooperatives and service windows.

Bihar state is the site of several pilot programs by the government and international organisations. At present, 31 CSVs are being piloted in Vaishali and Samastipur districts of Bihar state. These CSVs are in Rajapaker, Hajipur, Mahua and Pusa blocks. CIMMYT-CCAFS South Asia research portfolio has made significant efforts for developing, adapting, targeting and scaling portfolios of CSAPs and documenting the evidence.

#### For further readings:

<https://ccafs.cgiar.org/publications/climate-smart-villages-haryana-india#.VZoCoekVguQ>

## 2. CSAPs (for example, on zero tillage, laser leveling, site-specific nutrient management and combination of these practices)

Climate smart agricultural practices are location specific and tailored to fit the agro-ecological and socioeconomic conditions of a particular location. Interventions that work in one area may not necessarily be applicable in another. To address the emerging challenges of climate variability, portfolios of CSAPs have been advocated. The CSAPs refer to an integrative approach to address the interlinked challenges of food security and climate change, that explicitly aims for three objectives: (1) sustainably increasing agricultural productivity, to support equitable increases in farm incomes, food security and development; (2) adapting and building resilience of agricultural and food security systems to climate change at multiple levels; and (3) reducing greenhouse gas emissions from agriculture (including crops, livestock and fisheries). The interventions of CSAPs work together to increase a community's and also of individual farmers' resilience to climatic stresses while ensuring household food and livelihood security and where possible, reduce greenhouse gas emissions.

### For further readings:

<https://ccafs.cgiar.org/research-highlight/laser-land-levelling-how-it-strikes-all-right-climate-smart-cords#.VWbQV0aS8IT>

<http://icar.org.in/en/node/8853>

<http://blog.cimmyt.org/climate-smart-villages-the-framework/>

<http://blog.cimmyt.org/climate-smart-villages-local-adaption-to-promote-climate-smart-agriculture/>

<http://blog.cimmyt.org/climate-change-mitigation-social-learning-in-smallholder-systems/>

Journalists' day out in Climate-Smart Villages

Dinesh, D., Frid-Nielsen, S., Norman, J., Mutamba, M Loboguerrero Rodriguez, A., Campbell, B., 2015.

Is Climate-Smart Agriculture effective? A review of selected cases. CCAFS Working Paper no. 129.

Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security (CAAFS). <https://cgspace.cgiar.org/bitstream/handle/10568/67909/CCAFSwp129.pdf?sequence=1>

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