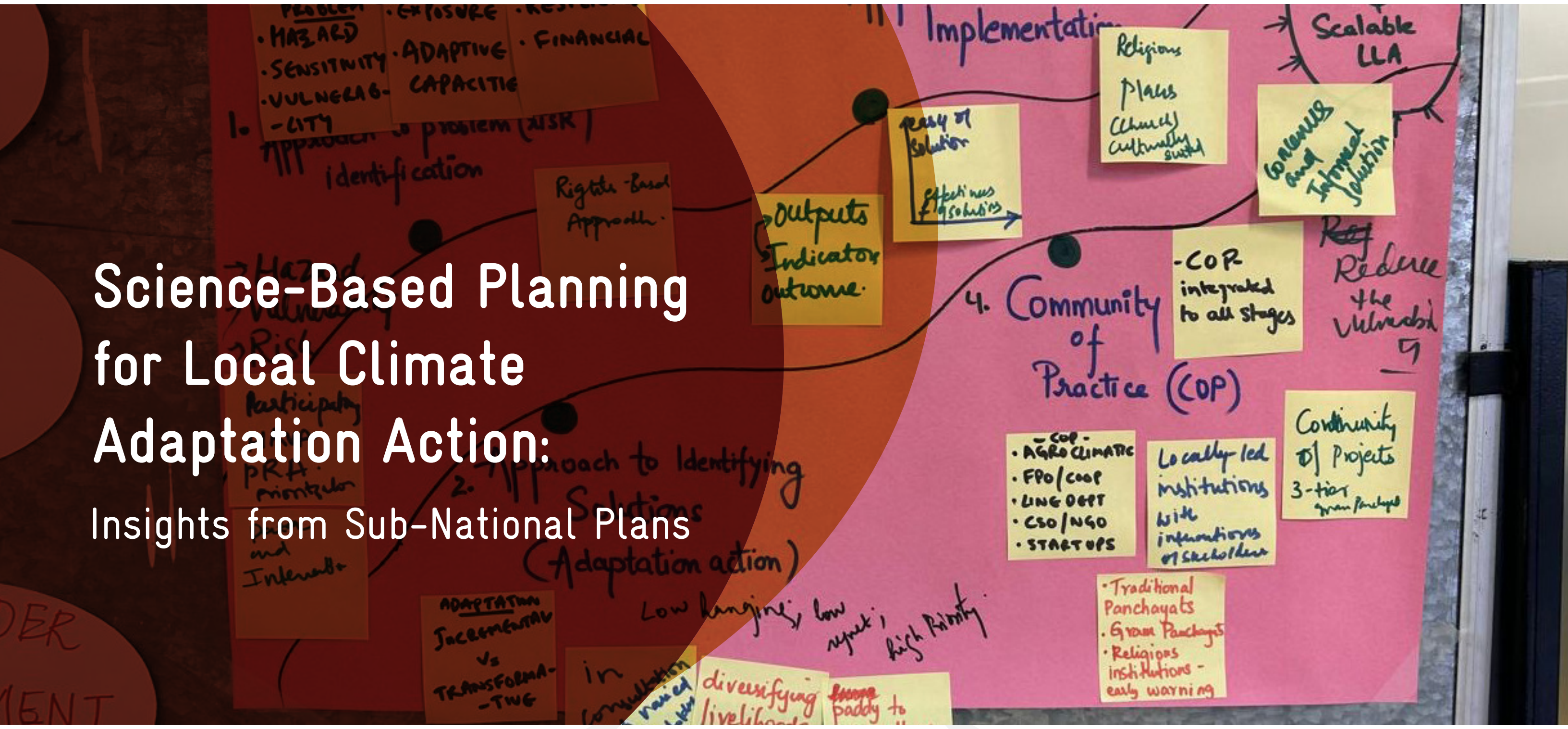


Science-Based Planning for Local Climate Adaptation Action:

Insights from Sub-National Plans

India's Nationally Determined Contributions (NDC) identifies better adaptation to climate change through increased investment in development programmes in climate-sensitive sectors of agriculture and water. However, these NDCs do not provide practical or detailed guidance on how to operationalise adaptation goals, e.g. in priority sectors, or about investments needs and benefits. The State Action Plan on Climate Change (SAPCC), which operationalise national climate plans, face challenges in identifying adaptation priorities and integrating them systematically into local development planning. A deeper understanding of projected impacts and effective adaptation strategies within agroclimatic zones can help guide, encourage, and accelerate public and private investments toward climate-resilient transformation.

Adaptation to climate change is taking place in some sectors, through the sectoral missions under NAPCC, however there is scope to make them robust with evidence-based planning approaches. IPCC Assessment Report 6 (AR6) highlights "the need to advance the understanding of climate change risks at sub-national levels, as well as the opportunities and impediments to adaptation action". Hence, there is a need for science-based adaptation planning which requires sound climate risk analyses and assessment of potential adaptation strategies.

The Indo-German development cooperation project, 'Climate Adaptation, Resilience and Climate Finance in Rural India (CAFRI II) is commissioned by the Federal Ministry of Economic Cooperation and Development, Germany, and jointly implemented by GIZ India and the Ministry of Environment, Forest and Climate Change, Government of India. The project is focusing on local climate risk-informed adaptation planning for designing effective interventions that address the most significant risks. Such localised plans are urgently needed to mitigate the adverse impacts of escalating climate risks and to build capacities among farmers, particularly women. **Under this project, GIZ India collaborated with the Centre of Excellence on Disaster Mitigation and Management (CoEDMM) at Indian Institute of Technology Roorkee (IITR), for a study to develop an analytical framework 'Climate-Risk Informed Adaptation Action Assessment (CRIAAA) for evaluating the climate science and evidence-based approach of the State Action Plan for Climate Change (SAPCC) and District Agriculture Contingency Plans (DCP).** The study assessed whether these plans provide insights into long-term changes in soil, water parameters, and crop growth. It also reviewed literature to identify modeling and methodology gaps that must be addressed for climate risk-informed prioritisation of adaptation measures. **The study focused on the Bundelkhand region of Uttar Pradesh and the Shivalik region of Himachal Pradesh. The objective was to recommend methods for assessing climate risk at the agroclimatic zone level (Bundelkhand and Shivalik) to identify block-level adaptation options, enhancing the effective implementation of SAPCC strategies.**

Key Results:

Climate Impact and Vulnerability Assessment at Local Levels:

The common framework for SAPCCs mandates that each state conduct a climate change vulnerability assessment focusing on the most vulnerable sectors. The UPSAPCC document provides detailed assessments at local, regional, state, and sector-specific levels. However, the HPSAPCC document offers broad, general assessments that may not have considered specific local issues and comprehensive climate science research.

Climate Trends and Future Projections:

SAPCC documents analyze climate data through a mix of historical and current assessments, along with future climate scenario modeling. The UPSAPCC presents extensive findings at the state and district levels, whereas the HPSAPCC could have had more coherence in district-level trends and future climate projections.

Limited Cross-Sectoral Model Integration:

SAPCC documents provide an opportunity to integrate climate and crop models across sectors. Given the interconnected impacts of climate change on agriculture and water sector, a more integrated modeling approach is needed to develop comprehensive adaptation strategies.

Limited consideration of gender:

While neither document explicitly details the integration of gender-disaggregated data into vulnerability and risk assessments, both acknowledge the importance of community involvement in sustainable agriculture and water management. Understanding how climate change affects men and women differently, particularly in agriculture and water sectors where gender roles significantly influence labor distribution, resource access, decision-making, and vulnerability to climate risks, is crucial.

Bottom-Up Approach and Stakeholder Participation:

The methodology suggests a combination of top-down and bottom-up approaches in the vulnerability assessment. The structured, indicator-based (top-down) framework quantifies vulnerability at a macro level (state-wide), while the selection of indicators implies the need for localised (bottom-up) insights, reflecting the specific sensitivities and adaptive capacities of communities within districts. This mixed-method approach integrates broad climate projections with local vulnerabilities and capacities, informing more effective adaptation measures.

Institutional Framework for Monitoring and Evaluation:

Both states have proposed robust institutional frameworks to oversee the implementation and monitoring of SAPCCs. Climate change departments and cells have been established as focal points for executing SAPCC processes. Within each sector, nodal departments and relevant stakeholders are tasked with implementing sector-specific adaptation strategies. Both states have suggested indicative indicators to assess the reduction in vulnerability achieved through these strategies. For example, in the UPSAPCC, Tier 1 indicators include the extent of crop diversification, micro-irrigation adoption, the number of houses protected from extreme flooding, and improved access to knowledge for decision-making by communities and policymakers.

Figure 2: State-wise Comparative Vulnerability Assessment Approach (Compiled by IITR)

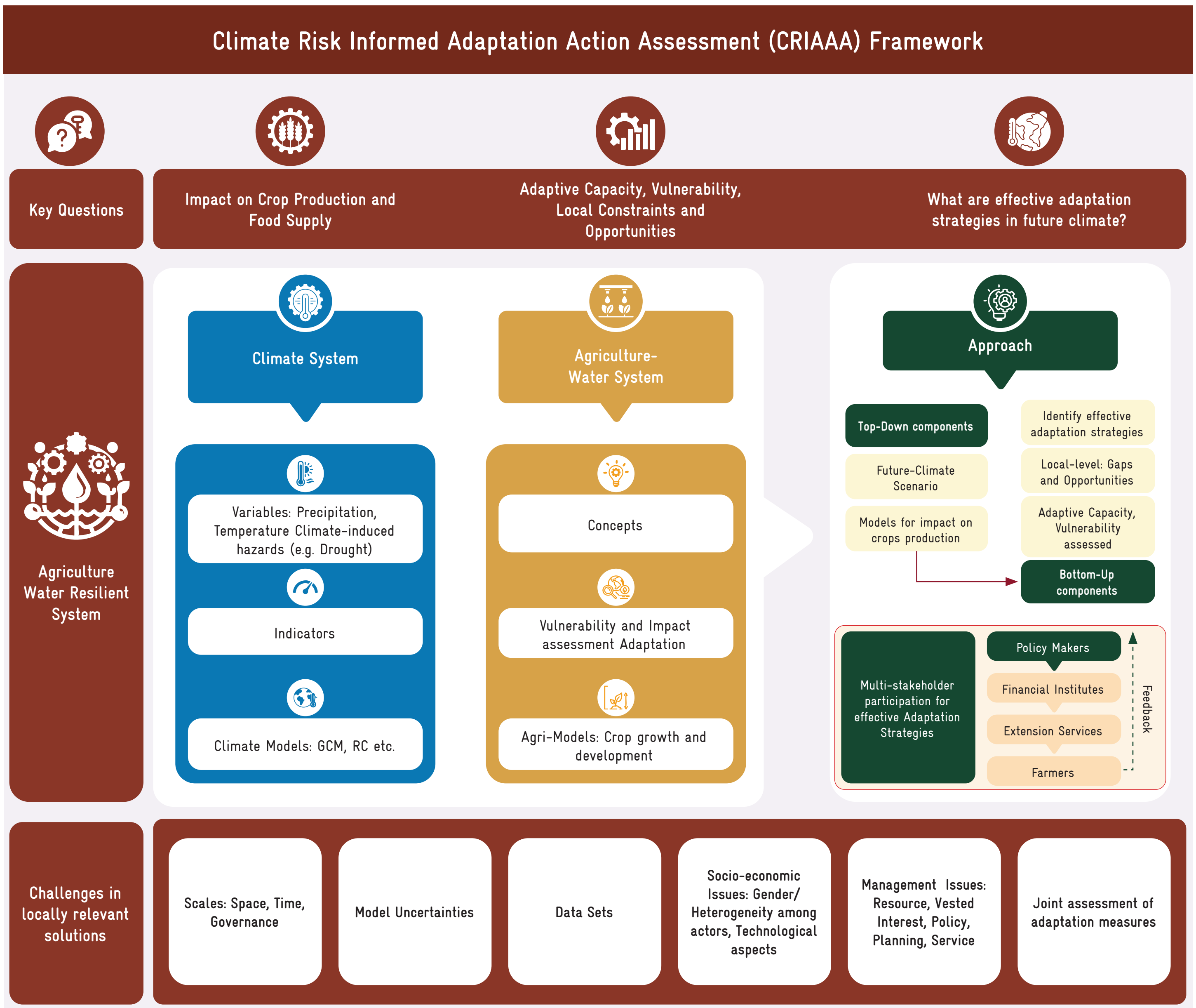
Key Parameters	Indication	Himachal Pradesh	Uttar Pradesh
Methodological Framework	IPCC Framework	IPCCAR5	IPCCAR5
Assessment Approach	Top-down or Bottom-up	No Explicit mention but methodology indicated mixed method approach	No Explicit mention but methodology indicated mixed method approach
Spatial Scale	Subregions/ district/sectoral level	District-Sectoral level studies/findings not clearly interpreted	Systematic District and sectoral level assessment and interpretation
Variables	Bio-physical, Socio-economics	Considered	Considered
Adaptive capacity	Economic, Environmental and Human Resources	Considered	Considered
Agriculture Vulnerability	Districts (Highest)	Bilaspur	Mahoba, Banda, Chitrakoot
Agriculture Vulnerability	Major Crops affected	Wheat, Barley, Maize, Rice	Rice, Sugarcane
SAPCC Linkage	SDGs, NDCs, State level Plans/ Schemes/Policies	Considered	Considered
Adaptation Finance	Financial Allocation and Gap assessment	Considered	Considered
Stakeholder Engagement	Consultations with Central/ State/Local level players	Multi-level stakeholders participation but local level engagement not clear	Multi-level stakeholders participation but local level engagement not clear
Gender Risk Data Disaggregation	Integration with Vulnerability Assessment	No explicit mention	Only % of male-female engagement in agriculture profile presented

Climate-Risk Informed Adaptation Action Assessment (CRIAAA) Framework

The CRIAAA framework addresses three key questions crucial for locally informed climate risk management, focusing on how climate variables like rainfall, temperature, climate-induced hazards (for instance drought); affect agricultural outputs and water availability. It emphasizes the role of General Circulation Models (GCM) and Regional Climate Models (RCM) in informing adaptation strategies, particularly through the integration of crop models that simulate crop growth under various climatic scenarios. However, implementing climate risk management at the local level faces several challenges, such as scaling across spatial, temporal, and governance dimensions, uncertainties in models, shifting baseline periods, and limited data availability. Further, heterogeneity among actors, based on gender and technological disparities, further complicates the process of identifying and implementing adaptation strategies effectively.

Additionally, the lack of granular data on inputs, resource policies, and services hinders effective crop modeling. A critical challenge is the joint assessment of adaptation measures, requiring reconciliation of diverse stakeholder interests, including policymakers, financial institutions, extension services, and farmers. Socio-economic and gender-related dynamics must be considered, as they influence community vulnerability and adaptive capacity. The framework proposes a dual approach, combining top-down strategies focusing on future climate scenarios with bottom-up strategies that prioritize local adaptive capacity and vulnerability. This approach aims to bring forward the gap between large-scale climate modeling and local applicability, enabling policies that are both scientifically robust and socio-economically equitable.

Figure 1: Climate-Risk Informed Adaptation Action Assessment Framework (CRIAAA). CRIAAA's 3-step framework showcases the key questions, the complex agriculture-water system, and the challenges in implementing locally relevant climate risk-informed solutions.



Recommendations: Planning for a science-based climate risk analysis at local-scale.

Planning a science-based climate risk analysis at a local scale requires sophisticated modelling, on-ground knowledge, and an understanding of both climate impacts and local vulnerabilities. To address gaps in SAPCCs, DCPs, and scientific literature, the following recommendations are proposed:

Understanding Local Climate Systems: Leverage historical climate data and localized agro-climatic indices to predict growing seasons and identify crop risk periods. Build models correlating these indices with crop yields to assess the impacts of climate variables on agricultural output.

Multi-Model Projections: Use regional climate models and ensemble outputs to capture a range of future scenarios, incorporating long-term projections (e.g., 2020s, 2050s, 2080s) to inform agricultural and water management planning.

Gender Risk Data: Collect gender-sensitive data on resource access and vulnerabilities, tailor adaptation measures, and develop gender-sensitive indicators for monitoring. Ensure gender considerations are integrated into climate adaptation policies.

Communicating Uncertainity: Clearly communicate the uncertainties associated with climate projections and model outputs, ensuring that stakeholders understand the range of plausible outcomes and can make informed decisions.

Participatory Approach: Engage local communities and stakeholders in model development and adaptation planning, ensuring measures are relevant and tailored to local needs.

Cross-Sectoral Integration: Foster collaboration across sectors like agriculture, water, forestry, and energy to develop integrated management strategies and robust adaptation measures

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