Supporting plant health communities in Pakistan to respond to climate risks in agriculture: A Scoping Study

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Summary

This study brief presents the findings of a scoping study conducted in Pakistan, between October 2023 and March 2024. The main purpose was to explore how through the PlantwisePlus programme, CABI can support Pakistan in achieving some of its climate and development priorities, as outlined in the key national policies and frameworks on climate change, particularly within the agriculture sector. The study identified areas of alignment, existing gaps, and opportunities to integrate and enhance PlantwisePlus priority actions in the country. Additionally, this study can also be used to identify potentially new opportunities for project development and partnerships in Pakistan, strategically aligning with the national and local stakeholders' priorities for inclusive, sustainable and low-emission trajectory towards a climate resilient agriculture sector.

Highlights

- PlantwisePlus interventions are playing a critical role in enabling plant health stakeholders in Pakistan to achieve some its broader Nationally Determined Contribution – National Adaptation Plan targets.
- CABI-Pakistan's close collaboration with provincial governments offers opportunities to support climate resilient agricultural priorities further, an effort already underway through PlantwisePlus and other initiatives within CABI.
- Through discussions with the provincial government, PlantwisePlus can leverage the plant doctor networks to identify the regions of high priority for the government to develop targeted climate smart agriculture (CSA) training packages for both extension and farmers.
- Robust campaigns and awareness programmes are also needed to increase the attractiveness of CSA practices as farmers can exhibit reluctance to change despite comprehensive trainings.
- There is a need to focus more on enabling the extension networks to deliver more targeted CSA advisories to the smallholder farmers. This is not only important to build the adaptive capacities of a very large agrarian rural population, but to also facilitate the food safety and efficiency in production to strengthen Pakistan's export market.
- While the need for lower-risk non-chemical alternatives to plant protection is well acknowledged, key informants expressed concerns that the current infrastructure and lab facilities may not be sufficient to support this shift. Market accessibility is also a key challenge for both input dealers and smallholders.
- Agricultural development pathways must increasingly integrate the enhancement of agro-biodiversity through the adoption of sustainable and climate smart agricultural practices, an imperative emphasized within Pakistan's climate and sustainable development policy frameworks.

Background

According to the climate risk index 2024, Pakistan topped the list of countries most affected by disasters in 2022, suffering from devasting floods, landslides and storms (Germanwatch, 2024). It incurred huge socio-economic losses due to these impacts, and the resource needs to become climate resilient and make the transition to a low-carbon economy by 2030 is approximately USD 348 billion. The floods of 2022 were eye openers for the government, impacting at least one third of the country and 33 million people. The estimated loss was about USD 15 B, of which USD 3.7 B alone was from the agriculture sector (Pakistan Floods, 2022). Tackling the impacts of climate change across all sectors by addressing the underlying vulnerabilities, is a national priority as has been outlined in Pakistan's Nationally Determined Contribution (NDC), the National Adaptation Plan (NAP) and other development policies, but the country is also severely constrained by resources.

As of 2024, approximately 40% of the population lived below the poverty line (World Bank, 2024). The country is heavily dependent on the agriculture sector, contributing about 24% of GDP and employing almost half of the population, according to the Pakistan Bureau of Statistics. The sector has one of the lowest productivities for major commodities (such as sugarcane and cotton) when compared globally, and faces multiple other challenges, currently exacerbated by climate change. A 0.5°C to 2°C change in temperature is projected

to cause up to 10 % reduction in agricultural production in Pakistan, primarily due to the sensitivity of crops to even slight changes in temperature (Dehlavi et al., 2015). Resulting implications can be quite dire for Pakistan, given its large export market of key commodities such as rice, cotton, sugarcane, mangoes, and other citrus fruits. The recent development of the China-Pakistan Economic Corridor is expected to bolster economic growth. However, it may also increase the risk of the spread of invasive pests from Africa to China and from Central Asia to Europe, due to greater connectivity and trade. (Raja,M.U., 2018).

The impacts of climate change are intensifying, threatening crop health. Smallholder farmers in Pakistan have very limited access to timely climate smart advisories on topics including crop selection, pest and disease control, seed varieties, and soil and water management. The extension department is the key linchpin to agricultural productivity but remains severely under resourced with the government spending less than 0.5% of the total GDP on this crucial network. Without addressing these immediate challenges, improving yields per hectare for key crops like wheat, rice, and cotton at least to global standards remains difficult (Tariq, 2025). As national economies grapple with the crop losses and other impacts to the agriculture sector, access to international markets for key commodities can serve as a strategic cornerstone of national resilience. For this, there is a need for more robust extension services and plant protection systems to ensure that farmers can produce efficiently to meet national demands and as well, supply to the global markets.

This scoping study was conducted in Pakistan to explore how CABI's PlantwisePlus, can assist the country in enhancing its plant health systems in the face of the emerging climate risks. This programme is working across 27 countries globally, including Pakistan, to enhance pest prediction, preparedness and prevention pathways, and delivering actionable plant health advice to national and local governments, and extension networks. PlantwisePlus aims to empower 75 million men and women farmers across these countries. This helps them to make informed decisions that improve yields and reduce losses and plays a critical role in promoting sustainable agriculture through the safe use of plant protection products and the adoption of climate-smart farming practices. There is a common understanding that smallholder farmers need timely, science-based, and climate-smart advice for managing crop pests and diseases, but this will also need more concerted emphasis on empowering plant health communities to address and adapt to climate-related risks. By identifying synergies, gaps, and opportunities for collaboration, the study aims to inform future programming and partnerships between CABI, national institutions, and other key stakeholders in Pakistan.

What we did

The scoping study employed a mixed methodological qualitative approach. Information was collected primarily through desk reviews and key informant interviews. The desk study included analyses of the NDC and NAP, and rapid reviews of the National Biodiversity Strategy and Action Plan (NBSAP) 2017–2030, National Food Security Strategy and the provincial plans of Punjab, Sindh, Khyber Pakhtunkhwa and Balochistan. Furthermore, research reports and journal papers were also reviewed mainly for background and context.

Interviews were conducted with key stakeholders (online and in person) representing the United Nations Environmental Programme, WorldWide Fund for Nature (WWF) and Pir Mehr Ali Shah Arid Agriculture University, Rawalpindi. In addition, the author also had the opportunity to virtually discuss some of the relevant climate change challenges with

government stakeholders at a CABI organized workshop on ‘Identifying and assessing the viability of low-risk alternatives to priority Highly Hazardous Pesticides’. The participants represented various departments working on plant health management in Pakistan and have provided some important insights for understanding the current challenges with NAP implementation in the country.

Findings

At policy and national levels of governance

The NAP and NDC of Pakistan recognize the vital role of the agriculture sector in adapting to climatic changes and in building a low-emission and resilient system. The usual challenges of lack of implementation feasibility, institutional coordination, and financing strategy remain and need to be urgently addressed to ensure the sustainability of relevant interventions. Key informants noted that although the NAP is lengthy and comprehensive, it missed a critical prospect of including more detailed and actionable sectoral measures for agriculture, a sector that is in crucial need of targeted interventions to improve adaptability, productivity and resilience.

The NAP recognizes the emerging climate risks that can compromise agricultural productivity, and the need for ‘devising a comprehensive, long-term agricultural growth strategy centred around promoting CSA practices, enhancing agricultural productivity, and supporting sustainable physical expansion’. When CABI's extensive networks with provincial governments and farmers were brought up during the key informant interviews, discussions were on the need to convene inclusive consultations, emphasizing the importance of engaging these crucial grassroot stakeholders, alongside national actors, for the planning and implementation of the NDC and NAP. Research suggests that this inclusive approach was largely overlooked in the past and needs to be prioritized moving forward. WWF Pakistan, for instance, has been leading many of the in-country consultations for NDC 2.0 and NDC 3.0 processes and this seems to be continuing. CABI-Pakistan’s ongoing partnership with WWF provides an avenue for further collaboration on projects and activities directly related to NAP-NDC implementation in Pakistan. Discussions on the integration of CSA into an agriculture growth strategy could not be covered under the scope of this study.

It was also found that the linkages between the key national climate policies needs better integration. Given that 60% of Pakistan is arid and 29% semi-arid, biodiversity conservation and sustainable land management are identified as priorities in the NDC, NAP, and NBSAP. However, these priorities are addressed in largely fragmented manners, with limited cross-referencing or coordination between the frameworks to enable joint, cohesive actions. The NAP, however, recognizes that there is a need to align objectives under the agriculture sectors, at least for effective implementation of the NDCs.

Analysis during this scoping study also suggests that the four provincial agriculture policies were formulated in alignment with national food security strategy and distinctly emphasize advancing a climate-resilient agricultural growth trajectory, promoting climate smart practices and technologies suited to local vulnerabilities. Given that the NAP was formulated much later, it is now crucial to align the national and provincial actions to fully mainstream climate commitments into provincial planning and ensure coherence between national climate targets and provincial agricultural development.

At programme and local levels of governance

PlantwisePlus interventions are playing a critical role in enabling plant health stakeholders in Pakistan to achieve some of its broader NDC-NAP targets including:

- Adoption of Climate Smart Agricultural practices for the production of a variety of crops.
- Adoption of mechanical and biological control methods to keep pest populations under control and to protect soil fertility and nutrient value agricultural produce.
- Incentivizing farmers to transition to climate smart water and land management practices[1].

While the national priorities are clear, this scoping study confirms that mobilizing the NAP and NDC at the grassroot level needs more concerted efforts and targeted support to empower local plant health stakeholders with tools, knowledge and technologies to understand climate risks in the context of sustainable plant health management. This scoping study identified several challenges as listed below.

At the local institutional levels of governance

- The Department of Plant Protection (DPP) is constrained by resource limitations and other systemic challenges related to adherence with trade regulations and international standards, affecting their current functional abilities to fulfil their mandates.
- The current systems remain vulnerable, a consequence of years of lack of focus on strengthening human capital, and inadequate funding.
- The risks and challenges of plant pests and diseases is increasing in the country, but they are not being documented rigorously. Institutions responsible for regular monitoring of plant pests and diseases often do not have sufficient core budget for continuous monitoring processes and are majorly reliant on donor funded projects/programmes to support these activities.
- National research organizations and public universities have the capacities to undertake lifecycle assessments of pest activities, considering future climate projections, but they are often limited to the scope of project funds.
- While it is widely recognized that climate change presents a significant and immediate threat to crop management and pest monitoring, addressing this challenge will remain difficult unless budgets, mandates, and institutional capacities are substantially strengthened at the local levels.

At the extension levels

- At both the local government and extension levels, there is a lack of (and thereby, a need for better) understanding of suitable CSA practices for pest management, and overall crop production. Tailored training packages suited for the different agro-ecological zones and priority crops in Pakistan is increasingly being demanded,

[1] Both the NDC and NAP of Pakistan have identified the interdependence between water resources and agricultural productivity, emphasizing the need for integrated approaches that enhance water-use efficiency (through irrigation systems), promote sustainable agricultural practices, and build resilience against climate-induced stresses.

adhering to international crop certification requirements (e.g. Good Agricultural Practices).

- Top-down training approaches are not yielding the desired results any longer. Farmers also tend to learn better through demonstrations.
- While the need for lower-risk non-chemical alternatives to plant protection is well acknowledged, key informants expressed concerns that the current infrastructure and lab facilities may not be sufficient to support this shift. Market accessibility is also a key challenge for both input dealers and smallholders.
- Farmers want real-time data for crop management. Climate information systems, integrating bundled services on crop, soil and water management practices are being piloted in the country, but scalability and replicability often pose challenges due to uncertainties of risks such as unpredictable weather patterns, local variations in climate, and emergence of sudden or new pests and diseases. This makes it difficult to design solutions that work reliably in different contexts.
- Better evidence is required to demonstrate that IPM practices are scalable solutions for farmers, with positive correlations for income and yield (Pakistan NAP).
- Targeted support is needed for grassroot levels to adapt to climate change and manage risks more effectively. Pakistan's growing rural population and remarkably diverse agro-ecological zones make it challenging to implement a 'one-size-fits-all' approach to increasing productivity of this sector.

The challenges identified above are consistent across the region, as evidenced by similar findings from scoping studies conducted in Sri Lanka and Bangladesh, highlighting a regional pattern of systemic weaknesses that hinder effective crop and plant health management. These challenges are complex and need to be further unpacked, an area that requires concerted efforts and one for CABI and PlantwisePlus to address through collaborations and partnerships, bridging science and policies.

Growing recognition for integration of climate change risk assessments, underpinned by more research

Findings further suggest that the role of the public universities and research institutions are limited to only providing background information to support the development of these policy frameworks, without further opportunity for meaningful engagement in the consultation processes. Historically, DPP had limited involvement in climate-related policymaking as such matters fell outside the scope of their mandate. However, there is now a growing recognition within these departments for the critical need to integrate climate risk mitigation and management approaches into plant protection strategies. They have expressed the need for further support from initiatives like PlantwisePlus to help strengthen the necessary capacity, knowledge, and frameworks for addressing climate-related threats to plant health.

Similarly, there is a better need to understand the role of biocontrol in climate adaptation and mitigation, through more research on plant and pest ecologies, complemented with climate modelling to improve reliability of results. Pakistan prioritizes 'the adoption of mechanical and biological control methods to manage pest populations while preserving soil fertility and the nutritional value of agricultural produce', as part of its NDC commitments. CABI, through PlantwisePlus, is already supporting the establishment of *Trichogramma* rearing laboratory facilities in two provinces, to advance biological control efforts. However, there remains a critical need for research in understanding how changing climate variables such as temperature and rainfall affect the efficacy and behaviour of biocontrol agents. Addressing

this research need is essential for ensuring that biological control solutions remain effective and sustainable under future climate scenarios. Conducting such research can be resource-intensive, as it requires continuity across multiple seasons and several years to yield meaningful results. Additionally, the uptake of IPM and biological measures is still very limited in the region as this is a massive transformation of current practices and requires reorienting programme activities to design farmer education and trainings to drive this behavioural change at scale.

Recommendations and way forward

Despite their critical role in safeguarding agricultural productivity and food security, plant health systems often receive limited attention in policy discussions, budget allocations, and institutional planning in Pakistan. This oversight has led to fragmented responses to plant pest and disease outbreaks, limited surveillance and diagnostic capacities, and a lack of coordinated action at both national and regional levels.

Although not explicitly mentioned, strengthening crop resilience through healthy plants underpins the success of the agriculture (primarily crop focused) sectoral priorities in the NAP and NDC of Pakistan, for instance, through the increased adoption of climate smart pest management (CSPM) practices. Similarly, the provincial agriculture plans have also prioritized a climate resilient growth trajectory. A successful implementation of these national policies is largely dependent on a sustainable and climate resilient domestic agriculture sector, further strengthening the export market for Pakistan.

Going forward, any ensuing policy action planning or implementation processes need to consider the intersection of biodiversity conservation and agricultural sustainability which is crucial for enhancing the overall resilience of the agro-ecological systems in Pakistan. This process of alignment will further facilitate the monitoring and reporting processes of NDCs and NAPs, which at the moment are still in the rudimentary stages of development. On this front, the CABI Pakistan office through its vast networks can collaborate with the national and provincial governments, and development partners working in the climate policy space to ensure that representations from provincial governments (and especially plant health system stakeholders) can be included in relevant strategy development processes. This is particularly important given the priority the government has placed on shifting to sustainable agriculture practices (using IPM strategies and biocontrol, for instance).

Moving towards smart plant systems in Pakistan

PlantwisePlus inventions in Pakistan are enhancing data-driven decision-making through the systematic collection and analysis of crop pest and disease management data from plant clinics. As global conversations rapidly move towards designing ‘smart plant systems’, within the scope of the current priorities of the programme, there is also a need to assess some of the foundational steps to support this transition in Pakistan. Some immediate key steps will be to:

- Support strengthening Pakistan’s agri-trade regulations and sanitary and phytosanitary measures (SPS) to meet international standards as a critical first step. Without this foundational reform, all other challenges, including those related to climate risks, will continue to be perceived as secondary concerns rather than integral to national progress, at least at the DPP level.

- Support evidence generation and synthesis from the ground upwards to communicate the relevance and need for functional plant systems that embed climate change and CSA into strategic plans to increase crop productivity and resilience.
- Leverage current programme outputs that are already promoting CSA at the local levels (e.g. through plant clinics, pesticide risk reduction campaigns) to assess the need for enhanced delivery of trainings and advisories, incorporating up-to-date and targeted information and smart technologies for improved monitoring of results.
- Leverage existing workshops and events strategically to integrate brief sessions on climate change risks to plant health systems during priority events, with a focus on strengthening capacity on different areas of interest - climate change and policies for instance.
- Determine the current need and demand to support the digitalisation of information for better data monitoring and governance of local systems, with a focus on improved decision-making and resource use efficiency.
- Explore working with the DPP and other relevant stakeholders to strengthen their monitoring and surveillance capabilities to detect and mitigate risks emerging from SPS related challenges along the supply chain. This is critical to ensure Pakistan's compliance and competitive edge in the export markets.
- Explore possibilities of developing strategic action plans through participatory actions with local governments to promote and increase the use of the CABI digital tools and explore collaboration with FAO and partners on the 'Digital Villages' initiative.
- Foster collaboration among institutions, universities and research organizations to pool resources and share expertise on understanding how biocontrol agents will respond under climate change conditions, as there is a big gap in research on this topic.
- Continue PlantwisePlus engagement with the DPP, the Ministry of National Food Security & Research (MNFSR) and other stakeholders in Pakistan on promoting the use and uptake of biocontrol, as it is an agriculture sector priority.

Additionally,

- Determine the possibility of targeting one or two locations in the country to develop 'climate-smart plant clinics', where men and women farmers will have access to more targeted advice on crop health management challenges, proactively supporting climate change adaptation and resilience building processes.
- Design robust campaigns and awareness programmes to increase the attractiveness of the CSA practices as farmers can exhibit reluctance to change despite comprehensive trainings.
- Develop better outreach mechanisms to communicate how PlantwisePlus in Pakistan is working on the government's priorities identified in NAP and NDC.
- Continue the inter-institutional coordination the Ministry of National Food Security and Research (MNFSR), and strengthen collaboration with the Ministry of Climate Change and Environmental Coordination and the Planning Commission to facilitate Pakistan's transition toward a sustainable and climate-resilient agriculture sector. This includes advancing integrated policy frameworks and targeted interventions that strengthen the inclusion and adaptive capacity of smallholder farming communities.

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Farmers in the field with CABI extension workers. ©CABI

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