WORKING PAPER

STRATEGIC PLANNING FOR CLIMATE-SMART AGRICULTURE: PARTICIPATORY ADAPTATION PATHWAYS FOR VULNERABLE DRY ZONE COMMUNITIES IN SRI LANKA

H.J.C. Jayasooriya
Thushara Dharmawardhana
G.G. de L.W. Samarasinha

HARTI
Hector Kobbekaduwa Agrarian Research and Training Institute

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114, Wijerama Mawatha
Colombo 07
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Hector Kobbekaduwa Agrarian Research and Training Institute
114, Wijerama Mawatha,
Colombo 07
Sri Lanka

Telephone : +94 11 2696981
+94 11 2696437

Fax : +94 11 2692423

Email : director@harti.gov.lk

Web page : www.harti.gov.lk

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FOREWORD

Sri Lanka's Dry Zone, vital to the country's agricultural landscape, faces growing threats from climate and national goals of food security and sustainability. These challenges endanger smallholder farmers' livelihoods and national goals of food security and sustainability. In response, the Hector Kobbekaduwa Agrarian Research and Training Institute (HARTI) has conducted this study to develop for climate-smart agriculture strategies through participatory adaptation in vulnerable Dry Zone communities.

This research reflects HARTI's commitment to combining scientific inquiry with community engagement. Using, participatory methods, it captures local farmers' insights to ensure adaptation strategies are context-specific and practical. The findings offer valuable guidance for policymakers, development practitioners, and stakeholders aiming to strengthen Sri Lanka's agricultural resilience.

I sincerely thank the research team for their dedication and the community members for generously sharing their knowledge and experiences. I hope this report inspires informed decision-making and collaborative action toward a more resilient and sustainable agricultural future in Sri Lanka.

Prof. A.L. Sandika
Director/CEO

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H.J.C. Jayasooriya
Thushara Dharmawardhana
G.G. de L.W. Samarasinha

EXECUTIVE SUMMARY

The impacts of climate change are increasingly evident across Sri Lanka's agricultural sector, with Dry Zone communities bearing a disproportionate burden. This region, characterized by erratic rainfall, prolonged droughts, and poor irrigation infrastructure, is home to a large population of smallholder farmers who rely heavily on rain-fed agriculture for their livelihoods. These farmers face escalating challenges due to changing climate patterns that threaten their food security, economic stability, and long-term sustainability. Although national climate adaptation policies such as *National Adaptation Plan (NAP) for Climate Change Impacts (2016–2025)* and the *National Climate Change Policy of Sri Lanka* recognize the need for transformative interventions, practical implementation at the grassroots level remains limited and uneven.

This research study was conceptualized in response to the gap between national adaptation priorities and the lived realities of rural farming communities in the Dry Zone. Its overarching aim was to develop participatory, evidence-based strategies for implementing Climate-Smart Agriculture (CSA) interventions in two villages—Ketanwewa and Keppetiyawa North—in the Hambantota District. The focus was on how context-sensitive planning, based on local knowledge systems and participatory methods, can support long-term agricultural resilience and sustainability. The study offers a replicable model for bottom-up climate adaptation planning in rural Sri Lanka. The methodological approach combined Participatory Rural Appraisal (PRA) and Rapid Rural Appraisal (RRA), enabling flexible, site-specific engagement in two agro-ecologically and socio economically distinct locations. In Ketanwewa, PRA was applied due to available time, community willingness, and lack of recent data, allowing intensive using tools like seasonal calendars, risk mapping, historical timelines, and problem-ranking. In Keppetiyawa North, where baseline data existed, RRA was supported by focused group discussions and key informant interviews. This dual approach ensured methodological rigor, data triangulation, and stronger community validation.

The vulnerability assessment revealed that the two villages faced markedly different climate risks and adaptive capacities. Ketanwewa, located in the low country dry zone (DL1), was highly exposed to recurrent droughts and water scarcity. The community depends almost entirely on the Ketanwewa Tank for irrigation. Due to siltation, encroachment, and disrupted feeder flows from infrastructure development like the Southern Expressway, the tank's storage capacity has drastically declined over time. Community records indicated a sharp increase in drought frequency and dry spells, reduced rainfall, and increasing abandonment of paddy fields. The PRA revealed that cultivation had been impossible for up to six consecutive seasons, severely affecting livelihoods and food security.

Socio-economic sensitivities in Ketanwewa worsen the environmental challenges. Most households possess less than half an acre of cultivable land, and off-farm or non-farm employment opportunities are limited, especially for women. Male migration for

work leaves female-headed households further vulnerable to food insecurity and economic hardship. The PRA's food path analysis confirmed a heavy dependence on external markets for staples like rice, vegetables, milk, eggs, and meat. Wildlife damage—from elephants, monkeys, wild boars, and peacocks—was a frequent and serious problem, further weakening agricultural resilience. Moreover, community interaction with extension officers and other institutional actors was minimal, showing limited institutional support for climate adaptation.

In contrast, Keppetiyawa North, situated closer to the boundary of the Dry Zone and Intermediate Zone, exhibited greater resilience and better resource availability. The village has multiple functioning tanks, improved irrigation infrastructure, and a more diversified employment structure. Only 10% of the population depends mainly on crop farming, while others employed in government services, skilled labour, or self-employment, reducing on agriculture. Nevertheless, the community still faces challenges such as limited water access for upland cultivation and frequent crop damage from wild animals. Unlike Ketanwewa, households in Keppetiyawa North often own larger land plots —some exceeding five acres—and grow perennial crops such as coconut and fruit trees. However, land productivity is low due to mono-cropping, weak collective marketing, and low value addition at the local level.

Based on these localized assessments, the study formulated village-specific Climate-Smart Agriculture (CSA) strategic frameworks aligned with the needs, capacities, and priorities of each community. For Ketanwewa, the recommended interventions focus on infrastructure rehabilitation, crop diversification, institutional support, and livelihood enhancement for vulnerable groups, especially women. Higher-priority actions include:

- Completing the feeder canal to restore water supply from the Walawa Left Bank irrigation system.
- Undertaking desilting and structural rehabilitation of the Ketanwewa tank.
- Promoting drought-resilient and wildlife-tolerant crops such as finger millet, mung bean, sesame, and lime.
- Extending elephant-proof fencing and regulating the use of abandoned lands to mitigate wildlife conflict.
- Enhancing access to training and institutional services by improving relationships with agricultural extension officers and other field-level institutions.
- Supporting off-farm and non-farm livelihood diversification through vocational training and small-scale entrepreneurship, particularly for women.

For Keppetiyawa North, where vulnerability is relatively lower, focus is on improving land productivity and integrating agricultural value chains. Recommended actions include:

- Promoting intercropping and crop diversification in uplands, particularly integrating high-value crops such as banana, ginger, turmeric, lime, and pepper under existing coconut plantations.
- Revitalizing underutilized community wells and promoting micro-irrigation systems for upland farming.
- Supporting collective production and marketing strategies to reduce transaction costs and improve market access.
- Expanding livestock-based income sources, including buffalo and dairy farming, with value addition such as curd production.
- Introducing off-farm employment schemes such as cottage industries (e.g., tailoring, food processing) to reduce dependency on agriculture and enhance women's economic participation.

Both village plans align with broader national climate adaptation frameworks and the Sustainable Development Goals (SDGs). They integrate local knowledge and scientific evidence to create structured implementation pathways, including priority actions, responsible institutions, and indicators for monitoring and evaluation. The participatory approach enhances legitimacy, community ownership, and the likelihood of sustainable adoption.

In conclusion, this research reinforces the vital role of participatory methodologies such as PRA and RRA in climate adaptation planning. These approaches reveal community knowledge and priorities while empowering rural actors to shape their development. By contextualizing CSA interventions to the specific vulnerabilities and capacities of communities, the study offers a scalable model for inclusive, community-led climate resilience in Sri Lanka. It also underscores the need for institutional coordination, multi-level governance, and gender-sensitive approaches in building sustainable adaptation frameworks. The findings and recommendations serve as a practical resource for policymakers, development agencies, and civil society to bridge the gap between national adaptation goals and local implementation.

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ABBREVIATIONS

AI	-	Agricultural Instructor
APSIM	-	Agricultural production System Simulator
CbCCA	-	Community-based Climate Change Adaptability
CBO	-	Community-Based Organization
CRIWMP	-	Climate Resilient Integrated Water Management Project
CSA	-	Climate-Smart Agriculture
Dept.	-	Department
DL1	-	Dry Zone Low Country – Agro-Ecological Zone 1
DSSAT	-	Decision Support System for Agrotechnology Transfer
EDO	-	Economic Development Officer
GEF	-	Global Environment Facility
GND	-	Grama Niladhari Division
HARTI	-	Hector Kobbekaduwa Agrarian Research and Training Institute
HHs	-	Households
IFAD	-	International Fund for Agricultural Development
IWMI	-	International Water Management Institute
NAP	-	National Adaptation Plan
NGOs	-	Non-Governmental Organizations
PRA	-	Participatory Rural Appraisal
RRA	-	Rapid Rural Appraisal
SDGs	-	Sustainable Development Goals
UNDP	-	United National Development Programme

CHAPTER ONE

Introduction

1.1 Background

Sri Lanka is increasingly experiencing the adverse effects of climate change, with its Dry Zone regions among the most severely affected. These areas, which account for approximately two-thirds of the country's landmass and house a significant proportion of the rural population, are highly dependent on rain-fed agriculture for their livelihoods (De Costa, 2008). Over the past several decades, it was observed that the climate trends in Sri Lanka have indicated a steady rise in average temperatures, reduced frequency of wet days, and increased unpredictability in seasonal rainfall, particularly during the *yala* season, which is critical for paddy and field crop cultivation (Herath and Rathnayake, 2005; Naveendrakumar et al., 2018). These impacts, along with high evapotranspiration rates, poor irrigation infrastructure, and resource degradation, have made Dry Zone agriculture increasingly fragile and vulnerable to climate-induced shocks.

Agricultural communities in Sri Lanka's Dry Zone face multiple socio-ecological vulnerabilities. Most smallholder farmers cultivate marginal lands with limited access to water, credit, extension services, and market facilities. These challenges are worsened by droughts, erratic rainfall, wildlife or invasive species encroaching on farmland (Esham and Garforth, 2013; Samarasinha et al., 2020). Insecure land tenure and fragmented land holdings hinder long-term sustainable practices. As climate risks continue to increase in intensity and frequency, many farming households are forced into distress coping strategies, including land abandonment, migration, and shifts to low-return off-farm labour, thereby undermining the resilience of local agrarian economies (Jayasooriya, 2017; FAO, 2013).

While the Government of Sri Lanka has acknowledged the importance of building climate resilience in agriculture reflected in the National Adaptation Plan for Climate Change Impacts (2016–2025) and the National Climate Change Policy, the practical implementation remains limited and uneven across regions. Most adaptation programmes have focused on technical solutions such as drought-tolerant seeds, irrigation rehabilitation, and early warning systems. However, these interventions often follow a top-down design, lacking adequate community engagement or contextual relevance. Numerous scholars and practitioners have pointed out that failure to integrate local knowledge, needs, and capacities into adaptation planning is a key reason why many past initiatives did not achieve their intended outcomes (Chambers, 1994; Bandara and Pathmarajah, 2020). A climate-smart approach must go beyond technology to include institutional reform, participatory governance, and spatially differentiated planning that reflects the diverse agro-ecological and socio-economic realities across rural Sri Lanka.

In this context, Climate-Smart Agriculture (CSA) offers a holistic approach to address the complex challenges faced by smallholder farmers. Defined by the Food and Agriculture Organization (FAO), CSA aims to sustainably increase productivity, enhance resilience (adaptation), and reduce greenhouse gas emissions where possible (FAO, 2013). However, in the Sri Lankan context, while CSA has been endorsed in policy discourse, its practical adoption at the village level remains nascent. A key reason is the lack of strategic planning frameworks to convert national CSA goals into locally appropriate actions. Studies have demonstrated that community-specific adaptation strategies are far more effective in sustaining long-term resilience compared to generic or centrally imposed plans (de Silva et al., 2021; Fernando et al., 2020).

Participatory methodologies such as Participatory Rural Appraisal (PRA) and Rapid Rural Appraisal (RRA) have gained recognition for their ability to generate rich, community-driven data and foster local ownership in adaptation planning. These tools enable the articulation of local vulnerabilities, risk perceptions, and adaptive capacities, particularly in settings where formal data may be scarce or outdated (Chambers, 1994; Kumar, 2002). In the context of CSA, such participatory tools can help co-create adaptation strategies that are both technically feasible and socially acceptable. Moreover, integrating PRA and RRA with existing development planning mechanisms can bridge the gap between grassroots realities and institutional decision-making, enhancing both the legitimacy and effectiveness of climate adaptation programmes.

Given the increasing climate variability and the pressing need for sustainable agricultural development in Sri Lanka's Dry Zone, this study aims to explore participatory strategic planning as a pathway for operationalize CSA at the community level. By engaging farming households in two contrasting villages in the Hambantota District, this research seeks to uncover how locally embedded knowledge and participatory assessments can inform the design of context-sensitive, equitable, and resilient agricultural interventions. The ultimate goal is to contribute to a broader shift toward adaptive, bottom-up governance models essential for climate-resilient rural transformation in Sri Lanka and similar contexts in the Global South.

1.2 Problem Statement

Despite growing policy focus on CSA in Sri Lanka, the implementation of locally grounded, participatory adaptation strategies remains limited. Many interventions lack micro-level vulnerability assessments, particularly concerning gender dynamics, land tenure, irrigation access, and institutional connectivity (Samarasinha et al., 2020; Jayasooriya, 2017). As a result, adaptation plans often fail to reflect community realities or address the distinct risks faced by marginalized groups, including women and land-poor households.

Moreover, the heterogeneity among villages within the same district—such as variations in tank infrastructure, livelihood diversification, or exposure to wildlife

damage—suggests that a one-size-fits-all approach to CSA is ineffective (FAO, 2013; Bandara and Pathmarajah, 2020). Participatory tools like PRA and RRA offer a way forward by centering community voices at the center of planning and enabling the co-creation of site-specific solutions.

The lack of such participatory strategic planning frameworks has led to a disconnect between community needs and government-led programmes. This study addresses that gap by integrating empirical vulnerability assessments with participatory planning to develop localized CSA strategies for two Dry Zone communities.

1.3 Key Terms

- Climate-Smart Agriculture (CSA): An approach to increase agricultural productivity, enhance resilience to climate change, and reduce greenhouse gas emissions where possible (FAO, 2013).
- Participatory Rural Appraisal (PRA): A set of participatory tools used to empower communities to analyze their own realities and plan development actions (Chambers, 1994).
- Rapid Rural Appraisal (RRA): A method that combines interviews, observations, and secondary data to quickly assess rural conditions (Kumar, 2002).
- Adaptation Pathways: Flexible, iterative strategies designed to address uncertainty and guide long-term climate adaptation planning (UNDP, 2017).
- Dry Zone: An agro-ecological region in Sri Lanka characterized by low rainfall, high evapotranspiration, and frequent droughts, making it highly climate-sensitive (De Costa, 2008).

1.4 Research Questions

This study was guided by the following key research questions:

1. What are the major climate risks and vulnerabilities faced by smallholder farming communities in selected Dry Zone villages?
2. How do community members perceive and cope with these risks under their current resource constraints?
3. What role can PRA and RRA play in identifying and prioritizing adaptation strategies tailored to local conditions?
4. How can the findings be used to inform policy and develop strategic frameworks for scaling CSA?

1.5 Objectives of the Study

General Objective

To develop a participatory, evidence-based strategic framework for implementing climate-smart agricultural interventions tailored to the vulnerabilities and adaptive capacities of selected Dry Zone farming communities in Sri Lanka.

Specific Objectives

1. To assess the nature and extent of climate-related vulnerabilities in selected villages using participatory methods.
2. To identify and prioritize key challenges, exposure factors, and socio-institutional constraints faced by the farming communities in each location.
3. To formulate village-specific CSA strategies that enhance resilience, promote inclusive development, and inform policy and programme design.

1.6 Significance of the Study

This study makes a timely and relevant contribution to both academic and policy domains of climate adaptation in Sri Lanka. First, it fills a methodological gap by applying PRA and RRA to generate location-specific data, offering a model for participatory vulnerability assessment and CSA planning. Second, it offers actionable insights for integrating grassroots adaptation strategies with divisional and national climate planning aligned with Sri Lanka's NAP and Sustainable Development Goals (SDGs) (UNDP, 2017).

Furthermore, the research highlights the importance of addressing gender, land tenure, and institutional dynamics in CSA interventions, which are often overlooked in mainstream climate vulnerability assessments (Fernando et al., 2020). By centering community voices, the study promotes an inclusive adaptation model that can strengthen policy relevance, improve implementation outcomes, and contribute to more resilient and equitable rural development.

1.7 Limitations of the Study

Despite its strengths, the study has several limitations:

- Context specificity: The research focuses on two case study villages in Hambantota District within the Dry Zone. However, findings may not apply to all Dry Zone areas.
- Temporal limitations**:** PRA and RRA capture community perceptions at a point in time and may miss long-term trends or seasonal variations.
- Institutional uptake: While the study develops strategic frameworks, it does not assess their implementation or long-term impact, which may depend on external institutional support.

These limitations, however, do not undermine the value of the research as a replicable framework for participatory CSA planning in Sri Lanka and r comparable socio-ecological contexts.

CHAPTER TWO

Literature Review

2.1 Introduction

Climate change poses complex and multifaceted challenges, particularly for smallholder agricultural communities in the Global South. In Sri Lanka, rural livelihoods are intricately linked to climate-sensitive systems, making them disproportionately vulnerable to changing weather patterns and environmental shocks. In response to these vulnerabilities, participatory research methods, such as Participatory Rural Appraisal (PRA) and Rapid Rural Appraisal (RRA), have gained prominence for their ability to facilitate community-led, context-specific adaptation planning.

This chapter critically reviews key themes and concepts that underpin the present study, including climate trends in Sri Lanka, climate change impacts on agriculture, adaptation typologies, community-based adaptation strategies, and the principles of Climate-Smart Agriculture (CSA). It also examines the role of participatory methodologies in climate adaptation planning and highlights empirical evidence from South Asia and Sri Lanka that supports a community-driven, strategic approach to building resilience in agriculture.

2.2 Climate Change Trends in Sri Lanka

As an island nation, Sri Lanka is highly vulnerable to the adverse impacts of climate change. Several long-term studies have confirmed significant shifts in rainfall and temperature patterns over the past decades. For instance, Herath and Rathnayake (2005) and Naveendrakumar, et al. (2018) observed a declining trend in wet days, particularly during the South-west monsoon, which critically affects *yala* season crop production. In addition, increased intensity of rainfall in shorter durations has heightened the risk of flash floods in urban and peri-urban regions (Sanjeewani and Manawadu, 2014).

Temperature trends are equally concerning. Sri Lanka has experienced a steady rise in both minimum and maximum temperatures, with De Costa (2008) and the Department of Meteorology (2020) reporting an increase of 0.16°C per decade since 1961. This warming trend, especially pronounced during the critical cultivation months of June–July, stresses crop growth cycles and productivity.

Moreover, the impacts of climate change in Sri Lanka affect agriculture, human health, water availability, ecosystems, and rural infrastructure, increasing risks for smallholder farmers, particularly in the dry and intermediate zones (Malaviarachchi et al., 2018; Samarasinha et al., 2020; De Silva, 2021). The North-East Monsoon, a key

determinant of agricultural viability in these zones, has become erratic, intensifying the uncertainty around seasonal cultivation planning (Marambe, 2014).

2.3 Climate Change Impacts on Agriculture in South Asia and Sri Lanka

The agricultural sector is highly vulnerable to climate variability and extremes. In South Asia, rural agricultural systems are already experiencing the cumulative effects of erratic rainfall, prolonged droughts, and rising temperatures (IPCC, 2021; FAO, 2019). These climatic shifts undermine crop yields, degrade soil fertility, and exacerbate water scarcity.

According to the IPCC Sixth Assessment Report (2021), smallholder farmers are among the most at-risk populations globally due to their dependence on rain-fed agriculture and limited adaptive capacity. In Sri Lanka, these risks are particularly evident in paddy cultivation and other field crops, where yield reductions are increasingly observed due to climate anomalies (Esham and Garforth, 2013; Department of Meteorology, 2020). Importantly, the burden of climate-induced stress is unevenly distributed. Studies have shown that rural women and marginal farmers bear the brunt of declining agricultural productivity and limited resource access (Herath and Alwis, 2014). These gendered and socio-economic disparities highlight the importance of designing inclusive adaptation strategies that address to community-specific vulnerabilities.

2.4 Adaptation to Climate Change in Agricultural Communities

Adaptation is widely recognized as the primary strategy to manage the risks of climate change in agriculture. Furthermore, climate adaptation is broadly characterized as efforts performed to mitigate, cope with, or benefit from recent or predicted climate change (Climate Change Secretariat, 2016). As described in the National Adaptation Plan for Climate Change Sri Lanka 2016-2025, adaptation is the most important strategy for dealing with the effects of climate change in the context of Sri Lankan agricultural sector. According to Sri Lanka's National Adaptation Plan (Climate Change Secretariat, 2016), the focus should be on both short-term coping mechanisms and long-term structural changes. These include land-use shifts, climate-resilient cropping systems, water-use efficiency, and institutional capacity building**.**

The FAO (2007) reports that analyses have shown that large reductions in adverse impacts from climate change are possible when adaptation is fully implemented. Short-term adjustments are considered autonomous in the sense that no other sectors (e.g., policy, research etc.) are needed in their development and implementation. In contrast, long-term adaptations are major structural changes to overcome adversity such as changes in land-use to maximize yield under new conditions; application of new technologies; improved land management techniques; and water-use efficiency techniques.

2.4.1 Typologies of Adaptation

Adaptation responses can be categorized as autonomous or planned, and as reactive or anticipatory (Smith, 1997; Stage, 2010). Autonomous adaptations are informal, household-driven strategies such as changing planting dates or switching crops. Planned adaptations are more formalized, often implemented through government programmes or development projects.

Anticipatory adaptation aims to reduce future risks by proactively building resilience, while reactive measures address current impacts. Empirical evidence suggests that traditional, autonomous responses—such as crop diversification or modifying irrigation practices—are often more flexible and locally appropriate (Eakin et al., 2014).

2.4.2 Potential Agronomic Adaptation Strategies

Chitranayana and Punyawardena (2014) proposed a cropping calendar to utilize as a tool to guide farming activities from land preparation to harvesting. Such data could help reduce the amount of irrigation water required and the frequency with which water is released from tanks in different regions, thereby conserving irrigation tank storage for post-operations in dry zone. It can also support decision-making for rain-fed upland agriculture systems as a decision support tool.

Adjusting fertilizer rates during the climate change may help to improve the quality of fruits and grains (Eswaran, 2018). Promotion of bio-fertilizers and mineral solubilizes, including the use of blue-green algae to reduce methane emissions from paddy fields and the use of thermophilic bio-inoculants to maintain nutrient flow dynamics in warmer soils are also adaptation measures to mitigate the climate change in South Asia (Ahmed and Suphachalasai, 2014).

Changing irrigation (Truelove, Carrico and Thabrew, 2015), drainage, and other water management practices in terms of quantity and timing would also be used by farmers to mitigate the climate change (Eswaran, 2018). Introduction of micro irrigation and reduction of irrigation depth (Esham and Garforth, 2013) and use of alternate wetting and drying technique are used to conserve the irrigation water (Abeysekera, 2018).

Some other heavily used adaptation strategies by farmers are the cultivation of low water requiring crops such as mung bean (Marambe *et al.*, 2015; Samarasinha *et al.,* 2020), finger millet, sesame, crop diversification along with perennials, (Weerakoon and De Costa, 2009; Jayasooriya, 2017), change in planting dates, crop rotation (Esham and Garforth, 2013). Farmers can adjust the length of the growing season to better suit the changing environment by changing the time of sowing or planting, as well as help plants to avoid heat stress during vital growth phases (Ahmed and Suphachalasai, 2014).

The Integrated Pest Management are being practiced by farmers (Jayasooriya and Aheeyar, 2015; Abeysekera, 2018) to improve the effectiveness of pest, disease and weed management practices (Eswaran, 2018). Farmers have also been using suitable agronomic and cultural management practices in order to avoid flowering during periods of high air temperature and relative humidity (Abeysekera, 2018) and are used to off –season cultivation of food crops and cultivation of crops in non – conventional areas (Eswaran, 2018).

Further, some technological developments have been identified in order to control and withstand the impacts of climate change. Leaf colour charts, alternate application and fertility maps (Abeysekera, 2018), different crop modeling systems APSIM (Agricultural production System Simulator), DSSAT (Decision Support System for Agro - technology Transfer) to find out the possible risk of climate variation on future crop yields. , GIS (Geographical Information System) is a mapping system, used in locations estimation, area determination, and geological analysis.

Crop weather forecasting and early warning systems will be extremely beneficial in reducing the risks of climate change-related losses. If a meteorological station issues a weather notice indicating that rain is expected over the next several days, farmers can plan their crop planting according to the weather forecast. And also some have defined climate change adaptation as comprising capacity-building activities such as information dissemination and farmer training programmes (Truelove, et.al., 2015).

Farmer associations, village level organizations, and production committees play a key role in promoting climate-adaptation among the members of respective grassroots level organizations. While exchanging their personal experiences and knowledge among the participants of the farmer associations, the organization can come to a shared conclusion about how limited natural resources are managed and how to get compensation for natural disasters (Weerakoon and De Costa, 2009; Hewawasam and Matsui, 2020).

In brief, agronomic strategies has been proposed to enhance climate resilience can be categorize as:

- Adjusting cropping calendars to align with rainfall patterns (Chitranayana and Punyawardena, 2014)
- Using bio-fertilizers and microbial inoculants to maintain soil fertility under warming conditions (Ahmed and Suphachalasai, 2014)
- Adopting efficient water management techniques, such as alternate wetting and drying, micro-irrigation, and improved drainage (Abeysekera, 2018; Truelove et al., 2015)
- Crop diversification and rotation, especially the use of low water-requiring crops such as mung bean, finger millet, and sesame (Weerakoon and De Costa, 2009; Jayasooriya, 2017)

Technological tools such as leaf colour charts, GIS-based planning, and decision support systems (e.g., DSSAT, APSIM) are also being explored to enhance forecasting and farm-level decision-making (Abeysekera, 2018).

2.5 Climate-Smart Agriculture (CSA) and Strategic Planning

Climate-Smart Agriculture (CSA) represents an integrated approach that simultaneously aims to enhance agricultural productivity, strengthen resilience to climate change, and reduce greenhouse gas emissions where feasible. It emphasizes sustainable land and water management, efficient use of inputs, and robust institutional support systems (FAO, 2013). In Sri Lanka, CSA has been identified as a national policy priority; however, its implementation has been hindered by challenges such as limited farmer awareness, inadequate infrastructure, and weak institutional coordination (Ratnasiri et al., 2020).

Regional experiences underscore the practical relevance of CSA. For example, India's National Innovations in Climate Resilient Agriculture (NICRA) programme illustrates how interventions like drought-tolerant crop varieties and micro-irrigation systems can build resilience among farming communities (Venkateswarlu et al., 2017). Similarly, Nepal has successfully incorporated CSA into community-based climate adaptation strategies, particularly in mid-hill farming systems, with positive outcomes for livelihoods and environmental sustainability (Paudel and Duex, 2017).

Despite policy support, Sri Lanka's CSA implementation has lagged due to persistent constraints, including insufficient farmer engagement and lack of context-specific interventions (Ratnasiri et al., 2020). This highlights the critical need for inclusive, bottom-up planning frameworks that considers local agro-ecological and socio-economic conditions. The effectiveness of CSA interventions is largely dependent on how well they are tailored to such localized conditions.

Strategic planning, in this context, refers to the deliberate, evidence-based prioritization of adaptation actions through participatory processes. It provides a structured pathway to operationalize CSA by aligning adaptation measures with ground-level needs and capacities.

2.5.1 Importance of Strategic Planning in Implementing Adaptative Actions

Strategic planning is essential for the effective implementation of CSA. It involves conducting vulnerability assessments, engaging stakeholders, and prioritizing adaptation interventions that are economically viable, socially inclusive, and environmentally sustainable. Participatory methodologies such as Participatory Rural Appraisal (PRA) and Rapid Rural Appraisal (RRA) are instrumental in this process, as they anchor planning in the lived experiences, perceptions, and capacities of local communities (de Silva et al., 2021; Bandara and Pathmarajah, 2020).

In the absence of strategic planning, adaptation efforts tend to be fragmented, reactive, and poorly aligned with long-term development goals. Effective strategic adaptation planning entails a clear assessment of local risks, goal setting, and the formulation of coherent action plans that integrate technical feasibility with social equity. While Sri Lanka has developed some district-level climate adaptation plans, many remain sectorally isolated and lack spatial coherence (Bandara and Pathmarajah, 2020).

Empirical studies in Sri Lanka indicate that participatory strategic planning significantly increases the adoption of climate-adaptive farming practices, including drought-resistant crop varieties, mulching techniques, and water-efficient technologies (de Silva et al., 2021). This underscores the value of a participatory strategic planning framework as both a conceptual and methodological foundation for advancing community-led climate adaptation in agriculture.

The case studies presented from Badulla and Kurunegala Districts further affirm the importance of context-specific planning. Through vulnerability assessments and PRA exercises, distinct local challenges were identified—such as soil erosion in Badulla and water scarcity in Kurunegala—each necessitating targeted adaptation strategies. Such locally responsive approaches are more likely to yield sustainable outcomes, particularly when aligned with broader provincial and national policy frameworks.

2.6 Participatory Approaches for Community-centered Data Collection and Adaptation Planning

Participatory Rural Appraisal (PRA) and Rapid Rural Appraisal (RRA) have evolved as methodological innovations aimed at democratizing data collection and enhancing local participation in development planning. While PRA emphasizes intensive, iterative engagement with communities through tools such as seasonal calendars, resource mapping, and problem ranking, RRA typically employs time-bound qualitative techniques like focus group discussions and secondary data triangulation to generate rapid insights.

Chambers (1994) argues that PRA fosters greater empowerment and learning by shifting power from external experts to local communities. Similarly, Kumar (2002) asserts that RRA is particularly effective when time or resources are constrained, provided it is conducted with methodological rigor and reflexivity. Both methods offer valuable epistemological alternatives to top-down assessments by emphasizing local knowledge systems.

Recent studies on climate adaptation in South Asia emphasize the complementarity of PRA and RRA. For example, in Nepal and Bangladesh, integrated use of participatory methods has facilitated the co-production of adaptation plans that reflect community priorities while incorporating scientific data (Ensor et al., 2019). In Sri Lanka, participatory methodologies have been successfully applied in projects such as the

Climate Resilient Integrated Water Management Project (CRIWMP), demonstrating their effectiveness in aligning adaptation interventions with local realities.

Participatory approaches like PRA are increasingly recognized for their effectiveness in data collection and rural planning. PRA emphasizes engaging communities in analyzing their own conditions, identifying problems, and developing solutions. This methodology builds ownership, enhances local knowledge, and increases the relevance of interventions (Chambers, 1994).

In Sri Lanka, PRA has been successfully used in various rural development projects, including irrigation planning (Koralagama et al., 2007) and disaster risk reduction (Kulatunga, 2014). PRA tools such as seasonal calendars, transect walks, and vulnerability mapping allow for rich, qualitative insights that are difficult to capture through surveys alone.

Evidence from Bangladesh also supports the effectiveness of PRA in climate resilience planning. A study by Ahmed et al. (2016) in coastal areas showed how community-led vulnerability mapping informed more targeted infrastructure investments. Similarly, India has institutionalized participatory village-level planning in its Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS), improving climate resilience outcomes (Jha et al., 2012).

In this study, the use of PRA enabled the identification of locally appropriate adaptation measures—like mulching, rainwater harvesting, and agroforestry—which were then embedded in village-level plans.

Literature affirms that participatory methods such as PRA and RRA are critical to operationalizing CSA at the grassroots level. For instance, the FAO (2013) emphasizes that stakeholder mapping, vulnerability assessments, and scenario planning—all typical PRA tools—are instrumental in identifying context-appropriate CSA options. Similarly, RRA can provide a rapid assessment of institutional and infrastructural readiness for CSA implementation, especially in resource-limited settings.

2.6.1 Community-based Adaptation Planning

Community-based adaptation (CBA) is grounded in the idea that local actors are best placed to identify and address climate risks in their context. CBA has been widely promoted in South Asia through projects funded by international organizations such as IFAD, UNDP, and GEF. These projects emphasize inclusive planning, capacity building, and locally led innovation.

Sri Lanka's Climate Resilient Integrated Water Management Project (CRIWMP) is a key national example. Operating in the dry zone, CRIWMP uses community planning to improve water governance, enhance livelihood resilience, and promote sustainable

land use. Mid-term evaluations show increased farmer participation and improved adaptive capacity.

This study contributes to the growing body of evidence supporting participatory planning in adaptation. By integrating local knowledge into village-level strategies and linking those to divisional planning frameworks, it offers a scalable model for future interventions.

Community-based Climate Change Adaptation (CbCCA) refers to bottom-up planning processes that empower communities to analyze climate risks and implement adaptive actions based on their needs and capacities. According to Ayers and Forsyth (2009), such approaches are effective when integrated into broader governance systems and supported by institutional linkages. CbCCA recognizes that local knowledge, if adequately elicited and validated, can be a powerful resource in addressing complex climate vulnerabilities.

In Sri Lanka, CbCCA has increasingly been integrated into donor-funded climate initiatives. Projects implemented in Anuradhapura and Monaragala districts have demonstrated the value of engaging farmer organizations and women's collectives in adaptation decision-making (Fernando et al., 2020). These case studies highlight the potential of participatory methods, especially PRA, to facilitate inclusive planning processes that are responsive to local contexts and power dynamics.

2.6.2 Empirical Evidence Supporting the Use of PRA and RRA

Although PRA and RRA are often used separately, literature suggests that a hybridized approach may offer synergistic benefits. In contexts like Sri Lanka where heterogeneity exists across districts and villages, tailoring participatory methods to local capacity, literacy levels, and institutional frameworks is essential.

For example, in a multi-village adaptation initiative in India, PRA was used in more cohesive, smaller communities while RRA proved more feasible in fragmented or time-constrained settings. This mirrors the rationale behind the methodological choices in the present study: using PRA in one village where prolonged engagement was feasible, and RRA in another where logistical limitations warranted quicker appraisals.

Such methodological adaptability enhances the credibility, validity, and relevance of community-generated data and ensures that diverse community voices are captured, analyzed, and translated into action plans.

2.6.3 Gaps in the Literature in Related to Use of PRA and RRA in Adaptation Planning

While substantial progress has been made in operationalizing participatory methodologies for climate adaptation, several gaps persist. First, few studies provide comparative insights on the use of PRA versus RRA within the same project

framework. Second, there is limited literature on how participatory data feeds directly into formal planning mechanisms at the divisional or district level in Sri Lanka. Third, most evaluations focus on project outputs rather than community empowerment or sustainability of outcomes.

The present study contributes to bridging these gaps by employing a dual-method approach across two locations, documenting not only the process of data collection but also how it informs strategic planning for climate-smart agriculture. By grounding the research in people-centered methodologies and contextual realities, this study adds empirical weight to ongoing discussions on participatory climate governance.

CHAPTER THREE

Methodology

3.1 Introduction

This chapter outlines the methodological framework adopted for conducting a participatory assessment of climate change impacts and community-driven adaptation planning in two Sri Lankan villages. Recognizing the need for inclusive, context-specific responses to climate vulnerability, the study applied distinct participatory approaches tailored to each site: Participatory Rural Appraisal (PRA) in Village One, and Rapid Rural Appraisal (RRA) combined with focus group discussions (FGDs) and recent baseline secondary data in Village Two. This dual approach enabled the research to generate localized insights while accounting for practical constraints and existing knowledge. The selection of participatory tools is supported by empirical evidence from climate adaptation research globally and within South Asia.

3.2 Research Design

A qualitative case study design was employed to explore climate risks, vulnerabilities, and adaptive capacities in two villages situated in different agro-ecological zones. This approach is appropriate for understanding complex socio-environmental processes and for promoting stakeholder engagement in adaptation planning (Baxter and Jack, 2008). The use of participatory methods aligns with the study's objective of facilitating community-led planning of climate-smart initiatives.

3.3 Site Selection and Sampling

The two villages were selected based on their contrasting adaptive capacities and exposure conditions.

Ketanwewa, located in the Meegahajandura DS Division of Hambantota District, is characterized by severe drought, lack of irrigation, limited livelihood options, and gender-based vulnerabilities. In contrast, Keppetiyawa North has better infrastructure, irrigation access, and institutional engagement, though it still faces challenges such as wildlife damage and underutilized upland farming.

Two villages were selected purposively based on criteria such as:

- Exposure to climate-induced risks (e.g., drought, erratic rainfall, soil erosion),
- Predominance of smallholder farming systems,
- Availability of recent baseline data in one location,
- Willingness of local actors to engage in participatory processes.

Respondents in each village were selected using purposive and stratified sampling to ensure diverse representation across gender, age, livelihood types, and levels of climate exposure. This approach captured a broad range of perspectives relevant to adaptive planning (Palinkas et al., 2015).

3.4 Data Collection

3.4.1 Participatory Methods for Primary Data Collection

The research employed Participatory Rural Appraisal (PRA) and Rapid Rural Appraisal (RRA) couple with focused group discussions as primary tools for data collection and engagement. These methods enabled the research team to generate bottom-up data i.e. to capture in-depth, ground-level insights into local vulnerability patterns, coping mechanisms, and community priorities. These methods ensured inclusive participation, enabled community knowledge to informed planning, and were grounded in best practices supported by academic literature in relation to climate adaptation planning.

A. Participatory Rural Appraisal (PRA) in Village One

In Village One, PRA techniques were employed to actively involve the community in identifying climate impacts, existing coping mechanisms, and future adaptation priorities. Key PRA tools used included:

- Seasonal calendars to track rainfall shifts and climate-related challenges across the agricultural calendar,
- Risk mapping to locate areas vulnerable to floods, landslides, or droughts,
- Problem ranking matrices to prioritize adaptation needs,
- Historical timelines to trace climate trends and responses over decades,
- Resource mapping to assess land, water, and natural capital availability.

These methods are recognized for empowering local communities to articulate their knowledge and play an analytical role in planning (Chambers, 1994; Pretty, 1995). Empirical research shows that PRA methods are highly effective in climate adaptation planning, particularly where top-down interventions may overlook local realities. For example, studies in India and Nepal have shown that PRA-based assessments enable the co-creation of locally appropriate solutions and strengthen institutional ownership (Karki et al., 2020; Tiwari et al., 2014).

B. Rapid Rural Appraisal (RRA), Focus Groups, and Secondary Data in Village Two

- In Village Two, where a recent baseline survey had already been conducted, a Rapid Rural Appraisal (RRA) approach was adopted. RRA is less intensive than PRA but provides a time-efficient, participatory way to gather community insights (Chambers, 1992). Key methods included: Focus Group Discussions (FGDs) with farmers, women's collectives, and youth,

- Key informant interviews with agricultural extension officers and local leaders,
- Review of baseline secondary data (socio-economic, land-use, and farming system information).

The integration of FGDs and secondary data enabled triangulation of findings and helped avoid duplication of effort. This approach ensured community views were incorporated while also building on existing data structures.

Available literature emphasizes the effectiveness of using RRA and FGDs in collaboration in data collection efforts in climate adaptation research. For instance, Shrestha and Pandey (2018) demonstrate that RRA methods, combined with group discussions, provide useful insights into vulnerability and community priorities in rural South Asia. Similarly, Ajibade et al. (2020) emphasize that secondary data, when critically contextualized, can enhance participatory planning without undermining local agency.

3.4.2 Secondary Data Collection

Required secondary data was collected from relevant local authorities, and development agencies, available published literature, and some unpublished institutional level reports as needed.

3.5 Rationale for a Mixed Participatory Approach

The dual application of PRA and RRA across the two study sites was guided by both contextual suitability and research pragmatism**.** PRA enabled in-depth community engagement and collective analysis in Village One, while RRA provided a quicker yet effective participatory assessment in Village Two, supported by relevant existing data. This methodological triangulation enhanced the robustness, relevance, and inclusiveness of the findings.

Component	PRA Village	RRA Village
Community involvement	High (participatory tools and full engagement)	Moderate (structured group discussions and secondary validation)
Data depth	Rich, qualitative insights	Broader context with prior quantitative data
Planning outputs	Community-owned adaptation plan	Community-validated adaptation plan

This mixed-method design is increasingly recommended for climate change studies that seek to balance deep participation with logistical feasibility (Reed, 2008; Sova et al., 2015).

3.6 Ethical Considerations

Ethical standards were upheld throughout the research process:

- Verbal informed consent was obtained from all participants.
- The voluntary nature of participation and the right to withdraw were emphasized.
- Sessions were conducted in local languages to ensure accessibility.
- Findings were shared back with community groups in ‘on-site feedback sessions' conducted immediately after data collection and the information was validated. Enquiries of the community members were addressed, and clarifications of the research team were also resolved with input community members.

Such ethical practices are central to participatory research and help build trust and legitimacy in the resulting community action plans (Cornwall and Jewkes, 1995).

CHAPTER FOUR

Socio-economic Characteristics of Study Areas

4.1 Socio-Economic and Demographic Characteristics of the Households in Keppetiyawa North GND

Keppetiyawa North Grama Niladhari Division (GND) is located in the Hambantota district of the Southern Province and is one of the GNDs under the Weeraketiya Divisional Secretariat. The GND has a total of 255 households comprising 901 members.

Table 4.1 presents the socio-economic and demographic characteristics of the households in Keppetiyawa North GND, including gender of members, age distribution and primary employment of the household heads (HHs). Among the total population of 901 members, males account for 47% while females slightly outnumber them, comprising 53%. Further this finding highlights a slight imbalance in gender distribution may have implications for various aspects of community development and social dynamics, including education, healthcare and workforce participation.

Table 4.1 illustrates a diverse age distribution in the Keppetiyawa North GND. The largest segment, comprising 21.9% of the total population, falls within the age range of 51-70 years. This suggests a significant middle to older age cohort, which may affect community services and planning, particularly healthcare and retirement support. Further study of this group's specific needs would provide valuable insights for policy and community development.

Conversely, the lowest representation is among individuals below 5 years old, accounting for 6.3% of the total population. This indicates a relatively smaller proportion of very young children in the GND, which may impact early childhood education, healthcare services, and family support programmes in the community.

It was discovered that household heads' primary employment encompassed a broad range of occupations. 10% of the HHs are engaged in crop farming, indicating the significance of agriculture as a primary occupation within the Keppetiyawa North GND (Table 3.1). This suggests a diverse local economy, with agriculture playing a significant role alongside other employment opportunities. Additionally, the relatively lower percentage involved in animal husbandry and non-skilled agricultural labour may warrant attention to support and sustain these sectors.

Table 4.1: Socio-economic and Demographic Characteristics of the Households (Keppetiyawa GND)

Category	Criteria	Percentage of Households
Gender of Household Members	**Male**	47
	Female	53
Age of Household Members	< 5 years	6.3
	6-16 years	17.0
	17-25 years	13.3
	26-36 years	13.2
	37-50 years	19.6
	51-70 years	21.9
	> 70 years	8.7
Primary Employment of HHs	Crop Farming	10
	Animal Husbandry	1
	Agricultural Labour (Non-Skilled)	1
	Non-Agricultural Labour (Non-Skilled)	15
	Government Employment	30
	Private Sector Employment	12
	Skilled Labour (Carpenter, Mechanic, etc)	10
	Self-employed - Pottery industry	4
	Self-employed	14
	Foreign Employment	2
	Baby Sitting	1

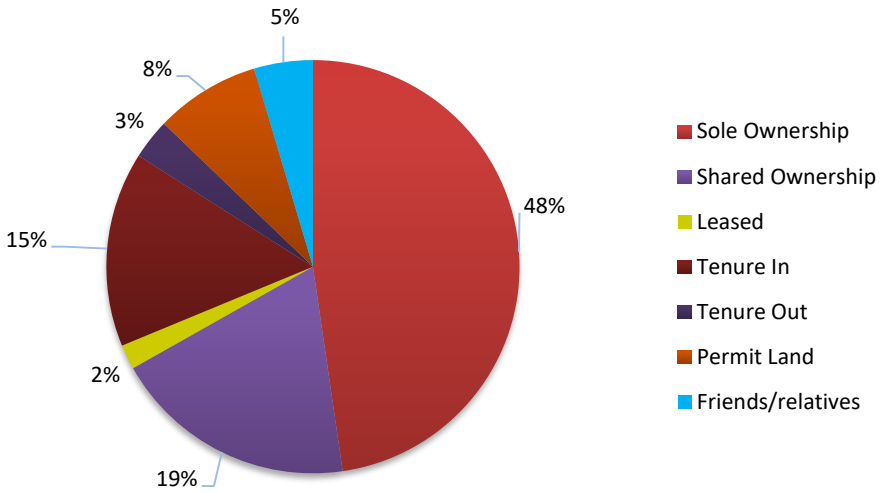
Source: HARTI Survey Data - Bandara et al., 2024

A significant proportion of household heads, comprising 30% of the total, are employed in government positions. This indicates a substantial reliance on government employment as a primary source of livelihood within the community. Representing 4.5% of the HHs are self-employed in the pottery industry, showing a niche market for pottery products in this GND with HHs pursuing independent entrepreneurial ventures in this sector. Supporting entrepreneurial efforts through access to finance, marketing and skill development could contribute to the growth and sustain small-scale industries like pottery in this community.

4.2 Type of Land and Land Ownership in Keppetiyawa North GND

Households commonly have a variety of land plots, including lowlands, uplands and fallow fields, which they may own, cultivate or manage on behalf of landowners. The households solely owned two primary categories of land plots: lowland (59%) and upland (7%). Lowlands were traditionally designated for paddy cultivation, while uplands were utilized for cultivating various crops beyond paddy.

Figure 4.1 presents the land ownership by land plots owned by the households in Keppetiyawa North GND. Data highlights the prevalence of sole ownership (48% of land plots) as the primary form of land ownership within this community. Sole ownership allows farmers to make independent decisions regarding land use, investment and management, which can contribute to agricultural productivity, economic stability and livelihood security.



Source: HARTI Survey Data - Bandara et al., 2024

Figure 4.1: Land Ownership by Land Plots Owned

Furthermore, approximately 8% of land plots owned by this community are held under permit status, specifically designated for agricultural activities. This indicates that farmers have obtained legal authorization to utilize these lands for farming purposes, often through formal agreements or permits issued by relevant authorities. This pattern of ownership highlights the complicated nature of land tenure systems influenced by legal particulars, individual choices and diverse relationships within the farming community.

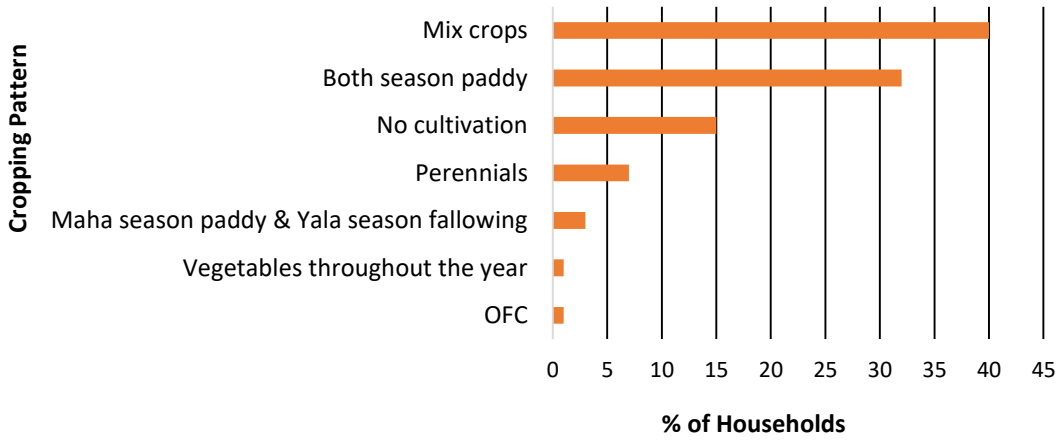
4.3 Source of Drinking Water in Keppetiyawa North GND

Safe and quality drinking water is vital for maintaining public health and well-being. Hence, this sub heading highlights the main sources of drinking water for households in Keppetiywa North GND to meet their drinking water requirements. Obtained data demonstrates that the primary source of drinking water for the majority of households, accounting for 79.2% is piped-borne water. These sources are provided either by the National Water Supply and Drainage Board (NWSDB) or the Community Water Supply and Sanitation Project (CWSSP). This indicates a robust and centralized water supply infrastructure within the community, ensuring reliable access to safe drinking water for these residents.

In addition to piped-borne water, a significant proportion of households, accounting for 20.8%, rely on domestic wells as their primary source of drinking water. This indicates a decentralized approach to water supply within the community, where households access groundwater through privately owned or shared wells. While domestic wells offer autonomy in water access, ensuring water quality and sustainability is essential to safeguard the health and well-being of these households.

4.4 Crop Farming and Livestock Rearing in Keppetiyawa North GND

Landowners in Kappetiyawa North GND adopted a diverse range of cropping patterns. Findings of the cropping patterns are demonstrated in the Figure 4.2. Thirty-two percent of the households reported cultivating both seasons of paddy, highlighting a predominant emphasis on rice farming. A minority, comprising 2%, engaged in year-round cultivation of vegetables, illustrating a dedication to varied and continuous agricultural production. However, the most common cropping pattern was mixed cropping, with 40% of households opting for a blend of various crops. A significant portion, constituting 15% had left their land uncultivated at the time of the survey, indicating periods of fallow or non-agricultural land utilization.

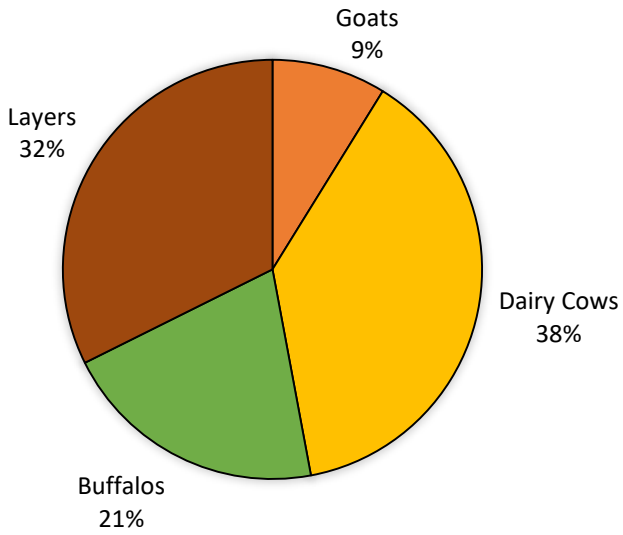


Source: HARTI Survey Data, 2023

Figure 4.2: Cropping Pattern of the Land Plots

Concerning the management of livestock and poultry over the past five years, approximately 24% of respondents, actively participated in such activities. Meanwhile, the majority, constituting 74%, did not engage in raising or owning livestock and poultry during this period. This finding suggests varying levels of involvement in animal husbandry within the community, with a notable proportion of households opting out of such endeavors. The presence of a substantial number of households engaged in livestock and poultry management underscores its role as a supplementary source of income and livelihood diversification within this community. However, the majority's lack of engagement may indicate alternative livelihood strategies or limited interest in animal husbandry among certain segments of the population.

As presented in Figure 4.3, the primary category of livestock among households is dairy cows, making up 38% of the households, indicating a significant emphasis on milk production within Keppetiyawa North GND. Additionally, layers, which are chickens raised for egg production, are prevalent, with 32% of households owning them. This finding implies a substantial involvement in poultry farming for egg production as well.



Source: HARTI Survey Data - Bandara et al., 2024

Figure 4.3: Type of Livestock Raised or Owned by Households

In addition to dairy cows and poultry management, buffalos were raised by 21% of households, showcasing a notable but relatively smaller proportion compared to other livestock types. Goats were owned by 9% of households, indicating a lesser prevalence of goat ownership.

4.5 Population, Socio-economic and Demographic Characteristics of Households Residing in Ketanwewa GND

Ketanwewa Grama Niladhari Division (GND) is located in Hambantota district of the Southern province and it belongs to one of the GNDs in Hambantota Divisional Secretariat. According to the resource map of Ketanwewa GND, Hambantota (2022), the population is 701 members residing in 210 households. Among these households, 206 are headed by males, while the rest are headed by women, indicating a predominant male household headship within the community.

Table 4.2 presents the socio-economic and demographic characteristics of the households residing in Ketanwewa GND, including gender of the household members, age distribution and primary employment. In Ketanwewa GND, males make up 51% of

the total population, with the remaining members being females. This indicates a slight majority of males, suggesting a relatively balanced gender distribution.

Table 4.2: Socio-economic and Demographic Characteristics of the Households (Ketanwewa GND)

Category	Criteria	Percentage of Households
Gender of HH Members	Male	51
	Female	49
Age of HH Members	< 5 years	10
	5-14 years	15
	15-35 years	32
	36-60 years	33
	61-80 years	7
	>80 years	2
Primary Employment of HH Members	Crop Farming	45
	Government Employment	15
	Private Sector Employment	2
	Self-Employed	16
	Foreign Employment	3
	Other	19

Source: Divisional Secretariat Hambantota, 2022

The predominant age group among household members in Ketanwewa GND is 36-60 years, indicating a significant demographic presence within this working-age range. This reflects that a substantial portion of the population belongs to the working-age group, which may impact for workforce participation, economic productivity and family dynamics. Following this, the 15-35 age group, accounts for 32% household members. This indicates a substantial presence of young adults and contributing to the community's demographic diversity.

A minority, constituting 9% of household members, are aged over 61 years old in Ketanwewa GND. This indicates a relatively small population of older individuals. Additionally, infants below the age of 5 years make up 10% of household members in Ketanwewa GND, highlighting a substantial presence of young children. Infants are a vulnerable demographic group requiring specific care, attention, and resources to support their health, growth, and development.

The primary employment of the majority of households in Ketanwewa GND is crop farming, representing 45% of households. This underscores the community's strong reliance on agriculture as the main source of livelihood and income. They cultivate mainly paddy, mung bean, finger millet, sesame, cashew, mango, banana and other fruit crops. Sixteen percent of household members are engaged in self-employment, while 15% serve in government positions. This highlights a diverse workforce, with

individuals pursuing entrepreneurship and public sector employment for livelihoods and income generation. Three percent of household members are employed in foreign countries, while 2% work in the private sector. This indicates some economic diversification with individuals seeking opportunities abroad and in the private sector alongside other forms of employment.

4.6 Nature of Land Ownership in Ketanwewa GND

Land ownership is a fundamental aspect of property rights and plays a crucial role in determining land use, development and economic activities within a community or society. As per the resource map of Ketanwewa GND (Divisional Secretariat Hambantota, 2022), sole ownership encompasses 162 acres of land extent, while 78 acres of land are held under grants. This data underscores the diversity of land tenure arrangements within the community, with a significant portion of land under private ownership and a smaller proportion distributed through grants or allocations.

Eighty-four acres of land are covered by permits, indicating legal authorization for specific uses, while 112 acres are classified as encroached lands, suggesting unauthorized occupation or use. This data underscores the complexity of land tenure and governance issues within Ketanwewa GND, reflecting challenges related to land management and enforcement of land laws.

4.7 Source of Drinking Water in Ketanwewa GND

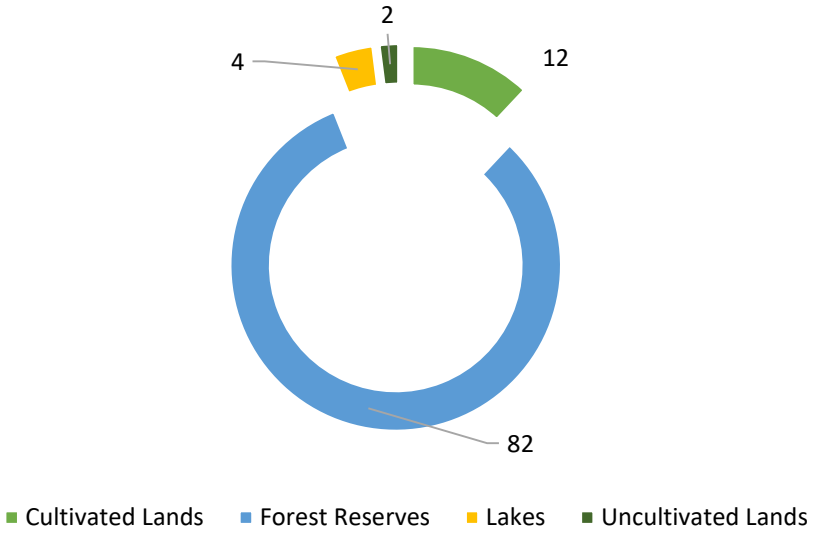
The importance of a reliable drinking water source cannot be overstated. Access to safe and clean drinking water is essential for maintaining public health, ensuring proper hydration and preventing waterborne diseases. A dependable drinking water source is crucial for various daily activities such as cooking, bathing, sanitation and hygiene practices. Moreover, improved access to water can alleviate the burden on vulnerable populations, particularly women and children, who often bear the responsibility of fetching water over long distances.

In the Ketanwewa GND, 98% of households have access to piped-borne water for their safe and quality drinking water needs. This high percentage indicates a widespread and reliable water supply infrastructure within the Ketanwewa GND. Overall, the high prevalence of piped-borne water access highlights the community's commitment to ensuring safe and reliable drinking water for its households (Divisional Secretariat Hambantota, 2022).

4.8 Crop Farming, Livestock Rearing and Fisheries Sector in Ketanwewa GND

The majority of land (82%) is designated as forest reserves under government governance. These areas are strictly regulated and not available for public utilization, particularly for farming activities. Forest reserves are managed to preserve

biodiversity, protect eco-systems and mitigate deforestation. Twelve percent of the total land extent has been cultivated in both lowlands and uplands, indicating agricultural activities across diverse terrains. Meanwhile, 2% of the land remains uncultivated, suggesting areas not utilized for agricultural. Four percent of the land is covered with lakes, indicating a significant presence of inland water bodies within the district. These lakes provide opportunities for inland fisheries, supporting fishing activities and livelihoods in the local community.



Source: Divisional Secretariat Hambantota, 2022

Figure 4.4: Land Use Pattern in Ketanwewa GND

In Ketanwewa GND, households prominently raise buffaloes for curd production, with a total of 138 buffaloes being raised for this purpose. Additionally, households raise 52 dairy cows, indicating the importance of milk production. This highlights livestock rearing as a significant economic activity, providing households with milk and dairy products for consumption and income generation. Although none of the households in Ketanwewa GND are engaged in poultry management, 15 goats are being raised (Divisional Secretariat Hambantota, 2022). The presence of goat rearing underscores the diversity of livestock activities, reflecting households' adaptability and resource utilization strategies.

Inland fisheries play a crucial role in providing employment, income generation and nutritional benefits to local populations, contributing to food security and economic development in Ketanwewa GND. Of the total households, 8% are engaged in inland fishing, indicating access to inland water bodies. In contrast, only 1% of households are involved in marine fishing, suggesting limited participation in fishing activities along coastal or offshore areas. This finding implies the importance of inland resources for fishing activities and livelihoods, with inland fishing being more prevalent than marine fishing (Divisional Secretariat Hambantota, 2022).

CHAPTER FIVE

Vulnerability Status and Adaptation Options: Case Studies from Ketanwewa and Keppitiyawa-North Villages

5.1 Vulnerability Status and Adaptation Options

As this study focused on the identification of climate adaptive interventions followed by the Dry Zone farming communities, it used two participatory techniques as data collection tools namely the Participatory Rural Appraisal (PRA) and Rapid Rural Appraisal (RRA). Accordingly, this chapter presents the information generated through primary data collected via these two methods in two villages in the Dry Zone, namely Ketanwewa in Meegahajandura Divisional Secretariat area and Keppetiyawa North in Weeraketiya Divisional Secretariat area in Hambantota District.

5.2 Vulnerability Status and Adaptation Options for Ketanwewa GND

5.2.1 Exposure of Ketanwewa Village to Adverse Climatic Events

Being located in the low country Dry Zone (Agro Ecological Zone - DL1), Ketanwewa is observed to be more exposed to adverse impacts of water scarcity caused by lack of rain and prolonged dry spells in comparison to the North Keppetiyawa. This was clearly reported in the trend analysis in PRA data collection (Table 5.1), where community responses show: (1) a continuous increase in the average severity of dry spells through over past decades; (2) a decreasing trend of rainfall. (3) a decreasing trend in the storage capacity of the village's only tank, named Ketanwewa; and (4) increasing encroachment into its catchment area by adjacent farmers, which contribute to the siltation induced storage capacity reduction. Therefore, from the community responses, it is clear their level of exposure for climate change induced adverse impacts has increased over time.

Keppetiyawa North village, being located closer to the boundary between Intermediate and Dry Zones has comparatively lower exposure to climate change related adverse impacts than Ketanwewa. This was also observed from the farmers' responses during the RRA activity, where they did not mention reduced rainfall or a decreasing trend in rainfall, as reported in Ketanwewa. Furthermore, Keppetiyawa North has seven tanks within the village, providing most families with access to irrigation water for their cultivations. Nevertheless, there was a small area with around 50 families who did not have access to tank water; their main source of water for cultivation is groundwater obtained from both dug wells and agro-wells.

Table 5.1: Trend Analysis of Ketanwewa Village from 1980 to 2023

Item description	-1981 1990	-1991 2000	-2001 2010	-2011 2023
Cultivation inside tank catchment	X	XX	XX	XXX
Water capacity of the tank	XXX	XXX	XX	XX
Rainfall	XXXX	XXX	XXX	XX
Forest area	XXXXX	XXXX	XXX	XX
Frequency and severity of drought	XX	XX	XXX	XXXX
Paddy yield	XXX	XXXX	XXXX	XXXX
Abandoned paddy lands	X	XX	XXX	XXXX
Upland cultivation	XX	XX	X	X
Home gardening	XXX	XXX	XX	XX
Education status of the village population	XXX	XXXX	XXXX	XXXX
Wild animal damage	XX	XXX	XXXX	XXXXX
Number of government jobs	X	XX	XX	XX
Number of self-employees	X	XX	XX	XX
Migration		XX	XX	XXX
Community organizations	X	XX	XXX	XX
Quality of transport facilities	X	XX	XXX	XXX
Number of families with vehicles	XX	XXX	XXXX	XXXX
Drugs addictions	XX	XXX	XXXX	XXXX

Source: PRA- Ketanwewa village, 2023

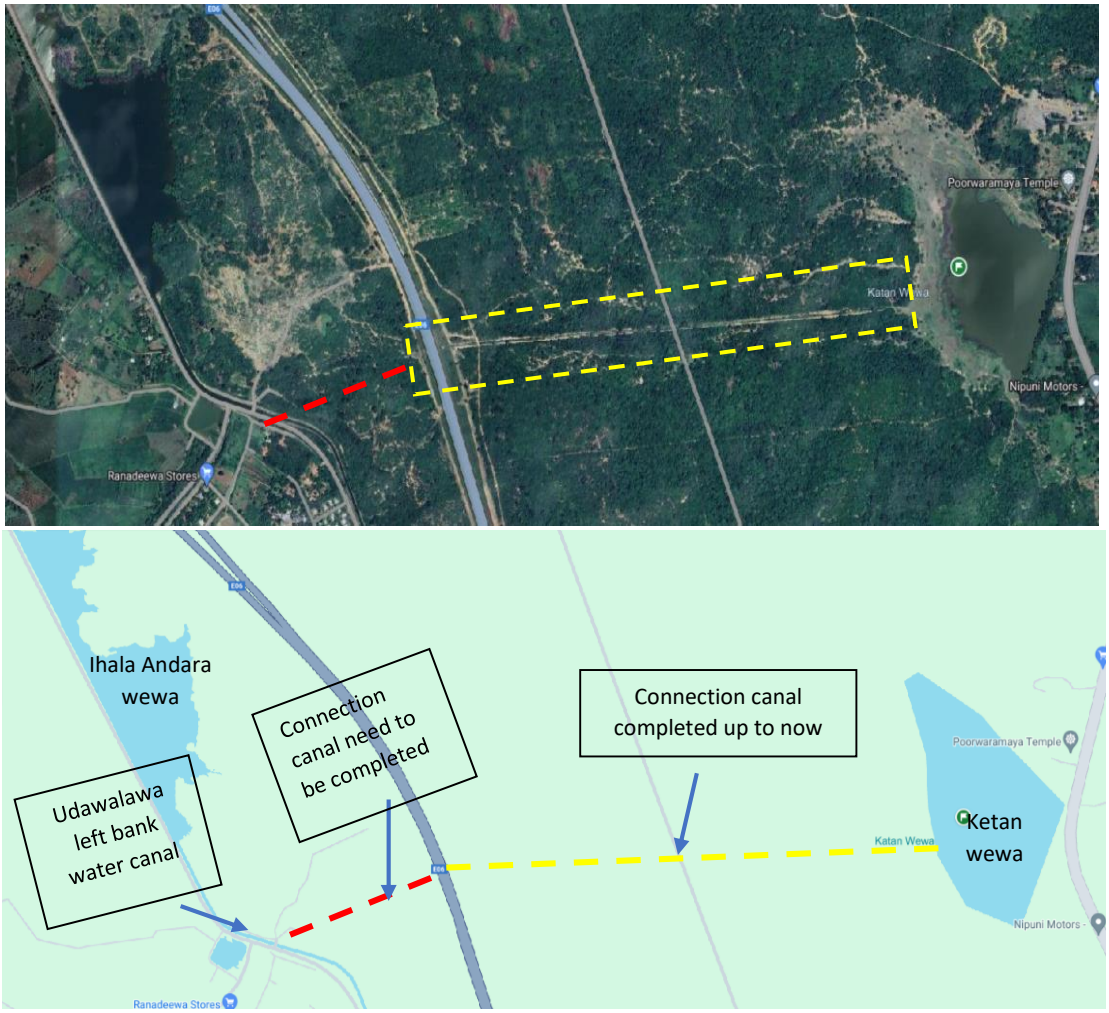
5.2.2 Sensitivity of Communities in Ketanwewa Village to Climate Induced Adverse Impacts

According to the community responses during the PRA activity, the main issue they are facing is water scarcity for their cultivation, mainly due to limited water capacity of the Ketanwewa tank. One of the reasons for this limited water holding capacity is siltation. As per the community responses, the last rehabilitation effort of the Ketanwewa tank was undertaken in early 1980's, and no de siltation has been done since then, despite significant siltation that occurred during and after the construction of Southern Expressway across the tank catchment.

Another reason for the low water capacity is the destruction of water feeding from its catchment. As they explained, earlier the Ketanwewa tank was continuously fed by from the water from upstream catchment areas. With phase 2 of Walawa Left Bank extension, a canal network was constructed across the tank catchment to convey the Walawa Left Bank water toward downstream areas, obstructing the natural water flow to the Ketanwewa tank. Furthermore, the construction of Southern Expressway across the catchment area worsened this situation, resulting in further of water inflow. In response to community's request, a culvert was placed across the Expressway to facilitate some amount of drainage water from upper catchment toward the tank.

Nevertheless, this was not an adequate solution to ensure sufficient water inflow to the tank and as a result, the tank has been unable to contain adequate water for the village cultivations.

As a result of both these reasons - siltation and obstruction of feeding - tank receives very limited water, and this amount has not been sufficient to serve the command area for full season water rounds unless adequate rains are received. According to the community, there are around 52 acres of lowland under the command area of this tank, and in order to cultivate these lands, the tank has to be filled at least three times per season. This situation has made village community highly sensitive to adverse climatic conditions, particularly during prolong dry spells. The severity of the issue is reflected in the statement of a farmer who participated in the PRA: "By 2023 *Maha* season, we were unable to cultivate our paddy land for six consecutive seasons due to inadequacy of water" (PRA- Ketanwewa, 2023).



Source: Google Map (accessed on 26-09-2023)

Figure 5.1: Satellite Image View and Map View of Ketanwewa Village and Its Feeder Canal Connection

In response to this issue, in 2015 villagers initiated the construction of a feeder canal to the tank from the Walawa Left Bank connection canal (which flows from Ihala andara wewa). Though they managed to dig that canal from tank up to the culvert across the Southern Expressway, approval from the relevant authorities was not received to complete the canal and establish the connection to the Walawe Left Bank connection canal. Despite the numerous request and efforts made over the past 9 years, this connection has not yet been realized. During the 'problem identification and prioritization' activity of the PRA event (Table 5.2), initiation of this connection to partly dug canal was prioritized as the number one issue that the villagers wanted to resolve. Figure 5.1 shows the position of this partly constructed feeder canal, Walawe Left Bank connection canal, and tanks.

Table 5.2: Prioritized Issues in Ketanwewa Village

	Issue	1	2	3	4	5	6	7	Total	Rank
1	Water scarcity		1	1	1	1	1	1	6	**1**
2	Wild animal damages			2	2	2	2	2	5	**2**
3	Lack of technical know-how about cultivation Lack of support and poor access to agri-extension)				4	5	6	7	0	**7**
4	Marketing problems (no convenience place for marketing, high influence from intermediates)					5	6	7	1	**6**
5	Difficulty of finding quality seeds						6	7	2	**5**
6	Land related issues (ownership issues, not having licenses, abandon lands exaggerate the wild animal issues)							6	4	**3**
7	Lack of financial resources/capital related issues								3	**4**

Source: PRA- Ketanwewa village, 2023

Average upland parcel size owned by the majority of residents is between ¼ ac to ½ acre making them resource poor in terms of land. Therefore, they have limited resources to engage in cultivations and thereby potential for income earning via cultivations is very limited. This low potential for income earning via crop cultivation due to lack of land resources has made the community more sensitive to adverse climatic conditions.

Land resource scarcity and water shortage have pushed the community to seek on-farm income outside the village. However, nearby areas also lack sufficient land and water, offering limited opportunities. The closest option is farmland near Mal-ara (a water canal flow adjoining to the village) about 3–5 km away, where mostly men go for work. As a result, women have become more financially dependent on men, losing their financial independence.

Apart from income earning, limited land availability also limits the community's capacity to produce food for own consumption, increasing their vulnerability in terms of food security. As shown in the food path analysis of Ketanwewa village (table 5.2), many major food items are sourced from outside the village, except for items such as coconut, and fruits were obtained mainly within the village. Women face more burden in securing food for their families, as many men have migrated for income earning activities.

Table 5.3: Food Path Analysis of the Ketanwewa Village

Food category	% **produce within the village**	% **obtained/purchaseed outside the village**
Rice	1%	9%
Coconut	90%	10%
Vegetables	3%	7%
Fruits	70%	30%
Yam	30%	70%
Egg	5%	95%
Milk	40%	60%
Fish	25%	75%
Meat	5%	95%

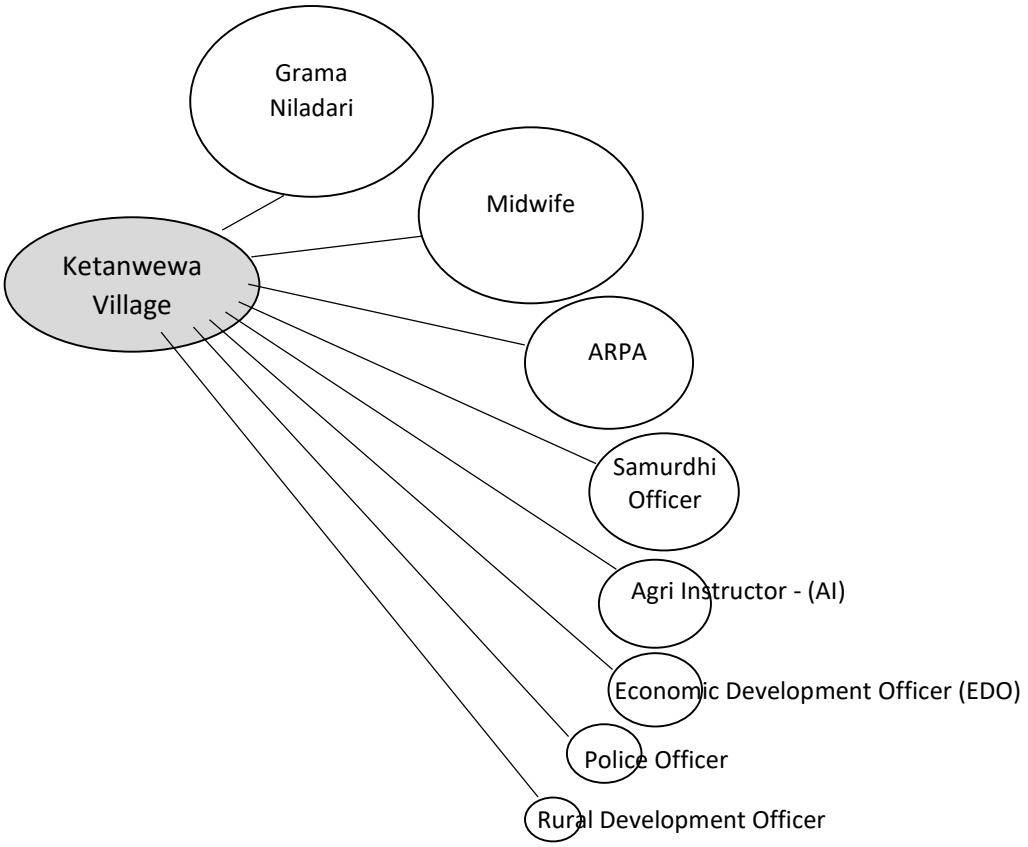
Source: PRA- Ketanwewa Village, 2023

Temporally out-migration of males due to the lack of income earning opportunities in the vicinity of the village has made the female members further vulnerable to various adverse impacts, such as losing the opportunity to engage in non-farm income generating activities, increased involvement in household chores, greater social commitments, and rising security-related issues.

As shown in the Table 5.2, another serious issue that Ketanwewa farmers faced is wild life damage to their crops. These damages are caused by elephants, monkeys, peacocks, wild boars and squirrels, while wild-elephant attacks have also resulted in property damage and even loss of lives. The absence of an elephant protecting fence to prevent elephants from forest areas is the main reason for these attacks. This has caused frequent damage to cultivations, placing villagers under serious discomfort. While already conducting their cultivations under many hardships, the frequent damage from wild animals has made them highly sensitive to additional adverse impacts in their day-to-day life.

Another issue increasing their sensitivity to climate induced and other adverse impacts is poor technical know-how about farming. As shown in Table 5.2, the Ketanwewa

community prioritized this as the third most significant issue they are face. This was also evident during the activity of identifying relative importance and relative distance with officers who are serving to the village community (Figure 5.2) where Agricultural Instructors were identified as having relatively low importance and a poor relationship with farming community. Additionally, Economic Development Officer (EDO) and Police Officers were also identified as having relatively low importance and weak connections with the community.



Note: The size of the circle represents the relative importance, while the length of the lines indicates the relative distance/strength of the relationship between respective officer and the village

Source: PRA- Ketanwewa Village, 2023

Figure 5.2: Graphical Representation of Relative Importance and Relative Distance with Officers Serving to the Village (based on community's opinion)

This correlates with other issues raised by the community during the problem identification and prioritization activity such as lack of rural development initiatives/projects and drug addiction among youth. In the context of persistent climate-induced adverse impacts, this poor support and weak relationships with officers responsible for providing technical know-how leave the Ketanwewa farming community more vulnerable to the negative effects of climate change. Beyond climate impacts, poor relationships and lack of support from Police and EDO also increase their social vulnerability, potentially exacerbating the effects of other adverse conditions they face in daily life.

5.3 Sensitivity of Communities in Keppitiyawa Village to Climate Induce Adverse Impacts

Compared to Ketanwewa village, Keppetiyawa North was better off in terms of sensitivity to climate induced adverse impacts and other socio – economic challenges, However, similar to Ketanwewa, Keppetiyawa North also faced significant hardships due to wild life damage caused by peacocks, monkeys and squirrels, prompting villagers to seek sustainable solutions to these wildlife threats.

There were seven tanks in the Keppetiyawa North village area, and only 2% of the total arable land remained uncultivated. In terms of primary employment, only 10% were engaged in crop farming, while majority were employed in non- agricultural sectors (non-agriculture-non skilled labour – 15%, skilled labour – 10%, government jobs – 30% and private sector jobs – 12%) (HARTI Survey Data - Bandara et al., 2024). This clearly indicates that the Keppetiyava North community is less sensitive to climatic impacts compared to the people in Ketanwewa.

While all the lowlands have access to irrigation water throughout both seasons, only about 30 families (about 25 acres) face water issues for upland cultivation and are requesting the rehabilitation of an abandoned community well (previously used as a drinking water source for a community-based water supply scheme) as a solution to secure water for their upland cultivation. Apart from this, there were no significant issues identified that increase the community's sensitivity to adverse impacts, either specifically related to climate change or more generally to other socio-economic challenges.

CHAPTER SIX

Suggested Adaptation Actions

6.1 Recommended Actions for Reducing the Vulnerability Status of Ketanwewa and North Keppetirywa Farming Communities.

It was observed that, despite the high exposure and sensitivity of Ketanwewa farmers to adverse impacts of climatic variations, there were no any notable viable adaption actions being undertaken by either of the two villages. However, some of the Ketanwewa farmers have tried practicing mung bean cultivation in some lowlands during the *Maha* season but it also has not frequently undertaken. Nevertheless, this effort is more suitable to be described as a coping measure rather than adaptive action. This clearly indicates the potential for introducing suitable climate adaptive measures either in the form of actions that helps to decrease their sensitivity and to increase their adaptive capacity.

As the level of vulnerability of communities in two villages are different and associated socio-economic context are also different, actions to be implemented in each location will also need to be location specific.

6.1.1 Proposed Actions for Ketanwewa

Actions proposed below for the Ketanwewa village community mainly focused on issues of water scarcity, limited off-farm and non-farm income opportunities - especially for women, and wild life damage to crops and property.

1. A major issue faced by the people in Ketanwewa, is lack of water for their cultivation. Completion of feeder canal to the tank is suggested as a high-priority action. It would be highly impactful to assist the village community to obtaining necessary approval from Mahaweli Authority of Sri Lanka to connect the partially constructed feeder canal to Walawa Left Bank water flow and facilitate the negotiations with farmer organizations currently receiving water from the canal to initiate the proposed diversion.
2. To expand the capacity of the tank, a desiltation programme should be conducted with necessary financial and technical assistance from relevant government organizations.
3. Raising community awareness and promoting of cultivation of perennial crops such as lime, pomegranate, and mango which require less water, is suggested to improve land productivity in uplands

4. Promoting the cultivation of other field crops (OFCs) such as green gram and finger millets in paddy lands during *Yala* season and in the third season, especially in low lying paddy lands where the moisture content is comparatively high.
5. To protect villages and their crops from wild elephant attacks, the existing elephant fence should be extended around the village boundary.
6. Making the community aware and promotion of cultivating crops which are less susceptible to other wildlife damages such as lime, gingerly, and finger millets in uplands is also suggested as a suitable action to reduce the potential damages to their cultivations from wild animals.
7. Introducing regulatory actions and programmes to re-start cultivations in uncultivated/abandoned lands is also recommended to reduce hiding places and decrease crop damage.
8. Promoting income diversification among farmers to engage in off-farm and non-farm activities is suggested to improve the community's economic wellbeing. Special attention should be paid on unemployed women. Increasing income opportunities within closer proximity to the village is necessary to enhance their participation in income generating activities.

6.1.2 Proposed Actions for North Keppetiyawa

In comparison to Ketanwewa, Keppetiyawa North remains less vulnerable and faces fewer hardships in managing agricultural livelihoods. The actions below for the Keppetiiyawa North village community mainly focus on low productivity of available uplands, limited livelihood diversification, and wildlife damage to crops.

1. Unlike in Ketanwewa, the average size of majority of uplands in the Keppetiyawa village is larger, ranging from ½ acre to over 5 acres. Most of these uplands are mainly consist of coconut cultivations and mostly they are tall, old trees. The village has an undulated topography with alternating valleys and slightly hilly ridges, resulting in low-lying areas with shallow groundwater and hilly areas with deeper groundwater.

   To increase land productivity, crop diversification through mix and intercropping with suitable perennial crops is suggested. Crops like lime, and pepper under coconut as they can survive with low moisture conditions, whereas, lands in low lying areas can be introduced with crops such as banana, turmeric and ginger. This will increase the land productivity and average income from unit land area compared to mono cropped coconut.
2. Despite the availability of larger land plots, cultivation is not undertaken on a larger scale and thereby production of those crops was scattered across the village. This has created a lot of issues in production and marketing such as poor bargaining power, high cost of production, uncertain markets and unnecessary dependence on mediators, which disadvantage farmers. Therefore, raising

awareness, promoting, and facilitating collective approaches in production and marketing is recommended.

3. Given the village's several perennial water sources and abundant low-lying lands with year-round grass cover, buffalo rearing can be promoted as a viable income diversification option. Farmers' knowledge and skills should also be developed to engage in value addition in dairy related products for better income.

4. Increasing the availability of off-farm income sources (such as food-based value addition and services to agriculture related small businesses), and non-farm income sources (cottage industries in garment, shoe making, bag making, paper-based products etc.) within the close proximity to village needed to facilitate women's participation in income generating activities.

CHAPTER SEVEN

Strategic Frameworks for Implementation
Village-specific Climate-Smart Agriculture Plans for Vulnerable Dry Zone Communities

7.1 Introduction

Building on the participatory assessments, vulnerability analysis, and tailored recommendations presented in previous chapters, this section outlines two strategic implementation frameworks—one for each study village. These frameworks convert community priorities, climate vulnerabilities, and local resource dynamics into actionable, context-specific roadmaps for guiding government agencies, development partners, and community organizations in delivering climate-smart agriculture (CSA) interventions.

Though both villages are in the same district, Ketanwewa requires basic infrastructure and survival-focused interventions, while Keppetiyawa North has the potential to move toward productivity optimization and market integration. These tailored strategies ensure relevance, efficiency, and adoption.

Each village-specific climate-smart agriculture plan presents a vision, goals, key strategies, priority actions, responsible actors, and monitoring indicators, aligning with national climate resilience policies and Sustainable Development Goals (SDGs). They are designed for practical implementation, scalability, and replication in other vulnerable rural areas.

7.2 Strategic Framework: Ketanwewa Village

Vision

To enhance the climate resilience and livelihood security of the farming community in Ketanwewa through context-specific, participatory, and inclusive climate-smart agricultural interventions.

Strategic Goals

- Improve water security for agriculture
- Diversify and stabilize local livelihoods
- Strengthen institutional linkages and technical support
- Promote inclusive economic participation
- Reduce crop losses from climate and wildlife threats

A detailed version of the proposed action plan can be found in Table 7.1.

Table 7.1: Key Strategies and Actions

Objective	Strategy	Key Actions	Responsible Actors/institutes
1. Increase water availability for cultivation	Rehabilitate and augment local irrigation infrastructure	I. Complete feeder canal connection to Walawa Left Bank canal II. Desilt Ketanwewa tank III. Introduce micro-irrigation kits in upland areas	Mahaweli Authority, Dept. of Irrigation, Divisional Secretariat, Farmer Organizations
2. Promote water-efficient and resilient crop practices	Introduce drought-tolerant, low-water crops	I. Promote green gram, finger millet, and lime on uplands II. Conduct farmer training on crop scheduling	Dept. of Agriculture,
3. Enhance crop protection and land utilization	Minimize wildlife damage and reclaim abandoned lands	I. Extend elephant fencing II. Promote wildlife-resistant crops (lime, gingerly) III. Initiate re-cultivation of abandoned fields	Dept. of Wildlife Conservation, Dept. Agriculture, Agrarian Services, Local Authorities
4. Strengthen local livelihoods through diversification	Expand non-farm income opportunities, esp. for women	I. Introduce vocational training (garments, food processing) II. Facilitate small grants or micro-loans to economically empower marginal women III. Support market linkages	Divisional Secretariat - EDOs, Dept. of Agriculture, Samurdhi Authority, NGOs
5. Build adaptive capacity through institutional support	Improve access to extension and community services	I. Reactivate agri-extension visits II. Strengthen village-level coordination III. Mobilize existing community-based organizations	Dept. of Agriculture, Divisional Secretariat - EDOs, Samurdhi Authority Local CBOs/NGOs

Implementation Roadmap

- **Phase 1 (0–6 months):**
  - Approvals and coordination for the feeder canal
  - Mobilize PRA committees for awareness sessions
  - Quick-start livelihood support (vocational training)
- **Phase 2 (6–18 months):**
  - Tank de-siltation and elephant fence extension
  - Crop trials and water-efficient farming roll-out
  - Support for women's business activities
- **Phase 3 (18+ months):**
  - Evaluate adaptive outcomes
  - Institutionalize extension services
  - Replicate scalable components in nearby villages

Table 7.2 provides a summary of the monitoring and evaluation schedule to be placed along with the strategic action plan proposed for the Ketanwewa village.

Table 7.2: Monitoring and Evaluation Indicators

Indicator	Target	Monitoring Tool
Percentage increase in cultivated area	+30% in 2 years	Farmer self-reporting, field verification
Percentage of households using drought-resilient crops	+50% farming households by year 2	Farmer self-reporting, Information by AI
Number of women trained/income-generating	20+ women in 1 year	Training records, business registry
Water availability in the tank	25% increase in command extent	Mahaweli Authority records
Wildlife damage incidents	-30% in 1 year	Community reporting, Dept. of Wildlife

7.3 Strategic Framework: Keppetiyawa North

Vision

To enhance agricultural resilience, economic diversification, and land productivity in Keppetiyawa North through tailored, community-driven climate-smart strategies.

Strategic Goals

- Optimize upland productivity
- Reduce wildlife-related farming losses
- Develop collective marketing and value chains
- Expand women and youth economic opportunities
- Improve institutional support and farmer training

A detailed version of the proposed action plan can be found in Table 7.3.

Table 7.3: Key Strategies and Actions

Objective	Strategy	Key Actions	Responsible Actors
1. Improve land use efficiency and crop productivity	Promote integrated cropping systems on uplands	I. Introduce intercropping: coconut + pepper, banana, lime II. Encourage mixed cropping based on terrain (low-lying vs hilly areas) III. Provide technical support and demonstration plots	Dept. of Agriculture, HARTI, Farmer Organizations
2. Strengthen community-based production and marketing	Develop collective action for scale and bargaining power	I. Facilitate farmer groups for joint input purchase and sales II. Support aggregation, storage, and transport logistics III. Link to institutional buyers or cooperatives	Divisional Secretariat, Agrarian Services, Export Development Board
3. Reduce wildlife-related damages	Introduce prevention and crop selection strategies	I. Promote less wildlife-sensitive crops (lime, turmeric) II. Extend and maintain fencing where needed III. Create buffer zones with deterrent species	Dept. of Wildlife, Dept. of Agriculture, Local Government
4. Expand economic opportunities for women and youth	Build alternative and value-added income streams	I. Introduce skills training: food processing, garment/crafts II. Support small business incubation and microcredit access III. Facilitate producer groups and digital marketing	Women's Bureau, Samurdhi Authority, NGOs, Youth Services Council
5. Enhance institutional support and farmer learning	Strengthen agricultural extension and information flow	I. -Reactivate agri-extension service II. Conduct seasonal planning workshops III. Promote access to climate and market information	Dept. of Agriculture, Divisional Secretariat, Farmer Networks

Implementation Roadmap

- *Phase 1 (0–6 months):*
    - Identify and map priority uplands for diversification

    - Form and register collective farmer groups
    - Launch women/youth livelihood training sessions
- *Phase 2 (6–18 months):*
    - Roll out mixed cropping trials
    - Facilitate market access partnerships
    - Launch pilot buffer crop zones against wildlife
- *Phase 3 (18+ months):*
    - Expand successful practices to larger plots
    - Institutionalize extension presence
    - Strengthen inter-village knowledge exchanges

Table 7.2 provides a summary of the monitoring and evaluation schedule to be placed along with the strategic action plan proposed for the Ketanwewa village.

Table 7.4: Monitoring and Evaluation Indicators

Indicator	Target	Monitoring Tool
% Increase in productive use of uplands	+40% of lands have been transformed/utilized for economically productive uses in 1.5 years	Field surveys, land use maps
% of farmer families engaged in collective marketing	+10% farming families by 1.5 years	Farmer group records
% reduction in crop loss due to wildlife	30% reduction	Wildlife incident logs
# of women/youth starting micro-enterprises	+30 new ventures being started in 1.5 to 2 years	Business registry, CBO records
Frequency of agri-extension visits	Monthly by Year 1	Officer reporting logs

7.4 Integration and Policy Alignment

Both frameworks are designed to support and complement existing national and sub-national policies, including:

- Sri Lanka's National Adaptation Plan (2016–2025)
- Ministry of Agriculture CSA Roadmap
- District Resilience Strategies
- Selected SDGs**:** 1 (No Poverty), 2 (Zero Hunger), 5 (Gender Equality), 13 (Climate Action), 15 (Life on Land)

These frameworks are not fixed prescriptions but should be considered flexible, community-informed guides. They offer a scalable model for adaptive agriculture that can be replicated in other dry zone villages with suitable contextualization.

REFERENCES

Abeysekera, R.M., 2018. Climate-smart agriculture in Sri Lanka: Potential, practices and policy recommendations. *Journal of the Department of Agriculture, Sri Lanka*, 17(2), pp. 77–90.

Ahmed, B., Rahman, M., and Haque, U., 2016. Participatory vulnerability assessment in climate-sensitive areas of Bangladesh. *Climate and Development*, 8(3), 261–273.

Ahmed, M. and Suphachalasai, S., 2014. Assessing the Costs of Climate Change and Adaptation in South Asia. Manila: Asian Development Bank. Available at: https://www.adb.org/publications/assessing-costs-climate-change-and-adaptation-south-asia

Ajibade, I., Sullivan, M., and Haeffner, M., 2020. Why climate migration is not managed retreat: Six justifications. *Global Environmental Change*, 65, 102187. https://doi.org/10.1016/j.gloenvcha.2020.102187

Ayers, J., and Forsyth, T., 2009. *Community-based adaptation to climate change: Strengthening resilience through development*. Environment: Science and Policy for Sustainable Development, 51(4), 22–31. https://doi.org/10.3200/ENVT.51.4.22-31

Bandara, N. J., and Pathmarajah, S., 2020. Strategic adaptation planning for water-stressed regions in Sri Lanka. *Journal of Environmental Management*, 275, 111235.

Bandara, M.A.C.S., Shantha, W.H.A. and Rathnayake, R.M.D.H., 2024. Baseline Survey on Keppetiyawa North Grama Niladhari Division. Colombo: Hector Kobbekaduwa Agrarian Research and Training Institute, 2024. xii, 51 p. ; 29 cm. (Occasional Publication; No.48)

Baxter, P., and Jack, S., 2008. Qualitative case study methodology: Study design and implementation. *The Qualitative Report*, 13(4), 544–559. https://doi.org/10.46743/2160-3715/2008.1573

Chambers, R. (1994). The origins and practice of participatory rural appraisal. World Development, 22(7), 953–969. Available at: https://doi.org/10.1016/0305-750X(94)90141-4

Chambers, R., 1992. *Rapid Appraisal: Rapid, Relaxed and Participatory*. IDS Discussion Paper 311. Available at: https://opendocs.ids.ac.uk/opendocs/handle/20.500.12413/2832

Chithranayana, R.D. and Punyawardena, B.V.R., 2014. Adaptation to the vulnerability of paddy cultivation to climate change based on seasonal rainfall characteristics. *Journal of National Science Foundation of Sri Lanka,* 42(2): 119-127.

Climate Change Secretariat, 2016. National Adaptation Plan for Climate Change Impacts in Sri Lanka 2016–2025. Ministry of Mahaweli Development and Environment, Colombo, Sri Lanka. Available at: https://climatechange.lk/NAP/NationalAdaptationPlanRevised%20Version.pdf

Cornwall, A., and Jewkes, R., 1995. What is participatory research? *Social Science and Medicine*, 41(12), 1667–1676. https://doi.org/10.1016/0277-9536(95)00127-S

De Costa, W. A. J. M., 2008. Climate change in Sri Lanka: myth or reality? *Journal of the National Science Foundation of Sri Lanka*, 36(Special), 63–88.

De Silva, C. S., Withana, M. M., and Gunawardena, A., 2021. *Assessment of farmer adoption of CSA practices in the dry zone of Sri Lanka*. Journal of Environmental Management, pp. 287, 112314. Available at: https://doi.org/10.1016/j.jenvman.2021.112314

De Silva, H., 2021. Integrating local knowledge in climate adaptation: A case study from rural Sri Lanka. *Climate and Development*, 13(4), pp.325–338. Available at: https://doi.org/10.1080/17565529.2020.1827522

De Silva, S., Dissanayake, D., and Somaratne, P., 2021. Participatory approaches in climate change adaptation planning in Sri Lanka: Experiences from local initiatives. *Sri Lanka Journal of Social Sciences*, 44(1), 15–27.

Department of Meteorology, 2020. *Annual Climate Summary – Sri Lanka 2020*. Colombo: Department of Meteorology. Available at: http://www.meteo.gov.lk/index.php?option=com_content&view=article&id=94&Itemid=310&lang=en

Divisional Secretariat of Hambantota (2022). Sampath Pathikada. Divisional Secretariat Hambantota: Divisional Secretariat Hambantota (unpublished).

Eakin, H., Lemos, M.C. and Nelson, D.R., 2014. Differentiating capacities as a means to sustainable climate change adaptation. Global Environmental Change, 27, pp.1–8. https://doi.org/10.1016/j.gloenvcha.2014.04.011

Ensor, J. E., Park, S. E., Attwood, S. J., Kaminski, A. M., and Johnson, J. E., 2019. *Can community-based adaptation increase resilience?*. Climate and Development, 11(4), 291–305. Available at: https://doi.org/10.1080/17565529.2018.1522507

Esham, M., and Garforth, C., 2013. Agricultural adaptation to climate change: Insights from a farming community in Sri Lanka. *Mitigation and Adaptation Strategies for Global Change*, 18(5), pp. 535–549.

Eswaran, R., 2018. Adaptation practices to climate change by farmers in the dry zone of Sri Lanka. *Asian Journal of Agriculture and Rural Development*, 8(1), pp.1–9.

FAO, 2007. *Adaptation to climate change in agriculture, forestry and fisheries: Perspective, framework and priorities. Inter-departmental Working Group on Climate Change, Food and Agriculture Organization of the United Nations, Rome. 32 pp. Available at: http://www.fao.org/3/a-au030e.pdf*

FAO, 2013. *Climate-Smart Agriculture Sourcebook*. Food and Agriculture Organization of the United Nations. Available at: https://www.fao.org/3/i3325e/i3325e.pdf

FAO, 2019. *Agriculture and climate change – Challenges and opportunities at the global and local level.* Collaboration on Climate-Smart Agriculture. Rome: Food and Agriculture Organization of the United Nations. 52 pp. Available at: https://openknowledge.fao.org/bitstream/4b6ecf83-2641-4134-8af2-8eeb384178f2/download

Fernando, N., Weerakoon, D., and Adikari, Y., 2020. *Community-based adaptation to climate change: Lessons from Sri Lanka*. Climate and Development, 12(7), 575–586. Available at: https://doi.org/10.1080/17565529.2019.1701975

Herath, H. M. G. and Alwis, A. D., 2014. Climate change adaptation through home garden practices: A study from dry zone of Sri Lanka. *Sri Lanka Journal of Social Sciences*, 37(1–2), 43–56. Available at: https://doi.org/10.4038/sljss.v37i1-2.7385

Herath, S. and Ratnayake, U.R., 2005. Hydrological impact of climate change in Sri Lanka. *Journal of Environmental Hydrology*, 13(3), pp.1–10. Available at: http://www.hydroweb.com/jeh/jeh2005/herath.pdf

Hewawasam, I. and Matsui, N., 2020. Community-based natural resource management in Sri Lanka: Lessons from local organizations. International Journal of Rural Development Studies, 15(1), pp.34–45.

IPCC., 2021. Sixth Assessment Report: Impacts, Adaptation and Vulnerability. Intergovernmental Panel on Climate Change. Available at: https://www.ipcc.ch/report/ar6/wg2/

Jayasooriya, H.J.C. and Aheeyar, M.M.M., 2015. Application of Integrated pest management (IPM) in Vegetable Cultivation: Past Experiences and Suggestions for promotion. Research Report No.175, Hector Kobbekaduwa Agrarian Research and Training Institute.

Jayasooriya, H.J.C., 2017. vulnerability of rainfed farmers to drought and potential strategies to enhance resilience capacity. Research Report No.211 Hector Kobbekaduwa Agrarian Research and Training Institute, 114, Wijerama Mawatha, Colombo 07.

Jha, R., Gaiha, R., and Sharma, A., 2012. Social audit and MGNREGA: Lessons from India. *Economic and Political Weekly*, 47(41), 77–86.

Karki, S., Sharma, K. P., and Kattel, G. R., 2020. Participatory planning in climate adaptation: A review of evidence from Nepal. *Climate and Development*, 12(7), 575–588. Available at: https://doi.org/10.1080/17565529.2019.1687698

Koralagama, D.N., Wijeratne, M. and De Silva, W.N., 2007. Emergence of participatory rural appraisal (PRA) technique as a strategy towards sustainable development: A Sri Lankan experience. *Journal of Agriculture and Rural Development in the Tropics and Subtropics*, 108(2), pp.163–174. Available at: https://www.jarts.info/index.php/jarts/article/view/149

Kulatunga, U., 2014. Participatory disaster risk assessment and planning in Sri Lanka. *Procedia Economics and Finance*, 18, 772–779.

Kumar, S., 2002. *Methods for Community Participation: A Complete Guide for Practitioners*. New Delhi: Vistaar Publications.

Malaviarachchi, G., Weerasinghe, H. and Wickramaratne, W., 2018. Climate change adaptation through farmer field schools in Sri Lanka. *Asian Journal of Agriculture and Rural Development*, 8(2), pp.140–149. Available at: https://archive.aessweb.com/index.php/5005/article/view/2586

Marambe, B., 2014. Climate Variability and its Implications on Agricultural Production in Sri Lanka. Sri Lanka Journal of Agrarian Studies, 20(1), pp. 1–12. Available at: https://link.springer.com/content/pdf/10.1007/978-3-642-40455-9_120-1.pdf

Marambe, B., Silva, P., Mallawatantri, A., and Ratnasiri, S., 2015. Climate Change and Agriculture in Sri Lanka: Adaptation Strategies. In: B. Marambe et al. (eds.), *Agriculture and Climate Change: Adaptation Strategies in Sri Lanka*. Colombo: Sri Lanka Council for Agricultural Research Policy, pp. 10–30. Available at: https://www.researchgate.net/publication/273448637_Climate_Climate_Risk_and_Food_Security_in_Sri_Lanka_Need_for_Strengthening_Adaptation_Strategies

Ministry of Agriculture., 2018. National Adaptation Plan for Climate Change Impacts in Agriculture. Government of Sri Lanka. Available at: https://www4.unfccc.int/sites/NAPC/Documents%20NAP/National%20Reports/National%20Adaptation%20Plan%20of%20Sri%20Lanka.pdf

Naveendrakumar, G., Vithanage, M., Kwon, H.-H., Iqbal, M.C.M., Pathmarajah, S. and Obeysekera, J., 2018. Five decadal trends in averages and extremes of rainfall and temperature in Sri Lanka. *Advances in Meteorology*, 2018. Available at: https://doi.org/10.1155/2018/4217917

Poudel, D.D. and Duex, T.W., 2017. Vanishing springs in Nepalese mountains: assessment of water sources, farmers' perceptions, and climate change adaptation. *Mountain Research and Development*, 37(1), pp.35–47. Available at: https://doi.org/10.1659/MRD-JOURNAL-D-16-00039.1.

Pretty, J. N., 1995. Participatory learning for sustainable agriculture. *World Development*, 23(8), 1247–1263. Available at: https://doi.org/10.1016/0305-750X(95)00046-F

Ratnasiri, S., Jayasinghe, S., and Fernando, N., 2020. Climate-Smart Agriculture planning: Opportunities and challenges in Sri Lanka. *Journal of Agricultural Science*, 12(4), pp. 35-49.

Reed, M. S., 2008. Stakeholder participation for environmental management. *Biological Conservation*, 141(10), 2417–2431. Available at: https://doi.org/10.1016/j.biocon.2008.07.014

Samarasinha, G.G. De L.W., Munaweera, T.P., Shantha, W.H.A., Bandara, M.A.C.S., Rambodagedara, R.M.M.H.K. and Dias, M.P.N.M., 2020. Assessing Vulnerability to Climate Change: A Study on Farmer Communities in the Dry Zone of Sri Lanka. Available at: http://www.harti.gov.lk/images/download/reasearch_report/new1/report_no_234.pdf

Sanjeewani, K.A.W. and Manawadu, L., 2014. *Urban flood resilience planning in Colombo City: Using geo-informatics to analyze spatial aspects*. In: International Conference on Cities, People and Places (ICCPP), Colombo, Sri Lanka, 31 Oct–2 Nov 2014. Colombo: University of Moratuwa. Available at: https://dl.lib.mrt.ac.lk/handle/123/10336

Shrestha, A., and Pandey, R., 2018. Community perception and climate change adaptation in the rural mountain areas of Nepal. *Climate and Development*, 10(7), 664–676. Available at: https://doi.org/10.1080/17565529.2017.1363720

Smith, J.B., 1997. Setting priorities for adaptation to climate change. Global Environmental Change, 7(3), pp.251–264. Available at: https://doi.org/10.1016/S0959-3780(97)00033-0

Sova, C. A., Helfgott, A., and Chaudhury, M., 2015. Multi-level stakeholder engagement in climate adaptation: A framework for action. *Climate and Development*, 7(5), 457–470. Available at: https://doi.org/10.1080/17565529.2014.951010

Stage, J., 2010. Economic valuation of climate change adaptation. In: Economics of Climate Change Adaptation. OECD Publishing. Available at: https://doi.org/10.1787/9789264090415-en

Tiwari, K. R., Rayamajhi, S., Pokharel, R. K., and Balla, M. K., 2014. Determinants of the climate change adaptation in rural farming of Nepal. *International Journal of Multidisciplinary and Current Research*, 2, 234-240.

Truelove, H.B., Carrico, A.R. and Thabrew, L., 2015. A socio-psychological model for analyzing climate change adaptation: A case study of Sri Lankan paddy farmers. *Global Environmental Change*, 31, pp.85–97.

United Nations Development Programme (UNDP), 2017. *Adaptation pathways: A strategic framework for climate-resilient development*. New York: UNDP. Available at: https://www.adaptation-undp.org/resources/publications/adaptation-pathways-strategic-framework

Venkateswarlu, B., et al., 2017. National Innovations in Climate Resilient Agriculture (NICRA): Achievements and Way Forward. *ICAR-Central Research Institute for Dryland Agriculture*.

Weerakoon, W.M.C.B. and De Costa, W.A.J.M., 2009. Climate change in Sri Lanka: Impacts, adaptation and mitigation. In: *Proceedings of the National Conference on Climate Change and Food Security in Sri Lanka*. Colombo: Department of Agriculture, pp. 11–18.

Hector Kobbekaduwa Agrarian Research and Training Institute,
PO Box 1522,
Colombo,
Sri Lanka.
Tel. +94 11 2 6969 81
+94 11 2 6964 37
Fax. +94 11 2 6924 23
e-mail dirctor@harti.gov.lk
Web www.harti.gov.lk

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