



Adoption of Climate-Resilient Practices of Rice Farmers in Rainfed and Irrigated Areas in Battambang Province, Northwest Cambodia

Identifying Challenges, Perceptions and the Role of the Stakeholders Involved

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List of most used abbreviations in this research

AC	Agricultural Cooperative
ASR	Agricultural Systems Research (Cambodia) Co. Ltd.
AWD	Alternate Wetting and Drying
BTB	Battambang
BUAC	Battambang Union of Agricultural Cooperatives
CA	Conservation Agriculture
CAO	Commune Agricultural Officer
CARDI	Cambodia Agricultural Research and Development Institute
CASIC	Conservation Agriculture and Sustainable Intensification Consortium
CIRAD	Centre de Coopération Internationale en Recherche Agronomique pour le Développement
CRA	Climate-Resilient Agriculture
CSA	Climate-Smart Agriculture
DAOs	District Agricultural Officer
DSR	Direct Seeded Rice
EWS 1294	Early Warning System 1294
EWS-KT	East West Seed Knowledge Transfer
FAO	Food and Agriculture Organization
FGD	Focus Group Discussion
FWUC	Farmer Water User Community
GDA	General Directorate of Agriculture
GHG	Greenhouse Gas
HEKS	Hilfswerk der Evangelisch-reformierten Kirche Schweiz
IA	Irrigated Area
IRRI	International Rice Research Institute
ITC	Institute of Technology of Cambodia
LLL	Laser Land Leveling
MAFF	Ministry of Agriculture, Forestry and Fisheries
MoWRAM	Ministry of Water Resources and Meteorology
NCDM	National Committee for Disaster Management
NGO	Non-Governmental Organization
NUBB	National University of Battambang
PCDM	Provincial Committee for Disaster Management
PDAFF	Provincial Departments of Agriculture, Forestry and Fisheries
PDWRAM	Provincial Department of Water Resources and Meteorology
RA	Rainfed Area
RUA	Royal University of Agriculture
SDC	Swiss Development Cooperation
SRP	Sustainable Rice Production Standard
STRV	Stress-Tolerant Rice Varieties
VC	Village Chief

List of AI

ChatGPT, OpenAI, Version 5, chatgpt.com

- Creating a graphic (heat map diversification Figure 10)
- Instructions for using Kobo Toolbox and Excel
- Improving the sentence structure of individual paragraphs
- Shortening individual self-written paragraphs

DeepL Translate, DeepL GmbH, DeepL free, www.deepl.com/de/translator

- Translating from German to English

DeepL Write, DeepL GmbH, DeepL free, www.deepl.com/de/write

- Improving grammar of self-written English sentences

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Cover photo: The faces behind the data (photos: Johanna Bischof)

All pictures and illustrations without further reference were taken or created by me (Johanna Bischof).

Abstract

BISCHOF, Johanna, Adoption of Climate-Resilient Practices of Rice Farmers in Rainfed and Irrigated Areas in Battambang Province, Northwest Cambodia - Identifying Challenges, Perceptions and the Role of the Stakeholders Involved

Cambodia is among the countries most vulnerable to climate change. Rising temperatures, increasingly erratic rainfall, and more frequent floods and droughts are expected to negatively affect agriculture, livelihoods, and economic stability nationwide (unepgrip 2025). In Battambang Province, rice farmers face growing uncertainty. Shifting rainfall patterns, more frequent droughts, and floods put additional pressure on already fragile farming systems. These climate-related hazards have already caused substantial yield losses and threaten household incomes, particularly for smallholders with limited or no access to irrigation. The goal of climate-resilient agriculture (CRA) is to strengthen the ability of smallholder farmers to adapt to climate change so that they can ensure production. Main pillars are cost-effective practices and high diversification. Farmers' decisions are shaped by financial resources, knowledge, social structures, and trust within the village. Since 2023, the Nurture Project has been active in northwestern Cambodia. Its goal is to increase the climate resilience and income of smallholder farmers. This research is embedded in the project's CRA intervention area. The objective is to assess the situation of rainfed and irrigated rice farming systems in southern Battambang Province, focusing on the adoption of climate-resilient practices and the influence on farmers decision-making by relevant stakeholders, as well, the level of crop diversification. The results will contribute to the design of effective adoption strategies for climate-resilient practices within the Nurture Project's future framework.

A mixed qualitative-quantitative approach was used. First, a literature review identified relevant practices. Expert interviews were used to select the most suitable practices for the local context and to gain a deeper understanding of specific practices. Fifty randomly selected farmers were interviewed (25 rainfed rice production, 25 irrigated). Four focus group discussions were facilitated using participatory tools and direct field observations were conducted. Finally, the preliminary results were validated and discussed during a restitution workshop.

The findings reveal clear differences between the rainfed (RA) and the irrigated (IA) area. RA farmers depend almost entirely on seasonal rainfall and typically cultivate one crop per year. In contrast, most IA farmers produce two or occasionally three crops when their plots are located close to irrigation canals. Access to water remains highly unequal within the irrigated area. Across both systems, agriculture is gradually becoming more intensive, while migration contributes to an aging farming population.

Eleven climate-resilient practices relevant for this context were selected and examined in the research area. Only three of these practices are widely known and used: incorporation of rice straw, conservation of rainwater, and use of weather forecasts. The practices of reduced tillage, coordination of cropping calendars, and the early warning system are barely known. There are clear gaps between knowledge and practice regarding climate-stress-tolerant varieties, cover crops, machine sowing of rice, the rice-fish-duck system, and alternate wetting and drying. Farmers who know these practices mostly have strong reasons for not practicing them. Cash-crop diversification is minimal and rice-centered. However, home gardens, which are mostly for household consumption, are diversified. This is especially true in the RA. Farming families usually keep a few cows for sale, chicken for meat, and some individuals keep ducks for eggs and meat or grasshoppers. While there is very limited diversification potential for fodder and only little potential for cash crops, there is high potential for diversification around ponds in the RA, mainly for household consumption or local markets. Social interactions within the community and with local authorities strongly influence farmers' access to information. The most important persons for information on agricultural practices are one's own experience (6.5/10), followed by family members (6.4/10) and neighbors (3.4/10). Neighbors influence decisions on crop varieties, especially in the IA. Development projects and farmer training are much more common in the IA, leaving rainfed farmers with little institutional support. Seventy-five percent of farmers use Facebook for agricultural advice and weather forecasts, but they mostly just scroll randomly, making them vulnerable to advertisements.

Overall, the study shows that adoption potential differs depending on farmers' perceived hurdles. Targeted strategies are needed to reduce information gaps, improve underlying conditions such as

rice-straw burning or limited cow management, strengthen trust within communities and ensure that practices are affordable and locally accessible. These factors are central for increasing the uptake of climate-resilient practices in both areas.

Keywords: climate-resilient, climate-smart, perception, adoption, rice-farming, Battambang Province

1 Introduction

Climate change, driven by anthropogenic greenhouse gas emissions, is altering rainfall patterns, temperatures, and weather systems in the medium to long term. Since monsoon rains are crucial for Cambodian agriculture, their increasing unpredictability poses a major threat for crop losses (Sigelmann 2020, 12). The university of Notre Dame (2022) ranks Cambodia 149th out of 180 countries in terms of vulnerability and readiness to adapt to climate change. Battambang Province is particularly exposed to climate-related hazards such as flash floods and droughts, which have repeatedly caused severe crop losses and threaten agricultural incomes (NCSD 2019; FDFA 2024). Smallholder farmers with limited irrigation access face the greatest risk of income loss during droughts.

Classified as a lower-middle-income country, Cambodia has 76% of its population living in rural areas and primarily dependent on climate-sensitive sectors. Migration work and poverty remain widespread, with 17.8% of the population living below the national poverty line in 2019 (ADB 2022). These socioeconomic conditions may limit farmers' capacity to adopt new agricultural practices. Agriculture in general plays a central role in Cambodia's economy, accounting for approximately 17% of the country's gross domestic product (GDP) in 2023 (The Global Economy 2025). Rice and corn are the two most important crops, with rice serving both as a staple food and as a major export commodity (NIS et al. 2025, 22,46). Battambang Province is strongly characterized by its agricultural landscape and is often referred to as Cambodia's "rice bowl" (Sevea 2022). Rice farmers in Battambang Province face growing uncertainty. Changing rainfall patterns, droughts and floods intensify the pressure on already vulnerable production systems (Sigelmann 2020; University of Notre Dame 2022).

Although the terms "Climate-Resilient Agriculture" (CRA) and "Climate-Smart Agriculture" (CSA) are often used interchangeably (cf. Sommons 2025, 2), the Indian Council of Agricultural Research (ICAR) distinguishes between the two concepts. CRA has a narrower scope than CSA and focuses primarily on cost-effective practices that ensure food security and climate adaptation for smallholder farmers. A key element of CRA is maximizing diversification within farming systems (Suresh Ramanan et al. 2022, 4, 8). The CRA concept is especially suitable for Battambang, where most farmers are smallholders and cost-effectiveness and food security are of great importance. The Nurture Project also uses this term. For these reasons, this research focuses on the CRA concept. The focus is therefore on adaptation rather than climate change mitigation.

Several theoretically promising climate-resilient practices have been identified for lowland rice cultivation. These include climate-stress-tolerant varieties. Water management practices comprise alternate wetting and drying, smart irrigation, rainwater conservation, adjusting planting dates, various irrigation techniques, irrigation scheduling, and laser land leveling. Sowing techniques include seed priming and both mechanical and manual direct seeding. Soil-improving practices consist of zero or minimum tillage, incorporation of crop residues, and the use of cover crops. Diversification practices include crop rotation, on-farm diversification, and integrated rice-fish-duck farming. Additional practices are the appropriate use of fertilizers and pesticides, improved access to farming information, weather forecasts and the early warning system 1294 as well as crop insurance (Onyeneke et al. 2021, 14–15; Oyeneke and Onugu 2022; Uch et al. 2023, 53; Mallareddy et al. 2023, 4, 17; Debangshi 2021, 312; FAO 2025b; Shahid et al. 2021, 150–153; Joshua et al. 2023, 8–9; Kumari et al. 2025, 171, 186; Souza et al. 2025, 10; Sevea 2022, 24).

Farmers' agricultural decisions are influenced by the availability of knowledge and financial resources (Behara 2025; FAO 2022). However, historical social challenges, such as loss of trust in neighbors and local authorities or conflicts in water management, also influence their decisions (Chhinh et al. 2023; Grasser 2024; Diepart and Thuon (2022). For example, unresolved water disputes and lingering mistrust from past interventions still affect community coordination around irrigation.

Since 2023, to address the above challenges, the Nurture Project has been active in four provinces of northwestern Cambodia, including Battambang Province. The project aims to contribute to the goal that "vulnerable smallholder farming households and their communities are more resilient to climate change and have increased incomes through climate-proofing of agroecological farming systems" (Suess und Melara 2022, 5). This goal is pursued through three intervention areas: (1) local water governance, (2) climate adaptation awareness, policy, and planning, and (3) climate-resilient

agriculture. The project is implemented jointly by the non-governmental organizations (NGOs) *Hilfswerk der Evangelisch-reformierten Kirche Schweiz* (HEKS/EPER) and Caritas Switzerland, and is co-funded by the Swiss Agency for Development and Cooperation (SDC).

This research is embedded in the Nuture project's third intervention area Climate-Resilient Agriculture by focusing on farmer-level implementation of CRA practices. The aim is to assess the current situation of rainfed and irrigated rice farmers in southern Battambang Province regarding their implementation of climate-resilient practices and the role of the stakeholders involved. Based on these findings, the study develops strategies and recommendations to strengthen the climate resilience of rice farmers. As the Nuture Project will enter a second four-year phase (2027–2031), the results of this research are intended to contribute to designing effective adoption strategies for climate-resilient practices within the project's future framework.

The NGO Seed Small Beginnings was involved as a collaboration partner for this research. This NGO's goal is to empower the local communities of remote villages in Battambang Province in the areas of education, health, and the environment.

The following research questions structure this research:

1. What is the rice farmers' current situation with reference to their farming area, crops, and current farming practices?
 - a. What are the differences in the situation between rainfed and irrigated areas in three villages in Battambang Province?
2. Which climate-resilient practices are suitable for rice cultivation in the research target area?
 - a. Which practices have already been adopted by the target farmers in the two different areas?
 - b. Which practices have potential for future adoption?
 - c. What strategies would be needed to increase adoption?
3. What is the potential for diversifying their farm products?
 - a. Which crops do or may they grow for household consumption?
4. How are farmers influenced or supported in adopting climate-resilient practices in the irrigated and rainfed area?
 - a. Who are the actors involved in disseminating climate-resilient practices, and how do they do so (direct/indirect)?

The chapters of the research follow a standard structure. Beginning with the state of research and methodology (which also includes limitations), followed by the results and a discussion of them (including recommendations for the Nuture project), and ending with a conclusion that answers the formulated research questions.

2 Current state of research

2.1 Country context Cambodia

Cambodia is located in Southeast Asia and borders Thailand to the west and northwest, Laos to the north, Vietnam to the east and southeast, and has a southern coastline along the Gulf of Thailand (see Figure 1). With a surface area of 181,000 km², the country's is 4.5 times larger than Switzerland (CIA 2025). The capital city of Cambodia is Phnom Penh, with around 1.5 million inhabitants. It is located at the junction of the Mekong and Tonle Sap rivers (World population review 2025). Siem Reap, the second largest city and famous for Angkor Wat and many other Hindu and Buddhist temples, is located in the northwest of the country. Angkor Wat is a UNESCO World Heritage site and makes Siem Reap a tourist destination. Battambang, the third largest city, lies in the northwest of Cambodia and is a major agricultural center. The road and railway connections to Phnom Penh and the Thai border make Battambang an important travel and trading point.



Figure 1: National map of Cambodia and its neighboring countries (Source: freeworldmaps no date)

Cambodia's landscape consists mainly of a flat central floodplain, bordered by upland areas and low mountain ranges. This central region also includes the Tonle Sap and the upper section of the Mekong River delta. The Tonle Sap is the largest freshwater lake in southeast Asia. During the rainy season, it quadruples in size to over 10,000 km² (Britannica 2025).

Administratively, Cambodia is divided into 24 provinces. Each province is subdivided into districts, which are further divided into communes, consisting of several villages (NIS 2025).

Cambodia has been classified as a low-middle-income country since 2015. After the civil war at the end of the 20th century, the country was severely damaged and was one of the poorest in the world. In the last decade, however, there has been economic growth. Seventy-six percent of Cambodia's 17 million people live in rural areas and mostly rely on climate-sensitive sectors. Poverty remains widespread, with 17.8% of the population living below the national poverty line in 2019 (ADB 2022). Over one million Cambodian people work as migrant workers abroad (NIS 2025). The Kingdom of Cambodia's economic growth over the past 20 years has been based on expanding the garment, construction, and tourism sectors. Agriculture is of central importance to Cambodia's economy, with a share of 17% of the country's GDP (figure from 2023) (The Global Economy 2025). However, Cambodia remains predominantly an agricultural country with rice and corn being the most important crops. Rice serves as both a staple food and an important export product (NIS 2025, 22,46).

2.1.1 Historical background of agriculture in Cambodia

Cambodia's agrarian roots reach back to the Angkor period (9th – 15th centuries AD), when agriculture was organized around temple-centered irrigation systems under hierarchical social structures that enabled large-scale rice cultivation. From 1863 Cambodia was a French protectorate: colonial policies formalized land rights and advanced land privatization, reshaping tenure and agrarian relations (Hall et al. 2018, 1; Cook et al. 2024, 31–34). Cambodia gained independence in 1953. From 1965 onwards, the Vietnam War spilled over into Cambodia, leading to great instability in the country and setting the stage for the rise of the Khmer Rouge. From 1975, radical collectivization, forced labor and the abolition of private property devastated agricultural production; an estimated 1.7 million people died from executions, starvation and disease (Kiernan, 2008). The regime's dismantling of traditional practices and mass relocations further disrupted farming systems (Chandler, 1991). These disruptions still influence trust in collective schemes and openness to change in agricultural practices. Vietnamese forces ousted the Khmer Rouge in 1979, and the 1991 Paris Peace Agreements initiated a new political settlement (bpb, 2015). A wave of international aid and investment followed this peace accord,

reshaping and distorting local economies as they shifted toward global market integration (Cook et al. 2024, 38).

Today Cambodia is a constitutional monarchy governed by the Cambodian People's Party, which won 120 of 125 seats in the 2023 parliamentary election, after the opposition Candlelight Party was denied registration (Auswärtiges Amt, 2025).

Cook et al. (2024, 25) emphasize that agricultural extension projects need to critically engage with the historically complex and dynamic relations of power, land, and farming—not only as a foundation of social structures but also as key to understanding current farmer decision-making and practices. Development programs must consider how land rights, power structures, and historical trauma affect farmer decision-making. For example, during the Khmer Rouge regime, there was an atmosphere of distrust and villagers reported each other to the regime. Such experiences, as well as the horrific violence during this period, can fundamentally and permanently alter trust in others (Zucker 2013; Grasse 2024).

2.1.2 Agriculture in Battambang

Battambang Province is predominantly agricultural, with forest areas largely confined during the past decades to the southwestern part of the Cardamom Mountains. According to Sourn et al. (2021, 1), there were significant increases in agricultural land and a deforestation from 1998-2018 in the Battambang province. The greatest changes were observed in the period 2003-2008. The key factors influencing land use and land cover change during the study period included policy and legal frameworks, economic development initiatives, population growth, infrastructure expansion, increasing land prices, and environmental and climate change. Additionally, landmine clearance and land concession projects contributed to the conversion of forested and shrubland areas into agricultural land. Satellite images showed a decrease of forest cover by 79% and an increase of agricultural land by 54% (Sourn et al. 2023, 5).

According to the National Institute of Statistics (2019, cited in Sevea 2022, 9), Battambang province has over 120,000 hectares of agricultural land. Fifty-seven percent of farmers own one to four hectares of land. Battambang is known as Cambodia's rice chamber. Rice is the most important crop in this province, with 133,000 hectares of cultivated land and 302,000 tons of production. Traditionally, rice is grown for subsistence purposes. The margin achieved through paddy production is generally low. The government wants to promote production and exports and is focusing, among others, on mechanization, access to inputs, and irrigation. Corn, which is mainly produced in Battambang, is the second most widely cultivated crop in the province (60,000 ha). Around 10% of corn is grown for human consumption, 90% as animal feed. Battambang's cassava production is also significant, covering 55,000 hectares. Cambodia's cassava is exported entirely to Thailand or Vietnam, which serve as intermediaries to the Chinese or international market (Sevea 2022, 9;13).

2.1.3 Irrigation schemes

The development of irrigation lies at the core of the agrarian modernization agenda of the Royal Government of Cambodia and development partners. Since the early 1990s, substantial investments in the rehabilitation and expansion of irrigation systems have led to a steady increase in irrigation infrastructure. According to the 2013 Agricultural Census, irrigated areas cultivating cereals and grains accounted for 22% of the total area under annual crops (NIS, 2015 in Diepart und Thuon 2022). Despite these ongoing efforts, a considerable number of systems remain un- or only partly functional, due to incomplete rehabilitation and persistent management challenges (Venot and Fontenelle 2016; Nang et al., 2011 in Diepart und Thuon 2022). At the same time, irrigation commonly induces land use specialization and a shift toward more commercial farming, which can heighten economic vulnerability (de Silva et al. 2014 in Diepart und Thuon 2022). Consequently, the availability and accessibility of water often vary within a single command area, leading to spatial differentiation and unequal potential for agricultural intensification. Research conducted by Diepart and Thuon (2022) in an irrigation scheme in Battambang province revealed conflicts and tensions related to water distribution. However, one main underlying factor is climate change, which delays the onset of the rainy season. Irrigation water is mainly used for early wet-season rice production and as a supplement to rainfed rice. When the first rain arrives, all farmers begin cropping simultaneously, resulting in insufficient water in the canal to meet the peak demand. Because irrigation systems are unreliable, many farmers rely on rainfed production, making effective CRA strategies even more important.

2.1.4 Climate

Cambodia's climate is shaped by monsoon winds, creating two main seasons. From mid-May to early October, the southwest monsoon brings heavy rainfall and high humidity. From early November to mid-March, the northeast monsoon brings drier air, less rain, and lower humidity (see Figure 2). The periods in between are transitional. Temperatures stay high year-round, ranging from 28°C in January to 35°C in April. Annual rainfall varies widely, from over 5,000 mm in the southwest highlands to about 1,270–1,400 mm in the central plains (Britannica 2025). This seasonal pattern requires farmers to time their planting closely with monsoon onset, which is increasingly unpredictable.

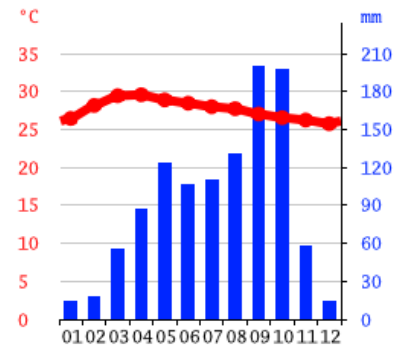


Figure 2: Climate diagram Battambang, Cambodia (Source: Climate-data no date)

2.1.5 Climate change vulnerability and environmental issues

Climate change, driven by anthropogenic greenhouse gas emissions, is changing precipitation patterns, temperatures, and weather patterns in the medium to long term. Monsoon rains are important for Cambodian agriculture, and climate change is increasing their unpredictability (Sigelmann 2020, 12). Cambodia's coastal areas are exposed to future sea level rises, which will bring flooding, storms, and saltwater intrusion, rendering valuable land unsuitable for agricultural use. While Cambodia is not a cyclone risk area, it is flood-prone during the monsoon floods. This results in an annual flooding pattern in the Tonle Sap region. Most agriculture is dependent on seasonal flooding and the flood-pulse system. Increased drought and/or sea level rise could change this flood pattern. Drought anomalies will have a greater impact on agriculture in the future, and the risk of wildfires will increase (UNEP/GRID-Europe 2019 cited in Sigelmann 2020, 20). The consequences of climate change include water shortages, agricultural losses, food scarcity, reduced biodiversity, and a higher prevalence of vector-borne diseases (IPCC 2022). CRA can help reduce reliance on affected flood-prone areas and promote practices better suited to shorter growing windows.

Cambodia is considered very vulnerable to climate change and is ranked by the Notre Dame Global Adaptation Initiative 149th out of 180 countries for vulnerability and readiness to adapt to climate change (University of Notre Dame 2022). Battambang province is highly exposed to climate-related disasters. In 2019, flash floods affected 1,400 people, with 21.6% of communes classified as “highly vulnerable” and 33.3% as “moderately vulnerable” to flooding. Droughts also caused substantial damage in the province, impacting approximately 104,700 hectares of rice in the same year (National Institute of Statistics, 2019 cited in Sevea 2022, 9). Such widespread losses threaten household food supplies and increase reliance on external aid. Agricultural incomes remain highly vulnerable to climate-related events, thereby reducing food security and increasing economic risk for rural households (FDFA 2024).

The massive forest decline and intensification of agriculture are putting terrestrial and aquatic ecosystems and biodiversity under pressure. The connection between the Mekong and Tonle Sap rivers forms a vast and vital ecosystem for Cambodia, playing a key role in supporting biodiversity and local livelihoods. However, dam construction leads to significant environmental and social impacts by flooding agricultural land, reducing yields of fish and disrupting the flow of nutrient-rich sediments (United Nations Cambodia 2021, 45).

The United Nations Cambodia (2021, 47) stresses that the existing lack of data and knowledge on ecosystem services and biodiversity values in Cambodia limits the integration of environmental concerns into economic policy and planning. In addition, there are no reliable large-scale systems for sustainable funding to manage protected areas effectively through a results-based approach. This represents a critical gap that endangers Cambodia's environmental goods, services, and biodiversity.

Another environmental issue is the overuse of pesticides. Often excessive dosages are applied due to a lack of training and inadequate information (main information source is the pesticide supplier). This leads to water pollution, development of resistances and health issues of the local community (Sevea 2022, 3).

2.2 Impact of climate change on rice production

Climate change means abiotic stress for the rice plant, which impacts growth and yield. At the physiological and cellular level, climate-induced abiotic stresses such as drought, flooding, salinity and heat stress trigger oxidative stress responses in rice plants, leading to cellular damage and impaired metabolic functioning (Shah et al. 2019). As rice production is heavily dependent on water, droughts are the most significant constraint. Especially during the reproductive stage (during flowering) droughts cause considerable yield losses (Liu et al 2006 cited in Shahid et al. 2021, 145). Severe water stress can stop photosynthesis, disrupt the plant's metabolism and lead to plant death (Jaleel et al. 2009 cited in Shahid et al. 2021, 145).

After drought and weeds, flooding is the third most important abiotic stress for Asian rice production. Although rice is a semi-aquatic plant, it dies within a few days if it is completely submerged. While the seeds can germinate under anaerobic conditions, rice plants cannot survive several days of complete inundation (Shahid et al. 2021, 145 ff.). Flooding causes oxygen deficiency and oxidative stress, leading to cellular damage and reduced survival of rice plants (Shah et al. 2019). In coastal areas in particular, the salinization of soils due to rising sea levels caused by climate change is a further stress factor. However, the interaction of increased temperatures and relative humidity can also exacerbate salt stress damage. Furthermore, temperatures above a certain threshold can lead to reduced grain-filling and thus reduced yield quantities and quality. Especially during the flowering stage, rice is very sensitive to high temperatures (Shahid et al. 2021, 145 ff.).

Farmers in Cambodia felt the impact of climate change several years ago. A survey conducted in northwestern Cambodia in 2013 showed that the majority of farmers surveyed noticed changes in rainfall patterns, a delayed start to the monsoon season, reduced annual rainfall, and more frequent dry spells and heat waves (Touch et al. 2017, 1).

2.3 Climate resilient agriculture

The Food and Agriculture Organization (FAO) introduced the concept of Climate-smart Agriculture (CSA) in 2009. FAO describes CSA as “an approach that helps guide actions to transform agri-food systems towards green and climate resilient practices” (FAO 2025a). CSA contributes to achieving international goals such as the SDGs and the Paris Agreement. It focuses on three key objectives: sustainably increasing agricultural productivity and incomes; adapting to climate change and strengthening resilience; and reducing or removing greenhouse gas emissions where possible (FAO 2025a). In principle, CSA practices are not a new concept, but often build on ancestral knowledge such as conservation agriculture (CA), agroforestry, creating ponds, rainwater harvesting or adopting to new varieties (Adesina and Loboguerrero, 2021 cited in Joshua et al. 2023, 4). Climate-resilient Agriculture (CRA) and CSA are often used as synonyms in the literature (cf. Simmons 2025, 2). The ICAR makes a clear distinction between the two terms. While CRA is based on production through cost-efficient measures and a strong focus on food security, CSA is broader. CSA focuses on sustainability with the three main areas of food security, adaptation and mitigation. According to ICRA, the CRA concept is applicable for small and marginal farmers in developing and under-developed countries (cf Table 1) (Suresh Ramanan et al. 2022, 4, 8).

For this reason, and because Nurture Project also uses the term CRA, this research is based on and uses the term Climate Resilient Agriculture CRA. It is therefore not about climate change mitigation but about adaptation.

Table 1: Comparison of the terms Climate-Smart Agriculture and Climate-Resilient Agriculture (Source: Suresh Ramanan et al. 2022, 4)

Concept	Climate-Smart Agriculture (CSA)	Climate-Resilient Agriculture (CRA)
Terminology	Global	Indigenous and region specific
Goal	Improving production and productivity	Ensuring production and productivity
Sustainability	In-built	Secondary focus
Technology adoption	No constraints	Constraints beyond technology availability
Investments	Can be Capital intensive	Aims to be Cost-effective
Approach	Countering the impact	Evading the impact
Foundational pillars	Accessible	Ensured
i) Food security		
ii) Adaptation	In-built	In-progress
iii) Mitigation	In-built and directly focused	Co-benefit
iv) Infrastructure	Well-built and existing	Needs improvement
Applicability		
i) Country level	Developed countries with low population pressure	Under-developed and developing countries with high population pressure
ii) Farm level	Large farmers	Small and marginal farmers
Diversification	Minimal	Maximum
Example	Precision farming	Integrated Farming

2.3.1 Climate-resilient practices for lowland rice farming

According to the literature, the following practices have the potential to increase the climate resilience of rice farmers in lowland cultivation through various modes of action.

Rice breeding

Climate stress tolerant rice varieties are bred to withstand the effects of climate change such as droughts, heat waves or flooding (Oyeneke and Onugu 2022 cited in Joshua et al. 2023, 4).

Uch et al (2023, 53) looked at the adoption of drought and flood-tolerant rice varieties in four provinces around Tonle Sap lake, including Battambang province. Of over 1200 respondents, only 14% had heard of stress-tolerant rice varieties (STRVs). Results of this study showed a yield increase of 1.0-1.5 t/ha with STRVs compared to the varieties used by farmers under rainfed conditions. In the endline survey, over 90% of the farmers surveyed responded that they were highly willing to adopt STRVs. The visual performance of STRV's is rated as a key factor for adoption. Concerns are seen in marketability and low market prices.

Table 2 contains ten varieties and their characteristics, which are promoted by the International Rice Research Institute (IRRI) as stress-tolerant rice varieties and have already undergone multilocation testing. These varieties have been officially released by the Royal Government of Cambodia and Cambodia Agricultural Research and Development Institute (CARDI) and are classified as high-yielding (Vergara et al. 2023, 56).

Table 2: Characteristics of stress-tolerant rice varieties in Cambodia (Source: Vergara et al. 2023, 57)

Variety	Maturity	Plant Height (cm)	Tolerance/Resistance Traits	Season	Other Special Traits
Sen Pdao	Early	110	Blast	Dry and wet	Aromatic
Chul'sa	Early	93	Blast, Brown Plant Hopper (BPH)	Dry and wet	
CAR14	Early	90	Blast, drought	Dry and wet	
CAR15	Early	100	Blast, BPH (MR)	Dry and wet	
Phka Rumduol-Prang	Early (PS)	120	Flood	Recession	Aromatic
Phka Rumduol	Medium (PS)	171	Flood	Wet	Aromatic
Phka Romeat	Medium (PS)	170	Flood	Wet	Aromatic
CAR4	Late (PS)	173	Flood, drought (MR)	Wet	
Riang Chey	Late (PS)	168	Stagnant flood	Wet	
Damnoeb Sbai Mongkul (DSM)	Late (PS)	160	Flood, drought	Wet	Glutinous

Notes: PS - photoperiod sensitive; MR - moderately resistant

Traditional varieties (TV) have lower yields compared to modern varieties (MV) but offer other comparative advantages: they are more climate-resilient, as they are more tolerant to environmental stress (drought, flooding, salinization). They also offer benefits for human nutrition and are cheaper to cultivate due to lower input requirements (IRRI 2018, 1).

The most popular varieties grown in the provinces around Lake Tonle Sap were: Phka Rumduol (33%; TV, long maturity variety), IR504-04 (24%; MV, early maturing variety from Vietnam, also known as OM), Rieng Chey (13%), CAR9 (6%), Sen Kra Ob (6%), and Malis Praing (4%) (percentage of surface in survey 2015). However this can change from season to season (Vergara et al. 2023, 60).

Water management

Alternate wetting and drying (AWD)

AWD is considered a water-saving and methane-reducing strategy in irrigated rice cultivation. By allowing the field to dry out intermittently, up to 40% of water can be saved and 50% of methane emissions avoided (Mallareddy et al. 2023, 4).

Rice paddies contribute to about 48% of all greenhouse gas emissions from cropland (Qian et al. 2023, 1). Therefore, AWD has the potential to reduce methane emissions from rice cultivation that occur under anaerobic conditions in flooded rice paddies. With this method, in contrast to constantly flooded rice cultivation, there is one or more mid-season drainages. The drainage time varies between 1-5 days depending on the methodology and choice of variety. Without affecting the yield, AWD should lead to optimized water use, a reduction of water consumption, a reduction of greenhouse gas (GHG) emissions and in some cases also to reduced water pumping costs. Soil aeration should be improved, which can lead to improved root growth (Vernet et al. 2025, 12 and LaHue et al. 2016). However, Vernet et al. make it clear that AWD also happens naturally, without project interventions, and that emission reductions, especially when carbon trading is involved, should not be overestimated by planned AWD.

AWD was developed by IRRI, extensively tested, and is used in many Asian countries such as India, the Philippines, Vietnam, and Bangladesh (Mallareddy et al. 2023, 4). Vernet et al. (2025, 6-7) tested this practice in the Kanghot irrigated perimeter, Battambang province, in the second rice cycle from October 2024 to January 2025. While some farmers reported positive effects in rice growth with stronger stems and roots due to AWD, others mentioned negative effects such as drought stress and increased weed pressure. Further challenges were identified in the area of water management coordination due to unlevelled plots, elevation differences, and unclear irrigation schedules, which particularly affect farmers located further away from irrigation doors. The farmers participating in the project were interested in using AWD in future cropping cycles but emphasized the importance of technical and financial support. Furthermore, Vernet et al. stressed the importance of identifying safe drainage periods that are adapted to the region and site selection. In the pilot trial, the 2nd and 3rd planned drainage periods had to be omitted due to a lack of water.

Smart irrigation

Crop-specific irrigation schedules are calculated using sensors, the Internet of Things, and weather stations. The farmer can access this via a smartphone app or web browser. The automated irrigation recommendation takes into account the specific crop, soil, climate, and other factors to determine the exact water needs of the crop. This can increase the yield and water use efficiency and reduce the amount of water, time, and costs. However, sensors are needed near the plant's roots. The current high cost of such sensors makes their use unfeasible for smallholder farmers at this time (Mallareddy et al. 2023, 15-16). Nevertheless, there is significant potential for reducing water usage. In China the water use in rice cultivation was reduced by 65% compared to the flooded irrigation method, in India - 41% compared to conventional flooded and - 13% compared to drip irrigation (Zia et al. 2021; Barkunan et al. 2019 cited in Mallareddy et al. 2023, 17).

Conservation of rainwater

During the rainy season, rainwater is captured and stored using catchment systems such as water tanks, dug wells, percolation tanks, or farm ponds. Providing one or two supplemental irrigations from these water-harvesting structures can sometimes result in reasonable yields for farmers (Debangshi 2021, 312).

Adjusting planting dates / Cropping calendars

According to FAO (2025b), a crop calendar provides information on the timing of agronomic activities specific to the crop and agroecological zone. The FAO offered a crop calendar database of over 130 crops in 283 agroecological zones and over 50 countries. Rice is represented in the database, but Cambodia is not.

Adapting the timing of activities in the rice field (sowing, spraying, harvesting) can reduce exposure to climate-related risks (Liang et al. 2021, 2).

In the Nurture project, there are climate-proof cropping calendars planned, which are intended to distribute the water quantities in the irrigation system more evenly through better coordination. The calendar should determinate the variety of rice and secondary crops, and should be transparent and fair in its disclosure of water distribution. The goal is not only to better utilize the water, but also to reduce conflicts (Nurture 2025).

Different irrigation techniques

Furrow irrigated raised bed planting was found to reduce irrigation water by 25-30% while increasing yields (Nayak et al. 2020 cited in Shahid et al. 2021, 151). Aerobic rice production technology involves

growing rice under non-puddled and non-flooded conditions. Irrigation water is measured with a tensiometer and shallow water at 1–2 cm is maintained after panicle initiation. This method saves 37–60% of water compared to conventional flooded systems. However, growing aerobic rice can result in a 20–40% yield loss, which can be offset through improved crop management and selecting the right varieties (Nie et al., 2012; Nayak et al., 2020, cited in Shahid et al., 150).

A tensiometer is a measuring instrument that tells the farmer when to irrigate. The pressure of the water in the soil is transferred to a color scale, which the farmer can use to read the soil moisture. In a trial in India, 17–30% of irrigation water was saved over the years using tensiometer-based irrigation (Bhatt 2020, 19).

Surface and sub-surface drip irrigation

Rice can be cultivated using drip irrigation. This reduces evapotranspiration, run-off, seepage and thus the amount of irrigation water required. Drip irrigation allows a precise water application to ensure the water needs of the crop. However, in conventional tillage cultivation, the drip laterals have to be moved and repositioned several times and the system requires regular maintenance (Mallareddy et al. 2023, 13; Kumari et al. 2025, 168).

Scheduling irrigation

Scheduling irrigation means irrigating according to the needs of the rice crop based on evapotranspiration, e.g. through AWD, tensiometer-based irrigation (up to 50% water savings), critical stage base lifesaving irrigation, or saturated soil culture (5–50% water savings) (Shahid et al. 2021, 151).

Laser land leveling (LLL)

Traditional land leveling practices are often imprecise and result in unevenness. The average height difference between the highest and lowest points in rice fields in South Asia is 160 mm, which requires additional water to flood the entire field. Leveling using laser technology can therefore help to save irrigation water, among other advantages (Kumari et al. 2025, 166). LLL has the potential to save 20–25% of water (Shahid et al. 2021, 151).

Sowing techniques

Seed priming:

This technique can improve germination even under unfavorable soil and climatic conditions and lead to stronger seedlings (Mallareddy et al., 2023 cited in Joshua et al. 2023, 7).

Direct seeded rice (DSR)

In Asia, rice is traditionally grown using the resource-intensive method of puddled transplanting of rice (PTR). In contrast to PTR, DSR is less labor-intensive and therefore less costly. Water losses due to percolation of 12–35% can also be prevented (IRRI 2021 cited in Joshua et al. 2023, 9). Additionally, unlike transplanting, DSR allows farmers to spontaneously respond to delayed monsoons or temporary water shortages and delay the planting time (Mallareddy et al. 2023, 12). Limitations of DSR are crop damage due to unexpected rainfall directly after sowing, weed infestation and increased nematode infestation.

A distinction is made between dry DSR and wet DSR. While in the first, dry seeds are broadcasted on dry, unpuddled soil after tillage or reduced tillage, in wet DSR, pre-germinated seeds are broadcasted on wet or puddled soil (IRRI 2021, cited in Joshua et al. 2023, 9; Kumari et al. 2025, 186).

In Cambodia, transplanted rice has largely disappeared due to the labor intensity involved. Manual direct seeding is now often carried out at very high seed densities of up to 400 kg/ha with low germination rates (Sevea 2022, 41).

Mechanical direct seeded rice = Mechanical direct sowing (mDSR)

Currently, four seed drill machines are commercially available in Cambodia. Their use would have the advantage that the rice would better withstand short dry periods, develop a stronger root system, and allow for better air circulation through row sowing, which reduces pests and diseases (sevea 2022, 41). However, there is a shortage of contractors offering rice sowing services. Individual farmers cannot justify investing in seed drill machines for limited use. And existing machinery service

providers tend to focus on land preparation rather than mechanized sowing (Dumont und Sivouthan 2024, 32).

Improving soil fertility

Zero / minimum tillage:

No or reduced plowing leads to a better soil structure, more organic matter and better water infiltration, root development and reduces moisture evaporation from the soil (Salihi et al. 2024, 149). Enhancement of soil health increases the resilience to climate change and reduces reliance on mineral fertilizers, which are often cost-expensive for Cambodian smallholder farmers (Beesa et al., 2021 cited in FAO 2022, 6). Trials in Battambang indicate the feasibility of mechanical no-till direct seeding in rice straw residues (Martin et al. 2025).

Crop residues incorporation

The experiment by Chen et al. (2018, 84) showed that after 30 days, 73% of the carbon added to the soil in the form of rice straw remained in the soil, after one year, 46% remained. This increases the soil organic matter, which correlates positively with the water storage capacity of the soil (Sheoran et al. 2019, 2835). However, this practice can increase GHG emissions from the rice field. Due to their high carbon content, low nitrogen content and high lignin content, rice stalks are considered low-quality organic material. In moist soils, they decompose rapidly, promote CO₂ release and serve as a substrate for methane formation (CH₄) (Samahadthai et al. 2010; Puttaso et al. 2011 cited in Kumari et al. 2025, 171).

Cover crops

Biodiversification through cover crops (grasses or mixtures of grasses and legumes) improves soil health, increases yields, and enhances resilience to climate-related stress (Souza et al. 2025, 10).

Cover crops may be grown in association with other crops or in the case of Cambodia's rice system in the fallow period between two main crops. When the cover crop is destroyed, its biomass is returned to the soil, either by incorporation or as a mulch layer on the surface. Cover crops are considered a useful agroecological tool that provides many ecosystem services (FAO 2011, 19; Meyer et al. 2018, 1). Cover crops are grown mainly to enhance soil health rather than to produce a harvestable yield. They contribute significantly to restoring and improving soil properties by fixing nitrogen, supplying biomass both above and below ground, enhancing soil structure, and preventing erosion through robust root systems. Additionally, they help recycle nutrients from deeper soil layers and contribute to reducing GHG emissions (CIRAD 2024).

Studies disagree on the impact of cover crops on the water balance of the soil. The meta-study by Meyer et al. (2018, 1) summarizes that cover crops in temperate climates reduce soil evaporation compared to bare soil, but increase plant transpiration. Across all studies, total drainage was reduced by cover crops, which can lead to reduced groundwater recharge.

Fifteen cover crop varieties have been certified in Cambodia by the General Directorate of Agriculture 2024, which is a crucial milestone for the breeding, release, production, processing, registration, distribution, import, and export of the varieties. Among the 15 varieties are legumes (such as sunnhemp, rattlepod or sesban), grasses (such as Sorghum, or finger millet), and others. To make the seeds available to farmers, the Cambodian Conservation Agriculture Research for Development Center (CARDEC) provides further technical support (CIRAD 2024).

Diversification:

While cover crops are a tool for enhancing soil fertility, they also offer the possibility of diversification. Further options are:

Crop diversification

Diversification contributes to an improved standard of living for rice farmers, as well as improved soil fertility, crop yields, and productivity (Onyeneke et al. 2021, 15). Furthermore, the adaptive capacity of crops to climate-related stressors can be enhanced. Empirical studies show that soil moisture and crop water-use efficiency are higher under crop rotation than under continuous monoculture (Tiermann et al. 2015; Schlegel and Havlin, 2017 cited in Kim et al. 2025, 2). Positive outcomes have

been reported in Florida with sugarcane–rice crop rotation. Another long-term field study showed that a rice-based rotation including oilseed rape led to significantly improved soil nutrient status, soil structure, and microbial diversity compared with continuous rice monoculture (Zhang et al. 2023; Liu et al. 2023 cited in Kim et al. 2025, 5).

Integrated rice-fish-duck farming

The rice–fish–duck–rice system is an integrated farming approach in which rice cultivation is combined with duck and fish production within the same field. The movement and feeding activities of ducks and fish contribute to the natural control of weeds and pests, thereby reducing biotic stress on rice and minimizing the need for agrochemical inputs. The fecal matter enriches the soil with organic nutrients. This integration enhances land use efficiency and overall productivity by generating multiple outputs - rice, duck meat, and fish - from a single area. Due to the intake of livestock, the system should follow the principle of organic or partially organic farming (FAO 2011, 120; Joshua et al. 2023, 8).

Access to information

Climate information and weather forecasts

Information on short-term weather forecasts as well as seasonal and long-term climate forecasts is crucial for building climate resilience among smallholder farmers. This allows farmers to adapt their cultivation and interventions to the weather (Onyeneke et al. 2021, 15; Antwi-Agyei 2021 cited in Sevea 2022, 23). In Cambodia, the Ministry of Water Resources and Meteorology (MoWRAM) is responsible for Cambodia’s meteorology and hydrology infrastructure and software and provide three and seven days online forecasts (Sevea 2022, 24).

Early warning system EWS1294

EWS1294 is Cambodia’s national early warning system that uses real-time river-level sensors and free mobile voice alerts to warn communities of natural disasters (People in Need (PIN) 2022). Registration is free and can be done by calling 1294. The National Committee for Disaster Management (NCDM) has overall responsibility for the system. At the local level, provincial and sub-provincial disaster management authorities are responsible for disseminating warnings, maintaining sensors, and responding to the concerns of local communities (Sevea 2022, 24).

RiceAdvice application

RiceAdvice is a free Android app developed by *AfricaRice* that provides farmers with personalized, farm-specific recommendations to improve rice yield and profitability while taking climate change into account (CGIAR Research Center 2020 cited in Joshua et al. 2023, 9). Currently, the tools of *RiceAdvice* are only available in English, French and Kiswahili (riceadvice 2025).

Appropriated use of fertilizer and pesticides:

Weed management

Changing climatic conditions and agronomic practices (reduced till / less standing water) can change the emergence of weeds and the effectiveness of weed control. Integrated approaches that consider variety selection, seed density, time of sowing, use of mulching, crop rotation, water and nutrient management are recommended (Kumar et al., 2018 cited in Shahid et al. 2021, 153).

Site specific nutrient management (SSNM)

SSNM reduces CH₄ and N₂O emissions and leads to better plant growth through optimized nutrient supply to the plants. SSNM-based fertilization is based on tools such as the leaf color chart or chlorophyll meter. IRRI has also developed the web-based SSNM tool “Rice crop manager,” which farmers in a study in India were able to use to significantly increase their yields and incomes (Kumari et al. 2025, 171–173).

Insurance policies cover the negative impacts of climatic hazards on agricultural production by compensating for crop failures, thereby stabilizing farmers' income and fostering the adoption of innovative technologies (Onyeneke et al. 2021, 14).

2.4 Farmers adaptation to new practices

A recent study in India looking at the adoption of the Rice Intensification System (SRI) among smallholder farmers found that labor and resources were the main constraints. Annual income, total irrigated land and social participation were also found to significantly influence SRI adoption, while farming experience was found to correlate negatively with adoption. The study highlights the need for targeted extension services to improve knowledge dissemination and provide resource support to encourage broader adoption (Behera 2025).

A broader review of the adoption of sustainable agricultural practices in southern Africa produced similar results, highlighting the numerous challenges farmers face, including limited access to technology, inadequate knowledge, and insufficient financial resources. Furthermore, the importance of strengthening the linkages between researchers, agricultural extension services and smallholder farmers was emphasized (Thobane et al. 2025, 14).

Children and schools offer a starting point for learning new practices. For example, Blue School provides a learning environment and at the same time teaches students about environmentally friendly technologies and practices that they can also implement at home (Swiss Water & Sanitation Consortium 2025).

2.4.1 Decision making process of farmers in Cambodia

Despite the many stakeholders, projects, and policies active in Cambodia, the adoption of CA at the farmer level is progressing very slowly. This is attributed to a lack of targeted policies and implementation strategies, as well as the challenge of changing farmers' behavior toward sustainability, especially when they are struggling with resource constraints (FAO 2022, 6).

According to the Agricultural Systems Research (ASR) baseline survey (2024, 14–15), the following are the most important sources of agricultural advice on land preparation and crop choice: household members, neighbors, traders (who are only important for crop choice) and machine service providers. For information on inputs such as pesticides or fertilizers, input sellers are the most important source. Buyers are the main source of information regarding the sale of the produce and play a role in crop choice advice.

With regard to the decision-making of Cambodian farmers, Kong et Castella (2021, 1) show that farmers are still caught in a boom-bust cycle of commercial crops. The main arguments for action lie more in market opportunities and high, short-term financial returns than in environmental aspects. Lack of trust between AC committee members and farmers was found to be a constraint in terms of moving operations forward (Chhinh et al. 2023)

2.5 The Nurture Project

To address the challenges named in Chapter 2.1.5 regarding vulnerability to climate change, the Nurture Project aims to apply a systemic approach, tackling financial, technical, institutional, and informational barriers that currently prevent farmers from strengthening their resilience. Nurture stands for Nurturing Climate Resilience in Cambodia. The project's overall goal is: "Vulnerable smallholder farming households and their communities are more resilient to climate change and have increased incomes through climate proofing of agroecological farming systems" (Suess and Melara 2022, 5). The Nurture project aims to achieve this goal through interventions that are designed to lead to the following three outcomes:

- Outcome 1: Vulnerable smallholder farmers have increased yields and reduced climate risks through better and more stable access to water for irrigation.
- Outcome 2: Vulnerable smallholder farmers and their communities and the private sector, benefit from improved social accountability, planning and policies related to climate change adaptation.
- Outcome 3: Vulnerable smallholder farmers adopt agroecological practices and diversify their sources of income. (Suess and Melara 2022, 5).

In the area of Outcome 3, Nurture identified different sub-sectors: vegetables, rice, poultry and cassava for interventions in the area of CRA. The programs Nurture-Veg, Nurture-CRA and Soil Improvement efforts are designed to give farmers access to climate resilient technologies (drip irrigation, quality seeds, net houses, cover crops) and sustainable farming practices. The adoption of CRA techniques is to be strengthened through improved financial management skills, diversified input supplies (including bio-pesticides) and improved access to markets (Dumont und Sivouthan 2024, 11).

Nurture's initial experience shows that farmers are more likely to adopt new techniques if they can see the results for themselves during field-based training or demonstrations. Key factors were hands-on experiences and first-hand demonstrations with trusted local farmers. It also proved important to show not only the 'how' but also the 'why' during the training sessions in order to improve farmers' understanding (Dumont und Sivouthan 2024, 31).

Challenges are still seen in various areas. In the area of Outcome 3 with regard to CRA, these lie in the following points: There is a lack of trust among farmers in integrated pest management (IPM), as all farmers surveyed considered every insect in their crop to be a pest, which can lead to overuse of pesticides. A survey by ASR showed that farmers misjudge changing rainfall patterns. Rainfall from January to March is overestimated, while it is underestimated from October to December. This has an impact on crop selection and irrigation (Dumont und Sivouthan 2024, 32).

The Nurture project phase 1 runs for four years from 2023-2026 and has a total budget of USD 9 million. It is being implemented by the two Swiss NGOs Caritas and HEKS. While Caritas brings experience in the field of irrigation, HEKS has in-depth knowledge in the field of agroecology. Both NGOs contribute 25% of the budget, while the remaining 50% is financed by the SDC.



2.6 The NGO Seed Small Beginnings

This research led to a collaboration between the Nurture Project and the NGO *Seed Small Beginnings*. This NGO works in a remote region in Battambang Province, referred to in this thesis as the rainfed area (see chapter 3.2.1 target area). The goal of *Seed* is to strengthen local communities and locally initiated projects in the areas of education, health, and the environment.

3 Material and methods

Fundamentally, the methodology of this research follows the main steps of qualitative research according to Bryman (2012, 384), (see Figure 3). To ensure that the work ultimately brings added value, it was important to embed it in the overall project objective of Nurture and to consult with the local team on a regular basis.

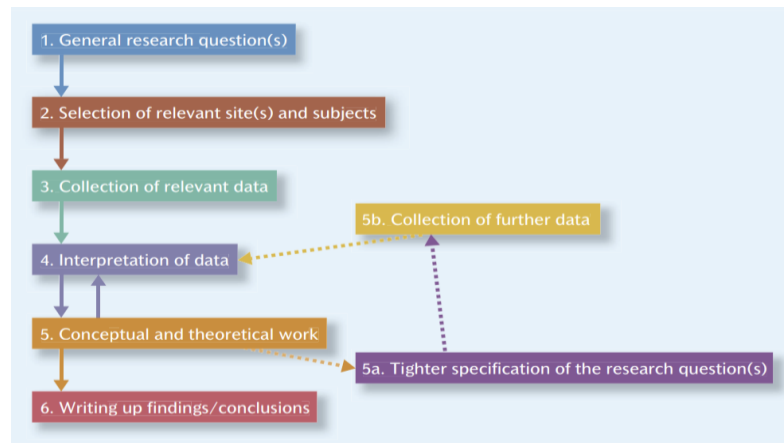


Figure 3: Main steps of qualitative research (Source: Bryman 2012, 384)

3.1 Secondary data collection – Literature review

A review of secondary data was conducted to better understand the local context and formulate the exact research questions. Gray literature such as Nurture internal project reports, proposals and strategies contributed to a better understanding of the project, possible gaps and already existing concepts and projects. The platforms ResearchGate, ScienceDirect, Swisscovery and Google Scholar were used to obtain further scientific articles. The search engines were used to find papers on the topics of CRA, rice cultivation, climate-smart farming, the in chapter 2.3.1 named climate-resilient practices, and agriculture in Battambang. All the literature was organized using Zotero.

3.2 Primary data collection

3.2.1 Target area

The following two regions in the south-east of Battambang Province (see Figure 4) have been selected. There are various English spellings of these places; in this research, the spelling used in this section is chosen. The selection of the regions were defined by the target regions of the Nurture Project and the NGO Seed Small Beginnings, which frame this research.

1. Region: **Rainfed rice area**, two villages that are the target area of the NGO *Seed Small Beginning*, which provides local education. *Seed* was essential in establishing contact with the farmers and provided support in the form of accommodation and translation in this region. The two villages are Tanut (Commune Preah Phos, District koas krala) and Anlong (Commune Robas Monkol, District Moung Ruessei). Although the two villages are only about 15 minutes apart by motorcycle, they belong to different districts, which is why only the first village belongs to Nurture's target area. For simplicity's sake, this region will henceforth be referred to as rainfed area (RA). This region has no irrigation canals and only minimal public infrastructure.
2. Region: **Irrigated rice cultivation region** in the village of Preaek Chik (Commune Preaek Chik, District Rukh Kiri), which belongs to the Farmer Water User Community (FWUC) Preaek Chik. This region is a target area of Nurture. Contact with the farmers was established through Nurture via the FWUC committee or village chief. A student from the National University of Battambang (NUBB) helped with the translation. For simplicity's sake, this region will be referred to as irrigated area (IA), even though not all fields actually have access to irrigation. Compared to the former, this region has a developed canal system for irrigation, which is fed by a dam located at a higher elevation. There is also generally more public infrastructure.

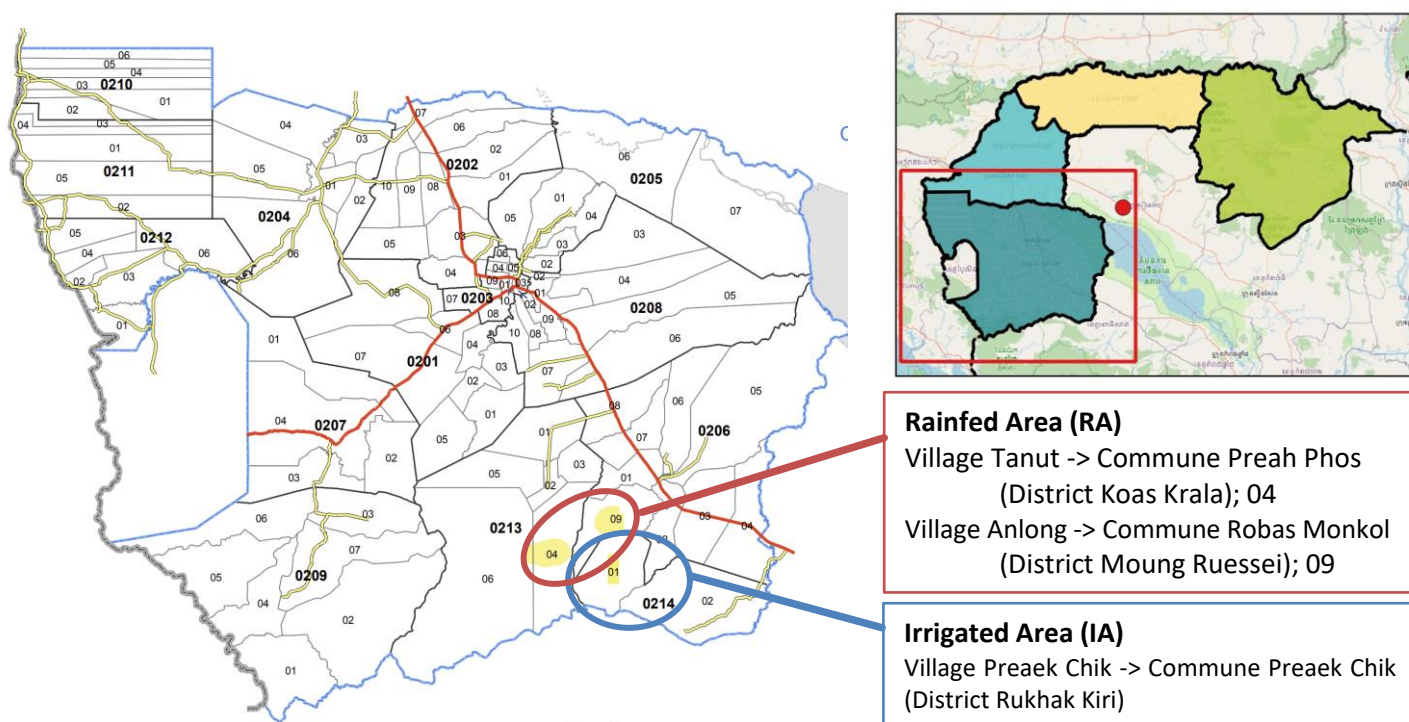


Figure 4: Target Region. Red: Rice cultivation under rainfed conditions, blue: rice cultivation under irrigated cultivations (adapted from Nurture no date)

3.2.2 Direct observations

Transect walk

In the target region, transect walks were conducted in preparation to create the survey, to understand local site conditions, and engage in conversation with the first farmers. Another objective was to gain an understanding of the region, including its road conditions and the accessibility of the farmers (Manikam et al. 2025, 3).

Visit of farmer training

To evaluate farmer training as a suitable approach to increase the adoption of climate-resilient practices, participant observations according to Bryman (2012, 273) were carried out at the following farmer training sessions at different location in the Battambang province (Table 3). The template to collect the information can be found in Appendix 2.

Table 3: List of the farmer training courses attended in Battambang Province

Date	Location	Topic	Organized by:
30.04.25	Preaek Chik (District Rukh Kiri)	Awareness cover crops	Farmer water user community, Battambang Union of Agricultural Cooperatives, supported by Nurture
22.05.25	Thippadei (District Koas Krala)	Awareness disaster preparation and risk reduction (Early warning system EWS1294)	Provincial committee for disaster management; supported by Nurture
07.08.25	Preaek Chick (District Rukh Kiri)	Make bio pesticides	East West Seed – Knowledge Transfer
14.08.25	Sangka District	Implementation of agricultural technologies for sustainable land management and the application of integrated crop management	PCRL- Project (Promoting Climate-Resilient Livelihoods in rice-based communities in the Tonle Sap region)
26.08.25	Ek Phnom District	Introduction of a Farmer Field School on Sustainable Rice Production Standard (SRP)	PCRL-Project

3.2.3 Structured farmer survey

Between June 6th and July 4th, 50 structured face-to-face interviews were conducted with farmers on their farms. Each interview lasted for about one hour. The approach used to conduct this survey was based on the methodology developed by Bryman (2012, 185 ff.).

The program Kobo toolbox was used to collect qualitative and quantitative data through closed, semi-closed and open questions. Before conducting the survey, its methodology was reviewed with the monitoring and evaluation team of Nurture and tested with two farmers from the rainfed area. The questionnaire was discussed with the two translators and checked for any ambiguities. The data was evaluated using Kobo and Excel. The farmers interviewed gave their consent for their data to be used in an anonymized form. Farmers mentioned by name or photographed were asked for their consent.

The target population were smallholder farmer household (according to Nurture's definition >5 ha) who live in the villages in the research area and grow rice, either in the RA or IA. A declared complete list of farmers who met these criteria was provided by *Seed* for the RA and by Nurture for IA. The sample size was 50 farmers, 25 in the RA and 25 in the IA. According to the central limit theorem, a minimum sample size of 30 is generally an appropriate size for basic statistical analysis (Ulyanov 2024). Therefore, the selected sample size is an appropriate size for the purpose of this research. The sample was selected randomly and, in the two rainfed villages, additionally stratified according to the number of farmers per village (strata is the village) (Bryman 2012, 192).

The aim was to inform the farmers in advance by telephone or in person about the planned meeting and the appointment. The interviewed person was the head of the household or someone in the household who knows what is done on the farm and is involved in operational decisions.

Due to various challenges and restrictions on site, which are explained in more detail in Chapter 3.5, 'Limitations of the study', it was not possible to fully follow the stratified random sample. However, all households met the aforementioned target criteria. Seven farmers were interviewed in Anlong, 18 in Tanut (=25 in RA) and 25 in Preaek Chik, IA. Since the interviews took place at household level, the number of female and male interviewees was not predetermined. Nevertheless, the number of female and male interviewees was exactly balanced by chance (42% of female heads of household answered, 42% of male heads of household answered, and 14% of female and male heads of household answered together).

To minimize the influence of the translator, key words (e.g., for different practices or crops) were translated into Khmer in advance so that both translators were using identical terms. The same questionnaire was used in both regions, but certain irrigation-specific questions were only asked in the IA (compare questionnaire in Appendix 2 Methodology)

3.2.4 Focus group discussions (FGD)

A total of four FGDs were conducted in the two target areas using the methodology described by Hartsrook (2009). Participatory tools, which do not require the ability to write or read were used (see Appendix 2 Methodology). The topics and questions were discussed in advance with the Nurture Battambang (BTB) team.

At the beginning of June, before the farmer survey was conducted, a first discussion with a selection of farmers from the target group was held in each region. The discussion took place in Khmer with two *Seed* staff members acting as facilitators and translators. The aim was to gain a better understanding of local conditions with regard to crop and livestock diversification (in RA & IR) and rainwater conservation (in RA) and water distribution by the FWUC (IA). Six farmers from different households and different age groups were invited. Instructions were given to *Seed* and *nurture*, who invited the farmers to involve two to three women and younger farmers and none with a special position within the community such as village chief or FWUC committee.

The second round of FGDs was held in August after the survey was completed and aimed at further exploring the gaps and opportunities of CRA identified. In the IA, the main topic was AWD, while in the RA, the FGD focused on cover crops. In both regions, three participants who already had experience with the practices were invited, along with three farmers who had not. The second topic discussed in both regions was access to information and how this could be improved.

3.3 Semi-structured key informant interviews

Fifteen experts or key persons listed in Table 4 were interviewed in a semi-structured interview, recorded and transcribed. The interviews with the village chiefs, the commune agricultural officer (CAO), and members of the provincial Departments of Agriculture, Forestry and Fisheries (PDAFF) were conducted with the help of a translator.

A part of the interviews were conducted prior to the survey to determine the most important climate-resilient practices for the context of rice cultivation in Battambang. Further key persons were interviewed after the farmer survey in order to gather more in-depth information on specific practices. The interviews were also used to triangulate information according to Bryman (2012, 392), thereby incorporating multiple perspectives, information sources, and methodologies.

Requests to IRRI and CARDI remained unanswered.

Table 4: List of key informant interviews

Nr.	Name	Organization	Position
1	Morm Kat	\	Deputy of village chief of Tanut
2	Heang Chen	\	Village chief Preaek Chik
3	Sanen Ath	Government	Commune agriculture officer Preah Phos
4	Chamroeurn oak	Government	Commune agriculture officer Preaek Chik
5	Bonditphop Ky	Nurture	Component manager climate resilience and market systems
6	Arabela Philipona	HEKS/EPER	Thematic advisor climate change, environment and resilience
7	Dr. Bob Martin	Agricultural Systems Research (ASR) Cambodia Co. Ltd.	Researcher
8	Setha Rath	Swisscontact	Deputy team leader, ISA-project (Innovation for Sustainable Agriculture)
9	In Sovanmony	Provincial Departments of Agriculture, Forestry and Fisheries (PDAFF)	Deputy Director
10	Myriam Adam	Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD)	Researcher and agronomist
11	Titouan Filloux		PhD researcher
12	Phim Phorn	Farmer Water User Community (FWUC) Preaek Chick	Deputy
13	Mr. Sa Mea	HUSK Ventures	N/A
14	Ms. Yan Sreyyat	Battambang Union of Agricultural Cooperatives (BUAC)	Director
15	Sat Chantha	National University of Battambang (NUBB)	Lecturer in agroecology

3.4 Restitution workshop

The research fieldwork concluded on September 8 with a restitution workshop in the RA. It was carried out according to the participatory evaluation methodology of University of Kansas (2025). All of the RA farmers interviewed were invited, as well as the village chief and the CAO. The workshop aimed to present the preliminary research results, seek validation with the target farmers, discuss open points and address knowledge gaps identified during the research process. A farmer from the village Tanut (see 4.5 case study) presented how he successfully produces and uses compost. The workshop was also an opportunity for farmers to be introduced to EWS1294 and the official MoWRAM weather forecast Facebook page - both practices which were identified as knowledge gaps in the survey. Finally, using a participatory approach, farmers were able to provide feedback on the solutions developed during the FGDs.

3.5 Limitations of the study

The following difficulties prevented the randomly selected farmers from being interviewed for the farmer survey:

- Various lists circulated within the IA that were supposed to correspond to the target group mentioned.
- The final list lacked information on the farmers' phone numbers and locations. It also turned out to be incomplete.
- The number of farmers households on the lists did not match the number given by the village chiefs.
- Farmers were found who theoretically belonged to the target group, but whose households were not on the list provided.
- The support agreed with Nurture from village chiefs or FWUC committees to locate the farmers was only limited. Communication took place via several people and was difficult. Direct contact with local officials was also challenging and was blocked several times on their part.

Thus, the farmers who could be located were asked about the other selected farmers or, in general, about farmers who corresponded to the target group. In this context, the incompleteness of the list was also noted.

In general, farmers often only know each other by their nicknames, not by the official names noted on the list. This made it difficult or impossible to ask farmers about other selected farmers. In both locations, the information on the number of hectares owned by the farmers often turned out to be incorrect.

Some farmers could not be interviewed because they had either moved away, no longer grew rice, or did not want to be interviewed. One interview had to be terminated due to too many external distractions and the farmer's lack of concentration.

Therefore, the random selection of participants for the farmer survey in the IA was only partially feasible, which may affect the representativeness of the results.

As with the organization of the survey, communication regarding the organization of the FGDs in the IA was complicated and involved several people. Finally, it was the FWUC committee who invited the farmers. The information regarding which farmers to invite was partially disregarded, and several village chiefs and higher-ranking FWUC members were also invited. Those farmers whose fields were located near the main canal and who were less affected by water scarcity and limited access to information were generally invited to participate in the FGD. In contrast, many of the farmers interviewed in the surveys did not have the same favorable circumstances. This results in limitations in terms of representativeness. Although the FGD was designed to be conducted without written knowledge, it was expected that the farmers would be able to make simple drawings. However, this was not mostly the case. This made some of the participatory elements of the FGD difficult to implement. Generally, farmers seemed unfamiliar with participatory approaches.

In all conversations and discussions conducted with translators, there is a risk that information may have been lost in translation, misunderstood, or translated incorrectly.

Certain applied social science methods were only possible to be practiced at a limited extent, as farmers were unwilling or unable to use them. In the survey, farmers were asked to rate known climate-resilient practices on a scale of 1-10, which many were unwilling to do or only did after much hesitation. Furthermore, the numerical ratings did not correlate with the qualitative assessments of the practices. For this reason, only the qualitative statements were used in the results presented.

4 Results

The following results come from expert and key person interviews, farmers surveys, focus group discussions and direct observations.

4.1 Characterization of the rice farming system in the target area

4.1.1 Rainfed area – General information

The village chief, who is responsible for managing all information and data relating to the village, explains that around 90% of the approximately 300 families in the village Tanut are farmers, and around 60% of them grow rice. After rice, cassava, corn, and pumpkin are the most important market crops in that order. Around 40% of families own less than one hectare of land and tend to migrate to Thailand or other regions of Cambodia to work. Often, the younger generations migrate, while the older ones stay at home. The current low prices are exacerbating migration. In terms of machinery, most farmers own a two-wheeled hand tractor, which they use for soil cultivation. For service providers and reparation of machines, farmers rely on other villages.

4.1.2 Irrigated area – General information

According to the village chief, around 90% of families in the village Preaek Chik are farmers, all of whom grow rice. Currently, rice, pineapple, corn, cassava, and vegetables are the most important local market crops, in that order, which was confirmed in the interviews. The village chief reports that most farmers can only grow rice once a year due to a lack of water, and only around 30% can grow it twice a year. All the farmers interviewed grew irrigated rice in two or even three cycles a year.

While soil cultivation and sowing are similar to those in the RA, farmers in irrigated cultivation flood their fields to a height of about 3-5 cm about one week after sowing and usually dry out the fields again before harvesting. In theory everyone has access to the water but in practice it depends a lot on where they are located on the water way, explained the village chief. He also has high hopes for the new dam, which is expected to bring more water and help increase rice cultivation.

More machinery is directly available than in the IA. Two families in the village own rice harvesters, which are rented out for harvesting. Within the village there are two drones that are used to apply pesticides and fertilizers. However, there is no seed drill for rice in the village, but there is one in another nearby village about 15 km away. Machine repairs can be carried out in the village itself.

4.1.3 Trend toward intensification

The province of Battambang is known for having the best soil in Cambodia for rice cultivation. However, there is a very strong trend toward intensification. Filloux (2025, Interview), a scientist from the French agricultural research and cooperation organization (CIRAD) even says: "At this stage of intensification, I'm not sure, if the soil makes a big difference as in our research area (Kanghot irrigated parameter) farmers can use more than 300kg of fertilizer per cycle. Then they have two, some even three cycles a year. Last year there was a big issue with brown grasshoppers, and some of them used 8 to 10 pesticide applications." According to Filloux, some farmers no longer want to eat their own intensively farmed rice anymore and buy rice to eat instead or have a specific field where they use fewer inputs.

4.1.4 Demographic background

Only 16% of all farmers interviewed were under 30 years old. At 28%, the 41-50 age group made up the largest proportion. Exactly 50% of farmers have been farming for over 20 years. In terms of formal educational background, the majority (52%) have only completed elementary school, while 22% have not completed any formal education (most of them from the RA). Only 16% have completed tertiary education or vocational training.

A third of those surveyed have another job in addition to the work on their own farm. If the additional jobs of the partner are included, 50% of the farms have an additional income. In both regions, agricultural labor for other farms is common (e.g. spraying pesticides, harvesting cassava), as well as small shops selling mainly food. In the RA, four mentioned that the husband works temporarily as a construction worker in another province while the wife stays at the farm. In the IA, only one person mentioned going to Thailand for work. On the other hand, there were more specific part-time jobs in the irrigated area, such as miller, primary school teacher, owner of a recycling station, gas station or pharmacy.

4.1.5 Farm size

On average, the farmers surveyed own 3.6 ha and, taking into account leased and rented land, they farm an average of 4.7 ha. As can be seen in Figure 5, farmers in the IA own slightly larger fields, while more fields are rented in the RA. Since no differentiation was made between owning and working on farmland in the first seven interviews, Figure 5 is based on the remaining 43 interviews.

4.1.6 Rice production

All but one of the farming families grow rice for home consumption, among other purposes. In the RA, 24% of farmers grow rice exclusively for home consumption, not for sale. In the IA, all farmers sell their rice except for what they keep for household consumption. Rice is also used in small quantities to feed the chickens kept around the house.

Of the total cultivated area by the survey farmers, rice fields make up 75% in the irrigated area and 57% in the rainfed area.

4.1.7 Choice of variety

As can be seen in Figure 6, in irrigated cultivation, the varieties OM (18/25 votes) and Srongea (16/25) are by far the most frequently mentioned varieties, while other varieties make up only a very small proportion. Also, in rainfed cultivation, OM (13/25) is the most frequently mentioned variety, followed by Neang Am (11/25) and Srongea (9/25). The "other" varieties include in the IA Kon Chen (= Phka Chan/Phka Cham Sen Sar), and in the RA varieties such as Malis Sor and Malis Krorhom (=red rice), as well as others for which no official name could be found. Many farmers do not grow just one variety, which is why the number of mentions is higher than the number of farmers surveyed.

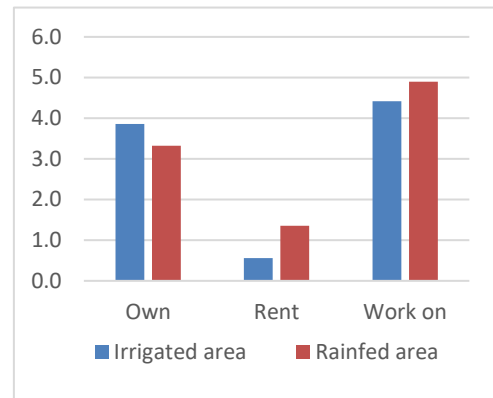


Figure 5: Comparison of farm size between irrigated and rainfed area (ha), (n=43)

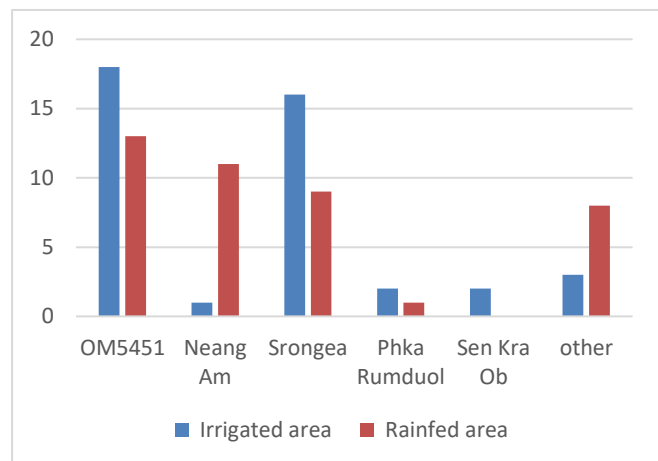


Figure 6: Number of farmers cultivating different varieties in the rainfed and irrigated area (n=50)

Most farmers choose their rice variety for several different reasons (Figure 7). In the RA, it was almost equally important that the rice was "easy to grow," had a short growing season, and could be sold at good market prices. Many cited low fertilizer requirements as "other" reasons. A quarter of the farmers perceived their chosen varieties as drought tolerant and consider this characteristic as the important reason. In the IA drought tolerance was a negligible reason. Most farmers always grow the same or the same two varieties that can be sold at good market prices. Compared to the RA, recommendations and discussions with neighbors are much more important. Two farmers in the IA have only had access to irrigation since this year and have therefore changed their choice of varieties. Whereas they used to grow the traditional varieties Neang Am and Kom Chen in rainfed cultivation, they have now adopted their neighbors' choice of varieties in their current irrigated cultivation and switched to Srongae and OM.

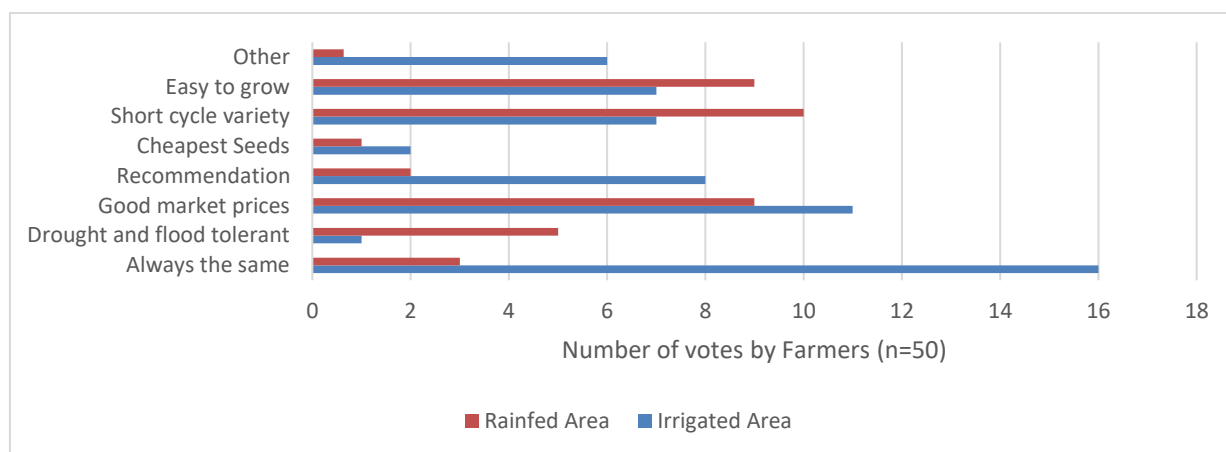


Figure 7: Frequency of farmers' reasons for rice variety selection

4.1.8 Sowing techniques

In both regions, rice is broadcasted by hand with two exceptions (broadcast by spraying machine and seed drill). Only one of the interviewed farmers uses a seed drill machine once. In the RA, farmers sow between early July and early August, with two already sowing in June. All farmers use dry, non-pre-germinated seeds, while 40% switch to pre-germinated seeds when the soil is wet. In irrigated cultivation, most farmers sow the first cycle between April and May and the second cycle between August and October. The majority (88%) use pre-germinated seeds, 60% use non-pre-germinated seeds. Many use non-pre-germinated seeds for the first cycle when the soil is dry, but almost always use germinated seeds for the second cycle. The average seed density is 190 kg/ha in the RA and 224 kg/ha in the IA.

4.2 Climate resilient practices in rice production in the target area

4.2.1 The most relevant climate-resilient practices for Battambang Province

Through discussions with local experts, different climate-resilient practices were evaluated (see Table 5). While all of the practices listed are theoretically possible for lowland rice production, such as in Battambang, the goal of this table is to identify the most relevant ones for the Battambang context. The evaluations were done using the color code underneath Table 5. See Appendix 3 Results for the full statements of the different experts. Nine practices, with one strong opinion (dark color) or several weak opinions (light color) were selected for further analysis using the farmer survey in the target region. The practices of the rice-fish-duck system and the rainwater conservation were also selected because they are strongly supported by the literature. The coordination of the cropping calendar was selected because it is already part of the Nurture project. All the selected practices are marked in bold with an asterisk (*).

Additionally, Mr. In Savonmony, the PDAFF deputy director explained - without elaborating specific practices - that rice breeding is the most important measure, followed by water management and sowing techniques.

Table 5: Summarized and simplified evaluation of climate-resilient practices by local experts. * means, that the practice was further analyzed during the survey.

Practices \ Evaluated by		Bonditphop Ky, Nurture, Former Component Manager for agroecology	Dr. Robin Martin, Director at Agricultural Systems Research (ASR) Cambodia	Commune agriculture officer & Village chief rainfed area	Commune agriculture officer & Village chief irrigated area	Leakhena Uk, Nurture, Provincial Manager Battambang
Breeding	Climate-stress tolerant varieties*	+	0	+	+	+
Water management	Alternate wetting and drying*	+	0	-	-	++
	Smart irrigation	0	0	0	0	+
	Conservation of rainwater*	0	0	0	0	+
	Cropping calendars*	+	0	0	0	+
	Scheduling irrigation	0	0	0	0	+
	Different irrigation techniques	0	0	0	0	0
	Laser land leveling	-	0	0	0	0
Sowing techniques	Seed priming	0	0	0	0	+
	Direct seeded rice	Standard	Standard	Standard	Standard	-
	Machine sowing of rice*	+	++	++	++	-
Improving Soil fertility	Zero/minimum tillage*	0	++	0	0	0
	Incorporation of crop residues*	0	++	++	++	0
	Cover crops*	+	+	-	++	+
Diversification	Rice-fish-duck-farming*	0	0	0	0	-
	Planting different crops*	+	+	-	0	+
Access to information	Climate information & forecast*	0	0	++	+	+ (-)
	Early warning system EWS1294*	0	0	+	+	+
	RiceAdvice application	0	0	0	0	0
Chemicals	Weed management	0	0	+	0	+
Insurance	Insure crop yield	0	0	0	0	- (+)

Legend: Color code for evaluation

Color & symbol		Signification	Color & symbol		Signification
Green = Positive expressions	Light green (+)	Practice is suitable for the local context, or one positive aspect is named	Red = Negative expressions	Light red (-)	Practice is not suitable for the local context, or one negative aspect is named
	Dark green (++)	Practice is suitable for the local context and/or several positive aspects are named		Dark red (-)	Practice is not suitable for the local context and/or several negative aspects are named
	Yellow	Normal current situation; standard		White (0)	No comment/no evaluation

Additional practices

During the research process additional, promising climate-resilient practices were identified:

Biochar: Due to improved water-holding capacity of the soil, using biochar can also be considered a climate-resilient practice. According to HUSK Ventures, Cambodian farmers are already using plant-based charcoal products. Through training sessions and demo farms, farmers were able to observe the results firsthand, such as increased yields and rice fields that appeared very green and healthy. HUSK explained that the main motivation for farmers using their biochar products is not to enhance their climate resilience, but rather to have a more cost-effective alternative to chemical inputs and to increase yields.

Laser land leveling: A farmer training, which was part of the PCRL project, included among other topics, the practice of LLL. IRRI is currently demonstrating this technique in the Battambang district and has explained that the laser makes the land very flat and therefore water efficient. This does not have to be done annually, but rather every three to five years. The cost is 120,000 riel/ha (30 USD/ha). Farmers who attended the training perceived that as too expensive. Also, the necessary technology is not readily available.

Compost: As part of the PCRL project, IRRI promotes composting rice straw as a climate-resilient practice. Va Channy, a farmer from RA, is convinced of the practical benefits of compost in rice cultivation as well (portrait in chapter 4.5). He produces both solid compost from plant materials and cow manure, as well as a type of compost tea, as liquid fertilizer.

Microbes: Cisbay (Cambodia) Co. Ltd. is the local distributor of Cisbay Asia Pacific, promising a CRA solution through microbes. These microbes grow around plant roots, improving resistance to pests, diseases and harsh conditions. Nutrient absorption in plants is said to be enhanced, enabling a reduction in fertilizer by up to 50% while achieving up to 30% higher yields. However, using this product for rice production costs 75–100 USD/ha, and it has only been available on farms at a very low level since Cisbay Cambodia was established in 2023.

4.2.2 Current knowledge and adoption of climate resilient practices

Figure 8 shows the percentage of surveyed farmers who state having heard about or seen the practices (in light colors) and those who state practicing them (in dark colors). If no bar is displayed in the diagram, it indicates that 0% of farmers are familiar with or practice the practice. Moreover, farmers were only asked in the IA about AWD and coordination of cropping calendars, as these practices are specific to irrigated cultivation.

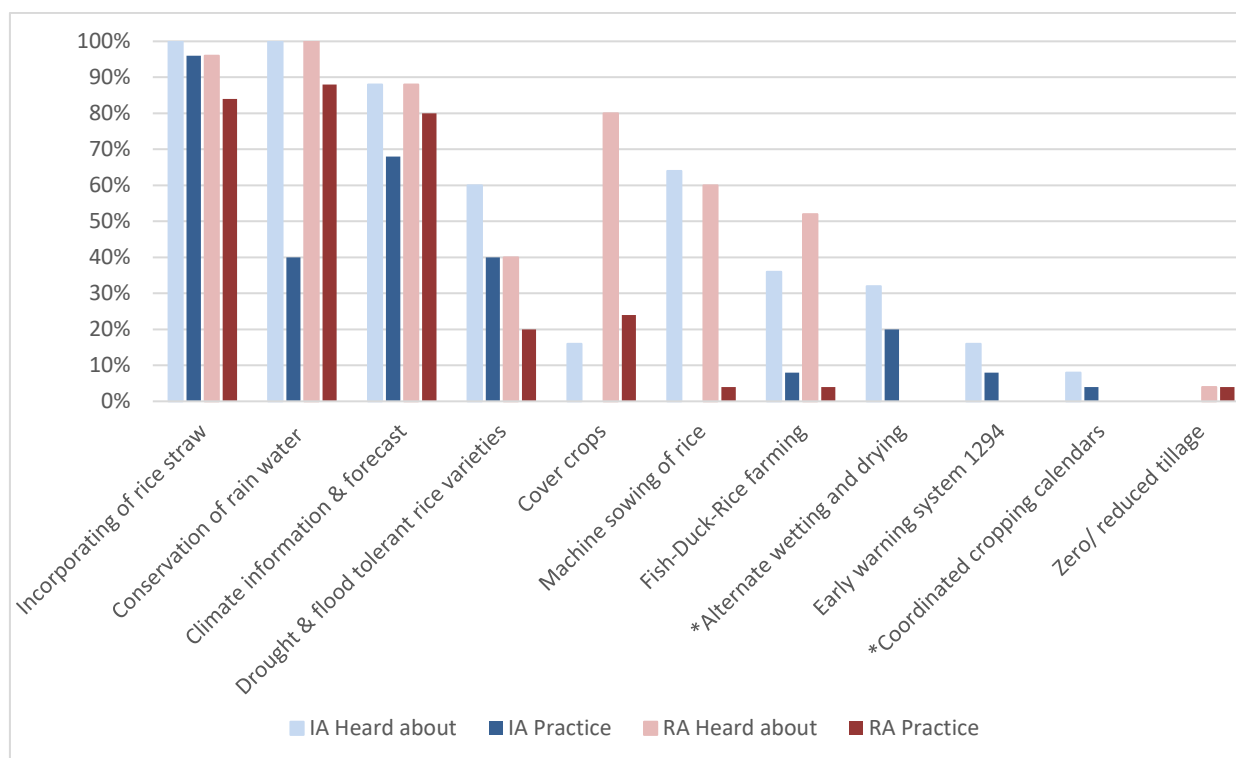


Figure 8: Percentage of Farmers stating that they know and practice climate-resilient practices in rainfed (RA) and irrigated area (IA). The asterisk (*) indicates that farmers were only asked about these practices in the IA.

4.2.3 Qualitative evaluation of the practices

Access to information:

EWS1294

None of the farmers surveyed in the RA were familiar with the EWS1294. In the IA, four farmers recently learned about it, two of them subscribed and perceived the system as helpful for obtaining information faster as they would recognize the hazard themselves. The other two found the system helpful but thought the technology was too complicated.

Weather forecasts and climate information

Facebook is the most important source of forecast information. In the RA, 68% use Facebook for this purpose, while 88% do so in the IA. In the RA in particular, the majority stated that they do not specifically search for weather forecasts and do not follow any special pages for this purpose. They simply scroll randomly through Facebook and see what is posted on their "For You" page. Only one farmer consults consciously the official MoWRAM page. This was also the case in the IA, although more farmers (n=4) used the official page. Farmers in both regions criticized the accuracy of the weather forecast but mentioned the use of being prepared in case of storm announcements. For several farmers in the RA, the forecast indicates when to sow the rice.

Breeding - Drought and flood tolerant varieties:

As shown in Figure 8, a significantly lower percentage of farmers in the RA (16%) believe they use drought-tolerant varieties compared to those in the IA (40%). The following varieties were considered drought-tolerant:

- In RA: Neang Am (4 votes), Red rice (2), Srongae (2), OM (3)
- In IA: Kon Chen (6), Srongae (5), OM (5), Phka Rumdul (1)

In the RA, farmers said that the drought would severely damage their rice anyway. Several IA farmers explained that they use Kom Chen in their rainfed fields, because they consider this traditional variety to be more drought-tolerant than OM, which they use in irrigated fields. When asked why, for example, Kom Chen is not also used in irrigated fields, a farmer replied: "It cannot be grown twice a year." It is also not possible to do the first cycle with OM and the second with Kom Chen because then they will

harvest later than their neighbors. This would result in the collector leaving and market access being impeded. A similar argument was made for Rumdoul.

Filloux (2025, Interview), researcher at CIRAD explains this as follows: “OM is a short-cycle variety, and the price is lower than long cycle varieties. But with OM you can have higher yields. Compared to other short-cycle varieties, OM is well known to be more resistant to pests and diseases. But it is a variety that reacts very well to fertilizer. Therefore, farmers are tempted to use more fertilizer, which is the most expensive input. Usually, medium or long cycle varieties are almost always more resistant to pests and diseases than short cycle varieties.” The CAO of Preah Phos argues with similar explanations, that old traditional varieties are drought tolerant, but only 25-30% of the farmers use it. Most prefer other varieties with higher yields and copy other farmers who grow modern varieties.

However, Jasmine varieties (especially Rumdoul) reach the highest prices on the market. For consumption, local varieties with more carbohydrates, such as Neang Am, are preferred.

Sowing techniques - Mechanical direct sowing

There is a big gap between having heard about mechanical direct sowing and practicing it: 60% vs. 4% (RA) and 64% vs. 0% (IR) (compare Figure 8). In other words, only one RA farmer reported using a seed drill. She said that when she sowed her rice by machine last year, the result was smoother than when she broadcasted. Nevertheless, she found the cost to be high at \$20/ha (not including the cost of the seeds). She rented both the machine and the worker from a village about two km away. Eventually she was able to harvest a higher yield than her neighbors and was very content with this technique.

In the RA most farmers saw this machine on Facebook or YouTube. They expressed concerns about its availability (“the video was from Thailand, here in Cambodia it is not available”), its cost and the cost of the gasoline as well as the lack of water and right soil preparation. However, they see advantages if the machine was available in their region. They think it would save time and labor, and make the fields look more uniform and healthier.

According to Martin (2025, Interview), direct seeding of rice is the climate-resilient practice which has “the biggest effect and is easiest to do”. Under rainfed rice cultivation he demonstrated an additional yield of 1t/ha by using this method. There are different direct seeding machines available. Agri-Smart Innovation, a khmer enterprise, produces the Angkor rice seeder, which can be used for dry and wet seedbeds. However, according to Martin and an IRRI researcher the Thai Kid machine is the best built, but it requires very leveled soil. Kubota also has a machine, that is advantageous for uneven seedbeds.

The Crop Care Shop (Prey Totueng Village, Chhnal Moan Commune, Koas Krala (12.655041°N, 103.105128°E) owns direct seeding machines. In general, availability is a challenge in the villages.

Improving soil fertility

Zero/ Reduced tillage

None of the farmers surveyed in either region had ever heard of zero or reduced tillage. Accordingly, there were no statements on the matter. The common practice is to plow twice before sowing rice.

While ploughing causes the top ten centimeters of soil to lose moisture, the no-till method can contribute to climate resilience. The limitations of no-till planters lie in cost and availability. In terms of feasibility, good results were achieved in an experiment in Battambang Province, where mung beans were sown directly into rice straw. Sowing took place successfully in January/February, i.e. during the dry season (although there was above-average moisture). It is generally recommended to sow mung beans immediately after the rice harvest in November/December. Martin (2025, interview) said: “We have never tried planting rice using the no-till method, but we have tried it with other crops such as mung beans. There is no reason why it should not work for rice.” Direct sowing of rice, however, depends heavily on soil moisture, as pre-germinated seeds are used in wet soil, which makes direct sowing difficult. Accordingly, he considers the method promising for the first cycle in irrigated fields, or in rainfed fields, and believes that no-till rice is feasible but not yet widely adopted. This second point was confirmed in the surveys.

Incorporation of crop residues

Of all the practices, the incorporation of crop residues has the highest adoption rate (84% in the RA and 96% in the IA). Many RA farmers rate this practice positively, said it softens and improves the health of the soil and acts as a fertilizer. In the IA, farmers said that they can save some of the chemicals through this practice, but more chemical fertilizer is still needed.

As shown in Figure 9, rice straw is often left in the field and partially collected to feed cows. However, burning rice straw is common. While most burned fields are set on fire unintentionally, some farmers intentionally burn the rice straw. One RA farmer explained that she collects some of the rice straw and burns the rest. "If you don't burn it, how can you plough?" Another IA farmer mentioned: "If I don't have time to wait, I'll burn it quickly."

It was also mentioned several times that children would start fires while watching the cows, to catch rats, for example. Most of the burned fields then catch fire from neighboring fields. Nobody sells the straw. Several researchers emphasized the importance of stopping rice straw burning as a first step.

One alternative is using rice straw in vegetable cultivation instead of black plastic foil. After baling the straw into bundles for use in vegetable production, about half of the four tons of straw per hectare remains in the field.

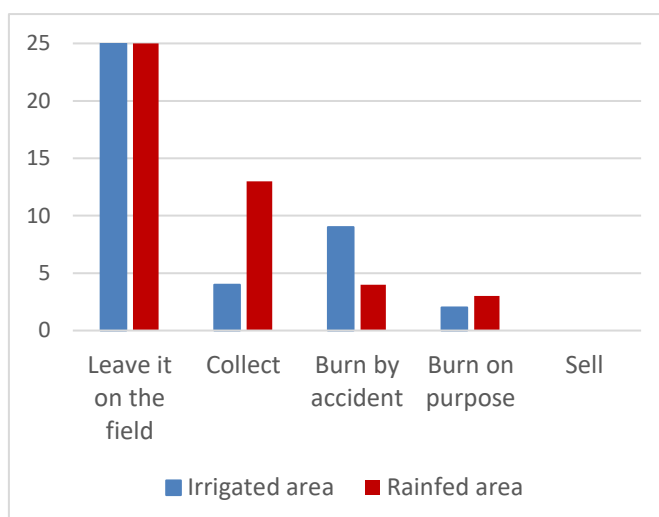


Figure 9: Frequencies of utilization of rice straw (n=50)

Cover crops

In April 2025, the BUAC held a training session at the IA to inform farmers about cover crops. Of the 25 farmers at the IA, four had therefore heard of cover crops but did not grow them. Cover crops, mainly mung beans, are much more widespread in the RA. There was no training on this topic in the RA, yet 80% of farmers are aware of cover crops, and 24% grow them, though not all in rice fields.

Farmers reported several positive aspects, such as "it makes the soil good, healthier and softer", "I can sell the mung beans", "the soil was very healthy and had fertilizer inside", "I need to use less fertilizer for the following rice cycle", "the yield of the next crop was better" or "the mung bean is very marketable". Yet, constraints were also mentioned: "I don't have money for the seeds or plowing", "there are a lot of cows, they will eat it all before you can harvest", or "I don't do it, because it is the rice field, which is for rice and anything else probably would not grow."

The challenge of inadequate cow management is that after the rice harvest, the fields become a community grazing area. Controlled grazing can promote the growth of certain cover crop species, but without control, overgrazing usually occurs.

Table 6 below shows the main problems and proposed solutions that were agreed upon during an FGD in the RA. The challenges are listed in order of importance.

Table 6: Challenges and solutions regarding cover crop cultivation, as identified by six farmers in the rainfed area during a focus group discussion.

Priority	Challenge in cover crop cultivation	Suggested solution
1.	Cows must be tied up during the rice harvest but are usually allowed to roam freely afterwards. Therefore, farmers are concerned about crop damage caused by freely grazing cattle and insufficient cow management.	A) Cover crops should be cultivated on fields close to the house, where the cows can be better controlled. B) The village chief should introduce stricter rules for cow management after the rice harvest.
2.	Crop damage caused by fire spreading from the rice straw burning	When plowing around the field, firebreaks should be created to prevent fires from spreading.
3.	Pest infestation	Use of insecticides
4.	Water shortage	No solution identified

During the FGD in the RA, farmers were shown photos of various officially registered cover crops in Cambodia. Everyone knew or used mung beans as a field crop, farmers knew keanf (*Hibiscus cannabinus*) because they used it to make tea. They used the flowers of *Sesbania sesban* for food. One farmer had positive experiences growing sunhemp in rice fields. The reasons for growing cover crops, respectively mung beans, were to eat them (three times the first choice), to improve the soil (two times the second choice), and to sell them (one time the second choice and one time the third choice). Soil improvement alone was never the main motivation. Farmer mostly want grain yield as well. They perceive the mung beans as “very marketable”. There are buyers in this region, but the prices fluctuate.

The two farmers who grow mung beans in rice fields do not do so every year but depend on their financial resources and availability of time. They sow the seeds in December after the rice harvest. Harvesting is done after two to three months by hand, in two stages over two weeks, as the crop does not ripen evenly. Using a harvesting machine would not be financially viable. Appendix 3 Results shows the costs and benefits of these two farmers. Experiments by Bob Martin in Battambang Province showed that direct sowing of mung beans after the rice harvest is possible with the locally available Thai Kid and Kubota machines (Martin et al. 2025, 7).

There are no roller crimpers available locally to terminate the cover crop; however, farmers can use their own machinery for this purpose.

Diversification – Rice-fish-duck farming

Regarding the rice-fish-duck system, the gap between knowledge and application is 28% in IA and 48% in RA. In the RA, common knowledge about the duck-rice interaction is that ducks help control pests and that their droppings improve soil fertility. However, farmers perceive the system as difficult to implement locally due to insufficient water availability in the fields. According to farmers’ observations, this practice is usually carried out in other areas where ducks are released into the fields after the rice harvest rather than during the growth phase, to prevent damage to the rice plants. Another concern, mentioned only once, is that ducks might compact the soil by running around in the field. Of the 13 RA farmers familiar with the system, only two knew about the possibility of integrating fish. They regarded fish as unsuitable due to water shortages and the extensive pesticide use, which they said would likely kill the fish.

In the IA, opinions on this system varied considerably. One farmer reported that a neighbor was already participating in a trial in which one part of the rice field was cultivated with ducks while the other part served as a control area. No rice grew in the part with ducks the following season. The farmer believed this was due to the duck excrement. Despite these concerns, several farmers expressed positive views, emphasizing benefits such as effective snail control by the ducks and the potential for additional income from fish farming. In one case, however, the ducks were completely lost due to predation by a dog. While fishing in rice fields is not so common, farmers already fish in their own ponds, with 20% doing so in the RA and 24% in the IA.

Most farmers were familiar with the practice because they had seen it themselves; only two had heard about it on social media.

Water management

Rainwater conservation

Ponds play a crucial role in water conservation in the RA. Most families either own a pond or have access to a shared one within their family or community. Approximately 84% of households use pond water for domestic purposes, 64% use it to provide drinking water for livestock, and 52% for irrigating home gardens. Ponds are usually located near the house. One household reported using pond water for supplementary rice irrigation, which enabled them to cultivate two rice cycles in the previous year. However, many farmers expressed concerns about the limited water availability and declining water quality. Some noted that pond water is often insufficient for all purposes and that renting tank trucks is sometimes necessary to transport water from larger community ponds that rarely dry up. Others pointed out that, due to the surrounding areas being heavily treated with pesticides and fertilizers, pond water can sometimes only be used for laundry and washing because it is unsuitable for drinking or other uses.

In the IA, only one farmer reported using pond water for both household needs and livestock. Ponds are generally located near irrigation canals and agricultural fields. Approximately 40% of farmers use pond water as a supplementary source for field irrigation. Some farmers explained that their ponds are filled by both rainfall and water from the irrigation system. Others noted that the distance between their ponds and the fields makes access more difficult and poses safety risks, such as drowning for

children. In several cases, ponds are situated adjacent to canals, allowing them to fill naturally when canal water levels rise.

AWD

The topic of AWD was discussed in depth during a FGD at the IA. The main finding was that all six farmers participating to the FGD, whether intentionally or unintentionally, already incorporated dry and wet periods into their rice cycle. The farmers explained that ten days after sowing and again a few days before the flowering stage, they dry out the rice field for a few days. No one uses measuring devices to determine the effective water level. The reason for applying this technique is to strengthen the plants (both stems and roots) and to reduce pest pressure from snails.

The decisive factor in whether this is actually done is the availability of water. This is why it is mainly done in the second cycle. In the first cycle, due to water scarcity, farmers cannot be sure that they will actually have enough water available to pump back in.

One possible disadvantage is that rodents (mainly mice) could enter the dry field and damage the crop. AWD does not generate any additional costs, as drying out does not involve pumping costs, but rather the water simply percolates or is released back into the canal without pumping.

To summarize, the fields are dried out a maximum of two times, especially in the second cycle, but this depends heavily on water availability. All participants in the FGD had fields located near the main canal, which greatly limits the representativeness of the statements. It also shows that the FWUC committee invites rather privileged farmers to the FGD. In the surveys, only 20% of farmers reported that they use AWD-like techniques. They do not want to empty the field of water or miss the opportunity to take water when there is enough in the channel since they can't be sure they will have water when needed.

Coordination of cropping calendars

This technique is new for all farmers except the village chief. According to him the FWUC has a plan to implement this technique, but the farmers would not participate because they are greedy and afraid of not getting enough water, which would waste their land.

4.2.4 Perception of climate change

There is already widespread awareness of changed climatic patterns and the resulting issues for farms. A RA farmer explained climate change as follows: "It is something that happens, when it is rainy season, but there is no rain. Last year, it really changed, becoming hot with little rain. But this year, even during the dry season, there was some rain." In general, farmers report that the usual dry and rainy seasons and thus rice growing seasons have changed and that rainfall patterns have become unpredictable.

Even though a third of the surveyed farmers were unfamiliar with the term climate change, they had experienced its consequences, such as droughts and floods, and how these affected their farms in the past. "The flood affected my cassava, making its roots rot, which is why I stopped growing it. Drought affects my rice fields. My rice died because of the drought last year." Farmers generally explained that flooding is problematic for cassava and pineapple, but that droughts and pests caused major yield losses (up to complete crop failure) in rice. Slightly more than half of the farmers have not changed their agricultural practices in response to observed and experienced climate change. In both regions, some farmers said that they adjusted their sowing dates according to the weather. In the rainfed area, farmers also said that they requested more water from the FWUC and used more pesticides. Some mentioned pineapple and watermelon as alternative crops that require little water.

4.3 Diversification of farm products

Rice is traditionally very strongly anchored in Cambodia's agriculture. Whenever possible, farmers will not forego a rice cycle in order to grow another crop. However, farmers are already growing various crops and raising different types of livestock. Various options and limitations for future diversification have been identified for market sales, household consumption and animal feed.

4.3.1 Current level of diversification

Crop diversification at household level

The following heat map (Figure 10) illustrates the percentage of farmers in the two regions who cultivate the specified crop alongside rice, as indicated by the color. The letters M, H and F indicate the purpose of the crop: M = market, H = household and F = feed. Empty fields indicate zero votes. For more detailed information on irrigation and area for each crop, see Appendix 3 Results.

The diagram shows that, in addition to rice, the most frequently grown large-field market crop in IA is pineapple, while in RA it is cassava. In IA, the ten most frequently mentioned crops, regardless of field size and intended use, are lemongrass (grown by 84% of farmers); coconut (80%); banana (68%); basil (64%); papaya (60%); mango (56%); pineapple (56%); garlic leave (52%); climbing wattle (52%) and chili (48%). In the RA, the ten most frequently mentioned crops are chili (96%); lemongrass (92%); custard apple (92%); mango (88%); banana (80%); coconut (67%); papaya (72%); jackfruit (72%); luffa (72%) and basil (64%).

The level of diversification is generally higher in the RA, where most crops are grown on a small scale in home gardens and some water from ponds is used for irrigation. Tree crops are particularly widespread in both regions, and even more so in the RA. Mung beans are only grown in the RA (by 16% of farmers). Almost all RA farmers grow chilies in their home gardens for household consumption. In the IA, fewer farmers grow chilies, but if they do is for sale and mostly on larger plots of land.

There were also more mentions of ‘other’ crops grown in the RA. The most mentioned crops, all of which are grown for household use, are: dragon fruit (24%); fingerroot (24%); galangal (20%); longan (20%) and sugarcane (16%). Avocado and zedoraya are also grown by individuals for selling. In the IA, the most common “other” mentions were longan (20%); orange (16%) and guava (12%), all for home consumption only (see Appendix 3 Results).

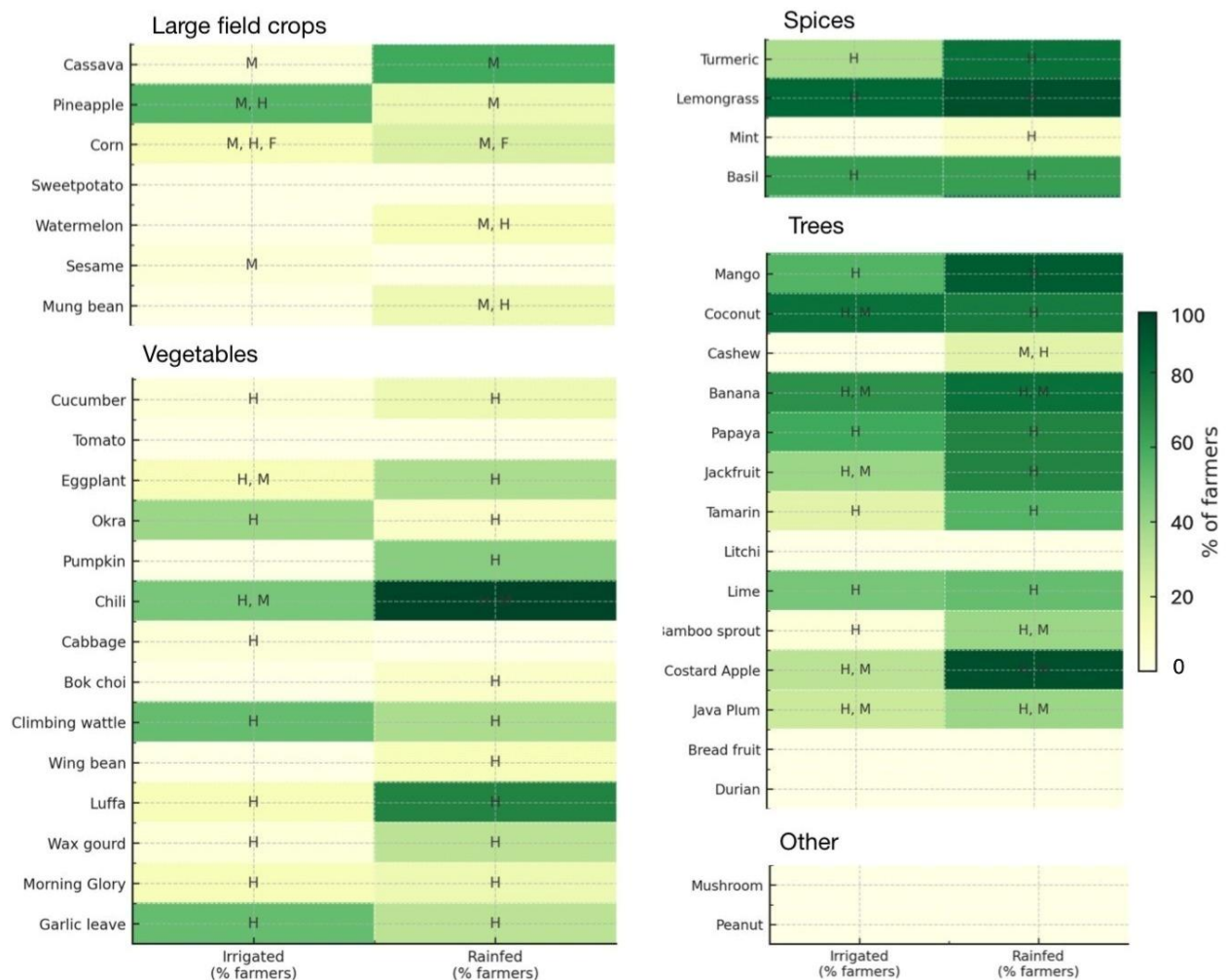


Figure 10: Heatmap of crop diversification of the surveyed farmers (n=50) (Source: Adapted from a creation of ChatGPT, based on own data)

Livestock diversification at household level

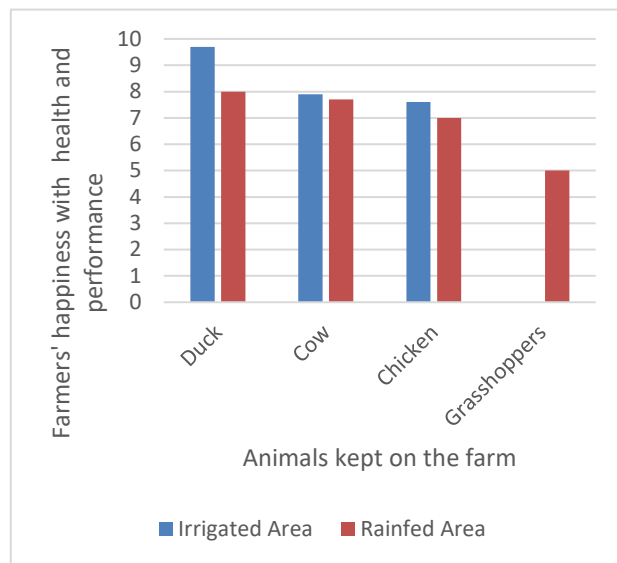


Figure 11: Farmers happiness with animal health and performance (0 = very low/ 10 = very high)

Cows are usually kept for sale providing a source of income when it is urgently needed. As one farmer in the RA explained, “Two years ago, I sold my cows when my husband died because I needed the money.” Slightly more families in the RA keep cows. In both areas cows are kept in small groups. On a scale of 0-10, farmers rate the health and performance of their cows as ‘healthy’ and ‘high’ with an average score of just under 8 points (see Figure 11). The cow bank concept, whereby a farmer looks after someone else's cow and keeps the calf in return, is common in both regions. All farmers feed their cows with grass and, especially during the dry season, with rice straw.

Chickens are the most common farm animals. Most farmers interviewed keep a few free-range chickens around the house. These are only used for home consumption of meat, not for eggs. Their health is rated slightly lower than that of the cows, with an average of 7.0 (RA) respt. 7.6 (IA). However, several farmers commented that

their chickens often fall ill and die quickly. One farmer in the RA said: “Last month nine chicken died because the pineapple farm next to my house sprayed pesticides.” Ducks are kept for their eggs and meat. These products are sold and kept for home consumption. Overall, the farmers were most satisfied with the health and performance of the ducks. Half of the duck farmers buy supplementary feed for their ducks from the market.

20% (RA) respectively 24% (IA) fish for their own household from their own pond. However, these fishes are neither fed nor deliberately bred or raised. One farmer in the RA grows grasshoppers for local sale. No one keeps goats or pigs.

Consumption vs production

An additional FGD revealed that all participants (6) in the RA consume eggs which are bought from ‘outside’ the village. Beef and pork were named as the most expensive foods they buy. There is no local village market, and only a few products are sold or given to neighbors. In the IA several products (mostly vegetables, chicken and fish) are sold at the local village market. All six participants buy animal products (fish, chicken, pork, beef and eggs) at the market. Again, all six farmers raise chickens, but none for egg production.

Changes over time

Market demand and prices are the main drivers behind decisions to stop cultivating certain crops or to start growing new ones. In the RA, 17 out of 25 farmers and 5 out of 25 farmers in the IA have stopped growing at least one crop in recent years. Some farmers said they have stopped growing cassava (28%) or maize (20%) due to poor prices and consequently low profitability. Individuals have stopped growing sesame (lack of labor), herbs (drought in 2024), peanuts (reduced yields, too much weeding), mung beans (husband moved away for extern work). In the IA, some farmers stopped growing pineapple (due to the long growing season or poor market prices), eggplant (too labor intensive), chili (poor market prices).

Regarding livestock farming, 42% of the farmers surveyed have stopped keeping one type of animal in recent years. In most cases, it was cow husbandry because either nobody had time to look after the cows, market prices were too low or money was urgently needed to pay loans, medical bills or other bills. Some stopped keeping pigs because the feed was too expensive and market prices were too low, while others stopped keeping ducks because they were either sick or producing too much feces.

In addition to those who have already stopped, a further 28% of farmers in the RA are considering stopping cassava cultivation if prices do not rise again next year. However, one common concern is: “If I stop, I don’t know what else I would grow, because here you can only grow cassava or rice”. In

the IA, 24% of farmers are undecided about stopping some of their current crop cultivation, and they have the same concerns as farmers in the RA. No farmer considered stopping rice cultivation.

4.3.2 Potential for future diversification

Cash crops

Some of the farmers surveyed (64% in the RA and 28% in the IA) expressed an interest in growing new crops. In the RA, pineapple and cashew were the most mentioned crops, as both have good market prices. However, they see the very high investment costs as a hurdle. The previously discontinued cultivation of cassava was also mentioned several times as a potential new crop. One farmer would like to grow durian. She believes that it would thrive in the region with proper care and attention. However, she lacks the money to purchase the seedlings. She also wants to grow more coconuts, which would provide her with an income in her old age with little work. In the IA, the farmers mentioned future visions of growing pineapple and various vegetables, as well as coconuts to provide for their old age. During the FGD, they furthermore mentioned the possible potential for growing durian, rambutan, green onion, and carrots. In both regions, several farmers said that they would like to grow something new to sell at a good price, but they do not know what. Java plum grown in the home garden, was mentioned to be marketable at local level.

Fundamental limitations in cash crop production include farmers' lack of knowledge or access to information about market demand and prices. On the other hand, farmers complain about high input costs, lack of water and, in some cases, reduced soil fertility. A statement repeatedly made by farmers in both regions is: "It is expensive to produce, but cheap to sell."

According to Adam (2025, Interview), farmers in irrigated regions are not willing to forego the second rice cycle. The main challenge is therefore to fill the gaps between cycles and diversify during the dry season with other crops such as watermelon, okra, maize, chili, or others, since access to irrigation is generally available. Regarding the RA, Martin (2025, Interview) says: "Sesame or mung bean are suited for cultivation after the rice harvest. They are very drought-tolerant." PDAFF representative Mr. In Savomony lists the following options for crop rotation in the rice system, which are already being cultivated at the farm level: sweet potato (already promoted in Bovel District), watermelons (in Ek Phnom), and sweetcorn (in Moung Russey). Mung beans and sesame are also suitable for the local market. Crop rotations are already established in the Ek Phnom region.

Livestock

Several farmers said they wanted to raise different types of livestock to the ones they already have (40% in RA; 32% in IA). Farmers in the RA mentioned that they would like to raise the following additional livestock: Cow (4 votes), Fish (3), duck (3), cricket (2), pig (2), Goat (1) and Buffalo (1). One farmer was particularly interested in diversifying his livestock, to improve soil fertility (see chapter 4.5 case study). In the IA farmers named cows (6 votes), pigs (2), chickens (2) and fish (1).

For household-consumption

A potential for diversification around ponds for household consumption or local sales has been identified. This suggestion was favored by RA farmers. Trees and seasonal vegetables could be grown around the pond, strengthening their own food supply and reducing expenses. Many farmers in the RA (88%) have access to a pond, although around 50% share it with family members or neighbors. These are often located close to the house. Farmers complain that they are too small to be of any real use for irrigating fields. However, they can be used to irrigate home gardens. In the IA, fewer farmers have access to a pond (46%). The village chief explains that the farmers do not have larger home gardens because they shop at the local market.

Some farmers already have highly diversified home gardens (Figure 13), which they successfully irrigate using small ponds. Others grow luffa on frames over small canals (Figure 12). These examples show what could be possible.



Figure 13 : Home garden: Under a shade roof, a farmer grows various vegetables, berries, and herbs, alongside trees such as coconut, banana, and custard apple, irrigated with the help of a small pond.



Figure 12 : Luffa grown over a small canal

Fodder crops

In principle, fodder crops could loosen up crop rotation and improve cows fodder ratio, leading to increased health and performance. But the potential that farmers adopt this practice is very limited. Improved feeding by smallholders for cow fattening could not be observed in the target area. The question of how he assessed this potential was incomprehensible to the RA village chief. The village chief of the IA, said: "The families cannot afford to grow something for the cows to eat." The experts interviewed also confirmed the low potential and said that cow fattening by smallholders has not been successful in Cambodia to date. Cows play a more important role as a reserve in case money is needed quick. The survey showed that farmers exclusively feed their cows on grass and rice straw, meaning they do not spend any extra money on feed. Farmers are generally satisfied with the health and performance of their cows (Figure 11) and they reported hardly any differences between seasons. Thus, no incentives for fodder crop cultivation could be identified.

Only one farmer with a larger herd of ten adult cows (plus their calves), said he would be interested in feeding his cows cover crops.

4.4 Actors influencing farmers' adoption of climate-resilient practices

The following subchapter is organized from the inside out according to Figure 14 below, which shows the various actors and their immediate proximity to the farmer.

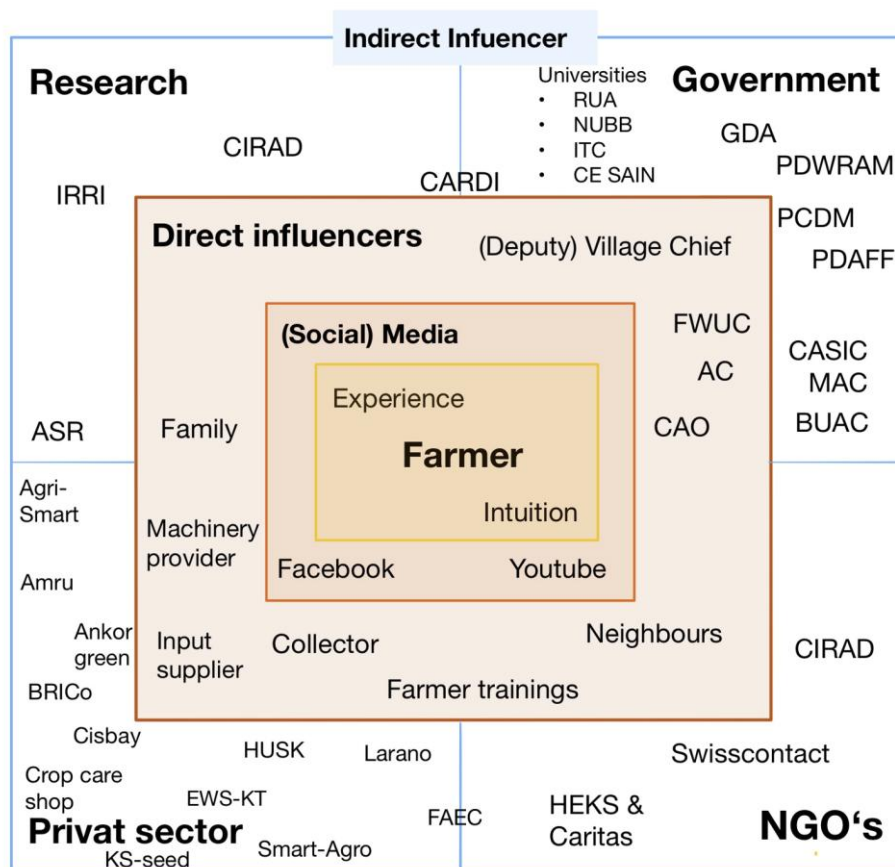


Figure 14: Stakeholders influencing farmers' decision to adopt climate-resilient practices. For abbreviations see list of abbreviations page 3.

(Social) Media

As shown in Figure 15 Facebook is the only frequently used social media channel for agricultural information in both RA and IA. Individual farmers also use YouTube. In the IA, 36% of farmers do not use any social media channels for agricultural knowledge, compared to 13% in the RA. None of the farmers could name specific Facebook or YouTube channels that they consciously follow to acquire knowledge. Most said that they randomly scroll and come across agricultural information, often it is also just advertisements. Various other platforms such as Telegram, TikTok, Instagram, apps, radio, and television are not used at all for agricultural knowledge.

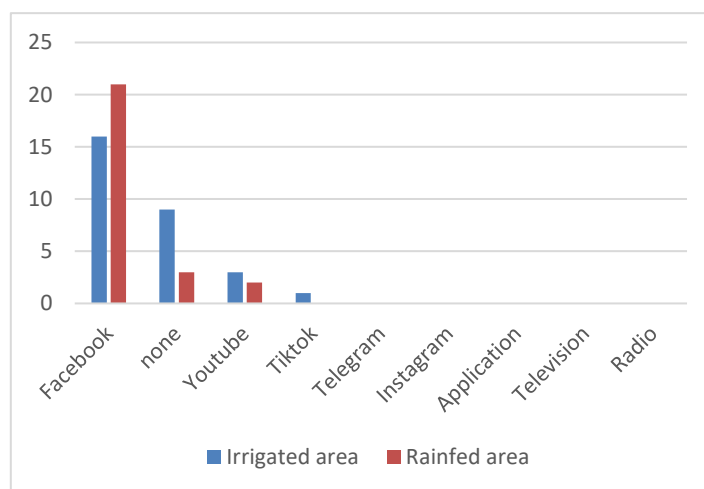


Figure 15: Frequency of (social) media channels used by farmers to access farming information (n=50)

4.4.1 Direct influence

In both regions, personal experience and family advice were the most important sources of agricultural advice (see Figure 16). However, many farmers in the RA also expressed doubts about their own experiences and intuition. “Because of the climate, I can no longer trust my intuition as much.” Another farmer said: “Sometimes it fails, it is never really successful. We don’t earn a profit, we just do it.” However, two farmers also explained that training helps them in this regard: “Last year, I did not achieve good results based on my experience. But now I will apply what I learned in the training. That gives me confidence.”

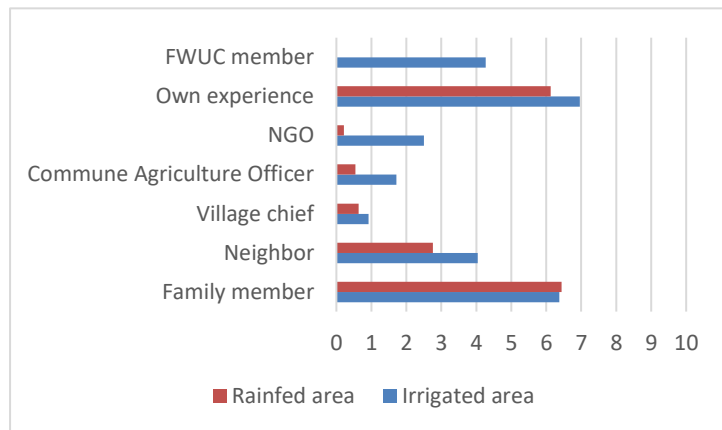


Figure 16: Importance of advice from various persons for the farmer's farming practice (0 = not important at all/ 10 = very important), (n=50)

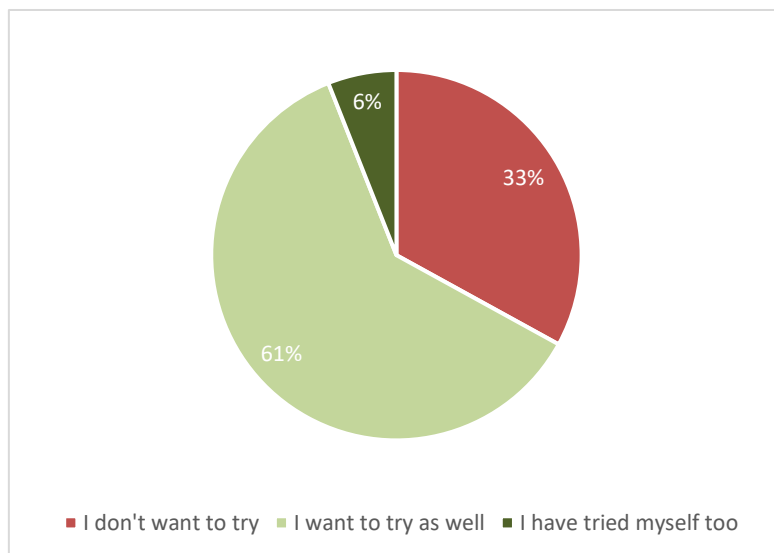


Figure 17: Farmers answer on the question how they reacted when their neighbor grew a new crop (n=18).

With scores of 2.8/10 (RA) and 4/10 (IA), farmers rate the farming advice they receive from their neighbors as comparatively low (Figure 16). When discussing agricultural advice, the focus is mainly on variety selection in IA, as this is relevant for the buyer. However, farmers do observe what others are doing and show an interest in adopting their practices: Sixty-one percent of farmers said that when their neighbor grew a new crop, they also wanted to try growing it. As not all farmers said their neighbors tried new crops in the past, n equals 18, not 50 (Figure 17).

The village chief (VC) resp. the deputy of the village chief served as a source of information for only a few farmers (RA: 3 farmers, IA: 3 farmers) because he invited them to training sessions. In the RA, one farmer said: “The village chief is far away from where I live. The deputy is also far away and does not come to this region.” In fact, the actual village chief of the RA has been ill for over two years, so the deputy has taken over his duties. However, the CAO has only been in contact with the VC and not the deputy. This has led the deputy to believe that the CAO is inactive in the region, while the CAO claims otherwise. The deputy invites certain farmers (according to some farmers, always the same ones) to training sessions, which has led to a lack of transparency and inclusion.

In the IA, farmers said that the village chief rarely offers agricultural advice, yet he is responsible for inviting farmers to training sessions. The VC said, he regularly talks with farmers, listens to their problems and announces new information, such as weather forecasts or the need to delay sowing. He also acts as the link between the FWUC and the farmers, passing on information such as where the water is flowing and if there are any problems. He says that the CAO is active in this village and provides training. But the VC does not trust the CAOs information completely: “When the CAO comes up with an idea, it is only 60% accurate. Then, when the farmers complain, it becomes 100% accurate.”

Recently, District Agricultural Officers (DAOs) at the district level and CAOs at the communal level have been established under the authority of the Ministry of Agriculture, Forestry and Fisheries (MAFF). Most of these are young people from the region. The CAO in Preaek Chik (IA) took up his post in

February 2025, while the CAO in Preah Phos (RA) started at the beginning of 2024. They both consider their primary responsibility to be reporting problems and data from farmers to the General Directorate of Agriculture (GDA), as well as facilitating market access for farmers and providing them with knowledge through training. However, so far, the CAO has also played a negligible role as a source of information for farmers in the survey regions. In the RA, two farmers attended one of his training sessions. In the IA, significantly more farmers were already familiar with and attended the CAO's training sessions. However, trust in his training was only partial. Again, reference was made to the lack of water: "The practice might be good, but it depends on the water availability." Or to the disbelief that the theory also works in the field: "Teaching with a whiteboard is not the same as teaching in the field."

According to the farmers interviewed in the RA, there are no active agricultural NGOs in their village. Only one reported an initiative involving seed support but was unsure whether it was an NGO or a private company. In the IA, according to the farmers, NGOs play a slightly larger, but still relatively minor role in disseminating information.

Agricultural Cooperatives (AC) are groups of farmers in rural areas that facilitate access to inputs and markets. In Battambang province there are 88 ACs with over 22'000 members (Suess und Melara 2022, 44). However, none of the farmers in either region were part of an AC. Even though some individuals in the IA joined a training provided by the BUAC on cover crops in April 25. Registered in 2017, the BUAC is chaired by Mrs. Yan Sreyyat and promotes the Sustainable Rice Platform (SRP). BUAC partners with Amru Rice to improve SRP rice sales (Srongae and Senkra Ob Variety). Since awareness of cover crops is necessary to meet SRP standards, BUAC raises awareness and facilitates access to cover crop seeds.

Opinions within the IA regarding the FWUC varied greatly. Some (six out of twenty-five) cited the FWUC as a very important source of information for water supply, rating it a nine or ten out of 10. Others expressed criticism and mistrust. They reacted angrily to questions about problems with the FWUC and stated that they offer no helpful agricultural advice (resulting in an average of 4.3, Figure 16). Several farmers mentioned uneven water distribution to the gates and among the farmers: "Mostly the FWUC only opened the east side and not the other side." or "I have to pay the same price, but I don't get the same amount of water. Some farmers have already received enough water, yet they claim they do not have enough. Then they get more, while others at the same time did not receive enough." The location of the fields strongly affects the amount of water received: "My fields are at the very end of the irrigation system. The existing canal was not enough for me, so I dug on my own to improve it. The farmer in front of me gets enough water, but there isn't enough left for me when it's my turn, even though I pay. Since I only get so little water, I requested a price reduction and now I pay 15'000 riel instead of 30'000 per hectare." Others, however, responded: "I don't have any problems, I'm located next to the canal." In addition, poor maintenance of the canals has been reported. Sediments are partially blocking the flow of water.

During an FGD in the IA, the farmers also discussed their satisfaction with water distribution (Figure 18). In addition to the previously mentioned problems, those present - the farmers, the village chief, and the FWUC committee - saw the solution as sticking to the existing schedule, which determines who receives water and when. Additionally, the FWUC requested more water from the MoWRAM. They created a plan detailing how much water they need for how many hectares. However, the farmers surveyed were unaware of any existing irrigation schedule.



Figure 18: Farmers rate their satisfaction with water distribution during a focus group discussion in the irrigated area

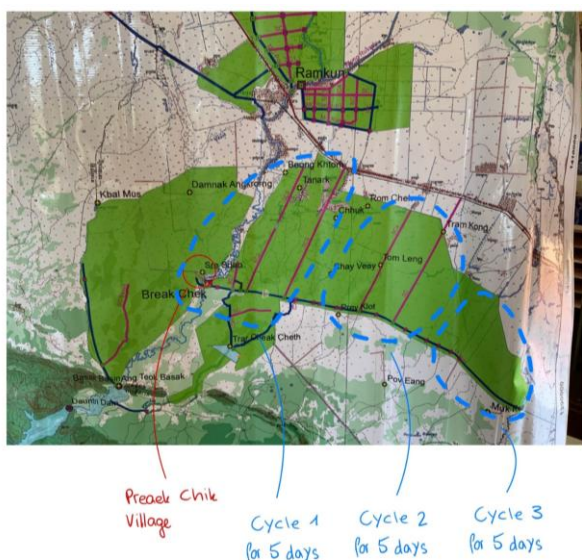


Figure 19: Rotation of water distribution in three cycles

According to FWUC Deputy Phim Phorn, the FWUC has a clear structure and water distribution is organized as follows: The water comes from the Dountri Dam, the new large dam, to the FWUC Preaek Chik, which is then divided into subgroups (previously 8, now 3). The government builds and maintains the main canals (pink and blue in Figure 19), while the farmers develop and maintain the smaller connecting canals. Water storage in the farmers' own canals/ponds is legal and acceptable. A farmer's costs are calculated per hectare, not per volume of water and amount to 30,000 riel/ha (7.5 USD/ha). If farmers do not receive enough water after the harvest, they do not have to pay the full amount. Water flow is based on a calendar. With the new three subgroups (see dashed blue circles in Figure 19), each group receives water for five days at a time, on a rotating basis.

Weather information – Social media and direct influencer

In both regions, Facebook and personal intuition (i.e., observing the sky) are the primary sources of weather information (Figure 20 and Figure 21). If they use Facebook, they mostly do not know which channels they follow. In the RA, one farmer followed the official MoWRAM page, while four did so in the IA.

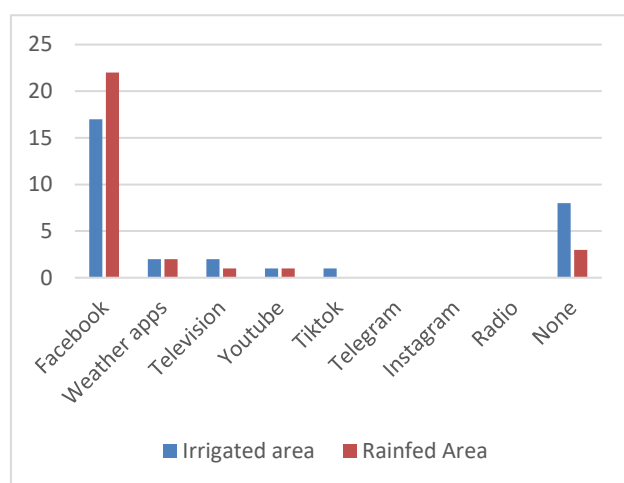


Figure 20: Frequency of farmers using (social) media information for weather forecasts (n=50)

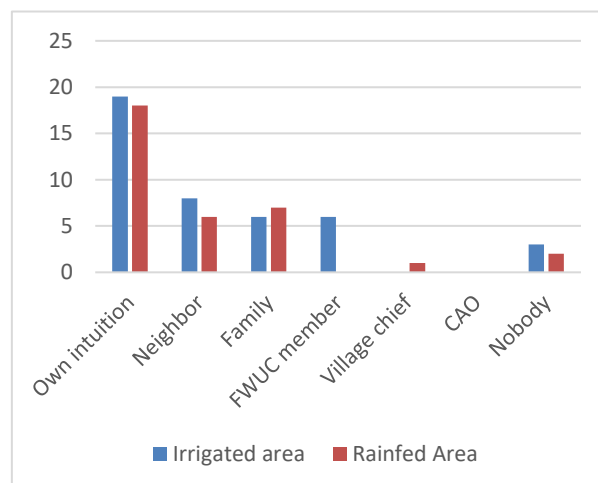


Figure 21: Percentage of farmers having weather information from different persons (n=50)

Farmer training

Farmer training is considered by the extension side to be an important and common tool for knowledge transfer. In recent years, significantly more training courses have taken place in the IA than in the RA. While 24% of RA farmers attended at least one training session (of any kind) in the last three years, 56% of IA farmers did so.

According to the six RA farmers who had participated in training sessions, these were provided by the village chief and a fertilizer seller, and a training session on mechanical direct seeding by Bob Martin from ASR. The farmers rated the usefulness of the training sessions at an average of 5/10 because the sessions were not tailored to their needs (e.g. only for farmers with two to three rice cycles), they did not have the money for the necessary inputs, and they were afraid of crop failures and the associated debts. The accuracy of the information received during the training was rated 8.3,

with the comment that complete trust is given only after trying it themselves and seeing that it works. This was the case with the recommendation to reduce seed density, for example. Three of the six farmers partially apply what they have learned (specifically, reduced seed density and advice on fertilizers use).

The RA deputy village chief occasionally invites some farmers, but not all, to training sessions. During an FGD, the farmers said that it is always the same people who are invited, but they never know why. Farmers are also invited to externally organized training sessions via the village chief, but the farmers said that not everyone is invited to these either. The RA farmers suggested that, for better information, the farmers be divided into groups, each with a team leader who would pass on the information to everyone personally. They felt that invitations via Facebook group chats were not helpful.

In the IA, farmers recalled various training courses on cover crops, EWS1294, varieties, rice straw burning, vegetables and poultry, use of pesticides, etc. They rated the usefulness of the training sessions on 8/10. One farmer said: "All of the training courses are useful, but the villagers often don't listen. They think that using less fertilizer will produce fewer results because they want fast results from chemical fertilizers and become upset if the fertilizer is not effective." In addition to chemicals, farmers focus is on water availability and one farmer noted: "The lesson was nice, but if there is no water, there is nothing."

There was a wide range of ratings regarding trust in the information provided during the trainings, with an average of 5.8. One IA farmer said: "I support and trust the CAO 100%. They have the knowledge and the experience. I want more trainings." Others, spoke of a loss of trust: "I used to trust them, but not anymore because they don't make any promises." Another farmer said: "The FWUC committee told me to grow anything I wanted, but when I asked for the needed water, there was none. I don't trust them anymore." A third said: "They assured me that the variety was pure. But I saw my neighbors who used these seeds and his field was not pure. Therefore, he didn't get a good price. We lost our trust."

In the IA, 50% of farmers apply some of the learned practices (specifically in the areas of soil preparation, use of fertilizers and pesticides and EWS1294). The reasons given for not applying these practices were: that they did not want additional expenses, the training took place at the wrong time within the crop cycle, they considered themselves too unskilled for the technology, or they wanted the project to contribute agricultural inputs.

In the IA, the invitation mechanism and the associated exclusion of certain farmers is similar to that in the RA. Normally, farmers should be informed two days in advance, a timeframe considered appropriate by the FGD farmers. However, some surveyed farmers said that they were often only invited on the morning of the event itself, if at all, and then did not have time to attend.

In this region, too, farmers reject the idea of a Facebook village chat for distributing training invitations or information from the FWUC, for example. They fear that the chat could be hacked and that a personal invitation would result in a higher level of commitment to attend the meeting. However, all households have a smartphone, and most people use Facebook. Therefore, the farmers see such a chat as a supplement to reminders but not as a substitute for personal invitations from the village chief.

4.4.2 Indirect influence

This sub-chapter identifies stakeholders who are not in direct (personal) contact with farmers but who may influence their context and thus their adoption of climate-resilient practices. For clarity, indirect stakeholders are divided into four groups (government, research, private sector, NGOs), even though the groups overlap to some extent.

National and subnational level – Government

Figure 22 below provides an overview of the relevant government structures which might influence farmers' adoption of CRA. At the national level, these include the Ministry of Agriculture, Forestry and Fisheries (MAFF), the GDA, and the Department of Extension for Agriculture, Forestry and Fisheries (DEAFF). At the provincial level, there are multiple PDAFFs (FAO 2022, 5). In Battambang, the PDAFF representative, Mr. In Sovanmony, explains his department's role in promoting CRA through their involvement in various projects, such as PCRL and ASPIRE. However, the latter does not focus on rice. The MoWRAM is responsible for the meteorological and hydrological infrastructure and software that provides online weather forecasts. The FWUC (see 4.4.1 Direct influence for more information) reports to the Provincial Department of Water Resources and Meteorology (PDWRAM). Currently,

Nurture is collaborating with the FWUC and the PDAFF on the first steps toward cropping calendars in the FWUC Preaek Chik. The National Committee for Disaster Management (NCDM) is responsible for hazards' identification and provides overall supervision of the EWS1294 at the national level, and collaborates with the MoWRAM and provincial ministries (Sevea 2022, 24).

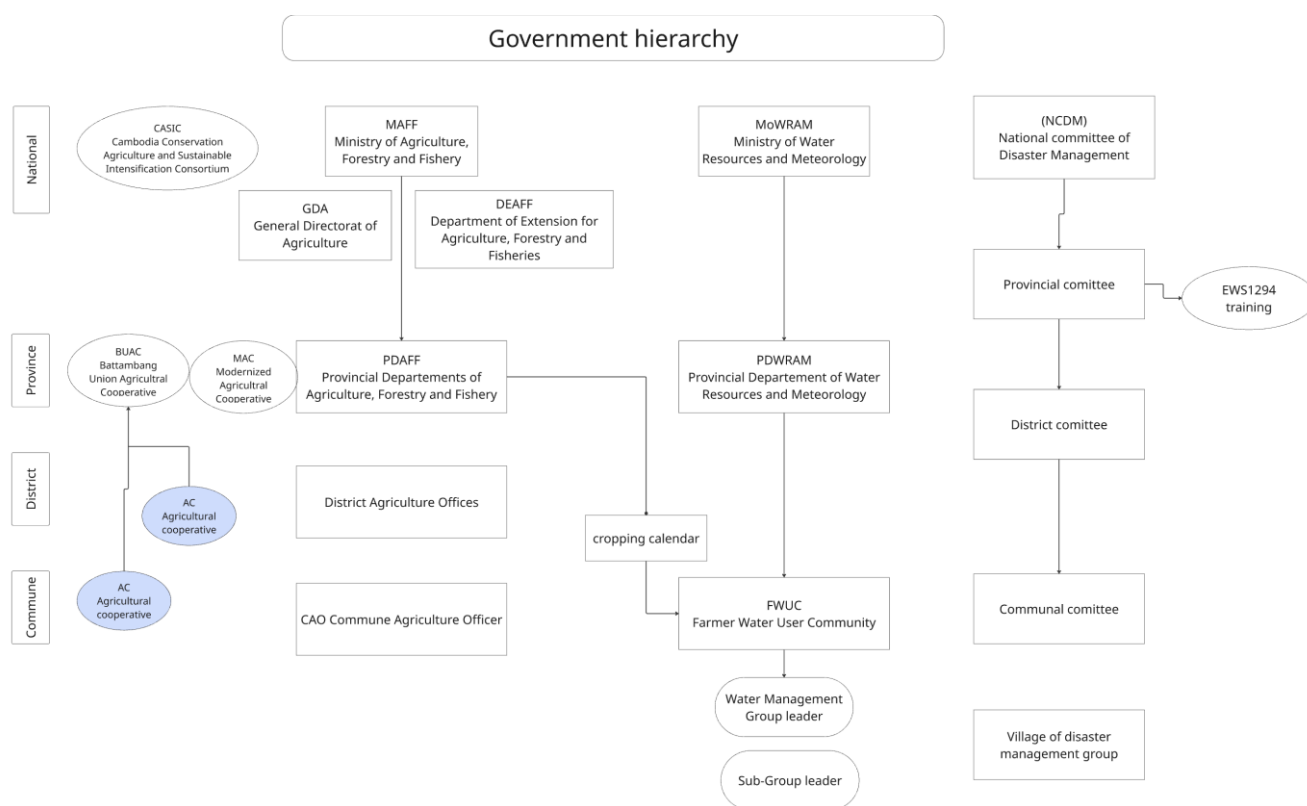


Figure 22: Governmental structure in the research area (blue = community-based organizations)

Research

The Royal University of Agriculture (RUA), the Center of Excellence on Sustainable Agricultural Intensification and Nutrition (CE SAIN), the NUBB, and the Institute of Technology (ITC) are involved on the university side of agroecology in general. In addition to universities, IRRI and CIRAD, both located in Battambang province, are particularly active in rice research. Both organizations also conduct farmer training courses. ASR also conducts smaller-scale local field trials.

Private sector

Several private companies are also already active. Larano, Angkor Green, and Agri-Smart are all active in the machinery sector. The latter produces the Angkor machines in Cambodia for direct seeding of rice. ASR owns the *crop care shop* in Koas Krala District, which offers machines for mechanical direct seeding of rice.

In the seed segment, East West Seed (EWS) operates in the vegetable sector, offering various farmer training courses and field demonstrations. Smart Agro sells seeds for cover crops and liquid organic fertilizer and more. They also offer farmer training. KS-Seed produces seeds for climate-resilient crop varieties, but mostly in the vegetable sector (including mung beans).

HUSK ventures, since 2019 in Cambodia, is specialized in biochar, made out of organic rice husk. They promote biochar-based products through farmer training and demonstrations. Already collaborating with EWS on demo farms, they want to engage with the public sector as well and are in contact with CAO's. Cisbay is another company that sells microbial inputs as a climate-resilience solution.

Amru Rice and Battambang Rice Investment Company (BRICo) are rice millers and exporters. The former is Cambodia's largest exporter of organic rice from Cambodia, and they also market SRP rice in collaboration with ACs.

Various banks and financial institutions, such as SME (Small and Medium Enterprise Bank) and ARDB (Agriculture Rural Development Bank) are official moneylenders for farmers. Both receive government

support. FAEC Cambodia (Facilitation Association of Economy for Cooperatives) is a local NGO that aims to provide smallholder farmers with access to financing, markets, and entrepreneurship opportunities.

Extension programs and policies

Various international development partners and NGOs collaborate with private and public partners. In Battambang province, these partners include CIRAD, Swisscontact, HEKS/EPER and Caritas. The Cambodia Conservation Agriculture and Sustainable Intensification Consortium (CASIC), is a multistakeholder coordination platform, established 2020 and chaired by the MAFF, is a network of actors supporting CA (FAO 2022, 5).

Several development programs promoting agroecology and/or climate resilience have already been implemented in Cambodia, particularly in Battambang Province. These include the 'Strengthening Climate Information and Early Warning Systems' program, which is run by the United Nations Development Programme (UNDP). The "Water Resources Management and Agroecological Transition Program in Cambodia" (WAT4CAM), organized by the Agence Française de Développement (AFD) and the EU, has also held field demonstrations and piloted CA practices and technologies.

The PCRL Project (Promoting Climate Resilient Livelihoods in Rice-Based Communities in the Tonle Sap Region) aims to reduce the climate vulnerability of rice-based communities in the Tonle Sap region and increase their resilience to climate change through an ecosystem-based, market-driven approach. Its partners include CIRAD, MAFF, MoRAM, IRRI, FAO and the GEF (Global Environment Facility).

The Dei Meas (Khmer for "golden soil") pilot project is part of the 'Agroecology and Safe Food System Transitions' (ASSET) project in Southeast Asia. It is led by the GDA and funded by the French Facility for Global Environment. The pilot project took place in Battambang province from 2022 to 2024. The goal was to incentivize smallholder farmers to adopt agroecological practices. Farmer training courses were held, cover crops and more diversified systems were promoted, and initial tests were carried out on AWD. The partner project developers were SmartAgro, CIRAD, and Swisscontact (Vernet und Chhin 2023, 5).

The Agroecology Learning Alliance in Southeast Asia (ALiSEA) is an open network of over 200 stakeholders who promote agroecology and work towards a healthy, resilient, sustainable, and fair food system in the Mekong region (four other countries besides Cambodia). ALiSEA is part of the broader ASSET program (2020-25) and collaborates closely with CIRAD (ALiSEA 2025).

Cambodia's current policy framework supports sustainable, productive, and CSA. This is reflected in the Agriculture Development Policy 2022–2030, which sets four objectives, including Objective 3: *Promote sustainable land, forestry and fishery resource management*. The policy aims to bring 30% of agricultural areas under climate-smart production systems by 2030 (FAO 2022, 6).

Criticism in coordination among partners

Experts from both CIRAD and Swisscontact criticized the lack of coordination and the overlapping of projects and development partners. For instance, NGOs are taking work and responsibilities away from private partners, such as Amru. This results in private partners showing little initiative to invest themselves and contribute their own resources. The sometimes-inadequate cooperation between development partners is evident in Battambang, for example, where both CIRAD and Nurture work on similar issues. Yet there is little exchange between them.

The logic and working methods of MAFF and MoWRAM were also criticized, particularly regarding how irrigation systems were developed. Often, these systems were developed not in the interests of farmers but rather those of the responsible actors within the authorities.

Cultural obstacles hinder development cooperation as well. Filloux (2025, Interview), agronomist at CIRAD, said: "They are still kind of in the Angkor myth legacy. Angkor was famous because they supposedly grew irrigated rice on terraces and cultivated two, three or even four cycles yearly on thousands of hectares 500 years ago. But this idea is controversial. As an agronomist who has studied this, I can clearly see that it is a myth." This myth, reinforced by agricultural practices during the Khmer Rouge, has led to the persistence of the idea of achieving as many rice cycles as possible per year. "It's like repeating the same mistakes decade after decade"(Filloux 2025, Interview).

4.5 Case study - Innovative farmer brings agroecological practices to the region

Case Study – Va Channy’s resilience through diversification, compost and cover crops

Va Channy is a newcomer and has only been living in Tanut Village for two years. He brings with him many ideas on how he wants to develop his agricultural activities from his more than 20 years of experience as a farmer. He and his wife come from another region of Koas Krala District, where they have been living in the middle of rice fields. His new house is now further away from the paddies. Va Channy's wife has increasingly struggled with health problems, which they attribute to the constant exposure to intensive rice cultivation. Therefore, he now wants to cultivate his five hectares in an alternative way: More diversified in terms of both plants and animals and with reduced use of chemical inputs, but with compost and cover crops. Like many other farmers in the region, he currently cultivates one hectare each of rice, cassava and pineapple under rainfed conditions. However, he also grows maize, watermelons, chilies and mung beans, which he markets and whose unmarketable parts he uses in his own household. A week after our conversation, we saw the new watermelon planting next to his house, and two and a half months later the harvest had already successfully ended. He currently keeps four adult cows. At his old place of residence, he also had goats, buffalos and fish, which he no longer has due to the move. Yet, he would like to keep more animals again in the future, including crickets, geese and ducks. This is how he wants to diversify his income. Va Channy says: "It is possible to raise these animals here if you take good care of them. Their droppings will also improve the soil." He either uses the manure in compost or spreads it directly on the field as fertilizer.

Va Channy is aware of the changing climatic conditions and tries to adapt his agricultural activities to the upcoming weather using meteo apps and the official weather information from MoWRAM. However, he also criticizes their accuracy. With his targeted selection of weather information, he is an exception, especially as many other farmers only see random weather forecasts when scrolling through Facebook, if at all.

Soil health is a particularly important aspect for him. So far, he has had good experiences with mung beans as a legume in crop rotation either with corn, watermelon or rice. He reports: "It is really helpful to improve soil fertility. I tried it in a soil that was very hard and after the mung bean cultivation the soil was much better. The yield of the next crop improved." With sunhemp as a cover crop, sown after the rice harvest, he achieved such good results that other farmers inquired and wanted to learn more. He also feels that incorporating crop residues is a valuable measure for improving the soil.

He senses the impact of pesticides not only in the deterioration of his wife's health, but also in the fact that fish that were supposed to be raised in rice paddies in his old home died. Accordingly, he wants to take action and farm more organically and work with compost. He expressed that he dreams to build a green agriculture community, as there is no such thing here yet. He also wants to share his knowledge about compost or the importance of reducing chemicals with other farmers. At the same time, he is interested in expanding his own knowledge and learning more in training courses. But in this remote village, "Even the NGO do not provide training. Also the government does not do anything."

During the restitution workshop, he shared his agricultural experiences with the other farmers. He explained exactly how he produces compost, grows cover crops and how these practices benefit his rice. The other farmers seemed very interested and asked many questions. From the government side the CAO was also invited to the event, confirmed everything Channy said, and gave him his contact details.



Figure 23: Va Channy dreams of a green community



Figure 24: Va Channy presenting at the restitution workshop his experiences of compost

5 Discussion

5.1 Characterization of rice farming systems in the RA and IA

The higher average age of the surveyed farmers is consistent with the statements of the village chief and suggests that many members of the younger generation have indeed migrated elsewhere, or that the interviews were primarily conducted with older household members.

In the IA, a clear discrepancy must be assumed between theoretical access to the irrigation system and the actual availability of irrigation water. While the village chief stated that only 30% of farmers can effectively irrigate and thus cultivate two cycles per year, all surveyed farmers reported cultivating two or even three cycles annually. This contradiction raises questions about the completeness of the list provided by the FWUC and, consequently, the inclusion of all farmers by the FWUC. Both this inconsistency, as well as direct statements from farmers during surveys and an FGD, demonstrate that actual access to and the volume of available water strongly depend on the location of the fields, and that water distribution is often perceived by farmers as unfair and not transparent.

In general, in the research areas the overall level of education is low. In the RA, the share of farmers with no formal education is even higher. The resulting illiteracy plays a significant role in external knowledge transfer, the accessibility of information channels, and their ability to acquire knowledge independently. During the focus group discussion, even the use of visual forms of expression (simple drawings) proved challenging. In the RA, opportunities for off-farm income diversification are also more limited than in the IA, which was mentioned as an additional driver of migration.

There is a generally strong trend toward intensification in agriculture in Battambang, but this is more pronounced in the irrigated area. In the rainfed area, traditional varieties (especially Neang Am) are still more important. In general, a greater selection of varieties are used there.

Modern short-cycle varieties, especially OM, respond well to high fertilizer use, which is why often a lot is used. In both regions, rice is a classic monoculture that is grown year after year (or several times a year in the IA) in the same field, with crop rotation being rare. Sevea (2022) describes the overuse of pesticides and the associated pollution and health problems. The farmers in this study also confirm this statement with comments about how pesticides are noticeably affecting them: for example, pond water is polluted with pesticides, ducks and fish are dying in rice fields, and some (e.g., Va Channy, portrait in 4.5 Case study) report how this is having concrete health consequences.

5.2 Adoption potential of climate-resilient practices

This research confirms Touch et al. (2017) findings that farmers are already clearly feeling the effects of climate change. Although most farmers are unfamiliar with the term “climate change”, they can cite specific examples of how their agricultural activities are being negatively affected. As precipitation patterns change and become more unpredictable, some farmers are beginning to doubt their most important source of agricultural advice—their experience—leaving them feeling helpless in some cases.

Generally speaking, the practices can be divided into the following four groups (compare Figure 8 and Table 7): The first group of known and used practices requires little information transfer, but there is room for improvement in the listed challenges. The situation is different for the second group of unknown and therefore unused practices. Here, local suitability needs to be examined more closely before knowledge transfer measures are pursued.

The third group is known to farmers but rarely used. In most cases, this is not due to a lack of information but to other reasons and obstacles that explain why the implementation level is so low (see the “challenges” column). The last group concerns practices that were not systematically surveyed at the farmer level but are already being promoted in Cambodia by private, development or research partners.

Table 7: Overview of suitability of climate resilient practices in the research area (IA = irrigated area / RA = rainfed area)

		Awareness	Adoption	Benefits perceived by farmers	Challenges in research area
Known and used	Incorporation of rice straw	High	High	- Acts as and replaces fertilizer - Improves soil characteristics	- Rice straw burning (on purpose or spreading by accident)
	Conservation of rainwater (e.g. ponds)	High	High (RA) / Low (IA)	- Multipurpose (especially in RA) - Bigger community ponds never dry out - Some, but limited additional irrigation, mostly for home garden - Storage of water from irrigation system (IA)	- Drying out during the dry season - Pesticide contamination - Drowning hazard for children
	Climate information and weather forecast	High	High	- Information for timing of farm activities (e.g. sowing) - Being prepared for heavy weather events	- Not accurate, not region-specific - Little use of the official service of the ministry of water resources and meteorology (MoWRAM)
Known but little used practices	Flood & drought tolerant varieties	High (IA) Medium (RA)	Medium (IA) Low (RA)	Tolerant to heat, flooding and to some degree to droughts	- Trend towards intense short-cycle rice production - Marketability - Change of variety with access to irrigation system - Drought still can severely damage the crop
	Cover crops	Low (IA) High (RA)	Low	- Soil improvement - Marketability of mung beans - Household consumption - Can have multipurpose - Mung beans are already established in the RA	- Lack of cow management - Rice straw burnings spread - Costs - Perception, that rice fields are only for rice cultivation - Pests - Water shortage - Price fluctuations for mung beans - Low acceptance, if only for soil improvement - IA: farmers rather want additional rice cycle than cover crop
	Machine sowing of rice	high	low	- Evenly sown field - Save time and labor - Good- and healthy-looking crop - Lower seed density	- Costs and availability of the machine - Lack right soil preparation - Lower potential on wet soil with pre-germinated seeds
	Rice-fish-duck system	high	low	- Improved pest control (snails) - Duck droppings improve soil fertility - Additional income	- Damage to rice plants through ducks - Water shortage - Extensive use of pesticides - Unsuccessful trial in the Irrigated area - Loss of ducks due to predation by dogs
	Alternate wetting and drying (only relevant in IA)	medium	low	- Strengthening of plant stems and roots - Reduction of pest pressure from snails - No additional costs	- Availability/ Distribution of water -> fear of not having water to pump back when needed - Lack of trust and transparency within the FWUC - Collective decision making - Rodents during dry period

		Awareness	Adoption	Benefits perceived by farmers	Challenges in research area
Unknown and unused	Ealy warning system 1294	Low	Low	- Fast information	- Lack of awareness - Technical skills: Registration (smartphone use) - No immediate benefit for farmers
	Coordination of cropping calendars (only relevant in IA)	Low	Low	Unknown by farmers.	- Lack of awareness - Lack of coordination, trust and transparency within the farmer water user community (FWUC) - Collective decision-making progress
	Zero/ reduced tillage	Low	Low	Unknown by farmers; Expert voice: - Protects soil moisture - Benefits and feasibility for cover crops after rice harvest	- Lack of awareness - Big change to common practice
				Benefits for Battambang region	Challenges for farmers in Battambang Province
Additional practices	Biochar	N/A	N/A	- Improved water holding capacity of the soil - Reduction of chemical fertilizer (- Carbon credit projects)	- Availability - Affordability - Lack of knowledge - Unclear acceptance
	Compost	N/A	N/A	- Made from local available resources - Affordable - Reduction of cost-intensive fertilizer - Soil improvement	- Lack of knowledge - Labor - No fast results
	Laser land leveling	N/A	N/A	- Water savings - Even seedbed	- Availability of machine - Affordability - Lack of knowledge - Lack of acceptance among farmers - Farmers perceive their field as too small for this practice
	Microbes	N/A	N/A	- Higher crop resistance to drought, pest, disease - Higher yields - Reduction of chemical fertilizer	- Affordability - Availability - Lack of knowledge

5.2.1 Climate-resilient rice production in BTB compared to the literature review

With regard to the results for climate-stress-tolerant varieties, it must be emphasized that these were based on farmers' perceptions of their used varieties. Farmers were not asked to evaluate scientifically tested climate-resilient varieties. The farmers perceived traditional varieties such as Neang Am and Kon Chen, but also OM (a modern variety from Vietnam) as climate-resilient, thus partially confirming IRRI's (2018) statement that traditional varieties have climate-resilient advantages over modern ones. Of the varieties declared by IRRI to be flood and drought tolerant and promoted by CARDI, farmers only used Phka Rumdoul (declared flood tolerant), but none of the varieties declared drought tolerant. Furthermore, only one farmer considered Rumdoul to be a drought or flood tolerant variety (compare Vergara et al. 2023). In contrast to Vergara et al. (2023), who also evaluated the most popular varieties around Tonle Sap, Phka Rumdoul is not widely used in the research region (2 mentions in IA, 1 mention in RA). However, the survey confirms the widespread use of OM. Vergara also mentioned that the choice of variety can vary greatly from season to season. This could offer an explanation for the inequalities.

In addition to the practices evaluated by local experts as the most important for rice cultivation in Battambang Province and subsequently assessed by farmers, four additional practices were identified during the research. These practices are already being tested, marketed, or applied locally. This paragraph aims to take a step back and compare these four practices with the reviewed literature.

Biochar was not mentioned as a climate-resilient practice in the reports and reviews by Shahid et al. (2021), Salihi et al. (2024), and Joshua et al. (2023). However, R. Hameed et al. wrote a chapter in Pramanick (2025) on biochar as a climate mitigation strategy (through long-term carbon sequestration), soil improvement, and improved nutrient efficiency. By stating that biochar can also help plants cope with climate extremes and reduce drought stress through improved water retention capacity of the soil, biochar is confirmed as a climate-resilient practice and the effectiveness of HUSK's biochar products can be considered credible.

Laser land leveling has been cited by various sources in the literature as an effective method for saving water (Shahid et al. 2021; Kumari et al. 2025), but it has not been known by local experts or has been deemed unsuitable for the local context. IRRI demonstrated theoretical feasibility in its field trial, but had imported a suitable machine specifically for its field demonstrations (as these are not widely available in Battambang). Participating farmers in the field training seemed rather uninterested and did not see the benefits, feasibility, or financial advantages of this practice. Thus, this initial assessment showed that this practice has theoretical potential and feasibility, but there is still little practical interest at the farm level (lack of availability and affordability).

Compost as a climate-resilient practice is also not described in all literature (e.g. not in Joshua et al. 2023; not in Salihi et al. 2024). However, Shahid et al. (2021) mentions compost as part of integrated nutrient management. Pramanik et al. (2025) mentions compost for soil improvement to increase organic matter, which in turn improves water-holding capacity, infiltration rate, and soil structure (similar to biochar). The practical feasibility of compost using locally available resources was demonstrated by farmer Va Channy (Chapt. 4.5 Case study) and also in various farmer training courses run by CIRAD and IRRI. Given that compost is practical, cost-effective, scientifically justified, and beneficial for improving climate resilience, this practice has the potential for increased use in the future.

The use of certain microbes for CRA is also missing in several sources. However, Shahid et al. (2021) emphasizes their importance and potential and mentions developing strategies for using microbes to withstand climate extremes. "In recent years, rice-specific climate-smart microbial technologies have emerged as a potential substitute for chemicals as they are cheap, eco-friendly, non-toxic, and easy to apply. Although these technologies are very promising for rice production, they are not so popular among the farming community, mainly due to a lack of technology transfer" (Shahid et al. 2021, 158). One of these emerging technologies is represented by the company Cisbay, which sells products for climate resilience through microbes. However, the fact that neither experts nor farmers mentioned this practice when asked about missing points confirms that this technology is not yet popular among users. It is questionable whether farmers are willing to pay comparatively high prices for these products, which are unknown to them. In addition, there is currently no distribution network.

5.2.2 General challenges and opportunities

In general, it can be said that not all practices are equally suitable for the local context and equally easy to implement. Farmers usually have good reasons for not implementing certain practices. Further research is needed, particularly in the area of water management combined with social barriers.

The potential of various practices differs between irrigated and rainfed rice cultivation. For example, mechanical sowing of rice shows the greatest advantage in rainfed regions (or for the first cycle in irrigated cultivation). On the one hand, the machines work less well on wet soil and with pre-germinated seeds. On the other hand, on dry soil, a measure to prevent drying out is more important and makes a difference to yield. Also, the potential of cover crops appeared to be greater in the RA, firstly because mung beans are already being cultivated and farmers already have buyers. Secondly, because there is simply more time in the year when only one rice cycle is cultivated instead of two.

In general, partners need to be aware of local differences and challenges in order to promote practices in a meaningful way. Care must be taken to ensure that the over-presence of development partners and projects in irrigated areas and strong market-based approaches of project implementations do not promote an undiversified and intensive cultivation of rice.

5.3 Discussion – Diversification

The regions studied are characterized by a strongly rice-centered system. Accordingly, cash crops or cover crops in rice paddies mainly have potential if they can be cultivated before or after the rice cycle and have a positive effect on rice cultivation by improving soil fertility.

The boom crop dynamic described by interviewed experts and literature (Kong und Castella 2021), which prevails in Cambodia, was also visible in the studied region. This was reflected in the current shift from cassava to pineapple and from farmers' suggestions for recently stopped cassava as a potential future crop. Depending on the price, everyone grows the same crop, causing the price to fall due to high supply (at least locally).

Limitations to cash crop diversification include a lack of market information, lack of knowledge about market mechanisms, water shortages, and a lack of know-how about growing alternative crops. Regarding water, a tendency to reject anything new was observed, due to alleged water shortages. As the CAO of the IA said: "If there is a possible new crop, they would not do it because of the lack of water." The lack of knowledge about the cultivation of new crops was evident in the answers to the question of which new crops they wanted to grow. New crops were mostly understood to be either new varieties of cassava or rice, or the renewed cultivation of cassava, which had been discontinued in the past.

Farmers are generally interested in growing new crops if market conditions are good, even if they do not know what those crops might be. This aligns with Kong et Castella (2021), who state that the main arguments for farmer action lie more in market opportunities and high, short-term financial returns than in environmental aspects. While most stick to a small range of familiar cash crops, there are some innovative ideas that are relatively new to the region and could be tested (cashews, durians).

Some farmers have concrete ideas about diversifying animal husbandry. While the farmers' ideas point to a strengthening of the already strong presence of cow husbandry, there are also some who are interested in fish or duck farming. This would be a starting point for establishing the rice-fish-duck system. Ducks were rated by the farmers as the healthiest of all livestock (8/10 in RA, 9.7 in IA), serving both for eggs and meat for household consumption and for the market (Table 10 in Appendix 3). Precisely because all farmers in the FGDs in both regions stated that they buy eggs, ducks represent an additional opportunity to meet household consumption and/or produce for the local market. Limitations include the fact that dogs could chase and kill ducks, overuse of pesticides in rice fields, and fish can only be considered in irrigated systems with standing water.

In general, the farms in the RA proved to be more diversified and less market-oriented than in the IA. Although rice is also the main crop in RA, rice fields account for a smaller proportion of the total cultivated area. In addition, unlike in IA, crop rotations with mung beans are already being used by some farmers. The home gardens in RA are also more diversified. While there is already considerable

diversification in terms of trees (mostly for household consumption), even greater diversification in this direction would probably be accepted. The village chief proposed as a climate-resilient solution to grow more trees. Experts spoke about greening the water channels. Farmers already grow a variety of local trees and know how to use their fruits. Therefore, planting more trees in home gardens, around ponds, and along waterways should be considered a strategy for diversifying crop production, increasing food security and possibly income (e.g. java plums for local market).

Another option is to grow perennial crops not on but around the rice fields for household consumption or the local market (e.g. hibiscus). However, with the increasing use of drones to apply pesticides (especially in the IA), there is drift to the plants at the edge of the field. Rice straw burning is another risk for perennial crops at the field borders.

In general, there is a gap between locally produced and consumed products (especially eggs and meat, but also vegetables); this local demand could increasingly be met by local production.

The acceptance and thus the potential of diversification around ponds to meet local demand is significantly greater. Unlike diversification along field borders, it would be less affected by pesticide applications by drones and rice straw burning. Diversification around ponds could have additional positive benefits, such as creating biodiversity hotspots, promoting beneficial insects, and possibly having an effect on the natural pest control of cash crops. However, the extent to which this hypothesis is correct still needs to be researched in the local context.

The potential for fodder production is very low, as farmers see no need for improved feeding and the associated additional costs, even though their cows may appear thin and malnourished to an outsider (Figure 25). At best, farmers with larger herds might see potential and interest in controlled grazing of specific cover crops while simultaneously promoting the cover crops. However, more evidence is needed here, and if implemented, technical support is needed to ensure that overgrazing does not occur.



Figure 25: Cows in Battambang Province

5.4 Discussion – Influencers

In Battambang Province and Cambodia in general, there are many partners in the field of CA, including some that focus specifically on climate resilience. Farmer training courses and demonstration farms organized by various partners (NGOs, CAO, FWUC, research) serve as a link between this indirect environment and farmers. Despite this multitude of projects and efforts, implementation at the farmer level remains relatively low. FAO (2022, 6), attributes this to a lack of targeted policies and implementation strategies, as well as the challenge of changing farmers' behavior toward sustainability, especially when they are struggling with resource constraints. While policies and implementation strategies were not evaluated in this study, the latter point can be confirmed. However, four further reasons for low implementation rates should be added:

1.) Unequal access to information

There are notably fewer information events in the RA than in the IA. Project implementation varies significantly across different regions. Even within the same region, access to information differ, partly due to the invitation mechanism for training via the village chief and the farmers' location. The same applies to the invitations via the FWUC. The farmers who participated in the FGDs were invited by the FWUC and were almost all located close to the main canal. These farmers saw no problems with the invitation mechanism or access to information. In contrast, more remote and randomly selected farmers reported problems with both.

In the RA, where training courses are rarely held, farmers have an especially weak information base. Their own experiences are their most important source of information, but many have had failures and do not know how to proceed. Facebook is hardly used in a targeted manner but rather only through the algorithm. Therefore, training courses tailored to farmers' needs could make a significant

difference. Two farmers said that the training they attended strengthened their knowledge and renewed their hope.

2.) Quality and quantity of information sources

On the one hand, it is important to increase the range of training courses available, especially in remote areas; on the other hand, the quality of the various influencing channels is also crucial.

The most important media source is Facebook. This is an opportunity, as this medium can be used to reach illiterate farmers in all regions in a visual way – e.g., with weather forecasts or videos of agricultural practices such as mechanical rice sowing. On the other hand, it also carries some risks. Since most farmers simply scroll randomly instead of following specific pages and content, the influence of Facebook is unpredictable. It is difficult to say how much of the agricultural advice consumed via Facebook actually comes from scientific sources and how much is just advertising.

The quality of the training courses is also crucial. On the one hand, it turned out that certain events mentioned by farmers as training courses were organized by input sellers. This raises the question of the purpose and benefits of the training. However, even training courses organized as part of official projects must be regularly evaluated in terms of quality to ensure that they actually meet the needs of farmers and stimulate their intrinsic motivation. Economic and health benefits (one health approach) have proven particularly effective, confirming the statement made by FAO 2022.

The quality of the weather service is questionable. Many use some kind of (often unofficial) Facebook page, yet criticize its accuracy (including that of the official MoWRAM page). Nevertheless, it can be recommended that farmers increasingly rely on the official page that corresponds to their location, especially with regard to possible future improvements in the weather service system.

3.) Communication difficulties

Communication and inclusion difficulties between VCs or FWUC committees and farmers have already been mentioned. Furthermore, as the example in the RA showed, there is also a lack of constructive exchange between CAO and VC in some cases. Various farmers also testified to missing and false promises, which in turn leads to a loss of trust. However, farmers also often have false and difficult-to-achieve expectations: practices should have a rapid effect, such as the application of artificial fertilizers, and not like organic fertilizers, which take a little longer to take effect.

4.) Social dynamics within the village

While ASR (2024) attributes major importance to advice from neighbors, this can only be partially confirmed by this study, namely in the area of variety selection. Instead, a lack of trust was observed in some cases, as described by Zucker (2013) and Grasse (2024).

The role of input sellers, machinery service providers, and rice collectors was explored in the ASR report for general agricultural advice, but neither there nor in this study was it explored in greater depth in relation to climate-resilient practices. Further research is needed in this area.

5.5 Recommendations to the Nurture project: Strategies to realize adoption potential

The following Figure 26 summarizes challenges why farmers do not implement climate-resilient practices (center circle) and what the Nurture Project can do in these areas (squares). All points are discussed in detail below.

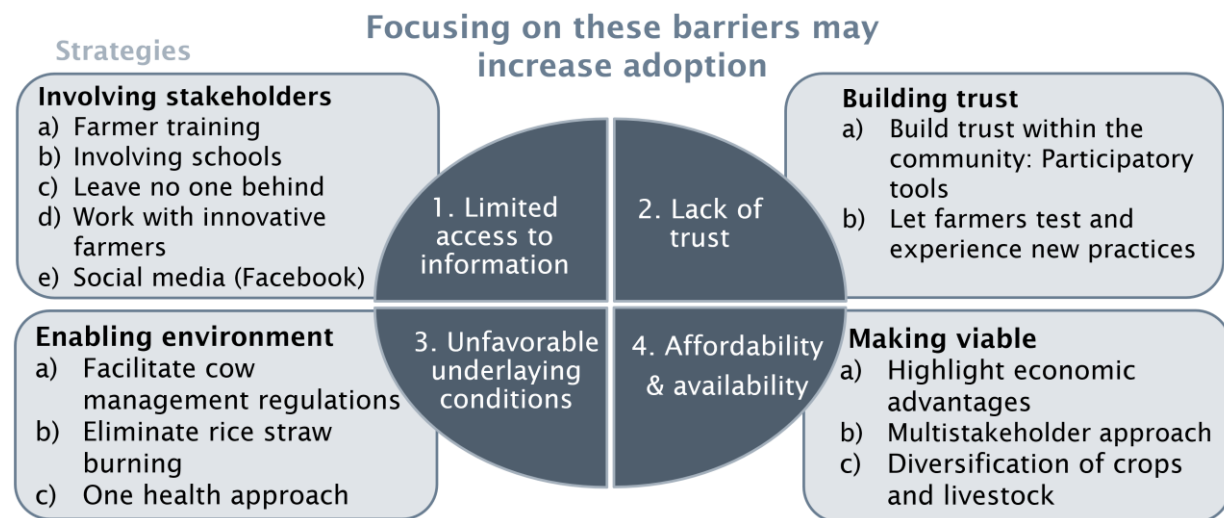


Figure 26: Recommendations to the Nurture Project to improve farmers' adoption of climate-resilient practices in rice cultivation

1. Challenge: Limited access to information

Figure 8 shows that certain practices are still completely unknown to farmers. Farmers rely heavily on their own experience and the advice from family members. The main social media information is Facebook. Often farmers just scroll through Facebook and get information from advertising. Training courses are not available in all regions. It is therefore important to improve access to high-quality, independent information for all farmers. This research suggests that the following points represent effective ways of achieving this:

a) Farmer training

Farmer training courses are already widely established and an important means of imparting knowledge. However, in order for these to be effective and for farmers to actually implement what they learn, hands-on trainings using locally available and affordable resources are important, and the practices must be cost-effective. For farmers, their own experiences are the most important agricultural advice, so practical experience gained through training is correspondingly important.

The training and methods used should also be accessible to illiterate farmers, as over 50% of those surveyed have only completed primary school, and in the RA, 36% have no formal education.

The timing of the training is also crucial. For example when it comes to seeds, the training must take place early enough before sowing so that the farmers have not yet sown their crops. One farmer from IA said about a meeting he attended on cover crops: "I wanted to try but did not order the seeds at the meeting because I had already broadcasted."

The invitation mechanism via village chiefs also needs to be reconsidered, as often only some of the farmers are invited. The idea of the RA farmers (subgroups and information distribution by group leaders) could be further developed and its implementation facilitated.

Since the farmers surveyed did not necessarily discuss what they had learned at home, easy-to-understand leaflets are a way to start the conversation at home and help as a reminder. This is particularly important for training on registering for EWS1294, as farmers often do not carry their cell phones with them and were therefore unable to register during the training. These leaflets should avoid written language as much as possible. For an example of a leaflet for the EWS1294, see Figure 35 in Appendix 4: Additional material.

Finally, the training courses conducted by Nurture's partners should be regularly monitored, evaluated, and constructively improved to ensure that they are tailored to the needs of farmers.

b) Children as actors of change

After the Blue Schools principle, schools can be used as a starting point and children as agents of change (Swiss Water & Sanitation Consortium 2025). As in the RA, remote regions often have little infrastructure, but they do have schools. This can be a starting point for otherwise remote regions where training or extension services are otherwise hardly available. For example, children can gain their own experience in school gardens and take this knowledge home with them. Easy-to-understand, illustrated leaflets can also help with this (Figure 27). The topic of rice straw burning in particular can be discussed with the children, as it is not uncommon for them to light these fires.

c) Leave no one behind principle

This principle should be applied more widely. This would mean integrating regions that are less easily accessible (e.g., the RA research area would theoretically also be in the target district of Koas Krala in Nuture) and placing greater emphasis on rainfed areas and on farmers living at the end of the irrigation scheme. The exclusion of some farmers was already apparent in the invitations by the FWUC for the two FGDs at the IA. On both occasions, farmers were invited, who were located close to the main canal, had fewer water problems and better access to information than those who were located further away. The exclusion of the RA was evident in the fact that significantly fewer training sessions took place there and no extension services are active in this region.

However, projects for climate resilience in the RA would be very interesting and promising. With a few exceptions, only one rice cycle is cultivated annually under rainfed conditions, this allows time for other practices, as well as often more climate-resilient long-cycle varieties such as CAR4 or Damnoeb Sbai Mongkul (cf. Vergara et al. 2023, 57). Cover crops (especially mung beans) are also already common in RA and can be integrated into crop rotation with rice (whereby no-till sowing of mung beans is promising for preserving important soil moisture). The focus of farmers in RA is already broader than that of IA, as the latter are very strongly focused on water from irrigation canals.

d) Collaborate with innovative farmers

Va Channy, portrayed in chapter 4.5, is a good example of how farmers who have already had positive experiences with climate-resilient practices can motivate other farmers. His explanations and photos were well received by the other farmers, as he demonstrated local feasibility and success. Farmers asked many questions, and the first follower was seen after only a short time. Va Channy would be a very good contact for Nuture to work with.

e) Social media channel

Facebook is widely used, but often not in a targeted manner, rather just for random scrolling. Many farmers use this platform to view agricultural practices, but often also advertisements. An interesting approach, which has not yet been pursued further in this research, is to use Facebook to share high-quality videos of locally implemented practices on a regional basis.

2. Challenge: Lack of trust

The inequalities and associated dissatisfaction within an FWUC regarding water access and availability mentioned by Diepart and Thon (2022) were also observed in the FWUC Preak Chick (IA). Farmers cannot understand the FWUC's water flow and schedules and have expressed mistrust. This, along with the rather limited interaction between neighbors, could still be a consequence of mistrust dating back to the Khmer Rouge era (Grasse 2024; Grasse 2024).

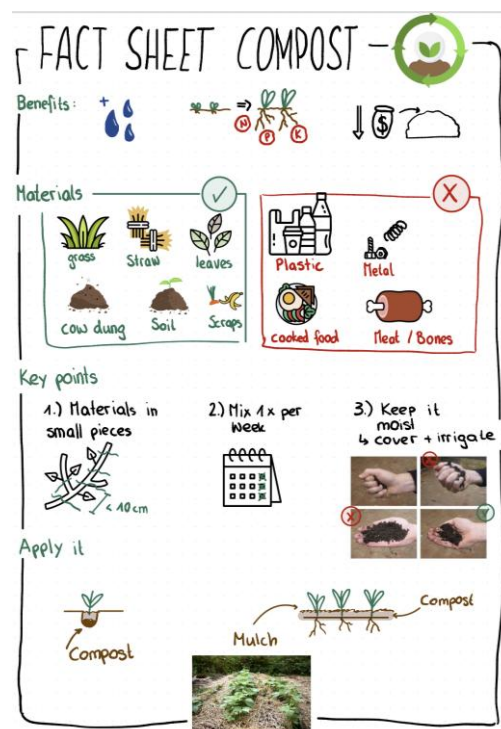


Figure 27: Example for illustrated factsheet for knowledge transfer in schools

a) Build trust within the FWUC - Participatory tools

FWUCs are therefore good entry points with which Nurture should continue to work, but taking into account local inequalities. Consequently, it is important to create transparency and involve farmers in the decision-making process. This study therefore confirms and reinforces the importance of participatory tools such as Caritas' IM Toolbox (Caritas Switzerland und Water Integrity Network no date).

In general, FWUCs, local power dynamics and the development of irrigation systems must also be viewed critically in order to avoid promoting unfavorable developments (undiversified intensification). The entire watershed should also be addressed, rather than just working with the FWUC (upstream and downstream dynamics).

The prevailing uneven distribution of water, lack of transparency, and mistrust provide an unfavorable basis for practices such as AWD and coordination of cropping calendars, for which collective decision-making and trust are fundamental conditions. This confirms the statements made by Vernet et al. (2025) on AWD in Konghot irrigation scheme (BTB province). The introduction of these practices can only happen, if at all, with measures to strengthen trust and transparency.

b) Let farmers test and experience new practices

As described in solution 1a, it is crucial that farmers gain hands-on experiences to build trust in the practice.

3. Challenge: Unfavorable underlying conditions

In both regions, there are substantial barriers that must first be overcome in order to lay the foundation for the adoption of climate-resilient practices.

a) Facilitate cow management

As mentioned above, poor cow management in the RA after the rice harvest poses a major risk factor for cover crops. Although some cover crops are promoted through controlled grazing, this is not currently the case. Farmers themselves suggested the solution of introducing stricter rules by the village chief. Nurture could facilitate the implementation of these rules through participatory approaches.

b) Eliminate rice straw burning

Burning straw not only affects air quality but also prevents the straw from being used for other purposes. Some farmers deliberately burn their straw, which then leads to accidental fires on neighboring fields. Farmers also fear fires when they grow cover crops after the rice harvest. To stop the burning of rice straw, it is therefore necessary to work not only with children but also with farmers, providing them with alternative options and showing them the benefits of straw (e.g. Mulching vegetable with straw instead of plastic).

c) One Health approach

The One Health approach means working together across human, animal, and environmental health because they all affect each other (WHO 2026). The case of Va Channy shows that human health problems can be a major motivator for fundamental change in agricultural practice. The fact that some farmers no longer want to eat the rice they grow themselves and have a separate field with fewer pesticides for household consumption also shows that farmers are aware of the negative effects of pesticides on their own health. Farmers also cited examples of livestock dying due to high pesticide use. CIRAD is already working with this approach.

4. Challenge: Affordability and availability

a) Promote cost-effective and locally available practices

Kong and Castella (2021) described that the main arguments for farmers to take action are not environmental reasons but market opportunities and short-term financial returns. Both points can be confirmed by this study. It is therefore important that the proposed climate-resilient practices do not cause additional costs but, in the best case, can even reduce costs.

It is equally important that the necessary materials and machines are locally available. For example, farmers responded positively to producing compost from local resources in order to save on chemical fertilizers, while LLL was viewed critically during a training session, and no one wanted to emulate the practice.

b) Multistakeholder approach:

Good efforts to promote CA through cooperation between private, public, and development partners are already underway. These efforts should certainly be continued. However, connections should also be strengthened among development and research partners, as they often work in similar areas and an increased exchange of experience could be very valuable. In Battambang province, increased cooperation with CIRAD, IRRI, and Swisscontact is certainly desirable. Often, many projects are active in similar areas, while in others none are implemented at all; here, too, better coordination would be desirable. Of course, Nurture is not as large as IRRI or CIRAD, but it could certainly take on the role of a mediator or help to scale up researched practices in more remote regions. It is also important to be aware that an over-presence of development partners should not lead to private partners simply profiting from this without contributing any resources themselves.

c) Diversification

Market prices fluctuate greatly. Accordingly, it can also make sense for farming families to grow vegetables, fruit, and raise animals for their own consumption, thereby reducing household expenses. The idea of diversification around ponds was favored by farmers.

It is also important to take a holistic view of the farm rather than seeing rice as an isolated branch of production. In doing so, the following questions should be addressed: How can by-products be utilized (straw for compost or mulch in vegetable gardens)? How can livestock be integrated into the system and synergies exploited (farmyard manure, duck-fish-rice system, diversified income from livestock)? How can crop rotation improve the next rice harvest (integration of cover crops, crop rotation with watermelons, for example)?

6 Conclusion

This study analyzed the situation of rice farmers in three villages in Battambang Province and compared conditions in rainfed (RA) and irrigated areas (IA). Across both regions, rice remains the central crop, cultivated mainly as a monoculture, in the RA in repeated annual cycles, in the IA 2 (-3) cycles a year. Farmers typically manage small to medium-sized farming land, with slightly larger farmed areas in the IA due to rented land and more stable access to water (work on 4.4 ha (RA), 4.9 (IA)). RA farmers also use modern short-cycle varieties but still rely more on traditional varieties and have a more diverse crop mix, while IA farmers predominantly grow short-cycle commercial varieties such as OM and Srongea. Farming practices remain input-intensive in both areas, although intensification is more pronounced in the IA, where multiple rice cycles and high fertilizer and pesticide use are common.

Several climate-resilient practices are suitable for the study area, especially those related to breeding (stress-tolerant varieties), water management (AWD, rainwater conservation), sowing techniques (machine seeding), soil fertility enhancement (incorporation of rice straw, composting, cover crops), diversification, and improved access to climate information. Farmers already implement some of these practices, although unevenly. The most common adopted measures include the incorporation of rice straw, rainwater conservation in ponds, and the use of weather forecasts to time farm activities. Machine sowing is known and tested but still limited by access to machinery. Practices such as EWS1294, cropping calendar coordination, zero or reduced tillage remain largely unknown and therefore unused.

The potential and hurdles for further adoption varies. Practices that reduce costs, use locally available resources, or provide clear visible benefits to the farmers —such as composting, cover crops, improved water storage, or diversification — hold the strongest potential. In contrast, practices perceived as expensive, complex, or dependent on shared infrastructure and collective decision making (e.g., laser land leveling, coordinated cropping calendars and ADW) face significant barriers. Strategies to unlock adoption potential include practical field demonstrations, farmer-to-farmer learning (Knowledge transfer through innovative farmers), training schools pupils of farming families, addressing affordability and availability of practices, and improving coordination between public, private, and development actors. Specific obstacles that should be addressed include the consistent elimination of rice straw burning and facilitation of regulation implementation for cow management at the village level. Knowledge transfer must consider the low literacy levels of many farmers, especially in the RA, and rely strongly on visual, practical, and locally adapted approaches. It is crucial to consider local dynamics of power and exclusion.

Both areas already show diversification of crops (particularly home gardens in RA) and livestock, while cash crop diversification remains small, and diversification for fodder production nonexistent. IA farmers grow fewer species for home use than RA farmers. Most families keep small herds of cows for sale when money is needed, as well as chicken for household consumption. In the cultivation of cash crops, farmers are caught in boom-and-bust cycles. However, they are generally open to growing new cash crops adapted to their environment if there is market potential. In RA, farmers saw potential in diversifying crops around ponds for household production. Duck farming also shows potential since ducks are perceived as the healthiest livestock, and their egg production could bridge the gap between local demand and production. There is little potential for feed production, as farmers show no interest in improving the health and weight gain of their cows.

Farmers are influenced by a broad network of actors. Their most important sources of advice remain personal experience and family members, although climate variability increasingly challenges the reliability of experiential knowledge. Neighbors influence variety and crop choices, and farmers observe their activities and success. Local authorities, CAOs, seed and input sellers, buyers, and machine service providers shape decisions indirectly through information, services, and market incentives. Development organizations, research institutes such as IRRI and CIRAD, and private companies introduce new practices and technologies through training and demonstrations, though adoption depends heavily on farmers' perception.

Further research is needed, particularly into the interaction between technical water management solutions and the social barriers that influence their implementation. Additionally, creating biodiversity hotspots around ponds, for example, could promote beneficial insects and support

natural pest control in nearby cash crops, providing additional ecological benefits. However, the potential impact of these effects requires validation under local conditions. Also, the role of cattle in Battambang Province should be investigated further. While farmers currently show little interest in fodder production, larger herd owners may offer entry points for controlled grazing on cover crops. Further evidence is needed to assess the feasibility of this approach, and technical support would be necessary to prevent overgrazing if it were to be implemented.

In summary, rice farmers in Battambang Province face clear climate-related challenges but have diverse entry points for strengthening resilience. Adoption of climate-resilient practices will depend on locally adapted approaches, visible benefits, inclusion and social structures within the villages.

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Appendix

Appendix 1 Disposition

Name Studierend	Johanna Bischof
Arbeitstitel (provisorisch)	Assessing the adoption of climate-resilient Practices among rice farmers in Battambang Province, Northwest Cambodia: identifying challenges, perceptions and the role of the involved stakeholders.
Relevanz des Themas	• <i>Theoretische:</i> While rice is the most important agricultural crop in Cambodia, its cultivation is also increasingly threatened by extreme weather events. Cambodia is one of the countries most vulnerable to climate change in the world. Climate resilient practices can be applied to make rice cultivation more resilient to droughts, heat waves and floods. However, adaptation in Cambodia is still limited. • <i>Praktische:</i> Many actors are currently promoting agroecological practices in Cambodia. A particular focus is on cover crops, but other practices such as no-till, mechanical direct seeding or alternate wetting and drying are also to be promoted more intensively. Nevertheless, the adoption rate of farmers is low. Nurture therefore wants to find out what it would take for farmers to adapt their practices and what challenges and problems exist.
Problemstellung & Forschungsfrage/-n	1. What is the rice farmers' situation with reference to their farming area, crops, practices used? 1.1. what are the differences in the situation in rainfed and irrigated areas in three villages in Battambang Province? 2. Which climate-resilient practices are suitable for rice cultivation in the research target area? 2.1. Which practices are already adopted by the target farmers in the two different areas 2.2. Which practices have a potential for future adoption? 2.3. What strategies would be needed for realising the adoption potential of some needed practices? 3. How are farmers influenced/supported in the adoption of climate-resilient practices in both irrigated and rainfed areas? 3.1. Who and how are the actors involved in disseminating climate-resilient practices? (direct/indirect) 4. What is the potential of diversification of their farm products? 4.1. Which crops do/may they grow for household consumption?
Hauptziel der Arbeit	To assess the current situation of rainfed and irrigated rice farmers in western Battambang province regarding their implementation of climate-resilient practices and the role of stakeholders involved. From this, to develop strategies and recommendations to increase the climate resilience of rice farmers.
Teilziele der Arbeit	1. To analyze rice farmers' situation with regard to their farming area, crops, and practices used in the Battambang Province. 1.1 To assess differences in the situation in rainfed and irrigated areas in three villages in the target area. 2. To evaluate climate-resilient practices suitable for rice cultivation in the target area. 2.1 To analyze climate-resilient practices that are already adopted and that have potential for future adoption. 2.2 To develop possible strategies to increase the adoption of suited practices. 3. To monitor actors that influence farmers' decisions in adopting climate-resilient practices in both rainfed and irrigated areas. 3.1 To differentiate stakeholders who act in direct contact with the farmers in the target group and actors who create an enabling environment for the adoption of climate-resilient practices.

	4. To assess the potential of diversification of farm products in the target region. 4.1 To list possible crops that could be grown for household consumption.
Stand der Forschung	• The consequence of climate change on rice cultivation in the Cambodian context • Definition of the terms Agroecology and climate resilient practices • Climate resilient practices in lowland rice cultivation • Stakeholder map
Definition Begriffe	• <i>Agroecological practices</i> • <i>Climate resilient practices</i> • <i>Smallholder Farmer</i>
Material & Methoden	• Literature review (internal project papers, additional research papers) • Transect walk • Key person interview • Focus group discussion • Survey – Kobo toolbox
Methodenwahl begründen	The review of internal project literature and that of project partners helps to better understand the context and to integrate my work well into what is already ongoing. It also serves to avoid repeating what has already been done. The supplementary literature review serves to provide a more independent, complete perspective on the state of the research, but also to evaluate appropriate practices that can be addressed in the survey and focus group discussions. The Transect walk serves to gain an initial overview of a Farm in the target area. The key person interviews are conducted with various stakeholders. On the one hand, people in the direct proximity of the farmers are interviewed, on the other hand stakeholders who are active in the field of agroecology or in the rice sector and thirdly experts in the field of climate resilience. The aim is to evaluate stakeholders who have an influence on the farmers and their adaptation to climate-resilient measures. In addition, experiences and findings from other experts should be consulted. Focus group discussions should be held mainly among farmers in the target areas and serve to discuss certain topics (e.g. diversification) in greater depth and to identify possible solutions from their perspective. Possible findings from the survey should also be discussed in greater depth. The survey will make up the largest part. The kobo toolbox will be used to survey 50 farmers from two regions (25 per region). The questionnaire is based on findings from the state of research, expert interviews and focus group discussions and will be tested with farmers to ensure it is easy to understand. Most of the evaluation will be carried out using the kobo toolbox and completed using Excel.
Verwendete Literatur (provisorisch, nicht abschliessend)	• Nuture and HEKS reports: - Nuture, 2024, Annual report - Suess and Melara, 2022, Nuture Nurturing Climate Resilience in Cambodia Project Proposal - HEKS, no date, Concept paper Agroecology for HEKS/EPER Global cooperation • Reports from Nuture partner: - Sevea, 2022, climate resilient agriculture assessment - ASR, 2024, strengthening the climate resilience of smallholder farmers: baseline survey in Battambang province - ASR 2025, Partner Final Report • Official government pages - MoWRAM: Ministry of water resources and meteorology - MAFF: Ministry of Agriculture, Forestry and Fisheries. • Further Literature - Joshua et al. 2023, CLIMATE-SMART AGRICULTURE FOR RICE FARMING: A REVIEW - Salihi et al. 2024, CLIMATE-SMART RICE PRODUCTION: A REVIEW - Shahid et al. 202, Climate resilient rice production system: Natural resources management approach - IRRI - Touch et al. 2022, Adaptation constraints and prospects for future research priorities in lowland rice-based farming systems: learning experiences from Northwest Cambodia

	- Touch et al. 2024, Adaptation constraints and prospects for future research priorities in lowland rice-based farming systems: learning experiences from Northwest Cambodia - Kong et al. 2021, Investigating farmers' decision-making in adoption of conservation agriculture in the Northwestern uplands of Cambodia - Bryman, 2012, Social science methods
Gliederung / Aufbau der Arbeit	Front Page Declaration of independent authorship Table of Contents List of Abbreviations List of Tables List of Figures Abstract - Summary of the whole thesis (RQ, methods, and results and Conclusions) 1. Introduction: - Context - summary of state of research - Research questions/ goal of the thesis 2. Current state of research - Synthesis of the current state of research (see above) 3. Material and methods (see above) 4. Results - Results of the different methods structured in order to answer the different research questions one after the other. After the results of each RQ a first discussion follows. 5. Discussion - Essence of the different discussions to the different research questions. - Broader, overall discussion - Comparison of own results with results from the literature 6. Conclusion - conclusion, limitations, further research 7. References Acknowledgements Appendix
Zeit-/Ressourcenplan	x liegt bei ☐ wird erstellt bis _____ ☐ wird nicht erstellt

Appendix 2 Methodology

2.1 Farmer survey – Template created on Kobo toolbox

Script farmer survey - Extract from Kobo toolbox

➔ Note: This script only includes the questions and structure of the survey. It does not include the question type or answer options. Questions that only appear if a previous question was answered a certain way are not noted either. All details are visible under kobotoolbox:
<https://kf.kobotoolbox.org/#/forms/aBekXFLL4GBF6StPB4mzSL>

A) Info questionnaire

1. Name of Translator
2. What day is it today?

B) Introductions and consent

- Thanks: First of all, I would like to thank you very much for taking the time to share your information with us.

- Introduction:

o For Seed region: Let me quickly introduce myself: My name is Johanna, I'm a student in agriculture and do my internship here in Cambodia. I work with seed on the topic of climate resilience in rice cultivation. Pothilin or XYZ is my translator today. Please ask at any time if something is not clear.

o For FWUC region: Let me quickly introduce myself: My name is Johanna and I work with the Nurture team on the topic of climate resilience in rice cultivation. I am here with XY (name of translator), he/she is here to translate. Please ask at any time if something is not clear.

Consent: I would like to briefly ask for your verbal consent to use the data. You are one of 50 farmers I am interviewing in this context. It will take around 45 minute. I will analyze the results and present them to the Nurture Team in Battambang and at my university. All the results will be anonymized Do you agree? If you have any questions before we start, please let us know.

C) Identification

- 1.) Name of the farmer
- 2.) Contact of the farmer
- 3.) What's the name of the village
- 4.) Do you grow irrigated rice?
- 5.) Do you grow rainfed rice?
- 6.) Are you the head of the household
- 7.) Sex of respondent
- 8.) How old are you (years)?
- 9.) For how long have you been a farmer?
- 10.) What is the highest level of education you've completed?
- 11.) Do you plan to stay and work on the farm or are you looking for another job outside the village?
- 12.) Do you have another job besides being a farmer?

Additional Comments:

D) Farm information

- 1.) How large is the total area of the farm (ha)?
- 2.) Crops

What crops are you growing this year on how much surface and for what purpose? Note: 1 ha = 10'000m²/ 1 rie = 1'600m²/ "A few plants" = 1

Cultivation

Purpose

Cultivated area (m²)

****Irrigation****

- | | |
|---------------------------|--|
| # Rice, អង្ករ | # Garlic leave, ស្លឹកខ្ចីម |
| # Cassava, ដំឡូងមី | # Turmeric, រមៀត |
| # Pineapple, ម្នាស់ | # Lemongrass, ស្លឹកត្រៃ |
| # Corn, ពោត | # Mint, ដីអង្កាម |
| # Baby corn, ស្បៀតពោត | # Basil, ជី |
| # Sweet potato, ដំឡូងជ្វា | # Mushroom, ផ្សិត |
| # Watermelon, ឪឡឹក | # Peanut, សណ្តែកដី |
| # Sesame, ល្ង | # Mango, ផ្លាយ |
| # Mung bean, សណ្តែកខៀវ | # Coconut, ដូង |
| # Cucumber, ត្រសក់ | # Cashew, ផ្លាយចន្ទី |
| # Tomato, ប៉េងប៉ោះ | # Banana, ចេក |
| # Eggplant, ត្រប់វែង | # Papaya, ល្អង |
| # Okra, ពោតបារាំង | # Jackfruit, ខ្នុរ |
| # Pumpkin, ល្អៅ | # Tamarin, អំពិល |
| # Chili, ម្ទេស | # Litchi, ផ្លែគូលេន |
| # Cabbage, ស្ពៃក្តោប | # Lime, ក្រូចឆ្មារ |
| # Bok choy, ស្ពៃតៀ | # Bamboo spouts, ទំពាំង |
| # Climbing wattle, ស្ពំ | # Costard apple, ផ្លែទាប |
| # wing bean, ពពាយ | # Java Plum, ព្រីង |
| # Luffa, ននោង | # Breadfruit, ផ្លែសាកេ |
| # Wax gourd, ត្រីឡាច | # Durian, ទុរេន |
| # Morning glory, ត្រីកួន | # Cover crop, ដំណាំគម្របដី (ឧទា ចង្រ្កងស្វា) |

2.1) Other crops

****Other Crops: ****

****Cropname****

****Purpose****

****Cultivated area (m²)****

****Irrigation****

2.2) In what field did you use the cover crop?

2.3) Which cover crop do you use?

3.) Livestock

****What livestock do you have on your farm? How many? Do you sell them or keep them for household consumption? How are they fed? How happy on a scale from 0-10 are you with the performance of the livestock (10 very happy, a lot of meat, good eggs, healthy animals)****

****Livestock on the farm****

****Farm animals****

****Number of adults****

****Purpose****

****Fodder****

****Performance & Health (0-10)****

- | | |
|-----------|------------|
| # Cow | # Fish |
| # Chicken | # Goat |
| # Pig | # Crickets |

other

3.1) Other: Only answer if other livestock are raised**

Species

Number of adults

Purpose

Fodder

Performance & Health (0-10)

Additional comments:

E) Diversification

- 1.) Did you grow any other crops in the past 5 years than the ones named before?
 - a. Which crop? Reason for stopping?
- 2.) Do you plan to stop growing any of your current crops?
 - a. Which crop? Why?
- 3.) Do you plan to grow any new crops?
 - a. Which crop? Why?
- 4.) Did you raise any other animals in the past 5 years than the ones named before?
 - a. Which animal? Reason for stopping?
- 5.) Do you plan to stop raising any of your current animals?
 - a. Which animal? Reason?
- 6.) Do you plan to start raising any new animals?
 - a. Which animal? Reason?
- 7.) Is any of your neighbors growing a new crop?
 - a. If yes, what crop?
 - b. How do you react?

Additional comment

F) Rice cultivation

- 1.) How many seasons of rice do you grow per year?
- 2.) What variety of rice do you grow?
- 3.) Why did you chose this variety?
- 4.) How do you sow the rice?
- 5.) When do you sow the rice
- 6.) Do you use pre-germinated or dry seeds
- 7.) What is your seed density (kg/ha)?

G) Climate change and sources of informations

- 1.) What does climate change mean for you?
- 2.) How did floods and droughts influence your farm in the last 5 years?
- 3.) Does anyone of your household own a phone?
- 4.) Do you consult any (social) media platforms or for weather informations?
 - a. Do you know the social media pages you consult?
 - b. Which application do you consult?
- 5.) Do you ask one of the following persons for weather informations?

H) Climate resilient practices

- 1.) Did you change something in your farming practices because of changes in the climate?

- 2.) Have you heard about...? (Practices 1-11 below)
 - a. Other:
- 3.) Do you use/practice one of the practices you have heard about?
 - a. Other:
- **1. Early Warning System 1294, ប្រព័ន្ធប្រកាសឱ្យដឹងមុន ១២៩៤ ពីហានិភ័យ/គ្រោះមហន្តរាយក្នុងតំបន់
 - a) Early Warning System 1294: How useful for you do you rate this practice
 - b) Comment:
- **2. Climate information and forecast, ព័ត៌មានអាកាសធាតុ និងការព្យាករណ៍អាកាសធាតុ
 - a) Climate information and forecast: How useful for you do you rate this practice
 - b) Comment:
- **3. Drought and flood tolerant rice varieties, ពូជស្រូវធន់នឹងគ្រោះរាំងស្ងួត និងទឹកជំនន់
 - a) Drought and flood tolerant rice varieties: How useful for you do you rate this practice
 - b) Comment:
- **4 Machine planting of rice, ការស្លុងស្រូវដោយប្រើប្រាស់ម៉ាស៊ីន
 - a) Machine planting of rice: How useful for you do you rate this practice
 - b) Comment:
- **5. Zero/ reduced tillage, មិនភ្ជួររាស់/កាត់បន្ថយការភ្ជួររាស់ដី
 - a) Zero/ reduced tillage: How useful for you do you rate this practice
 - b) Comment:
- **6. Incorporating the rice straw in the field, ការទុកចំបើងនៅលើដីស្រែ
 - a) Incorporating the rice straw on the field: How useful for you do you rate this practice
 - b) Comment:
- **7. Cover crops, ដំណាំគម្របដី (ឧទា ចង្កៀងស្វា)
 - a) Cover crops: How useful for you do you rate this practice
 - b) Comment:
- **8. Introduction of Fish and/or Duck in the Rice field - ការដាក់ត្រី ឬទា ក្នុងស្រែ
 - a) Introduction of Fish and/or Duck in the Rice field: How useful for you do you rate this practice
 - b) Comment:
- **9. Conservation of rain water (e.g. ponds), ការរក្សាទុកទឹកភ្លៀង (ឧទា ក្នុងស្រះ)
 - a) Conservation of rain water (e.g. ponds): How useful for you do you rate this practice
 - b) Comment:
 - c) For what do you use the collected water?
- **10. Alternate wetting and drying, ការផ្លាស់ប្តូររវាងការដាក់ទឹកក្នុងស្រែ និងបូមបញ្ចេញ
 - a) Alternate wetting and drying: How useful for you do you rate this practice
 - b) Comment:
- **11. Coordinated Cropping calendars, ប្រតិទិនដាំដុះ នេះគឺសហគមន៍កសិករប្រើប្រាស់ទឹក
ជាមួយគ្នាដំណើរការបែបនេះ បំណងមិនចង់ឱ្យកសិករទាំងអស់គ្នាចាប់ផ្តើមដាំដុះស្រូវនៅថ្ងៃ/ពេលតែមួយ
ដែលនាំគ្នាប្រើទឹកច្រើនពេកនៅក្នុងពេលតែមួយដែរ
 - a) Coordinated Cropping calendars: How useful for you do you rate this practice

b) Comment:

4.) Did you stop using any of these practices and why?

a. Comment

b. Other

5.) What do you use the rice straw for?

I) Farmer trainings

1. Did you participate in any farmer training in the last 5 years ?

a. What was the topic of the training?

2. Usefulness of training: On a scale from 0-10, how useful was this farmer training?

a. Comment:

3. Trust towards the training: On a scale from 0-10, how much did you believe the information you received at the training?

a. Comment:

4. Adaption: Do you apply what you have learned in the training at your farm?

a. Why?

J) Stakeholder dynamics:

****rate the importance of the following statements on a scale from 0 = not important to 10= very important****

1. Family member: How Important is their advice for your farming?

a. Comment:

2. Neighbor: How Important is their advice for your farming?

a. Comment:

3. Village chief: How Important is their advice for your farming?

a. Comment:

4. Commune Agriculture Officer (CAO): How Important is their advice for your farming?

a. Comment:

5. NGO: How Important is their advice for your farming?

a. Comment:

6. Your own intuition and experience: How Important is this for your farming?

a. Comment:

7. Which of the following (social) media channels do you use to get information about farming?

a. Do you know the name of the channel page?

****Agriculture Cooperative**

8. Are you part of an Agriculture Cooperative

a. For which crop

b. Agriculture cooperative: How Important is their advice for your farming?

**** FWUC**

9. Are you part of the FWUC?

10. FWUC: How Important is their advice for your farming?

11. Comment:

12. What Problems do you see in the FWUC?

Additional Comment:

K) Closing

Do you have any additions, or do you feel that something important has been forgotten?

Then all that remains is for me to thank you very much for your time and openness!

2.2 Template farmer training visits

Titel: "Name of the training"

Date:

Organizers:

Location:

Type of training:

Content:

Training Relevance

- Were the promoted techniques aligned with climate-resilient agriculture?
- Were local pest and disease challenges used as examples during the training?
- Are the techniques practically applicable in the local context (e.g. materials should be locally available at an affordable price, preparation is manageable)?
- Was the purpose of using these techniques explained — including both benefits for farmers (e.g. cost reduction, improved yields) and environmental benefit for the farmer (e.g. meaning for farmers about reduced use of chemical pesticides and soil health)?
- Was the importance of reducing chemical pesticide use explained in a way that resonates with farmers' experience and priorities?

Trained agricultural techniques

- Which specific techniques for organic pesticide production and use were promoted?
- Was during the training explained where and how farmers can access further support if needed?
- Were farmers informed about where to find or how to prepare the required materials and equipment?
- Was it clearly explained how the use of organic pesticides can lead to economic benefits (e.g. reduced input costs compared to chemical pesticides)?

Training Methods & Facilitation

- Did the training include practical, hands-on demonstrations of how to prepare and apply the organic pesticides?
- Was time allocated for farmers to ask questions and exchange experiences with each other? E.g. experiences from demo farmers was shared.
- Was the facilitator able to provide clear and competent answers to farmers questions?
- What types of supporting materials were used to deliver instructions (e.g. visual aids, handouts, posters)? Could this be improved?
- Were any materials provided to farmers to take home (e.g. instruction sheets and/or some items to try the techniques by themselves at their farms)?

Farmers perceptions

- Did farmers seem interested and engaged during the training? Did farmers seem open and curious about trying new practices during the training?
- Did farmers bring up examples or challenges from their own farming experience?
- Do farmers express an intention to adopt the promoted practices in their own fields?
 - If yes, what are the motivations?
 - If not, what reasons were mentioned for reluctance or barriers to adoption (e.g. limited access to materials, need more time, perceived costs, unclear benefits, lack of confidence)?

Answers from Farmers

- Why did you join the training?
- What is your general impression of the training?
- Can you use what you have learned on your farm? What?
- Do you think the information provided is also applicable to your farm? Challenges?
- When you go home do you talk with someone about what you have learned? With whom?

My perceptions

- Strengths:
- Weaknesses
- Possibilities to improve:
- Pictures:

2.3 Template FGDs

General information:

- Language: Khmer, so that the participants can really express their opinions
- Duration: Around 1.5h
- Facilitator:
 - o Must moderate the discussion without adding opinions
 - o Should create a relaxed atmosphere where people can express their opinions
 - o Should encourage all members to participate, not one person should be allowed to dominate the discussion.
- Reporting the findings:
 - o The translator will translate as good as he can, so that I can follow the discussion, can take notes and can ask follow up questions. The discussion will be summarized afterwards.

2.3.1 Round 1 - Topic Diversification:

Date	Anlong: 03.06 13:30 Preaek Chik: 04.06 8:30
Introduction	- Thanks: First of all, I would like to thank you very much for taking the time and participate in today's discussion. - Introduction: Let me quickly introduce myself: My name is Johanna, I'm a student in agriculture and I'm doing my internship here in Cambodia. The goal of my research is to understand more about how rice-farmers here in Cambodia can deal with climate change and also to understand better what other crops they could grow. Pothilin and Heang will support me today with the translations and with guiding the discussion. Alessandra is my supervisor and is here to support me as well. All the information gathered during this discussion will be used for research purpose only and is anonymous. Please feel free to openly discuss your opinions. Only for research purpose. Do you agree? Pictures: we take picture but not for social media, only for research purpose. Do you agree? There is food and water please feel free to help yourself. Please ask at any time if something is unclear.
Purpose	Part 1) Diversification: Get a better understanding of the agricultural Products which are produced and consumed. Visualize the flow of these products, maybe identify gaps and possibilities to grow/ produce some of the products at home. Part 2) Climate resilient practices: Irrigation Tanut & Anlong: Rainwater conservation Preaek Chick: challenges in water distribution within the FWUC and potential opportunities to overcome these. In addition to low market prices, a lack of irrigation was cited as the main problem in preliminary discussions. Arabella, climatic advisor from HEKS, drew my attention to inequalities within the FWUC and said that these challenges should be addressed. This is the goal in Preaek Chik. For the rainfed farmers of Tanut and Anlong, the existence and use of ponds to collect rainwater and the associated possibilities and problems should be discussed.

Discussions Questions	Part 1) Introduction for Drawing: - Which products (from plants or animals) do you produce and consume in your own family? - ... which do you share with your neighbors, which with the whole village and which do you sell to traders from outside (use the blue cards if you sell them for money and the yellow if you give it for free)? - How does it look the other way around? What food (or maybe feed for you animals) do you get from your neighbors, from the village market or do you buy from outside (again use the yellow and blue cards)? Follow up Discussion questions: - How does this change with the different seasons. Any products only during certain seasons? - -> mark the cards products with different colors: green: Dry (Nov-Feb), red: hot dry (March-May), blue: rainy (June-October) - So which is the most purchased product? Would it be worth producing it yourself? Would this even be possible? - Which of the purchased products do you spend the most money on (everyone can go and mark the corresponding card with the pen)? - If you think back 5 or even 10 years, has anything changed? Part 2) <u>Preaek Chik:</u> → Water distribution within the FWUC. Introduction of Activity 2: - How satisfied are you with the water distribution within the FWUC? - Reason (inequities)? Follow up Discussion: - What would be possible solutions to the reasons for the rather dissatisfied answers? - What could be improved or changed that all would be very happy? <u>Anlong & Tanut:</u> Introduction of activity 2: - Do you have access to a water or pond (no matter how small or large) for your house or for a field? if you agree stick a post it on the appropriate side of the poster. - -> pothilin and heang need to write it down if they can't - Follow up Discussion questions: - Do you have other ways to access water or gather water? - Do you share the pond with neighbors? - What problems are there with the pond? - Is there water in the pond during the dry season? - Is there any shade around the pond? Back to Poster: - If you have access to a pond, what can you use the water for (draw or write on a card). Ask heang and pothilin for writing
Participants (Name, contact, role)	Only farmers (no one with higher role within the community) Contacted via Heang (Anlong & Tanut), and Khorn (Preaek Chik). Instruction: 6 farmers form different households and different age groups (include young farmers). Include if possible 2-3 women.
Meeting location	- Seed staff house in Tanut - Preaek Chik: Commune Hall or FWUC hall (Leakhena confirms)
Facilitator:	Pothilin
Translator:	Heang
Prepare for the meeting:	- Flipchart according to the drawings underneath (in khmer language) - Example of drawings (for part 1)
Material needed during FGD	- Blue and yellow cards - Pens (many black, few red, blue, green) - Tape - Flipchart - Phone with google translate - Post-it (small thin in different colors, and bigger yellow and green)

Poster 1
Part 1, both
villages



Figure 28: Flipchart for focus group discussion on diversification

Poster 2
Part 2, Preaek
Chick (IA)

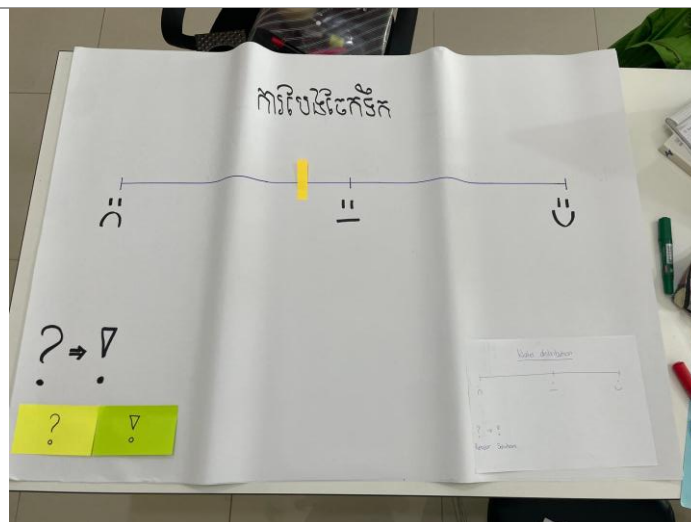


Figure 29: Flipchart for focus group discussion on water distribution

Poster 3
Part 2, Anlong/
Tanut (RA)

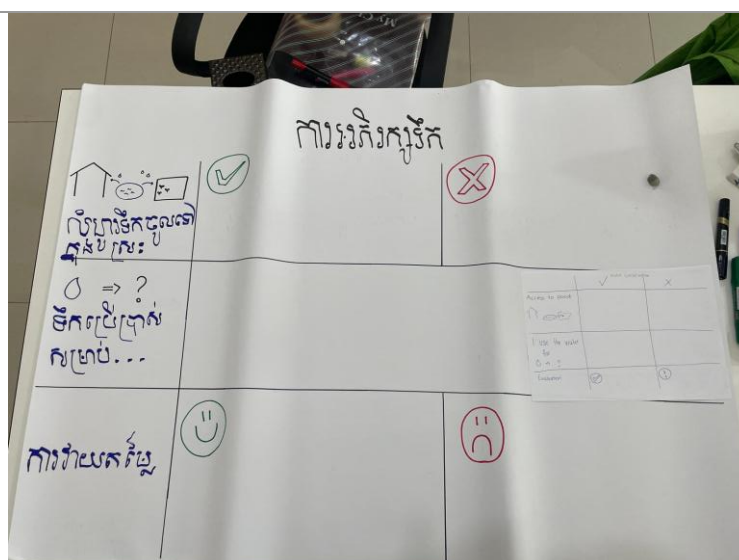


Figure 30 : Flipchart for focus group discussion on conservation of rainwater

2.3.2 Round 2 – Topic climate resilient practices and access to information

Date	Anlong: Friday 22.08. 13:30 – 15:00 Preaek Chik: Friday 15.08.2025 14:00-15:30
Introduction	- Thanks: First of all, I would like to thank you very much for taking the time and participate in today's discussion. - Introduction: Let me quickly introduce myself: My name is Johanna. Some of you might already know me. I'm a student in agriculture and I'm doing my internship here in Cambodia. The goal of my research is to understand more about how rice-farmers here in Cambodia can deal with climate change and what practices are suited. Tanut: Pothilin will guide the discussion, and Sothea will help me with the translation part. Preaek chik: Molyca and Samedy from nurture will support me today with the translations and with guiding the discussion. All the information gathered during this discussion will be used for research purpose only and is anonymous. Please feel free to openly discuss your opinions. Only for research purpose. Do you agree? Pictures: we take picture but not for social media, only for research purpose. Do you agree? There is food and water please feel free to help yourself. Please ask at any time if something is unclear.
Purpose	As a follow-up to the survey I conducted in June in this region I would like to further discuss and develop ideas to gaps and problems that were discovered. Tanut & Anlong: 1st part: The goal is to go in more depth with the use of cover crops. Some of you said during the interview that you heard about it or you even have your own experiences with it. That is very valuable and I would like to go into more depth to see where are issues, how they could be solved and how more farmers could be motivated to grow them. 2nd part: Through the research done, it is clear, that there is an issue in access to information (information about trainings but also about technical knowledge and weather information in general). Therefore in a second part, I would like to develop ideas, how this could be improved. Preaek Chick: 1st part: - Background changed climatic patterns -> less water availability. Question, how to use the water more efficient. There is a technique called alternate drying and wetting. - During the interview some of you told me, that you have experience with some kind of alternating wetting and flooding. That is very valuable and I would like to go into more depth to see where are issues, how they could be solved and how more farmers could be motivated to grow them. 2nd part: - Through the research done, it is clear, that there is an issue in access to information (information about trainings but also about technical knowledge and FWUC information in general). Therefore in a second part, I would like to develop ideas, how this could be improved.
Discussions Questions	Tanut: 1st part: Cover crops 1st poster - Intro: I have heard/ I grow (mark it) - What crop do you grow/ have you heard about (bring CIRAD list!) - Did you grow it in the rice field or another field? Why not in rice? If in rice, when in the cycle? - Why did you grow or did the person you heard/ saw it grow the cover crop. 1st part – 2nd poster - What is good about cover crops?

	- What is bad about cover crops? Issues? Cows? - How can these issues be solved? Cow herd management? (how is it normally done?) - What is needed that more farmers grow cover crops? 2nd part: Access to information - How do you currently get informed about farmer trainings or information related to farming - How would you like to get informed about a farmer training? - Will everyone be reachable this way? - Channel they can get information (missing attendance of CAO, village chief) -> how and who? Preaek Chik: 1st part: AWD Introduction - Explanation of AWD: AWD is an irrigation method for rice cultivation that alternates between flooding and drying periods. The goal is to reduce green house gas emissions, and improve the water-use efficiency and reduce pumping costs. This can lead to better root health and reduced pest pressure - How: As the name says, the field will alternately flooded and non-flooded by letting the water out of the field. This happens 1-3 times along the cropping cycle. The number of days of the drying period can vary from 1 more than 5 days. To do it preciously there is a pipe in the field, which allows to measure preciously when the water reaches the level to irrigate again. Before flowering the field will be continously flooded again. Follow up Discussion: - For whom is that completely new? - Who already dries his field sometimes? -> How? When? Why? What cycle? - What is good? (green cards) - Where are issues? (red cards) - What think the ones who do not apply it yet? Where could be potential/ where issues? - What are your ideas to solve the named issues? 2nd part: - During the survey, some farmers expressed their concerns about not getting informed or too late informed about trainings and technical knowledge. Some said "I don't get invited", others said "I was invited but didn't go". Some farmers also said, they do not know which canal is opened and when. - ? How is it for you? Do you get invited to trainings? Do you have access to technical knowledge? (yellow cards) - ? How is it currently? - The goal would be that everyone has the access to the information and nobody gets forgotten. - What could be improved to make sure, everyone gets the information about farmer trainings and the canal schedule (yellow cards)? - What is good about about this idea? (green cards) - What are issues with the ideas (red cards) - What do you think about the idea of a village telegram group chat? - How much in prior does the training need to be announced? - What time of the day is the best to do the training, so that most farmers can join? - What time of the year?
Advise for invitation of Participants and additional organisation	Contacted via Heang (Anlong & Tanut), and Khorn (Preaek Chik). Instruction: 6 farmers form different households and different age groups (include young farmers). Include if possible 2-3 women. Only Farmers (none with higher role within the community) Tanut.(RA) - Participants: 3 out of the following farmers who said that they have experience with cover crops: - Chhay chot, 0962259788 - Ban Chanthea, 081 43 75 69 - Va Channy, 015 489478 - Phom Savoth, 088 70 65 382 - (reserve: Roren Tho: 088 74 44 932) + 3 random farmers from different households and different age groups (include young farmers and women). If possible also include from beach khlok.

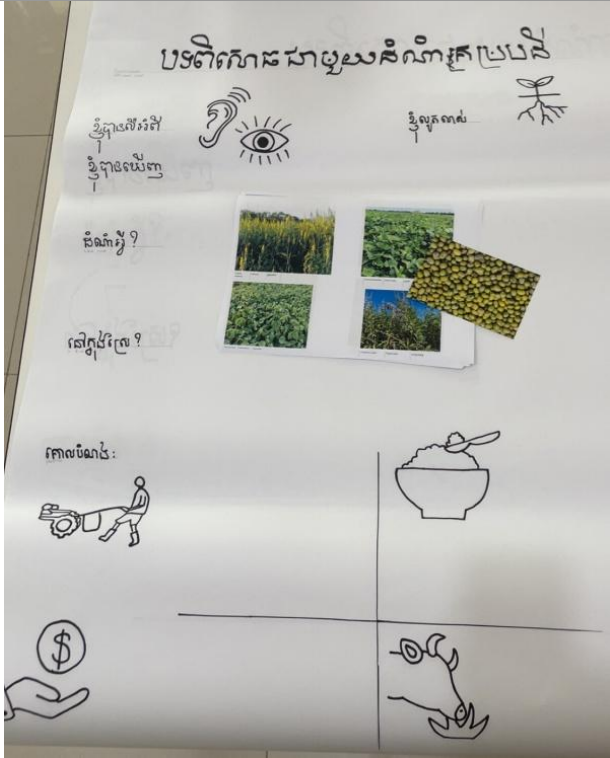
	Preaek Chik: - Participants 3 out of the following farmers who said they know/apply some kind of AWD: - Tuch Dem, 0713601717 - Sok Nheanh, 0977673728 - Phai Pheur, 0978199841 - Keur Sokun, 0979380502 - (reserve, if one of the others is not available: Vat Kan, 0973544420) + 3 random farmers from different households and different age groups (include young farmers and women) from the village preaek chik or preaek chik mouy.
Meeting location	- Seed staff house in Tanut - Preaek Chik: Commune Hall or FWUC hall (Leakhena confirms)
Facilitator:	Molyca (preaek chik)/ Pothilin (tanut)
Translator:	Samedy (preaek chik/ Heang (tanut)
Prepare for the meeting:	- Poster, refreshment, location, timing, invitation
Material needed during FGD	- Poster, - post-it (yellow, red, green) - pens - tape - refreshments
Poster 1 For part 1 in Tanut (RA)	 The flipchart contains the following elements: Title: ប្រព័ន្ធកសិកម្មស្រូវប្រាំង (Dry Season Rice Farming System) Top Left: ឱ្យបានលឺចំពោះ (Let everyone hear) and ឱ្យបានឃើញ (Let everyone see) Top Center: An eye icon with sound waves. Top Right: ឱ្យបានចាស់ (Let it be old) and a drawing of a tree. Middle: Four photos of rice fields and a pile of rice. Bottom Left: គិតជាអ្វី? (Think about it?), តើក្នុងក្រុង? (In the city?), and គោលបំណង: (Objective:). Below this is a drawing of a person sitting at a desk with a computer. Bottom Center: A drawing of a bowl of rice. Bottom Right: A drawing of a hand holding a dollar sign and a drawing of a hand holding a rice stalk.

Figure 31: Flipchart for focus group discussion on cover crops

Poster 2
For part 1 in
Preak Chick
(IA)

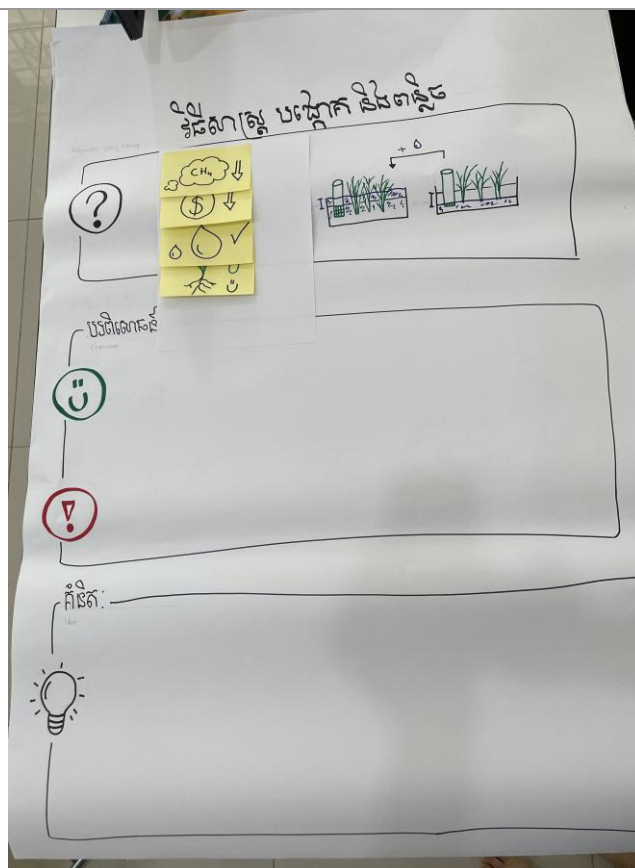


Figure 32: Flipchart for focus group discussion on alternate wetting and drying

Poster 3
For both regions

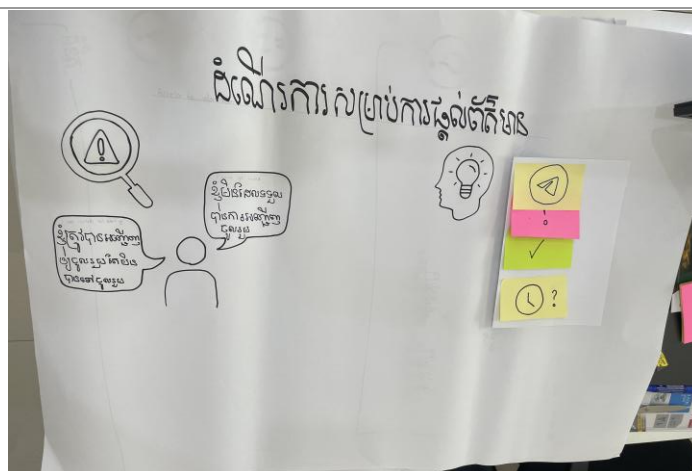


Figure 33: Flipchart for focus group discussion on access to information

Appendix 3 Results

3.1 Detailed results regarding diversification at the household level

a) Crops grown by the surveyed farmers

Table 8: Crop diversification of the surveyed farmers (n=50).

	Rainfed area				Irrigated area			
	% of famers	Thereof irrigated	Purpose (M=market, H = home consumption, F=Feed)	Thereof average area (G= Home-garden)	% of famers	There of irrigated	Purpose (M=market, H = home consumption, F=Feed)	Thereof average area (G= Home-garden)
Crops on large fields								
Cassava	0.6	0	M	2.27 ha	0.04	0	M	0.70 ha
Pineapple	0.16	0	M	1.13ha	0.56	0.64	M (0.85) H (0.53)	0.53 ha
Corn	0.24	0	M (1) F (0.17)	1.10 ha	0.12	1	M (0.67) H (0.67) F (0.33)	0.20ha
Sweetpotato	0				0			
Watermelon	0.12	0	M (0.67) H (0.67)	1.00 ha	0			
Sesame	0				0.04	0	M	0.5ha
Mung bean	0.16	0.25	M (0.5) H (0.75)	0.88 ha	0			
Vegetables								
Cucumber	0.16	0.25	H	G	0.04	1	H	G
Tomato	0				0			
Eggplant	0.36	0.57	H	G	0.12	1	M (0.67) H (1)	0.28ha (and 1 G)
Okra	0.08	0.5	H	G	0.4	1	H	
Pumpkin	0.44	0.45	H	G	0			
Chili	0.96	0.41	M (0.04) H (1)	1 pers : 0.5ha, rest G	0.48	1	M (0.58) H (0.91)	0.01
Cabbage	0				0.04	1	H	0.02ha
Bok choy	0.08	0.5	H	G	0			
Climbing wattle	0.36	0.38	H	G	0.52	0.85	H	G
Wing bean	0.12	0	H	G	0			
Luffa	0.72	0.5	H	G	0.12	1	H	G
Wax gourd	0.32	0.25	H	G	0.04	1	H	G
Morning Glory*	0.16	0	H	G	0.12	0	H	G
Garlic leaves	0.32	0.43	H	G	0.52	0.85	H	G
Herbs and Spices								
Turmeric	0.8	0.55	H	G	0.36	0.78	H	G
Lemongrass	0.92	0.50	H	G	0.84	0.85	H	G
Mint	0.08	1	H	G	0			
Basil	0.64	0.69	H	G	0.64	0.88	H	G
Trees and Fruits								
Mango	0.88	0.3	H	G	0.56	0.64	H	G
Coconut	0.76	0.42	H	G	0.80	0.5	M (0.15) H (1)	G
Cashew	0.2	0.2	M (0.6) H (0.6)	4 as G// 1x 2ha	0			
Banana	0.8	0.38	M (0.15) H (1)	Mostly G; a few for Market with	0.68	0.65	M (0.29) H (1)	Mostly G, for Market

				an average of 27 trees				average of 36 trees
Papaya	0.72	0.38	H	G	0.6	0.8	H	G
Jackfruit	0.72	0.44	H	G	0.4	0.6	M (0.1) H (1)	G
Tamarin	0.56	0.2	H	G	0.2	0.4	H	G
Litchi	0				0			
Lime	0.52	0.61	H	G	0.48	0.75	H	G
Bamboo sprout	0.4	0.30	M (0.1) H (1)	G	0.04	0	H	G
Custard Apple	0.92	0.39	M (0.05) H (1)	G	0.32	0.63	M (0.13) H (1)	G
Java Plum	0.4	0.60	M (0.2) H (1)	G	0.28	0.71	M (0.14) H (1)	G
Bread fruit	0	N/A	N/A	N/A	0	N/A	N/A	N/A
Durian	0	N/A	N/A	N/A	0	N/A	N/A	N/A
Others								
Mushroom	0	N/A	N/A	N/A	0	N/A	N/A	N/A
Peanut	0	N/A	N/A	N/A	0	N/A	N/A	N/A
Cover crops, other than mung bean	0	N/A	N/A	N/A	0	N/A	N/A	N/A

Table 9: Further mentions of plants that farmers have for their own household or market

	Rainfed area		Irrigated area			Rainfed area		Irrigated area	
	#farmers mentioned (n=25)	Purpose (M=market/ H=household)	#farmers mentioned (n=25)	Purpose (M=market/ H=household)		#farmers mentioned (n=25)	Purpose (M=market/ H=household)	#farmers mentioned (n=25)	Purpose (M=market/ H=household)
Dragon fruit	6	H	0		Yams	1	H	0	
Orange	2	H	4	H	Guava	5	H	3	H
Sugar cane	4	H	0		Plum	1	H	0	
Fingerroot	6	H	0		Jujube	3	M, H	0	
Galangal	5	H	0		Melon	1	H	0	
Milkfruit	2	H	0		Pomegranate	2	H	1	H
Longan	5	H	5	H	ក្រសាំង; Krasang	1	H	0	
Avocado	3	M, H	0		sugar palm tree	1	H	0	
Zedoaray	1	M, H	0		Sesbania Grandiflora	2	M, H	0	
Corossolier	2	H	0		June Plum	0		2	H
Aloe vera	1	H	2	H	Wild cherry	0		1	H
Long bean	1	H			Wood apple (ថ្លើត)	0		1	H
Sapodilla (ឈ្នួត)	0		1	H	Pomelo	0		1	H
Goseberry (កន្ទ្រីត)	0		1	H	Bilimbi (តាឈើតឹង)	0		1	H

b) Livestock diversification on household level

Table 10 Livestock diversification of surveyed farmers (n=50)

	Rainfed area				Irrigated area			
	% of farmers who raise this animal (n=25)	Thereof Average # adults	Purpose (M=market, H=household)	Happiness with performance and health (scale: 0-10)	% of farmers who raise this animal (n=25)	Thereof Average # adults	Purpose (M=market, H=household)	Happiness with performance and health (scale: 0-10)
Cow	0.64	3	H (1) M (0,06)	7.7	0.48	4	H (1) M (0.08)	7.9
Chicken	0.88	11	H	7.0	0.76	6	H	7.6
Pig	0				0			
Fish	0.2		H		0.24		H	
Goat	0				0			
Duck	0.12	7	H (1) M (0.77)	8.0	0.12	16	H (0.77) M (0.33)	9.7
Grasshoppers	0.04		M	5	0			

3.2 Evaluation of suitability of climate resilient practices in rice for Battambang Province through experts.

Note: Only the comments on practices which the stakeholder knew and/or had something to say are listed.

Table 11: Summary of expert evaluation of climate-resilient practices

Category	Practice	Bonditphop Ky, Nurture, Former Component Manager for Agroecology	Dr. Bob Martin, Director at Agricultural Systems Research Cambodia	Commune agriculture officer (CAO),(3) & Village chief (VC) rainfed area (5)	Commune agriculture officer (4) & Village chief irrigated area (6)	Leakhena Uk, Nurture, Provincial Manager Battambang
Rice breeding	Drought tolerant varieties	+ Varieties promoted by Cambodia Agricultural Research and Development Institute (CARDI)		+ Old traditional varieties are more tolerant against droughts, but only 25% use it, most prefer varieties with higher yields	+ 70% use the drought-tolerant variety"	+ The local varieties from CARDI should be the best for farmers.
Water management	Alternate wetting and drying (AWD)	+ Not yet promoted by nurture, but there is potential		-- not applicable for rainfed, only for irrigated rice farming (3)	0 20-30 families in the whole commune practices it, because they don't have enough water	++ This is the main thing that farmers should pay more attention, if they have capacity to manage the water.
	Smart irrigation					+ It should be introduced to farmers who have access to water.
	Conservation of rainwater					+ This may be new for them, but it's a good idea to introduce a new method based on their location and capacity."
	Adjusting planting dates = cropping calendar	+ Nurture wants to promote it in the future, within the FWUC to improve water distribution.		++ A delay of the planting is the second-best solution on how to cope with floods and drought (3)		+ The Nurture Project encourages farmers to use a cropping calendar to help them become more resilient to climate change.
	Scheduling irrigation					++ Very important for farmers that the irrigation schedule is well managed so they can save water and their pumping cost.
	Different irrigation techniques					
	Laser Leveling	- Only in large scale irrigated farming (some in BTB and BMC province)				

Sowing techniques	Seed priming					+ It would be useful to introduce applicable methods.
	Direct Seeded Rice (DSR)	0 Standard (Transplanting is rarely practiced)	0 Standard	0 Standard: most farmers broadcast by hand	0 Most farmers broadcast by hand	- It is costly. It would be good if farmers could find a better method.
	Machine sowing of rice	+ The only Nurture activity in climate- resilience in rice (trainings with ASR)	++ Most effective thing they can do in terms of climate resilience	++ Done by a few, saves time and labor costs, the field looks better (3)	++ Time saving, Seed saving, good-looking of the field; some families use the machine to plant (4)	- This is costly and sometimes too complex for farmers.
Improving fertility	Soil Zero/minimum tillage		+ We never tried planting rice no till, but other crops like mung beans. There is no reason why it should not work for rice			
	Crop residues		++ This keeps the soil temperature lower and the moisture in the soil	++ "Beneficial; increases the soil moisture and soil health. Some farmers keep the crop residues in the field, some burn it. Buring makes the land easier to prepare for the next season. (3)	++ Might be not a lot of benefits to just leave it on the field. The best is to plow it in. That produces 4 tons of compost per ha	
	Cover Crops/ Green manure	+ Agroecological practice possible for smallholder rice farmers. Mostly done in rainfed areas because in irrigated fields they rather grow rice.	+ Can be used to improve the feeding of the cows. The problem is, after the rice harvest the field becomes community grazing land.	- Farmers know it, but this is mainly for cassava and maize. Because here are cows who would eat it and water scarcity. (3)	++ Excellent for agriculture (4)	+ This should be introduced to most farmers so they can start planting cover crops and monitor their benefits.
Diversification	Integrated Rice-Fish Farming					- The concept may not apply anymore because they use chemical inputs, and the level of reduction of the chemicals is still not good.
	Planting different crops	+ Promotion of Vegetables, but on rice paddies not others crops, some grew watermelons or mung beans, but stopped	+ Sesame or mung bean are suited after the rice cultivation	- If there is a possible new crop, they would not do it because of the lack of water. (3)		+ Good idea to introduce. Different beneficial crops contribute to farmers' family survival.

Access to Information	Rice Advice Application					0 The provincial department of agriculture, forestry and fisheries (PDAFF) and the CAO should play their role in this work and inform farmers on this.
	Climate information and forecasts			++ Most important thing to cope with floods and droughts in rice (3)	+ CAO reports to the farmers so that they can prepare themselves	+ The general climate information or forecast may be useless to farmers but if the system provides more accurate and location based information this would be helpful.
	Early warning system EWS1294			+ “not a lot of farmers know about 2194” (3)	+ Useful for the flood; Some farmers are subscribed to, some not. (4) Village chief did not know 1294 (6)	+ The alert from the system can provide prior information for them to take action before risk or disaster happens
Appropriated use of fertilizer and pesticides	Weed management			VC wants to motivate farmers to think more about the effects of pesticides (5)	CAO had a strong focus on promoting organic fertilizer and reducing pesticides (4)	+ Farmers should have access to organic and semi-organic inputs at an appropriate cost and level of efficiency. Then, farmers will start using more effective and less harmful products, which will increase productivity.
Insurance	Insure crop yield					- / (+) It's good, but I notice that it's still largely dependent on the insurance company, which may not fully benefit farmers.

3.3 Cost-benefit analysis of mung beans

The following table shows a not representative estimation of costs and benefits for mung bean cultivation. The data is given from two farmers from the rainfed area.

Table 12: Cost-benefit analysis mung bean with data of two farmers

Costs		
Seed	5 USD/kg = 85 USD/ha	They often keep their own seeds from the previous year, since buying is perceived as quite expensive. Farmers used a seed density of 17 kg/ha
Field preparation	70 USD/ha	2 times ploughing for 35USD/ha each
Inputs	15 USD	0-1 pesticide application
Harvest	N/A	Carried out manually by the family. Since not all beans ripen simultaneously, two harvesting rounds are needed.
Benefits		
Yield	One farmer had 50kg on 3 rye (3x1'600m ² = 4800 = 0.5 ha) = 100 kg/ha One farmer had 1 ton on 1.5 ha = 670 kg/ha	Big differences between the farmers.
Selling price	"Good Price": 3'500-4000 Riel / kg "Bad price": 1'000 - 1'500 Riel/kg	According to the farmers the prices fluctuate a lot.

4.1 Fact sheet compost

FACT SHEET COMPOST



Benefits:

- Water (blue drops)
- Nutrients (N, P, K) from plant matter
- Cost savings (dollar sign and cloud)

Materials

Good Materials (✓)	Bad Materials (X)
grass	Plastic
Straw	Metal
leaves	cooked food
cow dung	Meat / Bones
Soil	
Scraps	

Key points

- 1.) Materials in small pieces

- 2.) Mix 1x per Week

- 3.) Keep it moist
 ↳ cover + irrigate


Apply it

- Compost for seedlings
- Mulch for plants



Figure 34: Factsheet compost for school lesson

4.2 Example of leaflet for a farmer training on EWS1294

This leaflet summarizes the content of the training in the first part and provides easy-to-understand instructions for implementation at home in the second part.

ជំហានការចុះឈ្មោះក្នុងប្រព័ន្ធប្រកាសឱ្យដឹងមុន១២៩៤

សូមអនុវត្តតាមជំហានខាងក្រោមដើម្បីចុះឈ្មោះប្រើប្រាស់ប្រព័ន្ធ៖

ចុះឈ្មោះដោយឥតគិតថ្លៃ
សម្រាប់ប្រព័ន្ធទូរស័ព្ទទាំង៣

ជំហានទី១
ទូរស័ព្ទទៅកាន់
លេខ១២៩៤

ជំហានទី២
រួចស្តាប់តាម
ការណែនាំ

ជំហានទី៣
សូមជ្រើសរើស
ខេត្ត.....

ជំហានទី៤
សូមជ្រើសរើស
ស្រុក.....

ជំហានទី៥
សូមជ្រើសរើស
ឃុំ.....

ជំហានទី៦
លោកអ្នកចុះឈ្មោះ
បានជោគជ័យ

ប្រព័ន្ធប្រកាសឱ្យដឹងមុន ១២៩៤ ត្រូវបង្កើតឡើងដោយអង្គការភីន សហការជាមួយគណៈកម្មាធិការជាតិគ្រប់គ្រងគ្រោះមហន្តរាយ។
ប្រព័ន្ធនេះរៀបចំឡើង និងបង្កើតឡើងដើម្បីឱ្យសាធារណជនទូទាំងកម្ពុជាចុះឈ្មោះប្រើប្រាស់ក្នុងប្រព័ន្ធ
នូវព័ត៌មានសម្រាប់ការគ្រោះមហន្តរាយធម្មជាតិដែលនឹងអាចកើតឡើងនៅប្រទេសកម្ពុជា។

អនុវត្តដោយ៖

គម្រោងនេះ

អនុវត្តដោយ៖

① វាយលេខ 1294

② ចុចបើកសម្លេង

③ ចុចបើកកន្លែងវាយលេខ

ជំហាននៃការចុះឈ្មោះ

④ ស្តាប់ការណែនាំ និងជ្រើសរើសទីតាំងរបស់អ្នក
សូមជ្រើសរើស៖

កាសាង្គីវ

ខេត្ត

ស្រុក

ឃុំ

Figure 35: Leaflet for EWS1294 (Source: PIN 2022 modified)