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Gender Dimension
of Climate Change Research in Agriculture
Case Studies in Southeast Asia

Editors
Thelma Romero Paris
Maria Fay Rola-Rubzen

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2019

The Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA) is one of the 26 specialist institutions of the Southeast Asian Ministers of Education Organization (SEAMEO). Founded on 27 November 1966, SEARCA is mandated to strengthen institutional capacities in agricultural and rural development in Southeast Asia through graduate scholarship, research and development, and knowledge management. It serves the 11 SEAMEO member countries, namely, Brunei Darussalam, Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Myanmar, the Philippines, Singapore, Thailand, Vietnam, and Timor-Leste.

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This book is dedicated to Dr. Gelia T. Castillo, Distinguished Rural Sociologist, National Scientist, and strong advocate for the recognition of women in agriculture.

> In many instances, it is probably fair to say that women at work in agriculture are "physically visible," but "conceptually or culturally invisible" even to those who actually see them. Fortunately, the visibility is improving and therefore the research that we do must go beyond being "sensitizing." Research must be operationally significant, i.e., it must indicate to someone who is responsible for policy, program development and implementation a more precise definition of the problem so that it will lend itself to feasible solutions.
>
> Castillo, Gelia T. 1988.
> *Filipino Women in Rice Farming Systems*, 32.

Foreword

The integration of gender in research, planning, and implementation of agriculture and climate change interventions is crucial in achieving outcomes on agricultural productivity, climate resiliency, and food and nutrition security in Southeast Asia. It ensures that the impacts of climate-smart agriculture (CSA) research for development (R4D) interventions benefit men and women, equitably. Gender dimension cuts across all thematic areas in CCAFS-SEA's R4D projects—from CSA, to climate risk management, low emissions development, and policies and institutions.

This book on "Gender dimension of climate change research for agriculture in Southeast Asia" features case studies on climate change, gender roles, and adaptation strategies in the region. Many studies have been done on gender analysis but not much has been done in the context of climate change and agriculture. This publication aims to find the links between socioeconomic and gender issues in the context of a changing climate.

All case studies featured in the book are driven by a common goal—to help develop and implement gender-sensitive, sustainable CSA R4D interventions in improving climate resiliency and food and nutrition security of vulnerable communities in Southeast Asia. Four of the case studies were conducted in the Climate-Smart Village sites, such as Sri Dasgupta's study and Tran Nhat Lam Duyen et al.'s research in Tra Hat village in Vietnam; Auni Haapala's study in Phailom village in Lao PDR; and Magnolia Rosimo's study in Guinayangan, Quezon province in the Philippines. Other case studies were conducted by Julie Basconcillo in Bulacan, Gerlie Tatlonghari, et al.'s research in Central Luzon and Arma Bertuso in eastern Visayas in the Philippines; by Justin McKinley et al., Tho et al., and Chi et al.'s research in the Mekong River Delta in Vietnam.

As the book documents unique adaptation strategies practiced by men and women farmers in several countries in Southeast Asia, it provides opportunities for looking for similarities and differences among these practices. Through these, readers will see how the roles of men and women affect their climate change adaptation strategies. This book also provides researchers with the necessary information to pursue gender analysis in the context of climate change in agriculture in an under-researched area of Southeast Asia.

As CCAFS is now on its second phase, the findings from these studies will help the outscaling of effective CSA interventions in other areas with similar conditions. We believe that the research results published in the book will be essential in guiding scientists and researchers in developing and implementing R4D programs and activities that are effective, problem based, and culturally acceptable.

Lastly, I would like to congratulate Dr. Thelma R. Paris, CCAFS-SEA gender advisor and retired socioeconomist-gender specialist of the International Rice Research Institute (IRRI), and Dr. Maria Fay Rola-Rubzen, Associate Professor, School of Agriculture and Environment, Faculty of Science, University of Western Australia (UWA), for spearheading the publication of this book. I also thank the contributing authors for the case studies featured in this book.

Leocadio Sebastian
Regional Program Leader
CCAFS Southeast Asia

Message

While many Southeast Asian countries have made notable strides to address the impacts of climate change, there are still knowledge gaps on how gender and climate change interact within the sphere of agricultural research and development. Only recently has there been an increased awareness that climate change problems, and subsequently, responses, are not gender-neutral. Women and men experience climate change differently, consequently their vulnerability and responses, as well as their adaptive capacity and adaptation choices also differ. Women, particularly those living in rural communities in developing countries, face higher risks because they rely mostly on local natural resources to provide their households with the basic necessities—food, fuel, and water—for livelihood and food security. At the same time, women are also known to be potential agents of change given the pivotal role they play in natural resource management, local knowledge, and coping and survival strategies during and after extreme weather events.

As part of our continuing efforts to build the resilience of the region's agriculture sector through our Umbrella Program on Climate Change Adaptation and Mitigation for Southeast Asia (CChAMSEA), the Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA) has joined forces with the CGIAR Research Program on Climate Change, Agriculture and Food Security in Southeast Asia (CCAFS-SEA) to publish this book *Gender Dimension of Climate Change Research in Agriculture: Case Studies in Southeast Asia*. CCAFS' work in this area has contributed significantly to the scientific and evidence-based information needed to gain a better understanding of the gender-climate change-agriculture nexus and to advance gender work.

SEARCA extends its sincerest gratitude to the authors and co-authors of the case studies and is pleased to be part of sharing their experiences and lessons learned from working with the men and women farmers in selected Climate-Smart Villages (CSVs) in Southeast Asia. This book's contributors, with technical editors Dr. Thelma R. Paris and Dr. Maria Fay Rola-Rubzen, have produced a remarkable piece of work embedding gender in climate change research.

Everyone matters in tackling the formidable challenge of climate change. We hope that this book will serve as a guide to scientists and researchers toward a gender-inclusive approach in designing and conducting climate change adaptation research projects to inform policy, improve men's and women's respective adaptive capacity, and safeguard the present and future generations from the worst effects of a changing climate.

Glenn B. Gregorio
SEARCA Director

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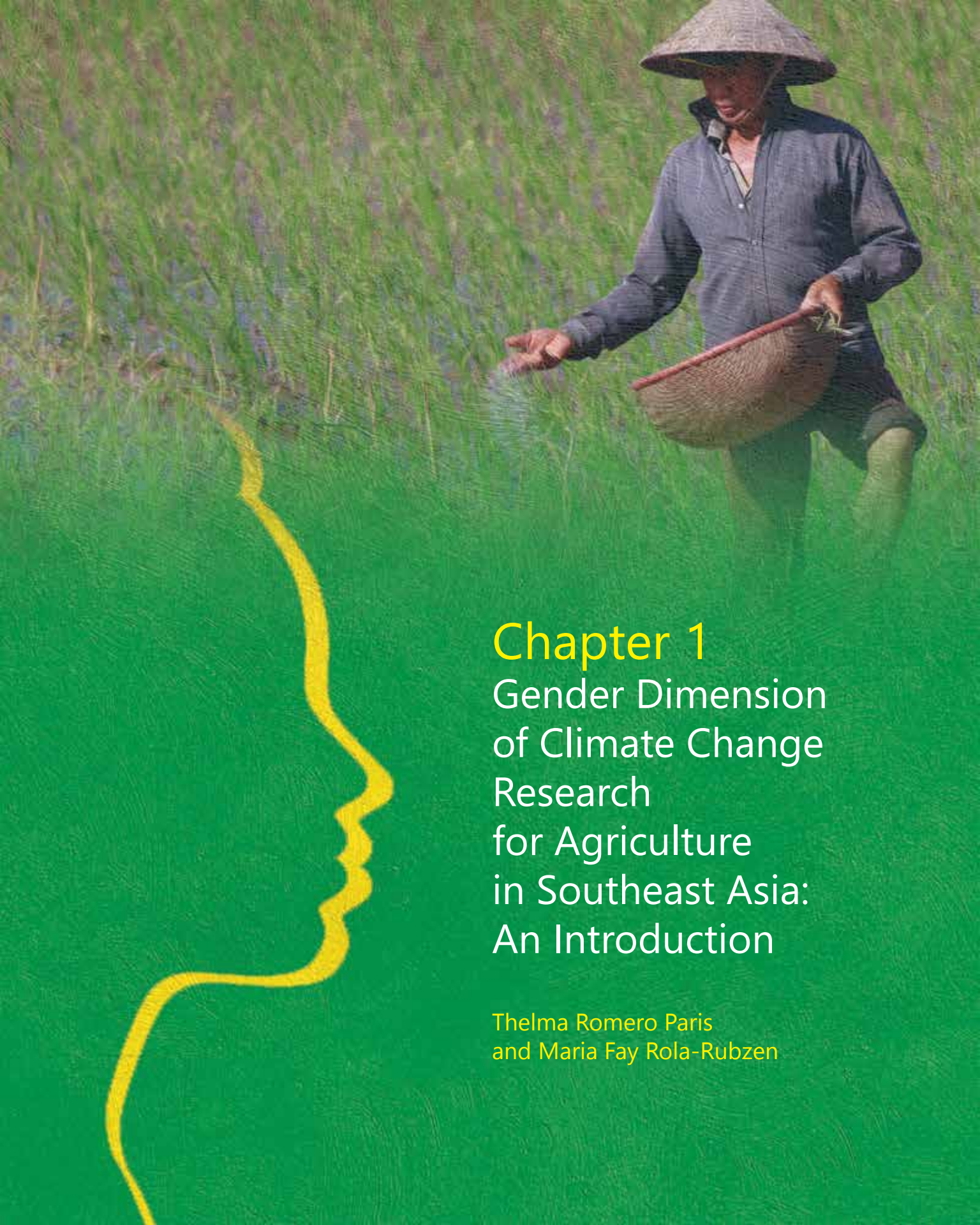
Acronyms

AMRIS	Angat-Maasin River Irrigation System
AWD	Alternate Wetting and Drying
AARIS	Angat Maasin Rice Irrigation System
CARD	Credit for Agriculture and Rural Development
CARP	Comprehensive Agrarian Reform Program
CBA	Community based adaptation
CCAFS	CGIAR Research Program on Climate Change, Agriculture and Food Security
CGIAR	Consultative Group on International Agricultural Research
CLRRI	Cuu Long Rice Research Institute
CBA	Community based analysis
CSA	Climate-smart agriculture
CoMSCA	Community Savings and Credit Association
DARD	Department of Agriculture and Rural Development
EV	Eastern Visayas
FAO	Food and Agriculture Organization
FGD	Focus Group Discussion
FLGU	Farmer Learning Group Unit
GSI	Gender Strategy Inclusion
IFAD	International Fund for Agricultural Development
HH	household
IPCC	Intergovernmental Panel on Climate Change
IPSARD	Institute of Policy and Strategy for Agriculture and Rural Development
IPM	Integrated Pest Management

IIRR	International Institute of Rural Reconstruction
IRRI	International Rice Research Institute
KII	key informant interview
LGU	Local Government Unit
LLL	Land laser leveler
MARD	Ministry of Agriculture and Rural Development
MAO	Municipal Agricultural Organization
MFI	Microfinance institution
MO	Market oriented
NASA	National Academy of Satellite Agency
QLPH	Quan Lo Phuang Hiep
PAGASA	Philippine Atmospheric, Geophysical and Astronomical Services Administration
PhilRice	Philippine Rice Research Institute
PCIC	Philippine Crop Insurance Corporation
PIRCCA	Policy Information and Response Platform on Climate Change and Rice in the ASEAN and its Member Countries
PAR	Participatory Action Research
PRA	Participatory Rural Appraisal
PVA	Participatory Vulnerability Assessment
SEA	Southeast Asia
SHG	Self Help Group
SO	Subsistence Oriented
TOT	Transfer of Technology
TSPI	*Tuloy sa Pag-unlad* Incorporation
VBS	Village Baseline Surveys



Chapter 1
Gender Dimension of Climate Change Research for Agriculture in Southeast Asia: An Introduction

Thelma Romero Paris
and Maria Fay Rola-Rubzen

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Introduction

Agriculture, which includes crop production, livestock raising, aquaculture, and agro-forestry, provides the major source of livelihood and food for smallholder farmers in Southeast Asia (SEA). However, climate change is affecting geographical locations, agroecosystems, and rainfall patterns in the region. Considered one of the world's most vulnerable to climate change, SEA is severely affected by the impacts of climate-related disasters. Being heavily reliant on agriculture, millions of people in SEA and their livelihoods are constantly at risk due to increased incidence of drought, flooding, and sea level rise. SEA is expected to be seriously affected by the adverse impacts of climate change. Since most of its economy relies on agriculture and natural resources as primary income, climate change has been and will continue to be a critical factor affecting productivity in the region. These changes in climate adversely affect agricultural yields, biodiversity, forest harvests, and availability of clean water, the impact being great in coastal and river deltas, where millions of people in SEA live (ADB 2010; Redfern 2012).

The impacts associated with climate change and climate variability differ from one country to another, from one region to another, and within the same community, as the magnitude and frequency of hazards and of the existing vulnerability can have varying degrees. Generally, the most impacted are the poorest populations and marginal groups. Additionally, there can be a different effect on men and women as consequence of social roles (e.g., performance of different tasks and different sets of knowledge and skills based on their distinct roles and responsibilities), inequalities in access to and control of resources/assets, and women's low participation in decision-making (Carvajal, Quintero, and Garcia 2008). Rural women are major contributors to the economy, both through their remunerative work on farms and through the unpaid work they traditionally render at home, on the farm, and in the community. Nonetheless, women appear to be less adaptive because of financial or resource constraints, because of male bias in receiving information and extension services, and because of higher labor loads for women created by available adaptation strategies.

In recent years, the call for gender main-streaming in climate change research for development programs has gained momentum. Under the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), several research initiatives were undertaken to gain a better understanding of the connections of climate change in agriculture, gender, and food

security (Kristjanson et al. 2017; Jost et al. 2015; Twyman et al. 2014). Climate-Smart Agriculture (CSA)[1] options have the potential to provide benefits to women when they have access to information on CSA. Indeed, women are just as likely as, if not more likely than men, to adopt CSA practices (Twyman et al. 2014).

Lambrou and Nelson's (2010) work contributes to a growing body of literature on gender and climate change and draws inspiration from pioneering work in the Indian context. Gender is one of the important socio-cultural dimensions typically included in climate change vulnerability assessments, but it is rarely incorporated in adaptation research and planning. A major contribution of Lambrou and Nelson's research is the development of an innovative methodological model for studying gender and climate variability for use in the context of climate change. The research uses gender-sensitive qualitative and quantitative methods and gender analysis techniques to capture the voices of men and women and quantify the degree to which their responses to climate variability differ. Their research tests the hypothesis that due to gender roles (i.e., the behaviors, tasks, and responsibilities a society defines as "male" or "female") and due to differential gendered access to resources, men and women experience climate variability differently and, hence, cope with climate variability and changing climate patterns in different ways. The findings confirm that there is a strong gender dimension in the way climate variability is experienced and expressed by farmers in their coping strategies to ensure their livelihood and food security. Women's and men's perceptions of and responses to impacts of drought conditions, as well as their access to resources and support, differ in important ways. These findings demonstrate that gender analysis enhances our understanding of what farmers perceive as risks and how they respond to climate changes. Such findings are essential to policy decisions by ensuring that the experiences of both women and men are embedded into policy design. This has implications for future research and for incorporating gender issues into adaptation to long-term climate change. Lambrou and Nelson (2013), in their study conducted in Andhra Pradesh, India, revealed that changes in climate over time have different impacts on men and women and that these differences are linked to their gender roles. They found that increase in emotional stress/anxiety was a highly ranked issue for men more than for women, which is somewhat surprising as women are expected to be more likely to report an increase in emotional stress than men. This finding is consistent with that of Tatlonghari and Paris (2013) in Luzon, Philippines, wherein men were found to be more emotionally stressed than women due to the devastation of floods on rice.

[1]Climate-smart agriculture (CSA) is an integrated approach which uses a combination of technologies and practices to meet food security goals while adapting to, and mitigating, climate change. In practice, it means having access to agricultural technologies such as crop varieties and livestock breeds that are more adapted to a changing climate, improve water management techniques to use water more efficiently, and practicing agro-forestry, crop rotation, mulching, intercropping, integrated crop-livestock management, and improved grazing to help conserve water and carbon in the soil. CSA also focuses on better weather forecasting, early warning systems, and insurance to help farmers reduce risk. Using available technologies and practices, CSA can increase agricultural productivity, adapt to climate change, reduce greenhouse emissions from agriculture, and strengthen resilience in smallholder farming systems and livelihood (WOCAN 2012).

The most recent study on understanding the gender dimension of agriculture and climate change in smallholder farming communities was done in Africa (Uganda and Ghana) (Twyman et al. 2014) and in Bangladesh (Jost et al. 2015). The key findings in the study in Africa are: (1) in general, fewer women perceive long-run changes in weather pattern, although in two sites, significantly more women than men perceive increase in temperatures in their lifetime; (2) women farmers often have significantly less access to many types of agricultural (e.g., CSA practices) and climate-related information; (3) women's restricted mobility, due to social norms, lack of access to transportation, and heavy domestic responsibilities (e.g., childcare), limit their options for adaptation, whereas men have a wider range of adaption options; and (4) if women are aware, they are just as likely as men to adopt CSA practices.

A main challenge for the climate change research community is to move beyond the current simplistic understanding of smallholder women as a homogenous group that is inherently nature-protecting but unable to adapt to climate change because of their overwhelming vulnerability (Arora-Jonsson 2011, cited in Tuana 2013). The authors further suggest that in order to understand in depth gender and the gender dimension of climate change, it is important to examine it within the context of climate variability, livelihoods, beliefs and social norms, and access to resources, information, and services. According to Jonsson (2011 p. 746, cited in Tuana 2013), "No scientific study is ever cited to document percentages such as the assertion that 70% of all poor people are women; there is, in fact, little gender disaggregated data to support the feminization of poverty hypothesis." Tuana (2013) emphasized that caution is necessary when examining evidence for gender-differentiated impacts on climate change. There is a need for appropriate data on women's and men's roles in food production and natural resource management and the gendered constraints that they face.

Goh's (2012) review of literature shows that increasing climate variability tends to lower agricultural production, with different impacts on women's and men's well-being and assets, including land, livestock, financial capital, and social capital. Both women and men spend more time and labor in agricultural production as a result of increasing climate variability, but women experience a heavier workload because of their other domestic chores. Men ranked impacts that affect their agriculture and income-generating work as high-impact areas, while women ranked impacts related to food production and household domestic work as high-impact areas. Studies also show that although men and women report similar impacts of climate hazards on agriculture and their homes, they value these impacts differently, depending on whether the impact falls within or outside their gender roles and responsibilities. Kristjanson et al. (2017) synthesized their initial research findings, which focused on the nexus of gender, agricultural development, and climate change. The study concluded that although much progress has been made in the last few years on identifying gendered research questions, and on developing new research approaches for addressing them, many gaps still remain.

Research gaps

Several authors suggest future research on addressing gender dimension of climate change research for agriculture, which can be applied in Southeast Asia. Goh (2012) suggests the need for empirical studies on how climate change affects women and men, in terms of their vulnerabilities, well-being, and assets. She also suggests the need to understand the contextual factors that mediate these impacts and the ensuing responses. Thus, research on gender and climate change should examine the gender division of labor in conjunction with livelihood within the local agricultural systems.

In terms of addressing the gender research questions identified with respect to climate risk, vulnerability context, adaptation strategies, and well-being, Kristjanson et al. (2017) recommend the following:

1. Conduct more in-depth research for better understanding of the differences between not only men and women but among the underrepresented groups, for example, women, youth, and ethnic groups.
2. Use a combination of quantitative and qualitative approaches to better understand the complex nexus of gender, agricultural development, and climate change, and draw out patterns of gender dynamics or changing gender roles in response to climate change.
3. Use more participatory and combined qualitative-quantitative research methods.
4. Invest in participatory action research approaches, and in the testing of new technologies, strategies, policies, and approaches with partners. Such measures can enhance the understanding of gender and climate change issues and build capacities of local partners for gender-responsive agricultural research for development.

On the other hand, Jost et al. (2015) recommend the following strategies:

1. Do more work to move beyond the conceptualization of women as a homogenous group in CSA programs.
2. Use participatory approaches in climate change adaptation research to understand beliefs and norms that contribute to gender dynamics.
3. When conducting interviews and focus group discussions, capture the variety of voices by splitting participants into more socially differentiated groups, and allow the probing of norms, rules, and beliefs related to gender and climate change within social groups.

Based on a study in India, Lambrou and Nelson (2013) emphasized the importance of documenting men's and women's views of their own lives so that the degree to which certain issues matter more to men or women is clear. They also pointed out the importance of collecting data from men and women separately when conducting research on gender in agriculture and climate change so that their responses are not biased by the presence of members of the opposite sex. Often, social restrictions inhibit women from voicing out their experiences and feelings in the presence of men.

A review of existing literature shows that there is a lack of research on understanding gender dimension of agriculture and climate change in smallholder farming communities in SEA, except for a few case studies done by Tatlonghari and Paris (2013), Bagsit et al. (2014), and Peralta (2008) in the Philippines. Results of these studies showed that although women and men work in complementary ways in agriculture, they have differences in their adaptation and coping responses to climate change risks. The study of Chi et al. (2013) in south Vietnam reveals that women more than men use anticipatory strategies (e.g., storing extra seeds for planting, keeping unperishable food and food products, spending less). In times of severe floods, they avail loans, resort to small trading business, rely on social networks, and get support from the community.

The overall purpose of the Consultative Group on International Agricultural Research (CGIAR) Program on Climate Change, Agriculture and Food Security (CCAFS) is to marshal the science and expertise of CGIAR and partners to catalyze positive change toward CSA, food systems, and landscapes (Huyer et al. 2016). The main goal of CCAFS' Gender and Social Inclusion (GSI) is to promote gender equality in supporting CCAFS' work across those arenas. CCAFS' approach to GSI is aligned with the CGIAR objectives to create opportunities for women, young people, and marginalized groups, and to promote equitable access to resources, information, and power in the agri-food systems for men and women in order to close the gender gap by 2030 (Huyer et al. 2016). In support of this goal, CCAFS has committed to undertake research that can inform, catalyze, and target CSA solutions to women and other vulnerable groups, increase the control of disadvantaged groups over productive assets and resources, and increase participation in decision-making. The GSI strategy focuses on women as central to agriculture in developing countries within a broader social context. This focus is appropriate since gender equality is a key leverage point for change, given women's important role in agricultural production, food security, nutrition, and livelihood. According to Huyer (2016), several concerns emerged from studies on gender and climate change in Africa and South Asia: (a) researchers and policymakers should understand the context of ecosystems, local knowledge, culture, gender relations, and capacities that influence technology adoption and adaptation; (b) technology is not gender neutral and can reinforce existing gender and power imbalances; (c) gender roles and relations are changing in response to socioeconomic and environmental stresses, and changing employment patterns and technology. Finally, technology to support resilience and adaptation to climate change by smallholder farmers can promote women's empowerment and the transformation of gender relations, in addition to sustainably increasing agricultural production. But this will only happen if they are implemented in a framework of mutually reinforced resources, women's control over assets, equitable decision-making between women and men, and strengthened capacity.

In November 2016, CCAFS-SEA research program under CGIAR organized a work-shop to present past and ongoing gender and

climate change research activities, particularly those conducted in Climate-Smart Villages (CSVs) under CCAFS-SEA. The discussions concluded that there is a need to conduct research on gender and climate change in SEA, draw patterns across research focus, identify knowledge gaps, and set future directions in SEA based on these gaps.

This book discusses the gender dimension of the relationship between agriculture and climate change. It explores whether men and women farmers in SEA experience similar or different vulnerabilities and the coping mechanisms or adaptation measures they use in response to climate change risks. It identifies gender gaps in access to and control of resources, information, services, technologies, training, finance, etc., which constrain men and women to adopt CSA and practices, and presents examples of participatory action research (PAR) that incorporates a gender dimension.

This book includes farm-level studies conducted by researchers (mostly social scientists) in SEA (i.e., the Philippines, Lao PDR, and Vietnam) including those by MS and PhD students. Most of these studies were conducted or are being conducted in the CSVs. CCAFS-SEA works in CSVs in focal countries (i.e., Lao PDR and Vietnam) to help smallholder farmers adopt innovative agricultural practices that can help them cope with climate change and enhance food security. Gender is considered as a defining factor in adaptation. Critical awareness of and effective measures to address gender inequalities, therefore, could be a key for addressing climate change risks. It is hoped that through this book, biophysical and social scientists, agricultural extension workers, and policymakers will gain a profound understanding of gender roles; gendered impacts of climate change; adaptation or coping strategies in response to climate change; and access to climate change information, services, and resources. This knowledge will lead to further research on the most effective ways to engage men, empower women, and challenge existing gender norms.

The organization of the book

This book is divided into four themes. The first theme, which is this introductory chapter by Paris and Rubzen, gives an overview of the book and discusses research gaps on gender in the context of climate change in SEA.

Theme 2 presents climate change risks, gendered vulnerabilities, and adaptation strategies in major rice production environments in south Vietnam and the Philippines. It comprises five chapters. Chapter 2 by Sri Dasgupta analyzes the climate risks that men and women face in Tra Hat, a CSV under CCAFS-SEA in the Mekong Delta, Vietnam. Chapter 3 by McKinley, Adato, Rutsaert, Pede, and Sander analyzes gender differences in perceptions on climate variability, coping strategies and acceptability of CSA technologies and practices in An Giang, Bac Lieu, and Tra Vinh, South Vietnam. Chapter 4 by Basconcillo discusses a similar research in two villages in San Rafael, Bulacan, Philippines, which are prone to frequent floods that damage rice. Chapter 5 by Bertuso details the

interrelationship among root and tuber crop production, climate change, and gender in typhoon-prone uplands in eastern Visayas, Philippines. Chapter 6 by Tatlonghari, Paris, and Villanueva talks about their study in Nueva Ecija, Philippines, on the vulnerabilities and adaptation strategies of men and women farmers in devastating flooding events.

Theme three focuses on CSA and gender issues. The theme consists of two chapters. Chapter 7, by Duyen, Sander, and Wassman focuses on gender issues and CSA technologies in Tra Hat, a CSV village in South Vietnam. They identify the impacts of climate change on rice production and livelihood as well as the gender-differentiated constraints of proposed CSA technologies and practices. Chapter 8, by Haapala discusses the application of a feminist approach to explore the feminine and masculine power dynamics within contemporary, technology-oriented climate change adaptation discourse. Her study in Lao PDR, analyzes how three CSA practices on rice production, namely, drought-tolerant seed varieties, dynamic crop calendar, and direct seeding, were understood and negotiated by the marginalized voices e.g., women at the local level.

Theme four (three chapters) provides examples of capacity building and participatory approaches that involve women farmers in ongoing research projects dealing with CSA technologies and practices. Chapter 9 by Tho, Chi, and Duong addresses women's lack of access to quality of seeds by including them in training activities on self-production of Tai Nguyen seeds (drought-tolerant) in Tra Hat, Bac Lieu, Vietnam. Chapter 10 by Rosimo, Dalusag, Gonsalves, and Vidallo demonstrates how a gender dimension is being incorporated in a participatory community-based project in Guinayangan, Quezon province, Philippines. Chapter 11 by Chi, Paris, Anh, and Duy discusses how women farmers in south Vietnam provided access to stress-tolerant rice varieties through their involvement in Participatory Varietal Selection (PVS) and training on crop management.

We invite you to join us in our journey as we explore the gender dimension of climate change research for agriculture in Southeast Asia.

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Chapter 2

Gender-Based Vulnerabilities and Adaptation to a Changing Climate: A Case Study in Tra Hat Village, Bac Lieu Province, Vietnam

Srijita Dasgupta

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Introduction

Marginalized populations, particularly women, have often been identified as groups that are much vulnerable to changing climate, mainly because of limited access to resources, which limits their capacities and opportunities for self-empowerment. The discourse on the gendered impacts of climate change stretches over a long period, and several studies have set strong grounds on the necessity to focus on gender when speaking within the spectrum of differentiated climate change impacts (Denton 2002; Terry 2009; Demetriades and Esplen 2010; Dankelman 2002; Nelson et al 2002). Yet, gender mainstreaming and the need for women's participation are still often overlooked. Women have been known to be an integral part of their families and often in maintaining both household and income-generating activities. Their unique knowledge, capacities, and important but often underestimated role in agriculture cannot be disputed (FAO 2011).

Studies on livelihoods shed light into differences in opportunities and vulnerabilities faced by communities (Kabeer and Tran 2000). In general, these studies have established that female-headed households (FHHs), in comparison to male-headed households (MHHs), are more likely to be poor (i.e., resource) because of several determinants, including income and land and property rights (Horrell and Krishnan 2006; Quisumbing et al. 2001). For example, a study in Nigeria, Africa by Babatunde et al. (2008) found that yield, household income, off-farm income, and non-labor hours were higher in MHH than in FHHs. This difference was attributed to unequal access to resources, which resulted in higher food insecurity among FHHs. Decisions to adapt have also been found to differ between the male and female headships in Eastern Uganda (Nabikolo et al. 2012) although perceptions of changes in climatic conditions have not been very different, as found in another study in China (Jin et al. 2015).

Despite several such studies, Waite (2000) noted that the vulnerability dimension of gender is not well understood. Moreover, many of these studies focused on the African continent; relatively fewer studies on gender research and climate change have been conducted in Vietnam. Several of the available documents on gender issues in Vietnam are published in the native language, limiting the dissemination of the available information to wider scientific and research bodies. In developing countries with a high population of women who are vulnerable, it is imperative that gender focus on research is strengthened to reduce vulnerabilities and enhance women's capacities to adapt to a changing climate.

Vietnam is a highly natural disaster-prone area with frequent strong and dangerous typhoons. It was reported that as many as 380 typhoons and tropical depressions hit the country between 1958 and 2007. The incidence of typhoons happening in all parts of the country is somewhat similar, but in the southern zone, typhoons are usually followed by long days of rainfall, eventually leading to landslides and floods (NSNDPRM 2007). Floods are also a common occurrence that is experienced in all zones of the country. The Mekong Delta stays flooded about 4–5 months a year. Droughts are the third most common natural disaster and are known to cause severe impact on the socioeconomic conditions of the country (Smajgl et al. 2015) Lack of freshwater due to salt intrusion and a narrowed-down river system are making it increasingly difficult to control and reduce the impact of droughts, particularly in the agriculture sector (NSDNPRM 2007).

Vietnam stands at a crossroad of progressive economic growth while also facing risks of dampened development due to the increasing impacts of changing climate. Much of the country's economic growth has been brought about by a focus on increasing productivity and export of rice. However, with changing temperature and precipitation levels, increasing sea level rise, and extreme weather events, rice yield is speculated to decrease in Southeast Asia (SEA), including in Vietnam (Redfern et al. 2012; Viet Nam News 2017). Therefore, climate change adaptation in rice production for people involved in agriculture is a priority for the country. Gender inclusion has been an important strategy in the development process, yet women, particularly in the rural areas, still face considerable challenges in their daily lives and in accessing resources.

Based on a UN desk review on gender and climate change in agriculture in Vietnam, Tran (2008) found that there is lack of research on the vulnerabilities, capacities, and adaptation strategies used by men and women in agriculture, including in livestock production. The rural population faces the challenges of changing climate but has an intuitional ability to adapt to changes. Men and women use different strategies to reduce risks; studying households under male and female headships will help provide insights into their responses (Goh 2012). Understanding their perceptions of changes is important in determining their vulnerabilities.

Gender analysis has been a valuable methodology in social science research to understand the opportunities and constraints faced by men and women in agriculture and in other sectors (Poats 1991). A gender analysis has been undertaken in Tra Hat village, located in Bac Lieu province, South Vietnam, to understand the vulnerabilities and adaptation processes of male- and FHH. During the study, no comprehensive gender analysis had been conducted in Tra Hat village. The study analyzed the climate risks that men and women face and how they adapt to these risks. It assessed livelihood strategies, perceptions on climate variability, impacts of climate change, and gender differences in accessing resources for adaptation under climate stresses.

Methodology

The study area

This study was conducted in Tra Hat village in the southern part of the Mekong Delta in Vietnam (Figure 2.1). Tra Hat is a climate-smart village (CSV) under the Climate, Agriculture, Food Security (CCAFS)–SEA research program. It belongs to Chau Thoi commune, Vin Loi district, Bac Lieu province, Tra Hat village's biophysical and socioeconomic conditions represent the Mekong River Delta (Phong et al. 2015). The region is in the commercial rice production area of Vietnam. Floods, freshwater scarcity, and salinity intrusion are recognized as main climate-related problems. Being located at the tail end of Quan Lo Phung Hiep canal system, lacking internal irrigation canals, Tra Hat village has limitations on farming techniques and crop diversification. Tra Hat farmers consider farmlands, rivers, and canals as their most important resources. There have been significant changes in the resources over the last 10 years. Before 1995, farmlands were used for only one rice cropping per year with low rice yield (3 t/ha). At present, due to improvement in farming techniques, farmers grow rice two to three times in a year.

Selection of FHHs was prioritized as it was important that FHHs got as much exposure as the MHHs in the surveys. In Tra Hat village, there were 25 FHHs (i.e., separated, divorced, and widowed). Out of these 25, 20 were available for the interviews. A total of 40 farming households (20 MHHs and 20 FHHs) were selected for the study.

Figure 2.1. Location of Tra Hat village (dot) in Bac Lieu province (in yellow)

Source: Ngo et al. (2015)

Data collection

Quantitative methods

Structured questionnaires included open-ended and perception-based questions on land size, income sources, gender-disaggregated data on labor use in rice production, access to resources, and decision-making power.

Farmers were asked to report the main extreme weather events in the last 10 years and how these events affected rice production and livestock.

Qualitative methods

Participatory Rural Appraisal (PRA) tools such as key informant interviews (KIIs), focus group discussions (FGDs), seasonal calendars and problem tree were used. Six

KIIs were conducted with male and female farmers, while six FGDs were conducted with separate groups of male and female farmers. The groups were separated so that women would not be intimidated by the presence of men during the discussions and would feel more comfortable in sharing their responses. Similar topics in the FGDs were discussed with the men's group and women's group. Seasonal calendars were drawn by men and women separately to present the crop and livestock production activities throughout the year in relation to the months when rainfall distribution is high and low. Division of labor in rice production by gender was also discussed by asking the main question, "In this village, who often does what specific activity?" Men and women were asked to list the sequential activities in rice production, livestock raising, and in the household.

Data analysis

Frequencies of responses of MHHs and FHHs were calculated to compare similarities and differences between these two groups of respondents.

Results and discussions

Socioeconomic characteristics of the sample

Forty farming respondents (20 MHHs and 20 FHHs) were included in the survey. The characteristics of the respondents are as follows: FHHs were slightly older (55.9 years old) than the MHHs (53.3 years old). Male heads of households had more years in school (5.5 years) than female heads (4.2 years). In 2009, the literacy rates of female and male (from 15 years old) in Bac Lieu Lieu province was 96% and 93%, respectively. In general, women are much less educated and, therefore, vulnerable to various forms of exploitation. However, an analysis of the data from three censuses conducted from 1989 to 2009 indicates that there has been a sharp decline in the gender gap from 10% in 1989 to 4.4% in 2009. This demonstrates consistent progress in the promotion of gender equality and empowerment of women (Minh et al. 2015). The average land owned by MHHs is 1.5 ha compared with 1.2 ha for FHHs. The average number of family members is 4.7 and 4.3 for MHHs and for FHHs, respectively.

Livelihood diversification

Diversifying livelihoods is a way of reducing the vulnerabilities that rural households may face from exogenous shocks or unforeseen events (Reardon et al. 1998; Block and Webb 2001). Inequality in accessing resources can further exacerbate vulnerabilities faced by households and communities and limit their possibilities to diversify livelihood and spread potential risks (Adger 1999). Rice farming is the major source of income of both MHHs and FHHs in Tra Hat village followed by livestock (85% vs 75%, respectively). Pigs and poultry (chicken, duck, and geese) are commonly raised (Figure 2.2). Due to lack of grazing land, few households raise large ruminants. About half of the MHHs and 40% of FHHs with small ponds within their homestead earn income from fish sales. More than half (60%) of MHHs and half of FHHs grow fruits in their homestead.

Vegetables are also grown by MHHs (45%) and FHHs (35%) for the market and for home consumption. Furthermore, FHHs (60%) and MHHs (35%) obtain income by working as seasonal hired workers. Women are hired for transplanting and gap-filling during peak seasons. Men are hired for land preparation, hauling, and harvesting. Half of the FHHs and 45% of the MHHs receive remittances from their sons and daughters who are migrant workers in cities. Younger men take on construction work while younger women work in clothing factories or beauty parlors. Salaries from fixed or regular jobs, which require higher education and skills, contribute a lower share to the income of both MHHs and FHHs (35%).

In summary, MHHs and FHHs are engaged in similar sources of livelihood. However, more FHHs obtain income by working as seasonal hired workers within the village. Thus, droughts or floods can result to loss of income for FHHs who are responsible for food, income, and nutrition security of their households. Remittances from sons or daughters working in the cities are an additional source of income to FHHS.

The seasonal calendar showing the weather, production, and economic activities (Figure 2.3) show two main seasons in Tra Hat village—dry season (December to April) and wet season (May to November) (Phong et al. 2015). The average monthly temperature

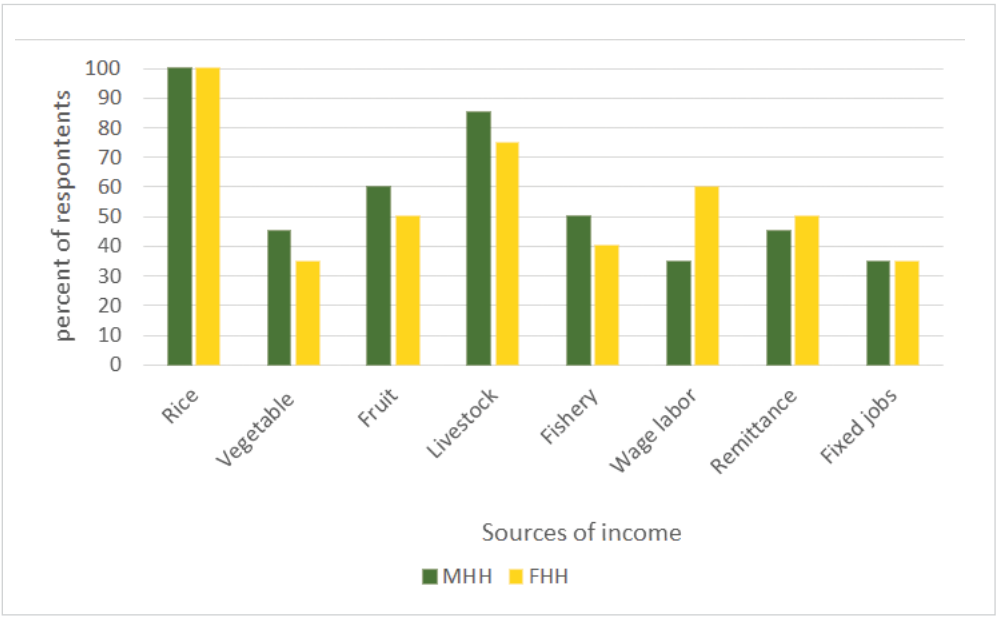

Figure 2.2. Various sources of income of MHHs and FHHs

ranges from 25.2°C to 29°C, with May being the hottest month and January the coolest. Rainfall during the wet season is about 90% of the total annual precipitation. Heaviest rainfalls are usually experienced in September–November. Lightest rainfalls are in December–April, the time of the year when drought usually occurs. Between May and July, depending on the rain, farmers grow short-duration modern varieties (MVs), e.g., OM4900, RVT, and STs (ST3 and ST5). After harvesting, farmers grow the traditional variety Tai Nguyen from September to February.

Since rice is the major source of income, staple food and cash availability also depend on the months when farmers sell their harvests (July and November). Resource-poor farming families are faced with food and cash shortages during specific months of the year. For example, before harvesting rice, farmers have to raise their capital to purchase inputs and hire labor.

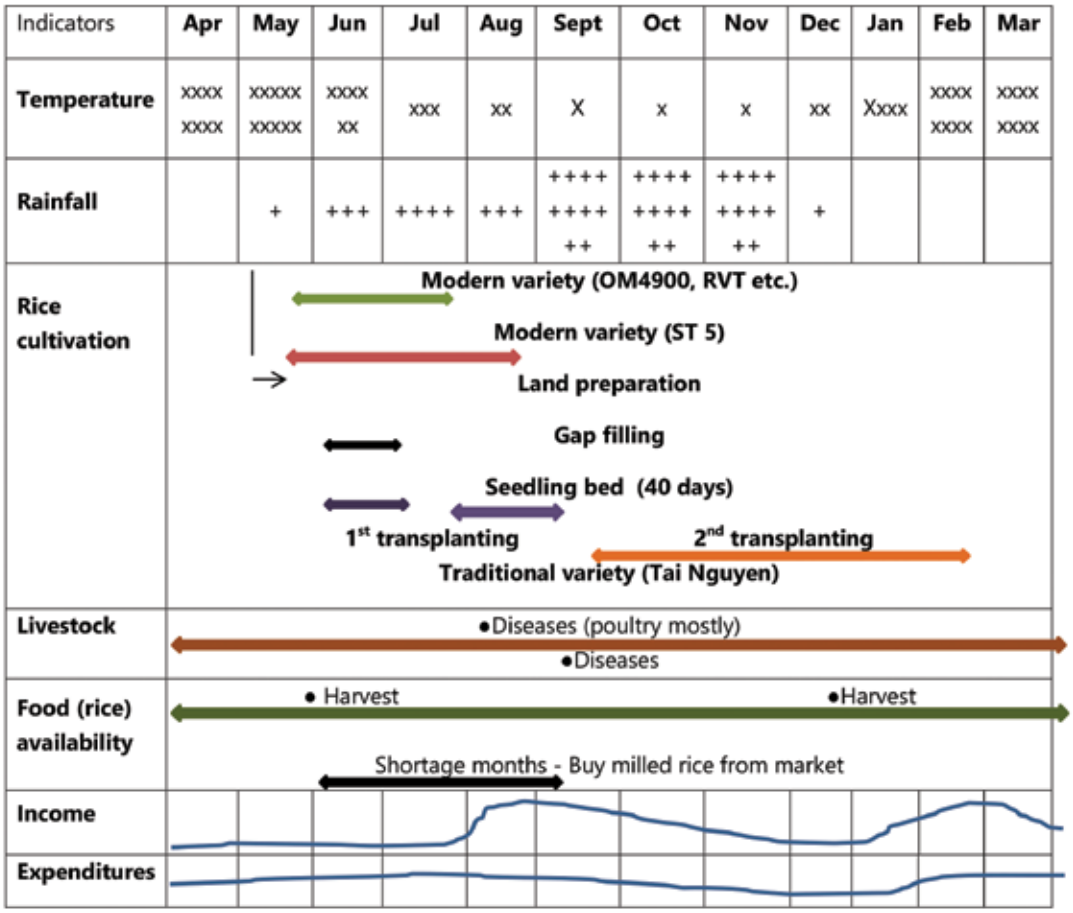

Figure 2.3. Seasonal calendar of Tra Hat in Bac Lieu province

Farmers are short of rice supply from May to August; thus, they purchase milled rice from the market. Swine and poultry diseases often occur in April when temperature is high, and in September when floods occur. Cash is available after selling rice, but expenditures are higher during the start of the cropping season.

Perceptions on climate change

Farmers' perceptions about climate change vary, influencing their adaptation strategies (Dang et al. 2014). The impacts of a changing climate are being felt by the villagers, and almost all the farmers in both household (HH) surveys and FGDs are aware of the unusual changes.

Farmers narrated their experiences and perceptions regarding changes in climate over the years. Although perceptions varied, there was consensus that the temperature has increased in the village in the past 10 years (Figure 2.4). Farmers also perceive that rainfall has decreased and that there have been unforeseen changes in the timing and amount of precipitation. They reported that temperatures are higher than before in the summer months and rainfall is much lower. Farmers also said that they have experienced an increase in extreme weather in the village—such as droughts, floods, and cyclones. They are concerned over the worsening impacts of some changes in the weather patterns, making it difficult for them to adapt.

According to some farmers, rainfall is now quite unpredictable because in the past, in mid-April, they were already preparing the land for planting of the short-duration MVs. At the time of interview, the farmers were expecting that the rains would come middle or end of May, worried that a month's delay in crop cultivation is quite long for them.

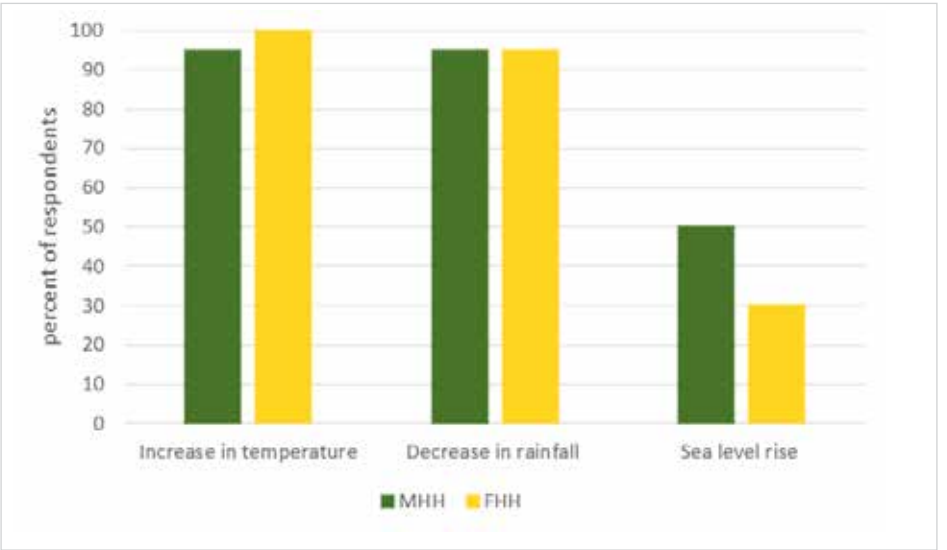

Figure 2.4. Changes in climate as perceived by MHHs and FHHs

Farmers' perceptions, in general, are similar to the Department of Agricultural Research for Development (DARD) officers' perceptions, and the perceptions given in broader scientific research. However, it should be noted that in addition to farmers' experiences, DARD Vietnam and recently, CCAFS, have been closely working with farmers in Tra Hat village by orienting them on the imminent climate risks and risk management and adaptation strategies. It is, therefore, likely that farmers' awareness and perceptions of changes in climatic conditions are a result of a combination of what they have experienced and the information they have gathered from different sources.

Climate change impacts

Impacts on rice production

Households identified different weather phenomena, but it is important to note that 100% believe that they are facing increasing incidence of yield losses and lower returns from rice production. The changing climate conditions bring about droughts and floods, which affect rice-rice production systems. Due to the unpredictability of weather conditions over the last few years, rice farmers obtained low yields or no yields at all. Majority of the farmers recognize drought and floods as serious problems. The years 2013, 2014, 2015, and 2016 (the year the study was conducted) were identified as drought years by about 68% of the farmers. Yield losses during those drought years occurred mostly in the last growth stages of Tai Nguyen rice because it coincided with the start of the dry season. For MVs, the plants tended to wither away at the early stages, and thus needed to be replanted. Tai Nguyen was identified as more vulnerable to damage because planting of MVs was usually timed with the arrival of the rainy season, indicating a shifting seasonal calendar. Yield losses varied between 3% and 100%. Increase in temperature, dry soil, and lack of water caused damage to the crops. Farmers have observed that rice plants now have reduced tillering ability, and consequently, wither away rapidly.

The only source of irrigation water in the whole village is a narrow canal, which is also facing pollution problems from fertilizer leaching, excessive growth of water hyacinth, and sedimentation. According to the village leader, the water level in the canal was relatively low in 2016. He expects water shortages and increased need to pump more water in the fields in the next cropping seasons. This situation is likely to increase cost in rice production. Yield loss as a result of drought and water shortage can be severe. One FHH said that her yield from Tai Nguyen rice in 2016 was only 3 t/ha, which is much lower than the expected yield of 6–8 t/ha. She added that during the heat wave the previous year, she was unable to irrigate her field regularly because it was located quite far from the water source. Pumping water from the canal was too strenuous and irrigating it twice or more increased production cost.

Increase in temperature and heat waves have also brought about pest infestation in the village. Drought also increased the cost of other inputs, such as fertilizers and pesticides. The impacts of floods were also documented by the villagers. The severity of impact arising

from floods depended on the elevation of the fields. Farmers whose rice fields were at a higher level were less affected than those whose fields were at lower elevation. Water logging of fields because of floods caused the stems of the rice crop to rot, resulting to yield loss. Another FHH reported low rice yields (1.5 tons/ha) in 2015, even with MV, because their low-lying fields became waterlogged from the continuous rainfall.

The returns from rice production were low because of the impact of extreme weather, increased price of inputs, and volatile rice prices. The surveys showed that several households had negative returns from the first cropping season in 2015. This can be attributed to the drought in 2015, the worst in almost 90 years in the Mekong Delta. It is highly possible that the 2015 drought had affected rice production in Tra Hat village and resulted in low net incomes. In the small-size farms, four of seven farms had negative net incomes. Of four medium-size farms and 28 large-size farms, one and four farms, respectively, had negative net incomes.

While salinity intrusion is an increasing concern in the Mekong Delta, none of the farmers expressed concern about its possible effect, at least not in the next 15 years. There can be two possible reasons for this: (1) the sluice gate that is protecting the village and (2) the location of Tra Hat village, which, according to a DARD officer, is quite deep into the freshwater zone.

Impacts on livestock

Extreme weather events also affect livestock production. In the last three or four years, death and diseases among poultry and pigs were becoming widespread. Sixty percent of the farmers surveyed reported that they faced more challenges each year in raising livestock, noting that number of deaths or diseases was on the rise. Mortality was also high among poultry.

Diseases have become widespread during seasonal changes, i.e., between May and June, which is a transition from dry to wet season, and again during December to January, which is the seasonal change from wet to dry. Women cited that increased pest incidence was an emerging threat in cultivating non-rice crops. One MHH recounted his experience:

"Ten years ago, I owned seven big congs of land (0.91 ha) and 15 pigs. In 2005, a very big flood severely damaged my crops and killed all my pigs. I ran into debt and to repay my loans, I had to sell six big congs (0.78 ha). Now I have only 0.13 ha and survive on money my wife and son send me from the city. In these 10 years, I have not been able to recover my losses because returns from rice are very low, and with each year, heat and lack of rain are reducing the yield. If I did not have to look after my mother-in-law, I would have long left the village to work in the city."

Coping strategies for climatic variabilities

The fact that climate is changing and its impacts are being felt to a great extent in the village is evident in the surveys. Adjustment to the changing climate has been an ongoing process in ways that favorably help the farmers to adapt in either a reactive or an anticipatory manner (Adger and Vincent 2005).

On-farm strategies

Farmers are aware of changes in weather patterns and are concerned about what the future might hold for them; a few are still unsure about what needs to be done. Faith in the government is profound, as evident in farmers' belief that the government will help them if there are serious problems in the village, particularly in rice production. Their faith in national policies is the result of government initiatives to introduce shrimp farming (by converting previously cultivated rice lands) in many salinity-intruded areas in the Mekong Delta (based on FGD and key informant interviews). They are willing to go into shrimp farming in the future, in case of increased salinity in the village, but they are also worried about the risks associated with new technologies.

During the study, no long-term adaptation strategies were identified by the farmers and therefore, their short-term adaptation strategies will hereafter be referred to as "coping strategies." However, there were no discernible differences in the coping strategies applied in rice farming by either MHHs or FHHs. One possible explanation for this is the fact that the villagers, as well as neighbors or other farmers, usually follow, learn, and apply new technologies that might increase rice productivity (based on FGDs with male farmers). Therefore, it can be assumed that all households, whether MHHs or FHHs, apply the same coping strategy in the field. Applying the same coping strategy also reduces risks and ensures that they can access loans and other forms of support during crisis (based on FGD and key informant interviews).

Figure 2.5 shows the coping strategies used by rice farmers. All farming households grow Tai Nguyen, a traditional rice variety that is drought tolerant, has stiffer stems, and can withstand prolonged period of waterlogging. Forty-five percent of MHHs and 30% of FHHs change their cropping patterns from three to two rice cropping per year. Farmers also use quality seeds to ensure good yield (to compensate for losses arising from climate change and to avoid pests). Tai Nguyen is planted by the farmers in the entire village during the second cropping season. The most common strategy, however, is to increase the use of inputs including fertilizer, pesticide, and irrigation. Increased incidence of drought and heat wave also put pressure on the farmers to pump more water into their fields.

Individual-level strategies

Individuals, however, have varied strategies (not just related to climate change) to ensure the sustainability of their livelihood and to cope with unforeseen risks (Figure 2.6). Among the FHHs, borrowing money is a key strategy and it is slightly higher than among the MHHs. Better management is the next important coping strategy of FHHs more than MHHs. Women, in general, are mainly responsible for budgeting household cash, especially during crisis months. They usually reduce the expenditures on food and clothes, to cope with the increasing cost of inputs for agricultural activities. For the poor and middle-income farmers, selling livestock is a more feasible option. Selling livestock for income is already a livelihood activity in the village, during the crisis months; it is a response to an unprecedented shock. Although less practiced, disposing of assets is done by MHHs more than FHHs.

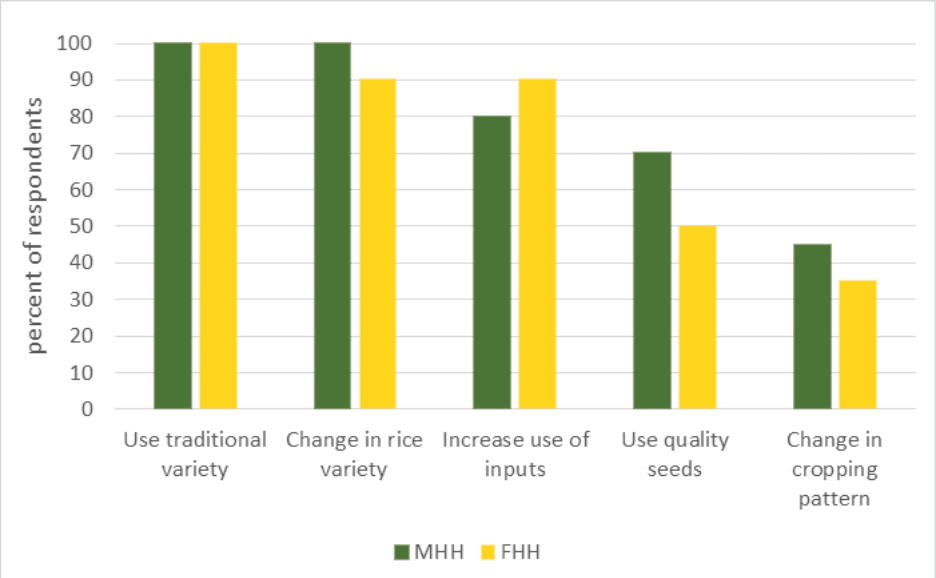

Figure 2.5. Coping strategies of rice farming households, MHHs and FHHs in Tra Hat, Vietnam

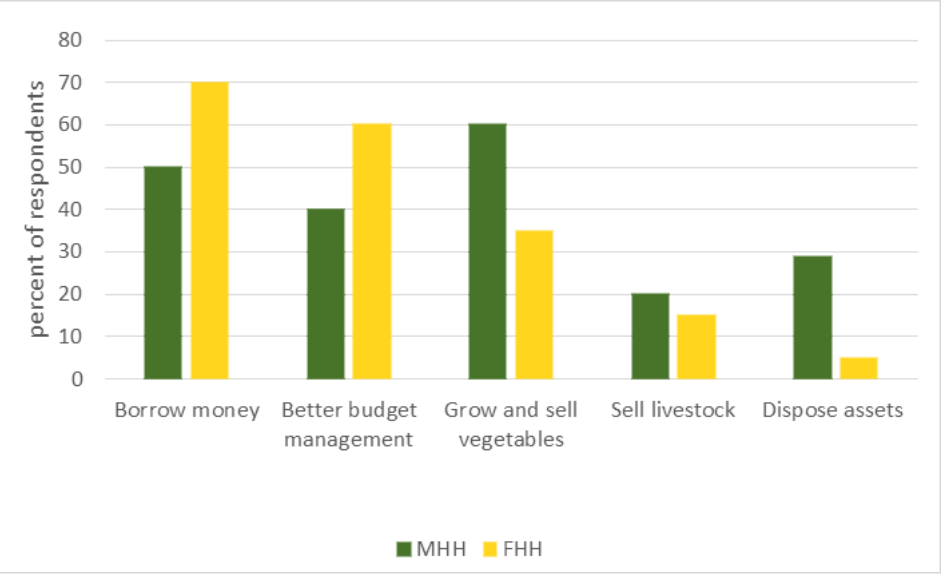

Figure 2.6. Coping strategies of MHHs and FHHs

Gender division of labor and perceptions for the future

Generalizations that men do most of the activities in rice farming are often made, underestimating the significant labor contributions of women in almost all operations. Survey results show that it is not possible to make a conclusive list of agricultural activities performed mainly by women because they are integral part of all labor-requiring activities, most of which often go unnoticed. This confirms studies on gender roles in agriculture that women's contributions are often underestimated and undervalued (FAO 2011; Okali 2011). Women's time and workload in the field tends to be lower when there are available male family members. FHHs, especially those who are not financially capable of hiring extra labor, are at a disadvantage. They suffer from double burden as they have to perform field work on their own fields, as well as serve as de facto managers of their households and in on-farm activities. However, female members in MHHs said that they have more leisure time now than before. Thus, it is important to consider that in analyzing the gender division of labor, women are not homogenous. Women's needs and roles vary by social and economic status, as well as by the presence of a male head of the household.

An FGD on the gender division of labor in the village was also held to delve deeper into this aspect. A female farmer (from an MHH) said:

"During irrigation, most women carry the pipes to the fields, connect them to the water pump and maneuver the pipes through the field. After this, the men take over and pump water to the fields. Thus, men and women work together in irrigating the fields." (FGD on gender division of labor, women's group)

This statement proves the point that women provide support to their families in several ways, many of which go unnoticed, and which even they themselves do not recognize. Among resource-poor households, women work as unpaid family labor to save money and provide support for the family when there is a labor constraint during peak periods. Thus, FHHs often are singlehandedly responsible for both agricultural activities and household chores (Boserup 1970 as cited in Okali 2011).

Women from near landless households also work as seasonal agricultural laborers during peak months. Other women work as domestic helpers, in beauty parlors, or in clothing factories throughout the year. Traditionally, both men and women are almost equally involved in rice farming. However, with the increasing adoption of machinery and commercialization, women's labor participation in rice production has declined. Rice farming activities such as transplanting and harvesting are now being done by mechanical transplanter and combine harvester-thresher, which are operated by men. There is consensus in Tra Hat that rice farming is becoming more of a male-oriented activity, while women are becoming increasingly active in rearing livestock, growing non-rice crops within their homestead, and managing the households.

When asked about their perceptions of the future, the responses varied between the MHHs and FHHs. Almost a quarter (22.5%) of the MHHs said they do not expect any change. Twenty percent of the FHHs said that women's role in rice farming will decrease in the future because of increased adoption of machineries, which, in turn, will reduce the demand for female labor. Men will be more involved in rice farming, whereas women will assume more managerial roles in the farm. Their work responsibilities in their homestead and in the household will remain the same. Forty percent of the MHHs said that the role of men in the field will increase in the future because after each extreme weather event, they will have to spend more time in replanting and preparing the fields again. Increase in frequencies of droughts will increase the time required for irrigating the fields and applying pesticides. Fifteen percent of the FHHs cited that removing rotten stems or plants after a flood or, in some cases, cleaning the dikes manually requires much strength and time. Perceptions of roles varied between male and female farmers, but the role of women in helping the household during crisis cannot be underestimated. A study in the Philippines showed that under the prolonged impact of natural disasters, women in a vulnerable community use their intuition and help their families to effectively cope with the risks (Tatlonghari and Paris 2013). Nonetheless, extreme weather events are likely to increase women's vulnerabilities and workload due to their additional roles in sustaining their family's livelihood and overall well-being (Paris 2007).

By gender norms, all reproductive and household chores have always been considered responsibilities of women, and perhaps for this reason, women often do not perceive household chores as additional workload (Bruun 2013). Despite the increased workload at home, particularly during and after floods, women are not willing to share their household chores and childcare responsibilities with their spouse. Although they appreciate some occasional help, in general, the women take pride in having full control in managing their households particularly in managing their budget.

Access to resources

Land

In accordance with the Land Law of 1993, the first Land Use Certificates (LUCs) issued under the program were in the name of the "head of household" (i.e., in the name of men only). Under the revised Law of 2003 of Vietnam, land owned by households with husband and wife still living can be registered under both their names (Menon et al. 2014). Despite this, only one MHH has both the husband's and wife's names in the land entitlement certificates. Majority of the households still have lands owned by the husbands only. In the FHHs, only one has the land title under her name. This is an important indication of vulnerability of females (wives) in MHHs. Land acts as the main collateral to secure loans; thus, women who do not have their names on a land ownership certificate are unlikely to access credit from formal sources.

Credit

All households had taken loans, at some point, for either agricultural purposes or personal reasons. Farmers usually bought all their agricultural inputs on credit, which they had to pay during harvest or after the rice had been harvested. Two kinds of loans are available to farmers—formal and informal. Most farmers obtain formal loans from the Agribank, which provides loans strictly for agriculture, with a collateral that is usually land. Therefore, women who do not have their names in the land title certificates are unlikely to have access to formal credit. The other source of loan is from neighbors and relatives and this is with or without interest. Of the MHHs, 35% have taken formal loans, whereas 25% of FHHs took informal loans. The women's union also helps provide loans for women farmers, mainly for raising livestock, by acting as guarantor for the loan. For some households, availability of rice (stored in their houses and later sold when cash is required) served as a form of security during crisis. Therefore, women who do not have their names on the land title certificates are unlikely to be able to access formal credit. The other source of loan is from neighbors and relatives with or without interest rates. A higher proportion (35%) of the male-headed HHs took formal loans while a higher proportion (25%) of the female-headed HHs took informal loans. The Women's Union also helps to provide loans for women farmers mainly for the purpose of raising livestock, wherein the association acts as the guarantor for the loan. For some households, availability of rice, stored in their houses and later sold when cash is required, served as a form of security during crisis.

Association memberships

The two main kinds of services that were highlighted by the farmers were the association memberships and the access to loans and credit schemes. None of the households mentioned receiving any extension services from DARD despite a policy of the Vietnamese government to extend extension services to the rural areas. The role of the farmers' association and the women's union were also very much subdued and only 11 MHHs and 9 FHHs reported that they were members of these associations. The low participation and interest in joining the different associations were mainly attributed to lack of awareness of the meeting schedules, lack of time, and lack of support from both these organizations. The women union leader pointed out that they suffer from budget shortages, which restrict the association from undertaking initiatives to attract members to the meetings.

Markets

The villagers are dependent on the markets for their products. Nonetheless, due to good infrastructure (roads and network), transporting farm products to the markets is convenient. Sellers of food and other household needs ply in and out of the village using a motorcycle. Thus, these mobile markets reduce women's time in going to the markets, as they do not have to leave their homes to market.

Farmers face problems in marketing rice after harvest. The usual practice is for farmers to contact the middlemen after each harvest and negotiate the price. After agreeing on the

farm price, the middlemen go to the village and collect the rice. Farmers are often unable to negotiate the price with the middlemen, who offer them a lower price for the rice, in comparison to the selling price of the same variety in the market. Households reported that they usually get between 6,000 and 8,000 VND/kg (USD 0.30/kg and USD 0.40/kg) for Tai Nguyen rice sold to the middlemen. The same variety is sold in the market at around 14,000 VND/kg (USD 70/kg). Collectors earned 10 times more than the farmers in 2011 due to their active participation in the value chain (Tran et al. 2013). Having more market power than farmers, collectors usually set low prices, particularly if there is a good crop (a surplus of paddy rice supply). Additionally, because most farmers are poor, their biggest need for cash is right after the harvest. They sell their output as quickly as possible and at any price (usually lower than the floor farm gate price, i.e., the minimum price set by the government), to settle their debts in time.

It was well articulated during the FGDs that farmers want intervention from DARD and the farmers' association present in the village, to help them form a strong cooperative and access the market themselves without the middlemen.

Agriculture-related training

There is gender inequality in access to training programs. Out of the 40 HHs, only 12 MHHs (60%) and 7 FHHs (35%) reported to have attended agriculture related trainings. Male heads of households were mainly trained on Integrated Pest Management (IPM), whereas FHHs were mainly trained on waste composting and not on agriculture-related topics. According to one female respondent, women's participation accounts for only about 20% of the total attendance. There are many reasons for the low participation of women in agriculture-related training programs. The leader of the village women's union said that one of the reasons is that women felt intimidated by the presence of men in meetings. In most meetings, men dominated the discussions and women felt shy to express their opinions. As a result of this "intimidation," the women were not motivated to attend mixed group meetings. They suggested that trainings be given for women only.

None of the farmers of households that attended trainings, however, admitted that they used the techniques they learned in the training. A female head who attended a two-day training on information and communication technology (ICT) said that although they were taught to use cellphones to contact markets and check for prices of rice and seeds, she found it very difficult to understand the concept in just two days.

Information on climate-smart agriculture

Despite Tra Hat village being a CSV with several Climate-Smart Agriculture (CSA) practices and technologies already being implemented, only 50% of the FHHs and 70% of the MHHs are aware of this initiative. The households also lacked information on many of the CSA practices and technologies. Moreover, FHHs have lower awareness of these technologies compared with MHHs. In addition, farmers did not have communication

and information dissemination sources from where they could get CSA information. There were also no early warning systems in the village that could inform people of imminent weather risks.

Constraints to income-earning activities and aspirations for the future

During the FGDs, majority of the female in both the MHHs or FHHs expressed their interest in engaging in income-generating activities during lean months. However, lack of skills, age, and distance from the village to the cities kept them from undertaking these initiatives. FHHs were also interested in earning income, but they said that they were overburdened with responsibilities. They also cited differences in wages paid to female and male workers because of the cultural perception of employers that men are stronger and are more efficient. Men usually earn around 150,000 VND (USD 7.5 per day), but females earn less at 120,000 VND per day (USD 6 per day) for the same kind of work. Some women were not willing to travel too far from their houses, preferring to get jobs in the village. They were interested in making handicraft and selling edible plants, but they lack market information and skills in entrepreneurship. Male farmers were willing to participate in training activities mainly on rice production and on latest technologies, whereas, women expressed willingness to be trained on livestock rearing. Therefore, in order to build their adaptive capacities, it is important that farmers are empowered with the knowledge, means, and capacity to reduce their vulnerabilities to the impacts of the changing climate in the Mekong Delta.

Conclusion

The impacts of climate change are evident in the study area, with majority of the farmers (both MHHs and FHHs) identifying unusual increases in temperature and reduced rainfall. Droughts, floods, and cyclones are the weather phenomena that are increasing in both frequency and intensity and posing threat to their livelihood, which is largely dependent on agricultural activities. The weather variability has affected both livestock and rice production. Crop losses due to climate change, coupled with non-climatic factors such as increased costs of farm inputs, mean low or even negative returns for the farmers.

Although several climate phenomena were identified by the farmers, they did not enumerate any long-term adaptation strategies for coping. This implies that village farmers are more exposed to risks with the absence of clear-cut measures to increase their adaptive capacities both to climatic and non-climatic factors. Lack of access to information on CSA, lack of access to markets, and the exploitation of middlemen, likewise hinder the farmers from fully adapting to climate change.

Analyzing the livelihood activities of MHHs and FHHs through gender lens, the study found that FHHs had slightly more diversified livelihood activities, with at least one off-farm income source to augment their on-farm activities, compared to MHHs. Men and women were both involved in different operations in rice farming. Participation of male members in rice farming was higher among the MHHs; the females were involved in livestock raising and other activities within

their homestead. The FHHs have greater work burden as they are engaged in both income-generating livelihood activities and daily household responsibilities apart from farming. However, FHHs remain vulnerable as they faced more constraints, such as no land entitlement, lack of access to formal credit facilities, lack of access to training programs, and heavier workloads.

The main gender-based problem identified is women's lack of exposure to technology through agricultural training programs, as compared with men. However, men also expressed their desire to be trained particularly on rice farming techniques. Another gender-based problem identified was that women in MHHs did not have their names on the land certificates, which can be a hindrance to accessing resources. Farmers also expressed concern about being exploited by middlemen, who generally give prices much lower than the actual market price. In general, both men and women mentioned lack of access to weather-based information on CSA. Farmers should, therefore, be given access to such information and training to reduce their vulnerability and to further help them adapt to the changing climate.

Recommendations

Based on the findings of the study, the following recommendations are made to help improve the livelihoods of farming households in Tra Hat village, as well as in other areas. One must keep in mind that different groups have different needs, thus a targeted approach would be more appropriate.

1. Since risks are managed at the household level, more specific vulnerability studies are needed involving more than one member (both male and female) of each household to understand the different dynamics of coping and risk reduction strategies.
2. Capacity building should be placed at the heart of interventions aimed at risk reduction. More needs-based trainings on agricultural technologies and means of adaptation to the changing climate should be organized, ensuring active participation of both genders. Men and women should be trained in ways that they are able to understand the content and later apply the lessons learned in the field. In addition, training the women on better household budget management could help reduce risks and vulnerabilities of farming households.
3. FHHs could be helped by providing needs-based training programs, including those that are targeted especially to women. As women farmers usually focus on livestock production as additional sources of household income, training sessions on this agricultural commodity would be helpful.
4. FHHs should be encouraged to join women's union as an avenue to provide them with the knowledge and skills on different income generation activities. Processing raw produce into other food products and making handicrafts for sale could further augment their incomes. Aside from providing information, cooperatives would help the women reach markets better.
5. More women should be encouraged to learn and apply better budget management and savings schemes/mechanisms so that they are able to tackle financial constraints during crises. In particular,

women's access to resources needs to be improved and guaranteed so that they can avail themselves of formal loans when necessary. These can be initiated and promoted through the women's union.

6. Communication tools, especially initiatives involving information and communication technology and early warning systems, would help farmers identify measures to help them cope with changes and enable them to make informed decisions. Mobile phones and the internet could be maximized to bring the needed information to farmers. Aside from checking the weather and climate advisories, farmers could also use these media to check the prices of their commodities and link them to markets.
7. Households could also contribute toward a community climate fund, which can provide additional financial support, especially during severe or unforeseen weather events.

Suggested future research

Although this research has identified the different vulnerabilities in MHHs and FHHs, it is important to understand the dynamics or gender relations within households. Future studies should try to understand the vulnerabilities and capacities of females residing in MHHs, particularly the wives. Status of food and nutrition security of the village should be addressed. In addition, more attention should be given to the opportunities and constraints of livestock rearing and to farmers' vulnerability to climate change impacts. The scope of diversifying on-farm activities also needs to be researched, so that sole dependency on rice-rice cropping pattern can be reduced.

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Chapter 3

Gendered Perceptions, Impacts, and Coping Strategies in Response to Climate Change: Evidence from Mekong Delta, Vietnam

Justin McKinley, Catharine Adaro, Pieter Rutsaert, Valerien Pede, and Bjoern Ole Sander

Chapter 3

Gendered Perceptions, Impacts and Coping Strategies in Response to Climate Change: Evidence from Mekong Delta, Vietnam

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Introduction

Southeast Asia is expected to be seriously affected by the adverse impacts of climate change. Since most of its economy relies on agriculture and natural resources as primary income, climate change has been and will continue to be a critical factor affecting productivity in the region (IPPC 2007). Vietnam is one of the vulnerable countries in Southeast Asia. By 2100, Indonesia, the Philippines, and Vietnam are projected to experience a potential fall of about 50% in rice yield, assuming there is no adaptation and no technical improvement (ADB 2010). The Mekong River Delta (MRD) is the most prominent irrigated rice system in Vietnam. The MRD is responsible for half of the country's total domestic rice production. A vulnerability study conducted in SEA by Yusuf and Francisco (2010) found that 10 provinces in Vietnam belong to the top 25% most vulnerable regions—eight of these are in the MRD. The primary vulnerability in the MRD was found to be risk exposure (Yusuf and Francisco 2010). Specific risks include floods, increased water shortages in the dry season (Snidvongs and Teng 2006), and salinity intrusion near the coastline (IPONRE 2009).

When poor smallholders are hardest hit by climate change, women's and men's ability to secure their livelihoods are affected. There can be different effects on men and women as a consequence of their social roles, inequalities in access to and control of resources, and women's low participation in decision-making (Carvajal-Escobar, Quintero-Angel, and Garcia-Vargas 2008). Gender studies focusing on the Mekong Delta indicate a complex and heterogenous picture. Paris et al. (2009) show that in some districts of the southern provinces, women's contribution to rice production is almost the same as that of men. Slight variations occur depending on the farming system. Women provide 46% of the total labor input in rice-cropping systems, 44% in rice-rice-rice cropping systems, and 48% in rice-upland crop-rice cropping system. In both production systems, family members contribute significantly in savings on labor costs and securing returns on investments. Cultural norms and expectations about gender roles prevail over changes in the division of labor and create additional constraints for women. Aside from women's involvement in rice production, women's livelihoods are highly dependent on natural resources. Livelihoods are heavily threatened by climate change since most women–especially in households in rural areas–mostly have the domestic responsibility for food production, collecting and storing food, fuel for cooking, feeding their families, as well as water for all domestic uses.

According to the UN (2017) policy brief, although many new laws and policies mention the need to integrate gender into planning, in practice, implementation, and collection of sex-disaggregated data relevant for climate change adaptation is still a shortcoming. To date, there has been little focus on how men and women adapt to challenges brought about by climate change. UN Vietnam (2009) mentioned that the productive, reproductive, and community spheres are the three areas where women face challenges from climate change. Thus, it clearly indicates that more women face risks from climate impacts to the agricultural sector. Being food producers, women have high dependency on land and natural resources for agricultural livelihood generation that makes them more vulnerable. Higher risks and greater uncertainty in agricultural production due to change in weather patterns and increased incidence of extreme weather conditions such as droughts, heavy rainfalls, and cyclones/typhoons will directly affect men and women's agricultural activities. In the context of resource scarcity and weather extremes, women are more vulnerable compared to men.

This paper examines the degree to which husbands and wives, within the same rice farming households, perceive and adapt to climate change risks. Findings from this study will be used to recommend gender-responsive policies that will address climate change challenges and provide opportunities for improved gender equality.

Methodology

Selection of study areas

This study was conducted in seven districts located in three provinces, namely, An Giang, Bac Lieu, and Tra Vinh. The study areas were selected on the basis of prior knowledge on climate change issues facing these locations. The climate stresses vary by province. For example, An Giang and Bac Lieu are highly vulnerable to floods, while Tra Vinh is least vulnerable to floods. An Giang is located inland, while Bac Lieu is near the coastal areas, and Tra Vinh is more prone to sea level rise (Tri, Nguyen, and Thanh 2012). Farmers grow rice during three cropping seasons: winter-spring, summer-autumn, and autumn-winter. The prominent cropping system varies by province. Bac Lieu, where farmers adopt rice-rice-rice systems, is prone to floods and salinity. An Giang is also prone to floods with rice-rice-rice systems. In Tra Vinh, rice areas are prone to floods and salinity, and the dominant farming systems are double rice cropping and rice-shrimp.

Selection of respondents

After the villages were selected, a list of farmers with at least 10 years of farming experience was prepared for each commune. Survey participants were then selected using a stratified random sampling procedure with equal numbers of respondents from each village. A total of 214 farming households

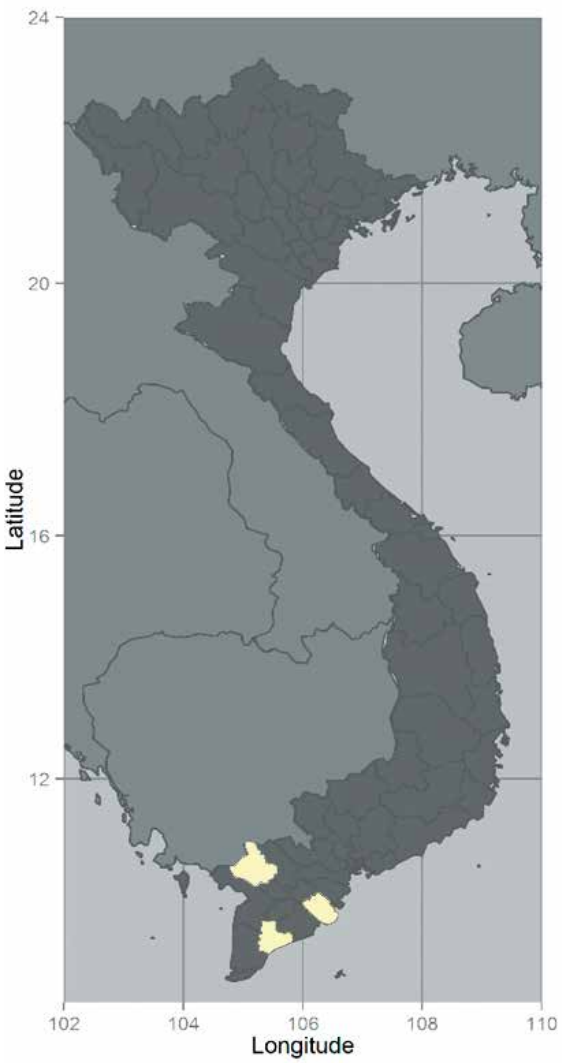

Figure 3.1. Locations of study sites

were selected as respondents: 90 in An Giang, 64 in Bac Lieu, and 60 in Tra Vinh. Data collection during the interview was done using a structured questionnaire consisting of several sections. In the first section, individual characteristics, farm characteristics, and household income were gathered from both husband and wife. The second section gathered information on climate change perceptions, access to climate-change, and other climate change-related particulars. The husband and the wife from each household were separately interviewed, which brings the number of respondents to 428 (214 pairs). The surveys were carried out by the Institute of Policy and Strategy for Agriculture and Rural Development (IPSARD), a local partner of the International Rice Research Institute (IRRI) in Vietnam. The survey was conducted in the three provinces covered by the study from December 2014 to January 2015.

Data analysis

This study applied Kappa statistics (weighted percentage agreement, Kappa estimates, and corresponding P-values) and Pearson Chi-square. The Kappa statistics are often used to examine the significant inter-rater agreement of two or more groups (Viera and Garrett 2005). This estimate fits the dichotomized data, especially to measure whether husbands and wives in the same household have corresponding or diverging perceptions about a jointly experienced phenomenon. Kappa estimates range from negative one to positive one, with a Kappa of one implying perfect agreement and a Kappa of zero inferring agreement by chance or random influence (Viera and Garrett 2005, cited in Ngigi, Mueller, and Birner 2016) an intrahousehold analysis similar to Ngigi, Mueller, and Birner (2016), which used Kappa[1] statistics

[1] As the Kappa estimate increases, the agreement between groups (e.g., husbands and wives) also increases. Viera and Garrett (2005) offer the interpretation of Kappa statistics as: less than 0, less than agreement; 0.01–0.20, slight agreement; 0.21–0.40, fair agreement; 0.41–0.60, moderate agreement; 0.61–0.80, substantial agreement; and 0.81–0.99, almost perfect agreement. A more thorough description of Kappa statistics can be found in Viera and Garrett (2005).

Viera and Garette 2005) The application of Kappa statistics in analyzing gender differences in climate change perceptions and adaptation strategies of the same farming households was conducted in rural Kenya, Africa by Ngigi, Mueller, and Birner (2016).

Results and discussion

Characteristics of respondents

All of the respondents are active in farming, with rice as the main crop grown. The husbands and wives interviewed have been farming for 28 and 24 years, respectively. The results show that the husbands are older on the average (50 years) compared to the wives (45 years). Husbands had more formal schooling (7 years) compared to their spouses (5 years). There are about five members in every household. The average farm size is 2.02 ha. Majority of the farmers own their lands at an average of 1.84 ha, while 0.18 ha are rented.

Sources of livelihood

Farming households diversify their sources of income in response to floods, drought, or salt intrusion. As shown in Table 3.1, farming households derive their income from various sources, but rice income comprises the highest annual income.

Of the total farming households interviewed, 96% derive their income from rice production. The importance of rice for our sample farmers is consistent across all provinces. Variations in other income sources occur across Bac Lieu where after rice, pigs are important (28%), followed by other crops (11%). There are more varied sources of income in Tra Vinh, such as off-farm wages (20%), shrimp sales (17%), pig sales (15%), and sales from other crops (13%). This higher income from shrimp seems to indicate higher profits from shrimps (commercial scale) than rice production. However, income from fisheries (from the river) is more important in Bac Lieu and An Giang than in Tra Vinh. Raising poultry is more practiced in Bac Lieu than in Tra Vinh and less popular in An Giang. It is difficult to separate the incomes of men and women because in Vietnam and in other Southeast Asian countries, incomes from various sources are pooled, and wives manage the family budget. However, in most cases, women have some control over the income from homestead vegetable production, sales from pigs and poultry, and from off-farm wages. Both male and female family members provide labor in different livelihood activities, depending on social and economic status, gender roles, opportunity costs, and access to resources.

Climate variability

Climate change is experienced in the form of climate stress. Thus, the enumerators asked the husband and wife separately about their perceptions or experience on specific extreme climate variability in relation to temperature, rainfall, and sea level rise. Climate stress varies across the provinces in the MRD. Flooding is highly reported as a climate change stress in An Giang, but not in Tra Vinh, while salinity is reported as climate stress in the coastal provinces of Bac Lieu and Tra Vinh. Based on an earlier study of McKinley et al. 2016,

Table 3.1. Sources of income in An Giang, Bac Lieu, and Tra Vinh

	Ang Giang		Bac Lieu		Tra Vinh	
Source of Income	Average Annual Income	% of Households	Average Annual Income	% of Households	Average Annual Income	% of Households
Rice	130.74	99	205.67	95	107.18	93
Other crops	21.36	16	10.43	11	8	13
Pigs	8	2	20.39	28	31.78	15
Poultry	0	0	9.8	8	5.5	3
Fisheries	43.75	4	50	2	0	0
Shrimp	0	0	103.30	5	154	17
Off-farm	45.35	22	22.5	6	22.92	20
Sample N	90		64		60	

Note: Income reported in million VND 1USD =21,800 VND, July 2015
Source: Household surveys (2016)

husbands and wives observed that the most significant changes in climate over the last 10 years are increased temperature and severe drought.

Using Kappa statistics, both husband and wife in the same household have similar perceptions on changes in climate, such as increase in temperature, severe drought, floods, and salinity as changes that affect their livelihood. The highest levels of agreement between husbands and wives are found for floods with a Kappa value of 0.90 (perfect agreement) and salinity with a Kappa value of 0.78 (substantial agreement). Husbands and wives agree that increase in temperature or extreme heat (moderate agreement) and drought (slight agreement) are the climate stresses that they experienced in their areas (Table 3.2). This study finds more agreement between spouses regarding climate change than what was reported in Ngigi, Mueller, and Birner (2016).

Climate change impacts on livelihood

According to respondents who were asked to identify the impacts of climate stress on rice production, the decline in rice yields resulted to decline in household rice food self-sufficiency. Both decrease in rice yield and in livestock production are mentioned as the major impacts of climate stress on livelihood.

Decline in rice yields

To assess farmers' perception on the impacts of climate stress on yields, respondents were first asked if the average rice yields increased, decreased, or did not change. Husbands (70%) and wives (69%) agreed that rice yields decreased due to climate stress. Their responses were followed by another question, "If you observed an increase or decrease, what is the percent change?" Husbands reported an average decrease of 41.37%; this proportion includes 31 husbands who reported total

failure. Similarly, wives reported a mean average decrease of 40.71%, including the response of 22 wives who reported total crop failure. The distribution of reported yield decreases is shown in Figure 3.2. The figure shows the density (i.e., percent of sample) on the Y-axis and the reported percent loss in rice on the X-axis. There are no gender differences in perceptions on extent of crop loss as the two densities trends are almost identical.

Decline in household rice sufficiency

Of the 214 households surveyed, a high percentage (78.97%) reported keeping rice for home consumption. Of these households, husbands (88.76%) and wives (85.80%) reported self-sufficiency of rice during normal years. However, lower rice yields or complete crop loss due to climate stress have led to a decline in household rice sufficiency. Wives reported longer days (32 days) of rice deficit during times of stress, while husbands reported shorter days (23 days). The consequences of this loss of rice self-sufficiency can be serious, particularly if the households are unable to compensate for these losses by purchasing rice from the market. Decreased food security can have negative consequences on the well-being (health and nutrition) of the members of the household. Although farmers borrow money for purchasing inputs during normal years, they tend to borrow more frequently after a flood or drought. Consequently, they fall deeper in debt.

Table 3.2. Intra-household perceptions of climate change

Climate Indicator	Husbands (% Yes)	Wives (% Yes)	Difference (%)	Chi-square	Agreement (%)	Kappa
Increase in temperature	66.36	67.29	0.93	52.29***	77.57	0.49***
Severe drought	57.48	53.27	4.21	20.85***	65.89	0.31***
Floods	44.39	42.52	1.87	175.50***	95.33	0.90***
Storms	12.62	9.81	2.81	9.06***	84.11	0.20***
Salinity	48.60	46.73	1.87	128.81***	88.79	0.78***
Drought	57.48	53.27	4.21	20.85***	65.89	0.31***
Heat	66.36	67.29	0.93	52.29***	77.57	0.49***
Sea level rise	6.54	11.21	4.67	9.03***	86.92	0.20***
None	0.93	0.93	0.00	0.02	98.13	-0.01

*Note: '***', '**', and '*' are significant at the 1%, 5%, and 10% levels, respectively.*

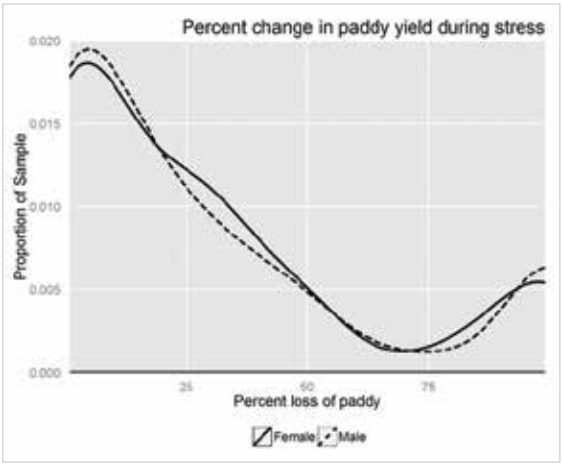

Figure 3.2. Reported decrease in rice yield by respondents

Decline in livestock production

Both men (31%) and women (32%) respondents reported that livestock production declined due to climate stress because the incidence of livestock diseases increased. Moreover, there is low or non-availability of green fodder for large animals during drought, extreme hot weather, and high incidence of diseases during floods. In fact, the low proportion of household income from sales of livestock can be attributed to the climate risks, which easily lead to livestock mortality. Decline in pig and poultry production affects women more than men because women take full responsibility for almost all of the pig and poultry management activities.

Gender division of labor in rice production

The major reason for the similar perceptions between men and women on extent of rice crop loss can be attributed to the active labor participation of women in rice production. In south Vietnam, women and men have distinct, but not necessarily rigid, tasks and responsibilities, which often vary by crop and activity. In some activities in smallholder farming systems, the wife and the husband share the same task to a greater or lesser degree. The wife can also take over the task of the husband in cases of outmigration. A general trend is that men are involved in what are culturally defined as heavy tasks, such as land preparation (particularly tillage), irrigating the fields, broadcasting chemical fertilizer, spraying pesticides, threshing (mechanical), and hauling farm produce. Women are predominantly involved in pulling seedlings, transplanting, re-sowing/gap-filling, and weeding. Although irrigation and spraying of pesticides are traditionally men's responsibilities, women also perform these tasks when men are not available (Paris, Chi, and Rola-Rubzen 2009). Harvesting is usually jointly conducted by men and women when it is not mechanized. Women conduct the majority of farm activities such as seed cleaning, selection, and storing seeds for the next cropping season, as well as cooking rice for daily meals or processing glutinous rice into delicacies for additional income.

Coping strategies

Even though husbands and wives have similar perceptions on climate change and climate stress, adaptation strategies may vary between the two, particularly when distinctions are made between farm and household financial adaptation strategies.

Farm-related coping strategies

A greater consensus was observed between husbands and wives regarding the change in farm-level coping strategies. (Table 3.3). Using a different rice variety is the most common coping strategy reported by wives (46.73%) and by husbands (44.4%). Do nothing or bearing/accepting the losses was reported more by husbands (45.79%) than by wives (39.25%). Husbands and wives leave the lands fallow due to floods, drought, or salinity. More husbands (19.6%) than wives (15.4%) change cropping pattern as a coping strategy.

While the responses in Table 3.2 show similar perceptions on climate change between husbands and wives, there is less agreement on farm-level strategies in response to climate change as shown in Table 3.3. The only Kappa value with fair agreement is the response for leaving the ground fallow. The Kappa value for changing the cropping pattern and changing from crop to livestock are both significant, but the magnitude only shows slight agreement. Overall, Table 3.3 shows that there are gender differences between husbands' and wives' responses to farm-related coping strategies in response to climate change stress.

Individual coping strategies

Respondents were asked how they cope with the negative impacts of climate stress. Table 3.4 shows the coping strategies by the husbands and wives. The majority of the respondents did nothing to cope with the negative impacts of climate stress. A higher proportion of husbands (56.1%) than wives (38.3%) prefer not to do anything in times of stress or after stress. The coping strategies cited by the husbands include reducing food/

Table 3.3. Intra-household differences in farm-level coping strategies

Change made	Husbands (%)	Wives (% Yes)	Difference (%)	Chi-square	Agreement (%)	Significant Kappa (P-value)
Change cropping pattern	19.6	15.4	4.2	2.82*	74.30	0.11**
Change rice variety	44.4	46.7	2.3	0.99	53.74	0.07
Change from crop to livestock	5.6	2.8	2.8	8.97***	93.46	0.19***
Diversify crops	3.7	2.3	1.4	0.19	93.93	-0.03
Grow fodder crops	1.4	0.9	0.5	0.03	97.66	-0.01
Relocate field	0.9	0.00	0.9	-	99.07	-
Leave the field fallow	19.6	11.2	8.4	20.44***	81.31	0.29***
Do not do anything	45.8	39.3	6.5	0.99	54.21	0.07

*Note: '***', '**', and '*' are significant at the 1%, 5%, and 10% levels, respectively.*

Table 3.4. Intra-household differences in coping strategies

Change made	Husbands (%)	Wives (% Yes)	Difference (%)	Chi-square	Agreement (%)	Significant Kappa (P-value)
Do nothing	56.1	38.3	17.8	11.59***	59.81	0.22***
Reduce consumption	26.6	30.4	3.7	18.20***	71.03	0.29***
Sold land	0.9	0.9	0.0	0.02	98.13	-0.01
Sold livestock	6.1	9.4	3.3	13.85***	89.25	0.25***
Sold assets	0.9	0.0	0.9	-	99.07	-
Friends' assistance	2.3	3.3	0.9	4.53**	95.33	0.14**
Gov't assistance	15.0	15.9	0.9	17.23***	81.31	0.28***
NGO-assistance						
Bank loan	21.5	27.6	6.1	7.43***	69.63	0.18***
Loan other	2.8	8.9	6.1	12.90***	91.12	0.21***
Delayed loan payment	0.9	4.7	3.7	9.31***	95.33	0.15***
Worked more	21.5	21.0	0.5	1.19	64.02	-0.07
End child school	0.5	0.5	0.0	0.01	99.07	-0.01
Use savings	12.7	22.0	9.3	30.31***	81.31	0.36***

*Note: '***', '**', and '*' are significant at the 1%, 5%, and 10% levels, respectively.*

rice consumption (26.6%), securing bank loans (21.5%), and working more (21.5%). The wives cited reducing consumption (30.4%), securing bank loans (27.8%), using savings (22.0%), and working more (21.0%). Although both husbands and wives have similar coping strategies, only the wives mentioned using up their savings, which indicates that women tend to keep money or save in anticipation of any family emergency including loss of income due to floods or drought, illness, or death.

It should be noted that more wives borrow money from informal sources. In this particular case, the male household head may not be aware of the wife's use of financial strategies. It can be assumed though that wives borrow from informal moneylenders who impose high interest rates, or from friends, relatives, and other people within their social network. Borrowing money also puts more pressure on wives to repay their debts, thus requiring them to work more to earn income. Although not common, selling livestock (small animals and poultry) is a coping strategy of wives more than husbands.

In Table 3.4 Kappa estimates were used to determine the level of agreement between spouses in each household on the coping strategy in response to climate change risk. Husbands and wives have fair agreement in reducing consumption (Kappa P-value 0.29), getting loans from informal sources (Kappa P-value 0.21) and using savings

(Kappa P-value 0.36). These results reaffirm that while perception of climate change stress and perceived impacts of climate change stress are quite similar between husbands and wives, individual coping strategies on financial strategies, such as getting loans from informal sources, delaying repayments, and using savings, are done by women more than men.

This finding is consistent with the fact that majority of women in south Vietnam make household decisions, such as food expenditures, savings, selling of small animals, borrowing from informal sources, and reduction of food consumption (Chi et al. 2013).

Access to information

Cropping pattern and weather forecast

A higher percentage of husbands (81%) than wives (76%) reported that they have access to information on improved cropping patterns and agronomic practices. Although the gap is small, more wives who are farming should be encouraged to participate in agriculture-related training programs. The gap is smaller with regard to information on weather forecast (98% for husbands and 93% for wives). This small gap can be attributed to the use of public loudspeakers in the village for disseminating information, particularly on extreme weather forecasts. Weather forecasts allow farmers to make well-informed decisions on farming practices, which lower their vulnerability to climate change.

Farm-related information

Aside from their husbands, wives generally obtain farm-related information from social networks, relatives, their associations and other women in the village. A study of Chi et al. (2008) which analyzed the factors affecting the uptake of an Integrated Pest Management package (Three Reductions, Three Gains) in 13 provinces in the Mekong Delta, indicated that the poor involvement of women in training sessions hurt adoption rates.

Desired training needs

Respondents were asked what future trainings they want to enhance their skills for better adoption of technologies and practices. Husbands and wives mentioned pest management (79% husbands and 70% wives); the husbands also mentioned training on crop production, crop and resource management (seed, nutrient, water, pests), and animal management. The wives, on the other hand, mentioned training on seed health, crop production, and animal management, in addition to pest management.

Climate-smart agriculture (CSA) technologies and practices to cope with climate change stress

In the future, climate change is likely to provide increased challenges in agriculture. Several potential climate-smart agriculture (CSA) technologies and practices were presented to the respondents (Table 3.5). These technologies and practices are being introduced by the Department of Agricultural Research and Development.

Table 3.5. Perceptions on the acceptability of CSA technologies and practices

Technologies and practices	Husbands (%)	Wives (%)	Difference
Stress-tolerant varieties	90.57	85.71	4.85
Improved cropping system	20.28	19.52	0.76
Changes in varieties	70.14	61.43	8.71**
New land management techniques	23.11	15.71	7.40**
Efficient water management	15.57	6.67	8.90***
Pest and disease management	67.92	42.38	25.54***
Disease and pest resistant varieties	14.22	3.33	10.88***
New livestock breeds	2.37	0.48	1.89*
Animal health management	11.79	3.35	8.44***
Change in cropping calendar	45.28	36.19	9.09**
Change in input use	63.98	34.76	29.22***
Crop rotation	15.79	5.71	10.08***

*Note: *, **, and *** are significant at the 10%, 5%, and 1 % levels, respectively.*

Respondents were asked to indicate if the technology is acceptable or not. The use of stress-tolerant rice varieties is most acceptable technology for both husbands and wives. The next commonly cited technologies and practices relate to changes in varieties and input use and to pest and disease management. Respondents are least interested in coping strategies related to livestock, which is expected, because only a small proportion of respondents is engaged in livestock production. Excluding those related to livestock production, the coping strategies can almost be viewed as sorted from the least labor-intensive to the more labor-intensive coping strategies. For example, shifting to the use of stress-tolerant rice variety, wherein the technology is embedded in the seed, essentially entails no additional input from the farmer. However, practices such as changing land management or pest and disease management will have a more-intensive learning curve and, in many cases, may even involve additional labor inputs from the farmer. The results may indicate that farmers are interested in optimizing their time inputs in climate-change coping strategies.

There is a wide gap between husbands' and wives' acceptability or non-acceptability of CSA technologies and practices (e.g., pest and disease management and changes in input use). The largest difference, significant at 1% level, between husbands and wives are related to changes in input use (29.2%) and pest and disease management (25.54%). Other examples of differences significant at 1% level include efficient water use, disease resistance and insect resistant varieties, animal health management, and crop rotation.

Conclusion and recommendations

There are no gender differences between husbands and wives with regard to perceptions of climate change, based on the data gathered

in this study. That both husbands and wives have similar perceptions of climate change risks is not surprising because women are also actively engaged in rice production, postharvest, and marketing. Although men are more likely to do nothing in response to climate change, women are more actively engaged in financial strategies such as getting a bank loan, using savings, or delaying a loan payment. Thus, women should be encouraged to actively join women-only groups, which are likely to be effective pathways for women's empowerment, nurturing self-confidence, as well as strengthening women's intra-household bargaining power, particularly in the face of gender inequity. Local policies should aim at promoting agriculture-based income-generating activities for women so that they can increase their resilience to climate change.

In general, the CSA technologies and practices that are highly acceptable are use of stress-tolerant varieties, change in varieties, pest and disease management, change in input use and change in cropping calendar. There is a gap between husbands' and wives' acceptability of CSA technologies and practices. Women's lower acceptability of CSA technologies and practices can be attributed to their lack of awareness of the benefits of these technologies and perception that these technologies require high input costs. Despite the significant contributions that women in south Vietnam make to rice production, the design and transfer of agricultural technology and extension services are performed with a male farmer in mind, thus leaving women's specific roles and needs along the rice value chain unaddressed. Current agricultural extension workers dealing with CSA technologies and practices for rice production and improved livestock management do not automatically include women as direct recipients of training programs. To facilitate adaptation of CSA practices by both men and women, much greater effort is needed to ensure that gender issues are addressed and integrated into the design of policies, programs, projects, and other research activities.

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Chapter 4

Gender and Climate Change Adaptation: A Case Study of Flood-Prone Rice-Farming Villages in Bulacan, Philippines

Julie Ann Basconcillo

Chapter 4

Gender and Climate Change Adaptation: A Case Study of Flood-Prone Rice-Farming Villages in Bulacan, Philippines

Julie Ann Basconcillo

Introduction

For millions of Filipinos, rice is life (Castillo 2006). Rice is the staple food for about 89% of the population of the Philippines and is the source of income and employment for about 12 million farmers and family members (FAO 2007). However, there are threats to the rice industry. The Philippines is exposed not only to tropical cyclones, especially in the northern and eastern parts of the country, but also to many other climate-related calamities such as floods (e.g., in Central Luzon, Bicol, and Southern Mindanao), landslides (due to the terrain of the country), and droughts. According to 2014 Philippine Atmospheric Geophysical, and Astronomical Services Administration (PAGASA) data, an average of 20 typhoons enter the Philippine area of responsibility annually. About 10 of these have combined strong winds and rainfall, which can disrupt agricultural production and cause damage to infrastructure. Climate change scenarios for the Philippines (Lasco et al. 2011; Lasco et al. 2008) predict adverse environmental and socioeconomic consequences, including greater frequency and intensity of heat waves, droughts, floods, and typhoons; altered ecosystems; reduced output and productivity of the agriculture, fisheries, and forestry sectors; livelihood losses; food insecurity; diminished water supplies; and heightened incidence of certain diseases.

Studies show that the ability to cope with and the capacity to adapt to climate change vary across countries and social classes, where the poor and women will be hardest hit by climate change (IPCC 2007). Climate change impacts will be more severe on women than on men because of their different roles in society due to gendered norms and women's socioeconomic status vis-à-vis men (Brody, Demetriades, and Esplen 2008; Lambrou and Piana 2006). In Southeast Asia (SEA), the family farm is jointly managed as both husband and wife contribute to the family plot. In Sub-Saharan Africa, husbands and wives farm their own plots separately without pooling resources (Quisumbing 2003). It is important to find out whether men and women in SEA have similar or different perceptions of climate change, which can influence adaptation strategies. Thus, this study was conceptualized to assess whether men and women have similar or difference in perceptions of climate change and coping strategies in response to climate change risks in flood-prone rice farming villages in Bulacan, Philippines.

Methodology

Selection of study areas

The research was carried out in two villages in San Rafael, Bulacan. While many municipalities in Bulacan are more prone to flooding, San Rafael was chosen because of its proximity

to the other project sites of the International Rice Research Institute (IRRI) on climate change mitigation. Alternate Wetting and Drying (AWD) technology, a water-saving technology, was being demonstrated and implemented in nearby irrigated rice farming villages. The initial idea was to organize and build climate-smart communities where both adaptation and mitigation projects in rice-based production systems could be implemented.

San Rafael is situated in the northwestern part of the province of Bulacan. It is politically subdivided into 34 villages, covering 16,525 ha of land area, and is predominantly an agricultural town. Rice is the primary crop from which the majority of the people derive their incomes. Secondary crops include corn, root crops, mango, and vegetables, while livestock raising and poultry production are the other sources of income in the municipality. San Rafael covers 2,900 ha of ricelands, of which 37% are irrigated. Two of the irrigated rice farming villages, namely Pulong Bayabas (about 160 ha) and Pansumaloc (144 ha) were selected for this research (Figure 4.1).

The climate in San Rafael, Bulacan consists of two pronounced seasons, wet and dry. The wet season starts in May and ends in November. July and August are the wettest months. Pulong Bayabas and Pansumaloc form part of the Candaba swamp, which absorbs most of the flood flows from the Pampanga River Basin. During the wet season, farmlands as well as residential areas are submerged for a couple of days. Based on the tropical rainfall measuring mission data from NASA (2012), rainfall has become more frequent and intense in San Rafael. The highest deviation of cumulative monthly rainfall from the normal sum for the 10-year period 2003-2012 was recorded in August 2012. Severe flooding was experienced in six of its villages from September to October 2009 and in September 2011 and August 2012. Based on PAGASA (2014) data, about 8 tropical cyclones passed over 100 km radius of San Rafael from 2000 to 2013, and 20 from 1980 to 2014.

According to NASA (2012), during the 2012 wet season, about 352 ha of rice fields (equivalent to 12% of the planted area of the

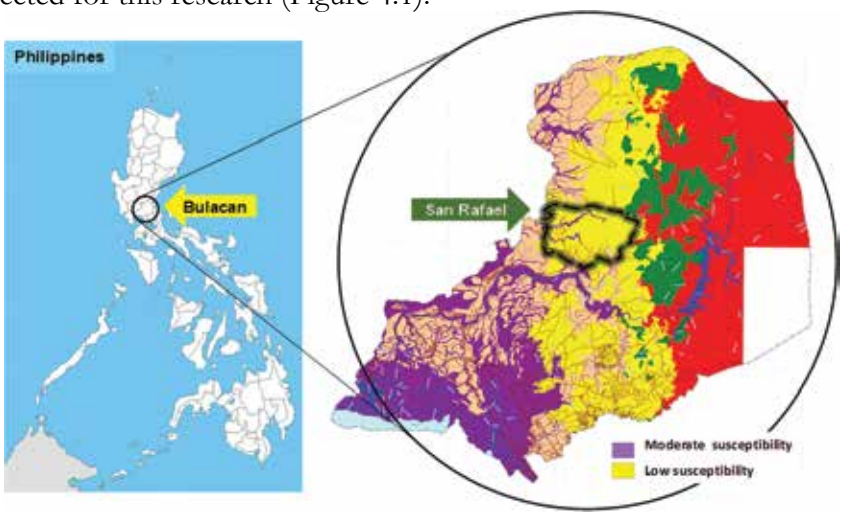

Figure 4.1 Location of study sites in San Rafael, Bulacan

Source: Preliminary Flood Hazard Map of Bulacan. Bulacan Provincial Risk Reduction and Management Council (PDRRMC)

whole of San Rafael) were totally damaged by monsoon rains. These damaged rice fields comprised 83% and 64% of the planted areas of Pulong Bayabas and Pansumaloc, respectively. The two villages suffered the highest loss–average yields were 2.4 t/ha and 2.5 t/ha, respectively, which are below the municipality average (4.9 t/ha). This could have significant repercussions on the food security of the villagers.

The participants

The participants in several activities such as focus group discussions (FGDs), surveys, and scoping meeting were drawn from the list provided by the Municipal Agricultural Office. The list contains the names of the individuals under whose names the farmlands are registered (i.e., landowners). Based on the list, there are 101 landowners in Pulong Bayabas (25 of which are women) and 120 in Pansumaloc (34 women). Several of them, however, are not farmer-cultivators in the strictest sense. Some had migrated to other municipalities and hired farmer-laborers (i.e., leaseholders) to tend the farms. Since the focus of this study are rice farmers, the respondents for the survey are composed of both the landowners and leaseholders (whose names are therefore not in the list). The respondents, composed of 56 farming households from Pulong Bayabas and 51 from Pansumaloc, were selected by random sampling. Officers and some members of the irrigators' association, as well as the agricultural and irrigation technicians assigned in the two villages, participated in the FGDs.

Data gathering

This study used a combination of FGDs and surveys. The surveys were conducted in September 2013, using pretested structured questionnaires. The questionnaires consisted of household profile, farm profile, labor input in rice activities, knowledge and perceptions of and attitudes toward climate change and variability, impact, risk-coping and adaptation options, farming technologies and practices, and institutional support. The respondents consisted of 116 women and 120 men from rice farming households.

Data analysis

Rice production operations were grouped into the following categories: land preparation, crop establishment, crop care and management, and harvest and postharvest. Frequencies and percentages of responses were computed to assess whether there are gender differences in perceptions on climate variability, impacts of flooding events, adaptation and risk-coping strategies, access to resources, information and services, and knowledge and awareness of climate change and variability.

Results and Discussion

Profile of respondents

The characteristics of the men and women farmers interviewed were almost the same. Men and women were of the same age (55 years old) and attended 8 years of formal school. There are 5 family members on the average, and average farm size per household is 1.5 ha.

Production system

Pulong Bayabas and Pansumaloc are two of the irrigated rice farming villages within the Angat-Maasim River Irrigation System (AMRIS). Two croppings of rice are done per year, reflecting the pattern of distinct dry and wet season in the region (Climate type I). Wet-season rice cropping is between June and November, and the dry-season rice cropping is between November and April. In recent years, AMRIS has promoted the adoption of Quick Turnaround program in selected areas, enabling farmers to increase their annual production by triple cropping (Figure 4.2a). Most farmers grow short-duration varieties and high-yielding varieties, such as NSIC RC216, NSIC RC222, PSB RC-10 and PSB RC 82. For example, NSIC RC222 has potential yields of 6.1–10 t/ha. Only a few farmers use hybrid varieties such as Bigante and other varieties. Half of the respondents are owner-cultivators and the other half are tenants to an average farm size of 1.5 ha.

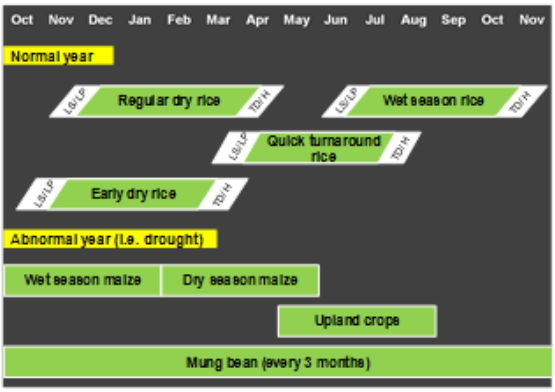

Figure 4.2a. AMRIS cropping calendar, 2012–2013

Note: PA=program area, LS=land soaking, LP=land preparation, TD=terminal drainage, and H=harvest

Since 2009 cropping season, there has been huge gap in rice yields between dry-and wet-season crops. For both villages, the 5-year average yield during the wet season is 2.4 t/ha only, which is half of the dry-season yield of 5.3 t/ha. During the wet season, the yield trend showed erratic movement over the years, which can mainly be explained by climate variability, including extreme events such as typhoons and excessive monsoon rains, which have markedly reduced rice yields in these two villages (Figure 4.2b).

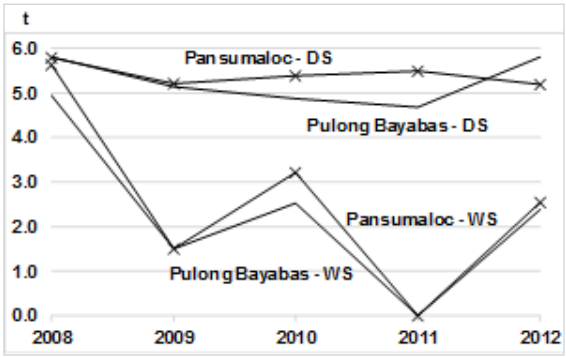

Figure 4.2b. Average rice yields in tons per hectare

Note: PA=program area, LS=land soaking, LP=land preparation; TD=terminal drainage, and H=harvest; WS=wet season, D=dry season

Gendered perceptions of climate change

Understanding how farmers perceive climate change risks and how it affects their willingness to adopt adaptation practices is critical in developing effective climate change response strategies for the agricultural sector.

In this study, men and women among rice-farming households experienced climate change in weather patterns (i.e., changes

in temperature, rainfall, and occurrence of tropical storms and weather-related shocks/extreme events such as drought and floods). The respondents were asked separately about their perceptions of the extreme weather events they experienced in the last 10 years, including change in temperature (early water stress and increase in temperature), change in rainfall (more intense, more frequent and long-duration rainfall, early arrival of southwest monsoon), change in occurrence of tropical storms (more frequent, stronger, and unpredicted), and change in extreme events (deeper, flash-, and longer-duration floods, and drought). There are no distinct differences between the perceptions of men and women who experience the changes and variability in climate change (Table 4.1). This is expected because lowland rice farming in Central Luzon, Philippines, is normally managed by the family particularly the husband and wife (Tisch and Paris 1994; Paris, Dayo, and Malasa 2004). Thus, they experience the changes in extreme temperature (i.e., extreme heat and drought), heavy rainfall, and tropical storms that cause flooding and affect rice production and other sources of livelihoods.

Table 4.1. Percent of men and women reporting climate change and variability

Climate change and variability	Women (%)	Men (%)
Change in temperature		
Early water stress	62	59
Increase in temperature (hotter)	50	54
Change in rainfall		
More intense rainfall	48	53
More frequent rainfall	31	38
Early arrival of southwest monsoon	41	51
Change in occurrence of tropical storms		
More tropical storms	55	59
Stronger tropical storms	59	57
Unpredicted tropical storms	44	45
Change in flooding		
Deeper flooding	59	64
Flash flooding	49	52
Longer duration of flooding	38	45

Note: No. of samples=116 Women and 120 Men

Sources of income

Household surveys showed that farming households in these flood-prone areas are engaged in diverse sources of livelihood. Rice farming is the major source of income (70%), and the remaining 25% of total household income comes from non-farm sources: self-employment (10%), salaried jobs (7%), pension and remittances from relatives abroad (5%), and other jobs such as welding and construction (3%). Self-employment refers to management of small retail stores, tricycle driving, and trading of goods. The rest comes from livestock (3%), employment as hired farm labor (1%), and vegetables (1%).

Thus, when floods or drought occur, the major sources of income from rice production, livestock, and off-farm wages will be adversely affected.

Labor participation of men and women in rice farming

Gender differences in perceived climate changes are often attributed to the distinct work men and women do, which are largely dictated by gender norms (Brody, Demetriades, and Esplen 2008). Thus, it is important to understand whether there are distinct gender roles within a given rice production system. As described earlier, farmers in San Rafael grow rice during the wet and dry seasons. Rice farming is a labor-intensive and a risky enterprise. As reported by both men and women, they experience increase in temperatures, as well as changes in rainfall, tropical storms, flooding, and early water stress. These stresses affect rice production as well as the men and women who provide labor. Since rice production is seasonal, all the farm activities should be performed on schedule. The sequential activities are grouped into four categories: land preparation (seedbed preparation including sowing, plowing, harrowing, and levelling); crop establishment (transplanting, direct seeding, pulling, and hauling seedlings into the field and gap-filling); crop care and management (weeding, applying fertilizer, irrigating/draining the fields, applying chemicals such as pesticides and fertilizer); and harvesting and postharvesting (harvesting, threshing, hauling, and milling). To meet the schedule, family members (male and female) work on their own farms, as well as in other farms. Thus, it is important to know who provides labor in rice activities and whose labor is affected due to climate stress.

In this study, participation is counted if one (male or female) respondent provides labor in at least one of the rice farming activities. As shown in Figure 4.4 land preparation, crop establishment, and crop care are predominantly done by men. Men and women share harvesting activities (Figure 4.3).

Labor activities during crop establishment show that pulling of seedlings and transplanting are no longer practiced. Farmers shift to direct seeding when seedlings die due to late rains. With the adoption of direct seeding, women's participation has declined as men have taken over this activity. Nonetheless, when flood occurs and rice seedlings get swept by the floods, there is a need for gap-filling sowing to sustain rice yields. This is when women are

able to contribute their labor, i.e., through re-sowing. Crop care (spraying pesticides and broadcasting chemical fertilizer) are predominantly done by men (Figure 4.4). In harvesting, both men and women are involved. An interesting change in rice farming has been the reliance on hired labor, particularly for weeding, application of fertilizer (organic and inorganic), irrigating the fields, and hauling of harvest.

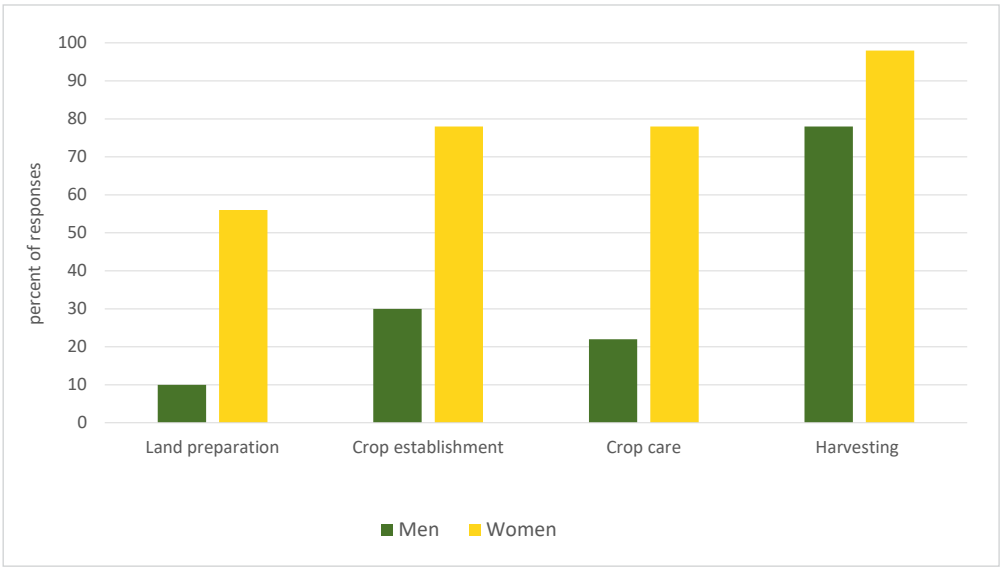

Figure 4.3. Labor participation of women and men in rice production

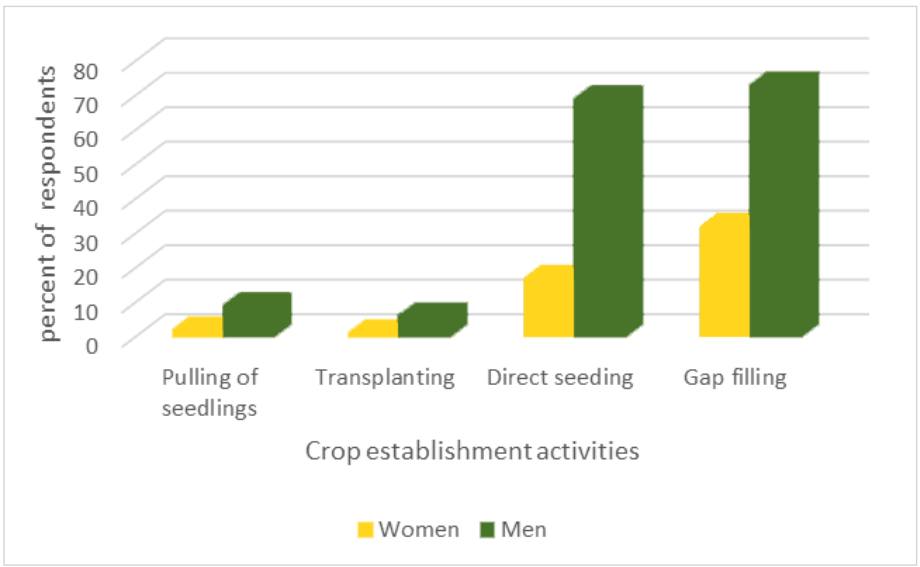

Figure 4.4. Labor participation of women and men in crop establishment in rice production

As presented earlier, women provide labor in farm activities, although their share is relatively lower compared with men. Women are also engaged in non-field, rice-related activities such as seed selection, purchase of inputs (pesticides and fertilizer), seed preservation, and selling of produce (Figure 4.5). These findings reveal that women have important roles to play in non-field, rice-related activities. Thus, their knowledge can be further enhanced if they are involved in training activities on management of improved seeds, amount and timing of application of fertilizer and pesticides, improved seed health, and if they can have access to information on paddy prices in the market.

Impact of flooding events

Men and women were asked separately how flooding has affected them (Table 4.2.) Although both men and women reported that they were highly affected in terms of crop loss and low yields, the men (89%) appeared to be more affected than the women (72%).

Since 2009 cropping season, there has been a huge gap in rice fields between the dry and the wet seasons. For both villages, the 5-year average yield during the wet season was 2.4 t/ha, which is only half of the dry-season yield of 5.3 t/ha. Flooding events lead to rice crop loss and low yields, which in turn affect food availability and potential income from rice sales. Since rice is the staple food and the only major source of income of poor farming households, they will suffer due to decreased food (rice) security and loss of income.

More men (57%) reported increased workload on the farm than women (26%) because they drain the fields in times of flooding. During drought, men have to cultivate and irrigate the fields more frequently. Nonetheless, flooding also increases women's labor input. When flood or drought occurs during the crop

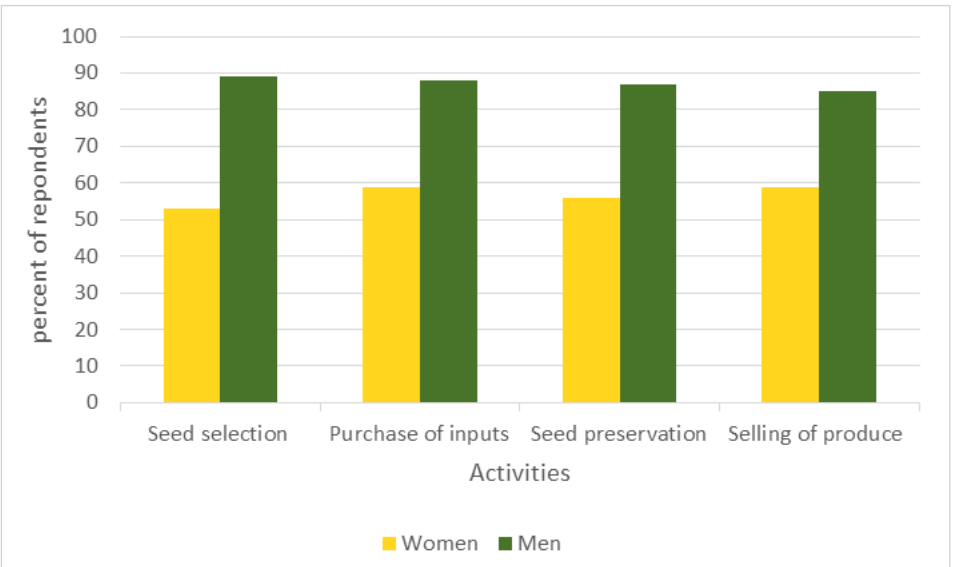

Figure 4.5. Labor participation of women and men in seed selection, purchase of inputs, seed preservation, and selling of produce

Table 4.2. Self-perception on impacts of flooding events on men and women

Impacts	Women (%)	Men (%)
Rice crop loss and low yields	72	89
Increased workload in the farm	26	57
Pressure to hire labor and machines	21	19
Increased workload at home	50	17
Increased pressure to seek other income	13	9
Increased indebtedness	22	19
Pressure to acquire loans	11	12
Pull children out of school	14	8
Increased health problem	22	9
Decreased quantity of food	15	13
Decreased quality of food	12	9
Increased pressure to provide food	7	15
Less available drinking water	14	10
More stressed/ anxious	19	13

Note: No. of samples= 116 Women and 120 Men

seedling phase, the women have to replant new seedlings between spaces to reduce crop loss or to maintain rice yields.

Based on gender role, a higher proportion of the women (50%) experienced increased workload at home. Women's workload includes doing household chores, taking care of children, and ensuring availability of quality food and drinking water. After a flood, women have to do more household chores, such as cleaning and washing dirty clothes. During typhoons when there is no electricity or gas, the burden of cooking food is borne by women—they also have to keep non-perishable food. Women and children suffer from health problems such as diarrhea and infectious diseases due to contaminated water and poor sanitation. Aside from increased health problems, both men and women experience decreased quantity and quality of food, but men are more pressured to provide food for the family. The workload of women to take care of pigs and poultry also increases after flooding. On the other hand, extreme drought may exacerbate existing water shortages.

Adaptation measures and risk-coping strategies[1]

Although the study shows that men and women have similar experiences on climate variability, their adaptation measures and risk-coping strategies differ, depending on their access to and/or control over resources and their participation in the decision-making process.

[1] Shorter term plans to overcome immediate challenges do not always take into account the longer-term consequences. Coping strategies help men and women to get by, but if they are exposed to the same climate conditions in the future, they will still likely be adversely affected.

Using the Wilcoxon-Mann-Whitney test to compare the ranked sum of adaptation measures and risk-coping strategies between genders, statistical differences were found in men and women's risk-coping strategies, namely, building dikes at 1% level, and re-sowing or gap-filling, and acquiring loans both at the 10% levels (Table 4.3). Majority of the respondents (70% women and 82% men) would customarily engage in re-sowing or gap-filling when floods or typhoons damage their rice crops, and store food and other necessities in anticipation of floods. During the interview, each respondent was asked whether he or she was involved in rice production activities. Only 22% of the women respondents said that they participate in rice production; however, 70% said that they are involved in re-sowing/gap-filling. These results reveal that when flooding occurs, women's labor participation increases. It can be gleaned from the data that the women are underreporting their participation or undervaluing their labor contributions as unpaid family members. Although changing rice variety was mentioned by a few men and women respondents, this practice remains to be promoted by providing farmers access to good-quality seeds of stress-tolerant varieties.

A higher proportion of men (40%) than women (28%) acquire loans (mostly from formal sources, e.g., farmers' cooperatives and irrigators association). Both men and women borrow from private moneylenders, friends, and relatives to buy new seedlings and pay for the labor required in re-sowing, settle any existing debt, and cover other household expenses. About 28% of the wives get loans from formal sources, such as cooperative

Table 4.3. Adaptation measures and risk-coping strategies often practiced (% of responses)

Adaptation and risk-coping options	Women	Men
Crop and natural resource management		
Change rice variety	18	22
Resow/Gap-filling*	70	82
Build higher dikes ***	1	19
Financial services and credit access		
Use savings	56	64
Acquire loan*	28	40
Seek support from relatives and friends	26	36
Human and social capital		
Reduce food consumption	21	23
Secure all valuable properties in elevated place	41	42
Store food and other necessities	71	70
Spend less	38	42

*Note: *** and * indicate significance level at 1% and 10%, respectively.*
No. of samples=116 Women and 120 Men

irrigators' association and banks. Beyond the gender-differentiated strategies, men and women do not have access to credit. The majority of the respondents do not borrow money from formal sources due to lack of necessary documents.

Utilizing savings is also a common practice among the respondents, albeit not statistically different between genders. This is not surprising because in the Philippines, husbands and wives have joint savings and assets. Furthermore, they often consult each other in whatever strategies they want to adopt in response to climate change. More men than women seek support from relatives and friends during times of crises.

This could partially explain the practice of selling rice originally meant for household consumption. However, this practice makes households vulnerable to food insecurity as they have to buy rice in the future, at a possibly higher price. Reducing food consumption, rice in particular, is also one way of extending the remaining stock of rice. Spending less, particularly on consumer durable goods and other items, is also a strategy mentioned by both men and women (Table 4.3).

Seeking government support and insurance programs is seldom practiced. While agricultural extension promotes insurance programs, farmers admit that they apply for crop insurance because of free premiums provided by the Philippine Crop Insurance Corporation to encourage farmers to apply for crop insurance.

Despite the risks faced by farmers, leaving the land fallow or changing the cropping calendar is not an option for them. Seeking alternative livelihoods, migrating, and selling assets and mortgaging lands are not in the list of options either. Raising livestock or poultry is seldom practiced due to lack of capital.

Men and women's access to information

There is a big gender gap in access to information on improved practices in rice production (agronomic and use of new farm machinery). This is due to the lower attendance of women to seminars, workshops and training on these topics (Table 4.4). These findings suggest that women have other means of gaining access to information, despite their low attendance in seminars, workshops, and trainings compared with men. More than 40% of the women said that they usually get information on from government agencies, such as the Philippine Rice Research Institute in Nueva Ecija and the Municipal Agricultural Office. Another 40% obtain information from radio and television, and 10% from fellow farmers. Among men, more than 40% said that they source their information from government agencies, another 32% from radio and television, and 15% from fellow farmers. A higher percentage of men more than women obtain information from fellow farmers, perhaps because more men are members of farmers' cooperatives.

Despite women's low attendance to seminars, workshops, and training programs, they have access to information on farm practices through their husbands who attend meetings on behalf of their households.

Table 4.4. Men's and women's access to information and services

Access to information	% of Women	% of Men
Improved practices in rice production		
Improved agronomic practices in rice production	73	94
Use of new farm machinery	74	93
Attendance in seminars, workshops and training which focus on:		
Improved agronomic practices in rice production	42	84
Use of new farm machinery	44	82

Note: No. of samples=116 Women and 120 Men

Women's participation in demonstration trials for new rice varieties is very low. Moreover, although about 60% of the women participate in seed selection and seed preservation (see Figure 4.5), agricultural extension personnel do not invite women to seminars, workshops, and training programs unless researchers explicitly require their involvement. Gender biases within institutions are still prevalent among the extension staff themselves, even if there are more women agricultural extension staff.

Knowledge and awareness of climate change and variability

While climate-smart agriculture (CSA) practices can help smallholders adapt to climate change, these farmers also need good quality and timely climate information from reliable sources in order to adopt such practices. A high percentage of the respondents mentioned that they have observed changes and variability in the climate in the past 30 years. Yet, only 64% of the women and 77% of the men knew the term "climate change" (Table 4.5). This suggests that an experience or simply a perception of climate change does not necessarily imply knowledge of the term. Television is the main source of information on climate change and variability. About half (52%) of women and less than half (49%) of men respondents obtained information from the radio. In general, households have access to electricity.

Summary and conclusion

Men and women have similar perceptions of climate change risks. This is expected because lowland rice farming in Central Luzon, Philippines is normally managed by the family particularly the husband and wife. Consequently, both suffer from the negative effects of climate change, such as yield reduction or complete yield loss, which in turn results in loss in income, and reduction in household rice supply. More men reported increased workload on the farm, and increased pressure to provide food. On the other hand, more women experienced increased workload at home, and increased health problem. Both men and women reported increased indebtedness due to floods.

Table 4.5. Knowledge and awareness of climate change and variability

Descriptor	Women (%)	Men (%)
Awareness that climate change is happening	64	77
Source of information, aside from observations or experience		
Television	97	97
Radio	52	49

Note: Number of observations=116 women and 120 men

Farmers rely heavily on short-term coping strategies. The majority of respondents customarily engage in re-sowing and replanting when floods or typhoons damage their crops. This practice substantially increases the farm workload of women. More men than women acquire loans from formal sources, and seek support from relatives and friends. Both men and women use savings and spend as common coping strategies. The increasing prices of seeds and of other inputs further put strain on the household budget as the meager incomes from the previous cropping season and from other non-agricultural sources are hardly sufficient for the daily needs. Women bear the brunt of financial stress as they are the custodians of household budget. Both men and women reduce food consumption and spend less.

Finally, with regards to information sources, although a high proportion of women have access to information on improved agronomic practices and agricultural technologies, they are not direct recipients of information provided by agricultural extension services. The gender bias in institutions is still prevalent among the agricultural extension themselves, despite the fact that majority of the agricultural extension staff members are women.

Recommendations

For gender-responsive planning and design of CSA technologies and practices, the following are suggested:

- Train women and men farmers on the management of natural resources and financial resources. During the dry season, 60% of the total costs go to fertilizer and seeds. Since women are the custodians of household budget, it is necessary for them to gain knowledge on CSA technologies and practices that can reduce input costs and promote more efficient utilization of resources. Thus, the entire household is likely to benefit if more women participate in workshops or training programs on resource and financial management. Any reduction in input costs could be used for other expenditures, e.g., children's education and better-quality food.
- Introduce CSA technologies and practices to women farmers, particularly on livestock management, along with providing them with opportunities to participate in community savings and micro-credit programs. Women need CSA technologies that can provide them

with alternative sources of income and enable them to have emergency funds or savings during calamities.

- Enhance women's knowledge on submergence/flood-tolerant rice varieties, seed management and seed health, and provide access to information on rice prices.

Acknowledgements

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Chapter 5

Gender, Climate Change, and Root and Tuber Crops: A Case Study in Eastern Visayas, Philippines

Arma Bertuso

Chapter 5
Gender, Climate Change, and Root and Tuber Crops: A Case Study in Eastern Visayas, Philippines

Arma Bertuso

Introduction

In the Philippines, staples such as rice, corn, and other cereals are widely considered as "primary crops," and thus have been traditionally accorded very high priority in terms of research, extension, and government policy. Root and tuber crops (RTCs) such as sweetpotato, cassava, taro, and yam are considered as "secondary crops," and are often associated with poor farming communities cultivating marginal lands. Contrary to the experts' label "secondary crops," RTCs are utilized in many parts of the world for multiple purposes under different agro-ecological and socioeconomic conditions. Worldwide, sweetpotato and cassava rank within the top 10 agricultural crops based on total annual production (UPWARD 2002; Campilan 2002). RTCs play an important role in the food security and livelihood of poor farming households in many less favorable agroecologies and remote communities. They are traditional/seasonal staples for many Philippine ethnic communities and are widely known as buffer crops during agroecological and socioeconomic crises. The value-adding potential of RTCs is now increasingly recognized and, as a result, there are rapidly expanding industrial and other commercial applications, locally and abroad (Data, Roa, and Tangonan 1997; Pardales et al. 2002).

According to FAO (1993), the main nutritional value of roots and tubers lies in their potential to provide one of the cheapest sources of dietary energy, in the form of carbohydrates, in developing countries. This energy is only about one-third that of an equivalent weight of grain, such as rice or wheat, because tubers have high water content. However, the high yields of most RTCs ensure an energy output per hectare per day, which is considerably higher than that of grains. Cassava, sweetpotato, and yam contain some Vitamin C; orange yellow varieties of sweetpotato, yam, and cassava contain a high level of β-carotene, a precursor of Vitamin A. Taro is a good source of potassium. Similar to other crops, the nutritional value of roots and tuber varies with variety, location, soil type and agricultural practices, among other things. RTCs are also seen as climate-resilient crops that could ensure greater food security for smallholder farmers. RTCs directly contribute to food security through production in smallholder farming systems as food and source of income, especially during the lean months. RTCs can withstand typhoons, floods, and droughts, and their short production cycle facilitates recovery from these shocks. Typhoon Haiyan (locally known as Super Typhoon Yolanda in the Philippines), one of the strongest tropical cyclones ever recorded, which hit the country in November 2013, led to loss of lives, crops, and livestock. In the most devastated areas, only sweetpotato stood green and robust in the fields and in the uplands amidst 95% fallen coconuts and other trees, and dried-

up grain fields. When food supply was most difficult in the first few weeks after the typhoon, sweetpotato and taro provided the local people with food. Nonetheless, communication and transport disruption made it impossible to market the produce to Tacloban. (FoodSTART+2016).[1]

Documentation studies have revealed an important gender dimension to RTC agriculture—secondary crops like RTCs are closely associated with those often considered the "secondary farmers"—women, who, in fact, have been shown to be mainly responsible for making decisions and taking actions on crop cultivation, utilization, and marketing (Paris 2002; Sister 2002; Mondala 2002; Adion 2002; Bartolini and Pardales 2002; Gabunada 2002; FoodSTART+2016). However, not much is known about how climate change has affected men and women who grow RTCs as minor crops in marginal and risk-prone areas, and how they use RTCs as an adaptation strategy in response to typhoons and drought.

Little is known on the context-specific social factors that support or hinder the adaptation of Climate-Smart Agriculture (CSA) practices on RTCs in the upland communities. Promoting the production and use of rootcrops could further involve women in designing and disseminating CSA practices in RTC farming. Studies suggest that more female farmers, as well as male-farmers, adopt CSA technologies and practices (including RTC production) when women's awareness, knowledge, and access to information about such practices increase (Kristjanson et al. 2017). As a result, the resilience of households, communities, and food systems is enhanced (World Bank, FAO and IFAD 2008).

This chapter focuses on the linkages of climate change, gender, and RTC production in climate risk-prone villages in Eastern Visayas, Philippines. Based on the findings, recommendations are made for local and international agencies to support women and men farmers in RTC agriculture.

Methodology

The study areas

Eastern Visayas was selected due to its vulnerability and exposure to climate change. Due to its geographic location in the center of the country, the region has been a constant site for landfall of typhoons that enter the Philippines. It is one of the four areas in the Philippines classified by the Center for Environmental Geometrics (2005) as most at risk to projected rainfall changes. Eastern Visayas is prone to extreme high temperature, extreme rainfall events, and sea level rise.

The research sites in this study were selected according to two criteria: (1) importance of RTC livelihood, and (2) representation of a market-oriented (MO) community and a subsistence-oriented (SO) community.

[1] Food Resilience Through Root and Tuber Crops in Upland and Coastal Communities of the Asia-Pacific (FoodSTART+) is a three-year research project (2015–2018) funded by the European Union and the International Fund for Agricultural Development (IFAD). The project aims to enhance food resilience among poor households in upland and coastal communities of the Asia-Pacific region through introducing root and tuber crops (RTCs) innovations (FoodSTART+ 2016).

The selection of Calbiga in Samar and Lawaan in Eastern Samar was based on a previous scoping study conducted by FoodSTART+ in 2015 (Figure 5.1). Calbiga was selected to represent the MO communities, as it is known as the trading area of RTCs in the region. The majority of farming households have access to a regular market (*tabo*), held twice a week. Calbiga, which is about 48 km south of the provincial capital town of Catbalogan and 59 km northeast of Tacloban City in neighboring Leyte province, is located in a strategic location for commuters and traders between these major cities. The town center lies along the Philippine-Japan Friendship Highway (Maharlika Highway) that links Samar and Leyte to the islands of Luzon and Mindanao. On the other hand, Lawaan was selected to represent the SO communities, where most households do not have access to major markets. It is predominantly agricultural, with many families relying on lowland and upland farming as their means of livelihood, as well as on coastal and deep-sea fishing. The main agricultural product is copra.

Sources of data

Secondary data, such as previous reports and articles, were collected and reviewed (CIP-UPWARD publications and FoodSTART+ scoping study). Primary data were gathered from men and women farmers using Participatory Rural Appraisal (PRA) tools, namely, key informant interviews (KIIs), Focus Group Discussions (FGDs), seasonal calendars, pie charts, and problem tree diagram (vulnerability and adaptation strategy). These PRA tools were particularly useful for this study given the limited time and funding to conduct extensive quantitative surveys. Moreover, these PRA tools also illuminated both individual and group level dynamics within a given population.

Figure 5.1. Location of Calbiga and Lawaan in Eastern Visayas

Four FGDs were conducted with separate groups for men and women. Of the total 20 participants, there were nine (4 men and 5 women) in Calbiga, and 11 (5 men and 6 women) in Lawaan. All the participants are engaged in farming, including RTCs, and are mostly tenants cultivating 0.25 to 0.5 ha. The majority are married (70%), and the rest are widowed (15%), and unmarried (15%). The age of respondents ranged from 38 to 63 in Lawaan and 40 to 60 in Calbiga.

The topics discussed in the FGDs were the following: sources of livelihood in MO and SO communities; gender division on labor; degree of women's decision regarding productive inputs; access to resources (varieties and inputs) and agricultural services (information and training); and climate change perspectives, including vulnerabilities and adaptive strategies. The climate resilient agriculture and gendered PRA tools were the following: livelihood systems matrix (farm, off-farm, and non-farm); pie chart (percent share of different sources of income); seasonal calendar (occurrence of drought and rains during the year); agricultural calendar (planting and harvesting dates of crops grown during the year); livelihood calendar (raising livestock, off-farm,[2] and non-farm employment); preference ranking of RTCs; gender analysis (with focus on who provides labor in specific RTC production); seasonality of food availability (months when rice supply is high and low); and months when pigs and chickens are sold.

Results and discussion

In conducting gender analysis in relation to climate change, it is important to understand the specific context in order to draw patterns. In this study, farming households were classified based on the degree of market orientation related to RTC production. As mentioned earlier, Calbiga represents MO communities, while Lawaan represents SO communities. In SO communities, RTCs are grown mainly for home consumption, whereas in MO communities, RTCs are grown mainly for the market with a small percentage for consumption.

A typical household in an RTC-growing village is engaged in several farming activities (mixed crop production and livestock raising) and off-farm and non-farm activities. According to the FGD participants, they are involved in these diverse activities to ensure food and income security throughout the year. Upland and lowland rice and coconut are the main crops in the communities of Eastern Visayas. Most households grow different types of RTCs, namely, sweetpotato, taro, cassava, yam, giant taro, cocoyam, and giant swamp taro. These RTCs are grown either as cash crop or as staple food in mixed cropping systems. Farmers also grow various vegetables for food and cash income, and fruits (pineapple and banana) intercropped with rice, corn, or RTCs. Mixed cropping is commonly practiced in both MO and SO communities. A typical mixed cropping

[2] Off-farm work pertains to paid seasonal labor/work that farmers take on in other farms within the village, while non-farm work are jobs such as domestic help, tricycle driving, construction work, and other labor work in the service sector not related to farming.

system in the uplands includes coconut, banana, upland rice, taro, cocoyam, and yam (Figure 5.2). The average cultivated area is 0.5 ha for both SO and MO communities. In the MO communities, farming households grow a number of vegetables, which are grown all year round for income. In the SO communities, vegetables are grown only for home consumption, with the surplus for sale.

Share of various sources of livelihoods to household income

In the MO communities, vegetable sales (30%), rice (24%), and RTCs (21%) are the major sources of household income (Figure 5.3). Income from perennial crops (banana and coconut) and livestock are quite low at 10% each, while the contribution of off-farm and non-farm income is lower (5%). In contrast, in the SO communities, livestock contributes the highest share in income (29%), followed by rice sales (21%), and non-farm activities (18%). Sales from RTCs are lower at 11% because they are used mostly for home consumption. Sales from vegetables (5%) and off-farm income (6%) contribute the least to household income. Thus, SO communities rely heavily on non-farm income, unlike in the MO communities where the share of non-farm income is very low. These findings reveal the differences in the contribution of these income sources to local livelihood. It should be noted that in both SO and MO communities, rice is not the major source of income.

RTCs (cassava, taro, and sweetpotato) are important crops as source of food and income (Table 5.1). Although rice is considered as the main staple food, RTCs are planted regularly in MO and SO communities because they are used as food when rice is not available.

In the MO households, women value taro as the most important crop, while men value cassava. These gendered differences can be attributed to gender role and other cultural factors. Men prefer cassava because it is an important source of income and is used in cultural practices (i.e., it is eaten with roasted pig and coconut wine). Women prefer taro

Figure 5.2. A typical mixed cropping system

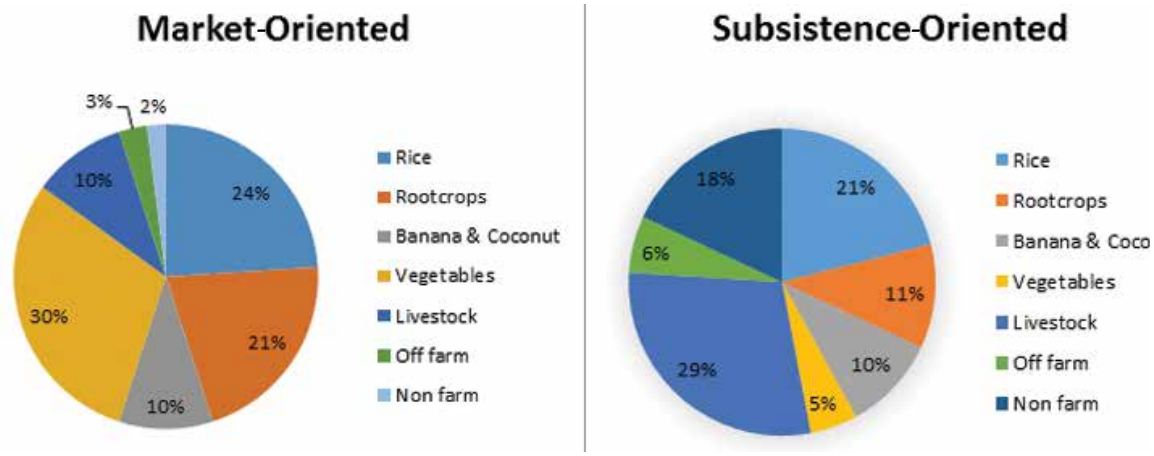

Figure 5.3. Percentage contribution of sources of livelihoods in MO and SO

because it provides income all year round from sales as processed delicacy. In the SO households, women rank sweetpotato as the most important RTC, followed by tuber crops such taro, cocoyam, and then cassava. In contrast, men rank taro as the most important, followed by sweetpotato and cocoyam. Sweetpotato is important to women because it is cooked for food and snacks—the women are mainly responsible for cooking sweetpotato, including sweetpotato vines. On the other hand, sweetpotato roots that are rejected for cooking are used as primary feed for pigs. Sweetpotato can be easily prepared (boiled) as an alternative to rice. In particular, RTCs are easy to sell and available all year round for income and food. Meanwhile, in the MO communities, the availability of a local food industry for processed RTC products (e.g., *binagol*, *sagmani*, and *ginan-an*) contributes to men's and women's preference for the taro variety *inito*. (Figure 5.4)

Table 5.1. Preference ranking of rootcrops production in market-oriented and subsistence-oriented communities (1=most important, 2=moderately important, 3=important)

Root and tuber crops	Market-oriented (Calbiga)		Subsistence-oriented (Lawaan)	
	Men	Women	Men	Women
Cassava	1	2		3
Taro	2	1	1	2
Purple yam	2			
Giant taro	3	3		
Sweetpotato			2	1
Cocoyam			3	2

Figure 5.4. Popular taro variety *inito* commonly sold in *pasalubong* (souvenir) shops along the national highway in Calbiga, Samar

Impacts of climate change on livelihood activities

The Eastern Visayas region is considered as one of the most vulnerable areas to climate change in the country, being prone to extreme weather events particularly drought, typhoons, and southwest monsoon. For discussions on the linkages between climate variability and specific key activities that occur and resources that are available at different times during the year, FGDs were done, as well as livelihood and vulnerability calendar. Figures 5.5a and 5.5b show the crop production and vulnerability calendar of farming households in the MO and SO communities.

Men and women groups in the MO communities reported that drought usually occurs in April to July (4 months), while typhoons occur in October to December (3 months) (Figure 5.5a). The SO communities mentioned that drought usually occurs from April to August (5 months), while typhoons occur from September to December (4 months). The SO communities in the coastal areas mentioned that southwest monsoon occurs in July to August (Figure 5.5b). Within a year, farming households in SO and MO communities are faced with climate change risks, which affect human lives, crop and livestock production, and other sources of livelihood.

During the months when drought and typhoons occur, farmers grow and harvest RTCs as alternative food to rice. RTCs are usually harvested in particular months and in times of calamities. The men's group mentioned coconut as one of the main crops in the MO communities, sales of which comprise an important source of income all year round. On the other hand, women did not mention this, maybe because men are more involved in coconut production. MO communities derive all-year income from the production of banana, cocoyam, giant taro, vegetable (eggplant, bell pepper, pepper, and string beans).

In MO communities, RTCs such as sweetpotato, yam, taro, and giant taro are grown because they require less water compared with rice. These RTCs are planted in April at the onset of drought, taking advantage of the residual moisture. Their chances of survival are higher, compared with other crops such as rice. As roots and tubers are grown underground, they are less affected by typhoons. In times when typhoons damage rice and other fruit trees,

Livelihood Activities	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Drought												
Typhoon												
Sweetpotato				P			H	H	H			
Taro	H			P						H	H	H
Cassava		P							H	H	H	H
Cocoyam*									P			
										H	H	H
Giant taro*	H			P								H
Yam	H			P								H
Banana*				P								
		H	H									
	P											H
Corn				P	P			H	H			
Upland rice				P	P	P			H	H	H	
Lowland rice						P			H	H		
Vegetables* • eggplant • bell pepper • pepper • string beans • bitter gourd • gourd												
Ginger			P	P							H	H
		H		P	P							
Pineapple	P				H							P
Coconut* (copra)												

Figure 5.5a. Crop production and vulnerabilities in MO communities

Note: P=Planting, H=harvesting (main season)
** income all year round (staggard harvest as needed)*

farmers have assurance that they have RTCs to harvest for consumption or sold. Sweet potato is harvested from July to September, while taro, yam, and giant taro are harvested from October to December or January. Cassava is planted in February and main harvesting is done in September–December. Farmers usually plant giant taro in April and harvest in December–January. Giant taro can be harvested after two or three years; it is used for local snacks called *binagol*. Since this is a commercial good, men are mostly in charge. Furthermore, men are engaged in processing giant taro because the grating process is tedious and can irritate the skin, and processing could take up an entire day. Meanwhile, women are busy with their household chores and child care, among other domestic tasks (Figure 5.5a).

Livelihood Activities	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Drought												
Typhoon												
Southwest Monsoon												
Sweetpotato	H								P			H
		P			H							
Cassava	H	P						H	H	H	H	H
Taro	H	H	H	H	H	P						H
	H	P										H
Cocoyam*	H	H	H	H	H	P						H
Yam	H	H	H	P								H
Banana*	P	P										H
Corn	P				H							
						P				H		
Upland rice						P				H		
Lowland rice						P				H		
Vegetables • squash • bitter gourd					P				H	H		
Coconut*												

Figure 5.5b. Crop production and vulnerabilities in SO communities

Note: P=Planting, H=harvesting (main season)
** income all year round (staggard harvest as needed)*

In SO communities, RTCs are harvested during the earlier months (January–May) of the year and are used more as food. During these months, much of the rice harvest is likely to have been already consumed. RTCs are grown all year round for food even during typhoons and southwest monsoon. RTCs are considered as alternative food to rice particularly in times of calamities (Figure 5.5b)

Cash flow

Figures 5.6a and 5.6b show the seasonal calendar of non-crop income for MO and SO communities. In the MO communities, drought occurs in April–July and typhoons happen in October-December. On the other hand, SO households noted periods of drought in April–August and typhoons in

September–December; they are more exposed to longer periods of drought than MO communities. Nonetheless, the commonality of both MO and SO households is that they resort to various sources of livelihood for cash income.

Livestock raising. Backyard livestock raising (pig and native chicken) is an important source of livelihood for men and women in SO households (29%), more than for MO households (10%) (see Figure 5.3). Women take care of piglets and sell them in December–January (Christmas and New Year season). Women also sell pigs in May–June (start of classes) because they need cash for their children's enrollment and other expenses. Farming households who own large animals earn additional income by renting them out for land preparation, plowing, and harrowing. Thus, cash is available from April to June and January.

Off-farm income. Off-farm income, such as working as hired agricultural labor, is also an important source of income, although seasonal. The demand for seasonal agricultural workers for rice production is high from April to June and extends to August in the SO communities. Men and women who work as hired agricultural workers earn PHP 150.00–PHP 25.00 per day (USD 2.88–USD 4.80), depending on the type of work. Men usually leave the village and work as construction workers from January to June.

Non-farm activities. In the SO communities, farm income is not enough to meet the family needs. Thus, members have to earn additional income from non-farm sources. Men earn non-farm income from fishing in April–May and August–December when there are no typhoons. Some women earn additional income by vending/peddling goods. Men and women work as hired laborers from May to August during the rice cropping season.

MO households who have capital and own a carabao also earn extra income by renting out the animal to other farmers during land preparation activities in the lowlands. Some wives earn additional income by cooking and selling processed rootcrops as delicacies. A few farmers earn cash through charcoal making from March to April and in July.

Others work as masseurs, seamstress, and small traders (buying and selling goods in the village. Some men work as city tour guides, especially during the summer months, and earn PHP 300–PHP 500 (USD 5.77–USD 9.62) per day. Younger men work in the construction sector from January to May. Vending goods is done throughout the year, while buy-and-sell of goods and processing and cooking RTCs into snacks and delicacies for the market are done the whole year round.

Adaptation strategies

All men and women respondents agree that weather changes have occurred in recent years, affecting their farming. Vulnerabilities mentioned by the respondents included more frequent and stronger typhoons and high temperature. This weather variability results in low or no yield of rice, crop damage (for vegetables, banana, and coconut) and death of livestock and poultry, thus leading to food- and income insecurity. Based on

Livelihood Activities	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Drought												
Typhoon												
Southwest monsoon												
Pig/native chicken raising	cash				cash	cash						cash
Renting out carabao for plowing	cash			cash	cash	cash						cash
Hired labor				cash	cash	cash						
Charcoal making			cash	cash			cash					
Making root and tuber crops delicacies©												

Figure 5.6a. Seasonal calendar and cash availability in MO communities

Note: © income is all year round

Livelihood Activities	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Drought												
Typhoon												
Southwest Monsoon												
Pig and native chicken raising				cash	cash	cash					cash	cash
Hired Labor				cash	cash	cash	cash	cash				
Construction worker	cash	cash	cash	cash	cash							
Fishing				cash	cash			cash		cash	cash	cash
Vending/peddling©												

Figure 5.6b. Seasonal calendar and cash availability in SO communities

Note: © income is all year round

their experience, farmers have learned to adapt strategies for extreme weather events (Figure 5.7). One strategy is growing and consuming RTCs when rice production is not possible. Moreover, depending on available opportunities, farming households use various strategies such as growing RTCs as alternative food, engaging in non-farm activities, out-migration, and harvesting and planting early. Family members provide more labor in RTC production. Most farmers harvest and plant rice early to avoid crop damage caused by climate stress. These common strategies are done by men and women to ensure food security and obtain cash income to meet their daily needs.

When temperature becomes unbearable in the field during the day, men and women respondents adjust their working time in the fields accordingly. For example, they work very early in the morning to avoid the strong heat, return home, and go back to the fields later in the afternoon until evening. Men and women also mentioned the importance of RTCs as a "survival crop" during calamities, as RTCs are less affected by typhoons and drought.

The men group in MO communities prefer the cassava variety *kalibre* because it matures in three months, similar to some sweetpotato

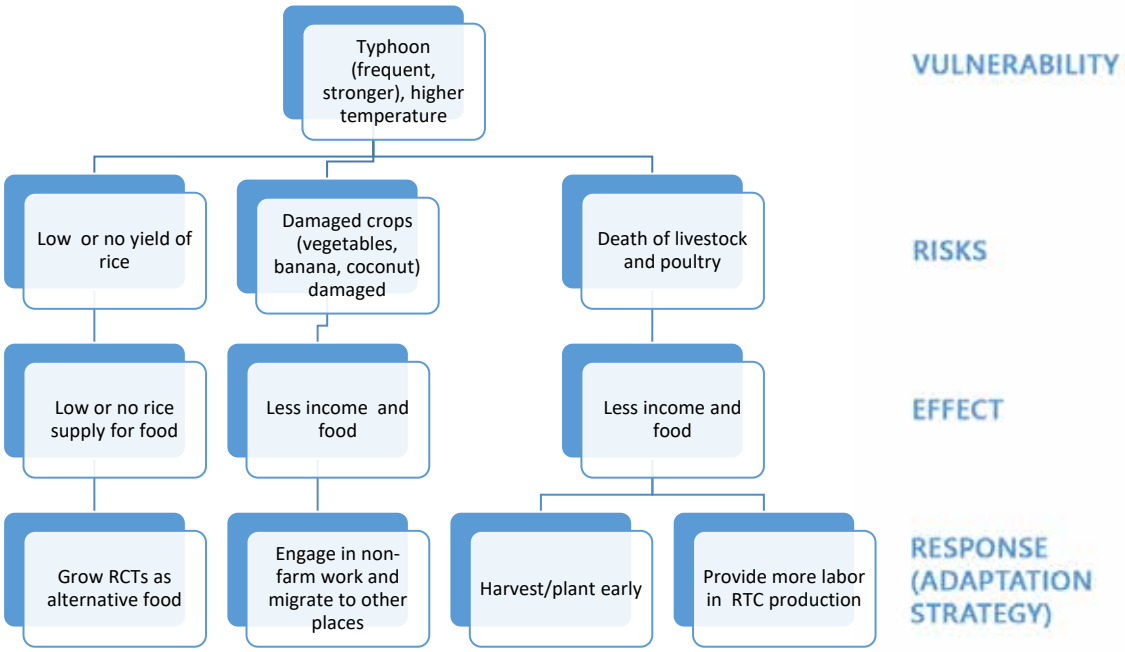

Figure 5.7. Problem tree of climate change risk and adaptation strategies of men and women in MO and SO communities

varieties. It can be easily harvested especially during typhoons and droughts. They make sure that RTCs are planted in their farms as alternative crops when rice is not available. As reported by women's groups in SO and MO communities:

"RTCs play an important role in times of typhoons. They are survival crops (pantawid gutom) as they are most unlikely to be damaged by typhoons and other calamities. They are also easier to plant and maintain. They are good for our health, especially for people with diabetes."

The men in SO households recalled:

"Thirty years ago, the giant taro was abundantly growing in marginal wetlands and was used for food. Now, due to the conversion of these lands to rice paddies, the area of giant taro has declined affecting food and source of income of farming households."

Men and women in the SO households shared the change in positive perception on RTCs. According to them, 30 years ago, RTCs were regarded as "poor man's crop". Only the poor used RTCs as substitute for rice. Nowadays, more people eat RTCs for better nutrition.

Gender roles and division of labor in taro and sweetpotato production

Gender roles and division of labor by type of rootcrops, by crop activity, by source of labor (family male, family female, child male, child female, hired male, and hired female) in MO and SO communities are discussed below.

Taro production. Taro, called *gabi* in Leyte, is one of the most important food crops in the Eastern Visayas. Production activities in taro production that require physical strength, such as land preparation, plowing, and harrowing, are done by male family members and male hired workers (Figure 5.8a and 5.8b). However, women participate in activities such as planting, hilling up, weeding, and harvesting. Marketing is done predominantly by female family members (70%). There is slight difference in the labor participation of men and women across the MO and SO households. These findings are similar to those of Ponce and Reoma (1985) who found that in Northern Leyte and Southern Leyte, the husbands or male heads of households are the regular workers, except in selling of the produce, which is done by the wives or female heads of households. The wives help their husbands in most of the tasks. The male children are more involved in taro production. The female children never assist in any of the taro production activities.

Sweetpotato production. A different pattern can be seen in labor participation by gender in sweetpotato production in SO communities. All family members help in land preparation (Figure 5.8c). However, in land clearing, hired females also participate, along with male and female family members. Female children do not participate in land clearing. Both male and female family members participate in planting. Weeding is predominantly done by female family members, with the assistance of male family member and hired male and female workers. Harvesting is mainly a family task with the help of male hired workers (Figure 5.8c).

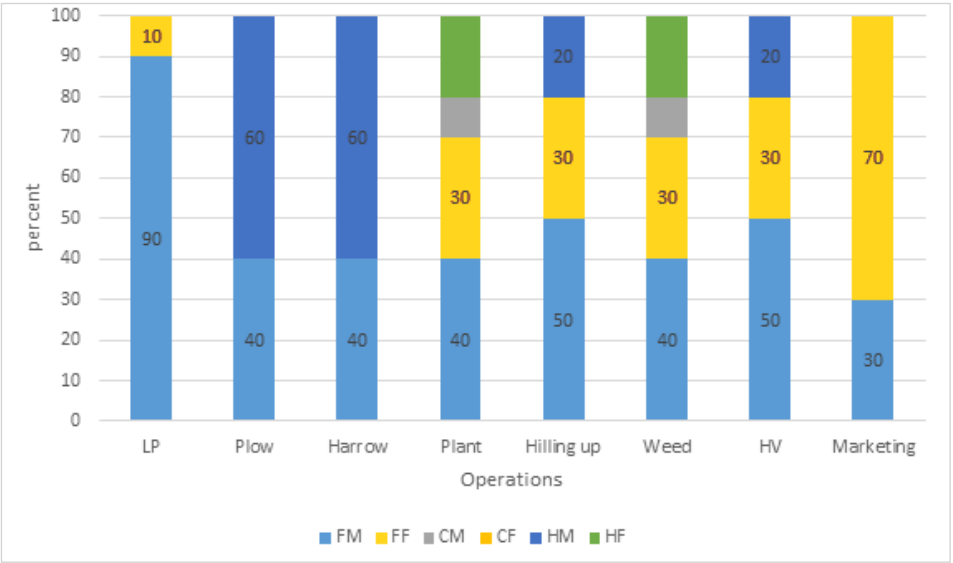

Figure 5.8a. Labor contributions in taro production in MO communities

Note: FM=Male; FF=Female; CM=Children Male; CF=Children Female; HM=Hired Male; HF=Hired Female; LP=Land preparation; HV=Harvesting

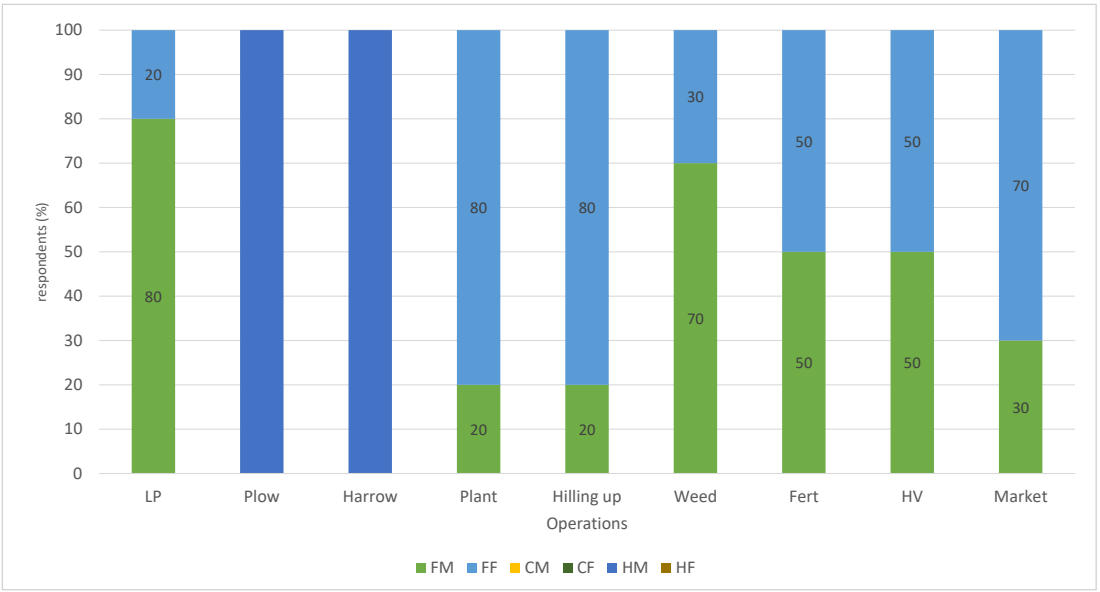

Figure 5.8b. Labor contributions in taro production in SO communities

Note: FM=Family male; FF=Family female; CM=Child male; CF=Child female; HM=Hired male; HF=Hired female; LP=Land preparation; Fert=fertilizer application; HV=Harvesting

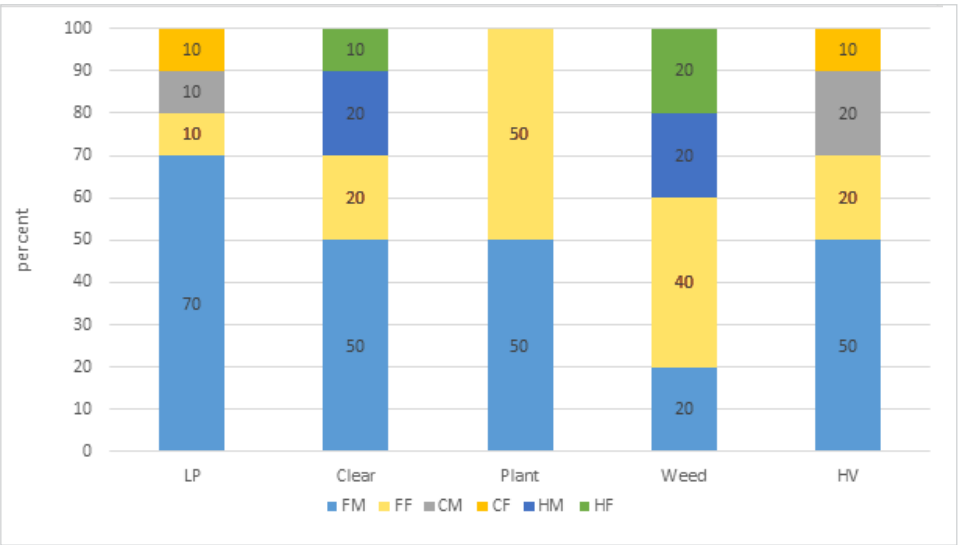

Figure 5.8c. Labor contributions in sweetpotato production in SO communities

Note: FM=Family male; FF=Family female; CM=Child male; CF=Child female; HM=Hired male; HF=Hired female; LP=Land preparation; Clear=clearing the land; Plant=planting; Weed=weeding; HV=Harvest

In the MO households, female family members also work with male family members and hired males in land preparation and plowing. In planting and weeding sweetpotato, almost all (family male, family female, male and female children and male and female hired workers) help in completing production activities. Harvesting is also mainly done by family male members (fathers and sons) and male hired workers, with the participation of female family members (Figure 5.8d).

Gender differences in decision-making

Because increased productivity is related to management decisions, it is important to understand not only who is doing the work, but also who is making the decisions. Direct involvement in an activity gives a family member decision-making authority related to that activity. Both MO and SO households mentioned that husbands are more responsible for making decisions on farming activities, while wives are empowered in making decisions on household matters. In both MO and SO households, women are mainly responsible for marketing RTCs. Thus, they decide on the sale of RTCs and on retaining the money earned from the sale. In other cases, the common practice is for men to sell the produce and collect the money, and then hand it over to the women to pay for household expenses. Women also take on more responsibility in participating in community activities and allocating money for social obligations.

Summary and conclusion

RTCs are important components of the mixed cropping farming systems in the MO and SO communities in Eastern Visayas. Crops such as sweetpotato, taro, cassava, yam, giant taro, cocoyam, and giant swamp taro are intercropped with rice, corn, coconut, banana, and vegetables. RTCs contribute not only to food consumption but also to income generation. They are important part of the food and survival strategies of farming households in Eastern Visayas. Respondents regarded RTCs as "survival crops" in times of vulnerabilities (e.g., typhoons, drought, and other calamities) and also as an important resilient crop for farming. RTCs are now considered an important food and are no longer seen as "poor man's crop."

Findings from this study confirm that weather changes have occurred in recent years, affecting farming. Vulnerabilities include more frequent and stronger typhoons (destroying crops), higher temperature (making it difficult for farmers to work in the fields during daytime), drought (reducing or comprising yields), and flooding. Men and women have similar perceptions on climate variability based on their active involvement, including their children, in RTC production, processing, and marketing.

Gender roles in crop production, off-farm, and non-farm activities differ by market orientation (subsistence-oriented and market-oriented). For both SO and MO households, rootcrops production is a family enterprise where the husband, wife, and their children have separate, shared, and complementary tasks. The division of labor in rootcrops production is socially determined. Although tasks that require physical strength such as land preparation are dominated by men, women participate in almost all other field activities. Women are engaged more in planting, weeding, harvesting, and marketing. In the MO communities, women play greater role in marketing. For MO and SO, women are mainly responsible for keeping the money for household expenditures, children's education, transportation, and food. Men take care of large expenditures such as purchasing of land, animals, machines, and other major farm inputs.

There are differences on preference for growing rootcrops between men and women. Among MO households, men prefer cassava because it is an important source of income, and it is used for cultural practices. Women prefer taro because it provides income all year round from sales when processed as a delicacy. Among SO households, women rank sweetpotato as the most important RTC, followed by tuber crops such as taro, cocoyam, and cassava. In contrast, men rank taro as the most important followed by sweetpotato and cocoyam. Sweetpotato is important to women because it is cooked for food as an alternative to rice as staple food. Women use sweetpotato vines, but rejected roots are used as primary feeds for pigs. There are differences in the importance of various sources of livelihoods between MOs and SOs that are linked to gender roles. In MO communities, marketing of taro is done predominantly by female family members rather than by male family members. Rice, vegetables, and RTCs are major sources of income. Men and women

provide labor in these activities. In contrast, in the SO communities, livestock comprises the highest share, followed by rice and non-farm activities. Labor participation of female family members is higher in crop and livestock production in SO communities.

Adaptation strategies are either done jointly or individually by men and women based on social norms. To reduce risks, MO and SO households resort to various sources of livelihoods. In both MO and SO communities, women take care of piglets and sell them during the holiday season and at start of classes to pay for children's school expenses. Thus, women play crucial but unrecognized roles as farmers, income earners, and ensurer of food security particularly during the lean months. Specifically, women play strategic roles in securing livelihood in times of food, cash, and labor shortages and during flood or drought.

In this study, women have relatively higher decision-making power at the household level and they are also more likely to have control over their own earnings, particularly from off-farm engagements and sale of small animals.

Key Research and Development (R&D) recommendations supportive of women

Both men and women are important agents of change in response to climate-induced change. Engaging women and men in technology design and management encourages changes in gender relations and facilitates the generation and adoption of climate-smart agricultural technologies and practices, which can contribute to enhanced food security and income at the community level. The resilience of women and men and local traditional knowledge are valuable resources for recovery and adaptation; thus, it is important to support them. The agricultural offices of local government units are recommended to implement the following R&D initiatives to support women and men farmers in RTC agriculture:

1. Introduce and test climate-smart breeding for heat/drought/salt tolerant and early-maturing crop varieties (including RTCs) that considers end-user preferences through participatory action research involving men and women farmers.
2. Support formal seed system for faster dissemination of improved varieties and establish stronger linkages with informal seed system (possibly including decentralized multipliers of clean planting material) and provide women and men with knowledge and skills in new methods of multiplication of sweetpotato planting materials.
3. Promote availability of other farm inputs and make them accessible to both men and women.
4. Develop farmers' capacities on CSA practices and value addition. Support men and women engaged in RTC by providing them access to new knowledge and technology, development support services, and substantial help to link them to markets.
5. Encourage women pig raisers to utilize other parts of RTCs as local feed in order to reduce expenses for commercial feeds.

6. Develop processing technologies for RTCs, which will enable women in subsistence communities to increase their incomes.
7. Create awareness on the importance of RTCs for resilience, nutrition, and gender empowerment.
8. Create market incentives for RTCs (e.g., product development through farmer business schools).
9. Facilitate engagement with and among relevant agricultural R&D organizations (national and international).

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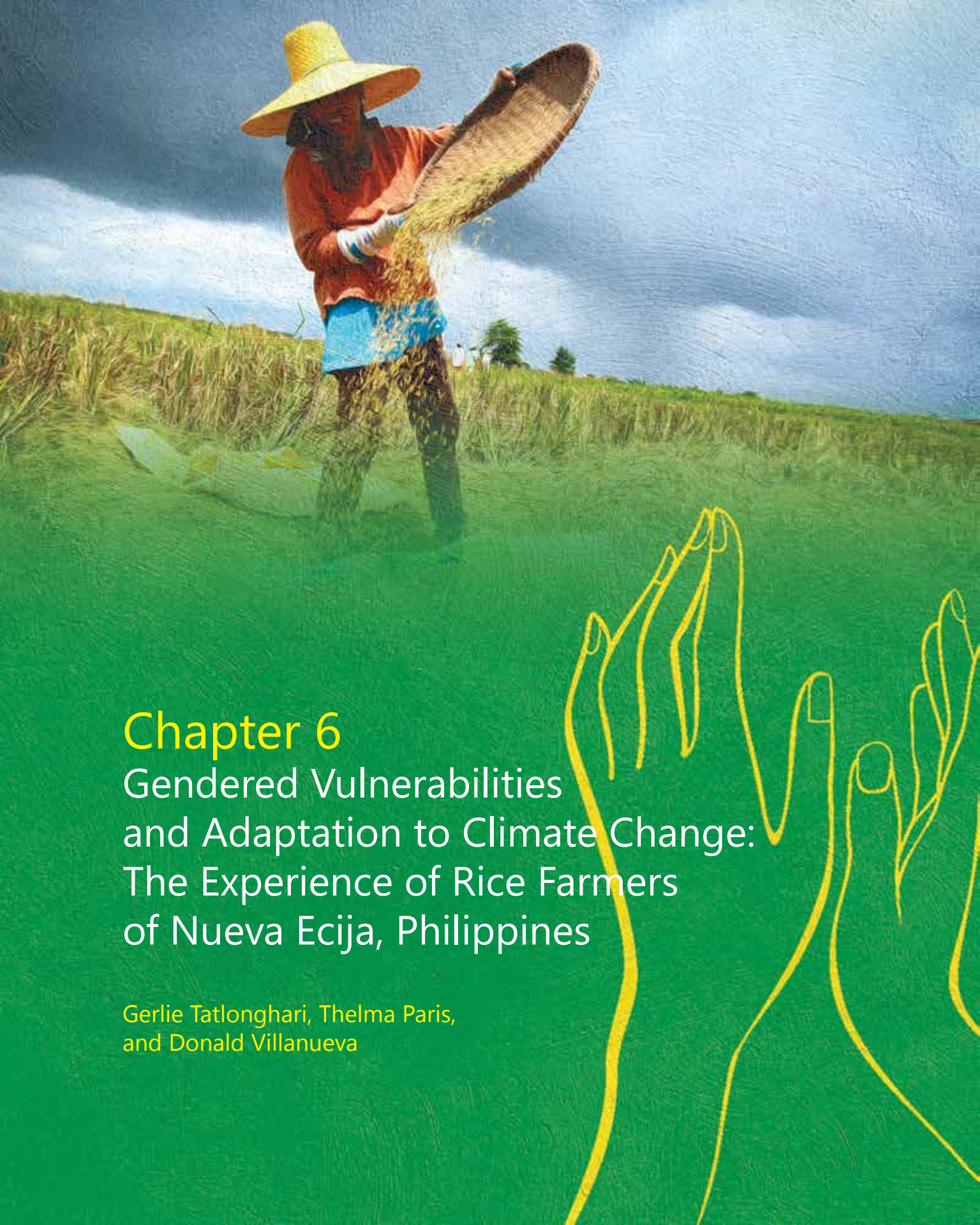

Chapter 6
Gendered Vulnerabilities and Adaptation to Climate Change: The Experience of Rice Farmers of Nueva Ecija, Philippines

Gerlie Tatlonghari, Thelma Paris, and Donald Villanueva

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Introduction

Since the 1950s, extremely hot weather and heavy precipitation have become more common. Climate change poses a bigger threat to developing and disaster-prone countries like the Philippines. According to the 2017 World Risk Report, the Philippines ranks third among disaster-risk countries. This finding is consistent with the study of the World Bank (2010), which listed the Philippines as one of the top 10 countries worldwide at risk for both climate change and disasters (Birkmann et al. 2011). During the last decade, the country experienced the highest recorded rainfall and the strongest typhoons (World Bank 2010). Weather-related disasters accounted for 98% of lives affected and 78% of lives lost between 2000 and 2008. Natural disasters already account for more than 0.5% of gross domestic product annually, and climate change is expected to further increase these losses. It is also expected that climate variability could increase the number, severity, and unpredictability of natural disasters.

Agriculture is one of the most vulnerable sectors to climate change. In the Philippines, agriculture plays a major role in the economy. Moreover, it is the main income- and employment-generating sector in the country's rural areas. A large part of Philippine agriculture, particularly rice farming, operates at subsistence level and is quite vulnerable to weather changes (IFAD 2012). For instance, from 1970 to 1990, 82.4% of the total Philippine rice losses were attributed to typhoons, floods, and drought (Lansigan, delos Santos, and Coladilla 2000). The loss of livelihood does not only pertain to economic losses; it also has various social implications. To go into detail, the adverse climate change impacts do not fall proportionately among men and women due to the underlying causes of vulnerability. Several studies around the world have shown that the consequences of climate change are worse for women than for men (Terry 2009; Demetriades and Esplen 2008; Alston 2007, 2010; Lambrou and Nelson 2010).

One of the pressing social conditions, yet often neglected in most societies, is the existing gender inequalities. It is one of the main causes of different vulnerabilities among men and women; women being the disadvantaged and vulnerable group. Globally, women have less access to resources such as land, credit, agricultural inputs, decision-making structures, technology, training, and extension services that could help them develop their adaptive capacity to avoid or minimize the adverse effects of extreme weather events (Denton 2004). However, these resources are hard to access and, in some instances, are institutionally unavailable to women (Osman-Elasha 2009). For instance, the customary law of some countries does not allow women to share land property rights along with their husbands or in some instances, female

heads of household are excluded from land entitlement schemes (Demetriades and Esplen 2008; FAO 2010). Because of this restriction, they cannot provide collateral required for credit, thus, limiting access to seed, new technology, and information. Limited access to resources could hinder adaptive measure (Denton 2004). Having a good understanding of their situation could help women to better adapt, but because of their limited education, they experience more hardship, are voiceless, and remain in a cycle of poverty. Women are likely to be adversely affected by damage to economic livelihood because basic survival strategies such as securing water and food, and wood for heating purposes, often fall on women. These are all on top of caring and nurturing the family (Enarson 2000).

In the rice farming communities in the Philippines, women's access to and control over resources depend on land ownership of the household. Due to economic needs, women are also expected to contribute to household income.

On the other hand, men also have specific vulnerabilities that can affect their health and safety that are also linked to ascribed gender roles, traditional norms and values, and the way the ideas of masculinity are constructed. In response to the threat posed by climate change, adaptation is viewed as urgent in the Philippines. Adaptation is understood as a modification of behavior that can either alleviate adverse impacts or open new opportunities in response to observed or expected changes in climate and associated extreme weather events (Adger et al. 2004, Adger et al. 2007; Nielsen and Reenberg 2010). Adaptation strategies can be linked to existing gender roles and relations and are likely to contribute to the increase in vulnerability of women to increasing flood events.

The concept of resilience is a starting point to look at how communities with long experiences of climate hazards adapt to their changing environment. Resilience is defined as a form of adaptation that that seeks to secure the continuation of desired systems that can absorb disturbance by enabling alteration in institutional form. (Nelson and Stathers 2009; Pelling 2011). The resilience of a community is often facilitated through social learning and self-organization. This often happens in communities where changes in the climate challenge the existing norms and relations. Some studies showed that because of some adaptation strategies adopted by women, there were some alterations in the existing gender roles, which caused a shift in current power relation within the household and community (Enarson 2000; Lambrou and Nelson 2010; Sultana 2010).

Given that adaptation strategies can either moderate or aggravate the gendered vulnerability and the impacts of changing climate, it is a challenge to recognize and explain how gendered adaptation practices are developed and reinforced. Hence, a case study was conducted in two villages in the municipality of San Antonio, Nueva Ecija, Philippines. The study aimed at assessing the adaptation strategies of men and women in rice farming communities when faced with flood events. The study attempted to explain how gender adaptation is influenced by gender identity and practices. It also attempted to find

out how men and women respond in times of crisis and to examine how to lessen women's vulnerability during extreme weather events.

Methodology

The study sites

Nueva Ecija is considered as the rice granary of the Philippines. However, because most of the rice farms are located at low-lying areas and the province is consistently visited by typhoons, it is considered as the second most flood-prone province in the Philippines (Manzanilla, Mariano, and Acda 2008). One of the most affected municipalities of Nueva Ecija is San Antonio. During the rainy season, San Antonio is characterized as the catch basin of water from the neighboring province. Consequently, it is prone to flooding from intense rainfall and typhoons. Two villages were selected for the study—Papaya and Cama Juan. Severe flooding has become worse in recent years due to frequent typhoons and has devastated rice farms in the village. In September 2011, Typhoon Pedring heavily devastated these villages.

Data collection

Qualitative and quantitative approaches were used to understand how gendered adaptations were shaped in rice-farming communities in the Philippines using gender as an analytical category. Two sets of data collection activities were conducted for each approach. The qualitative analysis consisted of activities such as secondary data collection, key informant interviews, participatory rural appraisal (PRA) activities, focus group discussions (separate men and women), and up to 20 in-depth interviews with men and women. Combined results from initial primary and secondary data collections were used to design a questionnaire for a structured survey. Total survey respondents was 402 (male and female); each household had both a male respondent and a female respondent. The survey was conducted to compare and analyze the household-level decision-making process, impact, and management mechanisms used by men and women. The interview enabled the researchers to further compare men's and women's vulnerabilities, capacities, and perspectives on climate change. Statistical tests such as chi-square test of independence was used to assess if there is a significant association between two categorical variables.

Data analysis

Statistical tests such as chi-square test of independence, student's paired t-test, and paired-sample test of proportion were used to determine if there are significant differences among the chosen variables. Chi-square test of independence was used to assess if there is a significant association between two categorical variables. Meanwhile, student's paired t-test was applied to determine if there are significant differences in the means of numeric variables between normal year and flood year. Furthermore, to examine if there are significant differences in the proportions of categorical variables between principal males and principal females, paired-sample test of proportion was used.

Results and Discussion

Climate change risks

Both men and women farmers in the study site observed that changing climate is now a reality. According to farmers, flooding depends on the number of typhoons and rainfall intensity. They also pointed out that typhoons and flooding have increased in recent years. These observations are consistent with the recorded floods and typhoons in the last 30 years. Within a 10 year period, flooding increased by 200%, while storm occurrence increased by 46% from 1970 to 2010 (Figure 6.1).

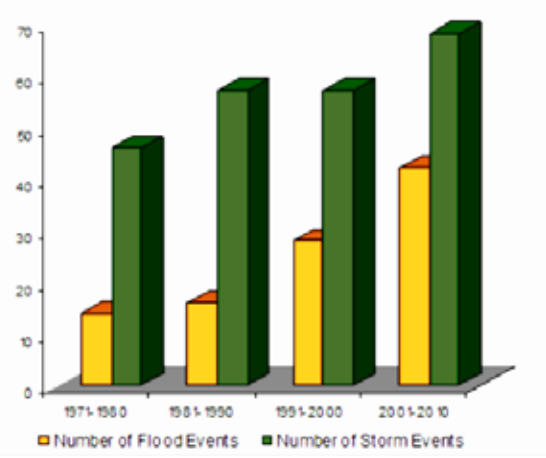

Figure 6.1. Number of floods and typhoon events in the Philippines, 1971–2010

Source: EM-DAT database (2011)

In San Antonio, Nueva Ecija in particular, time-series records from 1951 to 2005 showed that 50% of the rainfall were brought about by tropical cyclones that passed through the province (Manzanilla, Mariano, and Acda 2008). This is also observed by both men and women farmers who said that there were changes in the rainfall patterns (53%) and extreme weather (24%) (Table 6.1). Generally, men and women farmers, have the same observations about climate change, however, there is a significant difference in their perception about flooding occurrence. More women perceived the risk and threat of the intensity of flooding, while more men thought that the long duration of flooding greatly devastates farming activities.

Impacts of climate change on rice production

The farmers' rice productivity is directly affected by extreme flooding, which will adversely impact farming households' income and food security. Since most households are into subsistence farming, crop losses will mean hunger for some households who rely on their harvest for food. One of the female farmers lamented:

"All the families are very sad because we don't have anything to eat. You are fortunate if you have stock food in your house but if you don't, you are pitiful. You just have to survive by drinking warm water."

This heartbreaking situation commonly happens during the wet season, when flooding occurs three to five times in a year depending on the strength of the typhoon that passes through the village. The flooding in 2011 had devastating effects on farmers of Papaya as they did not just incur crop losses; they had negative income, which means that they needed to get loans or find other income sources just to augment their losses from farming (Table 6.2). Most of them did

not harvest anything and their crops were buried in mud. One male farmer narrated his experience during that flooding:

"I just asked myself why such losses happened to us. It was just so untimely that flood came in October when our crops were at the flowering stage, so we really incurred crop loss. This loss is more of a personal thing to me. I already lost the harvest that I was hoping for."

However, income sources of the farming households do not change. During normal year and flood year, rice farming remains the main source of income of the households (Figure 6.2). Although farmers incur many losses during flooding periods, they can have very high income during the dry season. This also explains why most farmers are still hopeful about their farming. They still expect that they can recover from their losses once they had an abundant harvest in the next dry season. This was pointed out by a husband and wife farmer during an in-depth interview:

"If you incurred losses and you stop farming, you will not be able to recover from your losses. Just like now, our son replants some seedlings [after the flood subsided]. Those who quit never win. If you quit, there's nothing left for you."

It is important to note that income from other sources also decreases during the flooding period. Since the study sites are rice-farming communities, other economic activities such as off-farm and non-farm labor and businesses are related to farming. Moreover, because of the flooding in the community, all other sources of livelihoods such as livestock, fishing, and other non-rice production are also affected. Food sources and health are also affected. Both men and women reported that basic food (meat, fish, and rice) and drinking water are in short supply during severe flooding. Also, more women reported increased health problems during flooding (Table 6.2). Unfortunately, women and young children are mostly affected by the rise in health problems during flooding.

Table 6.1. Observed changes in climate variability and flood occurrence in the last 20 years in two rice-farming villages in Nueva Ecija, Philippines by gender

Observed Changes	Percent Reporting Change (%)		X^2 test
	Men	Women	p-value
Climate variability			
Temperature	23	20	0.772
Rainfall	53	53	
Extreme weather events	24	27	
Flood occurrence			
Frequency of flooding	16	16	6.573 *
Intensity of flooding	58	68	
Duration of flooding	25	15	
Other observed changes	1	1	

*Note: * significant at 10%; No. of respondents: Men=201, Women=201*

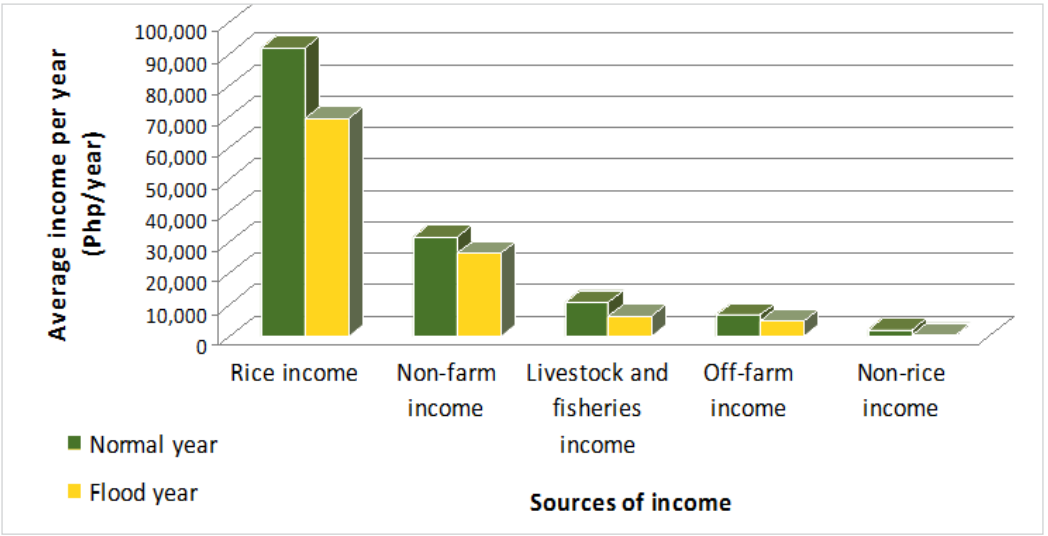

Figure 6.2. Income sources of the farming households during normal year and flood year, Nueva Ecija, Philippines

Table 6.2. Men's and women's perceptions on the impacts of flooding

Impacts	Men (%)	Women (%)	Difference (%)
Decrease in meat consumption	30	33	-3
Decrease in fish consumption	26	19	7 *
Availability of drinking water	20	24	-4
Availability of rice	52	57	-5
Decline in health status	67	74	-7

*Note: * significant at 10%; No. of respondents: Men=201, Women=201*

Extreme weather often creates conditions conducive to infectious disease outbreaks such as athlete's foot, common cold, cough, and fever.

In general, both men and women farmers agreed that flooding causes low yields (41%), increases indebtedness (28%) and for some, causes total crop loss (24%). Only 4% cited food insecurity as impact of severe flooding on regular agricultural activities. (Table 6.3).

The culture of cooperation and sharing food and resources during a crisis is strong among people in the community. As expressed by a woman farmer:

"We are not like other people that don't mind each other. In our village we have unity. We are like brothers and sisters. When we are about to eat, the rest [of our neighbors] will eat. Even if our food is only dried fish, we share and eat together. We are like this for a week."

Table 6.3. Men's and women's perception of the most significant impacts of severe flooding on regular agricultural activities

Impacts of severe flooding	Men (%)	Women (%)	Both (%)	X^2 test
Low yields	40	41	41	
Increase indebtedness	26	30	28	
Crop loss	25	22	24	1.225 ^{ns}
Food insecurity	4	4	4	
Others	3	2	3	

Note: ^{ns} not significant; No. of respondents: Men=201, Women=201

Impacts of severe flooding on men and women

Traditional gender roles resulted in differential impacts of flooding. Most of these impacts are experienced by both men and women although in varying degrees. Table 6.4 shows the impacts of severe flooding. The perceived impacts of severe flooding on men include pressure to acquire loan, pressure to provide food for the family, and pressure to seek other income sources. On the other hand, the perceived impacts of severe flooding on women are increased pressure to acquire loans, more stressed, and increased workload. One of the major impacts of severe flooding is the pressure to acquire loans due to losses because of flooding. Both men and women feel the burden of acquiring a loan to have the capital for the next planting season. Since men are considered as the family provider, they are pressured to provide food for the family,

Table 6.4. Men's and women's perception of the impacts of severe flooding on their lives

Impacts	Men (%)	Women (%)	Difference (%)
Increased health problems	5	11	-6 **
Increased pressure to provide food for the family	27	5	22 ***
Decreased quality of food	1	1	0
Decreased quantity of food	3	5	-2
Pressure to hire labor and machines	3	3	0
Pressure to acquire loans	34	20	14 ***
Feeling more stressed	7	18	-11 ***
More alcohol intake	0	5	-5 ***
Physical isolation	2	3	-1
Increased workload	6	18	-12 ***
Increased pressure to seek other income	12	11	1
Total (%)	**100**	**100**	

*Note: ** significant at 5%, *** significant at 1%; No. of respondents: Men=201, Women=201*

but because of the production losses, they are also pressured to seek other sources of income aside from rice farming. Meanwhile, women mentioned that they become more stressed during severe flooding. This is due to their increased concern on the safety of their family during flooding. Moreover, they become more anxious when their rice fields are destroyed. Crop losses would mean that the family would not have any income and food. On top of their daily household chores, they bear the burden of caring for the sick and elderly in their family. Increased pressure to take on extra off-farm and non-farm labor after severe flooding add to the workload of women.

Access to and control over resources

Flooding can have a devastating impact on rice-farming households. However, these impacts are experienced by individuals differently because of differences in vulnerabilities among different socio-economic groups such as among men and women. The results of the study confirmed that vulnerability to severe flooding is gendered due to differences in access to and control over resources. Although both men and women have limited access to and control over resources, the situation is worse for women. Very few women (2%) own land (Table 6.5). Land is considered the most important asset of the farmers, and having access to and control over it means having more power, status, and wealth in rice- farming communities. Since only a few women own their farmlands, their decision about farming is limited. Only 1% can decide on what varieties to grow. Moreover, a "farmer" status is designated to men, thus, extension services are still biased in favor of men. Some women interviewed in the study do not consider themselves as farmers, although they do almost all the farm work. A widowed farmer shared her experience in farming:

"When my husband was still alive, I used to help him in all farm activities, except in operating the hand tractor. Since I had to work on the muddy fields, my entire body itched. But I had to endure this problem since I am a farmer's wife."

Most of the women consider themselves as helpers and supporters of their husband in rice farming. Owing to limited access to capital and continuous losses in rice production when severe flooding occurred, men rely on women to acquire loans through informal sectors and to get support from relatives and neighbors. More women are getting support, particularly from relief rations because some men are too shy to ask for support from others.

Women have limited access to and control over resources, and thus, are more vulnerable to climate variability than men. Their vulnerabilities, however, are not due to their physical incapacity but due to their position and identity assigned to them by society.

Adaptation strategies to severe flooding

Differences in men's and women's access to and control over resources and in gender roles not only create specific gendered vulnerabilities and risks but also generate gender-specific capacities that influence their adaptation strategies to climate change.

Table 6.5. Access to and control over resources of men and women during the flooding period

Descriptors	Men	Women	Difference
Average years in school	7	7	0.5 **
Average years in farming	23.5	10.9	12.6 ***
Land ownership (%)	19	2	17 ***
Who decides on:			
What varieties to grow (%)	76	1	75 ***
Livestock management (%)	54	39	15 **
Who has decent rural employment			
Off-farm labor (%)	49	25	24 ***
Non-farm labor (%)	11	11	0
Who has accessed extension services (%)	26	18	8 **
Who acquired and repaid loans (%)	41	49	-8
Who received support (e.g., relief goods) (%)	87	91	-4

*Note: * significant at 10%, ** significant at 5%, *** significant at 1%; No. of respondents: Men=201, Women=201*

Results of the study showed that men still dominate in taking actions in response to severe flooding (Table 6.6). In terms of changes done by men and women in farming activities, men have more control in changing the rice variety, adjusting the planting activities, and cultivating smaller rice area during flooding period, since more male own and control the land. Men's control over the land implies that they also have more capacity to acquire loans than women.

The differences in men's and women's responses can be attributed to the ascribed gender roles of men being the "farmers" and women being the "helpers" or "farmer's wives." As "farmers," men are expected to take more responsibility regarding changes in their farming practices. Although women provide labor in replanting when seedlings are damaged and in building higher dikes, which require physical strength, their work often remains undervalued. Men also decide on the security of their households. However, their adaptive actions within the households are done hand-in-hand with women. A high percentage of men and women mentioned that they secure valuable items in elevated locations, store food and other necessities, and spend less during flooding.

Women consider family and friends as their main support system during flooding. However, only 23% of them said that they were able to take support from their relatives and friends since most of them are also affected by floods.

Nevertheless, it is important to note that more women get support from their relatives and friends during flooding. Much of this support is in monetary form or in-kind such as food and shelter. Most of the women get loans from their social networks due to

Table 6.6. Adaptation strategies in response to severe flooding

Adaptation strategy	Men (%)	Women (%)	Difference (%)
Change rice variety	63	52	11 *
Adjust planting activities	38	26	12 **
Cultivate smaller area than usual	26	15	11 ***
Replant when crops are damaged	42	32	10 **
Build higher dikes around the rice plots	54	41	13 **
Look for wage labor	25	22	3
Go fishing for food and/or extra income	37	20	17 ***
Get loan	67	58	9
Get from relatives/friends	17	23	-6 *
Secure valuable items in elevated location	67	62	5
Spend less	79	78	1
Store food and other basic necessities	81	74	7

*Note: * significant at 10%, ** significant at 5%, *** significant at 1%; No. of respondents: Men=201, Women=201*

lack of assets or collateral that can be used in getting loans from the formal sector. One female farmer narrated how she acquired and repaid loans to the people she knew in the village:

"There are farming expenses for which payment can be delayed, so what I do is to pay for the wage of the machine operator first. Then I talk to the owner of the machine, promising I will pay next time. For other expenses, I pay during harvest. You can get loans from people here who have "taling-giik" arrangement, which means that in return for the loan you have taken, you are bound to rent their thresher during harvest."

On the other hand, men and women learned to negotiate their gender roles. Men assume domestic roles while women spend more time outside, seeking income from non-farm work. Thus, farming household are deemed resilient during flooding resulting in switching of gender roles. A woman farmer leader quipped:

"I also have to bear the responsibility of repaying my loan so I need to find other sources of income. I told myself that I need to keep my promise to my money lender so that I can borrow again in times of need."

Due to lack of income opportunities within the villages, some farmers take their chances in looking for jobs in other places. Even women look for jobs and in some instances, go abroad, which some families find difficult to adjust to. A male farmer shared his experience:

"There's no other choice but to let her work outside the country for us to start a new life. We don't have any resources. Now, she's sending PHP 8,000 to PHP 10,000 per month. It is difficult and challenging because I must take on woman's role. I help my wife by raising pigs."

Conclusion and Recommendations

There are differences in men and women regarding the impacts of climate change. Although both of them face the same extreme weather events, women's experiences are different from those of men. This study shows that more women perceive the risk and threat of severe flooding; consequently, they are more anxious about the safety of their family and about the long-term effect of flooding in their livelihood and welfare. Both men and women are affected by losses brought about by severe flooding. However, women are more vulnerable because of unequal access to and control over resources that can be used to reduce the impact of severe weather events. Consequently, their adaptation responses are limited compared with those of men. Men dictate what to do in farming activities and what changes to apply in rice farms. However, women, like men, are capable of taking some responsive actions to climate change. They have learned to negotiate their gender roles with men, which results in increased resilience. Women's assets largely determine how they will be affected by and how they will respond to the impacts of climate change. Therefore, action should be taken to build up the asset base of women as a key factor in adaptation strategies. Gender-specific barriers to building assets (tangible and intangible) should be removed so that men and women can adapt better to the effects of weather shocks. Moreover, women's potential talents as key agents of change and their resourcefulness in adapting to climate change should be enhanced by providing them with opportunities to participate in agricultural training and extension, as well as in livelihood programs.

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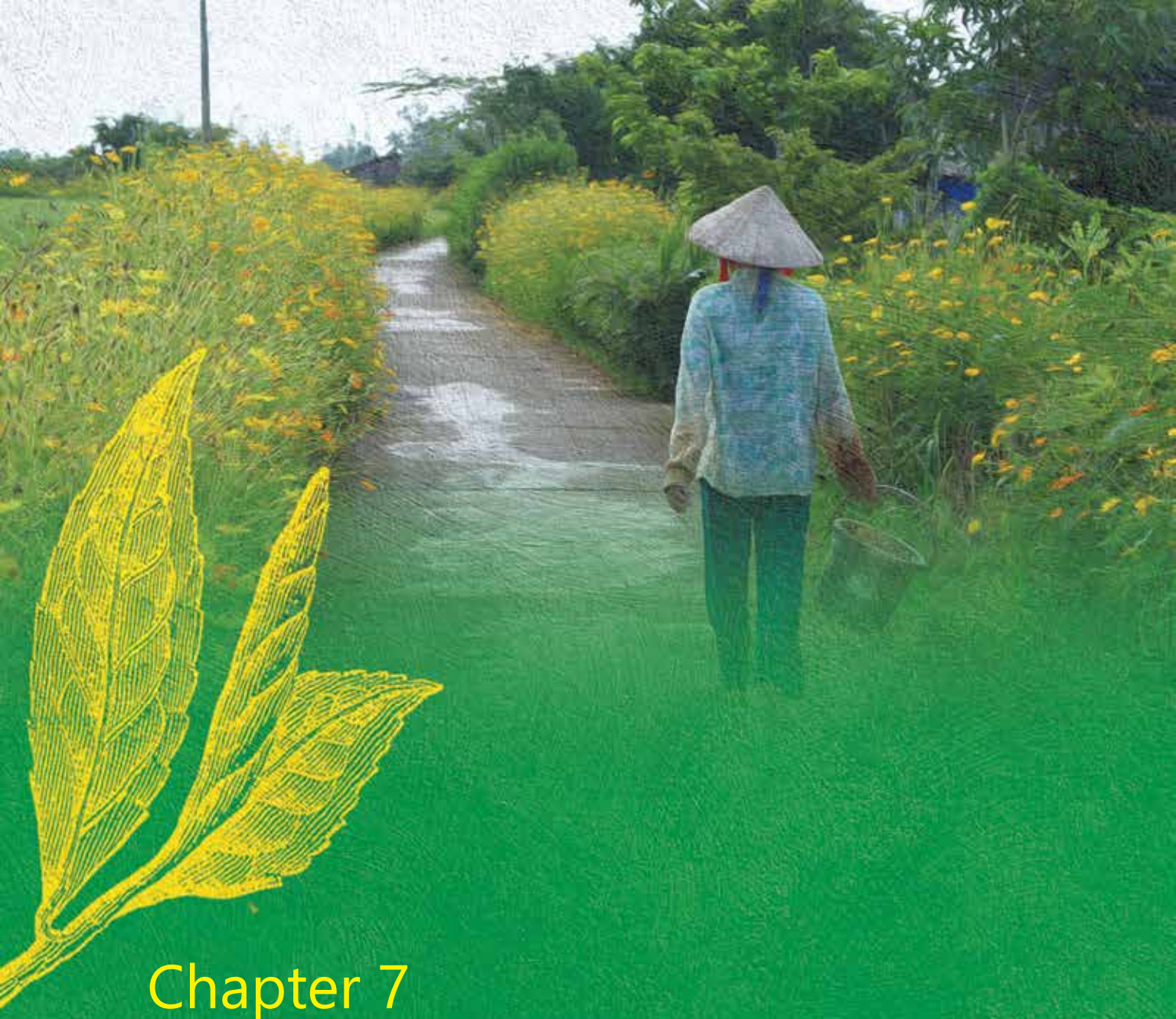

Chapter 7

Gender and Climate-Smart Agriculture: A Case Study in Tra Hat Village, Bac Lieu Province, Vietnam

Tran Nhat Lam Duyen, Bjoern Ole Sander, and Reiner Wassmann

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Introduction

The Mekong River Delta (MRD) is one of the two most important rice granaries in Vietnam. About 10,000 km^2 of the MRD are under rice cultivation, making the area one of the major rice-growing regions of the world (Ninh 2008). The delta has three rice cropping seasons--the main cropping is autumn-winter and the other two are winter-spring and summer-autumn. According to Marsh and Macaulay (2003), the average farm size in the MRD is 1.2 ha, which is considerably larger than the average farm size in the Red River Delta. The climate risks in the MRD are increasing the frequency and magnitude of flooding, seawater intrusion with high tide, sea-level rise (SLR), and seasonal tropical storms (Ninh 2008). Climate change could reduce rice yield in the MRD by over 40% in the summer-autumn cropping due to excessive flooding in the tide-inundated areas, and longer flooding periods in the central part of the Delta (ICEM 2009). However, the effects of climate change vary among the different parts of the MRD. While the flood-risk depth caused by SLR is most significant in the upstream areas (near the border with Cambodia), the coastal areas such as Ca Mau Peninsula are minimally affected by the flow of the Mekong River. The hotspot areas, which are affected by salinity, are mainly at the interface between fresh and saline water along the coastal provinces. In particular, it is on the East Seaside (Can Tho, Ben Tre, Tra Vinh, Soc Trang, Kien Giang, and Bac Lieu provinces), where tidal variation is higher than on the West Seaside (Phong et al. 2015).

Bac Lieu, which is located on the southeast of the MRD, is one of the major rice-producing provinces. This province can be a representative for both MRD's agriculture and aquaculture. It is strongly affected by climate change accompanied by SLR, hence exerts a strong impact on agriculture and aquaculture production (Phong et al. 2015). Particularly, drought and seawater intrusion affect almost 2,000 ha out of 7,000 ha of rice in Bac Lieu province. Thus, people in these vulnerable rice environments face climate change risks, which affect their livelihood and food security.

To develop the resilience of poor rice-farming households, Tra Hat village in Vinh Loi district, Bac Lieu province was selected as one of the six climate-smart villages (CSVs) in the Climate Change, Agriculture and Food Security (CCAFS)-Southeast Asia (SEA) project. Climate-Smart Agriculture (CSA) technologies and practices are tested in farmers' fields in CSVs to understand the interconnections between climate change adaptation, mitigation, gender, and food security.

All aspects of agricultural research, including CSA technologies, from problem identification, planning, testing, evaluation,

and dissemination have social implications. It is important to know the characteristics of the individual decision-makers or groups of decision-makers, such as their ability to perceive climate change and climate risks, their values and beliefs, and other individual attributes such as livelihood activities, asset holdings, age, marital status, or level of education (Kristjanson et al. 2017). In South Vietnam, both men and women are engaged in agriculture (crop, livestock, and aquaculture), particularly in rice farming. Several studies have shown that women contribute significant labor inputs in almost all activities in crop and livestock production (Chi, Paris, and Anh 2013; Grassi, Paris, and Chi 2017). The ultimate goal of the CCAFS-SEA project is to ensure that men and women can equally benefit from any intervention in agriculture to reduce climate change risks. An analysis of gender issues in the implementation and dissemination of potential CSA technologies in rice production is necessary to understand how different social expectations, roles, status, and economic power of men and women affect climate change adaptation (Huyer et al. 2016).

This study was conducted to gather both male and female farmers' perceptions of climate change and their adaptation strategies, identify the impacts of climate change on men and women in rice production, determine the constraints faced by male and female farmers in adopting and disseminating CSA technologies, and suggest gender-responsive policies that can help women combat the negative effects of climate change.

Methodology

The study area

Tra Hat village is a CSV located in south-western Vietnam, which is administratively part of Chau Thoi commune, Vinh Loi district, Bac Lieu province (Figure 7.1). Its total rice production area is about 316 ha and its average yield is 6–7 t/ha per cropping season. Available sources of freshwater for

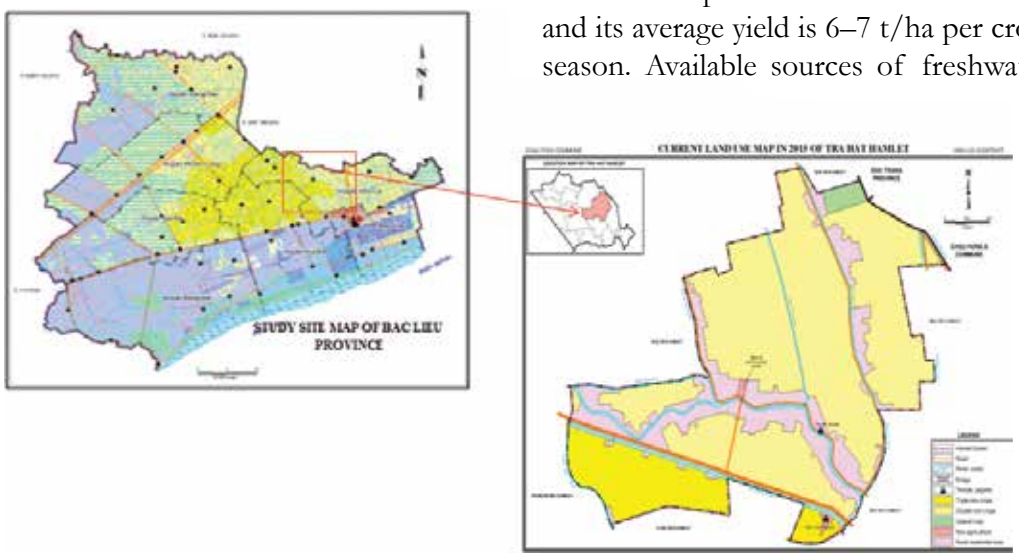

Figure 7.1. Land use map of Tra Hat village, Bac Lieu province, Vietnam

Source: Phong et al. (2015)

agriculture are mainly rainfall, water from Quan Lo Phung Hiep (QLPH) canal, and groundwater (Phong et al. 2015). Currently, there are not enough irrigation canals, limiting crop diversification and other alternative farming techniques. With an area of 306 ha, Tra Hat village is located at the tail end of QLPH, a salinity control canal system for the coastal area of Ca Mau peninsula where agriculture is usually faced with a lack of freshwater and salinity intrusion during the dry season (December–April) (Minh et al. 2015). Moreover, in the rainy season (May–November), some low areas in the village are inundated by heavy rains. The situation is expected to be more serious with the impacts of climate change and SLR (Phong et al. 2015). Rice, which is grown on 84% of the land, is the major source of cash income and provides food security. However, monoculture is sensitive to climate change and has low resilience. Tra Hat village has been identified in this study as the representative of the MRD areas that disseminate CSA technologies in rice production.

Data collection

This study used both primary and secondary data. Primary data were collected through surveys. Simple random sampling method was employed to select the respondents. The sample size was calculated based on Cochran's sampling technique (1963). A total of 110 respondents (49 male heads and 61 female heads) from rice-farming households were interviewed using a structured questionnaire. The study used some criteria recommended by FAO and CCAFS (2012), CARE (2009) for evaluating if the CSA-sensitive practices are following a gender-responsive approach to better respond to the needs and views of women and men. These criteria include the main activities of male and female farmers in rice production, including labor inputs (person-days per hectare), participation of men and women in decision-making on rice production and household activities, perceptions and adaptation strategies of male and female farmers on climate change, constraints faced by male and female farmers in applying CSA technologies in rice production, and factors affecting CSA technology adoption.

On the other hand, secondary data were gathered from relevant sources such as the CCAFS-SEA project, International Rice Research Institute (IRRI), Bac Lieu Department of Rural Development, General Statistics Office (GSO) of Bac Lieu province, as well as from previous studies, statistical materials, research papers, and reports.

Data analysis

Descriptive statistics such as means, totals, and percentages were applied in the analysis. The data included socioeconomic characteristics of the male and female heads of households (age, educational attainment, years in rice farming), farm size, gender-differentiated labor use in rice production per hectare, decision-making, perceptions on climate change, perceptions on CSA technologies, and factors affecting the adoption of CSA technologies as perceived by men and women. Chi-square test of independence was also applied to test for significant differences in responses, i.e., the extent men and women

report comparable perceptions of climate change. To capture perceptions of men and women and their reactions to extreme climate variability, respondents were asked to report their perceptions on various climate change variables (i.e., temperature, rainfall, drought, flood, salinity) that they have noticed in the past 10 years.

Results and Discussion

Socioeconomic characteristics of the sample

Before any CSA technology is introduced, it is important to first gather information on the target population or the intended beneficiaries. Based on the interviews, all respondents are engaged in rice farming and have an average of 1.8 ha of land. Owned land is larger (1.5 ha) than rented land (0.4 ha). On average, men are one year older than women and have one year more farming experience. There is a gap between men and women in terms of educational attainment. Men have seven years in school, but women have less (5 years). This difference is statistically significant. Today, this gender gap in education has diminished due to government laws that promote gender equality in access to education.

Gender division of labor in rice production

Although less often acknowledged, CSA technologies are not gender-neutral. In every society, there are distinct gender roles and gender-based division of labor. Thus, CSA technologies may have different impacts on men and women. The rigidity and flexibility of these roles for controlling and using resources are historically, pragmatically, culturally, and/or religion-based. The gender division of labor depends on many factors, including type of production system (irrigated or rainfed), economic status of households, availability of male working members, and degree of mechanization of specific operations (Pandey, Paris, and Bhandari 2010).

When analyzing the gender pattern of activities, it is important to observe how rigid or flexible the gender specification of a task is. Traditional roles are changing under conditions of rapid economic transformation of South Vietnam. For instance, the rise of mechanization resulted in reduced field activities for women (in terms of labor hours/day). However, the decline in women's participation in rice farming does not mean that women are no longer involved in managing the farm or they are not knowledgeable about farming. In fact, during the interviews, it was found that women are as knowledgeable as men in many aspects of rice farming, particularly on the amount and cost of inputs. When men are away for longer periods, women are compelled to take over the managerial responsibilities aside from the field activities.

According to Kabeer and Van Anh (2000), the gender division of labor is not rigidly enforced in Vietnam, but it varies by geographical location and household circumstance. Labor participation of men and women in Vietnam also varies on the type of production system. The migration study of Paris et al. (2010) showed that in irrigated rice farming, men and women contribute 48% and 52%, respectively,

of the total labor inputs per hectare. On the other hand, in rainfed rice farming, women provide more labor input (64%) than men (36%). In North Vietnam, women and men contribute an almost equal proportion of labor input (i.e., 52% and 48%, respectively) in rice production. Given women's active role in production, their contribution to sustaining livelihoods is critical. However, distinct inequalities in work burden in household and farm activities, reflect women's dual responsibilities in economic production and the domestic sphere (Grassi, Paris, and Chi 2017).

In Tra Hat village, rice is grown twice a year and the average farm size owned is 1.8 ha. The major activities in rice production comprise seedbed preparation (seed soaking); land preparation; crop establishment (sowing/row seeding, pulling of rice seedlings, transplanting, gap-filling, replanting); crop care and maintenance (irrigating the fields, applying fertilizer, spraying chemicals, manual weeding); harvesting-threshing; and post-harvest activities. Table 7.1 clearly shows that except in harvesting, women contribute labor in all of the activities. However, women's labor is concentrated on two stages of the rice cropping cycle, namely, crop establishment (40.7%) and postharvest (38.7%). Specifically, women contribute labor in seedbed preparation (33.3%), crop establishment (40.7%), and postharvest (38.7%). Men, on the other hand, lead all rice production activities, especially land preparation (71.1%), crop care (79.0%), and harvesting (100%). Based on the total labor inputs (person-days/ha), the relative share of men is generally higher than that of women. Men and women contribute 72.4% and 27.6%, respectively, out of 20.46 person-days per hectare.

Table 7.1. Labor distribution in rice production activities by gender in Tra Hat village, Bac Lieu province, 2016

Activities	Men (person-days)	Women (person-days)	Total (person-days)/ha
Seedbed preparation	0.27 (66.7)	0.13 (33.3)	0.40
Land preparation	2.81 (71.1)	1.14 (28.9)	3.95
Crop establishment	2.35 (59.3)	1.61 (40.7)	3.96
Crop care	7.99 (79.0)	2.12 (21.0)	10.11
Harvesting and threshing	0.37 (100.0)	0.00 (0.0)	0.37
Postharvest	1.01 (61.3)	0.64 (38.7)	1.65
Total	**14.81 (72.4%)**	**5.65 (27.6%)**	**20.46**

Note: Figures in parentheses are percentages

Source: Survey data (2016)

In summary, men and women can work either separately or jointly on the same field. There are also entrenched cultural issues that influence the roles of women and men. Due to culturally-determined gender roles, men take over an activity once it becomes mechanized. For example, women take part in harvesting as unpaid family workers and hired workers. However, when harvesting-threshing becomes mechanized, the men take over. This leads to the displacement of poor female workers who do not have alternative sources of income. Transplanting was used to be done by women, but when plastic drum seeders were adopted, the demand for women's labor declined. According to Paris and Chi et al. (2005), labor-saving technologies can have different impacts on women. Women from smallholder households are relieved from drudgery and can spend more time on other remunerative activities. On the other hand, women from marginal and landless households lost their income opportunities.

Women revealed some of the reasons for the gender division of labor during the interviews.

On irrigating the fields and water management, a female farmer said that:

"Since my husband is responsible for preparing the field, he manages irrigation water for the crop, too. As we need to pump water in or out of our fields, we need to carry a set of pipes and pumping machine. I am not strong enough to carry them, so it is my husband's job."

A married woman admitted that:

"Actually, I do know how to use the right amount of fertilizer and pesticides for our rice crop because I often do these work together with my husband. Usually, women don't have much knowledge about pesticide and fertilizer application. Moreover, we cannot carry heavy sprayer, so the work is always done by my husband. If he is not available, we usually hire male labor."

Another married women explained the gender division of labor on pulling rice seedlings, transplanting, and replanting, as well as straw management:

"For simple tasks like pulling up rice seedlings, replanting, and collecting the straw, my husband and I work together. I'm in charge of gathering straw and piling them and my husband burns them."

Gender differences in decision-making

Gender analysis, like any socioeconomic analysis of technology, starts with a series of questions such as, "who does a specific activity in crop and livestock production?" "who has access to or control of the products?" "who benefits?" and "who decides on specific concerns?." Increased productivity is linked to management decision-making because it is important to understand not only who is doing the work but also who is deciding about crop selection, crop management, postharvest, animal husbandry, and farm investments. Knowing who makes the decisions about specific areas of concern is important in the design and implementation of any project.

Studies on gender roles in agriculture, which include decision-making patterns, show that in societies where women participate in the market economy in some way and have direct access to cash, women wield greater power in intrahousehold decision-making and have higher status (IRRI 1985). Participation in decision-making on farm-related matters and household matters differ depending on several factors and circumstances, such as husband's short-term or long-term absence; women's experience, skills, and knowledge received from training programs; and direct access to agricultural extension services and inputs. A woman is more capable of making sound decisions on a specific issue when she has access to timely information and resources.

Table 7.2 shows the contributions of men and women in decision-making on specific concerns. Although about half of the men said they alone decide what crop and rice variety to grow, about a third said they make the decision with their wives. In crop management decisions, men dominate while decisions on time of harvest are made jointly by husband and wife. Women alone or husband and wife sometimes make decisions regarding the hiring of agricultural workers.

Women's participation in decision-making is generally low, even in decisions related to crop establishment and postharvest (8%–26% women vs 16%–78% men). However, more women make decisions regarding postharvest. For instance, women are mainly responsible for deciding on the rice allocation for home consumption (food security and income) (26% wives). In general, men have more access to technical knowledge and information for a number of reasons. One is that although women are visibly doing fieldwork, they remain excluded from farmers' training and agricultural extension activities.

As expected, women dominate in decisions related to small animals and poultry because traditionally, it is considered as a women's task. In Vietnam, women constitute about three-quarters of the labor force in the small-scale livestock industry, since they are responsible for 80%–90 % of the work in animal husbandry. According to ADB (2012), women have greater responsibility for livestock than men. Likewise, as respondents have reported by the respondents, women have a higher contribution to decision-making in managing livestock activities. However, in this study, about 30% of the women decide on how many livestock to raise and when to sell. More than 50% of the respondents answered that both men and women make decisions on livestock.

Day-to-day household management decisions such as food purchase, non-food needs, clothes, children's education, purchase of small livestock are commonly made by the wife alone.

Table 7.2. Contribution of men and women in decision-making in various farming activities

Activity	Decision to make	Men alone (%)	Women alone (%)	Both (%)
Crop selection/ rice varietal choice	1. Which crop to grow	50.91	11.82	37.27
	2. Which rice variety to grow	53.64	10.00	36.36
Crop management	3. When to apply fertilizer	83.64	10.91	5.45
	4. Amount of fertilizer to apply	83.64	10.91	5.45
	5. When to apply herbicide/insecticide	84.55	7.27	8.18
	6. Amount of herbicide or pesticide to spray	87.27	7.27	5.45
	7. When to irrigate/drain field	82.73	7.27	10.00
	8. How to manage pest and disease	78.18	8.18	13.64
	9. When, for what, and how many people to hire	66.36	10.91	22.73
	10. When to harvest	30.91	13.64	55.45
Postharvest	11. Which variety to use for next season	60.00	8.18	31.82
	12. How much rice to store for food and how much to sell	18.18	26.36	55.45
	13. When to sell rice?	16.36	21.82	61.82
Animal husbandry	14. How many livestock to raise	13.64	30.00	56.36
	15. When to sell livestock	12.73	28.18	59.09
Investment	16. How to raise capital for rice production	31.82	16.36	51.82
	17. How much to allocate for food expense	8.18	67.27	24.55
	18. How to raise funds for large investments (agricultural machinery)	38.18	9.09	52.73
	19. When to purchase livestock	12.73	30.00	57.27
	20. How to raise fund to purchase more land for rice	13.64	10.00	76.36
	21. How to raise funds for children's education	10.00	37.27	52.73
	22. How to raise funds to build/repair house	20.00	10.00	70.00
	23. Purchase consumer durable goods	5.45	23.64	70.91

Source: Survey data (2016)

Perceptions on climate change

Studies have found that there are gender differences in perceptions on climate change due to different exposure to shocks and adjustments on livelihood activities and roles within the household and community (Kristjanson et al. 2017). In this study, climate change is experienced as climate variability (i.e., changes in weather patterns) and weather-related shocks at the local level. Respondents are knowledgeable about extreme events (changes in temperature, rainfall, drought, and salinity that they experienced in the last 10 years). Men and women's perceptions of climate change in the last 10 years are presented in Table 7.3.

Table 7.3. Gender-differentiated perception of climate change in the last 10 years

Climate indicators	Men (%)	Women (%)	Pearson χ^2
Increase in temperature	77.55	81.97	0.3312
Irregular change in temperature	22.45	18.03	0.3312
Increase in rainfall	16.33	11.48	0.5430
Decrease in rainfall	36.73	55.74	3.9367*
Irregular change in rainfall	46.94	32.79	2.2856
Increase in drought	87.76	86.89	0.0185
Decrease in drought	2.04	1.64	0.0245
Irregular change in drought	10.20	11.48	0.0452
Increase in flood	48.98	42.62	0.4428
Decrease in flood	26.53	36.07	1.1387
Irregular change in flood	24.49	21.31	0.1563
Increase in salinity	89.80	85.25	0.5065
Irregular change in salinity	10.20	14.75	0.5065

*Note: * indicates statistical significance at 5% level; No. of respondents=49 male and 61 female*

Source: Survey data (2016)

Both men and women farmers reported that there is an increase in temperature, drought, floods, and salinity in the last 10 years. More women (55.74%) than men (36.73%) reported a decrease in rainfall. These differences are statistically significant at 5% level of significance.

In summary, men and women farmers in Tra Hat village reported similar perceptions and knowledge of climate variability, except on rainfall variability. This could be explained by their experiences during rice cultivation, shared through mass media that cover climate information.

Climate change impacts on rice production

Both men and women mentioned that floods and salinity result in higher production costs and in decrease or complete crop loss, which means more work for farmers. Women also have to help in gap-filling or replanting when seedlings are destroyed by floods. As voiced out by a female farmer:

"High level of rainfall results in low yields reduces the number of productive tillers and makes the rice plant weaker, which cause loss or lower rice yields. Furthermore, production cost increases because we have to pump water out of the field, apply more pesticides and fertilizer. We experience heavier workload."

A male farmer relates the problem with salinity:

"When salinity occurs, we cannot pump water into our rice field because the local government made a dam to prevent saltwater from coming in. Our production costs increase because we have to buy more chemicals."

Farmers' adaptation strategies to climate change risks

In the previous section, the data showed that there are no gender differences in the perceptions and experiences of climate change risks. However, there are gender differences in the adaptation strategies between men and women in Tra Hat village (Table 7.4). The common adaptation strategies by farmers are changing rice variety and cropping calendar, using alternate wetting and drying (AWD), and integrated pest management (IPM). More men (95.2%) changed rice variety, followed by changing the cropping calendar (79.5%), use of water-saving technique (AWD) (70.83%), and use of IPM (57.14%). Aside from changing rice variety, women respondents reported changing the cropping calendar (67.21%) and using a water-saving technique (AWD) (54.10%) as important adaptation strategies. However, change in cropping pattern is not considered an important strategy by both men and women. AWD was introduced and disseminated by the International Rice Research Institute (IRRI) and Bac Lieu Department of Agriculture and Rural Development (DARD) in Bac Lieu province. IPM has been organized and disseminated by Bac Lieu DARD for pest control for many years. Many training programs for IPM have also been organized by local farmers.

In summary, more men changed rice variety and cropping calendar, adopted water-saving technique, and implemented IPM. These differences can be attributed to men's greater knowledge and information due to having more access to information, agricultural extension services, and training. Except for changing the cropping calendar, the differences between the responses of men and women's adaptation strategies are statistically significant.

Table 7.4. Crop adaptation strategies of men and women farmers in Tra Hat village

Crop adaptation strategy	Men (% yes)	Women (% yes)	Pearson χ^2
Changed rice variety	95.9	83.6	4.2379**
Changed cropping pattern	20.4	66	4.6932**
Changed cropping calendar	79.6	67.2	2.0992
Used water-saving technique	70.8	54.1	3.4575*
Used IPM	57.1	26.2	10.8197***

*Note: *, **, and *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.*
No. of observations: Men=49 and Women=61

CSA technologies and practices

In Tra Hat village, a number of CSA technologies were introduced for farmers to test on their own fields using their own resources. These technologies are as follows: agricultural machinery such as laser land leveler, sowing machine, straw baler machine and improved crop natural resource management such as certified seeds, phosphorus reduction, nitrogen reduction, AWD, IPM, and change in cropping calendar.

Gender-differentiated perceptions of proposed CSA technologies

Based on the introduction of CSA technologies, the research team asked men and women how acceptable or how likely they are to adopt the technologies. There are statistically significant differences between men and women in choosing CSA technologies for rice production (Table 7.5). Among the CSA technologies, laser land leveling, nitrogen reduction, AWD, IPM, and change in cropping pattern are more likely to be adopted by men. However, the majority of men and women are most likely to use certified seeds which are suitable to their fields. It it interesting to note that more than half of the women interviewed find nitrogen reduction and AWD acceptable. This can be due to their cost-saving benefits.

These similarities and differences can be explained by men's and women's labor participation in rice production. Moreover, activities such as land preparation using machinery, application of fertilizer, water management, and spraying pesticides are dominated by men. Men make major farm-related decisions, for example, changing cropping patterns to avoid floods and drought. Husbands and wives often jointly made the decisions on what crop and which variety to grow .

Table 7.5. Acceptable CSA technologies as perceived by men and women farmers

CSA	Men (% yes)	Women (% yes)	Pearson χ^2
Laser land leveling	36.73	14.75	7.0885***
Use of sowing machine/plastic row seeder	42.86	31.15	1.6101
Use of straw baler machine	42.86	29.51	2.1159
Use of certified seed	79.59	78.69	0.0134
Phosphorus reduction	24.49	18.03	0.6951
Nitrogen reduction	97.96	78.69	9.0847***
Alternate Wetting and Drying	71.43	57.38	3.0749*
Integrated Pest Management	83.67	40.98	20.6334***
Change in cropping pattern	38.78	22.95	3.2403*

*Note: *, **, and *** indicate statistical significance at 10%, 5%, and 1% level, respectively.*
No. of respondents: Men=49 and Women=61
Source: Survey data (2016)

Key constraints to CSA adoption

The key constraints cited by both men and women are unfavorable biophysical conditions (scattered and fragmented plots, sloping land, and poor soil and water quality), lack of capital for initial investment and for farm inputs, and low market price. Other constraints mentioned are lack of government policies to support CSA technologies and lack of accessible service providers of machinery. More women than men expressed that CSA technologies require costly inputs (e.g., machinery), which are too complex, requiring them to undergo skills training.

The challenges of climate change in agriculture will require site-specific solutions, as well as recognition of the specific needs and constraints of both men and women and barriers and incentives for adoption of technologies by gender (Nelson and Huyer 2016). Men have more access to service providers of machinery for land preparation and harvesting-threshing. With that in mind, involving women in the development of new technologies can ensure that technologies are user-friendly, affordable, effective, and sustainable. Gender inequalities in access to resources, including credit, extension services, and information and technology, must be taken into account in developing technologies designed to curb the negative impacts of climate change. Women should also have equal access to training, credit, and skill-development program to ensure their full participation in climate change initiatives.

Perceptions on the factors enhancing the adoption of CSA technologies in rice production

Based on the constraints discussed in the preceding section, this study attempted to identify the key enabling factors that can enhance the adoption of CSA technologies in Tra Hat village. The results can provide rice scientists, agricultural extension workers, and policymakers in identifying the CSA technologies that can equally benefit men and women who engaged in rice farming.

Men and women farmers were asked the three most important incentives that can promote the adoption of CSA technologies. Both groups gave similar responses:

1. *Good rice yields and lower costs of production.* Since the farmers' goal is to maximize profits and minimize production costs, farmers will adopt rice technologies which do not require high production costs. Since women, in particular, are in charge of family budget, they will have the incentives to apply technologies which can reduce the use of inputs, for example, the adoption of 1M5R package (production technology, which calls for reducing the amount of seed, chemical fertilizer, pesticide, and water that are used, as well as post-harvest losses).
2. *More access to credit.* Farmer cooperatives in the village provide farmers access to credit. Thus, farmers who are members of cooperatives can apply farm inputs at the right time and with the right amount and installments at low-interest rates.

3. *Increase technical knowledge.* CSA technologies and practices require improved technical knowledge and skills. Both men and women are interested in participating in farmer-field schools and demonstration of technologies on farm and training activities using simple communication methods.

Conclusion

In this study, climate change is experienced as climate variability (i.e., changes in weather patterns) and weather-related shocks at the local level. The majority of the respondents (men and women) reported an increase in temperature, drought, floods, and salinity. More women experienced decrease in rainfall. Except in harvesting, women worked with men in almost all of the rice operations. Women's labor contributions are concentrated in crop establishment and postharvest while men took the lead in all rice production activities, especially in land preparation and crop management. Men do harvesting with the use of combine.

Both men and women mentioned that floods due to heavy rainfall and salinity result in higher production costs or complete crop losses. Farmers have to drain the water out of the flooded fields and apply more pesticides and fertilizer, thus, incurring more costs. This means more work for men and women. Women have to help in gap-filling or replanting when seedlings are destroyed by floods.

To adjust to climate variabilities, men and women used several farm-related strategies such as changing rice variety, cropping pattern, cropping calendar, AWD, and IPM. Although, a higher proportion of men used these adaptation strategies.

A number of CSA technologies were introduced for farmers to test on their own fields using their resources. The CSA technologies that the men found more acceptable are agricultural machinery, improved crop and natural resources management techniques, and change in cropping. Men were more likely to adopt machinery than women. However, women, particularly female heads of households, can also have access to labor-saving machinery, provided that they have access to service providers. Although the use of certified seeds of stress-tolerant rice varieties is highly acceptable to both men and women, more efforts should be made in providing seeds to women, especially to female heads of households. More women should be trained on the production of high-quality seeds and improved crop and natural resource management such as nitrogen and phosphorus reduction, AWD, and IPM. Since these management techniques will reduce inputs costs, women can be motivated to adopt these technologies based on their roles as budget keepers in the family.

Recommendations

1. Both men and women should be provided with access to climate information, as well as training and extension materials on CSA technologies and practices. Information is a powerful tool for enhancing adaptation to climate change because farmers would not accept CSA technologies if they are unaware of the possible impact of

climate change on their crop. Successful adoption of CSA technologies requires recognition of the need to adapt and of the benefits of CSA technologies. This can be achieved by providing training and demonstration trials. CSA technologies are relatively knowledge-intensive, requiring considerable managerial knowledge about proper input application. For example, AWD does not require more labor and capital than the traditional rice cultivation technique but it requires farmers with skills and farming experience so they can correctly apply the technique. Thus, extension services are important in promoting the adoption of CSA technologies. In addition, farmers who highly trust the skills of extension agents are more likely to adopt CSA technologies. This implies that when farmers have contact with extension agents, the quality of extension services provided becomes an important determinant of CSA adoption. Thus, upgrading the skills of extension workers is necessary to speed up the CSA adoption and dissemination of CSA technologies and practices.

2. Agricultural scientists and extension workers should increase their consultation and discussions with women farmers and ensure women's participation in climate change initiatives.
3. Local village leaders and policymakers have to pay more attention to gender perspectives when designing strategies for CSA technologies dissemination. Training classes and demonstration on CSA technologies should involve both men and women. Female farmers should be given more training opportunities with a high level of engagement and that is suitable for them given the nature of their farm work. Examples of these are on the production of quality seeds of stress-tolerant rice varieties and in crop and resource management.
4. Agricultural research for development programs should continue to provide support to incorporate gender perspectives into farmer-centric projects on climate change adaptation through systematic gender analysis, collecting and utilizing sex-disaggregated data, establishing gender-sensitive benchmarks and indicators, and developing practical tools to support increased attention to gender perspectives.

Finally, there is a need to recognize that women can provide substantive contributions with their knowledge and experience on issues related to the management of natural resources.

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Chapter 8

A Feminist Analysis of Oppressive and Emancipatory Potentialities Within Technology-Prioritized Climate Change Adaptation Intervention: A Case Study from Phailom Community in Lao PDR

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Introduction

The concepts of today's climate change adaptation practice and research, from "adaptive capacity" to "vulnerability" have, in practice, remained rather blurry. Regardless of this, adaptation is currently being executed at a rapid pace in both rural and urban areas, and the solutions to address the causes of vulnerability seem to be strongly leaning on a certain direction: technological solutions are currently the most widely applied adaptive response globally, as recently concluded by the Intergovernmental Panel on Climate Change (IPCC) (Noble, Huq, and Anokhin 2014).

In this chapter, I approached the contemporary technified adaptation discourse from a feminist perspective, thus understanding adaptation as a highly power-laden social process. Through a case of climate-smart agriculture pilot in Phailom community in rural southern Lao PDR, I aimed to reach the lived realities of those in the margins of adaptation discourse. In this community of about 102 households, adaptation technologies, such as new drought tolerant rice varieties, direct seeding as an alternative rice crop establishment method, and a dynamic crop calendar to help with timing of cultivation activities have been adopted by local farmers since 2014. The project was initiated by the Consultative Group for International Agricultural Research (CGIAR) as part of its international research program on Climate Change, Agriculture and Food Security (CCAFS).

Phailom is a particularly relevant case for studying the effects of technology-oriented climate change adaptation, as the community is currently a living laboratory for not just how social power relations and technology co-evolve, but also how "smart adaptation" makes reality and shapes the lives of locals. The current food insecurity, and the predicted climate change impacts in Lao PDR that might accelerate the struggle over food, also demand critical examination of the effects of the technified efforts aiming to improve the lives of those at the margins.

Indeed, while climate-smart initiatives and similar technology-oriented climate change adaptation projects are spreading across the globe, some critical voices raising concerns on the social injustices such interventions may produce have started to emerge (Gonda 2016; Carey, French, and O'Brien 2012; Kantor, Morgan, and Choudhury 2015). Feminist scholars have strongly emphasized the effects of technology on social relations are far from straightforward. Feminist scholars within science and technology studies (e.g., Haraway 1988; Wajcman 2010; Harding 1986; McNeil 2007) have worked toward unfolding this complicated nexus by showing how technology is never isolated from the society

and culture where it originates and where it enters. As they argue, prevalent sociocultural and political dynamics always affect how technologies make sense and are adopted at the local level. Correspondingly, technologies also embody certain assumptions, power, and practices, which play a role in transforming (gendered) power relations.

This chapter entered a "climate-smart" space at a moment when a technological intervention has begun to interact with the lives of locals. By applying a feminist lens, I developed a better understanding of how the farmers in Phailom, as well as the project practitioners, made sense of and negotiate the new technologies. An understanding of these meaning-making processes helped me analyze how the (gendered) power dynamics transformed at the local level as adaptation technologies became part of daily life in Phailom. The empirical data showed how both the local power dynamics, and also local-global power frictions, interact with and contribute to the making of climate change adaptation in the community.

This chapter has four parts. The first part elaborates the use of feminist approach as an analytical tactic for studying power dynamics within technified adaptation discourse and introduces the methods applied. The second part presents the results of the study, followed by theoretical and practical considerations, including four policy recommendations.

A feminist perspective to technified climate change adaptation

Feminist analyses in climate change adaptation research have so far been scarce. Recent contributions by feminist scholars have, however, shown that a feminist perspective can provide valuable new insights to adaptation and to the inequalities that might get reproduced within this discourse (Nightingale 2015, 2016; Gonda 2016, 2017). The value of the feminist approach lies in the possibility to shift the focus from gender roles, relations, and gender-differentiated impact of technologies to a wider context, where the examination of masculinities and femininities provides a framework for unveiling the multiple (asymmetrical) power dynamics and knowledge production that surround climate change adaptation science and practice (MacGregor 2009). As pointed out by MacGregor (2009), analysis of power relations between men and women and the discursive constructions of masculinities and femininities are particularly relevant in climate-related studies, because these constructions "shape the way we interpret, debate, articulate and respond to social/natural/techno-scientific phenomena such as climate change."

As Harding (1986) and Dankelman (2010) emphasized, what remains as the driving force for feminist studies is that gender[1] has, across cultures and history, shown asymmetry where

[1] I approach gender here by contributing to the recent development in the understanding of it: viewing gender (1) as a process and "doing" that is constantly reproduced in social interaction (Beauvoir 1988; West and Zimmerman 1987); (2) as inherently tied to socioeconomic structures such as division of work (see Harding 1986); and (3) as a category that is always intra-acting with other social categories such as race, class, ethnicity, and age (Wajcman 2010; Lykke 2010).

symbols, structures, and behavior counted as masculine are valued over feminine: modern/traditional, objectivity/subjectivity, rationality/irrationality, mind/body, culture/nature—where, in each case, the former is related to masculinity, leaving the latter to femininity (Lykke 2010; Harding 2008). The asymmetrical valuations of masculinities and femininities have been widely used as an argument for various arrangements, ranking from wage labor to the hegemony positions of science and technology as the "motors of progress" (Connell 2005). Within technified climate change adaptation discourse, masculine and feminine get repeated at symbolic levels: nature and traditional, considered as feminine, gets controlled and managed by modern climate technologies.

The epistemology of situated knowledges, initially conceptualized by Haraway (1988), has strongly influenced feminist critique of scientific objectivity and prioritization of technology with a key argument: because production of knowledge is always located in specific time, society, culture and political atmosphere, all knowledge should be viewed situated, resulting in partial views (Haraway 1988; Lykke 2010). From a feminist deconstructionist point of view, the seemingly objective and rational applications of science, such as climate change adaptation technologies, are not a direct result of techno-scientific innovation processes, but instead located in a certain socio-political context in time, and thus embodying power and values (Lykke 2010). Based on this view, technologies should be seen as power-laden social constructions that are not objective or stable, but constantly negotiated and remade (Lykke 2010; Haraway 1988; Winner 1980).

Haraway's theorizing of situated knowledge also aims to highlight the universal devaluation of feminine entails that some voices have remained more "on the side" and marginalized than others (Harding 2008; Haraway 1988). This is indeed what a feminist scholarship, through its theoretical, epistemological, and methodological framings aims to respond: to apply a research orientation "from below" that lifts up the feminine, silenced voices, and knowledge, which can present alternative realities (Harding 2008; Kristeva 1982). These voices thus include not only women's voice but all the voice of those in marginalized positions. For example, traditional or local environmental knowledge, often viewed as "non-scientific" or "irrational" by masculine systems, has been called for re-valuation by feminist scholars as it has been so far, largely marginalized in the climate change adaptation discourse (Israel and Sachs 2012; Wangui 2014).

In addition to devaluation of "feminine" knowledge, feminist inquiry has also raised concerns about the capitalist and market-oriented power structures reinforced by adaptation (Israel and Sachs 2013; Mies and Shiva 2014; Nightingale 2015). Nightingale has shed light on the increasing trend of considering "adaptive capacity" as something inherently linked to economic growth and diversification of livelihoods (Nightingale 2015). In line with this, it can be observed that adaptation practices, such as the climate-smart discourse, aim to increase crop productivity, income, and monetary benefits from labor (CCAFS and UNFAO 2014; Nightingale 2015).

Finally, in its endeavor to make enormous changes in global climate systems harmless, "adapting to climate change" creates an illusion of having control over nature. Through this domination and mastery, it has been claimed to present a pronounced form of hegemonic masculinity (Tschakert and Machado 2015; Israel and Sachs 2012). According to Nightingale (2015), such view tends to create an apolitical approach to adaptation, which gives further justification to manage and use nature as a commodity.

With its critique on techno-scientific climate change adaptation discourse, the feminist inquiry thus challenges the traditional, deterministic input-output thinking that tends to surround technological processes: the rationalistic assumptions that leave unproblematized the social processes through which technology is remade and recontextualized in local settings. Thus, viewing climate change adaptation technologies from a feminist perspective, it becomes necessary to pay close attention to the power structures and knowledge production in the creation and interpretation of the technologies, and to examine the voice of those who are at the center of making sense of the new artifacts.

Methods of data collection

The empirical data used in this case study were gathered in Lao PDR in March and April 2017, using both qualitative and quantitative methods. Following the feminist thought that views technologies as social constructs, the research methods were designed to capture the ways local female and male farmers perceive, understand, and access the new climate technologies based on their social positions, life situations, and work burden: the aim was to gather narratives of individual meaning-making of technologies. The key data were collected through thematic interviews with six female and three male farmers in Phailom. Questions evolved around the everyday life as a woman/man in Phailom, changes in weather experienced in past years, new adaptation technologies, and the future that farmers envision in relation to the technologies.

To contextualize the realities from where the meaning-making of technologies emerge, additional supporting data were gathered from farmers through PRA methods (seasonal calendar and history event timeline), a household questionnaire, and informal talks. PRAs were conducted separately for female and male farmers, resulting in four sessions. Of the 102 sample households in Phailom, 14 female household heads and 20 male household heads were interviewed using a structured questionnaire. To gain insights to potential social inequalities and local hierarchies that might frame the access to, adoption of, and perceptions on technologies, the samples included both households that had been testing the new technologies, and those that had not been part of the project for some reason. The questionnaire covered a variety of aspects from a family and decision-making structures to livelihood strategies and division of labor. Several open-ended questions in relation to changes in weather and farmers' experiences with the new climate technologies were also included.

Finally, project practitioners played an important source of data for understanding the project design and its background. Narratives from them provided valuable insights on how the role and meanings of the new adaptation technologies are viewed by the implementers of the project. In addition, secondary information about the project was derived from published project-specific report (see Yen et al. 2015; Villanueva et al. 2015).

Results and discussion

Making sense of adaptation technologies

In the following sections, I illustrate the logic of meaning-making of climate change adaptation technologies through a feminist lens from three viewpoints. First, drawing from empirical insights, I show how local hierarchies both shape and get shaped alongside the introduction of new technologies in Phailom. Second, I demonstrate how new creative meanings arise for the purposes of the technologies based on the local's understanding of climate and the surrounding environment. Finally, I show how capitalist structures, claimed to be tightly compounded to the adaptation discourse, emerged in Phailom. The three technologies under focus are described in Table 8.1.

Arranging the technological intervention at the local level: existing power asymmetries remain unchallenged

Participant observations and discussions with project practitioners and farmers showed that community leaders and local men stand at the forefront of the climate-smart project activities in the community: fathers, husbands, brothers, sons, and sons-in-law are primary users of technologies and those who have the capability, motivation, and knowledge to learn. Moreover, discussions with locals and project practitioners revealed that local community leaders hold a strong gatekeeper position in relation to the ongoing project: they negotiate with project practitioners about activities in the community, and they in the end decide the local participants for different technology trainings. The head of her household, Mrs. Thao,[2] 37, shares her experiences:

"I would like to try dynamic crop calendar even though I don't understand it yet. When there was a project training for dynamic crop calendar, our community leader submitted a list of people who could attend. My brother was on the list, so after the training, I went to see him and asked what he had learned."

Other farmers' narratives indicated that the existing gender roles and social norms define who could attend public meetings and make decisions regarding rice cultivation: both female and male farmers, including the leader of women's group, legitimize men's higher engagement in the new project.

[2] Names of respondents have been changed.

Table 8.1. Overview of the three main climate technologies introduced in Phailom, as presented by CCAFS project

Adaptation technology	Purpose of technology
Drought tolerant seed varieties A set of modern seed varieties that can tolerate drought, along with improved crop management practices, i.e., amount and timing of fertilizer application.	Help farmers to maintain and improve rice yield under irregular rainfall patterns and prolonged drought periods.
Dynamic crop calendar A paper brochure consisting of a weekly timetable to help in the timing of different cultivation activities. DCC is based on meteorological data in seasonal weather predictions.	Help farmers to maintain and improve rice yield through better addressing and being prepared to seasonal weather variations.
Direct seeding A crop establishment method for rice cultivation, where seeds are sown directly to the soils after ploughing the land. Direct seeding does not require wet soil and it can be done by one person using a direct seeding machine.	Help farmers to sow seeds on dry soils especially when rainfall is delayed. The method also eliminates seed nursery, pulling of seedlings and transplanting, thus reducing labour use for rice production.

"Women don't participate that much, because this kind of work is men's work. Rice cultivation is mainly men's work.[3] *Also, it's usually the men who attend meetings while the women stay at home."*
(Mrs Lumphai, 47, leader of women's group)

Mrs. Joy, a 36 year-old female household head, elaborates the same arguments as that of Mrs. Thao and Mrs. Lumphai. Her explanation also reveals that a certain project design is limiting women's participation.

"Most women can't read or write so they can't attend project activities. Men are heads of households, so they participate in meetings, and they can also decide. Women don't often make decisions."

Indeed, in addition to decision-making, the ability to read and write seems to be a precondition or, at least, a significant advantage to participate in and benefit from the project. Data from female households and male households help shed light on the disadvantaged position of many women and some elderly. The average number of years that men had attended school is 4.6, and nearly everyone, 19 of 20 respondents, had completed a minimum of one year, and

[3] Based on household survey data, local men mostly carry out "hard" and productive phases of rice cultivation, such as plowing, applying fertilizer, harvesting, and postharvesting. Women tend to be engaged more in manual work within cultivation, including seed nursery, pulling of seedlings, weeding, and harvesting.

5 of them, 8–10 years. Conversely, 12 of the 14 women interviewed had never attended school and only 2 of them had completed 3-6 years. In line with level of education, most of the women interviewed and some elderly men said they cannot read or write. Almost a third of the households mentioned this low level of education as the primary reason for not using the dynamic crop calendar. The design of the ongoing project, therefore, seems to marginalize especially the women and elderly farmers in attending trainings and adopting certain technologies.

Finally, there emerges another interesting power-laden arrangement that has taken place among farmers in Phailom at a time when the climate-smart project provided the community with a direct seeding machine for community use. From several female and male farmers' narratives, it is evident that the new machine has clearly favored those holding a high social position in the village, namely, community leaders and teachers. The direct seeding machine—the artifact itself—has thus become a status symbol at local grounds, where the access to it reflects the farmer's position in the community's social hierarchy.

The examples given illustrate how local social hierarchies, combined with the specific design of the technological intervention, seem to have created spaces where it has become easier for some farmers to attend and be included in the climate-smart process, while others have remained excluded. The results show that the arrangements made to accommodate the new technological intervention in Phailom are largely shaped by local forms of gender asymmetries and other social hierarchies that seem to stay invisible, ignored, or out of control for the project practitioners. This becomes evident in the ways the project activities are structured at the local level in favor of men's participation, as well as in certain technologies (particularly dynamic crop calendar) that are unreachable for illiterate farmers, most of them women of all ages. It is, however, not only women but also elderly men and farmers without high social positions in the village, who have experienced constraints in adopting or getting access to some technologies. On the contrary, the community leader, his deputy, and other villagers with high social positions, as well as male farmers who have shown capability and will to learn, seem to hold the strongest negotiating power over the technological intervention and its arrangements at local level.

Redefining climate-smart technologies: contradictions and creativity from below

Climate-smart technologies have been introduced in Phailom to improve local adaptive capacity in terms of food security under climate change impacts—an aim that was frequently mentioned by project practitioners. In particular, the dynamic crop calendar and drought-tolerant seed varieties have the climate-controlling function embedded in the design of the technology, while direct seeding can be resorted to in case of delayed rains. Despite the project's strong emphasis on the climate-related aims of technologies, only a few farmers—the male leaders who have been most closely engaged in the project share somewhat similar viewpoints. A community leader narrates his experience:

"Before, we transplanted and produced rice following the natural weather. But now because of climate change, the project is important because it will help get high yields." (Mr. Thong, 53)

Apart from community leaders, other farmers do not perceive that technologies under the climate-smart project are intended to mitigate the adverse effects of climate change." Indeed, none of the interviewees perceive the new seed varieties as something related to drought tolerance, but instead connect their increased rice yields to better application of fertilizer. The perceived importance of using the "right" fertilizers as recommended by the project is evident, for example, in Mr. Khamtan's elaboration:

"Last time we used the old fertilizer (the fertilizer we used before the project) because it is cheaper, even if the project staff told us to use the new fertilizer given by the project. And that is why we did not get high yield."

In the case of the dynamic crop calendar, farmers' perceptions of this technology were, in many cases, opposite of the project's outcomes. The project practitioners explained that the dynamic crop calendar is based on short-term seasonal weather forecast and should thus help farmers to conduct each cultivation task in optimal time, resulting in good yield. However, the farmers said that they could not follow the instructions, because of their dependence on the rain (Mrs. Lounny, and confirmed by seven other female and male farmers).

Farmers' narratives about the underlying causes of droughts also revealed how locals' perceptions of changes in climate and environment differ from those on which the climate-smart agriculture technologies are based. There was a consensus among the women's group that droughts are due to deforestation, which took place near the village some years ago. According to them, it was an outcome of high forest tax, which is an incentive for landowners to convert cultivated forestland to farmland. This also resulted in the cutting of trees and eventually, the establishment of a large sugarcane farm near Phailom owned by a Thai company. Women also mentioned how pesticides were used in the farm, which had consequences in Phailom—water quality in fish ponds decreased and mushroom in the community forest have become poisonous. The women's narratives are somewhat supported by a few other farmers, such as Mr. Vatsana, 60 years old:

"Before, there was a forest, but now it is gone, and there is a sugarcane farm in the next village. There is no protection from the forest anymore, and that is why we have droughts and sometimes storms."

Local narratives demonstrate how farmers' understanding of climate and the environment reflects the aims to maintain the quality of the surrounding environment instead of managing and controlling it. Furthermore, the reasons for and drivers of change in climate conditions have been repeatedly traced to changes in the surrounding environment, rather than to changes in global climate systems.

The insights to farmers' relationship with climate and land help to understand why the new technologies, especially the drought-tolerant varieties and the dynamic crop calendar, are viewed differently by the farmers and the project practitioners. The absence of climate narratives regarding drought-tolerant seed varieties aligns with locals' perception that climate is something that is not to be controlled but rather followed, and that climatic changes are, in general, attributed to local environmental changes. The differing narratives between project practitioners and farmers demonstrate the co-constitutive character of technology and challenge deterministic views of it: even the most "obvious" climatic functions within technologies can be creatively renegotiated based on local worldviews and relationship with climate and surrounding environment, as it has been done by farmers in Phailom.

Marginalizing subsistence—creating space for markets

The last section demonstrates how the capitalist structures that, according to a feminist critique are closely compounded to the climate change adaptation discourse, emerge in the discussion with farmers and project practitioners in Phailom. Particularly, two types of narratives can be traced in relation to how farmers envision the future, and here, a socio-spatial pattern emerges.

The first narrative–repeated mainly by those marginalized by the adaptation intervention, such as illiterate women and elderly—arises from the struggles of the realities of everyday life in contemporary Phailom, where many households still lack rice for the whole year, and where socioecological changes have resulted in new kinds of concerns toward availability of food. These farmers draw from their environmental knowledge in making sense of needed future paths. They say that improvements in the ricefield through technologies do not seem to be enough, as the land size for farmers is getting smaller; droughts are likely to occur, and food in the surrounding environment is decreasing. Overall, farmers' views of the future seem to reflect hopes of ending food shortage, either by increasing yield or by finding extra work for food and other expenses.

The second narrative belongs to those who have been closest to the climate-smart project: the project practitioners, community leaders, and a few male farmers. The new technologies seem to show a way toward market possibilities in the minds of some farmers, such as Mr. Suan, 44 years old:

"Next, I need to grow rice and vegetables for business. Because now, we cultivate rice only for home consumption, but in the future, we can cultivate to sell."

Seemingly in agreement with Mr. Suan, the leaders of the community appear to seek and desire an exit from the "traditional", that is, the subsistence culture of exchanging and borrowing.

"Before, people exchanged their produce. If I have chili and I need more fish from you, we can exchange. But now and in the future, it gets more difficult to do this. There are still households that exchange, but maybe in the future we will no longer exchange goods.

We will go to the market. If we don't' have money, we can't buy chili." (Mr. Thong, 53, community leader)

"We need more technology, big tractors, computers and other machines…we need to build more capacity, so we need more modern things." (Mr. Outhai, 47, deputy community leader)

The marketization narrative further strengthens among the project practitioners, who are those closest to the technological innovations. Indeed, stories from project practitioners give an impression that moving away from subsistence farming to market-oriented agricultural production seems a necessary step toward adapting to climate change; or at least, adaptation was used as an argument to pursue this idea for future development. An officer in the Research Center of Climate Resilience in Agriculture, a new government department established in early 2016, explicitly expressed his view about the connections between climate change adaptation technologies and the need for a more market-oriented approach. Access to markets instead of continuing with subsistence farming is, in his opinion, the key to motivating farmers to adopt new technologies, which, in turn, is needed to increase local adaptive capacity.

While the narrative of commercialization is being emphasized by the climate-smart project practitioners, there were opposing voices, too. When a government official was asked on whether farmers themselves are interested in marketing their produce, he said that it is difficult and challenging to convince farmers to go beyond subsistence farming. Nonetheless, after providing them training, some farmers have started to understand the value of increasing production and earning more income. Several other practitioners seem to have a similar point of view regarding the locals' preference for subsistence farming instead of establishing a link to markets. While the project practitioners clearly view the subsistence farmers' attitude as challenging, and hopes to see farmers moving on to sell their produce, they also recognize challenges in creating fair market access for local villagers.

A clear pattern emerges here in relation to devaluation of local and traditional knowledge. This is the subsistence logic of maintenance rather than profit-seeking, which seems to collide with, and thus, be disregarded within the technified adaptation discourse. The future visions also reveal that the meaning-making of technologies is characterized by contradictions. For example, the narrative of marketization told by project practitioners seems to be presented as a natural part of adaptation work and purpose of technologies; yet, in the next moment, the potential for increased vulnerability of farmers due to the logic of market-based agriculture is equally recognized.

Oppressive and emancipatory potentialities: policy-relevant insights

An analysis of the meaning-making of climate-smart adaptation reveals that the technified adaptation intervention in Phailom is currently strongly operating within, and, in some cases, strengthening several oppressive dynamics that feminist scholarship has

identified as closely tied to contemporary, technology-oriented adaptation discourse (Nightingale 2015; Wajcman 2010; Dankelman 2010; Gonda 2016). In particular, enhancement of existing social hierarchies, devaluation of local environmental and subsistence knowledge, and a direction toward marketization seem to frame the adaptation intervention. Alongside gender, for example, family structure, age, social position in the community, and literacy have played a role in determining the responses and access to new climate technologies in Phailom.

Moreover, the global ideals of climate change adaptation brought into Phailom through technological innovation confront the "feminine" local knowledge—the worldviews that emerge from locals' subsistence-oriented livelihoods and their long history with and dependence on the surrounding environment. This becomes evident in opposing ways local farmers and the project negotiate the technologies in relation to climate and the future. The empirical data demonstrate how masculinists' top-down way of constructing dichotomies emerges in the technified adaptation discourse (Lykke 2010): knowledgeable/ignorant, modern/traditional, rational/irrational, where the latter (feminine characteristics) tend to be associated with local farmers. In addition to global-local frictions, the technologies give birth to new asymmetries locally by creating a dichotomy between valuable scientific knowledge practiced by village strongmen, and traditional knowledge still practiced by those at the margins of the community and the climate-smart project.

Interestingly, locals' marginalized narratives demonstrate how their views on climate and the surrounding environment reflect a sustainable relationship to nature, albeit it would not be considered rational by a scientific community. For example, locals want to conserve surrounding forests as those are seen to protect the area from droughts and storms, while pesticides are strongly resisted due to their poisonous effect on ricefields and mushrooms in the forest. It is this worldview that the adaptation discourse unintentionally shatters by, for example, placing high emphasis on the use of synthetic fertilizers in maintaining soil fertility. This unintentional destruction and silencing of local environmental knowledge creates problems, although it is a widely documented pattern within climate change adaptation discourse, because it hides potential sustainable solutions to climate change impacts at the local level (Wangui 2014; Eriksen, Nightingale, and Eakin 2015).

Finally, the valuation of market-access and marketization of agriculture in Phailom seems to be another implicit narrative carried by the climate-smart technologies alongside "scientific objectivity." However, it also functions as a mechanism for potentially silencing the alternative ecological, local knowledge about the environment. Indeed, if the land becomes understood as a utility for profit maximization, it may well be that the local, more holistic relation to land and the subsistence worldview will become replaced by a more utilitarian worldview.

Policy-relevant insights

Based on the findings, as brought into light by a feminist analysis, four policy-relevant insights could be laid out. These remarks demonstrate the oppressive potentials that were identified to characterize the ongoing climate-smart project in Phailom; yet, if acknowledged and addressed adequately, these could transform into emancipatory possibilities. The policy-relevant insights are as follows:

1. The existing local, social inequalities, and hierarchies have a key role in shaping the project implementation at the local level. As the first step, it is crucial for climate-smart projects to identify gender inequalities at the local level to ensure that the most marginalized can also benefit from the project. In Phailom, many women's and elderly farmers' access to knowledge provided by the project will increase, if project training and technologies will lean on a non-literate form. In addition, more flexible project implementation that utilizes informal routes in delivering project information at the local level will enable more participation especially among women.
2. Adaptation technologies have a social character, and thus, the negotiation of technologies at the local level may result in creative new interpretations for the purpose and use of the artifacts. This is an important aspect for climate-smart projects to be aware of, as it can provide answers to, for instance, why some adaptation technologies might not be adopted by farmers. Farmers' understanding of the new rice varieties is an example of such, where majority of locals did not associate the seeds with tolerance for droughts, but instead connected the high yields obtained solely to an efficient application of fertilizer.
3. Locals have valuable knowledge about their environment that is not understood by the climate-smart project practitioners. Men and women have local knowledge about their environments that should not be ignored, but rather, incorporated in climate-smart projects. The integration of traditional knowledge including those from the marginalized such as the illiterate, elderly, and women should be considered in adaptation plans.
4. Capitalist dynamics seem to frame the contemporary adaptation practices. Thus, identifying the linkages between climate change adaptation and commercialization, including their implications on gender equality, should be part of the adaptation project cycle. By identifying these linkages, it is possible to assess how adaptation objectives can be reached without the pressure of commercialization. If commercialization of agricultural production is considered a crucial part of adaptation efforts within climate-smart projects, it is necessary to identify and address the potential gendered vulnerabilities that such pathway might create at the local level.

Conclusion

The project in Phailom, alongside similar types of climate-smart projects elsewhere (e.g., Gonda 2016; Kantor, Morgan, and Choudhury 2015), does not seem to reach

the roots of local gendered inequalities, but instead tends to further marginalize the most disadvantaged local groups. Yet, at the same time, the technological interventions seem to carry great transformative power elsewhere, which is evident in the emerging movement toward commercialization, profit-seeking, and business, in the case of Phailom. So, why does such paradox exist then? Are local power dynamics so unreachable that project interventions have no means to transform them? Or can it be that, for example, capitalist mechanism is inherently embedded in the contemporary climate change adaptation discourse, whereas, social equality has not been compounded to it to a similar extent?

I have aimed to provide some insights in relation to these questions by studying farmers' climate-smart adaptation strategies from a feminist perspective. Specifically, I have aimed to show the value of a feminist approach in its capability to broaden the understanding of the effects of adaptation technologies, and to make asymmetrical local and global power dynamics more visible. Alongside a slowly growing feminist scholarship, I argue that in the context of climate change adaptation, analysis of masculinities and femininities can provide a highly useful framework for unveiling the multiple power differentials and constructions of knowledge that surround contemporary adaptation discourse and practice. Moreover, the consideration of technology as a social construct or something that embodies meanings and power and is constantly given new meanings—further sheds light on how the global masculine power structures and knowledge embedded in adaptation practice interact with the negotiable, local dynamics. As shown in Phailom, the climate-smart objectives of technologies have gotten even opposite meanings as they have been negotiated based on local worldviews and understanding of climate and environment. This negotiation process is characterized by local and global power asymmetries, which should not be ignored by adaptation interventions.

By revealing the "true face" of adaptation at the local level, insights from this study can give new tools for climate-smart interventions to recognize the oppressive and emancipatory potentialities within their structures, and through this, strengthen their core aim that is extremely needed: to ensure that the efforts made at the local level truly enhance the adaptive capacity of rural communities and the most marginalized groups within.

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Chapter 9

Building the Capacities of Men and Women Farmers for Self-Production of Tai Nguyen Seeds: A Case in Tra Hat Climate-Smart Village, Bac Lieu Province

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Introduction

The Mekong Delta is known as the rice bowl of Vietnam, with 3.9 million ha of land under rice cultivation. It contributes more than half of the total national rice production. Rice cultivation systems in the Mekong Delta offer excellent field laboratories to study farmers' management of genetic diversity. Traditional varieties of rice have been largely replaced by high-yielding varieties, but are still grown on about 300,000 ha in the saline rainfed zones. One of the villages in this area is Tra Hat village in Bac Lieu province. Based on the Situational Analysis and Needs Assessment Report (SANA) of Tra Hat village (Minh et al. 2015), rice production remains to be the farmers' major source of income. Farmers practice two rice croppings per year: summer-autumn and later part of autumn to winter. Tai Nguyen, a traditional rice variety, is usually planted in the winter-spring season. It yields around 7 t/ha. It commands a high price in the market and is easy to sell. It contributes to both household consumption and cash income. However, the farmers cited the following problems in rice production, namely, (1) the degradation of the traditional rice seed of Tai Nguyen; (2) stagnant flooding (beginning of autumn to winter); and (3) lack of fresh water (after autumn to winter and beginning of summer to autumn). In addition, farmers apply large amounts of fertilizer and agrochemicals, and are dependent on credit. They apply chemicals to make the rice stalks shorter, to reduce lodging, and at the same time produce higher yields. In the Village Baseline Survey conducted by the CGIAR Research Program on Climate Change, Agriculture and Food Security in Southeast Asia (CCAFS) in 2014, one of the priorities identified by the villagers is to build the capacities of farmers on the purification and production of Tai Nguyen at the household and community level.

Within poor rice-farming households, both men and women are involved in the entire rice food chain from production to harvest, postharvest, and seed selection. However, women's roles in this food chain have been ignored or underestimated (Chi et al. 2015). Their potential as seed producers, particularly in reviving the seed purity of Tai Nguyen, has not been explored. Thus, a project was conducted in the Tra Hat Climate-Smart Village (CSV) in Bac Lieu province to:

- strengthen the knowledge and skills of the local staff and rice farmers on self-production of the special rice variety Tai Nguyen;
- establish local rice production groups of Tai Nguyen;
- identify farmers' perception of and demand for Tai Nguyen; and
- identify farmers' constraints and suggest recommendations for sustainable house-

hold and village-level production of pure seeds of Tai Nguyen.

This paper reports on the case study of building the capacities of men and women farmers for self-production of Tai Nguyen seeds in Tra Hat, Bac Lieu province.

The process

Sequential training workshops

To achieve the project objectives, several training workshops were organized that focused on seed revival, seed production, harvest, and postharvest of Tai Nguyen in Tra Hat village. These workshops were conducted by Cuu Long Rice Research Institute (CLRRI) in Thoi Lai district, Can Tho city, Vietnam, in collaboration with the Department of Agriculture and Rural Development (DARD) Bac Lieu province.

The workshops were conducted in several split classes. The first workshop conducted on 22 August 2015 titled "Seed revival from impure and pure seed sources." This was followed by another workshop on "Seed production process from source grade foundation" held on 27 October 2015. The third workshop, "Farming techniques: harvest and postharvest," was held on 8 January 2016. This was followed by the course "Field practice on seed production process from source grade foundation and certified seed" on 5 February 2016. Finally, a review meeting was held. Lectures were given by resource persons from CLRRI and DARD Bac Lieu. Training manuals in Vietnamese language were also provided to each participant. Field demonstrations were carried out on farmer plots (2,000 m^2) in Tra Hat, Chau Thoi, and Bac Lieu. The method followed the conventional procedure for seed production of the Ministry of Agricultural and Rural Development of Vietnam (MARD Vietnam 2006). The seeds were sown on 28 August 2015, transplanted on 10 October 2015, and harvested on 11 February 2016. Yield averaged to 7 t/ha. Both men and women participated in demonstration trials.

Evaluation of male and female farmers' knowledge before and after attending the training workshop on "Seed revival from impure and pure seed sources"

Twenty-eight trained farmers (7 women and 21 men) and 11 untrained women farmers were individually interviewed to assess their knowledge on seed revitalization of Tai Nguyen. Focus group discussions (FGDs) with trained women and men's groups, as well as with untrained women's group, were conducted to explore men and women farmers' capacity to join in a self-seed production team, and to provide Tai Nguyen seeds to other farmers in Tra Hat.

An initial assessment of trained men and women farmers' technical knowledge on the revitalization process of Tai Nguyen and their capacity to join the seed production team in Tra Hat was conducted. Likewise, the support and assistance of the local managers for seed production team in farmer communities was evaluated to explore the potential efficiency of the seed production team in producing Tai Nguyen seeds.

Evaluation of the support of local managers to the seed production team in farmer communities

Key informant interviews (KIIs) with the local managers at the provincial, district, and commune levels were conducted to confirm their support in organizing seed production teams in the community. Questionnaires for the individual survey, men and women FGDs, and KIIs were prepared to assess the outcomes of the training on the revitalization process of Tai Nguyen variety.

Data analysis

Individual knowledge levels were assessed by calculating the amount of agreement between each farmer's response to a standard set of interview questions and the aggregated responses of other farmers. Descriptive statistics were used to summarize the data. Because the samples were small, the Mann Whitney U test[1] was used to compare the knowledge scores of trained and untrained women, and of trained women and men. The Fisher Exact test was used to see the difference in response patterns to the knowledge statements of trained and untrained women, and of trained women and men. The qualitative information from FGDs and KIIs was integrated in this report.

Adoption of the method of knowledge score calculation was based from Price (1996):

$$Knowledge\ score = \frac{(RQn \times n) - 1}{(n - 1)}$$

Where:

RQn = Percentage of correct answer
n = is the number of choices

(n=3: where 1=yes, 2=no, and 3=don't know)

Results and discussion

Knowledge levels on seed quality and production of Tai Nguyen variety

Two domains of technical knowledge were classified. One is knowledge of seed quality and production of Tai Nguyen (11 knowledge statements), and the other shows the knowledge score on the revitalization of Tai Nguyen variety (20 statements) (Appendix Table). Table 9.1 shows that the knowledge score of seed quality and production of Tai Nguyen seeds of trained women (0.86) is significantly higher than that of untrained women (0.64). However, the scores of trained men are higher than those of trained women, although the scores are not statistically significant.

[1] The Mann Whitney U test is a nonparametric test of the null hypothesis that it is equally likely that a randomly selected value from one sample will be less than or greater than a randomly selected value from a second sample. Unlike the t-test, it does not require the assumption of normal distributions. It is nearly as efficient as the t-test on normal distributions. This test can be used to determine whether two independent samples were selected from populations having the same distribution; a similar nonparametric test used on dependent samples is the Wilcoxon signed-rank test *(https://en.wikipedia.org/wiki/Mann%E2%80%93Whitney_U_test)*.

Fisher's exact test is a statistical significance test used in the analysis of contingency tables. Although in practice it is employed when sample sizes are small, it is valid for all sample sizes. a null hypothesis (e.g., P-value) can be calculated exactly, rather than relying on an approximation that becomes exact in the limit as the sample size grows to infinity, as with many statistical tests *(https://en.wikipedia.org/wiki/Fisher%27s_exact_test)*.

Table 9.1. Knowledge score of men and women farmers

Knowledge domain	Trained women (n=7) (a)	Untrained women (n=11) (b)	Trained men (n=21) (c)	Mann-Whitney U	
				Difference (a) & (b)	Difference (a) & (c)
Seed quality and production of Tai Nguyen seeds (n=11 statements)	0.86	0.64	0.90	0.01584*	0.06640
Revival of Tai Nguyen variety (n=20 statements)	0.65	-0.05	0.83	0.00025**	0.00384**
Overall (n=31 statements)	0.72	0.20	0.85	0.00006**	0.00252**

*Note: * Significant at 0.10; ** Significant at 0.05*

The knowledge score of trained women on revival of Tai Nguyen (0.65) is significantly higher than that of untrained women (0.05). The knowledge score of trained men (0.83) is significantly higher than that of trained women (0.65). This trend is similar to the results for overall knowledge of the two domains (Table 9.1).

These findings reveal that there is a high potential for training more women on seed quality and production, as well as the revival of Tai Nguyen variety, from production to harvest and postharvest. Details of the knowledge scores (see Appendix Table 9.1) reveal that almost all the trained and untrained women are knowledgeable about the necessary conditions for seed purity. However, trained and untrained women have very low knowledge scores on the required seed moisture. In contrast, trained women have higher knowledge scores on the required seed moisture (14% or lower) for better seed germination. Trained women and men already know that using certified seeds ensures production of good-quality seeds.

Knowledge levels on revitalization of Tai Nguyen variety

Although the trained women said that they are knowledgeable about these practices, the results showed they have low levels of knowledge about the method of revitalization of Tai Nguyen. They complained that the lessons were too complicated and long. Thus, training workshops for women should be done several times (3–4), along with field practice on farmers' fields. Of the topics discussed, women were familiar with manual selection of seeds. Some trained women mentioned that they have some knowledge on transplanting (planting 1 seedling per hill in rows) and removing off-types and diseased plants.

Despite their participation in the workshops, more than half of the women still do not know the methods of production of basic seed and certified seed of Tai Nguyen. Because it was their first time to attend this kind of training, they had difficulty remembering all the

information given in the lectures. Those who had adequate knowledge were able to learn by observing and applying that knowledge during field work. Moreover, they received frequent visits/guidance (every 1–2 weeks) from technical staff members. Untrained women indicated that the suitable time for training is from 10 a.m. (after cooking) to 2 p.m. As expected, all untrained women farmers did not know about the method of seed revival, and had not even heard about it. Most of the trained men farmers knew little or did not know the method of seed revitalization at all. The training provided was their first, although some of them had been practicing this in the field. They indicated that the method of seed revitalization is difficult to remember because it is too long and complicated. They found some topics in the material difficult to understand, saying that the material was too technical. Thus, the material needs to be simpler and the training should be conducted 2–3 times.

Regarding the knowledge statement "Revitalization of rice variety can use initial materials obtained from production field," a significant difference between the responses of trained and untrained women was observed, but not between women and men. A similar trend was observed in a number of knowledge statements, such as the following:

- "In the first cropping season and after land preparation, transplanting requires only one tiller per hill in rows."
- "The field that produces pre-basic seeds must be segregated from other fields by at least 20 m."
- "The field that produces basic seeds or certified seeds must be segregated from other fields by at least 3 m."

This indicates that untrained women did not know much about methods of revitalization of Tai Nguyen variety. Similarly, there was a significant difference in the responses of trained and untrained women groups, and of trained women and men groups regarding the item on whether revitalization of rice variety must be conducted in four cropping seasons. There was no difference in responses in the rest of the knowledge statements between trained and untrained women, and between trained women and men farmers.

Knowledge levels on rice cultivation, harvest, and postharvest of Tai Nguyen

Most of the trained women know enough or much about the cultivation, harvest, and postharvest of Tai Nguyen variety because they manage farms. Women have more than 15 years of experience in rice farming. They had attended a training related to these methods.

Most of the untrained women know a little about the cultivation, harvest, and postharvest of Tai Nguyen. A few learned from their long experience in rice farming; nonetheless, they are willing to be trained to understand these methods better.

More than half of the trained men are knowledgeable about the cultivation, harvest, and postharvest of Tai Nguyen. Some of them learned through trainings they attended,

or through more than 15 years experience in rice farming. They perform most of the rice production activities. Some do not know the method well because they did not understand the contents of the training materials that were explained to them once.

Most of the trained men know the method of seed production because aside from the lectures, they have observed and practiced it in the field. They said that some parts of the training materials are too complicated to understand. They want to have frequent (2–3 times) training to improve their understanding. They mentioned that farmers are familiar with manual seed selection such as removing the off-types and diseased plants. Some gained their knowledge by watching television documentaries on seed production in An Giang and Vinh Long provinces.

Farmers' capacity and willingness to join the village seed production team

Trained men and women gave two reasons for their willingness to participate in the village seed production team. These are: (1) to get higher profits and good-quality rice; and (2) to have a trade name for this variety. Based on the information from the training workshops, they are motivated by the fact that production of high-quality seeds will command higher price in the market and, consequently, higher income. High-quality seeds command a higher market price at VND 1,000/kg to VND 1,250/kg (USD 0.05/kg to USD 0.06/kg) Moreover, revitalized Tai Nguyen rice variety has good eating quality (i.e., leftover rice remains soft). Women prefer this quality because during their busy schedule, they are not able to cook rice in the morning; they have to eat leftover rice from the previous dinner. Trained men said that they also want to produce pure seeds of Tai Nguyen variety to have a trade name for this variety. According to them, pure seeds will produce good-quality rice, which command higher prices, thus, higher returns. At present, Tai Nguyen seeds (longer-duration) are planted near the fields planted with short-duration rice varieties. The anthers of these short-duration rice varieties can be carried by the wind to the Tai Nguyen fields. Thus, after revitalization of Tai Nguyen, the basic seeds and certified seeds of this variety can be produced.

Constraints and lessons learned

Limited land and time. A few of the trained women farmers said that they will not be able to join the seed production team because they face several constraints, such as limited land (only 0.2 ha.) and time. Women have to work as unpaid family labor and as hired agricultural workers to earn income. Aside from field work, they do household chores, take care of their young children, cook, and do other income-generating activities.

Complicated teaching modules on seed revitalization. As mentioned earlier, farmers found the training materials too complicated. Thus, the women farmers encountered difficulty in remembering the lessons contained in the teaching modules.

Lack of policies to provide support to the rice production teams. When DARD first introduced the Tai Nguyen seed revitalization, farmers

were not convinced that they could be seed producers. They lack the capital as well as resources (e.g., machinery, irrigation, etc.). They need assurance from DARD that they will be provided with loans at low interest rates, seed certification, and reasonable prices and markets for the seeds.

Requirements for sustainable seed production of Tai Nguyen seeds

Based on the evaluation, the following conditions should be met to enable sustainable seed production of Tai Nguyen seeds:

Establishment of seed production teams in Tra Hat village. There is a need to first establish seed production teams that can produce Tai Nguyen seeds and provide continuous supply of quality seeds in Tra Hat. This will require the strong support of and cooperation among government offices, such as DARD Bac Lieu province, DARD Vinh Loi district, and the authority of Chau Thoi commune. DARD Bac Lieu should collaborate with Bac Lieu Seed Center, which can buy the seeds produced by local seed production teams. DARD Bac Lieu and Vinh Loi should assist in providing training classes depending on available funding. DARD Vinh Loi should request the Vinh Loi Committee to allocate funds for building the seed production and multiplication model and to transfer to the localities within the district. The District should assist in providing the initial breeding materials (which are bought from a research institute or university), conducting technical trainings, and processing of quality-seed approval. The District should also be responsible in allocating farm areas for planting pure stock of Tai Nguyen for continuous seed supply.

Selection of men and women as members of the local seed production team. The local authority of Chau Thoi commune should identify male and female farmers with sufficient land for seed production. Members of the local seed production team should be committed to joining the team of seed producers of Tai Nguyen. The local authority should assist in creating the seed production team, assigning the area for seed production of Tai Nguyen rice, and organizing the training activities. At present, the commune has two groups of rice seed producers; each group comprises 15 farmers. These groups will be upgraded to seed production teams. The leaders of Tra Hat will assist in creating the seed production teams. Tra Hat needs three seed production teams to produce seeds of Tai Nguyen. Collaboration between the seed production teams and the Seed Center is necessary to have an assured buyer of seeds. DARD Vinh Loi said the groups of rice producers or cooperatives, with managers as chairmen or directors, need to help the local seed production team to smoothly and effectively manage the production of revitalized Tai Nguyen. DARD officials of Bac Lieu emphasized that the participation of active farmers in the seed production teams is crucial for the effective operation of the local seed production teams. The local authority of Chau Thoi commune cited the following required conditions: (1) farmers should first agree to participate in the seed production team; (2) farmers should have a strong interest in revitalizing Tai Nguyen variety; (3) members of the seed production team should be trained well on

the revitalization of Tai Nguyen seeds; and (4) there should be both women, and in the local seed production teams.

Provision of adequate resources to farmer seed production teams. At present, farmers have individual small pumps which they operate using their own fuel. They also transplant rice manually. With these limited resources, it will be difficult for farmer-seed producers to meet the requirements for producing revitalization of Tai Nguyen seeds on time. There should be a common electric pumping station and other agricultural machines (e.g., transplanter). The price of farm inputs, such as pesticides and fertilizers need to be stable, and the inputs must be of good quality.

Building the capacities of the local seed production teams. One-time training is not enough. Due to the systematic process of seed production, farmers need to understand the method, as well as to develop the skills through hands-on experience. Farmers found the lectures too complicated. Thus, they need frequent training workshops to strengthen their technical knowledge and skills on seed revitalization of Tai Nguyen rice. For the first training workshop, seeds should be provided. The training organizers must also identify the topics that should be simplified, emphasized, or reduced.

Inclusion of women farmers and rural youth in the local seed production team. Women and youth in the village are often ignored as potential members of the local seed production team. Women in South Vietnam are actively engaged in rice production and postharvest. They dominate in transplanting, gap-filling, and drying. Husbands and wives provide labor in almost all rice activities, including farm management. When the husband is away, the wife manages the farm, as well as takes over activities, such as spraying pesticides. According to DARD:

"Women have the potential to help in the management of the team operations and implementation of plans. The inclusion of women in a team will make the team stronger. Compared with men, they are more meticulous in crop care. Women will make better managers. Men often spend their leisure time drinking and when they get drunk, they are no longer able to work."

The authorities of Chau Thoi commune on the other hand, say that, "Women perform their roles in transplanting, gap-filling, drying, weeding identifying insect pests, and selecting good brands of fertilizer."

The leaders of Tra Hat village have this to say about women farmers:

"Women give suggestions in rice production. They remind the men (husbands) to do rice operations on time, because men like to play chess and card games, drink, and may neglect their work. Women, on the other hand, are hardworking and are often overburdened because they combine their productive (agricultural work) and reproductive roles (childcare, household chores). They wake up at 4:00 in the morning and go to bed late at night to accomplish their daily tasks. To enhance men and women farmers' technical knowledge and skills on seed revitalization, production, the trainings should be given two-three times, with field practice. The training materials should be precise, short, and simple. To help women concentrate during training, the training should be conducted preferably from 10 a.m. to 4 p.m."

With regard to women's participation in the seed production team and seed revitalization team, DARD Bac Lieu suggests that:

"Women should constitute 30% to 40% of the team. This representation can help them become more confident in expressing their opinions and in participating in the operations."

DARD Vinh Loi district, authority of Chau Thoi commune, and leaders of Tra Hat comment that:

"Women should constitute 30%–35% of the team. With this representation, women can contribute in the selection of quality seeds, and in the supervision of the amount and timing of inputs (e.g., pesticides, fertilizer). Women know all the rice stages and can monitor the water level in the field. Male or female youth who are interested in farming (mostly children of farming households) should also be invited in the local seed production. They can play an important role in coordinating between contract farmers and the buyers. They can use communication technologies (e.g., cellphone, internet) in marketing the pure seed and in accessing other sources of information such as prices, climate information, and sources of farm inputs."

Establishment of policies for effective operations of the local seed production team. There is a need for DARD Bac Lieu to have a policy to enhance the team members' capacity in management by training the team/group leaders and farmers. Policies related to marketing the seeds are likewise needed. DARD Vinh Loi needs to develop policies on providing loans at low interest rates for seed production. There should also be a policy that will consolidate farmers' fields to enable farmers to use large machines such as laser land leveler.

Conclusion and recommendations

There was a lot of enthusiasm, interest and exchange of information among the participants of the training workshops. Farmers gained knowledge and skills on self-production technology of the special rice variety Tai Nguyen in traditional farming systems. The evaluation of women's and men's capacity in seed revitalization and multiplication of Tai Nguyen in Tra Hat CSV showed that women play important roles in these activities. Moreover, they have the potential to become members of the seed revival and multiplication team. After the training, women's technical knowledge on seed quality increased. That the training made a difference is evident in the high knowledge scores of the trained women compared with those of the untrained women. There are no differences in knowledge scores of trained men and trained women. Women also acquired technical knowledge on the method of seed revitalization of Tai Nguyen variety after training, although their knowledge scores in this domain are lower than those of trained men. The local managers of DARD have a high regard for women and indicated that they will support women's participation in terms of guidelines and policies. In this project, women's participation in the training activities was only 20%. However, there should be a policy to increase their participation to 30% and hopefully, to 50%.

The following recommendations are made:

1. To enhance men and women farmers' technical knowledge and skills on seed revitalization and production, the

trainings should be conducted 2–3 times and supplemented with hands-on field experiments. The training materials should be precise, short, and simple. To help women concentrate during training, activities should be conducted from 10:00 a.m. to 2:00 p.m.

2. Local managers and extension workers should raise women's and men's awareness of the long-term benefits of rice seed revitalization.
3. Active women and men should be selected and trained under ToT (training of trainers) program. Later on, the farmers can teach one another. There is a need for members of the community to contribute to the funds to give them a feeling of ownership of the project.
4. The project should be continued with increased representation of women farmers.
5. Farmers should have access to loans for seed production at low interest rates.

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Appendix 9.1. Percentage of male and female farmers' response to the knowledge statement

Knowledge statement	Trained women (a) (n=7)			Untrained women (b) (n=21)			Trained men (c) (n=11)			Exact Sig. (2-sided)	
	Yes	No	Don't know	Yes	No	Don't know	Yes	No	Don't know	Compare (a) & (b)	Compare (a) & (c)
Seed quality, seed production											
Seeds of good quality must be pure and/or have very less impurities	100	-	-	91	-	9	100	-	-	1.000	
Seeds of good quality must be strong and have uniform stand in the field	100	-	-	100	-	-	100	-	-		
Seeds of good quality must have good vitality and very strong development	100	-	-	100	-	-	100	-	-		
Seeds of good quality have 100% filled grains and without seed spots	100	-	-	100	-	-	100	-	-		
Seeds of good quality must not have any physical injury	86	-	14	91	-	9	95	-	5	1.000	0.444
Seeds of good quality must not have more than 25% surface area with red color or red stripe	86	14	-	64	27	9	76	19	5	0.757	1.000
Certified seeds of good quality must be 99% but must not be less than 98% pure	100	-	-	55	-	45	100	-	-	0.101	
Certified seeds of good quality must not have more than 10 weed seeds per 1 kg rice seeds	100	-	-	64	36	-	81	10	10	0.119	1.000
Germination rate of good quality seed should be at least 80%	100	-	-	91	-	9	100	-	-	1.000	0.076
Seed moisture must be 14% or lower	29	-	71	27	-	73	71	-	29	1.000	
Need to use seeds with certificate to ensure production of good seed quality	100	-	-	55	-	45	100	-	-	0.101	
Reinvigoration of Tai Nguyen Dục											
Reinvigoration of rice variety use initial materials obtained from production field	86	-	14	18	9	73	81	14	5	0.013*	0.537
Reinvigoration of rice variety must be conducted in 4 crop seasons	43	14	43	-	9	91	81	14	5	0.020*	0.042*

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Appendix 9.1. continued...

In the 1st crop season, field should be well-prepared and seedlings should be transplanted with only one tiller per hill in rows	100	-	-	45	9	45	90	-	10	0.038*	1.000
The field which produces tillers with pure seeds must be separated at least 20 m from other fields	71	-	29	18	9	73	67	10	24	0.049*	1.000
The field which produces tillers with certified seeds must be separated at least 20 m from other fields	71	-	29	18	-	82	76	14	10	0.049*	0.473
Flowering time of rice grown on seed production field must be before or after flowering time (at least 15 days) of rice grown in other fields	71	14	14	27	9	64	86	14	-	0.113	0.281
Seed production field should be provided with adequate water, fertile soils and free from disease and pests for uniform maturity	100	-	-	82	-	18	100	-	-	0.497	
In the 1st crop season, the rice plants with different phenotype and flowering time, weak growth, susceptibility to pest and low tolerance capacity to biotic and abiotic stresses should be removed	100	-	-	64	-	36	100	-	-	0.119	
Final evaluation should be done 1–2 days before harvesting, remove undesirable plants	100	-	-	55	-	45	100	-	-	0.101	
Before harvesting, the plants should have uniform plant height, level of mature grains per panicle and free from disease	100	-	-	73	-	27	100	-	-	0.245	
The hills in the production field must have proper labels and serial numbers	43	-	57	9	9	82	90	-	10	0.245	0.021*
The individual hills selected from the 1st crop season are transplanted in rows in the 2nd crop season to have line selection by observation of growth situation. The sticks with labels on each line with synchronized flowering, similar phenotype, leaves, and panicle	86	-	14	27	-	73	95	5	-	0.050	0.444
In the 2nd crop season, remove the plants with different flowering time, phenotype, length of panicles, and affected by insect/disease	86	-	14	45	-	55	90	10	-	0.151	0.295

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Appendix 9.1. continued...

In the 2nd crop season, select the lines with synchronized flowering and maturity, same height, uniform flag leaves and phenotype and free from insect and disease. In each line, harvest 10 representative hills. Measure the necessary criteria to remove the lines with different characteristics, low yield and different color	86	-	14	45	-	55	95	-	5	0.151	0.444
If the number of lines selected in the 2nd crop season is more than 85% of total lines, they are mixed as pre-basic seeds	86	-	14	-	9	91	90	5	5	0.000**	0.594
If the number of lines selected in the 2nd crop season is less than 85% of total lines, they are transplanted in the 3rd crop season to continue evaluation. The distance among lines must be from 30-35cm	57	14	29	9	-	91	90	5	5	0.013*	0.111
When transplanting in the 3rd crop, 1/3–1/4 seeds of each line hould be stored to provide for all possible contingencies. The rest should be transplanted in line and compared with the field and seed propagation field. All fields must have proper distance after transplanting	57	-	43	9	-	91	76	5	19	0.047*	0.496
In the 3rd crop, perform evaluation and comparison to select suitable lines. The verification is requested to verify the seed production field. The lines which satisfied the seed criteria are mixed as pre-basic seeds	71	-	29	27	-	73	90	5	5	0.145	0.253
Need to send the seed samples for examination to obtain pre-basic seeds	71	-	29	18	-	82	95	-	5	0.049*	0.145
Pre-basic seeds are planted in 4th crop season to produce basic seeds	43	-	57	9	-	91	76	10	14	0.245	0.098

Chapter 10

Incorporating a Gender Dimension in a Participatory Community-Based Project: A Case Study in Guinayangan Quezon Province, Philippines

Magnolia Rosimo, Jowen Dalusag, Julian Gonsalves, and Rene Vidallo

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Introduction

The Philippines is highly vulnerable to the impacts of climate change, including sea level rise, increased frequency of extreme weather events, rising temperatures, and increase in heavy rainfall. This is due to its high exposure to natural hazards (cyclones, landslides, floods, and droughts), dependence on climate-sensitive natural resources, and vast coastlines. Agriculture is the backbone of the economy of the Philippines. Cultivable crop lands are located in the lowlands and uplands. At present, the Philippine uplands are occupied and cultivated by roughly 24 million people—one-third of the country's population—with their lives and general wellbeing intimately linked with the forest and its resources. On these lands, a large percentage of the population suffers from extreme poverty (World Bank 2002 cited in Espiritu, Casin and Camacho 2010). Farming households are engaged in diversified farming and mixed crop-livestock systems due to extreme weather events, typhoons and drought, in particular. Upland rice environments in general have poor infrastructure, infertile and acidic soils, and heterogeneous landscapes. Farmers are mostly tenants, with little incentive to develop the land for soil erosion control (Paris, Dayo, and Malasa 2004). In the diversified upland areas, resource-poor women provide unpaid labor in crop (rice, corn, rootcrops, bananas, coconut) production, as well as in small-animal production. They also earn income by working as agricultural workers in other farms. They generally have less access to capital, extension services, inputs, and other resources related to agricultural production. Helping women gain greater access to and control over key assets (e.g., small animals) can increase resilience of households and communities to climate change (Rola-Rubzen 1997; Buenavista, Butler, and Mearles 1994). Participatory community-based adaptation strategies are also critical, given the location-specific nature of climate change impacts and adaptive capacity.

The project

This participatory action research project (PAR), "Generating evidence base for upscaling local adaptation of Climate-Smart Agriculture (CSA),"[1] is being conducted by the International Institution of Rural Reconstruction (IIRR) based in the Philippines which has been developing the concept of climate-smart villages (CSVs)[2] and processes of community-based adaptation. IIRR's work has focused on demonstrating the value of social learning approach and

[1] Climate-smart agriculture (CSA), forestry and fisheries seek to sustainably increase productivity, adapt to climate change, build resilience to shocks and variability (adaptation), reduce and remove greenhouse gases (mitigation and enhance the achievement of national food security and development goals. Introducing animal breeds and improving livestock management practices for increased productivity per animal while decreasing emissions is one example of CSA of smallholder farmers.

ways to generate portfolios of CSA options within the context of local municipalities (CCAFS 2016). The project was designed to deepen the understanding on CSA and to build upon the current knowledge base on undertaking gender-sensitive community-based adaptation (CBA) and local-level CSA upscaling, through PAR. This project is being undertaken in selected villages in Guinayangan, Quezon province, Philippines. This chapter presents how the gender dimension is being incorporated into the ongoing research project.

Methodology

Vulnerability to climate change is the extent to which a system, individual, or group of people is susceptible to, and unable to cope with, the adverse effects of climate change. It depends on exposure to climate change, sensitivity to its effects, and adaptive capacity (FAO 2011). Participatory Vulnerability Assessment (PVA) was undertaken to systematically generate knowledge on how development interventions in Guinayangan can facilitate community-based adaptation. Thus, it builds on community perceptions and utilizes participatory approaches in generating information. PVA methods emphasize the importance of understanding the issues that surround vulnerabilities, especially those of the poor, including gender dimension (Chiwaka and Yates 2005). PVAs were conducted by IIRR and Local Government Unit (LGU) team in 11 villages in Guinayangan, Quezon.

The steps in PVA are as follows: (1) situation analysis, (2) gender analysis, and (3) community-based PAR. Situation analysis of vulnerability includes examining the extent of vulnerability and ways people cope with and analyze present threats. Various PRA tools were used to gather information. These PRA tools include: (a) focus group discussions; (b) historical timeline, which outlines the significant events in the community such as major disasters; (c) seasonal calendar to map out periods when most vulnerabilities occur during the year; and (d) livelihood analysis and problem tree (causes of vulnerability, identification of causes, and prioritization). The study sought to find answers to the following questions:

- Where and what climate-related hazards were experienced by the community members?
- What are the differences in vulnerabilities by gender, age, and social groups?
- What are the characteristics of the vulnerable groups?
- What types of exposure and strategies for resilience were used and what were their effects on livelihoods?
- What vulnerabilities do the livelihood options bring?
- What are the causes of vulnerability (root causes)?

Aside from the "theoretical" definition of vulnerability, the PVA encouraged

[2] Climate-Smart Village (CSV) is an approach of testing CSA agricultural technologies and practices as well as social and institutional innovations which may help communities to adapt to the impacts of climate change, increase food security and improve livelihoods (CCFAS 2016).

farmer-participants to arrive at their own understanding of the concept. Thus, farmer participants were asked how well they understood the concept of vulnerability. The consensus was that vulnerability "is the condition of an individual or household to be affected by a hazard," and their ability to bounce back is deemed important. The farmer participants also characterized vulnerable households as those that do not have the capacity to immediately bounce back following an extreme weather event. Across all villages, men and women defined a vulnerable household as a: (a) household with only one source of livelihood; (b) household where there is no adult man; (c) household that does not own land; and (d) household with persons with disabilities. Situation analysis and identification of target groups (vulnerable groups with focus on poor women) offered suggestions for meaningful targeting of CSA.

The case of Arbismen village demonstrates how a better understanding of context and vulnerabilities can help in designing CSA activities that, in turn, will help local communities adapt to the risks and impacts of extreme weather. It provides insights into how CSA can lead to better adaptation by communities. The case also demonstrates how issues of equity and economic empowerment of women can be addressed. Along with PVAs, the social learning process was documented. These are: (a) understanding vulnerability to generate knowledge on appropriate adaptation options for farmers; (b) identifying and implementing CSA technology and practices while integrating the gender dimension; (c) identifying and implementing community-based enabling factors for sustainable implementation of PAR; and (d) scaling out of CSA activities.

Results and discussion

The study area

Arbismen is one of the 54 villages of the town of Guinayangan, Quezon. It is a third-class municipality with a total land area of 22, 800 ha. It is near the coastal areas but with inland areas that have diverse ecosystems consisting of public forestlands, upland coconut-based, and lowland rice-based farming systems. Constituents are largely smallholder farmers, half of them living below the monthly per capita poverty threshold. The coconut farms are located in the uplands where the dominant structure is monocropping. In the lowlands, rainfed rice land accounts for about 950 ha (41 villages). The rest of the seven villages are irrigated (106 ha). Hiwasayan River used to be the major source of irrigation, but it dried up during one extended dry season. In the coastal areas, mangroves have been converted into commercial fishponds, but have been abandoned and are lying idle. Arbismen is 11 km from the town center and is accessible through a paved road. It can also be accessed by boat from the town's municipal port.

The village covers a total land area of 560 ha of which more than 50 ha have been developed for rice farming. A total of 150 ha have the potential for planting rice, coconut, and banana. The rest are classified

as residential lands. Majority of the residents are landowners who are beneficiaries of the agrarian reform program. The village has facilities like barangay hall, health center, and day care center. Most of the households have piped water, electricity, television, cellphones, and motorcycles for rent and for own use. Microfinance institutions (MFIs), such as Center for Agriculture and Rural Development (CARD) and *Tulay sa Pag-unlad* Incorporated (TSPI, which means bridge for improvement) are accessible to loan borrowers.

Climate change risks

According to the respondents, climate-change related impacts on agricultural production in Guinayangan are brought about by strong typhoons, increasing unpredictability of the onset of dry and wet seasons, and prolonged dry spells.

Strong typhoons. Reflecting on the three past major typhoons, participants agreed that Typhoon Rosing in 1995 had the biggest impact on their livelihoods because it affected their rice, coconut, and banana production. It took them a year to recover from this calamity. Typhoon Glenda, which hit the country in 2014, brought more wind than rain and destroyed houses, coconut farms, and banana plantations (Figure 10.1). Fortunately, rice planting had not started due to a longer dry season preceding the typhoon. Farm lands were damaged by water with mud flowing from the uplands and by floods. Crops were submerged and livestock drowned. Fishing boats were damaged. Food security was a major problem because their means of livelihoods (fishing and/or rice farming) were affected for at least a year.

Figure 10.1. Strong typhoons damaged coconut trees

This information revealed that farming communities in the uplands are exposed to late rains and strong typhoons, which affect rice production, and consequently, leads to food (rice) insecurity. Respondents indicated that in the last 10–20 years, rains and storms occurred between June and December. However, respondents reported that in recent years, there were only occasional rains during this period and August has constantly been hotter and generally with no rain. Rainy season now starts in the last quarter of the year, and these rains are often associated with strong typhoons. This climate variability has resulted in changes in cropping patterns for rice farmers.

Prolonged dry season. Prolonged dry season which started in 2000 has severely affected rice farmers. Recently there was a crop failure and 80% of the rice farmers were not able to harvest a single crop. The seasonal calendar revealed that the wet season is reduced to four months (September–December). An extended dry season in the early 1990s affected rice production, as water was scarce and farms were entirely dependent on rainfall. Long dry season more often results in low or no production at all. Farmers reported that it rains only when there is a low-pressure weather event. Farmers used to grow two crops in a year. Now, due to the late onset of rains, farmers grow rice only during the wet season (Figure 10.2). Rice farmers suffer from crop failures brought about by the lack of soil moisture to sustain crops during the vegetative stage. Majority of the farmers practice monocropping, thus, they suffer from food insecurity. Prolonged dry spells also negatively affected the farmers' coconut production. The respondents noted that nuts produced during very dry month tend to be smaller.

Figure 10.2. Prolonged drought and unpredictable rains affected rice production

Sources of livelihood

The villagers rely on the following key livelihood activities, namely: (1) coconut farming followed by rice production; (2) backyard gardening; and (3) other non-farming jobs.

Coconut farming. Coconut production is a very important source of income to all farming households in the village. Instead of selling coconuts as food, farmers convert them into copra (dried coconut kernels of which the oil is extracted), which commands a higher price in the market (Figure 10.3). Nowadays, the harvest time for coconut takes about two months instead of the usual 45 days. Farmers attribute this change in harvest dates to weather variability. Production of coconut is highest from August to December. It is lowest from November to May when temperature is high. However, prices of copra are very high from April (lean month) and lowest in August. Thus, farming households are busy in copra production from April to November. During months of low production, farmers sell coconuts instead of converting them into copra because it entails lesser on-farm labor. The farm gate price of coconut during the peak season is PHP 35.00 per kilo while the normal or average price of coconut is PHP 18.00 per kilo.

Rice production. Rice farming is mainly dependent on rainfall. Only a few villages have access to small irrigation systems. Rainfed-rice farming in the lowlands and in small parcels of land in the uplands is the primary source of livelihood of majority of families in Arbismen. Farmers grow rice mainly for subsistence. Rice planting is done from June to September, depending on the onset of the rainy season. Harvesting is from November to December, as rains come in the last month of the third quarter. After harvesting, the rice lands remain fallow from January to July due to low or absence of rainfall. The recent prolonged dry season affected rice farmers because some were not able to grow rice or were not able to harvest.

In 2010 and 2011, farmers encountered harmful pests, such as snails and tungro disease, which affected crop yields. Farmers used non-chemical practices to control pests and diseases, such as planting *madre de cacao* (*Gliricidia sepium*) at the corners of the rice field, to prevent rice black bug incursion. Rice black bugs feed on rice from the seedling stage to maturity stage.

Crop diversification. Growing diverse crops is one common strategy that farmers used to spread risks as well as ensure to food supply. When rains are delayed, farmers grow corn, peanut, mung bean, and green leafy vegetables (e.g., pechay). Some, however, view this practice as risky due to weather variability over the past years. Aside from rice, coconut and banana production, households also grow vegetables such as eggplant, bitter gourd and string beans in the uplands. Income from vegetables is higher in November when the demand is high. Coconut farming is, therefore, viewed as more resilient to extreme weather relative to annual short-season crop production.

Fishing. A few coastal villages are into fish culture in ponds. Villagers often have one season for this system which begins in

Figure 10.3. Copra processing

December. Marketable fish (in terms of size) are harvested in April or May. Fish culture in ponds is done only when there is high precipitation rate. *Chanos-chanos* (milkfish) is the most common species raised in the area. Usually, 20% of the harvest goes to the pond owner and 80% to the lessee. Aquaculture is laborious in terms of water maintenance, so men supply most of the required labor. The common pesticide used in this system is *tisid*, an organic procedure that removes undesirable foreign biota that competes with the available food in the pond.

Livestock production. Most farming households raise large (carabao and cattle) and small livestock (goats, pigs) and native chickens. Carabao and cattle graze on open grassy fields. Goats and pigs are kept in pens to prevent them from damaging other neighbors' crops. Chickens are free range. Raising small animals to augment the household's income and buffer food stock is suitable for women. However, women face constraints in raising small animals, such as lack of cash to purchase commercial feeds.

Off-farm work. Twenty percent of the population of Arbismen provide labor (*magtatalok*). Laborers or *maglulukad* are usually smallholder farmers and tenants who consider copra production as the main source of income because it provides them with cash. They usually work as a group in different coconut areas and they consider that as regular employment. Many are also engaged in rice production at the subsistence level. In terms of coconut production, a 60:40 sharing arrangement is practiced in favor of the tenants.

Most of the rice areas are rainfed and can grow only one crop season. Farmers with access to a small irrigation system can grow two rice

crops. The first season (wet season) is in June and the second (dry season) in November. Labor is not paid in cash but on share basis or *talok-ani* (plant and harvest) system where 20% of the produce goes to the laborer and 80% to the landowner.

Farmers opt for this share-in-kind arrangements, where they receive payment in the form of a fixed share of the harvest. Under this arrangement, the labor required for planting and harvesting is provided by the same people and labor is paid according to the agreed upon share (e.g., every 5th sack goes to the laborer). During a crop failure, both the landowner and laborers absorb the losses. Thus, they share the risks, which can be moderate to high. In farming, labor costs comprise the highest share in production costs. For fishing, because many do not own motorized boats, the sharing of the catch is 50:50.

Nonfarm work. Male out-migration for temporary or long-term jobs is one of the major sources of income. Often, at least one family member opts to go out to find a temporary job to augment the family's income. Usually it is the men who migrate (locally); women are left behind to take care of the children and manage the farm and household. Men go to industrial zones such as Laguna, Cavite, and Manila. Men mostly take factory jobs and labor contracts (e.g., construction and carpentry). Women apply as domestic helpers or as salesclerk. They usually return when the production season starts, which is usually between June and December. Some stay in their work longer if the conditions and remuneration are attractive. This situation creates labor shortage for coconut harvesting and copra production in their villages, particularly during the peak season.

Aside from coconut production, farmers convert the midribs of coconut leaves into broomsticks. Other women are engaged in other livelihood activities such as broom production during low season for copra production for additional income.

Gender division of labor

Gender is perhaps one of the most important variables in household composition, especially as it relates to livelihood strategies. The division of labor in Arbismen and in other villages in Guinayangan is largely structured by gender and social class. Although men are perceived to dominate the coconut, rice, and fishing industries, women are actually engaged in most activities, except in those that require physical strength. Over time, gender roles have changed, defying deep-seated perceptions that women cannot do traditionally male jobs. As mentioned earlier, resource-poor women work as hired workers in transplanting and harvesting rice. However, due to prolonged drought, farmers could no longer grow lowland rice; thus, women have lost their income opportunities. This has compelled women to join hired workers in copra production, thus, the gender division of labor in copra processing has become less distinct. Men welcome women (farmers' wives) to also work as hired workers and get a share of the output. During peak copra processing, the activities of the workers often reach until late evening. This increases

women's time spent on this off-farm work but does not necessarily decrease their time for their reproductive roles (childcare, cooking, collecting drinking water, collecting firewood, cleaning the house, washing clothes, etc.) because men are rarely involved in these activities. However, to reduce drudgery and to spend more time in other off-farm remunerative work, a few women have purchased small laundry or washing machines through membership in microcredit associations, e.g., CARD and TSPI.

Rice production. Rice production is labor-intensive. Men and women have traditional division of labor depending on the nature of work that they perform. Rice farming can be organized into different operations, namely: (1) land preparation (non-mechanized and mechanized); (2) crop establishment (transplanting or direct seeding); (3) crop management (irrigating the fields, applying fertilizer, spraying chemicals, weeding); (4) harvesting; and (5) postharvest operations (drying and hauling). Land preparation is mainly done by men. Preparing the seedbed and transplanting seedlings are jointly done by men and women; weeding is predominantly by women; harvesting is a joint activity, and threshing (manual or mechanical) is solely by men (Figure 10.4). In general, the division of labor is based on physical strength rather than on culturally ascribed roles. Land preparation with a tractor or a carabao, spraying of chemicals using the heavy sprayer, and use of mechanical thresher all require physical strength. Although women do not provide labor in operations that require physical strength, often, they are responsible for hiring, supervising, and paying workers during peak season, particularly during transplanting and harvesting. Moreover, they are responsible for allocating the family's budget for household and farm expenditures, as well as for purchase of farm inputs. Women earn off-farm income in March–April as hired workers in other farms.

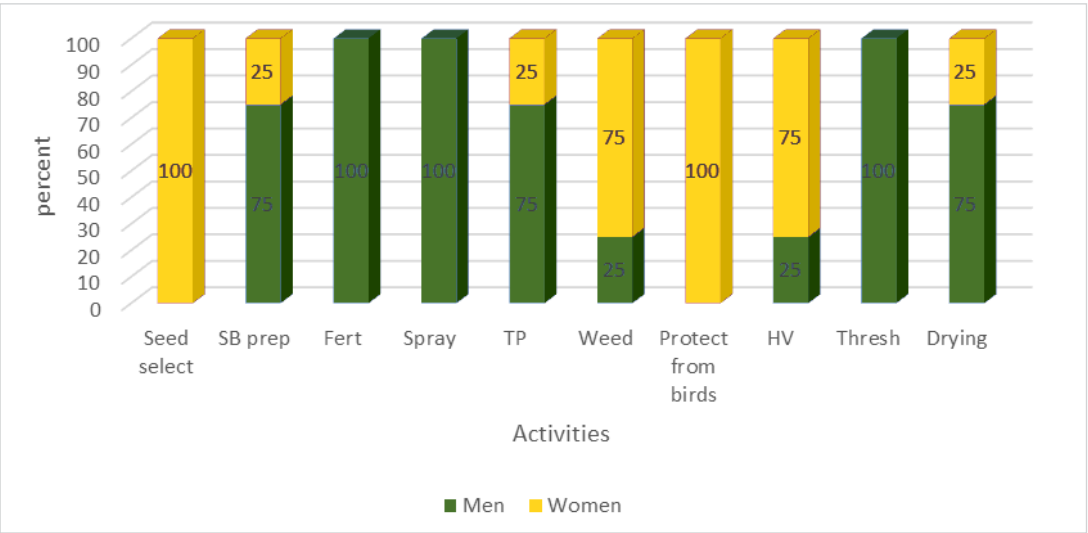

Figure 10.4. Percentage labor contributions by gender in rice production, Arbismen village, Guinayangan, Quezon province

Copra processing. Traditionally, copra processing is performed mainly by men. However, recently, more women workers are participating in most of the activities, except in harvesting nuts with a long pole (Figure 10.5). Women are now getting more involved in piling nuts, breaking nuts which requires skills and physical strength, separating the coconut meat, preparing the kiln and smoking, selling including counting the yield and loading. Women are responsible mainly in keeping the money from share of copra sales. Based on seasonal calendar, women earn income from copra processing in March, mid-August/ September, and October to December.

Vegetable production. Farming households grow vegetables on a subsistence level and small scale (less than 1 ha). More women provide labor in most of the vegetable production activities such as preparing the land, applying fertilizer, spraying chemicals, and watering the field. Setting of trellis is done by men, while harvesting and marketing are done by women. In contrast, in commercial vegetable production (1 ha and bigger) most of the operations, including harvesting and marketing are done by men.

Livestock management. Livestock raising is integral in the upland farming systems. Large ruminants are raised for land preparation and transporting of farm production. Small-scale swine, goat and poultry production is for selling or for household consumption.

Animal husbandry is not exclusively the domain of men. Management of large animals (carabao and cattle) is associated with men. Grazing the animals (dependence on green fodder in open fields rather than cut-and carry practice) is traditionally men's responsibility. However, women are also involved in grazing animals in open fields, and in feeding, bathing the animals, and renting them out for transport when men are not around. Building animal sheds is men's job.

Gender roles in swine production differ by scale of production. For commercial swine (white breed), men have greater roles in the preparation of housing and marketing. Women are more involved in fattening/ feeding. However, when native breeds (black) were introduced, women became more involved in management. Today, women are engaged in almost all operations such as selecting piglets for fattening, feeding, and giving water. Small-scale swine fattening is associated with women because more of the management activities (e.g., preparing the feeds, feeding, and bathing, cleaning the pens) can be combined with household chores or can be considered an extension of household tasks. Income from pig sales can be very important particularly during emergencies. Women's role in marketing also differs depending on whether it is done within the village or outside the village. Women are mainly responsible for marketing piglets or sows within the village whereas men take care of selling piglets/sows in the larger markets.

Men and women provide labor in goat production (herding/grazing, marketing). Goat production has lower labor requirements, compared with swine production. Women still have the bigger role in managing income from livestock. Small animals (pigs, goat) and poultry often represent the only assets rural women own and control.

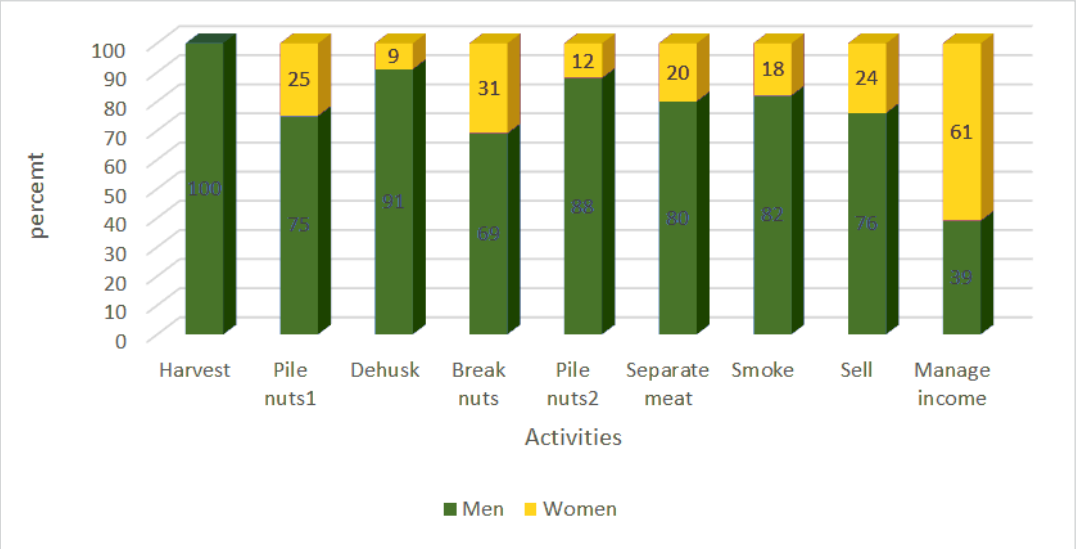

Figure 10.5. Percentage labor contribution by gender in copra processing, Arbismen village, Guinayangan, Quezon province

Women in Arbismen face a number of challenges in raising small animals such as lack of access to low-maintenance breeds and lack of local supply of inexpensive animal feed resources.

Participants confirmed that men and women share labor in most of the activities in livestock management. The survey results also support the conventional view that wives should hold the "purse" because they can contribute more in making decisions related to income. Traditionally, in the rural areas, wives are the custodians of household cash and have more decision-making authority than their husbands. They also hold some control in disbursement of cash for household matters. However, problem arises when this cash is not enough for daily household and family requirements as well as for farm inputs. Women are forced to look for additional sources of income to pay for daily household expenses, transport expenses, and school fees (Paris et al. 2004). In times of need, they are compelled to borrow loans from private money lenders at high interest rates. Thus, poor women should be given opportunities and resources to earn income, particularly to help them recover from droughts or floods.

Access to resources

According to literature (Moser and Satterthwaite 2008; Goh 2012), access to and control of assets are factors that determine vulnerability of a certain sector or social group. Various studies revealed that women have less access to the five livelihood capitals or assets, i.e., physical, financial, human, social and natural capital (Meinzen-Dick et al. 2011). The database of the project collected from the profile of 290 farmers validates the same findings. The data provided basic profile of farmers and their households and captured additional gender-related information, such as access to land and access to loans.

Access to land. Fifty-four percent (54%) of the respondents do not own their residential lands. In terms of farm-land ownership, 54% of the husbands (33) and 14.7% of the wives (9) have land titles under their names. Meanwhile nearly 10% of the respondents (6) have joint ownership, and 21.3% of the respondents (17) are tenants only.

In terms of land ownership, of the 150 respondents, 56.7% of husbands (85 respondents) have land titles under their names while 18% (27 wives) have titles under their names. Ten respondents (6.7%) have joint husband and wife ownership. About 19% are tenants. Only seven respondents are fishpond owners and most of them are men. In terms of vegetable landowners, 47.6% are men, 23.8% are women, 19.1% are joint men and women, and 9.5% are tenants.

In summary, husbands more than wives have their names on the land title. However, husbands and wives have access to land in terms of working on the parcel/plot as unpaid family workers.

Coping mechanisms in response to climate hazards

In response to climate hazards, farming households use various coping mechanisms such as borrowing from informal moneylenders, receiving government social protection assistance, sale of land rights or mortgage land.

Borrowing from informal money lenders. Farmers incur loans not only for farm inputs and repayment of debts but also for fulfilling social obligations, e.g., marriage, children's baptism, children's education, food, and other household expenditure. Men and women borrow loans from neighbors, microfinance institutions (e.g., CARD bank, TSPI), copra buyers, and cooperatives. Most respondents (74%) have access to MFIs. MFI's provide easy access to loans because they are available in the village and the loan process is simple. Most farmers continue to get loans, even after many months after a disaster, resulting in huge debts. Based on this survey, farmers do not borrow loans from rural banks; only a few get loans from cooperatives. One of the reasons for not borrowing from rural banks is the problem of non-repayment, particularly when crops fail due to climate hazards. Some women are worried over their ability to repay loans, due to lack of other sources of income.

Receiving government social protection assistance. Farmer respondents noted that the government's social protection program (4Ps) has helped tide their family with the monetary support. For those who are not part of 4Ps beneficiaries, microfinance institutions are their sources of emergency funds.

Selling of land rights or mortgaging land. Land is the most valuable asset of a household or individual since land provides livelihood and income. With the Comprehensive Agrarian Reform Program (CARP) based on Republic Act 3844 in the Philippines, which abolished tenancy and farmers, former leaseholders were given the legal and full ownership of the land. However, due to lack of capital to invest in rice production, many beneficiaries sell their agrarian land rights. Of the more than 100 farmer beneficiaries, 10%–15% have

sold their rights, according to the records of the barangay. This is due to their inability to develop the land due to lack of capital. The delay in the irrigation system has contributed to this practice. Most land buyers are from the well-off families who reside in the town. In times of disasters and because of the need to raise large amounts of cash for various purposes, farmers are forced to mortgage their lands. Although CARP has succeeded in reducing patron-client relation, poor farmers remain dependent on the informal sector.

Social Learning Process

Social learning is important in increasing the scale of CSA. In this project we use social learning in its context as a process that engages the different partners in the upscaling and outscaling of CSA practices. Interested farmers are first trained by the researchers and technicians on the practices. Those who implement these practices form groups to share their experiences and provide support to one another. The process below demonstrates that women are important partners and key practitioners and disseminators of CSA.

1. Understanding vulnerability to generate knowledge on appropriate adaptation options for farmers: The Case of Arbismen

Although not so obvious, the PVA and group discussions indicate that one of the vulnerable groups in the village is the group that provides labor for rice farming (*magtatalok*). Majority of them are women who are from farming households with marginal lands and those without lands. These are farmers who live in the upland area of Arbismen and who own small parcels of coconut areas. They do not get enough income from their coconut farm. They rely on rice areas where they provide labor. A number of the agricultural workers are agrarian beneficiaries who had chosen to sell their land rights and are now landless. Some belong to the younger generation and do not have their own farmlands, as their parents who are the agrarian beneficiaries still till the land. Although they provide family labor, their share is not enough for their needs. They opt to provide labor to other farmers to augment their income. If the harvest is good, these laborers can get a moderate share of rice as they usually work in more than one rice farm and get their share from several owners. Their only land is usually their residential lot with a small backyard. These landless and near-landless sections of the poor are most vulnerable to the impacts and effects of climate change.

2. Identifying CSA technology options and practices

In Arbismen and other villages in Guinayangan, livestock production is one of the more reliable sources of income and food for households. Pigs and goats are being raised easily in the farm households' backyards, helping diversify and reduce total reliance on crops. However, changing climate, especially the rising temperatures, directly affects the growth and reproduction rates of pigs and other livestock.

To address the problem, the IIRR introduced the low external input on small-livestock system (native pig) to communities in Guinayangan. Part of the Developing

Scalable Approaches for Community Based Adaption project of IIRR, CSA approaches, including livestock production, were introduced to help build farm resilience in anticipation of the impacts of climate change. Using PAR methods, the activity contributes to the broader goal of the project, which is to establish an evidence-base for sustainable outscaling of climate-resilient agricultural practices to enhance livelihood, resilience and adaptive capacities with gender dimensions. The project is currently supported by the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) in Southeast Asia.

a. Introducing native pig production and low external input system

As prolonged dry seasons have been observed to occur more frequently than typhoons in the last 2–4 years, women from marginal and near-landless households who work as transplanters/harvesters in rice production will continue to be vulnerable due to lack of alternative source of income. During severe droughts, men migrate on a short-term or long-term period to earn nonfarm income. But this is not an option for women since they have to take care of their children, crops, and animals, and do household chores. Women expressed their lack of assets (e.g., pigs, goats, chickens) and of start-up capital for a small-scale pig production enterprise. Building assets are critical for the poor and vulnerable sector because they can help the poor and vulnerable sector cope better with shocks, including climate shocks and the long-term impacts of climate extremes.

The IIRR interventions with the Municipal Agriculture office in Guinayangan tested two pathways for building assets of the identified vulnerable sector in Barangay Arbismen. One was the introduction of low external input production and low carbon footprint methods for pig production. In one of the FGDs to identify possible adaptation options, one of the suggested options was for an alternative approach to livestock raising that would be climate-smart, low cost and environmentally friendly. Of the 20 farmers in the group, only four (all men), said they were raising pigs on a commercial scale as source of livelihood. When probed why there were no women, participants said in unison that commercial pig production requires large capital to purchase commercial feeds. Traditionally, women were engaged in pig production; however, when small pig production became commercialized, the men took over.

To integrate gender dimension in the project in Guinayangan, IIRR decided to introduce and test CSA practices and technologies. In 2015, native pigs and low external input pig production were introduced to six farmers (5 women and 1 man), in Arbismen. Three native breeds—Kalinga, BT Black, and Macalelon sourced from the National Swine and Poultry Research Center in Quezon—are now being raised in the area. Decentralized and farmer-managed multiplication and dispersal centers have been established to further improve access to better breeds of native animals. Farmers are expected to help disseminate the idea within the community. Using pass-on scheme, 47 additional farmers

in four villages benefitted from receiving commercial pigs, and an additional 18 farmers from four villages were recipients of native pigs. All of the original beneficiaries have shared their livestock assets with at least two other farmers, many of whom have then gone on to also share with at least one additional farmer. Each farmer was given two gilts and commercial feed provision enough for the first month. The suggested model is to feed the gilts with commercial feeds for just one month. After that, farmers will rely on alternative feeds such as sweet potato, taro, banana, rice bran, coconut by-products etc. The experiment aims to demonstrate that swine production can be done with low cost investments. Starting with a small group of farmers engaged in action research, the program has grown within Arbismen and has now spread to neighboring villages, primarily engaging women in a livelihood that they control. The practice of low external input pig production has drawn wide interest and the number of women has increased to 74 farmers and expanded to five more villages (Figure 10.6). As the interest in pig production has been rekindled among women, the re-introduction of the improved native breeds was also tested. Native breeds tolerate high temperatures and humidity better than modern and commercial breeds. Another good trait of native pigs is their resistance to diseases and harsh weather condition. They seldom get sick; thus, there is no need to purchase antibiotics and other medicines. All these helped this low-cost approach to pig production to qualify as climate-smart.

Livestock can be raised on low carbon footprint diets and are an asset building approach, given the lesser investment outlay and potential for expansion in a short time. When raised in housing made of natural materials, the temperatures can be lowered in the pig pens (open sides permitting aeration and roofs made of natural materials).

Figure 10.6. Native pig production and low external input system can be climate-friendly

The low external input on small livestock system piloted in Guinayangan requires the use of locally produced inputs, while promoting health and productivity. Because of native pigs' higher tolerance for higher temperatures and resistance to parasites, pests and diseases, the system relies on the use of native pigs. Native pigs also have higher economic and nutritional value (meat is considered by local communities as tastier, crispier, and leaner) and contains lower fat and cholesterol, providing more benefits to farmers. Climate-smart livestock production can also reduce the carbon footprint by emphasizing small-scale, backyard systems

that rely more on locally grown alternative feed sources without chemical additives. So as not to be dependent on commercial feeds, the farmers participating in the project are required to grow their own intensive feed garden. Crops such as taro, cassava, sweet potato, and water hyacinth are being grown, not only to provide nourishment for the livestock, but also as an alternative food source for the households. Limited quantities of commercial feed are used during the first two months of pigs.

Housing structures made of materials like bamboo were built to protect the pigs from variable weather conditions and the risk of contracting diseases. Coconut husks, soils, rice hull, dried leaves, and saw dust were used to make the deep bed flooring system. Farmers observed that this practice has reduced the smell and consequently, flies, thus promoting the health of the pigs and providing farms with a source of natural compost. The housing design promotes the free flow of air through the pens.

No antibiotics were used and vaccination was done only for major diseases. In some cases, farmers used herbal supplements. Improved native breeds, farm-raised feed and housing made of native materials are key elements of this alternative approach to livestock production.

b. Sharing livestock assets

Farmers are expected to help disseminate the idea within the community. Using a pass-on scheme, 47 additional farmers in four villages benefited from receiving commercial pigs, and an additional 18 farmers from four villages were recipients of native pigs. All of the original beneficiaries have shared their livestock assets with at least two other farmers, many of whom have gone on to also share with at least one additional farmer. This pass-on scheme, locally called "Back two," which means give back two, requires that every member should give back two piglets to the association's other members for every farrowing of his/her sow.

c. Benefits from native pig production

Income security

Growing native pigs has proven to be reliable due to their tolerance for changing climate. They have higher survival rates compared with commercial breeds. A piglet can be sold for PHP 2,000 (USD 44) while a fully grown (3–4 months) native pig can sell at PHP 100–PHP 120 (USD 2.22–USD 2.67) per kilo live weight. If butchered, it can go as high as PHP 180.00 (USD 4) per kg and if cooked as lechon (roasted pig), it can be sold at PHP 200 (USD 4.45) per kg. Farmers claim that compared with other sources of income, they find this the most worthwhile as it generates the most income from a small investment. Since their assets are supplemented and savings increased, households have more disposable income, which they can use not only to support everyday expenses but also to purchase non-essential needs. Pigs are considered an asset they can readily sell to address emergency needs. Women reported that they have sold livestock to raise emergency funds. Others were able to acquire supplies and to meet other needs of their children through the sale of livestock.

Food security

Native pigs offer safe and nutritionally-rich food with their high protein content and because they can withstand changing climate, a pig enterprise provides reliable source of food for the family. The crops in the feed gardens can also become household food in times of emergency, such as sweet potato, cassava, and taro. Native pig production will not require taking loans or credit. Households and their relatives are often more likely to consume such products for family consumption especially at festive events. The potential of pigs to produce many litters also provides assurance that some pigs can be for family consumption.

Economic empowerment to poor women

In one mid-year assessment of CSA options conducted by the IIRR field team, swine raising is now referred to as women's livelihood compared with the previous practice in the village where commercial pig production was managed mostly by men. Women are now more involved in livestock management (70% of the total time in livestock management are done by women). Owing to this involvement in managing livestock, women now have a say on how to spend the income from this livelihood. Research has found that women now have a say on how to spend the income associated with livelihoods they manage, on children's education, food, and medical expenses (Quisumbing 2003). Many of the women claimed that they can now afford to serve lechon during special occasions (usually associated with rich households), thus improving their social status in the community. Women have gained confidence and self-worth.

3. Organizing Farmer Learning Groups (FLGs)

After identifying native pig production using low external inputs, IIRR organized FLGs to provide the beneficiaries with a platform for knowledge exchange. The FLGs are designed to bring together the beneficiaries and to help them have a sense of belonging in a community. Farmers began to approach others and demonstrated the positive impacts of adopting this livestock production method. Women's participation in the pig production learning group increased (of the 34 members in the Arbismen FLG, 20 are women). In addition, the Arbismen FLG has been able to reach out to more than 15 women in their own village and to more than 10 women in other villages. In the FLG, the members discuss ways of overcoming challenges as a community. The platform of FLGs has provided the farmers voice and opportunity to share their experiences in managing their swine and collectively analyze issues in livestock management. The research support component (participatory action research) means that methods are adapted to the local conditions and farmers can produce the finest quality pigs for markets, at a lower cost and in an environmentally sound manner. The FLGs provide beneficiaries with a platform for knowledge sharing about the breakthroughs in the action research being conducted in the community. After experiencing the benefits of rearing native pigs and of using low-input

methods for both native and commercial breeds, farmers approached others and showed them the evidence of the positive impacts of adopting this livestock production method. At present, two FLGs are focusing on low external input pig production, such as in village Arbismen, with 34 members, and village Ermita, with 15 members.

4. Encouraging the FLG members to save

This offshoot of the small livestock project provided an opportunity to test and develop a savings group with the same group of women pig raisers. The community savings association or CoMSCA[3] promotes the concept of Self-Help Groups (SHGs) as a way to empower the community. CoMSCA encourages households to save and manage a saving and credit component on their own. Since many farmers do not have access to formal saving mechanisms such as banks, farmers are not compelled to save. With CoMSCA, the culture of saving is encouraged. Being community-based loans (based on amount of savings), funds are more accessible without going through a complicated borrowing process. Moreover, trusted members of the village manage the saving/loans. CoMSCA is different from micro-finance institutions. It is self-managed and independent, which means the members of the group in the community are the ones who manage the money they put in. It is considered time-bound or it follows its own financial cycle, and group members share equity at least once a year in proportion to their savings. The concept works best in the Philippine context, for it creates local pools of capital and it provides access to useful lump sums which can be used for predictable expenses, to reduce shocks to vulnerable livelihood, to facilitate household cash-flow management, and to allow short-term investment. In three municipalities, it has been proven to work because of the socioeconomic characteristic of the communities involved (mostly very poor). CoMSCA is flexible and simple to adopt and implement because transparency is embedded in its system. It provides a frequent opportunity to save and regular opportunity to borrow. The system itself is savings-based and not credit-based.

[3] CoMSCA membership should have at least 25 members. The complete cycle is six (6) months where members are required to attend a meeting twice a month. Saving per member is pegged at a maximum of PHP 400.00 and minimum of PHP 20.00. Loans are also provided to members with 3% interest payable in 6 weeks. Loan priorities are agricultural inputs, emergency situations, tuition fees and health. CoMSCA started in 2015 in Arbismen and in 2016 in Sintones village. However, they stopped for a year and resumed again with improvements in the procedures. This savings scheme was developed by World Vision which is an international Christian, humanitarian, development advocacy and relief organization that is child-focused and community-based.

Voices from the beneficiaries of native pig production

Increased income and reduced cost of feeds

Juliana Belmin, a mother from Barangay Arbismen, grows native pigs despite her poor leg condition. She started in January 2014 after IIRR gave her one young suckling pig. Together with her son Melicio, they started raising only native pigs including managing the community breeding area. Now, she and her son combines native (black) and hybrid (white) pigs. She has a total of 23 pigs (3 white sows, 4 native sows and 2 boars, 5 white fattening, 2 pure native newborn). Most of their pigs came as a payment for native boar service mostly from the adjacent barangay, Capuloan Tulon, and 7 white piglets for sale. According to her, raising native pigs helped them reduce their expenses for feeds and other materials. It also helped her with her regular medication and personal expenses such as food and supplies. The meat of the native pigs also serves as food for the household.

She said that from her pigs alone, she has earned PHP 40,000.00 (USD 800) in a year. She used some of her earnings for additional low-cost housing of pigs and for payment for hired labor for land preparation of their small farm. She reiterated that native pigs are so easy to take care of. They are like trained pets as they go out of the pen when told to do so. They can adjust to climate change (extreme hot and cold). Most of all, one can start with small capital. She shared that before, she incurred PHP 200 (USD 4) a day for commercial feed costs. These alternative feeds are composed of sweet potato tops, cassava, trigo, rice hull, and yam. This ration is enough for a whole day of feeding for both white and native pigs. Meanwhile, if they use commercial feeds, it will cost them PHP 100.00 (USD 2) for a 3-kg commercial feeds per feeding, which is not even enough for the 23 pigs they are currently raising.

Before the project, they preferred raising white breed, but now they prefer to raise native black breed because it is more profitable to raise native breeds as it is cheaper to grow. Native pigs grow better with locally available feeds like cassava, banana trunks, coconut sap, tricantera, and yam. They mix these crops with commercial feeds, thus, reducing the cost of feeds. For example, they buy a kilogram of trigo and mix it with yam as feeds during the first three months of the piglets to prevent stunting.

Income from pig raising provided cash for emergency needs

Meanwhile another woman farmer leader, Gloria Macaraig shared how pig production has helped their family during the most trying time. When her husband suffered a stroke, she sold her pigs to finance the hospital expenses which otherwise they cannot afford if they only depended on their rice farming and income from copra production. *"I owe the life of my husband to my pigs,"* she declared.

Income from pig raising was reinvested in rice farming

This was also concurred by Nanay Leony as she had the same experience. Nanay Leony is one of the first farmers who volunteered as one of the oldest among the farmer researchers. Raising three young grandchildren together with her husband, they are tilling their small parcel of rice land as source of food. She provides labor through transplanting (*magtatalok*) despite her age to augment their income. So when she saw the opportunity of owning pigs as part of the research, she readily volunteered. She joined the first meeting hoping that she can solicit help from IIRR where she secretly gave a note to the facilitator asking for money to support the cost of food and schooling of her grandchildren. Instead, the team challenged her to join the research. Now she is growing both white and native pigs. She had also passed on pigs that benefitted four more women. Nanay Leony used her earning from taking care of native pigs to buy an important part of their hand tractor. Now they can use the hand tractor for preparing their land for rice cultivation.

Conclusion

This study showed that understanding vulnerabilities through PVAs contributed to appropriate approaches and CSA practices for small livestock that address gender issues. Native pig production that uses low external inputs has benefited women because it provided them with low labor requirement and easily manageable economic asset that requires a small start-up investment. Small livestock activities can help promote women's empowerment, particularly women from landless and near-landless households. In an economy dominated by crops that are vulnerable to climate change, small livestock production presents a less risk-prone livelihood venture. Production of small livestock is relevant to all ecosystems—coastal, lowland, and upland—in meeting food security, nutrition, livelihood, and asset-building objectives. Small livestock systems lend themselves to community-based dispersal mechanisms, reducing the need for reliance on cash inputs. Women pay back in kind, usually to other members of the local community. Pig production lends itself to community-managed out-scaling. IIRR works to empower the most vulnerable women and men to achieve climate-resilient livelihoods and reduce disaster risks. The women vowed to continue their savings group not only to meet their basic needs but more so, to be ready when another disaster strikes. Providing women farmers with multiple benefits, i.e., the reduced external input small-livestock system and membership in CoMSCA piloted in Guinayangan, Philippines is a good example of a CSA technological option combined with savings and micro-credit schemes for poor women.

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Chapter 11

Enhancing Women Farmers' Access to Climate-Smart Technologies through Participatory Approach in Rice Farming Households

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Introduction

Vietnam is one of the countries affected by climate change, which impinged on land use in the Mekong Delta, especially on the lives of the poor who are living in the stress prone areas with limited means for adaptation. These include vulnerable and marginalized women who have the least capacity or opportunity to learn and apply climate-smart agriculture (CSA). Moreover, participatory and gender perspectives (e.g., women participation) are mostly excluded in the evaluation and scaling out of CSA.

In 2011–2015, the Australian Centre for International Agricultural Research (ACIAR) funded the project "Climate Change affecting land use in the Mekong Delta: adaptation of rice-based cropping systems (CLUES),"[1] designed to increase the adaptive capacity of rice production systems in the Mekong Delta Region (MDR). It aimed to provide farmers and implementing agencies with technologies and knowledge that will ensure food security amidst climate change. Furthermore, it developed climate-smart technologies, including stress-tolerant rice varieties and their associated cultural practices.

One of the damaging effects of climate change is submergence caused by river overflows, excessive rain, and/or tidal inundation (Sairam et al. 2008). Submergence/flood aggravates flooding risks of lowland rice areas, adversely affecting rice production. In addition, the intrusion of salinity in the coastal area in the Mekong Delta has become more and more severe in recent years, particularly in the years with prolonged drought period and lower supply of freshwater flow from the upstream of the river. The main constraints to rice farmer's ability to adapt to the new hydrological regime are the lack of suitable cultivars, lack of soil nutrient management options, and insufficient knowledge of potential harm from acid sulphate soil.

Vietnamese women farmers play crucial roles as unpaid family workers and as hired agricultural workers in rice production. Traditionally, women's labor inputs are concentrated on and varietal selection, crop care, harvest and postharvest activities, preparing rice for the daily meal, and cooking rice products (Chi et al. 1994; Chi, Paris, and Luis 2007). With male labor outmigration, women have to take over men's responsibilities, such as preparing the land, identifying and controlling pests by spraying pesticides, as well as supervising labor (Chi et al. 2015; Paris and Chi 2005; Paris et al. 2010). These roles of women as farmers are not recognized and acknowledged, and thus, women farmers

[1] The Climate Change Affecting Land Use in the Mekong Delta: Adaptation of Rice-based Cropping Systems (CLUES) activities aimed at assessing the impact of climate change and sea level rise (SLR) on cropping systems in Bac Lieu, Vietnam on biophysical and socioeconomic benefits.

are seldom included in agricultural research for development project activities. Chi et al. (2015) emphasized that women farmers compared with men have lesser access to technical knowledge/information, improved rice variety seeds, and agricultural extension services. This exclusion of women has led particularly to the ineffective dissemination of CSA.

Incorporating the knowledge and experiences of men and women in the research and development process is necessary (Borjas 1997; Paris et al. 2011). Integrating gender perspective to climate change research is also important to reduce gender inequities, particularly in accessing new stress-tolerant variety seeds, and on crop improvement technologies and practices. The objectives of this study were to:

a. understand the linkage between climate change and gender in rice-based farming systems;
b. identify the gender gaps in access to resources, and constraints to CSA adoption;
c. use participatory approach to elicit men's and women's perspectives in varietal choice, and to reduce gender gaps in access to seeds and technical knowledge through training; and
d. assess women's empowerment when they are given access to resources e.g., seeds and training on CSA.

Methodology

The study was conducted in Hau Giang and Cantho communes in Hau Giang province (representing semi-flooded areas) and in Minh Dieu commune (representing saline-prone areas) in Bac Lieu and Hoa Binh provinces in South Vietnam. Rice farmers in Hau Giang grow two to three crops of rice in a year. In Bac Lieu and Hoa Binh, farmers grow shrimp-rice and rice-rice-rice annually.

Household survey and focus group discussion. Gendered perceptions/knowledge, and experiences on climate change and coping mechanisms were gathered through individual interviews of 200 respondents in flood/submergence and salinity areas. The interviews were conducted with male household head and wife in each farming household. The focus group discussions (FGDs) with separate groups of men and women farmers were also conducted using guide questions. Each group comprised 10 to 15 farmers.

Participatory Varietal Selection. New varieties tolerant to submergence and salinity developed by the Cu Ulong Delta Rice Research Institute under the CLUES project were tested through PVS. This farmer participatory approach consisted of researcher-managed trials (RMTs), farmer-managed trials (FMTs), and sensory evaluation under the RMTs. These trials, which included a set of rice lines/varieties, were conducted on farmers' fields. These fields represent flood/submergence and saline conditions. Both men and women farmers were allowed to visually evaluate the lines/varieties that were ready to be harvested. Men and women farmers were allowed to "vote" for their most and least preferred varieties during a field day; preference scores were calculated based on the protocol developed by Paris et al. (2011). This score was supplemented with farmers'

Figure 11.1. Men and women farmers voting on their preference for rice line/variety

analysis of the positive and the negative traits of their preferred varieties. Under the FMTs, men and women farmers were given seeds of the lines/varieties that they selected from the RMTs. The socioeconomics team collected the information on the varieties that farmers used in comparison with the test varieties. Under the sensory evaluation activity, samples from two preferred lines/varieties selected from the RMTs and farmers' variety were cooked and evaluated (based on cooking and eating qualities) by a panel of men and women farmers to assess the acceptability of the new lines/varieties. The PVS approach gave women an opportunity to voice their opinions, as well as the participation of social scientists, in rice varietal improvement.

Data analysis

1. Descriptive statistics were used to summarize the data collected from the household survey. Information from FGDs were analyzed using simple tabular analysis and frequencies.
2. Descriptive statistics were used to present varieties that were "most or best preferred" and "least preferred" by the farmers. For this, preference score (PS) for each variety was calculated as follows:

$$PS = \frac{No.\ of\ farmers\ most\ prefer - No.\ of\ farmers\ least\ prefer}{Total\ number\ of\ farmers}$$

A frequency table was used to analyze the distribution of preferences among tested rice varieties in sensory test. On the other hand, descriptive statistics were used to summarize the data surveyed from farmer-managed trials and information on knowledge and women's social status.

Results and discussion

Socioeconomic profile

The men and women respondents have been farming for 20 to 30 years. Each household has 3–5 members. Men have completed elementary school, while women have few years of schooling and they often have not completed elementary school. Most of the farmers (60%) in the semi-flooded study areas have marginal lands (less than 1 ha), while the rest (30%) have small (1–2 ha) and large farms (>2 ha). In the saline-prone areas, more than

half (55%) of the farmers who adopt shrimp-rice are large farm owners. The rest are marginal (28%) and small farm owners (17%). In contrast, more than half of the farming households who grow only rice (triple rice) are marginal farm owners, followed by small (40%) and large farm owners (10%).

Sources of livelihood

Farmers are faced with climate risks such as drought, submergence/floods, and salinity. To survive, they resort to different sources of livelihoods. The importance of rice as a major source of livelihood varies by rice ecology. More farmers in the flood/submergence areas are engaged in diversified sources of income compared with those living in the salinity prone areas.

In the flood/submergence prone areas, the major sources of income are from rice. The other sources of income are shrimp cultivation, small business, production of other crops, remittances, raising of large and small animals, and wage from agricultural labor. The women contribute to family income by growing and selling upland crops, taking care of small animals, working as agricultural workers, and from non-farm work where they get paid daily or weekly. They contribute more than men in small animal production and management, pension contributions, and business. On the other hand, husbands contribute to family income in aquaculture, rental of machine, and other sources. Both husbands and wives contribute a large share in taking care of large animals, other crops, land rental and other sources.

In saline-affected areas, rice comprised the largest share, followed by shrimp cultivation, and services paid monthly. The other sources of income are raising small animals. Women contribute to family income by growing and selling upland crops, taking care of small animals, working as agricultural workers, and engaging in small business. In contrast, men contribute to rice and aquaculture and other sources. Jointly, husbands and wives contribute to household income from rice production and aquaculture.

Farmers' understanding of climate change

Men and women are aware of the changes and extreme variability in the weather based on their long-term experience in farming and residence in the village. Farmers felt that the days are hotter and rains are more erratic (too early or too late). These abnormal changes are felt more in the salinity areas than in the flood/submergence areas. Increased salinity in the groundwater and soil is felt more in the saline-prone areas, particularly during the dry season. In the flood/submergence areas, about half of the respondents observed heavier rainfall during the wet season, and stronger storms/typhoons. There are similar perceptions between men and women due to their similar exposure to extreme climate events.

Impacts of climate variability and changes on men and women

This section discusses the impacts of climate variability on agriculture and health.

Farmers' knowledge based on already experienced climate events is vital for understanding how climate change is likely to impact men and women differently.

Impact of climate variability on agriculture. Farmers have experienced negative impacts on crop production in the flood/submergence areas and on shrimp production in the saline-affected areas. More husbands than wives perceived that climate change reduce crop yields. In contrast, more wives than husbands said that climate change caused more livestock deaths. These differences are based on gender roles and direct benefits in managing crops and livestock. While husbands are mainly responsible for crop management, the women are mainly responsible for animal management. Floods can cause disease, loss of livestock, and consequently, reduction in livestock population. Drought also affected livestock production and management due to lack of water for maintaining the health, nutrition, and sanitation practices for livestock. In the flood/submergence areas, more women than men mentioned the reduction in availability of fuel wood, which is a contrasting situation in the salinity areas. In these areas, collecting fuelwood is the women's responsibility.

Due to flooding/submergence, rice seedlings die or are swept away by floods. Thus, farmers have to transplant again or do gap-filling. This job is relegated to women. Thus, women are more exposed to health risks such as skin diseases and other water-borne diseases. They have observed that flooding of areas do not only destroy the crops or increase the incidence of pests on plants, but also increase occurrence of animal diseases and loss of livestock. The women's time/labor in the farm and household chores also increased. The other negative consequences are water contamination, seawater rise, increased soil acidity, emergence of new rice disease, death of plants, reduced plant number, and drastic reduction in fish population.

In salt-affected areas, men and women farmers estimated that rice income decreased by about 35%, while income from other sources decreased by 30% during the year due to severe salinity, shortage of freshwater, and less rain.

Impact of climate variability on health. More women than men are concerned with health risks. The common health problems during the period of severe climate change are flu, colds, and cough. Women complain of skin problems due to long hours of submergence in water, particularly during transplanting and gap-filling.

Gender-differentiated coping strategies to climate change

Small farming households apply coping strategies in response to climate change. Women and men have different coping strategies based on gender roles.

Crop production strategies. More men than women use more chemicals such as foliar fertilizer for plant growth and the prevention of plant disease and insect pests on rice and shrimp production. More men use more granular fertilizer to improve soil fertility and higher yields. In the flood/submergence areas, men take charge in draining water from the

fields to avoid submergence or inundation. They select rice varieties that can recover/survive under submergence, and repair and maintain the canals for better drainage. Men manage crops better by observing changes in the weather, visiting the fields more often, and applying more chemicals to prevent pest infestation. On the other hand, more women adopt anticipatory strategies to cope with the negative consequences of climate change. They store more seeds for the next cropping season. Women prefer to use higher seed rates in anticipation of damage or loss of seedlings due to floods. They avoid sowing during bad weather. Some farmers diversify their cropping patterns by planting other crops (coconut, sugarcane, mushroom, vegetables on the bunds, and water melon) and grow crops that are tolerant to submergence/floods.

In saline-prone areas, salinity occurs during the dry season. Thus, farmers have to wait for rains in order to prepare the land. They wait for rains to flush the fields of residual salinity and acidity before planting rice. Farmers shift the planting schedule. Farmers also irrigate the fields more frequently, drain the salty water, reduce soil acidity, and consequently reduce crop and shrimp loss.

Non-farm strategies. Farmers also resort to non-farm strategies such as obtaining support from the government in terms of cash to purchase new seeds, fertilizer, and petrol/diesel oil. Some farms get loans for rice and sugarcane cultivation, purchase agricultural machine, and for capital for small trading. More men than women avail loans from the bank. More women than men resort to expenditure-saving strategies such as spending less, storing food and other necessities, collecting wild vegetables/edible flowers from the ponds and nearby surroundings, catching small fish from ponds, preserving small pieces of fuelwood, and raising vegetables on their backyard.

In times of crop failure due to floods or salinity, only a few farmers are compelled to sell their large animals to purchase inputs for rice production or to pay debts. This is due to the fact that small and marginal farmers only have a few assets. Others look for additional jobs such as catching fish, or working as hired labor to pay for daily family expenses.

Migration to other cities is one of the coping measures in response to crop failure or losses. The incidence of male outmigration is higher than female migration in the flood-prone areas. In contrast, in the salinity areas, more women than men migrate to other cities.

Livestock production. More men than women in both study areas use medicine to prevent livestock disease caused by water pollution and to prevent the spread of animal disease and deaths. They get good quality water from the main river source for animal care (drinking, bathing, and cleaning the sheds). In times of cash shortage, both men and women borrow loans to purchase animals. On the other hand, more women than men seek additional work as hired laborers to raise capital for livestock production

Fish/shrimp production. Farmers use medicine and "vaccination" to prevent fish/shrimp disease. More women than men receive government support or loans for buying supplies (fingerlings, feeds, medicine, fingerlings, and fishing/shrimp nets). More men than women take charge in pumping good quality water

from the main branch of the river to clean/sanitize the ponds/fields. More men than women farmers work as hired labor in other farms to support the fish/shrimp enterprise.

Changes in gender roles due to climate variability

In rice production, women also work with men in most of the rice production activities, including heavy tasks such as cleaning the fields and bunds. Women contribute more labor than men in raising seedlings in the nurseries, replanting (gap-filling), hand weeding, removing off-types for seed selection, drying, and keeping the newly harvested grains in sacks. More men than women provide labor inputs in preparing the land, irrigating and draining the fields, cleaning/repair of dikes/making field internal ditches, broadcasting seeds, applying pesticides, harvesting (with combine harvester), threshing (mechanical thresher), and hauling and transporting. Women assist the men in almost all activities to a lower extent because they also have to attend to their household and childcare obligations.

Men reported that they spend more time in seed selection, land preparation, seed broadcasting, and fertilizer and pesticide application due to floods. When floods occur during harvesting time, they have to spend time salvaging the crops. On the other hand, women said that in times of floods, their time and labor in replanting (gap-filling), drying of newly harvested rice, removing off-types, bringing food to the farm, taking care of pigs and poultry, and cleaning the animal sheds increased. They also have to spend more time in managing their household and children.

Gender-differentiated access to and control of resources

In general, farmlands are mainly owned by the husband. Other couples have joint ownership on water pump and other agricultural equipment. Men are the major users of row seeder, rotavator, thresher, water pump, and deep well. Wives own fewer assets such as small livestock (pig, chicken), small items such as cell phone, cart (to carry vegetables and some meat and fish to sell). Disposing agricultural assets are jointly decided by the husband and wife. The wife has full control of small livestock. Thus, during times of floods and disaster, women can decide alone as to when to sell and determine the selling price of small livestock. More men than women own motorbikes. However, there are no restrictions for women to use the motorbike or bicycle for transporting children or doing errands.

Participation in training activities on climate-smart technologies

During the period 2010–2013, it was found that more men than women attended training programs in the flood/submergence areas (Table 11.1). Most (87%) of the female farmers did not attend any training. This situation was worse before 2010 when 92% of the women did not attend any training. Similar trends were found in the salinity areas.

This situation indicates the persisting gender inequality in training programs. However, the situation has improved because local government and extension workers are taking conscious efforts to invite more women in agriculture-related training activities. However, there is a need to sustain these efforts.

Training needs on climate-smart technologies

Based on the surveys and FGDs, there is a need for both men and women to enhance their skills and knowledge to better adapt to climate change. With regards to rice production, more men than women said that they want to be trained on better management of seeds, water, nutrient, pests) and postharvest technologies on storage. Aside from rice, they also want to grow, manage and store other crops such as peanut, corn, vegetables, and custard apple. These can be good sources of income. Men and women want to be trained on improved animal and shrimp management. More women than men expressed their desire to be trained on other income-generating enterprises such as handicraft making and producing delicacies and other home-based enterprises. Extension agents also need training on CSA, as well as on communication skills to be able to disseminate complicated technologies.

Access to climate change-related information

Access to climate change-related information is very important to help vulnerable groups to better respond to climate change risks. They receive their climate-related information from radio, television, and government loud speaker available in the village. Men and women have almost equal access to information on drought, flood or extreme events, and expected weather conditions. However, there are gender gaps in access to information on crop production. More men than women have access to information on crop production and management and pest and disease outbreaks and management. More women than men have access to information on livestock production and management and postharvest handling. These results confirm the importance of providing climate-related information to farming households to prevent human, crop, and livestock losses.

Table 11.1. Participation in training activities (% of responses)

Participation	Flood/Submergence area (n=160)				Salinity area (n=40)			
	Husband		Wife		Husband		Wife	
	Count	%	Count	%	Count	%	Count	%
Attend training from 2010–2013								
Yes	76	48	22	14	22	55	14	35
No	84	53	138	86	18	45	26	65
Total	**160**	**100**	**160**	**100**	**40**	**100**	**40**	**100**
Attend training before 2010								
Yes	55	34	9	6	16	40	9	23
No	105	66	151	94	24	60	31	78
Total	**160**	**100**	**160**	**100**	**40**	**100**	**40**	**100**

Farmers' awareness of adaptation measures to reduce vulnerability of crop, livestock, and aquaculture

Farmers in the Mekong Delta had been using diverse adaptation strategies to reduce the anticipated negative effects of climate change on their livelihood and well-being. Due to lack of rice varieties that can survive after floods/submergence and salinity, the farmers are always at risk of losing their crops, livestock, and their livelihoods.

This study tried to capture the level of awareness of men and women farmers of climate-smart technologies. In general, there is low level of awareness among the farmers on the improved farming and community practices to enable them to respond better to climate change consequences. Men and women are aware of new improved high yield rice varieties. However, despite the availability of new stress-tolerant rice varieties for flood/submergence and salinity areas, a low proportion of men and women are aware of their availability. A higher proportion of men than women are aware of changing the cropping calendar. Thus, our aim is to increase the adoption of new improved high yielding varieties and new stress-tolerant varieties for farmers to be able to adjust their cropping patterns and cropping calendar in response to climate change. In addition, farmers' awareness of changing current farm management practices remains low.

Constraints to adoption of CSA

Despite the advantages of CSA, farmers face several constraints in adopting and disseminating. These are:

a. Lack of sufficient information on technologies (lack of awareness and experience in testing new varieties); and lack of guidance from the local government, agricultural technician/extension worker in changing crop calendar to avoid floods, lack of cooperation among farmers to adopt synchronized planting. Moreover, farmers are faced with difficulty in selling farm produce or selling at low price after harvest.
b. Farmers are hesitant to adopt technologies such as no till/minimum tillage because of inadequate information and poor perceptions with regards to the outcomes of these technologies. For example, the "no till/minimum tillage" practice is risky because the roots may not grow deeper into the soil and the plants may easily lodge under bad weather. Site specific nutrient management (SSNM), which is being promoted to use fertilizer efficiently, is difficult to implement. It is too complex and time consuming for farmers. Leaving crop residues on the soil is not an appropriate technology and causes toxicity to water. Farmers have to detoxify the soil by applying lime. Farmers do not apply other technologies such as Alternate Wet and Drying (AWD) method due to their lack of sufficient information on this technology. Farmers do not adopt IPM due to high input cost especially for labor. They perceive that this technology is not appropriate when there is high pest infestation.
c. Waste management practices from livestock is difficult to apply and not suitable to their conditions because they do not have enough time. Farmers do

not have sufficient information on this technology and the experience in practicing this technology. The disadvantages of waste management from livestock are its high cost, toxicity, bad smell, and it is not applicable to farmers who raise only a few animals.

d. The recommendation to organize the community as a large field model and pool farmers as a group (same preference) is difficult to implement because houses are located far from each other. Moreover, there is lack of policy support on the cooperation between farmers and traders in selling farm produce.

Participatory varietal selection (PVS)

Researcher-managed trials (RMTs) and farmer-managed trials. Due to extreme climate variability, men and women have different preferences for varieties for their localities tested under researcher-managed trials (RMTs). Thus, it is important to examine whether there are similarities and differences in preferences for rice traits that should be considered in rice varietal development for areas prone to abiotic stresses (Chi et al 2015).

In the flooded/submergence areas, women farmers prefer a variety that has the ability to elongate and grow taller than the water level in the field during floods, is resistant to pest, requires less fertilizer, has good eating quality, easy to cook, and commands a high price. They prefer a variety that can recover from heavy floods so that they do not need to do gap-filling, which is a laborious and health-risk activity. On the other hand, men prefer varieties that have good eating quality, easy to sell at a high price, resistant to diseases, and require less fertilizer. High grain yield is one of the most important traits mentioned by both men and women farmers, requiring improvement in rice breeding programs. In saline-prone areas both men and women prefer rice varieties that are high yielding, resistant to insect/disease, tolerant to abiotic stresses, non-lodging, and have long grains.

In all rice ecosystems, both men and women prefer stress-tolerant varieties with high yields. Women are more concerned with the good cooking and eating qualities (expands while cooking and leftover remains soft). Farmers prefer early maturing varieties (90 days).

Impact of training on women's technical knowledge on climate-smart technologies

Women farmers were trained on climate-smart technologies and gained technical knowledge that can help them adapt to flooding and salinity. The analysis of the knowledge score revealed that women's knowledge on all knowledge domains increased significantly after the training (Table 11.2).

Women's empowerment

Before the training. Based on decision-making questions, men are more dominant in making decisions related to crop choice and what variety should be grown for the next season. Nonetheless, non-participation or non-consultation of women farmers in decisions on what variety should be grown could lead to non-adoption of varieties. For example, rice varieties may have higher yields but

Table 11.2. Knowledge score before and after training

Knowledge domain	Knowledge score		
	Before training (n=100)	After training (n=100)	T-value
Submergence tolerant rice variety (n=6 questions)	0.29	0.56	6.055**
Healthy seed production (n=19 questions)	0.29	0.76	17.018**
Input reductions (Three reductions three gains) (n=17 questions)	0.44	0.59	4.149**
Pest management- IPM (n=5 questions)	0.51	0.77	6.184**
Pest identification (n= 16 questions)	-0.14	0.03	5.241**
Nutrition management (n=5 questions)	0.85	0.92	2.349*
Harvesting (n=11 questions)	0.24	0.40	4.170**
Score overall (n=59 questions)	0.28	0.52	10.911**

*Note: Significant at 5%; ** Significant at 1%*

may not have specific postharvest qualities (cooking and eating). Women also have very low participation in decisions related to crop management, namely: (1) when to apply fertilizer, (2) amount of fertilizer, (3) when to apply pesticide/insecticide, (4) amount of pesticide/insecticide to use, (5) when to irrigate crops, (6)when to do gap-filling, (7) when to hire laborer for specific operation, and (8) when to harvest rice.

On the other hand, wives and husbands participate equally with decisions on the amount of rice to store and when to sell rice and other crops. However, women are highly empowered in deciding how much money to spend on food. Thus, women play an important role in ensuring food security (availability of quality food for home consumption through own production or through purchase from the market). During floods or drought, women bear the burden of ensuring adequate rice supply for their daily meals, and also in looking for cash to purchase quality food from the market. With limited access to non-farm income, women are "handicapped" in performing their roles in ensuring household food security.

Women are more empowered than men in making decisions related to backyard livestock/ poultry rearing (decisions on the number of animals to raise and when to sell animals). Women's empowerment can be attributed to their access to and control of small animals and poultry. Nonetheless, men and women equally make decisions on purchasing livestock. Wives also have a decision-making authority in the allocation of remittances from other family members, especially from their husbands.

Among other items related to investment, men are more empowered than women in decision-making related to allocation of funds to purchase farm inputs, spend on capital investments (land, machinery, water pumps, etc.), and on house construction. With regards to politics, men dominate in deciding whom to vote for. Thus, women do not have a voice in selecting policymakers.

After participating in PVS and training. The women who participated in the PVS activities received seeds of stress-tolerant varieties. All of them planted these seeds on their own farms, covering about 13 ha. Based on FGDs, the women farmers said that they have better knowledge and can make informed decisions on crop management, fertilizer application, and what rice variety to plant. After the training, they can identify insect pests better and can discuss with confidence their opinions related to rice farming with their husbands, other farmers in the community, and extension staff members. In turn, women are listened to. Some women stated that:

"Before, we did not dare express our opinions because we were not sure on what we would like to say. Now we are more confident because we learned a lot from the training. This is the first time that we received seeds directly from the project and also participated in the selection of rice varieties using ballots."

Conclusion

Both men and women farmers reported that they experienced climate change in terms of unusual occurrence of floods and salinity. Rice farming households were negatively affected by the consequences of these extreme events. Men and women have different risk-coping mechanisms. While men secure loans from banks and migrate outside the villages to engage in non-farm employment, women stay at home to take care of small animals and poultry and to earn income from diversified self-employment activities. Women also do more anticipatory strategies such as storing more seeds, non-perishable food items, and household necessities; spend less; do small trading; and rely on their social networks (family, friends, and community) in terms of support. Due to climate change, there were also changes in gender roles in rice production. Traditionally, gap-filling was mostly done by women, but with frequent floods, men also help to complete this tedious job. More women than men are vulnerable to the effects of climate change due to the persisting gender inequalities in access to key assets and resources (farm inputs and training).

Most of the farmers are not aware of climate-smart crop management and storage practices (minimum tillage, cover cropping, SRI, efficient use of fertilizer, leaving crop residues on the field instead of burning, composting, AWD, pest management, waste management from livestock, and improved grain storage); collaboration with community organizations (large field model, same preference farmer groups); and diversification of income-generating and livelihood activities in both flood and salinity areas.

Through participation in PVS activities, women and men can better express their opinions on the varietal traits they prefer based on their roles. Women's inclusion in the project activities gave them confidence in expressing their opinions/feedback of lines/varieties. Their direct access to improved stress-tolerant seeds changed the cultural perception that they are just housewives and that they do not know anything about rice farming.

The analysis of women's empowerment index indicates that men have more decision-making authority on crop choice, crop management,

and investment for big items and politics, than women. Women have more decision-making authority on matters related to selling/storing rice, livestock/poultry rearing, food expenditure, children's education, and allocation of remittances. Thus, it is important for CCAFS in South Vietnam to reduce gender inequalities in access to resources and technical knowledge by increasing their participation in project activities.

Women farmers were provided seeds of stress-tolerant varieties and hands-on training on how to produce quality rice using climate-smart farming practices. Their participation empowered them in making sound and informed farm-related decisions, particularly when men are engaged in non-farm employment away from their villages. This also increases women's knowledge on climate-smart technologies and their social position. Moreover, there is a need to give more recognition of the potential and critical roles of women as farmers and as farm managers in reducing poverty, ensuring food security, and adapting to climate change.

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This book presents the gender dimension of the relationship between agriculture and climate change. It explores whether men and women farmers experience similar or different vulnerabilities and coping mechanisms or adaptation measures in response to climate change risks. It identifies gender gaps in access to resources, information, services, technologies, training, finance, etc., which enable or constrain men and women to adopt climate-smart agriculture and practices, as well as presents examples of participatory vulnerability analysis and participatory action research, which incorporate a gender dimension.

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