Gendered Dimensions of Conservation Agriculture in Northwestern Cambodia

Daniel M. Sumner

Thesis submitted to the faculty of the Virginia Polytechnic Institute and State University in partial fulfillment of the requirements for the degree of

Master of Science
In
Geography

Maria Elisa Christie
Lawrence Grossman
Yang Shao

April 15, 2014
Blacksburg, VA

Keywords: gender, agricultural change, conservation agriculture, decision-making, Cambodia

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ABSTRACT

This research investigates gender-based constraints and opportunities to the dissemination of conservation agriculture based on a case study with smallholder farmers in the village of Pichangva, Rattanakmondol, Battambang Province, Royal Kingdom of Cambodia. Using qualitative and quantitative methods, including focus group discussions, semi-structured interviews, household surveys, and participatory mapping, we explore the effect of conservation agriculture on men's and women's allocation of labor, gendered power relations in intra-household negotiations, and access to resources and information. I found that conservation agriculture has the potential to decrease men's and women' s workload and drudgery in cash crop production and generates opportunities for other work; however, this may contribute to an increase in women's "triple workload" as they invest part of this "extra time" in additional domestic and community responsibilities. I also found that gender intersects with other factors to limit men's and women's access to and control over resources, access to information, and participation in household negotiations. These findings could have implications on smallholder farmers' decision to experiment with conservation agriculture.

Acknowledgements

This research was made possible by the generous support of the American people through the United States Agency for International Development (USAID) and the Gender Cross-cutting Research Activity of the United States Feed the Future Innovation Lab for Collaborative Research on Sustainable Agriculture and Natural Resource Management (SANREM IL) under the cooperative agreement number EPP-A-00-04 00013-00. The opinions expressed herein are the author(s) and do not necessarily reflect the views of USAID.

I would like to thank my advisor Dr. Maria Elisa Christie, Principal Investigator for the Gender Cross-cutting Research Activity of the SANREM IL, for her support and guidance during the preparation of this thesis. I am also sincerely appreciative of my other committee members Dr. Lawrence Grossman and Dr. Yang Shao for their support in developing and implementing my thesis research. I would also like to thank the Department of Geography and the Sidman P. Poole Endowment for helping fund this research.

I would also like to thank the collaborating institutions and research team that played an essential role in this research, Dr. Manuel Reyes from North Carolina A&T and Dr. Stephane Boulakia from the Agricultural Research Centre for International Development. I would also like the staff of SANREM IL in Rattanakmondol for their help in preparing the logistics and coordination for this project, Kong Rada, Sar Veng, Nin Bunnoeun, Kem Soeurng, and Thy Barang. Thank you to my two undergraduate research assistants from the University of Battambang, Ms. Sel Rechaney and Mr. Mao Rambo, who were invaluable during data collection.

Finally, thank you to my wife Catherine and my family and friends for their constant support and encouragement.

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Chapter 1: Introduction and statement of purpose

1.1 Introduction

In spite of crop yield gains over the past 50 years (FAO 2012), food insecurity and poverty remain widespread throughout the developing world and are partially linked to increasing land degradation and unsustainable agricultural practices. FAO 2011b indicates that the global population is estimated to increase to more than 9 billion by 2050 with a 70% increase in demand for food. Thus, despite recent advances in agricultural technology, farmers and policy-makers are faced with the challenge of increasing agricultural productivity while implementing sustainable natural resource management. Conservation agriculture (CA), with its suite of agricultural technologies and soil management, is increasingly being seen as a means to assist smallholder farmers with sustainably intensifying agricultural production, enhancing food security, counteracting soil degradation, stabilizing crop yields, and improving resilience to climate change (Knowler and Bradshaw 2007; Derpsch et al. 2010; Erenstein et al. 2012; Beuchelt and Badstue 2013). Though CA holds substantial potential for rural smallholder farmers, the transition from tillage-intensive agricultural production systems to alternative cropping systems designed around CA is not gender[1] neutral and may affect men and women differently within the farming household and the broader community. Men and women are actively involved but women's roles and responsibilities are often overlooked despite

[1] Gender is the socially constructed expectations of roles, responsibilities, and rights of men and women and the relations between them. The relations between men and women are mutable, but are also time, culture, and context specific and linked to other subjectivities such as age, class, race, and ethnicity (Doss 2001).

women comprising nearly half of the labor force (World Bank 2009; FAO 2011a). Gender is integral in defining several dimensions: the household division of labor; access to and control over natural, physical, and financial assets; power in intra-household decision-making; and access to information. Women make essential contributions to agricultural production and household food security, but there are documented gender gaps in access to assets and resources, including labor, land, and credit, with women often having less direct access to these key resources than men. It is estimated that increased gender equity within the agricultural sector could potentially increase agricultural yields by 20%; overall agricultural output by sector; and reduce food insecurity by 12-17% (FAO 2011). The implementation of CA may affect men and women differently in regards to labor requirements, access to trainings and other resources, and economic benefits. It is necessary for development policy planners and CA program implementers to document how program interventions might affect gender, but also how gender relations could influence the dissemination of CA.

1.2 SANREM IL, gender, and conservation agriculture

The United States Feed the Future Innovation Lab for Collaborative Research on Sustainable Agriculture and Natural Research Management (SANREM IL), funded by the U.S. Agency for International Development (USAID)[2] has been operating globally in 13 countries, including Cambodia, to design and implement Conservation

[2] This research was made possible by the generous support of the American people through the U.S. Agency for International Development (USAID) and the Feed the Future Innovation Lab for Collaborative Research on Sustainable Agriculture and Natural Resource Management (SANREM IL) under the cooperative agreement number EPP-A-00-0400013-00 at the Office of International Research, Education and Development at Virginia Tech.

Agriculture Production Systems (CAPS) that are tailored to context specific biophysical and socio-cultural conditions of smallholder farming communities. The management practices and techniques of CAPS are based on three interrelated core principles: (1) year-round organic soil cover, achieved through the introduction of cover crops, intercropping, or the retention of residue/mulch; (2) minimal soil disturbance, accomplished by using no-till practices; and (3) diverse crop rotations, sequences, and/or associations so that crop biodiversity is maintained and pest infestations are avoided (FAO 2008; Kassam et al. 2009). Through these principles, CAPS and other CA cropping systems are promoted as able to stabilize and increase crop yields (Hobbs et al. 2008; Kassam et al. 2009) and improve the interaction between physical, chemical, organic, and hydrologic factors within the soil (Wall 2007; Erenstein et al. 2012).

As part of SANREM IL research activities in Cambodia, the Gendered Perspectives Crosscutting Research Activity (Gender CCRA) seeks to identify gender issues relevant to the dissemination of CA by integrating qualitative and quantitative techniques and working collaboratively with SANREM IL's regional partners. SANREM IL[3] has been assisting 65 smallholder farming households in the following four communities: Boribo, Pichangva, Sengha, and Aukmum in Rattanakmondol District, Battambang Province, with the implementation of CA. Specifically, in Rattankmondol, SANREM IL is assessing the suitability of CA

[3] This project was conducted through the Gender CCRA in collaboration with Long Term Research Activity (LTRA)-12: Conservation agriculture for food security in Cambodia and the Philippines. LTRA-12 is led by the North Carolina Agricultural and Technical State University with host country institutions: University of Battambang (UBB); the Agricultural Research Center for International Development (CIRAD); and the Project to Support Agricultural Development in Cambodia (PADAC).

production systems in comparison to tillage-intensive production systems with regards to site-specific biophysical factors (agroecological context, soil organic carbon, and bulk density) and socio-cultural factors (access to assets, social networks, and gender. This research was conducted as part of the Gender CCRA with the overall purpose of identifying gender-based constraints and opportunities to the dissemination of CA in Rattanakmondol.

The Gender CCRA's research reflects a broader recognition that gender is an important factor that affects CA implementation (Knowler and Bradshaw 2007; Becuchelt and Badstue 2013; Harman Parks et al. 2014) and the value of using a mixed methods approach (Nyanga 2012; Lestrelin et al. 2012). While gender awareness has increased in investigations of CA dissemination, there still has been limited discussion of the diverse gendered opportunities and constraints associated with CA implementation. In order to explore the gender relations in the context of agricultural development, this research uses a livelihoods approach to explore gendered practices and activities; gendered access to and control over tangible and intangible assets; and men's and women's capabilities (Chambers and Conway 1991; Radel 2012). Additionally, the Gender Dimensions Framework (GDF), developed by USAID, also is used to investigate the intersection between gender and CA (Rubin et al. 2012). There are four overlapping dimensions of the GDF: (1) practices and participation, (2) access to and control over assets, (3) beliefs and perceptions, and (4) laws, legal rights, and institutions. These dimensions also include the crosscutting dimension of power. The GDF and livelihoods approach

offer a complementary approach to explore the context-specific gender relations relevant to the dissemination of CA cropping systems in Rattanakmondol.

1.3 Statement of purpose and preview of thesis

This research was designed to investigate the gendered dimensions of CA implementation among smallholder farmers in Rattanakmondol District, Battambang Province, Cambodia. Using a mixed methods approach, including Focus Group Discussion (FGDs), semi-structure interviews, a household survey, participatory mapping, and participant observation. The specific goals of this research are to: (1) investigate how gendered livelihood practices are linked to men's and women's participation in intra-household decision-making and the implementation of CA; (2) identify how CA implementation affects men's and women's allocation of labor to different productive, reproductive, and community roles[4]; (3) assess how gender-based differences in access to and control over land, agricultural machinery, and credit could impact the dissemination of CA; and (4) document how men and women access agricultural support services and information about CA. The questions are designed to document the gendered dimensions of CA and document potential gender-related factors that can contribute to or constrain the dissemination of CA. They also help document how CA development project interventions can promote gendered policies and practices that can reduce inequities between men and women.

[4] Productive roles can include subsistence and cash-crop agricultural production, livestock production, off-farm income generating activities, and wage/salary employment. Reproductive roles can include childcare and domestic work. Community roles can include activities within the community to maintain social networks and relations (Beuhelt and Badstue 2013).

The overall purpose of this research is to document the reflexive relationship between gender and agricultural development programs. By identifying how gender relations may affect the implementation of CA and how CA effects gender relations. The succeeding chapter details the position of this research within the existing geographic and development literature and reviews the relevant research on CA, gender, livelihoods, and international development through the lens of feminist political ecology. Chapter three outlines and discusses the results of a collaborative research program undertaken over eight weeks between June and July 2013 and earlier fieldwork conducted in January 2013. Chapter three is prepared as a co-authored manuscript for publication in the journal *Agriculture and Human Values*. The manuscript will highlight the following: current investigations of the gendered dimensions of CA implementation, noting the current gaps within the literature; the application of a livelihoods approach and feminist political ecology to investigate the intersection between gender and CA; agrarian change and CA implementation in the context of Northwestern Cambodia; results documenting the linkages between the gendered division of labor and intra-household decision-making, the of CA implementation on men's and women's labor allocation, gender-based differences in access to key assets (land, agricultural machinery, and credit) relevant to the dissemination of CA, and the spaces where men and women access information about CA; the linkages between gendered livelihoods and CA usage; and gender-based constraints and opportunities to the dissemination of CA in Rattanakmondol.

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Chapter 2: Literature Review

This research utilizes a diverse array of scholarship within the literatures of geography, international development, and natural resource management. The first section of this chapter introduces the management practices and techniques of conservation agriculture (CA) and discusses the observed benefits and constraints to the promotion of conservation agriculture within developing countries. We discuss the current research investigating the intersection between gender[5] and CA and highlight the dimensions of CA that need to be explored to identify who benefits, small or large holder farmers, men or women, capital rich or resource poor, from the introduction of CA. The remainder of this chapter shows how the lens of feminist political ecology intersects with broader themes within the development literature and can be employed to frame the investigation of CA and gendered livelihoods within the context of an externally funded research for development project in the village of Pichangva, Rattanakmondol District, Battambang Province, Cambodia. Specifically, in the sections below we explore how CA can restructure men's and women's livelihood activities and reconfigure patterns of labor allocation, assess how gender structures access to productive resources and capital, how gendered power relations within the household impact the allocation of resources and intra-household decision-making, identify how men's and women's livelihood

[5]We identify gender as the dynamic socially constructed roles, rights, responsibilities of men and women and the relations between them that are dependent on age, social status, class, race, ethnicity, and culture (Doss, 2001).

practices are linked to the construction of gendered space that affects men's and women's access to agricultural support services and training opportunities.

2.1 Conservation Agriculture: Observed benefits and constraints

Sustainable agricultural practices, including CA, represent a means to increase food security, promote soil health, and enhance resilience to climate change for smallholder farmers across the globe (Wall 2007; Knowler and Bradshaw; Hobbs 2007; Hobbs et al. 2008; Kassam et al. 2009; Erenstein et al. 2012). Conservation agriculture refers to a package of diverse agricultural management practices and technologies defined by three core principles: 1) year-round organic soil cover, achieved through the introduction of cover crops, intercrops, or the retention of residue/mulch; 2) minimal soil disturbance, accomplished by using no-till practices; and 3) diverse crop rotations, sequences, and/or associations so that crop biodiversity is maintained and pest infestations are avoided (FAO 2008; Kassam et al. 2009).

Conservation agriculture's suite of technologies and practices hold the potential to promote global sustainable agricultural production (Wall 2007; Knowler and Bradshaw 2007; Hobbs et al. 2008; Kassam et al. 2009; Erenstein et al. 2012). Improved interaction between physical, chemical, organic, and hydrological factors within the soil may increase soil productive potential and contribute to increased or stabilized yields (Kassam et al. 2009). Evidence also indicates that CA production can reduce labor burdens and production costs (Wall 2007; Erenstein et al. 2012). Conservation agriculture systems provide farmers' with greater resilience to climate variability due to the increased soil moisture-holding capacity and higher

infiltration (Hobbs et al. 2008; Kassam et al. 2009). The diverse benefits of CA can assist farmers with developing sustainable methods to intensify agricultural production. While the benefits of CA have been documented in the case of medium and large-scale farmers, the costs associated with implementation can impede smallholder farmers in developing countries from attaining benefits of CA.

Wall (2007) indicates that CA production is knowledge-intensive and entails complex techniques and practices that represent a fundamental change in agricultural production systems. Several factors can impede smallholder farmers from making the transition from conventional tillage-intensive production. Smallholder farmers often have limited access to agrochemicals (herbicide and fertilizer); specialized no-till seeding machinery; sources of credit; extension services, and information (Wall 2007; Giller et al. 2009; Beuchelt and Badstue 2013). With the use of herbicides, CA can reduce smallholder farmers' labor burden and drudgery (Nyanga et al., 2012; Knowler and Bradshaw 2007); however, weed pressure typically increases during the first years of CA implementation and without ready access to herbicides can place an unsustainable increase on men's and women's labor burden when only manual weeding is available (Wall 2007; Giller et al., 2009).

Within the literature on CA, a principal focus has been to identify variables that influence farmers' decision to implement CA. Knowler & Bradshaw (2007) conducted an extensive review and synthesis of empirical studies on the global adoption of CA to identify farmer and farm household characteristics (demographic, biophysical, economic, and exogenous factors beyond the farm unit) that may

influence farmers' decisions to implement conservation agriculture. Quantitative investigations have been useful in identifying the scale and pattern of the dissemination of CA and trends regarding farmers' decision-making related to CA (Wall 2007; Knowler & Bradshaw 2007). These studies have identified potential global patterns and make some general observations regarding CA implementation and farmer decision-making, but there is also recognition that CA management practices and techniques need to be tailored to context-specific biophysical and socio-cultural conditions of smallholder farming communities (Knowler and Bradshaw, 2007; Erenstein, 2003). Mixed-methods approaches are increasingly being used to understand the complex conditions and relationships that intertwine the socio-economic and biophysical processes underlying the dissemination of CA (Nyanga, 2012; Lestrelin et al., 2012).

Within the CA literature there is a gap regarding how gender intersects with other factors within and beyond the household and influences the dissemination of CA. International funding organizations such as the United States Agency for International Development (USAID) are required to investigate gender differences and potential gender inequalities within the context of all funded projects by identifying how proposed project results could affect men and women differently and assessing how men's and women's different roles, relations, and responsibilities within the household, within the community, and other spheres of influence may affect the outcome of proposed project interventions. While gender analysis is mandated for USAID funded projects, recent scholarship (Nyanga et al. 2012; Beuchelt and Badstue 2013; Harman Parks et al. 2014) has identified that the

introduction of CA generates costs and opportunities linked to: livelihood practices and labor allocation; access to productive capital, resources, and information; income, marketing, and value chains, household food security, and health concerns.

While gender has become more widely recognized as an important factor that affects the dissemination of CA, an in-depth discussion of the linkages between gender, CA, space, and livelihoods remains limited. Most analyses of gender and CA have focused on individual gender components, primarily labor allocation within land preparation and weed management activities (Nyanga et al., 2012) or have focused solely on documenting gendered differences in access to productive capital and extension services and training opportunities (Lubwama 1999). Harman Parks et al. (2014) and Beuchelt and Badstue (2013) highlight how a holistic approach can be used to assess the multiple gendered components of CA. By understanding how gender intersects with assets, capital, space, livelihood practices, knowledge, and perceptions, we can understand how CA affects men and women within smallholder agricultural systems. Feminist political ecology (FPE) offers a theoretical perspective to frame the connections between gender, agriculture, and international development and explore the gendered dimensions of CA.

2.2 Feminist Political Ecology: Framing the gendered dimensions of conservation agriculture

Within the discipline of geography, political ecology (PE) is a theoretical framework that has been used to investigate myriad complex nature society interactions, which govern access to and control over environmental resources with implications for environmental conservation and degradation (Zimmerer 1994;

Paulson et al. 2003). Political ecology places an emphasis on documenting the influence of knowledge, power, practice, and politics within environmental struggles and transcends multiple scales of analysis (Watts 2000). Feminist political ecology extends PE's scales of analysis to the household by exploring the gendered power relations and intra-household dynamics governing men's and women's access to and control over environmental resources and knowledge (Rocheleau et al. 1996a; Rocheleau 2008; Elmhirst 2011a; Wangui 2012). By analyzing the gendered relationships within and beyond the household we can identify how gender roles and responsibilities intersect with CA.

Feminist political ecology recognizes that men's and women's dynamic socially constructed roles, responsibilities, rights, and relations are integral in defining adaptive strategies to environmental change and structure access to and control over productive resources linked to livelihood viability and environmental health (Carney 1994; Rocheleau et al. 1996a; Nightingale 2006). FPE places an emphasis on everyday life, access to resources, gendered power relations, and gendered space, and intra-household negotiations to identify how men and women negotiate within rural livelihood strategies and identify gendered components of rural livelihoods that affect smallholder farmer's ability to integrate CA within existing practices and strategies. Specifically, we structured our analysis to explore four gendered components of CA described below: (1) livelihood practices, activities, and the allocation of labor; (2) access to productive resources (land, livestock, credit, etc.); (3) intra-household decision-making and gendered power relations; and (4) gendered space and access to information.

2.2.1 Practices, roles, responsibilities, and labor allocation

This research draws upon FPE's focus on everyday activities to investigate how the introduction of new agricultural technologies and management practices can impact the patterns of household labor. In addition, new technologies promoted by development programs can restructure gender roles and responsibilities within the household and the broader community for example, when smallholder farmers negotiate the transition from conventional tillage-intensive production systems to alternative sustainable livelihoods based on CA. Smallholder farmers' practices are an integral component of rural farming livelihoods and how men and women interact with the natural environment. The other key components of rural livelihoods are farmers' physical assets, the mechanisms they use to access productive capital and resources and individuals' abilities and identities (Chambers and Conway 1991; Ellis 2000; Radel 2012).

Gender relations structure men's and women's roles and responsibilities within livelihood practices and adaptive strategies to produce sustainable livelihoods. Rural livelihoods can be considered sustainable when they can, "cope with and recover from stresses and shocks and rural residents can maintain or enhance access to assets while not undermining the natural resource base" (Scoones 2009 pg. 175). In Rattanakmondol District, in Northwestern Cambodia, declining crop yields and increasing soil erosion threaten the sustainability of smallholder farming livelihoods. However, the introduction of CA has the potential to enhance the sustainability of rural livelihoods through stabilized yields, improved soil fertility, and increased resilience to climate change (Beuchelt and Badstue 2013;

Erenstein et al. 2012). While CA holds great potential for smallholder farmers, the introduction of CA may alter men's and women's roles and responsibilities within household livelihood strategies.

Within the international development and FPE literature, case studies have documented how agricultural program interventions have restructured the gendered division of labor (Carney and Watts 1991; Doss 2001). In a case study from the Gambia (Carney 2004), documented how the intensification of rice production restructured men's and women's labor patterns resulting in struggles between men and women over the control of labor allocation in rice cultivation. Further cases studies from Africa have identified how agricultural development projects can alter gender roles and responsibilities and lead to an uneven distribution of benefits and an increase in women's labor burden (Carney 1998). Additionally, Schroeder (1993) and Schroeder and Suryanata (2004) documented how development projects at different scales often differently impact men's and women's labor burden, because of a reliance on women's unpaid labor. The studies mentioned above indicate that it is important to document the interaction between development project intervention and gender roles and relations. The introduction of specialized no-till seeders has the potential to reduce the labor burden of men and women in regards to land preparation activities, but qualitative and empirical evidence is needed to document the impact of CA on men's and women's labor allocation and whose labor burden is reduced.

In addition to demonstrating the linkages between agricultural development projects, gender, and household labor dynamics, the development and

FPE literature has demonstrated how culturally prescribed gender roles can be contested and reconstituted by international development projects and policies (Schroeder 1993; Nightingale 2006). The struggle over gender roles and responsibilities are rooted in the everyday experiences of smallholder farmers and their position within society. Feminist theories of knowledge offer a useful tool to investigate how gender, science, technology, and labor intersect within the context of international development. Nightingale (2006) indicates that the focus needs to move beyond identifying how gender roles and responsibilities change, but also identify how gender as a socially constructed concept is renegotiated. By investigating smallholder's livelihood practices, we can gain a greater understanding of the potential ways in which CA can redefine socially constructed expectations of men and women.

Smallholder farmers' practices and activities comprise an integral component of rural livelihood strategies. Men's and women's practices are core component of rural livelihoods, but there has been an emphasis on assets-based approaches to documenting rural livelihood strategies (Radel 2012). Asset-based approaches assist in identifying the resources and capital that are available to rural farmers and document factors that affect men's and women's access. An emphasis on assets can obscure the reflexive relationship between men's and women's livelihood activities. A considerable body of scholarship has demonstrated the ways in which gender can define access to productive resources and knowledge (Rocheleau et al. 1996a; Carney 1996) with a specific focus on how rural men and women have unequal access to and control over land and other productive capital

(Kameri-Mbote, 2006). Studies within the development literature have also examined gender-based differences in social capital can affect access to land and productive resources (Flora 2001; Godquin and Quisumbing, 2008). Within investigations of the dissemination of CA, a principal theme has been to identify smallholder farmers' access to land, financial capital, agricultural machinery, and agro-chemical inputs (Wall 2007). Access to productive resources and capital affects the ability of smallholder farmers to experiment with CA. By conceptualizing access and practices as embedded and linked within broader gendered livelihoods we can explore how smallholder farmer's access to specialized no-till equipment and herbicide can alter the gendered division of labor and labor allocation within livelihood activities and how livelihood practices can modify men's and women's access to resources and capital.

Case studies around the globe have documented that in the initial years of CA implementation weed pressure can increase significantly (Knowler and Bradshaw 2007; Giller et al. 2009). In CA production systems where herbicides are readily available, labor drudgery can be reduced, especially for women (Giller et al., 2009); however, in cases where access to herbicides and other agrochemicals is limited and weed management is reliant on manual weeding, men's and women's labor burdens can increase to an unsustainable level. Harman Parks et al. (2014) note that within two smallholder farming communities on the island of Mindanao in the Philippines farmers rely upon manual weeding, for which women are primarily responsible. Because of women's multiple responsibilities and limited time, increased weed pressure could place increased demands on women's labor responsibilities. In

contrast, Nyanga et al. (2012) note that in CA production systems in Zambia herbicides are increasingly being used to manage weeds in lieu of manual weeding, leading to an increase in men's labor requirements and a reduction in women's responsibilities in manual weeding. These examples from the literature indicate that access to herbicide has the potential to alter men's and women's patterns of labor allocation in agricultural activities. To understand how increased weed pressure could operate as a constraint to the dissemination of CA in Rattanakmondol, this study will need to document men's and women's roles in weed management activities, identify men's and women's access to herbicide and other agrochemicals and assess the impact of CA weed management techniques on men's and women's labor burden.

Farmers' ability to access specialized no-till equipment can also affect the allocation of labor, including labor burden, roles, and patterns of labor. Mechanized no-till direct seeders can also increase efficiency during land preparation and reduce drudgery (Corbier-Barthaux and Richard, 2007), but Nyanga et al. (2012) found that in Zambia the introduction of specialized *Chaka* hoes for digging planting basins in CA production systems placed additional labor burdens upon women and reduced their performance in domestic roles and responsibilities. These examples show that with potentially 'labor saving' technologies and practices like CA, "it is important to determine whose labor is saved and at what point in the agricultural season" (Doss 2001 pg. 2080). The introduction of specialized no-till seeders can reduce the drudgery of land preparation activities (Hobbs 2007; Beuchelt and Badstue 2013). However, increasing mechanization can also reduce wage labor

opportunities related to land preparation activities (plowing, sowing, weeding, etc.) for men and poor women (Beuchelt and Badstue 2013; and Harman Parks et al. 2014). Increasing mechanization in agriculture can particularly limit women's opportunities (Moser 1993; Momsen 2010). The above case studies indicate how changes in men's and women's daily livelihood practices and labor availability can impact the outcome of CA development program interventions, but there remains a need for qualitative and quantitative evidence on the affect of CA implementation on men's and women's roles, responsibilities, and practices with an assessment of how gendered labor relations affect the dissemination of CA.

In South and Southeast Asia there is an increasing body of scholarship examining the reflexive relationship between development, gendered roles, responsibilities, and practices (Gururani 2002; Nightingale 2006; Elmhirst 2011b). These investigations of the intersection between gender and development have examined issues linked to community forest management and resource usage. Northwestern Cambodia is an area of dynamic resource usage with radically evolving environmental landscapes linked to rapid deforestation and the expansion of commercial agricultural production. Because of the linkage between increasing deforestation and expanding smallholder commercial agricultural production there is a need for increased for research on the latter.

The above examples from the FPE and development literature demonstrate how men's and women's livelihood practices can be impacted by development interventions, often increasing women's work loads. Generally in smallholder farming systems, women's roles, responsibilities, and activities are often under-

recognized and undocumented (World Bank 2009; FAO 2011). Deere (2005) identified four reasons why women's agricultural practices may be under recognized: (1) rural women often will report their domestic responsibilities as the primary responsibility even if they are actively engaged in agricultural activities; (2) studies focused on income-generating activities may not account for subsistence roles and responsibilities; (3) definitions of agriculture are often narrow and focus primarily on activities in the field, which can omit other important activities, livestock raising, house lot gardens, and post-harvest processing; and (4) definitions of economic activity normally define a minimum number of hours of work per week, which inadequately accounts for seasonal agricultural labor. An increasing number of studies are documenting women's contributions to household agricultural production, but in investigations focused on gender issues in agriculture and natural resource management it is important to conceptualize gender in a way that can account for the diverse cultural, political, and social processes that produce and constitute gender. One critique of the FPE literature is that gender equates to a focus on women, which obscures the intersection of gender with other subjectivities: age, race, culture, and ethnicity (Nightingale 2006; Mollett and Faria 2013). Nightingale (2006) indicates that most studies on gender roles, responsibilities, and practices often focus solely on women's roles and do not extend the analysis to men's roles.

FPE has demonstrated how gender roles and relationships are contested and reconstituted in the context of development projects (Schroeder 1993; Nightingale 2006). The struggles over gender roles and relationships are rooted in everyday

experiences and people's position within society. A detailed discussion of the gendered livelihood roles and practices and the impact of CA on labor patterns is one component of the gendered dimensions of CA. Shifts in gendered livelihood practices and the reconfiguration of gender roles is linked to access and control over productive assets and capital.

2.2.2 Gender, access to assets, and agricultural development

Smallholder's practices are an integral dimension of rural livelihoods, but land, machinery, water, livestock and other productive assets are also critical. Access to and control over assets (productive, human, social, etc.) are linked to rural smallholder farmers' ability to improve and enhance their livelihoods and empowerment; however, the FAO has identified gender asset gaps within farming communities with men and women having different abilities to access and control capital and resources (FAO, 2011). There are documented gendered gaps in access to land, assets, agricultural inputs, and technologies; however, the extent of these gaps and the pathways for closing them requires further research. The broad theoretical framework of FPE offers a lens to document men's and women's access to land, financial capital, and other assets.

A key theme within FPE's investigation of gender, the environment, and international development is gendered environmental rights and responsibilities (Rocheleau et al. 1996a). It explores how gender structures formal and informal access to and control over land and other productive assets and resources (Deere 1990; Rocheleau et al. 1996; Carney 1996). Individuals, households, or groups, including rural smallholder farmers, rely upon a diversity of mechanisms, processes,

and relationships to establish or maintain the benefits from assets or resources (Bebbington 1999; Ribot and Peluso 2003). Access broadly defined is the ability for individuals or institutions to benefit from assets or resources (Ribot and Peluso 2003). Control differs from access, in that control refers to the power relations (formal and Informal) that affect the mechanisms that the individual, household, and groups use to acquire and maintain access (Zwarteveen and Meinzen-Dick 2001; Valdivia and Giles 2001). Research within the FPE and development literature has examined how gender structures the formal and informal mechanisms used to acquire and maintain access (Carney 1996; Valdivia 2001; Quisumbing and Pandolfelli 2010).

Gender relations are an integral component in defining natural resource use and control (Agarwal 1995; Rocheleau et al. 1996a; Schroeder 1997; Rocheleau and Edmunds 1997). The mechanisms and relations that influence access are not static, but rather temporally and spatially specific with rights and responsibilities over resources variable and subject to change (Carney 1996; Schroeder 1997). Access to land, machinery, credit, agrochemicals, and improved seed varieties can impact the ability of farmers to implement conservation agriculture (Knowler and Bradshaw 2007). Women smallholder farmers' access to these assets and resources is often more indirect and negotiated than for men smallholder farmers (Rocheleau and Edmunds 1997; Doss 2001). As such, it is critical to identify who is and who is not able to use particular resources and capital and determine when an individual is able to use a resource.

Access to productive land and tenure security have been identified as important factors that affect farmer's land management and the willingness of smallholder farmers to invest in CA and the long-term benefits to soil quality (Wall 2007; Knowler and Bradshaw 2007; Erenstein et al. 2012). It is important to document how laws and legal rights can modify access to and ownership of productive assets like land, but also identify how customary land usage rights and inheritance patterns can also structure access to land. In many contexts of the developing world legal frameworks and government agrarian land reform programs have a gendered impact, with men and women having different abilities to claim the full usage rights associated with land ownership (Deere 1990). Investigations of land tenure, control, and access have historically focused on identifying land tenure systems that farmers use to acquire land and whether or not households have secure access their land. Doss (2013a) indicates that to investigate the gendered dimensions of access to land and land ownership researchers need to identify which individuals within the household own the land and if there is a land title, whose names are listed. Land usage rights can vary depending on ownership (Deere 1990) so documenting if land is owned solely or jointly between a spouse or other household members is important in identifying potential gender-based inequities in access to and control over land.

In Uganda, Bomuhangi et al. (2011) documented that although men and women respondents indicated that land was jointly owned, the majority of households did not posses formal land titles and in the cases where ownership documents were present women's names were often not listed on such documents.

Harman Parks et al. (2014) identified a similar situation within smallholder farming communities in the Philippines. While tenure security can be a constraint to the dissemination of CA among smallholder farming communities of Rattanakmondol, it is important to document men's and women's ability to access the bundle of rights associated with formal or customary land ownership. By identifying men's and women's access to land in Rattanakmondol we can better conceptualize men's and women's decision-making about agricultural production and potential investment in CA. While land is a critical asset for smallholder farmers gender analysis should also document men's and women's access to livestock, agricultural machinery, agrochemicals, and other important non-land assets.

Access to productive resources is structured by institutional laws, policies and customary rights. Additionally, men's and women's everyday relations and practices modify access to resources. Haraway (1988) notes that knowledge is situated within everyday relations and livelihood activities and relevant to an individual's position within society including gender, race, ethnicity, class, and culture. Everyday activities are gendered with men and women having different experiences, rendering multiple gendered knowledges. The FPE literature has explored the linkages between men's and women's lived experiences and gendered knowledge (Rocheleau et al. 1996b; Nightingale 2006). Gendered differences in roles, responsibilities, and practices link to men's and women's knowledge of agriculture and natural resources, but also structure men's and women's ability to access and control different resources and spaces. By investigating the linkages between livelihood practices and knowledge we can gain insight into men's and

women's everyday lives and relations and document how those relations structure access to productive capital and resources.

2.2.3 Intra-household decision-making and gendered power relations

Scholarship within the FPE has focused on the gendered power relations that define resource access and control, specifically land and other natural resources (Rocheleau and Edmunds 1997; Basset 2002; Radel 2012). Agriculture and other development project interventions can alter the gendered power relations within and beyond the household while gendered power relations in turn can affect the outcome of development interventions. Gendered differences in men's and women's abilities in intra-household negotiations may also impact the dissemination of CA within smallholder farming communities.

Development programs operate at multiple spatial scales and FPE has demonstrated the importance of including the household to assess how gendered power relations structure negotiations over the allocation of productive assets and resources. By examining the dynamic power relationships within the household we can explore how gender affects natural resource management and international development projects (Carney 1996; Rocheleau and Edmunds 1997). Development practitioners have also recognized that gender-based differences in access to resources, capital, and information configure gendered power relations within the household and mediate the impact of development projects and policies (Udry 1996; Doss 2001; Doss 2013b). A diversity of theoretical perspectives and methods have been utilized to document intra-household power relations and their impact

on the allocation of resources and income and development project outcomes. Before discussing these, it is important to establish a firm conceptualization of the household.

Typically, the household is defined as, "a group of people living under the same roof, eating out of the same pot, and making joint decisions" (Doss 2001 pg. 2086). Within this definition the critical component is that the group of identified individuals share some common resources and common budget and expenditure decisions (Glewwe 2000). Several studies have also used the term household interchangeably with family. However, applying these conceptualizations of the household can be problematic. Several studies in Southeast Asia have indicated that the household has become more difficult to conceptualize and identify with widespread migration and dislocation (Rigg et al. 2012; Rigg and Salamanca 2009; Derks 2008). Agarwal (1997) also highlights the need to recognize how the household is embedded within the broader institutional environment.

While there are generally agreed upon definitions of the household (Doss 2001; Glewwe 2000) it is necessary identify who within the household is engaged in decisions about agricultural production. The structure and composition of the household, including the age, education level, and status of the individual household members can all influence intra-household decision-making. In order to investigate how intra-household relations and negotiations affect the dissemination of CA the structure and characteristics of rural smallholder households have to be defined, including identifying who within the household is involved in negotiations.

The literature on intra-household decision-making has focused on using empirical analysis to investigate intra-household negotiations. Within most of these analyses there is an implicit bias that the husband and wife within the household are the primary decision-makers and other members of the household are assumed to be passive members. Focusing on households with a couple with an adult male and an adult female, the analysis can obscure some of the complexities surrounding men's and women's power and access to resources. In an investigation of improved maize technology in Ghana, Doss and Morris (2001) found that gender differences in the adoption of improved maize technologies were linked to gender-based differences in access to inputs. However, women within male-headed households were able to bargain within the household to obtain access to the necessary resources while women in female-headed households were not able to. Within an empirical framework it is difficult to assess the intra-household bargaining environment between and adult child and older parent, but such a framework is possible. Conceptualizing the household is complex so it is critical to identify who within the household is engaged in decision-making, but also tease out the nuances of intra-household negotiations.

While there has been a recognized need to reframe definitions of the household in terms that are context-specific, the household remains an important scale of focus for development project interventions (Carr 2005). However, within the past twenty years there has been substantial change in how the development literature conceptualizes the dynamic power relationships between social actors within the household. This discussion initiated within the development economics

literature. Understanding the past and current approaches used to analyze intra-household dynamics can inform the linkages between gender and power within the household and its relevance to agricultural decision-making and the dissemination of CA. Within the development economics literature, the focus has been on using empirical approaches to (1) model intra-household decision-making; (2) estimate the determinants of intra-household decision-making and resource allocation; and (3) analyze the processes of intra-household decision-making. Over the recent decades, several models of intra-household decision-making have been employed to examine the dynamics of intra-household decision-making in the context of international development.

Historically, within development economics the household was conceptualized as a monolithic entity where the household is "a collection of individuals who behave as if they are in agreement on how to best combine time, goods purchased in the market, and goods produced at the home, to produce commodities that maximize some common welfare index" (Udry, 1996 pg. 1101). In this model of the household, the distribution of income, assets, and resources within the household does not impact decision-making (Doss 2013b).

However, a substantial body of scholarship, including empirical studies and qualitative research have demonstrated that monolithic conceptualizations of the household are not appropriate and that decision-making outcomes do depend on intra-household dynamics and the distribution power within the household affects the allocation of resources within the household (Straus and Thomas 1995; Udry 1996; Doss 2001). Empirical and qualitative research has identified gender as a

salient factor in defining power within household decision-making and that men and women may have different priorities and men and women do not always pool their resources and income (Alderman et al., 1995; Doss 2001). Recent empirical analyses of intra-household decision-making have developed two broad alternative models of intra-household decision-making: 1) cooperative and 2) non-cooperative (Carr 2005; Doss 2013b).

In cooperative models of household decision-making, it is assumed that individual household members have different preferences and priorities and individuals within the household bargain over how resources and income are allocated (Doss 2001). Some cooperative models utilize game theory to investigate intra-household relations while others assume that bargaining within the household produce decisions that are *Pareto efficient*, where the outcomes of intra-household decision-making could not benefit one member of the household to the detriment of another (Doss 2001). However, within both frameworks an individual's ability to bargain in decision-making is impacted by access to land, other productive assets and resources, and the mobilization of social networks (Quisumbing and Maluccio 2003; Doss 2001). The second category of decision-making models involves cooperative models where it is assumed that resources are not pooled within the household and individuals make their own decisions over the allocation of resources. In non-cooperative models, it is hypothesized that the outcomes of decisions are not *Pareto efficient*, where decisions over the allocation of resources and income could lead to one member of the household being better and another member of the household becoming worse off (Doss, 2013). The above models of

intra-household decision-making are frequently used to test the assumptions of monolithic model of intra-household decision-making. Studies in some contexts support cooperative models (Quisumbing and Maluccio, 2003) while others suggest that non-cooperative models are valid (Udry 1996; McPeak and Doss, 2006).

While a broad set of empirical papers have focused on testing certain assumptions of intra-household decision-making, a broader scope of empirical and qualitative research has examined the factors that can alter men's and women's bargaining power over the allocation of resources. These types of analysis often do not employ a specific theoretical model of the household. This body of scholarship has identified several variables that can impact men's and women's power in intra-household decision-making: labor force participation; control over income; land ownership; land rights; livestock ownership; level of education; age; and the decision-making process (Doss 1996;Bomuhangi et al. 2011;Doss 2013a). Measuring bargaining power within the household remains difficult, if not impossible to actually measure. Proxy indicators that are correlated within bargaining power can be used, but still might not determine causal relationships between the impact of programs and policies on household decision-making. Income, employment status, access, assets, education, perceptions, and decision-making over expenditures and assets are examples of indicators that have been used as proxies of bargaining power within the household.

Mirroring the emphasis on access to assets and intra-household decision-making literature, FPE scholarship has also focused on examining how men and women negotiate access to productive resources integral to livelihoods (Rocheleau

and Edmunds 1997; Radel, 2012). Through this line of research, researchers within FPE and the broader field of PE have demonstrated how agriculture and environmental conservation development projects can redefine gendered power relations within the household integral to negotiations over the allocation of labor and resources (Basset, 2002). This investigation of smallholder farmers' experiences with CA contributes to the evidence documenting how negotiations within the household can impact the outcome of development project interventions and how development project activities can restructure power relations within the household. Studies within FPE and the broader development literature have demonstrated that intra-household dynamics have critical implications on the dissemination of improved agricultural technologies; however, there are still relatively few studies that examine the linkages between men's and women's participation in agricultural decision-making and the introduction of improved agricultural technologies. Documenting to what extent men and women are involved in decision-making can assist in identifying gender-based constraints and opportunities to the dissemination of conservation agriculture. When focusing on documenting participation in household decision-making it is important to recognize that while men and women may have input into decisions other factors may constrain the choices available to men and women. Documenting the relations involved in intra-household decision-making may assisting in identifying gender-based gaps in access to assets and information and potentially how the introduction of conservation agriculture can promote gender equity within agricultural production in Rattanakmondol.

2.2.4 Access to information and gendered space

The integrated practices and techniques of CA are characterized as knowledge-intensive where access to information and linkages between farmers, researchers, and extension personnel are integral in the dissemination of CAPS (Wall 2007; Giller et al. 2009). As indicated above, FPE is a useful framework for exploring the linkages between CA development project interventions and men's and women's access to productive resources like credit, land, and machinery. Information is also an important resource for rural smallholder farmers where limited or costly access to information may detrimentally affect agricultural productivity and the incorporation of improved agricultural technologies (Doss and Morris 2001).

Feminist political ecology's emphasis on gendered knowledge has illustrated how gender structures access to extensions services and agricultural training opportunities. In the Dominican Republic, Rocheleau et al. (1996b) documented how men had more privileged access to forestry extension personnel, training opportunities, and other scientific information. Despite their active roles in subsistence and cash crop production women farmers' production needs are often not addressed by extension personnel. As with other productive assets, understanding how gender structures access is key to identifying gender-based constraints and opportunities to the dissemination of CA within Rattanakmondol.

Understanding how and where men and women access information is critical to developing CA production systems that recognize smallholder farmers' different sources of information. Smallholder farmers are typically not as well connected to

information systems as large-scale operators and thus rely on connections within the community for information sharing (Mooko 2005; Wall 2007; Fletschner and Mesbah 2010). Because of their more limited access to extension services, rural women often rely on informal networks of neighbors and family relations through everyday connections to acquire information (Moore 2001). Extension services and agricultural producer groups are limited in Cambodia (MoWA 2008), including Rattanakmondol so farmers rely on informal relations to access agricultural information. Hoang et al. (2006) indicate that interpersonal networks can be used as a pathway to enhance farmer's access to information and facilitate development interventions, but existing social differences and inequalities have to be identified and taken into consideration during research for development program interventions. Feminist political ecology's focus on gendered space can contribute to this investigation of how men and women access agricultural information.

Gendered space can be constructed through men and women's dynamic performance of gender roles and responsibilities. These roles and relationships define myriad webs of access to and control of resources within spaces (Nightingale 2006; Rocheleau et al. 1995). Rocheleau (1995) indicates how the mapping of men's and women's spaces can assist in identifying gender roles and responsibilities that influence access to and control over resources. Gendered resource mapping has commonly been used to identify men's and women's interests, knowledge, and priorities to develop land management systems that equitably address the environmental issues of men and women. The same participatory mapping techniques can be applied to investigate men's and women's access to information.

Mapping the formal and formal relations that men and women use to access information can identify potential gender-based gaps in information access, which can potentially impact smallholder farmers' ability to implement CA.

While gendered resource mapping can be utilized to investigate where and how men and women smallholder farmers access information about CA, it is important to recognize that the data acquired through mapping reflects farmer's knowledge and perceptions that are dynamic and variable and situated in everyday life. Feminist geographers have shown how space is constructed through interactions between people and the environment and how space has a constitutive affect on gender norms and relations.

2.3 Framing the gendered dimensions of CA with FPE

Conservation agriculture is increasingly recognized as a means to improve the livelihood of farmers within developing, but the suitability of CA for smallholder farmers has been questioned. Documenting the context-specific socio-cultural and local biophysical conditions of a community can promote the dissemination of conservation agriculture. The literature has documented several factors that can affect adoption: patterns of labor allocation; access to productive resources; intra-household decision-making; and access to information. There have been limited investigations of the gendered power relations that structure access to and control over productive resources, information, and assets.

Feminist political ecology offers a framework to investigate the intersection of gendered livelihoods and conservation agriculture. In this research we investigate how gendered livelihood practices may affect smallholder farmers'

ability to integrate CA within existing livelihood strategies, as well as document how the dissemination of CA within Rattanakmondol could restructure socially-prescribed expectations of men's and women's roles and responsibilities. Examples from the FPE, gender, and rural development literature have documented women's exclusion from household negotiations at various scales and settings. These negotiations are integral in shaping households adaptability to environmental change. This investigation will explore men's and women's influence in negotiations within and beyond the household related to agricultural production and conservation agriculture. Access to land and other productive assets are integral to farmer's ability to experiment with CA. Access to these resources is often marked by substantial gender disparities. We will investigate how gender structures access to land, credit, and agricultural machinery linked to the implementation of CA and assess the potential for CA development programs to increase gender equity in access to and control over productive capital and resources.

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Chapter 3: Gendered Dimensions of Conservation Agriculture in Northwestern Cambodia

3.1 Abstract

Based on fieldwork with smallholder farmers in one village in Rattanakmondol District, Battambang Province, Cambodia, this paper examines the gendered dimensions of an internationally funded research project promoting the development of sustainable alternatives to tillage-intensive agricultural production. Conservation agriculture techniques and practices tailored to site-specific biophysical and socio-cultural conditions can benefit smallholder farmers. These techniques can improve their livelihoods by increasing household food and nutrient security; enhancing soil health; counteracting soil degradation; and increasing agricultural productivity. In the context of one village in Rattanakmondol, we use a feminist political ecology approach to examine the intersection between gendered livelihoods and conservation agriculture. We used mixed methods, including focus group discussions, semi-structured interviews, household visits, and participatory mapping to document the effect of CA implementation on men's and women's labor allocation in agricultural production and explore the gendered dimensions of access to and control over assets, resources, and information relevant to the dissemination of CA to smallholder farmers in Rattanakmondol. Our results indicate that men and women have different access to and control over productive resources and information. We also discuss how CA implementation has the potential to restructure the gendered division of labor in agricultural production and affect gender relations in Rattanakmondol.

Keywords *Cambodia, conservation agriculture, gender, agricultural change, access, decision-making*

Abbreviations

USAID	United States Agency for International Development
CIRAD	Centre de Coopération Internationale en Recherche Agronomique pour le Développement
PADAC	Project to Support Agricultural Development in Cambodia
FAO	Food and Agriculture Organization
MAFF	Ministry of Agriculture, Forestry, and Fisheries
MFI	Micro-finance Institution
MoWA	Ministry of Women's Affairs
PADAC	Project to Support Agricultural Development in Cambodia
USD	United States Dollar

3.2 Introduction

Despite crop yield gains over the past 50 years (FAO 2012), food insecurity and poverty remain widespread throughout the developing world and are exacerbated by unsustainable agricultural practices and degrading landscapes. Smallholder farmers are particularly vulnerable due to their reliance upon crop production and their susceptibility to market changes. Conservation agriculture (CA) is increasingly seen as a means to assist smallholder farmers with sustainably intensifying agricultural production, enhancing food security, counteracting soil degradation, stabilizing crop yields, and improving resilience to climate change (Derpsch et al. 2010; Erenstein et al. 2012 Beuchelt and Badstue 2013).

The soil management practices and technologies utilized in CA are based on three interrelated key principles: (1) year-round organic soil cover, achieved through the introduction of cover crops, intercropping, or the retention of residue/mulch; (2) minimal soil disturbance, accomplished by using no-till practices; and (3) diverse crop rotations, sequences, and/or associations so that

crop biodiversity is maintained and pest infestations are avoided (FAO 2008; Kassam et al. 2009). The benefits of CA's techniques and practices for smallholder farmers have been shown including enhanced soil production potential that can contribute to stabilized and increased crop yields (Hobbs et al. 2008; Kassam et al. 2009) and improved interaction between physical, chemical, organic, and hydrologic factors within the soil (Wall 2007; Erenstein et al. 2012). Research indicates that CA can reduce labor burdens and production costs (Wall 2007; Knowler and Bradshaw 2007; Ernstein et al. 2012). Studies have demonstrated the ability of CA implementation to reduce smallholder farmers' vulnerability to climate change by increasing soil moisture-holding capacity and improving soil infiltration (Hobbs et al. 2008; Valdivia et al. 2010).

Over the past half-century, governments and development organizations have made major attempts to promote various forms of conservation agriculture as a sustainable alternative to tillage. In the United States, soil conservation efforts were a counter to the devastating effects of the Dust Bowl in the 1930s. Globally, soil conservation measures were promoted by the British colonial administration in Africa and the Caribbean (Grossman 1997). Direct seeding practices rose to prominence in Brazil during the 1970s with the French Agricultural Research Center for International development (CIRAD) expanding upon and refining these practices so they are appropriate to a diversity of eco-regions and farming systems (Lestrelin et al. 2012).

Smallholder agricultural production can benefit from the implementation of CA, but CA techniques and management practices represent a fundamental change

in smallholder farming systems. Conservation agriculture has been characterized as knowledge-intensive, entailing complex practices and techniques and often accompanied by high costs for smallholder farmers that may constrain the dissemination of CA (Wall 2007). Most smallholder farming households lack access to agrochemicals, specialized no-till machinery, and financial capital and credit needed in CA implementation (Beuchelt and Badstue 2013; Giller et al. 2009; Wall 2007). Additionally, smallholder farmers are often unable to access extension services and agricultural trainings for assistance in implementing CA management practices (Wall 2007). Increased weed pressure during the initial years of CA implementation has also been noted as a cost of CA implementation and can increase men's and women's labor burdens in production systems reliant on manual weeding where herbicides are unavailable (Giller et al. 2009; Nyanga et al. 2012). Land tenure security has also been identified as a variable that could be a factor in the decision of whether to implement CA, as the beneficial impact on soil health and productivity are long term (Knowler and Bradshaw 2007). There are several benefits to smallholder farmers from CA implementation, but the costs mentioned above associated with CA implementation suggest that CA is not economically viable to smallholder farmers (Giller et al. 2009). The factors that can constrain or promote farmers decision to implement CA are highly context-specific (Wall 2007; Knowler and Bradshaw 2007; Derpsch 2010; Lestrelin et al. 2012). Identifying relevant site-specifi social and biophysical factors can assist in understanding the opportunities constraints the dissemination of CA.

3.3 The gendered dimensions of CA

The United States Feed the Future Innovation Lab for Collaborative Research on Sustainable Agriculture and Natural Resource Management (SANREM IL), funded by the U.S. Agency for International Development, has been operating globally since 2009, within 13 countries, including Cambodia, to design and implement Conservation Agriculture Production Systems (CAPS) that are tailored to site-specific conditions of smallholder farmers. In Cambodia, SANREM IL is working in partnership with the Project to Support Agriculture Diversification in Cambodia (PADAC) and the Agricultural Research Center for International Development (CIRAD) to assist 65 smallholder farming households with implementing CA and researching factors that could promote the further dissemination of CA in Northwestern Cambodia, including an investigation of the gendered dimensions of CA.

Several costs and benefits accompany the transition from tillage-intensive production systems to alternative cropping systems designed around CA, but changes within agricultural production systems may affect men's and women's access to assets and labor allocation differently (Erenstein 2003). Milder et al. (2001) note that development program efforts to promote CA, "are not always gender neutral in terms of labor requirements, empowerment, or economic benefits and costs" (pg. 25). There has been limited discussion on the gender[6] differentiated impacts of CA on small holder farmers and there is insufficient empirical and

[6] We define gender as the socially constructed expectations of roles, responsibilities, and rights of men and women and the relations between them. The relations between men and women are mutable, but are also time, culture, and context specific and linked to other subjectivities, like age, class, race, and ethnicity (Doss 2001).

qualitative evidence documenting whether CA will increase or decrease men's and women's labor burden and the affect of gender-based differences in access to and control over assets has on the dissemination of CA (Nyanga et al. 2012; Beuchelt and Badstue 2013; Harman Parks 2014). Gender is an integral component in defining the household division of labor, access to and control over natural, physical and financial assets, power in intra-household decision-making, and access to information. As such, development policy planners and CA program implementers need to document how gender relations could affect the dissemination of CA and how CA program development interventions could influence gender relations. Specifically, we developed four research questions to explore the intersection between gender, CA, and international development:

> RQ1. How are gendered livelihood practices linked to men's and women's participation in intra-household decision-making and the implementation CA?
>
> RQ2.How do gender-based differences in access to and control over land, agricultural machinery, and credit impact the dissemination of CA?
>
> RQ3. How does CA implementation affect men's and women's allocation of labor to different productive and reproductive activities?
>
> RQ4. How do men and women access agricultural support services and information about CA?

In Rattanakmondol, CA can promote the sustainability of smallholder agricultural livelihoods by increasing the productive potential of soil. To address our research questions, we use a livelihoods approach and the Gender Dimensions Framework (GDF) (Rubin et al. 2009). Broadly, the livelihoods approach is used to examine the means by which individuals, households, and groups earn a living. This approach accounts for 1) practices; 2) tangible and intangible assets; and 3)

capabilities that are utilized to develop strategies and generate outcomes that contribute to the household (Chambers and Conway 1991; Ellis 2000; Valdivia and Giles 2001; Oberhauser et al. 2004). The multi-disciplinary character of the livelihoods approach is rooted in development, cultural ecology, and rural sociology thinking and practice over the past fifty years, but rose to prominence in the 1990s (Rappaport 1968; Scoones 2009). The livelihood approach offers a conceptual framework to investigate the complex and dynamic contexts of rural agricultural communities (Bebbington 1999; Ellis 2000), but it has been critiqued for the lack of attention to power and scale (Scoones 2009). Rural livelihoods are embedded in power relations including gender, class, ethnicity, culture. We have incorporated power and scale into our approach to understand how gender affects the ways in which rural household negotiate livelihood strategies and adaptability, including the implementation of CA (Radel 2012; Harman Parks et al. 2014).

To understand how gender intersects with rural smallholder farming livelihoods and document how gender-based constraints and opportunities could impact the dissemination of CA, we used the four overlapping categories of the GDF. Similar to the livelihoods approach, practices and participation and access to resources are two of the integrated dimensions of the GDF. The GDF is comprised of two additional dimensions: 1) beliefs and perceptions; and 2) laws, legal rights, policies, and institutions. These four overlapping dimensions of the GDF are crosscut by the dimension of power indicating that smallholder farmers' access to assets and practices are embedded within broader social structures and power

relations, including gender, which can structure negotiations within and beyond the household concerning rural livelihood strategies.

This investigation of the intersection of CA implementation and gendered livelihoods also draws upon the broad theoretical framework of feminist political ecology (FPE), a sub-discipline of geography. Feminist political ecology is one of many analytical approaches used to investigate the intersection between gender, human-environment interactions, ecological change, and development and identify how gender relations impact and are impacted by political and ecological landscapes (Nightingale 2006; Rocheleau et al. 1996). Feminist political ecology has been applied to explore how gender structures men's and women's access to space, assets and resources; roles and responsibilities in a agriculture and natural resource management; power in intra-household negotiations; and access to information and local knowledge (Rocheleau 1995; Rocheleau et al. 1996; Udry 1996; Momsen 2010).

An important analytical theme within FPE is the investigation of how development interventions affect the gender dynamics linked to the allocation of labor within the household. Development interventions can redefine men's and women's responsibilities and practices in household livelihood activities, potentially leading to gendered differences in labor allocation and workload (Schroeder 1993; Carney 1998; Carney 2004; Wangui 2008). The interaction between development interventions and gendered livelihood roles and practices is context-specific, but there have only been limited investigations of how development projects promoting CA have transformed the gender relations in smallholder agricultural communities.

3.4 Research Setting

Agricultural livelihoods and agrarian landscapes in the upland regions of Southeast Asia and the Mekong sub-region have been transformed in the past decades due in part to internal migration, global market demands, mechanization, war, and land commodification (Lestrelin 2010; Castella 2012). This agrarian transition and intensification in the region is linked to deforestation, land cover change, declining soil fertility, and land degradation (Fox and Volger 2005; Castella et al. 2006). Policy-makers and development practitioners increasingly view CA management practices and techniques as a means to increase the sustainability of smallholder upland cultivation in the region Laos (Lestrelin and Giordano 2007; Lestrelin et al. 2012); Vietnam (Castella et al. 2006; Affholder et al. 2010); Thailand (Janeau et al. 2008; Pansak et al. 2008); and Cambodia (Boulakia et al. 2011).

Since Cambodia's reintegration into the global market economy in the early 90s, there has been substantial economic growth within the agricultural sector that has been essential to the growth of the domestic economy (Mund 20011; Ros et al. 2011). Agriculture is not only integral to economic growth, but is the livelihood base for the vast majority of Cambodia's rural population. Historically, agricultural production has centered on smallholder household rice production in the Mekong and Tonle Sap flood plains (Boulakia et al. 2012). The transition from a collective economy and a return to political stabilization has resulted in substantial transformations in land use patterns and agrarian landscapes within the upland forest reserves of northern and western Cambodia.

With the cessation of the Khmer Rouge Civil War in 1998, Cambodia's rural upland forest reserves experienced substantial population increase because of the potential for upland areas, referred to as *Chamcar,* for profitable annual crop production. In the past decade, there has been sustained increase in annual cash crop production (maize, cassava, soybean). From 2000 to 2008, the maize growing area in Cambodia increased from 71,460 ha to greater than 200,000 ha (MAFF 2010). Burgeoning demand from local markets and regional markets in Thailand has transformed Northwestern Cambodia, including Battambang Province, into a dynamic region of commercial annual crop production. Profitable maize and cassava production represents a viable pathway to improving livelihoods of smallholder farming households. Rapid agricultural expansion on ecologically sensitive upland land reserves coupled with tillage-intensive mono-cropping production systems has not been without costs, resulting in unsustainable deforestation, environmental degradation, soil erosion, lowered biodiversity, and declining soil fertility (Fox and Volger 2005; Boulakia et al. 2012). These challenges threaten the sustainability of livelihoods for the commercial smallholder farming households. The management practices of CA have the potential to assist upland smallholder farmers in Cambodia.

Our study area is located in Rattanakmondol District, located in central Battambang province, where SANREM IL is working with smallholder farmers in four villages: Boribo; Pichangva; Sengha; and Aukmum. We selected Pichangva for the focus of this research (Fig.1). Pichangva met our criteria safety; accessibility; number of farmers implementing CA (>15). Pichangva lies in the upland piedmont areas of the Cardamons Mountains on rolling plains ranging between 20 to 70

meters above sea level, but surrounded by isolated hills with higher elevations. Cropping systems in the area are focused on commercial maize, cassava, and soybean production, but subsistence rice cultivation is also present and perennial fruit tree production has been expanding in the recent decade. Since the beginning of the 20th century, the agricultural potential of Rattanakmondol and the area surrounding Pichangva has been recognized within the region, with cotton, peanut, and sugar cane production common. Formal land titles started being distributed during the early 60s. During the Pol Pot regime, Vietnamese occupation, and the later Khmer Rouge Civil War, agricultural production essentially ceased in the area with forced collectivization and abandonment. The area remained an active war zone until the UN-mandated ceasefire in 1996. At the end of hostilities, Pichangva and the surrounding area experienced significant immigration. The current population is 772 with 164 households comprised of former Khmer Rouge soldiers and former rice farmers from northern Battambang province (NIS 2008).

Maize and cassava comprise 82% of the total arable land and is cultivated primarily on acidic silty clay mollisols and vertisols (Boulakia et al. 2012; Belfield et al 2005). Commercial annual crop production is the principal income source for smallholder farmers in the area. Off-farm economic opportunities are limited within the region. Small groceries, repair garages, and charcoal production are some of the available off-farm opportunities, but are affected by the quality of the roads and sensitivity to competition. However, tillage-intensive mono-cropping of maize and cassava in the last decade has resulted in degradation of soil productive capital and

declining yields, which threatens the viability of agricultural livelihoods in Pichangva.

In Rattanakmondol, lower yields, increasing soil erosion, and the rising costs of agricultural inputs (seeds, fertilizers, and herbicides) is influencing substantial out-migration, especially amongst younger generations. Young farmers are often forced to find other source of employment due in part to rising land prices, with men typically looking for work in Thailand in the agriculture and construction sectors and women seeking jobs within the garment manufacturing industry in Phnom Penh. Remittances are becoming an increasing source of income for smallholder farmers in Pichangva. Because of these opportunities and challenges facing upland agricultural production, alternative crop production systems based on CA could increase the long-term sustainability of agricultural livelihoods of smallholder households.

3.5 Research methods

This investigation utilizes qualitative and quantitative methods, including focus group discussions (FGDs), semi-structured household interviews, a structured household survey instrument, participatory mapping, and key informant interviews to investigate the gendered dimensions of CA. Fieldwork was conducted during two visits to Rattanakmondol: two weeks in January 2013 to conduct FGDs, collect preliminary data, and pretest the household survey; and seven weeks in June and July of 2013 for the bulk of research activities.

In total, 66 individuals participated in this research (Table 1). There were 15 participants in the two FGDs, 47 participants in the household interviews, and four

key informant interviews with leaders of local agricultural cooperatives and SANREM IL or extension service personnel.

Table 1 Number of participants by gender

	Men	Women	Total
Focus Group Discussions	7	8	15
Household Interviews	22	25	47
Key Informant Interviews	2	2	4
Total	31	35	66

Source: Authors' fieldwork

Different sampling methods were used to select participants for the FGDs and household interviews. For the FGDs, we selected smallholder farmers who are currently implementing CA on a portion of their agricultural land in Pichangva. With the assistance of SANREM IL extension personnel, we employed convenience sampling (Bernard, 2006) to identify participants for the FGDs. Purposeful sampling was used to identify key informants. Household interviews consisted of farmers that have been participants in SANREM IL activities. We obtained a list from SANREM IL of the 49 smallholder farming households from Pichangva that have participated in project activities. Next we eliminated individuals that were no longer living in the village or were absentee landowners not engaged in agricultural production within the research site. We then selected a proportionally random sample stratified by the three categories: (1) farmers currently implementing CA; (2) farmers that had discontinued implementing CA; and (3) farmers interested in CA, but not yet implementing. The final household sample size was 26 with 21 of these comprised of married couples. Three of the remaining five included a widow

and two women who had recently separated from their husband. The remaining two contained a married couple where only one adult member of the household available to be interviewed. It is important to note that the majority of households that are currently or did implement CA are/did not experiment with CA on the majority of their land.

Our local support team included of SANREM IL extension personnel and two undergraduate students from the faculty of Agriculture and Food Processing at the University of Battambang. They played a crucial role as facilitators and note-takers during the FGDs and with interpretation and note taking during the household visits. They assisted with bridging cultural and linguistic barriers. In addition the SANREM team's familiarity with members of the community, experience with farmers' production practices, and knowledge of CA enabled a friendly and receptive atmosphere for our household visits.

3.5.1 Data collection

Focus group discussions were conducted separately between male and female respondents so as to generate a space where opinions could be expressed more freely. These discussions consisted of a series of participatory exercises focused on four themes: (1) local livelihood strategies, including men's and women's roles, responsibilities, and allocation of labor for productive, reproductive, and community activities[7]; (2) historical changes in agricultural production and gender

[7] Productive activities can include household subsistence agriculture, cash crop production, wage/salary employment, and small business. Reproductive activities refer to domestic activities and childcare. Community activities refer to roles in maintaining social relations and networks (Beuchelt and Badstue 2013).

dynamics within the community; (3) men's and women's participation in social groups and organizations, including access to agricultural support services and training opportunities; and (4) farmer's thoughts and perceptions on the benefits and costs of implementing CA.

The 47 household visit participants (28 implementing CA, 7 considering CA implementation, and 12 no longer implementing CA) included farmers ranging in age from 23-74 (avg. 47) for men and 25-62 (avg. 44) for women. There was not a substantial difference in education between men and women, with the majority of men and women having only completed some primary school level education, but more women interviewees had attended lower and upper secondary school. In general respondents under 45 years old had completed higher levels of education. These differences in education are rooted in the conflict and instability that characterized the late 20th century and limited access to education opportunities.

Household visits were conducted separately with men and women respondents and began with the collection of general demographic data and history with CA implementation. This was followed by a semi-structured discussion of participants' experience with CA implementation, including their motivation for implementing/or wanting to implement CA, types of benefits and costs associated with CA, the effect of CA on labor allocation; and men's and women's role in the decision to implement CA. The structured survey, adapted form the from the United State's Feed the Future Initiative's Women's Empowerment in Agriculture Index

(WEAI)[8], was used to document men's and women's participation in agricultural activities, access to and control[9] over productive assets (land, agricultural machinery, credit) and information (extension services, agricultural trainings, and producer groups), and participation in intra-household negotiations. The structured survey questions served as a basis for further discussion of issues raised during the survey. We used participatory mapping during the household visits to identify the spaces where farmers access and share information about CA and factors that constrain or promote information exchange in those places. We also visited 12 farms and observed men's and women's roles in land preparation and weed management activities in CA and conventional tillage-intensive production.

3.5.2 Data analysis

To analyze the quantitative data from the household survey and participatory mapping, we used descriptive statistics to compare men's and women's responses and identify similarities and differences in access to assets and information; participation in intra-household negotiations; and the affect of CA on labor allocation. To complement the descriptive statistics a two-tailed N-1 two-proportion test (Campbell 2007) with a 95% confidence limit and matched pair two-tailed *t*-tests, with a 95% confidence limit were used to test for any significant

[8] The Women's Empowerment in Agriculture Index (WEAI) was developed by the United States Agency for International Development (USAID) in partnership with the International Food Policy Research Institute (IFPRI), and the Oxford Poverty and Human Development Initiative (OPHI). The WEAI men's and women's participation in and control over agricultural production through investigating five domains: (i) Production - decisions about agricultural production; (ii) Resources - access to and decision-making power over productive resources; (iii) Income - control over the use of income; (iv) Leadership – participation in community activities and groups; and (v) Time – allocation of labor for productive and domestic tasks (Alkire et al. 2013).

[9] Access is where individuals, households, or groups are able use assets and resources to generate benefits (Bebbington 1999); control is the power relations (formal and informal) that affect the mechanisms used to access resources (Ribot and Peluso 2003).

differences between men's and women's responses. The data from the participatory mapping were coded to identify the types of spaces where men and women discuss aspects about CA.

Analysis of the qualitative information from the FGDs, semi-structured portions of the household visits, participatory mapping, and key informant interviews was a continuous process initiated during data collection including daily reflective journal entries, detailed weekly reports, and the identification of key themes to explore further in ongoing fieldwork including household visits. Post-data collection, we conducted content analysis to identify the linkages between CA and the interrelated components of gendered livelihoods. Specifically, we inductively coded the responses from the two FGDs and 47 household-visits using qualitative analytical software (Atlas. ti). In addition to using inductive coding and content analysis we disaggregated the qualitative data by gender so that we could compare responses between men and women, and categorized the data to identify gender-based constraints or opportunities for CA implementation. When appropriate, direct quotations were used to support key themes, but names have been omitted. our interpretation of the group discussions and semi-structured portions of the household visits is supported by previous investigations of smallholder farming systems within the region (Boulakia et al. 2012; Ricard 2011) and similar approaches used to document the gendered dimensions of CA implementation (Harman Parks et al. 2014; Nyanga et al. 2012).

Several studies of CA focus on empirically identifying factors that affect CA implementation, but few look to integrate qualitative and quantitative data into the

analysis (Lestrelin et al. 2012; Nyanga et al. 2012; Harman Parks et al. 2014). Commonly, a mixed-methods approach concurrent (parallel) design is used to integrate qualitative and quantitative data sets for the purpose of triangulation and to identify where qualitative and quantitative datasets overlap or complement each other. Within this conceptualization of mixed-methods, qualitative data is often used to validate quantitative results (Hesse-Biber, 2011; Creswell et al., 2003). Within such an orientation, it is difficult to view both types of methods in a mutual supporting dialogue without privileging one set of techniques over the other. In this research we used triangulation to compare and contrast our quantitative and qualitative results to identify patterns related to the gendered components of CA and document causal mechanisms linked to those patterns. We also recognize that potential dissonance between results from the household survey and semi-structured interviews could assist us conceptualizing the full complexity of gendered relations, roles, and responsibilities in the context of CA.

3.6 Results

This research found that CA implementation affects men's and women' allocation of labor differently and that gendered access to land, machinery, credit, and information may impact the dissemination of CA within the region. We identified that there are gendered differences in the allocation of labor in agricultural and domestic livelihood activities, with socio-cultural norms and beliefs defining men's and women's different roles and responsibilities in managing the farm and the household. Men and women have different access to and control over

land, agricultural machinery, and credit. These and other factors can limit men's and women's access to resources integral to CA implementation. Study participants showed interest in new agricultural technologies and management practices and noted the importance of communication within the community and beyond for acquiring such information, but farmer attitudes and limited options restrict access to formal agricultural support services and training opportunities. Gender differences further impact men's and women's access to formal and informal sources of information concerning CA.

3.6.1 Gendered livelihood roles and responsibilities

Our results from the FGDs, household visits, and our own field observations confirmed that there is a gendered division of labor. Men and women participants in the FGDs and household visits indicated that men and women both participate in agricultural activities with men primarily responsible[10] for tillage activities (plowing, discing, and furrowing) and herbicide application, because men have greater physical strength to handle the "heavy" agricultural machinery and carry the 16-20 liter backpack sprayer. Perceived greater physical strength was also reported as the reason men are primarily responsible for forest clearance.

Women are also involved in agriculture activities. Women in the FGDs and households visits named several activities in which they participate but do not necessarily control: sowing, fertilizer application, and harvesting. Male famers reported that these activities have a "lighter" workload and are thus better suited

[10] Primary responsibility indicates that an activity is required, fundamental to, or expected of an individual

for women. Many women in the household visits noted that they are primary responsible for manual weeding in rice, annual crop production, and perennial fruit tree production. Despite women's participation in agriculture activities their contribution is often overlooked. One man in the household visits noted: "I am responsible for all of the activities involved in maize production and my wife just helps with the manual weeding…my wife, like other women, just works around the house" (June 12, 2013). More specifically, in the FGDs men participants reported that only men apply herbicide. In contrast, women FGD participants indicated that men and women are both involved in herbicide application, because women and children assist by mixing the herbicide in water.

While women's participation in field agriculture activities is often overlooked, women are recognized for their household domestic activities including washing, cooking, cleaning, and taking care of children. In the FGDs men reported that they assist with the daily activities that support the household. Men's individual responses from the household visits contradicted the answers presented in the FGDs, with the men indicating they are often too busy with their work with the *Chamcar* and/or rice production to assist with domestic activities. Women in the FGDs and household visits indicated that generally men only participate in domestic activities by chopping firewood for cooking or using two-wheeled tractors to transport water for the household. Respondents in the FGDS and household visits indicated that other support activities associated with the household were reported as primarily women's responsibility including managing household vegetable gardens and fruit trees; raising small livestock (chickens, geese, and ducks);

marketing and selling the maize and rice production; and managing household finances. While men are primarily responsible for activities in the field, women's roles in the supposed "domestic sphere" are integral to supporting and managing the farming system.

The division of labor is linked to the decision-making dynamic. Men's and women's responses in the semi-structured portions of the household visits indicated that women have greater control over activities associated with household while men have little control over decisions regarding the daily activities of the household. Men and women participants reported that it is important for both men and women to be involved in farm management decisions. For example, one woman told us: " I talk with my husband about the maize production…when you get married you have to talk with your spouse about all of the aspects of agriculture production and a husband and wife have to agree about every decision" (June 27, 2013).

While participants reported that men and women are both involved in farm management decisions men participants indicated that they had greater control over farm management activities, and women participants responded that they only had some control over farm management decisions. In the household survey, we used two indicators to empirically identify men's and women's participation in decision-making for selected farm management decisions. We first asked respondents, who within or beyond the household was included for the selected activities. Our results support farmer's initial comments that despite the gendered division of labor, men and women need to be involved in household negotiations (Table 2).

Table 2 Men's and women's responses: "Who is involved in farm management decisions?"

	Main male/ husband		Main female /wife		Husband and wife jointly		Someone else in the household		Someone outside the household		Does not engage in activity	
Respondent	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
What types of crops should be grown ?	13%	16%	5%	20%	82%	64%	0%	0%	0%	0%	0%	0%
When should land preparation should occur?	45%	32%	9%	12%	41%	48%	0%	8%	5%	0%	0%	0%
When should manual weeding occur?	18%	4%	23%	36%	50%	48%	0%	4%	0%	0%	9%	8%
When should harvesting occur?	27%	20%	9%	16%	64%	64%	0%	0%	0%	0%	0%	0%
When to sell maize production ?	9%	4%	14%	24%	77%	72%	0%	0%	0%	0%	0%	0%

Percentages (%) rounded to the nearest whole number
Source: Household survey (Women N=25 and Men N=22)

There are some slight and noticeable differences between men's and women's responses regarding their involvement in intra-household decision-making. Approximately equal numbers of men (41%) and women (48%) reported the decisions about land preparation are made jointly between a husband and wife, but slightly more (45%) men and several women (32%) indicated that only the husband or main male in the household is involved in decisions about land preparation. Several men and women famers also reported that the main female/wife in the house made the decisions about manual weeding (Table 2).

To identify potential gender-based differences between men's and women's participation in farm management we used a second indicator, *"To what extent do you participate in decisions".* Men and women may both be involved in farm

management decisions, but our results indicated that there are gender-based differences in participation for a select variety of decisions (Table 3).

Table 3 Men's and women's responses: "To what extent do you participate in farm management decision?"

	Small extent[a]		Medium extent[b]		High extent[c]		No decision made	
Respondents	Men	Women	Men	Women	Men	Women	Men	Women
What types of crops should be grown	13%	24%	32%	40%	55%	36%	0%	0%
When land preparation should occur	14%*	60%*	18%	24%	68%*	16%*	0%	0%
When manual-weeding should occur	27%	16%	23%	36%	41%	40%	9%	8%
When harvesting should occur	22%	20%	23%*	60%*	55%*	20%*	0%	0%
Marketing the maize production	18%	12%	50%	60%	32%	28%	0%	0%

Percentages (%) rounded to the nearest whole number
*Indicates where differences are significant α=.05
[a]Small Extent-Respondent is not asked for their opinion or respondent can give their opinion, but not considered in the final decision.
[b]Medium Extent-Respondent is able to participate in the decision and everyone in the decision has to come to an agreement.
[c]Hight Extent-Respondent can make the decision even if other members of the household disagree
*Indicates where differences are significant α=.05
Source: Household survey

In land preparation, the majority of men (55%) indicated that they could make the decision even if other members of the household disagreed. In contrast, the majority of women (60%) indicated that could not give their opinion or their opinions do not affect the outcome of the decision. Men and women participants noted that this decision-making dynamic is linked to men's greater responsibilities in tillage activities associated with land preparation. A similar pattern is evident in

men's and women's participation in decisions about harvest activities with the majority of men (55%) indicating that they participate to a high extent while the majority of women (60%) participate to a medium extent. These findings seem to confirm our earlier results that men have full control over farm management decisions.

During the semi-structured discussion accompanying the survey men and women respondents indicated that gendered division of labor and participation in decision-making is not independent of each other. Farmers reported how women's roles in responsibilities in the household could impact field management decisions. Likewise, men noted that their responsibilities in field management could impact household management decisions. For example, a wife's marketing strategy and management of the household's finances are linked to decisions about the maize harvest and land preparation. One woman reported: "farmers in Pichangva often try to sow their maize sooner so they can harvest sooner to pay back their credit…in my household I am the one who negotiates with the middleman so I track the changes in the maize price and know when we need sow and harvest the maize so we can get the best price (June 13, 2013).

3.6.2 Access to and control over assets, resources, and capital

Our results from the semi-structured interviews and household surveys indicate that gender and other factors affects smallholder farmers' access to and control over productive resources and assets important to the dissemination of CA including credit, land and agricultural machinery.

Access to credit

Farmers within our sample increasingly rely upon credit to purchase the seed, fertilizers, herbicides, and other inputs used in annual cash crop production. One woman commented on the issue: "the price of seed, fertilizer, and herbicide is getting more expensive every year but the maize yield is not stable and the maize price is not increasing…my family has to take out loans to cover the rising costs (July 3, 2013). Formal and informal sources of credit are available to smallholder farmers, each with their own risks and benefits.

According to farmers there are five main sources of credit available: (1) moneylenders; (2) "middlemen"; (3) savings group sponsored by international NGOs; (4) family members; and micro-finance institutions. Prior to the availability of Micro-finance institutions (MFI), farmers had to rely upon loans from "local" moneylenders in a neighboring village or the provincial capital. The interest rates for this source of credit ranged from 5 to 20% per month. Conversely, MFI's become more widely available after 2005 and offer a cheaper source of credit with interest rates averaging 3% per month for up to 250 USD. For both of these credit sources, farmers have to use their land as the collateral and for many farmers this represents a substantial risk. One farmer commented: "farmers with less land and less capital have to take out more loans to cover their costs, but they often cannot pay back their loans and are have to move to find new land and opportunities" (June 12, 2013).

Farmers indicated that MFIs and local moneylenders are important sources of credit within the community for covering the costs for agriculture inputs. They also highlighted the need for more flexible, affordable, and smaller-scale sources of

credit. Savings group sponsored by international NGOs working in the area offer a more flexible form of credit that can assist farmers with covering daily household expenditures. A woman in the household visits noted the benefit of being a member of a savings group, "For the savings group I only have to contribute 10,000 KHR (2.50 USD) once a year… I can get money when I need it and the interest rate is low (1-3%/month) and you pay back the total with interest at the end of the year" (June 20, 2013). In our sample of smallholder farmers, a majority of women (52%) reported that there were a member of a least one savings group in the community. In comparison only 36% of men reported being a member and an additional 32% indicated they were not aware of any savings groups in the community. While more women indicated that they participate in at least one savings group men and women reported difficulties with acquiring loans from such groups, including an inability to receive a loan when they wanted and a lack of trust in the group's management of the savings.

Farmers identified several different sources of credit that were available and factors that constricts men's and women's access to credit. A more general factor affecting farmers' access to credit is the perception that borrowing money or taking out a loan can be associated with downward financial security and independence. For example, farmers typically take a credit from a local middleman, who purchase farmers' production and then sell to a larger processor, for the maize seed. One of the women from the household visits said: "When you take out a loan from a middleman to purchase the seed you have to sell your production back to that

middleman even if you could have gotten a better price elsewhere…sometimes the price is not enough to fully cover the loan" (July 5, 2013).

Recognizing some of the constraints that farmers face in accessing credit, SANREM Il initiated an internal subsidy and interest-free credit program to assist farmers with the transition from tillage-intensive production systems and invest in their soil capital. This program was available to farmers implementing CA from 2010-2012 and pre-finances the cost of agricultural inputs and services (sowing and spraying) on average amounting to 313 USD/ha. The reimbursement of the credit depends on farmers' yield. For a yield greater than or equal to 4.5 T/ha the entirety of the credit has to be repaid. The amount of 35 USD/ha is deduced for 250 Kg/ha below 4.5 T/ha.

This credit service was reported as an important incentive for farmers starting to experiment with CA by 73% of men and 84% of women. With the interest-free credit and the sowing and herbicide application services offered by SANREM IL, farmers perceive CA as easy alternative to conventional tillage-intensive agriculture with one man in the household visits noting: "with CA there is no need to worry about the seed, fertilizer, or herbicide because the project credit covers all the costs" (July 4, 2013). SANREM IL is no longer offering the interest free credit and in the household visits men and women farmers reported that its discontinuation could affect farmers' decision to implement CA. The lack of the free credit may not be an issue for wealthier farmers who have larger amounts of *Chamcar.* Smallholder farmers with lower amounts of financial capital, the lack of the credit program can be a substantial constraint. One woman said, "…more

farmers would be interested in working with the project (SANREM IL) and experimenting with CA if the project still offered the free credit … I am not sure if farmers will be interested in experimenting with CA if there is no credit incentive" (June 5, 2013).

Farmers reported that men and women both have the ability to obtain loans and access credit from the sources noted above. Nonetheless, gender impacts men's and women's participation in decisions linked to credit, agricultural inputs, and household finances. Men and women participants in the FGDs and the semi-structured interviews reported that women control the affairs of the house, including managing the household's finances. The results from the survey support this finding with the majority of men (68%) and women (80%) indicating that only women are involved in decisions about the household's finances: budgeting household expenses; paying back loans; and allocating the income from crop production. The results of the survey suggest though that while women may be able to participate more in decisions regarding household finances men are able to participate more in decisions regarding the necessary physical inputs for agriculture (Table 4). Men reported that their involvement in the daily management of the farm and labor so they know more about the types of fertilizers and herbicides that are needed. For example one man reported, "I am the one who goes to the upland plots and applies the herbicide so I know which type we should use or if we need to use a different variety" (June 5, 2013).

Table 4 Men's and women's responses: "To what extent do you participate in the decisions about agriculture inputs and household finances?"

	Small extent[1]		Medium extent[2]		High extent[3]	
Respondent	Men	Women	Men	Women	Men	Women
Choosing the type of seed	14%	24%	27%	52%	59%*	24%*
Choosing the type of fertilizer	14%	32%	32%	36%	55%	22%
Choosing the type of herbicide	9%	48%	23%	36%	68%*	16%*
Household finances	77%*	4%*	14%	8%	9%*	88%*

Percentages (%) rounded to the nearest whole number
*Indicate where differences are significant α=.05. *Source*: Authors fieldwork
[1]Small Extent-Respondent is not asked for their opinion or respondent can give their opinion, but not considered in the final decision.
[2]Medium Extent-Respondent is able to participate in the decision and everyone in the decision has to come to an agreement.
[3]Hight Extent-Respondent can make the decision even if other members of the household disagree
Source: Household survey (Women N=25 and Men N=22)

Women respondents indicated that they had less participation in choosing the specific type of chemical inputs than men. Conversely, the majority of women indicated that they participated more in decisions about managing the household's finances (Table 4). As with other decisions about the management of the household and the farm, farmers indicated that men's and women's responsibilities and participation in decision-making is not independent.

In the semi-structured interviews, farmers noted how women's decisions about household finances (in)directly affects the decisions about the choice of farm inputs. One woman reported: "one time my husband asked me if he could purchase ten bags of fertilizer and I said no because our family did not have the money so we needed

to purchase eight bags instead" (June 11, 2013). Several men also noted the (in)direct relationship and reported that they may decide what type of fertilizer or herbicide needs to be used, but they need their spouse's permission to make the purchase. In several interviews men also reported that their wives were also aware of the different types of fertilizers and herbicides that were available in the local markets. This decision-making dynamic relates directly to household decisions about loans. Men may know about what inputs are needed in *Chamcar or* rice cultivation and when to take out a loan, but women respondents noted that they track how much money needs to be paid pack and ensure that the debt is cleared.

Land

Within Pichangva and the surrounding communities, upland land reserves with high drainage capacity known as *Chamcar* are valued and intensively cultivated because of their potential for annual cash crop production, primarily maize with some cassava. Ricard (2010) estimates that of the 145 ha of arable land in Pichangva 75% (110 ha) is considered *Chamcar* while the remaining 25% (36 ha) is suited for lowland rice cultivation; the latter is mostly left uncultivated because the profitability of rice production is substantially lower than that of upland annual crop production. Within our sample, several households were cultivating smaller plots of rice for domestic consumption (Table 5).

Table 5 Household responses: Reported plot size for *Chamcar* and lowland areas

	Minimum	Maximum	Average	Standard Deviation
Total Agricultural Land	2 ha	24 ha	8.5 ha	7 ha
Chamcar	1 ha	13.5 ha	5 ha	3 ha
Lowland	0 ha	12 ha	1.5 ha	4 ha

Source: Household survey (N = 25)

Smallholder farmer's access to land in Pichangva is linked to historical and current complications surrounding land at the national level. Access to land and land ownership is an ongoing issue in Cambodia. The conflict is rooted in the collectivization policies during the Democratic Kampuchea period 1975-1979, the reintroduction of private land ownership in 1998, and the promulgation of the 2001 Land Law to increase tenure security and systematically structure land registration. An increasing rise in Economic Land Concessions (ELCs), granted to international corporations, designed to increase the development of industrial-agriculture has generated further conflict surrounding tenure security. In Pichangva, farmers reported several different ways to obtain access to land: 1) redistribution from former Khmer Rouge generals as part the reintegration of the Khmer Rouge beginning in 1996; 2) purchase from former Khmer Rouge soldiers; 3) inheritance from either the husband's or wife's parents; 4) purchase near the beginning of the 21st century; 5) renting land; and 6) "managing" land[11]. In our sample, smallholder farmers have employed several of the above mechanisms to acquire land; however,

[11] An informal land arrangement where a farmer agrees to clear the forest and then cultivate the *Chamcar* plots for an absentee landowner, normally a family member or a wealthier landowner from Battambang City. In this situation, farmers do not have to pay any rent but they also do not have any secure claim over the land.

land ownership remains complicated as smallholder farmers may have an official land certificate or only have Letters of Possessory Right or 'soft titles'[12].

Land tenure security may affect farmer's decision to invest in the long-term soil benefits of CA implementation. In a previous study of CA implementation in Pichangva and Boribo, Ricard (2010) noted that all participants, except those renting or "managing" reported secure land ownership, but the researchers did not ask farmers to produce formal or informal ownership documents. We utilized self-reported ownership[13], with all but two households reporting ownership; however, in 2012 the Royal Government of Cambodia (RGC) issued *Order 01*, entailing an accelerated land titling program with the assistance of 'youth volunteers' to measure and recognize a maximum of 5 ha per family if 'active use' of the land can be demonstrated[14]. The youth volunteer groups had already measured plots within Pichangva and the surrounding area with nine households in our sample reporting that they had recently acquired a formal land title for a portion of their land, but four households reported that they had not yet acquired a title through the program.

While tenure security is a complex issue in Pichangva and the surrounding area, local attitudes and national policy seem to promote gender equitable land access and ownership. The majority of men (82%) and women (68%) respondents reported that land was considered a jointly owned asset between a husband and

[12] Letters of possessory right or other 'soft titles' are often issued by village, commune, or district chief that recognize possession of the land but are not formally registered with the Land Office.
[13] Self-reported ownership (Doss et al. 2011) was initially used instead of reference to land titles or Letters of possessory right so as not to compromise respondents' participation in the household visits
[14] Unofficial translation of the Ministry of Land Management, Urban Planning and Construction's Manual for implementing *Order 01.*

wife, with both names listed on the letter of possessory right or land title. Joint ownership is legally mandated under the 2001 land law, which defines it so that ownership rights are shared equally between a husband and wife and land is confirmed as marital property (Mehrvar et al. 2008). Under the 2001, joint ownership is designed specifically to assist in securing women's land tenure and control over land. Farmer's perceive that local officials require couples to jointly register their land. One woman reported: "When you have a land title like we do for our rice plot and you are married the title has to be registered in the wife's and the husband's name…my husband and I both had to travel to the primary school and apply our fingerprints to the title (July 10, 2013). While it was reported that it was common practice for agricultural land to be jointly titled with men and women, several respondents that are currently implementing CA indicated that only one person owns the land in Pichangva (Table 6).

Table 6 Men's and women's responses by sampling group: "*Who owns the agricultural land in Pichangva?"*

	Main male/husband		Main female/wife		Self & partner/spouse jointly		Someone else inside the household		Someone (or group of people outside the household)	
Respondent	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
Implementing CA	17%	13%	8%	7%	75%	80%	0%	0%	0%	0%
No longer implementing CA	0%	0%	0%	14%	100%	86%	0%	0%	0%	0%
Interested in CA implementation	0%	0%	0%	0%	33%	50%	0%	0%	67%	50%

Percentages (%) rounded to the nearest whole number
*Indicate where differences are significant α=.05.
Source: Authors fieldwork (Women N=25 and Men N=22)

While both the husband and wife within a household may be officially listed as joint owners, how the land was acquired may affect whether men and women have equal access to and control over the land. For example, one man reported: "My family has 2.5 ha of lowland rice and 3 ha of *Chamcar* that I acquired from the government before I was married, listed in mine and my wife's name, but that land belongs to me…we have another 1 ha of lowland rice and 1ha of *Chamcar,* that was an inheritance from my wife's parents, listed in mine and wife's name, but that land belongs to my wife" (June 21, 2013). As a result, men and women may not have equal control over the land their access may be dependent on someone else in the household. In the semi-structured discussions women participants indicated that even when women inherit land they often do not have full control over that land. A woman farmer told us: "I received some land from my parents as an inheritance…the land is in both mine and my husband's name, but I do not decide how that land is managed" (June 21, 2013).

Our results from the household survey and semi-structured discussions suggest that joint ownership is common in Pichangva; however, our results also indicate that there are gender differences in decision-making regarding agricultural land (Table 7). *Chamcar* land is an important base for rural livelihoods in Pichangva and the surrounding communities. With *Chamcar* and annual cash crop production, farmers feel that they can improve the financial situation of the household. As such, farmers are not concerned about selling or renting agricultural land (Table 7): "when you rent out your *Chamcar* land you can only earn a little income … you do not earn as much money if you were to cultivate the land yourself" (June 13, 2013).

Chamcar land is an important base for rural livelihoods in Pichangva with men and women farmers echoing this sentiment. During the household visits were surprised when we asked who would be involved in decisions about selling agricultural land as land is their most important source of capital. Women participants in the household visits did indicate that in the past it was common for wealthier upland farmers to let less fortunate farmers clear the forest from uncultivated *Chamcar land* and "manage" the cash crop production for a period of time.

Table 7 Men's and women's responses: *"To what extent do you participate in decisions* about agricultural land?"

	Main male /husband		Main female /wife		Husband and wife jointly		Someone else in the household		Someone outside the household		No decision made	
Respondent	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
Purchasing and/or renting agricultural land	9%	4%	9%	20%	41%	48%	5%	4%	9%	0%	27%	24%
Renting out agricultural land	0%	0%	4%	4%	0%	4%	0%	0%	0%	8%	86%	84%
Selling agricultural land	0%	4%	0%	4%	9%	12%	0%	0%	9%	8%	82%	72%

Percentages (%) rounded to the nearest whole number
Source: Household survey (Women N=25 and Men N=22)

While men and women farmers indicated that it is uncommon for farmers to rent out or sell their plots of *Chamcar*, farmers are still actively pursuing opportunities to acquire more land. Most men and women respondents indicated that both the husband and wife within the household are/would be involved in the

negotiations about new land (Table 7). This finding suggests that both men and women have access to the full bundle of rights associated with land ownership. In the semi-structured discussion, some of the men participants jokingly indicated that they could decide by themselves to purchase new land, but it might be bad for their marriage and they could get a divorce. Additionally, in the semi-structured portions of the household visits men and women participants noted the men and women both have to be aware of several factors before new land is purchased: the potential productivity of the land, price of the land, the household's financial situation; and the availability of labor for land clearance.

Agricultural Machinery

Beginning in 2001, farmers started to invest heavily in agricultural machinery, primarily two-wheeled hand tractors. This allowed farmers to increase the area of land that could be cultivated, save money by not having to pay an intermediary for the plowing, and help ensure that the maize seed can be sown at the right time so the maize plants can withstand the monsoon rains in September and October. An additional benefit of hand tractor ownership is that it can be rented out for a fee to assist others with plowing. Within our sample, all participating households indicated that they had regular access to a two-wheeled tractor, with 21 reporting that they owned a two-wheeled tractor, two that normally rent, and one household that borrowed from a family member.

The majority of men (55%) and women (67%) reported that two-wheeled tractors are considered a jointly owned asset. Farmers in the household visits reported that owning a two-wheeled tractor is a symbol of a successful farmer. One

man indicated that with a two-wheeled tractor, "... a farmer feels proud when they have their own two-wheeled tractor because they don't have to depend on other farmers for help so you can sow the corn faster and on time" (June 17, 2013). The use of the hand-tractor is linked to men's land preparation responsibilities in rice and annual cash crop production. As such, two-wheeled tractors are particularly an important status symbol for men. These finding suggest the continued importance of plowing in the agriculture practices of smallholder farmers in Pichangva and the surrounding area.

These beliefs about agricultural machinery and men's and women's responsibilities in land preparation are linked to men's and women's role in decisions about agricultural machinery (Table 8). The decision to purchase a two-wheeled hand tractor represents a substantial investment for a smallholder household, normally costing 2,000 USD. A majority of women participants (64%) and several men participants (41%) indicated that the decision to purchase or rent a two-wheeled tractor should be made jointly between a husband and wife. One woman in the household visits commented on the importance of joint-decision-making, "purchasing a two-wheel tractor is a major expense for the household so it is important that everyone has their input heard and everyone in the household agrees" (June 12, 2013).

Conversely, a majority of men respondents (50%) noted that only men are involved in decisions about purchasing or renting a two-wheeled tractor. Men respondents noted that they are the ones who provide the labor for land

preparation so they know that a two-wheeled tractor could make the plowing go faster and reduce their labor burden.

Table 8 Men's and women's responses: "Who is involved in decisions about purchasing/renting agricultural machinery?"

	Main male /husband		Main female /wife		Husband and wife jointly		Someone else in the household		Someone outside the household		No decision made	
Respondent	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
Two-wheeled tractor	50%*	20%*	4%	0%	41%	64%	0%	0%	0%	4%	5%	12%
Four-wheeled tractor	18%	12%	9%	20%	50%	36%	0%	0%	0%	0%	23%	32%
CA no-till equipment	4%	8%	9%	8%	50%	48%	0%	0%	0%	0%	36%	36%

Percentages (%) rounded to the nearest whole number
*Indicate where differences are significant α=.05. *Source*: Authors fieldwork
Source: Household survey (Women N=25 and N=22)

Women respondents noted that men might directly benefit from the investment in agricultural machinery but women also raise concerns integral to the negotiations. One woman reported, "a household has to think about how much money they have before they make a large purchase like a hand tractor…I am the one who manages the money for the household so I know if we can invest in the benefits of a hand tractor or not" (June 20, 2013). Farmers indicated that there is a similar decision-making dynamic for negotiations about the rental of larger four-wheeled tractors to assist with land preparation.

In Pichangva, conventional tillage-intensive agricultural practices rely upon two-wheeled tractors or four wheeled tractors for multiple plowings per crop cycle. Alternatively, in CA production systems in Rattanakmondol SANREM IL uses

specialized no-till equipment, imported from Brazil, to sow the maize seed directly into the maize or cover crop residue. Farmers indicated that the specialized no-till equipment reduces their production costs associated with land preparation and helps prevent soil erosion; however, participants also indicated several costs and constraints associated with the use of the specialized no-till equipment.

The imported specialized no-till equipment used in CA was reported as too expensive of an investment for individual farmers, with costs ranging from 14,000 USD for a Vence Tudo three or four line no-till planter to 3,500 USD for a Fitarelli 2 row direct seed planter. The cost and availability of spare parts coupled with high service costs also makes the equipment costly for farmer cooperatives or small groups of individual farmers to manage. Additionally, farmers are concerned that within such organizations the equipment may not be managed effectively. Coupled with the high cost of the equipment, the small number of available planters is also a constraint. SANREM IL extension personnel reported that for the 2013 maize growing season from May to January the two Vence Tudo no-till planters would need to sow maize for 165 ha on 80 plots in four villages within a two-week period. During the household visits and FGDs participants emphasized that the time when the maize seed is sown is integral to the success of the crop. One man from the household visits discussed how the lack of planters could be a constraint: "last year (2012) I wanted to start working with the project (SANREM IL), but I could not wait for the planter to come sow the maize seed" (June 6, 2013).

While there are general factors that limit men's and women's access to and control over the specialized no-till equipment the results from the household survey

instrument indicate that there are no gender-based differences in men's and women's participation in decisions about renting the specialized no-till equipment (Table 8). Men and women participants in the household visits commented that it was important for the husband and wife within the household to come to an agreement before starting to experiment CA.

3.6.3 The effect of CA on men's and women's labor allocation

During the discussion about access to agricultural machinery, farmers indicated that the specialized no-till equipment used in CA could reduce the amount of labor men and women have to allocate to land preparation activities. In our sample, the majority of men (77%) and women (80%) noted the labor saving and drudgery reducing benefits associated with CA implementation. One woman indicated: "Implementing CA makes the work easy…when you are implementing CA you just hire the services of the planter and the machine does all of the work, applies the fertilizer, and sows the maize seed" (June 13, 2013

Farmers specifically reported that CA affects men's and women's allocation of labor during tillage activities associated with land preparation. In conventional tillage-intensive agricultural production farmers normally plow the land twice before sowing. For the first plowing, farmers normally hire the services a four-wheeled tractor and perform the second plowing themselves with a hand tractor. Approximately two weeks after the second plowing, the sowing occurs with the hand tractor is used to trace the lines, two other members of the household, usually women, follow on foot behind to apply the fertilizer and seed manually, and then the

hand tractor comes back to harrow. In comparison, in CA there is no need for the multiple plowings as the maize seed is sown directly into the residue.

Men reported that the reduced number of plowings decreased the amount of time they must allocate to land preparation. Women reported that their responsibilities were reduced as the fertilizer and seed is sown at the same time with the no-till planter. One man from the household visits commented on these observed benefits: "when we plowed, my whole family had to help during land preparation, but with CA my wife and children no longer have to sow the maize seed or apply the fertilizer" (June 19, 2013). Both men and women noted that during the sowing on their CA plots their only responsibility is to ensure that the machinery sows the seed properly.

Men and women farmers agreed that the introduction of specialized no-till equipment could reduce men's and women's allocation labor in land preparation. The "extra" time can then be reallocated to other agriculture and household activities. It is important to note that in addition to their CA plots, which comprise only portion of most farmers' land holdings, most of the households within our sample still manage most of their land with conventional tillage-intensive production: "Even when we were implementing DMC my family and I still had to cover all of the work on our the plots we still plowed, because we were only implementing CA on three ha" (June 20, 2013). Most farmers in the household interviews reported that they maintained their conventional tillage-intensive practices so they could compare the conventional methods with CA.

Participants in the semi-structured interviews emphasized the labor saving benefits of CA. This finding led us to ask what activities do men and women allocate their "extra" time from land preparation (Table 9).

Table 9 Men's and women's responses: "How do/did you allocate your "extra" time from CA?"

	Agriculture production	Wage and salary employment	Domestic Activities	Non-farm activities	Land reclamation
Men	72%	5%	14%	8%	23%*
Women	68%	20%	25%	9%	0%*

Percentages (%) rounded to the nearest whole number
*Indicate where differences are significant α=.05. *Source*: Authors fieldwork
Source: Household survey (Women N=25 and Men N=22)

The majority of men (72%) and women (68%) indicated that with CA they are able to allocate more of their labor to additional agricultural activities, including rice cultivation, annual cash crop production, and vegetable garden management. Several men also indicated that they also reinvest their "extra time" for forest clearance to remove remerging vegetation or clear previously unclaimed portions of land. In addition to having more time for agricultural activities, several women respondents indicated that with CA they could spend more time doing domestic activities around the house.

In the semi-structured portions of the household respondents indicated that socio-cultural norms and beliefs affect how men and women reallocate their "extra" time from CA. Farmers cited traditional divisions of labor emphasizing the complementary nature between men's roles as farmers and earning the income and women's roles in domestic activities and small-scale business activities. One woman

indicated: “with the maize production I assist with the manual weeding and maize harvest, but I am also the one responsible for looking after the house: cooking; cleaning; and watching my grandchildren, because someone has to be around the house while my grown children are working” (June 20, 2013). While men’s and women’s roles are viewed as complementary there is little exchange between men’s and women’s responsibilities on the farm or within the household with the fixity of gender roles regarding household domestic activities.

3.6.4 Access to information linked to gendered space

In addition to productive resources and capital like land, machinery, and credit, access to information and support services is integral to agricultural livelihoods in Pichangva. Within some countries in the developing world government agricultural extension services are a principal source of information, technologies, and training opportunities; however, in Cambodia the extension services are underdeveloped with only 1% of farmers nationally reported having contact with an extension agent (MoWA 2088). Currently government extension services are limited within Pichangva and the surrounding area. International NGOs provide agricultural trainings to support farmer associations and savings groups. In the household interviews and FGDs, participants indicated that upland farmers within the community are very interested in learning about new agricultural technologies and ways to increase crop production. Several farmers view agricultural trainings and farmer associations as means to acquire information to increase household income.

Extension services are limited within the area, but formal farmer associations and organizations are also underdeveloped. Several NGOs and internationally funded development programs like SANREM IL support smallholder farmers with services and training opportunities. The household interviews and FGDS indicate that men and women have different access to agricultural producer group meetings and field training opportunities (Table 10).

Table 10 Men's and women's membership in farmer associations/cooperatives

	Yes		No		No knowledge of group	
Respondent	Men	Women	Men	Women	Men	Women
Farmer association and/or cooperative	45%	36%	55%	64%	-	-
CA farmer association	59%	56%	41%	44%	-	-

Percentages (%) rounded to the nearest whole number
Source: Household survey (Women N=25 and Men N=22)

In our sample, the majority of men (55%) and women (64%) indicated that they are not a member of a farmer association/cooperative and unable to participate in agricultural training workshops and/or seminars. Distance is a constraint that limits both men and women. When trainings are offered they are announced via cellphone only to farmers who are currently members. Those who are not already a member or live far from the meeting locations are often not invited. For trainings held in neighboring communities, farmers are less likely to attend because of the difficulty to travel on the poor quality roads.

Our survey results indicate that men and women do not have the same access to agricultural training opportunities; however, it is common practice for both

husbands and wives to be listed as members and encouraged to attend meetings and workshops. In contrast, men and women appear to have equal access to seminars and meetings hosted by the CA farmer association (Table 10). The survey results suggest that men have more access to agricultural trainings but in the semi-structured interviews men and women respondents indicated that it is women who normally attend meetings and seminar trainings. Men indicated that they are too busy working with activities in the field to attend, but their wives have more "extra" time to attend meetings because they are primarily working around the house with domestic activities. One male farmer told us: "I am too busy with the work on my own land with the plowing and herbicide application to spend time to participate in group meetings…my wife is not really involved in the daily management of the farm so she is always around the house and has more time to attend meetings" (June 17, 2013). As such, women are often expected to attend meetings and seminars due to the perception that they have more "extra" time. This perception reinforces our finding that women's multiple roles and responsibilities go unrecognized.

While there is a perception that women have more "extra" time to participate in meetings or seminar trainings, field demonstrations and/or field trainings are perceived as men's domain. Field trainings, including CA field trips and demonstrations, often focus on technical information regarding land preparation and agro-chemical application, which are men's responsibilities. As such, women are not encouraged to attend. Coupled with socio-cultural beliefs, distance also limits women's ability to participate in SANREM IL's CA field demonstrations. The demonstration plots are located in a neighboring village approximately 13 km from

Pichangva. Women's household management responsibilities often prevent them from attending these trainings far from their house. One woman told us: "women are not able to attend the project's (SANREM IL) field trips to the demonstration plots because men cannot take care of the children while their wife is gone… I do not trust my husband to look after the house when I am gone" (July 5, 2013).

Field trainings, visits to demonstration plots, and CA farm association meetings are important sources of information about CA for smallholder farmers in Pichangva. Men and women also reported that their most important source of information about CA was the SANREM IL's extension personnel with their "coaching" on the no-till equipment and CA management practices. When the no-till planter is sowing the maize seed on a farmer's plot a member of the SANREM IL extension personnel is on hand to monitor the equipment and farmers are able to have one-on-one interaction and discuss information regarding CA management practices and techniques. In these situations men and women are both able to access information about CA when the planter is sowing on their plot. Neighbors, predominantly men, may also come to observe the no-till planter and enquire about the technical aspects of the planter and CA.

Everyday interactions with neighbors and family members are also important sources of information about new management practices or agricultural technologies, "… as the land changes, farmers have to be able to change their practices, agrochemicals, and seed varieties … talking with other farmers helps a farmer find out what practices and techniques are working so they can get better

production" (June 25, 2013). Gendered beliefs and attitudes structure the everyday spaces where men and women access and exchange information about CA.

Researchers and development practitioners have characterized CA as knowledge-intensive (Wall 2007). Field demonstrations, meetings, and contact with CA extension staff are not the only source of information about CA within Pichangva. Most farmers indicated daily interactions with friends, family members, and neighbors as other sources of information about CA. In the FGDs, men and women participants indicated that it was important for a farmer to talk with and observe other farmers that are getting a good maize production. One woman emphasized that it is not enough for farmers to hear about the benefits of CA, farmers have to be able to observe how CA can help the crop grow well. One woman indicated, "…people in the village now know about CA because of the project (SANREM IL) activities, because of those activities my neighbors are talking about CA and thinking about how it could benefit their household…It is important for other farmers to see someone else experimenting with CA" (June 14, 2013).

The results from the participatory mapping exercises indicate that gender affects the everyday spaces where men and women smallholder farmers access information about CA. Men discuss CA when they are working on their plot or visiting a neighbor's plot while women discuss CA in a greater variety of spaces, including house-lot gardens, pagodas, and markets (Fig. 2,3). In the example of a men's participatory map the respondent drew his house and his neighbors houses and upland plots where he talks with other farmers about CA including, how CA can save farmers time, the interest-free credit can assist with purchasing inputs. He

talks with men about CA because it is men who come to observe the no-till planter on his plot: "men visit my CA plot because they want to see the no-till planter and learn about how the planter sows the maize seed and can help improve the soil" (June 5, 2013). Other men reiterated the belief that upland fields are men's space because they have complete access to and control over those spaces linked to their activities and knowledge of upland cash crop production. One farmer reported: "I talk mostly with men about CA and the maize production because men control the agricultural production on the *Chamcar* land…men have the information about agricultural production, what practices should be used and what supplies are needed…in agricultural production women just agree with their husbands" (June 7, 2013).

The participatory mapping further indicated that fields are perceived as male-dominated spaces. Few women indicated that they talked with others about CA or agricultural production on their or a neighbors' field. One woman did indicate that she talks about CA with other women when they are taking a break from harvesting maize to eat lunch: "when we stop the conversation usually turns to how can you (farmers) get a good maize yield, what techniques should a farmer use to get a good production, including CA" (June 27, 2013). The majority of women reported that they talk with others about CA within their own home or when they visit a neighbor. The example of a woman's participatory map indicates this pattern (Fig. 3). Unlike most of the men's maps, she indicated additional spaces where she shares information: the market where she purchase food, clothes, and fertilizer; the pharmacy where she purchases medicine and attends trainings about malaria

prevention; and a town in the neighboring province of Pailin where she attends agricultural trainings about perennial fruit tree production.

3.7 Discussion of Results

The principal goal of this research was to investigate the constraints and opportunities to the dissemination of CA. In this paper, we identified that men's and women's livelihoods are strongly dependent upon upland annual cash crop production and comprised of certain assets and spaces that are linked to gendered roles, responsibilities and practices, and beliefs and attitudes regarding men's and women's capabilities in managing the household and the farm. We have adapted the livelihoods framework (Conway and Chambers 1991; Ellis 2000; Radel 2012; Harman Parks et al. 2014) to identify the gendered components of farmer's livelihoods in relation to CA (Fig 4).

In Pichangva, beliefs and perceptions regarding men's and women's capabilities and access to assets, resources, and information shape men's and women's various livelihood activities. Women do not have the same access to and control over land as men, and there is a gendered perception that women should be more involved in non-farm labor and household management responsibilities. Men have greater control over agricultural land and the physical assets and human capital associated with farm management. Development organization's CA programs and interventions need to account for the linkages between assets, capabilities, livelihood practices, and gender. The authors found that the introduction of specialized no-till equipment and CA management practices can

have profound implications for men's and women's livelihood practices, labor burden, and patterns of household labor allocation.

The livelihoods approaches has emphasized the importance of people's assets, including natural, human, social, and physical assets and capitals (Valdivia and Giles 2001). The gendered division of labor and socio-cultural norms affect men and women smallholder farmers' to key productive resources in Pichangva, but additional factors also affect these.

3.7.1 Constraints

We identified several general and gender-based constraints that could impede the dissemination of CA to smallholder farming households including access to land, the gendered division of labor, participation in agricultural training, access to agricultural machinery, and the availability of credit.

In Pichangva, land is the basis for livelihoods and the main source of income for farmers in the community. Land tenure security is recognized as an important factor needed to implement sustainable land management (Jones 2002), and could be a constraint for both men and women experimenting with CA. According to studies within the literature, capital-constrained farmers, especially those with unsecure access to land, may be less likely to begin implementing CA management practices (Knowler and Bradshaw 2007; Giller et al. 2009; Beuchelt and Badstue 2013). Farmers noted the complexities surrounding land tenure security in the region and farmers appeared to trust the official recognition by the village chief of farmer's letters of possessory right. Doubts surrounding tenure security could increase farmers' reluctance to experiment with CA as they could loose their access

to their long-term investment in their soil capital with the land being reallocated to other farmers or an international agri-business company.

Short-term land management arrangements, including renting or "managing" could be a constraint as the short-term benefits of CA are minimal and farmers could be limited in their control over land management decisions, including the decision to utilize CA. Farmers who are renting or managing a plot could be less interested in applying CA management practices because they may be more interested in short-term profits than increasing the soil production potential. Beuchelt and Badstue (2013) note that farmers might experiment with CA and other new agricultural technologies on rented plots and if they see the benefits they will implement CA on their own land.

Farmers noted that men's and women's land rights are recognized with both husbands and wives listed on formal and informal ownership documents. Joint ownership can ensure that women have access to and control over the land. Women's access to land is especially critical in situations of divorce, separation, or abandonment. There is a lack of clarity on how local authorities should handle land registration for divorced, abandoned, or separated women and likewise these women are unaware of the rights, policies that are available to them. Mehrvar et al. (2008) indicate that because of these issues land is often registered jointly. One woman female commented on her own experiences with these challenges: "My husband left me two years ago…when I went to register my land the officials said that the land had to be registered jointly…I am worried that I won't be able to control the land if my husband ever returns" (June 20, 2013). Despite apparent

gains in tenure security and the dissemination of CA, land security remains an issue that still needs to be addressed to promote the dissemination of CA in Pichangva, within the rest of Rattanakmondol, and nationally across Cambodia.

Gender is a defining factor in who does what within the household and on the farm, and understanding the gender division of labor is important to understand the effect of CA on rural livelihoods (Beuchelt and Badstue 2013). The introduction of specialized no-till equipment can affect men's and women's allocation of labor and increase labor drudgery, but with agricultural technologies and management practices characterized as "labor saving," "…it is important to determine whose labor is saved and at what point during the agricultural season" (Doss 2001, P. 2080). Women's and men's labor burden can increase with new technologies and management practices if additional tasks are added to men's or women's responsibilities or when current livelihood practices become more time-consuming or burdensome.

Our findings show that the dissemination of CA in Pichangva affects men and women's pattern of labor allocation differently. The principle of minimum tillage with specialized no-till equipment reduces men's and women's labor burden during land preparation and allows them to reallocate their labor to different activities. In Pichangva, there is little crossover between men's and women's labor roles and responsibilities, as noted elsewhere within the literature (Brickell 2011). Conservation agriculture may reduce men's and women's labor burden in land preparation, but a focus on farm management activities could obscure women's multiple roles and responsibilities. In many rural areas, including Pichangva,

women often have a triple workload, and are responsible for reproductive, productive and community management activities (Momsen 2010; Moser 1993). These multiple responsibilities in domestic activities, subsistence production, livestock raising, small business ventures, and community management, are often overlooked by development interventions, including CA programs. It is not possible to predict specifically who will benefit or lose from the introduction of CA or other technological innovations; however, development programs need to recognize that the effect of CA on smallholder farmer's labor allocation is gendered.

Studies show that during the initial years of CA implementation, weed pressure may significantly increase (Knowler and Bradshaw). In CA systems where weed management is based on manual weeding, men's and women's labor burden can increase to unsustainable levels (Giller et al 2009; Nyanga et al. 2012). Conversely, when herbicides are available, drudgery associated with manual weeding can be reduced. These findings from the literature suggest that CA can have a gendered impact due to men's and women's different responsibilities in weed management. In Pichangva, perennial weeds are an increasing issue with a growing reliance on herbicide for weed management. The application of herbicide and the characteristics of the cover crop can compensate for the increased weed pressure and reduce women's labor burden related to manual weeding. With variable herbicide application and limited cover crop development women's multiple responsibilities could limit the amount of time they are able to allocate additional labor for manual weeding.

Access to relevant information and training has an impact on the outcome of development program interventions. In Pichangva, men and women are both invited to participate in agricultural workshops and seminars; however, the attendees for field demonstrations and trainings are overwhelmingly men. As seen in other contexts in the developing world, social/cultural norms and women's multiple responsibilities constrain women's ability to participate in group meetings, attend field trainings, and access information (Meinzen-Dick and Zwareveen 1998: Quisumbing and Pandolfelli 2010; Fletschner and Mesbah 2011). For farmers in Pichangva, everyday interactions are an important source of information about CA. These relations are typically segregated by gender and thus can exacerbate existing gender gaps in access to information. If women are not able to directly access the available CA training events, they are less likely to be able to contribute to the decision about experimenting with CA.

Limited access to credit is a general constraint that affects men's and women's ability to implement CA. Farmers identified that there are limited income-generating opportunities beyond agriculture within the region and are concerned about the rising cost of chemical inputs needed in conventional tillage-intensive agriculture and CA. Collateral requirements coupled with social norms and perceptions limit farmers access to credit. Women could be disproportionally affected by these constraints due to their responsibilities managing the household's finances and ensuring that loans are repaid. Examples from the literature highlight that without access to credit and other financial capital CA and other sustainable natural resource management practices are unlikely to be accepted (Jones 2002;

Knowler and Bradshaw 2007: Erenstein et al. 2012). Smallholder farmers in Pichangva facing declining crop yields, increasing soil erosion, and the rising costs of chemical inputs farmers are hesitant to risk their land as collateral to cover the cost of inputs needed in CA due to uncertainty surrounding it's results.

Throughout this research farmers indicated the importance of tillage in agricultural production, particularly for weed management. One woman reported: "Plowing clears the land and makes it clean, killing the roots of the weeds" (June 24, 2013). A specific gender-based constraint related to land preparation is the link between land preparation and tillage activities and men's farm management responsibilities and social status: men could perceive a reduction in tillage practices as a threat to their farm management responsibilities, masculine identity, and sense of worth. While we identified that minimal tillage practices with specialized no-till equipment can reduce men's labor burden, the widespread investment in hand tractors and mechanized tillage equipment highlights the continued importance of tillage that can be a gender-based constraint the dissemination of CA.

3.7.2 Opportunities

Examples from the CA literature indicate that farmers' sensitization to land degradation and declines in soil productivity is one of the primary factors motivating farmers to experiment with CA (Knowler and Bradshaw 2007; Lestrelin et al. 2012). Farmers in Pichangva see the declining crop yields and increasing soil erosion and feel the need to identify new technologies and management practices to counteract soil degradation. One man in the FGDs noted: "Farmers must find new ways to grow maize: new seed varieties, new management practices, new fertilizers,

and new herbicides" (January 12, 2013. Men and women emphasized the importance of husbands and wives gathering as much information about new technologies and management practices as possible. By understanding how gender impacts smallholder farmers' access to information we can better understand farmers' perceptions of CA and what information needs to made available to men and women.

Within the literature, it has been demonstrated that negotiations and dynamics within the household can affect the dissemination of agricultural technologies and management practices, including CA (Udry 1996; Doss 2001; Doss 2013). The gendered decision-making dynamic found in this research is rooted in socio-cultural norms and the beliefs that men primarily control the farm and women primarily control the house. This dynamic has been identified in other contexts in Cambodia (UNIFEM 2004; Brickell 2011). In this research we identified that men's and women's roles, responsibilities, and decision-making are not completely independent with household decisions (in)directly impacting farm decisions and vice versa.

The complexity inherent in intra-household negotiations and men's and women's control over assets, spaces, and activities makes it difficult to conceptualize how these factors will affect farmers' decision to implement CA (Doss 2013). In this research we did identify gendered differences in decision-making. While men's and women's decision-making is perceived as independent, their decisions are interrelated in multiple ways. The decision to begin experimenting with CA could be perceived as solely a farm management decisions and thus fall

under the purview of men's domain. This research supports the finding that decisions on the farm and within the household are linked: farmers in Pichangva are aware of these relations and that decisions should benefit both. One woman from the household visit reported: "Everyone in the household needs to be involved in the decision to experiment with CA and consider the condition of the soil in their fields and the state of the household's finances" (July 9, 2013). Results from this study indicate women's roles, responsibilities, and concerns are integrated into the household decision-making dynamic. As such, women's concerns and interests need to be targeted and integrated into CA projects

In this research, we identified how gender intersects with other factors to constrain smallholder farmers secure access to land and their investment in the long-term benefits of CA. We found that the majority of households consider land to be a jointly-owned asset with men and women involved in investment and production decisions about land usage and management. Even when land is reported as a jointly-owned asset women are often not listed on formal and informal ownership documents and do not have full control over the land (Bomuhangi, Doss, and Meinzen-Dick 2011). That study states, "…ownership is not associated with full rights to do anything one wants to with the land" (p.15). In Pichangva it appears that men and women have an active role in decisions about land management and decision-making.

3.7.3 Strengths and limitations of approach

The methodological and analytical approach applied in this study has strengths and limitations. The mixed-method approach allowed us to collect

detailed qualitative information about the gendered dimensions of CA in Rattanakmondol including the gendered impact of CA implementation on household labor allocation; men's and women's ability to access key assets (land, machinery, and credit); participation in decisions about agricultural production and key assets; and how men and women acquire information about CA. We also acquired quantitative data about access to assets and participation in intra-household decision-making. This integration of multiple data sets acquired through several different qualitative and quantitative methods allowed us to generate a more complete understanding of the complex gendered dimensions of CA. However, there were still gaps within the research methods that limited the research.

Limitations of this approach include, linguistic and cultural barriers. The local research team was invaluable during this research program, but there was still cultural distance between the research team and the smallholder farmer participants. The authors did not speak Khmer and were not able to conduct interviews without the assistance of the local research team. Even with the assistance of the team there is still the potential for lost meaning due to difficulties in translating between Khmer and English. To address this issue we had several native speakers review the written translation of the research materials. Additionally, we also we had all of the survey response options translated and printed in large font to help the research team maintain a consistent in translation. This research utilized participatory techniques but farmer's participation was limited in that they were not engaged in designing the research agenda, which can

potentially affect the relevance of the research to participants and unwittingly omit topics important to them.

3.8 Conclusions

Conservation agriculture programs need to consider how program activities and policies could impact gendered livelihoods that connect men's and women's assets, practices and beliefs, and in turn could impact the dissemination of CA. This paper hypothesized that gender-based differences in access to assets, practices, and capabilities are relevant to CA. Using the livelihoods approach combined with a gender analysis we found that socio-cultural norms and beliefs structure men's and women's roles and responsibilities in farm management. Men's responsibilities focus on field activities, while women have multiple roles and responsibilities on the farm and in the household. Men and women also have different access to training and agricultural support services. In Pichangva, SANREM IL aims to improve smallholder farmers' livelihoods, improve soil quality, increase agricultural productivity, and increase gender equity. Our discussions with stakeholders and findings revealed gender-based constraints and opportunities to the expansion of CA in Pichangva and the surrounding area.

The factors that influence farmers' decision to experiment with CA are complex and context-specific (Knowler and Bradshaw 2007; Lestrelin 2012); however, it is necessary for CA development programs to challenge the assumption that experimenting with CA is solely a farm management decision. Programs need to identify who within the household makes what kinds of decisions and, if decisions are made jointly, ensure that men and women are both consulted during the

discussion about CA. Likewise, if only men are making decisions about agricultural production it is essential that women's interests and concerns are also addressed, or the introduction of CA could inadvertently affect women's interests. Women's roles and responsibilities in managing the household and finances are critical in negotiations between husbands or wives weighing the costs and benefits of CA. Additionally, it is not sufficient to simply ask who within the household is responsible for decisions about the house and the field. Multiple indicators including qualitative information are needed to document the gendered power relations that impact men's and women's influence in intra-household negotiations.

Farmers in Pichangva reported a number of pathways that can be used to access information about CA: CA farmer association meetings, SANREM IL field demonstrations; contact with SANREM IL extension personnel; and discussion with neighbors. Building on these multiple pathways CA projects need address general and gender-based constraints that affect participation. They could also incorporate additional content beyond the technical components of CA so the information is of interest to different members of the household. While participants in this study indicated that they felt confident about their land tenure security, land reform and the land titling process in Cambodia are still complicated, divisive, and politicized (Baird 2013. Milne 2013). National programs promoting farmer's access to land with the issuance of private land titles could promote the dissemination of CA and assist smallholder farmers with sustainable intensification and improve their livelihoods.

3.9 Acknowledgements

This research was made possible by the generous support of the American people through the U.S. Agency for International Development (USAID) and Feed the Future Sustainable Agriculture and Natural Resource Management Innovation Lab for Collaborative Research (SANREM IL) under the cooperative agreement number EPP-A-00-0400013-00 at the Office of International Research, Education and Development at Virginia Tech. The authors would like to acknowledge the support of all the researchers and staff of the SANREM IL project in Cambodia, especially Dr. Manuel Reyes, North Carolina Agricultural and Technical State University and Dr. Stephane Boulakia, Agricultural Research Centre for International Development (CIRAD). The authors would also like to thank the two undergraduate students from the University of Battambang, Ms. Sel Rechaney and Mr. Mao Rambo, who assisted in facilitating data collection activities.

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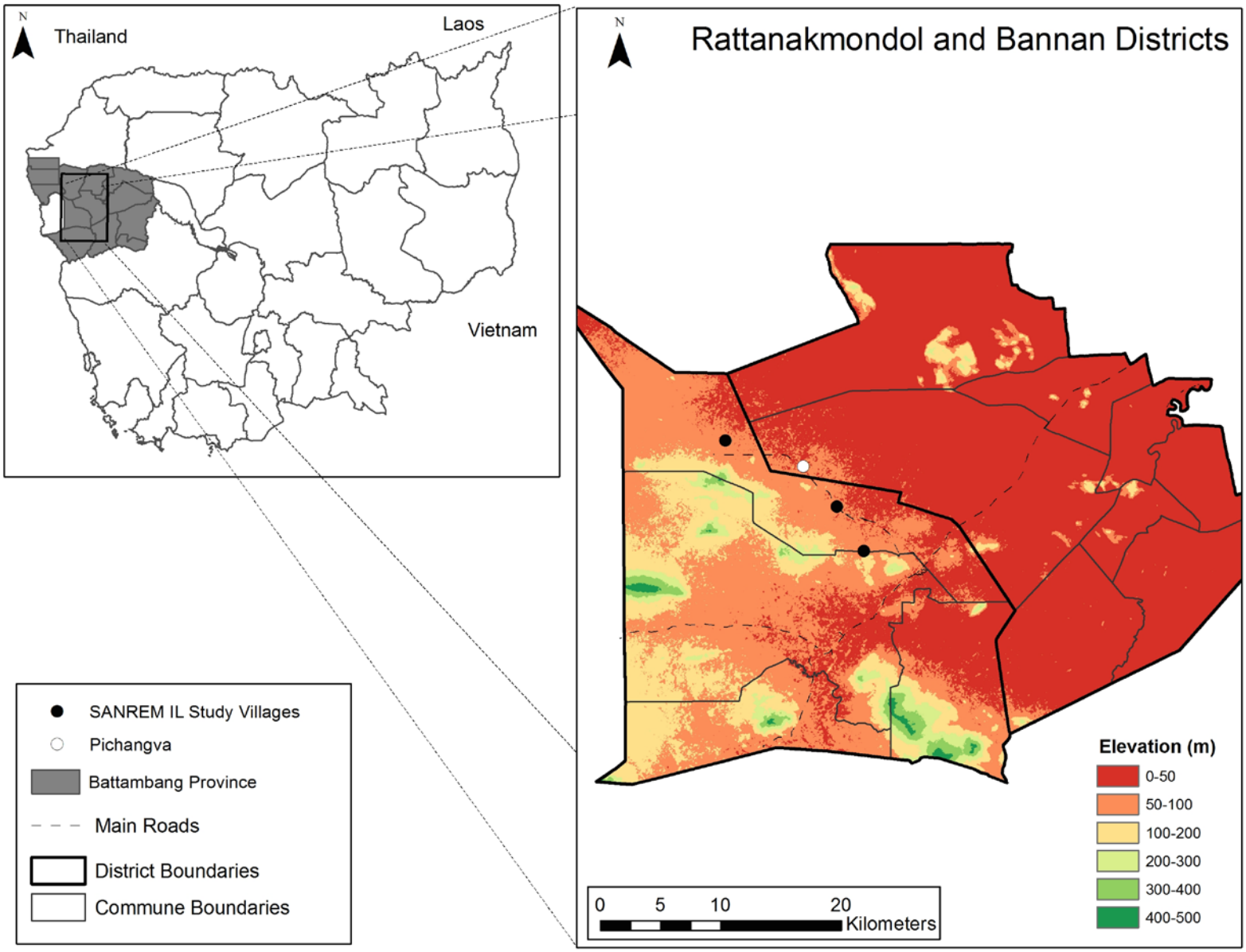

Fig. 1 Map of the study area
Map displaying the study area community, Pichangva and the other three villages, Sengha, Boribo, and Aukmum, that SNREM is currently operating, located in Rattanakmondol District, Battambang Province, Cambodia
Map prepared by authors

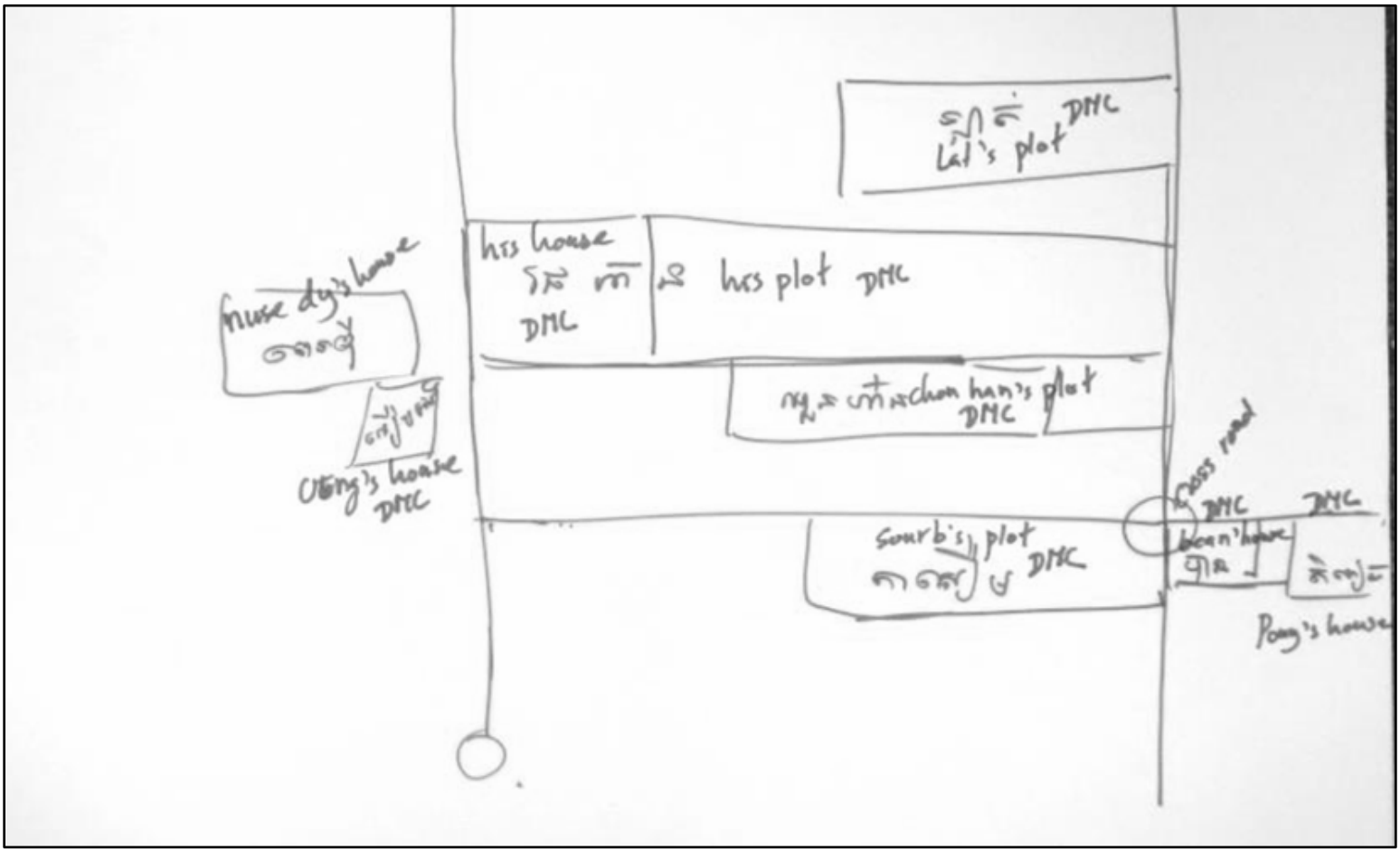

Fig. 2 Man's participatory map

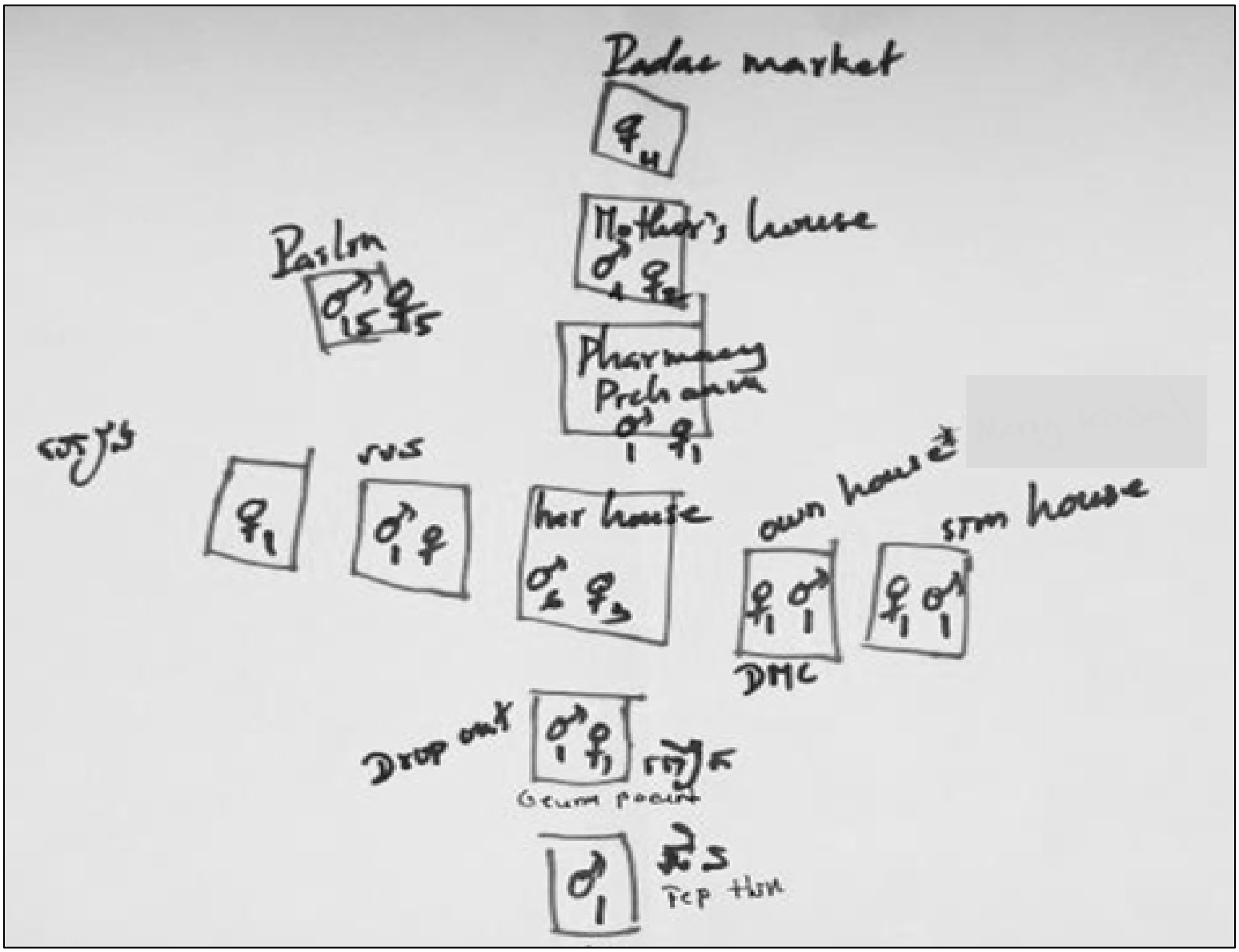

Fig. 3 Women's participatory map showing the spaces where she discusses CA

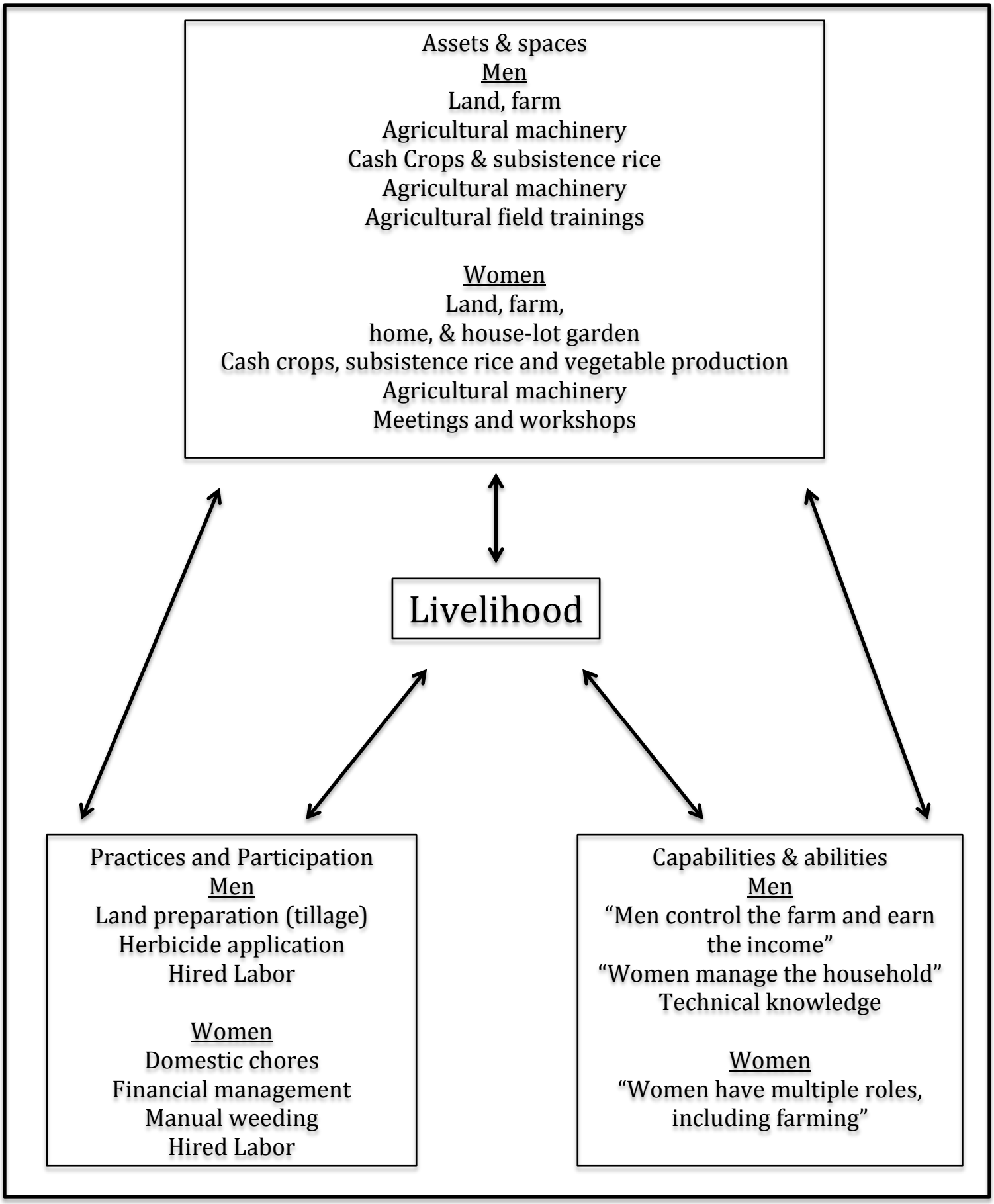

Fig. 4 Gendered livelihoods framework for conservation agriculture in Pichangva
Source: adapted from (Radel 2012, p.4)

Appendix A: Focus Group Discussion Guide

This document is meant to serve as a guide to SANREM partners working with the Gender Cross-cutting Research Activity (CCRA). Participants in Focus Groups should be equal parts men and women (5 – 10 each) and include young as well as old, and people of different status/wealth level. The community should be informed that both the men and women's groups need to include someone who can write down the groups' conclusions. Research team should also be equal parts men and women, with a minimum of 3 for each group to cover the roles below. Time is fluid; the following can be done in approximately ***three*** *hours. Elements such as level of education, facilities (allowing men's and women' groups to work in relative proximity and allowing multiple flip chart pages to be posted simultaneously) and community's prior experience working with NGOs and similar activities allows things to move more quickly. Exercises, including presentations and discussion, should mostly be done in gender segregated groups, though once the dynamic of participation has been achieved, or with encouragement by the facilitator, some exercises can be done with the combined, larger group to save time.*

The most important thing is to use this chart as a guide and to be FLEXIBLE and respond to the situation—particularly depending on when activities actually get started and when farmers' begin to show weariness and lag in interest/participation. It is better to take time to introduce key concepts and give clear instructions, and to have time for discussion after presentations, than to rush and obtain incomplete or contradictory information and leave processes unfinished. Do not ask leading or direct questions that put words in respondents' mouths; the exercises below are especially intended to allow farmers to describe their world from their point of view. Use prompt questions below, then be quiet and listen to the farmers. Wait for the participants to think and respond. Note that women may need more time than men for some activities. The facilitator must play an active role encouraging everyone's participation, often requiring s/he tactfully restrain dominant speakers. Encourage women and less vocal group members to be active contributors.

BE SURE TRANSLATOR UNDERSTANDS THAT THEY SHOULD TRANSLATE THE DISCUSSION, NOT JUST SUMMARIZE. NOTETAKERS SHOULD TAKE DIRECT QUOTES OF KEY DESCRIPTIONS.

4 – 5 people need to assist in each FGD (Preferably women working with women and men working with men) IT IS EASIER TO DO THIS WITH WOMEN OR MEN AT DIFFERENT TIMES SO IT IS THE SAME TEAM WORKING WITH EACH AND RESULTS ARE MORE COMPARABLE

ROLES:
1. Facilitator
2. Note-Taker
3. Observer (also takes notes, but not all of words, rather observation of group dynamics
4. Translator
5. Scribe for flipchart to alternate with facilitator
6. 5-10 Men
7. 5-10 Women
8. Photographer

Materials Needed:

2 Flip charts (fill out questions in advance for both groups)
Place to put the flip charts
Chairs or mats
Table to put map on
2 Community Satellite Maps (1 for men, 1 for women)
Tape, string, or other material to hold flipchart
Markers (in many different, bright colors)
1 black permanent marker
Notebooks and pencils for research team

1.) **Overarching research questions:**
   a. What are farmer's perceptions of the factors that contribute to land degradation?
   b. How do those factors affect men and women differently?
   c. How are land preparation activities gendered?

The chart below depicts an approximately 3-hour session. Be prepared to adapt. Post an agenda of planned activities if possible.

Time	Activity Description	Prompt Questions & Guidance	Data Collected
Full group of equal parts men and women; meeting with full research team			
15 min	**Preliminaries** Culturally appropriate beginning, welcome. Introductions: Can take longer if all in group introduce themselves by name. Good for inclusion and getting participation from the start, but depends on size of group. Overview of SANREM research project and importance of gender to SANREM; Explain participation is voluntary; Explain this builds on previous research by SANREM and the team; Outline of the day. Read IRB Verbal Consent Form (Appendix A) and make sure everyone agrees to participate and have their picture taken. Count (M/F) participants. Explain numbers matter but gender is more than counting bodies: takes into account differences in men's and women's roles, assets, priorities, constraints and more. It is important to have selected for a diverse group representative of the community, including old, young, women, men, and different ethnic groups and social status. Farmers and teams will break into two groups and take working materials with them at the end of this section. [If time permits: brief discussion on gender	This is a research project: Introduce CRSP project, previous relationship with HC institutions, community's relationship with the team, and plans for future collaboration: "*This is an opportunity for scientists to learn from you.*" Also explain: "*We are here to understand community perceptions of land degradation.*" Explain the activities for today: • Describing the characteristics of a good farmer • Timeline of changes in agricultural technology and the different impact these have had on men and women if this is the case. • Make a list of indicators of fertile, medium, and degraded soils. • Map where the fertile, medium, and degraded soils are in the *Read IRB and get group to vote with their hands if they agree* [If time permits: Gender Who knows the meaning of the word gender? How is it different from sex? Gender: social constructions of what is expected of, allowed and valued in a woman or man in a given culture, context, time and/or location. As opposed to sex:	Head count (separated by males and females) General information about the participants Gauge participants' understanding and ideas of gender Initial sense of gender in community; gets workshop on track and helps all understand and carry out later exercises Informed consent from participants for IRB

	and how gender roles have changed.] Stress SANREM seeks equity in participation and benefits	biological differences between men and women.	
Separate into men and women's groups with women from research team going with women, and vice versa			
15 min	**<u>Exercise #1: Opening question (Good farmer practices)</u>** Encourage everyone's participation. Write questions on flip chart paper (See Exercise 1 in Appendix B). Have a participant or facilitator write answers on the flip chart.	*"What are the practices of a good farmer?"*	Men and women's perceptions about agricultural practices and farmer's relationship with the environment
45 min	**<u>Exercise #2: Timeline</u>** Use only the questions on the right. Do not guide conversations. Listen. (Post questions on flip chart paper. (Have another sheet of flip chart paper for drawing the timeline). *Good note-takers from research teams in each group are essential.* ***Note-Taker:*** Record exact words used in quotes. Note factors farmers indicate that contribute to land degradation and what farmers consider the indicators of land degradation to be.	1. *"How has agricultural technology changed?"* 2. *"How have these changes impacted men and women differently?"*	Documentation of how farmers perceive land degradation Gender differences in the above data
45 min	**<u>Exercise #3: Mapping degraded landscapes in the community on satellite image</u>** **Part 1: List (15 min)** **GIVE FARMERS THE PAGE WITH THE THREE COLUMNS WITH COLOR OF BOX AND DEFINITION AT THE TOP** **KEEP THIS PAGE ON THEIR TABLE WHEN YOU PUT THE MAP ON TOP SO THEY CAN LOOK TO THE TOP OF THAT PAGE AS A GUIDE** **Part 2: Mapping (30 min)** Research team presents the satellite image and points out key landmarks (river, school, market, etc.) Be sure to have marked several people's plots on the map as well to help orient. Using different colors, mark the different soil	*Part 1. Listing* 1. *"What are the indicators of each soil? (Fertile, medium, degraded)* *Part 2. Please map the following according to group agreement:* Fertile soil(use green marker) Medium(use black marker) Degraded soils (use red marker)	List of factors that contribute to land degradation and promote soil conservation Perceptions of gender differences in above Location and map of degraded landscapes from farmer's perspective Gauge mapping ability and orientation

	quality areas on the satellite imagery Researchers need to draw some landmarks on the image help orient participants		
10 min	**<u>Snacks Distributed</u>**		
40 min	**<u>Exercise #4: Socioeconomic Activity Chart</u>** Chart the activities and roles of men and women in both productive and reproductive spheres. Raise awareness on importance of factoring in reproductive activities as supporting productive ones and noting the gender division of labor. <u>Productive:</u> work done for remuneration, in cash or kind (ex: wage labor, farming, crafts) <u>Reproductive</u>: Childbearing and rearing, domestic tasks that guarantee the maintenance and reproduction of the future and current workforce (ex: cooking, cleaning, etc.); <u>Community reproductive tasks</u> are non-paid activities carried out for common good. <u>Leisure and Education</u>: activities that occupy non-working time Have a list of activities they might suggest and begin filling out chart during discussion. Be sure livestock production is included.	***Use the Socio-Economic Activity Profile attached (appendix C)*** *List activities that you spend time on and who does what?* *Only men* *Men with the help of women* *Both men and women equally* *Women with the help of men* *Only women* *Children*	An understanding of who does what, the division of labor in productive, reproductive, and leisure/education activities Recognition of contribution of women's reproductive activities and how reproductive activities support productive ones List of activities and qualitative data on gender roles that may be relevant to CAPS Note which activities are listed under reproductive because they are in the household or garden but are in fact productive Data to help identify gender-based constraints and opportunities
10 min	**<u>Closing and Thanks:</u>** Researchers explain future SANREM CRSP activities and fieldwork. Answer questions	*1. Questions?* *2. Next steps and thanks.*	Farmers have opportunity to ask questions and get SANREM team input on soils issues.

SANREM CRSP & VT Verbal Informed Consent for Participants in Research Projects Involving Human Subjects

Identifying Gender-Based Constraints and Opportunities to CAPS in Battambang Province, Cambodia

Investigator(s): Dr. Maria Elisa Christie

I. Purpose of this Research/Project

The purpose of this research is to understand men and women's beliefs, and perceptions of soil degradation, land cover, land use change, and soil conservation. Additionally, this research will assess how Conservation Agricultural Production Systems (CAPS) and other changes in agricultural technology and agricultural practices have impacted men an women's livelihoods and labor allocation. This research will also explore intra-household decision-making process and relationships and their relationship to the decision to experiment with and incorporate CAPS. This research will contribute SANREM CRSP's research on conservation agriculture.

II. Procedures

- The focus group session on community soils will take 3 hours. Participants will be asked to describe and discuss the practices of a good farmer, describe how agricultural technology has changed in the region over time and how those changes have impacted men and women differently, describe and map fertile, medium, and degraded soils within the community, and Chart the activities and roles of men and women in both productive and reproductive spheres.
- Take Pictures

III. Risks

There are no risks associated with this research.

IV. Benefits

There is no promise or guarantee of any benefits.

V. Extent of Anonymity and Confidentiality

Your participation in this research is voluntary and anonymous.

VI. Compensation

There is no compensation for this research.

VII. Freedom to Withdraw

Subjects are free to withdraw from a study at any time without penalty.

VIII. Subject's Responsibilities

I voluntarily agree to participate in this study. I have the following responsibilities:

-Participate in a focus group session and discuss community soil types.
-Have picture taken.

Do you have any questions?

IX. Subject's Permission
I have heard the Consent Form and conditions of this project read to me and had all my questions answered. I give my voluntary consent to be photographed and interviewed during this visit.

_____ Date_____ Yes_____No

Flip chart Questions (use different page for each exercise)

Exercise 1: Opening Question (Good farmer practices)

"What are the practices of a good farmer?"

Exercise 2: Timeline

"How has agricultural technology changed?"
"How have these changes impacted men and women differently?"

Exercise 3: Mapping degraded/eroded landscapes in the community on satellite image
Part 1: What are the indicators of each soil? (Fertile, medium, degraded)

- **Show boxes with different colors with definition next to it**
  - **Fertile soil (use green marker)**
  - **Medium (use black marker)**
  - **Degraded soils (use red marker)**

Part 2: Map Fertile, Medium, and Degraded soils in the community?

Exercise 4:

Socioeconomic Activity Chart

Socio-economic Activities	Only men	Men with the help of women	Both men and women equally	Women with the help of men	Only women	Children	Observations
Productive Activities							
Major paid activities:							
Plowing							
Planting							
Weeding							
Harvest							
taking care of							

Socio-economic Activities	Only men	Men with the help of women	Both men and women equally	Women with the help of men	Only women	Children	Observations
animals							
Spreading manure							
Fertilizer application							
Marketing							
Major non-paid activities:							
Family (exchanges for above)							
Reproductive activities							
Domestic non-paid work							
Cooking for the family							
Taking care of children/elderly							
Taking care of the sick							
Community non-paid work							
Participate in assemblies and							

Socio-economic Activities	Only men	Men with the help of women	Both men and women equally	Women with the help of men	Only women	Children	Observations
meetings							
Cleaning community							
Leisure and Education							
Participate in trainings							
Attend church							
School							

Appendix B: Household Visit Guide

This document is meant to serve as a guide to SANREM partners working with the Gender Cross-cutting Research Activity (CCRA). Participants in household interviews should include married households, female-headed, and male-headed households. They should include young as well as old, and people of different status/wealth level. Make sure women and men are interviewed separately, with the women being interviewed first. (Sampling will be determined upon arrival and after pre-testing). Each interview will take ***Two Hours***.

The most important thing is to use this chart as a guide and to be FLEXIBLE and respond to the situation—particularly depending on when activities actually get started and when farmers' begin to show weariness and lag in interest/participation. Do not ask leading or direct questions that put words in respondents' mouths; the mapping, photo and survey exercises are especially intended to allow farmers to describe their world from their point of view. Use prompt questions below, then be quiet and listen to the farmers. Wait for the participants to think and respond. Note that women may need more time than men for some activities.

Be sure women are interviewed before men of the households, so they are not inhibited by men's confidence and knowledge. ***Get verbal informed consent for IRB before interviews. Remember to make code name for household participant and take GPS point of the household.*** Take careful notes to capture how people express things, not just what they say.

Roles needed:	**Materials needed**
1. Researcher	Flip chart paper
2. Translator	Camera
3. Note-taker	Audio recorder
	Markers
	Notebooks

Overarching research question:

2.) *How will CAPS impact men and women's allocation of labor?*
3.) Where and with whom do men and women share information related to CAPS?
4.) What is the role of women in household decision-making regarding the adoption of CAPS?
5.) What do men and women perceive to be the costs and benefits of the components of CAPS

The chart below depicts a household visit for approximately 2 hours. Be prepared to adapt.

Time	Activity Description	Prompt Questions & Guidance	Data Collected
5 min	**<u>Introduction</u>** Overview of SANREM research project and student's work; Explain participation is voluntary (read informed consent form, Appendix A).	This is a research project: Introduce CRSP project and student research (describe yourself), previous relationship with HC institutions, community's relationship with team, and plans for future collaboration: "*This is an opportunity for scientists to learn from you*." Also explain: "*We are here to understand men and women's agricultural practices and livestock practices*." Explain activities for today: 1. Semi-structured interview questions related to farmers' perceptions of the costs and benefits of implementing CAPS/DMC 2. Making a hand drawn map indicating the areas where the farmer shares information related to DMC techniques 3. Intra-Household Decision-Making Survey Say: "*We want to hear from both male and female heads of the household. At the end we can set up a time that I can interview your spouse/husband.*"	General information and focus for household interview
5 min	**<u>Demographic Information</u>** Collect basic demographic information and farming history. Record in Appendix B.	See Appendix B for the Demographic Information Questions	

20 min	***Exercise #1:*** ***Part 1. Semi-Structured Questions*** Initiate a conversation with the farmer concerning their perceptions and experiences with CAPS/DMC Record in Field Notebook	<u>Farmers Who Are Implementing CAPS/DMC for the First Time this Upcoming Cropping Season</u> 1. What is your motivation for implementing DMC this cropping season? 2. What role would did your spouse play in making the decision to start implementing DMC? 3. What are the other benefits of DMC? 4. What factors can make it hard for a farmer to implement DMC? 5. Do you participate in project activities (ex. PADAC/SANREM DMC trainings, field visits)? <u>Farmers Who Have been Implementing CAPS/DMC For More Than One Cropping Season</u> 6. When did you first start implementing DMC? 7. What was your initial motivation for implementing DMC? 8. Why have you continued to implement DMC this cropping Season? 9. Since you have started implementing DMC, have you increased the amount of land under DMC? **IF Yes,** Why did you increase the amount of land under DMC? 10. What role would did your spouse play in making the	Qualitative data on: - Farmers motivations for experimenting with CAPS/DMC - Farmers perceptions of the constraints and opportunities from CAPS/DMC Implementation

		decision to start implementing DMC? 11. What are the other benefits of DMC for a farmer? 12. What factors can prevent a farmer from implementing DMC? 13. Do you participate in project activities (ex. PADAC/SANREM DMC trainings, field visits)? <u>Farmers Who Are No Longer Implementing CAPS/DMC</u> 14. When did you first start implementing DMC? 15. When did you stop implementing DMC? 16. What was your initial motivation for implementing DMC 17. Why did you stop implementing DMC? 18. What role would did your spouse play in making the decision to start implementing DMC? 19. What are the other benefits of DMC for a farmer? 20. What factors can prevent a farmer from implementing DMC? <u>Farmers Who Have Never Implementing CAPS/DMC</u> 21. Why have you never implemented DMC?	

		22. What role would your spouse play in the decision to implement DMC? 23. What are the other benefits of DMC? 24. What factors could make it difficult for you to implement DMC? 25. What factors would a farmer have to consider in making the decision to implement DMC? (Ask all questions below to each group of farmers – If farmer has already answered these questions earlier in the discussion, check with the farmer to clarify their answer and move on to the next question)	
10 min	***Exercise #1*** ***Part 2. Labor Allocation Open-Ended Interview Questions*** Farmers will be asked a series of open-ended interview questions related to CAPS/DMC's impact on farmers labor allocation The purpose of this activity is to document farmers perceptions of how CAPS/DMC does or could impact their allocation of labor and amount of "extra time" Record in Appendix C. Conventional Agriculture: Agricultural production that uses tillage in land preparation. "Extra-Time": Will be defined by the farmer – farmers definitions of "extra time" will also be recorded in Appendix C.	**Open-Ended interview Questions** "Does DMC impact the amount of labor needed in land preparation?" "Does DMC reduce the amount of time needed in land preparation?" "How does DMC impact the amount of time women spend weeding?" "How does DMC impact the amount of time men spend in land preparation?" "Do you have more extra time to other things since you have started implementing DMC? **If Not Adopter (Do you think you would have more extra time if you implemented DMC?"** "If Yes, What do you do with your "extra time"?" "After implementing DMC, do you help your spouse with tasks that you did not do before?"	Qualitative data on: - Farmers' perceptions of CAPS/DMC's impact of famers allocation of labor - Farmers' perceptions of how CAPS/DMC could impact men's labor allocation and women's labor allocation differently -Activities involved in land preparation. -Potential gender-based differences in labor allocation and "extra time".

40 min	**Exercise #2:** **Part 1. Participatory Mapping** (Note, if the person is not comfortable drawing, cannot draw because of health or education, you can *always* suggest to the person that he/she can invite a friend, child, or other relative to draw for him/her as long as the participant tells the person what to draw. Also, the helper cannot be the person's husband/wife. It is also better to try to get the helper to be of the same gender. Just make sure you ask the helper for permission for IRB.) Record in Appendix D	"Have your received or shared information about DMC techniques with others, meaning have your heard about or told others about DMC techniques?" "What information about DMC techniques to you talk about?" *"We would like to do a mapping exercise, Have you ever drawn a map before?"* "*Could you please map the places where you have heard or talked about DMC techniques with others?"* Make disclaimer: *"I am not an artist and I do not know your community: this is an example only. Remind people to think of spaces/people beyond the community that they may share with."*	-Participatory map of the places where farmers share and/or hear about information about DMC techniques -Differences in experience with mapping between individuals and gender -Differences in the types of spaces that farmer share/hear about information about DMC techniques between individuals, CAPS implementation status, and gender
10 Min	**Exercise #2:** **Part 2. Describing the Maps**	After farmers have mapped and discussed the spaces where the share/hear information about DMC techniques, ask the famers to describe the spaces using the prompts below *"Do you to Talk about DMC techniques more with men, or more with women?"* ***(Go through all of the spaces that are mapped by*** *"Do you to Talk about DMC techniques more with men, or more with women?"* ***(Go through all of the spaces that are mapped by the farmer)*** • *How many men have you talked with?* • *How many women have you talked with?* • *Are there any other places that have talked about DMC techniques?* *"Do you talk about DMC techniques more with farmers in the project or more with farmers not in the project"* ***(Go through all of the spaces that are mapped by the farmer)***	-Information about with whom farmers share information about DMC techniques with -Information about where farmers receive information about DMC techniques -Information about the role of cellphones in sharing information about DMC techniques.

		• *How many famers in the project have you talked with?* • *How many farmers not in the project have talked with?* • *Are there any other places have talked about DMC techniques?* "From whom do you receive information about DMC techniques?" • Do you own a cell phone? **IF YES GO TO 70A** a. Do you use your cellphone to talk about information about DMC techniques?	
60 min	**Exercise #3: Intra-Household Decision-Making Survey** Record in Appendix E	Conduct Modules 2 – 5 of the Intra-Household Decision-Making Survey	- Information about the gendered nature of access to resources within the households. - Men's and Women's roles and opportunities to be members of community organizations. - Information about men's and women's influence in household decisions.
10 min	**Closing:**	"Do you have any questions for me?" Say thank you for their cooperation and	Opportunity for questions and setting

		ask if the farmer is willing to show me the places where there share or hear information about DMC techniques.	up additional Visits

Verbal Informed Consent for Participants in Research Projects Involving Human Subjects

Identifying Gender-Based Constraints and Opportunities to CAPS in Battambang Province, Cambodia
Investigator(s):
Dr. Maria Elisa Christie (Virginia Tech)
Daniel Sumner (Virginia Tech)

I. Purpose of this Research/Project
The purpose of this research is to understand men and women's beliefs, and perceptions of soil degradation, land cover, land use change, and soil conservation. Additionally, this research will assess how Conservation Agricultural Production Systems (CAPS) and other changes in agricultural technology and agricultural practices have impacted men and women's livelihoods and labor allocation. This research will also explore intra-household decision-making process and relationships and their relationship to the decision to experiment with and incorporate CAPS. This research will contribute SANREM CRSP's research on conservation agriculture. Virginia Tech University Personnel will conduct all research.

II. Procedures
Photo-Interpretation Exercise
Livelihood Participatory Mapping
Intra-household Decision-Making Survey Instrument
Take pictures of the people, households, fields, and animals
Collect GPS points for the farmer's house
Audio-record interviews

III. Risks
There are no risks associated with this research.

IV. Benefits
There is no promise or guarantee of any benefits.

V. Extent of Anonymity and Confidentiality
Your participation in this research is voluntary and anonymous.

VI. Compensation
There is no compensation for this research.

VII. Freedom to Withdraw
Subjects are free to withdraw from a study at any time without penalty.

VIII. Subject's Responsibilities
. I have the following responsibilities:
-Participate in the household interview and its participatory exercises and survey instrument
-Have my picture taken
-Have the interview recorded

Do you have any questions?
IX. Subject's Permission
I have heard the Consent Form and conditions of this project read to me and had all my questions answered. I give my voluntary consent to be photographed, recorded, and interviewed during this visit.
_____ *Date*_____ *Yes* *No*

Research Participant Demographic Information
G1.01 Household Codename Identifier:
G1.02 Name of Respondent:
G1.03 Sex of Respondent:

Male……1
Female……2

G1.04 Age of Respondent:

G1.05 Status of CAPS/DMC Implementation:

First Time Implementer……1
Implementer……2
No Longer Implementing……3
Never Implemented……4

G1.06 Type of Household:

Male and Female Adult……1
Female Adult Only……2
Male Adult Only……3

G1.07 Number of Children

G1.08 Education Level

G1.09 Outcome of Interview

Completed……1
In completed……2

G1.10 Ability to be Interviewed Alone:

Alone……1
With Spouse Present……2
With Adult Females Present……3
With Adult Males Present……4
With Adults Mixed Sex Present……5
With Children Present……6
With Adults Mixed Sex and Children Present……7

Exercise #1 Open Ended Interview Questions – Costs and Benefits of DMC Implementation

<u>Farmers Who Are Implementing CAPS/DMC for the First Time this Upcoming Cropping Season</u>

1. What is your motivation for implementing DMC this cropping season?
2. What role would did your spouse play in making the decision to start implementing DMC?
3. What are the other benefits of DMC?
4. What factors can make it hard for a farmer to implement DMC?

5. Do you participate in project activities (ex. PADAC/SANREM DMC trainings, field visits)?

Farmers Who Have been Implementing CAPS/DMC For More Than One Cropping Season

1. When did you first start implementing DMC?
2. What was your initial motivation for implementing DMC?
3. Why have you continued to implement DMC this cropping Season?
4. Since you have started implementing DMC, have you increased the amount of land under DMC?

IF Yes, Why did you increase the amount of land under DMC?

5. What role would did your spouse play in making the decision to start implementing DMC?
6. What are the other benefits of DMC for a farmer?
7. What factors can prevent a farmer from implementing DMC?
8. Do you participate in project activities (ex. PADAC/SANREM DMC trainings, field visits)?

Farmers Who Are No Longer Implementing CAPS/DMC

- When did you first start implementing DMC?
- When did you stop implementing DMC?
- What was your initial motivation for implementing DMC
- Why did you stop implementing DMC?
- What role do women have in making the decision to implement DMC?
- How can implementing DMC benefit a farmer?
- What factors can prevent a farmer from implementing DMC?

Farmers Who Have Never Implementing CAPS/DMC

1. Why have you never implemented DMC?
2. What role would your spouse play in the decision to implement DMC?
3. What are the other benefits of DMC?

4. What factors could make it difficult for you to implement DMC?

5. What factors would a farmer have to consider in making the decision to implement DMC?

(Ask all questions below to each group of farmers – If farmer has already answered these questions earlier in the discussion, check with the farmer to clarify their answer and move on to the next question)

- Does DMC impact the amount of labor needed in land preparation?

If farmer is not implementing DMC – How do you think DMC can impact the amount of labor needed in land preparation?

- Does DMC reduce the amount of time needed in land preparation?

If farmer is not implementing DMC – How do you think DMC can reduce the amount of time needed in land preparation?

- How does DMC impact the amount of time women spend weeding?

If farmer is not implementing DMC – How do you think DMC could impact the amount of time women spend weeding?

- How does DMC impact the amount of time men spend in land preparation?

If farmer is not implementing DMC – How do you think DMC can impact the amount of time men spend in land preparation?

- Do you have more extra time to other things since you have started implementing DMC? **If Not Adopter (Do you think you would have more extra time if you implemented DMC?**

- If Yes, What do you do with your "extra time"?

- After implementing DMC, do you help your spouse with tasks that you did not do before?

Exercise #2 Participatory Mapping – Mapping Where Farmers Talk About DMC Techniques

1. Have your received or shared information about DMC techniques with others, meaning have your heard about or told others about DMC techniques?

2. What information about DMC techniques to you talk about?

3. *We would like to do a mapping exercise, Have you ever drawn a map before?*

4. "*Could you please map the places where you have heard or talked about DMC techniques with others?*"
5. *Do you to Talk about DMC techniques more with men, or more with women?* ***(Go through all of the spaces that are mapped by the farmer)***
    1. *How many men have you talked with?*
    2. *How many women have you talked with?*
    3. *Are there any other places that have talked about DMC techniques?*
6. *Do you talk about DMC techniques more with farmers in the project or more with farmers not in the project?* ***(Go through all of the spaces that are mapped by the farmer)***
    1. *How many farmers in the project talked with?*
    2. *How man farmers not in the project have you talked with?*
    3. *Are there any other places have talked about DMC techniques?*
7. From whom do you receive information about DMC techniques?
8. Do you own a cell phone? **IF YES GO TO 70A**
9. Do you use your cellphone to talk about information about DMC techniques?

Appendix C: Intra-household decision-making survey

NOTE: a) identify the proper individual within the household to be asked the survey, b) link this individual from the module to the household roster, c) code the outcome of the interview (noting if the interview needs to be rescheduled), d) record who else in the household was present during the interview. This instrument must be adapted for country context including translations into local languages when appropriate.
Enumerator: This questionnaire should be administered separately to the primary and secondary respondents identified in the household roster.

Please double check to ensure:

- *You have noted the survey respondents Household Code Identifier*
- *You have read the IRB and gained informed consent for the individual in the household questionnaire;*
- *You have sought to interview the individual in private or where other members of the household cannot overhear or contribute answers.*
- *Do not attempt to make responses between the primary and secondary respondent the same—it is ok for them to be different.*

Start time of interview _____.
End time of interview _____.
Total time of interview _____.
Date of Interview:

MODULE G1. INDIVIDUAL IDENTIFICATION and DEMOGRAPHIC INFORMATION

	Code			Code
G1.01. Household Identification:.....	☐☐☐☐☐☐		G1.09. Outcome of interview	☐
G1.02. Name of respondent currently being interviewed Family Name, First name:			G1.10. Ability to be interviewed alone:	☐
G1.03. Sex of respondent: Male..... 1 Female..... 2	☐		G1.11. Civil Status ☐	Married …….. 1 Unmarried …. 2 Widow ……. 3 Widower …… 4
G1.04Age of respondent:				
G1.05 Status of CAPS Implementation First Time Implementer …… 1 Implementer …… 2 No Longer Implementing …… 3 Never Implemented …….. 4				
G1.06. Who earns an income in the household? Male adult only……..1 Female adult only……2 Male and Female adult only ……. 3	☐		G109 Completed..... 1 Rescheduled..... 2	G110 Alone.....1 With Spouse Present.....2 With Adult Females Present .....3 With Adult Males Present…… .....4 With Adults Mixed Sex Present .....5 With Children Present……..6 With Adults Mixed Sex and Children Present.7

G1.07. Number of Children Ask first, Do you have any Children				
G1.08. Education Level Also ask, Can you read?				

MODULE G2: ROLE IN HOUSEHOLD DECISION-MAKING AROUND PRODUCTION AND INCOME GENERATION

Household Codename Identifier | | | | | | |

Activity		In this last year did you partidipate iin t[ACTIVITY)? Yes.....1 No.....2 >> next activity	How much input did you have in making decisions about [ACTIVITY]?	How much input did you have in decisions on the use of income generated from [ACTIVITY]
ActivityCode	Activity Description	G2.01	G2.02	G2.03
A	Food crop farming (food that is primarily grown for eating in the house) Name of Types of Crops:			
B	Cash crop farming (crops that are primarily grown for sale in the market)' Name of Types of Crops:			
C	Livestock raising (cows, pigs, chickens, ducks)			
D	Non-farm economic activities, small business, self-employment, buy-and-sell			
E	Wage and salary employment: in-kind or monetary work both agriculture and other wage work			
F	Are there an other sources of income for the household (ie. Remittances or pensions)			
			G2.02/G2.03: Input into decision making No input……..1 Input into some decisions……2 Input into most decisions……3 Input into all decisions …… 4 No decision made……5	

MODULE G3: ACCESS TO PRODUCTIVE CAPITAL

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Productive Capital		Does anyone in your household currently own or rent any [ITEM]? Yes .....1 No.....2 >> next item	How many /much of [ITEM] does your household currently own/rent?	Who would you say owns most of the [ITEM]?	Who would you say can decide whether to sell the [ITEM]?	Who would you say can decide to rent out the [ITEM] ?	Who contributes most to decisions regarding the purchase or rental of [ITEM]?
Productive Capital		G3.01	G3.02	G3.03	G3.04	G3.05	G3.06
A	Agricultural land in production (Ex. Chamcar, lowland, hydromorphique)						
B	Agricultural land in another district						
C	Livestock (Ex. Cows, pigs, chickens)						
D	Hand Tractor						
E	Tractor						
F	Mechanized Herbicide Sprayer						
G	Farm Equipment (DMC/CAPs) – No Till Seeder						
H	Water pump						
I	Cell phone						
J	Means of transportation (bicycle, motorcycle, car)						
K	Other						

Self.....1
Partner/Spouse 2
Self and partner/spouse jointly.....3
Other household member ……..4
Self and other household member(s)……..5
Partner/Spouse and other household member(s)……..6
Someone (or group of people) outside the household…….. 7
Not applicable …….. 8
Self, partner/spouse & other household members .9

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MODULE G4: GROUP MEMBERSHIP AND INFLUENCE IN THE GROUP

Group membership		Is there a [GROUP] in your community? Yes ..... 1 No ..... 2 >> next group	Are you an active member of this [GROUP]? Do you attentd group meetings? Yes ..... 1 No 2	Do you hold a formal leadership position in the [GROUP]? Yes…….1 No……..2	Notes
	Group Categories	G4.04	G4.05	G4.06	
A	Farmer's association/cooperative				
B	PADAC Extensions Network				
C	Credit or microfinance group				
D	Trade and business association				
E	Civic groups (improving community) or charitable group (helping others)				
F	Local government				
F	Religious group (Ex. Buddhist, Muslim, Christian)				
H	Women's group (only if it does not fit into one of the other categories)				
I	NGOs List NGOs below:				

MODULE G5: DECISION MAKING

ENUMERATOR: Ask G5.01 for all categories of activities before asking G5.02. Do not ask G5.02 if G5.01 response is 1 and respondent is male OR G5.01 response is 2 and respondent is female. *If household does not engage in that particular activity, enter 98 and proceed to next activity.*		Who normally makes the decision regarding the [ACTIVITY]?	To what extent do you feel you can make your own personal decisions about these aspects of agricultural production?
		G5.01	G5.02
A	Choosing seed types		
B	Chooses what crops are grown		
C	Choosing fertilizer types		
D	Choosing herbicide types		
E	Choosing insecticide types		
F	Weeding		
G	Land preparation		
H	Harvesting		
I	Taking the crops to market		
J	Choosing whether to implement CAPS/DMC		
K	Minor household expenditures (such as food for daily consumption or other household needs)		
		G5.01: Who makes decision Main male or husband……1 Main female or wife ……2 Husband and wife jointly ……3 Someone else in the household……4 Jointly with someone else inside the household ……5 Jointly with someone else outside the household……6 Someone outside the household/other ……7 Household does not engage in activity/Decision not made……98	G5.02: Extent of participation in decision making Not at all ……1 Small extent……2 Medium extent……3 To a high extent……4