Using Qualitative Geographic Information Systems to Explore Gendered Dimensions for Conservation Agriculture Production Systems in the Philippines: A Mixed Methods Approach

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ABSTRACT

This research identifies gender-based constraints and opportunities for the adoption of conservation agriculture production systems (CAPS) based on a case-study with smallholder farmers in two villages in Misamis Oriental, Philippines. It explores gendered soil knowledge and perceptions, access to resources, and agricultural practices in the context of food security and soil conservation. This approach combines qualitative and quantitative methods such as focus group discussions, household interviews, participatory mapping, and GPS mapping. I found that men and women have gendered soil perceptions which are linked to topography, gender roles, and access to assets. These could have implications for whether men and women adopt conservation agriculture. I also demonstrate the importance of combining geospatial techniques and participatory methods for gender research in a development context. Much of the qualitative GIS literature focuses on incorporating qualitative data into a GIS, yet I argue it is important to incorporate geospatial tools into qualitative, participatory research to understand the spatiality of people's perceptions, practices, and resources.

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Chapter 1: Introduction and Statement of Purpose

1.1 Introduction

Degraded landscapes and unsustainable agricultural practices heighten food insecurity and poverty rates and are prevalent throughout the world (FAO 2011). Smallholder farmers are especially vulnerable to food insecurity and more likely to engage in unsustainable agricultural practices (Barrett 2002). In response, agriculture development programs have established conservation agriculture principles and practices that aim to reverse these trends. Yet, changes in farming systems can have different impacts on men's and women's time, resources, and labor input, particularly in smallholder households. Despite the fact that women make up nearly half of the agricultural labor force worldwide, in many developing countries, their roles in farming communities go unnoticed and they are less likely to participate in trainings and extension services (World Bank 2009; FAO 2011). It is necessary for development programs to understand both men's and women's perceptions, priorities, and concerns because these may differ from each other. In order to promote adoption of development activities and achieve sustainable outcomes, these programs must take into account the ways in which gender relations influence a program and how a program's activities influence gender relations.

The Sustainable Agriculture Natural Resource Management Collaborative Research Support Program (SANREM CRSP) funded by the U. S. Agency for International Development (USAID)[1] has been carrying out agricultural research in the Philippines since 1994. Beginning in 2009, SANREM CRSP has worked in Claveria, a municipality comprised of predominately smallholder farmers in northern Mindanao, with a focus on conservation agriculture production

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systems (CAPS). CAPS have been proposed by development researchers as a potential method to increase agricultural productivity, food security, and soil quality. It has three components: 1) maintaining year-round crop-cover including intercrops or mulch from previous crops; 2) minimizing soil disturbance by exercising little to no tillage, where the farmer does not turn the soil over in order to keep the soil structure the same, thereby reducing erosion and nutrient-loss, and 3) diversifying crop rotations by including adapted and appropriate crops to maintain biodiversity, contribute nitrogen, and avoid pest infestations.

SANREM CRSP is working in 13 countries around the world aiming to learn general lessons from the specific experiences on the ground. Social factors including gender relations must be considered for successful adoption and implementation of CAPS. This research is part of SANREM CRSP's Gender Cross-Cutting Research Activity (Gender CCRA), a qualitative, case study-based research program that collaborates with individual regional programs[2] and the Soils CCRA to identify gender-related factors that contribute to the success or failure of CAPS.

In order to explore gender relations in the context of development, the Gender CCRA uses a gender analysis framework called the Gender Dimensions Framework (GDF) (Rubin et al. 2009). This framework was developed to promote gender-equitable opportunities in agricultural value chains and helps USAID staff and partner institutions identify gender-based constraints and opportunities in its projects. The GDF consists of four dimensions: 1) access to and control over resources (tangible and intangible); 2) knowledge, beliefs and perceptions; 3) practices and participation; and 4) laws, legal rights, policies, and institutions. The dimensions overlap and also include the cross-cutting dimension of power. The GDF helps SANREM CRSP explore the

[2] This project is in collaboration with a Long Term Research Activity (LTRA)-12: Conservation agriculture for food security in Cambodia and the Philippines. It is led by the North Carolina Agricultural and Technical State University in collaboration with host institutions University of Los Baños (UPLB) and International Centre for Research in Agroforestry (ICRAF).

gender relations specific to each site and make recommendations for increasing the potential adoption of CAPS.

The Gender CCRA has been carried out using primarily qualitative methods. However, this research aims to explore how the combination of participatory and geospatial methods and the triangulation of data can contribute to a better understanding of gender issues in CAPS. Similar mixed method approaches have been implemented in urban community planning projects though much of the research has been limited to the United States. There is lack of research on how geospatial methods can contribute to social research specifically in rural, international scenarios that incorporate gender and development and concepts such as CAPS. We hope to demonstrate that a mixed methods approach in geographic and development research is effective for addressing food insecurity, gender issues, and conservation agriculture.

1.2 Statement of Purpose

The overall purpose of this research is to determine the gender-based constraints and opportunities for the adoption and implementation of CAPS based on a case study of smallholder farmers in the town of Claveria, Misamis Oriental, Philippines. The specific goal is to examine the gendered soil knowledge and perceptions, agricultural practices, and access to resources that are relevant to CAPS using a mixed methods approach combining participatory and geospatial methods. Methods include focus group discussions, household interviews, participatory mapping, and GPS mapping. These methods reveal gender relations that could impact the adoption of CAPS.

The following chapter positions this research within the existing literature. It reviews the previous research in feminist political ecology, critical GIS, participatory GIS, and qualitative GIS that is relevant to the study of gender, development, and mixed methods in geography.

Chapter Three is prepared as a manuscript for publication in the journal *GeoJournal*. It is written using personal pronouns in the plural form in order to reflect its collaborative nature. While it is based primarily on the research I carried out with collaborators in the U.S. and the Philippines during the seven weeks of my fieldwork in July and August of 2012, it builds on earlier fieldwork by the principal investigator of the Gender CCRA, and our restitution visit to the farmers in January of 2013.

1.3 References

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Chapter 2: Literature Review

This research draws on feminist political ecology (FPE), critical GIS, participatory GIS (PGIS), and qualitative GIS. FPE provides the theoretical framework for addressing gender issues in the context of development. The three areas of GIS contribute to the exploration of a mixed methodology for carrying out gender research that involves local knowledge, access to resources, and agricultural practices. These gender dimensions have a spatial component in the FPE literature with layers of information that cannot be exposed through a single method.

2.1 Feminist Political Ecology

Feminist political ecology is the study of how gender relations influence or are influenced by ecological and/or political landscapes, particularly in the context of development (Rocheleau et al. 1996b). Gender refers to the social constructions of what is expected of, allowed, and valued in a man or woman in a given culture, context, time, and/or location. Feminist political ecology explores how the social roles of men and women impact land management, resource use, and livelihood strategies. Its importance to empirical research has grown due to the redistributions of economies and markets, cultures, and environments at both the local and global level (Rocheleau 2012).

This research draws on feminist political ecology's emphasis on multiple knowledges, particularly gendered and local knowledge. Rocheleau et al. (1996) argue that men often have scientific knowledge of natural resources while women have subsistence knowledge gained from their role as caregivers and practices in their everyday lives. Gendered knowledge is one of the key concepts in FPE due to its importance in determining the different roles and decision-making processes of men and women in the context of environmental issues and changes (Rocheleau et al. 1996b; Udry 1996). Gendered knowledge also allows us to develop a clearer understanding of

a household's access to information, which is important to understand in relation to development. According to Andrea Nightingale, gendered knowledge is the "way in which access to scientific and ecological knowledge is structured by gender (Nightingale 2003 pg. 168)." By exploring and understanding the knowledge of both men and women, we learn about their roles, priorities, and practices which could be impacted by development projects (Mohanty 2003; Momsen 2010). Furthermore, incorporating gendered knowledge in development activities has the potential to address gender equity and increase sustainable results.

One way to focus on gender equity, natural resources, and conservation is to address men's and women's access to resources. In *Gender and the Environment: A feminist political ecology perspective* (1996) by Dianne Rocheleau et.al, it is argued that access to, control of, and labor with resources is gendered. Access is the ability to use, participate, and benefit from a resource; control is the power and/or ownership of a resource; and labor is the work put forth by a certain person in utilizing that resource. Rights to and responsibilities over resources in production, environmental maintenance, and quality of life are also gendered in terms of space, place, and knowledge (Rocheleau et al. 1996a). Rocheleau also argues access to resources is not fixed between groups, places, and time but, rather, is fluid, variable, and subject to change, particularly by those with power and often in a disproportionate balance between men and women. Historically, women's access to resources is indirect, less independent, and therefore more negotiated compared to men's (Rocheleau and Edmunds 1997). These differences in access to resources highlight the importance of including women in development research as well as increasing their visibility in natural resource management. In doing so, there is the potential to increase gender equity in development projects and in resource-rich communities.

One of FPE's contributions to geography and to development literature more generally is its discussion of gendered space (Rocheleau et al. 1995). Men and women have access to and control of different spaces, particularly in areas that differ in land use, value, and power. These gendered spaces and control, in turn create gendered knowledge, experiences, and resources. In Rocheleau's *Gendered Resource Mapping* (1995), she shows that it is important to know where gendered spaces are in order to understand whose environment is changing. At the same time, these spaces have complex layers of access, control, and labor which may overlap with gender differences. For example, in the Philippines research site discussed herein, men only have access to the home while women control it and provide the labor to maintain it. On the other hand, women generally only have access to the farm while men control and contribute most of the labor there.

Exploring men's and women's spaces, and mapping locations and resources with corresponding gendered knowledge, access, control, and labor helps shed light on the gender roles, responsibilities, and priorities in the household and community. Gendered resource mapping has helped researchers and community members design land use systems that equally address men's, women's, and conservation issues (Rocheleau et al. 1995; Rocheleau 1995). Previous efforts to map spaces have displayed mainly male-dominated lands and interests while excluding women's spaces. Among other things, this exclusion ignored important local knowledge about "ecological and cultural information" and sometimes caused women to be resistant to conservation plans (Momsen 2010). However, critics of gendered resource mapping claim that the information cannot be made useful for both policy makers and stakeholders (Rocheleau et al. 1995; McLafferty 2002). This criticism stems from the difficulty in maintaining the specificity of the information while making general conclusions (Rocheleau et al. 1995). It

has also been stated that some stakeholders do not benefit from participatory mapping because it can cause tension and disagreement among men and women in the community and in the household (Chambers 2006). Rocheleau et al. responds to such criticism by stressing that the gender resource maps are not necessarily "correct" and should be negotiated and revised by those who create and analyze them (Rocheleau et al. 1995). Consequently, it is important to remember that information gained from gender resource mapping should reflect knowledge and perceptions which are fluid and variable: the point is to *see* the spaces, places, and assets that make up the everyday life of stakeholders (Abbot et al. 1998; Rocheleau et al. 1995).

This emphasis on everyday life in FPE is drawn from feminist theories of knowledge. It comes from the "convergence of gender, science and environment in academic and political discourse as well as everyday life…." (Nightingale 2003 p. 9). One of the relevant feminist theories of knowledge is from Donna Haraway's idea that knowledge is situated (Haraway 1988). In other words, all knowledge is "situated" differently according to one's specific position in society, e.g., their environment, culture, gender, race, and class (Haraway 1988; Harding 1986; Nightingale 2003; Kwan 2002a). For instance, everyday life is gendered, thus rendering everyone's knowledge situated, since men and women have different experiences due to their social standings and circumstances. These gendered knowledges allows for the introduction of multiple knowledges on the same topics despite differences or contradictions. Feminist scholars argue that these gendered experiences and multiple knowledges are valid because experience cannot be truly objective (Haraway 1988; Rocheleau and Edmunds 1997; Nightingale 2003; Mohanty 2003). Furthermore, science and technology cannot be truly objective either because they are based on everyday lives, interpretations, different ways of knowing, or cultural values (Rocheleau 1995; Haraway 1987; Nightingale 2003). Certain feminist theories of knowledge

focus on the disempowering impact of technology on people, others contribute to understanding how technology affects how we study people and their lives (Harvey et al. 2005). Starting from the premise that knowledge is situated, this research explores the everyday lives and gendered knowledges of smallholder farmers using both social and geospatial methods and links them to development issues. To better understand how spatial technologies impact social research and local stakeholders, we turned to critical GIS.

2.2 Critical GIS

Gender, knowledge, resources, and practices all have spatial components (Rocheleau et al. 1995; Bosak and Schroeder 2005; Kwan 2002a). As such, spatial methods and technologies can be used to better understand these in the context of our research. Feminist theorists have played a major role in bringing a social theory lens—specifically critical analysis and essentialism—to questioning technologies and methodologies (Schuurman 2002). Since this research incorporated geospatial tools and methods, we turned to critical GIS to understand the role these would play in the research and their influence on stakeholders' participation and representation. Critical GIS also explores how GIS should be reconstructed to avoid essentializing, or characterizing it with certain attributes that are necessary to its function, and to expose the subjectivity and power relations in geospatial methods and tools (Pratt and Schuurman 2002; Harvey et al. 2005).

In the 1990s, there was a substantial, critical wave that placed GIS into an ethical discourse from which it has never fully emerged. Researchers argued that GIS was positivist, empirical, and strictly quantitative (Kwan 2002a; Pratt and Schuurman 2002) due in part to its extensive use in the military and its presence in the sciences. There were also concerns of its political and social impacts since it did not represent these contexts in its processes (Elwood

2006a; Kwan 2002b). GIS data and access to GIS information exposed complex power relations that concerned human geographers and its appropriateness to their field (Elwood 2006a; Cope and Knigge 2006). More recently, it has been argued that GIS does not obey research ethics when it comes to mapping, satellite imagery development, and data manipulation (Pratt and Schuurman 2002). Privacy, consent, and misrepresentation are just some of the issues raised by using geospatial data in research, all of which can have disadvantageous effects on projects and participants.

Critical GIS also questions the "top-down" approach associated with GIS. For example, geographers have been taught to separate the geography from the subject, which inevitably detaches the "mappers" from the "mapped" and disembodies both. These "detached observers" are accused of omitting sense of place attributes (McLafferty 2005; McLafferty 2002) and local knowledge. While what the mappers illustrate is presumed to be objective, it actually depicts what they have chosen to map and usually does not include local or stakeholder input. Many researchers have called this a "top-down" approach because the decision-making is centralized at the top with the mappers, or the ones with resources and education, while the information trickles down to the bottom (Chambers 2006; Dunn 2007). Donna Haraway (1991) associated this geospatial position of power with "a god's eye view" or an objective, all-knowing perspective (Kwan 2002b; Haraway 1991). This research interrogates the "god's eye view" by incorporating the locals' knowledge and perspectives combining geospatial techniques and participatory methods.

There is potential for empowerment of the "mapped" and the "mappers" with the increased acceptance of the combination of participatory methods and geospatial techniques (Nightingale 2003; Elwood 2010; McLafferty 2002). Feminist geographers were among some of

the first to argue against essentializing GIS as positivist, fixed, and strictly top-down (McLafferty 2005). They called for a mixed methods approach that incorporated participatory, qualitative methods in order to empower marginalized groups by analyzing space from their perspective. As a result, there is the potential these can help people gain control over their resources and decisions (Dunn 2007; McLafferty 2002; Rocheleau et al. 1995; Rocheleau 1995; Shah 1998). For the mappers, or those using GIS, mixing methods allows them to use GIS in ways that can help overcome technological biases and criticisms. They can do this by revealing the subjectivity in maps by offering "qualitative modes of explanation" and, in turn, supporting this information by offering statistical data as well (Rocheleau 1995; McLafferty 2002; Kwan 2002a).

Theorists from feminist political ecology and feminist geography argue that no one method or data type can produce a full "picture" of the research situation because it only captures a limited perspective (Elwood 2010; Nightingale 2003; Rose 1993). Thus, knowledge is partial and situated. Feminist geographers propose a mixed methods approach to address some of these issues (Elwood 2006a; Dunn 2007; Kwan 2002a). From a critical epistemology standpoint, mixed methods can reveal scientific biases through contradictory findings or multiple, subjective truths (Kwan 2002a; Nightingale 2003; Cope and Knigge 2006). For example, Nightingale (2003) used mixed methods to study community forestry in Nepal. She discovered that by using mixed methods researchers can complement, contradict, or complete the findings in research. Her two main points are that by mixing methods, "hidden insights can appear by analyzing the discrepancies between the results," and that "linking methods allows one to examine the partial knowledge produced in different theoretical and methodological contexts" (Nightingale 2003 p. 82). According to various scholars, restructuring and combining qualitative and quantitative

methods and critiques can show both context and content through a spatial lens (Cope and Knigge 2006; Rocheleau 1995; Nightingale 2003; Kwan 2002b; McLafferty 2002). In addition, incorporating case study and qualitative data into GIS can add meaning, relevance, and usefulness to spatial data (McLafferty 2002).

2.3 Participatory GIS

Participatory GIS (PGIS) and public participation GIS (PPGIS) are examples of practices that have emerged as a result of interest in critical GIS. Participatory GIS is the practice of involving people in using geospatial information and technologies in order for researchers to represent their spatial knowledge, beliefs, and perceptions (Abbot et al. 1998; Chambers 2006; McCall 2003; Dunn 2007). PPGIS is the practice of teaching people GIS at the local level in order to encourage knowledge production by local people themselves (Elwood 2006b). There is a geographical divide associated with these terms: according to Panek (2011), "PPGIS refers mainly to the activities more often practiced by 'the public' in the Global North countries, while PGIS refers more often to the activities practiced in the Global South countries" (pg. 236).

Both are claimed to empower people through means of technological education, access to information, collaboration, and increased decision-making power on community issues (Harris and Weiner 1998) such as public health, safety, and management. There is a lack of research on the use of these methods concerning gender issues in agricultural contexts. At the same time, these methods are still being argued and critiqued to determine if they are more top-down or bottom-up (Elwood 2006a). Our research argues that incorporating GIS with additional qualitative and participatory methods can help position GIS in the bottom-up category.

PGIS and PPGIS do not have defined methodologies in geographical research due to their innovation and openness to a diverse set of tools (Elwood 2006a; Abbot et al. 1998). Our

research contributes to critical GIS and PGIS in understanding how the combination of participatory and geospatial methods is a complex and not easily defined package with defined margins. Thus, it provides room for methods that may be appropriate for PGIS/PPGIS but also contradict them. For example, we incorporate geospatial technologies such as satellite imagery and GPS mapping with participatory methods such as participatory mapping and field visits. Local perceptions were obtained using geospatial methods, as is the case with both PGIS and PPGIS. However, the participants did not learn the technologies or produce their own maps or geospatial digital data, as is usually implied in PPGIS (Abbot et al. 1998). While both PGIS and PPGIS usually focus on the inclusions and exclusions of people and knowledge in GIS (Elwood 2006b), this research explores the inclusions and exclusions of GIS in studying people and knowledge. This leads us to another mixed methods approach, qualitative GIS (QGIS), resulting from discussions about the limitations and contradictions in GIS.

2.4 Qualitative GIS

Through the combination of participatory and geospatial methods, qualitative GIS has emerged as a new subfield in geography. It is defined as a mixed method approach that allows researchers to use the strengths of qualitative data such as rich, local, and gendered information, and integrate it with the strengths of GIS, such as its ability to visualize and layer relevant information, while providing quantitative and spatial information (Cope and Elwood 2009). Contextual data, interpretations, and situated knowledges constitute the "qualitative" in qualitative GIS. As a response to critical GIS, qualitative GIS combines approaches from feminist political ecology and feminist geography by integrating mixed methods to characterizing multiple forms of knowledge in a GIS (Cope and Elwood 2009).

While some researchers and scholars believe GIS lacks, and cannot incorporate, qualitative data, others believed it is a powerful tool that could represent knowledges, beliefs, experiences, and perceptions (Kwan 2002a; McLafferty 2002; Rocheleau 1995). Kwan has shown that while many GIS users think they are limited to the tools, algorithms, and datasets that come with the software, it is in fact possible to use original datasets and self-created tools. For instance, she has visualized women's life paths by incorporating data from their daily journals in a space-time 3D image. Kwan (2002) argues that despite the quantitative nature of many data sets, in GIS they can be transformed into various types of visual representations such as 3D images which can allow a "more interpretive mode of analysis." This leaves room for the potential to integrate images, numbers, and words to make a contextual narrative through cartography and geography. By incorporating data exploration, layering, and representation (McLafferty 2005) it is possible to visualize local knowledge in multiple contexts in a GIS.

QGIS is creating a greater recognition of local and situated knowledge among geographers (Cope and Elwood 2009; Bosak and Schroeder 2005; McKinnon 2001) since it provides the opportunity to combine qualitative information with quantitative interfaces. For example, in order to acquire local knowledge of the landscape, participatory research methods are the most appropriate. They require collaboration between the researchers and stakeholders and recognition of local contexts such as language (Cornwall and Jewkes 1995). Participatory methods focus on local knowledge and perceptions that might otherwise be overlooked and thus affect the development outcomes (Rocheleau et al. 1996b). However, they do have limitations. Problems with participatory methods include difficulty in quantifying and measuring information; location and spatial information of this knowledge is usually not considered; and data is not easily encoded to allow comparisons across sites and time. Furthermore, qualitative

information gained from participatory methods tends to have associated stigmas. For example, qualitative information has been described as scientifically inferior, biased, and non-rational (Pavlovskaya 2006). By incorporating a quantitative dimension in the research strategy, qualitative data—such as local knowledge— could gain more legitimacy in mainstream geography. In order to visualize, analyze, and represent people and their knowledge and space, data should be obtained through qualitative, participatory, and bottom-up approaches, and then applied to multiple spatial and temporal scales in a GIS (Mbile et al. 2003). In other words, this approach accepts the partiality of methods and knowledge and attempts to produce a holistic picture by incorporating both local and scientific knowledges.

2.5 GIS in Qualitative Research

Despite some human geographers' interest in QGIS (Kwan 2002a; Cope and Elwood 2009; McLafferty 2005; Pavlovskaya 2006), its implications and outputs are yet to be fully understood. Re-visualizing maps and thinking of them as subjective and situated is a challenge for many geographers, particularly those using GIS. According to McLafferty (2005, pg. 39), "The US Census Bureau's first GIS was developed primarily to facilitate collection and reporting of census data, rather than as a tool for understanding the census population." Pavlovskaya (2006) says we need to see how visualization can be used for analysis rather than to formulate conclusions. Using GIS in social research as a tool for understanding and describing a population will help reveal the multiple landscapes and knowledges as well as reducing the assumptions of accuracy and biases in geographical research (Pavlovskaya 2006; Openshaw 1998). This research found that using GIS in qualitative research allowed us to analyze soil knowledge and perceptions concerning gender and space while providing the opportunity to give back to the

farmers in the forms of geographic information of their farms, maps displaying their gendered soil perceptions, and soils analyses results.

Can GIS be used to deconstruct its assumed establishment of power that John Pickles associates with it in *Ground Truth* (1994)? In order to do this, qualitative GIS must challenge the existing state of GIS and use it to transform knowledge itself. Drawing from feminist perspectives and critical GIS, accepting partiality in knowledge production, and redefining the relationship between the researcher and the researched is possible by incorporating participatory methods and qualitative information into GIS (Kwan 2002a; Pavlovskaya and Martin 2007). This reflexivity is important when discussing qualitative GIS because of the varying levels of interaction between the researcher, the researched, and the data creation, use, and representation (Cope and Elwood 2009). While this may make research more complex, sometimes it is necessary to "complicate in order to clarify" (Rocheleau 2012).

Building on this reflexivity, our research aims to contribute to the QGIS literature by bringing yet another perspective to this new field. While much of QGIS focuses on incorporating qualitative, social, and local data into GIS (Cope and Elwood 2009), this research emphasizes incorporating GIS into social, qualitative research. In other words, we should focus not only on how social research can fit into GIS, but also seek to understand how GIS can better fit into human geography that stresses people's perceptions of soils and space rather than the actual physical characteristics of the landscape. For example, this research found gendered differences in ways farmers interpreted satellite imagery which ultimately influenced our conclusions of their spatial knowledge. Regardless of whether this is QGIS or simply using GIS in social science and humanistic research, it is important to understand the implications of using GIS for

development projects and stakeholders, and deconstruct its supposedly fixed position in quantitative science by revealing qualitative conclusions derived from GIS.

This research demonstrates how a feminist political ecology framework and mixed methodologies can serve to understand gender-based constraints and opportunities of CAPS. We do this by exploring the link between gendered knowledge, access to resources, and agricultural practices on the one hand and men's and women's traditional roles in the household, the farming landscape, and political constraints on the other. From this perspective and by integrating GIS with gender research and participatory methods, we can visually represent farmers' interests, priorities, and needs and associate those with specific locations and areas (Schuurman 2002). This allows researchers and research subjects to better understand social and environmental issues as well as diverse perceptions of space and place.

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Chapter 3: Using Qualitative Geographic Information Systems to Explore Gendered Dimensions for Conservation Agriculture Production Systems in the Philippines: A Mixed Methods Approach

Abstract

This research identifies gender-based constraints and opportunities for the adoption of conservation agriculture production systems (CAPS) based on a case-study with smallholder farmers in two villages in Misamis Oriental, Philippines. We explore gendered soil knowledge and perceptions, access to resources, and agricultural practices in the context of food security and soil conservation. Our approach combines qualitative and quantitative methods such as focus group discussions, household interviews, participatory mapping, and GPS mapping. We found that men and women have gendered soil perceptions which are linked to topography, gender roles, and access to assets. These could have implications for whether men and women adopt conservation agriculture. We also demonstrate the importance of combining geospatial techniques and participatory methods for gender research in a development context. Much of the qualitative GIS literature focuses on incorporating qualitative data into a GIS, yet we argue it is important to incorporate geospatial tools into qualitative, participatory research to understand the spatiality of people's perceptions, practices, and resources.

3.1 Introduction

Degraded landscapes and unsustainable agricultural practices, prevalent throughout the world, heighten food insecurity and poverty rates (FAO 2011). Smallholder farmers are especially vulnerable to food insecurity and more likely to practice unsustainable agricultural systems (Barrett 2002). In response, agriculture development programs have established conservation agriculture principles and practices that aim to reverse these trends. Yet, changes in farming systems can have different impacts on men's and women's time, resources, and labor

input, particularly in smallholder households. Despite the fact women make up nearly half the agricultural labor force, in many developing countries, their roles in farming communities go unnoticed and they are less likely to participate in trainings and extension services (World Bank 2009; FAO 2011). It is necessary for development programs to understand women's perceptions, priorities, and concerns because these may differ from men's. In order to promote adoption and achieve sustainable outcomes, these programs must take into account the ways in which gender relations influence a program and how a program's activities influence gender relations. Combining geospatial methods with more traditional and participatory social science fieldwork can contribute to understanding the role of gender in adopting development activities.

3.1.1 Introduction of Conservation Agriculture Production Systems (CAPS)

Conservation agriculture production systems (CAPS) have been proposed by development researchers as a means to increase agricultural productivity, food security, and soil quality according to the FAO. It is made up of three components: 1) maintaining year-round crop-cover, including intercrops or mulch from previous crops; 2) minimizing soil disturbance by exercising no or minimum tillage, where the farmer does not turn the soil over, thereby keeping the soil structure the same and reducing erosion; and 3) diversifying crop rotations by including adapted and appropriate crops to maintain biodiversity, contribute nitrogen, and avoid pest infestations.

The potential of CAPS to address various problems in farming is great (Hobbs 2007; Hobbs et al. 2008; Kassam et al. 2009; Knowler and Bradshaw 2007). Improved soil quality can lead to increased yields and incomes. Labor burdens and time between harvests can be reduced in the long-term (Knowler and Bradshaw 2007; Kassam et al. 2009). CAPS have also demonstrated resilience to climate variability due to the higher soil infiltration, which minimizes

the impacts of flooding and erosion (Hobbs et al. 2008). Along with these benefits, CAPS can increase the overall sustainability of land and enhance the future of smallholder farmers by providing food security in developing countries.

There are costs and constraints to CAPS adoption, however. Government subsidies are major reasons farmers adopt CAPS; these can result in dependent farmers who lack the knowledge and appropriate practices of the components (Giller 2009). Many farmers do not have access to the machinery required for planting, training to learn the techniques, or the inputs required in early stages such as herbicides and pesticides. Labor constraints could result from the increased presence of weeds in the first several years of adoption. Short-term benefits have also been argued to be variable (Giller 2009) and there are mixed findings of whether CAPS is economically viable and socially acceptable (Reyes 2009). Much of the CAPS research reports a major constraint to be the "resilient mindset" of farmers, extension agents, and researchers that tillage is necessary in farming (Reyes 2009; Derpsch and Benites 2003).

In 2009, it was estimated that 206 million hectares of arable crops were grown under CA (Kassam et al. 2009). Generally, communities that have high institutional support, supply chain service providers, and those with extreme and sudden environmental degradation issues have adopted CAPS (Derpsch and Benites 2003). Promotion using long-term economic determinants such as increased profits and yields is also one strategy for adoption. However, Southeast Asia has seen only marginal adoption in part because its main crop, rice, is grown under a tillage system (Kassam et al. 2009). Furthermore, there is little research on how CAPS impacts smallholder farmers in this region environmentally, agriculturally, economically, and socially. There is also a need for more research on the gender-based constraints and opportunities for CAPS adoption for smallholder farmers in the Philippines. By addressing the gendered

determinants of smallholder farmers in a region with marginal adoption, we have found new methods and topics to contribute to the CAPS literature such as the importance of integrating participatory and geospatial techniques and the importance of understanding local plant knowledge.

The Sustainable Agricultural Natural Resource Management Collaborative Research Support Program (SANREM CRSP) funded by the U. S. Agency for International Development (USAID)[3] has been carrying out agricultural research in the Philippines since 1994. Beginning in 2009, it has worked in Claveria with a focus on conservation agriculture productions systems (CAPS). In partnership with the International Centre for Research on Agroforestry (ICRAF), SANREM works with 15 households or "cooperators" in Claveria by implementing CAPS experiments for permanent adoption. SANREM CRSP is working in 13 other countries with the goal of learning general lessons from the specific experiences on the ground. Social factors must be considered for successful adoption and implementation of CAPS; therefore, the project must consider the implications of gender relations.

In the Philippines, farmer participation in research for development activities has often been "superficial" and has not led to "meaningful incorporation" of farmer perspectives (Fujisaka 1988). Many times, development efforts in the Philippines, as in many other countries, have neglected to include women or increased their workload (Sobritchea 2005; Magcale-Macandog et al. 2010). One of SANREM's research initiatives seeks to identify gender-based

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constraints and opportunities relevant to CAPS through a case study-based research program that collaborates with individual regional programs in SANREM CRSP[4].

3.1.2 Objectives and Research Questions

The objectives for this research were to identify gender-based constraints and opportunities relevant to conservation agriculture production systems. We asked the following research questions: do men and women have different soil knowledge and perceptions, access to resources, and agricultural practices in our research? If so, how can the combination of participatory methods and geospatial techniques serve to document these in relation to conservation agriculture production systems? Seeking to identify the gendered implications of conservation agriculture, we used the Gender Dimensions Framework (GDF) (Rubin et al. 2009). The GDF was developed to use with USAID value chain projects and address research conditions in a gender equitable manner. This framework has allowed researchers to explore gender relations and identify the gender-based constraints and opportunities that may affect adoption of development activities. The GDF has four overlapping categories: 1) access to and control over resources; 2) knowledge, beliefs and perceptions; 3) practices and participation; 4) laws, legal rights, and institutions. The dimensions overlap and also include the cross-cutting dimension of power. We used this framework to develop the research questions and activities.

This research explored how the combination of participatory and geospatial methods can contribute to a better understanding of gender issues in CAPS. This mixed methods approach has been frequently implemented in urban community planning projects with much of the research being limited to the United States. There is lack of research on how geospatial methods can

[4] This paper is the result of our work with a SANREM CRSP project in the Philippines led by the North Carolina Agricultural and Technical State University in collaboration with host institutions University of Los Baños and International Centre for Research in Agroforestry (ICRAF).

contribute to social research specifically in rural, international scenarios that incorporate gender and development, and concepts such as CAPS. We hope to demonstrate that a mixed methods approach in geographic and development research is effective in addressing food insecurity, soil erosion, gender issues, and conservation agriculture in an international development context.

3.2 Literature Review

To contribute to the fields of gender and development, and mixed methods in geography, this study draws on previous research from feminist political ecology (FPE), critical GIS, participatory GIS (PGIS), and qualitative GIS. FPE is the study of how gender relations influence or are influenced by ecological and/or political landscapes, particularly in the context of development (Rocheleau et al. 1996b; Rocheleau et al. 1996a). The three areas of GIS contribute to the exploration of a mixed methodology for carrying out gender research that involves local knowledge, access to resources, and agricultural practices. These gender dimensions have a spatial component in the FPE literature with layers of information that cannot be exposed through a single method.

FPE explores how men's and women's social roles impact land management, resource use, and livelihood strategies. Gender refers to the social constructions of what is expected of, allowed, and valued in a man or woman in a given culture, context, time, and/or location. From FPE, this research draws on the emphasis of gendered knowledge, access to resources, gendered space, and everyday life. Gendered and local knowledge are important in determining men's and women's different roles, priorities, practices, and decision-making processes in the context of environmental issues and changes (Rocheleau et al. 1996b, Udry 1996, Mohanty 2003, Momsen 2010). FPE argues that access to resources is gendered, as well as the rights to and responsibilities over resource production and maintenance (Rocheleau, Thomas-Slayter and

Wangari 1996a), with women's access being indirect and less independent (Rocheleau and Edmunds 1997). Access is the ability to use, participate, and benefit from a resource; control is the power and/or ownership of a resource; and labor is the work put forth by a certain person in utilizing that resource. Men and women also have access to, control of, and provide labor for difference spaces which create gendered knowledge, experiences, and resources. One of the feminist theories of knowledge related to gender and everyday life is rooted in Donna Haraway's idea that knowledge is situated (Haraway 1988). In other words, all knowledge is "situated" differently according to a person's specific position in society, e.g., his or her environment, culture, gender, race, and class. Our focus on everyday life allows us to explore people's knowledge and recognize that it represents valid reality, though it is necessarily subjective and partial (Harding 1986, Rocheleau and Edmunds 1997, Nightingale 2003, and Mohanty 2003). These topics in FPE highlight the importance of including both men and women in development research as well as increasing women's visibility in natural resource management. In doing so, there is the potential to increase gender equity in development projects and in resource-rich communities.

FPE utilizes gendered resource mapping and mixed methods in attempts to holistically address gendered resources, space, and multiple knowledges (Rocheleau et al 1995, Rocheleau 1995) in the context of development. Gendered resource mapping is a type of participatory mapping that has helped researchers and community members design land use systems that include local knowledge and conservation issues in development projects (Rocheleau 1995, Abbott et al. 1998). At the same time, criticisms of participatory mapping in general, include the exclusion of women's spaces and knowledge, the information does not easily communicate to policy makers, and that it is difficult to maintain the specificity of the information while making

general conclusions (Rocheleau et al. 1995, Chambers 2006). Furthermore, qualitative data gained from participatory methods have been described as scientifically inferior, biased, and non-rational (Pavlovskaya 2006). Yet, as described in feminist theories of knowledge, science and technology cannot be truly objective because they are based on interpretations, on different ways of knowing, and/or cultural values (Haraway 1987, Rocheleau 1995, Nightingale 2003). While certain feminist theories of knowledge focus on people's impact on technology, another aspect contributes to the impacts of technology and science on studying people and their lives by incorporating critical theory (Harvey et al. 2005). Starting from the premise that knowledge is situated, this research explores the everyday lives and gendered knowledges of smallholder farmers using both social and scientific methods and links those to development issues. We turned to critical GIS to better understand how spatial technologies impact social research and local stakeholders.

One response from geographers to criticisms of participatory mapping was the incorporation of geospatial methods such as GPS mapping, remote sensing information, and GIS analysis (Ismail 1999; Kwan 2002a; Pratt and Schuurman 2002). Since gender, knowledge, and practices all have spatial components, these geospatial methods can be used to better understand these in the context of our research. Feminist theorists have played a major role in bringing a social theory lens – specifically critical analysis and essentialism—to questioning technologies and methodologies (Schuurman 2002). Since this research incorporated geospatial tools and methods, we turned to critical GIS to understand the role these would play in a mixed methods approach and their influence on stakeholders' participation and representation. Critical GIS explores how GIS was characterized in the past, how it has been reconstructed to avoid

essentializing; it can expose the subjectivity and power relations in geospatial methods and tools (Pratt and Schuurman 2002; Harvey et al. 2005).

In the 1990s, GIS was considered positivist, empirical, and strictly quantitative. Policies and practices in GIS have been described as unethical, "top-down," and having a "god's eye view" that blurs realities and subjectivities on the ground (Pickles 1995; Kwan 2002a; Pratt and Schuurman 2002; Elwood 2006b; Haraway 1991). Yet in the last decade, feminist geographers and other researchers argued against essentializing GIS as a fixed method and tool that is not compatible with social research (McLafferty 2005). Calling for a mixed methods approach that incorporates GIS with participatory, qualitative methods, these same scholars argued that it was possible to empower people and overcome GIS biases and criticisms by revealing the subjectivity in maps and by including and legitimizing local knowledge in maps (Rocheleau 1995, McLafferty 2002, Kwan 2002a). By utilizing mixed methods, researchers can capture multiple perspectives and findings since no one method or data type can produce a full picture of the research situation. In addition, incorporating case study and qualitative data into GIS can add meaning, relevance, and usefulness to spatial data.

As a result of interest in critical GIS, different types of methods have emerged such as participatory GIS (PGIS) and public participation GIS (PPGIS). These methods involve local people in either learning or contributing geospatial information on community issues (Abbot et al. 1998; Chambers 2006; McCall 2003; Dunn 2007; Elwood 2006a). Another is qualitative GIS, a mixed methods approach that integrates qualitative data such as local knowledge, perceptions, and experiences with GIS (Cope and Elwood 2009). These methods have been associated with creating a greater recognition of local and situated knowledge among geographers since they provide the opportunity to combine qualitative information with quantitative interfaces (Cope

and Elwood 2009; Bosak and Schroeder 2005; McKinnon 2001). Despite some human geographers' interest in qualitative GIS (Kwan 2002a; Cope and Elwood 2009; McLafferty 2005; Pavlovskaya 2006), its implications and outputs are yet to be fully understood.

The mixed methods above usually focus on how GIS includes and/or excludes people and knowledge (Elwood 2006b). Our research explores how studies of people and knowledge can include GIS. Re-visualizing maps and thinking of them as subjective and situated is a challenge for many geographers, particularly those using GIS. Pavlovskaya (2006) says we need to see how visualization in maps can be used for analysis rather than to formulate conclusions about certain populations. Using GIS in social research as a tool for understanding and describing a population will help reveal the multiple landscapes and knowledges as well as reduce the political assumptions of accuracy and biases in geographical research (Pavlovskaya 2006; Openshaw 1998).

Can GIS be used to deconstruct its assumed establishment of power described by John Pickles in *Ground Truth* (1995)? To do so, qualitative GIS must challenge the existing state of GIS and use it to transform knowledge itself. Drawing from feminist perspectives and critical GIS, accepting partiality in knowledge production, and redefining the relationship between the researcher and the researched is possible by incorporating participatory methods and qualitative information with GIS (Kwan 2002a; Pavlovskaya and Martin 2007). This reflexivity is important when discussing qualitative GIS because of the varying levels of interaction between the researcher, the researched, and the data creation, use, and representation (Cope and Elwood 2009). While this may make research more complex, sometimes it is necessary to "complicate in order to clarify" (Rocheleau 2012).

Building on this reflexivity, this research aims to contribute to the qualitative GIS literature by bringing yet another perspective to this new field. While we do incorporate qualitative, social, and local data into GIS (Cope and Elwood 2009), our research emphasizes the reverse—the integration of GIS into social, qualitative research. For example, we incorporated men's and women's soil perceptions in GIS, but we also integrated satellite imagery interpretation and GPS mapping with participatory methods that revealed gendered relations during the process of these activities. By revealing qualitative conclusions derived from these methods it is possible to deconstruct GIS's supposedly fixed position in quantitative science, as well as increase our understanding of the implications of using geospatial methods for development projects and stakeholders.

This paper will demonstrate how a feminist political ecology framework and mixed methodologies can serve to understand gendered-based constraints and opportunities of CAPS. We do this by exploring the link between gendered knowledge, access to resources, and agricultural practices and men's and women's traditional roles in the household and the farming landscape. From this perspective and by integrating GIS with gender research and participatory methods, we can visually represent farmers' interests, priorities, and needs and associate those with specific locations and areas (Schuurman 2002). This approach allows researchers and research subjects to better understand social and environmental issues as well as diverse perceptions of space and place.

3.3 Study Site and Methodology

Our study site is in Claveria, a land-locked municipality in the province of Misamis Oriental in northern Mindanao, Philippines. Claveria consists of 24 barangays, or villages. Two of these were selected for this research: Rizal and Patrocenio (Fig. 1). These two villages met our

criteria for site selection: 1) safety; 2) accessibility; 3) relevance (agricultural community); 4) average farm size (<1 acre); and 5) availability of secondary GIS data, particularly satellite imagery with little cloud cover. These areas lie on a rolling plateau with elevations ranging from 350-950 meters above sea level. Claveria suffers from degraded landscapes due to soil erosion and poverty (Reyes 2009). The soils are classified as acidic upland soils and the average soil erosion rate is 200-350 mg ha-1 annually (Mercado et al. 2010). Despite poor soils, this area is a community of smallholder farmers that practice both commercial and subsistence farming. The dominant crops are maize, upland rice, sweet potato, vegetables, and cassava. Soil conservation methods we observed in these villages include contour farming and agroforestry, yet these were not generally practiced by participants in this research.

The population for this study consists of smallholder farmers in the two villages. The local population primarily speaks Bisaya and their main economic activity is farming. Based on a survey conducted by the Claveria Municipal Nutrition Action Office in 2011, Rizal has a population of 1,053 with 220 households; of these, 183 listed "farming" as their primary livelihood activity. The village of Patrocenio has a population of 3,504 with 746 households. Of those, 316 listed "farming" as their primary livelihood activity. According to Reyes (2009), "farmers are generally poor with 60% of the households earning below food threshold level (pg. 7)." The two villages do not have paved roads, and have limited access to potable water and electricity. ICRAF and SANREM CRSP have identified this population as being interested in change and opportunities that can improve their lives in both agricultural contexts and in gender awareness (Reyes 2009; Christie 2010).

3.3.1 Field Methods

Fieldwork took place primarily during three visits to the Philippines: one week in February 2012 to pretest the methodology and carry out preliminary research; seven weeks in July and August of 2012 for the bulk of the activities; and one week in January 2013 for restitution and validation of results. In addition, a technician from the local team finished collecting soil samples in September of 2012. We employed both qualitative and quantitative methods consisting primarily of a series of exercises during focus group discussions (FGD), household interviews, and visits to the farmers' fields. Before beginning the fieldwork, we introduced ourselves and the research to the village leaders and barangay council members and obtained informed consent to conduct research in their community.

There were 83 participants in this research, 40 from Rizal and 43 from Patrocenio. The people involved in the FGDs were different from those in the household interviews (Table 1).

Table 1: Number of participants by gender and method

	Men	Women	**Total**
Focus Group Discussions	21	26	**47**
Household Interviews	18	18	**36**
Total	**39**	**44**	**83**

We interviewed people from a total of 19 households. Seventeen of those households included one adult male and one adult female—both of whom we interviewed. The other two included one widow and one widower. Nine of the households were in Rizal and 10 were in Patrocenio. The different samples allowed us to use some of the same exercises in the FGDs and in the household interviews. One key informant interview with the leader of a women's association and one day of participant observation on a farm helped provide context and answer questions that came up during the main research activities.

Participants were selected through different sampling methods for the FGDs and the household interviews. The participants for the FGDs were selected using a convenient method (Marshall 1996). ICRAF delivered 24 letters of invitation to each of the two barangay halls for their distribution. While it was useful for recruitment, this method introduced bias into this sample. For the household interviews, we first obtained a list of the population from the Claveria Municipal Nutrition Action Office and randomized the names in Excel. Then, with the assistance of barangay staff and going down the list one name at a time, we stratified the sample to eliminate anyone who did not meet the following criteria: they were a smallholder farmer; they owned land (even if they were also hired labor); they were married with an adult man and woman in the household (except for the widow and widower which we purposely selected); they were not at one of our FGDs; and they did not previously participate in any SANREM activities. The barangay officials escorted us to the farmer's homes to introduce us, which helped reduce suspicion and increase the likelihood of farmers' participation.

In addition, our local support team played a crucial role and helped with the FGD in the roles of facilitators, note-takers, and observers. They also helped with interpretation, note-taking, and transcription of the household visits. Besides helping bridge linguistic and cultural barriers, their familiarity with the research population created a friendly and welcoming atmosphere for our repeated visits.

At the beginning of the FGDs, we explained the term "gender" and put it in their local context. Then we split the participants into gender-segregated groups to begin the discussion and activities. The FGDs consisted of two parts, one regarding local soil knowledge, beliefs, and perceptions and the other community practices. The first part of the FGD took three hours and consisted of a "what is soil?" exercise; descriptions of local soil samples; listing local soil quality

indicators; listing different community soils; and mapping these on a satellite image. In the second part of the FGD, farmers worked with the facilitators to develop a chart of socio-economic activities and a timeline of changes relevant to agriculture and gender. This second part of the FGD took approximately two hours.

The household interviews began with the collection of demographic information and farming history, and continued with the following: a photo interpretation exercise; description of local soil samples; participatory mapping; listing soils on the participants' farm; mapping household and community soils on a satellite image; and describing changes in climate and agricultural practices. These tasks took two to four hours. During the field visit, the farmers took us to their farm where we made area calculations of the farm boundary and the plots the men and women said contained their "best" and "worst" soils. We also took GPS point of the house and path to the field. Field visits took between one and two hours, depending on the distance from the house to the field. These also provided an opportunity to engage farmers in conversations about their farm in *situ*.

Focus Group Discussions

The FGDs were carried out by a team consisting of a facilitator, note taker, and observer for both the men's and the women's group. Women facilitated the women's FGDs and men facilitated the men's. For the FGDs, we requested an equal number of men and women, with a maximum of 10 for each group. Most of the participants, in addition to being farmers, had other occupations, such as healthcare workers, barangay officials, and teachers. Their status and higher levels of education compared to the household participants could explain discrepancies between the two. Both villages were very active in contributing information but the women were much

more outspoken than the men; gender-disaggregated FGDs created a space for both genders to speak more freely.

The FGD in Rizal took place in the barangay hall, which is a one-room government office where governmental proceedings take place. While 12 men and 12 women were invited, eight men and 15 women attended. The reason for low attendance of men and high attendance of women was explained by several women participants: due to the timing of the FGD (weekday at 9:00 am) the men were not able to attend because they needed to stay on the farm and they decided to send their wives in their place.

The first FGD in Patrocenio was conducted in February 2012 at the SANREM CRSP research site in the village of Bug-Ong. Thirteen men and 11 women attended the first part and six men and 11 women attended the second part in July. The activities were conducted as part of the pretesting of methodology. The second FGD took place in July 2012 with the same participants from the first FGD. It took place in the barangay hall and the schoolhouse located right behind the hall. Using separate venues was an adjustment from the FGD in Rizal where a couple of team members were concerned about the close proximity of the men and women when conducting the activities due to the potential of the groups hearing each other's answers. This was important to address since we did not want one group to influence the other. After introductions, the men stayed in the barangay hall and the women moved to the schoolhouse where they completed the second part of the FGD.

At the conclusion of activities, the men and women presented their work to one another. These activities provided an opportunity for discussion about local soils, agricultural practices, access to resources, and gender relations. They also provided better insight into the farmers' everyday lives and contributed to the fieldwork that followed.

A final FGD was conducted in January of 2013 with the participants of the household interviews, most of whom reported never having been in a FGD before. The goal was to provide restitution to the farmers and team involved during the July-August 2012 fieldwork. This included presenting findings from the household interviews to ground-truth results and providing the soil analysis results and Google Earth maps with the GPS data of the house and farm. Additional questions were asked of the participants in gender-segregated groups subsequent to the household interviews. In addition, ICRAF made several presentations on CAPS and distributed seeds to the farmers to test new crop covers. (See Appendix A for a full description of FGDs activities.)

Household Interviews

A total of 36 semi-structured interviews were conducted with participants ranging from 30-72 years for women and 33-77 years for men. There was not a great difference in education levels between the men and women but, overall, the women participants were more educated than the men. All except one woman had at least five years of elementary education, with five having completed the second or third year of high school; three graduated high school; and two entered college level. For the men, all but three had graduated elementary school, while two made it to the second year of high school, and seven graduated from high school.

The household interviews began by asking the participants for basic demographic information (age, education, number of children, etc.) and asking about their farming history. Next, we showed the participants two photos for them to describe: a local man furrowing his land with a cow and a picture of a chicken in a field of grass. Next, the farmers did the same soil sample description exercise as in the FGDs. After the soil sample discussion, we asked the farmers to draw a map showing resources and activities on their farm that they need for their

livelihood. Afterward, we asked whether the husband or wife has access to, control over, and provides labor for each resource they had drawn. We also asked them to draw in the map where they grow food, and asked questions about agricultural practices, animals, and soils associated with those spaces.

Finally, we showed the farmers a printed Google Earth satellite image of their household and farm. We asked them if there were different soil types around their home and, if so, to draw them on the map. Originally, we wanted the farmers to draw the soils from their participatory map onto the satellite image, but we didn't anticipate the fact that some of the farms are not located near the households and, thus, sometimes the farms were not included in the image. As a result, we used this exercise to document their local soil knowledge and perceptions in the community. Unfortunately, this method was not always convenient or useful because, in a couple of instances, when we first approached a farmer to set up an interview, they wanted to do it immediately and we did not have the opportunity to print a satellite image of their farm beforehand. In addition, some of the images were of poor quality and some of the participants did not have good eyesight and therefore had difficulty discerning landmarks and soil locations on the image. (See Appendix B for a full description of household interview activities.)

Visits to the farmers' fields

After the household interviews, we asked the participants if we could visit their farm. The plan was to go with the husband and wife separately but this was not always possible because some couples were more comfortable going there together. We were able to successfully complete the field visits with all the households except one— that household had recently rented their property to someone else and the renters did not allow us on the property.

At the beginning of the field visits we obtained area calculations of the entire farm using a hand-held GPS unit (Garmin 62 series). In almost every instance, the husband was the one who walked the boundary. Next, we calculated the areas of the best and worst soils that the husband and wife had chosen during the household interview. Our original plan was to have the husband and wife each walk the boundaries with us, separately from their spouse, in an attempt to gain the husband's and wife's perceptions without any influence from the other. We were able to achieve this in six households. In five households, both the husband and wife went to the field visit with us together; and, in another five households, the husband was the only spouse to visit the field with us because the wife was not able to leave the house or business.

3.3.2 Data Analysis

Qualitative Analysis

The data for the FGDs was obtained through flip chart pages that contained the farmer's responses and work, as well as written reports containing notes and observations by each team member. Using Microsoft Word, the responses from each exercise were incorporated into charts and disaggregated by village and gender. This allowed us to analyze the data by comparing the responses of men and women from each village by each exercise in the FGD and determine the similarities and differences.

For the household interviews, notes were typed by all team members every day after fieldwork. The notes included answers to the interview questions, participatory mapping observations, and field visit observations. In addition, interviews were recorded and later translated and transcribed for accuracy. Answers to the interview questions were typed into an Excel spreadsheet with the first row distinguishing the questions and the first column identifying

the participant by code[5]. Other notes, conversations, and answers that were relevant but did not pertain to interview questions were added to the chart under a "notes" column. The answers were then put in charts based on question and activity, and separated by gender response. We then compared responses by gender to determine major patterns from a qualitative perspective. Once the data were analyzed, they were categorized based on the GDF components and analyzed as either gender-based constraints or opportunities for CAPS adoption discussed in CAPS literature.

QGIS analysis

To analyze the geospatial data from the household interviews and FGDs, we incorporated photos of the FGD maps and household satellite maps into Google Earth and GIS. In Google Earth, we geo-referenced the photos and digitized each polygon in each map using the photo overlay tool. The polygons were saved as kml files and opened in ArcMap 10. Using the KML to Layer tool in the conversion tools, the kml files were converted to a layer file and displayed the placemarks file from the geodatabase layer that was created. Then the placemarks files were exported to obtain the shapefiles. The polygons were then merged based on gender and village for the FGD maps, and based on household and village for the household field visits. Maps were created to layer the men's and women's local community soils drawn during the FGDs, particularly the names of the soils and the best and worst soils, both distinguishable by gender.

The GPS data from the field visits were imported into Google Earth and Arcmap 10 using the same procedure described previously. Maps were created to display the soils labeled by household, spouse, and whether it was designated as best or worst soil. These were then analyzed qualitatively by visually observing similarities and differences between other attributes such as

[5] This was in accordance with Virginia Tech's Institutional Review Board requirements to ensure anonymity, confidentiality, and privacy for all participants.

soil locations; land use; soil names, and soil quality indicators. All of these were also analyzed by gender.

3.4 Results

This research found that access to resources, agricultural practices, and soil perceptions are gendered in Claveria. Men and women have different access to resources, particularly land and trainings. There is a gendered division of labor in this region with men mainly working in the farm and women mainly working in the household, yet women play a crucial role in the farming household. Topography influences gender roles, agricultural practices, and soil perceptions. While there are differences in men's and women's soils knowledge and perceptions, there are some interesting similarities that should be considered such as plant growth and location of best soils.

3.4.1 Access to Resources

Land

In our sample, women do not own land as often as men. Women generally obtain or access land through their husbands. There were four different ways people claimed to access land in our sample: 1) inheriting from either the husband's or wife's parents; 2) "mortgaging;"[6] 3) cultivating family or friends' land with permission; or 4) applying for land through the Certificate of Land Ownership (CLO) Program. In eight of the households the land was inherited from the husband's parents. Five applied for land from the CLO program. Four obtained it through family or friends and two inherited it from the wife's parents. Of the households that inherited land from the husband's parents, half of the wives said they did not own land. For those

[6] An informal land agreement where a farmer pays a specific sum for land from a landowner for a certain amount of time such as 1-5 years. When the agreement "expires" the landowner must repay the renter the amount paid during time on the land. If the owner cannot pay, the farmer can continue to farm on the land until they are reimbursed by the owner.

that applied to the CLO program, the husband was the one who applied for the land. In the case of households that accrued land through family and friends, it was the husband's family or friend that gave them land. Finally, of the households that inherited land through the wife's parents, one was going to put the title in the husband's name. In Claveria, when a woman inherits land, the title usually goes in the husband's name because he is considered head of the household. As a result, women lose their rights to the land and their access to this asset is mediated by their relationship to men. One woman farmer said, "It does not matter who inherits or obtains [the land], it goes in one name, and that's usually the husband. I do not own land, but my husband does, so that's how I get land" (July 23, 2013).

Men also have limited access to land, especially pastureland. Most of the farmers said they pasture on their own land. In the two villages we studied, an ordinance had recently been passed which restricts farmers from pasturing on other peoples' land. The motivation behind the ordinance was the farmers' complaints that other people were pasturing animals on their land and the animals had destroyed their crops or eaten all their grass. Some men found this ordinance particularly constraining because they had to reduce their cultivation space to make room for pastureland as well as watch the animals or tie them up so they would not damage crops. They also reported not having enough grass on their own farm and said they needed to start planting it to feed their animals. Though the ordinance was supposed to resolve pastureland issues, the men disclosed that there was ongoing competition and increasing conflict over pastureland within their own farm. According to one male farmer, "We have to pasture on our own land now because of [the ordinance]. I had to cut down on maize and plant grass there. And now the common pastureland has too many cows and no grasses" (July 18, 2013). Women, on the other hand, claimed there were not any changes to pasturing practices. Interestingly, when asked if

they had problems with other people pasturing on their land, most of the men said no, while the women said yes.

In addition to the gendered aspect, access to land is a complicated issue in the Philippines due to its agrarian reform program, migration, and increasing infiltration from foreign interests (Olano 2002). During the timeline exercises, the participants explained that instead of increasing ownership and control of the land, it is now common for farmers to sell, rent, and "finance"[7] their land to wealthier farmers. They claimed, "Farmers become laborers on their own land after selling to the 'capitalist.'"[8] While corporations do not actually own the land, they have gained control through lease agreements in which farmers are given cash advances "equivalent to five years of the annual lease rate" while the corporations use their land for 10-15 years (Olano 2002). Furthermore, when farmers decide to rent their land, the owners give up their land rights to the renters. In other interviews with women farmers, they described the complex, expensive process of obtaining land titles, which includes paying off taxes, having the land surveyed, and applying for approval (which can take up to two years).

Trainings

Women do not have the same access to trainings as men. During the household interviews, we asked the farmers if they ever attend agricultural trainings or seminars. Of the 18 men interviewed, 14 of them claimed they had attended trainings or seminars. Conversely, only four of the 18 women claimed they had attended trainings or seminars; and those women said they attended them in place of their husband. In fact, the final FGD with the household participants, most of the women reported it was the first such event to which they had ever been

[7] Financing a farm involves one farmer supplying the inputs for another farm. The farmer would then be paid back in the form of money or harvest production from the farm to which they supplied inputs.
[8] In this site, farmers refer to 'capitalists' as the wealthy landowners or major fruit companies such as Del Monte and Dole.

invited. This is mainly because the training or seminar hosts invite one person per household, and the head of the household usually attends. In an interview with the leader of the women's association group in Patrocenio, she explained that a woman not attending trainings is a problem in their village: "…the husbands won't let their wives attend any trainings. We have lots of trainings, such as seeds and hog-raising but that is a problem for the husband to let their wives go. Because only one household member should go...but the wives have to stay and care for the children" (August 5, 2012). In addition, most trainings held in the village concern land preparation, which is the men's task on the farm. As a result, women are not encouraged or interested in attending agricultural trainings.

While there are gendered constraints for women attending trainings, distance is a constraint that limits men's, as well as women's, ability to attend trainings. Many times when an agricultural training is to be held for a particular barangay, it is announced through the local barangay hall or center, similar to the way the FGD participants were invited. Those who frequent the centers are invited to and/or learn about the trainings. Those who live even a kilometer away from these barangay centers are less likely to learn of these trainings because it is difficult for them to travel there frequently. This was reported in several households we visited that were some kilometers away from the barangay halls. The men claimed that they "do not get out much because they live so far away" and as a result, are not often invited. By using a random sampling strategy to select household interviews, we overcame the bias that was reflected in our FGD participants.

3.4.2 Practices and Participation

***"Women don't farm"—or do they*?**

In the household interviews and FGDs, we found a gendered division of labor. In addition to farming their own land, men hold positions in the local government as barangay officials and work on other farms as hired-labor. Some women too work as hired labor on farms, but they mainly work in their own businesses which include sari-sari stores (convenience stores run out of their home), restaurants, and healthcare positions (Table 2).

Table 2: Men's and women's source of income outside of farming

	Men	Women
Off-farm labor	11	4
Barangay official	2	0
Sari-sari store	0	4
Medicine/health official	0	2
Food/restaurant	0	1

They are also mainly responsible for the household labor including cooking, cleaning, washing, and taking care of children. This division of labor was linked to the gendered decision-making dynamic. For example, in the participatory mapping exercises, the participants claimed that in addition to labor, women have complete access to and control of the household, but most of the men only had access and no decision-making authority. In contrast, the farmers reported men had full access to and control of the farm, while the women had access, some control, and some provided labor to various plots (Fig. 2-5).

This finding leads us to ask to what extent do women farm. The men rarely gave credit to women's participation on the farm in the FGDs and interviews. In the household interviews when we asked who did certain tasks on the farm, men rarely reported any activities carried out by women. Similarly, in the FGDs, men never listed women as being primarily responsible for

any farming-related activities, though women did. In the interviews, most of the women claimed they work on the farm between 5-6 hours a day and/or 2-4 hours on the weekends, depending on their other responsibilities. Women are likely to spend less time on the farm if they have small children, businesses, unpaid community work, or their house is not located on the farm (Table 3).

Table 3: Women's time on the farm and related factors

HH #	Time on farm	Distance: house to farm (km)	Number of children	Other work
1	8 hours/day (hired labor)	N/A*	9	Domestic tasks; drying corn
2	2-3 hours on weekends	1.21	7	Healthcare official
3	Weekends; 2 hours in the mornings on weekdays	1.13	3	Domestic tasks; marketing
4	8 hours (hired labor)	N/A*	5	Domestic tasks
5	2-3 hours on weekends	0.78	3	Sari-sari store; domestic tasks; marketing
6	5-6 hours/day	0.39	10	Domestic tasks
7	5-6 hours/day	0	5	Medicine distributor; domestic tasks; marketing
8	5-6 hours/day	0.17	2	Domestic tasks
9	7-8 hours/day	0	7	Domestic tasks; gardening; marketing
10	8 hours/day	0.39	5	Domestic tasks; marketing
11	5-6 hours/day	0.56	2	Domestic tasks; marketing
12	2-3 hours on the weekend	1.67	3	Sari-sari store; domestic tasks; marketing
14	3-4 hours/day	0.46	5	Sari-sari store; domestic tasks
15	3-4 hours on the weekend	0	0	Domestic tasks; drying corn; marketing; planting flowers;
16	2-3 hours on weekends	0	6	Sari-Sari Store; domestic tasks
17	5-6 hours/day	0	6	Domestic tasks; gardening; marketing
18	2-3 hours on weekend	0.38	1	Banana-Q business; domestic tasks
19	7-11 hours/day	0.22	9	Domestic tasks; marketing

*Not applicable because hired labor is performed on someone else's farm.

Yet, when we asked the women if they considered themselves farmers, all but one of them said yes. Women reported that when they could farm, they participated in the planting, harvesting, and weeding outside of their other responsibilities. In the FGDs, they listed planting flowers, raising pigs and chickens, bagging, tying, and staking as women's activities. Furthermore, women were involved with marketing and purchasing inputs. Thus, despite the fact that women do not always work in the farm as much as men, they play a crucial role in the farming household. In our observations, we confirmed that women carry out different farm tasks in the field.

According to the farmers, this gendered division of labor benefits the farming household because it compensates for the lack of capital and ensures all the work gets done. Both the men and women reported that their biggest challenge as farmers was "no capital." Many of the men mentioned that they had no choice but to farm because "it is all we know" and there are few other opportunities in the village for men. Both men and women said farming provides a sudden and sizable income at harvest time, which can be every four months or so. They mainly use that money for large investments such as machinery or their children's schooling. At the same time, the women reported in the socioeconomic activity chart that their businesses are non-paid activities because the money earned either pays for their children's school, covers the weekly household needs, is given to family, or paid to their debtors. The household participants claimed businesses allow the women to continue managing the home and taking care of children since the businesses are usually inside or very near the home. Overall, the farmers consider that women's roles as multi-taskers and the men's full time job as farmers complement each other by providing dual incomes and food, and allowing for a productive farming household. One woman said, "If they [women] can engage in business, women can still work and manage the home." One man

said, “If women are in business…daily needs can be sustained because farming takes time before a substantial income, [and] we can make ends meet” (January 26, 2013).

Topography and Livestock

All interviewees and FGD participants reported that men are solely responsible for land preparation activities such as plowing, furrowing, and harrowing. Farmers till their land multiple times for a single planting season and have been doing so for generations. Furthermore, all farmers interviewed believe tilling the land is necessary for good production. One said, “If you do not plow, the soil is hard, the seed won’t grow, and you will fail” (July 16, 2012).

We first learned in the FGDs that farmers mainly use animal tractors such as cows and carabao to prepare the land for planting. This is due to the steep topography of the region that makes tractors unsafe or incapable. For instance, in several plots we visited, the slopes were as steep as 70 percent. These landscapes and managing large animals can make farming difficult because they require a lot of physical strength. The farmers perceive land preparation and other physically demanding activities as “heavy” work. In the FGDs and interviews, farmers reported that “heavy” work is usually men’s responsibility because they are stronger than women. In the final FGD, all participants confirmed men work more on flat and sloping land compared to women, and stated that women generally work only on flat land because they are afraid to fall on steep land and it would take them longer than men to complete the work there.

Topography and farmers’ perception of strength are also linked to gendered spaces, assets, and roles. Since men have the strength to work on steep land and with large animals, their space is the farm and their gendered assets are the cows/carabao. In contrast, the women generally work in the home so their space is the house-lot/ business space and their gendered assets are the merchandise, chickens, pigs, and goats. This difference was reflected in multiple research

activities. In the photo showing a man plowing with a cow, the women always mentioned that the man is plowing. They rarely mentioned the cow until we asked if the cow affects the soil. Unlike the women, the man generally mentioned the cows and the fact that cows are the ones plowing. This reveals the gendered access and labor regarding this particular animal. During the participatory mapping exercise, both men and women showed that men have access, control, and labor over the cows/carabao while the women have access, control, and labor over the chickens, pigs, and goats. In fact, most of the participants claimed that women do not have access, control, or work with cows or carabao unless the husband is away (Fig. 3-4). When we asked why, the farmers said the chickens, pigs, and goats are usually considered house-lot animals and are easy to control. Since women are responsible for the home, these animals fall under their control. Conversely, the cows and carabao are men's gendered asset because they require strength and usually stay on the farm.

3.4.3 Knowledge and Perceptions

Gendered Soils Descriptions, Quality Indicators, and Spaces

Local perceptions of soil are complex in Claveria and are multi-layered. Many factors, both gendered and non-gendered, play a role in determining those perceptions. This study found gendered differences in the terms men and women use to describe soil. For example, men describe soils using physical terms such as color (Fig. 5), texture, topography, and acidity more often than women. Women tended to use soil quality terms such as fertility to describe soil. Despite the fact that men and women preferred to use different soil descriptions, this study found men and women had the same perception of soil descriptions and physical properties. For example, both men and women described productive soil as black, loose, fertile, good, and flat. They used words like red, compacted, hard, unfertile, bad, acidic, eroded, and rolling to describe

soil that was perceived as bad. In the FGD maps, the men and women labeled certain soils that overlapped, and the women would call it loose, while the men called it black. Yet, when they presented their maps to each to each other, both groups were in agreement despite their differences in description.

A non-gendered soil perception is using plant growth to identify soil quality. Both men and women believe soil to be good or productive if there is plant growth, whether it is crops or grass. In fact, most of the participants in the household interviews used plant growth to determine their best and worst soils on their farms (Table 4).

Table 4: Soil quality indicators of the households' best and worst soils

	Men		Women	
	Best	Worst	Best	Worst
Color	4	3	3	3
Topography	6	5	0	5
Plant growth	13	12	12	10
Fertilizer use	2	2	3	2

They also used plant growth on the satellite images to help distinguish soil types in the community. Most of the soils designated as good were drawn over green vegetation while bad soil was drawn over brown, bare landscapes. Some smallholder farmers even decide what to plant and where based on how well the land produces vegetation prior to planting. For example, one household had just acquired a large, flat, yet bare plot located next to a river. We assumed the farmers would describe this soil as good because it was flat and had black soil. However, the farmers reported they could not judge the soil yet because they had not planted on it or seen how it produced.

Crop priority is linked to local soil perceptions and appears to have some gendered differences as well as similarities. Though plant growth was a major soil quality indicator for

both men and women, one of the interesting gender differences in soil knowledge was seen in the types of crops that men and women discussed in the soil samples and in the household soil maps. In both activities (the soil sample discussion and the household soil discussion), the men chose very few types of crops for good soil types, while the women chose a variety of crops for good soil. For example, men only chose maize, rubber trees, and pastureland as their best soil. We observed that men mainly work with and talk about larger crops such as maize and tree crops more than any other crop. They also work in pastureland much of the day. Conversely, women picked many different types of crops as their best soils, mainly maize and vegetables. Vegetables are usually smaller crops which more often contribute to household consumption, something the women are responsible for preparing and selling. The most common crop for the worst soil was maize for both men and women. The second most common worst soil designated by the men was the house-lot, while the women chose the pasture area. In contrast to the best soils, these areas are the parts of the farm where the men and women work the least, and spend the least amount of time, respectively.

Spatial factors revealed gendered perceptions that related to men's and women's roles in the community. These differences were clearer in the context of *where* the soil they are discussing is located (in relation to the house, water, and topography), *what* they do with that soil (land-use, crop type), and *who* owns it. Again, the men were very interested in the physical landscape they could discern visually. In both FGDs, the men drew soils contiguously on a satellite image (Fig. 6-7). The men in the Patrocenio FGD even estimated the pH and organic matter of the soil samples and the soils they drew on the maps. They were also aware of directional North and seemed confident in their orientation, drawings, and descriptions.

The women had a different approach to drawing their community soil maps. In a general sense, they related to soils through the soils on their farm and through a social, applied perspective. The observers and note-takers in the FGDs reported that the women were drawing soils they knew of in the community that were the same type of soils they have on their own farms. In contrast to men, the women from both villages drew soils in distinct areas on the satellite images (Fig. 6-7). Most of them started by locating their residences and some of the key establishments in their barangay. They also tried to identify the types of soil by relating them to the names of farm owners. For example, one of the soils they identified in the Rizal FGD was considered good because it was owned by a "capitalist" and, once that was agreed upon, they proceeded to describe the soil based on its physical characteristics.

These gendered differences can also be seen in regard to land-use. In the FGDs, the women in both villages claimed that land-use was the most important indicator of soil quality. According to one of the team members in the Rizal FGD, "They primarily consider land-use as the first thing as this relates to their roles being always in the homes…so their relation to soil is for the home and for agricultural purposes. (July 6, 2012)"

While the men were confident in their own knowledge of the community soils, the women in the Rizal FGD were not so confident. During the presentation of their soil map, they said they were not sure of their answers and that what the men had mapped was probably more accurate than their map. Their reasoning was they had a difficult time interpreting the satellite imagery and they had not had first-hand experience with much of the community land like the men. Even though they interpreted their knowledge as minimal when compared to the men's soil knowledge, the women in Rizal did have some of the same perceptions of the soil as the men, specifically when choosing the best and worst community soils, which were basically the same

in terms of location and description (Fig. 8). Even though there were differences in their soil perceptions and interactions, such as soil quality indicators and spatial perceptions, there were some similarities, such as the importance of plant growth and location of the best soils.

Topography was another variable in men's and women's soil knowledge and perceptions. Flat soil was perceived by both men and women to be good soil while steep soil was considered to be bad soil. Women mentioned more good soil than bad soil during both the FGDs and household interviews. During the household visits, two women claimed they did not have any bad soil on their farm and that topography was not an indicator of good soil because they mainly work on flat areas. Conversely, men used topography more often than women to describe soil, particularly for bad soil. In the FGDs in the mapping community soils exercise, the men only mapped sloping soils and the women mainly mapped flat (plain) soils (Fig. 9-10).

Distance from the farm to a water source also has an impact on men's and women's soil knowledge and perception. The men associate soil that is close to water as good because the soil is moisturized and any nutrients from the hills drain down to that area. They also perceive this soil as good because it has potential to serve as a place where they can wallow the farm animals. However, the women claim soil close to water is bad due to the risk of flooding and the danger this presents for children. Women also perceived floodplains as not agriculturally productive because it is an unreliable investment. One woman said, "Soil near the river are the worst [since] they can't be planted because of flooding" (February 14, 2012).

3.5 Discussion

The main goal of this research was to determine the gender-based constraints and opportunities for the adoption of CAPS while using a mixed methods approach incorporating participatory and geospatial methods. The first section below shows how the GDF can expose

new considerations for further research in our site in the Philippines. The second reviews gender-based constraints and opportunities that we found could have implications for the adoption of conservation agriculture in the Philippines. Finally, we look at the role of mixed methods in understanding gendered soil perceptions of smallholder farmers in relation to CAPS.

3.5.1 Discussion of Findings

Smallholder farmers' access to resources, agricultural practices, and local soil perceptions are related to their gendered activities in Claveria. We argue that men's and women's access to resources is linked to gendered practices and to knowledge and perceptions associated with spaces in the landscape. These connections expose gaps to be considered in conservation agriculture programs. Gendered plant knowledge and socio-economic elements were exposed as relevant topics that are important to smallholder farmers.

Gendered access to resources such as land and trainings has direct impacts on men's and women's soil perceptions, knowledge, and agricultural practices. We speculate that women had difficulty discerning satellite imagery and different types of soils on their farm and in the community because they have not had training that might have exposed them to the different knowledges that men have. Also, while women mostly work on their own farms—albeit less time than the men do—they have limited time for off-farm labor because they have multiple roles and responsibilities outside of farming. In the mapping community soils exercise, men may have drawn soils across a greater expanse of land due to the fact that they are often hired as off-farm laborers and this would give them exposure to more types of land and soil. They also have access to agricultural trainings and local government positions where they have the opportunity to learn about soils, topography, and maps.

Men's direct involvement with soil such as land preparation (e.g. tilling and planting) and women's indirect involvement with soil such as weeding, harvesting, and marketing could explain the similarities and differences in gendered soil knowledge and perceptions found in this study. For example, women can develop local soil knowledge and perceptions from means other than digging in the dirt and attending trainings. Since women do not have total access to the farm, but do have total access to the home, their practices are more domestic and entrepreneurial. Thus, women with children and household businesses are less likely to devote as much time on the farm as the men and thus have less direct interaction with soil. However, because women do work in harvesting and marketing, they gain and develop soil knowledge and perceptions even if they never work with the soil. For instance, if a certain crop is successful, women will likely associate the soil on which it grew as good and if the crop is not successful, women will likely associate that soil as bad. Based on the best and worst soils as per farmer identification, we predict women spend more of their time with smaller crops used for consumption such as eggplant, beans, and peppers. This could give them more knowledge about those particular crops and their soil while the men may possess knowledge of larger crops and the soils on which these grow, such as corn and trees, as well as pastureland. The women also know exactly what type of fertilizer and how much is needed for a particular area of soil, which could indicate sharing of soil knowledge by the husband and may be linked to their role in making decisions with the household budget. This could have influenced their soil perception since fertilizer was a main quality indicator for women. In other words, women's access to other agricultural resources like fertilizer, and practices such as buying inputs, could also contribute to their gendered soil perceptions.

Men's and women's access to certain spaces in the landscape lead to gendered perceptions and practices. This was especially suggested in this region where topography had an influence on all of these categories. Steep topographies were perceived to have worst soils by both men and women, but men had more access to and worked on steep topographies more than women. Thus, we could speculate that men may have more knowledge about steep, poorer soils while women have more knowledge of flat soils. This is supported by the fact that women did not use topography as a quality indicator for good soils because they only work in flat areas. It also links to the fact that women had difficulty discerning bad soils because they do not have access to those areas. Men on the other hand had access to steep areas, worked on them, and described them often throughout the research.

Gendered differences in soil knowledge and perceptions bring to light how gender roles and spaces are influenced by access to resources. It also shows that men and women develop these perceptions of soil through means other than the physical properties of soil. Conservation agriculture programs need to take into consideration the multiple perspectives and knowledges of soil from men and women. Men tend to have a technical and physical knowledge and perception of soil while women's knowledge and perceptions are based on social and practical aspects. These gendered differences could be a result of their different interactions with the soils. Men work very closely with the soil while women sometimes work with it indirectly. This can create both similar and different soil knowledge and perceptions. Despite differences or similarities, when applied in collaboration, these knowledges and perceptions complement each other. For example, when deciding where to implement CAPS, it is important to consider the physical characteristics of the soil as well as the social characteristics such as ownership and what purpose it has in the household and community. We expect men would be more likely to

consider the color and topography while the women are more likely to consider land use when discussing a plot to use in CAPS experiments.

One common observation important to both men and women in Claveria that could have implications for CAPS is crop production and plant knowledge. Men and women both have access to their crop production despite their gendered interactions with it: men interact with it mainly on the farm and women interact with it in the home and market. This is linked to the perception seen in most of the households that crop production should contribute to both the household as consumption and to the farm as income. It suggests the importance of plant growth to both men and women when describing soils, indicating their quality, or looking at the spatial components of soils.

Exposing this type of soil knowledge and perception is important for conservation projects. In our research, we focus on soil quality and gendered soil knowledge. By including gendered plant knowledge into CAPS research, there is the potential to further understand the gendered differences in interaction with the soil and plants and men's and women's priorities, resources, and practices. It is also suggests the importance of acknowledging men's and women's similar knowledge of soil management and plant production, as well as differences, because both can potentially reveal new considerations for CAPS research.

Trainings and information can potentially lead to additional farming income. Since most trainings involve land management, agricultural trainings may be perceived to be economically relevant only to the men. In contrast, trainings outside of agriculture may be perceived as economically relevant to women. Yet, this research found that gender roles and practices are perceived by farmers to be economically beneficial and relevant to both men and women. With this in mind, projects and extension services ought to incorporate both men and women in all

types of trainings. Women's involvement in agricultural trainings and men's involvement in entrepreneur trainings could benefit the farming household because women are in fact involved with farming and men are impacted by the practices and decisions of the household business.

In Claveria, men and women's gendered practices are linked to their access to resources as well as their motivation to make profits. Women do not have the same access to land as men and have more domestic and managerial responsibilities, which are likely because of the gendered perception that women should be more involved in non-farm labor which was found in previous research (Estudillo et al. 2001). That study suggests, "Farming is intensive in male labor where returns to specific experience are higher for males, whereas women tend to receive higher returns on their education in the non-farm sector (pg. 142)." They also found having an uneven distribution of education and land ownership by having men work on the farm and women work in business actually increased families' combined income in the Philippines. Farmers are aware of the complicated access to resources and have adapted to make their gendered practices economically beneficial to the household.

Overall, smallholders' motivation to provide for their family and obtain capital plays a role in their gendered resources, practices, and perceptions. If there is to be any change in their everyday lives, it needs to consider this motivation and be directly applicable to it. In a farmer field day with CAPS promoters and SANREM cooperators, the promoters were mainly discussing the long-term benefits of CAPS regarding soil quality, while the farmers were mainly asking questions regarding financial short-term benefits. There is little evidence in CAPS literature to support that it is economically beneficial to the smallholder farmer in the short-term (Giller 2009). Thus, promoting and researching economic benefits—both long and short-term—could potentially increase farmers' interest and adoption of conservation agriculture practices.

3.5.2 Gender-based Constraints and Opportunities for CAPS

Gender-based Constraints

The main gender-based constraints for CAPS adoption found in this study are land tenure security, and access to capital and trainings. Land issues can be viewed under the GDF's laws, legal rights, and institutions dimension. They also overlap with the dimension of access to resources. Other gender-based constraints, which include weeding and tilling, are discussed under the practices and participation dimension.

Access to land is different for men and women, but could be a constraint for both in the adoption of CAPS. According to some of the CAPS literature, resource-constrained farmers, particularly with little access to land and agricultural inputs, are less likely to adopt conservation agriculture practices (Giller et al. 2009; Knowler and Bradshaw 2007; Jones 2002) because additional land and inputs are needed at the beginning stages of adoption. In addition, women not having a vested interest in owning land or being a full-time farmer might pose constraints, particularly for projects trying to implement CAPS, since they could interpret this finding to mean that women's involvement is not needed in CAPS projects. This is also significant because studies show that when women are not involved in the adoption of a (conservation) practice, it is less likely to succeed (Knowler and Bradshaw 2007; Magcale-Macandog et al. 2010). Because women are involved in farming through weeding, marketing, and raising livestock, these activities should be considered a part of CAPS.

Farmers' main concern regarding access to land was not specifically gender-related. They reported that the process of obtaining titles was long, expensive, and time-consuming. The process includes paying all back-taxes, surveying the land, and applying for approval, which can take up to two years. Seven of the 10 households that had inherited land did not have the titles

because they found the process to be too difficult. This is a potential risk for ownership and reduces the likelihood of the farmer staying on the land, which in turn, could impact CAPS adoption if the farmer is not concerned about long-term soil quality.

This is also applicable to the farmers who rent land, as we saw in four of the households. This short-term land management arrangement could be a constraint for CAPS because in the first four years of adoption, there are limited benefits. In the beginning, CAPS increases weeds, requires increased inputs, and does not necessarily increase yield. Farmers who are renting a plot of land for five years may be hesitant to adopt CAPS because they would be more concerned about production during that time rather than increasing the quality of a soil that is only temporary for their use. If land security is not addressed, the adoption of CAPS faces a significant constraint in the Philippines.

Another gender-based constraint for CAPS is access to capital. While this is a constraint for both men and women, it affects each gender differently. CAPS have not been proven to have short-term economic benefits to smallholder farmers (Giller et al. 2009; Knowler and Bradshaw 2007). Thus, there could be a potential for economic pressure on the women to provide more income from their businesses. The men would also be challenged to provide additional income to make up for the lack of production in the early stages of CAPS. Yet we learned there are few income-generating opportunities men feel are available to them besides farming. While the opportunity to become full-time hired labor is a possibility, most of the time, farmers have to be invited to work as hired labor, thus, it is not a guarantee. According to Jones (2002), "…if capital is limiting then any conservation [agriculture] measure…is unlikely to be acceptable."

Access to trainings is an important resource that has a significant impact on development projects. In Claveria, it is customary for only one family member to be invited to agricultural

trainings. We believe there is a perception that women do not need to attend trainings because their place is in the home and the men should attend trainings because they are usually the ones on the farm. When only husbands are invited to attend agricultural trainings, women are left out and deprived of useful information. According to Jones (2002), the less knowledge farmers have of conservation techniques, practices, and purposes, the less likely they will support or adopt it. While this research supports the notion that the husbands do indeed share agricultural knowledge with their wives, if women do not have access to these trainings then it is less likely they will understand the importance of land management, sustainability, and CAPS, and could influence household attitudes towards it.

Conversely, we learned from several women farmers that they are slowly making a presence in agricultural trainings. Sometimes, when the husband is busy or away from the village and cannot make it to the training, he sends his wife in his place, as we saw at the Rizal FGD. Other women are making even greater efforts to attend different trainings by joining the local barangay Women's Association group. This group brings women together for trainings and to write project proposals to apply for government assistance to start a business. Training topics include writing, cooking, personal hygiene, personal development, and financial budgeting. The business projects vary from restaurants, to flower stores, to hog-raising, growing vegetable gardens, and practicing health care. While these trainings and businesses do not necessarily incorporate agricultural trainings, they do provide women with information, resources, and income which can help empower women and increase their independence.

Conservation agriculture programs need to understand the gendered social practices in their research sites, particularly when it comes to trainings. Our recommendation is to invite both men and women from the villages for trainings and clarify that it is not just for the head of the

household. This will not only increase the exposure of CAPS to farmers but it will also increase the conversations and interpretations of CAPS.

Understanding the gender divisions of labor and time allocations in communities is important to CAPS adoption. In the short-term (the first four years), CAPS has been shown to significantly increase the presence of weeds on the farm (Knowler and Bradshaw 2007; Giller et al. 2009). This has significant impacts on farm labor and CA adoption. In Claveria, the women are primarily responsible for weeding. Hence, CAPS could increase their farm labor during the first four years of adoption. As women have limited time available to spend on the farm due to multiple responsibilities, the fact they are the ones who weed the farm could be a gender-based constraint for CAPS adoption. On the other hand, recent literature has shown that the use of herbicide was effective in decreasing weed growth in CAPS (Hobbs et al. 2008). Two households in this study reported using herbicide and claimed they no longer needed to weed their plots. While suggesting the use of herbicide is a reasonable recommendation to many, to others it may not be accessible due to lack of capital. CAPS programs should stress the economic benefits that will eventually come with CAPS adoption and clarify that any increased labor input is only temporary.

Another gender-based constraint for CAPS is that men are solely responsible for land preparation. Land preparation includes plowing, harrowing, and furrowing, all of which are considered a type of tillage. All of the participants in both the FGDs and the household interviews reported they plow their land as part of preparation for planting. This is important for CAPS adoption because one of its components is practicing minimum tillage.

At first it seems this finding would be an opportunity for CAPS because it would reduce the labor for men (Hobbs 2007). However, if we look a little closer at this practice, tillage is

ingrained into their culture and livelihoods and it is traditionally a man's activity (Basch et al. 2008). Convincing the farmers that minimum tillage will produce a successful crop will be the true challenge for conservation agriculture projects to implement CAPS in the Philippines. This could be deemed as a gender-based constraint for men as it is central to their identities as men and farmers. It is a main task in their role as a farmer. It is also a main source of income for the male farmers who are hired labor. If the men were to reduce their plowing activities, not only might they lose their sense of responsibility, but their sense of worth and contribution on the farm. The households could even be disadvantaged if the demand for tillage labor was reduced because they could be impacted economically. On the other hand, the farmers interviewed told us that as a response to minimum tillage, there is the possibility that men could devote the time saved from no tillage to spraying agrochemicals, which they said can only be done by men because the equipment requires strength. While this reveals that farmers are willing to consider change, social change takes time and is beyond the scope of a funded-project. Overall, projects needs to educate the farmers of the consequences tilling has on the soil and show them that minimum tillage is environmentally and economically beneficial.

Gender-based Opportunities

Opportunities for CAPS adoption are discussed here from both general and gendered perspectives. Soil conservation perceptions provide both general and gendered opportunities while fertilizer use reveals the incentive to improve the soil. Gendered decision-making is also an opportunity because men and women make different decisions that balance the control and benefit the household.

The CAPS literature tells us that one of the main opportunities for CAPS adoption is when farmers acknowledge that soils and landscapes are degrading (Knowler and Bradshaw

2007; Giller et al. 2009; Jones 2002; Hobbs 2007). This research found that farmers see that soil erosion and degradation are occurring on their farms and feel they should act in order to reverse any long-term damages. They were all aware of the importance of soil as sources of livelihood and a source of life. The majority of the men were aware that soil can be subjected to varying degrees of losses such as erosion and infertility, and that fallowing was important to soil recovery. They discussed *their* role in taking care of soil, and the importance of nurturing it so as to use it for cultivation and income. The women, on the other hand, noted the importance of soil through *its* role in their lives such as providing land for the household and for future generations. This suggests gendered perspectives in relation to soil importance through the different interactions men and women have with soil. These perspectives, though different, could be considered complementary regarding soil conservation and serve as a gender-based opportunity for CAPS adoption.

Fertilizer use is another agricultural practice with implications for CAPS adoption. All the households in our research site used some sort of fertilizer, organic or inorganic. This practice is complicated and is hard to distinguish whether it is a constraint or opportunity, much less a gender-based constraint or opportunity. For example, fertilizer use is a common practice among conventional farmers (Lamb et al. 2010) and is not necessarily motivated by the fact the farmers think their soil is degrading, which is important for CAPS adoption. Furthermore, most of the farmers in this study think they have to use fertilizer because their production depends upon it, not because it is improving their soil. One man said, "Our soil did not use to need fertilizer to produce…now it needs it. If we don't use it, we fail" (July 23, 2012).

The farmers believe their soil is degrading because they observed that they cannot produce without fertilizer. They are uncomfortable depending on it because they know it was not

needed in the past and it is not economically or environmentally sustainable. One household stopped using inorganic fertilizer because they could no longer afford it, and reported a "failed harvest" as a result. They eventually started using chicken manure because they said it was better for the soil; at the same time, this product was easily available from local chicken farms at a low cost. This could be seen as an opportunity because farmers might be willing to use an alternative way to have better yields and profits without relying on fertilizers. Furthermore, if they knew of ways to improve their soil and yields without having to buy fertilizer, they could save money and projects might appeal more to farmers. Their current use of fertilizers also suggests they are not completely resource-constrained, which is an opportunity for CAPS adoption (Jones 2002; Giller et al. 2009; Knowler and Bradshaw 2007).

According to the literature, an opportunity for CAPS adoption would be for men and women to have equal decision-making power in the household and farm. The gendered decision-making dynamics found in this research—men primarily control the farm while the women primarily control the house— have also been found in other studies focusing on gendered control, particularly in the Philippines (Nazarea 1995; Tisch and Paris 1994; Estudillo et al. 2001; Eder 2006). Men and women's division of labor and decision-making are not completely independent of each other (Udry 1996). For example, farm decisions (in)directly affect the household decisions and household decisions (in)directly impact the farm (Feldman and Welsh 1995). In this case, a wife's decision to take on a business venture could impact the labor and resources available for farming. Conversely, a husband's decision to plant one crop versus another could affect the wife's marketing strategy. Thus, in this case, gendered decision-making makes it difficult to discern who, if anyone has overall control of the household and/or farm.

Our research highlights the complexity of control, decision-making, and negotiation within a household on a farm that could ultimately affect a household's decision to adopt CAPS (Doss and Morris 2000). Even though the respondents reported the gender division of decision-making, this research argues that men and women in Claveria make separate decisions for the benefit of the entire household. For example, a woman may decide to start a business to provide additional income for inputs for the farm while the husband decides to plant vegetables for sale and for household consumption. Even though the decision to adopt CAPS may seem like a purely farm-related decision, and thus, the husband's decision, this research supports the notion that gendered decision-making concerning the farm and household are two parts of a whole and these farmers are well aware their decisions affect both the household and farm and they would only decide on changes that would benefit both.

Summary of Constraints and Opportunities

There is a financial component embedded in the gendered access to land and practices which affect a farmer's capacity to change their agricultural practices. There is also gendered knowledge that is not understood by researchers and trainers. This leads us to question the farmers' capability of adopting CAPS in Claveria. At the same time, there is a perception of a problem and the incentive to invest, which are the broad variables necessary for adoption.

While we have included men's and women's local knowledge, access to resources, and control, it is impossible to predict the negotiations that will take place in a household involving changing practices, roles, and responsibilities on the farm. However, by attempting to understand the gendered division of labor and decision-making, we can make an inference about whether the adoption of CAPS would benefit or hurt a household. Constraints and opportunities, in the context of gender, create a complex web of resources, practices, and knowledge of men and

women's everyday life. While this study shows that it is necessary to understand the social, cultural, and gendered dimensions of smallholder farmers, projects that address these, as well as the economic and environmental dimensions, will more likely offer an approach that can evaluate the likelihood of CAPS adoption.

3.5.3 A Mixed Methods Approach for Studying Gender in Agriculture

Geospatial information and gendered knowledge, practices, and resources

Using participatory and geospatial techniques revealed the different way farmers relate to and perceive soils. Mixing methods exposed multiple, gendered soil descriptions, soil quality indicators, and spatial soil perceptions that could not have been found using only one method. For example, different methods show men and women use different descriptions based on the context of soil, e.g. soils in general or soils they have interacted with either in the farm or community. If we had not asked about their own soil in the household interviews and just used generic soil samples to learn about their soil perceptions as in the FGDs, we would not have learned about the importance of plant growth in farmer perceptions of soils. Using multiple methods in the context of quality indicators, we were able to learn more about how they *relate* to soil, not just what they *know* about soil. Rather than putting qualitative data into a GIS, we found it more useful to use geospatial techniques to elicit qualitative information from participants and gain an understanding of people's soil knowledge, resources, and practices.

In the mapping exercises, we learned that men and women's soil perceptions are both spatial and gendered at the household and community level. The community soil mapping in the FGDs showed us farmers' gendered, spatial knowledge of soils including the differences in descriptions, indicators, and topographies. The participatory mapping revealed that men and women have access, control, and provide labor to different spaces and resources. For example, a

wife drew her banana-Q business and chickens on her farm while her husband drew cows and the contoured hills of his farm (Fig. 3-4). These resources and spaces lead to gendered perceptions. In the context of soil perceptions, it was important to include the spatial aspect because it allowed us to determine if men and women were talking about the same or different landscapes of soil. For example, farmers would mention areas of soil with maize most often but, in several cases, the farmers were talking about different areas of maize. These different areas could reflect gendered practices and resources on the farm.

Obtaining GPS data from the best and worst soils at the household level allowed us to determine gender differences as well as similarities in soil perceptions. For instance, we found men and women tended to pick the same best soils on their farm, but chose different worse soils (Fig. 11). While the farmers in our last FGD where we sought to validate findings could not explain this pattern, we believe it is because both spouses know and agree on best soil as part of the farm that is most productive. The worst soil could be the area of the farm where they spend the least time and/or it does not contribute much to their everyday life. Again, these gendered spaces could suggest and lead to gendered practices and access to resources on the farm while including specific locations.

Gathering GPS data also revealed the gendered knowledge and practices on the farm in the process of implementing the methodology. For instance, the men always showed us and walked the boundary of their farms while the women rarely did. The women did not always know their exact property line and it was difficult to get them to come to the field with us at all because they usually had other responsibilities that kept them in the home such as children, businesses, or chores. This suggested to us and was later verified that women spend significantly less time on the farm than the men. In the community soils mapping, the men discussed drawing

the soils from a physical perspective while the women discussed them from a social angle. In turn, this revealed gendered perceptions which can be linked to gender roles and practices that are important to understand when trying to implement development activities. Overall though, incorporating geospatial tools excited the participants and increased their curiosity about the research. In comparison to asking them questions, which sometimes resulted in farmer's becoming bored and asking to move on to the next activity, farmers seemed much more enthusiastic when the activities involved GPS mapping their farm or looking at satellite imagery of their village. One SANREM researcher stated, "Farmers do not like research; they like technology" (Prasad 2012). We believe this holds true for this site.

Geospatial Information and Qualitative Analysis

The GPS data provided quantitative measurements such as area calculations, distances, and elevation profiles of the farms and soils. This allowed us to visualize our research site and showed us differences in the house-farm patterns between villages. We found that Rizal houses were located on a main road while the farms are located on the outskirts of the village, while in Patrocenio, houses were on the farms but both were located off the main road (Fig. 12-13). This was an important spatial component for the researchers as outsiders because the layout of farming communities with respect to the house and the farm is not always evident from satellite imagery or from observation. Yet the combination of spatial ground observations with satellite imagery allows the layout of farms and houses to become clear. One man drew two separate maps on one piece of paper when asked to map his house and farm: one shows his house and the other his farm, with a road connecting the two (Fig.5). The GPS mapping helped understand the actual distance between the two and the path traversed to get from one place to the other (Fig.13). This was complemented by our walking with the farmer from home to field and

experiencing these ourselves. Understanding the layout of farming households and communities is important with respect to distance and access to resources, especially since men and women in this community generally work in different areas and have different access to certain resources.

While geospatial information provided quantitative data which is important in soils research sampling, it was not our goal to use GIS for this information or for statistical analysis. Rather, we wanted to use GIS to complement the qualitative data obtained from the men and women. We were able to demonstrate and represent the men's and women's perceptions and roles of everyday life with the environment and associate those with specific locations using geospatial and participatory methods. This allows researchers and locals to make progress towards a better understanding of gender relations in agriculture by representing diverse perceptions of soil, practices, and space.

The spatial data obtained from the participants may not be accurate in terms of science and statistics: our goal was to document farmers' perceptions. Furthermore, having inaccuracy and uncertainty in geospatial information is intrinsic and acceptable (Mowrer 1999; Couclelis 2003) and almost expected in this context and from the farmer's perspective. During the mapping process, most of the farmers said that their perceptions of soil and their locations are not fixed, but change depending on use and production. On farmer stated, "Ask us to draw these soils next year, and we might say something different. It depends if they are successful and how they are used. Soils change." (July 10, 2012). Mapping their perceptions and understanding the fluidity of this information with respect to space reveals the reflexivity in geospatial information while at the same time legitimizing local knowledge and perceptions.

Combining geospatial and participatory methods allowed us to understand the farmer's situation including soil perceptions, access to resources, and agricultural practices from a spatial

perspective. The methods showed us both visually and contextually that there is a relationship between gender and (conservation) agriculture that must be understood in order to recognize the complex interactions that play a role in the cultural change that adoption of CAPS would represent. By understanding how gendered knowledge and perceptions are spatial we can learn about their gendered access to resources and agricultural practices, which can ultimately help us analyze farmers' interests, priorities, and needs. This can lead researchers and stakeholders to have a better understanding of social and environmental issues that affect constraints and opportunities in development activities.

3.5.4 Limitations of Research

Limitations of this research include cultural and linguistic barriers, time, lack of participation in setting the research agenda, and availability of secondary data. The cultural barriers comprise of distance between the researchers and the farmers including the fact that we are not farmers and we have higher education levels. More time would have helped build relationships, improved the quality of data, increase the number of participants, and observe changes in agriculture from one season to the next. Linguistic barriers are also related to the cultural barriers and time limitations. The researchers did not speak the local language and there was not enough time to learn it well enough to conduct the research without local assistants. While we tried to compensate for this by having multiple assistants involved in this fieldwork, there is always potential for lost meaning and inability to translate between languages. Nonetheless, the small vocabulary we learned for greetings and key terms relating to soils and agriculture helped establish rapport. While we used participatory research methods, farmers' participation was limited in that they did not contribute to the agenda; this could impact the relevancy of the research to farmers and inadvertently omit topics important to them. Availability

of secondary data, including census and geospatial data, was limited. The census data was incomplete and some of the secondary geospatial data (e.g. DEMs) had a low resolution that was not applicable to our household level data. These shortcomings could have excluded significant people and places that are relevant to this research. In addition, inherent to case-study as well as qualitative research, the specific results cannot be generalized to a broader geographic scope. The findings reflect knowledge, access to resources, and agricultural practices in the Claveria sites; and the gender-based constraints, opportunities, and recommendations may not be applicable to others.

3.6 Conclusion

Conservation agriculture programs need to be aware of the gender relations in development sites, how project activities may impact these relations, and how they may impact the adoption of conservation agriculture components. This research hypothesized the existence of gender differences in local soil perceptions, access to resources, and agricultural practices relevant to CAPS. We found men related to soil through direct, physical interactions while women did so more indirectly, and through a social lens. Men generally have one main role in farming, specifically land preparation, while women have diverse practices related to farming such as weeding, marketing, and money management. Men have access to agricultural trainings and plow animals while women have access to business trainings and house-lot animals. These gender differences also have a spatial component and an economic aspect that could help researchers understand the implications as well as the likelihood of CAPS adoption. Findings revealed gender-based constraints and opportunities for the adoption of CAPS in Claveria for smallholder farmers. For example, the adoption of minimum tillage poses a constraint for men while women face a constraint through their access to resources, specifically trainings.

Opportunities include farmers' desire to conserve the soil, openness to change, and shared household decision-making.

The literature on qualitative GIS primarily discusses incorporating qualitative information into a GIS; this research contributes a new perspective by exploring the incorporation of GIS into qualitative research. While participatory maps provide relevant information for researchers, some claim GPS data in a GIS provide more detail than a hand-drawn map (Ismail 1999). However, we argue that participatory mapping together with GPS/GIS data collection combines the cultural landscape with the spatial accuracy of database maps. There is also potential for increased participation of farmers with the incorporation of geospatial technologies because some are interested in these tools and they can provide immediate data that could be useful to farmers. On one hand, researchers can learn more about a farmer's everyday life from a map he or she draws showing their house on stilts, their animals, and their favorite tree; and on the other hand, by using geospatial techniques, researchers can learn more about the everyday distances, paths, and the spaces farmers drew in their maps while having the capability to give them geospatial information. When used separately, these methods highlight important factors in gender research such as space and knowledge, but when used together, researchers can move beyond the conventional place-based understanding and analyze and visualize multiple geographic truths.

This research demonstrates the need for a mixed method approach that incorporates social and spatial information such as gender relations, soil knowledge, and access to resources. It also shows how a gender analysis in conservation agricultural programs can identify issues that may impact the implementation or success of a project. If both men and women are not included in research-for-development, parts of the story and situation are left out that could be significant

to the implementation of a project. Therefore, it also challenges the idea of development without stakeholder participation. By including local participation and potential stakeholders in this research we are able to make recommendations for conservation agriculture projects that aim to increase gender equity, improve soil quality, and increase agriculture productivity.

To increase stakeholder participation, including both men and women who are more secluded geographically and socially, we recommend going beyond handing out invitations to people at the barangay halls. Handing out invitations and posting announcements of trainings at basketball courts or "dryers" outside of the village center could help attract farmers because these are an important social site for both men and women: men use it as a recreation space and women use it for space to dry grains. CAPS projects could also include additional content in their trainings beyond the three components which may not be applicable to everyone. Building on women's comparatively higher education and managerial experience, workshops could prepare them to play a critical role as households weigh the costs and benefits of adopting CAPS components. Determining and communicating the short-term economic benefits of CAPS and putting it in the context of the gendered division of labor would also increase the likelihood of adoption by smallholder farmers. Including a restitution event as part of the research methodology can help to ground-truth finding and increase trust between researchers and participants. Incorporating participatory and geospatial methods to understand gender relations that are relevant to CAPS, in conjunction with economic determinants, can also provide a model to explore the gender-based constraints and opportunities of CAPS adoption in other sites.

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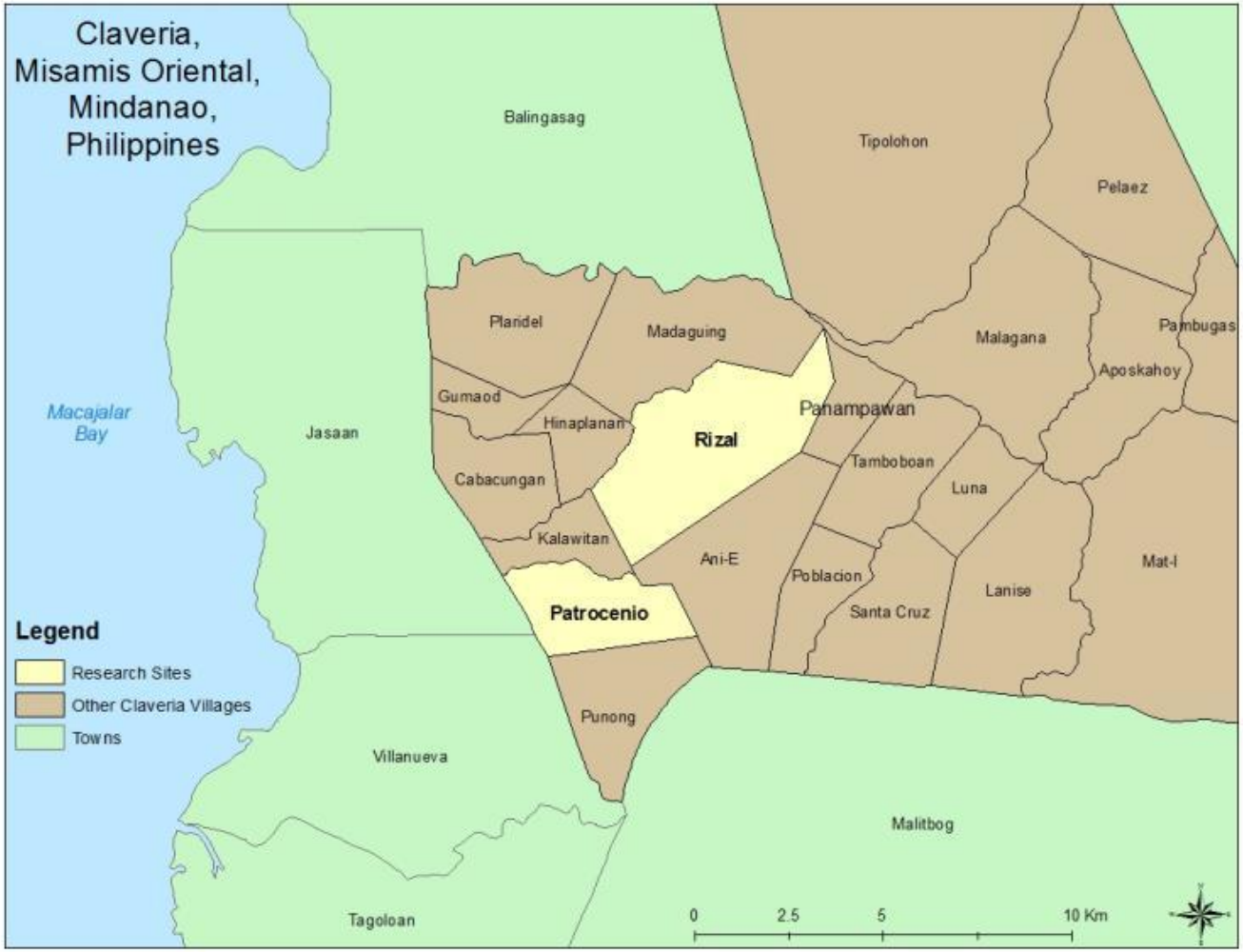

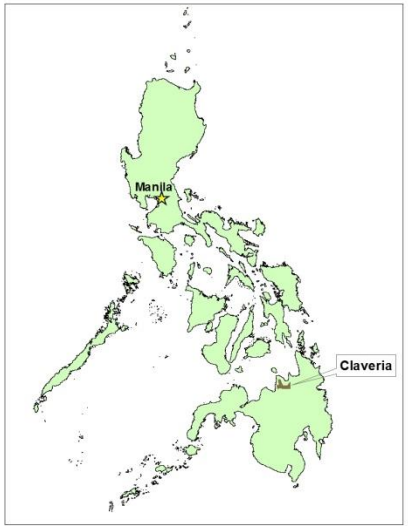

Figure 1: Map of research site

Map displaying the two research sites, Rizal and Patrocenio, located in the municipality of Claveria in northern Mindanao, Philippines.

Figure 2: Woman's participatory map from Rizal

A woman's participatory map showing a house on stilts with a sari-sari store where the woman has access to, control of, and works in, while the man only has access to both. It also shows the crops they grow: starting from the top, banana, corn, sweet potato, and beans. The wife only works where the banana and beans grow while the husband works in all crops. Along with the crops, she also drew two types of soils: good ("maayo") and bad (DM or "dili maayo" meaning not good). At the bottom she drew a cow and chickens. The husband has access to, control of, and works with the cow while the wife has access to, control of, and works with the chickens.

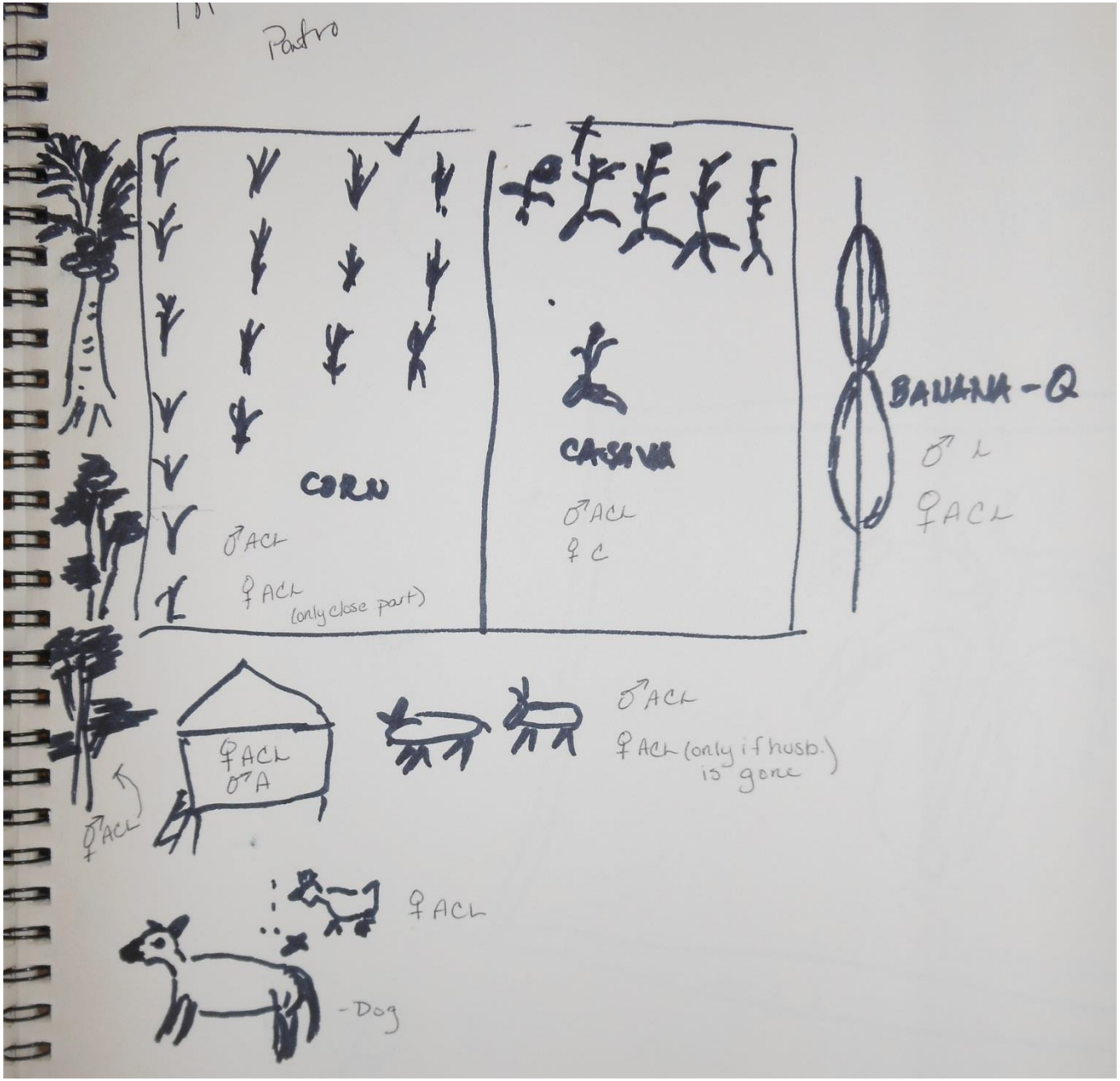

Figure 3: Woman's participatory map from Patrocenio

The woman's participatory map from household 18 showing their farm where they grow corn and cassava. She has access to, control of, and works in the corn because it is on flatter land closer to the house. For the house, she drew stairs and stilts and said she has access to, control of, and works in while her husband has access to it. Her banana-Q business is represented on the side and illustrates another livelihood strategy that contributes to the household. She drew cows and chickens at the bottom: she has access to, control of, and works with the cows only when the husband is away, while she always has access to, control of, and works with the chickens.

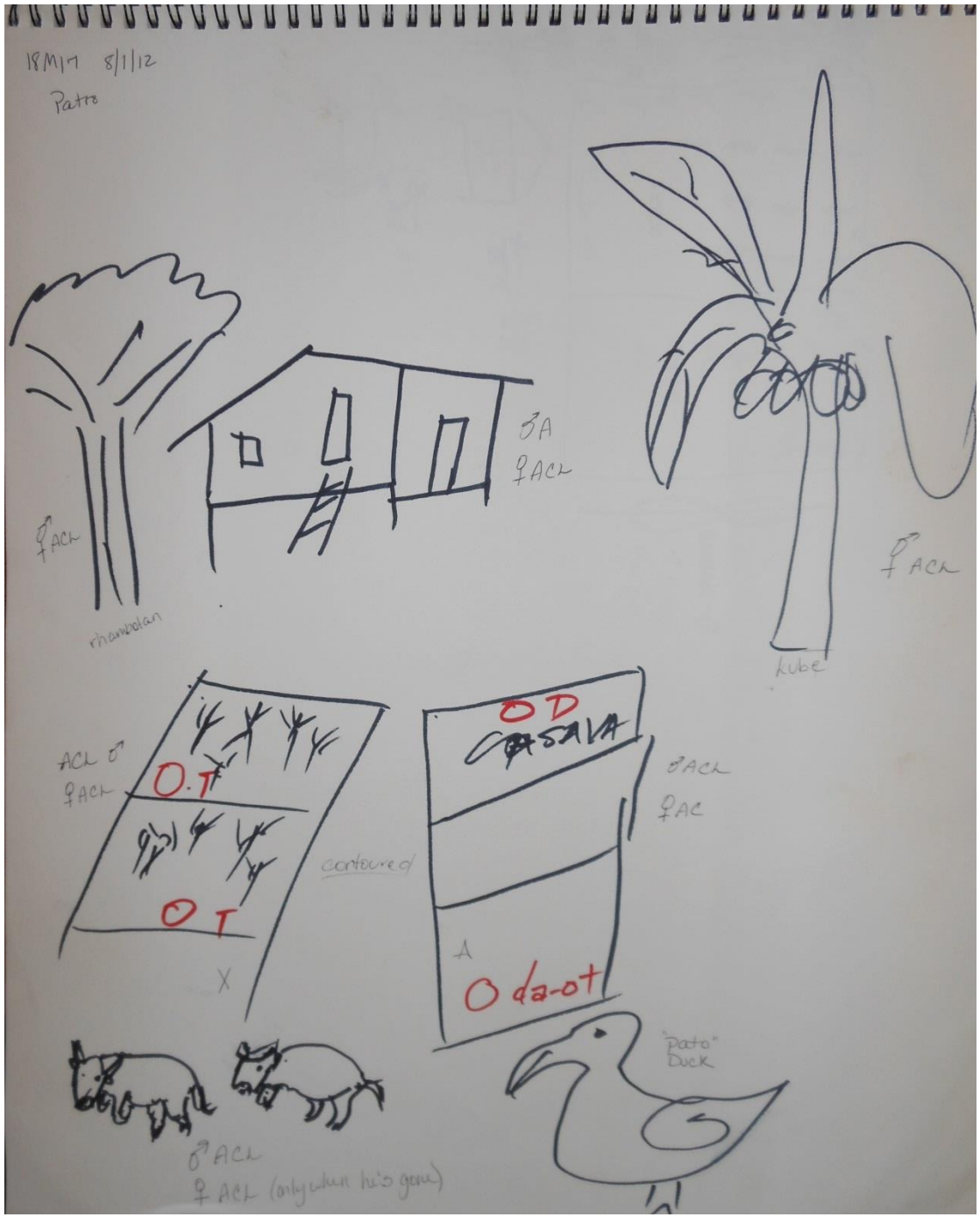

Figure 4: Man's participatory map from Patrocenio

The participatory map of the man from household 18, showing many of the same gendered resources as his wife's map in Fig. 3. The crop on the left is the corn which has good soil, indicated by the OT for "tambok" or fertile. The left plot is where they grow cassava and is considered bad soil because it is "da-ot" or acidic. He also mentioned how his farm is contoured. In addition, rather than chickens, he drew the family duck, Pato.

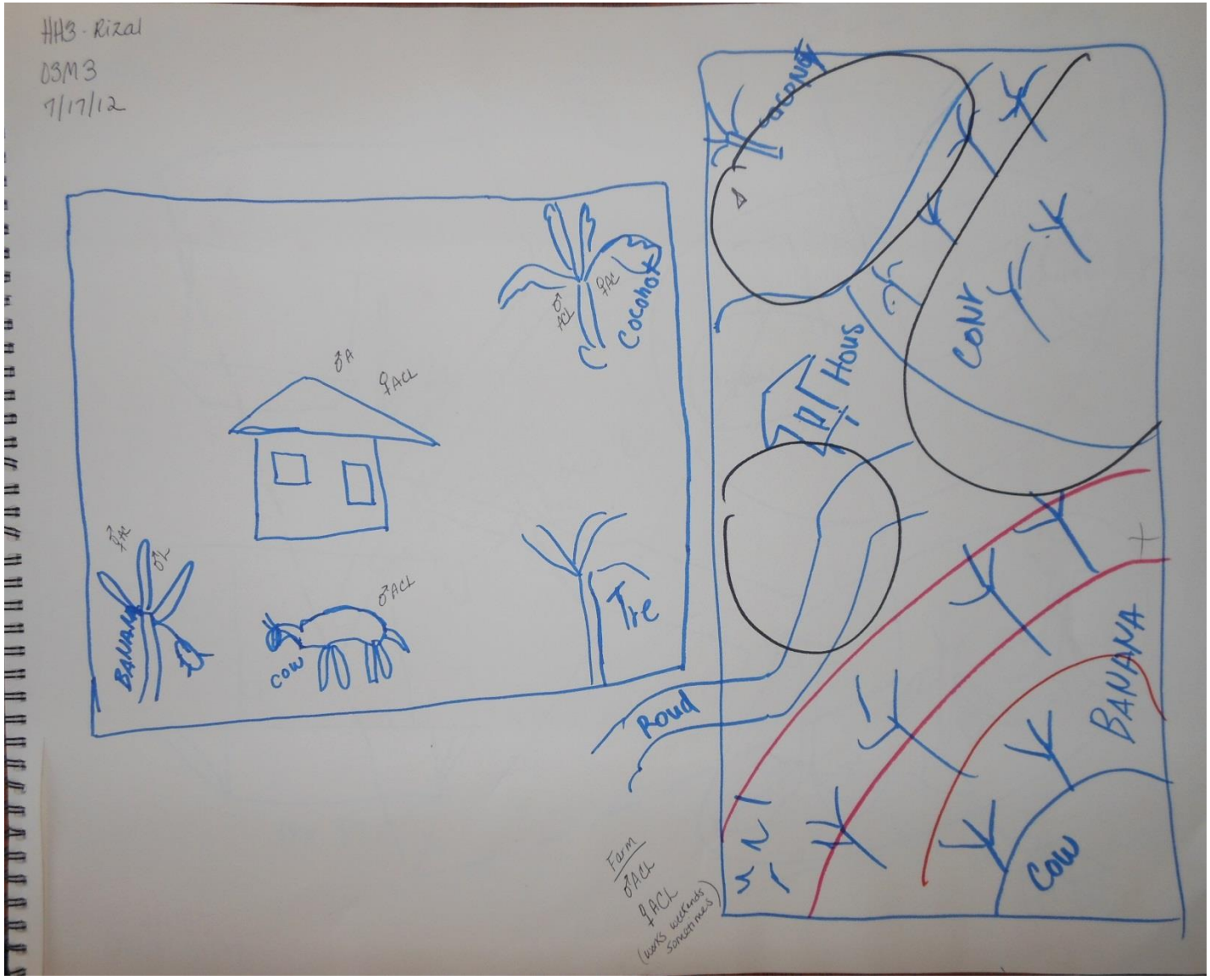

Figure 5: Man's participatory map from Rizal

A man's participatory map showing the gendered resources on his house-lot and his farm. Similar to other farmers, he said he only has access to his house while his wife has access to, control of, and works in it. He has access to, control of, and works with the cow. On their farm, they grow coconut, corn, and bananas. The different soils are designated with red and black. Many farmers drew the good soil in black and the bad soil in red in their maps. This man also drew his house and farm in separate areas to illustrate the distance between the two.

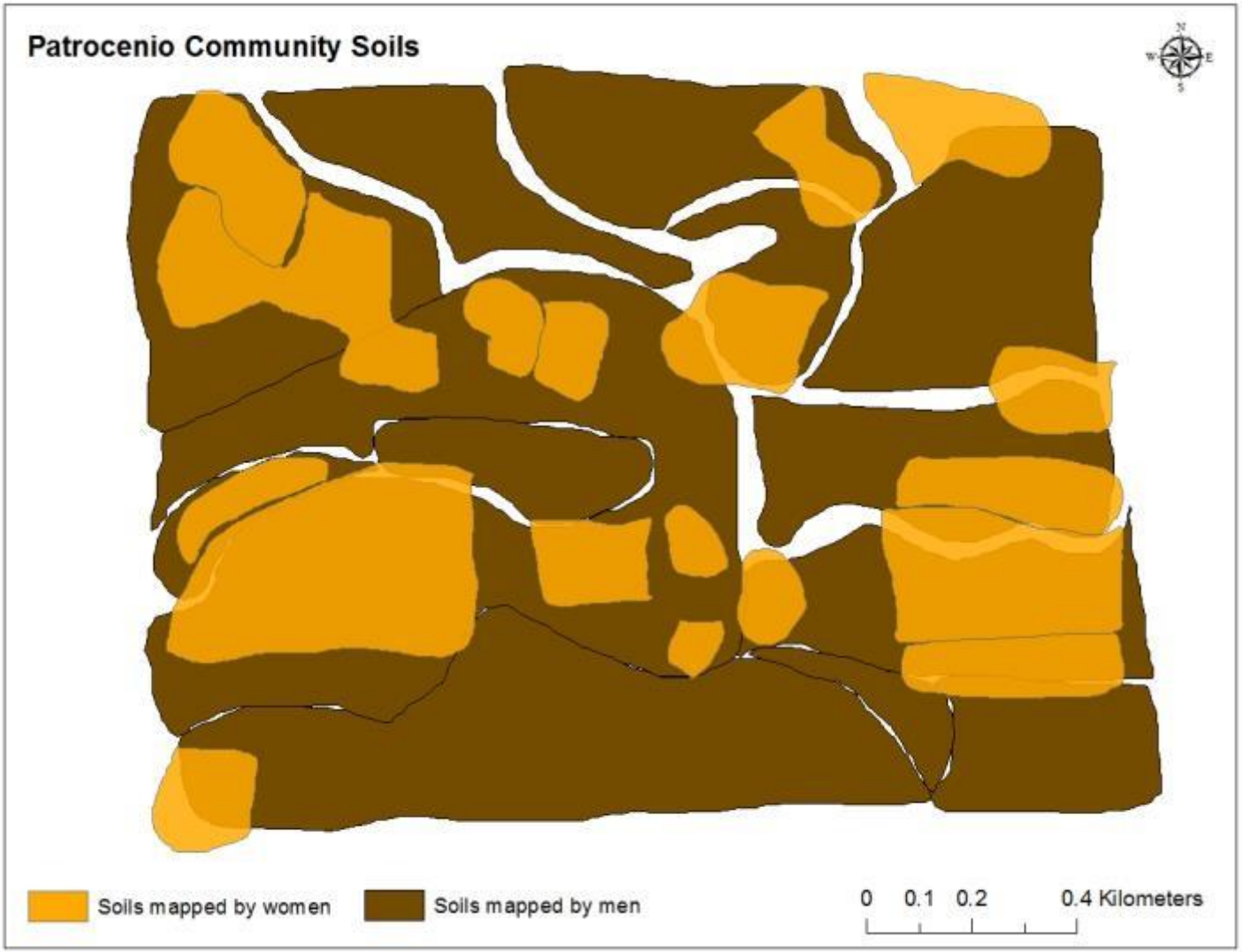

Figure 6: Men's and women's map of community soils in Patrocenio

This map shows the overlay of the soils that men and women drew on the satellite image in the Patrocenio FGD. Notice how the men drew soils contiguously across the image while the women drew patches of soil.

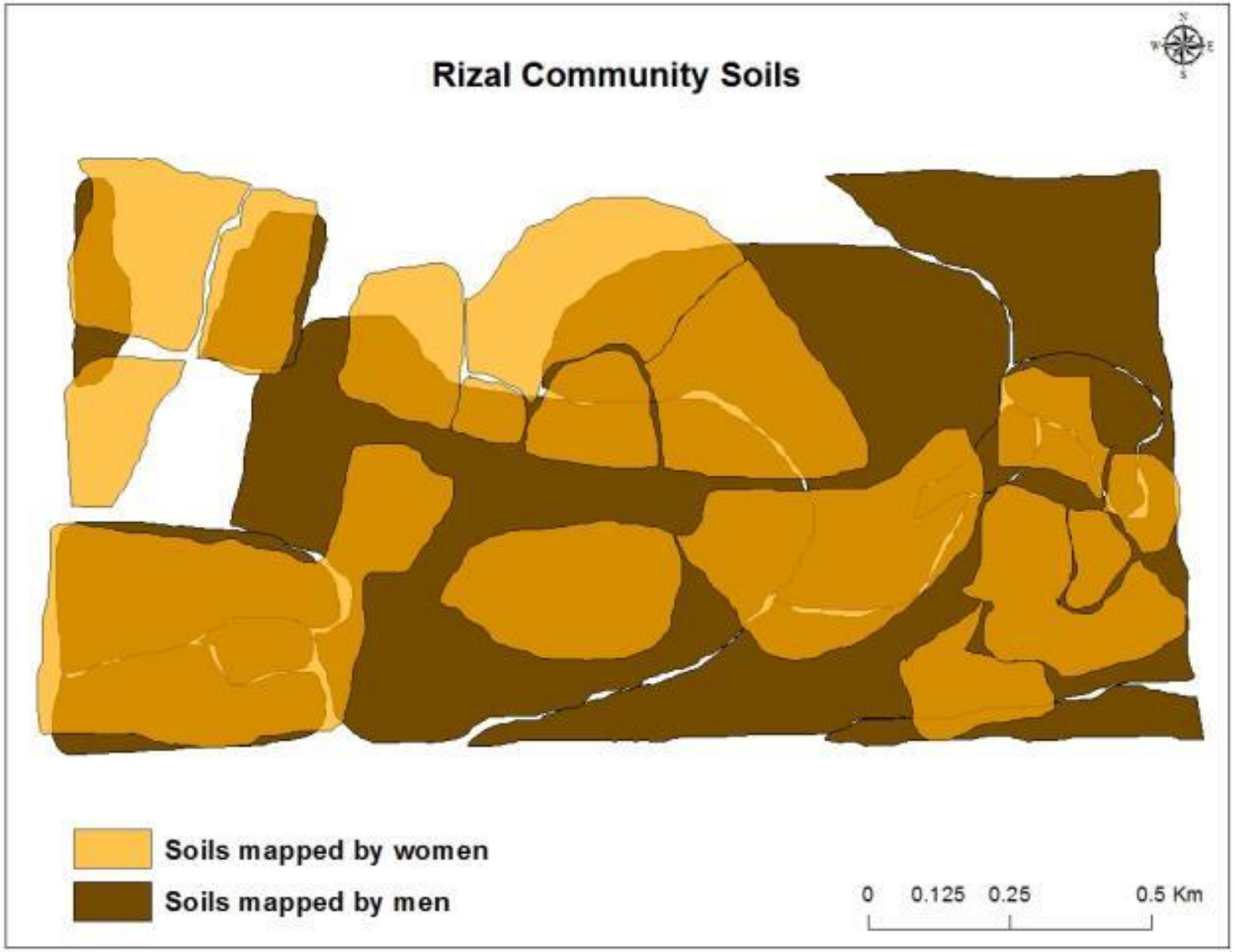

Figure 7: Men's and women's map of community soils in Rizal

This maps shows the overlay of soils drawn in the Rizal FGD from the satellite imagery. Again, the men drew contiguous soils compared to the women's smaller, broken up areas.

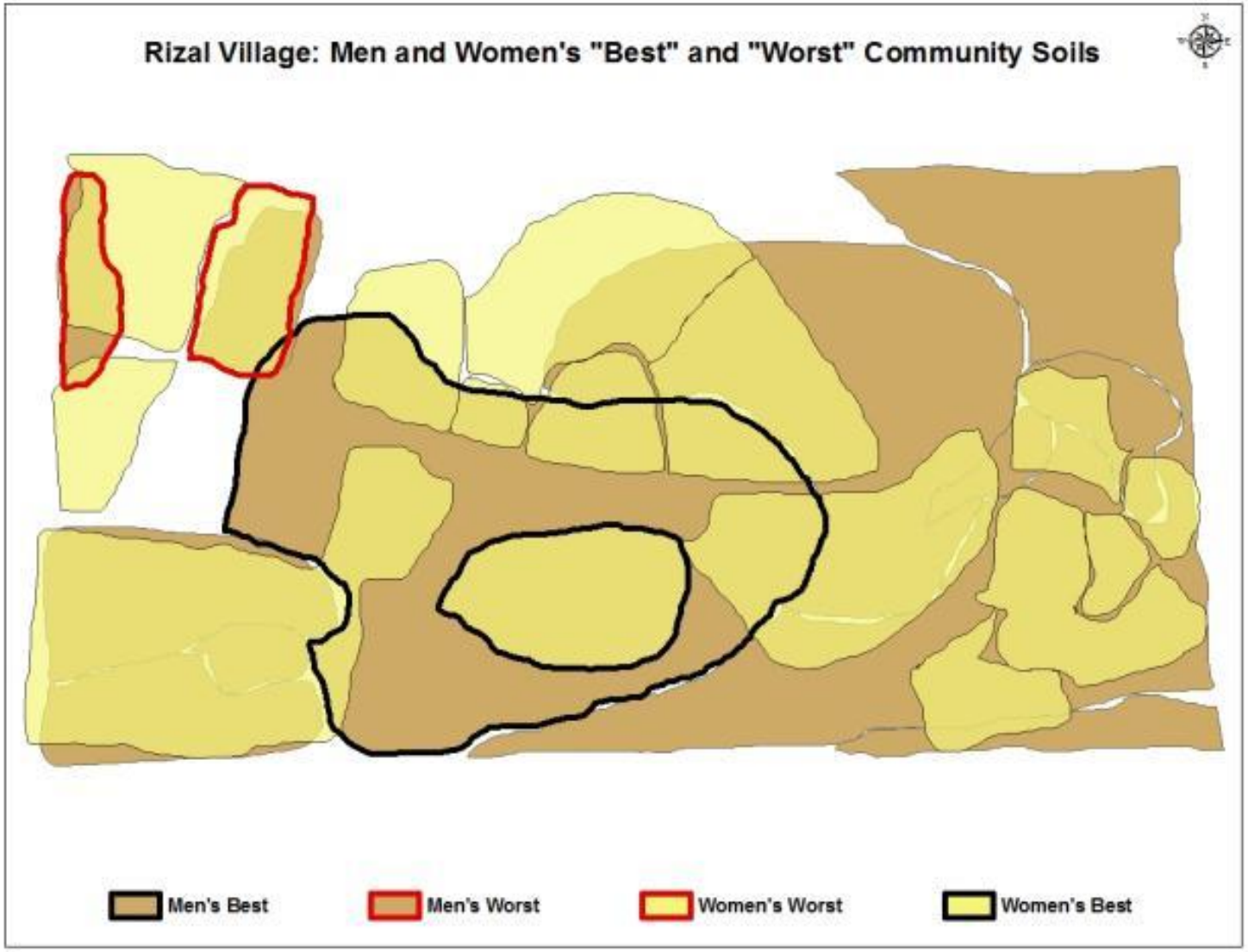

Figure 8: Men and women's best and worst community soils in Rizal

The men and women in Rizal chose very similar soils for the best and worst soils in the community. The best soil is located in the center of the village where the men describe it as black soil and the women describe it as loose soil. Their worst soils are not in the same plot but are fairly near each other in the northwest part of the village. They both call these areas red soil (see Fig. 8 for soil names).

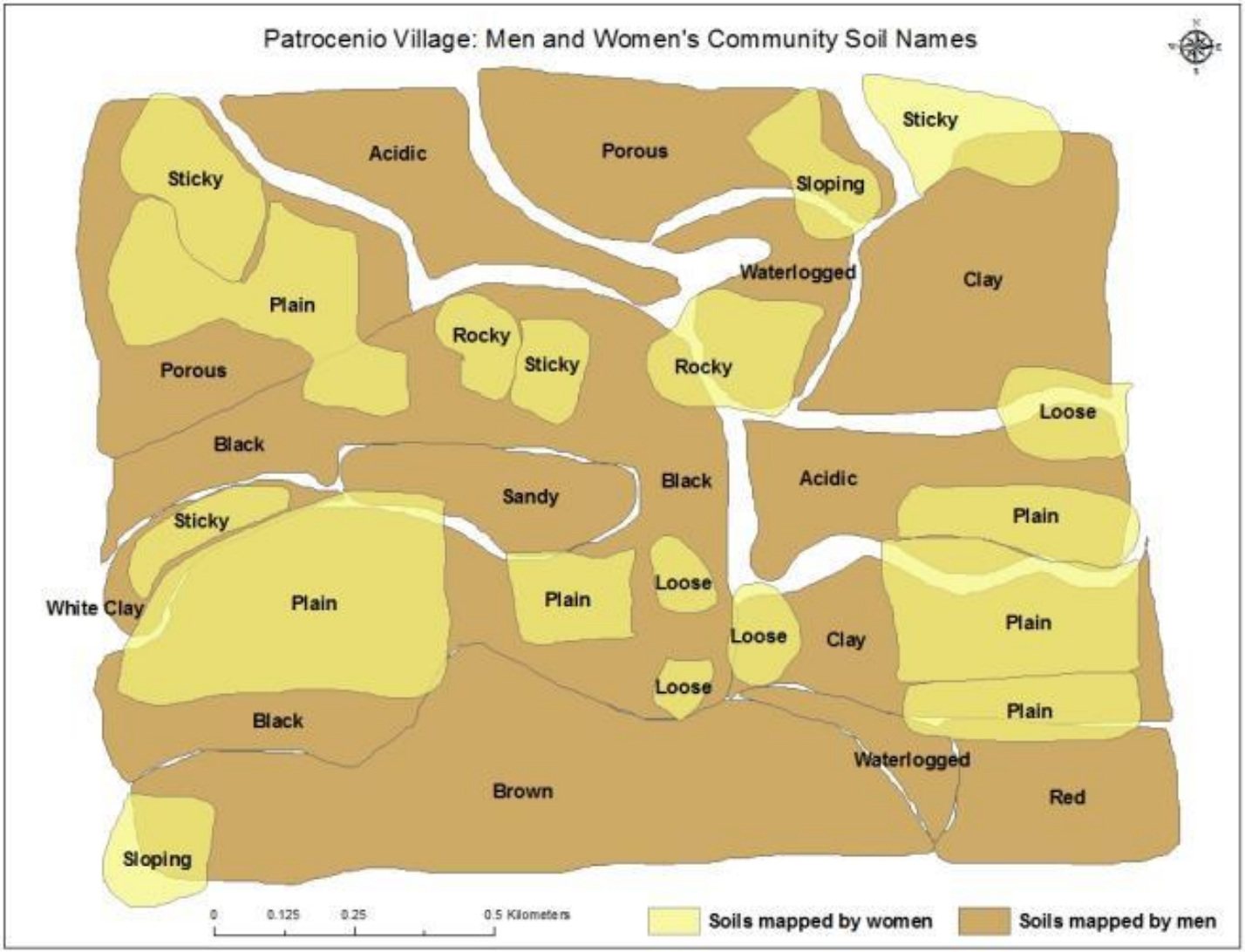

Figure 9: Men and women's community soil names in Patrocenio

This map shows the soils and their names the men and women drew in the Patrocenio FGD. Concerning topography, the women mainly mapped "plain" or flat soil where they generally work. The men primarily used physical terms such as color and texture.

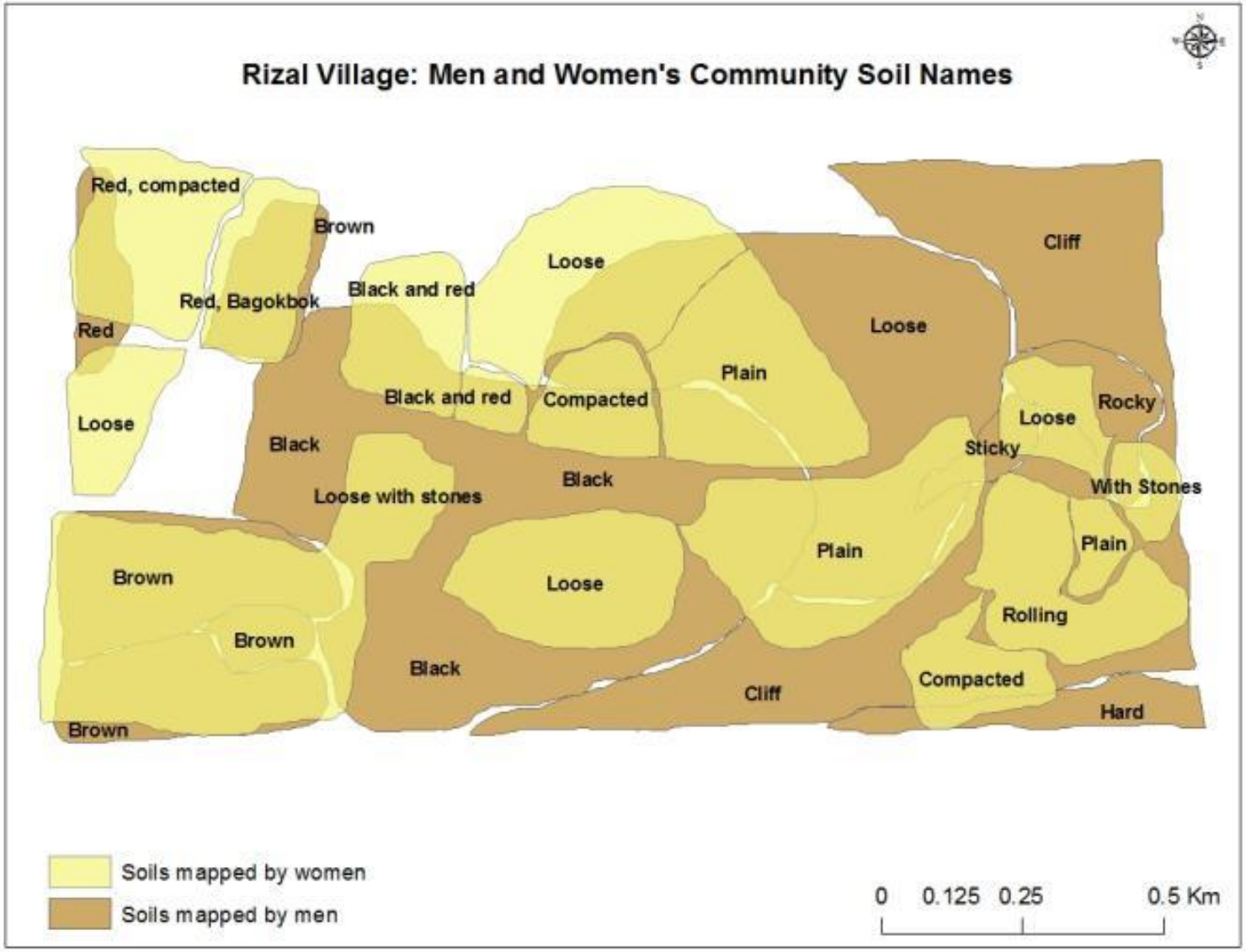

Figure 10: Men and women's community soil names in Rizal

This map shows the names of soil the men and women drew in the Rizal FGD. The women labeled soils such as "plain," loose, and red. The men drew black, loose, and "cliff" or steep soils.

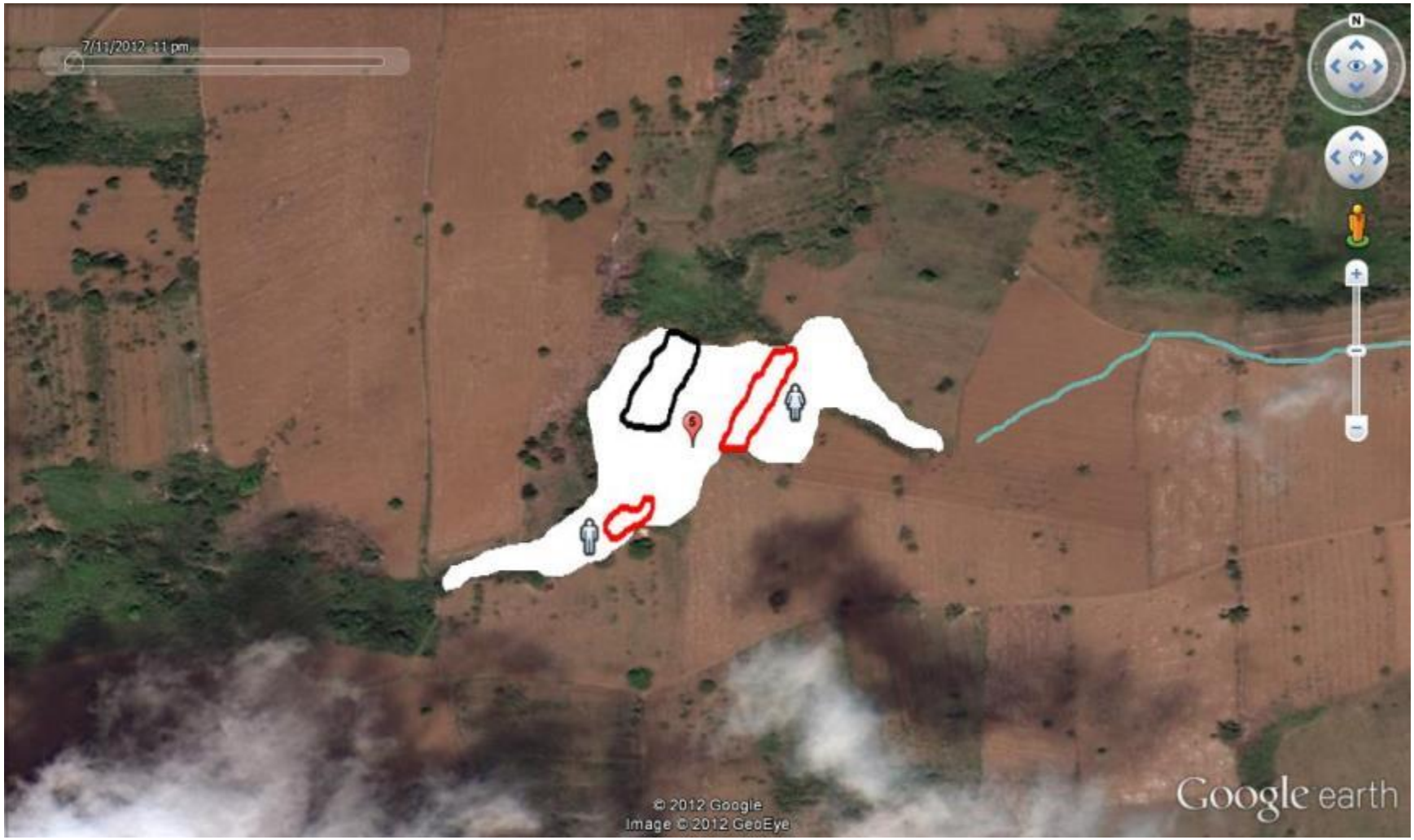

Figure 11: Household best and worst soils

This Google Earth image shows the GPS data from the field visit with household 5 in Rizal. The white polygon shows the farms boundary; the black polygon shows the boundary of the best soil; the red boundaries show the worst soils' locations. This map is one example that shows the husband and wife chose the same best soil but different worst soils. This was seen in ten households and was the main pattern revealed in the GPS mapping of soils.

Figure 12: Satellite image of farms visited in Patrocenio

Google Earth Image displays the farms and households we visited in the village of Patrocenio. The houses are denoted by a star and the fields are the white polygons. With the exception of household 12, most of the farming households in this village live away from the main road and most of the households are located on or close to the farm. The blue line is the path the farmers take from the house to the farm.

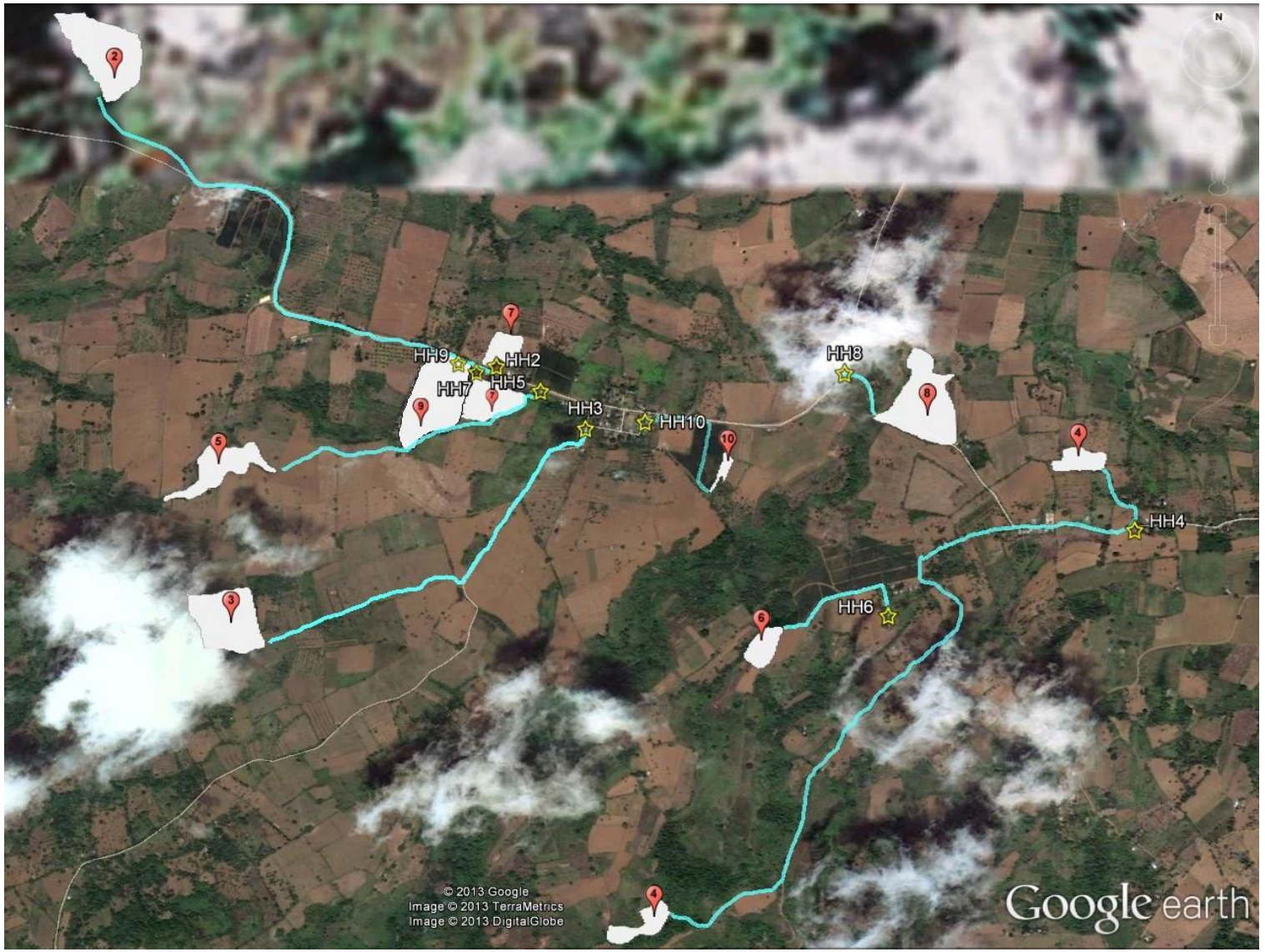

Figure 13: Satellite image of farms visited in Rizal

Google Earth Image displays the farms and households visited in the village of Rizal. In this village, most of the houses are located on a road while the farms are located on the outskirts of the village. The blue lines are the paths taken from the house to the farm. The numbered red balloons associate the field(s) with the household number.

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). The qualitative research activities herein serve to gather data used in the Gender Dimensions Framework (GDF) that is used in this CCRA. Participants in Focus Groups should be equal parts men and women (approximately 5 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 a 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. If possible, include two additional groups for youth (girls/young women and boys/young men). 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. However, some activities, such as the Community Soils Mapping, must be done in separate groups to allow women to discuss and focus on gender issues without interference.*

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 map, photo and soil 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 women present before men after break-out groups so they are not inhibited by men's confidence and knowledge. Tension is predictable in any exercise regarding access and control over resources and labor allocation, as women often raise the issue of income allocation and not "seeing" or "touching" the money from the sale of agricultural commodities produced with their labor—in same cases even referring to this money being directed to other women/wives, etc. One possible strategy to diffuse this is to allow men to respond to women's presentations before making their own, and allow women to respond to men's, and finally to have a facilitated discussion on the differences and try to achieve group agreement. This can help obtain clear information and avoid causing unnecessary divisions. Towards this aim, it is important to stress that the person presenting for the group is to do just that, present a summary of the groups' input, and not their personal views. It is also useful to poll other members of the group by asking for a show of hands for people to express disagreement when this is palpable (many women will express their view collectively but not speak individually). BE SURE TRANSLATOR UNDERSTANDS THAT THEY SHOULD TRANSLATE THE DISCUSSION, NOT JUST SUMMARIZE. NOTETAKERS SHOULD TAKE DIRECT QUOTES OF KEY DESCRIPTIONS.

8 roles needed (3-4 will be needed for *each* of the two break-out groups):

1. Facilitators
2. Note-Takers
3. Observers
4. (Translator, if needed)
5. Scribe for flipchart to alternate with facilitator
6. Women's Community Group
7. Men's Community Group
8. Photographer

Materials Needed:

2 Flip charts (fill out questions in advance for both groups)
2 Community Satellite Maps (1 for men, 1 for women)
Tape, string, or other material to hold flipchart
Markers (in many different, bright colors)
Notebooks and pencils for research team
4 small containers (like Tupperware) with local soil samples (two per group). Label the tubs of 'good' soil #1 and the tubs of 'poor' soil #2 with black permanent marker. (Must be collected in advance from community land).

1.) **<u>Overarching research question:</u>** Do men and women have different soil knowledge and access to resources—including land, agricultural inputs, and livestock— in the Philippines?
2.) What are the implications of conservation agriculture production systems components (year round soil cover, minimum tillage, and crop rotation) on men and women's local soil knowledge, agricultural practices, and access to resources in the Philippines?

3.) How can the combination of participatory methods and geospatial techniques serve to document gendered knowledge, practices, and resources in conservation agriculture production systems?

4.) How can geospatial techniques help understand meaningful relationships between gender and conservation agriculture production systems?

The chart below depicts approximately 3-hour session, including a short soda/snack. Be prepared to adapt. Post an agenda of planned activities if possible and write the questions to be asked (under the prompt Questions and Guidance section) on the Flip Chart!

Time	**Activity Description**	**Prompt Questions & Guidance**	**Data Collected**
Full group of equal parts men and women; meeting with full research team			
15 min	**<u>Exercise 1: Preliminaries</u>** Prayer or other 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 (read informed consent form); Explain this builds on previous research by SANREM and the team; Outline of the day. Read IRB Verbal Consent Form 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	This is a research project: Introduce CRSP project, previous relationship with HC institutions, community's relationship with the team, and plans for future collaboration: Say: "*This is an opportunity for scientists to learn from you."* Also explain: Say: "*We are here to understand community soil types and their locations in the community."* Explain that they will be: • Discussing what soil is. • Describing 2 soil samples and explaining how they know the quality of the soil; • Ranking soil quality indicators • Making a list of soil types in their community; and • Mapping the soil types by hand on a satellite image. • Presenting the exercises Say: *"We want to hear from both men and women so we would like you to break into a*	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

Time	Activity Description	Prompt Questions & Guidance	Data Collected
	different ethnic groups and social status. Farmers and teams break into two groups and take working materials with them. [If time permits: brief discussion on gender and how gender roles have changed.]	*men's group and a women's group after we describe these activities. We will have both groups present at the end."* [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: 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	**Exercise #2: Opening Discussion Question** Encourage everyone's participation. Write question on flip chart paper. Have a participant or facilitator write answers on the flip chart.	Write on flip chart: *"What is soil?"*	Men and women's initial thoughts and perceptions about soil.
20 min	**Exercise #3: Soil Samples Discussion** Pass around the first soil sample (Note: need to be collected in advance from community land--#1 should be "good" soil and #2 should be poor soil). Ask the groups the first question then pass around the second sample and ask the first question. After they describe both soils ask questions 2 and 3. Make sure each person gives an answer. USE ONLY THE QUESTIONS ON THE RIGHT. DO NOT GUIDE CONVERSATIONS. LISTEN. (Post questions on flip chart paper. Pass each soil around and have each person answer. Have note takers or a participant write the answers to the questions on separate sheets of flip chart paper. Observe which senses farmers use to examine soil; how do they determine soil quality? *Good note-takers from research teams in small groups are essential.*	Write on the flip chart: 1. *"How would you describe the soil?"* 2. *"Which one is better?"* 3. *"How do you know which one is better or worse?"*	Documentation of HOW farmers know and classify soils; not final conclusion about which soil is best. Vocabulary and categories (color, texture, smell, crop, taste, etc.) used to classify soils. Gender differences in the above data.

Time	Activity Description	Prompt Questions & Guidance	Data Collected
	Note-Taker: Record exact words used in quotes. Note categories farmers use to distinguish types of soils.		
20 min	**Exercise #4: Prioritization of Local Soil Quality Indicators** Ask farmers what are the indicators of soil quality. Once the participants have discussed how they define and classify these soils, ask them to rank the indicators in order of importance (1=most important)	Write on flip chart: "What are the indicators of soil quality?" Ask: "What is the most important indicator of soil quality?"	Use the terms they used when asking them to rank the indicators. Document gender differences.
20 min	**Exercise #5: Community Soils List** Ask participants to make a list of different types of soil in the community and describe their characteristics. Use the attached chart on flip chart paper prepared in advance and write in the answers. Explain the rating system (1=good soil; 2=neutral soil; 3=bad).	*Write: "How many different types of soil are there in your community?"* For each soil ask/write: *1. "What is the name of the soil?"* *2. "How would you rate the soil?"* *3. "How would you describe this soil?"* *4. "What do you use this soil for?"*	List of community soils and their descriptors
40 min	**Exercise #6: Community Soil Mapping on Satellite Image** Research team presents the satellite image and points out key landmarks (river, school, market, etc.) Decide the boundaries of the community that are to be depicted. Write the questions on the flip chart and also use the number section from the chart from Exercise #5. Have the groups map previously listed soil types from Exercise #5 on the satellite image. Using different colors mark the different types of soils and their names on the community satellite image. Make sure to number the soil drawn on the map, with the same number on the chart. Researchers might need to draw a landmark on the image to overcome participants' hesitation and to help orient.	*Write:* *1. "Where are the different soils on your list located? Please draw them on the map."* *2. "Which ones are the best and poorest soils? Please mark them on the map."* Say: Prepare to make presentation to the mixed group. Several people can present on the description of the soils, the soils list, and the satellite map.	Location and map of community soils from farmers' perspective Gauge mapping ability and orientation Community boundaries established
Full group- bring groups back into one; distribute snacks and drinks			
10 min	Researchers set up the flip chart with prompt questions to guide presentation. Put up the farmers maps and their lists.		

Time	Activity Description	Prompt Questions & Guidance	Data Collected
40 min	**<u>Exercise #7: Presentation of Exercises 2, 3, 4, 5, 6</u>** Presentation by men and women farmers on five exercises.	1. Women present Exercise #2 (what is soil). 2. Men present Exercise #2. 3. Women present Exercise #3 (soil samples). 4. Men present Exercise #3. 5. Women present Exercise #4 and #5 (soil quality rank and community soils list). 6. Men present Exercise #4 and #5. 7. Women present Exercise #6 (community soils map). 8. Men present Exercise #6.	Level and quality of participation of both men and women. Gender differences in soil knowledge, beliefs and perceptions and forms of classifying and evaluating soil quality. Gauge local traditional knowledge and also degree of access to and understanding of technical information provided from outside; note gender differences in access to such information.
10 min	**<u>Closing and Thanks:</u>** Researchers ask or reconfirm household volunteers and explain will be doing more fieldwork in the summer for two months on soils. Set up collection of the four soils samples of men and women's best and poorest soils. Set up volunteers for household visits. Can read IRB description.	1. Questions? 2. Next steps and thanks.	Farmers have opportunity to ask questions and get SANREM team input on soils issues.

Verbal Informed Consent for Participants in Research Projects Involving Human Subjects

Using Qualitative GIS to Explore Local Soil Knowledge and Gendered Landscapes for Conservation Agriculture

Investigator(s): Dr. Maria Elisa Christie, Program Director, Women in International Development Program; Mary Harman, Geography Graduate Student

I. Purpose of this Research/Project

The purpose of this research is to understand men and women's soil knowledge, beliefs, and perceptions; soil management practices; and access to agricultural resources. This research will contribute SANREM CRSP's research on conservation agriculture. We ask that eight households, including at least two-female headed households, volunteer to be part of the study. We would like equal parts men and women with different ages, farms, social status, and household types. More than ten households can participate if desired.

II. Procedures

The focus group session on community soils will take 3 hours. Participants will be asked to describe two local soil samples, prioritize local soil quality indicators, make a community soils list, and map the community soils on a satellite image. It will take place at a local community gathering place.

For the household visits, the researcher will need to visit the household twice, either in the same day or two separate days. We would like to visit twice so that we can talk to the male and female head of the household separately. The household visit will last 2 hours.

During the household visit, participants will be asked to describe local photos of soil or livestock; make a hand drawn map of participants' agricultural spaces and the household's soil types, draw their soils on a satellite image, and talk about changes in their agricultural practices and in the landscape.

During the field visit, the researcher will take photographs and video of the people, households, fields, and animals. They will also take GPS points of the participant's house, fields, and path(s) connecting the two. Soil samples will be taken by UPLB. The participants will be asked to describe their soils, agricultural practices, and landscape.

III. Risks

The research team believes this research will pose no threats. However, there is always the possibility of jealousy among community members in being involved in a development project. Thus, in order to reduce this possibility we must make clear that there is no material compensation for participating in the research and there is no promise or guarantee of any benefits.

IV. Benefits

Participating in this research will allow farmers to know about the soil health and soil practices. Ultimately this research hopes to assist farmers, SANREM CRSP, and its partner organization, UPLB, in making a conservation agriculture plan. However, there is no promise or guarantee of any benefits.

V. Extent of Anonymity and Confidentiality

Your participation in this research is voluntary and anonymous. Any personal information will be coded and will be kept separate from research data. At no time will the researchers release the results of the study to anyone other than the individuals working on the project without your written consent. The researcher, the principal investigator, and the translator will have access to

the data. It is possible that the Institutional Review Board (IRB) may view this study's collected data for auditing purposes. The IRB is responsible for the oversight of the protection of human subjects involved in research. The data will be destroyed one year from now after the researcher has completed her thesis.

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. Subjects are free to not answer any questions or respond to experimental situations that they choose without penalty.

VIII. Subject's Responsibilities

I voluntarily agree to participate in this study. I have the following responsibilities:
-Participate in either of the focus group session, household visit, and field visit.
-Discuss community soil types.

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 hereby acknowledge the above and give my voluntary consent:

_____ Date_____ **Yes No**

Exercise #5 Community Soils List

Write this chart on flip chart paper for both men's and women's groups.

# on map	What is the name of the soil?	Classification			How would you describe this soil?	What do you use this soil for?	Notes/Quotes
		1 Good	2 Normal	3 Poor			

Appendix B: Household Interview Guide

This document is meant to serve as a guide to SANREM partners working with the Gender Cross-cutting Research Activity (CCRA). The qualitative research activities herein serve to gather data used in the Gender Dimensions Framework (GDF) that is used in this CCRA. Participants in household interviews should be a collection of married households, female-headed, and male-headed households. They should include young as well as old, and people of different status/wealth level. Time is fluid. These interviews should either be of men and women from the same household, or 10 women and 10 men from different households. Make sure women and men are interviewed separately, with the women being interviewed first. (Sampling will be determined upon arrival and after pre-testing). The following can be done in approximately* ***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. 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 mapping, photo and soil 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. Posting definitions and symbols for Control (C), Access (A) and Labor (L) on paper in view of the participant and other creative approaches helps guide the process.

Be sure women are interviewed before men of the households, so they are not inhibited by men's confidence and knowledge. BE SURE TRANSLATOR UNDERSTANDS THAT THEY SHOULD TRANSLATE THE DISCUSSION, NOT JUST SUMMARIZE. ***Get verbal informed consent for IRB before interviews. Remember to make code name for household participant and take GPS point of the household.***

Roles needed:

1. Researcher
2. Translator
3. Note-taker
4. Observer

Materials Needed:

Flip chart paper
Camera
Audio Recorder
Watch
GPS
Markers (in many different, bright colors)
Photo
Notebooks and pencils for research team

Overarching research question:

5.) Do men and women have different soil knowledge and access to resources—including land, agricultural inputs, and livestock— in the Philippines?

6.) What are the implications of conservation agriculture production systems components (year round soil cover, minimum tillage, and crop rotation) on men and women's local soil knowledge, agricultural practices, and access to resources in the Philippines?

7.) How can the combination of participatory methods and geospatial techniques serve to document gendered knowledge, practices, and resources in conservation agriculture production systems?

8.) How can geospatial techniques help understand meaningful relationships between gender and conservation agriculture production systems?

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

5 min	**Introduction** Overview of SANREM research project and student's work; Explain participation is voluntary (read informed consent form).	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 household soil types and their locations on your farm. I am also interested in understanding men and women's agricultural practices and livestock practices."* Explain that they will be: 1. Describing 2 pictures of soil and animals. 2. Describing two soil samples from the community. 3. Making a hand drawn map of all the agricultural resources in the physical landscape of his/her farm, indicating which places he/she has access to and control over. 4. Mapping the soil types of the household farm by hand on the same map, as well as on an aerial image. 5. Identifying which soil he/she uses as his/her 'best' or 'worst' soil. Following the interview, the researcher will use a GPS to mark the 'best' and 'worst' soil for later soil sampling by the team. 6. Talking about changes in the landscape and practices. 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.
10 min	**Demographic Information** Collect basic demographic information and farming history.	*1.* Name: *2.* Code Name: *3.* Date:	

	Record in **Appendix B.1**	4. Age 5. Number of children: 6. Education Level: 7. Civil Status: 8. *"How long have you been living in this village?"* 9. *Are you a farmer? How long have you been farming?* 10. *"Do you have any other work or other sources of income?"* 11. *"Do you own any land? If so, does someone own the land with you? If not, who owns the land you work? Do rent the land?"* 12. *"How did you obtain the land?"* 13. *"How long have you been working this land?"* 14. *"What challenges do you face as a farmer?"* 15. *"What benefits do you find in farming?"*	
20 min	**<u>Exercise #1: Photo Interpretation</u>** Have participants describe local community photo of an agricultural area and livestock. Record in notebook. The purpose of this exercise is to elicit knowledge, beliefs, and perceptions about soil and understand farmer's "worldview." Also to get an idea of crop cover, crop rotation, tillage, and other soil management practices. **Record in Appendix B.1**	16. *"What is going on in this picture?"* 17. *"Do you think these animals affect the soil? If so, how?"* 18. *How do they affect your crops?*	Qualitative data on attitudes and perceptions.
10 min	**<u>Exercise #2: Soil Samples Discussion</u>** Ask the participants to describe two local soil samples. One should be a "bad" soil and one should be a "good" soil.	19. *"How would you describe these soils?"* 20. *"What do you call these soils?"* 21. *"Which one is better? How do you know"*	
10 min	**<u>Introduce Gendered Access, Control, and Labor Mapping Activity</u>** Explain that we are asking the person to draw a map of all the agricultural resources in the physical landscape of his/her farm, indicating which places he/she has access to and control over. Then the person will be asked to map the soil types of the household farm by hand on the same map. (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	**"***We want to know how men and women live in this area. What do they do to earn money and survive? Where do men and women work? And Who makes decisions over resources? We also would like to learn about the different types of soil that you use, so we can better understand how men and women farm and pasture."* *"Have you drawn a map before?"* Research can make an initial sketch of a household farm. Simple sketches make people feel comfortable. Draw examples of local things: animals, crops, river, etc. Make disclaimer: *"I am not an artist and I do not know your community: this is an example only. Remind people to focus on agriculture including animals."*	Note key gender issues and changes to probe further with other exercises. Difference in experience with mapping between individuals and genders.

	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.)		
15 min	**Exercise #3: Gendered Access, Control, and Labor Mapping Activity** Let the farmers draw. Do not interrupt the mapping process, but when the person has finished drawing, ensure that he/she has labeled features.	*"Please draw the resources and activities on your farm that you need for your livelihood."* If needed you can suggest these ideas: *"Draw your house, the land that you use, water, your animals, and any other things that are important for you to grow food, feed your animals, make money, and take care of your family."*	Participatory map of labor, control and access over resources.
5 min	**Explaining Access, Control, and Labor** Mapping Access and Control to assets/resources in the physical landscape needed for agriculture (including animals). Draw a locally recognized symbol for male and female such as stick figures with pants or skirt. Post letters C, A, and L with short definition—listed to the right. On the initial sketch of a household farm put A, C, and L with resources.	*"Of the resources people use, we would like to know who between the man and the woman has access to, control over, and provides labor."* Explain Access, Control, and Labor. *Access: "Who has the ability to participate, use, and benefit from a resource?" (Ex: "Can I borrow your pencil?" (YES)* *Control: "Who has the power to decide how a resource can be used? Who owns the resource?" (Ex: "Can I break your pencil?" NO!)* *Labor: "Who does the work?"* "*Could you draw which areas or things men and/or women have access? Please indicate which the gender symbols and an A."* *"Over which do men and/or women have control?" (Mark with C with gender symbol)* *"What labor is done by men and/or women?" (Mark L with gender symbol)*	
20 min	**Mapping Crops and Spaces for Food** Now, you will be asking about plots and planting. Make sure the person has drawn the plots they own and/or work. For each food space, ask questions **22-40 (Appendix B.2).** Record answers in notebook with corresponding numbers.	*"Please draw the spaces where you grow food."* Ask about Access (A), Control (C), and Labor (L) and draw gender symbols. 22. *"What has been planted here? What will you grow here next? Or what is the rotation here?"* 23. *"Do you fallow your plots?"* 24. *"Who decides when to fallow or not?"* 25. *"If so, for how long? If not, why not?"* 26. *"Do you use fertilizer? If so, where does it come from? If not, why not? Who usually buys it?"* 27. *"How do you work and prepare the plot? With tractor or animals?"* 28. *"Who does this work?"* 29. *"Who plants?"* 30. *"Who decides what to plant?"* 31. *"Who weeds and/or cares for the plot?"* 32. *"Who applies the fertilizer?"*	

		33. *"Is this plot irrigated or rain fed?"* 34. *"Who irrigates?"* 35. *"When do you harvest?"* 36. *"Who decides when to harvest?"* 37. *"Who participates in harvesting?"* 38. *"What do you do with what you harvest?"* 39. *(if sells it) "Who sells it?" (if consumes it) "Who cooks it?"* 40. *"Who decides?"*	
10 min	**<u>Mapping Animals and/or Pasture</u>** Mapping pasture and livestock spaces, practices, and ACL. For each "pasture" space the person draws, ask **questions 41-48 Appendix B.3**. Be sure to ask these questions and write the corresponding A, C, L and gender symbols. Also be sure to number each pasture space with a corresponding number in your notebook.	**"**We also want to know about your animals. Where do you take the animals to pasture? Please draw the path." 41. *"Do you own or take care of any animals? If so, what kind and how many?"* 42. *"Where do you take your animals to pasture?"* 43. *"Who takes the animals to pasture here?"* 44. *"Who decides where the animals pasture?"* 45. *"Do you have to pay to use this space?"* 46. *"What do the animals eat here? Does this change with seasons?"* 47. ***"**What do you use your animals for?"* 48. *"Who decides if you can sell the animals?"*	
20 min	**<u>Exercise #4: Household Soils List and Mapping Activity</u>** Mapping soils at the farm. **Note:** Be sure to ask the person questions about the soil and fill in the chart **(Appendix B.4).** Please number each soil name on the map and put next to the soil name in the chart. For other soil questions not in chart, record them in **Appendix B.5.** If farmer cannot write, researcher can write the soil name for him or her on the map.	**"***On your farm, are their different soils? If so, draw and name them."* Ask chart questions. Show them the satellite image and locate landmarks they should be able to identify. Make sure they are oriented. (If they can't see the map or don't understand it, skip this exercise.) Ask: *"Do you know any other soils in the community or near your household?" "Can you locate them on the map? If so, draw their boundary and what you call that soil"* Ask chart questions. **Chart questions** -*"What is the name of the soil?"* -*"What is the rating?"* -*"How would you describe this soil?"* -*"What is this soil used for?"* When the person is done mapping the soils, ask: 49. *"Are there any other soil types that you use and have not drawn here?"* 50. *"What are you 'best' and 'worst' soils? Please the mark them on your map."* **(Make sure you notice which soil type**	List of soils. Participatory map of household soils with A, C, L. Gendered knowledge, beliefs, and perceptions of soil.

		in the chart above is marked.) *51. "Why did you choose this as your 'best' and 'worst' soil?"* *52. "How did you learn about soils?"* *53. Do you ever attend trainings or seminars on soils or agriculture?*	
10 min	**<u>Exercise #5: Changes in Climate, Pasturing, Planting, Soil Over Time</u>** Record answers in **Appendix B.6 for questions 54-65.**	*54. "Have you noticed a change in the climate?"* *55. "If so, how was it before?"* *56. "How is it now?"* *57. "Have you noticed a change in pasturing?"* *58. "If so, how was it before?"* *58. "How is it now?"* *60. "Have you noticed a change in practices for planting?"* *61. "If so, how was it before?"* *62. "How is it now?"* *63. "Have you noticed a change in the soils?"* *64. "If so, how was it before?"* *65. "How is it now?"*	
10 min	**<u>Closing and GPS of 'Best' and 'Worst' Soils</u>**	*"Do you have any questions for me?"* Ask them if they are willing to do the field visit now or if they would like to set up another time. Please see Field Visit Guide.	Opportunity for questions and setting up next visits.

APPENDIX B.1:

1. **Name:**
2. **Code Name:**
3. **Date:**
4. **Age**
5. **Number of children:**
6. **Education Level:**
7. **Civil Status:**
8. **"How long have you been living in this village?"**
9. **Are you a farmer? How long have you been farming?**
10. **"Do you have any other work or any other sources of income?"**
11. **"Do you own any land? If so, does someone own the land with you? If not, who owns the land you work? Do rent the land?"**
12. **"How did you obtain the land?"**
13. **"How long have you been working this land?"**
14. **"What challenges do you face as a farmer?"**
15. **"What benefits do you find in farming?"**

APPENDIX B.2:

16. **"What is going on in this picture?"**
17. **"Do you think these animals affect the soil? If so, how?"**
18. **"How do they affect your crops?**
19. **"How would you describe these soils?"**

20. **"What do you call these soils"**
21. **"Which one is better? How do you know?"**
22. **"What has been planted here? What will you grow here next? Or what is the rotation here?"**
23. **"Do you fallow your plots?"**
24. **"Who decides when to fallow or not?"**
25. **"If so, for how long? If not, why not?"**
26. **"Do you use fertilizer? If so, where does it come from? If not, why not? Who usually buys it?"**
27. **"How do you work and prepare the plot? With tractor or animals?"**
28. **"Who does this work?"**
29. **"Who plants?" (L)**
30. **"Who decides what to plant?" (C)**
31. **"Who weeds and/or cares for the plot?" (L)**
32. **"Who applies the fertilizer?"**
33. **"Is this plot irrigated or rain fed?"**
34. **"Who irrigates?"**
35. **"When do you harvest?"**
36. **"Who decides when to harvest?"**
37. **"Who participates in harvesting?"**
38. **"What do you do with what you harvest?"**
39. **(if sells it) "Who sells it?" (if consumes it) "Who cooks it?"**
40. **"Who decides?"**

APPENDIX B.3.

41. **"Do you own or take care of any animals? If so, what kind and how many?"**
42. **"Where do you take your animals to pasture?"**
43. **"Who takes the animals to pasture here?" (L)**
44. **"Who decides where the animals pasture?" (C)**
45. **"Do you have to pay to use this space?"**
46. **"What do the animals eat here? Does this change with seasons?"**
47. **"What do you use your animals for?" (L)**
48. **"Who decides if you can sell the animals?" (C)**

APPENDIX B.4.

# on map	What is the name of the soil?	Classification			How would you describe this soil?	What do you use this soil for?	Notes/Quotes
		1 Good	2 Normal	3 Not-so-good			

APPENDIX B.5.

49. "Are there any other soil types that you use and have not drawn here?"
50. "What are you 'best' and 'worst' soils? Please the mark them on your map." (Make sure you notice which soil type in the chart above is marked.)
51. "Why did you choose this as your 'best' and 'worst' soil?"
52. "How did you learn about soils?"
53. "Do you ever attend trainings or seminars on soils or agriculture?"

APPENDIX B.6.

54. "Have you noticed a change in the climate?"
55. "If so, how was it before?"
56. "How is it now?"
57. "Have you noticed a change in pasturing?"
58. "If so, how was it before?"
59. "How is it now?"
60. "Have you noticed a change in practices for planting?"
61. "If so, how was it before?"
62. "How is it now?"
63. "Have you noticed a change in the soils?"
64. "If so, how was it before?"
65. "How is it now?"
66. "Do you have any questions for me?"

Field Visit: Why is your land important to you?