KNOWLEDGE MOBILIZATION FOR SUSTAINABLE FOOD PRODUCTION: NUTRITION GARDENING AND FISH FARMING COMMUNITIES OF PRACTICE IN THE KOLLI HILLS, INDIA

by

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Abstract

This study explores the importance of knowledge mobilization in the formation of more sustainable food systems. In particular, it examines the development and maintenance of sustainable food production practices that enhance food security for small farmers in the Kolli Hills, India. It uses qualitative techniques to understand how information and knowledge sharing about sustainable agricultural techniques takes place in two communities of practice (CoP) – nutrition gardening and fish farming. My exploration of the formal and informal knowledge systems emphasized the importance of combining traditional agricultural knowledge with expert and scientific knowledge to develop food production practices that improve nutrition for farm families and could increase household income. Farmers interacted with the formalized knowledge system through resources such as agricultural institutions and government extension, whereas informal knowledge systems included face-to-face interaction while collecting water, washing clothes or attending festivals and other community gatherings.

My focus on each CoP allowed me to gain an understanding of the types of knowledge that practitioners had, the sources for that knowledge, as well as what information was lacking in order to properly carry out their respective practices. Nutrition gardeners lacked understanding of pest control, soil health, organization of plants and produce preparation methods. Fish farmers lacked information about timing of harvests, how to prepare harvested fish, how to market excess fish, and starting a hatchery. Farmers in both CoPs believed that face-to-face contact with experts and each other would be the most effective mechanism in order to improve access to information. When asked about the use of Information and Communication Technology (ICT), farmers agreed that video could be used to enhance meetings. Overall, farmers agreed that modern ICTs such as computers are most suited for younger, educated people, but the prevalence of cell phones might suggest their future use for accessing and sharing information.

This study also examined the ways that communities are formed around sustainable food production practices, including the factors that have shaped their formation, their purpose and function, who is involved, and what activities hold the communities together. Amongst practitioners of both CoPs, their primary reason for participating was the health and nutrition of their families. The nutrition gardening community was created as members interacted informally in a variety of ways – through cooking demonstrations, exchange of recipes, and at festivals, etc.

Individual participation, community cultivation, relationship-building and open-ended conversations were most valuable to them in the formation and maintenance of their practice. Fish farmers on the other hand interacted more formally and placed value on meetings, projects, content publishing and access to expertise as important in holding their community together. These differing qualities offered insight into the potential sustainability of each CoP. Nutrition gardening is no longer functioning due to a lack of rainfall, lack of access to a variety of seeds and gardening expertise. Fish farming continues to thrive and its success in contrast to nutrition gardening may be attributed to the value of being part of a collective and the excitement of learning together.

This research has shown that understanding knowledge mobilization amongst small-scale farmers is an essential component in the establishment of sustainable food production practices that promote both food sovereignty and security for all.

Preface

These two papers emerged from a larger research project called “Alleviating Poverty and Malnutrition in Agrobiodiversity Hotspots of India” (APM) which was a partnership between the MS Swaminathan Research Foundation and the Faculty of Agriculture, Life and Environmental Science at the University of Alberta. The authors, Hudson, S, N. Krogman and M. Beckie, acknowledge the contributions of the team members at the M.S Swaminathan Research Foundation (MSSRF), Wayamba University in Sri Lanka and the University of Alberta. We also extend our gratitude to the farmers of the Kolli Hills for sharing their time, reflections and knowledge to contribute to this study. This research is supported by the Canadian International Food Security Research Fund, with funding from the Canadian International Development Agency (CIDA), the International Development Research Centre (IDRC) as well as the Social Sciences Humanities and Research Council (SSHRC). Their financial, material and intellectual support is appreciatively acknowledged.

An early draft of paper #1 (“The Social Practices of Knowledge Mobilization for Sustainable Food Production: Nutrition Gardening and Fish Farming in the Kolli Hills of India”) was presented at the “Knowledge Mobilization Workshop: Supporting Sustainable Agriculture Communities of Practice with Low Cost ICT” in Wayamba, Sri Lanka in 2013 and at the REESA 7th Annual Graduate Student Conference: Seeing Through a Different Lens: Multidisciplinary Perspectives on the Future of Environmental, Resource and Agricultural REESearch in Edmonton, Canada in the same year. The methodology of this work was presented at the “13th Annual Advances in Qualitative Methods (AQM) Conference” in 2014. Further, a poster including data from this research was presented both at the “First International Conference on Global Food Security” in Noordwijkerhout, Netherlands in 2013, at the “Engagement Scholarship Consortium Conference: Transforming University Policies and Practices” at the University of Alberta, Edmonton, in 2014 and at the “Bentley Lecture in Sustainable Agriculture 2017”. The final draft of this paper was published in *Food Security: The Science, Sociology and Economics of Food Production and Access to Food* (ISSN 1876-4517; DOI 10.1007/s12571-016-0580-z) in 2016.

A presentation was also given based on the overall experience of conducting research in the Kolli Hills at the "Kule Institute for Advanced Undergraduate Research Conference: Tomorrow's Ideas, Now" at the University of Alberta in Edmonton, 2013.

This thesis is an original work by Suraya Hudson. This research project, of which this thesis is part, received research ethics approval from the University of Alberta Research Ethics Board, "Understanding Social Practices of Knowledge Mobilization for Sustainable Food Production and Provisioning among Farmers and Laborers in Kolli Hills, India," No. Pro00036755, February of 2014.

Dedication

For the most brilliant, compassionate, amazing and humble man to ever exist…
Your words: “I do not pretend to impart wisdom or virtue… after all, how I am, and what I know, I learned from each of you.”

-Bob Hudson

Forever Yours, Papa Bear.

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Chapter One: Introduction

The intersecting challenges of food security throughout the world, such as climate change, resource degradation, a growing population and increasing income disparity, deserve our immediate attention (Hudson, Krogman & Beckie 2016). Short term national interests continue to eclipse long-term collective concerns about our local and global food systems. This is evident with the continued emphasis on agricultural industrialization, concentration of capital and resources and globalized trade of a limited number of agricultural commodities.

The Green Revolution in the 1960s transformed farming practices all over the world and for some of the poorest countries, like India, it was common for traditional farming practices and diverse local varieties of foods to be replaced by monocultures of cash crops (Shiva 2016). This shift in agricultural practices did not address food security nor did it benefit the poor financially, but instead, increased long term debt for marginal and small farmers (Carolan 2012). The Green Revolution has also been linked to negative ecological impacts such as compromising ecosystem integrity and biodiversity (Altieri 2009).

For the purposes of this research, traditional knowledge refers to the knowledge that is passed down informally from generation to generation. Farmers in particular inherit this knowledge from their ancestors and build upon it continuously as they gain access to new sources of information and learn from their own experiences (Morales & Perfecto 2000). New knowledge, on the other hand, refers to that knowledge that is associated with a scientific and technological approach – also typically generated and mobilized by formal institutions.

In recent decades, the increase in socio-economic disparities along with adverse ecological impacts have garnered public interest, scientific research and interdisciplinary academic inquiry. There are many varying ideas and approaches to achieving food security, but because small farmers generate over 80% of the world's food supply, it is appropriate to simultaneously address traditional knowledge and scientific understanding in order to build a more resilient agriculture system (FAO 2013; Narayanan et al. 2004). Toward this end, this thesis examines social learning among farmers of Kolli Hills, India to create and exchange knowledge for sustainable, healthier food production in their communities.

Research Purpose and Objectives

This study was part of a larger research project called "Alleviating Poverty and Malnutrition in Agrobiodiversity Hotspots of India" (APM) project which was a result of a partnership between the MS Swaminathan Foundation based in Chennai, India and the Faculty of Agriculture, Life and Environmental Sciences at the University of Alberta. The overall goal of this program was to enhance nutrition and food security at the individual, household and community levels in rural India (MSSRF & University of Alberta 2010). The purpose of my research is to examine the development and maintenance of sustainable food production practices, particularly to enhance food security for small-scale farmers in the isolated communities of the Kolli Hills in Tamil Nadu, India. The project is based on the fundamental premise that knowledge is critical to the development of more sustainable food systems. Using qualitative techniques, I explore how information and knowledge sharing about sustainable agricultural techniques takes place in agricultural communities of practice. More specifically, my objectives are: 1) to understand how knowledge is acquired and shared; 2) to identify what obstacles farmers face and what aspirations they have with respect to knowledge mobilization; 3) to explore if there is a role for information and communication technologies (ICT) in supporting or contributing to the social practices of knowledge mobilization; 4) to examine the different ways in which communities of practice are formed and maintained and; 5) to explore what factors allow the Communities of Practice (CoP) to be sustained.

Chapter Two: Paper #1: ("Knowledge Mobilization for Sustainable Food Production in the Kolli Hills, India") uses data collected from Participatory Rural Appraisal (PRA), semi-structured interviews and participant observation to understand how knowledge about sustainable food production is acquired and mobilized amongst small-scale farmers in the Kolli Hills of India. We explored ways in which farmers are accessing, using and sharing knowledge about nutrition gardening and fish farming as well as what barriers exist for equitable access to this information. We also asked farmers what information is still lacking about these practices and what mechanisms could be put in place to improve access to this knowledge. We included the current use of and the potential role for ICT to enhance knowledge mobilization. ICT can be broadly defined as anything used to capture, convey, share or articulate information and

communication. This paper has been published in *Food Security: The Science, Sociology and Economics of Food Production and Access to Food.*

Chapter Three: Paper #2: ("Establishing Sustainable Food Production Communities of Practice") uses the same data to understand nutrition gardening and fish farming as Communities of Practice (CoPs). I examined the factors that have shaped their formation, their purpose and function, who is involved, what activities hold these communities together, and their role in strengthening sustainable food production and consumption practices. The target journal for this paper is the *Journal of Agriculture, Food Systems and Community Development.*

Theoretical Guidance

Two major theoretical frameworks informed this study: social practice theory and community of practice theory. Both of these theories helped to understand how farmers gain, share, and apply knowledge to sustainable food practices.

The social practices of knowledge mobilization approach in Chapter 2 (Paper #1) provides a novel lens to understand daily routines and how they change through the introduction of a new practice. The work of Shove, Pantzar & Watson (2012) was particularly useful for understanding learning, the sharing of knowledge and the ways that people put this knowledge into practice. The three main elements that these authors describe as the ingredients of social practices are materials, meaning and competency. The practice can only exist when these three elements are all present and linked (Shove et al. 2012). For farmers, in order for their practices to become routine, they must have the resources to carry out the practice, develop skills and knowledge in order to do so, but also must find meaning in the development of these practices. Applying social practice theory helps us to understand how members of society work individually and collectively in order to transform their communities and the world around them. Furthermore, ensuring that both formal and informal knowledge were taken into account was important, particularly in an isolated and rural community, where the transfer of information is often difficult. Malcolm, Hodkinson & Colley (2003) offer definitions of both formal and informal learning that are useful for the purposes of this study. Formal knowledge can be described as acquisitional or individual learning (vertical or propositional knowledge) whereas informal knowledge describes learning through everyday embodied practices (horizontal

knowledge). The exploration and focus on knowledge mobilization, including formal and informal learning, set the precedent for the next chapter.

Chapter Three (Paper #2) explored communities of practice theory, which was useful in providing insight into the ways that farmers participate in the same practices and create learning communities around them. This was key to an exploration of the potential for the sustainability of a particular practice. Understanding the three main elements that differentiate a community of practice from other types of communities offered by Wenger and his colleagues was of value for this study. Firstly, there is a shared domain of interest, secondly, a community is formed around this interest and finally the creation of the practice itself which takes time and sustained interaction (Wenger-Trayner 2015). Within a CoP analysis, I used Wenger, White and Smith's *Orientations* to understand the typical patterns of activities and connections through which members experience being members of a community (2009). This was useful in understanding what factors hold the CoP together, which offer important indications of the possibility of a sustained practice.

Significance and Contributions to Research

The following study will be of interest to social scientists, policy makers, those interested in the promotion of sustainable food systems, researchers and others interested in food security, and all stakeholders involved in development work from international organizations to small-scale farmers themselves. Understanding what sociological factors predispose a newly introduced practice to either succeed or fail in any circumstance is important in all areas of study. This research applies social theory to sustainable food production and can be used as an example for those who are doing small scale-agricultural development work throughout the world.

Most academic research and development work related to food security tends to focus on agricultural and environmental sciences. This research, on the other hand, takes a much deeper look at the sociological factors in the development of sustainable food production. Although it has examined only two case study scenarios, this type of study could easily be implemented on a larger scale.

The isolated and rural context for this research on food security is an important feature of this study. There are many regions around the world where such levels of food insecurity exist,

such as in sub-Saharan Africa. The relatively homogenous population in the Kolli Hills, in terms of income and education levels, is similar to other small, remote villages across the world. Most other projects that have been conducted in the Kolli Hills were focused on microfinancing for small business development or the formation of self-help groups (i.e., empowerment of women). The agriculture-related government funded programs in the area were meant to focus on extension activities, technology dissemination, input distribution and agricultural training, but the farmers explained that the only government presence is for the public distribution system that supplies staples like rice, flour and sugar to farmers. The APM project has addressed this lack of focus on the farmer and integrated sustainable food production to address poverty and malnutrition (MSSRF 2014). Within the larger APM project, my particular study takes a more in-depth analysis of how the farmers themselves gain access to knowledge, resources and motivation to participate in sustainable agricultural practices and what factors contribute to the continuation of those practices.

It is my hope that this research has provided some insight into the ways that farmers participate in small-scale sustainable farming practices and how they create learning communities around those practices. Using case studies of nutrition gardening and pond fish farming, we were able to understand how farmers are connected in sharing the same practice, their motivations to participate, and what knowledge sharing exists within the CoP model that would not otherwise exist through a top-down approach. I also hope that this research might inform the development of new, sustainable practices in other regions, particularly under the effects of climate change. Researchers and development workers must be aware of the importance of knowledge creation and sharing, the fluidity and adaptability of a community as well as be sensitive to changing physical and social context within different communities.

Food security for small-scale farmers in India, as well as the potential for development of more sustainable food systems globally, is dependent on farmers being actively involved in the generation and mobilization of knowledge. Overall, I believe that taking a sociological approach to understand what factors must exist in order to create sustainable food production practices for the benefit of the small-scale farmers is important because it addresses the role of social relations in sustainable food production, a topic often ignored in agricultural studies. Understanding communication and forms of information sharing, through the co-creation of knowledge across partners and stakeholders, will help us to contribute to knowledge that informs the potential of

ICTs for sustainable development, particularly in the area of long term agricultural sustainability and food security.

Limitations of Research

There are limitations to this research that need to be addressed. Firstly, because I did not speak the local language (Tamil), I had to rely on a translator. There may have been problems with interpretation because of the language barrier. During interviews and PRA activities, the translator may have summarized answers from farmers for speed rather than accuracy. Audio recordings of the interviews allowed us to sit down with the translator after-the-fact to ensure that no information was lost.

Because of my limited time in the Kolli Hills, I did not get ample data to properly address another earlier objective of this study – gender analysis. My two months in the field did not allow a focus on gender, although I was mindful of gender relations during the study period and conducted a few PRA's with men and women separately. In the end, this component of the research was intentionally omitted to make my thesis manageable.

Reflections on Social Location

I have been fortunate to have had the opportunity to travel extensively during my life, starting from my first trip outside of Canada to Kenya at the age of four. Having the opportunity to see and learn about poverty first hand at such a young age has shaped my values and influenced the way that I understand the world. These experiences have also guided my education and therefore have influenced my research interests in a major way. My upbringing on acreages and farms, along with influences from my parents, have also given me an appreciation for nature and the environment. My post-secondary education has also sparked my interest in international relations, environmental sociology and sustainability. In my free time, I also love to try new foods and enjoy being creative in the kitchen, cooking healthy and gourmet meals. All of these experiences combined have coloured my research analysis in some ways.

I stood out among others in this rural poor region of India due to my appearance (i.e., significantly lighter skin, non-traditional clothes, my height and stature). Farmers in this region

were curious about our differences and were more than eager to talk to me. They not only answered my questions, but also wanted to know about me and my life in Canada. I feel tremendous gratitude for the openness of the community members to my questions and their enthusiastic involvement in many participatory group meetings.

In the following chapters, I document, describe and analyze the information and ideas given to me by farmers in the Kolli Hills who, despite climate change, the influence of agribusiness, government pressure and social isolation, continue to practice, share and adapt knowledge for the sustainable production of food.

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Chapter Two: Paper #1 – Social Practices of Knowledge Mobilization for Sustainable Food Production: Nutrition Gardening and Fish Farming in the Kolli Hills of India

Abstract:

Concerns about food security are growing around the world, precipitated by climate change, resource degradation, a growing population and increasing income disparity. In India, food insecurity is high in many rural farming communities, especially among isolated tribal populations. In this study, we examine how knowledge about sustainable food production is acquired and mobilized among small-scale farmers belonging to the Malayali Tribe, who reside in the Kolli Hills region of Tamil Nadu, India. We focus on nutrition gardening and fish farming, two production practices recently introduced to alleviate poverty and malnutrition in the region. Using qualitative participatory research methods, we explored ways in which farmers are accessing, using and sharing knowledge about these practices, and barriers to equitable access. We also asked farmers what information is still lacking about these practices and what mechanisms could be put in place to improve access. This research revealed that participants in both nutrition gardening and fish farming rely primarily on external experts (non-governmental agricultural research and extension) for formal training (e.g. workshops) and advice, despite a long history and traditional knowledge of gardening and river fishing. Agricultural knowledge is also mobilized within the region less formally between individuals and households through face-to-face contact or verbal communication via mobile phones. The use of additional communication technologies (e.g. computers) to enhance access and mobilization of knowledge was perceived to be most relevant and beneficial for young, educated people.

Key Words: Sustainable Food Production, Knowledge Mobilization, Social Practices, Formal and Informal Knowledge, Information and Communication Technologies, Fish Farming, Nutrition Gardening, Kolli Hills, India

Introduction

Concerns about food security are growing around the world, prompted by climate change, resource degradation, a rapidly expanding global population and increasing income disparity. According to The Food and Agriculture Organization (FAO 2013), 12% of the global population is unable to meet dietary energy requirements. The largest proportion (approximately 827 million people) live in developing countries and most often reside in rural areas (FAO 2013). In India, between 2010 and 2012, 17.5% of the population was undernourished (FAO 2012). In the country's southernmost state, Tamil Nadu, more than 12 million people are living in poverty, and almost 52% of the population is rural based (Census of India 2011). Rural poverty is concentrated among landless and small-scale farmers, whose income is most dramatically affected during droughts (The World Bank 2013).

From 2009 to 2014, a multi-faceted action research program was carried out in three regions of rural India to enhance nutrition, income and food security among tribal farming populations. This project, titled "Alleviating Poverty and Malnutrition in Agro-Biodiversity Hotspots" (APM), was developed through an international collaboration involving the M.S. Swaminathan Research Foundation (MSSRF) and the Faculty of Agriculture, Life and Environmental Sciences at the University of Alberta. The study we describe in this paper is based on 10 weeks of field work in the jurisdiction (Panchayat) of Vallapur Nadu Gram in the Kolli Hills region of the southern state of Tamil Nadu. Our purpose was to investigate how knowledge about sustainable food production is mobilized among small-scale farmers and labourers.

The Kolli Hills are relatively inaccessible aside from footpaths that connect the Kolli Hills to surrounding plains, as there is only one road suitable for vehicles (Kumar-Range 2001). Agriculture is the mainstay of the region (51% of the total area), while the remainder is a protected reserve forest (Kumar-Range 2001). Due to climate change, rainfall is decreasing, and droughts are prevalent. The combination of drought and poor soil quality has resulted in relatively low agricultural production (MSSRF & University of Alberta 2011). The staple, locally produced foods are rice and minor millets, but the introduction of cash crops, predominantly cassava, has been displacing production of traditional millet varieties that are high in nutritional value (MSSRF & University of Alberta 2011). Fruits such as bananas, jackfruit,

tamarind and citrus, as well as coffee, spices, medicinal and aromatic plants are also grown, but despite this diversity, there is little to no household consumption of fruits and vegetables (University of Alberta & MSSRF 2013). Generally, malnutrition is high. Most of the population of 42,000 is Malayali, one of India's scheduled tribes, who work as farm labourers or own small or marginal farm holdings (Kumar-Range 2001; MSSRF & University of Alberta 2011). Because of their relative isolation, the Malayali have limited access to services, are discriminated against as a more primitive culture and have limited political voice (Finnis 2009).

Nutrition gardening and pond fish farming are two food production practices introduced through the APM project to address the high rates of malnutrition and poverty in the Kolli Hills. These practices were selected as they build upon traditional knowledge of forest gardening and river fishing in these communities, and are low technology interventions that could be continued by local villagers once the program ended. All participation is voluntary. Nutrition gardening was introduced to increase the diversity of vegetables consumed in the household and to decrease the need for purchased produce, thereby increasing overall household resiliency. Gardeners save approximately 200 Rupees per week (approximately $3.90 CAD) and allocate only 15 minutes daily for garden responsibilities. The inputs are low-cost, the technology use is low-risk, and the practice can be adapted to different climates (Krishnal et al. 2012; Alayon-Gamboa & Gurri-Garcia 2008; Marsh 1998). Pond fish farming was introduced as an additional source of protein and essential fatty acids, and for the potential for additional employment and income (Cruz-Casallas et al. 2011; Belton & Thilsted 2013). Fish farmers similarly require only 15 min per day for daily responsibilities and members invest 200 Rupees per month for supplies and operations.

Fish farming and nutrition gardening can be characterized as sustainable food production practices as they use and enhance local knowledge and ecological resources to develop more self-reliant and resilient agri-food systems that produce nutritious food, and enable improved livelihoods for local communities (Altieri et al. 2012). Given that knowledge plays a central role in the development of these systems, we set out to explore how small-scale farmers in the Kolli Hills access, use and share agricultural information, particularly related to nutrition gardening and fish farming. We also investigated what information is lacking for farmers to carry out these practices and how it would be most easily accessed. Accessing and mobilizing information in this study includes the use of information and communication technologies (ICTs), which can be described broadly as anything used to capture, convey, share or articulate information and

communication. For this paper, both low and high technologies were considered (oral, written, visual or aural) and included anything from posters and pamphlets to mobile phones and computers. To explore these topics with key informants in a meaningfully engaged way, and to understand the contextual factors that influence their daily practices, we used qualitative and participatory research methods: participatory rural appraisal, semi-structured interviews and participant observation. Social practice theory informed analysis of the data. The following section consists of a literature review on knowledge mobilization as a key component of social practice theory as well as a brief discussion about the role of knowledge in agricultural development. We argue that knowledge mobilization is an important component of a more resilient and secure agri-food system. Following a description of data collection methods, the results are presented in five sections: an overview of knowledge mobilization over time in the Kolli Hills; current agricultural knowledge systems; traditional and new knowledge for nutrition gardening and fish farming; an exploration of the use of ICTs as tools for knowledge mobilization and finally; a discussion on barriers to equitable access to information. A discussion of key findings related to the social practices of knowledge mobilization concludes the paper.

Literature Review

Characterizing Agricultural Knowledge

Over the past five decades, there have been significant changes in approaches to agriculture research and extension, and in how knowledge and the role of farmers have been perceived and characterized (Scoones & Thompson 2009). In the productivist, industrial agriculture model that became prevalent during the 1960s (giving rise to the Green Revolution), farming is viewed as a technical activity whereby farmers are seen as recipients of knowledge produced by scientific experts and disseminated by extension agents (Transfer of Technology model). Diffusion of Innovations theory (Rogers 1983) provided an analytical framework for characterizing farmers as progressive or late adopters of scientific and technological innovations, and situates them along an awareness-interest-evaluation-trial-adoption continuum. Individual characteristics (e.g., age, education) influence adoption as well as access to information and communication methods, from interpersonal to mass communication. For example, radio and television can quickly create

awareness of new techniques and technologies to a wide range of people, but interpersonal communication via extension agents can provide more detailed information and enhance credibility of information during interest and evaluation phases, while peers provide useful input and feedback during trial and adoption (Ponniah et al. 2008). Critiques of the model point to its pro-innovation bias and its failure to consider context and issues of power, but it remains an important and widely used tool in agriculture extension and marketing research.

Beginning in the 1970s there was a shift towards systems-level analysis and participatory or 'Farmer First' approaches (Chambers 1983). Participatory approaches challenged the hierarchical model of knowledge construction and dissemination, and instead viewed farmers as centrally situated agents, actively engaged in knowledge generation and the linking of knowledge acquired through both informal (experiential, farmer-to-farmer) and formalized (scientific, technological) systems. Innovation results from knowledge being shared and combined from different sources, but to be sustainable it needs to be relevant and sensitive to specific contexts, traditions and routine practices.

For centuries, traditional farmers have created diverse and adaptable agricultural systems with the use of indigenous practices to support community food security and agro-biodiversity conservation (Altieri 2004). These traditional farming systems are knowledge intensive and rely on local resources and low-level technology, in contrast with the high external input, technology intensive approach characteristic of modern, industrial agriculture. The knowledge that is generated in traditional farming systems is continually produced and reproduced by small-scale farmers through an iterative process of observation and experiential learning (theory and practice), and is strongly shaped by the socio-cultural and bio-physical contexts (Altieri 2004; Yano and Lanusosang 2013). In India, there are over 550 traditional farming communities (Narayanan et al. 2004). Many scholars stress the value that traditional agricultural practices have in creating diverse, resilient and climate adapted forms of agriculture, which are essential to biodiversity and natural resource conservation, community food security, rural livelihoods and local as well as national economies (e.g., Chambers 1997; Altieri et al. 2001; Rosset 2011; Wolfensen 2013). Bennet et al. (2014) argue that building a resilient agriculture for the future will rely on the traditional knowledge and skills of small-scale farmers alongside new forms of innovation that address human needs and decrease adverse effects of agriculture on the environment. A diversity of solutions is needed, they argue, not a wholesale adoption of one

mass approach. This diversity of food production is the hallmark of many small-scale farmers, who vary their farming activities over seasonal cycles, family needs, and in response to the weather and pests that they must contend with year to year. Indeed, we argue, fish farming and nutrition gardens fall within this category of building more resilient agriculture.

Currently, over 80% of the world's food supply is generated by small-scale farmers, yet many experience high levels of poverty and malnutrition (FAO 2013; Wolfensen 2013). While some authors argue the need for further intensification of agriculture to meet the food security needs of a growing global population (Pickett 2013), others contend that improvements on livelihoods and food security for small-scale farmers can be made through the provision of effective knowledge generation and dissemination systems, aiming to strengthen links among farmers, agricultural educators, researchers and extension workers (Singh & Hensel 2014). Narayanan et al. (2004) stress the importance of correlating traditional knowledge with existing scientific understanding, as these farming populations continue to lead a life of co-existence and interdependence with their natural environment. In fact, resilient systems are characterized by continuous social learning, where trial and error and joint problem solving builds up community capacity to cope with hardship and unexpected changes (Berkes 2009) to agricultural conditions.

Knowledge Mobilization and Social Practice Theory

This study focuses on the sharing of knowledge as a central component in the way that social practices come to fruition. A social practice can be understood as any intentional behaviour that becomes routine. Social practice theory identifies people as carriers of practice, where ritualistic action becomes normalized (Schatzki 2001a, b). The ways in which farmers and others involved in sustainable food production share and communicate information can be classified as social practices. Like knowledge, these practices are constantly changing and evolving (Ropke 2009). This theory is of relevance to this study because, as Hobson (2002) demonstrates, participation in sustainable behaviour can change practical consciousness and consequently daily practices. The analytical framework developed by Shove et al. (2012) is particularly valuable in informing this research. They suggest that social practices are made of three main elements – materials (things and the body), competence (ability and skills) and meaning (symbolic importance). It is when these elements are linked that social practices exist and become stable. When the links are

broken, the practices are broken. Hargreaves (2011) adds that leaders or stewards may initiate a new, more sustainable practice and catalyze the creation of a new network. Similarly, Bennet et al. (2014) argue that social practices can change when outside institutions facilitate sharing of knowledge combined with action, on the ground, and allow success and failure to be experiences through experimentation.

Central to the development and changing of social practices is the sharing and transfer of knowledge. Knowledge mobilization can be understood as a broad and encompassing term that includes the products, processes and relationships among knowledge creators, users, and mediators (individuals or intermediary organizations that support knowledge brokering) (Institute for Community Engaged Scholarship, n.d.). Scholars such as Levin (2008) suggest that the simple translation of knowledge is not enough to change social practices.

> Knowledge by itself is not enough to change practice, since practices are social and therefor reinforced by many elements such as norms, cultures and habits. (p.8)

Although knowledge is not the only factor influencing the development of new social practices, it provides a starting point to understand how they form and become routine, and for the purposes of this study, allows us to see how sustainable food production practices may become normalized through learning and sharing of traditional and new knowledge. It is the social learning that comes through changing social practices, often initiated or evolving with knowledge mobilization, that has the potential to support more resilient food systems for marginalized, small-scale farmers.

Methods

This study takes a qualitative research approach to examine knowledge mobilization for sustainable food production. Qualitative methodology is well established in social practice and knowledge mobilization research as a useful approach to understanding learning processes and the nature of learning outcomes. This study takes place in a particular context (space and time), and will have relevance to other traditional farming communities with similar characteristics as well as for researchers and NGOs working with these communities. The research is based on two

and a half months of fieldwork in the Kolli Hills from April to July, 2013. Participatory Rural Appraisal (PRA), semi-structured interviews and participant observation were used to gather relevant data. During the fieldwork, there were opportunities to observe many activities such as farm visits, local meetings and public activities such as cooking demonstrations. One of the core initiatives of the APM project was to establish a Village Resource Center (VRC) in the main town of Semmedu and two Village Knowledge Centers (VKC) in the small villages of Asakadupatti and Alawadipatti as resource hubs for community members to access and share agricultural information, gain skills training (e.g., computer classes) and serve as venues for community meetings. These centers were key reference points for our study.

Participants in this research were recruited using purposive intermediary snowball sampling. MSSRF served as the intermediary in this process as they had good knowledge of, and existing relationships with, most of the farmers in the project area. PRA gatherings took place early in the morning or in the evening so as not to interfere with the daily work of farmers. All PRAs were held in locations convenient for participants, such as a village meeting area. There was no incentive offered for participation, although refreshments were served at each meeting and small gifts were given to those who were individually interviewed. A translator was used for data collection and transcription.

Figure 1: PRA with a group of women in Odaikadu creating a spider diagram.

PRA was used so that community members could be actively involved in the research process. The continuous critical (and self-) reflection that this method requires can empower

local people to actively analyze their own living conditions, problems and potentials for change (FAO 1999). Twenty participatory diagrams were created with the insight from 15 to 20 groups of community key informants (6–15 people per group). Groups were selected on the basis of age, gender, and participation in social practices around home gardening and fish farming. We used a variety of established PRA diagramming exercises such as timelines, spider and media footprint diagrams, and also created custom exercises. These activities focused on farmer aspirations, barriers to knowledge mobilization, formal and informal methods of communication, traditional vs. new knowledge about sustainable agriculture as well as current and potential use of information and communication technologies.

Individual interviews with 20 men and women were conducted to further substantiate findings from the PRAs and gain more in-depth understanding of various food-production activities that take place in the Kolli Hills. These interviews were done with community leaders to understand more detailed accounts of the social practices that exist, with MSSRF staff to understand the goals, motivations and inner-workings of current and future projects and with the staff if other local NGOs to understand what other programs are being run in the area.

Findings and Discussion

Knowledge Mobilization Over Time

A group of men and women (approximately 18 to 70 years of age) created a timeline outlining different ways that they accessed information and communicated with each other. In the 1970s, communication involved the use of written letters, telegrams, radio and newspapers. In the early 1990s, telephones were only available at the local post office, and one television was used by all who resided within the project area. In 2006, distribution of colour televisions to poor families was the result of a statewide election promise. Currently, the use of radios has been mostly replaced by televisions, mobile phone use is popular, and a few computers have been made available at the VRC and VKCs.

Prior to the 1940s, the Kolli Hills were only accessible by footpaths. With the building of a dirt road by the forestry department, vehicle travel in and out of the hills became possible (Kumar-Range 2001). During the 1950s, the road was tar-surfaced, which enabled traders from

the plains to begin regularly travelling into the region to purchase food products such as cardamom, jackfruit, tamarind and bananas (Kumar-Range 2001).

Current Formal and Informal Knowledge Networks

By creating a detailed spider diagram, farmers identified available sources of agricultural information. Collectively, these can be identified as part of the material element (Shove et al. 2012), which is critical to the development of social practices related to sustainable food production. regional television stations, such as Podhigai, deliver agriculture programming on a range of topics for the general farming population. For example, Pon Vilaiyum Bhoomi, airs five times per week, two times per day, before or after farmers' work in the fields and covers topics such as cultivation and pest management techniques. Farmers may also use their mobile phones to access MSSRF's agricultural information program, which sends out messages to farmers daily, either through Short Message Service (SMS) in Tamil characters, or through automated voice messages. MSSRF also has a helpline to answer any project-related questions. MSSRF field staff are also available by mobile phone to answer questions. Information pamphlets and books are available in government offices or in the VRC/ VKCs on a variety of topics, such as bee-raising, nutrition gardening and pest control. Posters in the community promote the annual Valvil Ory Festival, which highlights the values, culture and traditions of the Kolli Hills, a major part of which is related to agriculture. While a few computers have been made available for public use in the centres for villagers to learn basic computer skills, watch informative films or use the internet, farmers said that the internet connection was too slow to be effective.

A government official from the Department of Agriculture identified various extension projects in the region including: seed storage, production and marketing training, crop protection, animal husbandry and agriculture engineering. He explained that there were three extension representatives who visited the field every 15 days. Throughout time spent speaking with farmers, however, only one farmer made mention of government extension services, explaining that they have an office in the town of Semmedu in case questions arise. Other than the aforementioned government-funded television programs, most people said, the government does not come.

Farmers also listed the different opportunities that they had to share information in less formal settings such as in the villages in the mornings and evenings, while collecting water, while washing clothing, while working in the fields, during transportation times, in the marketplace, during yearly migration and while participating in the Mahatma Gandhi Rural Employment Guarantee Scheme[1]. These informal interactions allow farmers to share information, knowledge and experiences gained informally or formally.

By increasing farmers' access to knowledge from different sources through a variety of communication channels, the APM project has facilitated knowledge mobilization through expanded social networks, thereby creating opportunities for the adoption and diffusion of innovations (Chambers 1983; Ponniah et al. 2008). Strengthening these formal and informal knowledge networks builds resilience by creating spaces and places where knowledge holders share information, demonstrate know-how, and invite others to learn more (Janssen et al. 2006) as they see the fruits of their labour (Bennet et al. 2014).

Traditional vs. New Knowledge for Nutrition Gardens and Fish Farmers

In order to further explore the formal and informal knowledge networks that exist in the Kolli Hills, a PRA was conducted to understand the role of traditional and new knowledge (Singh and Hensel 2014) for nutrition gardeners and fish farmers. Two groups of nutrition gardeners and two groups of fish farmers were asked to create a diagram that outlines where they learned the types of skills needed in order to maintain their respective practices. Farmers were asked to categorize each of the skills as *existing knowledge* (learned from parents, grandparents, neighbors or friends), or as *new knowledge* (gained with the aid of the APM project). They also determined if the skill that was acquired was as a result of a combination of existing and new knowledge. Finally, participants were asked which of the skills they thought they needed to learn more about, and the best way to obtain that information. The results of these exercises for nutrition gardeners and fish farmers are outlined below.

[1] Intended to enhance livelihood security of rural household by providing at least 100 days of guaranteed employment per year for every household (Sharma n.d.).

Figure 2: Example of Nutrition Garden

Figure 3: Fish Farmers at Fishing Demonstration

Nutrition Gardeners

In the past, villagers gardened in scattered plots around their homes and traditional knowledge about land preparation, weeding, organic fertilizing and harvesting had been passed on to them by their parents, grandparents or neighbors. Pests were identified as the most significant problem in part due to the uncontained nature of their gardens previously. MSSRF addressed this by having gardens established adjacent to peoples' homes, placing netting around the gardens and by promoting the use of other low-cost practices, such as crop rotations, use of organic pesticides and animal and green manure to improve soil fertility.

Farmers explained that women and children traditionally maintained these gardens, but since the introduction of contained gardens, men also became involved, particularly in preparing the land.

Gardeners agreed that three new important things learned were how to preserve produce, how to better organize the garden so as to maximize harvest output, including how to rotate crops, and also expressed interest in learning how to save seeds for the future. Overall, nutrition gardeners preferred to receive information face-to-face whether individually or in a meeting/demonstration within their villages. One group mentioned that this learning might be improved through the use of video.

Nutrition gardeners also expressed the need to learn more about food preparation, when to harvest various vegetables and about marketing. Food preparation is a common skill, but cooking demonstrations are very popular. The first author attended a demonstration, whereby a

carrot dish was prepared in front of an interested audience of men, women and children. With every step of the process, nutritional benefits of all of the ingredients were described. Gardeners were very excited about these meetings and expressed interest in attending more in the future. Some of the produce that has been introduced into the gardens is new to farmers, so their unfamiliarity may explain their eagerness to learn more about when to harvest vegetables and how to cook them.

The initial training and continuous support from MSSRF, along with the informal sharing of gardening information amongst villagers encouraged and enabled households to grow and consume high-nutrient vegetables and fruits with low input costs (Krishnal et al. 2012), resulting in daily practices that became habitual and routine (Shove et al. 2012). Farmers were also interested in opportunities to generate increased income, but limited access to land and low rainfall impacts production output at the time of this study, there was not enough surplus to sell in the marketplace (Table 1).

Table 1. Sources and Types of Agri-food Knowledge for Nutrition Gardeners

Existing Knowledge	New Knowledge	Both
Fertilizing	Food Preservation	Food Preparation
Harvesting	Plot Organization	Pest Control
Irrigation	Seed Saving	Seed Sowing
Land Preparation		
Weeding		
When to Plant Seeds		

Fish Farmers

As shown in Table 2, both groups of fish farmers relied heavily on MSSRF experts for the development of this practice despite indicating they had past experience with river fishing. Because the community ponds are quite large, most of the group members needed to participate in harvesting with the help of two hired professional fishermen. A trial harvest alongside MSSRF's fish scientist and other staff was observed during fieldwork. This particular pond was shallow enough to wade in, so five men, beginning in one corner, walked in a row carrying the

net to try to round up the fish into the opposing corner, while people standing around threw rocks and sticks to lure the fish into the net. Once captured, the farmers would grab the fish by hand. Group members divided the catch equally. This technique was useful for this particular pond, but it would be easy to imagine that the process may not be so straightforward, for example, if water levels were much higher, and farmers might not be able to effectively walk along the bottom.

Table 2. Sources and Types of Agri-food Knowledge for Fish Farmers

Existing Knowledge	New Knowledge	Both
Pond Preparation	Fish Hatcheries	Fish Cleaning
	How to Fill Ponds	Food Preparation
	Marketing	
	What to Feed Fish	
	When to Feed Fish	
	When to Harvest	
	Where to Get Feed	
	Where to Get Fish	

Villagers had some knowledge on how to prepare fish for eating, although one group said their knowledge increased through cooking demonstrations. Farmers explained that they use similar recipes to prepare fish as they would for other vegetable and chicken dishes. Pig is also eaten in the area, but only on special occasions. For farmers, the biggest appeal for this practice is the nutritional value of the fish, given that fish has not been the mainstay of the Malayali diet.

Both men and women participated in monthly meetings, contributed equally to the group savings account and participated in leadership roles within the groups. Women took on daily responsibilities such as feeding the fish and food preparation after harvest, whereas men were responsible for maintaining the pond and harvesting fish.

All communication among members of this practice occurred in face-to-face meetings, through exposure visits or through cooking demonstrations, unless they used a mobile phone to call MSSRF's fish scientist or field technicians. Similar to nutrition gardeners, although they preferred face-to-face training through group meetings, they indicated that the use of video in presentations would be a useful learning tool.

All farmers, although satisfied overall with the training provided, would have liked to learn more about food preparation, when to harvest and how to expand the enterprise in order to sell excess fish in the market. Farmers expressed the need to learn more about harvesting through face-to-face meetings. A training video that demonstrated more fishing techniques might be useful to farmers, especially since MSSRF may not always be present.

Use of ICT Tools for Knowledge Mobilization

To understand knowledge mobilization in an agricultural community, we investigated past, current and evolving behaviours, including the use of modern technologies. Having a broad definition of what an ICT entails – anything used to capture, convey, share or articulate information and communication – allowed us to gain a deeper understanding of how communication practices emerged and evolved. Despite the fact that mobile phone use in the Kolli Hills is increasingly prevalent, farmers said that they would prefer face-to-face communication to learn about agricultural information. This finding is supported by studies on adoption-diffusion (e.g., Ponniah et al. 2008) in that interpersonal communication can provide more context specific information, thereby enhancing credibility and encouraging application. Farmers did express more interest in technology use when the question was reworded so that ICTs were presented not as a replacement for face-to-face contact, but rather as an enabler or a way to enhance the organizing and planning of face-to-face meetings, or the learning process. Twenty households were asked about the ownership and use of mobile phones within their homes, only one of which said that they had none (5%). Fifty-five percent of households said that they had one mobile phone; men were the primary users with the exception of one household, where the wife was the primary user. Thirty-five percent of households had two phones (one for each spouse), whereas 5% of the households had three phones, which were used by the mother, daughter and son.

Another PRA showed the frequency of use of various technologies based on age, where farmers self-identified into two groups: younger and older generations. Farmers were asked to indicate how often they used each of the technologies that were already drawn into a diagram such as television, radio, mobile phones and fax machines. Answers ranged from once a day to never. Both generations agreed that they made use of mobile phones and televisions on a regular

basis (once a day or more). While farmers can gain access to agricultural information through the government-funded farm television program, mobile phones are used informally to speak to immediate family, relatives and friends when the distance is too far to travel by foot. MSSRF has also initiated a voice and SMS texting program that enables farmers to receive automated messages (either an audio recording or a text) that provide daily information about nutrition. Approximately 350 out of a total 3673 farmers in the project area were making use of the tool in the spring of 2013.

Both younger and older groups indicated that they would get messages via loudspeaker weekly, whereby organizations drive through the villages to make announcements about various things such as school enrollment, government subsidies, information from agriculture extension, health programs (opportunity for eye examinations), disability awareness programs, election dates, and product sales such as silver vessels. Other NGOs in the region, such as the Dhan Foundation, use the loudspeaker to promote and recruit farmers for the non-agricultural programs that they are running, such as women's self-help groups, subsidies for disabled and vulnerable people and skills training for youth. Farmers of all ages said that they made use of the yearly exhibition that offers training and presentations for farm-related activities. All of the farmer participants agreed that they do not use fax machines to communicate.

Technology use based on age differed greatly between generations whereby the older generation said that they never made use of computers or radios, whereas the younger generation said they use these technologies weekly. Although the use of high-technology (aside from television and mobile phones) is not yet widespread, people are not opposed to the idea as long as it does not replace their existing face-to-face contact. Overall, the younger generation seems to be most receptive to, and excited about using new technologies.

Barriers to Equitable Access to Information

During one-on-one interviews, men and women of all ages were asked about their perceptions of access to information based on age, gender, income, geography and education level. Farmers in the Kolli Hills face limitations in their access to information given the remoteness of the area and the unreliability or lack of public transportation. Public buses are often off-schedule and have fewer seats than interested travelers. Many people said that distance was a factor in their use of

the VRC/VKCs. They expressed interest in having a centre within walking distance of their homes and the development of more VKCs in the area has been budgeted by MSSRF for the future. The VRC and VKCs were, however, seen as valuable new venues for accessing information (books, informative pamphlets, newspapers, computers) by anyone in the villages. Most farmers indicated that the use of these centers and particularly the use of computers were most suited to those who have higher levels of education and mostly young people who are most comfortable with and proficient in technology use and therefore most able to access information in this way. The MSSRF ICT program assistant confirmed these findings admitting that these knowledge centers were not being used to their full potential by adults but that they did provide opportunities for children and youth to be exposed to new technologies. Children between first and eighth standard often make daily use of the centres, accessing computers (including painting programs and the use interactive educational programs) and also books and newspapers. The uptake of ICTs by young members of the villages suggests greater ease of knowledge mobilization in the future, as these technologies become more ubiquitous in the Kolli Hills. MSSRF is working to encourage villagers of all ages and education levels to use the centers. When asked about disparities in access to information based on income, all agreed money was not a factor as the population in this area is economically homogenous. Although living conditions were similar amongst farmers, some farmers had the means to send their children away for higher education.

Mobile phone use was widespread in the villages but reception in the Kolli Hills can be intermittent due to heavy rainfall. The use of mobile phones appeared to have the most significant gendered differences in access. Although many households had two mobile phones, one for the husband and the wife, in households with only one mobile phone available, the male head of the household had primary use of it. Migration of men for seasonal work to the surrounding plains also created gendered differences in access to information, as this provided them with first hand exposure to outside information. Many staff members of NGOs in the area suggested that there are still unequal gender relations in the Kolli Hills, but farmers said that although that may have been the case in the past, men and women are becoming increasingly equal.

In summary, farmers in the Kolli Hills access information through formalized systems such as MSSRF's knowledge centers, automated message programs or hotlines but barriers do

exist due to distance to these centres, local perceptions about education, age and technology use, as well as gendered differences in access to mobile phones and travel to surrounding areas. Informal knowledge systems bridge these gaps, as farmers are constantly sharing information in everyday activities and settings. It is through building these knowledge networks that sustainable food and farming practices are developed and may be sustained when MSSRF's work in this region is completed (Folke et al. 2005).

Conclusion

This paper identifies ways that small-scale farmers in Kolli Hills communicated in the past, how they currently gain access to information about sustainable food production practices and what kinds of aspirations and opportunities exist for the future. Understanding knowledge mobilization of the Malayali Tribe can contribute to ensuring that all farmers, even those in remote areas, have access to information about sustainable food production practices so that they may take control of their own food production in ways that are environmentally sound and sustainable in the long run. As Bennet et al. (2014) so clearly articulate, efficiency of production in some cases is far less important than building skills, knowledge and confidence in self-reliant practices that support a diversified set of options for food production.

Two food production practices introduced by MSSRF – nutrition gardening and fish farming – are useful to compare for many reasons. Although they are new practices, they are not unfamiliar, as both had traditional forms that were practiced in the Kolli Hills in the past. Both promote sustainable food production and have common goals of relieving nutritional deficiencies that are prevalent in the area. Fish farming is a group endeavor focused on investment and features an organizational structure with regular meetings. Despite equal gender representation, men take on most of the responsibilities. Home gardening on the other hand, is focused on the individual household. Although family members of all ages participate in gardening, women tend to be the predominant players in this activity. Insight into the different dynamics between group and household activities, including the role of gender, broadens our understanding of the social practices of knowledge mobilization in these communities.

Farmers rely on expertise to gain initial training and advice on introduced sustainable agricultural practices, but are also in contact with each other face-to-face within their villages, in

the workplace or via mobile phone to continue to improve their practices around fishing and gardening. Advanced technologies such as mobile phones and computers are available in the Kolli Hills, but the preference for most farmers is still face-to-face exchange of agricultural information. Farmers reported that ICTs are most useful for educated, young people and often express lack of time to try new technologies due to other responsibilities or the travel time that is necessary in order to access them.

The farmers of the Kolli Hills now have access to knowledge centers established by MSSRF, that provide relevant knowledge about sustainable food production. The introduced methods of nutrition gardening and pond fish farming are being taken up in the region, as a result of the formal teaching and training offered by MSSRF as well as through the informal sharing of ideas and information among farmers in a variety of settings. These projects have been positively evaluated by local villagers, have high rates of adoption and have thus far been associated with a multitude of benefits.

From the outset, these interventions were based on traditional agri-food knowledge and practices, targeted poverty alleviation and improved nutrition, and were designed to be self-sufficient. Sustainability of these practices will however, depend on both factors internal to the communities (e.g. leadership, knowledge mobilization) and other external factors (e.g., rainfall, market potential). Nutrition gardeners are learning sustainable practices such as the use of organic readily-available pesticides, how to make organic fertilizers (e.g., vermi-compost, green manure) and a seed bank initiative has begun to promote seed saving. For fish farmers, feed is readily available, and a fish hatchery has been built for efficient and inexpensive access to small fry.

The introduction and uptake of nutrition gardening and fish farming can be understood using Shove et al.'s (2012) social practices elemental framework. Members of both practices have the necessary materials in order to carry out their activities whether they were pre-existing or supplied through the APM project. Furthermore, traditional and new knowledge gained through training from MSSRF were integrated to create competency suited to the local context. Both groups have also developed the third element (meaning) whereby farmers find reason to partake in these particular practices; in both cases, first and foremost, the health and nutrition of their families and secondly as a potential new source of income. The development of both of these practices is dependent on what Reckwitz (2002) describes as motivational knowledge.

Farmers have the tools, skills and training necessary for the practice, and also develop personal and community meaning that puts value on their participation. All three of these elements come together to support the development and normalization of these practices (Shove et al. 2012). The interplay between informal and formal knowledge was evident within these social practices and strengthens their uptake, building a more resilient system given the spread and investment in knowledge about how to do these practices well, and with less effort over time given the practices embed well into their existing seasonal activities (Bennet 2014) and constitute low risk investments. Although the practices are quite different in nature, both exemplify how social practice theory and informal/formal knowledge systems can work together.

By taking a social practices of knowledge mobilization approach, this study was able to investigate how agricultural information has been accessed over time, particularly how new communication channels enable the development and sharing of information about new practices that promote sustainable food production. This approach provides a valuable lens for investigating and understanding daily routines and how they change as a result of external interventions. The study has shown that there are advantages in merging informal and formal knowledge systems for sustainable agricultural development, and this has the potential to build a more resilient agriculture. However, success is dependent on farmers being actively involved in the generation and mobilization of knowledge that can contribute not only to their own food security but also to the development of more sustainable food systems for the future. We believe this study will have relevance to other regions where small-scale, low risk activities can be supported by organizations and institutions willing to acknowledge the importance of social context and work to build upon traditional agricultural knowledge and practices.

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Chapter Three: Paper #2 – Establishing Sustainable Food Production Communities of Practice: Nutrition Gardening and Pond Fish Farming in the Kolli Hills, India

Abstract:

This study describes the formation of nutrition gardening and pond fish farming Communities of Practice (CoP) among small-scale farmers of the Malayali tribe living in the Kolli Hills region of Tamil Nadu, India. We examine the factors that have shaped the formation of these CoPs, their purpose and function, who is involved, what activities hold these communities together, and their role in strengthening sustainable food production and consumption practices. Data were gathered through Participatory Rural Appraisals (PRAs), key stakeholder interviews and participant observations during four months of fieldwork. Motivations reported by nutrition gardeners and pond fish farmers to create and maintain CoPs were to improve the health and nutrition of their families and to obtain expert advice in sustainable food production practices. Both CoPs are in the early stages of development and differ not only in the types of food they produce and the skills and tools needed for their success, but also in their structure; nutrition gardening is a relatively individualistic practice, whereas pond fish farming is a group endeavor. The ways in which they experience being in a community also differs. Whereas nutrition gardeners relied on open-ended conversations and community creation through relationship building, fish farmers found it most important to hold group meetings and maintain transparent record-keeping. We conclude that what determines the nature and success of a community of practice depends on the individual interests and resources available to the members, as well as the values and needs of the broader community in which they are situated.

Key Words: Sustainable Food Production, Knowledge Mobilization, Communities of Practice, Orientations of Communities of Practice, Nutrition Gardening, Fish Farming, Kolli Hills, India

Introduction

There is growing consensus that increasing emphasis on agricultural industrialization, concentration of capital and resources, and globalized trade of a limited number of agricultural commodities is generating socio-economic disparities and ecological impacts that threaten global food security (Thrupp 2000; Godfray 2010). In India, where the negative impacts associated with these agricultural trends is compounded by climate change stressors, such as severe drought and intense flooding, food insecurity is especially high among poor and marginalized small-scale farmers (Singh 2000; Shiva 2016). In 2009, a six-year interdisciplinary research program titled, "Alleviating Poverty and Malnutrition in Agrobiodiversity Hotspots" (APM), was initiated in three regions of rural India to improve food security among small-scale farmers through improved access to information and knowledge exchange about sustainable food production. This research was developed through collaboration between the University of Alberta's Faculty of Agriculture, Life and Environmental Sciences and the M.S. Swaminathan Research Foundation (MSSRF) based in Chennai, India (MSSRF & University of Alberta 2011). As part of the APM program, we examined communities of practice that formed around two food production practices – nutrition gardening and pond fish farming – established through the APM project among small-scale farmers of the Malayali tribe in the Kolli Hills region of Tamil Nadu. The introduction of each of these practices offered the opportunity for farmers to address nutrition deficiencies, save money from less market purchases and make money from selling excess produce. These practices were selected as they build upon traditional practices of forest gardening and river fishing, and are low technology interventions that could be continued by local villagers once the program ended. Consistent with MSSRF's mandate, a participatory, community-based approach was used in the introduction and development of these practices.

Agriculture is the mainstay of the Kolli Hills region of Tamil Nadu, India, where 51% of the total area is under agriculture and the remainder is a protected reserve forest (Kumar-Range 2001). Soil fertility and agricultural production output is relatively low (MSSRF & University of Alberta 2011). Traditionally, there were a variety of locally produced foods such as rice, minor millet, bananas, jackfruit, tamarind, citrus, coffee, spices, medicinal and aromatic plants (MSSRF & University of Alberta 2011). In recent decades, malnutrition has been high in the region, with little to no household consumption of fruits and vegetables, and low protein intake. The

introduction of cash crops, predominantly cassava, has increasingly displaced the production of nutritious varieties of small millet that have been grown in the region for centuries (MSSRF & University of Alberta 2011). Most of the 42 200 inhabitants are Tamil speaking and belong to the Malayali population, one of India's scheduled tribes[2], and own small and marginal farm holdings or work as farm labourers (Kumar-Range 2001; MSSRF & University of Alberta 2011). They are discriminated against as being a primitive culture, have limited political voice, and unequal bargaining positions for the selling of produce resulting from their relative isolation that has limited their access to markets, products and services (Finnis 2006). Aside from footpaths that connect the Kolli Hills to the surrounding plains, there is only one road suitable for vehicles (Kumar-Range 2001).

In this study, we investigate how the Malayali farmers learn from others and adopt new agricultural practices that can improve their food security. Although there are obvious environmental, political and social constraints in raising the awareness and adoption of sustainable farming practices, we suggest that it may also be due to the current systems of knowledge mobilization among research centres, agricultural extension and the farmers themselves. Improved knowledge sharing among these parties may improve farmers' ability to assume more control over what they produce, reduce environmental externalities and the cost of production, enhance environmental quality through the promotion of practices that capture the regenerative processes of growing food, and increase access to nutritious food for families and communities. Greater understanding about communities of practice that form to advance sustainable agriculture and improved nutrition can inform other efforts to work with small farmers as a community of farmers who routinely learn from each other and often from outsiders as well.

We begin with a brief overview of the literature pertaining to sustainable agriculture and communities of practice to provide a theoretical framing of this study. This is followed by a description of the data collection methods. We then discuss the findings in relation to the development and maintenance of nutrition gardening and pond fish farming communities of

[2] Described as having indications of primitive traits, distinctive culture, geographical isolation, shyness of contact with the community at large and backwardness (Ministry of Tribal Affairs, n.d.)

practice. The conclusion provides summative remarks about the role of these communities of practice in fostering individual and collective learning about sustainable food production.

Literature Review

Agri-Food Systems: Food Security and Food Sovereignty

The Green Revolution, which began in earnest in the 1960s, was based on the premise that scientific and technological advancements in agriculture would provide lasting solutions to poverty and hunger in countries characterized by peasant-scale agriculture. The introduction of high yielding hybrid crop varieties and livestock breeds, increased mechanization, large-scale irrigation systems, and the wide-spread use of synthetically manufactured pesticides and fertilizers were put in place to improve agricultural productivity in the Global South (Sen 1974; Dhanagare 1987; Singh 2000; Shiva 2016). While gains were made in production outputs and efficiency, the emphasis on export markets and increasing corporate control across all aspects of agri-food systems (e.g., inputs, land, labour, markets) did little to alleviate hunger and poverty at the local level. Additionally, the Green Revolution has been linked to significant negative ecological and social impacts including loss of ecosystem integrity and biodiversity, malnutrition and disruptions to traditional livelihoods, social structures and cultural practices, all of which increased the vulnerability of millions of small-scale farmers worldwide (Altieri 2009).

Similar to other developing countries, the Green Revolution transformed farming practices in India by replacing traditional farming practices and regional food diversity with monocultures of cash crops (Shiva 2016). Over the past several decades, India's enrollment in the global agri-food system has resulted in greater state support for export-oriented crops, the overuse of chemical fertilizers and irrigation, and higher domestic food prices (Shiva 2016). The focus on increased productivity of export-oriented cash crops has not addressed food security or put more cash in the hands of the poor (Carolan 2012). Consequently, long-term debt among small and marginal farmers has increased, which has exacerbated food insecurity. Among the isolated and poor farmers of the Kolli Hills region of Tamil Nadu, where the production of traditional varieties of small millets with high protein and mineral content has shifted to the

larger-scale production of less nutritious cassava, there is a high prevalence of iron, protein and calcium deficiencies (Finnis 2006).

In response to the legacy of agricultural modernization efforts beginning in the mid-1980s, development agencies, agricultural think tanks and non-governmental organizations began supporting the development of more ecologically sustainable, economically viable and socially just agri-food systems. For example, in contrast to the linear and top-down transfer of technology (ToT) model, thinking and practice have shifted towards models that place the farmer and their needs first (Chambers and Ghildyal 1985; Scoones & Thompson 1994; Scoones & Thompson 2009; Carolan 2012). More recently, the concept of food sovereignty – the right of each nation or region to maintain and develop their capacity to produce basic food crops and maintain cultural diversity – has placed emphasis on farmers' access to resources, local-autonomy in a variety of areas and a strong emphasis on farmer-to-farmer networks (Altieri 2009; Desmarais 2012; Claeys & Lambek 2014). Traditional knowledge related to seed saving, food preservation and the use of ecologically based fertilizers and pesticides have been shown to be key to the success of community-based local agriculture (Thrupp 1989; Sinha 1997; Altieri 2009). Smallholders manage over 80% of the world's estimated 500 million small farms and provide over 80% of the food consumed in a large part of the developing world (International Fund for Agricultural Development (IFAD) 2013). Former Secretary General of the UN, Ban Ki-moon (2010) explained:

> Smallholders and rural producers have a vital role to play in overcoming global hunger and poverty, and new and varied partnerships are needed, with particular emphasis on the interests of women. (p.1)

This is supported by the International Fund for Agricultural Development (IFAD 2013), which contends that smallholders, with their immense collective experience and intimate knowledge of local conditions, likely hold many of the solutions to a more sustainable agriculture.

Food security is not exclusively a quantitative issue concerned only with increasing food volume – it is equally a qualitative one which involves assuring sustainable nutritional security (Freedman 2015) and improved food sovereignty. Our study examines two case studies of communities of practice among the Malayali – nutrition gardening and pond fish farming –

which not only provide access to more nutritious food but also increases farmers' capacity to grow food for local consumption, as opposed to supplying global markets. These practices revolve around social learning for sustainable food production and healthier food consumption as farmers create and exchange knowledge within their communities.

Nutrition Gardening

Nutrition gardening, often in the form of home or community gardening, has played an essential role in local food systems, particularly in developing countries throughout the world. This form of small-scale food production has proven to meet farmers' needs without negatively affecting the resource base and, in fact, often improves it (Torquebiau 1992). The benefits for farmers are widespread and include the improvement of food and nutrition security, monetary gain (either through lessened expenditures or profits from marketing), improving human capacity, the empowerment of women and the preservation of indigenous knowledge and culture (Mitchell & Hanstad 2004). Although there are similarities that exist amongst home gardens in different settings, they are unique in structure, functionality, composition and appearance, as these factors depend on the environment within which they are situated, the preferences and skills of family members as well as the accessibility of resources (Galhena, Freed & Maredia 2013).

In Cuba, gardens have allowed communities to become adaptable and resilient in the face of major political, social and economic changes that correlate to Cuba's international isolation (Buchmann 2009). Gardeners have collectively responded to food insecurity by sharing produce and labour across gardens. Community networking in this way allows individual households to easily access resources and information. In Sri Lanka, there have been recent national initiatives that have promoted home gardening throughout the country. These programs have demonstrated the importance of home gardens in providing alternative food sources and generation of income, particularly for a country having been hit by a tsunami in 2004 and having experienced the impacts on food security from a long civil war (Yamada 2006; Uyangoda 2010; Galhena et al. 2013).

We must also be mindful that projects can fail for a variety of reasons, such as in Peten, Guatemala, whereby conservation and development agencies have failed to successfully promote home gardens amongst migrant families. Traditional gardens exist in the area and are highly

productive, diverse and rich (Márquez & Schwartz 2008). The gardens introduced by NGOs have not been welcomed by the older generation because they have much less diversity than traditional gardens. Furthermore, the lack of sustained success can be attributed to the lack of the younger generation's interest in gardening and other agricultural activities. Marquez & Schwartz explain that the reason for this loss of interest is because there is a high demand for their labor in the service sector (public education, trades, etc.) because of rapid economic and population growth (2008). They conclude that the project initiators failed to take into consideration the local environment or people's needs (Márquez & Schwartz 2008).

Pond Fish Farming

According to the FAO, large-scale aquaculture is recognized as the fastest growing food industry in the world, but small-scale aquaculture also has an important role to play for sustainable food production (Townsey 2013). There have been many projects throughout the world that promote food security through small-scale aquaculture. In Tobasco, Mexico, households consumed the fish that they had produced themselves approximately four times per month which covered almost half of their total monthly consumption of fish. The production of fish provided families with a reliable source of micro-nutrients and protein as well as considerable expenditure reduction (Mitchell 2015). In Thailand, the collective rather than individual nature of the practice of shrimp and tilapia farming has benefitted farmers immensely, as they have seen improvement in access to the market, reduced transaction costs by working as a collective versus as individuals, and greater access to extension services for access for technical expertise (Yamamoto 2013). The importance of comradery in the sustainability of practices has also been noted amongst smallholder fish farmers in the Philippines who use the traditional "bayanihan" system; a collective action practice where members help each other survive common hardships, such as adapting to flash floods, rising sea levels and a longer dry season (Agbayani et al. 2013).

Failed fish farming endeavors also exist, such as with some notable small-scale aquaculture farmers in eastern Africa, where quality of fish, lack of fish food, poor extension, poor knowledge dissemination, lack of traditional experience, gender inequality in control of resources, land tenure insecurity, poor infrastructure, and overall poverty all intersect with the sustainability of fish farming (Mwanja & Nyandat 2013).

Communities of Practice

Communities of Practice (CoPs) reflect the fundamental social nature of human learning. They are those "groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly" (Wenger-Trayner 2015, p.1). These dynamic, information-driven communities consist of both formal and informal networks, whereby members have a shared domain of interest (Nickols 2003; Au, Reiner & Urbanowski 2009). It can also be described as a collection of people who engage on an ongoing basis in a common endeavor in a process of continual, collective learning, as opposed to individual knowledge gain, which is sometimes called situated learning (Smith, M.K. 1999; Eckert 2006; Wenger-Trayner 2015). As CoPs evolve, there is ongoing support for the interaction of members as their sense of belonging builds through the sharing of knowledge (Li, et al. 2009).

A community of practice differs from other groups and communities by three main elements. Firstly, there is a shared *domain* of interest and a commitment to that domain, a shared competence of members, where members share information and learn from each other. Secondly, the *community* is created in the pursuance of their common interest through joint activities and discussions. Finally, the *practice* itself takes time and sustained interaction, whereby members develop shared resources, experiences, stories and tools and ways of addressing problems (Wenger-Trayner 2015). Interventions which can facilitate knowledge exchange and relationship-building can help these groups gain their full potential (Li, et al. 2009). The strength of a CoP lies in continuous learning and active participation of its members.

Within a CoP analysis, Wenger, White and Smith (2009) refer to *orientations* of CoPs as the typical patterns of activities and connections through which members experience being a community (pgs. 69-70). Communities may rely on meetings, open-ended conversations or may organize themselves around common projects. They may also focus on the creation and sharing of content, rely on expert advice, on relationship building, community cultivation, or serving a common cause in a specific context. These orientations are described in further detail below (Table 1).

Table 1. Orientations of Communities of Practice

Orientation	**Description**
Meetings	Members engage in shared activities for a specific time. Regular face-to-face, well-attended meetings, with enthusiasm to participate, connection to others and useful outcomes to ensure the communities' existence.
Open-ended Conversations	Rarely meet formally but instead, maintain ongoing, conversations as their primary way of learning.
Projects	Organized around a particular project; members participate in activities together.
Content	Interest in creating, sharing and providing access to documents, tools and other content. Valuable and well-organized content is useful for members to attract new members and makes it possible to offer a community's expertise to others.
Access to Expertise	Reliance on expertise (internal or external) to answer questions, fulfill requests for advice or to engage in collaborative, just-in-time problem solving.
Relationships	Emphasis on the interpersonal aspect of learning together. Involves networking, trust-building and mutual discovery.
Individual Participation	Individuals experience learning through participation, personalized exchange, individual development and multi-membership.
Community Cultivation	Need to reflect on the effectiveness and health of the communities to make things better. Activities are well planned, reference materials are well produced and organized, and members find that someone is always responsive to their requests, contributions, and changing needs.
Serving a Context	Outward-facing mission as a key driver of community evolution.

Adapted from "Digital Habitats" by Wenger et al. 2009 p.69-100

Methods

This study takes a qualitative research approach to examine how communities of practice are formed and maintained around sustainable food production. Data were gathered in the field through Participatory Rural Appraisal (PRA), semi-structured interviews and participant observation, as well as through documentary analysis. Fieldwork consisted of the first author spending two and a half months (April to July 2013) and the third author spending two weeks (April 2013) in the Kolli Hills region. Participants in this research were recruited using purposive intermediary snowball sampling. MSSRF served as the intermediary in this process as they had good knowledge of existing relationships with most of the farmers in the project area.

PRA gatherings took place early in the morning or in the evening so as to not interfere with the daily work for farmers. All of the PRAs were held in locations convenient for participants, such as a village meeting area. There was no incentive offered for participation, although refreshments were served at each meeting and small gifts were given to those who were individually interviewed. Individual interviews with 20 men and women community leaders were conducted to further substantiate findings from the PRAs and gain more in-depth understanding of food production activities that took place in the Kolli Hills and the inner workings and relationships that exist within CoPs. A translator was used for data collection and transcription. During the fieldwork, there were opportunities to observe many activities through farm visits, local meetings and public activities, such as cooking demonstrations.

PRA was used so that community members could actively be involved in the research process. The continuous critical (and self-) reflection that this method requires can empower local people to actively analyze their own living conditions, problems and potentials for change (FAO 1999). The PRA that was inspired by Wenger, White and Smith's *Orientations* was of particular value for this study (2009). Both fish farmers and nutrition gardeners were asked to place a circle on a diagram showing the relevance of each orientation along a continuum, from least important to most important. This rating system allowed for open-dialogue amongst practitioners as they decided what was most relevant for their particular CoP.

Findings

For this research, we examined communities of practice formed around nutrition gardeners and pond fish farmers, in order to understand how each emerged, how the characteristics of members differed, what qualities leaders had within each community and what factors allowed the community of practice to maintain itself. We were mindful of the development of the *shared domain*, *community* and *practice* of each, which are the essential components of a CoP, as well as the various orientations – patterns of activities and connections – utilized by each CoP (Wenger-Trayner 2015). The following section summarizes the findings for each of these communities of practice.

Figure 1: PRA with a group of men and women fish farmers in Thathandipatti

Nutrition Gardening

Nutrition gardeners placed equal importance on six orientations they identified as most relevant to this practice: *individual participation*; *access to expertise*; *open-ended conversation*; *community relationships*; *community cultivation,* and, *serving a context*. Group *meetings* were seen as more important in the initial stages of formation, whereas creating and sharing written *content* on how to do the practice and being part of group projects were not seen to be central to this community. In the following paragraphs, we examine these orientations and how they related to the nutrition gardening CoP.

Nutrition gardening is a household level practice whereby individuals and families take on daily responsibilities, such as seeding, weeding, watering and harvesting. *Individual participation* was therefore noted as essential, and there was no evidence of households sharing gardens. Although MSSRF provided initial training and inputs for gardening, each household ultimately took responsibility for their own gardens – from land preparation, to seed selection, to harvest and preparing food. Families also decided on garden duties for specific members. The initial preparation and planting of a garden required a few hours while daily maintenance throughout the growing season took approximately 15 minutes per day. If rainfall allowed, there could be up to four full garden harvests per year. Gardening was most popular among women and children between the ages of 20 and 60. However, men took part in some of the more strenuous activities, particularly in preparing the plot and planting of seeds between harvests. Farmers with the lowest income were likely to be most interested in nutrition gardening as it reduces the amount of money spent in the market on fresh produce.

Access to expertise was important to nutrition gardeners, even though uncontained gardening has existed for generations in the Kolli Hills. MSSRF staff provided agronomic advice (i.e., plot placement, crop rotation within the garden, intercropping for purposes of integrated pest management, vermicomposting) and demonstrated food preservation (drying, pickling) and cooking techniques. Village volunteers (both men and women) were also recruited to support the development of these communities of practice and act as liaisons between the community and the project staff. These volunteers had to have a minimum of 10th standard education which generally compares to the completion of a high school diploma in North America, basic knowledge about computers (as they also ran the village knowledge centers[3]) and strong links with their communities. Initial training lasted one to two days, but there were ongoing learning opportunities throughout the year about nutrition, agricultural practices, and government schemes to provide financial aid to farmers. Villagers could contact village volunteers to access supplies for their gardens and gain advice on pest management and irrigation. Volunteers explained that they enjoyed personal growth, opportunities for learning, being of service to others, and the minimal monthly honorarium provided by the APM project.

[3] Village knowledge centers were set up by MSSRF as resource hubs for community members to access and share agricultural information, gain skills training (e.g., computer classes) and serve as venues for community meetings.

Community members identified *meetings* as somewhat important for the initial introduction of gardening techniques and also for the regular cooking demonstrations. However, after several regular face-to-face visits from community volunteers and MSSRF field staff members in the villages, formal public meetings became less necessary. Most farmers also expressed that since the establishment of their gardens, they only accessed MSSRF staff when they needed more seeds or other supplies.

Gardeners placed importance on learning from each other through *open-ended conversations,* which aided in the formation and maintenance of *community relationships*, both of which were key to exchanging information and learning from each other's experiences. Discussion about fertilizer use, pest control and the lack of water (due to drought) were common conversation topics at the household and community level. Recipe sharing and the sharing of excess produce with family and neighbours were also common practices amongst nutrition gardeners. These exchanges, both verbal and material, took place most commonly in the workplace (in a government program that assures 100 days of paid work, or in the fields), in the market, in villages in the evenings and at the numerous religious festivals throughout the year. These exchanges bolster relationships of reciprocity and mutual trust (Miller & Esterik 2004). Nutrition gardeners continuously mentioned the importance of *community cultivation;* working together to empower their communities to become more food secure. Community teamwork was evident as they prepared food together at festivals.

Community members agreed that participation in the practice was beneficial because it *served a specific common context*. The largest benefit was the improvements in the general health and nutrition of their families. The second benefit was that it saved money because families no longer had to purchase as much produce from the market. Overall, families with gardens saved an average of 200 Rupees (approximately $3.90 CAD) per week. Due to the small size of the gardens, the volume of production was relatively low; hence, selling surplus produce in the marketplace was not a viable option during the time of the fieldwork.

Pond Fish Farming

Group fish farmers placed the greatest importance on *content publishing*, *group meetings*, *access to expertise* and *serving a context*. *Open-ended conversations*, *projects*, *relationship-building*

and *community cultivation* were identified as being slightly less important, while *individual participation* was seen as least important in the way that this particular group functioned.

The APM project initiated community pond fish farming primarily as a way to address protein deficiencies prevalent among farmers in the Kolli Hills, but also for potential income generation. Farmers believed *serving a context* – for the health and nutrition of their families – was one of the most important reasons to participate in the practice. Through nutrition training from MSSRF, farmers were taught about what kinds of symptoms exist for common diseases that affect others in their area related to protein and iron deficiency, which can potentially be prevented through the consumption of fish. Furthermore, there is potential for income generation if these enterprises become large enough to sell surplus in the marketplace, which would also increase the variety of food available in the Kolli Hills. The importance of *community cultivation* (the overall goals of alleviating poverty and malnutrition for the well-being of the community as a whole) and *relationship building* (teamwork as important for the success of this type of joint venture) were also seen as somewhat important, but both came second to the importance of the health and nutrition of the farmers' families.

Although river fishing existed historically among the Malayali people, pond fish farming as an enterprise and communal activity was a novel practice introduced by MSSRF, therefore *access to expertise* was named as an essential community orientation, particularly since most of the groups had only experienced one harvest at the time of this research took place. This group relied on the expertise of the MSSRF fish scientist who led this initiative. They used his expertise to gain access to the community fish ponds, specifically to obtain the necessary permits from the government, to access inputs, such as fishlings and nets for harvest, and to learn about cleaning and cooking fish. As this was a new practice, fish production at the time of data collection only provided enough fish for the participating families. People were very eager to increase yields so that they could sell excess fish in the marketplace, and were also interested in starting hatcheries in the hills to be able to more easily obtain their fishlings as many had died during transport.

MSSRF identified four usable community ponds (which were otherwise used for bathing, washing clothes and as drinking water for cattle), eight individual fish ponds in the project area, and 50 group ponds outside of the project area. Village level meetings were held to make farmers aware of the potential benefits of starting a pond fish farming project, and to gain more

knowledge about fish farming. In order to keep organized, farmer groups maintained a set of documents (*content publishing*) kept up by a group of leaders (president, secretary and treasurer) who were chosen by group consensus. Famers expressed the importance of this orientation because the use of these documents was important to keep all transactions and plans transparent for all stakeholders.

Involvement in pond fish farming was voluntary, but the APM project had attempted to address gender equality by encouraging equal membership of men and women in the projects. Six men and six women made up the members of these groups. Each group had a formal self-governing structure whereby monthly *group meetings* were held to collect savings, maintain records, decide what investments needed to be made and to create schedules for fish feeding. Meetings were also open to outsiders who were able to listen or ask questions. Most decision-making happens in this formal meeting context, but *open-ended conversations* were still mentioned to be somewhat important to ensure that all members took care of their allocated responsibilities throughout the month, dealing with potential problems such as drought or pest control and also monitoring accountability of all members with investments. People felt that openness and teamwork were key to the success in maintaining this practice. All members contributed 100 Rupees (approximately $1.95 CAD) per month, most of which contributed to purchasing ingredients and making the fish feed. Two group members worked approximately one hour each day to feed the fish, and the responsibilities ran in two-week cycles. The only reason for a member to leave the group was if they had to temporarily move for work outside of the Kolli Hills.

By consensus, members decided upon leadership roles within the group. As mentioned above, within each group, there were three leadership roles (president, secretary and treasurer) and roles could change after every harvest to allow new members to learn different responsibilities. A common quality of the leaders is that they had relatively higher levels of education than the other members, and one group explained that they also ensured that an elder with experience took on one of the leadership roles. The president of one of the fish groups explained that he was motivated to participate in this practice after learning about it from MSSRF. In order to recruit the other members, he explained that he went from house to house to create a group. When asked about personal motivations for taking on leadership roles, farmers explained that it created good learning opportunities with regards to banking, teamwork and

nurturing a personal interest in fish ponds, but again, improving the health of their families surpassed these.

The communal nature of the fish ponds was a good indication of the potential sustainability of the practice. After the set-up of the first two fish pond groups, other farmers became interested in the practice and began asking members questions about how to feed the fish, the success of fish rearing as well as the production costs and potential earnings associated with marketing. Some of the wealthier farmers had their own individual wells near their homes that they made use of for fish farming, also with the help of MSSRF. Group farmers and individual farmers used each other as resources, as they were in contact with each other and discussed things such as how they were introduced to the practice, how they learned how to farm the fish and about marketing potential. The sharing of labour, the sharing of the fish after harvest, the motivation and interest in participation in the practice by members and non-members alike are all signs of the viability of this community of practice. Members had a common interest in increasing their yield to potentially sell it in the local market and were engaged in a continual process of learning.

Care of the ponds was new to most members and they relied on each other to maintain the ponds and share the responsibility to deal with problems, which is why farmers placed *project orientation* in the middle of the spectrum. Cleaning the pond, preparing food for the fish, pest control, theft prevention, harvesting and preparing fish are all projects that were essential to the maintenance of this food production practice and were carried out by all members. There is little focus on the individual in this context, which is why *individual participation* was placed at the bottom of the spectrum, save for the individual group members cleaning and cooking of fish after harvest. The entire group agreed upon all investments, labour divisions, and decisions.

Similar to nutrition gardening, there are challenges associated with pond fish farming. One pond failed due to drought, which is a concern for the sustainability of the project as climate change impacts continue to result in cycles of drought and flooding. Members of the group fish ponds came from many surrounding villages, so distance/travel is a hindrance for some. Furthermore, one of the ponds is located near a temple, and the Hindu tradition does not allow women who are menstruating to approach it. Therefore, during certain times, the women are not able to actively fulfill their responsibilities because of religious beliefs. The transportation costs for bringing fishlings to the Kolli Hills are also high, as well as the packing charge, time and

energy spent, and there is also a significant loss of fishlings during transport. During the data collection period, all ponds were stocked by MSSRF. The hopes of creating hatcheries in the area failed because of the lack of water; however, farmers have located other fish hatcheries in the region and access them on their own regularly. Furthermore, after getting help from professional fishermen from the surrounding plains during initial harvests, pond fish farmers now have the skills to carry out their own harvests.

Discussion and Conclusion: The Future of Communities of Practice in Agriculture

We will now return to the three elements of CoPs in relation to the social practices of nutrition gardening and fish farming. To remind the reader, this involves a shared *domain* of interest whereby members are competent in contributing to it as they share information and learn from each other. Secondly, the *community* is created as members engage in activities and discussion in order to pursue their interests. Finally, the *practice* develops from sustained interaction amongst the members as they develop shared resources, experiences, stories, tools and ways of addressing problems (Wegner-Trayner 2015).

The *domain* of interest for the members of each of the communities of practice is reflected in their common goals and commitment to achieving them through the practice in which they participate. The health and nutrition of the families of nutrition gardeners and fish farmers was consistently mentioned to be the main goal. This is consistent with the literature that has supported the success of home gardening practices in sustaining food security throughout the world for years (Torquebiau 1992). Similarly, the contribution of aquaculture to the livelihoods of the rural poor is seen amongst small-scale fish farmers throughout the world, including increased consumption of highly nutritional fish, the creation of employment and increased income generation (Edwards 2013).

The *community* of nutrition gardeners was created as members regularly attended cooking demonstrations, cooked together at local festivals, exchanged recipes and shared excess produce. They also compared yields and shared information about establishing and maintaining a garden through fertilizing, crop rotation and pest control. Individual participation, community cultivation, relationship-building and open-ended conversations were most prevalent as nutrition gardeners built their community around these practices. By contrast, the community of fish

farmers was supported more formally as members learned how to collectively take part in pond fish farming, do banking, create a system of nominating people for leadership roles, participate in regular and democratically run meetings, share responsibilities, maintain books and records to keep all activity transparent, and invest money equally in the practice. The orientations relevant to fish farmers as they build their community are meetings, projects, content publishing and access to expertise.

The *practice* of gardening involved individual households and although a community of practice began to develop, the long-term implementation of this practice failed. The authors have learned recently from MSSRF staff that nutrition gardening has not been successful for a number of reasons, including the continuation of a long drought, limited access to seeds, and a lack of technical support following the end of the APM project. By contrast, pond fish farming has become a sustained *practice*. To this day, pond fish farming continues to be a source of food supply as well as an income opportunity.

It is difficult to measure the contribution of small-scale aquaculture to food security because there is a lack of available information, which is characteristic of most small-scale production (including nutrition gardening) because it tends to be scattered, seasonal, hard to recognize and often involve people who may not engage regularly with local institutions (Townsley 2013). Outputs of such practices are often mostly consumed within the household, with excess put into local markets, which is also difficult to measure (Townsley 2013). Despite these evaluation challenges, the contribution of small-scale agriculture to food security is undeniable. In order to ensure that this practice continues to thrive, it is essential that farmers have access to relevant information as well as have social spaces and opportunities in which their accumulated knowledge can be mobilized. Townsley explains,

> the key challenge is to make sure that people, including the poor, have access to the information they require and the technology that is most appropriate for them. It needs to be explicitly recognized that lack of such access is often a key feature of poverty in many rural areas, and innovative approaches are likely to be essential. (2013, p.67)

The community of practice approach allows researchers to understand how farmers, of equal standing, learn from each other how to shift small-scale practices to improve farm productivity

and maintain environmental conditions for sustained subsistence. Townsley celebrates informal knowledge dissemination among small-scale farmers, as demonstrated through the CoP approach. He asserts that formal systems, in contrast, often share information and carry out training in ways that often mirror existing power relations and therefore often do not reach all of the targeted recipients (2013).

The *orientations* that nutrition gardeners and pond fish farmers identify with offers insights into what holds these CoPs together. Fish farmers placed the greatest importance on content publishing, group meetings, access to expertise and serving a context whereby nutrition gardeners placed the most importance on access to expertise, open-ended conversation, community relationships, serving a context and community cultivation. These are evidently quite different, which begs the question of why, based on the 2017 updates on the sustainability of these practices, has one succeeded and the other has failed.

Nutrition gardening has been less successful than pond fish farming for a number of reasons. Although drought continues to be a key challenge for both practices, there is also limited access to a diversity of seeds and families have explained that the lack of technical support from MSSRF staff since the conclusion of the project has been to their detriment. The lack of technical support as the main cause of the breaking up of the CoP in the Kolli Hills is in contrast to the failure of the NGO-supported gardens in Guatemala, the cause of which has been attributed to a high demand for labour in the service sector (Márquez & Schwartz 2008). The gardeners in the Kolli Hills, because of their relative isolation and agricultural focus, do not see this kind of service sector demand. Although gardens have had success in improving food and nutritional security for small-scale farmers in other areas, the contexts in which they exist (environmental conditions, accessibility of resources, preferences and skills of practitioners, etc.) contribute to the sustainability of the practice (Torquebiau, Galhena, Freed & Maredia 2013; Koont 2011; Buchmann 2009). Although nutrition gardening has not proven to have become a sustainable practice, many gardeners expressed that learning the practices was useful and meaningful, particularly in gaining knowledge about nutrition.

Fish farmers on the other hand, initially mentioned that they relied heavily on MSSRF staff for almost every aspect of the practice (where to get fishlings, what, when and where to get feed, when to harvest, how to build and maintain hatcheries, and how to market the fish) but despite not having MSSRF following the end of the project, their CoP still is thriving today. The

overall success this project is mirrored in Tobasco Mexico, as they both attained their common goals – to address micro-nutrient and protein deficiencies as well as contribute to money saving (Mitchell 2015). The sustainability of this CoP could be attributed to the group nature of the practice as it was with the shrimp and tilapia farmers in Thailand who benefitted with improved access to market, reduced transaction costs and greater access to extension services because they worked as a collective (Yamamoto 2013). Compared to nutrition gardeners, it may be the case that the success of fish farmers can be attributed to them seeing more value in the practice itself, not only in terms of outcomes but also in the excitement of learning together and being part of a collective.

It is our hope that this research has provided some insight into the ways that small-scale farmers participate in food production practices and create communities of learning and support around them. Using a community of practice lens to examine these two case studies, we were able to investigate how farmers feel they are connected or united in sharing the same practice, their motivations to participate, and what knowledge sharing exists within the CoP model that would not otherwise exist through a top-down approach. It is also our hope that this research might inform the development of new, sustainable practices in other regions that are beneficial for the farmers and their communities, particularly under the effects of climate change. Researchers and development workers must be aware of the importance of knowledge creation and sharing, the fluidity and adaptability of a learning community as well as be sensitive to changing physical and social context within different communities.

The gardeners and fish farmers in this study faced challenges and benefits to taking part in these communities of practice, particularly within the changing environmental conditions of the Kolli Hills. Lack of rainfall due to climate change made some gardens fail and in one case caused a fish pond to dry up. Furthermore, if MSSRF no longer service these small-scale agricultural interventions, it is up to the CoP members to acquire the materials and skills needed to continue with these practices.

Both nutrition gardening and pond fish farming were introduced through the APM project as they built upon previous traditional practices of uncontained gardening and river fishing. The APM project provided some resources to help improve upon these traditional practices through the development of communities of practice. Sustainability of these practices and CoPs will depend on both factors internal to the communities (e.g., leadership, knowledge mobilization) as

well as external factors (e.g., rainfall and market potential). What makes a CoP succeed depends on both the individual interests and resources of the members as well as the goals and objectives of the community as a whole. Wenger (2000) reminds us that a successful community of practice can be dynamic, and involve open dialogue within and outside of the community as well as oscillations in levels of participation. If the CoP maintains a focus on the value of the community and creates excitement about the communal learning that exists, the group can weather difficulties (Wenger, McDermott & Snyder 2002). We hope that this brief comparison of how the communities of practice operated for two small-scale sustainable agricultural practices can offer insight into the nature of knowledge mobilization and cooperation to improve not only nutrition and food security, but also food sovereignty for small-scale farmers.

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Chapter Four: Conclusion

The purpose of this thesis was to examine sustainable food production practices for food security in a rural and isolated community in southern India. This research was part of a larger project called "Alleviating Poverty and Malnutrition in Agrobiodiversity Hotspots of India" (APM) which resulted from a partnership between the MS Swaminathan Research Foundation (MSSRF) and the Faculty of Agriculture, Life and Environmental Sciences at the University of Alberta. Although many interventions were introduced in the Kolli Hills through the APM project, I used nutrition gardening and fish farming as case studies because they built on traditional practices and had the potential to generate food that could decrease malnutrition and provide opportunities for saving and earning money.

I explored the factors influencing the development of a community of practice (CoP) around each of these case studies. The CoPs facilitated mutual learning and information sharing among the villagers for the development of these social practices that promote sustainable food production. I explored how information and knowledge was attained, shared and mobilized within CoPs, and identified obstacles and aspirations with respect to knowledge mobilization including the possibility of a role for ICT to support this. Furthermore, I was able to get an understanding about how communities are formed around certain practices and what factors influence their continuity. I was able to effectively attain my research objectives using qualitative research techniques: Participatory Rural Appraisal (PRA), semi-structured interviews and participant observation.

Social practice theory and the community of practice framework informed this research as they provided two ways to evaluate the importance of knowledge in the development and maintenance of practice. Although knowledge is not the sole factor involved in the creation of a social practice, it provided a starting point for understanding how sustainable food production practices become normalized through learning and sharing of traditional and new knowledge. Social practice theory pointed to three main elements of social practice: *materials*; *competence*; and *meaning* (Shove et al. 2012). The community of practice framework built on this by examining how learning communities are formed around these practices using the main elements that make these communities distinct from each other in terms of their *domain*, *community* and *practice* (Wenger-Trayner 2015). The social learning that occurs through the development of a

practice, often evolving with the mobilization of knowledge, can help to create resilient food systems for marginalized small farmers.

This study will be of interest to social scientists, policy makers, those interested in the promotion of sustainable food systems, researchers and others interested in food security and food sovereignty, and all stakeholders involved in development work from international organizations, to the small-scale farmers themselves.

Summary of Findings

The major transformation of farming practices since the 1960s and the consequent restructuring of the global food system as a whole has had major socio-economic and ecological consequences. The switch from biodiverse traditional crops to monoculture cash crops has left small farmers (who supply 80% of the world's food) malnourished, in debt and distanced from their traditional livelihoods (Shiva 2016; Carolan 2012; FAO 2013; Altieri 2009). Furthermore, drought, poor soil health and the increased presence of pests leave small farmers, particularly those in marginalized and isolated communities, the most vulnerable to food insecurity.

This study is centered around the belief that knowledge is critical to the development of more sustainable food systems. Understanding how information and knowledge about sustainable food production is acquired and mobilized is important so that marginalized and isolated farmers in particular, may take control of their own food production in ways that are sustainable and environmentally sound (Hudson, Krogman & Beckie 2016). An important component that I considered was the interplay of formal and informal knowledge systems amongst small-scale farmers. Not only did I look at the ways that farmers interact with the formalized knowledge system (i.e., agricultural institutions and government departments of extension), but also the ways that they create and share information with each other as part of an informal knowledge system. Combining both traditional agricultural knowledge with expert and scientific knowledge about sustainable food production is essential in addressing concerns about food security and the well-being of farmers and their families. In the Kolli Hills, formal knowledge sources included agricultural television programing, information from NGOs (mostly MSSRF) and local exhibitions; whereas face-to-face informal interaction occurred while farmers were collecting water, washing clothes, or attending festivals.

In Chapter Two: Paper #1 ("Social Practices of Knowledge Mobilization for Sustainable Food Production in the Kolli Hills, India"), Shove, Pantzar & Watson's (2012) social practices elemental framework was useful to examine how nutrition gardening and fish farming were introduced and taken up. The first element, *materials* – things and the body – is evident in that the practitioners have the necessary materials (already held or provided by the APM project) in order to carry out their practices.

The second element, *competence,* includes the skills and training necessary in order to develop a practice. As this study focuses primarily on knowledge mobilization, this element was of particular interest. By looking at our case study communities of practice specifically, we were able to understand what kinds of information practitioners are still lacking in order to properly carry out their respective practices. Fish farmers needed more information about when the fish are ready to harvest, how to prepare the fish once harvested, how to market the fish to increase income. Fish farmers also had many questions about how to start their own hatchery. Nutrition gardeners reported that they did not have adequate information about pest control, soil health, plant organization (intercropping within their gardens) or how to prepare the produce. When asked what mechanisms could be put in place to improve access to information in order to sustain their respective practices, some farmers expressed interest in enhancing meetings with video, but otherwise most farmers agreed that face-to-face contact with experts and each other was the best way to exchange information. This research re-affirms that the way in which new information and communication technologies are introduced needs to be sensitive to the current practices of communities and their future aspirations (Islam & Gronlund 2011).

Another important part of the *competence* element is understanding what barriers exist for farmers to gain access to agricultural information. Although there are still more traditional types of communication present, like banners, signs and loudspeaker announcements, that are accessible to all community members, modern communication technologies are now available in the Kolli Hills. Almost everybody has a cellphone and every household has a television. Information centres are available for computer and internet use as well as the viewing of educational videos and live feed presentations. ICTs appeal to the younger generation, but significantly less so to the older farmers. Among my study participants, there was a general consensus that modern technologies are suited for young, educated people. Others commented

that trying to learn new technologies was too time consuming because of their other responsibilities or they were too difficult to access.

Finally, practitioners in both CoPs have developed *meaning* whereby farmers find reason to participate in their particular practices; in both cases, first and foremost, the health and nutrition of their families and secondly as a potential new source of income.

Chapter 3: Paper #2 ("Establishing Sustainable Food Production Communities of Practice: Nutrition Gardening and Pond Fish Farming in the Kolli Hills, India") expanded the study of knowledge mobilization to understand how CoPs have formed around the introduction of both nutrition gardening and fish farming practices through the APM project. Using Wenger-Trayner's three elements of CoPs (2015), I examined, through a different lens, the factors that have shaped the formation of CoPs, their purpose and function, who is involved, what activities hold the communities together and explored their role in strengthening sustainable food production and consumption practices. The *domain* was reflected in the common commitment to achieving the primary goal of all practitioners – the health and nutrition of their families. I explored *community* creation around both practices with the help of Wenger, White & Smith's *Orientations* framework (2009). The nutrition garden community was created as members interacted informally in a variety of ways – through cooking demonstrations, exchange of recipes, and at festivals, etc. They placed value on individual participation, community cultivation, relationship building and open-ended conversation in the formation and maintenance of their CoP. By contrast, fish farmers interacted more formally as they learned the group's responsibilities involved in fish rearing, attended regular meetings, maintained record-keeping, learned how to do banking, etc. The *orientations* that they felt most important in holding their CoP together were meetings, projects, content publishing and access to expertise. The final element of CoP is the *practice* itself where members act as practitioners in an ongoing shared endeavour. I learned that nutrition gardeners are no longer participating in their practice due to lack of rainfall, lack of a variety of seeds and lack of access to expertise. Fish farmers however, continue to participate in their practice and have seen much success. The difference in outcomes of each CoP may be attributed to the value of being part of being a collective (in a relatively formal setting) and the excitement of learning together.

Areas for Future Research

Although I was sensitive to the role of gender while doing my research, observations of relationships amongst men and women farmers, between experts and farmers, and even amongst the staff within MSSRF made it clear that a more explicit inclusion of gender norms and relations would make for a more holistic study. As mentioned in the introduction, further research might explore how gender relations impact the structure and functioning of agricultural communities of practice, the priorities for different kinds of knowledge, communication patterns for knowledge mobilization or access to material and capital resources.

For this study, I explored social practices that were introduced by one organization, as there was little influence from other organizations that were focused on agriculture in the Kolli Hills. It would be interesting to explore how MSSRF's "pro-nature, pro-poor, pro-women and pro-sustainable on-farm and non-farm livelihoods" (MSSRF 2014, pg, 1) approach to development might compare to other organizations working in rural India with differing philosophies, priorities or approaches. Apart from the Kolli Hills, the APM project had two other project sites in Tamil Nadu where similar interventions were introduced. A useful follow-up study to this one would be to examine how knowledge mobilization about the same sustainable food production practices differs in the other study sites, which might reveal important contextual social, economic or spatial factors for knowledge mobilization. Furthermore, it would be of interest to study agricultural communities of practice as they form organically as opposed to being influenced by a particular project intervention.

An exploration of the information networks that exist in rural communities, and how ICTs can be used to connect farmers to work together to create their own CoPs, would be of great value. Additionally, future research might examine the role of technology stewards for sustainable small-scale agricultural practices, exploring how they increase their skills and connections over time. Technology stewards are community members who become leaders as they take responsibility for a community's technology resources for a time. Not only do technology stewards take on individual activities but more importantly they embody a crucial role within their community as members continue to learn together (Wenger, White & Smith 2009).

Because of the limited time that I spent in India, I did not get to see either the initial formation of the communities of practice nor was I there long enough to see if they became sustained practices. We relied on MSSRF to provide updates on the progress and maintenance of each CoP and from them learned that nutrition gardening was no longer being practiced in the Kolli Hills, while fish farming continued to thrive. A longitudinal study would be of value to determine if this is still the case years down the road, and also to understand how information networks have changed and if any new mechanisms (namely, ICT) have been put in place to enhance the mobilization of knowledge. A comparative exploration of knowledge mobilization across other communities with diverse ethnic and cultural backgrounds would help isolate the factors that contribute to the sustainability of a practice over the long term.

Additional research could examine the effectiveness of the knowledge centers that have been established. I recently learned that the Village Resource Center (VRC) is still functioning as it was when I was there in 2013. The Village Knowledge Centers (VKC) are still being managed by the local community in respective locations. The village volunteers receive technical support if needed but there is no monetary incentive to volunteer. The computers continue to still be used only by children. It would be interesting to study if these knowledge centers are in fact being used to their full capacity (e.g., farmers identify other important uses that they feel would be beneficial), and how the use of these knowledge centres changes over time, and by whom (e.g., women, diverse age groups).

Finally, it would be interesting to further investigate the ways that new technologies are presenting opportunities to engage the younger generation in farming and enhance the mobilization of knowledge. Youth are increasingly becoming uninterested in farming for reasons such as the downgrading of farming and rural life, access to land, and the deskilling of rural youth (White 2012). Additionally, youth are deciding to move to the labour market for reasons such as better income security, lack of resources or government policies (Proctor & Lucchesi 2012). As the literature suggests, youth are often most willing to use new technologies (DeGennaro 2008; Lenhart, Madden, & Hitlin 2005). Research could be done to understand if the incorporation of new communication technologies (as methods of agricultural knowledge mobilization) can engage youth and young adults in farming. An interesting question then, for example, might be to understand the value that people place on the technology that they use (e.g.,

how much they are willing to spend on technology use relative to their income) that could enhance the ease or attractiveness for youth continuing to farm.

Policy Implications

An important component to this study is understanding what hinders the exchange of information that could be valuable in creating sustainable food systems. As is often the case, there is a disconnect between government programs and meeting the needs of the farmers in the Kolli Hills. An interview with the Assistant Director of Agriculture in the Kolli Hills helped us to understand what the role of the government entailed. Included in his long list of government-led projects were things such as production and marketing techniques, crop protection, animal husbandry, artificial insemination, sericulture, agriculture engineering, provision of subsidies for the purchase of machinery, water storage, etc. When asked how all of this information was communicated to people, he explained that there was a big yearly meeting and three grassroots-level agriculture officers visit farms every 15 days. The farmers, when asked about this, explained that there was little government agricultural support in the area other than the functioning of the Public Distribution System (PDS). The PDS was implemented by the Ministry of Consumer Affairs, Food and Public Distribution with the Government of India to alleviate poverty and provides wheat and rice to farmers. Unfortunately, this program indirectly reduces incentives for farmers to grow traditional, biodiverse and local crops (MSSRF & University of Alberta 2011). The Assistant Director of Agriculture referred to the farmers as an “underutilized work force”, and the focus on export-oriented agriculture is evident, particularly with the introduction of cassava as a cash crop. The displacement of the production of traditional millet varieties that have been growing in the region for centuries, and are high in nutritious value, shows that government priorities are not the same as those of the farmers, who are more focused on the health and nutrition of their families. In my opinion, the government should also be providing, in addition to other programs, support for farmers to restore traditional and more sustainable practices that can contribute to food security and community resilience. It is in the best interest of the farmers, the community and the country that sustainable practices are promoted over those that favor profit, given the risks posed to farmer to be dependent on export cash crops. Of course, it may be the case that the lack of support in sustainable food production

is not due to the strong relationship between government and business, but rather from a disconnect between government and the needs of the farmer. In this case, there should be a focus on coordination of efforts between government and NGO's who are more suited to carry out work at the local level.

Finally, the government should recognize and support the important role of youth for the future of farming. The introduction and use of new, useful and interesting technologies could act as incentive for rural youth to participate in farming as they are gaining more information in novel ways. The rural poor of India have been described as isolated from the information revolution (Cecchini & Scott 2003). The government might invest in youth training or develop new uses for technologies to reach out to young farmers, for example through the development of applications that are suited to their local context. An effort by the government to not only include, but place emphasis on youth in policy and program development might begin to create a sense of belonging to the larger world for farmers, as it becomes increasingly interconnected through ICT.

Concluding Remarks

In this research, I have explored how information and knowledge sharing about sustainable agricultural techniques contributes to the establishment of sustainable food production practices in the Kolli Hills, India. Paper one used social practice theory to examine how knowledge is acquired and shared, what obstacles exist amongst farmers with respect to knowledge mobilizations and to explore if there is a role for ICT in enhancing the social practices of knowledge mobilization. Shove, Pantzar & Watson's explanation of the ingredients of social practice – *material, meaning* and *competency* – helped us to understand how community members created sustained agricultural practices. Paper two uses communities of practice theory and takes this exploration further to begin to understand how farmers create communities around these forming practices. I explored how they are formed and maintained, and gained an understanding of what factors allow the CoPs to be sustained. Wenger-Trayner's CoP elements: *domain; community;* and *practice* offered a way of understanding what factors hold CoPs together and support sustained practice.

Our global food system continues to be threatened not only by environmental factors, but also by state priorities and market greed. Small-scale farmers, particularly in the underdeveloped and developing worlds are consistently the most negatively affected despite their major contribution to the global food supply. Changing our priorities to focus on food sovereignty and food security for small farmers at the local level is essential if we are to create a more sustainable and just food system. Understanding how knowledge about sustainable food production is mobilized amongst small-scale farmers is an essential component in the establishment of practices that promote food security for the farmers' themselves, as well as for the global community.

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Appendices

Appendix A: Letter of Contact

January 14, 2013

RE: Letter of Invitation to Participate in Study

Dear participant,

I am a Master's Student in the department of Resource Economics and Environmental Sociology at the University of Alberta. The project I am doing is a research study entitled *Understanding Social Practices of Sustainable Food Production and Provisioning: Gender Relations and Knowledge Mobilization among farmers and laborers in Kolli Hills, India.* I would like to invite you to participate in this study with me!

In this study, I hope that interested participants would participate in a Participatory Action Research (PAR) workshop, that lasting approximately 2-3 hours. Additionally, I would like to conduct individual interviews lasting from 60-90 minutes. The overall time frame for the PAR workshops and focus group meeting will be over the next two to three months.

Your participation is a time for you reflect on the ways in which you access information about food production and provisioning and to consider and identify new possibilities to ease the communication of this information. Please see the attached write-up for a more in-depth description of my project and its purpose.

If you are interested in participating in this study or learning more about it, please contact me for more details. I can be reached through email at **suraya@ualberta.ca** or by phone at **780 905 8756**. If you wish to contact my supervisor, Dr. Naomi Krogman, she can be reached at naomi.krogram@ualberta.ca or by phone at 780-492-4178.

This study was approved by the University of Alberta Research Ethics Board. Information can be obtained from the Ethics office by calling 780 492 2615.

Thank you for your consideration!

All the best,

Suraya Hudson

Appendix B: Letter of Consent for PRA

Dear participant,

You have been invited to participate in a research project entitled: *Understanding Social Practices of Knowledge Mobilization for Sustainable Food Production and Provisioning among farmers and laborers in Kolli Hills, India.* Please read this form carefully and feel free to ask any and all questions you may have.

Researcher Name and Affiliation: Suraya Hudson, Master's candidate in Environmental Sociology, Department of Resource Economics and Environmental Sociology, University of Alberta, phone: 1-780-905-8756, email: suraya@ualberta.ca

Supervisors:

Dr. Naomi Krogman, GSB 5-15, Department of Resource Economics and Environmental Sociology, University of Alberta, Edmonton, AB T6G-2H1 Canada
Phone: 1-780-492-4178
Email: naomi.krogram@ualberta.ca.

Dr. Mary Beckie, Enterprise Square 2-383, Faculty of Extension, University of Alberta, Edmonton, AB T5J 4P6 Canada
Phone: 1-780-492-5153
Email: mary.beckie@ualberta.ca.

Purpose of Study: The main purpose of this study is to understand the way farmers and labourers learn about how to carry out farming in a way that assures that the soil, water, seeds, and skills for farming are protected for long term production. I am also interested in how farmers obtain and share food, and process their own harvest. I am interested how farmers share information. For example, is it through word of mouth, as in friendship and associations one has? Is it also through meetings farmers have, the radio, and access to some computers through which

they can gain information? I would also like to explore how women and men, of different ages and kinds of farming activities, learn about farming in the Kolli Hills community. I have prepared some group exercises that will actively involve community members in creating knowledge that will generate a rich understanding of the current actors, networks and practices that exist. The PAR Workshop will last from sixty to ninety minutes, none of it will be recorded or videotaped, but there will be still photos taken of the process. I will be the only person using the data to make a summary of what I have learned.

Potential Benefits: Your participation is a time for you reflect on the ways in which you learn information about how food is produced and how you distribute your food for short and long-term purposes, for your family and perhaps others. I am very much interested in how you share information about farming and food preparation practices.

Potential Risks: I don't think there is anything that could negatively affect you from this research, but I cannot guarantee positive outcomes for your personally, from the research either.

Confidentiality: Each interview session will last between 45 minutes and 2 hours. I will never refer to you by name in the study, and I may assign you a fake name to protect your identity. I will store this consent form separately from your recorded interview, and assign you a number instead of your real or fake name, so no one would ever be able to put your particular interview together with the recording of your interview. I will store your typed-out translate interview from the audio recording in my supervisor's office, in a locked filing cabinet for a minimum of five years after the completion of the study. The results of the study will be used in my Master's thesis and possibly in other publications or at workshops and conferences.

Right to Withdraw: Your participation is voluntary, and you need answer only those questions you are comfortable with. During the interviews, if you wish to shut the recording off, or stop the interview, you are free to do so. You may withdraw from the research for any reason, right up until the interview or up to seventy-two hours from the time of the interview. If you withdraw from the research project at any time, any recording or information you have given me will be taken out of the study.

Compensation: There will be no monetary compensation for participants in this research. A small token gift will be given in appreciation of your time.

Questions: Please feel free to ask me any questions about my research project at any point; you are also free to contact the researchers at the numbers provided if you have any other questions. The plan for this study has been reviewed by a Research Ethics Board at the University of Alberta. If you have concerns about this study, or questions regarding participant rights and ethical conduct of research, you may contact the Research Ethics Office at 1-780-492-2615. This office has no direct involvement with this project: Research Ethics Office, 308 Campus Tower, 8625-112 St, Edmonton, Alberta T6G 1K8.

C**onsent to Participate:** I have read and understood the description of Suraya Hudson's research. I can ask any questions that I have about this research and am satisfied with the answers to questions I have asked. I consent to participate in this research project, understanding that I have opportunities to withdraw my consent. A copy of this consent form has been given to me for my records.

_____	_____
Date	Name of participant
_____	_____
(Signature of Participant)	(Signature of Researcher)

Appendix C: Letter of Consent for Individual Interviews

Dear participant,

You have been invited to participate in a research project entitled: *Understanding Social Practices of Sustainable Food Production and Provisioning: Gender Relations and Knowledge Mobilization among farmers and laborers in Kolli Hills, India.* Please read this form carefully and feel free to ask any and all questions you may have.

Researcher Name and Affiliation: Suraya Hudson, Master's candidate in Environmental Sociology, Department of Resource Economics and Environmental Sociology, University of Alberta, phone: 780 905 8756, email: suraya@ualberta.ca

Supervisors:
Dr. Naomi Krogman, Department of Resource Economics and Environmental Sociology, University of Alberta, phone: 780-492-4178, email: naomi.krogram@ualberta.ca.
Dr. Mary Beckie, Faculty of Extension, University of Alberta, phone: 780-492-5153, email: mary.beckie@ualberta.ca.

Purpose of Study: The main purpose of this study is to understand the way information about sustainable food production and provisioning is accessed and shared. I am interested in the forms of communication that farmers currently use, what is available for use, as well as any challenges to effective communication that may exist. I would also like to explore the role of gender, and how it relates to social practices of sustainable food production and provisioning within the Kolli Hills community. The interviews will last from 60 to 90 minutes. The interview process will be your time to answer questions, offer suggestions and share stories. Although I have prepared a list of questions, the conversation will be flexible. The interviews will be digitally recorded then transcribed. I will be the only person transcribing the data. During the interviews, if you wish to shut the recording off, you are free to do so.

Potential Benefits: Your participation is a time for you reflect on the ways in which you access information about food production and provisioning and to consider and identify new possibilities to ease the communication of this information.

Potential Risks: There are no known foreseeable risks in this study.

Confidentiality: Each interview session will last between 45 minutes and 2 hours. As a means of confidentially protecting your identity, pseudonyms will be used in the research writing. Additionally, each waiver of consent will be numbered and stored separately from the digital audio files. You will be given ample time to review the transcripts to ensure they accurately reflect your thoughts. You are also free to delete, add, or modify them as you see fit. If the interview location is not conducive to tape recording, I will make notes and then share these with you. Additionally, as required by the University of Alberta Research Ethics Board, the data collected from this research will be kept and securely stored at the University of Alberta, Department of Resource Economics and Environmental Sociology in Dr. Naomi Krogman's office (515 General Services Building). It will be stored in a locked filing cabinet for a minimum of five years after the completion of the study.

The results of the study will be used in my Master's thesis and possibly in other publications or at workshops and conferences. In any public use of the data generated from the study, I will respect your wishes and use only the agreed-upon quotes and information.

Right to Withdraw: Your participation is voluntary, and you can answer only those questions you feel comfortable with. There is no guarantee that you will personally benefit from your involvement. The information that is shared will be held in strict confidence and discussed only with the research team. You may withdraw from the research for any reason, right up until the interview or up to seventy-two hours from the time of the interview. If you withdraw from the research project at any time, any data you have contributed will be destroyed at your request.

Compensation: There will be no monetary compensation for participants in this research. A small token gift will be given in appreciation of your time.

Questions: Please feel free to ask me any questions concerning the research project at any point; you are also free to contact the researchers at the numbers provided if you have any other questions. The plan for this study has been reviewed by a Research Ethics Board at the University of Alberta. If you have concerns about this study, or questions regarding participant rights and ethical conduct of research, you may contact the Research Ethics Office at 492-2615. This office has no direct involvement with this project.

Consent to Participate: I have read and understood the description provided and have had an opportunity to ask questions and my questions have been answered. I consent to participate in this research project, understanding that I may withdraw my consent at any time. A copy of this consent form has been given to me for my records.

_____	_____
Date	Name of participant
_____	_____
(Signature of Participant)	(Signature of Researcher)

Appendix D: PRA/Interview Script

Sustainable Food Production and Provisioning

Food Production and Provisioning

1. How long have you and your family lived in this area?
2. Can you tell me about your family's history of farming in the area?
3. Do you own your own land? Are you renting the land for your own use? Do you work for someone else? (open to discussing combination of these questions)
4. Can you please tell me which of the following activities you are involved with?
    a. Growing food for your family
    b. Growing food for sale
    c. Preparing food for sale (e.g., cleaning, bagging)
    d. Preparations and cooking food for your family
5. How many years have you been doing this? (based on question 4)
6. Can you please tell me about your farm and what you grow? (Or the fields that you work on).
7. Please describe your daily/weekly/monthly tasks for the activities you are involved with. Do you work on your own or with other family or community members?
8. If you are farming,
    a. Which of the following methods do you use to farm?
        i. Use of farm chemicals (fertilizers, insecticides, herbicides)
        ii. Farming without the use of manufactured goods. (Use of products you need to buy vs. locally available (e.g., free manure) – (open to discussion).
        iii. Use of composted organic matter; use of worms in composting
        iv. Do you save and use your own seeds from year to year?
        v. Do you grow more than one crop at a time on the same field?
        vi. Do you grow different crops in succession on the same field (in rotation)?
        vii. Other?

b. Which of these techniques have been introduced to you by MSSRF (M. Swaminathan Research Foundation) vs. things that you have learned on your own (common to the area)?

9. Are there any other techniques that you would be interested in trying? If yes, what are the reasons that you have not yet tried them?

Acquiring and Sharing Knowledge

10. Where do you obtain information about the food activities you are involved with?
    a. From your parents or grandparents?
    b. From other farmers or community members?
    c. From extension agents?
    d. From buyers or marketers?
    e. From radio, TV?
    f. Other?
11. How do farmers share information with each other?
    a. By talking face-to-face?
    b. At formal gatherings?
    c. Informal Gatherings? (e.g., meeting by water wells)
    d. Meetings for organizations representing farmers or other community groups?
    e. By telephone?
    f. Other?
12. Are there any difficulties in getting information?
13. What do you think would make access to this information easier?
    a. Do you think that cell phones or community radio would help you to get information more easily?

Gender (depends on gender of respondent)

14. What are the main responsibilities (typical day during each of the seasons)? What are the roles of your spouse? (probe the following)

a. Is there a difference between men and women in terms of …
    i. Types of food activities
    ii. Access to land and other farming resources
    iii. Access to information
    iv. The use of cell phones, radio or other communication methods
    v. Participation within the community

Demographics

15. Please provide the following information
    a. Name
    b. Address
    c. Age
    d. Marital status
    e. Number of children

Appendix E: Video & Audio Recording Permission Agreement

Name(s): _____

Date: _____

Location: _____

I grant permission to Suraya Hudson and the University of Alberta:

a) To make audio recordings of the sessions described above.

b) To allow these recordings to be delivered, as managed by the University of Alberta, free of charge and for educational purposes and at presentations and conferences.

c) To allow Suraya Hudson to delete third-party material displayed or presented which, to the best of their knowledge, the University has received no permissions or copyright clearance.

d) To allow Suraya Hudson to edit or add introductory and conclusion screens in order to introduce and identify the recordings as appropriate.

_____ _____

Signature of Participant Date

_____ _____

Signature of Voice Recorder (Suraya) Date