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Climate-Smart Agriculture: Building Resilience for Women Farmers in Kalchebeshi, Nepal

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SIT Study Abroad

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Abstract

This case study outlines women's involvement in climate-smart agriculture and key climate adaptation strategies which are being implemented in the town of Kalchebeshi, Nepal. Kalchebeshi is considered a Resilient Mountain Village because of the town's integrated approach to addressing climate change and building resilience for farmers. Key findings examined gender differences in farming responsibilities and the significance of farmers' groups in women's overall decision making and community involvement. Additionally, changes in water management and pesticide use have been shown to have a positive impact on the lives of women farmers in Kalchebeshi. This paper reinforces the importance of involving vulnerable groups of people in the process of implementing climate adaptation and resilience building programs. The case study suggests that climate-smart agriculture can be an effective way of addressing women's' vulnerability to climate-change. Data was collected through interviews with women farmers and detailed participant observation.

Key words: Women, Climate Change, Adaptation, Agriculture

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Acronyms

CEAPRED……..Center for Environmental and Agricultural Policy Research, Extension, and Development

CSA……Climate-Smart Agriculture

ICIMOD……..The International Centre for Integrated Mountain Development

RMS …….. Resilient Mountain Solutions

Introduction

Agriculture is one of the most vulnerable sectors to the impacts of climate change. Although the effects of climate change are being felt by farmers and mountain people worldwide, global warming is impacting Nepal in extreme ways. The warming trend in the Himalayas has been higher than the global average, creating challenges for those who depend on agriculture for their livelihood (Paudel et al., 2017). However, vulnerability to climate change depends not only on natural factors, but also on social, cultural, and economic factors. In addition to climate change, the outmigration of men in recent years has impacted the vulnerabilities of farmers in mountain communities (Khatri-Chhetri et al., 2019). Since women often play the role of farmer, caregiver, and household managers, they are generally put in a more vulnerable position than men. In the face of climate change and outmigration, women also face structural power inequalities and poor access to the resources and information required to cope and adapt to climate-induced impacts (Paudel et al. 2017).

With an increased awareness of the effects of climate change, there has been a movement to embrace agricultural alternatives that promote a more resilient and responsible relationship with the land. Climate-smart agriculture (CSA) has emerged with the aim to build resilience for rural farmers, proposing an integrated approach to adapt to climate change. CSA includes a range of technologies, practices, and services including a simple adjustment in crop management practices, to the more complex plantings of fodder trees (Khatri-Chhetri et al. 2019; "Climate smart agriculture," n.d.). Additionally, CSA works to use agriculture as a tool to minimize gender inequalities and climate-induced gender vulnerabilities by sharing practices and technologies through increased cooperation, and information sharing among stakeholders ("Climate Smart Agriculture", n.d.).

Building off of the CSA concept, one specific program in Nepal has emerged to help farmers adapt to climate change and build resilience. The Resilient Mountain Solution (RMS) program has evolved at the International Centre for Integrated Mountain Development (ICIMOD) in collaboration with the Center for Environmental and Agricultural Policy Research, Extension, and Development (CEAPRED). The pilot is working with over 40 farmers' groups, including representatives of 1,089 households in eight different villages around Kavrepalanchok, Nepal. Over 80% of the household representatives are women, and many are from marginalized communities (Agrawal et al., 2016). The aim of the project is to build future resilience for vulnerable communities in Kavrepalanchok by providing ongoing support and trainings on CSA. The eight villages which CEAPRED is working with are considered Resilient Mountain Villages. Since the onset of the program in 2014, participants of the program have commented on the overall positive benefits for everyone in the communities, especially women.

With overwhelming evidence that CSA has positive impacts on the lives of women, my research aims to explore what women's role in CSA is and what specific climate adaptation interventions are being implemented in one Resilient Mountain Village in Kavrepalanchok, Nepal. Through interviews and participant observation, this case study evaluates how CSA is working towards social and gender inclusion through the formation of farmers' groups. This paper additionally examines how innovative CSA technologies are positively impacting the lives of women farmers. Research data was collected mainly from women farmers from one Resilient Mountain Village who have been working with CEAPRED to shift their farming practices to be more climate-smart.

Defining Key Terms

To glean a better understanding of how women in Kalchebeshi have been adapting to climate change and building resilience, it was important for me to first define the terms. Every scholar and report seems to define these terms differently, sometimes using them interchangeably. For the sake of this research, I define adaptation as an adjustment in practices due to changing environmental conditions. Resilience building, however, is different from climate adaptation in that it is "the ability to anticipate, prepare for, and respond to hazardous events, trends, or disturbances related to climate" ("Climate Resilience Portal," n.d.). Building climate resilience accounts for the multilayered dimensions that contribute to climate change and focuses on addressing not only the environmental concerns but the social and economic concerns as well. Resilience building is crucial in order to help vulnerable groups of people learn to make informed decisions for the future in regard to the environment. Finally, it is important to understand the term *gendered vulnerabilities*. While women are not inherently more vulnerable to the impacts of climate change, this project will focus specifically on women as they are at odds with more structural inequalities than men are. I will be basing my analysis off the assumption that *gendered vulnerabilities* are referring to specifically women's difficulties or inabilities to cope with and adapt to climate change.

Literature Review

Based on current literature surrounding women, climate-change, and adaptation, there is agreement among scholars that interdisciplinary approaches are crucial to address gendered vulnerabilities and to help communities adapt to climate change. Some programs have been focusing on using women's groups to increase decision-making power for women and better equip them to deal with environmental changes. Other programs are focusing more on resource

management to increase participation of women in the community. On top of addressing social inequalities, many programs are addressing climate change by creating and implementing low-impact farming technologies. While all approaches have different benefits, there seems to be a push for programs that address both social and environmental issues, tackling climate-change in a holistic fashion.

Climate change is already altering the intensity and frequency of rainfall in many countries around the world, potentially exacerbating both flooding and water scarcity (Abeka et. al., 2012). According to US Aid's climate risk profile of Nepal, the average annual temperature is projected to increase by between 1.6 and 2.2°C by 2050. Additionally there is predicted to be a 35-52% increase in extreme rainfall events by 2050, putting agricultural productivity and livelihoods at risk (US AID, 2017). A country's ability to adapt to climate change is determined by a range of factors, including, amongst others, knowledge, technology, and the presence of other interconnections such as globalization, urbanization, and technological and infrastructure development (Goodrich et al., 2019; Mainlay & Tan, 2012). In Nepal specifically, outmigration plays a major role in the country's ability to adapt to climate change. Several studies have found that women experience increases in both their work burden and the cost of hiring wage labor in Nepal. However, there have also been found to be positive benefits of outmigration as women have been found to participate more in agriculture and thus in economic activities, ultimately empowering them to take on more responsibilities within their community (Jaquet et al., 2019).

Although several studies have found positive impacts of outmigration on women's community involvement, there are other factors in addition to outmigration that make it disproportionately more challenging for women to adapt to climate change. A case study of women's water management in Melamchi Watershed Area, Nepal found that overall men work

up to sixteen hours a day and rest for nine hours, whereas women work for eighteen and rest only for six hours. Men were found to spend more time the field during the wet season but an equal amount of time caring for livestock of time was spent by both genders. Women were found to spend up to four hours a day fetching water and three hours a day cooking in addition to the two to three hours needed for other household chores. Women were additionally found to have limited participation in decision-making responsibilities within the community (Shresthi et al., 2019). This study indicates that women's vulnerability to climate change is largely dependent on their socioeconomic status and gender roles, which undermine their ability to adapt to and cope with climate change.

Since women are generally more vulnerable to climate change, a number of scholars have commented on the importance of giving a voice to women when deciding what specific actions to take regarding climate adaptation. The dominant climate change narrative presents women often times as victims, rather than agents of change (Terry, 2009), but women possess valuable knowledge derived from their traditional gender roles (Figueiredo & Perkins, 2013). For example, the knowledge that women possess because of their roles as cooks, caregivers, and water and firewood collectors, allow them to make special contributions towards climate change adaptation (Goodrich et al., 2019; Figueiredo & Perkins, 2013).

Because of the gendered differences in knowledge in ecological and environmental related conditions, scholars have argued that there needs to be a push for programs that consider the social inequalities that contribute to gendered vulnerabilities, and work to give women access to the resources and information that help them adapt to climate change. Figueiredo and Perkins (2013) argue that one way to build women's adaptive capabilities is to increase their access to resources and socioeconomic status. Figueiredo and Perkins (2013) use a climate-justice theory

to argue that education and the involvement of women in formal-decision-making processes can also strengthen their adaptive capacity. The Mary Robinson Foundation defines climate justice as the linkage of "human rights and development to achieve a human-centered approach, safeguarding the rights of the most vulnerable and sharing the burdens and benefits of climate change and its resolution equitably and fairly" ("The Geography of Climate Justice," n.d.). A large part of working towards climate justice involves including those who are vulnerable to climate change in discussions about what specific actions to take ("The Geography of Climate Change," n.d.).

In order to better involve the most vulnerable groups of people in decision-making responsibilities, certain programs are working to increase local level political participation through community-based environmental education. There is extensive literature on how community-based education and organizing are crucial for creating conditions where local people can share knowledge (Figueiredo and Perkins, 2013). Community environmental education implies an education plan created as a result of community involvement and designed to match community interests ("Supporting Community Based Environmental Education," n.d.). The current literature on community-level environmental education agrees on the importance of community involvement in helping farmers make informed decisions (Figueiredo & Perkins, 2013). Furthermore, CSA uses a knowledge-transfer approach which scales up the technologies by engaging the affected farmers in the decision-making process for adaption of new CSA (Khatri-Chhetri et al., 2019). Other literature has commented on the importance of using a "bottom-up approach" which encourages communities to use local knowledge and skills to better identify their vulnerabilities to climate change and development fitting adaptation strategies (Figueiredo and Perkins, 2013).

Additional communities have seen positive impacts on focusing on building climate resilience by shifting farming practices. For example, using biopesticides to increase human health and soil fertility (Dojh, 2015) is on example of a CSA technology that is being widely implemented. All literature defines CSA in a slightly different way, some scholars focusing on the effects of specific technologies while others focus on the effects of the overall approach (economic, environmental, and social interventions). One study conducted on the use of biopesticides found that they are effective in very small quantities and often decompose quickly, thereby resulting in lower exposures and largely avoiding the pollution problems caused by conventional pesticides (Dojh, 2015). This study focused specifically on the demand of store-made fertilizers, which ultimately increased income due to increased crop yield but had no impact on savings from the type of fertilizer bought (Dhoj, 2015). Other studies, however, *have* found there to be an increase in profit due to the transition of homemade fertilizer. Farmers who have transitioned to making their own fertilizers and pesticides have commented on overall savings (Subedi, 2016), largely due to their ability to concoct it in their own home. In a study conducted on *Jholmal* use, farmers were found to save fifty percent of their farm expenditure annually just because of reducing their spending on chemical pesticides (Subedi, 2016).

Since there is no fixed package of CSA interventions, they must be location-specific, meaning they should be based on climatic risks, agriculture production system and other bio-physical/socio-economic conditions (Khatri-Chhetri et al., 2019). Since the effectiveness of CSA is so dependent on specific conditions, this case study will focus women's engagement with CSA in one location only. This paper will examine the effectiveness of the CSA approach by investigating changes in decision-making responsibilities, community participation and resource management for women in the town of Kalchebeshi. It will further investigate specific climate-

adaptation strategies that women are implementing to understand whether climate justice can be achieved through a holistic approach.

Methodology

For my field study I was interested in understanding women's role in climate-smart agriculture and what specific climate adaptation and resilience building strategies they were implementing. I was specifically interested in understanding these topics from the perspective of women farmers. To obtain this data, I spent two days in Dhulikhel and seven days in Kalchebeshi, Kavrepalanchok where I interviewed farmers and observed climate-smart farming practices. Participant observation involved attending trainings for farmers and working in the field with participants.

Research Site

I chose Kalchebeshi as my research site because I was interested in learning more about the RMS program that ICIMOD and CEAPRED have begun in this town. Nestled in the hills in the outskirts of the Kathmandu Valley, Kalchebeshi and other surrounding agricultural towns are a main supplier of produce and dairy products for Kathmandu. The region is also prone to incidence of drought and floods and changes in rainfall patterns due to climate change, making it considered a "high-climatic risk hotspot" and therefore an important area for prioritizing efforts to promote women friendly CSA interventions (Khatri-Chhetri, 2019). All twenty-five families in Kalchebeshi are involved in agriculture and rely on food production as a main source of income. Helping to address vulnerabilities to climate change, CEAPRED trains farmers on climate-smart farming technologies. CEAPRED also provides ongoing support by strengthening

farmers' knowledge about climate change, market demands, financial management, and other important topics to help build climate-resilience.

Kalchebeshi's location made it an especially interesting site to conduct research. Located only around fifty kilometers outside of Kathmandu, most young people as well as a considerable amount of men, have moved to Kathmandu, Banepa, or even other countries to study or find jobs. The high out migration rate of men and young people have left women with many responsibilities both on and off the farm, forcing women to bear the brunt of climate induced impacts. After arriving in Kalchebeshi, I learned that the farmers' group that CEAPRED has been working with in this town was in fact composed of all women. This made Kalchebeshi a highly appropriate research site to study women's role in climate-smart agriculture.

Conducting Research

After an initial informant interview at CEAPRED's head office in Dhulikhel, I decided to stay in Kalchebeshi for the remainder of my field work. I was interested in building deep relationships with farmers before interviewing them, so it seemed beneficial to do a case study of one town only. Staying in one place for the duration of my research also allowed me to take detailed observations as I helped my homestay mother and other farmers' group members with farm work every day. Living with a homestay family in Kalchebeshi additionally helped me partake in other activities and trainings that the farmers' group had planned. During this week, I attended two trainings being run by CEAPRED for farmers in the community: one on market demands, and one on greenhouse management.

Over the course of my fieldwork I conducted five interviews and in-depth participant observations. Although I had hoped to interview seven to eight farmers, I was only able to conduct four interviews with farmers due to a number of limitations. Besides the initial

informant interview with CEAPRED's RMS coordinator, all other interviews were with women involved in Kalchebeshi's farmers' group. The primary informant interview was conducted fully in English, while the remainder of interviews were conducted in Nepali. One out of four of the interviews with farmers was conducted without a translator while the other three were conducted with a local student helping with basic translations. Due to my limited Nepali language abilities and the translator's limited English abilities, most interviews were structured or semi-structured. Questions with farmers involved asking them what type of work they do on the farm, what specific climate-smart strategies they are using, and the impacts of these new practices on their lives, among other things. Questions were aimed at understanding whether the participants' lives have changed since shifting their farming practices, and whether or not they perceive these changes to be positive for woman in the community.

Once arriving in Kalchebeshi, I used CEAPRED's field technician, my homestay mother, and the president of the farmers' group as resource people for my project. All three people, especially the president of the farmers' group, were eager to introduce me to people to interview. While I had initially hoped to interview women of many different backgrounds (age, caste, and family makeup) I ultimately ended up interviewing people based mostly on availability. All farmers I interviewed were part of the farmers' group in Kalchebeshi, and thus had all received training from CEAPRED on climate-smart agricultural practices. To accommodate their busy schedules, all interviews with farmers were conducted either after dinner in someone's home, or while helping them with farm work during the day.

Ethical Considerations

Before conducting any interview I made sure I had their "informed consent" and that they were aware of the nature of the research. Since I was conducting most interviews in Nepali, I

obtained verbal consent to audio record the interviews, so I could easily go back and receive translation help from SIT staff and clarify any misunderstandings. In order to protect the identity and integrity of my participants, I will not disclose their names. Although my questions were not highly sensitive, I did my best to ask culturally appropriate questions, giving them the option to opt out of answering any questions. I also allowed them to choose where they wanted to conduct the interview and at what time.

Limitations

The language barrier proved to be the biggest obstacle in conducting field work. Despite being able to ask all of my questions in Nepali, the local accent was challenging for me to understand, encouraging me to use a translator. Although the translator spoke decent English, she was unable to translate verbatim, hence why many of my findings are quite general. I considered conducting all interviews without a translator and translating them while back in Kathmandu, but I felt as though having someone there to help with general translations would be helpful for me to ask follow-up questions. Although I was unable to ask many follow up questions for the one interview where a translator was not used, I was able to gather a more in depth-response because of the verbatim translation that my SIT language teacher helped with.

Time was also a major limitation to my field work. I chose to conduct field work in one location to minimize travel time and maximize efficiency, however since I was only in Kalchebeshi for one week I was unable to conduct as many interviews as I had originally hoped to. I considered staying for more than seven days to try to interview additional people, but both the death of a local person as well as the celebration of large wedding reduced the availability of potential participants. Interviewing only five participants has resulted in the scope of my work being quite limited.

I recorded all interviews, so I could later go back and clarify information, helping minimize miscommunications. All interviews with farmers were conducted either in the field while working, or in the home of the farmers' group president. All interviews that took place in the home had other people observing and oftentimes interrupting to give their own input on the question. Observers included the president of the farmers' group, my homestay mother, the children of the farmers' group president, and other women farmers from the community. Having other members in the farmers' group present during interviews may have influenced the amount of information the participant was willing to share. However, since most of my questions were focused on women's role in agriculture, I steered away from asking overly sensitive questions.

Bias may also have been introduced by my identity as a white foreigner conducting fieldwork in a rural village. While I did my best to build trust with participants before interviewing them, there is still information that participants may have failed to tell me as a foreign research student. Using a translator from the community may have added an added layer of bias because of her very own involvement with CEAPRED's program. Additionally, her English was only good enough to summarize what participants were saying, inevitably leaving out specifics. For this reason, many of my findings are quite general. However, accessing the research site through CEAPRED's field technician, and living with a homestay while in Kalchebeshi helped minimize participants' distrust in me.

Findings

Overall findings from interviews and participant observation suggest that women are highly engaged with CSA and are finding successful ways to adapt and build resilience to climate change. Gender differences in farming practices and responsibilities were shown to contribute to the large and significant presence of the all-women's farmers' group. The farmers'

group was found to be a key player in overall resilience building, both helping to address social and environmental issues. Finally, the CSA technologies that the farmers' group has been able to promote were found to have had unanimously positive effects for women farmers in Kalchebeshi.

Gender Differences in Farming Practices

After spending six days working in the fields helping to cut grass, I observed blatant gendered differences in farming responsibilities. One participant agreed that while both her and her husband do the same amount of daily work, they do different types of tasks. Her husband digs the field and operates the tractor, while she usually does other "light work" including fetching water, cutting grass for their livestock, spraying bio-pesticides on the crops, and planting seeds. All farmers who were interviewed had at least one family member who had migrated to either Kathmandu or another country to find work or attend school. While not all people who had migrated from these families had large farming responsibilities prior to leaving Kalchebeshi, two participants claimed that their workload had increased since their kids had outmigrated due to the decrease in helping hands. Aside from gendered differences in farming responsibilities, there was also a difference in how men and women viewed their vulnerability to climate change according to participants. The farmers' group that CEAPRED is working with in Kalchebeshi is an all-women's group simply because men were uninterested in joining. Such gender differences has allowed women to be heavily engaged in the farmers' group and receive many benefits from their involvement.

Significance of Farmers' Groups

In many rural towns throughout Nepal, community members have formed farmers' groups to create mutual benefits, both related to agricultural practices and sales. The RMS program has been working directly with a number of different farmers' groups around Kavrepalanchok District to arrange trainings on CSA practices. The program also runs trainings on financial management, market-demands, climate-change impacts, and other important topics to better equip farmers build resilience in the face of climate-change. In Kalchebeshi, the all-women's farmers' group began five years ago at the onset of the RMS program. Since the formation of the group, women have expressed an increase in decision-making power, knowledge sharing, and community building among women farmers in the community.

Five years ago, Participant A was chosen by CEAPRED to be the chairman of the farmers' group due to her enthusiasm about the RMS program. In our interview she expressed how she felt the need for women to have a larger leadership role in the community, especially since women are often times the main farmers in their family. Three out of four farmers interviewed considered themselves the "head farmer" in their family, either because their husbands had left to work in a nearby town or city, or because they took on more responsibility on their family's farm than other family members. Since being elected as chairman of the farmer's group, Participant A organizes trainings and monthly meetings. Before she was chairman of the group, she would informally organize meetups with other community members, but in our interview she noted that now there is a real incentive to organize formal monthly meetings. During these meetings women come together to discuss how they can better support each other in the field, what further training they hope to receive from CEAPRED, and their monthly earnings. Another participant expressed how she was grateful for the farmers' group

because they are able to come together with other people who understand what it is like to be a woman in Nepal, giving her a greater sense of belonging in the community.

Promoting CSA practices within the farmers group has also increased women's involvement with other community members. Although no participant explicitly noted this, they all mentioned how they had received training on climate-smart technologies from another community member, or they themselves were training other people. Next to the house of the farmers' group president, lays a knowledge park where all CSA technologies are demonstrated. The knowledge park has encouraged people from other towns in Kavrepalanchok to come to Kalchebeshi to receive trainings from farmers in Kalchebeshi's farmers group. Training other community members on how to set up an insect trap, construct a soil cement water tank, or apply straw mulching to the garden is helping women in Kalchebeshi come together and share knowledge with each other. The dissemination of knowledge that happens between members of the farmers' group is giving them an excuse to interact with people outside of their immediate town, helping them form more widespread social networks.

Since the main responsibility of training visiting farmers is predominantly in the hands of the president, some participants did not feel as though their involvement with people outside of the town had increased. The integrated CSA approach to building climate resilience therefore does not impact everyone equally and is bound to reinforce power hierarchies even among vulnerable groups of people. It did seem, however, that there were other benefits for members who were not in charge of training other people, including having more time to farm.

The farmers' group has also acted as an important source of knowledge to better understand the environment and ways to adapt to climate change. While participants joined the farmers' group for different specific reasons, everyone agreed that they needed education

services to better deal with the changing climate. RMS has been working to educate farmers on the science behind environmental changes they are experiencing. One participant noted how within the past ten years they have been experiencing more extreme weather patterns but never knew this was a result of climate change. Since RMS began, CEAPRED's field technician helped them understand why these changes were happening and what to call these changes. This participant continued to explain how she is now able to adjust when she plants seeds because of her knowledge about untimely and spotty rain fall due to global warming. The farmers' groups has also allowed members to understand why certain CSA technologies are important. For example, at the onset of the program members were trained on the dangers of chemical usage on both human health and the environment. After beginning to use a biofertilizer called *Jholmal* and seeing the positive impacts, one member now educates neighbors on the dangers of chemicals and encourages them to use alternative and safer pesticides such as *Jholmal*. The farmers' group has been an important resource for helping women understand the importance of CSA technologies and educate others on the benefits of such practices.

Key Climate Adaptation Interventions

Jholmal:

All farmers involved in Kalchebeshi's farmers group have adopted the use of *Jholma*l, significantly reducing participant's reliance on chemical pesticides and fertilizers. Acting as both a biopesticide and biofertilizer, *Jholmal* is a low-cost effort to manage pests. Among other farmers in the group, the president of the farmers' group commented on how she fixes her concoction of *Jholmal* by mixing together a combination of farmyard manure, animal urine, locally sourced plants with insecticidal or insect repellent properties, and natural microbes in her

own house. She prepares three different types of *Jholmal* varying in composition and usage, depending on need.

All participants noted additional benefits of using *Jholmal* in addition to pest management, including increases in income, time, self-reliance, and improved health. All farmers I spoke with had received training on *Jholmal* either from CEAPRED's field technician or from the farmers' group president. Five years ago, all participants sprayed volumes of chemical pesticides on their crops, in spite of being aware of the associated health concerns. One participant admits that she was put in a more vulnerable position than men were, because of her constant contact with chemical pesticides. She continued to note that she used to get skin rashes and bad coughs, but since beginning to use *Jholmal* she no longer get sick as frequently. She therefore is able to save more money because she does not need to buy as many medicines or take as many trips to the doctor in Banepa, a city about forty minutes away by bus. Cases of cancer and other more serious health concerns were also an incentive for farmers in Kalchebeshi to adopt the use of bio-pesticides. *Jholmal* has also decreased all participants need to spend money on chemicals.

Additionally all farmers who I interviewed expressed how creating *Jholma*l is easier with improved cowshed management. Traditionally, bedding material in the shed would absorb the urine, or excess urine would simply spill out. Nowadays, with CEAPRED's help, women in Kalchebeshi have built a drainage system to collect animal urine in a storage tank. My homestay mother enthusiastically explained to me how she uses the collected urine to prepare *Jholmal* for her plants and feed her bio-gas plant.

While all participants commented on the overwhelming success of *Jholmal*, there have been times when pests have gotten so bad that they have been required to use chemicals on their crops. The RMS program coordinator noted how this year there was an outbreak of the fall

armyworm, causing large damage to the maize. In response, the government encouraged farmers to use chemical pesticides and despite their strong opposition, farmers were required to use small amounts of chemicals to quickly fight against the pest. However, this is the only occasion in the past five years where the pest could not easily be controlled by applying *Jholmal*. Overall, *Jholmal* has proven to be a successful CSA technology that has provided women with many benefits.

Water management:

In Kalchebeshi, women have been working to address water scarcity and uncertainty for irrigation and drinking water by adopting simple water conservation and irrigation systems. The most successful water management practice that participants have claimed there to be have been the use of soil cement tanks. Kalchebeshi is a water scarce village, and farmers have claimed there to be a change in rainfall patterns, making it difficult to predict when and for how long rain will fall. At the beginning of the RMS program, farmers were encouraged and trained on how to build plastic ponds to collect rainwater for irrigation and livestock use. Since then, CEAPRED has started to encourage the use of soil cement tanks as an alternative to plastic tanks because rodents were beginning to eat through the plastic. The cement tanks are made from soil, cement, and sand, and can be easily constructed and repaired, making them a viable adaptation strategy for addressing water scarcity. The soil cement tanks have only recently begun to gain traction so only two participants had a soil cement tank; however, all participants had a plastic water tank to collect rainfall. All participants expressed how grateful they are to now have a reliable water supply for at least six months of the year. This year the monsoon season lasted nearly two months longer than normal, but thankfully due to the cement water tanks, farmers were able to collect all of the extra water to be used post-monsoon season.

In the past, if there was a lack of water farmers were unable to irrigate their plants and would harvest only the amount of vegetables in which they were able to irrigate, but these days it is different. All farmers who I interviewed commented on the success of the new water management practices including an increase in free time. One participant noted that having a reliable water source has minimized her trips to the stream or water spigot and has given her a surplus of free time which allows her to attend town meetings, socialize, and attend training sessions. Improved water management systems has proven to act as a successful climate adaptation strategy for addressing the unpredictability of water in Kalchebeshi.

Analysis/Discussion

How do Gendered Vulnerabilities Play a Role in CSA?

Not only is gender a powerful and pervasive contextual condition, it also intersects with other contextual conditions to shape gendered vulnerabilities. In the case of women in Kalchebeshi, women's vulnerabilities have been largely shaped by outmigration of family members and changing environmental conditions that have created unfavorable conditions for farmers. Since all participants commented on the challenges of farming nowadays with changing environmental conditions, it is obvious that farmer's livelihoods are at high risk to climate change. In Kalchebeshi, CEAPRED has been working to address such vulnerabilities, contributing to the success of the program. Although the program is working with men in other nearby towns, it was especially interesting to conduct research in Kalchebeshi where there is an all-women's farmers' group. Through the course of my field work, the words "vulnerable" or "vulnerability" were never explicitly stated by participants, but their words suggested that their responsibilities as women forced them to suffer the negative impacts of climate change more so than men. The success of the program is largely attributed to the fact that it accounts for

gendered vulnerabilities when deciding which farmers' groups to work with and which local people they will conduct trainings with. By addressing gendered vulnerabilities, CSA has the potential to minimize women's drudgery and help build resilience to climate change.

Why is CSA an Effective Strategy in Kalchebeshi?

My findings suggest that CSA has been effective because of its multifaceted approach to building climate resilience. In the context of this paper, the word "effective" is used to describe programs that address both social and environmental issues. While considering gendered vulnerabilities, CSA has been shown to empower women, address environmental concerns, and act as a long-term adaptation solution. Analyzing my findings from a climate-justice perspective allows one to view climate change as an ethical and political issue rather than one that is purely environmental in nature. By viewing climate change as a complex ethical, political, and environmental issues, programs that consider all of these factors are bound to be the most successful.

In Kalchebeshi, RMS has been working to address the ethical and political side of climate change by working with some of the most vulnerable groups of people. By working with in all women's farming group in Kalchebeshi, women are becoming agents of change by increasing their community participation and overall decision-making responsibilities. Current literature has shown the importance of taking a holistic approach to dealing with climate change, emphasizing the importance of creating an equal playing field for both women and men in decision-making roles. A main reason that participants found the program to be successful was largely because of their ability to make decisions over natural resources, ultimately having positive impacts on both the community and the environment.

CSA is also proving to be effective in Kalchebeshi because local knowledge is being accounted for prior to any sort of training with farmers' group members. Past programs that have failed to address local knowledge have taken a "top-down" approach, having positive impacts on the environment but not necessarily on social inequalities. CSA is proving to change the narrative around climate change and proving that women may be victims but can also be capable agents of change. Women do not only need to be empowered to make change, but there need to be more programs that focus on the actual capabilities of women to make informed decisions and have positive impacts within their community.

Finally, the CSA approach in Kalchebeshi is working to use traditional gender roles and knowledge to benefit the community. In the case of Kalchebeshi, one participant claimed that if she could read and write she would have loved to be a teacher. To help the participant achieve her dreams, she has begun to act as a teacher for others in the community by teaching them about the use of *Jholmal* and the benefits of farming organically. Other women have expressed how since they are in charge of cooking in their home, they understand the importance of finding efficient ways to fuel their gas stove. With the knowledge that women possess as a result of deeply ingrained gender roles in Nepali society, communities can benefit from having women in decision-making roles, especially related to natural resources.

What is the Future of CSA?

Although this case study focuses specifically on one town's relationship with CSA, there seems to a hopeful future for the emergence of CSA to other rural towns in Nepal. Since CSA is generally a somewhat self-sufficient and long-term approach to helping communities deal with climate change, there is potential for the implementation of CSA in other towns around Nepal. Programs such as RMS have the ability to help communities build climate and socioeconomic

resilience. However, such changes are incredibly context specific and what may work in Kalchebeshi may not work in other villages. Ultimately, it is important to recognize what the specific needs of the village are before expanding a program or agriculture concept to other places. As more and more programs such as RMS arise, it will be important to use CSA as a tool to include women in more regional and national level planning, in addition to working at the community level.

Conclusion

Due to traditional gender roles as well as a number of other factors, women often bear the brunt of climate-induced impacts. Such impacts are most significant for farmers whose livelihoods are dependent on natural resources. Although women are disproportionately more impacted by climate change than men are, they are still often times left out of decision and policy making at both a community and regional level. In order to address such gendered vulnerabilities this case study has focused on women's role in climate-smart agriculture, mainly focusing on how farmers' groups have impacted decision-making responsibilities and community involvement. It has additionally discussed key climate adaptation interventions that women are benefiting from in Kalchebeshi, one Resilient Mountain Village located in Kavrepalanchok, Nepal. Based on findings from this project as well as other literature, it can be argued that an integrated approach to CSA can act as an effective tool in addressing ethical, political, and environmental concerns related to climate change. The Resilient Mountain Solution program is just one of many programs that are successfully promoting CSA, targeting women as agents of change within their community. To increase women's decision-making power at a more regional and national level, there needs to continue to be policies and

organizations that view climate change as not just an environmental issue, but an ethical one as well.

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Appendix A

List of Interviews:

In-Person Communication, Dhulikhel, November 9, 2019

In-Person Communication, Kalchebeshi, November 14, 2019

In-Person Communication, Kalchebeshi, November 14, 2019

In-Person Communication, Kalchebeshi, November 15, 2019

In-Person Communication, Kalchebeshi, November 18, 2019

Appendix B

Photos from Research Site:

Figure 1. Soil cement tank

Figure 2. Plastic water collection tank

Figure 3. Cowshed management: Urine drainage system