

FINAL TECHNICAL REPORT / RAPPORT TECHNIQUE FINAL CLIMATE AND NUTRITION-SMART VILLAGES AS PLATFORMS TO ADDRESS FOOD INSECURITY IN MYANMAR: FINAL PROJECT END REPORT

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IDRC Grant / Subvention du CRDI: 108748-001-Climate and nutrition smart villages as platforms to address food insecurity in Myanmar



Climate and Nutrition-Smart Villages as Platforms to Address Food Insecurity in Myanmar

Final Project End Report

Project Number: 108748 – 001



Project Title	Climate and Nutrition-Smart Villages as Platforms to Address Food Insecurity in Myanmar
IDRC Project Number	108748 – 001
Research Organizations involved in the study	International Institute of Rural Reconstruction (IIRR) Y.C. James Yen Center, Km. 39, Aguinaldo Highway, Biga 2 Silang, Cavite Philippines, 4118 Tel : +63 46 430 0016
Location of Study	Republic of the Union of Myanmar
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Report Type and Number	Final Project End Report
Period covered by the report	January 15, 2018 to June 15, 2021
Date	July 15, 2021

To cite this document:

Barbon WJ, Chan Myae, Gonsalves, J. 2021. Final Technical Report: Climate and Nutrition-Smart Villages as Platforms to Address Food Insecurity in Myanmar. International Institute of Rural Reconstruction, Yangon, Myanmar

This work was carried out with the aid of a grant from Canada's International Development Research Centre (IDRC), www.idrc.ca

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Acronyms

CCAFS	Climate Change, Agriculture and Food Security
CGIAR	Consultative Group for International Agricultural Research
CBA	Community-based adaptation
CSA	Climate smart agriculture
CSV	Climate smart villages
DAR	Department of Agriculture Research
FAO	Food and Agriculture Organization
HDDS	Household Diet Diversity Score
HFIAS	Household Food Insecurity Access Scale
IDRC	International Development Research Center
IIRR	International Institute of Rural Reconstruction
KAP	Knowledge, Attitudes and Practices
MCSAS	Myanmar Climate Smart Agriculture Strategy
MOALI	Ministry of Agriculture, Livestock and Irrigation
NCSAC	National Climate Smart Agriculture Center
YAU	Yezin Agriculture University

Executive summary

The overall goal of this research project was to test ways to help build the resilience of Myanmar smallholder farmers and their households; making them food secure, better nourished, and, with more secure livelihoods. This research effort recognized that the manifestations, impacts and local responses of climate change differ across agro-ecosystems in Myanmar requiring different adaptation measures. Targeted, location specific, community-based strategies and processes are deemed necessary. The climate smart village approach (CSV) is one such platform that can facilitate community-based adaptation in agriculture.

The CSV Approach was developed by CGIAR's through Climate Change, Agriculture and Food Security (CCAFS) approach in 2012 in Africa and South Asia. CCAFS later implemented the approach in Latin American and Southeast Asia. The International Institute of Rural Reconstruction (IIRR), a strategic partner of CGIAR-CCAFS also went on to establish CSVs in the Philippines, Cambodia and Myanmar. CCAFS provided the initial investment to scope for opportunities and set-up the initial set of CSVs in Myanmar in 2017¹. For IIRR, CSVs serve as platforms and venues for climate change adaptation wherein location-specific strategies for addressing climate risks and challenges are tested, developed and subsequently scaled up. The CSV is a process-oriented demonstration of how to assist local communities adapt to climate change by incubating CSA innovations and locally out-scaling them, thereby establishing an evidence base. Individual action is not enough in coping with climate change, CSVs provide platform for multi-stakeholder participation and collaborative work in targeted, clearly delineated geographic areas (“territories” or “small landscapes”).

The 3-year research sought to investigate the following three research areas; a. to fine-tune, refine and adapt the CSV approach in the unique agro-ecological and social context of Myanmar, b. to set-up social learning processes to accrue multiple co-benefits of the CSVs in the area of gender equity, nutrition and food security and c. to promote and build capacities to out-scale social, technological methods to government, civil societies and academic institutions.

Research findings point to the importance of considering land tenure, poverty levels and, specific climate risks and vulnerabilities in implementing the CSV approach in Myanmar. The analysis of land tenure regimes in the four CSVs showed that it influences and determines the nature of the adaptation options and, their eventual uptake. There are differences villages with high incidence of landlessness (for example in Ma Sein CSV in the Myanmar delta where 76% of total households do not own farm lands) when compared to other CSVs where as much as 80% to 95% of households owned farm land. With high landlessness in Ma Sein CSV, the agriculture adaptation options are limited to homesteads, the small patch of land around the household dwelling which production is limited to few vegetables and raising small animals. A secure land tenure influences the decision of farmers to engage in diversified ventures combining short-term production and long-term adaptation related production practices. In CSVs where 80%-95% of the households owned land, CSVs grow between 6-8 crops per season.

In terms of how the level of poverty affects adaptation, the research analysis demonstrates that poverty and wealth levels also influence the adoption of adaptation options. Villages with higher poverty

¹ Report of CCAFS-funded scoping study in Myanmar. <https://ccafs.cgiar.org/news/unlocking-myanmars-potential-establishing-climate-smart-villages>

incidence have limited capacity to adopt methods such as diversification of crop production, use of climate resilient crop varieties or growing vegetables in homestead areas (backyard production). Poor households do not have capacity and investment to engage in new ways to adapt to emerging climate risks. On the other hand, we also found out that an increase in wealth is negatively correlated interest/willingness to implement adaptation options (co-efficient value at -0.191). Wealthier households are not also likely to adopt some of the more labor intensive CSA options (eg diversification and intercropping). Adaptation options offered would have to be flexible, responding to the resource base, economic status and needs of households. IIRR has always taken the position of promoting adaptation options (regenerative and agro-ecological, low input approaches) that would appeal more to the poorer households.

The complexity of the Myanmar context in terms of land tenure, levels of poverty and climate risks and vulnerabilities, sets the stage for the importance of the “portfolio approach” to adaptation. The portfolio approach is about presenting a menu (list) of options that households can choose to implement or not depending on their capacity to implement and adopt. The portfolio approach is a more inclusive approach, ensuring that there is an opportunity for every household whatever is its context—in terms of land tenure and wealth status. There are also options that are promoted for women—such as raising small livestock within homesteads which IIRR found to be an appropriate option in the context where women cannot own farm lands. Intensifying homestead production provides opportunities for women to work the land, earn income and at the same time achieve household food security. The research also endorsed the value of the idea of a CSV Adaptation Fund, which is an allocation of US\$4,000 to US\$ 4,500 provided to each CSVs per production year. This Fund is not a revolving fund (farmers don’t need to pay them back) and is administered by the project’s local NGO partners in the CSVs. The local NGO partners identify the recipient farmers including women based on criteria (i.e interested to do trials, low capacity to invest, location of farms). When used strategically and in a targeted manner this local financing mechanism (usually provided in kind) can serve to incubate ideas, catalyze action and deliver a minimal degree of scale (“building of a critical mass of adopters”) and the momentum that fosters the spontaneous spread of adaptation options.

The research also confirmed the value of social learning processes in generating co-benefits of gender equity and nutrition for households of the CSVs by providing data that CSVs can contribute to increased incomes, improved food security via household food production and a change in perceptions towards women economic empowerment and improved nutrition. Across the 4 CSVs, we have noted an average of 87% increase in the total gross cash received by the households from selling crops and animal produced.

An analysis of data collected over two years on household diet diversity scores (HDDS) in the 4 CSVs, our results (*Effect Likelihood Ratio Test*) indicate that the number of CSA practices and technologies adopted is positively associated with a higher HDDS, the value $\text{Prob} > \text{ChiSq}$ is 0.0002. However, it was found that the location of the CSVs did not influence HDDS as the scores were similar across four CSVs. The diversified production systems of crops, animals and vegetables afforded the households access to diverse food from their own production efforts. The upland CSVs of TaungKhamau and Saktha reported increases of at least 10% in households consuming their own produce. This is followed by the dry zone CSV of Htee Pu showing 3% increase in households consuming their own produce.

The research also tracked the changes in the perceptions of household members towards the role of women in the CSV activities as well as perceptions towards nutrition and diets. A “difference-in-difference” (DiD) analysis was undertaken to see whether adoption of at least one of the adaptation

options could change perceptions towards gender, nutrition and diets. Our DiD analysis indicated that when households engaged in at least one of the adaptation options, improved perceptions towards women's engagement in economic activities was noted. Men from households engaged in adaptation options had more positive perception on women engaging in economic and livelihood activities- without sacrificing her other roles in the household. Women in these same households, on the other hand, had a positive perception too to the notion that women do not have to be dependent on men for cash to cover personal needs. Relying on the same approach of DiD analysis, it was noted that households implementing adaptation options had a positive view about the importance of preparing nutritious food for the household and that it doesn't need to be difficult for the households. The other change among households with adaptation options was the increased positive perception towards the importance of sanitation.

Towards the end of the project, we conducted a preliminary study on the scaling of CSA via CSVs in Myanmar. Through desk research and interviews with strategic agencies and leaders representing government, the business/private sector, international donors, international non-government organizations, academia and research organizations—our findings showed that while there is progress in the implementation of the Myanmar Climate Smart Agriculture Strategy (MCSAS) adopted by the government in 2016, there are still a lot of work to be done involving various stakeholders in country to see a wide scale adoption of CSA in the Myanmar agriculture. These needs include reforms in the government agriculture extension system by allocating sufficient support such as technical expertise, materials and financial investments for the system to reach as many farmers as possible. The study also indicated the importance of continued investment in farmer capacity development on climate smart agriculture. The research has already gained interest among government agencies and international organizations. For instance, as a recognition of IIRR's work with the CSV approach, IIRR is now part of the National Technical Support Group for Climate Smart Agriculture in Myanmar. This is convened by FAO-Myanmar to support the government in implementing the MCSAS.

In the final year of the research in 2020, the COVID-19 pandemic affected some planned activities in the four CSVs, reducing the ability of the research team to travel and organize group-based field activities, including learning events at the national and international levels. In spite of these challenges and difficulties, the field research teams were able to undertake the final household survey before the end of 2020. Thereafter the team focused on data analysis, preparation of research reports and papers from the data sets that already available for analysis. Booklets, posters and brochures were produced in the local language in lieu of face to face community-level education and awareness building. Planned learning events were also shifted to online virtual platforms. From February 2021 up to the end of the project in June 15, 2021, there was a sudden shift in the political context in Myanmar, creating new additional challenges that complicated further the implementation of field activities in the CSVs, requiring a six-month no-cost extension until June 2021. In collaboration with The Knowledge for Democracy Myanmar Initiative of IDRC, IIRR and The Alliance of CIAT and Bioversity facilitated a successful 3-part online event in 2020 which discussed the Transformation of the Myanmar Food Systems and identified priorities for further research and policy making. The discussions from this series were included into a paper submitted for consideration in the open access Journal of Environmental and Sustainability Indicators.

The research problem

Rural communities make up 44 percent of the global population according to the World Bank in 2019. A

big part of these communities bears a disproportionate burden of poverty, poor health, and poor quality of life (Steiner & Fan, 2019). Southeast Asia has around the same proportion of rural population despite the rapid progress of urbanization within the region (Arfanuzzaman & Dahiya, 2018). In Myanmar, the rural population is at 69% in 2019, indicating a largely rural society of the country (World Bank, 2019). The agriculture sector of Myanmar is a significant pillar to its economic development as it continues to constitute 21% of Myanmar's GDP in 2018 (World Bank, 2019), and employs more than half of the country's labor force (Myint, 2016). While urbanization in Myanmar is steadily on the rise with notable reductions in poverty, rural poverty is still a big concern (Thuzar, 2015), and Myanmar, whose rural poor accounts for 84% of its total poor, remains one of the most impoverished countries in Asia (IHLCA, 2011).

Climate change impacts refer to the effects of extreme weather and climate events, and the effects of climate change on natural and human systems (IPCC, 2014). It is commonly believed that the impact of climate change falls disproportionately on the rural and poor populations regardless of countries and regions. Climate variability is experienced in most parts of Myanmar. Some parts receive excessive rain while other parts deal with drought during the cropping cycles. Access to safe and reliable water is a key constraint to livelihoods and food production particularly for agriculture, livestock, and domestic use. Any program that will build resilience in agriculture and livelihoods in Myanmar will, out of necessity, have to feature diversification including increasing reliance on trees, livestock and off-farm income as risk aversion strategies for the poor. In this regard, poor women suffer disproportionately from hunger, food insecurity and the lack of adequate health services. Women have relatively lower status in the household and are the first to sacrifice their own hunger and nourishment if the household does not have sufficient food.

Three research areas were explored in this research. The first research area was the *testing and enhancement of the process of community-based adaptation (CBA) in various agro-ecological contexts in Myanmar*. This research sought to further develop the CBA process and test it within the unique context of Myanmar. IIRR continued to use and promote the climate smart village (CSV) approach where CBA processes are facilitated and a portfolio of CSA options are derived.

The second area was *the link between the CBA processes deployed within the CSV in addressing the three major development problems affecting the Myanmar rural communities, namely, climate variability, food insecurity and poverty*. The project demonstrated how CBA processes can build more resilience, help address food insecurity and malnutrition and finally create opportunities and spaces for women to significantly contribute to economic development, food security and better nutrition.

The third area was the *scaling of community-based adaptation*. This research investigated how the climate smart villages can serve as platforms to promote community-based adaptation in Myanmar. IIRR engaged government and civil society as vehicles to scale-up community-based adaptation and to identify effective strategies for scaling-up in subsequent efforts by other players especially government.

Progress towards milestones

This action research project was implemented between January 15, 2018 to June 15, 2021. This also included a 6-months no-cost extension as a response to slowing down of project implementation in 2020 caused by the restrictions of COVID-19 pandemic. Table 1 presents the overall progress towards achieving project milestones in the grant agreement. Hyperlinks to research outputs and products already available online are also provided to serve as additional evidence of accomplishment of the

milestones. Overall, the research achieved most of the milestones except for the milestones that pertain to out-scaling and reaching more farmers and communities. The challenges posed by COVID-19 pandemic in 2020 made it difficult to initiate planned outreach in the last year. The political crisis in Myanmar on February 2021 also made this all the more challenging because of the uncertainty with regards to government policies and services this research project sought to influence.

Table 1: Overall Progress of Project Milestones from 2018-2021

2018-2021 Research Project Milestones	Accomplishments/Evidence
6 months (for first 6 months – January-June, 2018): First interim technical report (update) submitted including details on the following:	
1. Commitment of relevant stakeholders secured (including Yezin University and the research institutions per site), partnership and collaborative details with third party organization established; and recruitment and hiring of key personnel and identification of consultants (including for gender and for nutrition) completed	IIRR signed a Memorandum of Understanding with the Department of Agriculture Research of the Ministry of Agriculture, Livestock and Irrigation (DAR-MOALI) to jointly promote climate smart villages within the overall Myanmar Climate Smart Agriculture Strategy. IIRR also engaged four local non-government organizations who are embedded in the regions where the CSVs are. This is to ensure that field implementation will be efficient as these local NGOs understand the local context and speak the local language. Towards the middle part of the project, in recognition of IIRR championing CSA and CSVs, IIRR was made member of the National Technical Group on CSA of Myanmar convened by FAO-Myanmar and MOALI.
2. Achieved clarity on the nutrition metrics and nutrition messages by consulting with experts in Philippines and Myanmar	During the inception workshops conducted on April 2018, IIRR together with local NGO partners and allied agencies such as DAR-MOALI and the Food Security Working Group of Myanmar and technical experts agreed and finalized the following:
3. Project inception workshop held and report describing research team’s roles and responsibilities, mechanisms for coordination, communication, teamwork modalities and work plans finalized	<ul style="list-style-type: none"> • Final research design that describes the datasets that needs to be collected, the data collection methodologies, and the potential research papers to be produced. • Agreed on strategies of integrating gender analysis and communication strategy for the research. • Achieved clarity on specific metrics to be used in the study (e.g. HDDS, HFIAS0 and the key nutrition messages to be promoted.
4. Detailed research design, strategies (including gender and communication strategies), methodologies and key indicators (for agriculture and nutrition) to track finalized.	<ul style="list-style-type: none"> • Workplan for the 3 years and the workplan for year 1. IIRR also agreed on budgets.
5. Selection of Climate Smart Villages (CSVs) in Shan and Chin states and local NGO partner completed	Early in 2018 at the start of the research, IIRR conducted rapid scoping for 2 additional climate smart villages from Shan and Chin states. At least 6 villages were considered, visited and consulted to finally arrive at 2 CSVs. IIRR also identified local NGO partners that will lead the field work in these 2 CSVs identified.
6. Orientation meetings conducted for local NGO partners and highlights documented	IIRR regularly conducted annual review and planning meetings with the implementation partners, DAR-MOALI and the Food Security Working Group. These meetings were conducted on January of 2019 and 2020. The final meeting is scheduled before the end of August. This will be made virtually given the restrictions from the COVID-19 pandemic and the political unrest in Myanmar.
7. Implementation guide for the community-based adaptation (CBA) processes defined and agreed upon by all project implementers	<p>The original idea for this milestone is to have a implementation guide for the entire project. During the inception this was challenged by the partners as this is against the principle of a iterative process where the implementation is adapted depending on how the context of the villages are changing. IIRR resolved this by providing implementing partners and staff specific guidelines in the major phases of the implementation. As a result, IIRR developed process guidelines and conducted training sessions for the field implementers in using these guidelines as follows:</p> <ul style="list-style-type: none"> • Guidelines for the Participatory Climate Risk and Vulnerability Assessment • Guidelines for Identifying and Prioritizing Adaptation Options

2018-2021 Research Project Milestones	Accomplishments/Evidence
	<ul style="list-style-type: none"> Guidelines for the Social Learning Activities in the CSVs Guidelines for the Conduct of Household Surveys including data encoding and organizing
12 months (for 7 to 12 months): Second Interim technical report submitted including details on the following:	
<p>8. Village profiles and baselines on climate vulnerability and food security based on Participatory Vulnerability Assessments, surveys and CBA indicators completed and shared widely</p>	<p>The profiles of the 4 climate smart villages are uploaded to IDRC Connect for public access with the following links:</p> <ul style="list-style-type: none"> Htee Pu CSV: http://hdl.handle.net/10625/57254 Taungkhamauk CSV: http://hdl.handle.net/10625/57255 Ma Sein CSV: http://hdl.handle.net/10625/57256 Saktha CSV: http://hdl.handle.net/10625/57257
<p>9. A compendium of portfolio of potential CBA options (local/indigenous practices and research introduced) per village, per agro-ecological context prepared and shared among stakeholders</p>	<p>In 2018, based on the results of the baseline studies composed of participatory climate risk and vulnerability assessments and household surveys, IIRR developed the following</p> <ul style="list-style-type: none"> Htee Pu CSV: http://hdl.handle.net/10625/59386 Ma Sein CSV: http://hdl.handle.net/10625/59384 Saktha CSV: http://hdl.handle.net/10625/59385 Shan state agro-ecology: http://hdl.handle.net/10625/59387 <p>IIRR changed the CSV by end of 2018 because of the lack of support from community leaders. This portfolio of options are still applicable to Taungkhamau CSV as they share the same agro-ecology in southern Shan state.</p>
<p>10. Options for adaptation and nutrition-sensitive agriculture practices prioritized, identified and supported in various scales targeting:</p> <ul style="list-style-type: none"> Small-farms (mostly involving men farmers) Homesteads (specifically targeted for women participants) Schools (communally manage by both school officials, parents and learners) 	<p>This milestone is about implementing prioritized options for adaptation identified in Milestone 9 above for 4 production seasons (2018-2021). The project supported the implementation by providing an annual CSV Support Fund which is between US\$ 2,000-4,500 per CSV. This amount will be used to purchased materials such as seeds of improved varieties, materials to establish homestead production, fruit tree seedlings, small livestock and the like—depending on the priority options identified by the CSV participants. IIRR also took it to prioritize providing support for poor and vulnerable households to ensure that there is social inclusiveness in the implementation of the adaptation options. IIRR team regularly monitor the implementation of the options. Here is one example of the season long documentation of the implementation in 2019 (http://hdl.handle.net/10625/58004). In between the production season in the CSV that runs between June to November of the year, IIRR partners also conduct learning sessions and on-site coaching to participants implementing the options. The learning modules are here: (http://hdl.handle.net/10625/59399).</p>
<p>11. First batch of primers/posters on CBA and climate and nutrition sensitive agriculture in the Myanmar language produced, printed and distributed via nutrition education sessions</p>	<p>This research also produced a number of primers and brochures to serve as tools in promoting the CSV approach in Myanmar. These primers and brochures are as follows:</p> <ol style="list-style-type: none"> Primer on the Concept of Climate Smart Villages (2018) in Myanmar language (http://hdl.handle.net/10625/57253) Primers on Adaptation Options per CSV (2018) both in English and Myanmar language. The English version in these links: <ul style="list-style-type: none"> Htee Pu CSV: http://hdl.handle.net/10625/59380 Taungkhamauk CSV: http://hdl.handle.net/10625/59381 Ma Sein CSV: http://hdl.handle.net/10625/59379 Saktha CSV: http://hdl.handle.net/10625/59378

2018-2021 Research Project Milestones	Accomplishments/Evidence
	<p>3. Primers on Insights from the Implementation of the Myanmar CSVs (2020). English versions in these links:</p> <ul style="list-style-type: none"> ▪ Htee Pu CSV: (https://hdl.handle.net/10568/108683) ▪ Taungkhamauk CSV: (https://hdl.handle.net/10568/108682) ▪ Saktha CSV: https://cgspace.cgiar.org/handle/10568/110701
<p>12. Collaboration and links with township-level administrative offices established towards the implementation of out-scaling activities in years 2-3</p>	<p>The out-scaling pathways identified early on in the project will be via government, via academia and via the development NGO sector. For local offices of government, IIRR and partners regularly conduct an annual Roving Workshop where representatives from the Township Offices are brought to the CSV to see and interact with the participants. This is to promote the various adaptation options as well as for the township officials provide support to the community. IIRR have conducted these workshops in 2018 and 2019. The one scheduled for 2020 was cancelled by the COVID-19 restrictions.</p> <p>For academia, IIRR regularly engaged with the Yezin Agriculture University (YAU) particularly with the National Climate Smart Agriculture Center (NCSC) hosted by the university. The research engaged the university in translating a number of our materials for the farmers. Since 2018, IIRR also attended and presented papers in the National CSA Conference convened by YAU-NCSC and FAO-Myanmar.</p> <p>For the development NGO sector, IIRR has worked closely with the Food Security Working Group, the largest NGO alliance promoting agriculture and food security in Myanmar. With the FSWG, IIRR conducted 3 learning events for the FSWG. In 2018, IIRR brought FSWG leaders to the IIRR CSVs in the Philippines. In 2019 IIRR conducted one Training Workshop (proceedings here: https://hdl.handle.net/10568/107415) with field visit to Ma Sein CSV and one policy dialogue on building resilience in agriculture. Finally, IIRR also established a Facebook Group Page to share updates and knowledge materials generated from the Myanmar CSVs. Currently, this Facebook Group Page has been suspended indefinitely given the current political unrest in the country and possible misuse of the Group Page for political gains.</p>
<p>18 months (for 13 to 18 months): Third interim technical report (update) submitted including details on the following:</p>	
<p>13. Second batch of primers/posters on leveraging nutrition in small holder agriculture in the Myanmar language produced, printed and distributed</p>	<p>The second batch of learning materials were focused on promoting key messages on leveraging nutrition in smallholder agriculture. IIRR developed two materials for these milestone as follows:</p> <ul style="list-style-type: none"> ○ Nutrition Education Modules aimed for community facilitators intending to facilitate nutrition education within agriculture development programs. : http://hdl.handle.net/10625/59401 ○ Brochure on Promoting Nutrition in CSA (both English and Myanmar languages) is designed to community readers. Concepts are presented in very simple language with a lot of visuals. This brochure was translated in 3 Myanmar dialects—Burmese for Htee Pu and Ma Sein CSVs, Pa-o for Taungkhamauk CSV and Chin for Saktha CSV. English version uploaded to CGIARSpace already: https://hdl.handle.net/10568/109055
<p>14. Methodological innovations in setting up and facilitating CSVs are documented, packaged and presented to township authorities, the national Department of Agriculture and national NGO networks (e.g., the Food Security Working Group,</p>	<p>For this milestone, IIRR wrote and submitted a journal article entitled: “Applying Participatory Action Research in Community-Based Adaptation among small holders in Myanmar” to the open access journal <i>Frontiers in Climate</i> in their special theme on Climate Risk Management. This manuscript is currently under review, once accepted, probable publication will be later this 2021 or early next year 2022. This article presented an analysis of the socio-technical methods that IIRR implemented in the Myanmar CSVs. The objective of the paper is to show how a mix of these</p>

2018-2021 Research Project Milestones	Accomplishments/Evidence
<i>Scaling-Up Nutrition Network, etc.)</i>	<p>methods enabled the CSVs understand their climate risks and vulnerabilities, identify options and build capacities via social learning. An early version of this paper manuscript was presented during the 2019 Annual National CSA Conference in Myanmar. Proceedings are found here, IIRR delivered the first presentation. (http://www.fao.org/3/cb4438en/cb4438en.pdf).</p>
<p>15. <i>Regional (multi country) learning exchange for targeted Myanmar stakeholders with partners in other CSVs in Asia in coordination with CCAFS-Asia conducted and documented</i></p>	<p>Most of the planned regional learning events to promote the Myanmar CSVs was for the year 2020. These were cancelled because of the COVID-19 restrictions. As an alternative, IIRR organized two webinar series in 2020 and 2021. The first webinar was organized together with IIRR’s Global Learning Program, IDRC’s Knowledge4Democracy (K4D) in Myanmar and the International Center for Tropical Agriculture (CIAT). This was a 3-part online event conducted between June and July 2021 to discuss Transformation of the Myanmar Food Systems. This was conducted between June and July. The webinar series gathered 12 speakers from Myanmar, Philippines, Vietnam and Cambodia as well as representatives from IDRC-Canada. Each session was attended by 90 participants many of them returned for the succeeding sessions. The titles of these online webinar series are as follow;</p> <ul style="list-style-type: none"> ▪ “Understanding Inclusive, Healthy, and Sustainable Food System for Policy and Practices in Myanmar” ▪ “Food Systems related initiative in Myanmar” ▪ “Transforming Food System in Myanmar, Vietnam, Philippines and Cambodia” <p>The second webinar series was conducted together with IIRR’s Global Learning Program and the CGIAR-CCAFS in Southeast Asia. The series composed of 2 sessions in January 2021 featured the lessons from the CSVs in Laos, Vietnam, Philippines, Cambodia and Myanmar. This webinar was divided into two sessions as follows:</p> <ul style="list-style-type: none"> ▪ Session 1: Climate Smart Villages as Platforms for Community-based Adaptation in Southeast Asia, January 20, 2021 ▪ Session 2: Creating Co-Benefits from Climate Smart Agriculture (CSA) as a Case for Scaling Out via Development Programs, January 27, 2021 <p>Each of this session featured 6 speakers and reactors and was attended by at least 450 participants coming from various countries in southeast Asia, Africa and the US and Canada.</p>
<p>16. <i>First drafts of two working papers written and shared widely before.</i></p>	<p>In partnership with the National University of Ireland-Galway particularly under the graduate program on climate change, agriculture and food security (MS CCAFS), IIRR engaged 2 graduate students to study and prepare research papers for the Myanmar CSVs. The engagement was conducted on April to July 2020. Online meetings were conducted and datasets were shared to the students and supervising faculty. Out of this engagement, the following paper manuscripts were produced:</p> <ol style="list-style-type: none"> 1. Impacts of climate smart agriculture interventions on food security and diet diversity in climate smart villages in Myanmar: Insights from community level studies (2021). This paper is currently being prepared for journal submission. IIRR aims to have this publish later this year or early next year. 2. Gender and Climate Smart Agriculture Interventions in Climate-Smart Villages in Myanmar (2021). This paper is currently being finalized by the supervising faculty members in NUI-Galway. IIRR also engaged in June 2021, a gender specialist/researcher from the University of the Philippines in Los Banos. IIRR aims to have a decent version of this manuscript by the end of August 2021.

2018-2021 Research Project Milestones	Accomplishments/Evidence
24 months (for 19 to 24 months): Fourth interim technical report submitted including details on the following:	
<p><i>17. Third batch of primers/posters on the potential of small livestock for multiple benefits to small-holder farmers in the Myanmar language produced, printed and distributed</i></p>	<p>After two years of implementing adaptation options in the CSVs, IIRR selected options that are gaining traction and scale. These options are presented in poster form for easy sharing in the CSVs and the nearby villages sharing similar agro-ecologies. There 10 posters, 9 are for specific technologies and practices on adaptation and then 1 poster on women empowerment in the CSVs. The compilation of posters have already been uploaded to CGIARSpace here: https://hdl.handle.net/10568/109054</p>
<p><i>18. Three policy proposals on CBA, CSV and leveraging nutrition in agriculture written and presented to targeted policy makers and other stakeholders</i></p>	<p>A paper on the Myanmar Food Systems was generated from deliberations during the webinars conducted in 2020. This paper provides an overview of the landscape of food systems work in Myanmar, offering ideas for entry points for transforming Myanmar food systems. Policy work and engagement with policy makers has been challenging in 2020 when the focus of the government was the COVID-19 pandemic. In 2021 the situation was further exacerbated by the sudden shift of the political context of Myanmar, where the civilian and democratically elected government was ousted. The paper is targeted for wider distribution among donors and NGOs in Myanmar later this year or early next year.</p> <p>A primer on Co-Benefits of Climate Smart Agriculture to Nutrition was produced. This primer is to pitch the concept of leveraging agriculture to address nutrition needs. IIRR is actively engaged in the Scaling Up Nutrition Civil Society Alliance (SUN-CSA) in the Philippines, Cambodia and the Asia region. In Myanmar IIRR is waiting for final acceptance to the network. IIRR’s engagement to SUN-CSA Myanmar is the promotion of nutrition in agriculture development focused programs of NGOs. The primer can be found here: https://hdl.handle.net/10568/107814</p>
<p><i>19. Village level capacity development including farmer field days and roving workshops for local decision makers are conducted and documented</i></p>	<p>Since 2018 the start of the research until 2020, IIRR has conducted CSV level capacity development activities. IIRR have conducted a total of 8 farmer field days convening a total of 351 participants with 195 men and 156 women. The assigned field researcher embedded in each CSV also conducted informal meetings and on-site sessions to guide and “hand-hold” participants to the implementation of adaptation options in the CSVs. IIRR prepared modules for these learning sessions and farmer field days. In 2020, given COVID-19 restrictions, all face-to-face farmer learning sessions were cancelled. Instead, IIRR printed the posters from Milestone 17 to remind farmers about the practices that they need to continue.</p>
<p><i>20. Initial out-scaling CSVs via farmer-to-farmer engagement, uptake by township authorities and adoption by other NGOs observed to be happening within the township where the first CSV was setup reaching to at least 500 households per township (total 4 townships)</i></p>	<p>Out-scaling in this research is about out-scaling of adaptation options within the CSV example from 2-3 farmer adopters to more adopters of the option within the CSV and out-scaling of this option outside the CSV. IIRR have observed some intra-CSV outscaling and to some extent in the nearby villages. Our field teams were planning to conduct geo-tagging exercises for farms to have used at least one adaptation option (example—a crop variety introduced and tested by the project). This was exercise was supposed to map out the dispersion of a specific adaptation option promoted in the CSV. This was not made possible in the second half of 2020 more so in 2021 given the changing context of Myanmar. This is still a study that IIRR consider to implement in the future, at least in one of the 4 CSVs. Our farmer field days and roving workshops designed to showcase the work of CSV for farmers and government officials outside the CSV have reached a modest number of 351 farmers with 195 men and 156 women and 85 government officials.</p>

2018-2021 Research Project Milestones	Accomplishments/Evidence
<p>21. First drafts of two working papers (on the special role of CSA and the potential of agro-ecological based CSVs) written and shared widely before publication.</p>	<p>IIRR produced two drafts of working papers. One is aimed to be a journal article and the other as a Working Paper for CCAFS. These two papers are:</p> <p>“Climate Smart Villages are Platforms for Climate Adaptive Community Development in Rural Myanmar” (2021). This paper is aimed to be submitted as a journal article and is currently prepared for submission. This paper presents the data analysis on key development indicators—cash income, consumption and perceptions on nutrition and women’s role in economic activities. Initial results indicated that the work in the CSVs have the potential to bring about change in these community development indicators.</p> <p>“Pathways to Scaling Out Climate Smart Agriculture in Myanmar: Preliminary Assessment” (2021). This is authored by a Myanmar researcher, former coordinator of the Food Security Working Group based on a preliminary assessment of the opportunities, needs and future work required to out-scale climate smart agriculture in Myanmar. IIRR aims to have this as a working paper for CCAFS.</p>
<p>30 months (for 25 to 30): Fifth interim technical report (update) submitted including details on the following:</p>	
<p>22. Continued out-scaling of CSVs via various pathways (via farmer-to-farmer exchanges, uptake of township authorities, research agencies and adoption by other NGOs) reaching to a total of at least 10,000 households for the 4 target townships where the CSVs are located.</p>	<p>Many of the activities aimed at out-scaling was scheduled in 2020. IIRR has not made significant progress in out-scaling considering the challenges posed by the COVID-19 pandemic.</p>
<p>23. Participate in Regional Southeast Asia Conference on CBA via CSV in collaboration with CCAFS</p>	<p>This project on the Myanmar CSVs has always been considered as an outreach program of the CGIAR-CCAFS southeast Asia. As such, IIRR Myanmar has always been invited to attend and present papers, progress and insights from the research in Myanmar to regional events. The first event that the Myanmar CSVs were asked to presented was the annual CCAFS-SEA meeting in Hanoi, Vietnam on 2018. The presentation focused on the design and research themes. The Myanmar CSVs is presented as a unique approach to CSVs where it has taken a more community development direction rather than too focused on technology development for climate smart agriculture. The presentation material can be found here: http://hdl.handle.net/10625/59389.</p> <p>On July 9-13, 2019, IIRR Myanmar was also asked to present in a regional roving workshop of CCAFS SEA and SEARCA. The workshop is aimed at influencing other countries in the ASEAN to adopt the CSV approach in nurturing climate smart agriculture and community adaptation. IIRR Myanmar focused its presentation on leveraging nutrition and food security in the CSVs in Myanmar. Workshop agenda can be found here: https://www.searca.org/phocadownload/knowledge_events/2019-asean-csv/ASEAN-CSV-agenda.pdf</p>
<p>24. Final copies of four working papers published online and widely shared with stakeholders and partners</p>	<p>At the end of the project on June 15, 2021, IIRR has yet to publish online the manuscripts it has produced. One has been submitted already awaiting acceptance by the journal and two are prepared for submission by the end of July 2021 and 4 are currently being reviewed by co-authors and targeted to be finalized for publication by September 2021.</p>

2018-2021 Research Project Milestones	Accomplishments/Evidence
36 months: Final technical report submitted including details on the following:	
<p>25. Project endline survey and studies conducted and report generated to capture the following project results at the household and community-level:</p> <ul style="list-style-type: none"> • Changes in farm and household productivity and livelihoods • Changes in adaptation and resilience of farmers and Households to adverse climate change impacts • Changes in the household food security, dietary diversity and level of knowledge, attitude and practices with regards to nutrition • Changes in the economic and social roles of women at household and village levels • Changes in the role and participation of stakeholders at village and township levels as a result of social learning activities 	<p>The endline studies composed of household surveys in the four CSVs have been conducted successfully in between October to November 2020. The data has been encoded and subjected to data analysis using various statistical tools. All the manuscripts drafted has presented data analysis results for the target development outcomes of this research project.</p>
<p>26. A critical mass of farmer-specialists in each CSVs continue to provide on-farm mentoring to other farmers in their village and neighboring communities</p>	<p>IIRR has no data on this given the challenges of organizing and gathering farmers in 2020 and 2021. However, IIRR has identified key individuals who have championed specific adaptation options in the four CSVs. These individuals are the potential farmer-specialists that will be development in future projects in the CSVs.</p>
<p>27. Increased uptake and usage of the knowledge products from the research to improve policy and programming of the Department of Agriculture at township and regional/state levels.</p>	<p>The final year of 2020 and 2021 of the projects unfortunately have been affected by COVID-19 pandemic and the political crisis that is happening in Myanmar. It is difficult if not impossible to conduct policy engagement work in 2020 to 2021. IIRR continues to be committed in programming in Myanmar and in the follow-programs of this research, IIRR will focus on influencing donors and large NGOs in how they design and implement programs on agriculture and climate change adaptation.</p>
<p>28. Final copies of the working papers produced from the research submitted to relevant journals and e-learning sites</p>	<p>IIRR is optimistic that manuscripts will be published in the journals and as CCAFS Working Papers starting in September 2021 onwards to the first quarter of 2022.</p>

Synthesis of research results and development outcomes

The overall goal of this research project was to test ways to build the resilience of Myanmar smallholder farmers and their households, making them food secure, better nourished, and with more secure livelihoods. The primary research approach that IIRR utilized for this project is participatory action research (PAR). This choice is anchored on the core tenets and principles of IIRR on “people-centered development”. Figure 1 shows the key steps that IIRR followed in implementing the Myanmar climate smart villages. This framework is anchored on principles of community-based adaptation that highlights location specificity of the climate change adaptation in agriculture-based communities. The basis of community adaptation is an understanding of how climate change affects the local agriculture systems. From this understanding, a process is facilitated to enable communities to identify adaptation options or responses to the identified climate change-induced risks and vulnerabilities. The approach takes on a portfolio approach—developing a menu of technological and practice options (point 2 in the diagram) where people can choose those that they think works well with their own agro-ecological and socio-economic context.



Figure 1: Key processes in Community-based Adaptation in the Myanmar CSVs

The research effort deliberately prioritized options that generate co-benefits such as livelihood, nutrition and income. Adaptation is not accomplished as a single intervention, but rather as a continuum, requiring an overarching approach that address the underlying drivers of vulnerability to those designed exclusively to respond to climate change impacts (ODI, 2010). With a portfolio approach, diversification and intensification objectives can be achieved, especially for small holders and those with marginal landholdings. Finally, IIRR utilized social learning techniques (guided by evidence and knowledge generated from the testing of adaptation options) to out-scale the work in the CSVs. In its work in the climate smart villages in the Philippines, the importance of establishing proof of concept sites, where minimal levels of adoption on scale is demonstrated, while also generating evidence were found to be very important in supporting wider uptake of the adaptation options.

In 2018, IIRR identified 4 villages in various locations in Myanmar, after on-site visits by a IIRR scoping mission team which studied agro-ecologies, farming systems and socio-cultural-economic dimensions of the Myanmar agriculture villages. As a result of these scoping studies, IIRR identified 4 villages to be designated as climate smart villages. The profile of these 4 CSVs are in Table 2. These villages were selected as they represent the major agro-ecologies of Myanmar and as such the impacts of climate change are also differentiated in these 4 villages.

Table 2: Profile of Targeted Myanmar Climate Smart Villages

Name of Village	Sakta	Htee Pu	Ma Sein	Taung Khamauk
Agro-ecology	Highlands	Dry Zone	Delta	Upland
Major crops	Rice, corn, vegetables	Groundnut, pigeon pea, green gram	Rice	Rice, millets, corn
Township (Tsp)	Hakha	Nyaung-Oo	Bogale	Nyaung-Shwe
State/Region	Chin	Mandalay	Ayeyarwaddy	Shan
Total households	200	275	103	94
Total Population	865	1,1180	453	405
Female	445	603	249	215
Male	420	577	214	190
Distance from Tsp. nearest	32 km	35 km	11 km	20 km
Ethnic Group	Chin	Burmese	Burmese	Pa-o

For more than three years, IIRR has implemented (three) key processes of community-based adaptation in the 4 CSVs. By systematizing this process of CSV establishment and implementation new insights have been derived. **Table 1 in Annex 1: Additional Tables** summarizes the different socio-technical methods that IIRR has used to facilitate the establishment of the Myanmar CSVs. These methods include household surveys, participatory climate risk and vulnerability assessments, focus group discussions, crop trials and the like.

These socio-technical methodologies and tools combined and complemented both agriculture research (technical) and social mobilization and organizing (social) dimensions. This complementation is essential for climate change adaptation efforts to be sustained—the subjects (farmers, households and villagers) have to own this process of adaptation. For technical support, IIRR worked with different research agencies with its partners from the Department of Agriculture Research (DAR) of the Ministry of Agriculture, Livestock and Irrigation (MOALI) to ensure that technologies and practices to adapt smallholder agriculture to climate change promoted in the CSVs are backed by researches of scientists, specialists and practitioners.

The key research results are presented below per research objectives.

Objective 1: To fine-tune, refine, adapt and optimize the climate smart villages approach as a platform for supporting community-based adaptation processes in four different agro-ecological and diverse socio-cultural settings within Myanmar;

The manifestations of climate change and how communities are affected by climate change ,differ across agro-ecosystems in Myanmar. The effects and impacts of climate change to the community will be influenced by the capacity-levels of communities, to cope and adapt to these changes. Therefore, responses to climate change also differ, requiring that adaptation measures recognize the value of targeted, location specific, community-based strategies and processes. Our research findings point to the importance of considering land tenure, poverty levels and, specific climate risks and vulnerabilities in developing portfolios of options in community-based adaptation.

Our analysis of the land tenure regimes in the four CSVs showed that it influences and determines the nature of the adaptation options and their eventual uptake. In villages with high incidence of

landlessness for example in Ma Sein CSV in the Myanmar delta has 76% of its total households do not own farm lands where compared to other CSVs where as much as 80% to 95% of households owned farm land (Table 3) As a result of the high incidence of landlessness in Ma Sein CSV, the agriculture adaptation options are limited to homesteads, the small patch of land around the household dwelling which production is limited to few vegetables and raising small animals.

Table 3: Change in the Land Ownership and Land Sizes between 2018 and 2020

Parameters	Htee Pu			Taung Khamauk			Ma Sein			Sakta		
	2018 (%)	2020 (%)	P-value ^a	2018 (%)	2020 (%)	P-value ^a	2018 (%)	2020 (%)	p-value ^a	2018 (%)	2020 (%)	P-value ^a
Land Ownership												
• Yes	80.25	80.25	1.000	87.06	91.76	0.344	55.81	24.14	0.000	80.56	95.54	0.001
• No	19.75	19.75		12.94	8.24		44.19	75.86		19.44	4.46	
Land Size ^b												
• Less than or equal to 1 acre	5.64	0	0.001	24.32	21.79	0.839	29.17	9.52	0.002	52.87	37.38	0.018
• 1.1 acre to 2 acres	20.51	13.85	0.112	43.24	33.33	0.025*	22.92	38.1	0.008	34.48	30.84	0.871
• 2.1 acres or more	73.85	86.15	0.001	32.43	44.87	0.023*	47.92	52.38	0.011	12.64	31.78	0.000

a McNemar's test was conducted to determine if there is a significant difference on the proportion (increase or decrease) over time.

b Only households who owned land were included in the analysis.

If p-value < 0.05, then the proportion is statistically significant at 5%

If p-value < 0.01, then the proportion is statistically significant at 1%

A more secure tenure status provides the freedom to make decisions about how land is used. A secure land tenure influences the decision of farmers to engage in diversified ventures combining short-term production and long-term adaptation related production practices. In CSVs where 80%-95% of the households owned land, these CSVs are growing between 6-8 crops per season compared to Ma Sein CSV where the few households (**Table 2 Annex 1 Extra Tables**) that have land areas growing rice and some other crops (betel nut, betel leaf).

A secure land tenure influences the decision of farmers to engage in diversified ventures combining short-term production and long-term adaptation related production practices. For instance, in Htee Pu CSV in the central drylands, where farmers have secure access to land and, freedom to decide on land use options, they chose to pursue a more long-term adaptation option such as agro-forestry with fruit trees. On the other hand, farmers in the Sakta CSV where farm lands are traditionally considered “communal” as per customary laws and shifting cultivation is practiced, farmers tend not to invest in long-term adaptation options such as agro-forestry.

In terms of how the level of poverty affects adaptation, our correlation analysis (Table 4) showed that poverty and wealth levels are important in determining uptake of (at least one adaptation options) by households. The wealthier households with larger land holdings, tend to not to adapt any of the CSA options promoted by the CSVs. The households that have lower wealth levels have the tendency to implement the CSA options (many of which were aimed at diversification and intensification). This would imply that adaptation options need to be designed in ways that are appropriate to the socio-economic status of the households.

IIRR has generally taken the position of promoting adaptation options that would appeal more to the

poorer households, than to the better off households. The CSA options promoted in the CSVs were identified and prioritized by the participants from the village. Based on the household surveys conducted in 2018 and 2020, indicated that at least 50% of the households in the CSVs are categorized as poor to ultra-poor. Given this reality, it is important that the CSA options promoted and supported provide opportunities for the poor smallholder farmers to adapt to climate change.

Table 5: Correlation coefficients between Different Variables with CSA Adoption

Variables	Type of data	CSA adoption (1=yes, 0=no) Nominal
• Wealth Index score	Continuous	-0.191**
• Ability to meet basic needs (Likert scale) ^a	Ordinal	-0.094**
• Land ownership (1=yes, 0=no)	Nominal	-0.009
• Land size (0=no own land, <=1 acre, 1.1 to 2.0 acres, >2 acres)	Ordinal	-0.059

* significant at 5%, ** significant at 1%

Measures of correlation

- Point biserial correlation coefficient- Continuous vs. Nominal
- Rank biserial correlation coefficient- Ordinal vs. Nominal
- Phi coefficient - Nominal vs. Nominal

The complexity of the Myanmar context in terms of land tenure, levels of poverty and climate risks and vulnerabilities, makes a strong case for a “portfolio approach” to adaptation. The portfolio approach involves a menu (list) of options that households can choose to implement, depending on their capacity to implement. In this research project, IIRR facilitator a participatory process with technical inputs from scientists to come up with options for adaptation unique to each agro-ecology. The options identified included technologies such as the promotion of new, improved varieties of the current crops (especially climate hardy varieties), new crops to be integrated with the objective of diversifying production, the raising of small animals, growing vegetables in the homesteads, and growing more trees into both farms and homesteads.

The portfolio approach or having a list of options ensures that there is an opportunity for every household whatever is its context—in terms of land tenure and wealth status. There is an option designed for households with land and for households without farmland. This portfolio approach allows for opportunities for gender equity where both men and women have equal opportunities to engage in climate adaptive economic activities.

There are also options that are promoted especially for women—such as raising small livestock within homesteads which was found to be an appropriate option for building the asset base of women, in a context where women cannot own farm lands. Intensifying homestead production provides opportunities for women to work the land, earn income and at the same time achieve household food security. The CSV Adaptation Fund, which is an allocation of US\$4,000 to US\$ 4,500 provided to each CSVs per production year, when used strategically, and in a targeted manner can serve to incubate ideas, catalyze action and deliver a minimal degree of scale (“building of a critical mass of adopters”). The generated momentum can foster a spontaneous spread of adaptation options. **Table 3 in Annex 1: Extra Tables** summarizes the CSA options implemented with the number of individual adopters in 2018-2020 production season with support from the CSV. The most common options preferred by many households are the integration of fruit trees into the farms. Trees are less sensitive to seasonal climate variability which makes them more resilient. Another CSA option is the intensification of homestead production (utilizing the land space around the house) and growing of small livestock. This CSA option is very beneficial to women who have no access to off-site farms and/or who have not the time to do farming off-site. Adaptation Fund allocated for each

CSV. In total we have 10 adaptation options across the 4 CSVs involving more than 700 individual farmers and their households.

In summary, this research has refined, adapted, optimized and fine-tuned the climate smart village approach to fit into the unique characteristics of the 4 agro-ecologies of Myanmar as follows:

- Followed a systematic implementation of socio-technical processes, methods and tools to ensure community participation and ownership for higher chances of sustainability
- Consider the land tenure regimes of the community—a more secure land tenure the higher uptake for long-term production system with higher success of reducing climate change risks and losses.
- Consider wealth and levels of poverty in the community to guide intervenors on the portfolio of adaptation options to be supported—ensuring that there is an adaptation option for every segment of the community –farmers, women, men, landless households, etc. This is an opportunity to make the CSV more socially inclusive and able to build the capacities of the poor and vulnerable to climate change.
- Consider setting up an CSV Adaptation Fund to support the initial uptake of the CSA options identified. This is very important especially in the context where communities have high incidence of poverty where smallholder farmers will not have enough capital to implement new production options.

Objective 2: To develop and test scalable social learning processes and institutional mechanisms which facilitate or drive community-based adaptation processes resulting in multiple/co - benefits for the farm household.

In 2019 , 69 % of the population lived in rural areas of Myanmar. While urbanization in Myanmar is steadily on the rise, with notable reductions in poverty, rural poverty is still a big concern. The rural poor accounts for 84% of Myanmar’s total poor. In this research, the climate smart village is espoused to address climate change adaptation while addressing development outcomes such as poverty, nutrition, and women empowerment in smallholder agriculture communities. The focus of this research area was to study what social learning mechanisms within the CSVs can be implemented that will contribute to multiple/co-benefits . Table 6 shows the number of social learning events and the participants.

Table 6: Number of Events and Participants to the CSV Social Learning Events

Social Learning Activities	No. of events/publications	Total Participants
Farmer Field Days (men + women)	8	351
Men		195
Women		156
Roving Workshops	8	60
National Learning Events	4	89
from Government	<i>na</i>	25
from NGOs	<i>na</i>	62
from Academia	<i>na</i>	2
Local Publications (no. of publications)	10	<i>na</i>

Source: International Institute of Rural Reconstruction, Myanmar

1. Supporting the implementation of selected CSA adaptation options at farms, homesteads and school levels through the annual allocation of CSV Adaptation Fund. This is the financial mechanism for the project to support the initial uptake of the CSA options. Implementing

the CSA options is essential in facilitating social learning activities that is based on actual experiences of farmers.

2. Farmers Learning Sessions and Farmer Field Days. Farmers' field days were carried out with the participation of farmers from other villages. During the field day, farmers visited to the school garden, home gardens, crop performance trials and small livestock. Farmers are also given the opportunity to provide feedback, opinion, comments and their future plans of establishing CSA activities in CSV and other villages. The Farmer Learning Sessions are small group meetings facilitated by IIRR field researchers or with the assistance of local government specialists or extensionist.
3. Roving workshops. As an out-scaling activity, roving workshops at four project areas were carried out to share the CSV activities with township level government officers, NGO, INGO and the private sector. The roving workshops gave opportunities to the participants external to the CSV to learn about the work in CSV as well as give their suggestions and feedback to the various CSA activities. For example, during the Roving Workshop in Htee Pu CSV (dry zone)—researchers from the government came back to conduct an assessment of the crop trials. In Sakta CSV in Chin, one feedback was the importance of identifying production options during the winter which is not part of the CSA options for Sakta CSV. In TKM CSV in Shan, as a result of the Roving Workshop, a group of agriculture university students from Yezin Agriculture University came back to conduct their own learning activities.

On the potential co-benefits of the CSVs toward community development outcomes, our findings from the quantitative studies also suggest that CSVs as a platform for community-based adaptation can address development needs, having the potential to change household incomes, increase food security via household food production and change perceptions towards women economic empowerment and improved nutrition. More of this is presented in the research paper entitled *"Climate Smart Villages are Platforms for Climate Adaptive Community Development in Rural Myanmar"* prepared for publication.

Diversification of production in the CSV is what drives the creation of multiple co-benefits to the households in the CSVs. In this research, IIRR studied the relationship between the promotion of diverse CSA practices that have been implemented in four Climate Smart Villages (CSV's) across Myanmar to improve household food security and achieve dietary diversification. Based on data collected across 2 years, the results indicate that the number of CSA practices and technologies adopted is positively associated with changes in household diet diversity, but in the short-term improvements in the households' food security scores.

Based on data collected from 2018 to 2019 for household food insecurity and access scores (HFIAS) and household diet diversity scores (HDDS) in the 4 CSVs, our results of the Effect Likelihood Ratio Test (Table 7) indicated that the location of each CSV has the most significant influence on HFIAS Scores: The P-value of 0.0038 is small enough to indicate very convincing significance meaning location is strongly supported to influence HFIAS Score. The P-value for 'Numbers of CSA' is very large at 0.5127 meaning no significant influence can be inferred. This would suggest that CSA interventions, carried out under these circumstances, have no influence on the HFIAS Score that a household may achieve over such timescales. The impact of different variables on HDDS was also determined (Table 8) and this time indicated that both 'Location' and 'Number of CSA' options implemented had significant influence ($p = 0.0002$).

Table 7: Effect Likelihood Ratio Test (ELRT) carried out to determine which factors influence the HFIAS Scores of households across all four CSV's.

Source	Nparm	DF	L-R ChiSquare	Prob>ChSq
Location 2	3	2	11.1549622	0.0038*
Min TEMP	1	0	0	-
Max TEMP	1	0	0	-
Ave. Temp	1	0	0	-
Rainfall (inches)	1	0	0	-
Rain days	1	0	0	-
Number of CSA	5	4	3.27635049	0.5127
CSA (all) YN	1	0	0	-

Table 8: Effect Likelihood Ratio Test carried out to determine which factors influence the HDDS of households across all four CSV's.

Source	Nparm	DF	L-R ChiSquare	Prob>ChSq
Location 2	3	2	16.6549429	0.0002*
Min TEMP	1	0	0	-
Max TEMP	1	0	9.0949e-13	-
Ave. Temp	1	0	0	-
Rainfall (inches)	1	0	0	-
Rain days	1	0	0	-
Number of CSA	5	5	23.8026591	0.0002*

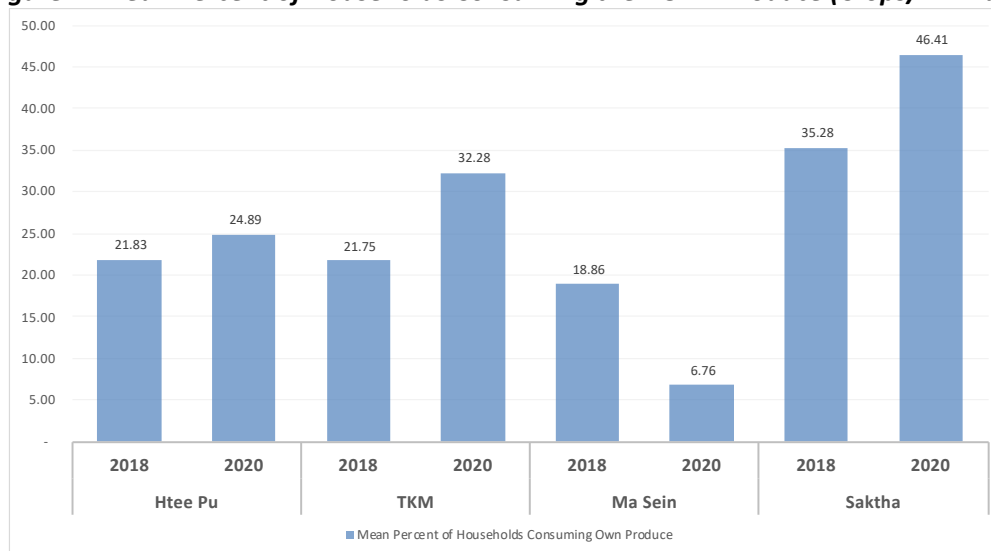
IIRR envisage that with diversified production systems of crops, animals and vegetables—these afforded the households access to diverse food from their own produce. We describe here the potential pathways of how the adoption of specific CSA practices tailored to the unique context of Myanmar's four agro-ecologies contribute to change in diet diversity. The potential impact of the adoption CSA options to household food security will require subsequent monitoring as most CSA options implemented in the CSVs are medium to long cycle interventions which have not yet accrued economic benefits to the households, suggesting longer study periods may be needed to identify potential food security gains as well as supplementary external support for the 4 CSVs in Myanmar.

While the ELRT indicates that CSA adoption does not translate to higher HFIAS, IIRR investigated the changes in the rate of consumption of the household of its own agriculture produce. The idea is as agriculture production diversify to include food crops and animals—it will create opportunities for households to consume their own produce thereby contributing to more accessible food. Our analysis (Figure 2) indicated that three CSVs except for Ma Sein CSV have increased percentages of households consuming their own produce. In some cases, the entire produce is consumed as the case of corn in Saktha CSV. The upland CSVs of TaungKhamau and Saktha indicated the highest increase of at least 10% increase in the percent of households consuming their own produce. This is followed by the dry zone CSV of Htee Pu showing 3% increase of households consuming their own produce. The delta CSV of Sakta indicated a reduction of percent of households consuming their produce—dropping at much as 12% of the households driven by the increased percent of households no longer engaged in agriculture production in 2020.

Again, the disruptions caused by COVID-19 might have contributed to this increase consumption.

Whatever is the cause of this increased consumption, it is important to note that diversifying crop and animal production has the potential to improve food access during times of crisis and difficulties caused by either climate change or by an economic slowdown this case due to the COVID-19 pandemic. Having own food to consume during crisis has also the potential to ease the burden on women to find food for the household, a task still traditionally assigned to women.

Figure 2: Mean Percent of Households Consuming their Own Produce (Crops/Animals)



Our analysis also indicated an increase in cash gross incomes (cash received) in crops and animals where adaptation options were implemented. Across the 4 CSVs, we have noted an average of 87% increase in the average of the total cash received by the households from selling crops and animal produced (**See Annex 1**). However, our analysis of the household wealth index (**See Annex 2**), an objective measure of household wealth and poverty is inconclusive, showing very little significant change between the baseline and endline data. Perhaps the cash income is not significant enough to bring about change in the household assets on which the household wealth index is based upon. There are several factors that this can happen such as that the other adaptation options require a longer gestation period (beyond the 3-year action research) to generate surplus income (e.g., agro-forestry of fruits and small livestock). We also considered the possibility that households in 2020 when the endline data was collected, is experiencing the impacts of the economic slowdown in 2020 due to COVID-19 pandemic. This economic slowdown and uncertainties of the future because of the pandemic might have caused the deterioration of the subjective metric of well-being (a self-rated ability to meet basic needs) where in general households are not confident that they can meet their basic needs.

Finally, we studied the potential of the CSVs in changing the perceptions of men and women on two areas—one on women economic empowerment and second on nutrition and food preferences. IIRR collected and analyzed data to find out changes in the perceptions of household members towards the role of women in the overall CSV activities as well as perceptions towards nutrition and diets. For this analysis, we conducted a “difference-in-difference” (DiD) analysis to see whether adoption of at least one of the adaptation options influenced a change in the perceptions towards gender and nutrition and diets.

Our DiD analysis (Table 9) indicated that households engaged in one the adaptation options have indicated improved perceptions towards women’s engagement in economic activities. Particularly, men from households with adaptation options have attained a more positive perception to the notion that women can engage in economic and livelihood activities, without sacrificing her other

roles in the household. Women in the households with adaptation options also have a more positive perception to the notion that women do not have to be dependent on men for cash for their personal needs.

Table 9. Test on the difference-in-difference between respondents with and without CSA interventions by gender on the extent of agree or disagree to each statement

Statement	Male				DID ^a	Female				DID ^b
	Without CSA		With CSA			Without CSA		With CSA		
	2018	2020	2018	2020		2018	2020	2018	2020	
	A	B	C	D		E	F	G	H	
1	A man should be responsible for providing money for his wife's personal use even if she is capable of earning it herself.				0.00	1.82	1.75	1.79	2.19	0.47
2	A situation where a woman spends the majority of her day away from the home to make money is not right.				0.66	3.39	2.46	3.36	2.94	0.51
3	If a woman gets too involved in livelihood activities, her family will likely suffer.				0.64	3.18	2.15	3.17	2.68	0.54

a Difference-in-Difference = (D-C) - (B-A)

b Difference-in-Difference = (H-G) - (F-E)

* significant at 5%

** significant at 1%.

Note: "No responses" were excluded in the analysis.

Using the same approach of DiD (Table 10), households implementing adaptation options have attained a positive perception towards the importance of preparing nutritious food for the household and that preparing nutritious food doesn't need to be difficult for the households. This is important change in perception as this will set the stage for the promotion of producing fruits and vegetables as part of agriculture production to ensure that households can easily access nutritious foods. The other change among households with adaptation options was the increased positive perception towards the importance of sanitation.

Table 10. Test on the difference-in-difference between respondents with and without CSA interventions on the percentage of respondents who agree on the attitudes and practices statements in household nutrition

Statement	Researcher's note	Without CSA		With CSA		DID ^a
		2018	2020	2018	2020	
		A	B	C	D	
1	I put oil into the food when cooking.	61	48	49	47	12
2	We boil our drinking water we got from rain and from the pond before we drink it	87	83	76	89	16
3	Preparing nutritious food for the family is very hard to do.	70	83	80	75	-18
4	It is important to eat fruits and vegetables of different colors to get vitamins and minerals.	76	81	69	87	14

a Difference-in-Difference = (D-C) - (B-A)

* significant at 5% ** significant at 1%

Note: "No responses" were excluded in the analysis.

This research demonstrated the potential of utilizing the climate smart village approach as an approach of not just promoting adaptation in agriculture production of smallholders but also in creating co-benefits on gender, nutrition and food security. This is done by integrating key messages on gender, nutrition and food security into the learning events in the CSV. In addition, it is also important to include a key consideration or criteria in prioritizing the adaptation options—women engagement, nutrition and food security.

Objective 3: To scale up the most successful social, technological. and methodological(climate smart, gender equitable and nutrition sensitive) agriculture innovations through sub-national governments/institutions, civil society organizations and research and teaching institutions

This objective is focused on the out-scaling of key innovations, practices, processes and methods used in the climate smart villages. The out-scaling target of the research is two-pronged. One is to promote the use of the climate smart villages as an approach to facilitated community-based adaptation in agriculture-based communities in Myanmar. This is done via influencing other development agencies in Myanmar including donors to integrate the CSV approach. Secondly, is the out-scaling of specific adaptation options found to be working and effective in the CSVs. To realize these targets, IIRR identified three pathways to do these as follows:

via government extension—The government’s Department of Agriculture (DoA) -Extension Services will be primary agency for intervention. The scaling strategy is to integrate CSA and CSV into the current extension materials of the DoA such as posters and booklets on Good Agriculture Practices (GAP) per crop. There is a policy basis for doing this as this is in line with the Myanmar CSA Strategy adopted by the government of Myanmar in 2016. The CSV approach is identified as one of the strategies to develop, promote and scale CSA in the country. Specific, crops targeted for integrated CSA practices is in corn production, horticulture and small livestock production.

IIRR also has a formal partnership with the Department of Agriculture Research of the Ministry of Agriculture, Livestock and Irrigation (MoALI). IIRR and DAR signed a 5-year Memorandum of Understanding (MoU) with the Department of Agricultural Research (DAR) of the on 22 October, 2019 to collaborate at the national level programs of Myanmar in building resilience of small holder farmers to climate change, food and nutrition security, and economic development through participatory action research and training. IIRR regularly reported to the DAR for accomplishments in this project as well as explore opportunities for research collaboration in the CSV. In the meetings in 2019, IIRR and DAR identified areas for joint-research in the area of gender analysis in the dry zone CSV and a plan for conducting capacity development activities in Myanmar and abroad for DAR researchers. These were subsequently postponed due the restrictions posed by COVID-19. In 2020, IIRR and DAR also worked on preparing crop decision tables, a decision matrix for farmers that aligns the appropriate agronomic response to the climate/weather conditions in the region. This work was piloted in the central dry zone in partnership with the International Center for Tropical Agriculture (CIAT).

via civil societies and NGOs—The scaling strategy here is to build capacities of local and international non-government organizations in Myanmar. IIRR identified the Food Security Working Group as the strategic partner to deliver learning events to civil society organizations and NGOs in Myanmar. The strategy is to enable local and international NGOs to design and implement their own programs on CSA and CSVs. Since 2018, IIRR has conducted 3 learning events and training courses for their members of the Working Group. IIRR also developed and translated materials to the Myanmar language for participants to take to their respective organizations.

In 2020 and 2021, IIRR conducted webinars to present the CSA and CSV activities in Myanmar. These webinars provided targeted local and international NGOs in Myanmar updates on the CSA and CSV initiatives in other countries in southeast Asia. IIRR is a member of the National Technical Support Group for CSA in Myanmar convened and spearheaded by FAO-Myanmar. This CSV based work has also been picked up by strategic donors in Myanmar. One example is the LIFT (Myanmar's largest funding portfolio for livelihoods and food security) Call for Proposal for Chin State where the Saktha Climate Smart Villages of IIRR was included in the Bibliography. The call and guidelines also referred to climate and nutrition-smart approaches in agriculture—themes that are espoused in this research project. (https://www.lift-fund.org/sites/ift-fund.org/files/uploads/documents/LIFT_CfP_Chin_June2019_Published.pdf)

via the academe and research community. This scaling pathway is via engagement with Yezin Agriculture University (YAU) and with the other research agencies in Myanmar such as those working with IDRC's K4D program. For YAU, IIRR regularly participated in the annual National CSA conference since 2018. In the annual conferences in 2019 and 2020—IIRR presented preprint versions of research papers emanating from its climate smart village work. In 2019, IIRR also organized learning visits of university students to the CSV in Southern Shan where YAU have an extension campus. Through these sustained engagements with the YAU—IIRR is contributing to the integration of climate smart agriculture in the curriculum and research activities of the university. The publications and materials produced once printed will be added to the library of the National CSA Center of the university.

IIRR also collaborated with the IIRR Global Learning Program, IDRC's Knowledge4Democracy (K4D) in Myanmar and CIAT to organize and facilitate 3-part online event to discuss the Transformation of the Myanmar Food Systems. This was conducted between June and July. This was attended by at least 12 speakers and reactors from Myanmar and outside of Myanmar. On average, the event was attended by 90 attendees, many of whom are repeat attendees in the succeeding sessions of the series. The titles of these online webinar series are as follow; a. "Understanding Inclusive, Healthy, and Sustainable Food System for Policy and Practices in Myanmar", b. "Food Systems related initiative in Myanmar" and c. "Transforming Food System in Myanmar, Vietnam, Philippines and Cambodia". A synthesis report entitled "Myanmar Local Food Systems in a Changing Climate: Insights from Multiple Stakeholders" has been prepared and awaiting publication in journal or as a CGIAR-CCAFS Working Paper.

In 2021, IIRR conducted a preliminary assessment of the scaling pathways for CSA in Myanmar using a combination of desk study, consultation and key informant interviews with experts from government offices, local and international organizations. The objective of the study was to consult on the experiences and views of various stakeholders in scaling up CSA in Myanmar. Our findings showed that for successful implementation of the Myanmar Climate Smart Agriculture Strategy (MCSAS) adopted by the government in 2016, reforms in the government agriculture extension system, including with further investments for the provision of technical expertise capacity development and funding will be needed. financial

Our consultations also revealed the need for strengthening the science and technical evidence for CSA based on the unique features of the Myanmar agro-ecological zones. This includes climate information services, soils mapping, rainfall and temperature monitoring for better forecasting. There are a number of CGIAR members particularly WorldFish and the International Water Management Institute that are currently implemented or planning of implementing programs on climate smart agriculture in Myanmar which the CSV approach can be utilized as a methodology for community engagement. Towards early 2022 a portfolio will be prepared of CSA/CSV related research outputs targeted to be presented to the various CGIAR, ACIAR and DFID initiatives in

Myanmar. Through the other programs of IIRR in Myanmar, the integration of CSA and CSV approaches in implementing livelihoods development programs in the context of COVID-19 recovery will also be pursued.

Research partnerships

At the start of the project in 2018, IIRR intends to build research partnerships with 3 agencies as follows: Food Security Working Group for policy research, Yezin Agriculture University for CSV-specific student research on climate smart agriculture under the university's National Climate Smart Agriculture Center and the Department of Agriculture Research through their local research stations that are near the CSVs.

IIRR has consistently pursued these partnerships and continuously explore opportunities for joint research. As the project does not allocate resources to commission specific researches in the CSVs, IIRR's approach is to leverage the work in the CSVs to encourage these agencies to conduct their studies and researches within the CSV. Specific to the local research stations of DAR—IIRR is working with them in implementing crop trials in the CSVs for varieties being developed and tested by these stations. IIRR is encouraging them to conduct crop trials in the CSV in addition to doing trials in high controlled experimental farms of the station. For example, on several occasions the dryland research station have visited and interacted with the farmers testing the improved crop varieties that were provided by the research stations. IIRR continued to explore opportunities and potential donors to support the conduct of these complementary studies in the CSVs. Meetings with LIFT and other INGOs were also conducted to continuously promote CSA and CSV programming in Myanmar. Pursuing these partnerships in the final year of the project in 2020 was very slow given the challenges caused by pandemic restrictions in the country.

Within the southeast Asia region, this research work in the Myanmar CSV is considered as an outreach CSV of the CGIAR-CCAFS CSVs in Vietnam, Laos and the Philippines. While CGIAR-CCAFS is not providing financial support to the Myanmar CSVs project, all the research outputs from Myanmar are published in the CGIAR-CCAFS knowledgebase online. IIRR since 2018 have always attended CGIAR-CCAFS events in the SEA region to report and share the experiences of the Myanmar CSVs. In 2021, in collaboration with CCAFS and this project, conducted a 2-part webinar series on out-scaling of CSVs and CSA. The series composed of 2 sessions in January 2021 featured the lessons from the CSVs in Laos, Vietnam, Philippines, Cambodia and Myanmar. This webinar was divided into two sessions as follows:

- Session 1: Climate Smart Villages as Platforms for Community-based Adaptation in Southeast Asia, January 20, 2021
- Session 2: Creating Co-Benefits from Climate Smart Agriculture (CSA) as a Case for Scaling Out via Development Programs, January 27, 2021

Each of this session featured 6 speakers and reactors and was attended by at least 450 participants coming from various countries in southeast Asia, Africa and the US and Canada. A synthesis paper is currently being prepared jointly by IIRR and CCAFS partners to distill the experiences of the 5 countries in SEA region on scaling. This will be a working paper to be published in the CGIAR-CCAFS knowledgebase targeted before the end of 2021.

Governance

The success of this research project depends on the effectiveness of people's participation in the community-based adaptation process and of support from local and national government agencies. The research as part of its design will engage the most vulnerable villages and its members. IIRR is

very careful not to make a mistake of “elite capture” of the key adaptation options. The CSV activities were designed to engage and benefit the small-holder farmers, landless seasonal workers and women in the CSV. In 2019, IIRR has started organizing informal farmer learning groups according to the adaptation options they have chosen to implement. These farmer learning groups are considered next users of the research results from the various field trials of CSA options. IIRR planned to organizing women and mothers around discussions related to nutrition, food security and gender starting in 2020 up to 2021. All of these efforts are directed at a long-term goal of leaving behind core community-based organizations within the CSV who will continue to practice the discipline of farmer innovation, experimentation and adaptation. These efforts have been reduced in scale or were not even conducted because of COVID-19 restrictions

Research ethics

Surveys and other data collection activities that were conducted already including those that were conducted in 2020 that involved personal information were treated with utmost care. This includes data security and prior informed consent was collected beforehand. Data collection activities that involved the participation of children and minors (e.g. school-based research activities)—were made with the consent from parents or under the presence of the parents. The Project did not involve clinical data collection activities to ascertain nutrition outcomes. The research only studied household level food security, diet diversification and livelihood outcomes in the context of climate change and vulnerability. When the datasets collected from the HH surveys were shared to the researchers in NUI-Galway, they were asked to sign a data protection agreement with IIRR that protects personal information and that prohibits storing data from any other sources that IIRR did not approve. The investigators have fully uphold intellectual property rights. All related literature and references were fully attributed to their respective authors. All reports and related documentation arising from this project have acknowledged all those involved accordingly.

Use of research results

Myanmar is a country interest in the southeast Asia region because of its status as a country in transition. IIRR believes that even with the unfolding crisis and regression of Myanmar, it will remain to an interest for future studies on linking community development, agriculture development, climate change and building peace and security—a number of these can be built from the initial research results of this Myanmar CSV research project. By design, IIRR has envisioned that the research results of this project will impact the wide-scale promotion of climate smart agriculture via CSVs in Myanmar through the various scaling pathways described in detail above. Depending on the trajectory of the recovery of the country from the current double crisis of political change and COVID-19 pandemic—IIRR will continue to promote and engage at policy level conversations around the CSV research results to influence government programs on climate change and agriculture. IIRR will continue to promote the research results to influence donor investments in the country to integrate CSVs as a modality for program delivery on climate change adaptation in the Myanmar rural communities. IIRR aims that in the next 3 years, the research results presented in various publications in journals and the CGIAR knowledgebase will be pick up by policy makers, donors, researchers and NGOs within and outside of Myanmar.

Synthesis of results towards AFS themes

▪ *Increasing agricultural productivity (Availability)*

This research contributed to the AFS theme on agriculture productivity by working towards improving the resilience and productivity of agriculture systems of small-holder farmers in key agro-ecological contexts of Myanmar. This was done by facilitating a process of community-based

adaptation where farmers identify their vulnerabilities and risks to climate change, then use this understanding to identify and select the best bet options that are being introduced and tested. These best bet options were tested and further improved based on the unique needs and context of the four CSVs. These experiences in improving agriculture production by using climate smart practices and technologies were later used in the farmer-to-farmer learning and sharing events. These options are anchored on key principles of diversification, ecological integrity (water, soils and trees) and nutrition sensitivity that ensures that the production activities are contributing to diet diversification and food availability across the entire seasons while also augmenting incomes (or result in savings of food expenses). By facilitating this process, IIRR and its partners are building the capacity of the farmers to anticipate risks, identify options and innovate or experiment on these options.

From the table of CSV options presented above, we have demonstrated the importance of location-specific CSA options. A number of these activities were tested to provide opportunities for women headed households as well as to small-scale marginal farmers to enhance their household productivity. These technologies and practices also address nutrition and food security. In the baseline studies—one of the least consumed food groups in the HH diet in the CSVs are meat, legumes and fruits. We have also noted an increase of farmer-cooperators of these options. With the facilitation of farmer-to-farmer learning events such as farmers field day, farmer learning group sessions, roving workshops—IIRR has enable the up-take of CSA options that found to be working and beneficial to the farmers.

- *Improving nutrition (Utilization)*

Aside from contributing to building resilience in agriculture productivity, this research also demonstrated the potential of CSA via the CSV approach in improving household food security and nutrition of the target households in the CSVs. While there is a limited scale of nutrition-specific interventions in the project (limited to nutrition education and awareness building activities only), the research demonstrated the potential linkages between agriculture and nutrition. This research have revealed that the diversification of agriculture production, a hallmark of the CSA options promoted—has contributed to diet diversification and change in the perceptions of households towards nutritional practices.

From the results of the household surveys, IIRR was able to develop the key messages needed to address the gaps in the KAP, food security scores and diet diversity scores. IIRR has developed nutrition education modules based on these key messages. For instance, as we promoted home gardens among the HH in the CSVs, these HHs have learned the value of gardens to nutrition and food security and not just for income. For field crops, the propagation of fruit trees and legumes as well as raising of small livestock are all responding to the baseline survey results that indicated that HH are not consuming enough fruits and protein (legumes and meat). IIRR promoted roots & tuber crops, leguminous crops and dark green leaves vegetables in homestead gardens and farms as these crops will be the major contributing factor of improving nutrition with the support of well-prepared nutrition education sessions and trainings.

- *Informing policy*

This research project was conducted to provide strategic support to the Myanmar Climate Smart Agriculture Strategy (MCSAS) of the Ministry of Agriculture, Livestock and Irrigation. This document served as a policy guide for the Ministry as it develops and pursues programs on climate change in agriculture. This document was formulated with support from CGIAR-CCAFS in collaboration with Myanmar's Yezin Agriculture University. More about the MCSAS here

<https://ccafs.cgiar.org/research-highlight/myanmar%E2%80%99s-climate-smart-agriculture-strategy-roadmap-resilience-and#.W2wuVhh9i->

The research has already gained interest among government agencies and international organizations. For instance, as a recognition of IIRR’s work with the CSV approach, IIRR is now part of the National Technical Support Group for Climate Smart Agriculture in Myanmar. This is convened by FAO-Myanmar to support the government in implementing the MCSAS. This project was also mentioned as a key element in realizing the MCSAS of Myanmar in a study conducted by YAU and CCAFS taking stock on the implementation of the MCSAS. See full report here: <https://hdl.handle.net/10568/106513>

For government, there is now growing acceptance of a systems approach to agriculture research versus crop/commodity-based approach because a systems approach is better in addressing the issues of climate change in agriculture. In a meeting with the Department of Agriculture Research, this approach is embedded in their long-term programs and plans. Among donor agencies, LIFT—the major donor for livelihoods and food security programs have already mentioned the importance of climate smart approaches to programs that they want to fund. One example is the LIFT Call for Proposal for Chin State where the Saktha Climate Smart Villages was included in the Bibliography. The call and guidelines also referred to climate and nutrition-smart approaches in agriculture—themes that are espoused in this research project. (https://www.lift-fund.org/sites/lift-fund.org/files/uploads/documents/LIFT_CfP_Chin_June2019_Published.pdf)

IIRR believed that with more tangible evidence demonstrated on the ground at the CSV level coupled with engagement at the broader level stakeholders-we will be able to see an out-scaling of the CSA via the CSV approach in Myanmar.

Project outputs

The open access dissemination plan for this project is primarily through the CGIAR-CCAFS knowledgebase and for selected materials through open access peer-reviewed journals. IIRR also considers IDRC Connect as an additional platform for open access to the research outputs produced out of this project. **Table 7 of Annex: Extra Tables** presents the research outputs that are already available online in open access repository of CGIAR-CCAFS and IDRC Connect.

As of the writing of this report, IIRR continues to work on producing research manuscripts targeted for publication this year and next year. These manuscripts are aimed as Working Papers for CGIAR-CCAFS and for some to be submitted in Open Access peer-reviewed journals. These manuscripts are of varying degree of completion—some were submitted to journals already and some are still in the internal review and editing stages and few are at the writing stage still. The table below describes the status and target timeframe for finalization and publication of these papers.

Paper Title	Authors	Status
Applying Participatory Action Research in Community-Based Adaptation among small holders in Myanmar	Wilson John Barbon, Chan Myae, Rene Vidallo, Phyu Sin Thant, Emily Monville-Oro, Julian Gonsalves	Accepted for Open Access Journal Publication— <i>Frontiers in Climate special topic on Climate Risk Management</i>
Climate Smart Villages are Platforms for Climate Adaptive Community Development in Rural Myanmar	Wilson John Barbon, Chan Myae, Rene Vidallo, Phyu Sin Thant, Emily Monville-Oro, Julian Gonsalves	Prepared for open access journal submission in September 2021
Impacts of climate smart agriculture	Andrew Hanley, Galina	Prepared for submission

interventions on food security and diet diversity in climate smart villages in Myanmar: Insights from community level studies (collaborative work with the National University of Ireland-Galway)	Brychkova, Wilson John Barbon, Su Myat Noe, Chan Myae, Phyu Sin Thant, Peter C. McKeown, Julian Gonsalves, Charles Spillane	to the MDPI <i>Journal on Sustainability</i> , to be submitted in September 2021
Gender and Climate Smart Agriculture Interventions in Climate-Smart Villages in Myanmar (collaborative work with the National University of Ireland-Galway)	Sally McCarrick, Galina Brychkova, Una Murray, Su Myat Noe, Maria Helen Dayo, Julian Gonsalves, Peter C. McKeown, Wilson John Barbon, Charles Spillane	Ongoing review and finalization by National University of Ireland-Galway
Myanmar Local Food Systems in a Changing Climate: Insights from Multiple Stakeholders	Phyu Sin Thant, Apple Espino, Giulia Soria, Edgard Rodriguez, Wilson John Barbon, Julian Gonsalves	Submitted to the open access <i>Journal of Environmental and Sustainability Indicators</i>
Pathways to Scaling Out Climate Smart Agriculture in Myanmar: Preliminary Assessment	Ohnmar Khaing, Wilson John Barbon, Julian Gonsalves	Manuscript ongoing review, targeted for CCAFS Working Paper
Climate Smart Villages in Southeast Asia: Case Studies and Lessons Learnt for Scaling of Climate Smart Agriculture (collaborative work with CCAFS)	Reiner Wassman, Rene Vidallo, Tiffany Talsma, Vinh Le Bui, Jerome Villanueva, Wilson John Barbon, Julian Gonsalves	Manuscript ongoing review, targeted as CCAFS Working Paper for September 2021
Building Adaptive Capacities of Local Communities: Stories of change from the Climate Smart Villages in Myanmar	Chan Myae, Van Bawi Lian, Salai Khar, Wilson John Barbon	To be made available in IDRC Connect and IIRR website

Problems and challenges

The most significant problem and challenges faced by this research project is the COVID-19 pandemic that started in 2020. Practically, this research lost most of the entire year to conduct strategic activities in the field and at the national level. There are other field activities, mostly meetings and workshops has been cancelled. As international travel was disrupted by the pandemic, a number of regional events and workshops were also cancelled or reformatted e.g. converted to virtual webinars in lieu of face to face meetings. Given the challenges and restrictions posed by the COVID-19 pandemic, the project was given a 6-month extension in 2021 from January 16 to July 15, 2021. With approval from IDRC, IIRR also re-aligned and re-designed a number of CSV activities as the pandemic context prevented IIRR from conducting meetings, workshops and training.

Another change in the context that happened was the sudden change in the political context of Myanmar when the Myanmar military took over the civilian government. This take over has resulted to massive national and international protests for the months of February up to April 2021. The protests have disrupted even more field activities including transport and banking making it difficult to move project funds. It was only in late April to May 2021 when the protests started to decrease that some of our schedule field activities by the partners happened. During this slowing down of field activities, the research team focused more on producing as many research papers possible

using the data sets collected from the CSVs from 2018 to 2020.

One risk identified in the proposal is operational risks caused by lack of capacity to implement the activities by the local partners. Since the 2018, IIRR has instituted mechanisms and activities that builds capacities of our local NGO partners especially the field researchers assigned to the research. We continued to facilitate learning exchange via WhatsApp, Facebook Group Page and Google Chats. For very important activities such as the baseline studies, validation of the baseline results and identification of adaptation options—IIRR has conducted internal training workshops for the local NGO partners to ensure that they are properly guided and the same time receive training. This reporting period we conducted a refresher workshop for the endline household surveys conducted in October-November.

Overall assessment and recommendations

The International Institute of Rural Reconstruction-Myanmar Program is privileged to partner with the International Development Research Center -Canada in this just concluded action research effort in the general area of community-based climate change adaptation with social learning, food security and nutrition co-benefits. This was a medium sized grant, proposed by IIRR and negotiated directly between the donor (IDRC-Canada) and a project proponent (IIRR). In a donor environment which increasingly relies heavily on competitive grant mechanisms, it is more challenging for smaller organizations to secure funding. What this effort has demonstrated is that there is a value for a donor to dedicate a small portion of its funding portfolio for unsolicited proposals for proponents which have a long track record for delivering on the front lines of climate action in ways which support participatory and incremental development which are likely to be sustained. In the early stages of this effort, senior officials from IDRC-Canada visited Myanmar, visited target sites and met with communities. IIRR and IDRC staff worked jointly and virtually met three times during the pandemic to resolve issues resulting from the pandemic in 2020 and subsequently from the political situation that engulfed Myanmar in 2021. In many ways, thanks to collaborative stance of IDRC, the IIRR team and its four local NGOs were able to re-strategize and shift its focus to research analysis, research report preparation and virtual events to validate research and increase visibility for the program.

IDRC should continue to support a few of such funding windows to its long time or new trusted partners. The IIRR staff were privileged to deal with IDRC staff and colleagues in Canada, Myanmar and India who were flexible, valuing the need for mutual respect, joint decision making and shared accountability. Hopefully IDRC and IIRR and our development partners got value for money from this partnership and the communities achieved lasting outcomes.

Annex 1:

Additional Tables

Table 1: Summary of Socio-Technical Methodologies and Tools in the Myanmar CSVs

Steps in the CSV Establishment	Methods/Tools	Purpose	Socio	Technical
Social Preparation	Opening Wedge Activities	To build community trust and initial interest to participate	•	
Assessment of Agriculture Systems and Climate Change Risk	Household Surveys	To facilitate targeting and monitoring outcomes	•	
	Participatory Vulnerability Assessments and Gender Analysis	To collectively identify and analyze climate risks to agriculture and gender To build awareness of climate change risks	•	•
Identification of Options for Adaptation	Focus Group Discussions (sector based)	To develop a menu of options based on local knowledge	•	•
	Secondary Research	To identify latest technologies and practices developed by scientists		•
Multi-location and participatory Testing of Identified Options	Participatory Varietal Selection	To field test new varieties of major crops To characterize new varieties vis a vis specific climate condition		•
	Crop Trials	To field test introduced crops to the system		•
	Demonstration	To field test integrated systems (e.g., trees, small livestock, gardens)		•
	Setting up adaptation fund	To support strategic adaptation options	•	
Farmer to Farmer Learning	Farmer learning groups	To share knowledge and materials	•	
	Farmer Field Days	To develop farmer specialists		
Scaling Out CSVs	Roving Workshops	To build awareness of policy makers and NGOs	•	

Table 2. Percentage of households who cultivated crops and owned animals by village and by year, Myanmar

Crops and Animals Grown	Htee Pu (n=243)		Taung Khamauk (n=85)		Ma Sein (n=87)		Sakta (n=112)	
	2018	2020	2018	2020	2018	2020	2018	2020
Crops								
Corn	6.17	0.00	75.29	77.65	0.00	0.00	22.32	42.86
Elephant foot yam	0.00	0.00	0.00	0.00	0.00	0.00	28.57	49.11
Fruits	0.82	2.47	3.53	0.00	0.00	0.00	16.96	25.00
Groundnut/Peanut	68.31	67.49	75.29	81.18	0.00	0.00	0.00	0.00
Pigeon Pea	18.11	29.63	7.06	10.59	0.00	0.00	0.00	0.00
Rice	0.00	0.00	63.53	85.88	26.44	19.54	30.36	16.96
Sesame	34.16	5.35	2.35	22.35	0.00	0.00	0.00	0.89
Sorghum	0.00	22.22	0.00	0.00	0.00	0.00	0.00	0.00
Tomato	13.58	27.16	0.00	20.00	0.00	0.00	0.00	0.00
Vegetables	0.00	3.29	15.29	4.71	8.05	0.00	80.36	60.71
Other crops	2.06	4.94	29.41	11.76	32.18	8.05	12.50	19.64
Animals								
Chicken/Poultry	22.22	49.38	14.12	4.71	28.74	27.59	55.36	73.21
Cow/Ox/Buffalo	44.86	46.09	51.76	17.65	0.00	0.00	42.86	13.39
Goat	7.82	18.93	0.00	0.00	0.00	0.00	0.00	1.79
Pig	8.23	6.17	36.47	10.59	40.23	18.39	34.82	60.71
Other Animals (horse, mythun, fish, rabbit)	2.06	2.06	0.00	0.00	0.00	0.00	10.71	2.68

Table 3: Options for Climate Smart Agriculture in the 4 CSVs

CSA Options	Why climate-smart?	No. of Individual Adopters			Climate Smart Villages			
		2018	2019	2020	Htee Pu	Saktha	TaungKha Mauk	Ma Sein
1. Participatory Varietal Selection (PVS)	Enable the farmers to identify which varieties work in a specific climate scenario.	38	65	122	•		•	
2. Diversification of farm production with vegetables; legumes with crop trials for new introduced crops	Minimizes the risk of losses in case climate variability reduced yields of main crop.	30	61	80	•	•	•	
3. Integration of fruit tree in farms (avocado, mango, banana, jackfruit, oranges)	Minimize the risk of losses; trees are more tolerant to variability of rainfall and temperature; sequester more GHGs	70	109	125	•	•	•	•
4. Planting of legume trees in farms and along boundaries (Alnus spp, Casia spp, Gliricidia spp)	Manages the soil degradation and erosion; minimizes dependence to artificial inputs, sequester more GHGs	17	13	89	•	•	•	
5. Homestead production of vegetables, fruits and cash crops	Addresses household food security and under nutrition in times of climate change stresses	40	70	132	•	•	•	•
6. Small livestock production in homesteads	Served as emergency assets in case of climate change shocks, provide opportunities for women	32	44	150	•	•	•	•
7. Aquaculture (homestead and farm ponds)	Diversify income sources, provide opportunities for women	7	21	20		•		•
8. Community-based animal propagation centers (pig, chicken, duck and fish)	Provide sustainable sources of stocks for HH level livestock production	0	16	1	•	•	•	•
TOTAL VILLAGERS PARTICIPANTS		234	399	719				
9. School gardens (vegetables, fodder, fruit trees)	Served as source of planting materials, education tool for students on CSA	3	4	4	•	•	•	•
10. Improving water storage facilities	Reduces the risk of water shortages in dry conditions	0	1	7		•		

Table 4: Gross Cash Received by Households from Selling Crops and Animals Produced (in MMK)

Crops and Animals Grown	SAKTA		TKM		MA SEIN		Sakta		Ave. Cash (in MMK) Received across all 4 CSVs		Variance (B-A)	% Change
	Ave. Cash (in MMK) Received ^a		Ave. Cash (in MMK) Received ^a		Ave. Cash (in MMK) Received ^a		Ave. Cash (in MMK) Received ^a		2018 (A)	2020 (B)		
	2018	2020	2018	2020	2018	2020	2018	2020				
Crops												
Corn	57,307		164,125	286,777			6,800		76,077	286,777	210,699	277.0
Fruits	370,000	92,083	266,667				49,474	67,143	228,713	79,613	-149,100	(65.2)
Groundnut/Peanut	19,157	56,012	37,414	67,364					28,285	61,688	33,403	118.1
Other crops	59,400	18,792	34,164	35,000	365,338	560,000	70,679	29,091	132,395	160,721	28,326	21.4
Pigeon Pea	142,841	307,285	47,500	29,333					95,170	168,309	73,139	76.9
Sesame	112,205	9,231	18,750	22,979					65,477	16,105	-49,373	(75.4)
Sorghum		27,830								27,830	27,830	
Tomato	117,664	66,544		814,412					117,664	440,478	322,814	274.4
Vegetables		3,688	339,046	167,500	20,857		717	3,235	120,207	58,141	-62,066	(51.6)
Rice			3,870	54,541	5,185,478	9,852,647			2,594,674	4,953,594	2,358,920	90.9
Elephant foot yam							159,688	55,455	159,688	55,455	-104,233	(65.3)
Animals												
Chicken/Poultry	55,699	357,238	4,000	40,000	275,675	263,492	17,726	14,073	88,275	168,701	80,426	91.1
Cow/Ox/Buffalo	21,101	25,000	142,500	293,333			52,083	400,000	71,895	239,444	167,550	233.0
Goat	76,842	58,152							76,842	58,152	-18,690	(24.3)
Pig	125,450	206,133					96,077	15,118	110,763	110,625	-138	(0.1)
Other Animals (horse, mythun, fish, rabbit)			123,274	108,111			94,833	1,000,000	109,054	554,056	445,002	408.1
												87.3
										Average % change		

Foreign exchange rate: \$US 1= MMK 1,250

Table 5. Wealth ranking (quintile) by CSV, Myanmar.

Wealth Quintiles	Htee Pu (%)			Taung Khamauk (%)			Ma Sein (%)			Sakta (%)		
	2018	2020	(p-value) ^a	2018	2020	(p-value) ^a	2018	2020	(p-value) ^a	2018	2020	(p-value) ^a
Wealthiest	39.92	39.09	0.864	3.53	5.88	0.688	0.00	0.00	NA	4.59	4.46	1.000
Above middle class	23.87	27.57	0.313	17.65	16.47	1.000	3.45	0.00	0.250	26.61	22.32	0.584
Middle Class	18.93	14.40	0.161	16.47	22.35	0.424	1.15	0.00	1.000	40.37	45.54	0.551
Poor	13.58	16.46	0.324	38.82	42.35	0.710	10.34	2.30	0.065	27.52	25.00	0.742
Ultra-poor	3.70	2.47	0.508	23.53	12.94	0.012	85.06	97.70	0.007	0.92	2.68	0.625

^a McNemar's test was conducted to determine if there is a significant difference on the proportion (increase or decrease) over time.

If p-value < 0.05, then the proportion is statistically significant at 5%

If p-value < 0.01, then the proportion is statistically significant at 1%

NA - not applicable

Table 6. Descriptive statistics of the wealth index during the baseline (2018) and the analysis of variance (ANOVA), Myanmar.

Village	2018 Baseline					2020 Endline				
	Minimum	Maximum	Mean	Std. Dev.	F-test	Minimum	Maximum	Mean	Std. Dev.	F-test
Htee Pu	-1.55	2.02	0.59	0.78		-1.08	1.94	0.60	0.66	
Taung Khamauk	-1.65	1.53	-0.33	0.65	199.41 **	-1.34	1.35	-0.08	0.55	391.75 **
Ma Sein	-2.52	0.67	-1.46	0.65		-2.78	-0.05	-1.78	0.37	
Sakta	-1.13	1.29	0.10	0.45		-1.11	1.30	0.15	0.42	

** significant at 1%

Table 7: List of Research Outputs available in Open Access Online Repositories

Available from IDRC Connect	
The profiles of the 4 climate smart villages and a primer of the CSV Concept (in Myanmar) are available IDRC Connect for public access with the following links:	<ul style="list-style-type: none"> ▪ Htee Pu CSV: http://hdl.handle.net/10625/57254 ▪ Taungkhamauk CSV: http://hdl.handle.net/10625/57255 ▪ Ma Sein CSV: http://hdl.handle.net/10625/57256 ▪ Saktha CSV: http://hdl.handle.net/10625/57257
Primer on the Concept of Climate Smart Villages (2018) in Myanmar language	http://hdl.handle.net/10625/57253
Compendium of adaptation options per agro-ecology (2018). All are available in IDRC Connect for public access.	<ul style="list-style-type: none"> ▪ Htee Pu CSV: http://hdl.handle.net/10625/59386 ▪ Ma Sein CSV: http://hdl.handle.net/10625/59384 ▪ Saktha CSV: http://hdl.handle.net/10625/59385 ▪ Shan state agro-ecology: http://hdl.handle.net/10625/59387
Nutrition Education Modules aimed for community facilitators	http://hdl.handle.net/10625/59401
Available from CGIAR-CCAFS Knowledgebase	
<ul style="list-style-type: none"> • Primers on Adaptation Options per CSV (2018) both in English and Myanmar language. The English version in these links: 	<ul style="list-style-type: none"> ▪ Htee Pu CSV: http://hdl.handle.net/10625/59380 ▪ Taungkhamauk CSV: http://hdl.handle.net/10625/59381 ▪ Ma Sein CSV: http://hdl.handle.net/10625/59379 ▪ Saktha CSV: http://hdl.handle.net/10625/59378
<ul style="list-style-type: none"> • Primers on Insights from the Implementation of the Myanmar CSVs (2020). English versions in these links: 	<ul style="list-style-type: none"> ▪ Htee Pu CSV: (https://hdl.handle.net/10568/108683) ▪ Taungkhamauk CSV: (https://hdl.handle.net/10568/108682) ▪ Saktha CSV: (https://hdl.handle.net/10568/110701)
<ul style="list-style-type: none"> • Training Documentation of the Training Workshop in 2019 conducted for members and leaders of the Food Security Working Group-Myanmar. 	https://hdl.handle.net/10568/107415
<ul style="list-style-type: none"> • Brochure on Promoting Nutrition in CSA is designed to community readers. Concepts are presented in very simple language with a lot of visuals. 	English version: (https://hdl.handle.net/10568/109055)
<ul style="list-style-type: none"> • Climate Smart Agriculture Options for Myanmar Small-Holder Farmers: Education and Training Posters for Villages. These are 10 posters, 9 are for specific technologies and practices on adaptation and then 1 poster on women empowerment in the CSVs. 	https://hdl.handle.net/10568/109054
<ul style="list-style-type: none"> • Primer on Nutrition Co-Benefits of Climate-Smart Agriculture in Myanmar 	https://hdl.handle.net/10568/107814