

Documenting the application of the Myanmar Climate-Smart Agriculture Strategy

Working Paper No. 292

CGIAR Research Program on Climate Change,
Agriculture and Food Security (CCAFS)

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Nang Ei Mon The
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RESEARCH PROGRAM ON
**Climate Change,
Agriculture and
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Correct citation: Htwe NM, The NEM, Naing NNZ, Hein Y. 2019. Documenting the application of the Myanmar Climate-Smart Agriculture Strategy. CCAFS Working Paper No. 292. Wageningen, the Netherlands: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Available online at: www.ccafs.cgiar.org

Titles in this Working Paper series aim to disseminate interim climate change, agriculture and food security research and practices and stimulate feedback from the scientific community.

The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) is a strategic partnership of CGIAR and Future Earth, led by the International Center for Tropical Agriculture (CIAT). The Program is carried out with funding by CGIAR Fund Donors, Australia (ACIAR), Ireland (Irish Aid), Netherlands (Ministry of Foreign Affairs), New Zealand Ministry of Foreign Affairs & Trade; Switzerland (SDC); Thailand; The UK Government (UK Aid); USA (USAID); The European Union (EU); and with technical support from The International Fund for Agricultural Development (IFAD). For more information, please visit <https://ccafs.cgiar.org/donors>.

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Abstract

This paper documents the testimonials of those who implemented the Myanmar Climate-Smart Agriculture Strategy (MCSAS) and accounts of those who experienced its application on the ground. Success stories and challenges in implementing MCSAS were documented. Based on the stakeholder interviews conducted, MCSAS is proven to be a valuable document in guiding the implementation of context-specific climate actions in Myanmar. Nineteen government and NGO programs, four policy documents, and an estimate of one billion USD investments were influenced by MCSAS. Following the MCSAS, the National Climate-Smart Agriculture Center of Yezin Agricultural University was established in 2018. Several projects focusing on farmers, particularly the Climate-Smart Village in the Dry Zone and the Farmer Field School in the Delta Zone, were also studied to understand the depth of the influence of MCSAS. In these cases, climate-smart practices adopted have helped farmers cope with climate change and increased their household incomes. Nevertheless, suggestions were made to further improve the Strategy with more specific actions that could be implemented and the funding options that implementers could pursue. The Strategy also needs to be integrated into the current programs of the government and its contents translated in the local language in a format that local people can understand.

Keywords: *Climate action; climate-smart agriculture; case study; SWOT*

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Acknowledgements

Special thanks to the CGIAR Research Program on Climate Change, Agriculture and Food Security in Southeast Asia for its financial support to conduct this study. Additional thanks go to the following individuals and institutions for their valuable contributions:

- Dr. Thanda Kyi, Deputy Director General, Department of Planning;
- Daw Thuzar Myint, Director, Land Use Division, Department of Agriculture;
- Dr Zarni Minn, Director, Department of Rural Development;
- Department of Agricultural Research:
 - Daw Mar Mar Aye, Assistant Director, Rice Section;
 - Daw Khine Khine Htwe, Research Officer, Agricultural Economics Section;
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 - Dr. Mar Mar Win, Research Officer, Pulses Section, Agricultural Economics Section;
- Dr. Nang Hseng Hom, Rector, Yezin Agricultural University;
- Dr. San Oo, Deputy Director General, Environmental Conservation Department;
- Ms. Nina Raasakka, Programme Officer, Myanmar Climate Change Alliance/United Nations Environment Programme;
- Dr. Khin San Nwe, Climate Smart Agriculture Specialist, Food and Agriculture Organization of the United Nations, Sustainable cropland and forest management in priority agro-ecosystems of Myanmar;
- Daw Yin Minn Latt, Country Program Officer, International Institute of Rural Reconstruction;
- Dr. Myo Ma Ma Than, Program Manager, Hilly and South-East program, Network Activity Working Group;
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- U Nyi Nyi Lwin, Field Coordinator, Myanmar Institute for Integrated Development; and
- Daw Tin Nilar Than, Township Coordinator/Agriculture Expert, Cesvi Foundation, Myanmar.

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Acronyms and Abbreviations

ADB	Asian Development Bank
ADS	Agriculture Development Strategy
CBA	community-based adaptation
CCAFS SEA	CGIAR Research Program on Climate Change, Agriculture and Food Security in Southeast Asia
CSA	climate-smart agriculture
CSO	civil society organization
DAR	Department of Agricultural Research
DECIDE	Decision mechanisms to Empower Communities and Integrate Development Elements
DOA	Department of Agriculture
DOP	Department of Planning
DRD	Department of Rural Development
ECD	Environmental Conservation Department
FAA	fish amino acid
FAO	Food and Agriculture Organization of the United Nations
FFS	farmer field school
GAP	good agriculture practices
GEF	Global Environment Facility
GHG	greenhouse gas
ICIMOD	International Centre for Integrated Mountain Development
IDRC	International Development Research Center
IIRR	International Institute of Rural Reconstruction
IPM	Integrated Pest Management
IRRI	International Rice Research Institute
MAPDRR	Myanmar Action Plan on Disaster Risk Reduction
MCCA	Myanmar Climate Change Alliance
MCSAS	Myanmar Climate Smart Agriculture Strategy
MEDA	Mennonite Economic Development Associates
MIID	Myanmar Institute for Integrated Development
MOALI	Ministry of Agriculture, Livestock and Irrigation
MONREC	Ministry of Natural Resources and Environmental Conservation
NAG	Network Activities Group
NGO	non-government organization
R&D	research and development

SLM-GEF	Sustainable cropland and forest management in priority agro-ecosystems of Myanmar
SRI	System of Rice Intensification
TWG	technical working group
UNEP	United Nations Environment Programme
YAU	Yezin Agricultural University

Introduction

Climate change poses a serious threat to livelihood security and worsens the risks experienced by climate-sensitive sectors such as agriculture and forestry. Due to the increased frequency and intensity of extreme weather events and climate variability, declining crop yields and associated economic losses create vulnerability within farming communities. To reduce climate vulnerability and adapt to a changing climate, awareness and understanding of current climate trends are indispensable capacities that an agricultural farming community must possess.

The Intergovernmental Panel on Climate Change published on its Fourth Assessment Report its findings on the observed climate trends, variability, and extreme events in Southeast Asian countries from 1951 to 2000. Temperature increase was recorded at 0.1 to 0.3 °C per decade, precipitation and number of rainy days had declined from 1961 to 1998, and droughts were normally associated with the El Niño Southern Oscillation years occurring in Myanmar, Laos, the Philippines, Indonesia, and Vietnam. Moreover, the frequency of monsoon depressions and cyclone formation in the Bay of Bengal has declined since 1970, but their intensity is becoming stronger, causing severe floods and dealing damages to life and property (Parry et al., 2005).

Based on the records in the last six decades (1951–2015), the rainfall in Myanmar has increased by an average of 29 millimetres per decade. Changes in rainfall have also influenced the duration of the monsoon season. The start of the southwest monsoon has been pushed at the latter part of the year while its withdrawal occurs earlier in the year (Aye, 2016). The Department of Meteorology and Hydrology, with the aid of the Regional Integrated Multi-Hazard Early Warning System, projected that from 2021-2050, the entire country would be warmed at 1.2-1.8 °C every June-November.

In the other months, the temperature would remain warm at the same magnitude but would be experienced only in the southern part of Myanmar and its deltaic region. Elsewhere in the country, warming would increase by 2.5–3.0 °C from December-May.

Meanwhile, precipitation was projected to increase by 10% over most parts of the country from March-November. In the northern, eastern, and central regions, rain would decrease by up to 80% during the cold months of December-February (Policarpio, 2015).

The key features of probable climate trends at the country level for Myanmar are: (i) a general increase in temperature with more extremely hot days and more extreme rainfall, resulting in more droughts and floods; (ii) an increased risk of flooding as a result of higher average rainfall intensity in monsoon events; and (iii) more variable rainfall in the rainy season, with an increase across the country from March to November and a decrease between December and February (Ministry of Natural Resources and Environmental Conservation [MONREC], 2018).

Myanmar is now experiencing more intense floods, cyclones, and droughts that deal immense loss of lives and suffering, damages to infrastructure and assets, and economic impacts. The impacts of climate change are felt down to the societal level, as the people's wellbeing and productive capacities, particularly in agricultural farming, are affected. Specifically, the shortening monsoon season and the increasing average annual temperatures are reducing the productivity of agriculture, pushing the people out of the country to seek for livelihood opportunities abroad.

This calls for more collective actions among relevant stakeholders, including the Government of Myanmar, civil society organizations (CSOs), non-government organizations, and local communities. The challenge now is for them to work together to build a climate-resilient and low-carbon Myanmar. The vision statement of the agriculture policy is *“by 2030, Myanmar achieves inclusive, competitive, food and nutrition secure, climate change resilient, and sustainable agricultural system contributing to the socio-economic well-being of farmers and rural people and further development of the national economy.”*

After committing to apply the principles and practices of climate-smart agriculture (CSA) to contribute to regional food security and environmental protection on 10 May 2014, the Myanmar Climate-Smart Agricultural Strategy (MCSAS) was launched in 2015. The launch was led by the Ministry of Agriculture, Livestock and Irrigation (MOALI) and relevant institutions and international development partners and was facilitated by the CGIAR Research Program on Climate Change, Agriculture and Food Security in Southeast Asia (CCAFS SEA) and the International Rice Research Institute (IRRI).

MOALI is the main implementing agency of the MCSAS, in collaboration with other government agencies and local and international partners within Myanmar and other countries in Southeast Asia. Currently, the Department of Agriculture (DOA), Department of Agricultural Research (DAR), and Yezin Agricultural University (YAU) are implementing several agricultural development projects in line with the Strategy, such as establishing a CSA centre in YAU.

In general, the MCSAS promotes climate change investments in agriculture and provides context and analysis in international climate negotiations. Moreover, other active climate adaptation and mitigation projects in agriculture are implemented by various organizations. The effectiveness of the MCSAS must be examined to assess its applicability in Myanmar.

Objective

This paper aimed to assess the relevance of the Strategy as a guide or reference of donors, non-government organizations (NGOs), international organizations, and government offices for their development/investment plan or curriculum development in Myanmar.

Approach and methodology

The study involved several stakeholder interviews and case studies. Based on the desk review of the current agricultural projects that focus on climate change, food security, and agriculture in Myanmar, the key informants for stakeholder interview were chosen and contacted for their permission and availability. The interviews were conducted from 3-30 April 2019. A total of nine government officials from two ministries and eight personnel from NGOs and development agencies granted personal interviews.

List of stakeholders from government institutions (union level)

1. Dr. Thanda Kyi, Deputy Director General, Department of Planning (DOP), MOALI, Nay Pyi Taw, Myanmar
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Stakeholder interview results

1. Discussion with Government Institutions

In examining the relevance of the MCSAS within the operations of government institutions in Myanmar, six major departments/institutions appeared to be relevant. MOALI was mandated to build the CSA system in the country. Under MOALI, the DOA, DAR, DOP, and YAU were tasked to formulate, implement, and coordinate in climate change, agriculture and food security matters. ECD under MONREC was the national focal point for all climate change policies and their related programs and projects in the country. Based on the extent of integration and incorporation of MCSAS into their activity, the discussions with the concerned departments were presented.

1.1 Department of Agriculture, MOALI

DOA implements the agricultural policies and strategies of MOALI, including the MCSAS. The main responsibilities of DOA are supporting the utilization of modern, advanced and sustainable production; processing and packaging technologies; and improving supply, transport and marketing technologies to increase the production of safe and nutritious agricultural, livestock, and fishery food products. These products are all capable of satisfying the growing needs and demands of local and external markets. Aside from these responsibilities, DOA is tasked to help farming communities in facing existing climate extremes and stresses in agriculture.

1.1.1 Integration of MCSAS into Concerned Actions

DOA joined in crafting the MCSAS with CCAFS, IRRI, and YAU in 2014. DOA set up its own action plans to apply CSA by following the approved MCSAS document.

The current policies of DOA related with climate change and agriculture are:

1. collaborate with internal and external organizations to acquire needed technology, construct basic infrastructures, and uplift the capacity of concerned departments and organizations,

aiming to mitigate losses and damages caused by natural disasters and implementing resilient agriculture, livestock and fishery activities;

2. support the empowerment of socioeconomic responsiveness of farmers, livestock keepers, and fisher folks in case that they are facing climate change and natural disasters; and
3. conserve natural ecological system to sustain increased utilization, mitigate soil and biodiversity losses, and improve soil fertility.

To transform these policies into action, DOA devised the following strategies. These strategies were improved by integrating the country's vision on agriculture with the short-, medium-, and long-term steps of MCSAS:

1. collaborate in the area of conservation and protection of ecological system and natural environment for the emergence of sustainable agriculture, livestock, and fishery activities;
2. conduct a program on genetic resources conservation and utilization with technical committees, relevant departments, and experts;
3. observe the Environmental and Social Management Framework in the implementation of the rural infrastructure development program;
4. control soil degradation in hilly, sloping, watershed areas in coordination with concerned departments. To mitigate soil erosion in the dry zone caused by water and wind, soil conservation farming practices, good agriculture practices, and effective water harvesting and use could be adopted;
5. release time-bound weather information to support the activities in the agriculture, livestock, and fishery sectors;
6. implement climate resilient good practices such as conservation agriculture, organic agriculture, good agriculture practices (GAP), biotic and abiotic stress-tolerant varieties (heat tolerance, salt tolerance, drought tolerance, deep water tolerance), good animal husbandry practices, good aquaculture practices, land use management, and green water management; and
7. enhance the implementation of Integrated Pest Management (IPM), soil conservation farming practices, crop rotation, and crop diversification programs.

1.1.2 Investment projects related with MCSAS

To accomplish their policies and strategies related to CSA, DOA carried out three investment projects from 2015 to 2018. The Climate Friendly Agriculture Program was a national level pilot project, implemented in Nay Pyi Taw Union Territorial Area from February 2015-June 2016. Although the MCSAS document was still developing at that time, it was seen as an opportunity for DOA, along with their experience on the Climate Friendly Agriculture Program. Supporting the adaptation programs in the Regional Trusts of MCSAS, DOA implemented two national level CSA investment activities: (1)

Green Water Management Program in selected areas in Mandalay and Magway Regions and (2) Nitrogen Use Efficiency Management Program in selected areas in Nay Pyi Taw and Sagaing Regions, from July 2016-May 2018.

By conducting these programs, success stories were achieved. Due to the implementation of the CSA program, local farmers improved their knowledge on climate change adaptation technologies, and participatory guarantee system. Through a farmer-to-farmer learning approach, green water management technologies were disseminated to other neighbouring farmers and villages. Specifically, the dissemination was conducted with the help of demonstration farmers as they could grow cash crops even in dry season by using rainwater harvested in ponds.

Farmers in the project areas realized that applying chemical nitrogen fertilizers, together with organic fertilizers, would improve nitrogen use efficiency of crops and uptake on this technology. Moreover, they improved their knowledge on which crop residues they should sequester to improve soil carbon and should avoid losing into the atmosphere, which would contribute to climate change on a long-term basis.

Currently, DOA is implementing the five-year national level investment program, “Land Resource Evaluation for Productive and Resilient Landscape in Central Dry Zone of Myanmar, 2016-2020.” It also follows the Regional Trusts and Cross-cutting Trusts of MCSAS. To strengthen their research and extension capability on climate change and agriculture, DOA conducted two critical actions in this investment program;

1. Training for soil survey and mapping and land capacity clarification, including technical assistant support to survey team, and providing equipment to township and district level offices; and
2. Training on crop suitability mapping (in terms of land and climate parameters), including support to survey team and promotion and demonstration of soil conservation techniques.

In the meantime, digital soil map was developed, and land suitability and land use planning were done for program implementation.

1.1.3 Lessons learn on MCSAS application in relevant programs

Based on DOA’s experience of applying the MCSAS, the Department recommended that it should present more comprehensive climate change scenarios. The potential impacts of climate change on crop production and the corresponding adaptation plans based on those scenarios should be mentioned for each agroecological zones of Myanmar.

MCSAS runs consistently with the missions of DOA, i.e., to disseminate agricultural technologies adaptable to climate change and do seed multiplications in DOA's seed farms, which are resistant and adaptable to climate change. However, a few limitations exist, making the implementation of MCSAS challenging to rural and agricultural development projects. These include (1) limited budget on extension activity (e.g. in Farmers Field School approach) and (2) need of suitable climate change adaptation model for each agroecological zones as Myanmar has different agroecological zones.

As a response, DOA suggested the following points: One of the principles of CSA is mitigation of greenhouse gas (GHG) emissions. As GHG emissions are mainly from soil process, soil management practices for GHG mitigation are being taught to staff and farmers. Moreover, since soil or land degradation is likely to bring more severe damages, soil and water conservation technologies such as Sloping Agricultural Land Technology, contouring, water harvesting, and conservation agriculture should be promoted. MCSAS should be translated in Myanmar language to be understood by the farmers. Specific action plans should be added but should be in line with the current agriculture-related policies and the Agriculture Development Strategy (ADS).

1.2 Department of Agricultural Research, MOALI

DAR is mandated "to develop improved high yielding varieties and hybrids with good quality and good regional adaptation to generate a profitable cropping system and production technology, to develop crop varieties and production technologies resilient to climate change and global warming, to develop agricultural technologies and biotechnology, and to disseminate research findings through Farmer Channel."

DAR's research policy is to increase crop productivity and farmers' income through applied agricultural research. The Department is primarily responsible for the: (a) development of new crop varieties and hybrids with high yield and good quality adapted to agro-ecological and climatic conditions; (b) increase in crop production by using quality seeds; (c) application of biotechnology and molecular techniques in breeding programs; (d) participatory breeding and selection of new crop varieties among farmers; (e) conservation of diverse genetic resources and released varieties and pre-breeding preparation of crops in the Seed Bank; (f) integrated pest and diseases management researches for the safety of consumers and environment; (g) participatory researches on GAP and Good Manufacturing Practices from seed to post-harvest of crops; and (h) establishment of National Agricultural Research and Extension System in collaboration with concerned agencies to strengthen research and development (R&D) activities, among others. Along with these responsibilities, most of their agricultural researches are contextualized under climate change as it is currently a pressing issue in the agriculture sector.

1.2.1 Integration of MCSA strategies into Concerned Actions

The Strategy guides DAR when it formulates its annual master plan of research programs. Specifically, the Strategy serves as a reference to contextualize the programs under a climate change lens. Using this lens, it provides various responsibilities to the different technical sections of DAR. For example, following the Strategy's mitigation program, the water utilization section researches about the reduction potential on methane of cultural practices, water management, and use of effective crop varieties.

Meanwhile, several other sections follow the adaptation priority programs of MCSAS. For instance, in the Biotech section, Rice and Food Legume Section, and Fibre Crops Section, climate-resilient crop varieties are developed as an adaptation strategy to climate change. At the same time, following priority programs of Cross-cutting Trusts of MCSAS, agricultural economics section is conducting researches for the effective policy implication and strengthening of agricultural policies to address climate change.

Supporting the MCSAS priority programs on "Strengthening Research and Extension," all the technical sections of DAR are performing relevant researches in their respective fields such as (a) rice varietal development for flood-prone environment; (b) rice varietal development for salinity-prone environment; (c) rice varietal development for drought-prone environment; (d) rice varietal development for high night temperature effect; (e) development of climate-resilient crop varieties, (f) assessment of climate-resilient crops varieties were ongoing activities; (g) development of short duration varieties of pulse; (h) drought- and heat-tolerant pulse varieties; (i) development of high-yield varieties tolerant to abiotic stress (drought, cold, submergence, salt) through double haploid breeding; (j) development of drought-tolerant varieties through in vitro nuclear technique; and (k) development of high-yield varieties with biotic and abiotic stress tolerance and good quality through molecular base technique.

1.2.2 Investment Projects related with MCSA strategies

Table 1 presents the ongoing research projects of DAR guided by the MCSAS.

Table 1. Climate Change and Agriculture projects Implemented by the Department of Agricultural Research

Program	Implementation Period		Level of implementation	Locations of project/program
	Start	End		
Climate friendly agribusiness value chain	2019	2026	National	Central dry zone of Myanmar
IRRI-CURE collaboration for Unfavorable Rice Environments	2010-2011	2016-2017	National	Ayarwaddy, Mandalay and Sagaing Regions on the areas of MyaungMya, Latputta, NgweSaung, NyaungTone, Wakhalma,

				Pathein, Kangyidaunt, Dhanyphyu, Pegu, DiteOo, Oattayathiyi
Rice based rural household in the lower region of the Ayarwaddy delta	2012-2013	2014-2015	Regional	Lower region of Ayarwaddy in the areas of Bokalay, Latputta, and Mwlamyaing kyne
Rice based rural household in the central dry zones	2013-2014	2014-2015		Mandalay, Sagaing and Magwe Regions in the areas of Meithila, Wonetwin, Hlaineret, Pakyoteku, Myine, Yinapin and Pale
Diversification and intensification of rice based cropping system in lower Myanmar	2011-2012	2015-2016		Pegu and Ayarwaddy Regions in the areas of Taunggu and Maubin
Machine harvestable variety	2018	Continued	National	Pulses growing region
Climate resilience variety with market preferences traits	2019	2022	National	Pulses growing region
Development of short duration & BB resistant rice variety.	2016	2021	National	Yezin
Development of submergence tolerant BB resistant rice varieties.	2016	2021	National	Yezin
Maker Assisted Backcrossing in rice for salt & submergence tolerant & BB resistant Line.	2015	2021	National	Yezin
Maker Assisted Backcrossing in tomato for TYLCV tomato Yellow leaf Curve Virus resistance line.	2017	2020	National	Yezin
Development of drought tolerant groundnut variety.	2018	2022	National	Yezin
Development of green gram for yellow mosaic resistance.	2018	2021	National	Yezin

The research project, Climate Friendly Agribusiness Value Chain, is being implemented by the agricultural economics section of DAR in partnership with the Asian Development Bank (ADB) and FAO. This project is funded with an amount of USD 64.92 million. The intervention areas are R&D,

institutional strengthening, enhancement of crop varieties and farming practices, crop and income loss risk management, disaster risk management, gender perception, public awareness, information and advisory service, and climate-resilient investment.

1.2.3 Lessons learn on MCSA strategy application in relevant programs

DAR prioritized climate-resilient research programs after receiving the MCSAS. Part of DAR's involvement in the MCSAS was its initiative to establish the National Agricultural Research System. Although the Strategy was being adopted by relevant government offices, a few concerns still arose based on the experience of DAR. For example, DAR pointed out the lack of information on the implementation plan, as well as the monitoring and evaluation process of MCSAS. In relation to this concern, the Department also called for developing specific action plans that are consistent with the Strategy.

Furthermore, public-private collaborations could improve its implementation. These collaborations could be formed by communicating the Strategy well to all relevant stakeholders. At the same time, the MCSAS must complement Myanmar's ADS and follow its sustainable development plan to catalyse an efficient implementation.

The MCSAS was believed to be an effective guide to build the resilience of agriculture systems while minimizing their emissions, both of which could enhance food and nutritional security and improve the livelihoods in the country. It must overcome communication-related hurdles such as the awareness of rural communities and encourage their participation to ensure its proper implementation.

1.3 Department of Rural Development, MOALI

DRD is undertaking sustainable rural development measures to improve the quality of life of people and their living standards. This department is the focal point for rural development in Myanmar and is mandated to construct rural infrastructures such as roads and bridges, rural water supply and sanitation, rural electrification, and rural housing. The DRD is also tasked to improve the livelihoods and income generation of the people.

Specifically, the responsibilities of DRD are on: (i) sustainable rural roads and bridges, promoting socioeconomic development and supporting agricultural productivity; (ii) water utilization plan to supply potable water; and (iii) national off-grid rural electrification systems. Additionally, DRD provides other basic social infrastructures in the rural areas to enhance the livelihoods and incomes of rural communities. These include a revolving fund, vocational trainings, and reconstruction of rural housing for communities in emergency situation and natural disaster.

1.3.1 Integration of MCSAS into Concerned Actions

DRD is conducting climate-related programs as part of its function. Myanmar's adaptation plan to disaster risk reduction, the Myanmar Action Plan on Disaster Risk Reduction (MAPDRR), was formulated and being implemented based on the MCSAS. The MAPDRR is an action plan that operating at the village level to reduce vulnerability and risk. Collaborating with ADB and DOA, DRD adopted several components of the Climate Friendly Agribusiness Value Chain Investment Project, especially for rural infrastructure development, covering 10,000 villages nationwide (around 30 villages from each township in Myanmar).

DRD is currently preparing to implement the "Resilient Communities Development Project," which consists of three components; (1) village-level community infrastructure development; (2) rural livelihood improvement by CSA practices; and (3) disaster risk management programs, covering climate change awareness and education and leading to the establishment of action committees. The investment for this project amounts to USD 230 million and covers 7,000 villages in 17 selected townships.

1.3.2 Lessons learn on MCSA strategy application in relevant programs

DRD has little experience so far since it is only at the early stages of utilizing the MCSAS. However, reviewing the document for their current works, the Department deemed the MCSAS comprehensive already. Detailed action plans and the corresponding estimated budget should be added, revised, or improved; the Department suggested.

1.4 Yezin Agricultural University, MOALI

The University was one of the focal institutions in crafting the MCSAS. As a leading academic institution in agriculture science and technology in Myanmar, YAU is developing undergraduate and post-graduate programs and curricula on CSA. The University is even enforcing CSA research and extension through multidisciplinary approaches.

Following the MCSAS, the National Climate Smart Agriculture Center of YAU was established in 2018. It is responsible for overall coordination of CSA initiatives, providing and disseminating information related to CSA, vetting training programs, increasing access to national and international expertise, and generating linkages and alignment among concerned institutions and with related national strategies. The Center aims to be a regional hub of excellent on climate change, agriculture, and nature resource management. Currently, its research programs are focused on agricultural adaptation strategies, practices, and perceptions of farming households and communities, as well as mitigation strategies such as crop physiology and GHG emission, and crop breeding programs on stress-resistant

and -tolerant varieties for stress-prone environments. The Center is currently at the operationalization phase, and is supported by FAO and the Global Environment Facility (GEF).

1.5 Environmental Conservation Department, Ministry of Environmental Conservation and Forestry

The ECD is one of the six departments under the Ministry of Environmental Conservation and Forestry. The Department is responsible for implementing national environmental policy, strategy, framework, planning, and action plan to integrate environmental issues into the country's national sustainable development process. This is implemented to promote natural resource conservation and sustainable utilisation and address pollution on water, air, and land. In implementing these activities, the Department works with government organisations, CSOs, private sectors, and international organisations.

The policy, strategy, and action plan of ECD related with climate change and agriculture are to: (1) develop a plan for climate change mitigation and adaptation, combat desertification, and ensure ozone layer protection; (2) implement, coordinate, and mainstream climate change adaptation and mitigation measures as described in the Myanmar Climate Change Policy and Master Plan; and (3) reduce the vulnerability of the people to climate change-related disasters and impacts. While no specific agriculture project operates under ECD, it is still responsible for bringing together representatives from the Myanmar Climate Change Policy and Myanmar Climate Change Master Plan for relevant discussions.

The ECD also utilized the MCSAS in crafting its master plans on climate change and agriculture. This led to a comprehensive plan for the two interconnected issues, which was eventually launched by the Myanmar government this 2019.

2. Discussion with Non-Government Organizations/Development Agencies

2.1 Myanmar Climate Change Alliance/United Nations Environment Programme

The Alliance was established in 2013 by UNEP and MONREC. Myanmar's overarching priority was the social and economic development of the country and its people. Observed and projected impacts of climate change pose as a threat for the country and can even reverse Myanmar's recent gains on social and economic development. Recognizing these circumstances, Myanmar called for a robust policy instrument, ensuring that all sectoral investments and development plans fully acknowledge and address the challenges posed by the changing climate. MONREC-led collaborative efforts that ran for over a year (April 2015-August 2016) and involved many stakeholders led to the formation of the Technical Working Group (TWG) on the MCCA Programme. In turn, the Programme crafted the Myanmar Climate Change Policy and the related Myanmar Climate Change Strategy and Master Plan, 2018-2030.

These were the guiding policy and strategic framework that would ensure that concrete, coordinated, and sustained actions over a long run could transform Myanmar into a low-carbon and resilient country.

2.1.1 Integration of MCSAS into Concerned Actions

The MCSAS was deemed as a strategic document in crafting the master plan for the agriculture sector. After the Master Plan was crafted, the following activities were conducted by the Alliance:

1. Successful implementation of comprehensive vulnerability assessment in Labutta, Pakokku and Hakha Townships and implementation of local adaptation plans and
2. Used the Master Plan for 2018-2030 as a basis to work with IRRI in developing separate plans for the agriculture, livestock, and fisheries under the context of CSA. Part of this development is conducting trainings for trainers.

Agriculture is an important means of livelihood in Myanmar, making the adaptation actions on this sector priorities of the government. In this regard, UNEP is working on several projects that help reinforce the multisectoral TWG on climate change. These projects include the Least Developed Countries Negotiators Global Support Programme, National Adaptation Plan Global Support Programme, and two Least Developed Countries Fund projects that will help Myanmar adapt to climate change and maintain and strengthen the institutional capacity needed to deal with this issue.

2.1.2 Lessons learn on MCSA strategy application in relevant programs

Based on the experience of MCCA and UN Environment, they highlighted the following points concerned with MCSAS.

1. It helped guide the capacity-building interventions under the MCCA for kickstarting the Master Plan for Climate Smart Agriculture, Livestock and Fisheries 2018-2030.
2. There is a good focus on rice production. Farmers may be reluctant to change their practices into those that better suit the changing climate. The challenge now is to encourage the farmers to adopt climate-smart practices in a format that suit them.

2.2 Food and Agriculture Organization of the United Nations, Myanmar

With the focus on climate change, food security and agriculture, FAO Myanmar has been implementing SLM-GEF project since July 2016 in closed collaboration with MOALI and MONREC. The project aims to build the capacity of farming and forestry stakeholders to mitigate climate change impacts and improve land condition by adopting CSA, sustainable forest management, and sustainable land management policies and practices.

2.2.1 Integration of MCSAS into Concerned Actions

Following the MCSAS and other relevant policies, the Project helps in mitigating the looming threats of climate change under which Myanmar is vulnerable. The project works at national, sub-national, and community levels and will have a solid field component consisting of farmer field schools (FFSs) and community-based forestry activities. These activities can build the capacities of farmers and communities and identify the best practices for scaling up in three agroecological zones:

- In the Delta, the primary focus for capacity building is on climate-smart paddy farming, alternative crops, water management, and mangrove protection.
- In the Central Dry Zone, focus is on reforestation and afforestation, water-saving agricultural techniques, agroforestry, and annual crops.
- In Chin State, focus is on community-based forest management, shifting cultivation, and complementary strategies on forest and cropland components.

In addition, the MCSAS served as a guide in preparing the CSA handbooks for FFSs (in the delta, dry zone, and hilly regions) and for researchers and other stakeholders, as well as for the CSA curriculum for undergraduate and post-graduate students at YAU.

2.2.2 Investment projects related with MCSA strategies

Currently, FAO Myanmar is conducting a national level investment project related to climate change, agriculture, land management, and environment. Titled, “FAO SLM-GEF,” the project has been running since 2018 and will end in 2020. It focuses on climate change adaptation and mitigation. The Project’s policy, strategy, and action plan are focusing on these issues:

1. Improvement of current CSA strategy;
2. Production of road map for CSA implementation
3. Capacity building/trainings/workshops on CSA

Specifically, the major programs implemented by this project are shown in Table (2).

Table 2. Current Programs of FAO SLM-GEF project, Myanmar

Programs	Implementation Period		Level of implementation	Location of project/program	Collaborative Organization
	Start	End			
Need Assessment for Climate smart Agriculture	March, 2017	May, 2018	National, Regional, Local	Chin State Mandalay Region Ayeyawady Region	Department of Agriculture offices Yezin Agricultural University

Farmer Field School Implementation for Climate smart Agriculture	October, 2017	December, 2020	Local	Chin State Mandalay Region Ayeyarwady Region
Establishment/ Operationalization of CSA Center			National	Yezin Agricultural University
Curriculum/ Handbook Development			National Regional Local	
Training of Trainers for DOA staff	2018	2020	National, Regional. Local	Project sites across the country

Following the MCSAS, the FAO SLM-GEF project collaborates with MOALI in integrating various related programs. A few priority programs stated from the MCSAS such as coherent policy institutional strengthening, R&D, enhanced crop varieties and farming practices, public awareness, and information and advisory service were integrated into the policy, strategy, and action plans of the SLM-GEF project. The activities in FFSs and the establishment of the CSA Center were only two of the success stories that arose from this collaboration.

2.2.3 Lessons learn on MCSA strategy application in relevant programs

According to interview results, they viewed the MCSAS as a good reference to collaborate with governments and international organizations to address climate change issues in agriculture. The FAO SLM-GEF project representative explicitly stated that the MCSAS was a useful source of information for their program and some parts of the Strategy could be used as a training material when conducting trainings. MCSAS provided all stakeholders with an overall understanding of MOALI's priorities related with climate change issues in agriculture. The stakeholders learned about the contents of short-, medium-, and long-term steps of CSA implementation in Myanmar. However, the MOALI staff, specifically the junior personnel, are yet to be assessed if they can fully understand the Strategy because it is currently available only in the English language.

Regarding the other plans of the FAO SLM-GEF project on climate change and agriculture, the CSA activities mentioned in the MCSAS will be implemented as much as possible during the project period. Furthermore, FAO actively collaborates with government institutions to craft coherent policies on priority programs of cross-cutting thrusts in the MCSAS.

Similar with the stakeholders interviewed, the FAO SLM-GEF project provided recommendations to improve the MCSAS:

- The review and improvement of the MCSAS consistent with current policies and available information such as Myanmar's ADS and Myanmar Climate Change Policy.

- Accessibility and distribution of MCSAS to all relevant stakeholders in both English and Myanmar languages
- Development of outreach materials on climate change in Myanmar language, which suit the situation and needs of various target groups
- Introduction and integration of MCSAS to community awareness, knowledge, and education to enable target groups to learn more about climate change and disaster preparedness
- Formulation and implementation of action plans in a sustainable manner
- Systematic observation and research activities, as well as technical, financial, and expert support

2.3 International Institute of Rural Reconstruction, Myanmar

2.3.1 *Integration of MCSAS into Concerned Actions*

The activities of IIRR in Myanmar are part of its commitment to demonstrate and promote participatory and people-driven approaches to rural development. With support from CCAFS SEA, IIRR established Climate-Smart and Nutrition-Smart Villages in rural areas. These villages would serve as platforms to scale out CSA technologies and practices in Myanmar, supporting the Regional Thrusts and Cross-cutting Thrusts of the MCSAS. The CCAFS-funded program supporting strategic field-level activities has led to more resources and support from key stakeholders. In particular, the International Development Research Center (IDRC) provided funding for a three-year project that would fully implement the Climate-Smart Village approach in Myanmar.

The new project, “Scaling Out Community-Based Adaptation via Climate Smart Villages: Platforms to Address Food Insecurity in Myanmar,” is implemented to see how a network of CSVs implementing community-based adaptation (CBA) processes can effectively influence potential next-users to replicate such processes. Building on the current knowledge base on undertaking gender-sensitive and nutrition-friendly CBA and local-level scaling-out of CSA, the project is implemented through participatory action research in four selected villages.

After looking into Myanmar’s plans on climate change and agriculture and consulting the MCSAS, IIRR has focused on the following activities:

- to provide complementary support in the implementation of the MCSAS;
- to contribute in the body of knowledge available for local and international organizations working towards the resilience of vulnerable communities in the country;
- to test and adopt the CSV approach as a platform for community-based adaptation processes and for developing and testing climate-smart and nutrition-smart technologies in each agro-ecological zone of Myanmar;

- to develop and implement an approach to scale-up community-based adaptation through the CSVs in each agroecological zone; and
- to encourage national and sub-national (regional and township) governments concerning agricultural development policies and programs to scale up CBA processes via the CSVs.

Meanwhile, based on the MCSAS, these are the current programs of IIRR in Myanmar (Table 3).

Table 3. Current Programs of IIRR CSVs project

Programs		Implementation Period		Level of implementation	Location of project/program	Collaborative Organization
		Start	End			
Scaling Out Community-based Adaptation (CBA) via Climate Smart and Nutrition Villages as Platforms to Address Food Insecurity in Myanmar		2018	2020	Regional and Local	Chin State: Hakha Township, Sakta village Southern Shan State: NyaungShwe Township, TaungKhamauk village Mandalay Region: Nyaung U Township, HteeHpu village Ayeyarwaddy Region: Bogalay Township, Ma Sein village	KMSS (Karuna Mission Social Solidarity) KMF (Kalayarna Mitta Foundation) CDA (Community Development Association) RDA (RadanaAyar Association) DAR (Department of Agricultural Research) YAU (Yezin Agricultural University)
Applying seasonal climate forecasting and innovative insurance solutions to climate risk management in the agriculture sector in SE Asia		2019	2022	Regional and National	2 Agro Eco Zones in Myanmar (Not identified yet)	DMH (Department of Meteorology and Hydrology) DAR (Department of Agricultural Research) DOA (Department of Agriculture) YAU (Yezin Agricultural University) DALMS (Department of Agricultural Land Management and Statistics)

2.3.2 Lessons learn on MCSAS application in relevant programs

Following the MCSAS, IIRR works in R&D, institutional strengthening, crop varieties and farming practices, crop and income loss risk management, disaster risk management, gender perspective in CSA, CSV approach, public awareness on climate change, information and advisory service, and climate-resilient investment agenda of various projects. In doing so, IIRR believes that the MCSAS is an important piece of policy document because: (i) it provides the vision and direction on how Myanmar will build resilience on its agriculture sectors; (ii) it serves as a platform for collaboration between government, international NGOs, and donors to direct crucial investments to the components of building a climate-resilient agriculture sector in the country; and (iii) it laid out the priorities for government budget and personnel that needs action.

The strengths of the MCSAS, as listed by the IIRR, are:

- MCSAS follows a systems approach to the entire agriculture sector and not only focusing on crops. It provides opportunities to anchor CSA in the broader program of rural development.
- MCSAS recognizes the role and value of stakeholders such as government, academe, private sector, and development organizations in achieving climate resilience in agriculture.
- MCSAS prioritizes knowledge generation and sharing, which is important in the process of climate adaptation.

IIRR pointed out the following aspects in the MCSAS that could still be improved and strengthened:

- The current document lacks a provision for implementing mechanisms. It needs to define the lead office, the collaborating agencies, and their roles and responsibilities.
- The MCSAS lacks a long-term investment plan that will present how the implementation will be funded.
- The MCSAS must tackle other aspects that can improve the climate resilience of Myanmar. These include food security, nutrition, food systems, infrastructure development, and agriculture finance.

The new project, “Applying seasonal climate forecasting and innovative insurance solutions to climate risk management in the agriculture sector in South East Asia” complements CSV activities, providing climate information services and crop advisory in Myanmar that will benefit farmers, institutions, and business sectors along the climate service value chain. Aside from this, IIRR-Myanmar is committed to develop and implement climate resilience in agriculture as its flagship program.

2.4 Network Activities Group, Myanmar

The Network Activities Group (NAG) is a non-profit, non-governmental organization dedicated to improving the lives of people in Myanmar. The main approaches of NAG are building the capacity of

the people and community-based and CSOs, creating economic opportunities and promoting good governance in target areas. Overall, NAG aims to implement sustainable development activities for the poor and vulnerable people of Myanmar.

The strategic aim of NAG are to (1) promote relevant and viable business opportunities for the communities through increased access to investments, technology, and capital; (2) establish strong policies, specifically in natural resource management, food security, and livelihood development, through active community participation; (3) empower communities by allowing them to speak up in decision-making processes; and (4) fulfilling their basic needs through accountability and transparency. These activities, many of which are focusing on livelihood development, food security, and natural resource management, started in 2015 and would end in 2020.

Following the MCSAS, NAG implemented the following programs with international NGOs (Table 4).

Table 4. Current Programs of Network Activities Group project

Program	Implementation Period		Level of implementation	Location of project/program
	Start period	End period		
Rice production	March 2016	March 2020	Local	Kayin State
Mang Bean value chain	September 2017	February 2020	Regional	Magwe Township, Minbu Township and Kayan Township, Thone Gwa Township
Sesame Value chain	2013	2019	Regional	Magwe Region

2.4.1 Lessons learned on MCSAS application in relevant programs

Based on the discussions with NAG, they recognized that the MCSAS is a valuable reference for implementing climate change-related projects in agriculture. Specifically, the following programs were attributed from the Strategy: coherent policy formulation, institutional strengthening, public awareness, improvement of crop varieties and farming practices, public awareness, crop and income loss risk management, disaster risk management, and information and advisory service. Following those programs, NAG's current activities on rice seed production and marketing became relevant to the MCSAS. A total of 700 smallholder rice farmers from 33 villages in two townships participated on these programs.

The NAG added that the Strategy is relevant to local NGOs as well since it deals with preparing projects on climate change and agriculture. This must be translated to the local language, though, to be understood even by non-experts.

2.5 Cesvi Foundation, Myanmar

Cesvi started its operations in Myanmar in 2002, and soon after signed its first Memorandum of Understanding with the Ministry of Health. In May 2008, activities were rapidly expanding to support post-Nargis relief efforts. Cesvi's goal in Myanmar is to empower communities to enable them to achieve their goals and engage with local governments and stakeholders. Inclusiveness, participation, and ownership are at the core of Cesvi's approach of Community Empowerment Programming. Cesvi has been promoting community-based participatory planning and development at the village level since 2006 and developed the manual, "Decision mechanisms to Empower Communities and Integrate Development Elements (DECIDE)." DECIDE presents a wide range of approaches, tools, and practices for promoting participation and accountability among community development committees. These are used by communities to select beneficiaries and develop transparent and realistic action plans.

Cesvi has integrated community inclusion and empowerment into its climate change and food security projects and water and sanitation action plans. Moreover, the Foundation is implementing adaptation activities through research and extension action plans with consultancy firms. Following MCSAS, Cesvi has been conducting capacity building activities on CSA practices through FFSs, trainings, and farmer visits in the dry zone from since 2016.

Aside from these activities, participatory demonstration of climate-smart crop diversification and intensification and agroforestry were conducted in the dry zone. These were complemented with a seed program to produce drought-resistant and heat-tolerant short-duration varieties, as well as postharvest and processing program (including storage facilities, seed banks, crop threshers), all which have been implemented since 2012. Participatory crop varietal selection on rice, groundnut, and cotton coincided with these activities. The selection was conducted in the dry zone from 2017-2019 with YAU, DOA, and DAR.

From these activities, Cesvi was able to generate a few success stories:

- Enhanced knowledge and skills on CSA practices such as optimized plant population, minimum tillage, natural compost, and insecticide making and use and increased accessibility to the following: CSA advisory services at the community level government extension agents; and drought-, heat-tolerant, pest-resistant short-duration crop varieties
- During the project intervention, farmers could harvest 15% more yield than those that practised monocropping (only groundnut) and could even reduce the risk of climate change and market instability.
- A total of 450 acres of lands established for agroforestry plantations

- Over 3,000 farmers received climate-resilient crops and varieties through village-level seed multiplication farms even beyond the project support. Among the 500 seed growing farmers, 30% of them achieved a 10% increase in income by producing and distributing qualified seeds.
- Using locally made rice and multi-crop threshers, food loss was reduced from 38% to 24% in paddy, from 50% to 34% in groundnut, and from 53% to 35% in pulses (green gram, pigeon pea and green gram).
- Three kinds of heat-tolerant rice varieties were chosen by farmers and scientists through four times of mothers and baby trails in Shwe Bo and Myingyan Townships.
- A new variety, the YZG99013 groundnut, was chosen by farmers and scientists as the best drought-tolerant variety.

The future plans of Cesvi related with climate change that are dependent on donor approval are: (1) Climate Friendly Value Chain action in the dry zone (2019-2022); (2) agroforestry (2019 -2020); (3) research, extension, and capacity building (2019-2020); (4) institutional strengthening; and (5) scaling up of agricultural infrastructures (i.e., storage) (2019-2022). With FAO, Cesvi will utilize FFSs to teach CSA (2019-2020).

Based on the MCSAS, research and extension was deemed as an entry point to formulate coherent policies and build strong national and local institutions. Still, the Strategy must address sustainable management of natural resources such as crop lands, forest lands, and residues to promote rural and agricultural development.

2.6 Myanmar Institute for Integrated Development, Myanmar

The Myanmar Institute for Integrated Development (MIID) is a non-profit institute collaborating with governments, communities, local CSOs and NGOs, international organizations, and technical specialists to strengthen capacities, governance processes, knowledge bases, and intervention models for an integrated development program. Several activities of MIID that could be related with the MCSAS are improving livelihoods, enhancing access to water supply, and equipping communities with relevant capacities to address key issues and manage natural resources in the Southern Shan State. These are conducted with the International Centre for Integrated Mountain Development (ICIMOD).

Several action plans of MIID related with climate change and agriculture are natural resource management and agriculture, food security, and nutrition. All of these plans contribute to the adaptation and mitigation measures of Myanmar to its agriculture sector. The project of MIID that is specifically related with agriculture is the “HIMILICA: Rural Livelihoods and Climate Change Adaptation project,” which was implemented in the Nyaung Shwe and Kalaw Townships in Southern Shan State from January 2014-December 2017. HIMILICA was a 700,000-dollar project whose primary beneficiaries were mountainous communities. The project reached 400 farmers with the help of ICIMOD.

MIID has yet to fully access the MCSAS, keeping them from providing feedbacks about the Strategy's utilization on the ground. This calls for an improved availability and accessibility of the Strategy to local NGOs. It must be translated to the local language to enable them to fully grasp its contents.

3. Strengths, Weaknesses of, Opportunities for, and Threats to the MCSAS

3.1 Strengths

- MCSA follows a systems approach to agriculture and provides opportunities to anchor CSA in the broader program of rural development.
- It recognizes the role and value of stakeholders such as government, academe, private sector, and development organizations in achieving climate resilience in agriculture.
- It emphasizes knowledge generation and sharing, a key step in climate adaptation.
- It guides capacity building interventions in crafting policies, programs, projects, and action plans related with climate change issues (e.g. Myanmar Climate Change Policy and Myanmar Climate Change Master Plan)

3.2 Weaknesses

- The current document does not define clearly how actions will be implemented. Specific action plans and map plans are missing; the roles and expected contributions of implementing offices are still vague.
- The MCSAS lacks a clear long-term investment plan.
- It should cover other related issues such as food security, nutrition, food systems, infrastructure development, and agriculture finance. Moreover, the Strategy must be in line with Myanmar's ADS.
- The MCSAS must be written in both English and Myanmar languages to improve its accessibility to relevant stakeholders.
- It is not yet known if the staff from MOALI can access or fully understand the MCSAS.
- The Strategy lacks complementing outreach materials written in the Myanmar language and suited for various audience groups.
- The sustainability of the action plans is still in question.
- Farmers have poor level of knowledge about climate change.

3.3 Opportunities

- Stakeholders can understand the overall picture of MOALI's climate change policy as the MCSAS mentioned its short-, medium-, and long-terms steps.

- The Strategy can promote transformative technologies to local communities if it can discuss clearly the cost of adoption and resource use effectiveness.
- Implementation can be efficient if the Strategy is linked with the ADS.
- Aside from the ADS, the Strategy must complement current policies such as the Myanmar Agriculture Development Strategy, the Myanmar Climate Change Policy, and the Myanmar Climate Change Strategy and Master Plan.
- The MCSAS must be discussed in communities and schools through awareness campaigns and academic activities. It can be integrated with the discussions on climate change and disaster preparedness.
- Systematic observation and research activities are needed, together with technical, financial, and expert support.

3.4 Threats

- The farmers understanding, or lack thereof, may hinder their motivation to change their practices. Any intervention must be communicated in a format they can understand.
- The lack of clear guidelines on implementation, roles and responsibilities, investment plans, and other key information may discourage stakeholders to utilize the Strategy.
- The activities that can come from the MCSAS may be redundant if they are not properly integrated with the existing policies, strategies, and programs of the government. Integration with programs concerning related issues (food security, agricultural finance, and nutrition, among others) must be achieved as well.

4. Highlight of MCSA Strategy Outreach

- Based on the records from the CGSpace Database on 24 October 2019, the MCSAS document has already been downloaded 9,970 times. It can be downloaded from the link <https://cgspace.cgiar.org/handle/10568/69091>.
- The assessment team observed a remarkable amount of investment on CSA through the MCSAS. Under MOALI, different departments have specific budget allocation for CSA-related projects, including the five-year USD 64.92-million project, Climate Friendly Agribusiness Value Chain, by DAR and DOA and the USD 230-million project, Resilient Communities Development Project by DRD. Since 2016, the estimated amount of investment on CSA has been about USD 1 billion and the average annual investment amounts to about USD 150-200 million throughout the country. These investments cover cross-cutting issues such as food and nutrition security.

By reviewing and referring to the MCSAS, the following outputs were produced:

4.1 Climate Change and Agriculture projects

1. Climate Friendly Agriculture (2015-2016, DOA)
2. Green Water Management (2016-2018, DOA)
3. Nitrogen Use Efficiency Management (2017-2018, DOA)
4. Land Resource Evaluation for productive and Resilient Landscape in Central Dry Zone of Myanmar (2016-2020, DOA)
5. Climate friendly agribusiness value change (2019-2026, DAR)
6. Climate resilience variety with market preferences traits (2019-2022, DAR)
7. Development of short duration & BB resistant rice variety (2016-2021, DAR)
8. Development of submergence tolerant BB resistant rice varieties (2016-2021, DAR)
9. MAS in rice for salt & submergence tolerant & BB resistant Line (2015-2021, DAR)
10. MAS in tomato for TYLCV tomato Yellow leaf Curve Virus resistance line (2017-2020, DAR)
11. Development of drought tolerant groundnut variety (2018-2022, DAR)
12. Development of green gram for yellow mosaic resistance (2018-2021, DAR)
13. Implementation of comprehensive vulnerability assessment in Labutta, Pakokku and Hakha Townships and implementation of local adaptation plans (MCCA)
14. Master Plan for Climate Smart Agriculture, Livestock and Fisheries, through development of training module for ToT (MCCA, IIRI)
15. Sustainable cropland and forest management in priority agro-ecosystems of Myanmar (SLM-GEF) (2016-2020, FAO)
16. Scaling Out Community-based Adaptation (CBA) via Climate Smart and Nutrition Villages as Platforms to Address Food Insecurity in Myanmar (2018-2020, IIRR)
17. Applying seasonal climate forecasting and innovative insurance solutions to climate risk management in the agriculture sector in SE Asia (2019-2022, IIRR)
18. Addressing Climate Changes Risk on Water Resources and Food Security in the Dry Zone of Myanmar (2015-2019, Cesvi, UNDP Myanmar, Adaptation Fund)
19. Rural Livelihoods and Climate Change Adaptation project (2014-2017, HIMILICA, MIID)

4.2 Policy Documents

1. MOALI. (2018). Myanmar Agriculture Development and Investment Plan (2018-2022). NayPyiTaw, Myanmar: Ministry of Agriculture, Livestock and Irrigation.
2. MONREC. (2018a). Myanmar Climate Change Master Plan (2018-2030). NayPyiTaw: Republic of the Union of Myanmar, Ministry of Natural Resources and Environmental Conservation.

3. MONREC. (2018b). Myanmar Climate Change Policy. NayPyiTaw: Republic of Union of Myanmar, Ministry of Natural Resources and Environmental Conservation.
4. MONREC. (2018c). Myanmar Climate Change Strategy (2018-2030). NayPyiTaw: Republic of the Union of Myanmar, Ministry of Natural Resources and Environmental Conservation.

The following are the academic and research works published by following the MCSAS:

4.3 Books

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4. International Water Management Institute (IWMI). 2015. *Improving water management in Myanmar's dry zone for food security, livelihoods and health*. Colombo, Sri Lanka: International Water Management Institute (IWMI) 52p.
5. Yasuhito Shirato and Akira Hasebe 2019. *Climate Smart Agriculture for the Small-Scale Farmers in the Asian and Pacific Region*, National Agriculture and Food Research Organization (NARO), Tsukuba, Japan and Food and Fertilizer Technology Center (FFTC) for the Asian and Pacific Region, Taipei, Taiwan, ISBN-978-4-908914-02-7.
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7. Thornton, P.K., Rosenstock, T., Förch, W., Lamanna, C., Bell, P., Henderson, B. and Herrero, M., 2018. A qualitative evaluation of CSA options in mixed crop-livestock systems in developing countries. In *Climate Smart Agriculture* (pp. 385-423). Springer, Cham.

4.4 Peer Review Papers

1. Hein, Y., Vijitsrikamol, K., Attavanich, W. and Janekarnkij, P., 2019. Do Farmers Perceive the Trends of Local Climate Variability Accurately? An Analysis of Farmers' Perceptions and Meteorological Data in Myanmar. *Climate*, 7(5), p.64.
2. Hein, Y., Vijitsrikamol, K., Attavanich, W. and Janekarnkij, P., 2019. Economic Assessment of Climate Adaptation Options in Myanmar Rice-Based Farming System. *Journal of Agricultural Science*, 11(5), 35-48.

4.5 Conference Papers

1. Hein, Y., Vijitsrikamol, K., Attavanich, W., & Janekarnkij, P. (2018a). Climate Trends,

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Case studies of successful MCSAS implementation

Based on the stakeholder interviews, two stories from the dry zone and delta area of Myanmar were studied. The first case study was conducted on a beneficiary village of FAO's FFSs in the Ayeyarwaddy Delta. The success of the FFS program is narrated below.

Case Study (1): Farmer Field School Program, Maung Tee village, Latbutta Township, FAO SLM-GEF Project

Implementation: FAO, AVSI Foundation and MOALI

Funding: Global Environment Facility

Duration: 2018-2020

FAO has been implementing a set of projects collectively known as "Sustainable cropland and forest management in priority agroecosystems of Myanmar" since July 2016. It promotes various relevant CSA techniques and practices mainly through FFSs in five pilot townships. In the Delta, the FFS program focuses on: (a) climate-smart paddy farming; (b) alternative cropping system; (c) water management; and (d) mangrove protection. FAO implemented FFS activities in Latbutta Township in 2018. At the beginning of the project, 15 villages were selected as pilot villages and 30 farmers per village were selected as participants in the FFS committee.

Under the FFS programs, 11 technical sessions are conducted wherein basic technical knowledge are shared with the local farming community. The following concepts and practices are distributed by FFS programs.

1. Concept and Practices of CSA including conservation agriculture, crop rotations, and GAP
2. System of Rice Intensification (SRI) including its methods, preparation of homemade organic compounds, indigenous microorganism, fish amino acid (FAA), and tobacco-chili-ginger pesticide
3. General discussion and field practice on SRI including dynamic group exercises and special topics
4. IPM
5. Agroecosystem analysis
6. Exchange visit programs
7. Farmer's field day
8. Postharvest technology

9. Farming as a business
10. IPM on green gram and general discussions
11. Harvesting of green gram and general discussions

With the coordinated efforts of relevant departments and local authorities, these FFS programs were carried out in their target areas. Maung Tee village was one of the project beneficiary-villages and actively participated in the FFS program. The village is situated in Latbutta Township, Ayeyarwady Region in the delta of Myanmar. Almost all areas in the Region experience excessive rainfall and severe flooding. These are effects of climate variability that can deal major impacts on agricultural production and land degradation.

A total of 258 households live in Maung Tee Village. From a population of 566 villagers, 48% is female while the rest are male. Some of the villagers serve in the private sector and government but the major livelihood in the village is still agriculture. More than half (53%) of the village population relies on this sector for livelihood and food. Agriculture occupies 1,342 acres of land in the village, with farm size ranging from 20-50 acres on average and being owned by 256 households.

As a result of knowledge sharing and training programs under the FFS, almost all the participating farmers in Maung Tee Village improved their awareness aware on local climate change. For instance, they now perceive that monsoons are becoming more unpredictable and irregular because of late entry (i.e., after June), early offset, reduced rainfall, and decreased number of rainy days.

During a monsoon, the amount of rain has been decreasing while the duration of rainy days has been erratic. With temperature becoming warmer in the monsoon, summer, and winter seasons, the usual experiences of farmers no longer come in a consistent manner. There are times there are no extreme event and stress such as saltwater intrusion and flood. Short dry spell occurs during the crop season and rain unexpectedly falls in the critical period of crop growth.

Due to these changes in the climate, rice yield has decreased. The dry spell and unexpected rainfall, specifically, are considered the major climate stress in local farming.

“We noticed that we suffer the impact of climate especially extreme heat because of mankind activities especially in logging trees.”

- FFS committee, Latbutta Township

Before the FFS program, agricultural productivity was limited by the absence of appropriate practices to conserve the soil, prevent erosion, and improve the production. Farmers in Maung Tee Village only relied on traditional cultural practices for rice production once. They had limited access to new technologies and farming practices, and are generally reluctant to change their usual farming practices.

In 2017, FAO introduced CSA rice production techniques like the SRI, alternate wetting and drying, preparation and application of FAA, utilization of indigenous microorganisms, use of effective microorganism solutions, establishment of vermiculture unit, compost making, and use of light trap for insects. FAO implemented these activities by working with the local Department of Agriculture offices and through the technical assistance from service providers (e.g. AVSI Foundation).

They provided local farmers with rice seeds to apply CSA practices on their fields. Among those who received rice seeds, champions were selected to share their practices via farmer-to-farmer approach. These champions were obliged to showcase their lands and assist in the demonstrations. Aside from demonstration exercises, knowledge sharing and training programs were conducted under an FFS. On a normal program, a credible resource person would speak in the morning; the practical part of the program will follow in the afternoon.

A farmer named U Win Naing shared his experiences as a farmer champion. At 52 years old, he already has 35 years of experiences on his 10-acre farm. Before adopting the SRI, he was practicing traditional methods that he believed would produce better yields. When he adopted the SRI, he saw that the seedlings were smaller and younger than those produced from traditional methods. He realized then that these seedlings had grown stronger and eventually convinced his fellow farmers to adopt the SRI and other CSA practices as well.

By that time, they had believed that the CSA practices they adopted were suitable on their farms. He received various forms of incentives for his service as a champion of the SRI method. The incentives were either in kind or in cash, including weeder tools and coverage for production costs on his demonstration plots. U Win Naing was grateful of the lessons he learned:

“I am very thankful for this FFS program as it has made us realize the modern and environment-friendly rice production technology. Before, we had no awareness about the impacts of climate change on rice production, but now we have some insights on it. This is exactly what this project has brought to us.”

- U Win Naing, Maung Tee village, Latbutta



An FFS Committee was established and joined by 30 farmers in Maung Tee to oversee the operations of the FFS programs. Muhn Naing Oo is one of its members. He is 62 years old with 45 years of farming experiences. He also owns 68 acres of lowland. After actively participating in the FFS programs, he was elected as the leader of the Village. Muhn Naing Oo shared that:

“I have learned some knowledge related with agricultural technologies, organic agriculture and preparation of bio-fertilizer from the FFS program activities. Moreover, I have improved my knowledge about seed, soil and water management, pest and disease management, fertilizer and agrochemicals application, soil conservation practices, role of weather information in farming, and water-saving technologies by participating in this FFS program.”

He believes that through the lessons and experiences they gained from the FFS, they were able to cut their crop losses and, in turn, increase their yields. With the yields increasing, his income increased as well, enabling him to pay his household’s debt and improve their standard of living. Muhn Naing Oo added that he and the other farmers now prefer agricultural adaptation practices to climate change than other knowledge and cultural practices.

Daw Khin Than Win is a 54-year old female member of the FFS Committee. She owns nine acres of agricultural lowland and 40 years of farming experiences. Before the FFS intervention, they were applying conventional rice farming that failed to provide enough income for their family. To

compensate the lack of income from farming, her family applied for alternative jobs.

When she was introduced to the SRI, she believed that her family could save production inputs and even gain more benefits. This motivated her to engage in FFS programs and share what she learned with her fellow farmers. Similar with the other farmers, FAO provided her with SRI-based technologies to save seeds, water, and money that would have been allotted for fertilizers and plant protection chemicals.

Another female member of the FFS Committee is Ma Thin Thin Cho, a 40-year old owner of 10 acres of lowland in the village. She has been farming for 20 years already, burning rice straw after harvesting to save transport costs and using it for household purposes. After attending the FFS programs, she learned that this practice pollutes the air, removes soil nutrients, and emits carbon contents into the atmosphere. Instead of burning, she now buries the rice straw to produce compost, which can become organic fertilizer for her rice fields.



“Being a member of the FFS committee has many benefits for me because I got knowledge about agriculture technologies and perceived the effect of rice production from climate change. Moreover, I also got experiences by visiting other FFS in the township and observed on their progress and making

comparisons with my village. So, I thank FAO and related organizations very much for giving me the opportunity to become a member of FFS committee.”

- *Ma Thin Thin Cho, Maung Tee village, Latbutta*

Even with these testimonials, the impacts of the FFS programs are difficult to view and measure since this intervention is only at the implementation stage. However, according to the interview results, the FFS programs has just achieved its desired results, some of which are even visible already: increased crop yields and increased CSA adoption rate of farmers. Their awareness on the relationship of climate change and agriculture has also improved significantly.

The project implementation employed an educational approach, wherein participants learned in a classroom-like setting and applied the lessons in demonstration farms and site visits. By the end of this FFS program, there may be a sustainable application of CSA practices.

The second case study is conducted in one of the CSVs managed by IIRR. The CSV is found in the dry zone of Myanmar.

Case study (2): Climate Smart Village, Htee Pu village, Nyauung U Township
Implementation: International Institute of Rural Reconstruction
Funding: IDRC and CCAFS
Duration: 2017-2019

With support from IDRC-Canada and CCAFS, IIRR and its local partners implemented a three-year research project that aimed to deepen and build the current knowledge base on conducting gender-sensitive, nutrition-centric CBA and local level scaling out of CSA. The CSVs established by IIRR and its local partners in 2017 represented the four major agroecological regions in the country: the central dry zone, mountain uplands, upland-plateau, and delta.

Nyaung U Township, one of the dry zones in Central Myanmar, is suffering from the impacts of climate variability. Lesser rainfall, drought period, late entry and early offset of monsoons, and soil degradation exacerbated by intensive cultivation are the common problems on this region.

Htee Pu village is found in Nyaung-U Township in the Mandalay region of Myanmar’s dry zone. A total of 1,180 villagers live on this village, 51% of which is female. The villagers are grouped into 275 households and rely on crop cultivation, livestock rearing, casual labor, and home-based jobs such as

processing in toddy palm and tamarind as sources of livelihood. Crop cultivation accounts for 50% of the livelihood activities followed by livestock rearing at 15%. The village administrator reported that farmers were primarily growing pigeon pea, tomato, sesame, and groundnut on the 1000 acres of arable lands in the village.

In 2017, the Htee Pu CSV was established by IIRR and the Community Development Association. They conducted participatory varietal selection on pigeon pea, ground nuts, and green grams, as well as small-scale livestock rearing, cultivation of perennial fruit trees at home, FFS, and trainings on agricultural practices. Among these activities, the farmers were most interested on school garden, small-scale livestock rearing, and home gardening.

At the beginning of the project, IIRR gave some fruit trees such as mango, guava, and pomegranate to the farmers who owned 30 acres of farmlands. This was to promote income diversification and reduce potential losses from the effects of climate change. Currently, 20 women-led households were tapped to grow jackfruit, dragon fruit, and custard apple on their lands as additional source of income and contribution to nutrition security. Meanwhile, to establish small-scale livestock farming, the project provided two goats to those women-led households as they are deemed poor and lacking the capacity to conduct home-based businesses.

These households were tasked to multiply the initial number of livestock on their farms. Another activity in the CSV was the crop diversification program through participatory approaches. IIRR supported the growing of groundnut seeds (2 tin per households) to upland farmers.

Through the CSV activities, the farmer noticed the changes in the weather in the last five years and perceived that such changes brought negative impacts on crop production, livestock rearing, and even human health. Low rainfall, water scarcity, temperature increase, and low productivity are the major issues on this CSV. Moreover, dry spell period occurring in crop season and unexpected rain in critical crop growth period are also happened in Htee Pu village.

Majority of farmers in the village believed that “climate is changing because there are excessive use of agrochemicals, rapid deforestation, and accumulation of industrial waste.” This change is reflected in the summer becoming longer and dominant compared to the other two seasons (Monsoon and Winter). Temperature has surpassed the seasonal averages during these periods.

Rainfall in the area has been gradually decreasing in terms of amount and duration in the last five years. Onset of monsoon is becoming late too. Normally, it will start on May; it now comes after June. During the middle of the monsoon season—a critical period for crop growth—the amount of rain decreases, and duration of rainy days shortens. The exit of monsoons remains the same, though. Overall, the local farming community thought that those climatic changes brought negative impacts on their farming activities.

U Lwin Ko, a farmer engaged in the programs in the CSV, shared his experience. He is already 44 years old with 20 years of farming experience under his belt. He owns three acres of agricultural land and practices monocropping of sesame or pigeon pea. In the recent years, however, those crops were no longer profitable due to changes in the climate. He had no idea how to change his farming activities due to limited alternatives and available water source. The case is similar with the other farmers in Htee Pu Village.

Monocropping would eventually be replaced by intercropping with the help of the CSV program. U Lwin Ko got 25 mangoes seedlings from IIRR and began mango gardening as an alternative on his farmland. After he realized that these tree-crop farming practice could provide him a more secured farm income than monocropping, he expanded his mango cultivation to 200 trees. He shared:

“We learn many beneficial knowledge from the IIRR CSV project, and the most likely activity is climate-smart agriculture technology. With the support of them, I can change my farming activity to tree-crop farm from monoculture. I really appreciated the mango seedlings to begin an alternative farm activity. It would be better if IIRR could support enough numbers of seedlings to the farmers in need. It makes crop diversification in my farming. Now I am thinking to grow other potential tree crops and raising an orchard if the chance permits me.

They not only introduced alternative crops, IIRR also supported livestock farming opportunity for poor and women-headed households in our village. It is very effective for these household and it helps to reduce household poverty. Additionally, I would like to add one more demand of our village. It is the supply of water both for household use and agricultural purposes. Water shortage is a serious problem for our village, and it is better if some organization supports to cope this problem”

- U Lwin Ko, Htee Pu Village

U Nyo Wynne is a 71-year old farmer with 50 years of farming experience. He joined the participatory varietal selection and tree-crop farming programs to improve the income generation of his 10-acre farm land. Like U Lwin Ko, he found the planting of sesame and pigeon pea no longer profitable and looked for an alternative.

He had received 50 mango seedlings from IIRR and eventually grown his mango plantation to 100 trees. He found this alternative better than monocropping since it reduces the frequency of land preparation. Now, using the knowledge and skills he learned from the other CSV programs implemented on his community, he plans to adopt rainwater harvesting and storage for his farm. He expressed his enthusiasm in leaning water-saving technologies.

Neighboring farmers finally noticed the benefits of this alternative practice and planned to adopt it on their farms. Htee Pu Village is now becoming a potential area for mango production in the Naung U

Township. The farmers believe that commercial mango production will be eventually established.

Daw Htay Lin is a 50-year old female participant of the CSV programs. She owns no land and therefore cannot generate enough income for her family. However, due to her participation on the programs, she was elected as leader of the women's group on her village. She is now building home gardens with fruit trees and managing a small-scale goat farm. These activities are providing income for her family. Currently, she is looking for more trainings on livestock and a more secure water source for her home garden.

Daw Myint Kyi is a 54-year old female participant of the CSV programs. Like Daw Htay Lin, she owns no land and is already a widow. Before the CSV programs, she worked as a hawker, selling tamarind leaves and some products from her home garden in Nyaung U. She was able to learn goat raising and home gardening in the CSV program and now can contribute income on her family. She shared that:

“I am very pleased with the project because their technical assistance and supports have been very helpful to our family. We really want to see the sustainability of project outcomes in our area. Once I did not have any initial capital for small-scale farming and home garden expansion. But now our family owns some livestock animals and expands our home garden activity. We can make secured income from those farming activities and we can adapt the risk of income losses due to unfavorable weather condition in agricultural farming activity.”

- Daw Myint Kyi, Htee Pu Village

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Appendix

Photos during stakeholder interviews













RESEARCH PROGRAM ON
**Climate Change,
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The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) is led by the International Center for Tropical Agriculture (CIAT). CCAFS is the world's most comprehensive global research program to examine and address the critical interactions between climate change, agriculture and food security. For more information, visit us at <https://ccafs.cgiar.org/>.

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