The Current State of Climate Change Perceptions and Policies in Myanmar: 2014 Report

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Abstract

This report was constructed to assess the current perceptions and policies regarding climate change in Myanmar. It is comprised of a country report outlining current policies relating to climate change, as well as results from two stakeholder perception surveys conducted at the local and national level in Myanmar. The stakeholder perception survey was administered to 33 local stakeholders and 12 national stakeholders from government organizations, farmers' groups, universities, and research institutes. Results indicate that the primary concern regarding climate change is mostly concentrated on rainfall trends, such as drought and flooding. In addition, local stakeholders have concerns over heat stress, whereas national stakeholders are less concerned with the issue. Only 11 local stakeholders report that their institution currently has a division or staff member working on climate change issues. Seven of 12 national stakeholders reported that their institutions did have a division or staff member working on climate change issues.

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Background

The CGIAR consortium initiated the research program on Climate Change, Agriculture, and Food Security (CCAFS) in 2011. The stated goal of the research program on CCAFS is, "*to promote a food-secure world through the provision of science-based efforts that support sustainable agriculture and enhance livelihoods while adapting to climate change and conserving natural resources and environmental services."* To help achieve this goal, CCAFS has been divided into four themes: (1) adaptation to progressive climate change, (2) adaptation through management of climate risk, (3) pro-poor climate mitigation, and (4) integration for decision making.

By phase two in mid-2015, the original themes of CCAFS will be replaced with four flagship programs: (1) climate-smart agricultural practices, (2) climate information services and climate-informed safety nets, (3) low-emissions agricultural development, and (4) policies and institutions for climate-resilient food systems. Topics of importance to CCAFS, such as gender, innovation, and knowledge, will be integrated across all flagships.

The Policy Information and Response Platform on Climate Change and Rice in ASEAN and its Member Countries (PIRCCA) project is one of the trial projects funded under Flagship 4. PIRCCA has an overarching goal to enable policy makers in ASEAN countries to make informed decisions on: (1) food security policies focusing on the supply and availability of rice, (2) climate change adaptation policies, and (3) gender action plans. The relevance and foundation of this project stems from the outstanding role of rice for food security in ASEAN countries and the specific vulnerabilities of rice production to climate change impacts. ASEAN member states have committed to act as one community in improving their capacity to adapt and mitigate the effects of climate change in their respective countries. However, these initiatives are hampered by the limited access to relevant data, information, and scenarios that could help them decide on R&D approaches/methods in addressing climate change challenges at different scales. The PIRCCA project aims to establish a platform of information exchange between stakeholders at different levels and scientists. The proposed platform will bridge the gap between science and policy makers, and also establish informal and operational links with other stakeholders, such as the private sector.

There are three sets of activities in the PIRCCA project over the period 2014-2017. The first set, entitled "Setting the Stage", includes: (1) identification of key stakeholders and engagement mechanisms, (2) identification of key national priorities and knowledge gaps in terms of climate

change and food security, and (3) identification of geographical domains for up-scaling and out-scaling of proven good practices that can inform decision making on adaptation to climate change. The second set of activities, denoted as “knowledge generation for policy application”, includes information profiling toward the needs of specific user groups, data management, and capacity building. The last set of activities, which represents the heart of the PIRCCA project, is denoted as “strategic alliances for paradigm adjustment”, and it aims to create a network for efficient information exchange among ASEAN stakeholders in different institutions.

The PIRCCA project in its impact pathway is expected to contribute to two major outcomes by 2019. First, recommendation from the PIRCCA project will lead to rice policies that will be mainstreamed into at least 3 provinces in the Mekong Delta in Vietnam and one municipality in Myanmar. In order to achieve this outcome, the PIRCCA project recommendations are expected to contribute to the rice restructuring program in Vietnam in 2015, as well as in Myanmar in 2016. Second, at least one equitable food system policy incorporating climate-smart practices is to be fully implemented in Vietnam, Myanmar, and at least two other ASEAN member states by 2019. This target is to be measured through: frequency of times in which climate-information is considered in decision making by sub-national and national governments, the number of policy dialogs negotiating the use of climate information in decision making, the number of training participants who agree to follow up with their respective ministries and institutions after PIRCCA trainings, and collaboration among strategic alliance groups quantified as the number of letter of agreements between alliance group partners.

This report summarizes the major activities undertaken in 2014 under “Setting the stage” and highlights major findings and implications for subsequent activities in the coming years.

Vietnam and Myanmar as Target Areas

Ideally, the PIRCCA project would have been implemented in all ASEAN countries. However, resource constraints dictated that PIRCCA be implemented on a smaller scale. As such, Vietnam and Myanmar were selected as the target areas for the PIRCCA project. This decision was based largely on the variation of the rice sectors between the two countries. Vietnam, the second largest rice exporter in the world, has a very well-developed rice economy. Conversely, Myanmar’s rice economy is less developed compared to many of its ASEAN neighbors. This dichotomy among the two countries allowed for analysis to be conducted concurrently on rice sectors at two very different levels of development.

Myanmar Country Report

Background

Despite many great technological advances in the second half of the 20th century, weather and climate are still key factors in determining agricultural productivity in most areas of the world. Agriculture is one of the most vulnerable sectors affected by climate change. Climate change-related phenomena, including unusual fluctuations in temperatures and rainfall patterns, as well as their associated impacts on water availability, pests, diseases, and extreme weather events, are likely to substantially affect the potential of agriculture production (Swe and Nandar 2011).

Climate change impacts pose risks to food security in communities that are susceptible to poverty and degradation of properties. The current variability and extreme in climate, and future changes to the normal range of temperatures and rainfall caused by increasing global concentrations of greenhouse gases (GHGs), constitute direct climate risks to food production. Such risks to agriculture vary across time and locations, depending on different agro-ecosystems, farming practices, and production conditions. Accordingly, strategies in adapting to these impacts require adjustment to variable circumstances of rural people in diverse landscapes. Understanding the requirements of information to manage climate risks in these varied contexts is very important.

In Myanmar, climate change has only recently become a priority of the government. The country's vulnerability to climate change was widely recognized after the catastrophic destruction and loss of lives and livelihoods brought about by the tropical cyclone Nargis in 2008. Identified potential climate change impacts on Myanmar include incremental sea-level rise, saltwater intrusion, loss of mangroves, higher incidence of drought, loss of biodiversity and ecosystems such as wetlands, and loss of land resources. Myanmar is already experiencing some effects of climate change—a clear trend in rising temperatures, shorter monsoon duration, and greater frequency of intense rainfall and severe cyclones along Myanmar's coastlines (Drakenberg and Wolf 2013).

Indeed, most formal assessments suggest that climate change will affect Myanmar significantly. Major expected changes include rising temperatures, higher rainfall, and a possible shorter rainy season, which, in combination, will contribute to a considerable increase in flooding. Rising sea levels along the coasts are likely to compound these problems by aggravating saltwater intrusion and soil salinity in the coastal areas and river deltas. By the end of the century, climate studies project that mean temperatures will rise between 1 and 4 degrees in Myanmar, though

outcomes will vary throughout the year and spatially across the country (RIMES 2011, World Bank 2012). Average maximum temperatures are likely to increase as well.

Recent climate studies, such as those conducted by RIMES (2011) and World Bank (2012) project that average rainfall will increase by around 10% over the coming decades, particularly during the monsoon season. Combined with a continued shortening of the rainy season observed over the past 40 years, many climatologists expect greater concentration and variability in rainfall that will lead to increased frequency and intensity of flooding (RIMES 2011, World Bank 2012). Other studies, however, which highlight potentially conflicting information about rainfall totals and extremes, suggest that there may have been no significant trends over recent decades (RIMES 2011). Together with expected increases in the sea level, the changes underway place Myanmar among the most vulnerable countries globally in terms of projected changes in extreme weather, agricultural productivity loss, and sea level rise (Wheeler 2011).

Climate change perspective on present agricultural policies and initiatives

(a) Agricultural policies related to the climate change issue

The agricultural policies, laid down by the Ministry of Agriculture and Irrigation (MOAI), are mainly focused on the food and nutrition security of Myanmar. These food and nutrition security policies do not only promote the productivity of the agricultural sector and the livelihoods of rural people, but also encourage mitigation and adaptation strategies for climate-resilient farming systems to some extent.

At the 24th ASEAN Summit held on 10 May 2014, Myanmar had agreed to practice climate-smart agriculture (CSA) for specific agricultural policies on the climate change issue. Currently, climate-smart agriculture strategies in Myanmar are being formulated and will be launched soon. The government of Myanmar is also driving to initiate crop insurance programs to mitigate negative impacts of climate change.

(b) Agricultural initiatives related to the climate change issue

Some climate change adaptation measures are currently implemented by MOAI, along with its food and nutrition policy. These agricultural initiatives related to climate change measures are: cropping system adjustment; use of stress-tolerant crop varieties; crop diversification and intensification; application of good agricultural practices, including the modified system of rice intensification (SRI), alternate wetting and drying (AWD) method, and hybrid rice technology. In

some areas, farmers practice some adaptation and mitigation measures using their indigenous knowledge such as delay in sowing time (crop calendar adjustment), dry plowing before rainfall to harvest rainwater, and changing cropping patterns from monocropping to multiple cropping.

Institutional Settings Concerning Climate Change Adaptation

Unlike most countries in the ASEAN region that have already established a high-level governmental body responsible for the development and implementation of policies, plans, and measures to address climate change issues at the national level, Myanmar has yet to develop one (Lian and Bhullar 2010).

The government of Myanmar has taken several steps toward sustainable development, conservation of natural resources, and disaster risk reduction. In July 2013, the Myanmar Disaster Management Law was enacted. The Law includes the provisions for formation of disaster management bodies and their duties and responsibilities for all phases of disaster, and the establishment of a disaster management fund at the national and region/state level. The law also provides guidance to carry out the measures of disaster risk reduction along with other development plans of the country. However, even with the existence of the Myanmar Disaster Management Law, there is still need for laws on regulatory mechanisms that focus directly on building the resilience and adaptive capacity of communities and ecosystems to climate change impacts. Other identified existing laws that, in one way or another, relate to climate change mitigation or in reducing emissions of greenhouse gases (GHGs) and pollutants are, the Forest law Act (1992), the Wildlife Act (1994), and the Protected Area and Forestry Policy Statement (1995). As climate change impacts could severely undermine economic growth in Myanmar, the formulation and implementation of policies that directly relate to climate change adaptation is vital for sustainable development (National Environmental Conservation Committee, Ministry of Environment Conservation and Forestry [MOECAF] 2012).

At present, tasks related to climate change adaptation are being deputized to the Department of Meteorology and Hydrology (DMH). For this, the DMH is assigned with activities relating to climate change and adaptation such as: observing meteorological and hydrological data; analyzing data; issuing timely warnings and forecasts; monitoring changes in climate condition; cooperating with related organizations and neighboring countries; researching climate phenomena; issuing global and local climate change; organizing international and local seminars, meetings, and workshops; educating the public about climate change effects and adaptation; and cooperating in projects for climate change adaptation (Yi 2012).

Myanmar under the UNFCCC

The Government of Myanmar signed the United Nations Framework Convention on Climate Change on 11 June 1992 and ratified it on 25 November 1994. Apart from developing its National Adaptation Programme of Action (NAPA), Myanmar, in fulfilling its commitments and obligations, was also required to prepare its Initial National Communication (INC). Through the INC process, Myanmar gradually built its institutional, scientific, technical, informational, and human capacity at all levels. This safeguards the country's effective implementation of the Convention in a sustainable manner. The INC project focused on analyzing levels of GHGs, climate change scenarios, associated risks and vulnerabilities, potential measures and technology transfer for mitigating climate change and the degree of public awareness on climate change issues (NAPA 2012).

A Glimpse of Myanmar's National Adaptation Programme of Action

The National Adaptation Programme of Action (NAPA) to Climate Change (2012) serves as the simplified, rapid, and direct channel for least developed countries to communicate their urgent and immediate adaptation needs. NAPAs emerged from the multilateral discussions on adaptation measures within the UN Framework Convention on Climate Change (UNFCCC). The NAPA report states that its principal goal is to identify and communicate priority activities (referred to as Priority Adaptation Projects) to address Myanmar's immediate and urgent adaptation needs for implementation that will help the country to adapt to climate change impacts by building/enhancing the resilience of vulnerable communities. The objectives of Myanmar's NAPA are to: (1) communicate observed and projected climate change impacts in Myanmar; (2) prioritize adaptation projects for eight main themes—Agriculture, Early Warning Systems, Forest, Public Health, Water Resources, Coastal Zone, Energy and Industry, and Biodiversity; (3) assist Myanmar in achieving its national developmental goals and strategies; and (4) communicate NAPA Priority Adaptation Projects for Implementation in Myanmar to address immediate climate change adaptation needs and thereby build the climate change resilience in vulnerable communities. NAPA specifies 32 urgent and immediate priority adaptation projects for effective climate change adaptation in the eight main sectors/themes mentioned. It has identified agriculture, early warning systems, and forest as the first priority sectors. Priority adaptation projects, as well as the sectors, were selected using participatory discussions and analyses, including expert opinions and community and cultural/traditional

knowledge. For agriculture, the priorities set in building climate change resilience in vulnerable communities are encompassed in the following identified projects (DMH 2012):

> **Priority 1:** Reduced climate change vulnerability of rural and subsistence farmers through locally relevant technologies, climate-resilient rice varieties, and ex-/in-situ conservation of plant genetic resources.
>
> **Priority 2:** Increased climate change resilience of rural and subsistence farmers in the Dry and Hilly Zones through legume crop diversification and climate-resilient varieties.
>
> **Priority 3:** Increasing the climate change resilience of Dry Zone communities by diversifying and intensifying home-gardens through solar-power technology, high-income fruit crops, and climate-smart agriculture approaches.
>
> **Priority 4:** Reducing the vulnerability of livelihoods in agro-ecological zones to climate change through the transfer of a wide range of high-yielding and climate-resilient rice varieties.

Under the NAPA, the following measures have been implemented in Myanmar to improve agricultural productivity and ensure food security:

- The government implemented 129 irrigation projects between 1988 and 2002. This includes the Thapnahseik Dam, which is the largest dam in Southeast Asia.
- The International Development Enterprise (IDE) project: (1) developed small-pot water technologies, for example, micro-irrigation facilities (treadle pumps and engines), and (2) created linkages between local farmers and fruit and vegetable markets. This has enabled certain farmers in Myanmar to move from subsistence rainfed farming to small-scale commercial (and thus income-generating) farming.
- In the Central Dry Zone, varieties of crops are cultivated using crop intensification systems. This includes: (1) mix/multiple cropping systems, that is, two or more crops in the same field to improve soil fertility, increase crop yield, and act as insurance against crop failure, and (2) sequence cropping systems, that is, two or more crops in a time sequence in a year to reduce intercrop competition.
- In the Ayeyarwaddy Delta, a range of rice varieties have been introduced for cultivation, including traditional quality, salt-tolerant, deepwater, waterlogged, and submerged rice varieties, such as Pawsan Hmway, Pawsan Baygyar, and Pharpon Pawsan. These are highly valued and cover 20% of the Delta region.

Based on the needs identified by vulnerable communities, the following is a summary of the options that should be considered for effective adaptation in the agriculture sector:

- Planning for climate change/variability to reduce the impacts of drought, heat stress, and other climate extremes on crop yields;
- Agronomic management practices to conserve soil and water, for example, mulching, cover crops, conservation tillage, integrated nutrient management, and contour terraces;
- Sustainable water use and management to increase/maintain the availability of water supplies for drinking and irrigation;
- Sustainable crop management, including climate-resilient and early-maturing varieties, and conservation of traditional varieties to increase/maintain crop production under a changing climate;
- Sustainable climate-resilient mixed farming systems (including floating farmlands) that integrate livestock (cattle, goats, pigs, ducks, and fish) and crops, as well as agroforestry systems that mix crops, trees (e.g., tamarind, mango, neem, lead tree, and cutch tree), and livestock; and
- Restoration of abandoned agricultural fields that have perennial and species with soil binding root systems in order to conserve soil, increase water infiltration, and reverse land degradation/aridification.

Myanmar's NAPA report on climate change was sent to the UNFCCC in May 2013. Adhering to the priorities stated in the report, the Minister for Transport, U Nyan Tun Aung, stated that the implementation of the NAPA proposals would benefit rural communities and the nation by promoting sustainable development (Phyu 2013).

Identified Key Gaps, Barriers, and Challenges

Five major gaps can be identified as barriers to effective adaptation against climate change impacts: (1) weak coordination among concerned institutions, (2) inadequate and insufficient information, (3) poor resource mobilization, (4) weak technology, and (5) lack of proper formulation of policy. The national agenda on climate adaptation should focus on overcoming these gaps at macro level policies as well as in sector level policies/strategies, so that the country can successfully overcome the threat of climate change.

Climate change is a complex problem that cannot be solved through efforts of a single ministry. Different activities are undertaken by various agencies under the direct guidance of the

country's vice-president. Not only government agencies, but also a significant number of other stakeholders, are undertaking various initiatives on climate change. However, decisions made by different organizations are weakly coordinated. The institutions' efforts need to be coordinated in order to achieve the desired policy outcomes involving numerous individual initiatives.

Climate adaptation is essentially an information-driven process. The value of reliable climate forecasts could be clearly seen in the events of cyclone Nargis and Giri, two of the strongest typhoons to make landfall in Myanmar. Improved weather forecasts could have helped the government to better organize one of the country's largest evacuation operations, potentially saving many more lives. As far as the situation in climate information is concerned, the Department of Meteorology and Hydrology (DMH)—the nationally mandated climate information provider in Myanmar—offers a limited portfolio of climate information products (CIPs). DMH has also regularly launched the 'Monsoon Forum' with the aim of providing a seasonal outlook. However, the limited scientific capacity of DMH may hamper the generation of more reliable climate projections. Therefore, the level of climate information availability can be considered as inadequate and there are major gaps in the existing system of climate information and communication not only in availability, but also in the quality of information.

Public finance alone cannot be relied upon to meet the resource needs of climate adaptation and mitigation. Strategies of resource mobilization should be identified to mobilize sources other than public funds, such as international and non-state local sources. International mechanisms have been currently developed to support measures that reduce GHG emissions and program for Reducing Emissions from Deforestation and Degradation of Forests (REDD+). Hence, the country needs to be ready to capture opportunities made available by international sources. In addition, public-private partnership activities, community-based initiatives, programs of civil society organizations, and corporate funding from the private sector are other alternatives sources for adaptation.

Though Myanmar has made improvements on a few agricultural technologies such as water management methods and biotic and abiotic stress-tolerant varieties, there are still unexplored technological improvements for adaptation in other areas such as identifying relevant measures and practices to decrease GHG emissions and reducing different sectors' vulnerability to climate change. NAPA Myanmar has focused on identifying priority sectors that need technology improvements, removing barriers for deployment and diffusion of technologies, increasing the

capacity of local institutions/experts and raising public awareness on climate change issues. Developing climate-resilient technologies deserves priority attention of all stakeholders, which includes public, private, community, and non-government agencies.

Recent efforts initiated by the Ministry of Environmental Conservation and Forestry (MOECAF) have helped in filling some gaps in policy formulation on climate change at the national level. Currently, it is working toward preparing a second national communications report to the UNFCCC. Though the government of Myanmar has listed the priority areas to identify the impacts of climate change on many sectors of the economy or to initiate necessary policy actions to overcome them, a significant gap exists in policy and governance of climate change issues that needs to be addressed through carefully designed policies, with the participation of the public as well as non-state actors, such as community organizations, the private sector, and civil society organizations.

National Priorities on Climate Change and Food Security

In July 2014, a Memorandum of Understanding (MOU) was signed by the Ministry of Environmental Conservation and Forestry (MOECAF), the United Nations Environment Programme (UNEP), and the United Nations Human Settlement Programme (UN-Habitat) to formalize their collaboration in the field of environment and climate change in Myanmar. The said MOU sealed the cooperation between the three parties toward the implementation of the Myanmar Climate Change Alliance (MCCA) Programme, which aims to build capacity to integrate climate change considerations into policies, and develop the National Climate Change Strategy and Sector Action Plans in Myanmar. The new MOU reflects the organizations' shared priorities in mainstreaming climate change issues into the Myanmar policy development and reform agenda. The three key areas of cooperation are: (1) to raise awareness of key climate change stakeholders, which are the government, civil society, academe, and the private sectors, to address climate change; (2) support bottom-up planning processes for the integration of climate change agenda facilitated by enhancing capacity and strengthening the national coordination mechanism, leading to the development of the National Climate Change Strategy and Sector Action Plans; and (3) learning by doing through pilot demonstration of activities that will build resilience to climate change in the coastal or delta region (Abel and Alam 2014)

Priorities in terms of information Needs for Climate Change and Food Security

In a study of climate risk concerns of community farmers in Myanmar conducted by Chivanno et al. (2006), he concluded that the climate risk concerns of the farmers vary depending on factors

such as farm geography, farming practices of the community, and local features. Generally, “prolonged midseason dry spells that happen soon after transplanting seedlings” and “flooding near end of the crop cycle before harvest time” were identified by the farmers as the two important phenomena that have significant threats to livelihood. In another study performed by the SEA START in 2006, the assessment of household risk to climate change impacts was based on change in rice productivity of each household according to climate impact scenarios. Data analysis, which focused on the change in rice productivity under different climate scenarios and its impact on farmers’ livelihood, showed that vulnerability is a site-specific condition which depends on the degree of climate impact and socioeconomic conditions, as well as the physical condition of each site. Thus, the profiles of vulnerability to climate change differ from one community to another. At the macro-level, several studies have established climate change risk maps that will serve as guides for information (Anshory and Francisco 2009, and Ericksen et al 2011). However, there is still a need to link these studies to decision-making at the sector level, spanning from national to local. The following priorities have been identified by RIMES and FAO from climate change risks to food security perspective (RIMES 2011):

1. Set up pilot projects to establish linkages between the science-based information being generated and decision-making at various levels, including community level actions. These projects should also include components for raising community awareness on climate change impacts on food security.
2. Forums for exchanging and interpreting climate change risk information based on current climate variability and future climate change projections among key stakeholders at national, provincial, and community levels.
3. Building capacities of research institutions to take up detailed studies to characterize climate and climate change risks in sectors such as animal health, pets, and diseases of agricultural crops, human health and nutrition, forestry, and coastal zone impacts.
4. Integrated systems based on ground-based, satellite, and climate model information for monitoring the country’s crop status at high resolution.
5. Generation of evaluated climate change scenario information with confidence and uncertainty statistics at a resolution of 20-25 km to guide food security-related long-term strategies.
6. Set up agro-climatic observational networks, including networks for agro-meteorological observations following standard design criteria for high-density observations in climate zones exhibiting higher variations. A data management system should also enable

sharing of data to key agencies involved in food security-related decision making and linking to the food security information portal.

Institutional Frameworks and Stakeholder Mapping

At the national level, Myanmar's policy formulation with regards to climate change is lodged at the Office on Climate Change Affairs under the Office of the President as seen in Figure 1. The national guidelines on environmental conservation and climate change are sourced from here. The Office of Climate Change Affairs is supported by several government agencies in the formulation of guidelines on environmental conservation and climate change. A principal agency which supports the president's Office on Climate Change Affairs is the National Environmental Conservation Committee (NECC), previously known as the National Commission for Environmental Affairs. The NECC was established in April 2011 and undertakes activities such as conducting various types of awareness campaigns; coordinating with relevant departments to amend or add environmental conservation in the curriculum of the national education system; receiving funds and/or materials and equipment from NGOs, INGOs, and other entities; advocating and providing recommendations to government agencies and institutions; and issuing of notifications, orders, and instructions with approval of the president's office. The NECC is in a position to establish working committees at the union level and sub-committees at the state and division levels. This includes the development of corresponding terms of reference. The NECC submits reports to the president's office. The NECC is chaired by the Union Minister. Members include deputy ministers from various ministries of the union.

Although MOECAF is the focal ministry in NECC, the Ministry of Agriculture and Irrigation (MOAI) is responsible for the overall development of the crop sub-sector, including extension, research and development, irrigation, agricultural mechanization, formulation of agricultural plans and policies, higher education in agriculture, agriculture microcredit and loans, agricultural land reclamation, land development and land reform, biodiversity, land surveying and mapping, and coordination with key concerned agencies. Regarding climate change adaptation and mitigation, the MOAI is also the key agency in setting up and implementing action plans and activities to respond to climate change at the national level as seen in Figure 2. The institutional structure of the MOAI has ten departments, with the following involved in formulating climate change policies: the Department of Agricultural Planning (DAP), Department of Agriculture (DOA), Irrigation Department (ID), Department of Agricultural Research (DAR), Water Resource Utilization Department (WRUD), and Yezin Agricultural University (YAU).

The main function of the DAP is to coordinate with various departments inside and outside the MOAI. The major thrusts are: providing assistance to policy makers in adopting agriculture policies, formulation of various agricultural plans, relations with international organization and governments, strengthening interagency cooperation and coordination, agricultural trade and business management, reporting and compilation of agricultural statistics, conducting surveys, recommendation for further development of the agricultural sector, and development of human resources in agricultural vocation. Meanwhile, the DOA is the largest institution under the MOAI involved in transferring appropriate technology, development of pest and plant disease control, development of land use, cooperation and coordination with DAR for technology dissemination and generation, and distribution of quality seeds to farmers and multiplication and distribution of climate change-resilient varieties to farmers. Furthermore, the DOA is also responsible for formulating program response to climate change. DAR, on the other hand, aims to: (1) develop high-yielding crop varieties, (2) generate profitable cropping systems and cultural practices at various agroecosystems, and (3) provide improved varieties and technologies to farmers through extension departments. DAR likewise formulates CSR researches and produce varieties resistant to the effects of climate change such as increased water salinity and accelerated sea levels.

The Yezin Agricultural University (YAU) supports the Ministry through the provision of agricultural education and produces well-equipped and professionally qualified agriculturists to continuously contribute to national agricultural research and extension.

As described in stakeholder mapping, climate change issues are administered by the National Environmental Conservation Committee (NECC), which is responsible for overseeing all climate change-related issues. Under the NECC, there are 19 inline ministries that are responsible for handling environmental and climate change issues in respective sectors. Although MOECAF is the focal ministry, MOIA is in charge of climate change issues on agriculture and food security.

Under the Ministry of Transport, the Department of Meteorology and Hydrology is responsible for supporting climate and weather information in other sectors, and assisting disaster prevention programs of the NECC. Figure 1 indicates its linkage to other sectors.

Under the Ministry of Agriculture and Irrigation, the Minister's Office directly assigns issues related to climate change to the Department of Agricultural Planning, Department of Agriculture, Department of Agricultural Research, and Yezin Agricultural University. These departments directly report to the Minister of MOAI. Among these four departments, the DOA reaches out at

the local level and directly communicates with the communities and farmers. At the local and provincial levels, extension agents under the Department of Agriculture have the responsibility to share their knowledge and appropriate technologies, and also report back to the Minister's Office.

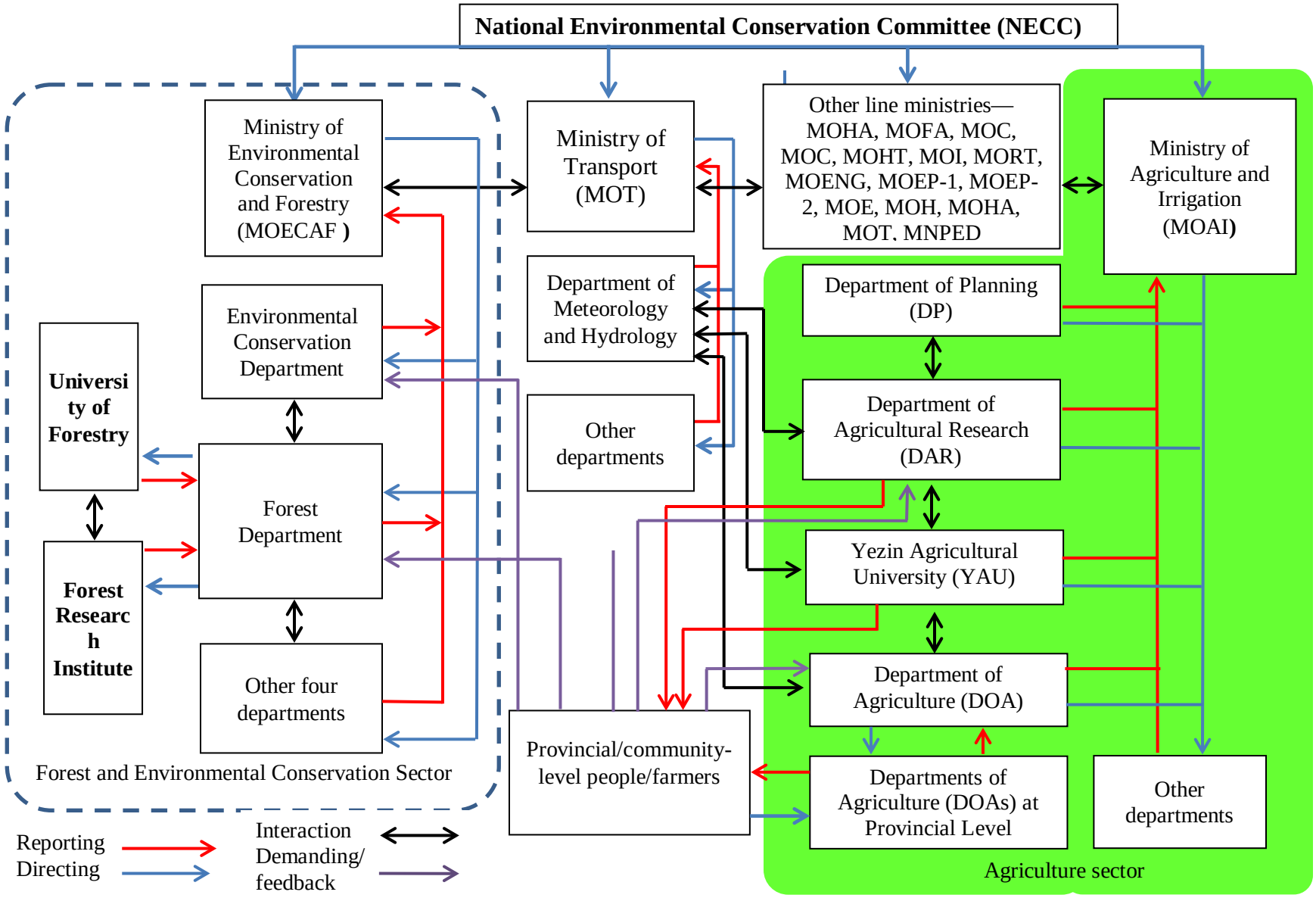

Fig. 1. National stakeholder mapping in the formulation of climate change policies in Myanmar.
Source: Authors' investigation

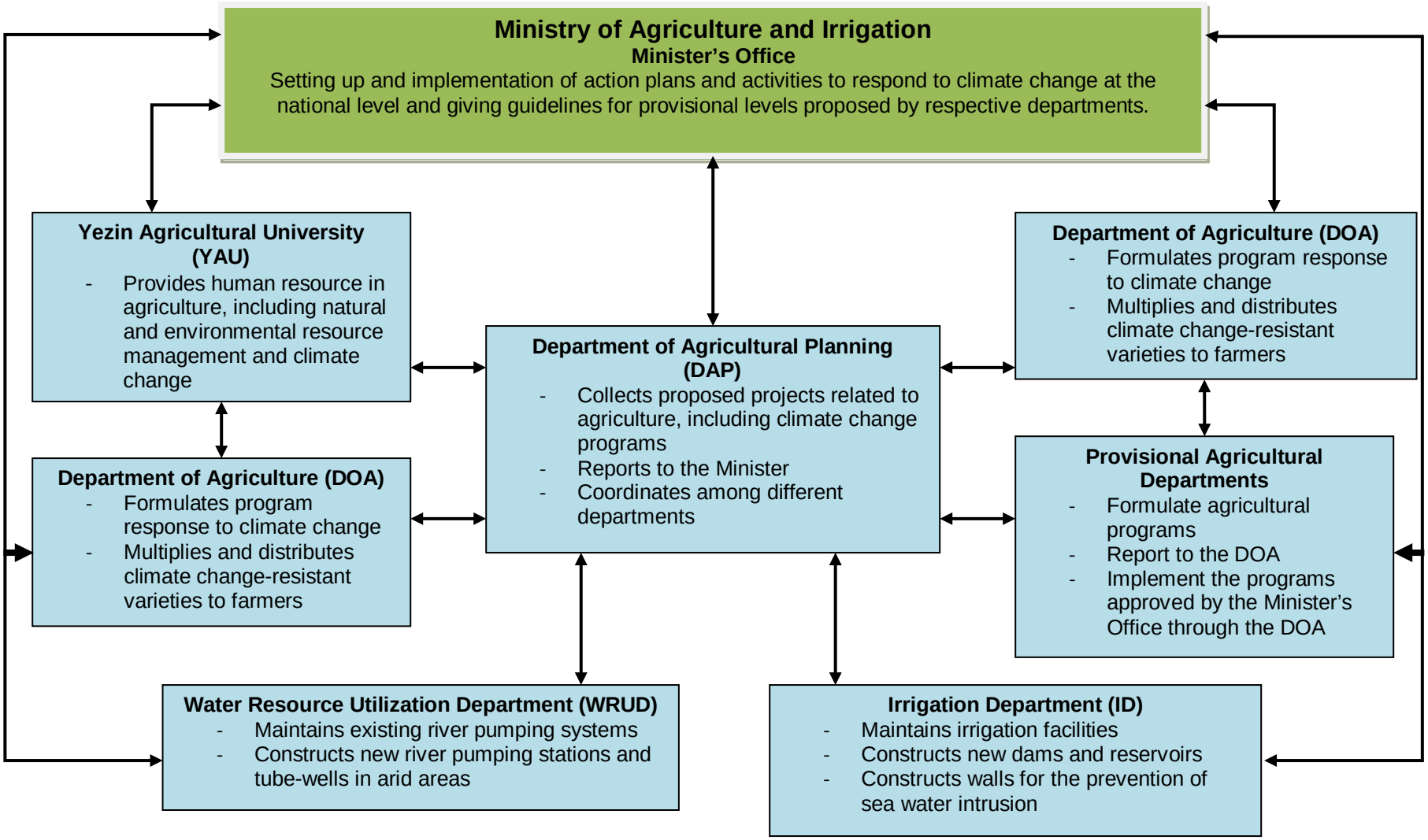

Fig. 2. Institutional framework of MOAI in formulating climate change policies, Myanmar.
Source: Authors' investigation

Stakeholder Survey

Methodology

As part of the activities listed under “Setting the stage,” a stakeholder survey was initiated in Myanmar from August to December 2014. This survey was implemented to: (1) gain expert opinions on stakeholder perceptions of climate change and food security issues, (2) understand the need of stakeholders for climate information, and (3) better understand the current preparedness of institutions in facing climate changes challenges. Data were collected from local and national stakeholders in Myanmar. Respondents to the questionnaire vary in affiliation among government offices, international NGOs, farmers’ groups, research institutions, universities, and private companies. The respondents were considered expert stakeholders on climate change and food security issues in their respective countries and were identified by IRRI’s local partner YAU in Myanmar. Results of the expert stakeholder questionnaire will be used in subsequent years to inform site-specific decisions on data collection, policy needs, dissemination of information, and, ultimately, feasible policy recommendations.

Myanmar Local Stakeholder Survey

A total of 33 respondents participated in the local survey of expert stakeholders in Myanmar. The respondents represented government agencies, private companies, and farmers’ associations. Every respondent reported that their areas had been affected by climate change. The most cited impacts of climate change on rice production by respondents were heat and drought (n=23), rainfall trends (n=12), and flooding (n=11). Even with climate change affecting their regions, only 33% of the respondents reported that their institution had a division or staff member who worked specifically with climate change. Furthermore, only 24% of the respondents reported that there were climate change policies at the local level.

The respondents were asked to rank how important they believed information to be with regard to future climate-related challenges on a four-point scale: 1 = not important, 2 = less important, 3 = important, and 4 = very important. Only two climate-related challenges scored higher than 3 (i.e., important). Those challenges were rainfall trends (μ=3.61) and drought-prone areas (μ=3.09). Stakeholder perceptions on climate-related challenges by institution type can be seen in Figure 3. Respondents also reported drought (n=14), flood (n=8), change in the cropping calendar (n=5), and heat (n=5).

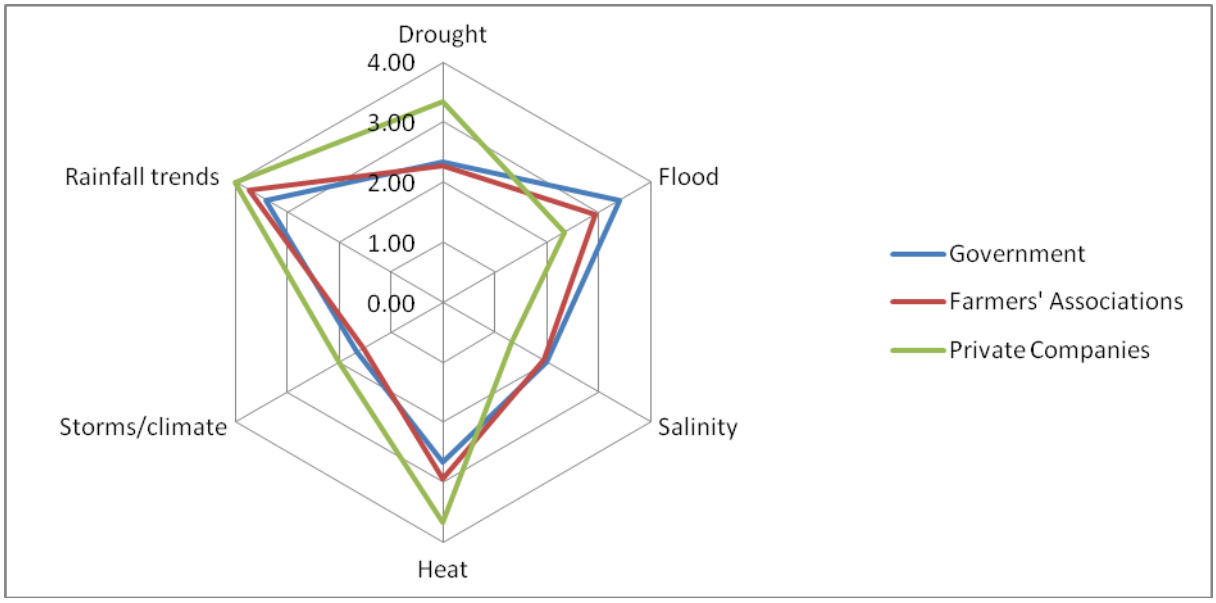

Fig. 3. Importance of information at local level by institution type, Myanmar.

Respondents overwhelmingly reported that they considered communication skills to be the most important training area (n=23). The second most favorable skill mentioned was the demonstration of models at the farm level (n=7). The methods that were most cited as being favorable among the stakeholders for raising public awareness about climate information are media releases (n=26) and local community meetings (n=14).

Myanmar National Stakeholder Survey

There were a total of 12 respondents for the national stakeholders' questionnaire. Of the surveyed respondents, eight represented an institution that had previously been involved in policy formulation. The most common policy the respondents were involved in was the national seed policy, with five respondents stating their involvement in its formulation.

Seven respondents reported that their institution had a division or staff that manages climate change issues; all respondents reported that their institutions had previously used climate information in decision making. Majority of the respondents cited meteorological stations as their primary source of climate information, with a few also citing media outlets. Only four respondents said that they had previously worked with their financial unit when formulating

policy. In addition, only two respondents have ever used economic models in policy decisions and only one respondent has ever been able to set the budget in policy implementation.

Respondents were asked to rank how important they believed information was with regard to future climate-related challenges on a four-point scale: 1 = not important, 2 = less important, 3 = important, and 4 = very important. Respondents at the national level in Myanmar found most of the climate-related challenges important (Table 1), with rainfall and flooding as the two items of the most concern. Similarly, when respondents were asked to rank the importance of climate information on decision making in rice production using the same scale, extreme weather events, rainfall trends, storms, and floods were rated as the four most important pieces of climate-related information (Table 2). The most cited climate change adaptation (CCA) method for rice production was the use of high-tolerant rice varieties. In addition, quality seed was also ranked as the most important information package for rice production (Table 3).

Table 1. Reported importance of climate challenges by national stakeholders.

Climate-related challenges	Rank	Mean
Flood-prone areas	1	3.58
Rainfall trends	2	3.50
Drought-prone areas	3	3.42
Storms/climate hazards	4	3.42
Salinity-prone areas	5	3.08
Heat-prone areas	6	2.75

Table 2. Reported importance of information packages by national stakeholders.

Climate-related information	Rank	Mean
Extreme events	1	3.92
Rainfall trends	2	3.83
Storms	3	3.58
Floods	4	3.58
Temperature trends	5	3.33
Economically vulnerable areas	6	3.25
Drought	7	3.17
Sea level rise	8	3.08
Saltwater intrusion	9	2.83

Table 3. Reported importance of decision information packages by national stakeholders.

Decision-making on rice production activities	Rank	Mean
Quality seeds	1	3.67
Crop health (disease, insects, etc.)	2	3.50
Cost-benefit and marketing/market access for farmers	3	3.50
Water management	4	3.42
Integrated nutrient management (fertilizer use, etc.)	5	3.33
Storage	6	3.17
Land preparation and crop establishment	7	3.08
Milling and processing	8	3.08
Harvesting	9	3.00
Drying	10	3.00
Mechanization	11	2.75

Websites and emails were the respondents' most favorable way to receive climate-related information, with seven respondents preferring this method. In addition, six respondents also prefer receiving information from reports. The least favorable method was maps with just two people preferring to receive climate-related information in this way. The respondents also believed that the best way to distribute climate-related information was through media releases, with nine respondents preferring this method. Finally, respondents believed that the key training area for improving their department's skills in policy decision on climate issues was learning to conduct cost-benefit analysis. Eight respondents found this to be a key training area. Conversely, only one respondent found economic modeling to be a key training area.

Conclusions

There are still challenges in promoting climate change adaptation both in the national and local level in Myanmar. The weak mechanism of existing institutional and technological structures indicates the need for improvement of adaptation strategies. It might be due to a lack of strategic clarity and clear policy visioning. There is still a huge gap in information and knowledge, which impacts decision-making at the local level. Another major constraint for improving adaptation is technology, which is based on existing knowledge and limited information. The climate information provided in Myanmar is short-term in nature and relies on climatic variability, ignoring the uncertainties and scale of climate change impacts. The survey taken in different locations indicated that these barriers may undermine the effectiveness of the initiatives promoted nationally as well as locally in Myanmar.

The complexity of climate change adaptation in Myanmar should be understood in how different institutions play a role in facilitating adaptation at the local level. As there is a lack of sufficient information on issues and their impacts, adaptation strategies have to be formulated based on experience to deal with climatic variability and extreme climatic events. However challenging and difficult it may be, it is not impossible. Formulated strategies should be flexible, innovative, and context-specific with the provision of contingency. Adaptation strategies have to be built on existing knowledge, skills, and local and international best practices. Here, support from the state and international community is keen for facilitation.

The need for location specific policies is seen in results from Myanmar in this stakeholder perceptions survey. Although stakeholders are concerned with issues of water, such as drought and flooding, the focus in Myanmar is more on rainfall trends and less on sea level rise and saltwater intrusion. Conversely, results from another study indicate that, in Vietnam, concerns with water focus more on sea level rise and saltwater intrusion than on rainfall trends.

Moving forward, special attention needs to be given to site- and user-specific information packages for climate change policies. The results of this stakeholder survey have not only reinforced the importance of this issue, but will also prove to be a useful tool in crafting specific policies in the future.

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Appendix 1. List of stakeholders participating in Myanmar.

The authors express their sincerest appreciation to the national questionnaire participants in Myanmar from the following institutions/offices/organizations:

- Department of Agricultural Research
- Department of Agriculture
- Settlements and Land Records Department
- Ministry of Agriculture and Irrigation

The authors express their sincerest appreciation to the local questionnaire participants in Myanmar from the following institutions/offices/organizations:

- Staff Officers
  - Mandalay Region
  - Sagaing Region
- Township Managers
  - Mandalay Region
  - Sagaing Region
- Extension Offices
  - Mandalay Region
  - Sagaing Region
- Farm Leaders
  - Mandalay Region
  - Sagaing Region
- Farmers
  - Mandalay Region
  - Sagaing Region