

## Agriculture contexts of Myanmar under climate change

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**Abstract:** Myanmar has long been renowned as a country blessed with rich natural resources. About 74% of the populations are engaged in agriculture, livestock, fisheries and forestry, which are highly vulnerable to climate change. Now the farmers often encounter poor harvest and total yield loss due to the climate variability. Field surveys were conducted in April, 2012 in three regions (central dry zone, coastal and hilly areas) to study their livelihoods related with climate change and to identify the perception and awareness on environment and climate change issues. Crop residues used for fuel and animal feed is observed more in dry region than the other two regions. All respondents used cattle manures as organic fertilizers. The respondents gather their own fuel wood from nearby forest, and all of those with cattle practice free range grazing. Most respondents noted worse weather and negative trends in availability of drinking water for people and animals, declining soil fertility and crop yield. Similarly, many respondents said they found it more difficult to collect fuel wood and non-timber forest products, while fish-catch was reducing. Findings revealed the complexity of lives in rural Myanmar, and the importance of environmental resilience.

**Key words:** Agriculture, livelihood, perception, manure, climate change.

### Introduction

Myanmar is a South-east Asian country with total land area of 676,577 Km<sup>2</sup> having longest distance of 936 km from east to west and 2,832 km from north to south. Myanmar's population is estimated at 59.1 million, consisting of diverse ethnic groups speaking over 100 different languages and dialects. Situated in the western most part of the south-east Asia, Myanmar enjoys rainy season, cool season and hot season annually. With long major rivers across the country, fertile flat low lands and clean environment, Myanmar is an agro-based country traditionally. Presently, there are about 11.98 mha of net sown areas and expansion of new agricultural land in remaining 0.24 mha of fallow land and 5.61 mha of cultivable land is being encouraged by the government (DAP, 2011). Most of the agricultural land which is about 8.07 mha (67.4%) are currently cultivated by small-scale farmers with an average size (2.4 ha) of holding. National target aims to meet the paddy growing area of 8.3 mha in 2010-11, and average yield of 4.1 mt/ ha. In the face of climate change Myanmar is of no exception. Natural hazards such as heavy rain and floods, intense heat and drought, cyclones and storm surges are common occurrence in these days. There were evidences of climate change in Myanmar taking place since 1980s. Southwest monsoon duration becomes shorter, which leads to the extension of cyclone season. Globally, Myanmar is ranked 2<sup>nd</sup> in terms of global climate risk index for countries most affected from extreme weather events (1990-2008). The examples of most extreme cases are as: (i) Cyclone Nargis struck the Ayeyarwady Delta in May 2008 with intensity unprecedented in the history of Myanmar, which took 138,373 human lives and Kyats 13 trillion of damage (1 US\$=850 Kyats in 2012). The hardest hit areas covered Ayerawady and Yagon Regions, and Kayin and Mon States. (ii) In October 2010, Cyclone Giri hit Rakhaine State, bringing with it heavy rains and huge tidal surges. It was one of the most intense storms ever hit Myanmar. Many townships, especially Kyaukphyu, Myebon, Minbya and Pauktaw were severely affected. In total, 45 people lost their lives and over 250,000 people were affected, with over 20,300 houses completely destroyed. The paddy area damaged was about 60% of growing area of that region (38,587 ha) (NECC 2012). (iii) In October, 2011, a tropical depression formed in the Bay of Bengal crossed

the coast between Maungdaw of Myanmar and Cox's Bazar of Bangladesh, with a mean wind speed of about 60 mph. The area in Maungdaw and Sittwe were damaged but no casualty was reported. After crossing the coast, the depression caused heavy rain in Rakhine State, Chin State, Sagaing, Magway and Mandalay regions. Under the influence of this depression, mountain torrent with heavy rain at Pakokku District resulted in the people death toll of 161. The affected townships were Pakkoku, Pauk, Seikphyu, Myaing townships of Magwe region with the total affected persons were 29,751. Fourteen dams, 5 river pumping stations were damaged. Among the total crop areas of 3,253 acres were destroyed, by flooding, eroding and sand cover (Fig. 1 and Fig. 2).

Myanmar has long been renowned as endowed with rich biodiversity, mineral resources, water resources, and particularly a high percentage of forest cover remaining with species richness and endemics. About 74 % of populations are engaged with natural resources such as agriculture, livestock, fisheries, forestry activities, etc, which are highly vulnerable to climate change. Therefore, climate change aspects are of vital importance for economy and livelihood in Myanmar. These days, farmers often encounter the poor harvest and total yield loss due to the climate variability. Degrading environment and depleting natural resources have been occurring in Myanmar since several decades ago. The reasons may be complicated and inter-related issues, such as population pressure, over exploitation of timber and illegal logging, and agriculture encroachment into forest areas and etc. The situation is compounded by the adverse impacts of the climate change. In 1990, Myanmar's dense forest covered more than 45% of the country's area. By 2010, the extent of the country's dense forests had been reduced by more than half, to ~20%. The forests remain a vital source of rural energy and maintaining livelihoods in terms of food, construction materials and other basic resources. Myanmar still relies on biomass with 64 % of all primary energy consumption in 2007 (FRA, 2010). Biomass fuel is predominantly derived from fuel wood from the forest. The rural population is relying directly on natural resources for their lives, livelihoods and employment. Environmental degradation directly affects the rural people as follows: (i) Soil degradation leads to decreasing agricultural productivity, food insecurity and loss of

income; (ii) Water shortages lead to increased workloads to collect water, and lead to decreased agricultural production; (iii) Climate change leads to negative impacts



**Fig. 1.** Rice fields covered with sand in Pakokku Township

The most affected people are poor farmers whose livelihoods are highly dependent on natural resources and very vulnerable to climate variability. For the planning designs of the rural development and poverty alleviation, an urgent and crucial need is to get the information of village communities on their existing technologies relating with climate change issues. With the different ecosystems they are dealing with, the climate change impacts on their livelihood, and their mitigation and adaption mechanisms to climate change may vary. Concerns reflected by communities are partly based on their perception of local climate and/or their vulnerability. In this regard, field surveys were conducted to study the actual situation of income generation activities related with climate change, and to identify the perception and awareness of the communities on environment and climate change issues

### Materials and Methods

The survey was carried out in April, 2012 in three geographically different regions, namely central dry zone (Magwe Region), coastal area (Ayeyarwady Region) and hilly areas of Southern Shan State. The farmers' interviews, personal observations and questionnaires were undertaken on the concerns of households relating to climate and energy issues. The primary data were collected from the selected households in study villages and the secondary data were gathered from the Department of Agriculture and the Settlement and Land

on agriculture, health and basic infrastructure; and (iv) Forest degradation leads to loss of fuel, food, medicine and increased workloads.



**Fig. 2.** Rice seedling bed under drought in Yemathin Township

Records Department under the Ministry of Agriculture and Irrigation, and from UNDP offices in the selected townships. It covered household, community and township levels and two villages under each two townships of each region: 360 farmers' interviews were done from 12 villages. Field observations emphasized on livelihood activities such as crops, cultivation practices, cropping patterns, livestock rearing, manure management and etc. A simple descriptive analysis was done for the data analysis.

### Results and Discussion

Due to the time constraint, the sample size for a field survey was not adequate to make a comprehensive assessment. The following summery pieces together with snap shots can build a general, but incomplete picture of the survey areas. Findings from household survey (Table 1) revealed the complexity of lives in rural Myanmar, and the importance of environmental resilience. A few farmers grow summer rice where irrigation is possible. Rice-based cropping patterns were prominent in all study areas. Depending on the residual soil moisture after rice harvest, some grow double cropping. Most villages grow rain-fed rice in the monsoon season, and some grow crops such as peanut, sesame and pulses in dry and delta regions while ginger, potato, maize, and wheat in Shan States. Vegetables such as tomato, cabbage, onions and garlic were cultivated mostly in Shan States.

**Table 1.** Summary of agriculture activities in study areas

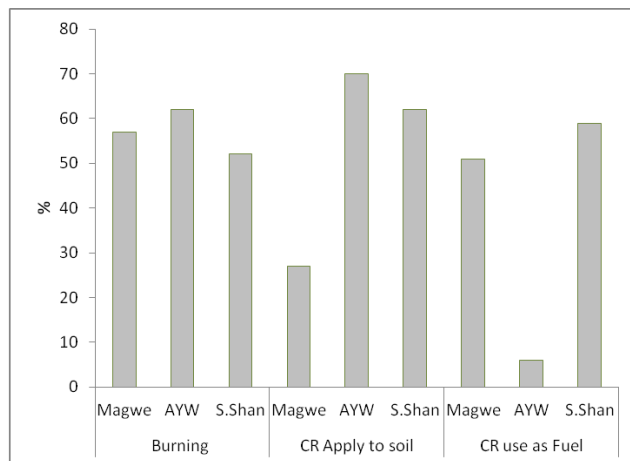
State/ Region	Total respondent	Summer rice					Monsoon rice			other crops			
		No. of grower	Urea	others use	Cowdung use	River pump	No. of grower	Urea use	others use	Cowdung use	No. of growers	crops name	Urea use
Dre zone	120	5	3 (60)	5 (100)	4 (80)	5 (100)	61	30 (49)	19 (31)	49 (80)	89	*	40 (33)
Ayeyarwady	89	36	25 (69)	11 (31)	3 (8)	36 (100)	73	46 (63)	23 (32)	0 (0)	7	**	3 (3)
Southern Shan	118	43	28 (65)	33 (77)	21 (49)	41 (95)	50	20 (40)	40 (80)	11 (22)	82	***	78 (66)

\* Virginia, Pigeon pea, Sesame, Black sesame, Peanut, Lablab been, Green pea, Onion, Chickpea, \*\* Green pea, \*\*\* Maize, Sunflower, Peanut, Garlic, Pigeon pea, Tea, Cowpea, Wheat, Onion; Figures in parenthesis: %

As a traditional practice of farming, crop residues and weeds are burnt in the field prior to land preparation for next crop (Figs. 3-5). In the dry zone of central Myanmar where the animal feed and fuel are scarce, the residues of paddy, pulses, peanut and corn are used for cattle feeding

and those of sesame, pigeon pea, cotton are for household fuel and small cottage industries like jiggery production. Crop residues used for fuel and animal feed is observed more in dry region than the other two regions. The number of farmers who did not apply the residues back to the soil

was the highest in Magway region. The possible reason is that crop residues are commonly used as fuel and animal feeds because of their scarcity. Therefore, Magway region showed the largest number of farmers who used residues as fuel wood. Ayeyarwady region has the lowest number of farmers using residues as fuel because the good quality mangrove fuel wood still exists there (Fig. 6).



**Fig. 6.** Comparison of crop residue management in different regions. (Note: Number of respondent in Magway Region, Ayeyarwady Region and Shan State is 120, 89, 118 respectively)

All those who responded gather their own fuel wood from nearby forest, and all of those with cattle practice free range grazing. There is a direct dependence on natural resources for livelihoods; it means that there is exposure to stocks such as forest loss, floods, droughts or climate change. Livestock are an integral part of the agricultural

economy and farming practices generally use the draft power of cattle. Small farm machinery, such as power tillers, small tractors, threshers, etc. has been applied for a few decades. Most farmers are still using their traditional farming tools like plough and harrow for land preparation while mechanized farming is applied only in commercial farms. In general, farming systems in Myanmar include traditional rice cultivation, upland crop production, and livestock rearing (especially buffalo and cow). Chicken, pigs, ducks, sheep and goats are raised for domestic consumption and extra income. It was observed that different types of cattle are employed for farming in different areas. Ayeyarwady region uses more buffaloes while Magway region has more cows and Shan state has both cattle. It is probably because buffaloes were more suitable for wet weather and clay and heavy soil conditions. Besides, most farmers in Shan state used one buffalo or cow drawn plough and harrow in hilly areas, while a pair of cattle was common in other regions.

It was observed that cattle feeding systems and manure management in Ayeyarwady region are different from other regions. Most farmers in Ayeyarwady region have no manure collection site (cattle shed) near their houses; generally, the cattle are released to graze in the harvested fields to feed by themselves for several months. The fields are naturally fertilized with animal manures of grazing cattle. As a consequence, the least % of farmers with proper manure storage was found in Ayeyarwady region among the three regions (Table 2). More farmers use cut-and-carry systems for feeding their cattle in Magway and Shan regions and they may provide better quality of feeds with rice bran, peanut cakes, etc. The low quality feed not only gives poor health to the cattle but also more methane emission through their digestive systems. The proper feeding and manure handling (storage) systems are key factors for the reduction of GHG emission from the livestock sector.

**Table 2.** Summary of livestock breeding activities in study areas

State/ Region	Total respondent	Cattle			Manure management			Cattle feed			Livestock rearing (total person/number)		
		with cow	with buffalo	no. of cattle	pile up	Pit	with roof	Gather by self	Buy	Graze	Pig	chicken	Duck
Dre zone	120	63 (53)	0 (0)	203	30 (48)	38 (60)	32 (51)	63 (100)	7 (11)	41 (65)	27/33	44/377	0/0
Ayeyarwady	89	0 (0)	43 (54)	150	23 (54)	1 (2)	0 (0)	25 (58)	6 (14)	31 (72)	50/87	50/875	39/2831
Southern Shan	118	9 (16)	24 (20)	212	42 (98)	20 (47)	18 (42)	42 (98)	17 (40)	30 (70)	19-Nov	24/133	17/46

Figures in parenthesis: %

**Table 3a.** Community awareness on climate change issues

State/ Region	Total respondent	Wheather			Drinking water			Animal drinking water			soil fertility			Crop yield			Pest/disease		
		No change	Better	Worse	No change	Better	Worse	No change	Better	Worse	No change	Better	Worse	No change	Better	Worse	No change	Better	Worse
Dre zone	120	45(37.5)	0(0)	75(62.5)	52(43.3)	55(45.8)	13(10.8)	51(42.5)	43(35.8)	12(10)	24(20)	4(3.3)	58(48.3)	18(15)	1(0.8)	66(55)	40(33.3)	0(0)	54(45)
Ayeyarwady	89	27(30.3)	9(10.1)	73(82)	39(43.8)	74(83.2)	6(6.7)	36(40.5)	16(18.0)	23(25.8)	20(22.5)	0(0)	58(65.2)	20(22.5)	0(0)	59(66.3)	36(40.4)	5(5.6)	13(14.6)
Southern Shan	118	43(36.4)	2(1.7)	72(61)	87(73.7)	22(18.6)	9(7.6)	68(57.6)	20(17.0)	1(0.9)	60(50.9)	0(0)	37(31.4)	61(51.7)	13(11)	42(35.6)	55(46.6)	5(4.2)	37(31.4)

Figures in parenthesis: %

**Table 3b.** Community awareness on climate change issues (continued)

State/ Region	Total population		CF			Fuel wood availability			Non-timber FP			Fish catch			CC impact		Degraded impact		
	Male	Female	No. of member	Village area (acre)	No change	Better	Worse	No change	Better	Worse	No change	Better	Worse	Same	More to man	more to women	Same	More to man	more to women
Dre zone	247	307	10	74	53(44.2)	8(6.7)	51(42.5)	26(21.7)	1(0.8)	42(35)	4(3.3)	1(0.8)	13(10.8)	78(65)	7(5.8)	34(28.3)	73(60.8)	5(4.2)	39(32.5)
Ayeyarwady	287	301	0	0	38(42.7)	24(27)	45(50.6)	16(18)	8(9.0)	40(44.9)	10(11.2)	3(3.4)	98(110)	42(47.2)	51(57.3)	26(29.2)	33(37.1)	56(62.9)	30(33.7)
Southern Shan	284	324	87	624	33(28)	1(0.9)	79(66.9)	25(21.2)	6(5.1)	71(60.2)	16(13.6)	2(1.7)	71(60.2)	84(71.2)	16(13.6)	9(7.6)	89(75.4)	5(4.2)	15(12.7)

Figures in parenthesis: %

**Table 3c.** Community awareness on climate change issues (continued)

State/ Region	Storm/strong wind			Heavy rain			Flood			Drought			Sea water/salinity (tube well)			Combat strategy		Cropping system	
	very often	sometimes	never	very often	sometimes	never	very often	sometimes	never	very often	sometimes	never	very much	a little	no specification	sold things out	loan	change crop	late sowing
Dre zone	9(7.5)	88(73.3)	3(2.5)	18(15)	91(75.8)	1(0.8)	13(10.8)	90(75)	16(13.3)	31(25.8)	88(73.3)	1(0.8)	2(1.7)	0	31(26)	17(14)	82(68)	30(25)	24(20)
Ayeyarwady	18(20.2)	86(96.6)	16(18)	41(46.1)	76(85.4)	2(2.3)	23(25.8)	67(75.3)	29(32.6)	28(31.5)	61(68.5)	19(21.3)	19(21.3)	49(55)	5(0.6)	26(29)	93(104)	4(4.5)	54(61)
Southern Shan	6(5.1)	57(48.3)	39(33.1)	9(7.6)	53(44.4)	42(35.6)	9(7.6)	53(44.9)	39(33.1)	8(6.8)	57(48.3)	33(28)	0	0	0	4(3.4)	34(29)	7(5.9)	34(29)

Figures in parenthesis: %

Concerning with the awareness and perception on climate change impacts on their daily life, more respondents in all regions noted worse weather and negative trends in availability of drinking water for man and animals, Non-timber Forest Products (NTFP) and fuel wood (Table 3A, B and C). All respondents felt that crop fertility had worsened or was, at best, unchanged in recent years; none felt it had improved. There were similar findings for crop yields. The vast majority stated how it was increasingly difficult to obtain wood and NTFP from forests, how the number of trees in forests was declining, and how fish catches were going down. These show that livelihoods are already becoming increasingly precarious. Although responses related to climate change were unclear, the only stated strategies to cope with climate change and environmental shocks were: to take out loans, to grow alternative crops, and to sow crops later. These findings reveal that rural livelihoods highly dependent on natural resources such as forests, land, fish, water and a stable climate- there are currently few alternatives to adapt to environmental shocks. Since the climate change impacts are becoming more and more evident, Myanmar urgently needs to adapt climate change impacts on its key socioeconomic sectors and communities. Incorporating the adaptation strategies into the development plans and policies will enhance the country to achieve its main goal of poverty alleviation.



Fig. 7. Agriculture encroachment in hill tops in Shan state



Fig. 8. Community Forests in Delta areas



Fig. 9. Agroforestry in southern Shan state

In all study areas, the disappearance of forest trees is clearly visible. The underlying causes are the long time over-exploitation of timber and fuel wood, encroachment of agriculture and settlement and etc (Fig. 7). It was found that the new plantation of mangroves under community forests (CF) project at the degraded paddy fields and nipa plantation is an effective alternative means for their livelihood. The Forest Department has been promoting community forestry and agro-forestry across the entire country especially in the study regions with the active participation of the community, local NGOs and international NGOs (Fig. 8 and Fig. 9). The successful establishments of CF and woodlots by the communities contribute to restoration of forest cover and to sustainable forest management thereby improving carbon sink and mitigating climate change. However, in all regions of study areas, the current coverage areas of CF are only a very few percentage of that it should be. It is undeniable that national and international financial supports are essential for the community development in these areas. The more important fact is the local people's awareness

and active participation for their own improvement and sustainability.

Due to the environmental degradation, unsure and poor harvests due to climate variability and damage by cyclones and flood enhance the farmers to get rid of farming. At present Myanmar has a big issue of increasing numbers of migrant workers from rural to urban, as well as to foreign countries. Many regions are facing the problem of insufficient workers in farming industry. Under the political constraints for several decades, the country has poor economic growth and low job opportunities comparing with neighboring countries, which are the main factors of increasing migrant labors outside the country. It was noted that among the estimated total population of 60 millions in Myanmar, the working aged people is 37.4 millions of which 3-4 millions are working in foreign countries. It means 5-6 % of the total population (10-12 % of working aged people) is currently working abroad. The significant numbers of migrant workers are observed in Thailand, Malaysia, Singapore, Japan, Dubai, and in the western countries. Since Myanmar shares a long border with Thailand, migrant Myanmar workers in Thailand was recorded about 2 million people in 2011.

Myanmar is at an historic stage in its development under the new government, and ongoing economic and political reforms promise to deliver wide-ranging social and economic benefits and create many opportunities for individuals and domestic and foreign investors alike. Under this situation, strenuous efforts are needed to upgrade the all-round development of the country. Myanmar is now facing the environmental problems of land degradation, deforestation, water scarcity etc. which is compounded by climate variability. Climate change related phenomena include unusual fluctuations in rainfall patterns and temperatures, as well as their associated impacts on water availability, pests, disease, and extreme weather events, all of which can substantially affect the potential of agricultural production. Findings from household survey revealed the complexity of lives in rural Myanmar, and the importance of environmental resilience. Since the climate change impacts are becoming more and more evident, Myanmar urgently needs to adapt climate change impacts on its key socioeconomic sectors and communities. Incorporating the adaptation strategies into the development plans and policies will enhance the country to achieve its main goal of poverty alleviation.

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