

**The Republic of the Union of Myanmar
Ministry of Agriculture and Irrigation
Settlement and Land Records Department**

**Land Utilization, Land Types and
Land Tenure in Myanmar**

Myint Thu

Abstract

The findings of the 2010 Myanmar Census of Agriculture (MCA) and previous censuses were used to examine land utilization, land types, land tenure in the agriculture, livestock and poultry raising and aquaculture sectors. MCA 2010 is a comprehensive statistical undertaking geared towards the collection and compilation of information on crop production, livestock/poultry keeping/breeding, forestry-related activities, fishing activities and aquaculture operations. This is the fourth census of agriculture to be conducted in the Republic of the Union of Myanmar. The first census was conducted in 1958 and this was followed by censuses in 1993 and 2003. This technical paper analyses the changes in agricultural land from 1961 to 2009 and land utilization by various kinds of crop in different regions and states. Changes in the number of holdings by farm size were observed from the results of MCA 2003 and MCA 2010. The total area of land holdings by major land use was examined to distinguish the proportion of land utilization by specific sectors such as agriculture, livestock and poultry and aquaculture. The number and area of parcels is also an important parameter and was used to examine land fragmentation and land consolidation. A comparison was made between the number and area of the parcels between MCA 2003 and MCA 2010 data and these results showed that the number of parcels per holding decreased in 2010 compared with 2003. Thus, it can be seen that land fragmentation probably decreased too.

Moreover, it was found that the utilization of rubber land type was highest during the MCA 2003 and MCA 2010, followed by garden, paddy, ya, kaing types of land. According to the results of MCA 2010, the area of dhani land type decreased and became fragmented. In MCA 2010, the proportion of total land area by owner-like land tenure was 96.65 percent, followed by trespassed and other land tenure (2.94 percent and 0.41 percent respectively).

Keywords: Land utilization, land type, land tenure, land fragmentation, the proportion of major land used pattern, agricultural land holding and the number and area of parcel.

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List of Abbreviations

MCA	Myanmar Census of Agriculture
FAO	Food and Agriculture Organization

Land utilization, land types and land tenure¹

Myint Thu²

1. Land utilization

1.1 Introduction

Land is one of the most important resources of any country. It is a fixed, scarce, tangible and immovable resource and it is a degradable and transferable entity that needs to be used carefully if it is to contribute significantly to sustainable food security. Land is used extensively and intensively and the demand for land has been increasing for its various uses over time as populations have been increasing. In fact, almost everywhere there are competing land uses such as forests, agriculture, industry, housing, infrastructure, services and recreation. As such, the land use pattern is highly influenced by the various deliberate interventions of the people and has been undergoing significant changes throughout the world (Lee *et al.* 1988, World Bank 1984). Changes in the use pattern are a highly complex matter. They are shaped by agro-climatic, demographic, socio-economic, political and institutional factors either independently or jointly. Figure 1.1 depicts the gradual expansion of agricultural land area in the Republic of the Union of Myanmar from 1961 to 2009.

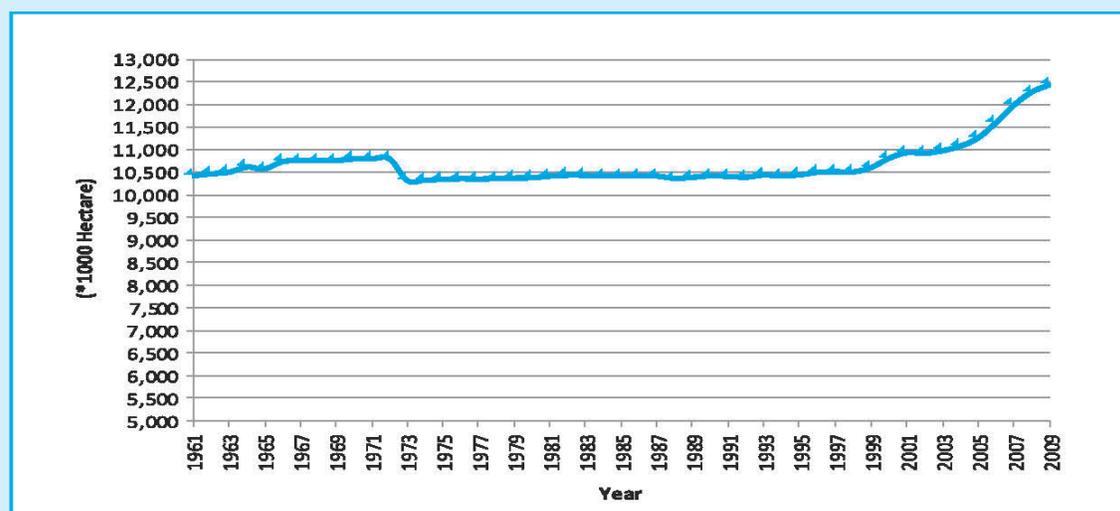


Figure 1.1 Expansion of agricultural land area in the Republic of the Union of Myanmar from 1961 to 2009

Source: FAOSTAT, Food and Agriculture Organization of the United Nations.

¹ This paper was presented in the National Data Dissemination Seminar on Myanmar Census of Agriculture 2010 in Myat Taw Win Hotel, Nay Pyi Taw on 5-6 November 2012.

² U Myint Thu is the Assistant Director of the Settlement and Land Records Department of the Ministry of Agriculture and Irrigation.

1.2 The effects of the estimated number of population on the expansion of agricultural area

In order to determine the effects of increasing population on the expansion of agricultural area between 1972 and 2009 in Myanmar, a linear regression analysis was used. The dependent variable was designated as agricultural area and the independent or predictor variable was the estimated population. The Republic of the Union of Myanmar is mainly dependent on the development of the agricultural sector. Nearly 70 percent of the total population resides in rural areas and are engaged in the agricultural sector for their livelihood. As the population has been increasing yearly, the agricultural area has been expanded in order to catch up the increasing population from year to year. The data on agricultural area was available from the website of FAOSTAT, United Nations and the estimated population was used from the Central Statistical Organization, the Republic of the Union of Myanmar because a population census has not been conducted since 1983. (Annex 1)

The regression results are reported in Table 1.1. It shows that the estimated population variable was statistically significant at the 1 percent level. The R^2 (0.55) indicated that 55 percent of the variance in agricultural area from 1972 to 2009 was explained by the estimated population density. The model also estimated that if 1 unit increased in the estimated population density, the agricultural area increased in the proportion of 0.74 with other variables being constant. The regression equation appeared to be useful for making predictions since the R^2 is 0.55. The specific model is:

$$Y = 8534210.321 + 0.74 X + e$$

Y = the agricultural area in hectares

X = the number of population

e = Random error term

Table 1.1 Regression results from the model

Model	Coefficients ^a				
	Unstandardized coefficients		Standardized coefficients	t	Sig.
	B	Std. error	Beta		
1 (Constant)	8,534,210.321	527,442.189		16.180	.000
1 population	.051	.011	.742	4.691	.000

a. Dependent variable: agricultural areas

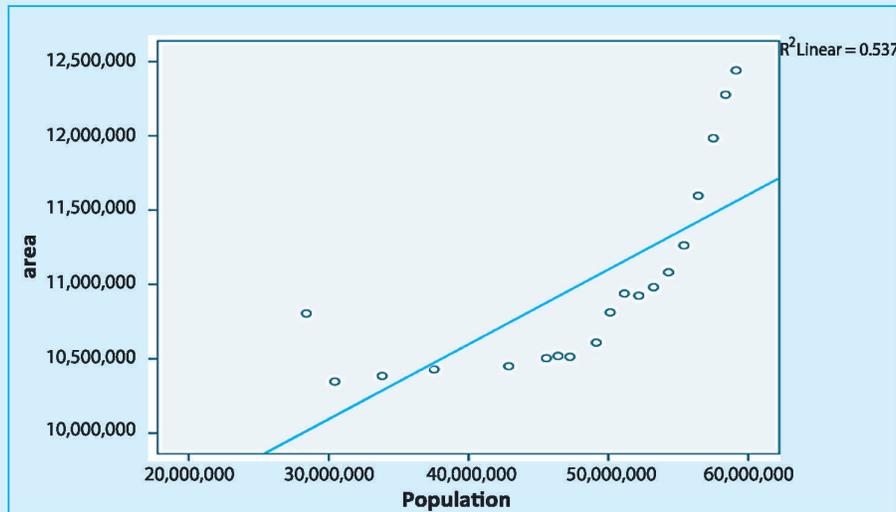


Figure 1.2 Agricultural area by number of population with the fit line at total
 Fit line at total ———

Model summary^b

Model	R	R square	Adjusted R square	Std. error of the estimate	Durbin-Watson
1	.742 ^a	.550	.525	441,352.71600	.533

a. Predictors: (constant), population

b. Dependent variable: agricultural areas

1.3 Land utilization by various kinds of crops

According to the results of MCA 2010, 24.60 million acres of cultivated area were under cereal crops comprising 22.87 million acres of paddy, 1.17 million acres of maize (seed and cob combined), 0.29 million acres of sorghum and 0.26 million acres of wheat.

Regarding the utilization of land by region and state, one third of the total paddy cultivated areas in the country (7.22 million acres) was found in Ayeyarwady region, which is called the rice bowl of the Republic of the Union of Myanmar, whereas 3.53 million acres in the Bago region, 3.28 million acres in Sagaing region, 2.12 million acres in Yangon region, 1.31 million acres in Mandalay region, 1.19 million acres in Rakhine state, 1.12 million acres in Mon state and 0.99 million acres in Magway region were used in the cultivation of paddy. It can be seen that the rest of the 2.12 million acres of paddy cultivated area was found in the other eight regions and states, namely Kachin state, Kayah state, Kayin state, Chin state, Tanintharyi region, Shan (South) state, Shan (North) state and Shan (East) state.

Regarding the cultivation of wheat, 80.39 percent of the wheat cultivated area was found in Sagaing region whereas Mandalay region, Shan (North) state and Shan (South) state were reported to have planted wheat on 7.52 percent, 6.66 percent, and 4.80 percent of the land respectively of their total land area.

Of the total sorghum cultivated area, 47.35 percent was found in Mandalay region, 27.95 percent in Magway region and 22.68 percent in Sagaing region. Only 2.02 percent of the total sorghum cultivated area was found in the remaining fourteen regions and states.

Of the total maize cultivated area, 31.28 percent was in Shan (North) state whereas Sagaing region, Shan (South) state, Ayeyarwady region and Chin state shared 19.43 percent, 17.62 percent, 7.24 percent and 7.12 percent respectively, of the maize planted areas. Only 17.36 percent of the maize cultivated areas were found in the remaining twelve regions and states.

14.74 million acres were under peas and beans. Among them, 39.46 percent of the pulses cultivated area was under black gram, 25.69 percent was under green gram and 17.07 percent was under pigeon peas.

Table 1.2 Comparison of holding structure according to MCA 2003 and 2010, the Republic of the Union of Myanmar

Size of Holding	2003					2010				
	Number of holdings reporting	%	Total area of holding (Acres)	%	Average area per holding (Acres)	Number of holdings reporting	%	Total area of holding (Acres)	%	Average area per holding (Acres)
Total	3,344,516	100.00	21,191,713.60	100.00	6.34	4,986,686	100.00	31,615,398.61	100.00	6.34
under 1 acre	471,782	14.11	144,047.61	0.68	0.31	247,584	4.96	111,711.05	0.35	0.45
1 acre and under 3 acres	766,422	22.92	1,429,510.90	6.75	1.87	1,345,024	26.97	2,338,996.04	7.40	1.74
3 acres and under 5 acres	635,806	19.01	2,409,183.40	11.37	3.79	1,102,363	22.11	3,959,043.18	12.52	3.59
5 acres and under 10 acres	796,439	23.81	5,515,205.34	26.03	6.92	1,336,222	26.80	8,805,156.43	27.85	6.59
10 acres and under 20 acres	504,426	15.08	6,811,095.95	32.14	13.50	727,458	14.59	9,488,066.19	30.01	13.04
20 acres and under 50 acres	157,945	4.72	4,430,661.97	20.91	28.05	212,246	4.26	5,750,601.72	18.19	27.09
50 acres and over	5,332	0.16	452,008.43	2.13	84.77	15,789	0.32	1,161,824.00	3.67	73.58

Source: Myanmar Censuses of Agriculture 2003 and 2010

1.4 Changes in the number of holdings by farm size during the period from 2003 to 2010

The total number of holdings increased by 1,642,170 or by 49.10 percent from 2003 to 2010. This was a result of the increasing number of holdings of 1 acre and over in the seven-year period. But the number of reported holdings less than 1 acre decreased by 224,198 or by 47.52 percent. Although the number of holdings of 1 acre

and over increased, the proportion of holdings of 10 acres and under 50 acres decreased from 19.80 percent in 2003 to 18.85 percent in 2010, which may be because of the continuing fragmentation of the agricultural holdings.

In MCA 2003, the highest numbers of holdings were those of 5 acres and under 10 acres, followed by those of 1 acre and under 3 acres, then holdings of 3 acres and under 5 acres. In MCA 2010 the highest numbers of holdings were those of 1 acre and under 3 acres, followed by holdings of 5 acres and under 10 acres, then holdings of 3 acres and under 5 acres and finally holdings of 10 acres and under 20 acres.

The total area of all agricultural holdings in the country grew by 49.2 percent from 2003 to 2010. As the number of holdings less than 1 acre decreased in seven years, their total actual area also decreased by 22.5 percent. In 2003, the holdings between 10 acres and under 20 acres provided the highest total area, followed by those holdings of 5 acres and under 10 acres, and holdings of 20 acres and under 50 acres. In 2010, the highest total actual area was made up of the group of holdings of 10 acres and under 20 acres, followed by the holdings of 5 acres and under 10 acres, and holdings of 20 acres and under 50 acres. As observed in the proportion of the number of holdings of 10 acres and under 50 acres, the proportion of the total area in this group of holdings also decreased from 53.05 percent in 2003 to 48.20 percent in 2010.

Although the total number and actual area of the agricultural holdings in the Republic of the Union of Myanmar increased from 2003 to 2010, the average area per holding remained approximately 6.34 acres. However, it can be noted in Table 1.2 that the average area per holding decreased in the various groups of holdings of 1 acre and over.

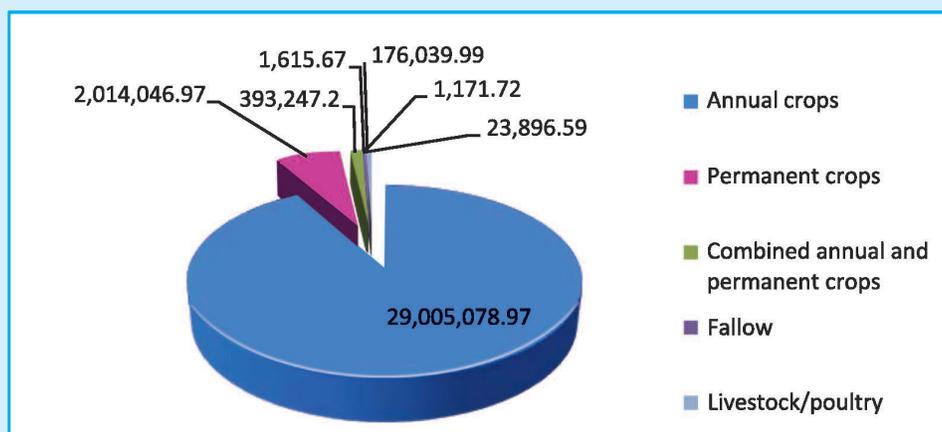


Figure 1.3 Total areas of land holdings by major land use, the Republic of the Union of Myanmar 2010

Source: Myanmar Census of Agriculture 2010

1.5 Total area of land holdings by major land use, in the Republic of the Union of Myanmar 2010

In MCA 2010, 91.74 percent of the total land area was under annual crops, 6.37 percent was under permanent crops, 1.24 percent was under a combination of annual and permanent crops, 0.56 percent comprised of other land uses, 0.08 percent was fallow land, 0.005 percent was used for aquaculture, and livestock and poultry raising was taken up by 0.004 percent. Thus, about 99.35 percent of the total land area was used for the cultivation of crops and only 0.65 percent was used for of aquaculture and livestock and poultry raising activities.

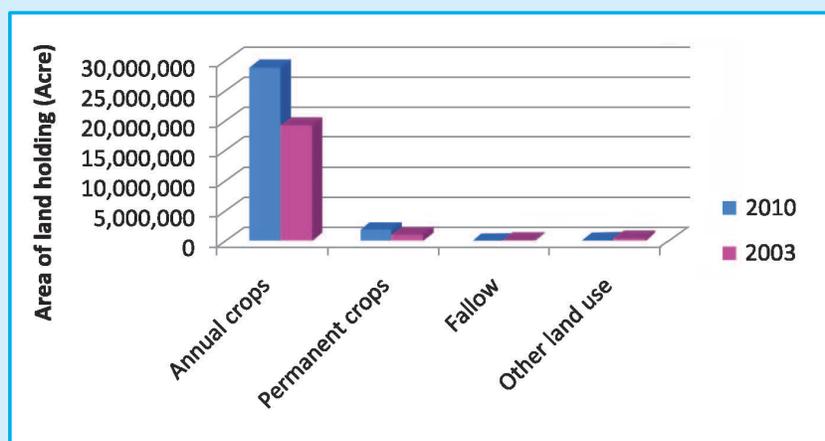


Figure 1.4 Total areas of land holdings by major land use, the Republic of the Union of Myanmar 2003 and 2010

Source: Myanmar Census of Agriculture 2003 and 2010

Table 1.3 Total areas of land holdings by major land use, the Republic of the Union of Myanmar 2003 and 2010

Land use	Total area (hectare)				Growth (%)
	2003		2010		
Total land holdings	21,191,713.60	100%	31,219,062.52	100%	47.32
Annual crops	19,396,626.76	91.53	29,005,078.97	92.91	49.54
Permanent crops	1,102,418.68	5.20	2,014,046.97	6.45	82.69
Fallow land	194,521.04	0.92	23,896.59	0.08	-87.72
Other land use	498,147.12	2.35	176,039.99	0.56	-64.66

Source: Myanmar Census of Agriculture 2003 and 2010

The proportion of the land area under annual crop increased by 1.38 percentage points from 2003 to 2010, but the actual area under annual crops grew by

49.54 percent. The area under permanent crops increased by 1.25 percentage points whereas the actual area under permanent crops grew by 82.69 percent. The proportion of the total area that was fallow land and other land use decreased by 0.84 percentage point and 1.79 percentage points, respectively, from 2003 to 2010 and the actual areas that were fallow or devoted to other land uses both had large negative growth rates.

1.6 Land utilization

Land use refers to the utilization of the agricultural lands such as growing crops, raising livestock or culturing fish that were carried out on the land making up the holding with the intention of obtaining products and/or other benefits. Land use is different from “land cover”, which describes the physical characteristics of the land, such as grassland or forest. Land utilization was categorized into seven groups, which are defined in Annex 2.

1.7 Land fragmentation

Land fragmentation is influenced by the total number of parcels and the size of parcels within the holdings. The number of parcels within land holdings changed from 1993 to 2010. According to the censuses, the number and proportion of holdings with a single parcel decreased from 1.2 million holdings or 45.52 percent in 1993 to only 645 thousand holdings or 19.29 percent of the total holdings in 2003. But the number of holdings with a single parcel remarkably increased in number and proportion in 2010 (3.2 million parcels or 64 percent of the total holdings). The growth rate of one-parcel holdings decreased by 48.10 percent between the 1993 and 2003 censuses, whereas the growth rate of such holdings sharply grew by 394.99 percent for the same period.

Table 1.4 Comparison of land holdings and number of parcels in the MCA 1993, 2003 and 2010, the Republic of the Union of Myanmar

Number of parcels	Total land holding reported						Growth from 1993 to 2003	Growth from 2003 to 2010
	1993	%	2003	%	2010	%		
Union total	2,729,820	100	3,343,792	100	4,987,721	100	22.49	49.16
1 parcel	1,242,534	45.52	644,924	19.29	3,192,312	64.003	-48.096	394.99
2 to 3 parcels	1,046,412	38.33	2,502,159	74.83	1,631,263	32.706	139.12	-34.81
4 to 5 parcels	277,719	10.17	169,250	5.06	146,072	2.929	-39.06	-13.69
6 to 9 parcels	142,057	5.20	26,526	0.79	17,895	0.359	-81.33	-32.54
10 parcels and over	21,098	0.77	933	0.03	179	0.004	-95.58	-80.81

Source: Myanmar Censuses of Agriculture 1993, 2003 and 2010

The proportion of holdings with two or three parcels increased from 38.33 percent in 1993 to 74.83 percent in 2003 and then decreased to 32.71 percent in 2010.

Conversely, the number and proportion of the holdings with four parcels and over continuously decreased from 1993 to 2010 as can be seen in Table 1.4.

Table 1.5 Comparison of total number, total area and average area of parcel between MCA 2003 and 2010, the Republic of the Union of Myanmar

Size of Holding	2003			2010		
	Total Number of Parcels	Total Area of Parcels (Acres)	Average area per parcel in acre	Total Number of Parcels	Total Area of Parcels (Acres)	Average area per parcel in acre
Total	7,055,745	21,191,713.60	3.00	7,561,600	31,615,399.42	4.18
Under 1 acre	575,452	144,047.61	0.25	644,443	311,515.52	0.48
1 acre and under 3 acres	1,483,392	1,429,510.90	0.96	3,122,716	5,211,993.61	1.67
3 acres and under 5 acres	1,362,840	2,409,183.40	1.77	1,671,338	5,932,141.48	3.55
5 acres and under 10 acres	1,877,209	5,515,205.34	2.96	1,444,152	9,297,539.57	6.44
10 acres and under 20 acres	1,294,639	6,811,095.95	5.26	545,864	6,878,657.23	12.60
20 acres and under 50 acres	445,212	4,430,661.97	9.95	123,674	3,290,339.69	26.60
50 acres and over	17,001	452,008.43	26.59	9,413	693,212.32	73.64

Source: Myanmar Census of Agriculture 2003 and 2010

Table 1.5 indicated that the total number of parcels increased by 7.17 percent from 2003 to 2010 whereas the total area of parcels grew by 49.19 percent from 2003 to 2010. The average area per parcel increased from 3.00 acres in 2003 to 4.18 acres in 2010 or by 39.33 percent. As mentioned in Table 1.5, the average area per parcel also increased in the various sizes of holdings. In comparison with the results of the 2003 Myanmar Census of Agriculture, the average area per parcel increased by 92 percent for holdings of less than 1 acre, 73.96 percent for holdings of 1 acre and under 3 acres, 100.56 percent for holdings of 3 acres and under 5 acres, 117.57 percent for holdings of 5 acres and under 10 acres, 139.54 percent for holdings of 10 acres and 20 acres, 167.34 percent for holdings of 20 acres and under 50 acres, 176.95 percent for holdings of 50 acres and over.

2. Land type

2.1 Classification of land types

In MCA 2010, land type refers to the classification used by the Settlement and Land Records Department (SLRD) for assessment of land. It has been defined according to the utilization of land by the cultivation of a specific crop on it. The type of land describes the classification of the land in accordance with the record of the parcel kept at SLRD as described below:

- Paddy classified as rice land.
- Ya classified as dry land.
- Kaing classified as alluvial land.
- Garden classified as garden land to be planted with permanent trees.
- Dhani, which is a land along the mouth of the river within reach of salt water that limits the planting of crops except dhani trees and other palm trees, which are the only plants adaptable to the soil.
- Rubber, which is land suitable for rubber trees.
- Other land types, which include all other land on the holding, not elsewhere classified. It also includes uncultivated land producing some kind of agricultural products.

Table 2.1 Changes in percentage of land types from MCA 2003 to 2010

Items	2003		2010		Changes in %	
	Number of parcels	Area of parcels	Number of parcels	Area of parcels	Number of parcels	Area of parcels
Paddy	2,241,357	11,808,376.88	3,736,992	18,312,891.89	66.73	55.08
YA	1,297,442	6,169,514.61	2,531,264	9,231,972.37	95.10	49.64
Kaing	291,853	911,165.12	498,884	1,361,087.13	70.94	49.38
Garden	393,034	752,890.73	467,690	1,247,496.88	18.99	65.69
Dhani	17,230	40,892.20	21,984	37,013.95	27.59	-9.48
Rubber	20,958	151,028.99	86,663	612,675.38	313.51	305.67

Source: Myanmar Census of Agriculture 2003 and 2010

With the exception of dhani land type of parcel, other land types of parcel such as paddy, ya, kaing, garden and rubber increased in number and area of parcels. The number and area of paddy parcels increased by 66.73 percent and 55.08 percent respectively from MCA 2003 to MCA 2010. The number and area of ya parcels increased by 95.10 percent and 49.64 percent respectively from MCA 2003 to MCA 2010. The number and area of kaing parcels increased by 70.94 percent and 49.38 percent respectively from MCA 2003 to MCA 2010. The number and area of garden parcels increased by 18.99 percent and 65.69 percent respectively from MCA 2003 to MCA 2010. The number and area of rubber parcels increased by 313.51 percent and 305.67 percent respectively from MCA 2003 to MCA 2010.

3. Land tenure

3.1 History of land tenure

Until 30 August 2012, the Myanmar legislation regulating farm land ownership comprised the Land Nationalization Act of 1953 and the Tenancy Act of 1963. The gist of the act is that all agricultural land possessed by non-agriculturist landowners, as well as those portions of land owned by farmers in excess of permitted holding limits is to be expropriated by the state for redistribution to tillers who have no land of their own. The redistribution, however, does not necessarily mean creating new owner-farmers, but the land thus expropriated under the act is to belong solely to the state, the farmers being given only the right to cultivate by the land committee. The act also forbids the farmers from selling, mortgaging, or leasing their land. This previous Law was repealed by the Farmland Law, which came into force on 31 August 2012.

Land tenure refers to the arrangements or rights under which the holder operates the land(s) making up the holding. There are three types of land tenure:

1. Owner-like refers to the legal ownership-like possession that provides statutory security of using the land.
2. Trespassed/squatter are lands belonging to the government but occupied without permission to use the land.
3. Other land tenures are various types such as land registered to other households but rented by the holder, etc.

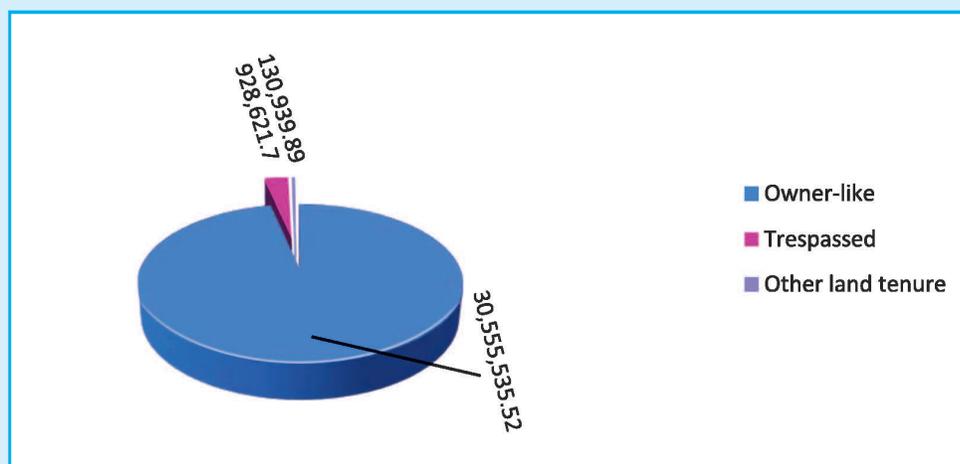


Figure 3.1 Three kinds of land tenure by the area of parcel

Source: Myanmar Census of Agriculture 2010

In MCA 2010, the proportion of total land area by owner-like land tenure was 96.65 percent and followed by trespassed and other land tenure at 2.94 percent and 0.41 percent respectively. Among the three types of land tenure in the 2010 census, owner-like type of tenure was found to be more than 90 percent of the total area of parcels and the remaining 10 percent was occupied by the combination of trespassed and other land tenure in all regions and states.

With respect to trespassed type tenure, more than 3 percent of the total area of parcels was found only in four regions and states, i.e. Shan (South) state, Shan (East) state, Sagaing region and Ayeyarwady region and the remaining 13 regions and states had less than 3 percent of the total area of parcels as trespassed land.

Considering the other land tenure, less than 1 percent of the total area of parcels was other type tenure in all regions and states with the exception of Kachin state and Shan (East) state.

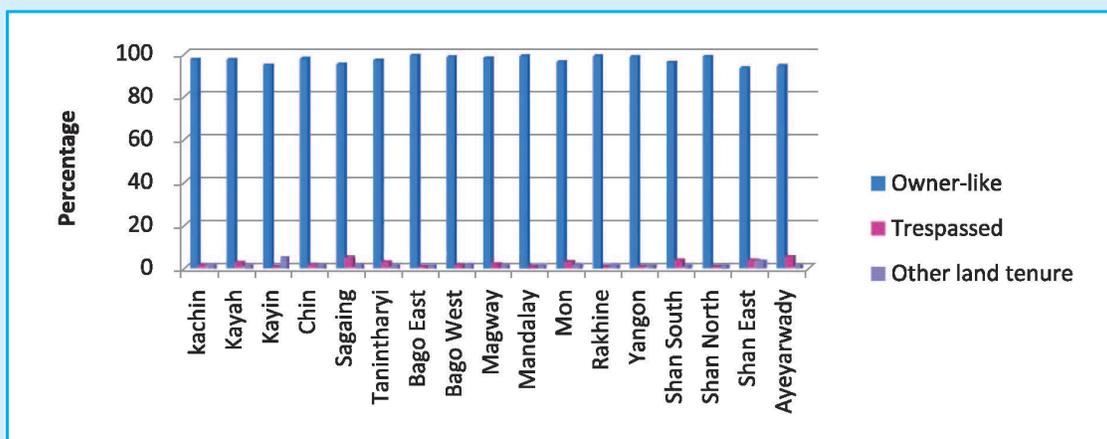


Figure 3.2 The percentage of total area of parcel by land tenure in region and state

Source: Myanmar Census of Agriculture 2003 and 2010

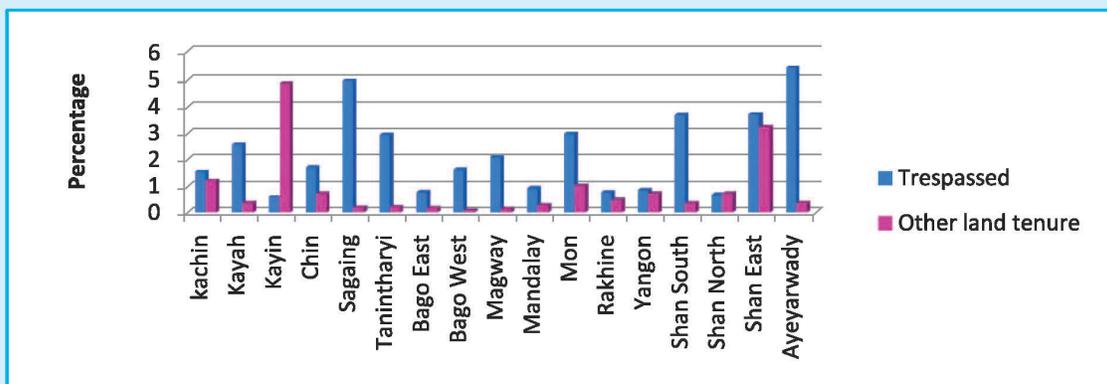


Figure 3.3 Comparison in the percentage of total area of parcel between trespassed and other land tenure in region and state

Source: Myanmar Census of Agriculture 2003 and 2010

4. Conclusions

The agricultural area of the Republic of the Union of Myanmar has expanded as the population has increased from year to year. Indeed, using linear regression analysis, 55 percent of the variance in agricultural area from 1972 to 2009 can be explained by the estimated population density. The linear regression model also estimated that if 1 unit increased in the estimated population density, the agricultural area increased proportionately by 0.74 with other variables being constant. The two variables, the size of population and the agricultural area, are statistically significant at the 1 percent level.

Both the total number and areas of holdings less than 1 acre decreased from 2003 to 2010.

The total number of land parcels increased by 2.02 million or by 58.94 percent in holdings of less than 5 acres from MCA 2003 to 2010. Such increases in the number of parcels might have resulted from the expansion of land areas and might not be related to land fragmentation because the total area of parcels in the holdings of less than 5 acres increased by 7.47 million or by 187.63 percent from MCA 2003 to MCA 2010. Moreover, the average area per parcel of holdings of less than 5 acres increased from 1.16 acre in 2003 to 2.11 acre in 2010. But the total number of parcels decreased by 1.51 million or by (- 41.58 percent) in the holdings of 5 acres and more than 5 acres from MCA 2003 to MCA 2010. The total area of parcels in the holdings 5 acres and more than 5 acres increased remarkably by 2.95 million or by 17.15 percent from MCA 2003 to 2010. The average area per parcel of the holdings of 5 acres and more than 5 acres increased by 4.74 acres in MCA 2003 to 9.50 acres in MCA 2010. Thus, it can be concluded that land fragmentation is likely to have decreased in the different sizes of holdings.

Although the total area of parcels in the holdings of 10 acres and under 20 acres increased by 8.33 percent from MCA 2003 to MCA 2010, the number of parcels decreased by 57.84 percent. Therefore, it can be noted that land consolidation was likely to have taken place in holdings of 10 acres and under 20 acres from MCA 2003 to MCA 2010.

In holdings of 20 acres and under 50 acres, both the number and total area of parcels decreased by 72.22 percent and 25.74 percent. It can be concluded that the number of parcels in holdings of 20 acres and under 50 acres is likely to have changed into holdings of various farm sizes because the number of parcels increased in the

various sizes of holdings apart from the holdings of 20 acres and under 50 acres, holdings of 5 acres and under 10 acres and holdings of 50 acres and over. But in the holdings of 5 acres and under 10 acres and holdings of 50 acres and over, the total area of parcels decreased.

Although the number of dhani parcels increased by 27.59 percent, the area of dhani parcels decreased by 9.48 percent from 2003 to 2010. Therefore, it can be concluded that the holdings with dhani land type are likely to have fragmented between MCA 2003 and MCA 2010.

In addition to the fragmentation of holdings with dhani land type, dhani land type was likely to have changed into other land types such as paddy, garden, kaing or ya land type because many other crops can be grown on dhani land if the intrusion of saline water is prevented. It can be concluded that more than 96.89 percent of the total area of parcels was occupied by owner-like land tenure and 2.22 percent and 0.89 percent of the total area of parcels devoted to trespassed and other land tenure respectively at the Union level. There are limitations to comparing land tenure data in MCA 2003 and MCA 1993 because the information on land tenure was not available in 2003. Since the new Farmland Law came into force on 31 August 2012, the entire parcel owned by holdings will have to be registered legally and this Law allows the holders to sell, mortgage, lease, exchange and give the whole or part of the right to use the farmland in accordance with the stipulated terms and conditions by registering the transferable deeds.

5. Recommendations

Agricultural land cannot increase indefinitely to meet the needs of a growing population. Thus, it is recommended that intensive production systems should be emphasized rather than extensive production systems.

Whereas the proportion of fallow land and other land utilization in 2010 decreased, a large portion of the total land area was utilized for crops cultivation, followed by livestock raising and aquaculture. However, the proportion of land used for livestock and aquaculture was considerably low. Therefore, the harmonious and proportionate development of agriculture, livestock raising and aquaculture should be enhanced by appropriate development planning.

In MCA 2010, in addition to the extensive utilization of land for livestock raising and aquaculture activities, these activities were also operated as secondary activities by the households in the home lots and crops land. Thus, further study should be done to determine the proportion of land used by these activities in the home lots and crops land.

Since the findings indicated that land fragmentation decreased in 2010 and the number and proportion of holdings of less than 1 acre decreased, it would be a good indicator for the development of agricultural sector because farmers can introduce mechanized farming practices in their farm land as they appear to have a sufficient parcel size to use modernized farm machineries. Although the area of farmland expanded during the period between MCA 2003 and MCA 2010, the number of parcels per holding decreased. Therefore, any agricultural development planning and policy should consider how to reduce the number of parcels per holding as the expansion of farmland area.

According to the results of MCA 2010, the area of dhani land type might have decreased and fragmented. This might be an acceptable indicator for the development of the agricultural sector because dhani is mainly used for the roof of rural houses and alternative material for dhani, zinc roof, is readily available everywhere. According to MCA 2010 other crops like paddy and gardens crops were grown in place of dhani. Therefore, additional cultivation of paddy and other food crops in place of dhani land is more beneficial for the development of agricultural production.

Annex-1

Agricultural area and the number of population from 1972 to 2009

Year	Agricultural area (Hectare)	Estimated number of population
1972	10,805,000	28,410,000
1975	10,347,000	30,440,000
1980	10,385,000	33,820,000
1985	10,429,000	37,540,000
1990	10,428,000	40,520,000
1995	10,450,000	42,870,000
1996	10,504,000	45,570,000
1997	10,519,000	46,400,000
1998	10,513,000	47,250,000
1999	10,609,000	49,130,000
2000	10,812,000	50,130,000
2001	10,939,000	51,140,000
2002	10,925,000	52,170,000
2003	10,982,000	53,230,000
2004	11,082,000	54,300,000
2005	11,263,000	55,400,000
2006	11,597,000	56,420,000
2007	11,984,000	57,500,000
2008	12,277,000	58,380,000
2009	12,440,500	59,130,000

Source: FAOSTAT, FAO Year book SOFA 2000, Agricultural at a Glance, 2010 Republic of the Union of Myanmar.

Annex-2

Some land utilization terms can be defined as follows:

Annual crops

This is land under *annual/temporary crops* with less than one year growing cycle or crops that are sown or planted again for further production after the harvest.

Permanent crops

This is land devoted to *permanent crops* such as the raising of fruit and/or nut trees and/or industrial permanent crops. Also known as long-term crops that do not have to be replanted for several years.

Combined annual/permanent crops

This refers to a parcel planted under mixed annual and permanent crops regardless of the planting pattern as long as both crops are considered the main crops of the parcel. If one of the crops is sparse and scattered around the parcel, the land use of the parcel should be reported only under the crop that was thickly planted.

Fallow

This is a land left idle for at least one agricultural year but not beyond five years for the purpose of regaining its fertility.

Livestock / Poultry

This is the land used for keeping and/or breeding livestock and/or poultry.

Aquaculture

This is the land used for all types of aquaculture activities.

Other land use

This includes all other lands on the holding, not elsewhere classified.

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**The Republic of the Union of Myanmar
Ministry of Agriculture and Irrigation
Irrigation Department**

**Sustainable Irrigation Development and
the Increase of the Area Under Irrigation**

Dr. Maung Maung Naing and Myint Myint Than

Abstract

The production of crops is dependent on cultivable land and the availability of water. One fourth of the total area of Myanmar is cultivable land and there are about 12 million hectares of net sown area at present. It is possible to develop the remaining fallow land and cultivable waste land. The country is also rich in water resources and the major rivers and tributaries contribute 1,082 km³ of water per annum from a drainage area of about 738,230 km². But, only about 10 percent of the fresh water resources is used for agriculture and some smaller quantities for domestic use, industrial use and other purposes. Because of uneven rainfall distribution throughout the country and the fact that the rainy and dry seasons last approximately a half-year each, irrigation has become a major component of crop cultivation. Different types of irrigation facility have been developed at different times, especially for paddy fields. The construction of headwork structures across rivers and creeks to divert the water flow to paddy fields and isolated small tanks in the Central Dry Zone (CDZ) comprise the earliest irrigation system in Myanmar. Then, isolated dams and multipurpose reservoirs were constructed at the upper reaches of creeks and rivers to expand irrigation areas especially for rice production in conjunction with other sectors. Groundwater exploitation and river water pumping systems were also developed for irrigation. The construction of embankments and sluice gates in the delta and in Lower Myanmar were carried out both for irrigation and flood protection. This paper discusses the achievements of irrigation development and the increasing of the area under irrigation and the prospects for better development of the irrigation sector.

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Sustainable irrigation development and the increase of the area under irrigation¹

Dr. Maung Maung Naing² and Myint Myint Than³

1. Introduction

The sustainable development of the agriculture sector is the basic and the most important issue for a country like Myanmar, which is an agricultural country. The agriculture sector contributed 30 percent of GDP, 13.7 percent of total export earnings and accounted for 61.2 percent of the labour force in 2010/2011. The production of crops and the development of the agriculture sector are required for poverty alleviation and socio-economic development for rural people in Myanmar. The population of Myanmar reached about 60 million in 2011. Food production should be increased to meet the demand of the growing population. Thus, the Ministry of Agriculture and Irrigation (MoAI) has laid down a number of targets to fulfill the needs of the country: achieving surplus in paddy production; achieving self-sufficiency in edible oil; and stepping up the production of exportable pulses and industrial crops.

In this connection, irrigation plays a major role in the development of Myanmar's agriculture sector. Small-scale and medium-scale irrigation projects have been constructed throughout the country, especially for paddy irrigation, thus allowing round-the-year cultivation of paddy in conjunction with other crops. A different type of irrigation system was developed based on the natural water flow of rivers and creeks, and cultivable land especially along the Ayeyarwady river and Sittaung river basins. Because of irrigation development, farmland has been brought under irrigation and these irrigation systems can stabilize crop production and supply water for irrigation as well as provide supplementary water needed because of the rainfall deficit.

2. Background of irrigation development

2.1 Potential land for cultivation

The total area of Myanmar is 67.66 million hectares and at present there are about 12 million hectares of net sown area and these areas under paddy and other crops. To expand the area under agriculture, the remaining 0.23 million hectares of fallow land and 5.40 million hectares of cultivable waste land can be developed. Thus, if water is available, crops can be cultivated throughout the year in Myanmar.

¹ This paper was presented in the National Data Dissemination Seminar on Myanmar Census of Agriculture 2010 in Myat Taw Win Hotel, Nay Pyi Taw, on 5-6 November 2012.

² Assistant Director, Irrigation Technology Centre, Irrigation Department

³ Staff Officer, Irrigation Technology Centre, Irrigation Department

2.2 Water

Myanmar is divided into distinct rainy and dry seasons. Ninety percent of the annual rainfall in different regions of Myanmar is received during the rainy season from May to October. Precipitation varies countrywide (Table 1).

Table 1: Rainfall distribution in Myanmar

Region	Annual rainfall (mm)
1. South and western coastal strip	5,000
2. Delta	2,000 – 3,000
3. North and eastern hilly regions	1,300 – 3,000
4. Central dry zone	760

Table 2: Potential water resources in Myanmar

No.	River basin	Surface water		Ground water	
		(km ³)	(%)	(km ³)	(%)
1	Ayeyarwady	455.13	42.07	303.42	61.33
2	Sittaung	81.15	7.5	28.4	5.74
3	Other	545.61	50.43	162.89	32.93
Total		1,081.89	100	494.71	100

Myanmar has high potential water resources. An annual water volume of 1,082 cubic kilometres is flowing in the rivers and the drainage area, which are spread widely over the country. The Ayeyarwady river and its tributaries such as the Chindwin, Mu, Panlaung, Zawgyi, Myitnge, Mone, Man, Salin and the Sittaung river and its distributaries, namely the Bago river and others rivulets, contribute water mainly to the agriculture sector, especially for paddy irrigation. In addition, the potential for groundwater largely found in the Ayeyarwady river basin to be exploited for irrigated agriculture (Table 2). At present, only 10 percent of fresh water resources is utilized for irrigation.

3. Irrigation needs

Farmers' traditional rainfed agriculture practice cannot guarantee sufficient crop production. Because of unequal rainfall distribution over time and place, irrigation is essential to secure a sufficient water supply for agriculture. In Myanmar, temperature is not such a significant factor in crop cultivation and it is similar in different regions (Figure 1).

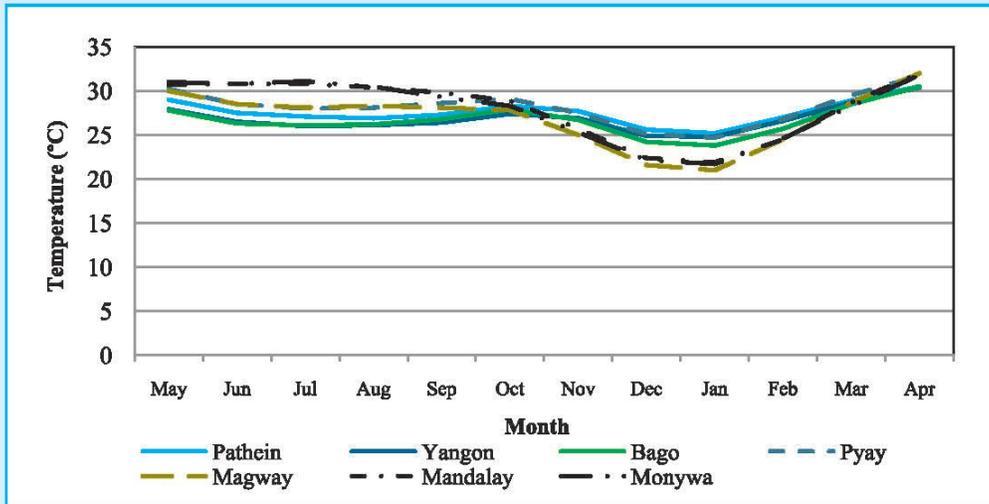


Figure 1: Monthly mean temperature in selected regions

Source: Statistical Yearbook 2010

However, regional rainfall as mentioned above is unequally distributed in time and space and is an uncontrollable factor in crop cultivation. Monsoon rainfall is available only during the rainy season and this is also not sufficient for crop needs, especially in the Central Dry Zone (CDZ). This rainfall deficit has to be met by supplementary irrigation and in the dry season irrigation is indispensable, if crops are to be produced throughout year (Figure 2).

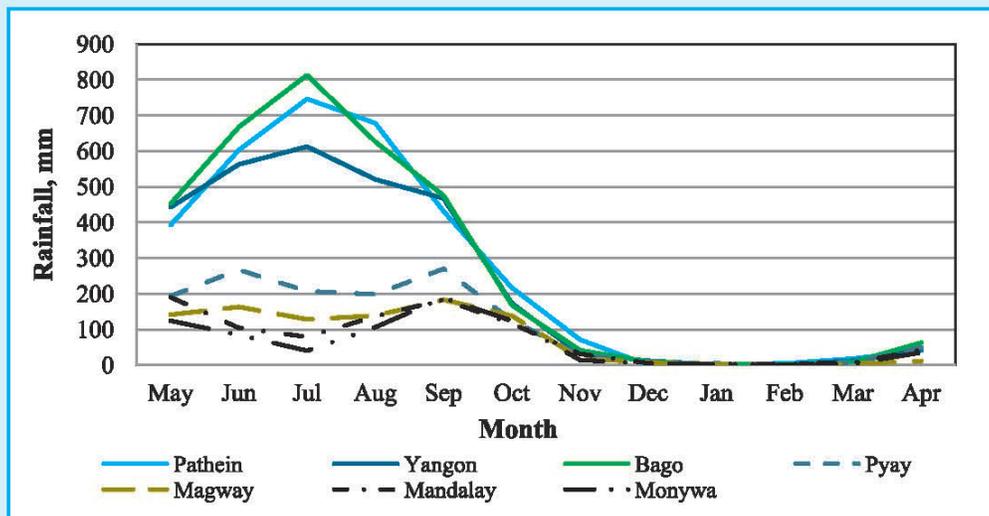


Figure 2: Monthly rainfall in selected regions

Source: Statistical Yearbook 2010

4. Irrigation development

4.1 Types of irrigation facilities

Different types of irrigation systems have been developed and applied to utilize natural water resources effectively for irrigation and these are diversion headworks (weirs), small tanks, dams and reservoirs, canals, groundwater exploitation (using deep and shallow tubewells) and river water pumping systems. Sluice gates and embankments were also constructed for flood protection in conjunction with irrigation and these types are found especially in the delta region and in Lower Myanmar. Small tanks and dams and river diversion weirs were developed mostly in the CDZ. The types of irrigation systems in the Ayeyarwady and Sittaung river basins is shown below (Figure 3).

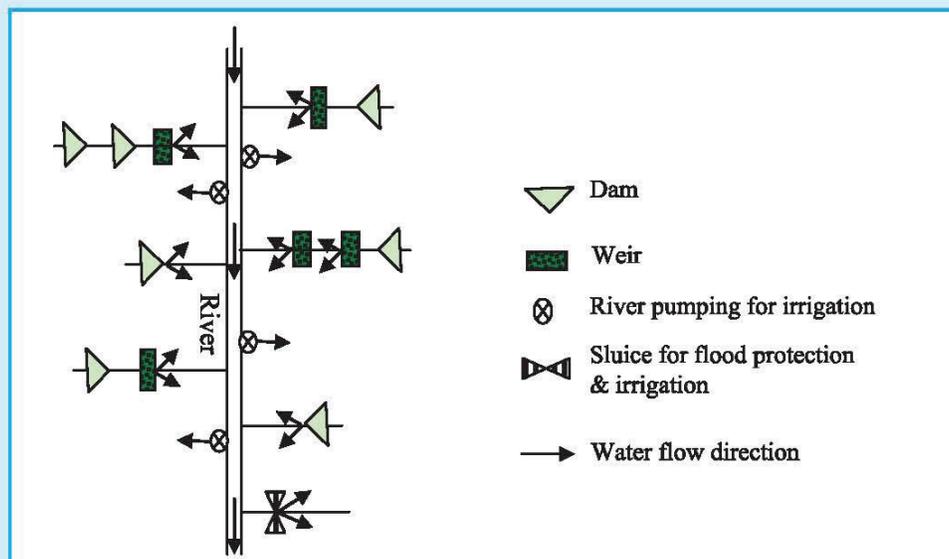


Figure 3: Irrigation systems in the Ayeyarwady and Sittaung river basins

4.2 Development of irrigation facilities

Irrigation has been initiated and developed in the CDZ such as in Mandalay, Sagaing and Magway regions since ancient times. Because these regions are dry and receive only a small quantity of rainfall. The Myanmar kings developed irrigation facilities, especially small tanks and river diversion weirs there. These systems were rehabilitated and developed again during the colonial period. Irrigation systems of Zawgyi, Panlaung, Mu, Mone, Man and Salin rivers and creeks were very popular and effective for irrigation in the CDZ. Later, dams were gradually constructed for irrigation over a wider area in Myanmar. Obviously, after 1988, small and medium dams and reservoirs were

constructed throughout the country and a summer paddy programme was also initiated in 1992/1993 . Thus, irrigation facilities were constructed also in the delta and in Lower Myanmar as part of this programme. Moreover, the Water Resources Utilization Department was established under the Minister of Agriculture and Irrigation in 1995 to develop more irrigation with groundwater exploitation and river water pumping. Thus, irrigation projects and facilities have been increased and developed by the Irrigation Department (ID) and the Water Resources Utilization Department (WRUD). Multipurpose dams and reservoirs have been constructed in conjunction with irrigation dams.

Table 3: Development of irrigation works in different era (up to September, 2012)

Irrigation project areas		*A M Kingdom to 1962	From 1962 to 1988	From 1988 to 2012 (Sep)	Total
Delta and lower Myanmar ¹	(No)	16	7	91	114
	(ha)	7,323	43,726	664,138	715,187
Central Dry Zone ²	(No)	51	29	130	210
	(ha)	336,690	104,995	440,043	881,728
Others ³	(No)	2	33	18	53
	(ha)	1311	46,715	50,594	98,620
Total	(No)	69	69	239	377
	(ha)	345,324	195,436	1,154,775	1,695,535

* Ancient Myanmar Kingdom

- 1) Ayeyarwaddy, Yangon, Bago & Mon
- 2) Sagaing, Mandalay & Magway
- 3) Others regions and states

Source: Irrigation Department, October, 2012

The number of irrigation facilities has increased through time and at present there are 377 irrigation facilities (according to the registration of the Irrigation Department) (Table 3). Among them, 210 facilities are found in CDZ and about 1.7 million hectares of cultivable land can be irrigated. The yearly increase of irrigable area and flood protected area is also shown in (Figure 4).

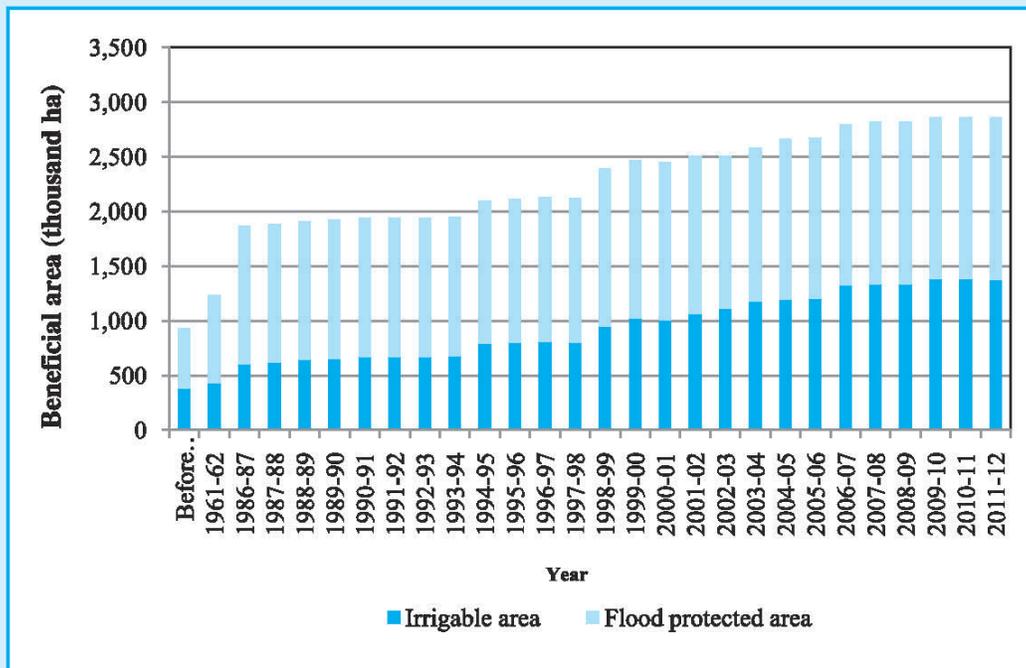


Figure 4: Increase of flood protected area and irrigable area

Source: Outline of the Irrigation Department, 2012

The number of river water pumping projects and groundwater exploitation projects has also increased. The WRUD has established 327 river water pumping projects and 8,313 tubewell projects, including deep tubewells and shallow tubewells (Table 4 & Table 5). These projects were mostly developed in the CDZ. According to the registration of the WRUD, 201,098 ha and 41,720 ha can be irrigated by river water pumping projects and groundwater exploitation projects, respectively.

Table 4: Development of river water pumping projects for irrigation

Sr. No.	Region/State	Special project		WRUD's program: Electric & diesel types		Total	
		No	Irrigable area (ha)	No	Irrigable area (ha)	No	Irrigable area (ha)
1	Kachin			5	850	5	850
2	Kayah			3	1,915	3	1,915
3	Kayin			6	3,480	6	3,480
4	Shan			4	1,913	4	1,913
5	Taninthayi			11	850	11	850
6	Rakhine			4	324	4	324
7	Sagaing	5	30,960	51	24,547	56	55,507
8	Mandalay	9	27,196	67	21,130	76	48,326
9	Magway	4	13,355	47	21,492	51	34,847
10	Mon			5	1,578	5	1,578
11	Bago			56	22,134	56	22,134
12	Yangon	5	8,499	19	4,838	24	13,337
13	Ayeyarwady	3	8,499	23	7,538	26	16,037
Total		26	88,509	301	112,589	327	201,098

Source: Water Resources Utilization Department, October, 2012

Table 5: Development of groundwater irrigation

Sr. No.	Region / State	Deep Tubewells (No)	Shallow Tubewells (No)	Total Tubewells (No)	Total Irrigable area (ha)
1	Kachin	8	36	44	108
2	Kayah	5	-	5	15
3	Shan	14	-	14	81
4	Sagaing	880	1,968	2,848	21,000
5	Mandalay	1,347	675	2,022	7,700
6	Magway	1,298	-	1,298	4,271
7	Bago	600	112	712	3,382
8	Yangon	476	90	566	1,672
9	Ayeyarwady	618	186	804	3,491
	Total	5,246	3,067	8,313	41,720

Source: Water Resources Utilization Department, October, 2012

Table 6: Irrigated crops by river-pumping projects in the Central Dry Zone (unit in hectares)

Region	2008-2009			2009-2010			2010-2011		
	Paddy	Others	Total	Paddy	Others	Total	Paddy	Others	Total
Sagaing	11,708	-	11,708	15,786	-	15,786	16,914	-	16,914
Mandalay	16,556	203	16,759	17,218	881	18,099	17,044	-	17,044
Magway	17,103	-	17,103	18,226	-	18,226	18,922	-	18,922
Total	45,367	203	45,570	51,230	881	52,111	52,880	-	52,880

Source: Water Resources Utilization Department, October, 2012

4.3 Irrigation area

Almost all irrigation projects supply water mostly for rice production and only a small quantity of water is supplied to other crops. The Irrigation Department's projects mostly supply water for paddy production. Paddy irrigation is given priority over river water pumping and groundwater projects (Table 6). Among other upland crops, pulses

and oil seed crops are also major crops in Myanmar and they take part in the main cropping pattern of the irrigation projects together with paddy. The irrigated area has increased to 2.3 million ha by the irrigation projects, but the irrigable area is still less than 18 percent (Figure 5).

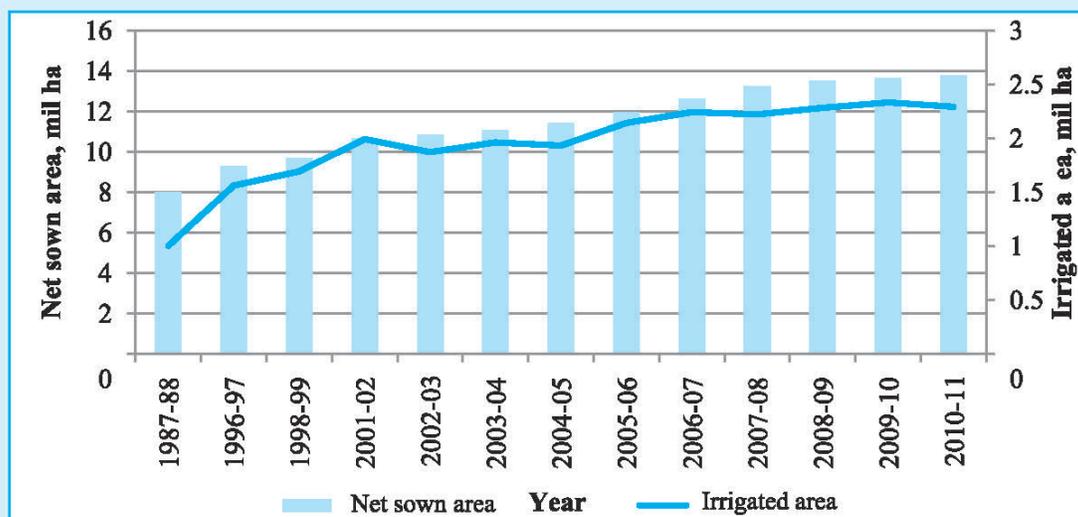


Figure 5: Net sown area and increase of irrigated area in Myanmar

Source: Myanmar Agriculture in Brief, 2012

4.4 Increase of total irrigated area (Myanmar Census of Agriculture 2010)

The irrigated area has been increased by the different types of irrigation facilities. Based on the census data, the total area irrigated in the country was about 2.34 million ha in 2010, which is an increase of 68.16 percent over the area in 2003. The increase of the irrigated area by type of irrigation facilities is shown in (Table 7).

Table 7: Increase of total irrigated area by different type of irrigation facilities

Type of Irrigation Facilities	Total area irrigated (ha)		Growth (%)
	MCA 2003 ¹	MCA 2010 ²	
Union Total	1,389,275.41	2,336,273.89	68.16
Own Wells	86,040.78	185,863.38	116.02
River or Creek	565,722.94	917,092.67	62.11
Private dam/canal	142,346.02	183,042.61	28.59
Government dam/canal	595,165.68	909,546.84	52.82
Other sources	-	140,728.39	-

Source: 1) Report on Myanmar Census of Agriculture 2003

2) Settlement and Land Records Department (MCA 2010 data)

Table 8: Average of all crop holdings, urban crop holdings and rural crop holdings by cropping pattern of the parcel (Unit-Acre)

Region/State	All crop holdings		Urban crop holdings		Rural crop holdings	
	All	Average	All	Average	All	Average
Union of Myanmar						
Number of Irrigated Parcels	1,350,847		30,223		1,320,624	
Total Area of Irrigated Parcels	4,905,409	3.63	103,755.95	3.43	4,801,652.70	3.64
Kachin						
Number of Irrigated Parcels	53,515		4,118		49,397	
Total Area of Irrigated Parcels	270,436	5.05	15,425.89	3.75	255,010.26	5.16
Kayah						
Number of Irrigated Parcels	19,980		942		19,038	
Total Area of Irrigated Parcels	50,545	2.53	2,426.03	2.58	48,118.97	2.53
Kayin						
Number of Irrigated Parcels	2,496		24		2,472	
Total Area of Irrigated Parcels	5,647	2.26	214.90	8.95	5,432.42	2.20
Chin						
Number of Irrigated Parcels	14,908		733		14,175	
Total Area of Irrigated Parcels	23,731	1.59	1,308.13	1.78	22,422.82	1.58

Region/State	All crop holdings		Urban crop holdings		Rural crop holdings	
	All	Average	All	Average	All	Average
Sagaing						
Number of Irrigated Parcels	258,828		5,514		253,314	
Total Area of Irrigated Parcels	1,101,550	4.26	26,284.39	4.77	1,075,265.51	4.24
Tanintharyi						
Number of Irrigated Parcels	1,684		59		1,625	
Total Area of Irrigated Parcels	4,017	2.39	257.27	4.36	3,760.08	2.31
Bago East						
Number of Irrigated Parcels	20,297		478		19,819	
Total Area of Irrigated Parcels	140,488	6.92	3,821.41	7.99	136,666.67	6.90
Bago West						
Number of Irrigated Parcels	19,183		344		18,839	
Total Area of Irrigated Parcels	76,019	3.96	1,346.06	3.91	74,673.11	3.96
Magway						
Number of Irrigated Parcels	174,360		2,353		172,007	
Total Area of Irrigated Parcels	422,050	2.42	5,762.20	2.45	416,287.60	2.42

Region/State	All crop holdings		Urban crop holdings		Rural crop holdings	
	All	Average	All	Average	All	Average
Mandalay						
Number of Irrigated Parcels	263,417		2,652		260,765	
Total Area of Irrigated Parcels	745,180	2.83	7,790.08	2.94	737,389.51	2.83
Mon						
Number of Irrigated Parcels	10,709		330		10,379	
Total Area of Irrigated Parcels	45,950	4.29	1,123.30	3.40	44,826.33	4.32
Rakhine						
Number of Irrigated Parcels	14,455		74		14,381	
Total Area of Irrigated Parcels	15,340	1.06	48.52	0.66	15,291.09	1.06
Yangon						
Number of Irrigated Parcels	29,819		261		29,558	
Total Area of Irrigated Parcels	139,953	4.69	1,312.53	5.03	138,640.18	4.69
Shan South						
Number of Irrigated Parcels	81,606		5,779		75,827	
Total Area of Irrigated Parcels	165,133	2.02	16,090.78	2.78	149,041.79	1.97

Region/state	All crop holdings		Urban crop holdings		Rural crop holdings	
	All	Average	All	Average	All	Average
Shan North						
Number of Irrigated Parcels	104,069		2,781		101,288	
Total Area of Irrigated Parcels	229,390	2.20	7,174.65	2.58	222,215.07	2.19
Shan East						
Number of Irrigated Parcels	50,463		2,771		47,692	
Total Area of Irrigated Parcels	112,601	2.23	5,762.31	2.08	106,838.32	2.24
Ayeyarwady						
Number of Irrigated Parcels	231,060		1,010		230,050	
Total Area of Irrigated Parcels	1,357,380	5.87	7,607.50	7.53	1,349,772.96	5.87

Source: 1) Settlement and Land Records Department (MCA 2010 data)

The comparison of each average crop holdings is as shown in Table 8 for every region and state by cropping pattern of the parcel.

Table 9: Average of all crop holdings, urban crop holdings and rural crop holdings by main land use of the Parcel (Unit-Acre)

Region/State	All crop holdings		Urban crop holdings		Rural crop holdings	
	All	Average	All	Average	All	Average
Union of Myanmar						
Number of Irrigated Parcels	1,678,782		34,873		1,643,909	
Total Area of Irrigated Parcels	5,773,106	3.44	116927	3.35	5,656,180	3.44
Kachin						
Number of Irrigated Parcels	57,195		4,371		52,824	
Total Area of Irrigated Parcels	283,084	4.95	16,217	3.71	266,867	5.05
Kayah						
Number of Irrigated Parcels	22,485		1,015		21,470	
Total Area of Irrigated Parcels	56,939	2.53	2,632	2.59	54,306	2.53
Kayin						
Number of Irrigated Parcels	3,686		28		3,658	
Total Area of Irrigated Parcels	7,910	2.15	266	9.50	7,644	2.09
Chin						
Number of Irrigated Parcels	15,931		760		15,171	
Total Area of Irrigated Parcels	25,881	1.62	1,351	1.78	24,531	1.62

Region/State	All crop holdings		Urban crop holdings		Rural crop holdings	
	All	Average	All	Average	All	Average
Sagaing						
Number of Irrigated Parcels	335,749		6,544		329,205	
Total Area of Irrigated Parcels	1,371,295	4.08	29,964	4.58	1,341,332	4.07
Tanintharyi						
Number of Irrigated Parcels	2,254		63		2,191	
Total Area of Irrigated Parcels	5,000	2.22	263	4.17	4,737	2.16
Bago East						
Number of Irrigated Parcels	21,462		512		20,950	
Total Area of Irrigated Parcels	149,129	6.95	4,053	7.92	145,076	6.92
Bago West						
Number of Irrigated Parcels	22,603		343		22,260	
Total Area of Irrigated Parcels	89,140	3.94	1,353	3.95	87,787	3.94
Magway						
Number of Irrigated Parcels	232,005		2,913		229,092	
Total Area of Irrigated Parcels	539,148	2.32	6,852	2.35	532,296	2.32

Region/State	All crop holdings		Urban crop holdings		Rural crop holdings	
	All	Average	All	Average	All	Average
Mandalay						
Number of Irrigated Parcels	328,286		3,563		324,723	
Total Area of Irrigated Parcels	908,147	2.77	9,558	2.68	898,589	2.77
Mon						
Number of Irrigated Parcels	17,708		803		16,905	
Total Area of Irrigated Parcels	56,776	3.21	2,226	2.77	54,550	3.23
Rakhine						
Number of Irrigated Parcels	17,732		118		17,614	
Total Area of Irrigated Parcels	18,278	1.03	62	0.53	18,216	1.03
Yangon						
Number of Irrigated Parcels	43,546		312		43,234	
Total Area of Irrigated Parcels	165,762	3.81	1,497	4.80	164,266	3.80
Shan South						
Number of Irrigated Parcels	94,510		6,490		88,020	
Total Area of Irrigated Parcels	192,017	2.03	18,379	2.83	173,637	1.97

Region/State	All crop holdings		Urban crop holdings		Rural crop holdings	
	All	Average	All	Average	All	Average
Shan North						
Number of Irrigated Parcels	108,864		2,929		105,935	
Total Area of Irrigated Parcels	242,548	2.23	7,782	2.66	234,766	2.22
Shan East						
Number of Irrigated Parcels	52,672		2,847		49,825	
Total Area of Irrigated Parcels	116,572	2.21	5,905	2.07	110,668	2.22
Ayeyarwady						
Number of Irrigated Parcels	302,094		1,262		300,832	
Total Area of Irrigated Parcels	1,545,479	5.12	8,567	6.79	1,536,912	5.11

Source: 1) Settlement and Land Records Department (MCA 2010 data)

The comparison of each average crop holdings is as shown in Table 9 for every region and state by main land use of the Parcel.

Table 10: The analysis of its main findings was as follows by cropping pattern of the parcel

Crop holdings	Average					
	All		Max		Min	
	Acre	Hectare	Acre	Hectare	Acre	Hectare
All crop holdings	3.63	1.47	6.92 (Bago East)	2.80 (Bago East)	1.06 (Rakhine)	0.43 (Rakhine)
Urban crop holdings	3.43	1.39	8.95 (Kayin)	3.62 (Kayin)	0.66 (Rakhine)	0.27 (Rakhine)
Rural crop holdings	3.64	1.47	6.90 (Bago East)	2.79 (Bago East)	1.06 (Rakhine)	0.43 (Rakhine)

Table 11: The analysis of its main findings was as follows by main land use of the parcel

Crop Holdings	Average					
	All		Max		Min	
	Acre	Hectare	Acre	Hectare	Acre	Hectare
All crop holdings	3.44	1.39	6.95 (Bago East)	2.81 (Bago East)	1.03 (Rakhine)	0.42 (Rakhine)
Urban crop holdings	3.35	1.36	9.5 (Kayin)	3.84 (Kayin)	1.78 (Chin)	0.72 (Chin)
Rural crop holdings	3.44	1.39	6.92 (Bago East)	2.80 (Bago East)	1.06 (Rakhine)	0.43 (Rakhine)

5. Conclusions and recommendations

- Water resources in Myanmar are abundant, yet many of them are unexploited and can be used for irrigation. Different types of irrigation facilities have been developed and applied to secure the water supply for crop cultivation. The irrigated area throughout the country has gradually increased.
- The CDZ suffers from a rainfall deficit. The region needs a supplementary supply of water for irrigation even during the rainy season. Thus, irrigation is essential for the region and irrigation facilities have been developed there.

- The total irrigated area is about 2.34 million ha (2010) and this is still less than 18 percent of the net sown area. The area under irrigation should be increased.
- In Bago East region and Kayin state, rural crop holdings and urban crop holdings are maximal. In Rakhine state, rural and urban crop holdings are minimal because of the cropping pattern of the parcel.
- In Bago East region and Kayin state, rural crop holdings and urban crop holdings are maximal. In Rakhine state and Chin State, rural crop holdings and urban crop holdings are minimal because of the main land use of the parcel.
- To promote crop production, all of the irrigable area under irrigation projects should be improved and brought under irrigation.
- All concerned departments and organizations should improve the registration of irrigation area data such as irrigable area, irrigated area, kind of crops with seasons, and kind of crops with irrigation, based on actual field conditions.

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**The Republic of the Union of Myanmar
Ministry of Livestock and Fishries
Livestock Breeding and Veterinary Department**

**Improving Rural Farmers' Economy:
Combining the Raising of Cattle/Other
Livestock with Crop Cultivation**

Dr. Soe Myat Aye

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Abstract

Livestock and fisheries combined contributed 1,447.1 billion kyats (7.6 percent) to the national GDP in 2009/2010. The private sector contributed 98 percent of the total national livestock value. Primary livestock producers comprise mainly rural farmers who make up 75 percent of the country's population. Commercial farmers own large-scale farms for poultry, pig and dairy production in peri-urban and urban areas. In general, draught cattle, buffalo, sheep/goat, local pig, local chicken and duck are kept traditionally in small-scale rural farms. Dairy cattle and buffalo, exotic breeds of pig and commercial poultry are bred intensively by commercial farmers. Sixty-four percent of meat and 40 percent of eggs come from small-scale rural farmers and the remainders are from commercial farmers.

Paddy accounted for the largest portion of the planted area consisting of 22.86 million acres or 92.96 percent of the total area under cereal in 2010. The Myanmar Census of Agriculture (MCA) 2010 estimated the total number of livestock holdings as 4,306,321 which comprised 98.49 percent of rural livestock holdings with the reported area of 4,241,201 acres and 1.51 percent of urban livestock holdings with the reported area of 65,120 acres.

About 34 million chickens were raised in livestock holdings and about 86 percent of the total comprised native chickens, 8 percent were layers, 6 percent were broilers and the rest were semi-broilers.

Myanmar also has a long history of raising cattle and buffaloes as draught animals.

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Improving rural farmers' economy: combining the raising of cattle/other livestock with crop cultivation¹

Dr. Soe Myat Aye²

1. Introduction

Myanmar is the largest country on mainland Southeast Asia with a total land area of 676,577 sq km and unlike most neighbouring countries, she still has a vast amount of land resources with the potential for crop cultivation and the grazing of animals. Three-quarters of the population of Myanmar is rural and the agriculture sector directly or indirectly engages two-thirds of Myanmar's inhabitants. Industrial byproducts from the large areas of cereal crops and industrial crops are used as roughage or concentrated feed for livestock. In the same way, agricultural byproducts from other crops are used as animal feed.

The livestock sector in Myanmar is dominated by indigenous breeds kept primarily under traditional production and management systems. The majority of large livestock (cattle and buffalo) held in Myanmar are for dual draught and milk production purposes. There is limited commercial livestock activity in Myanmar and most of it is primarily located in peri-urban areas, with a focus on dairy cattle and broiler and laying poultry.

Myanmar is mainly dependent on draught cattle and buffalo for almost all agricultural land preparation activities and this has made a positive contribution to nature conservation and the sustainable development of the agricultural sector.

The Government of the Republic of the Union of Myanmar launched the Rural Development and Poverty Alleviation Programme on 1 July 2011 and this will continue until the end of 2015. The goal is to reduce the poverty rate by half in 2015 to fulfill the ultimate vision of Myanmar's Millennium Development Goal. To achieve this goal, the Rural Development and Poverty Alleviation Central Committee has drawn up an action plan which comprises eight components. The livestock component has been given priority as an agricultural component in the action plan to increase livestock breeding and the production of livestock and fishery products.

Various approaches at different levels of livestock farming are practiced within the context of rural development programmes. All livestock development activities are

¹ This paper was presented in the National Data Dissemination Seminar on the Myanmar Census of Agriculture 2010, in Myat Taw Win Hotel, Nay Pyi Taw on 5-6 November 2012.

² Dr. Soe Myat Aye is the Staff Officer of the Statistics Section of the Ministry of Livestock and Fisheries.

intended to improve household nutrition and income generation at basic level and to achieve food security, food safety and export earnings at country level. There are various approaches at different levels of livestock farming designed step-by-step to develop the sector further:

- Backyard husbandry to small-scale commercial farming
- Agriculture and livestock integrated farming
- "One Village One Product".

2. Pros and cons of engaging cattle and buffalo in the agriculture sector

According to official data, livestock and fisheries combined contributed 1,447.1 billion kyats (7.6 percent) to the national GDP in 2009/2010. The private sector contributed 98 percent to the total national livestock value. Moreover, it is estimated that about 60 percent of the total population is directly or indirectly involved in agriculture related activities. Myanmar had a population of 59.78 million according to official data in 2010. This has been steadily increasing since 1999, as shown in Table 1. From a livestock perspective this increases the demand for draught power, food, income generating activities and employment.

Table 1: Population estimates of Myanmar

Year	Male	Female	Total	Growth rate (%)
1999	24.40	24.73	49.13	2.02
2000	24.91	25.22	50.13	2.02
2001	25.42	25.72	51.14	2.02
2002	25.94	26.23	52.17	2.02
2003	26.47	26.76	53.23	2.02
2004	27.00	27.30	54.30	2.02
2005	27.54	27.86	55.40	2.02
2006	28.10	28.42	56.52	2.02
2007	28.59	28.92	57.50	1.75
2008	29.02	29.36	58.38	1.52
2009	29.40	29.73	59.13	1.29
2010	29.72	30.06	59.78	1.10

Source: Ministry of National Planning and Economic Development, Planning Department

2.1 Livestock/poultry holdings in Myanmar

According to the results of MCA 2010, the legal status of the livestock/poultry holders in the Republic of the Union of Myanmar can be categorized into single household holders and joint household holders. Of the total number of livestock holders, the majority, 99.58 percent or 4.2 million, were single household holders and there were 18,179 or 0.42 percent joint household holders. The highest number of household livestock holdings was in Sagaing region as shown in Table 2.

Table 2: Number of livestock/poultry holdings by legal status of the livestock/poultry holder, by region/state, RoUM: MCA 2010

Region/State	Legal status of the household livestock/poultry holder		
	Single household holding	Joint holding with other households	Total household livestock holdings
Kachin	136,010	547	136,557
Kayah	22,664	2	22,666
Kayin	37,057	332	37,389
Chin	85,384	124	85,508
Sagaing	722,695	3,088	725,783
Tanintharyi	45,914	64	45,978
Bago East	232,793	608	233,401
Bago West	277,821	1,208	279,029
Magway	588,619	2,896	591,515
Mandalay	667,307	2,010	669,317
Mon	100,609	1,426	102,035
Rakhine	271,982	1,545	273,527
Yangon	188,411	1,488	189,899
Shan South	103,913	314	104,227
Shan North	170,395	368	170,763
Shan East	52,543	239	52,782
Ayeyarwady	583,987	1,920	585,907
Union	428,8104	18,179	4,306,283

Source: MCA 2010

MCA 2010 reported that the household livestock holdings in Myanmar were mainly headed by male under the age groups 40-49 years old as shown in Table 3.

Table 3: Total number of household livestock holders by sex and age of the livestock holder, RoUM: 2010

Age	Male holders	%	Female holders	%	Total holders	%
Less than 30 years old	313,299	7.28	28,526	0.66	341,825	7.94
30 - 39 years old	893,824	20.76	59,241	1.38	953,065	22.13
40 - 49 years old	1,164,512	27.04	102,529	2.38	1,267,041	29.42
50 - 59 years old	962,671	22.35	116,348	2.70	1,079,019	25.06
60 - 69 years old	431,475	10.02	70,002	1.63	501,477	11.65
70 years old and over	134,711	3.13	29,183	0.68	163,894	3.81
Total livestock holders	3,900,492	90.58	405,829	9.42	4,306,321	100.00

Source: MCA 2010

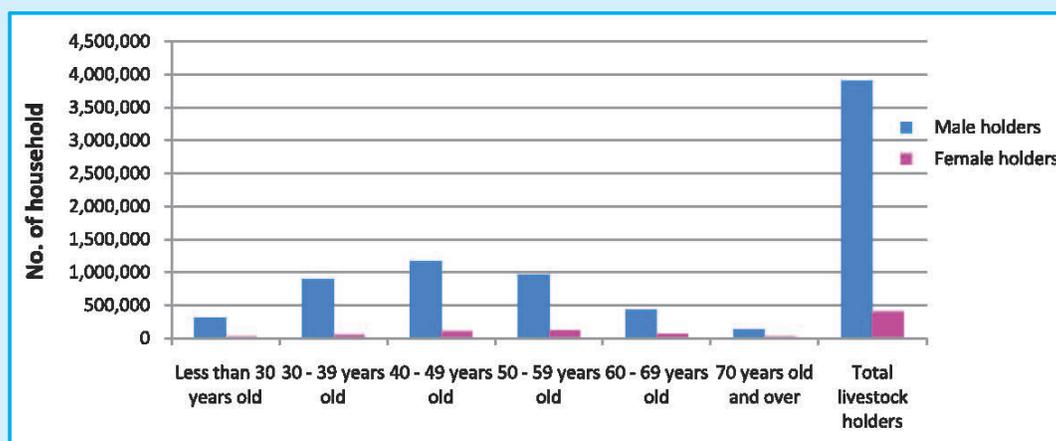


Figure 1. Total number of household livestock holders by sex and age of the livestock holder, RoUM: MCA 2010

Myanmar is mainly dependent on agriculture and almost all the activities for land preparation are done by draught animal power (cattle and buffalo) and farm mechanized power. Though the farm mechanization system is improving, there is still a great need for draught cattle power in rural development programmes. It is important to note that developing draught cattle and buffalo for land preparation for crop cultivation has been emphasized in Myanmar. MCA 2010 reported that the population of draught cattle and buffalo amounted to 11.7 million heads or 92 percent of the total population of large livestock. The results of MCA 2010 showed that on average there were three livestock per holding; for small livestock the figure was also three livestock per holding and for poultry the average was 15 fowls per holding. Livestock holdings with livestock population for 2010 are shown in Table 4.

Table 4: Number of holdings in terms of livestock, RoUM: MCA 2010

Kinds of livestock	Nos. of holding reporting	Nos. of livestock	Average per holding
(1)	(2)	(3)	(4)
Large livestock total	3,974,848	12,695,163	3.19
Draught cattle	3,220,595	10,216,226	3.17
Dairy cattle	100,998	310,726	3.08
Other cattle	194,839	627,010	3.22
Draught buffalo	435,248	1,480,487	3.40
Dairy buffalo	3,009	11,749	3.90
Other buffalo	4,270	12,600	2.95
Horse	12,977	28,909	2.23
Mule	1,390	2,835	2.04
Donkeys	195	379	1.94
Other large livestock	1,327	4,242	3.20
Small livestock total	1,456,496	4,368,900	3.00
Sheep	12,990	292,594	22.52
Goat	113,536	1,083,428	9.54
Pigs	1,304,383	2,746,826	2.11
Others	25,587	246,052	9.62
Poultry total	2,605,531	37,656,750	14.45
Chicken	2,487,705	33,922,522	13.64
Duck	112,272	3,309,672	29.48
Quail	1,010	356,734	353.20
Others	4,544	67,822	14.93

Source: MCA 2010

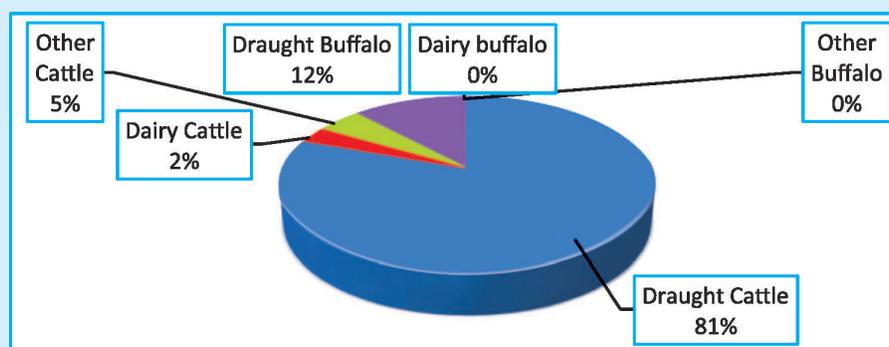


Figure 2. Population of cattle/buffalo breeds in share of total cattle/buffalo population, RoUM: MCA 2010

Table 5: Livestock population and annual growth, RoUM: MCA 2003 and 2010

(Thousand number)

Species	Year		Annual growth rate (%)
	2003	2010	
(1)	(2)	(3)	(4)
Cattle & buffalo	7,842	12,659	8.8 %
Sheep & goat	647	1,376	16.1 %
Pig	1,792	2,747	7.6 %
Chicken	27,942	33,923	3.1 %
Duck/quail/other	5,045	3,734	-3.7 %

Source: MCA 2010

Table 6: Livestock population by region/state, RoUM: 2010

No.	Region/State	Cattle	Buffalo	Sheep/ goat	Pig	Poultry	Duck
1	Kachin	393,238	138,000	12,757	191,257	1,374,260	21,092
2	Kayah	42,652	2,999	2,627	33,315	282,490	228
3	Kayin	96,909	6,263	8,883	32,219	437,293	18,014
4	Chin	79,290	24,352	22,225	121,022	783,629	291
5	Sagaing	2,500,214	213,658	209,111	348,276	3,904,606	29,112
6	Tanintharyi	44,607	39,198	7,499	37,848	645,439	10,121
7	Bago	1,289,263	116,253	14,694	312,601	3,902,948	356,279
	Bago East	610,353	103,804	7,098	221,830	2,107,066	322,636
	Bago West	678,910	12,449	7,596	90,771	1,795,882	33,643
8	Magway	1,755,693	29,827	370,291	212,772	3,052,917	5,480
9	Mandalay	1,940,922	67,513	528,288	227,223	3,610,855	218,781
10	Mon	257,081	24,500	17,700	56,919	1,388,533	123,347
11	Rakhine	851,415	218,315	122,692	129,043	2,159,904	45,404
12	Yangon	476,229	36,591	27,628	127,486	3,075,993	377,980
13	Shan	451,799	372,232	4,739	378,954	2,982,297	25,703
	Shan South	184,906	55,096	1,286	60,857	1,033,243	8,851
	Shan North	217,983	244,663	3,128	211,063	1,094,773	1,760
	Shan East	48,910	72,473	325	107,034	854,281	15,092
14	Ayeyarwady	974,650	215,135	26,888	537,891	6,321,358	2,077,840
	Union	11,153,962	1,504,836	1376022	2,746,826	33,922,522	3,309,672

Regions and states reporting the highest cattle population in 2010 were as follows: 1) Sagaing region, 2.5 million (22.4 percent); 2) Mandalay region, 1.9 million (17.4 percent); 3) Magway region, 1.7 million (15.7 percent); 4) Bago region, 1.3 million (11.6 percent) (Figure 3).

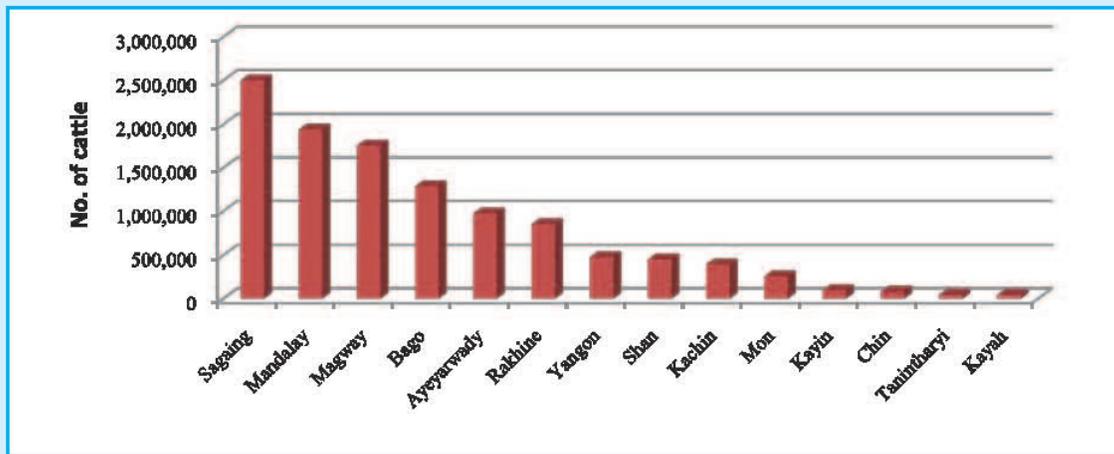


Figure 3. Cattle population by region/state RoUM: MCA 2010

Most buffalo population were the following: Shan State, 372,232 (24.7 percent); The three dominant buffalo raising states were Rakhine state with 218,315 heads (14.5 percent); Ayeyarwady region, 215,135 (14.3 percent) and Sagaing region, 213,658 (14.2 percent) (Figure 4).

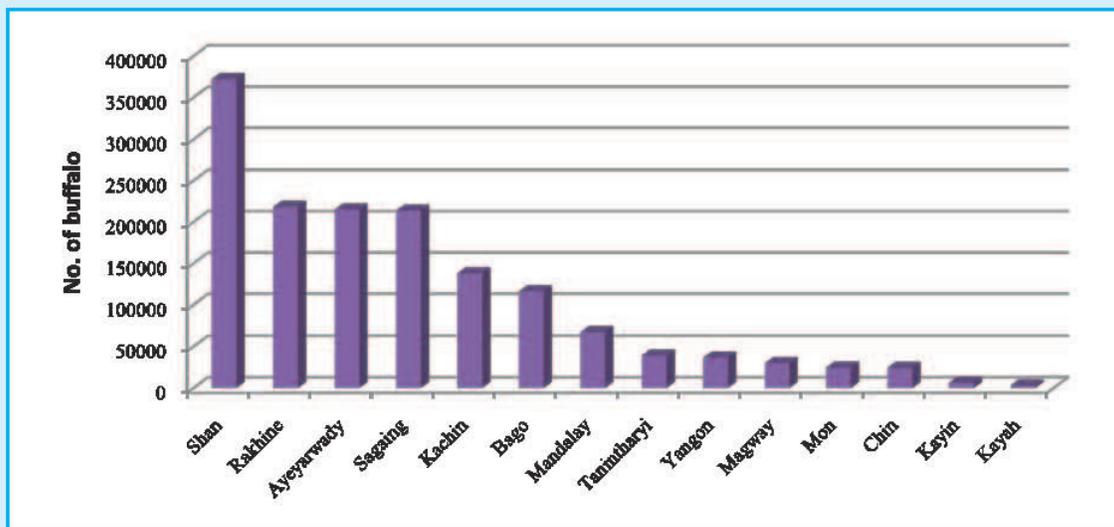


Figure 4. Buffalo population by region/state, RoUM: MCA 2010

Sheep and goats were found mostly in Mandalay region, 528,288 (38.4 percent); Magway region, 370,291 (26.9 percent); Sagaing region, 209,111 (15.2 percent); Rakhine state, 122,692 (8.9 percent) (Figure 5).

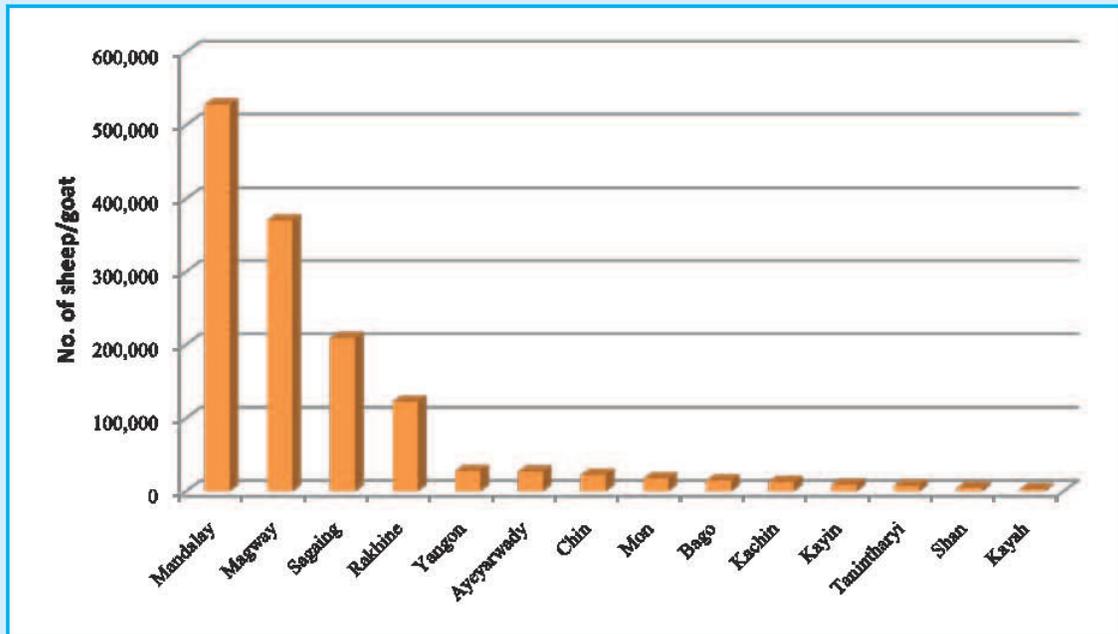


Figure 5. Sheep/goat population by region/state, RoUM: MCA 2010

The pig population was the highest in Ayeyarwaddy region, 537,891 (19.6 percent); Shan State, 378,954 (13.8 percent); Sagaing region, 348,276 (12.7 percent) and Bago region, 312,601 (11.4 percent) (Figure 6).

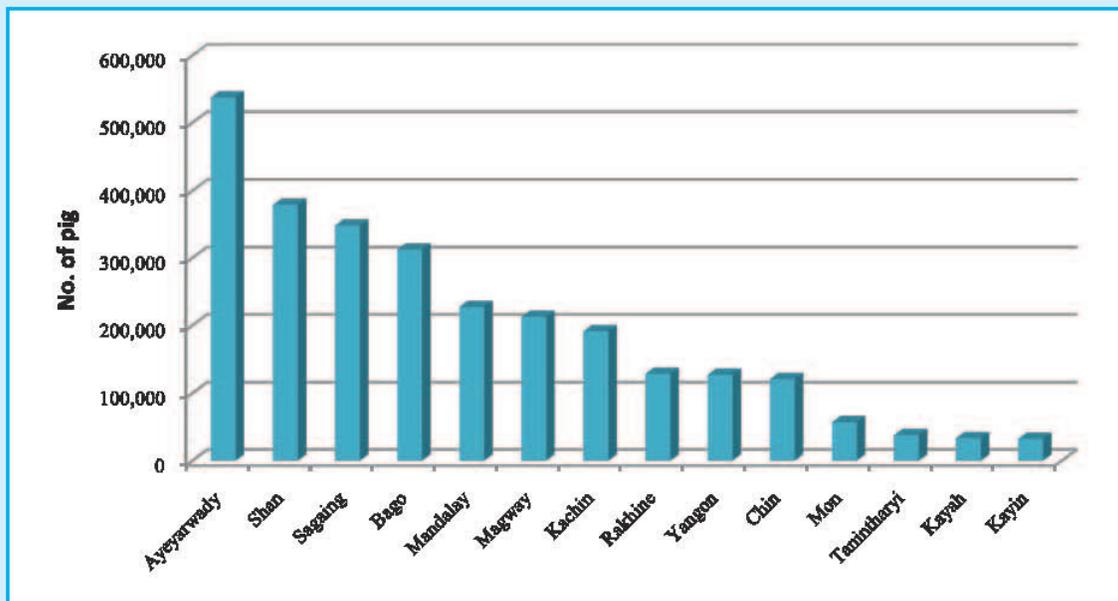


Figure 6. Pig population by region/state, RoUM: MCA 2010

The chicken population was the highest in Ayeyarwady region, 6.3 million (18.6 percent), Sagaing region, 3.9 million (11.5 percent), Bago region, 3.9 million (11.5 percent) and Mandalay region, 3.6 million (10.6 percent) (Figure 7).

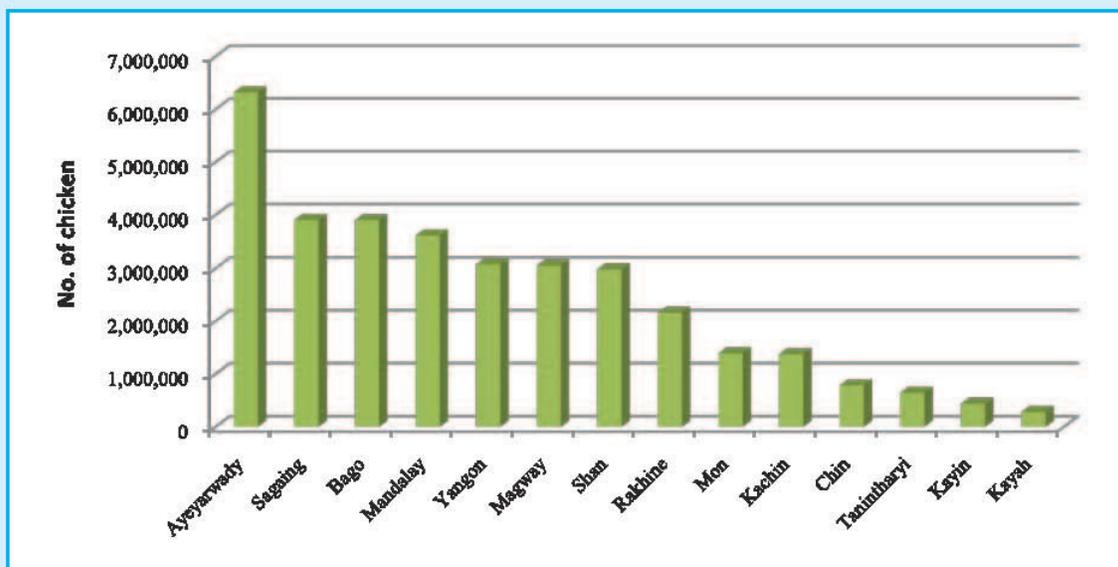


Figure 7. Chicken population by region/state, RoUM: MCA 2010

The duck population was highest in Ayeyarwady region 2.07 million (62.8 percent) Yangon region 377,980 (11.4 percent), Bago region 356,279 (10.8 percent) and Mandalay region 281,781 (6.6 percent) (Figure 8).

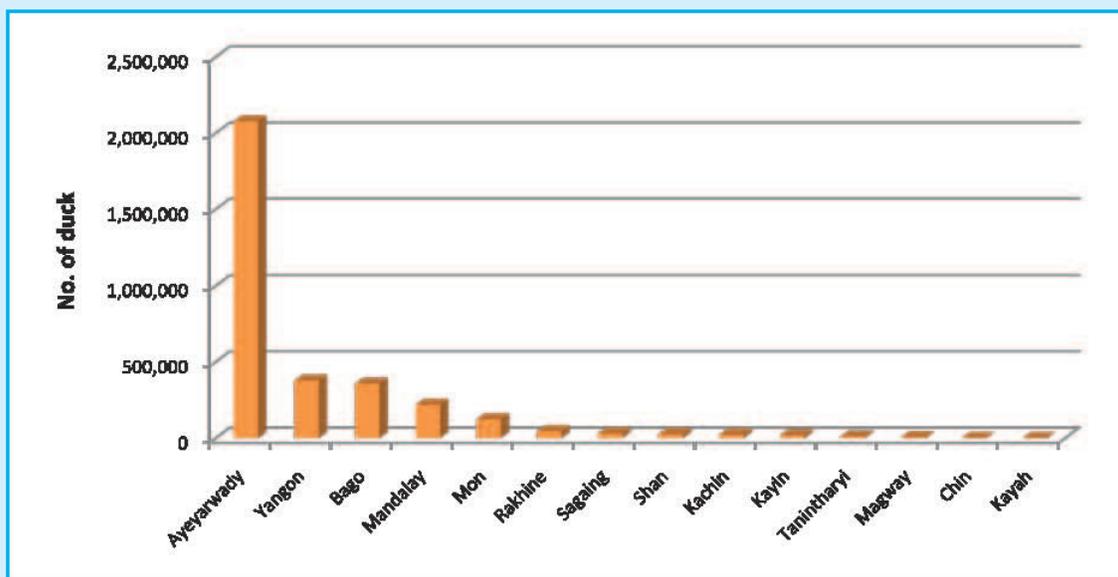


Figure 8. Duck population by region/state, RoUM: MCA 2010

2.2 Working draft cattle and buffalo population

All male cattle, both sexes of buffaloes above three years old and less than 1 percent of female cows are interpreted as working draught animals by the LBVD. The growth rate of cattle has been fairly stable at 9.1 percent from 2003 to 2010. The majority (80.7 percent or 10.2 million) of large livestock were draught cattle followed by draught buffalo (1.4 million or 11.7 percent). Draught cattle and buffalo populations for 2003 and 2010 are shown in Table 7.

Table 7: Number of working draught cattle and buffalo population

(thousands)

Working draught cattle / buffalo	Year	
	2003	2010
Male draught cattle	4,171	6,715
Male draught buffalo	436	591
Female draught buffalo	302	504
Total	4,909	7,810

Source: MCA 2010

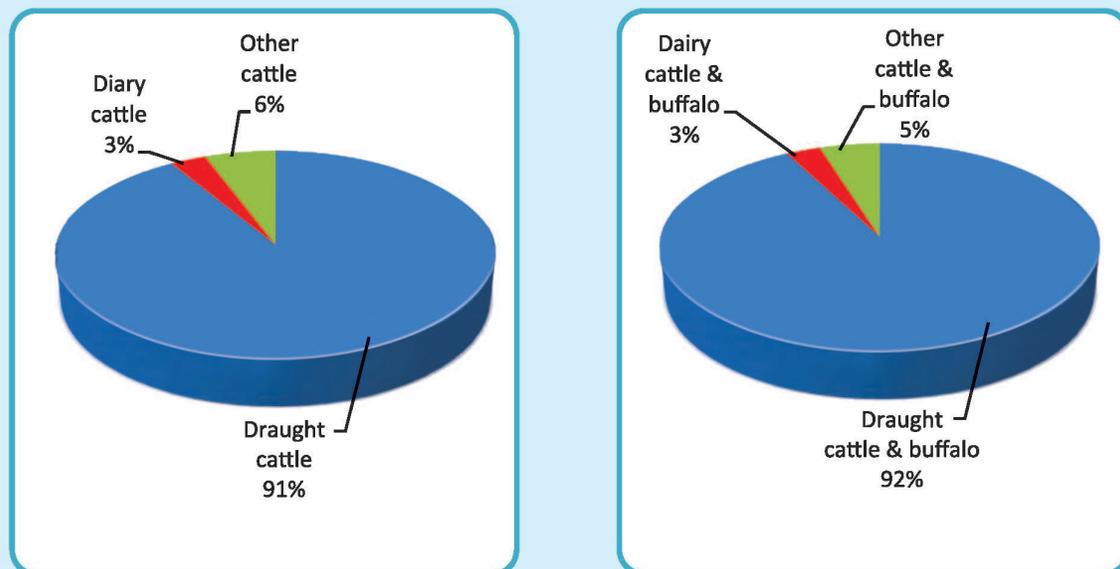


Figure 9. Population sharing in cattle and buffalo, RoUM: MCA 2010

(Thousand Number)

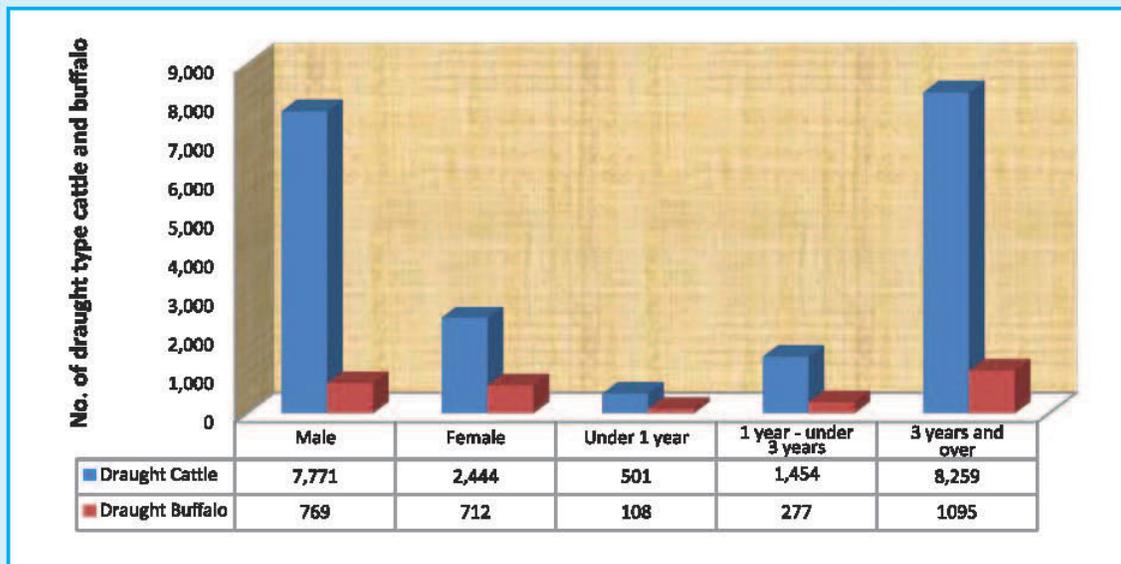


Figure 10. Number of draught type cattle and buffalo by sex and age group, RoUM: MCA 2010

2.3 Use of machinery/equipment and livestock buildings

MCA 2010 reported that the machinery/equipments most frequently used in the livestock holdings were the trough and the mill. The least used machinery/equipment were generators and heaters (Figure 11).

Most of the livestock holdings used livestock houses/sheds, stockyards, poultry houses and other types as shown in Figure 12.

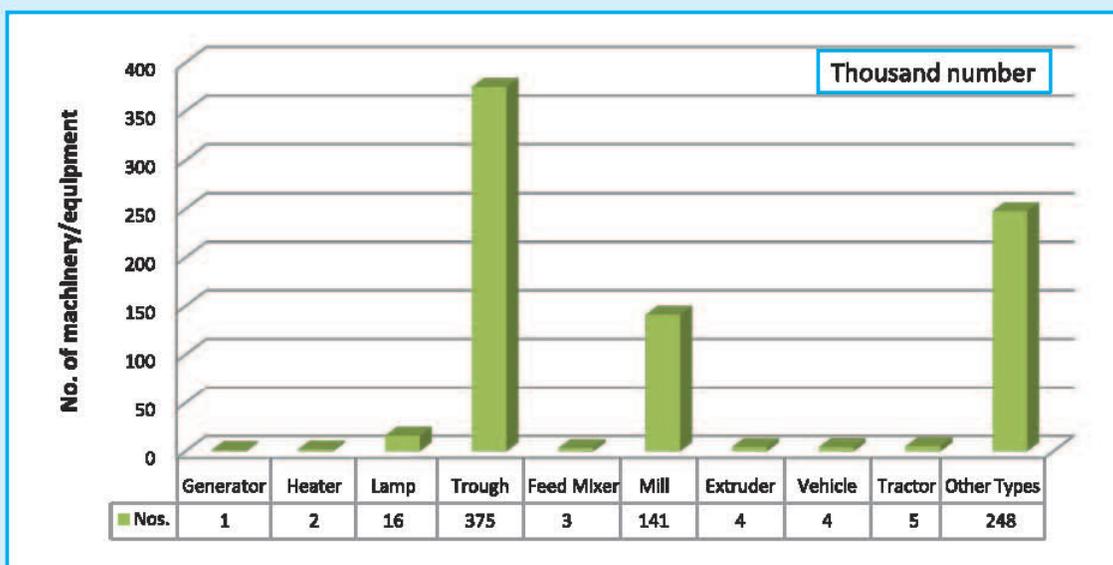


Figure 11. Number of household livestock/poultry holdings that kept/bred livestock/poultry that used machinery/equipment, by type of machinery/equipment used, RoUM: MCA 2010

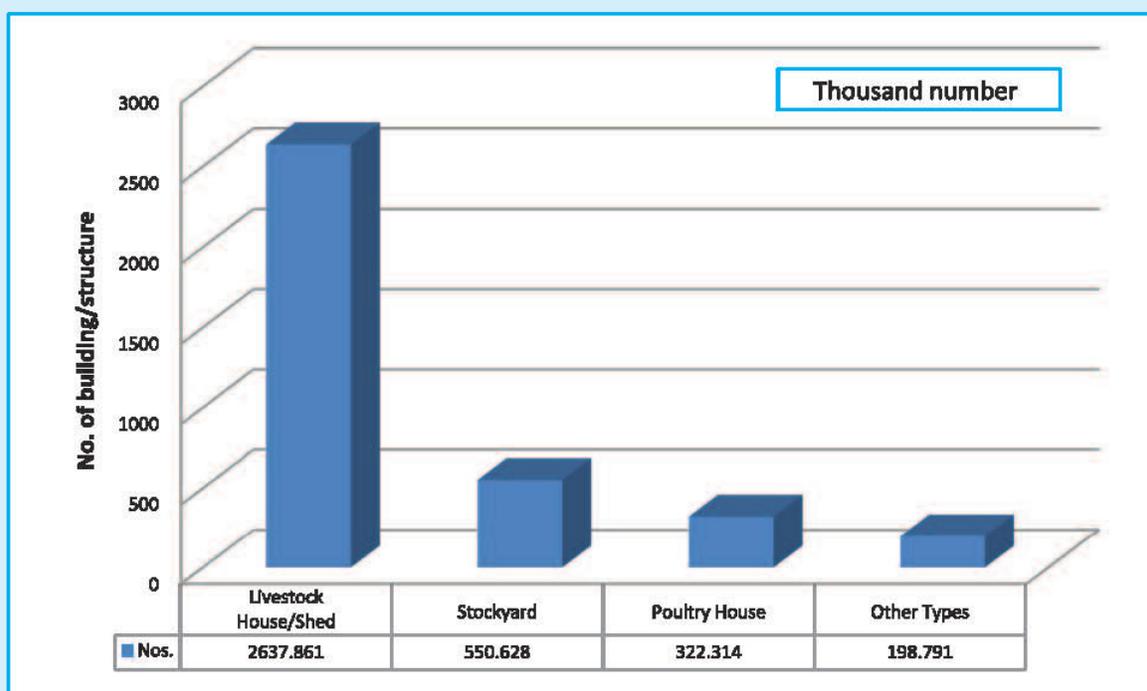


Figure 12. Number of buildings/structures used by type of building/structure used, RoUM: MCA 2010

2.4 Effective sown areas

The effective sown area increased dramatically over the period from 2006 to 2010.

Table 8: Sown area of crops group

(Thousand Hectare)

No.	Crop name	2006-07	2007-08	2008-09	2009-10	2010-11
1	Cereal crops	8,806	8,762	8,776	8,777	8,779
2	Oil crops	3,111	3,491	3,655	3,748	3,690
3	Pulses	4,003	4,207	4,277	4,383	4,501
4	Industrial crops	1,076	1,184	1,238	1,260	1,299
5	Culinary crops	277	289	289	335	328
6	Other crops	3,145	4,192	4,726	4,860	4,970
	Total sown	20,417	22,126	22,961	23,363	23,567

Source: MoAI, SLRD

Table 9: Utilization of tractors and power tillers in crop cultivation

Particular	Units	2006-07	2007-08	2008-09	2009-10
Draught cattle	000' Number	9,139	9,557	9,781	10,072
Tractors	Number	9,594	9,872	9,909	10,110
Agricultural mechanization department	"	2,694	2,530	2,458	1,772
Tractors Owned by peasants	"	6,900	7,342	7,451	8,338
Power tillers	Number	110,530	88,126	98,010	132,730
Power Tillers Owned by peasants	"	110,530	88,126	98,010	132,730
Total tillage hectare-turn by AMD	000 hectare-turn	2,346	1,974	2,902	3,788
Tractors used in total tillage hectare-turn	"	904	609	695	821
Power Tillers used in total tillage hectare-turn	"	1,442	1,365	2,207	2,967
Total tillage hectare-turn by peasants	"	2,315	1,767	2,106	3,863
Tractors used in total tillage hectare-turn		2,315	1,767	2,106	3,863

Source: MoAI, AMD

2.5 Generic livestock resource

Livestock play an important role in the lives of many people in Myanmar in terms of livelihood, employment, food security and nutrition and draught power for crop cultivation and rural transport. Livestock manure also provides a large amount of natural fertilizer for crop planting and horticulture. Livestock are also regarded as a financial reserve. Table 10 shows production of meat, milk and eggs according to the administrative records of LBVD.

Table 10: Production of meat, milk and eggs in 2003 and 2010

Generic livestock resources		Livestock products	
		2003	2010
(1)		(2)	(3)
Cattle/ buffalo	Meat (000' MT)	96.9	232.5
	Milk (000' MT)	829.43	1,602.5
	Hide (000' Nos.)	907	1,867
Sheep/goat	Meat (000' MT)	14.8	40.9
	Skin (000' Nos.)	1,633	3,175
Pig	Meat (000' MT)	220.8	518.2
Chicken	Meat (000' MT)	379.6	996.5
	Egg (000' Nos.)	2,809,184	7,029,975
Duck	Meat (000' MT)	42.2	97.7
	Egg (000' Nos.)	333,514	697,124
Other poultry (quail, goose, swam, muscovy)	Meat (000' MT)	2.8	7.4

Source: LBVD

3. Better livestock economic activity compared to crop cultivation

Livestock are generally more adaptable to environmental risk than crops. They are mobile, which increases survivability and may also be relatively omnivorous, and thereby able to survive dramatic effects on specific feed resources. Native animal varieties in particular are adapted to local environmental risks and use natural resources efficiently. Finally, the provision of food, e.g. milk and eggs, by livestock provides nutritional insurance and consumption smoothing opportunities for households.

Small-scale family poultry production is practiced by most rural households throughout the developing world, and can also be found in peri-urban and urban environments. Small semi-scavenging flocks of indigenous-breed birds and backyard poultry provide scarce animal protein in the form of meat and eggs, and are sold or bartered to meet essential family needs.

They are generally owned and managed by women and children, and are often essential to women's incomes and their position within their households. Poultry plays important social and cultural roles in the lives of rural people, not least in building social relations with other villagers. The output of village poultry is lower than that from