CHAPTER V

FARMERS' PERCEPTION, KNOWLEDGE AND MANAGEMENT

5.1 Introduction

In several countries, soil erosion has become a national concern and considerable efforts have been put into research and soil conservation programmes. Results from research stations are important but are not always representative for a large area. In some countries several criticisms have been made in the past because data from stations were taken as a reference to design conservation measures for the whole country, with the obvious errors in extrapolation and design of conservation packages, and thus response for the poor performance during implementation. Data from research stations are useful but they should be always confronted with site-specific conditions and never generalized.

In absence of research facilities, empirical field assessments of erosion levels and soil loss can take place using erosion damage assessment field surveys and empirical measurements of soil loss by the means of caps, graduated sticks planted at regular intervals in the fields, soil deposition along bunds and by farmers perceptions on past erosion, soil conditions and productivity levels.

In addition to the rough field measurements, interviews, discussions and field walks with farmers are very important to determine the severity of soil erosion and its effects on production levels.

Moreover, farmers (specially the old ones) may recall and describe the conditions of their fields in the same way they can tell about their sons and daughters. They may remember the fertility levels (crops that did not need fertilizers in the past but nowadays cannot grow without them) existing decades ago, the decrease of productivity of their fields in relation to rainfall amounts, describe the evolution of rills and gullies if any, report on the evolution of crop rotations and reasons for change, sense the worsening of climatic conditions, relate the depletion of woody biomass to the levels of erosion and increase of runoff, discuss an infinite number of other matters that would easily guide the understanding and assessing the severity and extent of erosion trends and their interrelated causes (Carucci, 2001).

5.2 Farmers' perception

Data and information about farmers' perceptions on soil erosion were collected during household survey and field observations in 2007. The results indicate that farmers in Dry Zone Area of Central Myanmar are able to identify soil erosion and fertility loss indicators, take a holistic view of soil degradation and have a broad knowledge of the reasons for soil degradation. They perceive soil degradation mainly by reduced yields, soil changing in appearance and becoming stony or coarse. The most frequently mentioned soil erosion indicator was soil becoming coarse and stony, followed by rill formation, dissection of fields and gullies and topsoil removal.

The most important perceived indicator of soil fertility loss was reduced crop yield, followed by poor crop performance and yellowing of the crop. Farmers also have knowledge of solutions; however, participation in soil conservation activities is minimal because of the immediate threat of food insecurity. Any programme designed

to address soil degradation in the region will have to be cognizant of farmers' knowledge and holistic view of soil degradation, and be integrated with aid measures to guarantee food security.

5.3 Farmers' knowledge and management

5.3.1 Types of soil by farmers

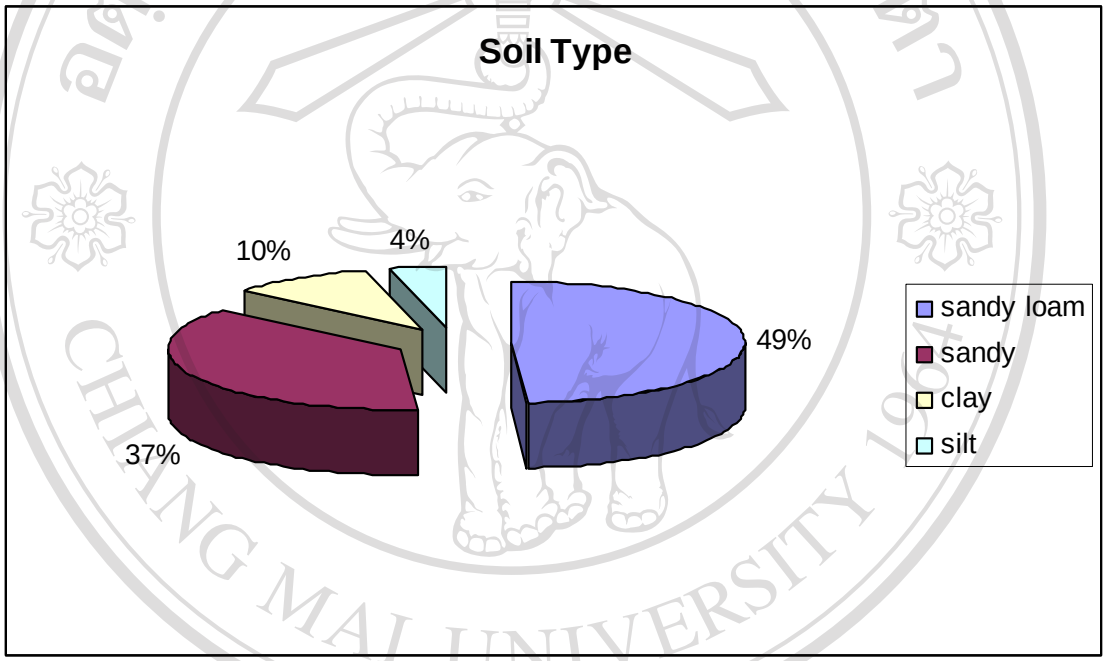

Figure 18. Types of soil in the study area.

According to farmers' response, surface soil texture of the study area is predominantly fine sandy loam (49%), sandy soil (37%), clay soil (10%) and 4% of silt (Figure 18). This indicates a generally high erodibility of the area in terms of texture indicator.

5.3.2 Soil fertility status

In sampled farmers' fields, 86% of all farmers' soil is sandy and sandy loam. The farmers responded that most of their fields are poor to fair in soil fertility. All soil series have low fertility and declining organic matter levels. Nitrogen is required for all non-legume crops on all soil types.

Farmers in Dry Zone Area of Central Myanmar are able to identify soil erosion and fertility loss indicators, especially by reduced yields and crop performance, using increased amount of fertilizers.

5.3.3 Fertilizer classification

Farmers generally have good knowledge about fertilizer classification. Beside chemical fertilizers, organic fertilizers are also added by the farmers in study area. 42% of sampled farmers were using Urea fertilizers, only 5% of farmers were using T-super, 29% of those were using Compound fertilizers and 24% were using other types of fertilizers (Table 3).

Table 3. Type of fertilizers using by farmers in the study area.

Type of Fertilizers	Number	% of Total
Urea	42	42
T-Super	5	5
Compound	29	29
Others	24	24

5.3.4 Benefits and limitations of fertilizer application

All farmers know the benefits of fertilizer, such as yields and more healthy plants. Present agricultural systems in Myanmar follow the traditional methods which utilize the available natural resources combined with improved cultural practices. Although the use of synthetic chemicals such as fertilizers and pesticides has been well established in Myanmar's agriculture, the quantity actually used is much lower than the recommended optimum rates. Hence, there is no evidence so far that the use of such synthetic compounds in Myanmar has caused any serious disruption of natural ecosystems or environmental pollution.

The use of natural resources for agricultural production had long been a traditional practice of farmers in Myanmar. The effectiveness of farmyard manure (FYM) on crop yield and soil physical properties have well realized and used by Myanmar farmers since many decades. Prior to the introduction of chemical fertilizers in the late 1960s, agricultural production was solely dependent on the use of FYM and locally available organic manures. The type and quantity of the organic manures used at different locations varied greatly, depending upon their availability.

When chemical fertilizers were introduced in the late 1960s, there were dramatic increases in crop yields. Introduction of high yielding varieties also helped to improved crop yields. Since fertilizer use by farmers has been considerably less than recommended, and because of the nutrient requirements of high yielding varieties, there has been a substantial depletion of plants nutrients from soils. This has resulted in a critical decline in soil fertility and productivity.

Limitations relate to fertilizer costs and risks connected with climate conditions. The drier the conditions the more risky fertilization becomes.

5.3.5 Effects of fertilizer on soil

In dry zone the rational application of fertilizers is often necessary to support and enhance a balanced growth of crops. However, in dry areas the application of fertilizers is a delicate operation. Trend of using fertilizer amount is increasing probably nutrient depletion by erosion and mono-cropping (Table 4).

Table 4. Trend of using fertilizer amount.

Trend of using fertilizer amount	Percentage
Decreasing	1
Normal	4
Increasing	58
Not specified	37

(Source: Field survey, 2007)

5.3.6 Crop residue management

There are three ways of crop residue management: i) burning in the field, ii) bring it home for livestock feed, or iii) use it as an alternative energy source for cooking.

In the study area, most of the crop residue is extensively used for livestock feeds (by products of oil crops, peas and beans etc.) and energy source for cooking. Firewood is used almost exclusive for household cooking and also widely used in small cottage industries such as brick making, cheroot production and jaggery boiling. Due to lack of fuel wood, the stems of pigeon pea and sesame are also burned for domestic use. Most of sesame straws are either sold or used for the jaggery industry.

5.3.7 Tillage operation

In Myanmar, the land is solely own by the State and farmers have only right to cultivate on it. Therefore, farmers are not willing to invest in erosion control measures other than doing small farmers' diverse ditches. According to the farmers' response, trend of changing number of tillage operation is increasing being top soil depth is getting shallow due to erosion (Table 5).

Table 5. Trend of changing number of tillage operation from sampled farmers.

Changing no. of Tillage operation	Percentage
Normal	37
Increasing	63

5.3.8 Farming systems

Multiple and mixed cropping are typical cropping systems because single cropping is not safe for the farmers facing the meager and unreliable rainfall. The cropping pattern of Magway district is summarized as in Figure 19.

Magway and neighboring townships benefit from higher rainfall and wider range of options (run type of groundnut, sesame and pulses and beans). Pigeon peas are grown in pure stands or in rows. Intercropping is also common in the area. Double cropping is the main pattern (first sesame, then other crops) except for pigeon pea, runner type of groundnuts and short staple cotton. Long sorghum is planted as second crop mainly for animal feeds (bullocks) and rarely for human consumption (only in bad years).

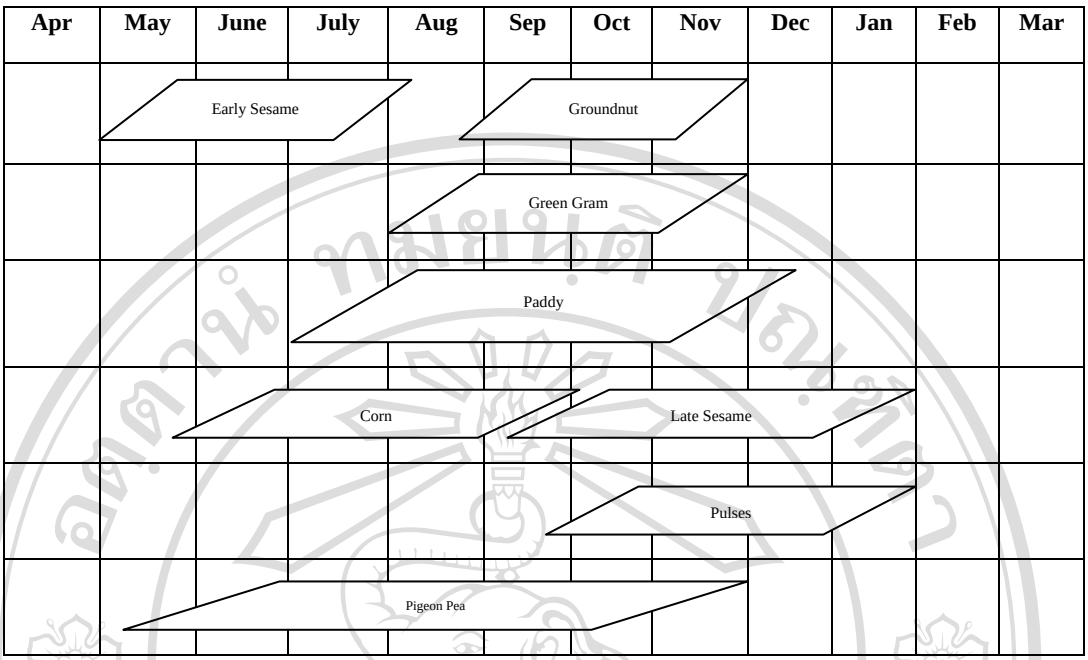

Figure 19. Cropping pattern of Magway district, Myanmar.

(Source: Field survey, 2007)

Millet is also planted along traditional bunds and in poor soils (animal and human consumption). Toddy palms are found around farm boundaries and along bunds.

Sorghum is a typical fodder crop in the area. Traditional farm yard manure is common although compost is often poor (lack of sufficient and homogenous breakdown, leaching and loss of nutrients, poor conservation, lack of watering, etc.). Farm yard manure is extensively used in the region.

Cattle are mainly used for draught power and transportation of farm products and water. The number of cattle owned is based on the feed and water availability. Sheep and goats are also common and they are important for small scale farmers.

5.4 Soil erosion issues

5.4.1 Farmers' ranking factors on causes of erosion

Factors identified as important included heavy rain, soil type and slope. Causes are directly linked with farmers' agricultural practices included continuous cultivation and deforestation and lack of drainage canals. During field survey, farmers identified the causes of soil erosion are as follows (Table 6).

Table 6. Cause of Soil Erosion perceived by farmers.

Causes	Percentage reporting
Heavy Rain	39
Slope	13
Soil Type	17
Deforestation	11
Continuous cultivation	10
Lack of drainage canals	10

5.4.2 The effects of soil erosion

Farmers generally aware that soil erosion directly affects their life. It leads to low crop yields, food insufficiency and poverty. The peoples' livelihood is solely based on agriculture in the region and thus having good soil quality is important.

They perceive soil erosion and land degradation mainly by yield variability, changing in soil color and appearance, occurrence of stony and pebbles followed by rill, sheet and gullies formation.

Land degradation in the Myanmar Dry Zone is becoming a matter of serious concern for its negative implications on the livelihood of the rural population and the environment from which they largely depend.

5.4.3 Soil enhancement

In Myanmar, chemical fertilizer use remains relatively low and often not efficiently used because of high price and sometime shortage of fertilizer and poor adoption of technically feasible chemical-management strategies.

However, with little capital for expensive chemical fertilizer at farmers' level, increasing yield potential seems to be inaccessible. Besides, chemical fertilizer is the major cost of crop production in Myanmar, accounting for approximately 35-45% of the total variable cost. As chemical fertilizers being ecologically and economically expensive, attention should pay on increase using of farm yard manure and locally available organic and biological fertilizers.

Generally farmers believe that all crops are good for the soil because of their cover and crop residue etc. However, some crops are better than others to enhance the soil. The farmers noticed that all leguminous crops are the bests for soil enhancement because crops growing after leguminous crop are always profitable. However, shortage of fuel wood and limitation of grazing land, they need to grow sesame and forage crops to get energy source and livestock feed. Table 7 is showing although

40% of sampled farmers growing pulses and beans including groundnut, 35% and 17% of those are growing sesame and others crops .

Table 7. Farmers' ranking on adaptable crops.

Crops	**Farmers' Ranking**	
	Percent	**Frequency**
Sesame	35	35
Groundnut	34	34
Pulses & beans	6	6
Others	17	17
Not specified	8	8

(Source: Field survey, 2007)

Cropping systems that can enhance soil status are also perceived by the farmers in the study area. They believe that mixed and multiple cropping is the bests cropping systems and crop rotation is the best crop management practice. This shows that farmers understand very well the role of cropping systems but their actual practice is somehow on mono-cropping (Table 8).

Table 8. Farmers' ranking on adaptable cropping systems.

Cropping systems	**Percent**	**Frequency**
Mono	37	37
Mixed	63	63
Total	**100**	**100**

(Source: Field survey, 2007)

5.5 Farmers' problems

The major constraint on soil erosion management is not local knowledge as much as it is the tenure arrangements which allow "temporary owners" to manage the fields as they see fit. Most of these temporary owners are not willing to invest in erosion control measures other than small water diversion ditches.

This study specifically examines the soil erosion risk as linked to knowledge and management practices in the Dry Zone Area of Central Myanmar. Some of the questions that guided the research were: 1) how farmers classify soils, particularly with regard to fertility and erosion; 2) what do they view as the cause of erosion; 3) how do they control erosion; and 4) what are the opportunities and constraints to erosion control, including other socio-cultural and socio-economics factors.

5.6 Farmers' perception on erosion control measures

Farmers' perception of the dangers of soil erosion risk is increasingly recognized as having a rational basis. Little independent corroboration exists,

however, that farmer behaviour accords with the technical efficiency and cost effectiveness of soil and water conservation measures.

One of the most interesting developments in renewable natural resource management in recent years is the recognition that many local farm practices do have a rational basis. Whereas high technology approaches to agriculture developed since the Second World War have tended to downplay farmers' own knowledge in favour of technology transfer and use of external inputs, the new agenda for sustainable agriculture' stresses learning from farmer experience, putting local needs first and promoting stewardship (or husbandry) of the land in the hands of the people expected both to conserve natural resources and also to benefit from enhanced future production. An implication of the change is that farmers may often make better decisions than the 'expert', not because of any greater analytical skills but because of the experience gained in integrating a vast array of factors responsible for controlling production. A further implication is that the farmer as the primary 'stakeholder' is unlikely to undertake practices which undermine the future and put household livelihood and food security at jeopardy unless immediate survival were at risk.

5.7 Farmers' views of soil erosion and need for conservation

Although based on only one growing season of data, a clear idea of what might be rational behaviour for a small farmer emerges; behaviour which would be at some variance from standard extension recommendations. What do farmers in the areas actually believe? A sample of 20 farm households at each of five different sites were interviewed in 2007 to ascertain (a) their perception as to the danger of soil erosion risk, and (b) the need for soil and water conservation.

There is a general feeling that erosion is severe and that conservation is important. The majority of farmers thought that the danger of erosion is ‘moderate’ but the need for soil conservation is ‘very important’. Farmers were also asked what types of erosion they thought made conservation important. In regard to awareness of soil erosion, nearly all respondents at Taungdwingyi and Myothit Townships spoke of gullies, but less than half at Magway. A few identified rills and sheet erosion at any site. Gullies are, of course, obvious in the landscape, and they have received considerable attention in Myanmar. The loss in soil quality because of sheet erosion seems to go almost unnoticed; it is probably rationalized in other contexts such as ‘over-use of the soil’, ‘drought’ and ‘desertification’. Such rationalizations serve to divert attention and ascribe blame for agricultural problems to simplistic, intangible and uncontrollable factors (such as drought), whereas the field situation indicates the crucial interdependency between the vagaries of climate and the loss in soil quality. This rendering of the soil plant system more vulnerable to natural variability in climate is the major deleterious process in this semi-arid area.

5.8 Multinomial regression analysis

The multinomial logit model was used to study the identification of major socio-economic and physical factors influencing on soil erosion in the context of individually farmer’s specific data on multiple choice. From farmers’ perception and response socio-economic characteristics are shown in Table 9.

Table 9. Socio-economic characteristics of sampled farm households.

Characteristic	Total Number	Mean	Stand Deviation
Age of HHH	100	50.81	12.587
Family members	100	6.00	2.283
Growing Area (Acre)	100	10.64	6.832
No. of Livestock holdings	100	5.56	5.131

Source: Field survey, 2007

Data and information about farmers' perception on soil erosion risks were collected during household survey and field observation. The study was conducted with 100 farmers at different land use and slope levels. They perceive soil degradation mainly by reduced yields, soil changing in appearance and becoming stony or coarse.

The variables used in this analysis were explained as in Table 10.

Table 10. Definition of variables and variable values.

Variable	Definition	Values
Erosion (SEO)	Status of Erosion Occurrence	1= low, 2= medium, 3= high
Education (EDU)	Household Head Education	1= Primary, 2= Secondary, 3= High school, 4= University
Agri. Training & (AgT)	Agri. Training & Extension Service	0= No, 1= Yes
Land Use (TOL)	Type of Land Use	1= Forest land, 2= Barren land, 3= Agricultural Land
Soil (TOS)	Type of soil	1= Sandy, 2= Sandy loam, 3= Clay, 4= Silt
Cropping Systems (CS)	Type of Cropping	1= mono, 2= mixed
Erosion (TOE)	Type of Erosion	1= sheet, 2= rill, 3= gully
Slope (GTL)	General Topography of land	1=flat, 2=rolling, 3= hill
Soil Colour (OSC)	Occurrence of Soil Colour Changes	0=No, 1=Yes
Stony (OSP)	Occurrence of stone & pebbles	0=No, 1=Yes

Source: Field survey, 2007

The most frequently mentioned soil erosion indicators were soil becoming coarse and stony, followed by rill formation, dissection of fields and gullies and topsoil removal.

Selected representative independents variables were included: farm household characteristics, land use management characteristics and soil conservation management characteristics.

- **Farm household characteristics**

From the sampled farmers, 66% of farmers have primary education, 23% of those have secondary education, 8% have high school education and only 3% of those have university education. However, 80 % of sampled farmers have no access to agricultural training and extension services.

- **Land use management characteristic**s

In Myanmar, the land is solely own by the State and farmers have only right to cultivate on it. Therefore, farmers are not willing to invest in erosion control measures other than doing small farmers' diverse ditches. However, the trend in land use has been an expansion of agricultural land and a reduction in forest area in the study site. Currently, 76% of sampled farmers are doing in agricultural land, 23% in forest land and 1 % in grazing and barren land. The consequence of these trends is thought to be an increase in the likelihood of severe soil erosion in the past.

According to the farmers' response, trend of changing number of tillage operation is increasing being top soil depth is getting shallow due to erosion.

- **Soil conservation management characteristics**

From the sampled farmers, 86 % of their soils are sandy loam and sandy soils, 10% of those are clay and only 4% is silt soil. Therefore, most are sandy and sandy loam soils and very sensitive to wind as well as water erosion during dry season.

And trend of using fertilizer amount is increasing year by year to get normal crop yield, it probably causes of nutrient depletion by erosion and practicing mono-

cropping. According to type of crop management, 72% of farmers are practicing weeding and crop rotation together, 13% are practicing weeding only. Application of farm yard manure (FYM) and compost is only 1% respectively.

Based on the erosion occurrence, major socio-economic and physical drivers that influence on soil erosion risk from farmers' perceptions and estimated regression equation are as follows;

$$ln(P/1+P)=52.826+85.245EDU+70.392TOL+64.645TOS+61.516CS+53.911TCM+73.736FRFE+69.165TOE+92.113GTL+69.190OSC+64.898OSP+\epsilon \quad (5)$$

Table 11. Statistical analysis for multinomial regression.

Effect	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	52.826(a)	.000	0	.
EDU	85.245	32.419	6	.000
AgT	54.528(b)	1.702	2	.427
TOL	70.392(b)	17.567	4	.001
TOS	64.645(b)	11.819	6	.066
CS	61.516(b)	8.690	2	.013
TCM	53.911(b)	1.086	8	.998
FRFE	73.736(b)	20.910	10	.022
TOE	69.165	16.339	8	.038
GTL	92.113(b)	39.288	4	.000
OSC	69.190(b)	16.364	2	.000
OSP	64.898(b)	12.073	2	.002

Significant value of Household Head Education (EDU) is 0.000 and < 0.05, it means that Education Level of household head is significantly influence on Erosion Risk Occurrence in his field. Significant value of Type of Land (TOL) is 0.001 and < 0.05, it means that Type of Land such as forest land, barren land and agricultural land are significantly influence on Erosion Risk. Significant value of Cropping Systems (CS) is 0.013 and < 0.05, it means that Cropping Systems such as mono-cropping and multiple-cropping are significantly influence on Erosion Risk Occurrence. Significant value of Farmers' Ranking Factors on Erosion (FRFE) is 0.022 and < 0.05, it means that Farmers' Ranking Factors on Erosion is significantly influence on Erosion Risk Occurrence. Significant value of Type of Erosion (TOE) is 0.038 and < 0.05, it means that Type of Erosion is significantly influence on Erosion Risk Occurrence. Significant value of General Topography of Land (GTL) is 0.000 and < 0.05, it means that relationship between topography such as flat, rolling and hill and Erosion Risk Occurrence is statistically significant in the study area. Significant value of Occurrence of Soil Color Changes (OSC) is 0.000 and < 0.05, it means that farmers perceive soil erosion mainly by changing in soil colour and appearance. Significant value of Occurrence of Stone and Pebbles (OSP) is 0.002 and < 0.05, it means that farmers perceive soil erosion mainly by occurrence of stony and pebbles followed by rill, sheet and gullies formation.

According to Table 11, the most important socio-economic and physical factors that influencing soil erosion from farmers' perception are slope of land, education level of household head, occurrence of soil colour changes in their field and type of land use that the farmers were practicing in the region .