PROJECT ALA-97/68

UPLAND DEVELOPMENT PROGRAMME IN SOUTHERN MINDANAO (UDP)

FIELD MANUAL FOR AGRO-ECOLOGICAL ZONING

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FIELD MANUAL FOR AGRO-ECOLOGICAL ZONING

(AEZ)

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1 LAND USE SURVEY OF SITIO CLUSTERS

1.1 Initial concepts

1.1.1 What is Agro-Ecological Zoning

AEZ is the assessment of the possibilities for production of specific crops within a given agro-climatological, physiographic, pedological and socio-economic context at sitio or sitio cluster level.

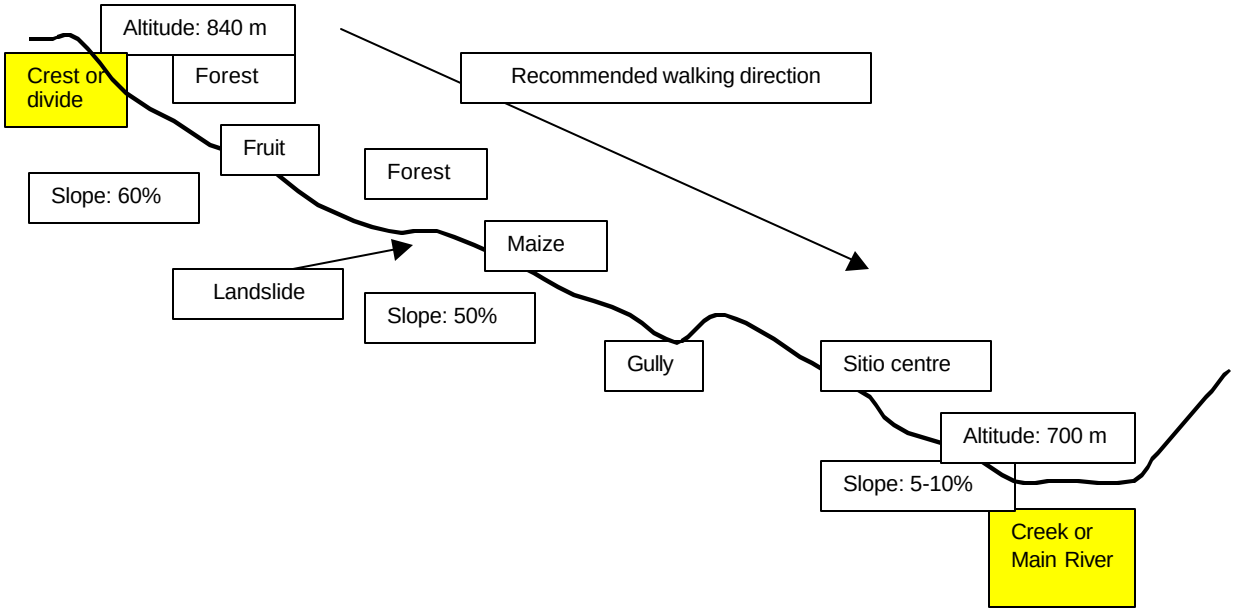
Information from AEZ is used for the preparation of the land use map. Information for AEZ is collected during transect surveys.

1.1.2 What is a transect

A transect is a track running from the crest of the watershed to the main creek in the sitio. Rainwater falling down at both sides of the crest will run in different directions and join different creeks.

While following the track of the transect, observations are made and written down in a notebook. The kind of observations to make are specified in section 3. An example of a transect is presented in Figure 1.

Figure 1 - Transect survey: example drawing of the transect at the end of the survey



1.1.3 Data collection during transect survey

At each of the observation points geographical co-ordinates are measured using the Geographical Positioning System (GPS). Climate is assessed before the transect survey.

Further data needed are briefly indicated in Table 1 below.

Table 1 - Data gathering during a transect survey

PHYSIOGRAPHY	SOILS	VEGETATION AND LAND USE
Altitude	Soil texture	Crops/Fallow
Slope gradient	Topsoil thickness	Grassland
Evidence of erosion		Forest
		Livestock

In the Farm Planning stage the commuity can decide to take soil samples for analyses to be carried out. For soil analysis BSWM is the qualified institution. The members of the Municipal team can take the samples. The most important of them are pH and Organic Matter content.

1.1.4 What are natural resources

Natural resources are the sources used by the communities for production and survival. They include climate, soils, water and vegetation.

1.1.5 What is sustainable resources management

Sustainable resources management is the use of resources, in such a way that they are not depleted and conserved for further use by coming generations.

Unsustainable use on the contrary finally leads to their depletion, putting finally a burden on survival of the community.

1.2 Planning of transects

For each sitio, 1 transect will be surveyed (an average of 4 in each watershed. These transects are meant to characterise the entire watershed in the sitio and therefore should be well located at representative places. Rules for positioning the transects are:

- A transect starts at the crest and runs down to the major sitio creek;
- The major direction followed is that of the shortest way possible down to the creek; in this way a topographical sequence is followed assuring coverage of the major Land Use Types;
- Through the choice of the transect one should be sure that all major land use types are covered, if possible, but not necessarily, including the sitio centre and its surroundings;
- Use the sitio sketch map for the choice of transect locations;
- Locate a transect such that major problems relating to natural resources management are covered.

2 Survey of transects

2.1 Procedure

Observations are made every 200 m taking care of making at least 1 observation in each of the broadly distinguished units of land use. A minimum of 4 observations per transect is considered necessary. Observations concern all retained criteria for Land Use Survey indicated in Figure 1 above and described in more detail in section 3.

Field observations will be completed with information taken from maps (rainfall distribution) or from the reading of a graph (air temperature). A form to be completed for each of the observations during field survey is attached in ADDENDUM.

For easiness of work, features observed are field coded. The codes are indicated in the corresponding tables in section 3. But personal observations are considered as important as the coding. Observations that are not provided for in the tables, and that you consider valuable, are written down in a personal report attached to the form.

During field survey a sketch of the route followed is gradually drawn up. This results in a document resembling the sketch shown in Figure 1. The sketch produced in most of the cases will be more complete than what is shown. Observations numbers are indicated on this sketch. The sketch transect also comes in addition to the written notes on each observation.

2.2 Minimum equipment needed

2.2.1 Minimal and normal procedure

Be sure to collect all the necessary equipment before going out for a transect survey. A checklist of equipment needed is presented in Table 2. After collection of the equipment you should decide upon the location of the transects in the watershed (sitio cluster).

Table 2 - Checklist of equipment needed for transect survey

Geographic Positioning System with battery loaded (GPS)
Spare loaded battery for GPS
Altimeter (for elevation measurements)
Clinometer (for measurement of slope gradient)
Compass
Spade for texture assessment
1 litre of water for texture class assessment
Ruler of at least 50 cm long with indications t 15 cm and 50 cm
Clean plastic bags that can contain 100 g of soil
Black marker pen to mark the bags with the date of sampling and the sample No.
Pencil, eraser, writing/sketching board, rubber bands, note book, plastic cover to protect note book from rainwater

Transects surveyed contribute to the establishment of the Land Use Map. Establishment of this map is computer assisted and improves the accuracy of the formerly established sitio sketch maps. Therefore each survey team shall be equipped with a GPS station, an altimeter and a compass. These readings will allow plotting of observations on the sitio map.

The altimeter needs regular calibration. This means that before going out to the field the reading of the altimeter should be re-adjusted, taking as a reference the known altitude of e.g. the Municipal Hall or the Municipal Team's office. The reference altitude can be set, by taking the altimeter from a known reference, e.g. sea level = 0 m, to the new reference, preferably in less than 1 day.

The slope gradient is strongly related to the occurrence of erosion. The team therefore shall be equipped with a clinometer, allowing assessment of the slope gradient. Slopes should be measured according to:

- The general sense of the transect and,
- The estimated steepest slope occurring at the site of observation.

Observations on soils can be effectuated using a simple spade. Assessment of the textural class is done on a moist sample from the topsoil (0 to 25 cm) and from a depth of about 50 cm. For texture assessment the team will be carrying along water (1 litre in a bottle is largely sufficient for 1 transect).

To accurately assess the depth of sampling, take a ruler and indicate the required depths before starting the survey. The textural class is assessed in the field according to the criteria presented in Table 7).

In addition, be sure to bring along on your survey necessary writing and sketching materials. For writing and sketching it is preferable to use a pencil instead of a ballpoint (ballpoints do not write well on dirty or slightly moist paper or get stuck with small soil particles sticking on the paper or the pen). A small A4 size wooden writing table, a set of rubber bands to hold the paper on the writing table and an eraser are also advisable.

As many times in the Philippines rain falls in the afternoon, preferably surveys will start in the early morning hours. Notes are to be completed and corrected and a survey report written in the afternoon, when back in the office. Valuable information can be added at the office at condition that the time between observation and report writing is not too long.

3 CRITERIA FOR LAND USE MAPPING

3.1 Climate

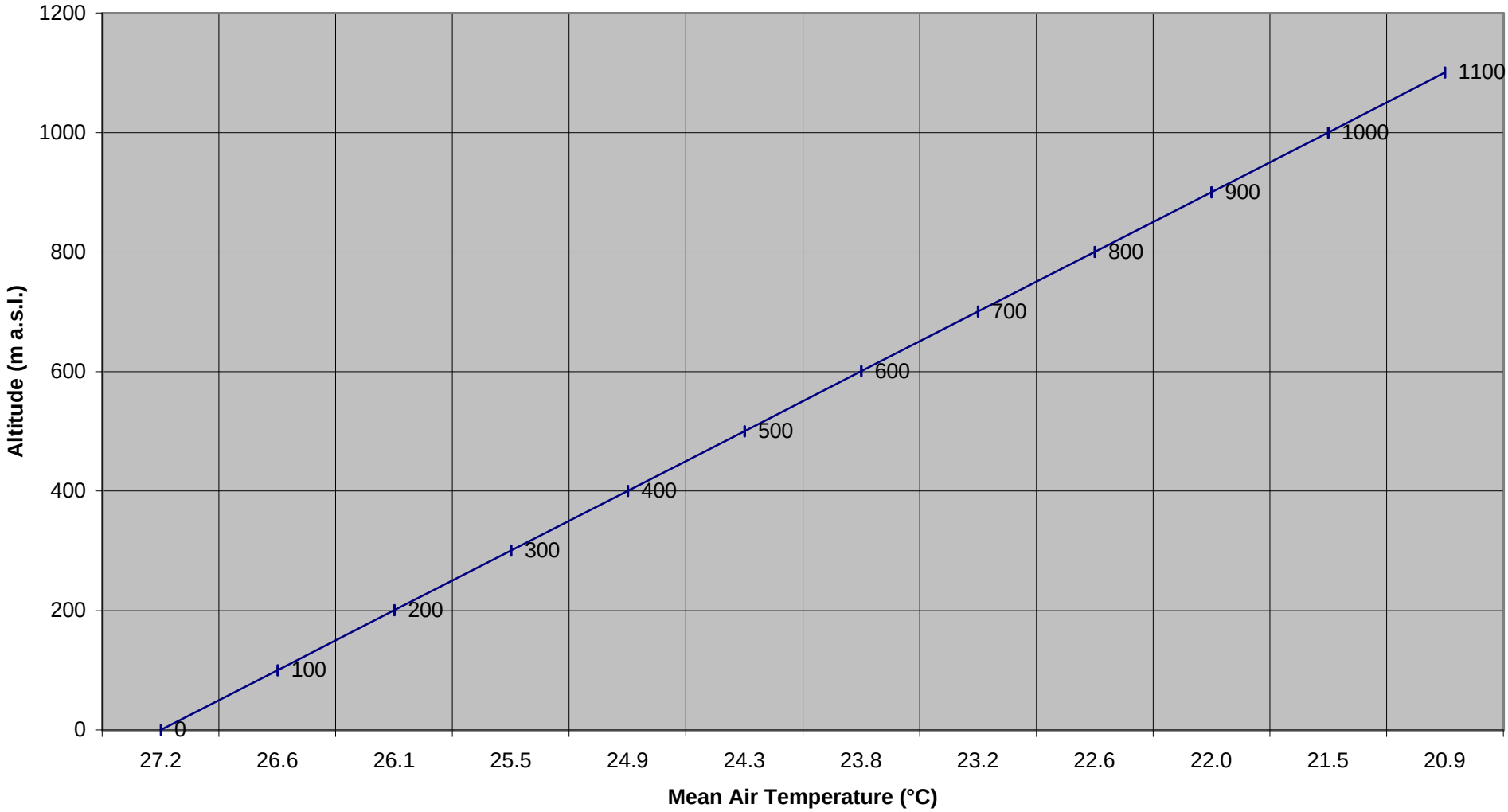
Climatic crop adaptability is the first factor in consideration for AEZ. Climatic data are incomplete and disperse for the uplands of Southern Mindanao. The following takes into account the imposed conditions.

3.1.1 Air temperature

Air temperature is altitude dependant. The gradient of the mean air temperature is generally in the order of -0.5 °C per 100 m altitude increase.

The uplands concerned with the project are generally situated between 100 and 1000 m a.s.l. The graphic (Figure 2) provides a rough, but reasonably accurate, guide to estimating the average temperature at a given altitude.

Figure 2 - Altitude and Mean Air Temperature



3.1.2 Rainfall

In Mindanao four main zones of rainfall distribution - length of growing period are distinguished. The following broad zones of rainfall distribution are recognised in the project area (Table 3).

Table 3 - Zones of rainfall distribution - length of growing period

SYMBOL	CLASSIFICATION	DESCRIPTION
A	Wet	Annual rainfall > 2500 mm. Slight dry season moisture deficit. Growing period of 330 to 270 days (dry season of 1 to 3 months)
B	Moist	Annual rainfall between 2500 and 1500 mm. Moderate dry season moisture deficit. Growing period of 210 to 270 days (dry season of 3 to 5 months)
C-1	Dry	Annual rainfall < 1500 mm. Dry season moisture deficit. Growing period between 150 and 210 days (dry season of 5 to 7 months)
C-2	Very dry	Annual rainfall < 1500 mm. Dry season moisture deficit. Growing period between 90 and 150 days (dry season of 7 to 9 months)

A dry month is defined as a month with less than 100 mm of precipitation on the average, a dry season as a succession of months with less than 100 mm of precipitation on a monthly basis.

The geographical distribution pattern is shown in Figure 3 (from BSWM, 1991). The transition zone B-C does not appear on the map but should be accounted for when working in a given area.

Figure 3 - Zones of rainfall distribution - Length of growing period in Mindanao

3.2 Physiography

3.2.1 Slope gradient

The following slope classes are distinguished (Table 4).

Table 4 - Slope classes and erosion hazard

CODE	GRADIENT (%)	DESCRIPTION	WATER EROSION HAZARD	PREFERENTIAL USE
M	0 - 3	Level to nearly level	No or low erosion hazard	All climatologically adapted crops
N	3 - 8	Gently sloping to undulating	Moderately susceptible to water erosion	Most climatologically adapted crops can be cultivated; contour ridging recommended for annual crops
O	8 - 18	Undulating to rolling	High susceptibility to water erosion	Highly demanding crops show yield decline; contour ridging for annual crops
P	18 - 30	Rolling to moderately steep	High susceptibility to water erosion	Pasture, fruit trees or woodland. Annual crops in contour ridges intermittent with hedgerows
Q	30 - 50	Steep	Very high susceptibility to water erosion	Woodland, fruit trees. Annual crops only in contour ridges intermittent with hedgerows
R	> 50	Very steep	Erosion or erosion hazard	Woodland.

3.2.2 Evidence of erosion

In terms of mechanised soil workability (ploughing by Karaboa) erosion evidence can be translated as indicated in Table 5.

Table 5 - Erosion evidence and soil workability

CODE	TYPE OF EROSION	WORKABILITY
S	Sheet wash	Soil can easily be ploughed
T	Rills	Ploughing is easy, rills are obliterated by annual ploughing
U	Creep	Soil can easily be ploughed. Existing erosion steps facilitate work along ancient contour lines.
V	Gullies	Working of the soil is hampered but is still possible in most of the cases.
W	Ravines	The plot is lost for further cultivation of annual crops. Remedial actions are needed for further agricultural use.

Degrees of erosion are classified as follows (Table 6).

Table 6 - Erosion classes

CODE	CLASSIFICATION	DESCRIPTION
E0	No apparent erosion	
E1	Slight	Sheet wash occurs under annual crops. This is evidenced by the gradual down slope removal of the organic top layer of the soil, eventually its accumulation at the lower end of the plot and occurrence of rills at distances of over 3 meters in the sense of the contour.
E2	Moderate	Rills occur at less than 3 meters distance in the sense of the contour line and gullies start to develop at the lower end of the plot. Generally observed under annual crops on sloping land

E3-1	Severe	Creep erosion is evident as visualised by a stair wise structure of the topsoil layers. This occurs under the influence of ploughing along the contour lines with a mouldboard plough forcing the topsoil to move slightly down at each application with the mouldboard.
E3-2	Severe	Gullied soils with exposed subsoil or parent rock generally at the upper side of the plot.
E4	Very severe	Gullies merge into ravines. Landslides are frequent

3.3 Soils

3.3.1 Soil texture

For the assessment of texture only 3 broad classes are distinguished. The following rules are applicable (Table 7).

Table 7 - Soil textural classes

CODE	CLASSIFICATION	DESCRIPTION
A	Light	Sandy materials. When moist: difficult to shape into a sausage, readily breaking apart when the sausage is bent, not sticking to the fingers when pressed and tearing the fingers apart
B	Medium	Loamy materials. When moist: a sausage can be formed, however when bent this will easily break into peaces, sticking slightly to the fingers when pressed and tearing the fingers apart
C	Heavy	Clayey materials. When moist: a sausage can be formed which will not readily break into fragment when bent, sticking to the fingers when pressing. When ploughed in too wet conditions sticking to the mouldboard reducing speed of soil work

3.3.2 Topsoil thickness

Four topsoil thickness classes are distinguished (Table 8).

Table 8 - Topsoil thickness classes

CODE	CLASSIFICATION	DESCRIPTION
J	Thick	Thickness of over 20 cm. Stable topsoil not subject to sheet erosion
K	Moderately thick	Thickness between 10 and 20 cm. Moderate sheet erosion can be suspected
L	Thin	Thickness between 5 and 10 cm, continuous. Sheet erosion and long time cultivation have depleted the topsoil
M	Very thin	Thickness of less than 5 cm, discontinuous. Topsoil disappeared due to long time cultivation and sheet and rill erosion

3.4 Vegetation cover and land use

Classes that can be distinguished are indicated in Table 9 (adapted from BSWM, 1991).

Table 9 - Classes of land use/vegetation cover

CODE	CLASSIFICATION	DESCRIPTION
A	Agriculture	Agricultural lands are those lands that are used for different agricultural activities. Dominant crops grown in these areas are corn, coconut, banana, fruit trees, coffee/cacao, rice
B	Grassland/shrubland	The grassland/shrubland areas are those underitilised, overgrazed, idled and highly degraded areas.
C	Woodland	The woodland areas are mainly the forested areas or those that are covered with trees or woody type of vegetation. These areas comprise those that must be permanently retained to forest environment. Human activities should be minimised.
D	Wetland areas	The wetland areas consist mainly of marshes and fishponds

E	Special and miscellaneous land use	Built-up areas, Quarries, Volcanic ashes, Reservoirs, Roads & Waterways, Tourism

4 ZONING

The features observed during land use survey are compared with the specific crop requirements. Crop requirement tables are produced in a separate volume. Matching of observations with requirements is explained in ADDENDUM 2.

ADDENDUM 1 - OBSERVATION SHEET

This sheet is to be competed for each of the observations made during the transect survey.

Sitio name							
Barangay name							
Municipality name							
Names of Surveyors							
Date of survey							
Average annual rainfall (mm)							
Observation No.	1	2	3	4	5	6	…
GPS READING							
Latitude							
Longitude							
Altitude (altimeter reading)							
PHYSIOGRAPHY							
Slope gradient (%) (clinometer reading)							
Evidence of erosion (Table 5)							
Erosion classes (Table 6)							
SOILS							
Soil Texture (Table 7)							
Topsoil thickness (Table 8)							
VEGETATION AND LAND USE							
Vegetation cover (Table 9)							

ADDENDUM 2 - HOW TO USE THE CROP REQUIREMENT TABLES

In what follows the use of the Crop Requirement Tables is illustrated with a possible transect observation as an example.

5 Field observation

N.B.: Only the data relevant for Agro-Ecological Zoning are filled in.

Sitio name							
Barangay name							
Municipality name							
Names of Surveyors							
Date of survey							
Average annual rainfall	1800 mm						
Number of dry months	3						
Observation No.	1	2	3	4	5	6	…
GPS READING							
Latitude							
Longitude							
Altitude (altimeter reading)	800						
PHYSIOGRAPHY							
Slope gradient (%) (Clinometer reading)							
• Sense of transect	27						
• Steepest slope							
Evidence of erosion (Table 5)							
Erosion classes (Table 6)	E3-1						
SOILS							
Soil Texture (Table 7)	Medium						
Topsoil thickness (Table 8)							
VEGETATION AND LAND USE							
Vegetation cover (Table 9)							
MEAN AIR TEMPERATURE (Altitude & Figure 2)	22,6						
SUPPLEMENTARY LABORATORY DETERMINATIONS							

PH surface sample	5,5						
PH at 50 cm depth							
Organic Carbon content (%) surface sample	0.5						

6 Crop requirement table for banana

Growing condition appreciation	Optimal or near optimal	Moderate	Marginal	Non suitable
Climate (general maps and graphic)				
Mean air temperature (°C)	>18	18-16	16-14	<14
Total annual rainfall (mm)	>1500	<1500		
Rainfall distribution (No. of dry months)	0-3	3-5	5-8	>8
Physiography (field observations)				
Slope gradient (%)	0-12	12-25	25-50	>50
Erosion classes	E0, E1, E2	E3-1	E3-2	E4
Soil characteristics (field observations and laboratory results)				
Texture	Medium	Heavy		Light
PH	7.0-5.6	5.6-5.2	5.2-4.5	<4.5
Organic carbon (%)	>1.5	1.5-0.8	<0.8	

7 Matching crop requirements with field observation

Growing condition appreciation	Optimal or near optimal	Moderate	Marginal	Non suitable
Climate (general maps and graphic)				
Mean air temperature (°C)	**X**			
Total annual rainfall (mm)	**X**			
Rainfall distribution (No. of dry months)	**X**			
Physiography (field observations)				
Slope gradient (%)			**X**	
Erosion classes		**X**		
Soil characteristics (field observations and laboratory results)				
Texture	**X**			
PH		**X**		
Organic carbon (%)			**X**	

Total by class	**4**	**2**	**2**	

8 Choice of crops

Other crops for the same mapping unit may be better or less suited. Appreciation will also be changed by the introduction of new technologies. The slope gradient for instance may become marginal with the introduction of hedgerow technology.

On the basis of this classification the choice of crops may be decided for the particular unit of the land use map.